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THE

YEAR-BOOK OF FACTS

IN

Science and Art:

EXHIBITING

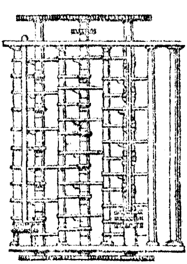
THE MOST IMPORTANT DISCOVERIES AND IMPROVEMENTS
OF THE PAST YEAR,

IN MECHANICS AND THE USEFUL ARTS; NATURAL PHILOSOPHY;
ELECTRICITY; CHEMISTRY; ZOOLOGY AND BOTANY; GEOLOGY
AND GEOGRAPHY; METEOROLOGY AND ASTRONOMY.

Illustrated with Engravings.

BY THE EDITOR OF "THE ARCANA OF SCIENCE."

"Science exalts the mind, and raises it above minor matters."
PRESIDENT'S ADDRESS TO THE BRITISH ASSOCIATION, 1843.



Mr. Babbage's Calculating Engine.—See p. 167.

LONDON:
DAVID BOGUE, FLEET STREET.
(LATE TILT AND BOGUE.
MDCCCXLIV.

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THE FRONTISPIECE.

This Portrait of DR. JUSTUS LIEBIG, the celebrated Professor of Chemistry in the University of Giessen, has been reduced from a large Print just received from Germany.

THE VIGNETTE.

Mr. Babbage's Calculating or Difference Engine, lately deposited in George the Third's Museum, King's College, London.

Obituary

OF PERSONS EMINENT IN SCIENCE OR ART. 1843.

T. C. HOFLAND, landscape-painter.
ABRAHAM RAIMBACH, engraver.
LOUISA SEYFARTH, (Miss L. Sharpe,) artist.
W. S. GILPIN, landscape-gardener.
SYLV. F. LACROIX, the distinguished mathematician.
D. S. HAHNEMANN, originator of the Homœopathic System.
DR. JACOBSEN, who filled, in the Academy of Sciences at Paris, the Chair vacated by the death of Sir Everard Home.
ANTOINE MARIE PEYRE, architect.
HENRY THOMPSON, R.A., artist.
J. SAUTERLEITE, German artist—glass-painting, &c.
HIS ROYAL HIGHNESS THE DUKE OF SUSSEX, formerly President of the Royal Society.
FREDERICK WILH. FACIS, medallist.
JAMES HAKEWILL, architect.
IPPOLITO ROSSELINI, Egyptian antiquities.
GEORGE MADDOX, architect and artist.
REV. W. LEWIS RHAM, rural economy.
J. C. LOUDON, rural economist; author of several works on Gardening, Agriculture, Natural History, &c.

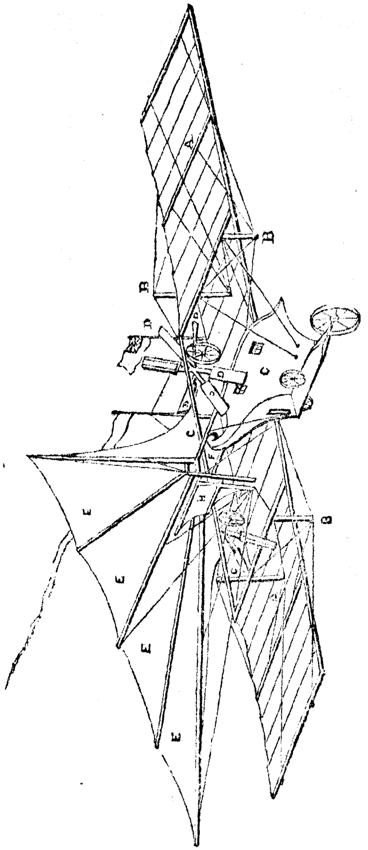
THE

YEAR-BOOK OF FACTS.

Mechanical and Useful Arts.

HENSON'S AERIAL TRANSIT MACHINE.

THIS apparatus, which has been patented, has excited considerable attention, from its great apparent simplicity. It consists of a car, in which not only are the passengers to be placed, but likewise a steam engine, and the quantity of fuel necessary for such voyage; to this is attached a rectangular frame, formed either of wood or bamboo cane, covered over with oiled silk or with canvas; this frame is to supply the place of the balloon, and is, according to Mr. Henson's view, to be buoyed up by the action of the air; it will stretch out on either side of the car beneath, somewhat like the wings of the bird when sailing through the air. Two vertical fan-wheels, furnished with oblique vanes, which are to receive their propelling power from the steam-engine in the car beneath, are to urge forward the whole apparatus; at the stern of the car is the portion of the machinery destined to make the apparatus ascend or descend: it consists of a triangular frame, resembling the tail of a bird, covered over as the other frame: underneath this is placed a rudder, by whose action a course either to the right or to the left may be taken, besides which a sail is stretched between two masts, which are situated in the car itself. The buoyancy of all this machinery, under the circumstances proposed by Mr. Henson, is, we believe, impossible; the knowledge which has been gained of mechanics impresses us with a conviction that his views are fallacious. He thinks that an engine of from 25 to 30-horse power would be sufficient to propel his apparatus; but the amount of canvas or oiled silk required for its buoyancy, he states to be equal to one square foot for each half pound weight—the whole machine being about 3,000 lbs., and the area, or surface spread out to support it, 4,500 square feet in the two wings, and 1500 feet in the tail; making, altogether, 6,000 square feet. But he has taken no account of the fuel and water which are absolutely necessary for the action of his steam-engine. Now, the weight to be buoyed up, taking the apparatus at 3,000, would be 53,400 lbs. Instead of an engine of 30-horse power, one of 13,550 would be required. The machine is to be launched from a height, and allowed to run down some distance on an inclined plane, by means of vertical wheels attached to the bottom of the car; the momentum being acquired, the fan-wheels raise it into the air, and drive it forward; but if the weight be such as we have stated, a descending velocity would be acquired of 60 miles per hour, or 5,808 feet per minute—so that, for safety, it would at least be necessary to start from Mont Blanc, to give time for the rotatory fan-wheels to be set in motion.



Description.—A, A, the main frame, or wings, composed of longitudinal pieces, and bow-like frames across them.

B, B, B, B, &c., upright posts, or standards, to the upper and lower ends of which metallic braces, shown by the single lines, are attached, supporting various points in the frame.

C, C, a longitudinal piece, which forms the outer boundary of the space required for the vanes, or propellers.

D, D, D, &c., the vanes, or propellers, mounted on shafts, as shown in the figure, and drawn by steam-engines by means of bands.

E, E, &c., the tail, turning on a point at *F.*

G, the car, containing the steam-engine, cargo, conductors, and passengers, in suitable compartments.

H, the rudder.

The covering of the wings and tail is of silk, or linen; that of the wings is divided into three lengths for each end, joining each other at the double frames shown. This division facilitates the rapid reefing and spreading of the covering, which is effected by the cords running parallel with the longitudinal pieces, of the wings. The tail and rudder are in like manner governed by cords proceeding from the car.

The novelty of the steam-engine lies chiefly in its boiler and condenser. The former consists of nearly fifty hollow truncated cones, averaging about three feet in length, and of four inches and a half in their greatest width: their blunted points, of about one inch in diameter, are downwards, and the whole are arranged above and about the fire; they present about fifty square feet to the action of radiating, and about as much more to that of communicative heat. The steam is worked in two cylinders, in which it is cut off at a quarter of the stroke. It is concluded the engine will be of nearly 20-horse power.

We need scarcely add, that Mr. Henson's contrivance is altogether out of the pale of the probability of success.

OPENING OF THE THAMES TUNNEL.

This stupendous work, as regards the passage beneath the Thames, was thrown open to the public as a thoroughfare for foot passengers, at a toll of one penny, on the 25th of March. The two roadways for carriages are also completed; but the Middlesex shaft and the approaches on each side remain to be perfected.

The Tunnel is now entirely completed, measuring 1200 feet. The entire work has been executed in about nine years of actual operation, at a cost of about £446,000; but it is estimated that when the Wapping shaft, approaches, &c., are perfected, the expense will be about £614,000. Seven lives have been lost in executing the Tunnel, whereas nearly forty men were killed in building the new London Bridge. As an exhibition, the Tunnel has been very attractive; the sum of £1,705 having been received from visitors, at 1s. each, in one year. Within five days from the opening, upwards of 60,000 persons passed through the Tunnel, at the toll of one penny each.

STEAM-ENGINE INDICATOR.

A simple Steam-engine Indicator has been invented by Mr. A. Rous, who was formerly a working engineer in Cornwall. It consists of a half-second pendulum, to which a pencil is fixed and pointed against a card. The card is attached to the beam of the engine, and as it moves perpendicularly the pencil on the pendulum marks on it waving lines, which are wide apart when the piston moves quickly, and closer together as the velocity of the piston decreases. The distances between the lines indicate the spaces moved through by the piston in half a second in different parts of the stroke.

MAMMOTH STEAM ENGINE.

An enormous cylinder of 144 inches diameter, for the great engine designed to drain the Haarlem Lake, has been cast at the foundry of Messrs. Harvey and Co. of Hayle; it is the largest cylinder ever cast entire for any purpose. A blast cylinder of 144 inches has, indeed, been constructed at the same works, but this was cast in parts. The largest cylinder ever made for mining purposes was of the diameter of ninety inches and a fraction. It was boasted, a few days since, that the cylinders for her Majesty's steam frigate, *Penelope*, were the largest ever made, being ninety-two inches in diameter. The cylinders of the *Penelope*, however, are only two-fifths the size of that cast at Hayle, the piston of one containing 6647 square inches, that of the other 16,286; the operation was completely successful. More than *twenty-five tons* of iron were melted for the occasion, and the whole of that mass of liquid fire ran out into the mould in less than six minutes: not a single casualty occurred. The ironfounders of Hayle may now justly boast that they have executed by far the greatest work in their line which has ever been attempted.—*Mining Journal.*

VELOCITY OF STEAM-ENGINES.

PROF. MOSELEY'S Report of Experiments on Steam-engines, with Morin's instrument for measuring Velocities, has been read to the British Association.* The experiments have not been completed, and the present communication was rather to report progress than to state results. The object had been to ascertain, by actual experiment, the velocity of the piston of a single-acting Cornish pumping-engine at all points of its stroke. Morin's velocity-measuring machine was received from Paris, and by it spaces described in the 20,000th part of a second may be easily discerned. It describes a curve somewhat resembling the epicycloid, and from this curve the velocities are ascertained. The principle of the indicator, by which the experiments were made, is this: a circular disc of cardboard is made to revolve on a fixed axis, and a revolving pencil connected with the piston, describes the indicating curves. The disc which was sent as a specimen indicated the result of experiments made at the Cornish engine at Old Ford. The results were, that the piston of the engine of Old Ford, on the day of experiment, acquired its maximum velocity of ten feet a second, at four feet of stroke, and from that point the velocity gradually diminished, until the piston was brought to rest.

NEW PLAN OF STEAM-BOAT BOILER.

A NEW variety of Steam-boat Boiler has, during the last year or two, been gradually coming into use in the steamers on the Thames. It is now being extended to sea-going vessels, and it is not too much to expect from its introduction a complete revolution in the art of navigation by steam.

The variety of boiler to which we allude is of the locomotive kind, that is, the flues consist of locomotive tubes, the furnaces being arranged much in the way usual for marine boilers. The boilers, however, are much stronger than usual, the shell and furnaces being of extra thick plate, and the sides and ends are very firmly stayed.

The purpose of this plan of boiler is to enable marine engines to be wrought with a higher pressure of steam than at present, without additional danger; and thereby render practicable the full development of the expansive system. A great saving in fuel will thus be accomplished, as well as a large amount of *boiler* room. Indeed, boilers *of the same power*, on this new construction, will not take up more than half the room occupied on the former plan.

It is to Messrs. Miller and Ravenhill, we believe, the introduction of this new variety of boiler is due. The boilers of the *Blackwall*, *Prince of Wales*, and other vessels, constructed by Messrs. Miller and Ravenhill, are of this description; and the same makers are now constructing a set of these boilers for the *Infernal*, a new Government steamer, now being fitted with engines.—*The Artizan*, No. 8.

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* The Association met at Cork, August 16, 23; the Earl of Rosse, President.

NEW STEAM-VESSELS.

ANNEXED are the most important novelties of the year, of this class:—

Her Majesty's Royal Steam Yacht Victoria and Albert.—The launch of this singularly beautiful and magnificent steam vessel took place at Pembroke, on the 26th April. The following are the principal dimensions:—Extreme length, 225 feet; length on the deck, 205 feet; length between perpendiculars, 200 feet; length of keel for tonnage, 181 feet 2 inches; breadth outside paddle boxes, 59 feet; breadth for tonnage, 33 feet; breadth moulded, 31 feet 11 inches; depth in hold, 22 feet; burthen in tons, 1,049. She is divided into five water-tight compartments, and her engines, by Maudslays and Field, are of 450-horse power. Her construction is entirely novel, and according to designs prepared by the Surveyor of the Navy. She is considered by competent judges to be superior in point of beauty, buoyancy, and strength, to any other description of steam vessel ever produced in this country. She is built only with plank; the first two layers being of oak 1¾ inches thick, placed across each other diagonally at an angle of 45 degrees; the outside plank being of larch 3 inches thick, lying longitudinally or with the sheer of the ship; and the whole being bound up with vertical and diagonal iron bands. Between each layer of plank, the surface is covered with thick tarred felt; the vessel therefore cannot leak, nor be in the least degree damp inside; and being divided into five compartments by four water-tight bulkheads extending as high as the state deck, it is impossible for the body ever to sink, although it might be bilged in any part from accident. Her engines are collectively of 400-horse power; they are upon the direct action-principle, with double cylinders, as patented by Joseph Maudslay and Joshua Field. They have brine or change pumps, to prevent the deposit of salt when using sea water, refrigerators to cool the water by extracting the heat from it before it goes overboard, expansion gear by which the steam can be used more economically; but the boilers produce an ample quantity for full speed without this resource. The engines are compact, and occupy but a very small space in the vessel, compared with their great power to move paddle-wheels 10 feet 6 inches broad, and 31 feet diameter, including the feathering boards. The engine-room is surrounded by water-tight bulkheads, not the least heat is communicated from the furnaces to any other part of the vessel, and their presence is not perceptible in the rooms adjoining them.

The Steam Frigate Rattler.—This is a vessel to which Mr. Smith's screw is adapted, and was built in Sheerness dock-yard. The following are some of the principal dimensions:—Extreme length, 195 feet; length on the deck, 176 feet 6 inches; length of the keel for tonnage, 157 feet 9½ inches; extreme breadth, 32 feet 8½ inches; breadth moulded, 31 feet 10 inches; depth in hold, 18 feet 7½ inches; burden in tons 888 and 34-94ths. The engines are by Messrs. Maudslay. The gearing by which the screw is driven has been made with great care and nicety. The teeth of the main wheels are divided into three steps; that is, they are cut in the direction of their length into three portions, each of which is placed a little before the other; the pitch being thus virtually divided into three parts. By this expedient, a great equability will be given to the action of the gearing, and we anticipate that it will work with very little noise.

The Great Britain, of which the leading details were given in the *Year Book of Facts*, 1843, was launched at Bristol, on the 19th of July, in the presence of H. R. H. Prince Albert. This stupendous vessel has not, however, been yet completed.

The Novelty, built by Wimshurst, is an iron vessel, to test the applicability of steam in combination with a screw, as an auxiliary power to merchant-ships. She is three-masted, with a capacious hold; and, as her funnel forms the mizen-mast, and as she is, of course, without paddle-boxes, she differs in no respect, in external appearance, from an ordinary sailing vessel. She is fitted with a pair of non-condensing engines; the cylinders are 13 inches diameter, and the length of the stroke 2 feet 4 inches; the effective force of the steam on the piston is stated at 20 lb. mean pressure. The engines make about 55 double strokes per minute, and the power is applied direct to the crank on the screw axis, without the intervention of gearing, or any kind of multiplying apparatus. The tonnage of the *Novelty* is 328; and, with 140 tons of ballast on board, her unmerged sectional area is 164 feet. Her power is stated to be only 25 horses, and her speed 8½ statute miles.—*The Artizan*, No. 2; a truly valuable addition to our scientific periodical literature.

The Prince of Wales, built to ply between London and Margate, by Miller and Ravenhill, is a very handsome vessel. Her chief dimensions are—length of keel, 180 feet; breadth of beam, 22 feet; depth of hold, 10 feet 6 inches. Propelled by two engines of 68-horse power.

The Mermaid, with Mr. George Rennie's conoidal propeller, is 130 feet long between perpendiculars, 16 feet 6 inches broad, 9 feet deep in hold, and of 164 tons burthen. She has two engines, on the direct-action principle, of 45 horse power each, which, with the boilers and appendages, weigh altogether only 47 tons. The cylinders are of 37 inches diameter: the length of stroke, 32 inches; number of strokes per minute, 35 to 36. The motion is communicated to the propeller through the medium of two pairs of cog-wheels.

The Screw-Propeller, by Mather, Dixon, and Grantham, of Liverpool, has been very successful with an iron vessel, fitted with their patent improvements. The screw is worked direct, without the intervention of spur-wheels, by the aid of a steam engine and boiler on the locomotive principle, consisting of two cylinders 13 in. diameter, and 18 in. stroke, and when light, the screw makes about 85 revolutions per minute; the pressure of the steam in the boiler is about 50 lbs., and is used expansively. The vessel is 65 feet long, 12 ft. 6 in. beam, and draft 3 ft. 9 in.

The British Steam Frigate Penelope has created much interest in the nautical world, by being cut in half and lengthened 63 feet amidships, and transformed from a sailing to a steam frigate. The engines are by Seaward and Capel. There are two of them, conjointly being 700 horse power, although the nominal power is only 620 horse, the velocity of the piston being taken at 220 feet per minute. The diameter of the cylinder is 92 inches, and the length of stroke nearly 7 feet. Every part of the engines and boilers is made adequate in capacity and strength for 700 horse power. The engines are made upon the direct-action principle, and upon the same plan as the engines of the *Cyclops*, *Gorgon*, and steam frigates in Her Majesty's steam marine. The engines are furnished with an apparatus, by which the paddle-wheels, one or both, can at any time be disconnected from the engines. The chimney of the boiler is arranged like a telescope funnel in two parts to slide into or shut up one within another. She has three masts, and is rigged in every other respect as a sailing vessel, with the exception that the yards connected with the mizen mast will be struck, and only hoisted when required to be used.

The Peiki Tijaret (The Precursor of Trade) has been built for the Ottoman Steam Navigation Company, for the conveyance of the mail and passengers between Constantinople and Trebison. She was constructed from the designs of Messrs. Ritherdon and Carr, by Mr. Fletcher, and fitted with engines by Miller, Ravenhill, and Co. Her dimensions are, length between perpendicular, 168 ft., beam, 26 ft. 6 in., depth of hold, 16 ft. 6 in., and draft, 10 ft. 6 in.; burthen 468 tons, O.M. She has a pair of beam engines of 90 horse power each.

The Bentinck Steamer, built for the Peninsular and Oriental Steam Navigation Company, is 250 feet in length from the head to the taffrail, 40 feet in breadth, and 31 feet in depth, and admeasures, including the spar deck, 2,020 tons. Her engines are of 520-horse power, and her cost about £84,000. The 'Bentinck' was launched at Liverpool on the 17th January, 1843. The state saloon is about 32 feet square, being the whole width of the vessel at the stern, and is approached by a corridor. On each side are ranges of state cabins, and at the end is the ladies' cabin on one side, and stewards' room on the other. The decorations were designed and furnished by Mr. Bielefield, of London and Liverpool; those in the state saloon consist of a series of ten views from Affghanistan, beautifully enamelled on slate by Steedman; the frames are of Bielefield's papier maché. The ladies' cabin is fitted up with paintings, enamelled on slate, by Heedman, after Watteau. The ship is divided by iron bulk-heads into five compartments, giving her great safety in case of accident; and there are large cisterns for water, hot and cold baths, improved warming apparatus on the worm-tub principle, and every other essential to make her one of the most complete and efficient steam vessels ever produced.

The Virago is one of the second class frigates belonging to our service. Her dimensions are as follow:—Length between perpendiculars, 180 ft.; keel, 156 ft.; extreme breadth, 36 ft.; breadth for tonnage, 35 ft. 8½ in.; moulded breadth, 35 ft.; depth in hold, 21 ft.; tonnage, 994, M.N. She is fitted with two engines of the collective power of 300 horses, manufactured by Boulton, Watt, and Co. which occupy less space than any yet employed in her Majesty's navy or otherwise.

The "Waterman, No. 9," is a little iron steamer, constructed by Napier, of Millwall, for the Waterman's Company, under the guarantee that she should beat every vessel of her class, and burn less fuel; both of which feats she has achieved. Her length, between perpendiculars, is 107 feet; breadth at paddle-boxes, 15 feet; depth, 7 ft. 2 in.; draught of water, 2 ft. 9 in. The vessel is propelled by one engine, with a cylinder of 30 inches diameter, and 3 feet stroke, which is supplied with steam by a cylindrical boiler 7 feet in diameter. The boiler is placed in the vessel upon its end, so that it only occupies a superficies of the vessel's floor equal to that of a circle 7 feet in diameter. The bottom of the vessel is made double, and the space between the two bottoms is made available for accomplishing the condensation of the steam by external cold. The boiler is consequently supplied only with clean and fresh water; and should the bottom of the vessel be injured by any casualty, no leakage into the ship can, therefore, ensue. The engine of this "Waterman" is "direct action;" but its *directness* is of a peculiar description. There are four piston-rods, which are prolonged above the shaft by a distance equal to the length of the connecting-rod. Upon the top of these piston-rods a cross is placed, and from the centre of this cross the connecting rod is hung. The air-pump, feed pump, and bilge-pump, are wrought by a short lever, one end of which is attached by links to the cross. The paddle-wheels are made with leathering-floats, which enter and leave the water perpendicularly, or at any desired angle, in a manner similar to that of Morgan's wheels. The parallelism, however, is differently maintained, being accomplished by a ring suspended in a position eccentric to the wheel by the crank-pins of cranks attached to each float. The most extraordinary part of this vessel, however, is the boiler, which only occupies a circle of 7 feet in diameter upon the bottom of the ship. The fire-grate of the boiler is cylindrical, and is of the diameter of the shell, diminished by the breadth of a water-space all round. Above the fire, a water-space of 14 inches in depth extends all over the grate, with the exception of a space left at that part most remote from the fire-door for the escape of the smoke. All above this horizontal water-space is one large chamber, in the middle of which the chimney is situated; but around the chimney are a number of concentric circles of locomotive tubes, communicating at their under ends with the water in the horizontal water-space, and at their upper ends with the water reposing on the top of the chamber. The hot air proceeding from the fire must, before it can reach the chimney, wend its way through this forest of brass tubes: in which operation it is robbed of its heat to the uttermost farthing. The steam-producing powers of this boiler are very great, and its consumption of fuel moderate.—*The Artizan*, No. 3.

New Sailing Vessel with Auxiliary Steam Power and Screw Propeller.—The *Margaret* is a new Vessel, to run from Hull to Liverpool, *viâ* the Caledonia Canal, and constructed of iron, with water-tight bulkheads, on the clipper-schooner build, and rigged with proportionate masts and spars, for sailing on all occasions when the wind is favourable. She has two engines on board, of 14 horse power each, working an Archimedean screw (Smith's patent), to be used in calms or when close-hauled. This is the first sailing vessel ever built for carrying a large cargo, with small auxiliary steam power, working a screw. In calm and still weather, this vessel's speed, with only 28 horse power, and a cargo on board of 190 tons dead weight, was upwards of six knots per hour: close-hauled, and reduced to her fore and aft canvas, on applying the screw her speed was raised from three knots to seven and a half and eight knots, the screw not only destroying the lee-way entirely, but bringing her up to windward of her course; and, with a fresh breeze on her quarter, and all sails set, the screw also at work, she ran nine and a half to ten knots. She beat through the Pentland Frith, in a heavy gale of wind, with the screw entirely disconnected, weathering and beating completely eight or ten merchant-vessels in company, and was only kept way with by a cutter, supposed to be one of the revenne cruisers.—*Hull Packet.*

ACCIDENTS ON RAILWAYS.

THE official Report, lately published, shows a progressive diminution in the number of Accidents. The last report contained an analysis of the returns of accidents from the 12th of August, 1840, the date of the passing of the Act for the Regulation of Railways, to the 1st of January, 1842, from which it appeared that the number of railway accidents of a public nature, attended with personal injury, during the last five months of 1840, amounted to twenty-eight, by which twenty-two deaths and upwards of one hundred and thirty-one cases of injury were occasioned; while during the twelve months of 1841, the number of accidents of a similar description amounted to twenty-nine, with twenty-four deaths, and seventy-one cases of injury. During the past year (1842), the number of accidents of this description had been only ten, the number of deaths five, of which only one occurred to a passenger while travelling by a train and not observing the proper degree of caution, and the number of cases of injury were only fourteen. These did not include accidents which had happened to individuals owing solely to their own inadvertence and misconduct, nor accidents to servants of the company under circumstances involving no danger to passengers, neither of which could be fairly classed among railway accidents of a public nature. With respect to the comparative safety of railway travelling, a comparison of the number of accidents attended with death or injury to passengers with the number of passengers conveyed by railway during the same period, which appears to have been upwards of 18,000,000, it would seem to indicate that the science of locomotion, as far as the public safety is concerned, has arrived at a very high degree of perfection, seeing that out of more than 18,000,000 conveyed by railway in the course of the year 1842, only one had been killed while riding in the train, and observing the common degree of caution.—*Athenæum*, No. 804.

HAWTHORN'S NEW LOCOMOTIVE ENGINE.

ON the 11th of April, a splendid and powerful New Locomotive Engine, the *Star*, manufactured by the house of Messrs. R. and W. Hawthorn, Newcastle, made its first trial trip on the railway from Carlisle to the cut in Cardew Mines, a distance of six miles, which, on returning, was passed over in ten minutes, including one stoppage. The trial was in every respect satisfactory, both as regards speed and fuel. The quantity of fuel consumed by this engine is considerably less than any engine upon the common construction. The *Star* is constructed on Messrs. Hawthorn's patent principle, having return tubes in the boiler, in consequence of which the caloric traverses twice its length, thus giving it a greatly increased evaporative power.—*Carlisle Patriot.*

NEW STEAM BREAK.

Mr. Peter Robertson, superintendent of the engine department, on the Glasgow and Ayr Railway, has invented, and for some time applied, a very simple and effective Steam Break. The steam being introduced into a little cylinder, at the side of the fire box, presses upon the piston, which is connected almost immediately to a strong iron or steel hoop, which is thus made to apply exactly, and press with great energy upon the circumference of the driving wheel. The effect is to stop the train in much shorter time than can be effected by the ordinary carriage breaksmen.

WOODEN RAILWAYS.

A new system of Railroads, composed entirely of wood, has been laid down to test the principle, near Vauxhall Bridge. It is the invention of Mr. William Prosser, who has proved the system. The line laid down, though short, has yet a variety of gradients as well as curves and straight lines, as the following statement will show :—For 33 feet fall, 1 in 25 ; 85 feet, 1 in 400 ; 170 feet rise of 1 in 100 ; 80 feet level, 140 feet fall of 1 in 95 ; and 25 feet rise of 1 in 12, in which line there is a curve of 720 feet radius. The line is constructed of Scots fir rail, 6 inches square, prepared by Payne's process, that of exhausting the pores of the wood, and injecting, under great pressure, metallic solution, and afterwards lime, which semi-petrifies the wood, rendering it indestructible by damp, &c. It also gives it the properties of resisting pressure and wear to a great extent, while it increases the " bite" of the wheel, enabling locomotives to ascend inclines otherwise impracticable. This being the case, railways can be made at comparatively less cost, as the great outlay is caused by the necessity of having as level a line as possible, and instead of going round or over hills, the practice is now to go through them, to the manifest loss of the shareholders.

There is a locomotive engine at work ; this engine, a common road carriage, built by Mr. John Squires, is adapted for running on the wood rail by another contrivance for guiding the locomotive. This consists of an addition of anti-friction wheels fixed to each end of the carriage ; these wheels run on bevil axles, and have a double flanch, the inner flanch running parallel to the inside of the rail, and the upper one parallel to the surface, but not touching it, except in cases of accident to the main wheels, when they come on the rail, and convey the carriage to its destination in safety.

THE KINGSTOWN AND DALKEY ATMOSPHERIC RAILWAY.

Atmospheric propulsion on railways is now an *accomplished fact.* Several preliminary trials have been made on the line we are about to describe, and very shortly the establishment will be in full operation.

The scene of this triumph of science is one line of the train laid down for the purpose of conveying granite from the quarries of Dalkey for the construction of the magnificent harbour of Kingstown.

It will scarcely be necessary to describe the general principles of the Atmospheric Railway; but there are some details connected with its practical application which it may be requisite to enter into, as the applicability of the system depends principally on the mode of keeping the pipe air-tight. This explanation we quote from No. 10 of the *Artizan*, a work at once sound and popular, elaborate and economical: In the Atmospheric Railway, a pipe of about 12 inches diameter is laid between the rails on which the carriages run; this pipe is exhausted at one end by an air-pump; a travelling piston is forced along it by the pressure of the atmosphere; and a rod, or plate, of iron, connecting the piston with the carriages, traverses a slit on the top of the pipe. The great difficulty to be overcome was to cover this slit with a substance which would be air-tight, and yet would permit the connecting rod to pass without offering much obstruction.

For this purpose the opening at the top is covered by a continuous valve, extending the whole length of the pipe. It is formed of leather riveted between two iron plates. The upper plate is wider than the slit, and prevents the leather from being pressed in by the pressure of the atmosphere; the lower plate just fits the slit, and is curved to the shape of the pipe. One edge of the leather is fastened to a longitudinal rib, cast along the opening, and forms a hinge, as on a common pump valve. The other edge of the valve, when it covers the opening, forms, with a ridge cast on the pipe, a channel or trough, on its whole extent. This trough is filled with a composition of bees-wax and tallow, which, when melted and cooled, adheres to the side of the valve, and keeps it air-tight. As the travelling piston is forced along the pipe, one side of the valve is raised by four small wheels fixed behind the piston, so as to admit the connecting rod to pass. The opening thus made also admits the air to act against the piston. The rupture thus made in the composition of wax and tallow is cemented again, before the train passes, in the following manner:—A steel wheel, regulated by a spring, is attached to the carriage, and presses down the valve immediately after the connecting arm has forced it open, and a copper heater, about 5 feet long, filled with burning charcoal, passes over the composition and melts it, thus leaving the valve air-tight as before, and ready for the next train. A protecting cover, formed of thin plates of iron about 5 feet long, and hinged with leather, is placed over the valve, to protect it from the rain or dust. It is contemplated to have each pipe about three miles long, with a stationary engine for each length of piping to exhaust the air; and an arrangement is made, by means of which the piston, as it approaches the end of the pipe, opens a valve which admits it into the next length of piping, so that the train may proceed without stopping.

It is evident that as the tractive force is derived entirely from the pressure of the atmosphere on the piston, its amount will depend on the area of the piston, and on the extent to which the exhaustion of the air can be carried by the air-pump. It must also be evident that the difficulty of keeping the pipe air-tight will increase with its length, and with the pressure obtained. The vacuum-pipe on the branch of the Birmingham, Bristol, and Thames Junction Railway, where the atmospheric system has been in operation for more than three years, is only 9 inches internal diameter, and but half a mile long. It is on an incline of part 1 in 120, and part 1 in 115. A vacuum, equal in some instances to a column of mercury 23½ inches high, has been obtained, and loads of 13 tons have been propelled. On the Dalkey branch of the Dublin and Kingstown Railway, the pipe is 15 inches in diameter, and its length, so far as it has been tried, is one mile and a quarter. The average incline is 1 in 100; the exhaustion has been extended to 22½ inches of mercury, and three carriages loaded with passengers have been propelled up the incline at a speed exceeding 40 miles an hour.—See the engravings of this Railway, in the *Illustrated London News*, No. 88; also the substance of the Report to Parliament on this invention, in *Year-Book of Facts*, 1843, p. 14.

COST OF BRITISH RAILWAYS.

Designation.	*Length.*	*Cost.*
Arbroath and Forfar	16	£160,000
Androssan and Johnstan	5½	19,250
Aylesbury	7	59,000
Ballochney	6	38,431
Birmingham and Derby	38¾	1,030,000
Birmingham and Gloucester	55	1,329,300
Bishop Auckland	8¼	96,000
Bodmin	14½	35,498
Bolton, Kenyon, and Leigh	9¾	157,750
Brandling Junction	17¾	326,790
Canterbury and Whitstable	6	80,000
Chester and Birkenhead	14¾	496,999
Chester and Crewe	20½	458,333
Clarence	32½	500,000
Dublin and Kingstown	6	303,724
Dundee and Arbroath	16½	140,000
Dundee and Newtyle	12½	170,000
Durham Junction	4½	130,000
Durham and Sunderland	13¼	256,000
Eastern Counties	18½	1,234,958
Edinburgh and Dalkeith	8½	133,053
Edinburgh and Glasgow	46	1,200,000
Edinburgh and Newhaven	2	140,000
Garnkirk and Glasgow	8	107,364
Glasgow and Ayr	33½	732,381
Glasgow and Greenock	22½	533,333
Grand Junction	82½	1,921,496
Great Northern	45	1,300,000
Great Western	117½	5,508,160
Hull and Selby	8½	369,589
Lancaster and Preston	20	440,000
Leeds and Selby	20	340,000
Leicester and Swannington	16½	140,000
Liverpool and Manchester	30½	1,407,172
London and Birmingham	112¼	5,698,375
London and Blackwall	3½	643,343
London and Brighton	42½	1,800,000
London and Croydon	8¾	615,159
London and Greenwich	3¾	668,280

London and South Western	76½	2,054,386
Manchester and Birmingham	29½	895,491
Manchester and Bolton	10	650,000
Manchester and Leeds	49¾	2,113,988
Midland Counties	57½	1,257,811
Newcastle and Carlisle	61½	950,000
Newcastle and Shields	7	240,000
Northern and Eastern	28¾	269,496
North Midland	68	2,635,942
North Union	25	578,931
Paisley and Renfrew	3	30,000
Sheffield and Rotherham	5¼	170,000
Slamennan	12½	120,400
South Eastern	69	1,850,000
Stockton and Darlington	25¼	250,000
Stockton and Hartlepool	8	92,500
Whitby and Pickering	24	135,000
Ulster	7¾	107,602
York and North Midland	23	445,942

SOLID AND HOLLOW AXLES.

A PAPER, by Mr. J. O. York, who has a patent for Hollow Axles, was read at a late meeting of the Institution of Civil Engineers, giving an account of some experiments which he has made for the purpose of testing their strength as compared with Solid Axles. The paper described the common causes of fracture, attributing it to the concussion and vibration produced by various circumstances, such as a bad state of the line, the sudden opposition of any obstacle on the rail, or the shocks arising from the wheels striking upon the blocks or the chairs when thrown off the line. These shocks, which it was impossible to calculate the extent of, it was contended should be provided for by axles which would bear a series of heavy blows without fracture. The force of vibration, and its tendency to produce fracture in rigid bodies, was then treated of, with its effect in destroying the most fibrous texture of iron where elasticity was prevented, as is the case with railway axles, comparing the action with that upon the axles of ordinary road carriage, where the concussion was reduced by an elastic medium, such as the wood spokes of the wheels, which were bad conductors of vibration. By calculation it was shown that the twisting strain arising from the curves of the railway was of too small an amount to be considered as a cause of destruction to the wheels or axles.

A long series of experiments which had been made in the presence of Major-General Pasley, and numerous engineers, was then read, and showed results confirmatory of the position assumed by the author of the paper. In the discussion which ensued, it was allowed that theoretically the hollow axles must be stronger than the solid ones, inasmuch as the same weight of metal was better distributed, and the practical experiments fully bore out the theory. Some curious specimens of solid axles which had borne a great number of blows before breaking, were exhibited by the Patent Axle Company, from Wednesbury. The quality of the iron was excellent, and had the same material been manufactured into hollow axles, it was agreed that many of the melancholy accidents upon railways would not have occurred.—*Mechanic's Magazine*, No. 1022.

APPLICATION OF MANUAL POWER TO RAILWAY LOCOMOTIVES.

MR. TATE, contractor for keeping the rails and road of the Grand Junction Railway in repair, has constructed a machine, which does not weigh more than about four cwt., by which two men can, for a short time, convey it, themselves, and four men as passengers, at a speed of from 20 to 25 miles per hour; and, at half that speed, doubtless, they would carry three times that number. A little boy, not more than seven or eight years old, propelled the machine, from a state of rest to a speed of from three to four miles per hour, with the writer and another person on it, weighing together, it is imagined, not less than seven cwt.! Mr. Tate is of opinion that when labour is cheap, and under peculiar circumstances, manual labour may be even cheaper than horses or steam, especially where speed is required. The machine alluded to was made to accommodate the workmen, &c. on the line, and Mr. T. informed the writer that, with two men, he had gone fifteen miles of the line, stopping at twelve different points, within the hour. It is well known that a horse, on a good railway, will draw at least fifty passengers at the rate of twelve miles per hour; assume, therefore, that eight men shall be equal to one good horse (allowing 20 or 25 per cent. for friction of machinery, &c., we shall then still have a power equal to the horse), and, as that number exceeds the usual average number of each train on the Greenwich Railway, is there any thing to prevent six sets, or gangs, of men, performing 112 trips per day—viz. every quarter of an hour each way, for fourteen hours; fifty persons each trip, or 5,600 per day? and, if so, and able-bodied men can be procured at 2s. per day, then manual power will be cheaper than horses or steam, as this would only amount to about 1s. per trip, or about one farthing each for the whole distance of nearly four miles, or less than the sixteenth of a penny per mile! *Mr. Thomas Motley.—Mining Journal.*

DECORATION OF THE NEW HOUSES OF PARLIAMENT.

MR. BARRY has transmitted his Report to the Commissioners on the Fine Arts, in which he thus states his views relating to the Internal Decoration of the New Houses of Parliament:—

"With reference to the interior of the New Houses of Parliament, generally, I would suggest that the walls of the several halls, galleries, and corridors of approach, as well as the various public apartments throughout the building, should be decorated with paintings having reference to events in the history of the country; and that those paintings should be placed in compartments formed by such a suitable arrangement of the architectural design of the interior as will best promote their effective union with the arts of sculpture and architecture. With this view, I should consider it to be of the utmost importance that the paintings should be entirely free from gloss on the surface, and that they may be perfectly seen and fully understood from all points of view. That all other portions of the plane surfaces of the walls should be covered with suitable architectonic decoration, or diapered enrichment in colour, occasionally heightened with gold, and blended with armorial bearings, badges, cognizances, and other heraldic insignia, emblazoned in their proper colours. That such of the halls as are groined should have their vaults decorated in a similar manner, with the addition occasionally of subjects or works of art, so interwoven with the diapered ground, as not to disturb the harmony or the effect of the architectural composition. That such of the ceilings as are flat should be formed into compartments by moulded ribs, enriched with carved, heraldic, and Tudor decorations. That these ceilings should be relieved by positive colour and gilding; and occasionally by gold grounds, with diaper enrichments, legends, and heraldic devices in colour. That the screens, pillars, corbels, niches, dressings of the windows, and other architectural decorations, should be painted to harmonize with the paintings and diapered decorations of the walls generally, and gilding. The door-jambs and fire-places should be constructed of British marbles, of suitable quality and colour, highly polished, and occasionally relieved by colour and gilding in their mouldings and sculptural enrichments.

"That the floor of the several halls, galleries, and corridors, should be formed of encaustic tiles, bearing heraldic decoration and other enrichments in colours, laid in margins and compartments, in combination with polished British marbles; and that the same description of marbles should also be employed for the steps of the several staircases.

"That the walls, to the height of from eight to ten feet, should be lined with oak framing, containing shields with armorial bearings, emblazoned in their proper colours, and an oak seat should in all cases be placed against such framing. That the windows of the several halls, galleries, and corridors, should be glazed doubly, for the purpose of tempering the light, and preventing the direct rays of the sun from interfering with the effect of the internal decorations generally. For this purpose, the outer plating is proposed to be of ground glass, in single plates, and the inner glazing of an ornamental design in metal, filled with stained glass, bearing arms, and other heraldic insignia, in their proper colours; but so arranged as that the ground, which I should recommend to be of a warm yellowish tint, covered with a running foliage or diaper, and occasionally relieved by legends in black letter, should predominate, in order that so much light only may be excluded as may be thought desirable to do away with either a garish or cold effect upon the paintings and decorations generally. Practically, I consider that the double glazing will be of essential service in carrying out the system of warming and ventilating proposed to be adopted in the building generally; which system renders it unnecessary that the windows in those portions of the building above referred to should be made to open, so that all prejudicial effects upon the paintings and other decorations, which might be caused by the dampness and impurity of the atmosphere, and much practical inconvenience, and probably unsightliness, in the means that would be adopted for opening and shutting casements, would be avoided.

"That in order to promote the art of sculpture, and its effective union with painting and architecture, I would propose that in the halls, galleries, and corridors, statues might be employed for the purpose of dividing the paintings on the walls. By this arrangement, a rich effect of perspective, and a due subordination of the several arts to each other, would be obtained. The statues suggested should, in my opinion, be of marble, of the colour of polished alabaster, and be raised upon lofty and suitable pedestals, placed close to the wall in niches, surmounted by enriched canopies; but the niches should be shallow, so that the statues may be as well seen laterally as in front.

"The architectural decoration of these niches might be painted of such colours as will give the best effect to the adjoining paintings, being relieved in parts by positive colour and gilding; and the backs of them might be painted in dark colours, such as chocolate, crimson, or blue, or they might be of gold, for the purpose of giving effect to the statues."

OPENING OF THE NEW GRAVING DOCK AT WOOLWICH.

The opening of this stupendous work took place on July 18, when the Dock was entered for the first time by Her Majesty's Frigate, *Chichester*, for the purpose of being coppered, &c.

The basin in question is of solid granite, with steps, or alters, on each side, fifteen inches to one foot deep, affording facilities for descending to the bottom, and also for props or supports being affixed, thus enabling any vessel, whatever may be her size, to be supported on her keel without injury. The length is 300 feet at the top of the water, 245 feet at the bottom; the width of the basin is 80 feet at the top, gradually diminishing as the basin deepens. As it approaches the bottom it presents the appearance of a perfect concave some 26 feet deep. To this basin there are two folding gates, or locks, extending the whole width of the dock, made of iron and timber doubled, and weighing about 60 tons each; and the perfection with which these gates work, and are adjusted to each other, may be seen in the fact, that though each of them is of the enormous weight of 60 tons, two men, or rather a boy and a man, can move them easily. These gates open to the general basin communicating with the Thames. The dock itself is filled by the river tide, or by a steam-engine, working with two twenty-horse boilers, which can either fill the dock or withdraw the water in about six hours' time. When the engine is required to empty the dock, the water withdrawn from it can either be discharged into the common sewer, or into the basin, which communicates with the Thames. The engine is situated some hundred yards from the basin, is by Boulton and Watts, and is a beautiful piece of mechanism. The time it takes to empty the dock varies according to the size of the vessel received in it, a large vessel displacing more water than a smaller one. In the case of the *Chichester*, which appeared to be of the size of a forty-six gun ship, the time taken was about six hours. There is also upon the top of the engine-house a tank, holding some two hundred tons of water, available in cases of accident, and, in the yard, there are also other wells accessible by pumps supplying fresh water for the use of the dockyard, the latter wells being perfectly unconnected with the dock itself.

The time occupied in these works has extended over something more than seven years, and the difficulties which the engineer has had to meet and surmount may be judged from the fact that the basin itself is cut through a stratum of peat, and another of quicksand, through which percolated a spring which afforded some eight hundred gallons of water per minute. The whole of these strata were dug through to the depth in some places of 125 feet, and the sub-springing waters were conducted through various channels towards the river. The alters, or steps, on each side of the dock, which are twenty-four in number, extend from the top to the bottom of the basin, which, viewed from its upper end, presents the appearance of an inverted parabola, and the whole of which is formed of hewn granite masonry; every stone being joggled to its neighbour by pieces of Bangor slate, so that no part of the work can sink in, or get out of place; or, if it should, then, that all parts of it would sink equally, without disturbing their respective bearings and proportions to each other.

The masonry, which is eighteen inches in depth, is laid upon concrete seven feet thick, The dock itself is executed from the plans of Mr. Walker, by Messrs. Grissell and Peto, and is calculated to have cost some eighty thousand pounds, exclusive of the steam-engine.—*Times.*

RAISING SUNKEN VESSELS.

Sir T. Deane has explained to the British Association the method adopted by his brother, Mr. C. A. Deane, to raise the *Innisfaile* steam-vessel, of five hundred tons, which was sunk by striking against an anchor in the Cork river, a few years ago. The ordinary methods of raising sunken ships having proved ineffectual, a coffer-dam was made round the vessel in the middle of the river, and pumped dry by means of eight or nine chain-pumps. The leak was ascertained by digging under the ship, and a cow-hide was nailed over it to keep it water-tight. The coffer-dam was removed as quickly as possible, when the *Innisfaile* again floated by her own buoyancy; and the steam having been got up, she was taken to Passage to undergo the necessary repairs. The whole cost was £400, and the work was done in the course of four tides.

CONCLUSION OF OPERATIONS ON THE WRECK OF THE ROYAL GEORGE.

On November the 4th, the divers worked for the last time in searching for guns, to which their efforts had been exclusively devoted for more than six weeks, in consequence of the whole of the woodwork of this celebrated wreck having previously been removed. When the *Royal George* went down, in 1782, there were one hundred guns on board, viz. twenty-eight iron 52-pounders, sixteen iron 12-pounders, twenty-eight brass 24-pounders, and twenty-eight brass 12-pounders. Of the above, six iron 12-pounders, and nine brass 12-pounders, were removed in the course of the same year by means of the diving-bell; after which, nothing was done till the year 1834, when Mr. C. A. Deane first brought the diving-helmet and dress (which was a very old idea, suggested in various books for nearly three centuries back,) to such a state of perfection as to render it available for the most important and practical purposes, to which it never had been applied until he showed the example.

In the years 1834, 1835, and 1836, Mr. Deane recovered seven iron 32-pounders, eighteen brass 24-pounders, and three brass 12-pounders, twenty-eight in all; for these he received salvage from the Board of Ordnance, after which the remaining guns being buried in mud, or under the timbers of the upper parts of the wreck, eluded his efforts, as nothing but gunpowder could render them accessible. In 1839, when Major General Pasley, then Colonel of the Royal Engineers, commenced his operations, he recovered twelve guns, eleven more in 1840, and six in 1841; but, in 1842, he only recovered one iron 12-pounder, because he then directed that the divers, who had got down to the floor-timbers and keel, should not lose time by searching for guns, but should confine their efforts to the removal of the woodwork of the hull; and he pursued the same system in the summer of 1843, until the whole of the keel and bottom-planking were got up; after which the half-anchor creeper drawn transversely, and a frigate's anchor longitudinally across the original position of the hull, proved that no more woodwork remained; he then directed that guns only should be sought for, in consequence of which no less than thirteen have been recovered this season. Hence, forty-two guns in all have been recovered by the divers employed under Major-General Pasley, which, with fifteen recovered in 1782, and twenty-nine recovered by Mr. Deane, as before mentioned, amount to a total of eighty-six, leaving fourteen guns still at the bottom; of which number six are iron 12-pounders, one is a brass 24-pounder, and six are brass 12-pounders. The quantity of iron ballast in the hold of the *Royal George* when she sunk was 126 tons 12 cwt., generally in pigs of seven to the ton, of which more than 119 tons have been sent up by the military divers, and delivered into Portsmouth dockyard; so that the quantity now remaining at the bottom is less than seven tons, being only forty-seven pigs, which, having been scattered about by the constant creeping, and by the numerous explosions, cannot obstruct the anchorage. In respect to the fourteen guns still remaining, all buried about four feet under the mud, and of which only one is a heavy gun, should a ship's anchor hereafter get hold of one of them, which is possible, though very unlikely, it will, on being weighed, raise the gun up to the surface of the mud, or a little above it, after which it will release it; and, if the spot be marked by a small buoy to guide a diver down to the gun, he may sling it with ease; whilst from its form it can in the meantime have done no injury, either to the ship's anchor or cable. The quantity of gunpowder fired this season amounted to 19,193 pounds, that is, to nearly 214 barrels.

Mr. Purdo, the principal master-attendant of Portsmouth dockyard, having examined the spot, by dragging a frigate's anchor repeatedly over it, and meeting no obstruction, reported to Rear-Admiral Hyde Parker, that the ground where the wreck of the *Royal George* ormerly lay was now clear, and quite as fit for the use of Her Majesty's ships as any other part of the anchorage at Spithead; which report, in corroboration of Major-General Pasley's opinion, having been communicated officially to the Admiralty, their lordships have ordered the wreck buoy to be removed from the spot, as being no longer necessary. In the sailing instructions annexed to the tide tables, annually published by order of the Admiralty, it will be seen that there were six or seven fathoms of water only over the wreck of the *Royal George*, the hull of which, then nearly perfect, stood 33 feet higher than the general level of the anchoring ground.

Though the demolition and removal of this celebrated wreck commenced in 1839, yet only two months of that year, and six months of each of the four succeeding years, that is, twenty-six months, or little more than two years, were employed in actual labour; and this object might have been accomplished much sooner, perhaps in half the time, if Major-General Pasley, who directed, and the officers and men who executed this important undertaking, had possessed on commencing it the experience that they afterwards acquired in the course of their operations, to which there was no parallel in the history of mankind; but to which Mr. Deane's introduction of the diving-helmet, and the improvements in the voltaic battery, especially that made by Professor Daniell, undoubtedly paved the way. In the course of these operations, however, Mr. Siebe's improved diving-apparatus was used exclusively after the first year or two, as being safer and more convenient than Deane's original pattern; and, latterly, plate batteries of zinc and iron were used instead of Daniell's constant battery, having been found more convenient for firing gunpowder, though not considered better for other purposes.—*Abridged from the Times.*

COFFER-DAM AT WESTMINSTER BRIDGE.

For some years past it has been known that the foundation of Westminster Bridge has suffered seriously, and, in fact, has become undermined to a considerable extent by the wash of the river. The consequence of this has been a settlement of the various piers, attended with an extensive alteration of the original level of the arches and road-way; whilst, from the soft nature of the stone, such parts of the piers as are exposed to the action of the atmosphere by the alternate rising and falling of the tide, have become much injured.

Mr. Walker, the eminent engineer, upon examining the foundation of the bridge, discovered that the edges of the caissons on which the piers of the arches were originally built, and which extended a short distance beyond the superincumbent masonry, had become undermined; and although those parts on which the piers rested, were solid and in good condition, (though, in some cases, sunk below their original level), yet that their projecting ends were forced upward; whilst the wash of the tide was hourly working under their edges, and thus rendering the foundation insecure.

To remedy this evil, Mr. Walker commenced by forming an extensive Coffer-Dam, by driving down two rows of piling into the clay below the gravelly bed of the river; and having done this, the whole of the gravel and clay between the inner and outer faces of the Coffer-Dam was excavated to a considerable depth below the level of the caissons. This excavation was then filled up with puddling, thus excluding the possibility of any leakage, either through or under the piling; and by which means was obtained a certainty of carrying on the works, not merely secure from occasional interruption by water, but in perfect dryness at all times. The Coffer-Dam being thus made secure, the whole of the water, gravel, sand, and soil, between the inner face of the Coffer-Dam and the foundation of the piers, was removed to a level of 3 feet below that of the caissons themselves, which were left perfectly dry. To restore the foundation, Mr. Walker surrounded all the piers at a distance of 6 feet from the stone-work facing with a series of piles of green beech, 15 feet long; their lower ends being driven many feet into the clay, and their upper extremities cut off flush at a level with the edge of the foundation. This range of piling had bolted on to it walling-pieces at the distance of every 2 or 3 feet; the bolts extending through the piling, and being made fast to the bed of the caisson itself. The space between the inner piling and the caisson was then filled up within a short distance of the top with concrete, on which is laid squared masonry paving 18 inches in thickness, accurately fitted. The piers of the bridge themselves, on the southern side, were carried out or extended some 12 feet beyond the face of the original pier, and were based on platforms of wood, resting at distances of 3 feet on bearing-piles. The whole of the masonry is executed with Bramley Fall stone, cemented with pozzolano. The new stone facings of the piers average 2 feet in thickness, *i. e.* the headers are 2 feet 6 inches thick, and the stretchers 1 foot 6 inches; and they have dove-tailed joints.

It will thus be seen that the outer edges of the caissons on which the piers rest were completely surrounded and defended from the underwash of the water; whilst the foundations were extended and rendered completely solid—first, by the beech piling, which, being at all times covered with water, and never exposed to alternation of wet and dry, may be supposed to be almost imperishable; and secondly, by the intervening concrete and stone covering.

The under surfaces of the piers and arches were completely repaired, and, where necessary, faced with fresh stone-work; and all injured or unsound arch-stones are replaced by new ones. In the first place, the diameter and form of the stone to be replaced having been determined by accurate measurement, three pieces of stone were prepared, which, when placed together, exactly corresponded with the size of that to be displaced; the injured arch-stone was then cut out, and a large piece, corresponding exactly with the lower portion of that removed—*i. e.* having its inner surface larger than its exposed surface—was next laid in its place, but having upon its lower surface a projection or joggle fitting into a cavity in the lower stone on which it rests. The two upper portions, which are nearly perfect cubes, were then placed upon the top of the new stone, and were thus fastened to it: corresponding holes were made on the surface of the upper and lower stones; in the hole of the upper one was fixed a sort of slate bolt, kept from falling out by a string, and which preserved the end of it level with the surface of the stone in which it was eventually to enter. Upon this latter being put into its proper place, with the hole on its lower surface containing the bolt brought right over the corresponding hole in the lower stone, the string was cut, the bolt let fall with its lower end into the under stone, and part of its upper end in the upper stone, thus accurately connecting the two. Such was the state of the works at the close of April last.

Messrs. Walker and Burgess then thought it prudent to take the opinion of two other eminent engineers, Messrs. Cubitt and Rendell; we understand their opinion also to have been that the sinking of the piers of the bridge was caused by the great load upon the clay foundation, there being no piles under the bridge, and the ground on the Surrey side being of a loose nature.

In autumn last, the carriage-way of the bridge was stopped, the state and situation of that part of the bridge by which the alarm had been caused, rendering this step necessary. The following was the state of the works at the close of the year:—The pier called the "seventeen-feet east pier" has been repaired and widened. Its pressure on the bed of the river was found to be at the rate of five tons and a half to a square foot; the timbers of the original caisson, which were very much decayed, had been on the edges of the stonework of the pier forced out of their horizontal position, and bent and broken upward by the enormous weight. The engineers, amongst other means to remedy this defect, enclosed the whole of the lower portion of the pier with sheet piling, driven seven feet into the clay of the bed of the river, and made water-tight by the closeness of the piles one to the other. Between the piles and the pier, stonework, closely cemented, was introduced, and the work was submitted to the judgment of those who were considered competent to form an opinion, and who gave an opinion that the means adopted were the best that were available. Nevertheless, the pier began or continued to sink, and danger was apprehended for the fate of the arch which it supported. The plan adopted to prevent such a catastrophe, and which it is hoped will prove effectual, was this—the pavement of the bridge was taken up, and the immense mass of Kentish rag-stone, cement, &c. composing a concrete, and weighing upon the pier 2,400 tons, was removed from the spandril of the arch. Since this has been done, the pier has remained firm, and the settling at the foundation appears to have ceased. The concrete has since been removed from the spandrils of all the arches; and, in the place of a solid mass, brick arches have been substituted between the spandrils, by which nearly a third of the weight of the bridge will be removed, and the consequent pressure of the piers on the clay-bed of the river relieved. The enormous weight of the balustrades and the heavy recesses will be removed, by which a further reduction of weight will be obtained, and the future projected ornamental alterations facilitated*.—*Times.*

* For Reports of the previous Repairs of Westminster Bridge, see *Year-Book of Facts*, 1839, p. 43; 1840, p. 93; 1842, p. 59.

GREAT MINING OPERATIONS NEAR DOVER.

MAJOR-GENERAL SIR C. WILLIAM PASLEY has addressed to the Editor of *The Times* a long and important letter respecting the great Explosions near Dover, by which Round-down Cliff, an immense projecting mass of chalk in the proposed line of the South-Eastern Railway, has been thrown down. "To Mr. William Cubitt, the engineer in chief of the railway," observes the Major, "is justly due the merit of having conceived the idea of removing a mass of chalk rock nearly 300 feet in length, but of still greater height, and averaging 70 feet in thickness, by simultaneous explosions of gunpowder, instead of employing labourers to scarp it away, which would, probably, have cost nearly £8,000; the merit of success also belongs to him, inasmuch as he took the most judicious means to insure it." Our further extracts relate to the firing of the batteries.

"The whole of the arrangements for firing these great charges by the voltaic battery were made by Lieutenant Hutchinson, assisted by Lance Corporal John Rae, and Private Thomas Smith, of the Royal Sappers and Miners, and by two naval pensioners, John Leary, a blacksmith, capable also of working in tin or copper, and William Gordon, a rigger, all of whom had been employed under the same officer at Spithead. Leary, who distinguished himself some years ago whilst under the command of Captain Dickenson, of the Royal Navy, by converting ships' tanks into a diving-bell, by means of which that enterprising and intelligent officer recovered the treasure sunk in the Thetis frigate on the coast of Brazil, was employed on his arrival at Dover in making voltaic batteries for the proposed explosions, nine in number, each consisting of six cells of Professor Daniell's constant battery, such as had been used by me in all my mining operations; and he also put together the wires for three conducting apparatuses, each 1,000 feet in length, and consequently composed of 6,000 feet of copper wire. Each apparatus consisted of a pair of wires attached to a strong rope, and secured and insulated by Gordon in the same substantial manner that had been adopted by us at Spithead; for though there was very little necessity for guarding against the action of water, yet the letting it down and dragging it up the high chalk cliffs exposed this apparatus to a good deal of wear and tear; and it might also have been injured by the hob-nailed shoes of railway labourers, to which it was continually exposed, as I observed particularly on the day it was used, when every person that came near it trod upon it; and which, had it not been thus protected, might have destroyed the connexion and prevented the explosion, of which I have known instances in the course of our former experiments. As soon as the batteries and conducting apparatuses were complete, Lieut. Hutchinson made experiments to ascertain whether he could fire all the three charges simultaneously by one powerful battery, as had been done by Dr. Hare, of Philadelphia, who first applied voltaic electricity to practical purposes, by using it for blasts in rocks to obtain stone for building, in 1831, as minutely described in Silliman's *American Journal of Science*, vol. xxvi. p. 352; and also briefly noticed in the Transactions of the British Association for the Advancement of Science, held in Bristol in 1836. From his own experiments, made with this object, Lieutenant Hutchinson drew the same inference that I had done about three years before,—namely, that one cannot depend upon more than two charges exploding simultaneously, for though by a battery of extraordinary power he succeeded in firing twelve small experimental charges at the distance proposed for the great mines under his direction, yet there was a perceptible interval of time between the reports, which resembled a volley of musketry rather than the discharge of a single gun. He therefore determined to adopt the plan which I had proposed to use in 1839, had it proved advisable to fire four subaqueous charges simultaneously against the wreck of the Royal George, namely, to have a separate voltaic battery for every charge, and a person at each, with one conducting wire fixed to the pole of the battery, and the other in his hand ready to complete the circuit, according to the time marked by the chief, who was to give the words *one—two—three*—with an interval of about one second between each, and then the word *fire*, which was to be the signal for completing the circuit; and by this mode I expected that the explosions would all take place simultaneously, on the principle of marking time in music. The powder in each of the three chambers prepared for the several mines at Dover was contained in bags, placed in a large box, the former expedient having first been adopted in the practice of the Royal Engineers at Chatham; but we never used box and bags also, which I considered superfluous. As these boxes formed what may be called double cubes, Lieutenant Hutchinson very judiciously had a couple of short branches forking out from the lower extremity of each conducting apparatus into two central points of the oblong charge. Very short and fine pieces of platina wire were placed, according to custom, near the closed ends of strong tin tubes fixed to the outside, and leading into the centre of the powder-boxes, in which tubes bursting charges of fine powder were introduced, surrounding the platina wires, on the same principle that had been used at Spithead, but without those extreme precautions that had been found necessary to resist the great pressure of water to which our charges there were subject.

"In the course of Lieut. Hutchinson's experiments, an unforeseen difficulty occurred, owing to Daniell's batteries, which had been very promising, losing their power after the first frosts set in. This difficulty had never embarrassed us before, because in our experiments at Chatham we always took the battery out of a warm room, and it required a longer time to impair its power than our experiments there ever occupied; and at Spithead, where Lieutenant Hutchinson first used the battery, it was generally kept in the cabin of one of our lighters; besides which the work was only carried on during the summer months. He was, therefore, obliged to have a small wooden shed built for his batteries at Dover, and to keep fires lighted whilst using them, by which he god rid of the difficulty.

"I have since been informed, that in experiments tried at Calcutta, a very energetic battery lost half its power when the temperature fell from 120° to 60° of Fahr. When this difficulty occurred, a prejudice was naturally excited against Daniell's battery, and four very powerful plate batteries were ordered at Dover in consequence, which were made by an intelligent tradesman of that town. The trough of each of these contained twenty cells, according to Dr. Wollaston's construction, with zinc and copper plates, measuring seven by ten inches, the latter of which only were let down into the trough when the battery was about to be used; and these plate batteries were combined with the batteries made by Leary, as before mentioned; so that one very powerful battery, consisting of forty plates of the common system, and of eighteen cells of Daniell's constant battery, was to be used for each of the three great charges.

"At the same time, I am now of opinion that the plate battery is the most convenient of the two for firing gunpowder, and the simplest that I have seen is that which is now being used by Mr. R. Davidson, of Aberdeen, in his interesting exhibition of electro-magnetic power at the Egyptian Hall, Piccadilly. This battery, which contains twenty cells, differs from Dr. Wollaston's in using amalgamated zinc, and in substituting plates of iron instead of copper, all the plates measuring eight by eleven inches, and the action being produced by diluted sulphuric acid, upon the purity of which, Mr. Davidson says, the efficiency of his battery chiefly depends. On inquiring who first adopted iron plates instead of copper, Mr. Davidson assured me that he had used the former metal himself for about twenty years, but that the merit of this arrangement was disputed by Mr. Sturgeon and Mr. J. Martyn Roberts. I advise those who ascribe the merit of applying the voltaic battery to the purposes of blasting in earth or rock, or the peculiar construction and management of the first plate battery, well calculated for this purpose, to any of our own countrymen, to refer to the documents before quoted, and they will find that they are doing an injustice to Dr. Hare, of Philadelphia. But it must not be forgotten, that Mr. William Snow Harris, of Plymouth, was prior even to Dr. Hare; having fired gunpowder by electricity in March, 1823, which he effected to the astonishment of numerous spectators by a common electrical machine, from the cabin of a small vessel at anchor in that port; whilst the charge was placed in another at a considerable distance, and separated from the former by the water, through which his conducting apparatus passed. But the electrical machine, though perfectly efficient, never would have superseded the common modes of firing mines, as the voltaic battery has done; because the former not only requires a much more delicate manipulation than could be expected either from civil or military miners, and would be more easily broken or deranged; but it also requires artificial heat at all times, even in summer; whereas the voltaic battery can always dispense with this very inconvenient arrangement, even in the depth of winter, excepting in the case of very long exposure to a low temperature."

A very minute account of this stupendous work, with nine clever engravings, will be found in the *Illustrated London News*, No. 40.

On April 18, another of these extensive "blowings-up" of Dover cliffs came off at Lydden-Spout coast-guard station. This blast proved proportionally successful in its effects to the unparalleled one, when, with the enormous quantity of 18,500lbs. of gunpowder, the destruction of Round-down cliff was effected on the 26th of January last. The mass of chalk operated on now formed the base of the same cliff, the crown of which, to the depth of 90 feet, was blown off by a blast consisting of 7,000lbs. of gunpowder, on the 2d. ult. The present blast consisted of upwards of 10,000 lbs. of gunpowder, which was placed in fifteen cells or chambers, at proper distances along the base of the chalky cliff about to be removed; and, the conducting wires being properly placed, all were fired at once, as on the occasion of the last blast, by an apparatus invented by the junior engineer, Mr. Hodges. This explosion seems to have created quite as great a sensation as the blast of Round-down.

NEW IRON BEACON FOR THE GOODWIN SANDS.

THIS Beacon, which has cost the inventor, Capt. Bullock, no little pains and expense to mature, is "ponderous footed;" and it consists of a cast iron chamber, six feet six inches high, by four feet square, terminating in a solid point, and weighing about four tons. Within the chamber there is contained a socket, which is strengthened by iron brackets. In this socket is fixed five feet of the circular shaft of the beacon, which is made of inch-iron, cast hollow, the diameter of the lower part of the shaft being seven inches, and of the upper six. The two portions of the beacon are united by a flange and core; and the entire height, from the top of the chamber to the mark, is twenty-seven feet. The mark is an ellipse, six feet by four in diameter, composed of round bars of wrought inch-iron, strongly secured to the shaft by a flange and core, constructed so as to form a most conspicuous beacon, and also to offer the least possible resistance to the action of the wind. Next spring, by the direction of the Elder Brethren of the Hon. Trinity Board, it will be planted at the eastern end of the dangerous Goodwin, on the south side of the Swatchway into Trinity-bay. The sand at this part of the Goodwin is of a very hard and compact nature, so as to render the sinking to any depth a task of no very easy completion; but it is expected that the ponderous foot, or base of the beacon, being inserted some nine feet in the sand, the pressure from without of the sand upon the sides and the top of the base, in addition to its own weight (which when filled with sand, will be upwards of six tons) will secure its perpendicular position and stability.—*Dover Chronicle.*

MAJOR PARLBY'S BREAKWATER.

THE Society of Arts have voted to Major Parlby a silver medal, for his plan of forming Breakwaters, of which the following description has appeared in the *Mechanics' Magazine*, No. 1039.

The principle of this breakwater is taken from what may be observed in every part of the world—viz., the effects of reeds in rivers and lakes, and of seaweed in the ocean, in calming or subduing the turbulence of the swell or waves. Now there is a fucus, or marine plant, common in the seas about the Cape of Good Hope, which grows in a long tubular form, from twenty to thirty feet in length; at one end—that which floats upon the surface of the sea—it has a trumpet-formed termination, while the other attaches itself to rocks at the bottom of the sea. This has served as a kind of model to Major Parlby for the construction of the component parts of his breakwater, which is, indeed, merely planting a complete bank of artificial gigantic reeds in the middle of the sea. Major Parlby's first idea was the employment of a considerable number of spars, such as those used for scaffolding, enlarging one end, and adding cork to make them more buoyant, and attaching the other end by a piece of chain or rope, to the bottom of the sea, by means of ballast, cast iron framings, or other practical means, and placing these spars about three feet from each other from centre to centre, and from fifty to eighty in depth; but an intelligent gentleman having suggested the employment of Indian rubber, Major Parlby purposes now to form the breakwater by pieces of the coir rope of India, (which is itself exceedingly buoyant, and almost imperishable in salt water), and coating and forming the reeds, or floating trumpets, with India rubber, so as, in some degree, to resemble the very weed itself. A more happy, or a more practical plan of forming a breakwater, can hardly be conceived, as they can be of every form, shape, and size, and have this peculiar advantage over all breakwaters that have yet been proposed, that they do not interfere with the sea way, but a vessel can sail through them without injury in every direction, and thus no particular entrance to a harbour is required, but vessels can enter whatever the wind and tide may be. The application of this breakwater (Major Parlby remarks) may be found of great service for the following purposes:—For protecting roads for shipping, harbours, piers, landing places, &c. For forming harbours of refuge in the open sea for ships, coasters, and fishing-boats, wherever it is desirable, where good anchoring ground can be found. For preserving the coasts of the sea, and thus much valuable property from annual dilapidation and loss, by the falling of cliffs, the washing away of land, and from the effects of the violence of the waves. For breaking and calming the sea on all the sloping sandy shores where bathing machines are in use, so as to prevent the dangerous and injurious effects of breakers on the shore.

Practical men, who will immediately begin to inquire into the cost of breakwaters of this description, may be guided in their estimate by the calculation of the number of floating reeds, or trumpets required, placed at three feet apart, and fifty feet in breadth; a breakwater of extent equal to that at Plymouth, which is about 1700 yards, or nearly a mile, will require $1700 + 50 = 85,000$; the cost of these will, of course, depend upon the depth of the sea, as the trumpets must be long enough to reach from the bottom to the top of the water at the highest tide; and, as far as calculations have at present been made, the expense of the coir and India rubber trumpets, with the cast iron gratings and ballast to fix them securely at the bottom of the sea, may be about £2 each trumpet—consequently, the expense of a breakwater on this principle, equal to that at Plymouth, would be £160,000 —a very small sum compared with the expense of that magnificent work, which, however valuable as a protection to the harbour in severe gales of wind, has, in consequence of its unyielding materials, been the cause of the loss of several vessels; and as large open seaways are obliged to be left at each end of the breakwater, the swell and turbulence of the sea enters with great violence at times, rendering the passage in and out extremely dangerous. The breakwater, on Major Parlby's principle, may stretch completely across a channel from shore to shore, without offering much impediment to the seaway; and, certainly, no dangerous one. It is also capable of being removed at any time, without any considerable expense; a thing impossible to be done with stone breakwaters.

CAPTAIN NORTON'S LOTUS FLOATING BREAKWATER.

ON a lake or pond where the lotus grows, Captain Norton had observed, that when there were a strong breeze and waves on one side, on the other the water was comparatively smooth, resulting from the wind having no hold on the broad expanse of lotus leaves. He had also observed, after a storm at sea, the solid timbers of a wrecked vessel splintered in pieces by being driven against the shore, while a wicker basket escaped uninjured. These two results suggested the idea of constructing a floating breakwater of osiers, according to the singularly ingenious model in the Polytechnic Institution, the expense of which would be trifling compared with others.—*Polytechnic Journ.*

THE PLYMOUTH BREAKWATER LIGHTHOUSE.

THE last stone of the Lighthouse tower, at the western end of this stupendous sea-barrier, has been set. The tower is 122 feet in height from the level of the bottom of the sea, and fifty-six feet from the level surface of the breakwater. It is composed of thirty-one courses of large blocks of dressed granite, the first of which was laid on the 22d of February, 1841. The lighthouse is divided into five stories, in which are an oil-room, a store-room, a dwelling-room, a bed-room, and a watch-room. It has fourteen windows, seven of which are in the watch-room, the frames being constructed of bell-metal, as are also the outer doors. The lantern is the only thing now necessary to complete the lighthouse for service.

KEENE'S MARBLE CEMENT

Is described as a combination of sulphate of lime and alum. The gypsum undergoes the same preparation as for plaster of Paris, being deprived of its water of crystallization by baking. It is then steeped in a saturated solution of alum; and this compound, when recalcined and reduced to a powder, is in a fit state for use. The cement has been most extensively applied as a stucco; but the finer qualities (when coloured by the simple process of infusing mineral colours in the water with which the cement powder is finally mixed for working), being susceptible of a high degree of polish, produce beautiful imitations of mosaic, and other inlaid marbles, scagliola, &c. The Cement is not adapted to hydraulic purposes, or for exposure to the weather, but has been used as a stucco in the internal decorations of Windsor and Buckingham Palaces. From its extreme hardness, it has been found serviceable when used for imbedding and setting the tiles of tesselated pavements, &c.; and it has been adopted for this purpose at the French Protestant church, the new fire-proof chambers in Shorter's-court, and the Reform Club-House. The extreme hardness of the cement is its principal recommendation, when applied as stucco and for mouldings.—*Magazine of Science*, No. 216.

CONCRETE.

Mr. Hawkins has made to the British Association a communication on the formation of Concrete, showing more particularly the importance of having the stones of the proper sizes, so that the smaller ones should, as nearly as possible, fill up the interstices of the larger. Where the sizes were properly adjusted, he found that one proportion of lime to twenty of shingle formed a stronger concrete than when larger proportions of lime were used. Some engineers are in the habit of using one of lime to six of shingle, and the proportions generally used, are as one to eight. A specimen of concrete made in the proportions he recommended, and with shingle of proper sizes, was found after a short time to be stronger than an old Roman wall. Mr. Macneill said he preferred artificial cement to lime, and he had found great advantage to result from allowing the mass of concrete to fall from a height, by which means the shingle became more compressed together. Mine dust mixed with the lime, he believed, made the most perfect concrete. Mr. Jessop and Mr. Taylor also approved of mine dust. The latter observed, that it was probably from the quantity of iron in mine dust, that its adhesive properties were derived.

THE NENE ESTUARY EMBANKMENT.

This extensive undertaking was designed for the purpose of enclosing from the sea a tract of most valuable land, amounting to about 4,000 acres: this will, when enclosed, be principally the property of the Commissioners of the Nene Outfall, under whose auspices the works are being carried into effect, and in which they are assisted by the professional services of that eminent engineer, Sir John Rennie. The embankment is nearly three miles and a half in length, and for some distance averages twenty-eight feet in height, and at some parts of the line of works there is a depth at high tide of fourteen feet. About one mile and three quarters, or one-half the whole length, is already completed, and from this portion of the work, as a specimen, it is allowed by experienced persons that it will be one of the best examples of a sea-wall to be found in England. The land, it is estimated, will vary in value from £50 to £80 per acre, and, as a maiden soil, would be a fine site for a model farm of one of the agricultural societies of England. The works are rapidly progressing under the superintendence of Mr. H. H. Fulton, resident engineer, and the contract was taken in August, 1842, by Mr. H. Sharp, for £60,000. The Nene Outfall Commission has already effected great improvement in the condition of part of the fens of Cambridgeshire and Lincolnshire, by procuring a natural drainage for the lands in lieu of the inefficient and expensive system of drainage by windmills and other mechanical means, at the same time improving the navigation of the river Nene from the sea to Wisbech, to such an extent that formerly Humber keels of seventy or eighty tons could with difficulty reach that port; whereas now, vessels of 400 or 500 tons can, without the assistance of a pilot, owing to the straightness of the channel, get up to Wisbech without the slightest difficulty. This investigation, as an artificial tidal channel, is said to be the finest of that description in the country. It was designed and executed under the direction of the late Mr. Thomas Telford and the present Sir John Rennie, and so important has been the result of these works that the trade of the port of Wisbech has been trebled during the last ten years.—*Abridged from the Times.*

FALL OF GREENWICH PIER.

THE failure of this pier took place on the 16th of May. It was not a matter of surprise to parties who understand the practical construction of such works. The immediate cause of the failure was dredging in front of the piles after the contractors had left the works, and the arrangement of the piles being faulty, as regards construction; the upper part is composed of brickwork in cement, eighteen feet high, and fourteen inches thick at top, capped with granite, one foot thick, backed with concrete, and standing upon a foundation of Yorkshire stone landings, laid on a small quantity of concrete, with a substratum of foul gravel. The landing in front rests on a row of cast iron piles, twenty-five feet long, and five feet apart, grooved to admit between them three cast iron plates, each six feet in height; these iron piles were fastened by four, or two pair of wrought iron land ties, two inches square, to wooden piles, eighteen feet long, and twelve inches square, driven in land at a distance of twenty-five feet and a half from the front, and five feet apart. The high water mark is about four feet from the top, and low water mark twenty-two feet below, or about seven feet below the stone landing. From inquiry, it is suspected the lower ties were not fixed. The superincumbent weight of the brickwork appears to have forced out the upper part of the iron piles to a considerable distance, and caused the brickwork above to slip down, and force out the iron plate.—*Correspondent of the Civil Engineer and Architect's Journal.*

THE GREAT CROTON AQUEDUCT.

THIS stupendous aqueduct of 32 miles, for conveying water to New York from the Croton River, is near completion. The work was commenced in 1835: it consists of:—

First, an artificial reservoir, called the Croton River Lake, 45 miles from the Battery—the extreme part of the city: this lake is formed by a hydraulic stone-masonry dam, with two waste weirs or aprons, for the over fall of the water, one of 87 feet, and one of 180 feet, these being separated by a gate-house. The height of these waste weirs is 55 feet above the bed of the river, and 40 feet above the low water level.

The dam backs the water five miles, and makes a lake of an area of 400 acres, and of a capacity equal to 500 millions of gallons.

The water enters a gate-house, where the quantity is regulated, before it enters the aqueduct, which is a stone structure, lined and arched with brick.

The face of the interior of the aqueduct is at the bottom an inverted arch, width 6 ft. 9 in., height 8 ft. 5½ in., area 53⅛ square ft., about large enough for an omnibus and four to pass through. The line of the aqueduct being on a regular declivity of 13¼ inches to the mile down to the Harlem River, a distance of 33 miles, it has a line of tunnels of 6841 feet, being sixteen in number, sometimes through earth, and sometimes through solid rock; the deepest cut is 80 feet, and the least 25 feet. In Westchester only, the aqueduct crosses 25 streams of water, which are from 25 to 13 feet below the top of the aqueduct.

The grade line of aqueduct across the Harlem is 25 feet above tide water, and the top of the water now passes over Harlem River in one pipe of 36 inches, placed on the earthen dam made in the construction of the high bridge.

The bridge itself will be when finished one of the most stupendous works of the kind in the world. Its cost is estimated at one million of dollars, and its elevation is so great as not to impede the navigation of the stream. Some idea of this vast undertaking may be formed from the fact, that the excavation for one pier has been carried 34 feet below the surface of the water, and then a rock foundation not having been reached, 240 poles, from 30 to 40 feet long, were driven in for the purpose. Several piers having been already carried, by the aid of coffer-dams, from four to fifteen feet above high water mark.

The river is 620 feet wide at water line, but the slope of the river banks adds an additional distance of 830 feet, making in all 1,480 feet.

The plan now in progress crosses the river with eight arches of 80 feet span, and on piers of 31 by 44 feet at the base, resting on the bed of the river, and seven arches on piers on the land from the edge of the water up the two banks of the river.

The spring of one of the arches is 95 feet above the lowest foundation put down; the top of the parapet will be 149 feet from the lowest foundation. It is intended that the water shall pass over this bridge in pipes, to have it secure against the possibility of danger.

The interesting works at Clendinning Valley, being a bridge over a valley of 1,900 feet in breadth, the greatest height of the aqueduct, is 50 feet from the bottom of the valley; beautiful archways are constructed for three streets, 34 feet for the carriage-way, and 10 on each side for side walks.

Next in interest is the reservoir at Eighty-sixth Street, which might well be called the detaining or clarifying reservoir. It has two divisions, together thirty-two acres—greatest depth of water 25 feet, containing one hundred and fifty millions of gallons. Two lines of thirty-six-inch pipes connect this with the reservoir at Fortieth Street, which has also two divisions, forming together an area of four acres—depth of water when filled thirty-six feet. From this point four and a half miles to the Battery. Whole length of line from the Battery to the artificial lake fifty miles. There are in this great work 55,000,000 of bricks, and 700,000 cubic yards of stone masonry.

The water in the aqueduct is regulated at the entrance gate, so as not to flow under any pressure; it has not been permitted to flow in the division near the city at a greater depth than two feet, but the works at the Croton dam required a few days back that more water should pass through the first division (the distance between Sing Sing and the Croton River), being eight miles, and it was found to pass seventy-five millions of New York gallons in twenty-four hours, and that its velocity was over two miles per hour.

The Croton Lake now retains, beyond the daily river supply, in reserve, five hundred millions of gallons; and a small expense would add other immense artificial lakes to hold back an additional supply; but the necessity of this is hardly conceivable. It is estimated that the London supply, from all the companies, is but twenty-four millions of gallons, and Paris four millions only.

NEW HYDRAULIC MACHINE.

Mr. Schwanfelder, of Newington Causeway, has invented an apparatus for raising water, which, from its simplicity and extraordinary power, as compared with the common pump, will most probably, when generally known, be extensively patronized. It is merely a box, about nine inches square, and four thick, containing the principal motion, which is centrifugal: the handles for working it projecting on each side, and the ejection pipe placed in front; the pump barrel, which, in this case, is one inch and a quarter in diameter, proceeds from below to the water, within which is fixed a valve, which must, in every case, be within the usual atmospheric pressure-distance of the surface, as in the common pump. While the machine is in action, this valve remains open, and the water rushes in a continual stream; its use being to prevent the return of water on the pump ceasing work. This small model, with a discharge pipe not exceeding half an inch in diameter, will deliver about thirty-two gallons per minute, or eighty tons in twelve hours; and this with a force which a mere child might exert. On screwing on a jet, converting it into a force-pump, it threw a stream perpendicularly nearly forty feet, and horizontally a greater distance; and when water is required for the top of high buildings, its powers, as a lifting pump, are of the same powerful character. The box above mentioned will be, in the finished machine, nearly cubical, with several outlets, having each a stop-cock, and to which hose, or the ends of pipes, may be screwed, to carry the water in different directions, or in cases of fire. Such a machine for raising water will become of great importance in mines and collieries, for coffer-dams, well-sinking, theatres, factories, breweries, and all large buildings requiring a high service of water; and its application to garden and fire-engines will render them far more effective than any of the present plans.—*Mining Journal.*

WATER-JET PROPELLERS.

A CURIOUS mode of propelling steam-ships has been invented by Mr. Ruthven, of Edinburgh, who proposes to give a better direction to the propelling power by forcing jets of water through nozzles placed below the water line. One novel feature of the invention is, that it contemplates employing the head-wave, which is now one great obstacle to the progress of vessels through water, as a means of propulsion. To effect this, the water heaped up at the bow is to be admitted into two large orifices, which are to conduct it to a hollow axle; thence it is to be driven by the "centrifugal force" of revolving wheels to the peripheries, and forced through the jet-pipes into the water, the reaction of which it is expected will be a more effective and useful propeller than either paddle-wheels or screw. The plan is as yet only in model; and without wishing to prejudice the jet principle of propulsion, we must observe, that the notion of diminishing the resistance of the head-wave, by admitting the water to pass through orifices, is but little in advance of the Portuguese scheme for raising a car in the air by fixing a magnet at the top. We must add to that, the scheme is not a new one: it has been often tried, and always without success.—*The Artizan*, No. 9.

WATER-WHEELS.

MR. MALLETT, of Dublin, has read to the Institution of Civil Engineers, a long mathematical inquiry on this subject, and developed the following conclusions:—

1st. When the depth of water in the reservoir is invariable, the diameter of the water-wheel should never be greater than the entire height of the fall, less so much of it as may be requisite to give the water a proper velocity on entering the buckets.

2nd. When the depth of water in the reservoir varies considerably and unavoidably in depth, an advantage may be obtained by applying a larger wheel, dependent upon the extent of fluctuation and ratio in time, that the water is at its highest and lowest levels during a given prolonged period: if this be a ratio of equality in time, there will be no advantage; and hence, in practice, the cases will be rare when any advantage will obtain by the use of an over-shot wheel greater in diameter than the height of fall—minus, the head due to the required velocity of the water reaching the wheel.

3rd. If the level of the water in the reservoir never fall below the mean depth of the reservoir, when at the highest and lowest, and the average depth be between an eighth and a tenth of the height of the fall, then the average labouring force of the large wheel will be greater than that of the small one; and it will of course retain its increased advantage at periods of increased depth of the reservoir.

THE WATER-POWER OF GREAT BRITAIN.

IN estimating, numerically, in any known measures, the average quantity of water which rises from the earth in vapour, descends upon it in rain, or exists in the atmosphere, there are imperfections in the data, and other difficulties, which reduce the conclusions to mere approximations; and even as such they are far from satisfactory, though, so far as observation and experience have gone, there is some agreement between them and the theories.

According to the calculations, the average quantity of water suspended in the atmosphere, if it were all precipitated to the surface of the land and sea, would amount to four inches in depth, or 11,794 cubic miles of water. This is greatest at the equator, being about $8\frac{1}{3}$ inches, while at the poles it is only about $1\frac{1}{3}$; in the average latitude of Britain it is about $2\frac{1}{2}$ inches. The quantity of rain which falls would follow the same law, if it were not that different surfaces do not equally supply the same evaporating power. The average annual depth of rain for Britain, according to the experiments of Dr. Dalton and others, may be taken at 30 inches. This supplies all the springs, and all the water which works on the surface of the earth, including streams and rivers, and their floods; and the quantity discharged annually into the sea is estimated at about 13 inches depth in the year; but here it will be no great error if, for the sake of simplifying the calculation, it is taken at 12 inches, or four-tenths of the average fall of rain.* The surface of the British islands, in round numbers, as already hinted, is 77,000,000 acres, and, at the average given, it would be easy to calculate the quantity of water which falls upon it during any given time. If, however, the power of this water is sought, a smaller, but indefinite breadth of land must be taken, because there are some places which discharge no water, and others where it cannot be rendered available as a power. Say that the total breadth, in all the lands in Britain, from which it is available, is 50,000,000, and that for England and Wales 20,000,000; and, making allowance for waste, one foot in depth of water over each of these is a power, whether it can be turned to account or no.

The first gives 2,178,000,000,000 cubic feet of water, and the second 871,200,000,000 cubic feet.

To reduce these, or either of them, into horse-power, there is this datum, according to the ordinary estimates: about $37\frac{1}{2}$, say 38 cubic feet of water, falling every minute on an overshot wheel of 10 feet

* Prize Essays of the Highland Society, vol. vi.—On the Construction of Reservoirs of Water for Agricultural Purposes. By Messrs. James Adam and Findlater.

The depth of twelve inches is quoted, without acknowledging that it is correct: it is believed to be much more.

diameter, is reckoned the power of one horse. Divide each of these numbers by 525,960, the minutes in a year, and the first is the cubic feet for all Britain in each minute, and the second the same for England and Wales. Divide, again, by 38, and the results are the horse-power; that for the whole islands being a constant power of 108,973, and that for England, 43,590. This, however, supposes the water-power to be only on a ten-feet wheel, and that wheel to be in motion every minute of the year.

But in no one instance will such be the case. Twelve hours in the day will be the utmost length of working, and one-sixth of the year will suffice for ordinary farm work, and this gives twelve times the above number, or 523,080 horse-power. But this is supposing only a single ten-feet fall, and every additional ten feet doubles the power. Say that the average of falls, one with another, in England and Wales, is fifty feet, and the total horse-power working, as above stated, will be upwards of 2,000,000. This is for the surface water alone; and if the floods were conserved in tanks and reservoirs, judiciously placed, and of proper size, this power would be increased, and a great saving of alluvial matter effected; but there are no satisfactory data for calculating the amount.*

Then for the water which will be obtained by general drainage over and above the quantity which escapes from the lands, there are absolutely no data whatever, for that must depend on the breadth of land which is drained, and the quantity of water afforded by the subsoil springs. It has been calculated that, where the land before draining is very moist, the drainage water will irrigate, in a proper manner, one-fifth as much water meadow as the land drained.† But this is too much for the average of England, and we must not allow more than one-eighth, and perhaps one-tenth would be nearer the truth.

The usual estimate is, that 10,000,000 of the 12,000,000 acres of arable land in England and Wales require drainage; and, in order to carry the system of irrigation as far up the hills as possible, 10,000,000 more out of the residue, and which require draining, would be added to that amount. All this could not be done in a year, or probably in a century; but it is a result which could be aimed at, and therefore it may be kept in view. Water sufficient to irrigate about twenty acres would on a wheel twenty feet in diameter, give one-horse power; and if we divide by this, the 2,000,000 acres, irrigated by the drain-water of 20,000,000 acres, it would give us a power of 100,000 horse-power, upon a single fall of twenty feet. But when tanks and reservoirs are used, the last, if there be more than one, should be made to answer as mill-ponds. During heavy rain this would retain the flood-

* The alluvial soil deposited by the waters of the Nile, according to Mr. Rennell, is 14,784,000 solid feet per hour, and by the Ganges, 2,509,056,000 solid feet per hour.

The Mississippi deposits 8,000,000 solid feet per hour; and the Koangho, according to Barrow, carries into the sea 2,000,000 solid feet of sediment every hour.

† See page 34 of the Fourth Report of the Commissioners on the Nature and Extent of the Bogs in Ireland.

water and the substances with which it is charged, and thus conserving both the fertilizing and the mechanical power in those places where they might be most advantageously applied.

What have been stated are only approximations; but the principles are sound, and it may be of advantage to those who wish to study the subject, and profit by studying it, to have the outline of all its advantages before them. The next inquiry will be into the nature of the substances by which water should be impregnated for irrigation, and also the increase of manures for cultivated land that might be obtained by preserving the sewerage and refuse of towns.—From an exceedingly valuable and interesting pamphlet, by Mr. J. Bailey Denton, just published, entitled, "The Question, What can be done for British Agriculture? Answered;" quoted in the *Mechanics' Magazine*, No. 1024.

POWER TRANSMITTED BY BELTS.

A PAPER, by Mr. Sang, has been read before the Royal Scottish Society of Arts, descriptive of a method of ascertaining the amount of force transmitted by a Belt, and consequently the amount of power consumed by any machine driven by a belt. His method of finding out this will be understood from the following explanation:—When we see a belt passed over two pulleys, and look without any narrow examination at the motion, we regard the action as a very simple one; there is more in it, however, than appears at first sight. For the sake of clearness, let us call the driving-pulley the drum, and the other the pulley. The belt passed over them, whether plain or crossed, has two free parts, one of which draws, and the other of which follows. If it were possible that no force were needed to turn the pulley, these two free parts would be in the same state of tension; but whenever any resistance is made to the motion of the pulley, the drawing part is distended more, and the following part less than usual; and experiments show, that, within all practical limits, this change is exactly proportional to the pressure necessary for overcoming the resistance. As the movement proceeds, the distended part of the belt is lapped over the drum, and, so to speak, the contracted part is lapped over the pulley, so that the circumference of the drum moves more swiftly than that of the pulley: thus, if the distension be 1 to 100 for 100 inches of the drum there would only be 99 inches of the pulley passed over. The difference between the velocity of the drum and that of the pulley thus indicates the pressure needed to carry the drum round. Now this pressure, combined with the distance through which it acts, gives the force used; and hence, the simple difference between the distances passed over by the circumference of the drum and by that of the pulley is exactly proportional to the force; and we have only to contrive some method of registering this difference, in order to have a record of the total force transmitted by the belt. There may easily be contrived a variety of arrangements for showing the difference between the motions of the drum and pulley. Thus a pair of indicators may be fitted, one to each shaft, so as to tell the total number of turns made by each; from this number, by help of the measured diameter, the distance passed over by each circumference can be found, and thus the element for knowing the force transmitted can be had. Or otherwise —and this, perhaps, is the most convenient arrangement—a light pulley, having its circumference one foot, may be brought to bear against the belt on the drum, and another against the belt on the pulley; if these light pulleys have counting ears attached, a simple reading off and subtraction will give the difference of distance.

These remarks will, probably, sufficiently elucidate the principle of the plan. The actual amount of force corresponding to a certain indication must of course be ascertained by an independent method for the first belt; but that once ascertained, the amount of force due to any other indication, or any other belt of the same material, may be approximately computed, regard being had to the weight of a foot of belt. We look upon this expedient as one distinguished by great penetration, and by an ingenuity of the most refined description.—*Artizan.*

ROE'S ANTI-FRICTION PUMP.

A PUMP lately prepared by Mr. Roe for her Majesty's dockyard, upon the principle denominated by him as his Anti-friction Pump, promises to be of great power and utility, and is very simple, which in all things of this class is a great merit. The principal difference between it and the old pump consists in a reversal of the old method, inasmuch as in the old pump a leathern bucket is made to work in the pump-barrel or cylinder, while in this new and improved pump a cylindrical metallic piston is made to work in a metallic ring; and it will be instantly perceived that the difficulty of tight working may be abated with a corresponding decrease of friction. In the old pump the bucket plunger, by hard pressure against the sides of the pump-barrel, caused considerable labour to overcome, while in this the labour is so far diminished as to encourage the presumption that two men, with a double-action pump of 6½ barrels, will raise 120 gallons of water per minute. In ordinary calculation, however, it would be safe to say that the friction is diminished full 25 per cent. We can conceive nothing more admirable than this pump as a portable machine, to be fixed in a wooden case upon wheels, and transported to the scene of work in foundations, sewers, &c. The cost is not greater than that of the ordinary pump.

SHALDERS'S FIRE-ENGINE.

THE entire weight of this brass engine is only 26lbs. exclusive of the reservoir steadying stand, and it can be used wherever a lad four feet high can find elbow-room; a man working the lever with one hand and guiding the jet-pipe with the other, delivers at a moderate speed eight gallons of water per minute to an elevation, in calm air, of 45 feet, or to a distance of 60 feet. It is not subject to choke or to get out of order, whether it is much used, or remains for months idle. Access is had to the hydraulic working parts merely by turning one large screw.

AMERICAN IMPROVEMENT IN THE WIND-MILL.

Mr. Perry Davis has patented a modification of the ordinary vertical Wind-mill, with inclined sails or vanes. The shaft of the wind wheel has its bearings in the upper part of a tower, which rests, and turns, on a circular railway, and on a hollow shaft attached to the main framing. A solid shaft passes through the hollow shaft of the tower, and is made to revolve by a crown wheel on the shaft of the wind wheel; and from its lower end, motion is communicated to any kind of machinery to be driven. The lower inner edge of the tower is provided with cogs into which the teeth of a pinion, on the end of a vertical shaft, take for the purpose of turning it. This last mentioned shaft is connected with a centrifugal regulator, or governor, the balls of which are operated on by a sliding clutch that clutches either of two bevel pinions on its shaft, so that when the mill runs too fast the balls are thrown out so far as to clutch the upper wheel, and thus to turn the tower, and the wind wheel, from the wind; and when it runs too slowly, the balls fall, and clutch the lower wheel, which turns the wind wheel to the wind.

CLARK'S PYRO-HYDRO-PNEUMATIC APPARATUS.

A patent has been granted to Mr. C. Clark, 78, Cornhill, for a Pyro-hydro-pneumatic Apparatus invented by him. We are enabled to mention that the most novel part thereof is a steam condenser, which acts without the aid of cold water, or the coiled or any other tubing hitherto used in the process of distillation. The vessel used by Mr. Clark is capable of receiving and condensing a certain quantity of steam as fast as it comes over out of the boiler, and to do so at an equal ratio, without interruption. The liquid obtained is of as low a temperature as any produced in the common way. It is well known that the steam of certain liquids, when reaching the still- head (whence it is generally made to pass direct into the narrow coil pipe), remains impregnated with a proportion of such elementary impurities contained in the steaming liquid, as are capable of being atomically volatilized by a boiling heat exceeding 212°. Whenever these generally heavy impurities convey a bad taste, the condenser, as well as some other vessels connected with it, have the effect of removing such taste, without destroying any of the purer liquid combined with such odorous effluvia, which, as it were, rise at the top of the steam. This condensing apparatus may be attached to any still; and, in addition to its utility on the large scale, it will prove a great convenience in all distillations on the small one, by rendering the aid of the cold water tube unnecessary, yet condensing with uniform regularity, and making it possible to purify or rectify the steam rising into the still-head, prior to its liquefactionby the condenser.—*Mechanics' Mag.* No. 1022.

MARINE GLUE.

This appears to us one of the most valuable inventions of the day, and not one of the least extraordinary. We could easily have conceived the practicability of making a composition possessed of some of the qualities by which the glue is distinguished: there are substances familiar to us which would give the same adhesiveness, perhaps, and the same flexibility, but then they become softened by heat, and the substances again which resist heat are soluble in water. We have no doubt that Indian rubber is one of the chief ingredients of the glue, but Indian rubber alone would never answer, and the other substances with which it is compounded appear to completely remove the defects which would attach to Indian rubber singly.

It is needless to enter here into the details of the experiments by which the marine glue has been tested. Those experiments, however, have been most severe and conclusive. Pieces of wood joined by the glue have been subjected to adverse strains, and precipitated from a great height upon a granite pavement. They have also been exposed to shot and shells, and subjected to every conceivable *experimentum crucis*, and in every case in which the joining has been properly made, the wood has given way before the glue. In the case of violent concussion, the wood has been shattered in every direction, while the glue remained comparatively unaffected. These experiments have been publicly made at the dockyards of Woolwich and Chatham; so that they are completely authenticated.

Among the experiments were the following. A strain was applied to the extent of 19 tons, at which point one of the bolts broke, but the junction of the wood by the glue remained perfect. Two bolts of 1½ inch in diameter were inserted on the following day, and the strain was again applied until it reached 21 tons, when one of the bolts was broken, the junction of the wood still remaining perfect, and apparently not affected. Another experiment was tried with two blocks of African oak, of similar dimensions, but bolted in a different manner, so as to apply the strain at right angles to the junction made with the glue at the centre. The wood split at a strain of 5 tons, but the joint remained perfect. The glue in one case was applied to elm; it resisted a strain equal to 368lbs. on the square inch. This trial was made while the block was in a wet state, which state is considered most favourable for the effect of the glue. Several large pieces of timber were glued together and suspended to the top of the shears at the dockyard at Woolwich, at a height of about 70 feet above the ground. From that elevation they were precipitated on to the granite pavement, in order to test the effect of concussion: this wood was shattered and split, but the glue yielded only in one instance, in which the joint was badly made, and after the third fall. The cement mixed with poison has also been proposed as an application to the bottom of ships.

For joining together pieces of timber for large masts, the glue appears to be particularly valuable, as by virtue of its elasticity it opposes no impediment to the yielding of the mast, when a strain comes upon it. For keeping decks tight, again, it is of much value, as it is not disturbed by the working of the ship. It is also an excellent substance for filling up the cracks and flaws in timber, as, by cementing the sides of the cracks together, it renders it of no importance. These, however, are trivial uses. We are thoroughly convinced that ships will, before long, be put together by the marine glue entirely. And in the case of dock gates, breakwaters, and numberless other structures, it will also be extensively used. Those who are desirous of learning more respecting this excellent compound, we refer to a pamphlet entitled "Notes on the Marine Glue," by Alfred Jeffrey, patentee; a production of much literary merit, and singular modesty.—*Artizan*, No. 3. See also *Year-Book of Facts*, 1843, p. 76.

IMPROVEMENT IN IRON BOATS.

We notice in the Pittsburgh (U. S.) papers, that an improvement has been made in the construction of Iron Boats, to render them safe from accident. The vessel being built in the ordinary manner, an inner lining is introduced between the ribs, and fastened to them by screw bolts or rivets. This lining is from two to three inches apart from the outer covering, thereby rendering the spaces between the ribs a complete set of iron boxes. As the inner sheathing is made water-tight as well as the outer, however much the outer may be damaged the inner will still keep the vessel safe, and as the leak can only extend to the space between the rib or ribs immediately injured, a great amount of damage outside would cause but a small leakage. The lining being attached to the upraised limb or flanch of the iron rib, before it can be injured, the ribs must be torn apart, but to sunder them seems next to impossible, from the substantial manner in which they are held to their places, by the inner lining; but even should any partial damage occur, the bolts being easily got at, any leakage could be quickly stopped. At a comparatively small expense, a vessel is rendered by this combination a great deal stronger than one built in the old manner. Bulkheads are entirely dispensed with, leaving the run of the ship perfectly clear, an affair in itself of great importance to a ship of war, where room for manœuvring and the health of a large crew is indispensable. It is added, that the government steamer now on the stocks at Pittsburgh is to be supplied with this lining, and that when finished she will be the handsomest, strongest, and safest Iron Boat afloat.—*Mechanics' Magazine*, No. 1024.

PRESERVATION OF TIMBER.

A new process for the preservation of wood from decay has been submitted to examination by Mr. Payne. It consists in immersing the wood first in a solution of sulphate of iron (copperas), and then producing a vacuum in the tank containing the liquid. The air in the pores of the wood consequently escapes, and when the pressure of the atmosphere is again admitted, the sulphate of iron is forced into the vacant pores. The wood is afterwards immersed in a tank containing chloride of calcium mixed with water, and the process of exhaustion is repeated. The chloride of calcium where thus enforced into the pores of the wood is said to be decomposed, and forms with the previously injected sulphate of iron a new solid compound, sulphate of lime (plaster of Paris.) The specific gravity of the wood thus prepared is nearly doubled. This plan differs from the Kyanising process principally in the nature of the solution employed, corrosive sublimate being the substance used in the latter. The comparative merits of the two preparations can be tested by time alone. In the process of M. Boucherie, which received the sanction of the French Academy of Sciences, the preserving fluid is injected into the living tree, and the vital energies of the plant are made available towards imbibing the solution.

TIMBER TANK.

A WROUGHT-IRON cylinder, 51 feet long and 6 feet diameter, has been erected in Portsmouth dock-yard, for the purpose of "Burnettizing" timber under pressure. It is composed of plates half an inch thick, and double riveted; and the ends are of cast iron, with doors, 2 feet 6 inches square, for the admission of logs. It is fitted with two air-pumps of 14 inches diameter, for the purpose of extracting the air, and two force-pumps for increasing the pressure when filled with the solution. On a late trial, the cylinder having been charged with 20 loads of timber, the air-pumps, which are arranged to be driven by Lord Dundonald's rotatory engine, were set to work, and a vacuum of 26½ inches was obtained in 30 minutes. A cock in the connecting pipe was then opened, and the solution rushed into the vacuum from the cistern. When the cylinder was filled with the solution, the force pumps were set to work, and the pressure was raised to 200lbs. on the square inch. Under this pressure, there was not the slightest leakage from any part of the cylinder, nor from the doors. The timber was removed on the following day, and a log was cut up, when it was found that the solution had penetrated to the very centre, and completely saturated it. The apparatus is in future to be worked at 100lbs. on the square inch; and this is found to be sufficient for the due saturation of the timber within twenty-four hours, under the process of previous exhaustion of the air. The whole of the work was executed by Messrs. W. Fairbairn and Co., of London, and the cylinder riveted up by their patent riveting machine.—*Civil Engineer and Architect's Journal,* No. 64.

[The difference between Kyan's process and that of Sir William Burnett, is, that the former employs a solution of sublimate of mercury, and the latter a solution of chloride of zinc].

IMPROVED WINDLASSES AND CAPSTANS.

MR. ROBINSON, of Commercial Road East, has patented the following improvements in Windlasses and Capstans.

The first of these improvements, (which are no less than thirteen in number,) consists in making use of two barrels, one of which is half the size of the other, with guiding pulleys between. The reader acquainted with this class of machines, will see, at once, that this is but the old Chinese windlass revived. The second is also an old acquaintance, the fusee windlass, with this difference, that the conical barrel has a number of bits or stops inserted in the face of it, in a spiral direction, to prevent the cable, we suppose, from being run off too quickly. The third is a guide-plate, to regulate the running out of the cable. The fourth consists in making the cross-heads for working the barrels of windlasses, where such cross-heads are used, of four bars instead of two. The fifth, sixth, and seventh embrace three different modes of giving motion to windlass-barrels, two of them by means of bands or straps, and the third by toothed surfaces. The eighth consists in employing a second barrel, with grooves, for the purpose of keeping the cable straight, another modification of the Chinese windlass, with the grooves substituted for the intermediate pulleys. The ninth is the Chinese windlass again, according to a third modification. The tenth improvement consists in throwing the nipping parts out of action by lowering the cross-head, and raising the palls by means of a semicircular gripper acted on by a handspike. The eleventh is a mode of giving motion to a windlass through the medium of a capstan. The twelfth is the substitution of two eccentrics for the ordinary cross-head. And the thirteenth is a new mode of working capstans, through the intervention of a revolving tube, and a couple of wheels and pointer.

CAPTAIN SMITH'S LIFE-BOAT.

THERE is, as in every thing that is useful and good, the utmost simplicity in this invention. It appears that Captain Smith, R. N., late commander of the *Excellent* gun-ship, at Portsmouth, one day observed that there was room upon the paddle-box over the wheels of a steam-boat, where, without the slightest impediment to action, and without at all encumbering the vessel, a boat might be made to rest; and, in addition to its good situation on board, it could, with the greatest facility, and without disturbing any of the arrangements that might be going forward, be dropped upon the surface of the sea, even in the midst of a storm. The experiment was, accordingly, made, and has been very successful, as is attested in a letter from the secretary to the Royal Mail Steam Packet Company. It is therein stated, that in the loss of the large steamer, the *Solway*, invaluable service was rendered by one of Captain Smith's paddle-box boats, "which, in a few minutes after the ship struck, was thrown into the water so hastily, owing to the alarm and confusion, that she was filled with water up to her thwarts, yet received above fifty men, women, and children, and towed by one of the cutters, carried the whole safely back to Corunna, a distance of twenty miles, in a dark night, with a considerable sea on. If time had permitted to get the other paddle-box boat over before her pinnace was swamped, it is certain that every one of the passengers and crew might have escaped, in the same manner that two of these paddle-box boats alone rescued the whole crew of the *Isis*, amounting to above one hundred persons, during a gale of wind and a heavy sea.

NEW LIFE-PRESERVER.

IN this invention, by Mr. H. Reece, a protector of wire gauze similar to that of Mr. Jeffreys' respirator, is affixed over the mouth and nostrils, and a support (from air confined with India rubber) is fastened to the back; the fiercest spray may dash against the mouth, but its violence is broken at the first impediment; a few drops may trickle down the second, but through the third the air alone passes, warming itself in its passage; the swimmer floats, the animal heat retained, his confidence rapidly returning. The temperature of the sea is rarely under 40 deg. Fahr.; at that temperature, twenty hours' exposure could be easily borne; the supply of animal heat from respiration, its only source, being unchecked, the lungs are kept unchilled, and the neglect of this vital point has sacrificed many a life. On the first formation of the Royal Humane Society, a plan of artificial respiration was adopted. The lungs were inflated with cold air; none ever recovered. An apparatus for trying warm air has been presented, and the remedy will doubtless succeed. There is also this merciful dispensation of providence, that the ship dismasted by the storm is driven always to the shore; the victims sink within sight of the land; their shrieks heard from a shore thronged with those anxious though unable to give assistance. A certain protection is now offered. The unwillingness of ship-owners to furnish their ships with life-preservers has arisen from the inefficiency of those employed.—*Illustrated Polytechnic Review.*

MARINE SAFETY PORTMANTEAU.

Lieut. Irvine has presented a Trunk, or Portmanteau, so constructed that neither water nor damp air can penetrate any part of it, although immersed in water for months. It is so buoyant, that in case of accident it could be thrown overboard with a grapnel and a few fathoms of rope attached, and be the means of saving the contents perfect. Although the safety of valuable property and documents is of great importance, it is only secondary to the salvation of human life. The writer has witnessed its efficacy at the baths in the Westminster-road, when a small trunk filled with clothes supported in the water six grown people; and after floating about for an hour or two, was opened, and the contents were perfectly dry.

THE MACKINTOSH LIFE PRESERVER.

This Life Preserver is a short cloak or cape, made by Messrs. Mackintosh, of Manchester. When put on, nothing appears but a common cape, which would draw no attention whatever if worn in the streets. By air blown through a valve, this cape is felt, but scarcely seen, to swell to the thickness of an inch and a half. It is now a life preserver. The inventor has, by three modes of proof, satisfied himself of the buoyant powers of this safety-cape. First, he calculated that the volume of air would support 15lbs. in the water—equal to the tenth part of the weight of an individual of about 10 stone; and, therefore, would keep the head and neck, at least, above water. Second, the dead weight borne was between 15 and 16lbs. Third, he personally tested the contrivance in water six inches deeper than his own height, when he floated, with head, neck, and shoulders above water, as expected.

NAUTICAL LIFE PRESERVER.

MR. F. TAYLOR, shipwright, in Leith, has invented a deck chair, which is so constructed, that in an instant it can be couverted into a Life Preserver, somewhat resembling a boat, entirely water-tight, and incapable of sinking. The chair, or seat, is 24 inches long by 18 inches broad, when used as such, but when converted into a Life Preserver, it is about 43 inches long, which is propelled by two small oars fixed on pivots. Mr. Taylor has made various successful experiments with his new invention.

SAILS WOVEN WHOLE.

MR. JOHN H. SADLER, at Holbeck, in Leeds, has invented a loom for weaving each Sail of a Ship, even of the largest class, in one entire piece; and a machine, also, for spinning, doubling, and laying the yarn, either for two-thread or three-thread, for the warp and weft; thereby giving much greater strength to the cloth, with half the weight.

CHANGES IN METALS.

MR. LUCAS has reported to the British Association the progress of the committee appointed at the last meeting, to ascertain, experimentally, whether any and what Changes take place in the internal constitution of Metals when exposed to continual vibration and concussion. The effect of concussion on the shafts of tilt hammers is very remarkable. The shafts are made of the best ash, but after three or four months' use the strength of the wood is so much deteriorated, that the shafts break off short, as if they were rotten. Copper is also similarly affected by concussion, and in working copper articles, and in rolling silvered plates of copper, the workmen find it necessary to anneal the metal, to prevent it from breaking.—Mr. J. Taylor observed that this subject had been much discussed at Manchester, and with the same results. He alluded to the difficulty of procuring good chains, and said it occurred to him, that probably it might arise from the chain-maker being *too good* a workman, and that the evil was caused by too much swaging in finishing the work. If, however, the quality of the iron could be restored by annealing, as might be inferred from these experiments, that would present the means of obtaining good chains in the first instance, and of strengthening them after use.

MINING MACHINE.

MR. JOHN TAYLOR has invented a Machine for raising and lowering the Miners in the deep mines of Cornwall. It is composed of two wooden rods, with platforms fixed at given distances upon them, and placed either vertically or following the inclination of the vein, as is the custom for the shafts in tin and copper mines. These rods receive an alternating motion from a steam-engine; and, at the moment of pause caused by the cranks passing over the centres, the men step from one platform to another, and thus either ascend or descend in the pits without fatigue. By the usual mode of arriving at or leaving their labour, the workmen are exhausted by traversing ladders to the depth, frequently, of more than 200 fathoms; and their health has been found to be seriously injured. This machine has been successfully at work in the Tresavean mine for upwards of a year, and its use will, it is hoped, be soon extended.

CANNEL COAL AS A WORKING MATERIAL.

CANNEL Coal is principally obtained in England from Yorkshire, Shropshire, Derbyshire, and Cumberland; it is also found in parts of Scotland and South Wales. It occurs in seams, generally about three inches, but occasionally one foot thick, amongst ordinary coal; sometimes, as at the Angel Bank Colliery, near Ludlow, it constitutes the entire bed. Compared with jet it is much more brittle, also heavier and harder; it is less brown when worked, less brilliant, but more durable when polished; neither of them are at all influenced by acids or moisture, although they temporarily expand by heat.

Cannel Coal may be thought to be a dirty and brittle material, but this is only partially true; it is far better suited to the lathe than might be expected, although a peculiar treatment is called for in the entire management, which commences with the selection of pieces free from flaws, of a compact grain, and of a clean conchoidal rather than of a flaky structure.

As regards the artificer, Cannel Coal may be considered to be made up of horizontal layers, and to have a grain something like that of wood. The horizontal surface may be readily distinguished from the vertical, either by its splitting off in flakes, or by its appearing as if varnished at those parts contiguous to the ordinary coal, and which must be chipped away as useless: sometimes hard fragments or crystals, apparently of iron ores, interrupt its uniformity of surface, and flaws, which show when broken the varnished appearance, occasionally diminish its strength.

The material is cut out with a saw; that for ivory is most proper, but the hand-saw will answer; the pieces are then roughed to the shape with a chopper, or a parallel blade of steel, about eight inches long, one and a half wide, and one quarter thick, sharpened very keenly with two bevils at the one end, and used with the hand alone. For making a snuff-box, whether plain, screwed, or eccentric turned, the plankway, or the surface parallel with the seam, is most suitable; it is also proper for vases, the caps and bases of columns, &c. Cylindrical pieces, as for the shafts of columns, should be cut from either edge of the slab, as the laminæ then run lengthways, and the objects are much stronger; these latter pieces when prepared should be driven into conical chucks with a mallet, as the blow of a hammer near the edge would shiver off a flake lengthways. Similar plankway pieces, however, should be chucked with a hammer, that the blow may be exactly central, otherwise the cylindrical piece would perhaps be broken in two transversely. Cement is also very much used for chucking the work.

All the tools for Cannel Coal are ground with two bevils exactly like the chisel for soft wood turning, but they are held horizontally; a small gouge, from one quarter to three-eighths of an inch wide, also slightly bevilled off from within, is used for roughing out, or rather bringing the work as near as possible to the shape to save the finishing tools: these should be ground with thin and very sharp edges, otherwise they burnish instead of scrape the work. The ordinary tools for ivory and hardwood, if employed, must be held downwards at an angle of about twenty degrees; these are sometimes used with a wire edge turned up in the manner of a joiner's scraper.

The plankway surfaces turn the most freely, and with shavings much like those of wood; the edges yield small chips, and at last a fine dust, but which does not stick to the hands in the manner of common coal. Flat objects, such as inkstands, are worked with the ordinary joiners' planes, &c.; but with these, likewise, it is also better the edge should be slightly bevilled on the flat side of the iron. The edges of Cannel Coal are harder, and polish better than the flat surfaces.—From *Holtzapffel's Turning*, an excellent work.

NEW PROCESS OF MAKING WROUGHT IRON DIRECT FROM THE ORE.

Mr. Clay has described to the Institution of Civil Engineers this new process. First, he explains the various stages through which the metal passes, between the reduction of the ore and its arriving at the state of malleable iron, by the ordinary mode of manufacture; and then he explains the process which he has invented, and introduced practically at the Shirva Works, Kirkintilloch, Scotland.

By the ordinary system of iron-making, the ores are reduced into the state of carburet of iron, and then, by refining and puddling, the metal is decarburetted, thus making it into malleable iron by a number of processes, which are recapitulated:—

1st. Calcining the ore.

2d. Smelting in a furnace, by the aid of blast, either cold or heated with raw coal, or coke, for fuel, and limestone as a flux.

3rd. Refining the "pig" into "plate" iron.

4th. Puddling, shingling, and rolling, to produce the "rough," "puddled," or No. 1 bars.

5th. Cutting up, piling, and rolling, to produce "merchant," or No. 2 bars.

6th. A repetition of the same process, to make "best," or No. 3 bars.

Seeking to diminish the number of manipulations, by the new process a mixture of dry Ulverstone, or other rich iron-ore (hæmatite), is ground with about four-tenths of its weight of small coal, so as to pass through a screen of one-eighth of an inch mesh. This mixture is placed in a hopper, fixed over a preparatory bed, or oven, attached to a puddling furnace of the ordinary form. While one charge is being worked and balled, another gradually falls from the hopper, through the crown, upon the preparatory bed, and becomes thoroughly and uniformly heated; the carburetted hydrogen and carbon of the coal, combining with the oxygen of the ore, advances the decomposition of the mineral, while, by the combustion of these gases, the puddling furnace is prevented from being injuriously cooled. One charge being withdrawn, another is brought forward, and in about an hour and a half the iron is balled, and ready for shingling and rolling.

The cinder produced is superior in quality to that which results from the common system; it contains from 50 to 55 per cent. of iron, and is free from phosphoric acid, which frequently exists, and is so injurious, in all the ordinary slags; when re-smelted it produces as much No. 1 and No. 2 cast iron, and of as good quality, as the ordinary "black band" ore of Scotland. The cast iron produced from the slag (amounting to one-third of what was originally contained in the ore) is mixed with the ore and coal in the puddling furnace; and thus, while nearly all the iron is extracted from the ore, as much wrought-iron is produced in a given time, and the same cost of fuel, as by the old system.

The first process, producing puddled bars of superior quality, is consequently on a par with the fourth stage of the old system, as it avoids the necessity of the preceding separate manipulations.

From the absence of all deleterious mixture, by once piling and reheating the rough bars, iron is produced of a quality in every respect equal, and in powers of tension superior, to that which results from the second piling and re-heating in the common mode; it is therefore contended that the two processes produce from the hæmatite nearly one-third more iron, of as good a quality as is usually obtained by the six processes of the old system.

The iron thus produced bears a high polish, is very uniform in its texture, is ductile and fibrous, having more than an average amount of tensile strength, and at the same time appears to be more dense, as it possesses a peculiar sonorousness, resembling that of a bar of steel when struck. It has also been converted into steel of a good quality.

The paper is illustrated by a drawing of the furnace necessary for the process, and by specimens of the iron and steel produced.

USE OF GAS IN THE PREPARATION OF IRON.

M. Ebelmen has communicated to the Academy of Sciences, at Paris, a paper respecting the production and use of Gas in the Preparation of Iron. By means of a gas generator of a new construction, M. Ebelmen has arrived at the following results:—In producing gas by means of coal and cold air, the oxygen of the air changes completely into oxide of carbon. The temperature of the gas which escapes from the generator is superior to that of the fusion of anatomy. As soon as steam and air are introduced, the proportion of combustible gas augments in the gaseous mixtnre, but the temperature at the time of leaving the generator is lowered. The quantity of steam which can be introduced into the generator is necessarily limited, and depends on the quantity of heat furnished by the apparatus. The quantity of carbon used in employing steam is a little less for each litre of gas produced than if air was used. The only inconvenience of steam is the lowering of the heat in the pipes of the generator, which in some cases would be serious. The heat required for fusing is 300 degrees. By the new generator of M. Ebelmen it is easy to obtain this heat, but it must not be exceeded, for in this case the pipes would become red-hot, and produce oxide. The waste heat may be again used for the production of steam for the generator, or heating the air, which is to serve for the fusion of the metal. M. Ebelmen states, that the gas obtained from wood has but a slight degree of heat on leaving the generator, and that it is much dearer than that obtained from coal.

MANUFACTURE OF IRON.

EXPERIMENTS upon Cast and Malleable Iron at the Milton Iron Works, Yorkshire, by Mr. David Mushet, go to overset the popular notion, that hot blast iron is weaker than cold blast, and are indeed favourable to the belief that the hot blast is the stronger of the two. They further show, that the cohesive strength of cast iron is not in the proportion of its specific gravity, while its elasticity and power to resist impulsion appear to become greater just in the proportion its specific gravity become less. It would also appear, from these experiments, that the strongest qualities of iron are numbers three and four, and that iron re-melted in an air furnace is considerably stronger than if re-melted in a cupola.—*Artizan*, No. 7.

ZINCING IRON.

A PAPER has been read to the Institution of Civil Engineers, by Mr. F. Pellatt, upon Zinc as a protecting covering for Iron, and the adaptation of the process of electro-deposition for this purpose. Zinc, like most metals in commerce, is not to be met with pure: in the other metals, however, the impurities do not generally tend to the injury of the metal; but the impurities of zinc generate a galvanic current, by which the metal is rapidly destroyed. The impurities existing in ordinary zinc, and the difficulty and costliness of the process of sublimation, in order to procure pure zinc, were noticed. It was also strongly insisted on, that impure zinc itself being of little value, could not afford protection to any other metal upon which it might be superimposed; and that, therefore, the mode of plating iron with melted zinc, of commerce, was objectionable. The report made to the French Academy by Mons. Dumas was quoted. He says: "the zincing of iron, by steeping in a bath of melted zinc, has many inconveniences. Besides, the iron combining with the zinc, constitutes a very brittle superficial alloy, the iron losing its tenacity." It is well known, that in the deposition of metals from metallic salts by the electro process, the pure metal alone is deposited, so that the zinc deposited is free from any injurious admixture. The iron, also, being coated with zinc in a cold solution, its internal structure is in no way changed. The expense of the process is stated to be trifling, not exceeding that of four coats of oil paint. It was stated that the patentees, Elkington and Co., Moorgate-street, had lately given an estimate for zincing the suspension-bridge at Hungerford-market.

RUSSIAN METHOD OF SILVERING CAST-IRON.

MAJOR JEWREINOFF has arrived, after a series of experiments, at the following efficient method of Silvering Cast-iron. The liquid for silvering is prepared in the following manner:—Cyanide of potassium, prepared according to Liebig's method, is introduced into a stoppered vessel, and freshly prepared pure chloride of silver, still in a moist state, added; the whole being covered with water, and shaken violently for some time at the ordinary temperature. An excess of chloride of silver is taken, and should a small quantity of it remain undissolved, a few pieces more of the cyanide are added, after some time; taking care, however, to avoid having an excess of the latter salt, but always a small quantity of undissolved chloride at the bottom of the vessel. This last circumstance is important, because when the liquor contains too much free cyanide of potassium, it is easily decomposed, and moreover does not silver so well. Before employing it, it is filtered, and is thus rendered perfectly clear, iron and a little chloride of silver remaining on the filter. "I effect the plating," says Major Jewreinoff, "by means of a galvanic battery of one pair, consisting of a zinc and a coke cylinder, which are separated from each other by means of an earthen diaphragm. The pair are placed in a glass vessel containing dilute sulphuric acid, and dilute nitric acid is conveyed into the earthen diaphragm. Experience has shown that the best mixture for the coke cylinders should consist of five parts by weight of finely pulverized coke, eight parts pulverized coal, and two parts common rye flour. When the cylinders are dry, they are placed in earthen crucibles, in the lids of which there is an aperture for the escape of the gases, and are then heated to redness. Those cast-iron objects may be most easily silvered which have not been painted, as the removal of the paint from the surface of the metal is somewhat difficult. The cleansed object is immersed in the silver solution, and connected with the zinc pole by means of a conducting wire, and a platinum plate immersed in the liquid at some distance from the object to be silvered, and connected with the coke cylinder. A plate of cast-iron, of four square inches surface, is generally completed in thirty minutes."—*Bulletin de St. Petersbourg.*

IMMENSE IRON BAR.

THE *Merthyr Guardian* gives an account of an extraordinarily large Bar of Iron, which was lately cast at the Dowlais Iron Works. The pile, weighing about 3,000lbs., after being sufficiently heated, was taken to the hammer and shaped into a bloom; it was reheated, and drawn a second time under the hammer, after which it was again heated (for the third time), and worked in the rolls to a round bar, 8 inches in diameter, and about 14 feet long. A Correspondent of the same paper mentions, as something still more remarkable, a cable bolt which has been since cast at the Cyfarthfa Iron Works. The pile, weighing about 26 cwt., was, after being properly heated, taken out of the heating furnace and put at once into the rolls, and, in the short space of twenty minutes, came out a perfect bar, about six and a half inches diameter, nearly 27 feet in length, and as " straight as a line."

PREVENTION OF RUST.

Mr. Payen has communicated a plan to the Academy of Sciences, at Paris, by which the oxidation of iron by the atmosphere may be prevented: it consists of plunging the metals in a mixture of one part concentrated solution of impure soda and three parts of water.

A LARGE SHAFT.

In October, a large cylindrical mass of wrought iron, weighing no less than 22,400lbs., was conveyed from the foundry of Messrs. Fawcett and Preston, Liverpool, to the Clarence Dock, where it was to be shipped for London. This immense piece of metal was intended for the shaft of her majesty's steam-frigates. It was placed on two strong trucks, and was drawn through the streets by eleven powerful horses, twenty or thirty men holding by drag ropes in the rear to prevent the trucks from attaining too much velocity in descending inclined planes.—*Liverpool Albion.*

BOTHWAY'S IRON BLOCKS.

An experiment has been mads in Plymouth Dockyard, to try the comparative strength of Mr. Bothway's single metal blocks against the rope it is calculated to take, namely, a three-inch one. A rope of that size was rove in the block, and one end brought to a windlass and hove on until it broke. A three-and-a-half inch was then tried; though larger than required for such a block; this also gave way; and the last is considered by practical men fully equal to the powers of an eight or nine-inch block. The iron blocks have also another great recommendation, in doing away with the rope strappings, as many serious accidents have occurred by their breaking.

CAST-IRON BUILDINGS.

Letters from M. Gutzlaff state that the art of constructing Buildings of Cast-iron has been known for centuries in China. He has found a pagoda entirely composed of cast-iron. It is covered with bas-reliefs and inscriptions, which, from their forms, characters, and dates, show that they are as old as the dynasty of Tang, which was upon the throne as far back as from the fifth to the tenth century of the Christian era. It is in the shape of an octagonal pyramid, is forty feet in height, and eight feet in diameter at the base. It has seven stories, each containing extremely curious historical pictures. M. Gutzlaff represents this monument as being strikingly elegant, and surpassing in this respect everything of the kind he had previously seen in China.

CAST-IRON PALACE.

Mr. Wm. Laycock, of Liverpool, has constructed a Palace of plate and panels of Iron, upon a wooden skeleton, for King Eyambo, of Old Calabar. The structure consists of two stories and an attic. The first floor contains a centre hall, 40 feet by 14, and four rooms 18 feet by 15 ; the whole 10 feet high. The second floor is thrown into one grand state room, forming the royal audience chamber, 50 feet by 30, extending to 40 in the recesses, and lighted by thirteen windows. It is extremely airy and handsome, and is 12 feet in height. The attic is one apartment, extending over the entire building. The ceiling and walls of the hall of audience are richly decorated by Mr. Dodd, of Bold-street, and on the walls are placed a number of Jennings and Bettridge's splendid pictures, in papier maché. When in Africa, the building will be placed seven feet clear above the ground, on piles of hard wood, leaving space for store and bed-rooms, the whole being designed rather as a state or business palace than as a domestic residence. It is surrounded by a balcony and verandah, and will be painted a light stone colour, to resist the solar heat.

DESCRIPTION OF AN IRON WOOLLEN FACTORY.

Mr Fairbairn has exhibited to the Institution of Civil Engineers a model, showing the plans, sections, and architectural elevation of a Woollen Factory, to be constructed of cast and wrought Iron, near the town of Izmet (Turkey) for the Sublime Porte.

Almost all the houses, and many of the public buildings, in Turkey, being constructed of timber, destructive fires were frequent. In many parts of the country the common building materials were expensive : iron had therefore been resorted to for construction, and Mr. Fairbairn had already sent over an iron-house for a corn-mill, 50 feet long, 25 feet wide, and of three stories in height, and with an iron roof. It was finished in 1840, and erected at Constantinople in the succeeding year.

The success of this attempt induced a second order, which was for an extensive woollen-factory, to be composed entirely of cast-iron plates, the interior being formed throughout of brick arches, upon cast-iron columns and bearers, with an iron roof. He then described in detail the construction of the different parts of the building, and the machinery which would be driven by a fall of water of 25 feet in height, of the computed average power of 180 horses.

Several ingenious devices were described for preventing any objectionable effects from the high conducting power of the metal. The piers between the windows were hollow, so as to admit a current of air through during the hot season ; and the iron roofs were so arranged as to have beneath them a coating of plaster, to serve as a non-conducting substance.

The two principal rooms were described to be 272 feet long, 40 feet wide, and 20 feet high ; and 280 feet long, 20 feet wide, and 20 feet high; with a great number of other rooms, for the several processes in the manufacture of coarse woollen cloths, for the counting-houses and apartments of the directors, and for the reception of the sultan, &c.

The area of inclosed surface, including the court-yard and buildings, was nearly three acres, or 110,621 square feet.

The floor surface in the basement rooms = 16,480 square feet.

The floor surface in the upper rooms = 54,616 square feet.

ROLINSON'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF SHOT.

THESE improvements consist in manufacturing iron Shot by cutting, compressing, and rolling, instead of by casting as usual; the iron being of course in a wrought or malleable state before it is operated upon. The new shot possesses much greater density, bulk for bulk, than shot of the common short; is truer in point of form, and less liable to deterioration from exposure to the weather. The mode of manufacturing it is thus described.

"I take a common round bar of wrought or malleable iron, and heat it in a furnace to nearly a welding heat, when I divide it by a circular saw, or with shears, into pieces, corresponding, as regards the solid contents thereof, with the weight of the shot intended to be manufactured, making a small allowance for waste in the subsequent processes. I put these pieces into common spherical moulds, such as are used in the manufacture of iron shot by casting, and apply, by any of the common and well-known methods, a degree of pressure sufficient to round the pieces enclosed in the moulds. I then pass the rounded pieces through a rolling-machine, which is in general construction similar to the metal-rolling mill in common use, and differs from it only in certain modifications and additions. The roller being put in motion by a connecting band from a steam-engine, or other moving power, the pieces of iron are removed from the spherical moulds where they are first rounded, and while they are yet in a hot state, and dropped into the circular holes formed by the meeting of the grooves in the roller and those of the stationary cup; and after they have been forced through those holes by the rotatory action of the roller they are subjected a second time to the same process, or as much oftener as may be deemed expedient."—*Mechanics' Magazine*, No. 1051.

THE LARGEST WROUGHT IRON GUN IN THE WORLD.

MESSRS. WARD AND CO. have completed, at the Hammersley Forge, at the foot of Fifty-ninth Street, North River, United States, the Largest Gun, as it is said, that we have any record of. It is 14ft. long, 3ft. in diameter at the breech, and weighs thirty thousand pounds, or fifteen tons. It is made for government, and will be placed on board the *Princeton* steamer. This extraordinary gun is hammered out with a hammer weighing thirty thousand pounds. The proces of heating and hammering such an immense shaft is wonderful. The machinery for placing the gun in the furnace, of putting it on the anvil, of turning, cutting, and hammering, are so complete, that it is moved with a precision and facility truly astonishing. Cast-iron guns of this size are frequently accomplished, but no attempt, we believe, has ever been made to make a gun of this size from wrought iron. It is calculated that the strength and power of this piece, when finished, will carry a ball of one-third greater weight, and one-fourth increased distance, than the best cast-iron guns.

CONCUSSION SHELLS AND FIELD ARTILLERY.

CAPTAIN NORTON has made application to the Master General and Board of Ordnance, to be permitted to adapt his Concussion Shell to Field Artillery, believing that such shells may be used with good effect against an enemy posted in block-houses, farm-houses, mills, &c. &c. These shells have been already tested from the eight and ten-inch guns, otherwise called the 68 and 130 pounders, and the Select Committe of artillery officers at Woolwich, in their Official Report to the Master-General, dated 15th October, 1842, have pronounced them "simple, safe, and efficacious."

SELF-PRIMING GUN.

MESSRS. NEEDHAM, the gun-makers, of 26, Piccadilly, have patented an important and very useful improvement in percussion locks; by which the caps are, by the motion of the lock, placed at once, and without the trouble of putting them on the nipple, as in common percussion locks, with the fingers; in a small cavity beneath where the nipple generally is, and there held fast till exploded on pulling the trigger. The contrivance further provides, that directly one cap is exploded it is forced from its cavity, and another cap instantly takes its place. The caps are contained in a hollow groove along the sides of the stock, which groove is covered with a small plate of brass, which does not increase the bulk, nor does it render the stock unsightly. The groove holds sixty caps, which lie in it in such a way that it is an impossibility for them to stick in or block up the passage to the lock, and there is a small and simple instrument to feed or replenish the groove or reservoir when empty. From the description, it would appear that the contrivance is complex; but such is not the case, the whole is simple, and is effected by a small lever placed in the lock, upon which the cock works. It has these advantages over the method now in use:—Additional power from the cap or priming being brought immediately upon the charge without the intervention of a nipple, the impossibility of the caps falling off or being lost, the protection of them from wet, the total avoidance of danger from the caps flying to pieces so as to injure the shooter, and the increased expedition in firing, in the proportion of five times to three. This invention in guns used by the military is very obviously an improvement of the greatest importance. The soldier will never miss fire, and will fire with a rapidity hitherto never calculated upon, and the cavalry soldier will be able to trust to his pistol or carbine with the confidence arising from the certainty that the cap has not slipped off; a certainty on which he cannot now rely, because a very little experiencee will show that it is not a very easy matter for a horseman in action to fit a cap to the nipple of a percussion lock. To sportsmen the same advantages will arise.—*Mechanics' Magazine*, No. 1057.

A FIRE-PROOF POWDER MAGAZINE.

Mr. J. A. Holdsworth has patented a magazine to contain powder in ships of war, as being impervious to fire, though subject on all sides to the greatest possible degree of heat. A model of a magazine, about nine feet square, was placed on a wharf within a few feet of the water's edge. This model is formed of a double set of thin iron plates, riveted together at about two inches and a half asunder, the hollow being filled with water, and supplied from a vat placed somewhat above the level of the magazine, and entering it through a pipe inserted in the lower part of the model. A channel of communication exists through every side as well as the top and bottom, and from the upper surface a second pipe conveys the stream of water back to the vat from which it is supplied. The door of the magazine is hung on hinges, made hollow, and guarded from leaking by stuffing boxes, so that the water flows into the door through one hinge, and out through the other. The patentee having explained the principle of his invention, placed a quantity of combustible matter within the model, over which some gunpowder was laid on a sheet of paper. A registering thermometer having been placed inside, the door was closed, and a stack of dried timber deposited on every side of the model, was set a-light. The fire was kept up more than half an hour, and the water rose to very nearly boiling heat, continually passing in a stream through the upper pipe into the reservoir containing cold water. On the door being opened, the combustible matters and powder were found to be perfectly uninjured, and the highest point to which the mercury had risen within the model was marked at 100 degrees of Fahrenheit. A somewhat similar principle has been applied to the stoker's room in the *Victoria and Albert* royal steam yacht, where the bulkheads have been constructed of two plates of sheet iron, instead of wood faced with iron, a stream of water constantly flowing between, by which means the temperature of the engine room is kept cool.

QUICK FIRING.

A mechanic at Rudkyoping (Denmark), by name Rasmusseu, has invented a Musket from which thirty discharges per minute may be made with ease. The experiments which have been instituted show that it strikes an object at eighty paces distance, with the greatest accuracy. The rapidity of the discharge may be considerably increased; in fact, on one occasion, the musket was worked at sixteen shots in twenty seconds.—*United Service Magazine.*

THE ADVANTAGES OF WIRE ROPE OVER HEMPEN ONES.

Since the introduction of Wire Ropes in the mines of Saxony, experience has proved them to be more advantageous than Hempen Ropes, both in cheapness and durability, which has warranted their introduction into all the mines of Saxony. The price of the hempen rope of 288 threads is, to the price of the wire rope which replaces it, as 1 is to 0·3483 ; consequently, the wire rope is 65·17 per cent. cheaper than the hempen rope. The price of a hempen rope of 336 threads, the largest used in the mines, is in the proportion of 1 to 0·3405. Hence, the wire ropes are two-thirds cheaper than the hempen ropes which they replace, and, under many circumstances, of greater durability, particularly in moist situations, or where the rope remains for a long time coiled on the drum, when it decays from mildew. Besides these advantages, the wire ropes are one-third the weight of the hempen rope which they replace. Wire rope of twelve wires weighs, per lachter (equal to two French meters, or 78 6-8 English inches), 3·4309 pounds; hempen rope, of 288 threads, weighs 9·62 pounds, or as 0·3536 is to 1. The wire used is 3·3 millimetres in diameter, equal to 0·39 inches, and the strength of the wire ropes is in proportion to the number of wires. The wear and tear of wire ropes is less rapid than by hempen ropes ; consequently, the hempen ropes, to have an equal durability with wire ropes, must, at the outset, be much stronger. The maximum strength, or breaking strain, of hempen ropes of 288 threads, is, expressed in pounds, equal to 19,800 pounds ; whereas, the breaking strain of the wire rope of twelve wires, used in the place of the above hempen rope, is, when new, 11,200 pounds. Wire ropes, having a much less elasticity than hempen ropes, must, consequently, be coiled on a drum of greater diameter. The result of the experiments made at Freiberg is, that the drum of iron wire ropes must never be less than eight feet in diameter, and the maximum of the working load must be between one-sixth and one-seventh of the breaking strain. Wire ropes have been in use since 1834 in the mines of Hartz, and have been lately introduced at the coal mines of the northern counties in England, and on most of the railroads where stationary engines are used.—*Freiberg Mining Journal.*

THE EARL OF ROSSE'S LEVIATHAN TELESCOPE.

THE Rev. Dr. Robinson, the celebrated astronomer, of Armagh, in a letter to a Correspondent of the *Times*, describes the gigantic Telescope, now constructing by the Earl of Rosse, as nearly complete. He says: " The speculum, which weighs three tons, has been ground to figure, and can be polished in a day. The tube, partly a cubic chamber where the mirror is fixed, and partly a cylinder, of inch deal, strongly hooped, and eight feet diameter at its centre, is complete. The massive centres on which the telescope is to turn are in their place, and the apparatus which supports the speculum, which is of iron, and of great weight, is also complete. The telescope is not to be turned to any part of the sky, but limited to a range of half an hour on each side of the meridian, through which its motion will be given by powerful clockwork, independent of the observer. For this purpose it stands between two pieces of masonry of Gothic architecture, which harmonize well with the castle. One of these pillars will sustain the galleries for the observer, and the other the clockwork and other machinery, one of which is finished, and the other nearly completed. An extremely elegant arrangement of counterpoises is intended to balance the enormous mass, so that a comparatively slight force only will be required to elevate or depress it. The arrangements will not permit the examination of an object at any time, but only when near the meridian, when objects are best seen. So large a telescope will always require the most favourable circumstances of air, &c. and there will always be enough of objects at any given time to employ it fully. The aperture is six feet, and the focal length fifty-two feet."

The detailed account of the casting of the Speculum, in a letter from Sir James South, will be found in the *Year-book of Facts*, 1843, p. 68. This letter has so well explained the history of the great six-feet speculum, that little more remains to be said; but Professor Robinson has given a very interesting account of the polishing of the Earl of Rosse's specula. Lord Oxmantown has in many respects deviated from the usual process. His polisher of the mirror's diameter, intersected by transverse and circular grooves, into portions not exceeding half an inch of surface, is coated, first with a thin layer of common optical pitch, and then with a much harder compound. It is worked on the mirror and counterpoised, so that little of its weight bears; but the want of pressure is compensated by a long and rapid stroke. The mirror revolves slowly in a cistern of water, maintained at a uniform temperature to prevent the extrication of heat by friction. The polisher moves slowly in the same direction, while it is also impelled with two rectangular movements. The machine is driven by steam, and requires no superintendence, except to supply occasionally a little water to the polisher, and to watch when the polish is complete. By an induction from experiments on mirrors from six to thirty-six inches aperture, it was found that if the magnitudes of the tranverse movements be 1-3 and 9-100 of the aperture, and their times be to its period of rotation as 1 and 1-8 to 37, the figure will be parabolic; but to combine with this the highest degree of lustre, it is found necessary to apply towards the close a solution of soap in liquid ammonia, which seems to exert a specific action. The certainty of the process is such, that the solid mirror of thirty-six inches aperture, after being scratched all over its surface with coarse putty, was in the Professor's presence perfectly polished in six hours, and was placed in its tube for examination, without any previous trial as to quality.

A very interesting series of engravings of the Earl of Rosse's workshop at Parsonstown; the telescope of 27 feet focal length, now in use; and the walls for the support of the leviathan telescope, will be found in No. 69 of the *Illustrated London News*.

MOIRE METALLIQUE.

Herberger recommends the following process for obtaining a most beautiful Moiré Metallique:—The plate iron to be tinned is dipped into a tin-bath, composed of 200 parts of pure tin, 3 parts of copper, and 1 part of arsenic. Thus tinned, the sheet-iron is then submitted to the seven following operations:—1. Immersing in ley of caustic potassa, and washing. 2. Immersing in aqua regia, and washing. 3. Immersing in ley of caustic potassa, and washing. 4. Quickly passing through nitric acid, and washing. 5. Immersing in a ley of caustic potassa, and washing. 6. Immersing in aqua regia, and washing. 7. Immersing in a ley of caustic potassa, and washing. Every time that the sheet-iron is placed in aqua regia the oxide of tin thereby produced must be entirely removed, since otherwise spots would form. The quickly passing through nitric acid softens the unpleasant metallic glare which, at certain angles of refraction, renders the design invisible. The copal resins deserve the preference for coating the sheet-iron after the crystallization has been thus obtained.—*Mechanics' Magazine*, No. 216.

CORROSION OF CAST IRON AND STEEL.

On May 30, was read to the Institution of Civil Engineers, an important paper by Mr. Mallet, M. Inst. C. E., "On the Corrosion of Cast and Wrought Iron and Steel exposed to the Action of Air, and of Salt and Fresh Water, under various circumstances." It was very voluminous, and we can only give a limited notion of its contents or of its value; it contained not only the theory of the corrosion of iron, but also its characters, and reviewed the practical efficiency of almost all the methods hitherto attempted for preventing its usual injurious effects. The paper shortly recapitulated the results of the two preceding communications on the subject, which had for their object to determine the actual loss of metal by corrosion in given conditions; the first period of exposure of the specimens was 387 days, but it was obvious that the original surface of the metal influenced greatly the rate of corrosion: they were again subjected to the action of air and water for 732 days, and the results are given in the paper and in a volumnious series of tables, clearly arranged for reference for practical engineers. Some experiments were also given upon wrought iron, coated with zinc, by the process called "galvanizing," and also on cast iron protected by paint of powdered zinc. The relative average quantities of rain falling annually are in Dublin, 25,874 inches, and in London 21,714 inches. The rate of corrosion of iron exposed to the ordinary atmospheric influences at Dublin is directly as the volume of rain or dew falling on it in a given time as the elevation of temperature with equal moisture, and as the barometric pressure. Exposure over a crowded city, or near the sea, would increase the rates of corrosion. The results of the second immersion seemed to show that with cast iron the rate of corrosion was a decreasing one, when the coating of plumbago and rust had been removed. Specimens cast half an inch thick were affected more than those of one inch in thickness, owing to the difference of homogeneity in the two surfaces. The rapidity of corrosion does not depend so much upon the chemical constitution of the metal, as upon its molecular arrangement, and the condition of its constituent carbon. The same kind of iron corrodes more rapidly when cooled fast and irregularly, than it does when carefully treated. The difference of corrodibility between hot and cold blast iron is very small, and arises chiefly from their relative specific gravities. An account of the condition of the carbon in them, No. 1 and 2, bright grey iron of commerce, while they are the most valuable for construction, are also the most durable: slow cooling and annealing increases the durability. The mode of analysis used by the author is given in great detail, and was approved of by Dr. Ure in the discussion, when he described that which he usually employed. Six equal parallelopipeds of cast iron were immersed for 180 days in sea water slightly acidulated with muriatic acid, frequently renewed; they were removed, and the coat of plumbago rubbed off at intervals of 30 days; the original weight of each piece was 1060 grains, the weight of each specimen after 180 days was 1041·4 grains, showing an absolute loss by corrosion of 18·6 grains. It is noticed that the Kyanized oak boxes in which the specimens were sunk in the harbour of Kingstown were all perforated two inches through by the "Lymnaria tenebrans," whose ravages are thus proved not to be arrested by Kyanizing. Chilled cast iron is stated to corrode more slowly when exposed to the air only, than that cast in green sand; this is the reverse of corrosion in water. The action upon wrought iron removes alternate portions of the metal, so as with Damascus iron for gun barrels to destroy the electro-positive parts, leaving a grating of minute parallel rays that could be looked through. The finer and more uniform the quality and texture of the iron, the slower is the rate of corrosion. Faggotted bars, and Lowmoor boiler plate, are those kinds which corrode slowest. Hardened cast steel, after "tilting," corrodes least, and low shear steel is destroyed most easily. The author then proceeds to examine the modes of protecting iron by zincing, and says that no mode of coating with zinc appears capable of preserving iron from the action of boiling salt water, but that, on the contrary, the zinc oxidates with unusual rapidity, and the iron is destroyed. He then reviews the causes of destruction of boilers of steam vessels, the results of corrosion of wrought iron in voltaic contact with alloys of copper and tin; and as to the process of Messrs. Elkington for coating iron with zinc, &c., by electro deposit, although he thinks it incapable of resisting any abrasion or even exposure in water for any great length of time, it would be practically useful when exposed freely to the weather, and for architectural purposes it would be very valuable. He then goes to the subject of the durability of iron ships, and after arguing carefully all the causes of their probable decay, and explaining a multitude of interesting facts relative to them, he arrives at the conclusion, that if the proper means be adopted for guarding against or reducing the rate of corrosion, and the amount of fouling by adherent marine plants and animals, in future iron vessels may be rendered as much safer and more enduring than those of timber, as the steam ships of the present time are superior to the vessels two centuries past. The full details are given of all the principal modes of preserving iron, and particularly those invented by the author, which consist first in coating with zinc; then a varnish, of which the basis is asphaltum; and then a poisonous paint to prevent the adherence of marine plants and molluscous animals. In the discussion which ensued the author's plans and observations were fully approved; and in support of the durability of iron vessels, it was stated that iron canal-boats, which had been made forty years since, were now in use in Staffordshire; and that the "Aaron Manby," which was built in 1821, and was the first iron steamer ever sent to sea, had been constantly in use up to the present time without requiring any material repair.—*Illustrated Polytechnic Review*, No. 22.

DANIELL AND HUTCHINSON'S NEW MANUFACTURE OF LIME.

Messrs. Daniel and Hutchinson have discovered that there are large tracts of sand on the coasts of this kingdom, and particularly on the coasts of the county of Cornwall, which are at present either treated as valueless, or made use of, like other sand, for purposes of mechanical intermixture merely, as in the making of mortar, breaking up of tenacious soils, &c.; but from which, nevertheless, Lime of an excellent quality, applicable to building, agricultural, manufacturing, and other purposes, can be manufactured in large quantites. The patentees state that they have ascertained, "by numerous and careful analyses of the sand referred to, that it usually contains more than 70 *per cent. of carbonate of lime.*" The mode of reduction which they adopt is thus described:—"In the first place, in order to test whether the sand on which we propose to operate is of the proper quality, we put an ascertained quantity into a retort, and pour dilute muriatic acid upon it; if it contain carbonate of lime, a violent effervescence ensues, and carbonic acid is rapidly evolved (the presence of which may be readily detected by its reddening litmus paper). We then neutralize the muriatic acid by the addition of liquid ammonia, and precipitate the lime by adding the carbonate of ammonia in excess. We next weigh this precipitate, which gives us a measure of the average quantity of lime which may be extracted from larger quantities of the sand of which that experimented upon was a sample. If the weight of the precipitate is from six to eight tenth parts of the original weight of sand tested, then the sand is of a proper quality for the purpose of our manufacture; but if much under that, the product will in some places not be sufficient to defray the expenses of reduction. In manufacturing the lime on a large scale, we proceed as follows:—We make use of reverberatory furnaces, varying in size according to the quantities operated upon, but the bodies of which are generally from 20 to 30 feet in length, from six to ten feet in their greatest width, but gradually contracted towards the end, where they open into the chimney, and from 15 inches to 2 feet in height. The sand is laid upon the bed of the furnaces to the height of the bridges, which are made a little higher than usual, in order that they may protect the sand from being blown forward by the direct action of the current of flame upon them. The high degree of heat to which the sand is here exposed expels the carbonic acid so quickly, that in about two hours the process of conversion is generally perfected. The lime is then withdrawn from the furnace through doorways made at intervals, either in the sides, end, or bottom, for that purpose. It is now in a proper state to be employed as a manure; but to fit it for the various other purposes to which it may be applied, we first pass it through fine sieves to separate any extraneous substances which it may contain."

When it is desired to convert the lime so obtained into hydrate of lime, the patentees add the necessary equivalent of water; if into sulphate of lime, or gypsum, they add the necessary equivalent of sulphuric acid; and so on through all the various combinations of which lime is susceptible.—*Mechanics' Magazine*, No. 1059.

AMERICAN EXCAVATOR.

THIS machine, constructed by Carmichael and Co., for Excavating Earth-work, has received in America the appellation of "The Yankee Geologist." The machine is composed of the following parts, namely, a strong wooden platform, mounted on wheels, which run on a temporary railway; second, a powerful crane, firmly fixed at one end of the platform; third, on the other end of the platform, a steam engine, which actuates the machinery; fourth, a shovel, scraper, excavator, or digging tool, which is suspended by a strong chain from the jib of the crane, which chain passes over pulley wheels, and thence round a drum connected with the machinery; and lastly, the arrangement of wheel-work necessary to produce the various evolutions and motions of this novel machine. As to the quantity of earth excavated in a given time, it may be stated that 30,719 car (waggon) loads, each containing 1½ cubic yard of hard excavation, consisting of clay, sand, coarse gravel, and boulders of various sizes, some of them closely bedded together, and many of them requiring blasts to cause their displacement, were excavated in forty-six days.

NEW LIGHT.

IT is now four years since the first experiment on the subject of rendering continuous, and fixing at a given point, the electric fluid, and making it applicable to the general purposes of lighting, was made at Paris; but the discoverer was not able to induce any person to advance even 1,000f. for an apparatus on a sufficiently large scale for a public experiment. A public experiment has, during the past year, taken place at the Place de la Concorde. On one of the bases of the statues called the Pavillon de Lille, a glass globe of apparently twelve or thirteen inches diameter, with a moveable reflector, was fixed in connection with a voltaic battery, and at a little before nine o'clock the electric fluid was thrown into it by a conductor. At this time, all the gas lights in the place, about 100 in number, were burning. As soon as the electric light appeared, the nearest gas lights had the same dull, thick, and heavy appearance as oil lamps have by the side of gas. Soon afterwards, the gas lights were extinguished, and the electric light shone forth in all its brilliancy. Within 100 yards of the light, it was easy to read the smallest print; it was, in fact, as light as day. The estimate made by scientific persons, who were present, was, that the electric light was equal to twenty of the gas lamps, and consequently that five of these lights would suffice to light the whole place most brilliantly. There would also be another great advantage in the electric light. It gives out no bad smell; it emits none of those elements which, in the burning of gas, are so injurious to health, and explosion would be impossible. The only danger that would arise would be at the battery itself, but that would be under the control of competent persons; and even in this respect there would be no danger, even to unskilful persons, with an apparatus of moderate size. Internal lighting would be as practicable as external lighting, for, by conductors, the fluid would be conveyed to every part of the house. This experiment was with a voltaic battery of two hundred pairs, composed as follows:—1st, an outer globe of glass; 2dly, in this globe a cylinder of charcoal, open at both ends, and plunged in the nitric acid contained in the outer globe; 3dly, in the cylinder of charcoal a porous porcelain vase, containing acidulated water (with sulphuric acid)—this replaces the cloth in the common battery; 4thly, in the porcelain vase a cylinder of amalgam of zinc plunged in acidulated water. The pile was on the Pavillon de Lisle; the two copper conductors from the two poles, and pointed with charcoal, lead to an empty globe from which the air has been exhausted. The two fluids on meeting produce a soft but most intense light. The strength of the electric light did not appear to exceed that of the hydro-oxygen; but then how much more simple is the apparatus; how much less costly the expense of production! The hydro-oxygen light requires a double and most expensive apparatus, and is only applicable to a few localities; the electric light may be applied externally and internally in any place.—*The Builder*, No. 39.

AMERICAN REFLECTING LANTERN AND HELIOTROPE.

This Lantern was constructed by Messrs. Henry N. Hooper and Co., of Boston, under Major Graham's directions. It was similar in form to the Parabolic Reflector Lantern, sometimes used in lighthouses, but much smaller, so as to be portable.

The burner was of the Argand character, with a cylindrical wick, whose transverse section was half an inch in diameter, supplied with oil in the ordinary manner. This was placed in the focus of a parabolic reflector, or paraboloid, of sheet copper, lined inside with silver about one-twentieth of an inch in thickness, polished very smooth and bright. The dimensions were as follows:—

	Inches.
Diameter of the base of frustrum of reflector........	16·
Distance of vertex from base........................	3·75
Distance of focus from vertex	2·25
Diameter of cylindrical burner......................	·50
Diameter of a larger burner, which was never used, but which, by an adapting piece, could be easily substituted	1·25

The instrument answered the purpose for which it was intended, admirably well, and was of great use in tracing the due north line. While it occupied the station at Park's Hill, 15 feet above the surface of the ground, or 828 feet above the sea, in the latter part of September, and early part of October, 1841, the light from it was distinctly seen with the naked eye, at night, when the weather was clear, from Blue Hill, whose summit, where crossed by the meridian line, is 1071 feet above the sea; the intervening country averaging about 500 feet above the sea, and the stations being 36 miles apart.

The light appeared to the naked eye, at that distance, as bright, and of about the same magnitude, as the planet Venus. Viewed through the transit telescope, of 43 inches focal length, it presented a luminous disk, of about thirty seconds of arc in diameter. From its brilliancy at that distance, Major G. has no doubt that it would have been visible to the naked eye at 50 miles, and through the telescope at 100 miles, could stations, free from interposing objects, have been found so far apart.

It was remarked, that the wick employed by Major G. was considerably smaller than that usually made, even for polar lamps; and to this cause he attributed, in a great measure, the perfection with which the parallel rays were transmitted from the reflecting parabolic surface, so as to make them visible at so great a distance. Though a greater quantity of light is generated by a larger wick, the portion of rays reflected in a direction parallel to the axis, and which alone come to the eye, is the smaller as the flame transcends the focal limit. The size of wick most advantageous for use may easily be determined by experiment: Major G.'s impression is, that the smaller its transverse section, provided it is only large enough to escape being choked up by the charred particles, even one-third, or perhaps one-fourth, of an inch, the farther the light would be visible.

It has occurred to Major G. that lanterns of this description might be used with great advantage as station-marks, in extensive trigonometrical surveys, requiring primary triangles of great length of sides. A revolving motion might be given to the lanterns, so as to make the light transmitted from them visible from many different stations within short intervals of time. Their simplicity, and the ease with which they are managed, would perhaps give them, for such purposes, a great advantage over the Drummond, or Bude, lights, even though they be not so brilliant as the latter.

The helitrope, which he employed in the day-time, was made by order of Mr. Hassler, at the instrument shop of the coast survey office. It was a rectangular parallelogram of good German plate glass, $1\frac{4}{5}$ by $1\frac{1}{5}$ inch in size, giving an area of reflecting surface of $2\frac{16}{100}$ square inches. This also was seen at the distance of 36 miles.—*Proceedings of the American Philosophical Society.*

DR. URE'S REPORT ON THE BUDE LIGHT.

From the Report of a Committee of the House of Commons, it appears that this light is so called from Bude, in Cornwall, the residence of its inventor, Mr. Gurney—a name bestowed upon it at the Trinity House, to distinguish it from the ignited lime light, which he first described in his work on chemistry, in the year 1823.

The Bude light originally consisted of an oil argand flame, having a stream of oxygen thrown up over its internal surface, which produced a very vivid illumination. It was found, however, after having been used some time in lighting the House of Commons, that oil lamps thus fed with vital air were expensive, and difficult to regulate.

Mr. Gurney then tried to illuminate the House with a naphthalized coal-gas, in argand burners, similarly supplied with oxygen; and though this produced a light of sufficient intensity, he encountered a formidable obstacle to its continuance from the deposition of liquid naphtha in the tubes of distribution. He next happily discovered a method of obtaining, from ordinary coal-gas, purified in a simple apparatus of his own, and burned with oxygen derived from the atmosphere, an effulgence adequate to every purpose of internal and external illumination, which is now used in the House of Commons with perfect success, and at a cost of only twelve shillings per night, whereas that of the candles previously used there amounted to six pounds eleven shillings per night.

This new Bude light possesses the following advantages over all other kinds of artificial illumination hitherto displayed.

First.—It gives as much light as the best argand gas flames, with only one half the expenditure of gas. This very remarkable fact was established by experiments carefully performed with the same standard wax candles which I employed for comparison prior to my examination before the late committee appointed to ascertain the best mode of lighting the House of Commons. A common argand gas flame was found to emit light equal to ten such candles (three to the pound), and a Bude burner, called No. 10, gave a light equal to 94·7 of the candles. Thus the Bude flame had nearly ten times the illuminating power of the gas argand flame; while, by means of an accurate gas-meter, the former was ascertained to consume only 4·4 times the quantity of gas consumed by the latter, demonstrating the economy of the Bude light over common gas to be greater than two thirds; and this economy increases in proportion to the magnitude of the light. The source of this surprising superiority may be observed by comparing the two flames: the base of the argand gas flame is of a blue tint for fourteen-sixteenths of an inch, a space in which the gas burns with intense heat, but little or no light; whereas the base of the Bude flame acquires a dazzling whiteness at three-sixteenths of an inch from the metal. Thus we see, that, through a range of eleven-sixteenths of an inch, the common gas argand flame is wasted in producing the nuisance of heat without light.

Secondly.—From the phenomena just noticed, as also from the circumstance of the Bude flame emitting a double light with a single volume of gas, when compared with the gas argand, it is manifest that he former, in equal degree, can disengage at the utmost only half the at that the latter does.

Thirdly.—The Bude light simplifies greatly the means of artificial illumination, since it concentrates in one flame as much light as will diffuse, throughout a large apartment, a mid-day lustre, which may be softened by shades of every hue, and reflected by mirrors in every direction.

Fourthly.—From this property proceeds its value as a ventilator, since the single tube which carries off the burned gases serves to draw out also the effluvia from a crowded chamber.

From all these facts, I am of opinion that Mr. Gurney's new Bude light is a most meritorious invention, for both public and private buildings, as it removes altogether the objections hitherto justly urged against the use of the highly hydrogenous gas of the London companies in dwelling-houses, namely, that its heat is great in proportion to its light, when compared with the more highly carburetted gases of Edinburgh and Glasgow. The time must therefore be now at hand when the great economy and convenience of lighting private houses with gas will be experienced by the inhabitants of the metropolis, as they have been for such a considerable time by those of every town of importance in Scotland. That the same quantity of coal-gas may be made to produce a double amount of illumination in Mr. Gurney's patent burner to that obtained from it in an ordinary argand, will appear to many a paradoxical, if not a doubtful, proposition. Of its reality, however, I am fully convinced, and I think the fact may be accounted for in the following way:—

Light, in general, is proportional to the intensity of ignition, a truth well exemplified in the effect of the oxy-hydrogen flame upon a bit of lime or clay. On the same principle, when the flames of two candles are brought into close contact, they afford a compound light considerably greater than the sum of their separate lights. Now, Mr. Gurney's burner gives such a compound flame. It consists of two or more concentric cylinders of flame, mutually enhancing each other's temperature, just as in Fresnel's polycycle oil argand lamps used in the French lighthouses.

In addition to the augmented intensity of ignition, we must also take into account the peculiar nature of the combustion of carburetted hydrogen gas, whether as generated from coal in a retort, or from oil in a lamp. The vivid whiteness of its flame is due to the separation in solid particles, and subsequent ignition of its carbon. Pure hydrogen, when burned, affords a very feeble light; and whenever so much air is mixed with coal gas, as is sufficient to consume all its carbon simultaneously with its hydrogen, it burns with a dim blue flame. Now, in the base of a common argand flame, an excess of cold atmospheric oxygen is allowed to act upon the coal gas in the vacant spaces between the pin-holes, whereby the temperature being greatly lowered, while the carbon is consumed in the gaseous state, the light from these two causes is nearly null. It is not till the gaseous mixture rises and forms a continuous hot cylinder, without interstitial streams of air, that it emits a white light from the ignited particles of the carbon precipitated in the interior of the flame.

In Mr. Gurney's concentric series, the prejudicial excess of atmospheric air is prevented, and only so much permitted to come into contact with the gas, as will effect the due separation and ignition of its carbon, even at the origin of the flame. To these two causes conjoined, viz. the increased intensity of ignition, and the limited supply of oxygen, it is that the new Bude flame owes its economy of illumination. The effect of oxygen in excess is elegantly demonstrated by throwing up a stream of it within a gas argand flame, for the light is thus nearly annihilated, while the heat is prodigiously augmented. As regards the specification of the patent for this improved mode of lighting, which I have carefully examined, I have no hesitation in declaring it, in my opinion, to be valid and unimpeachable.—*The London Journal and Repertory of Arts, Sciences, and Manufactures.*

NEW GAS-BURNERS.

Mr. H. Dircks has read to the British Association a paper on the construction of Luntley's Shadowless Gas-burners, and the shape of Glass Chimneys for Lamps. The object of the burner is to bring the gas issuing from the small orifices into direct contact with atmospheric air at the ordinary temperature. Mr. Dircks contends that the heating of the air previously to its combustion diminishes the brightness of the flame; because, while each volume of carburetted hydrogen gas requires ten volumes of atmospheric air for its perfect combustion, the expansion of the air by heat necessarily reduces the weight of oxygen contained in the same volume of air; and, therefore, unless some means be adopted of increasing the supply of air, the oxygen will be deficient. Another alleged advantage of the burner arises from the small quantity of metal through which the orifices are perforated, for by that means a smaller quantity of heat is abstracted in burning. The peculiarity in the form of the glass chimney consists in having the upper end enlarged. The effect of this enlargement, Mr. Dircks states, is to open the top of the flame, and increase its brightness.

IMPROVED CHAMBER-LIGHT.

The rush being apt to fail, and the oil light, unless skilfully managed, occasioning obvious inconvenience, the following contrivance may be considered an improvement on the old fat light with a paper wick :—Provide a common cylindrical ointment pot, a two-ounce size in the winter; in the summer, a smaller one. This is filled with any kind of fat, as with the waste fat from the kitchen. This is trimmed by about half an inch of the common wax wick sold at the tallow-chandler's, being simply stuck into a thin slice of wine-bottle cork, upon which first place a strip of stout filtering paper; this is about half the diameter of the cork in breadth, and a diameter and a half in length. It need not be quite so broad, but it must be at least the length stated. The reason for using the bibulous paper is that it feeds the wick properly; without it, or some such contrivance, it will not burn.

Remove with the handle of a tea-spoon sufficient of the fat to allow the cork to be a little below the surface, and then place the fat so removed over the cork and paper, neatly spreading it, to make an even surface. The light is now prepared. Probably the plan might be improved, for the convenience of those who are not early risers, by having an aperture at the bottom of the pit, and placing it in water, which would rise to the level when the fat is melted, and extinguish the wick when it is exhausted. If not extinguished when the fat is burned up, the cork, &c. will be consumed, and occasion an unpleasant smell.

LIGHTING AND VENTILATING.

On April 7th, Professor Faraday read, at the Royal Institution, a paper on Lighting and Ventilating. The subject was interesting, not from any novel theory, but for the application of known facts to useful purposes, especially Lighting and Ventilating,—ventilation being here used in its common acceptation, as meaning only the mode of withdrawing, from places where human beings are to live, the bad air consequent on combustion, and so leaving the atmosphere in its natural condition, in which alone it can be beneficial to man. After some general remarks on the nature of combustion, the consequent formation of water and carbonic acid, Mr. Faraday described the new process for which his brother has taken out a patent, and exhibited a chandelier to which it had been applied. The ordinary glass chimney is first placed on the lamp, which is fed with external air, as usual: a second chimney, somewhat larger and taller, is then put on, and covered with a thin sheet of mica. In the space between the glasses there is no communication with the external air, except through what Mr. Faraday called an aërial sewer, which sewer is intended to carry off the heated and decomposed air, and is continued till the air is discharged outside the house, or into the flue of a chimney. In brief, the invention consists in the application of the down-drawing stove principle to a lamp burner. This arrangement, in the chandelier exhibited, formed a part of the central support, and was ornamental as well as useful.

Trial was made between the celebrated inventions—the Bude and Faraday Lights, fixed for that purpose in two of the libraries of the Reform Club. The result of the experiment was in favour of the Bude Light as to the brilliancy of illumination, the perfect ventilation, and the freedom from heat. The Bude gives a light equal to 30 argands, and lights the room perfectly at every point. The Faraday light consists of 18 lights, and the smoke of the gas is carried off by tubes. The heat increased six degrees after the Faraday was lighted; it is of a subdued tone, and far from brilliant. It will thus be seen that the Bude has added to its fame by these experiments, the more by reason of both lights being great improvements upon the old system. The Bude, we believe, has been quietly but rapidly gaining in public estimation, and to the many public and private edifices which now possess it, the principal clubs will, doubtless, soon be added. During the experiments it was stated that the Faraday light was about four times more expensive than the Bude.—*Times*, Nov. 8th.

VENTILATION OF LIGHTHOUSE LAMPS.

PROFESSOR FARADAY has read to the Institution of Civil Engineers, a paper "On the Ventilation of Lighthouse Lamps; the points necessary to be observed, and the manner in which these have been or may be attained."

The author states that the fuel used in lighthouses for the production of light is almost universally oil, burnt in lamps of the Argand or Fresnel construction; and, from the nature and use of the buildings, it very often happens that a large quantity of oil is burnt in a short time, in a small chamber exposed to low temperature from without, the principal walls of the chamber being only the glass through which the light shines; and that these chambers being in very exposed situations, it is essential that the air within should not be subject to winds or partial draughts, which might interfere with the steady burning of the lamps.

If the chamber or lantern be not pefectly ventilated, the substances produced by combustion are diffused through the air, so that in winter, or damp weather, the water condenses on the cold glass windows, which, if the light be a fixed one, greatly impairs the brilliancy and efficiency, or, if the light be a revolving one, tends to confound the bright and dark periods together. The extent to which this may go may be conceived, when it is considered that some lighthouses burn as much as twenty, or more, pints of oil in one winter's night, in a space of 12 or 14 feet diameter, and from 8 to 10 feet high, and that each pint of oil produces more than a pint of water; or from this fact, that the ice on the glass within, derived from this source, has been found in some instances an eighth, and even a sixth, of an inch in thickness, and required to be scraped off with knives.

The carbonic acid makes the air unwholesome, but is easily removed by an arrangement which carries off the water as vapour. One pound of oil in combustion produces 1·06 pounds of water and 2·86 pounds of carbonic acid.

The author's plan is to ventilate the lamps themselves by fit flues, and then the air inside the lantern will always be as pure as the external air; yet having closed doors and windows, a calm lantern, and a bright glass.

EFFECTS OF INTENSE HEAT.

AFTER the great conflagration at Hamburgh there were abundant opportunities for examining the effects of high degrees of Heat. There were bricks the surface of which were fused, and thus coated with enamel; lime had become brittle and loose, and re-acquired its caustic property; pieces of granite burnt into fragments, and the surface of many square stones separated into thin layers. The bells were partly fused, at the same time becoming oxidated, and forming a slag and red-copper ore. A portion of the fused metal broke through the vaults and entered the sepulchres, coating and filling the skulls and bones with metal;—and the bell-metal underwent a partial refining, the tin being separated by fusing, and the copper left behind in a porous state; steel became soft and condensed by glowing into a thick mass; iron, after being fused, formed a slag, and changed into a graphite-like substance, or even into magnetic iron-stone, which was found in the shape of crystalline octahedra; glass was frequently fused into a kind of enamel, but sometimes it was only fritted, had received a crystalline appearance, and resembled Réaumur's porcelain. A magazine of blue paper was entirely destroyed, but the smalt was left behind without undergoing any change, and found afterwards fused together into a lump.

The large store of minerals of Messrs. Abel being likewise destroyed by the conflagration, there was a fine opportunity for examining the effects of fire on those substances. The greater part of them was destroyed, being fused or fritted, especially the metallic minerals: the cobalt alone had been able to resist the influence of the intense heat, and the smalt had partially become harder and bright, in such parts where it was glazed or changed into a black carbonaceous substance. The sparry iron-ore had preserved its crystalline form, but was transformed into brown iron-ore; the green iron-ore had indeed undergone the process of fusion, but still preserved its peculiar colour. All the magnesian minerals resisted the red-heat; garnets and opals remained unchanged; the iron garnet, however, lost its brightness, and assumed a yellow-brown colour; the diamonds were either entirely burnt or had become opaque and smaller. Black mica and chlorite schist became of a golden yellow, and siliceous sandstone was changed into opal, clay into porcelain-jasper, flints became white, fused with iron into a breccia, or were coated with a green enamel.

Another remarkable circumstance is, that the foot-paths and roofs covered with asphalte *did not ignite*, and that the ground underneath the smouldering ruins, which, for a whole fortnight—in some instances for eight weeks, or even three months—remained red-hot, was so little affected by the heat, that an ice-cellar was found filled with undissolved ice.—*Dr. Zimmermann.*

COMBUSTION OF FUEL AND SMOKE.

MR. S. HALL, of Basford, has patented the following improvements, which are stated to be supplementary to those described under Mr. Hall's previous patents, relating to combustion, of 1836, 1838, and 1841. The first consists in certain "peculiar" arrangements for supplying atmospheric air to furnaces through a great number of passages, or in a greatly divided state. The air is first introduced through a great number of tubes standing vertically at the outer or chimney end of the furnaces, the different streams from which reuniting, pass into one column along a hollow chamber *under* the main flue, until it arrives at the bridge, where, in a considerably heated state, it is divided into two currents, which are carried on each side round the brick-work or fire-place enclosing the burning fuel, and admitted into the fuel through a number of orifices in the brick-work and the fire-door. The second improvement consists in producing a more rapid combustion in the furnaces of locomotive engines, by admitting, through various channels, atmospheric air to the carbonaceous parts of the fire as well as to the volatile parts. A third consists in causing a draught through the fire of locomotive engines when the engines are stopped, or before they are set to work, by means of a pipe which proceeds from the front of the locomotive to the chimney, and passing up that is connected to another pipe, which is to be dipped into the boiler of any other locomotive at hand which happens to have its steam up. A fourth consists in preventing the escape of sparks from locomotive chimnies, by throwing up jets of water from time to time into the chimney by means of a perforated hood, the aggregate amount of the holes in which is to be greater than the area of the chimney.

PLAN FOR BURNING WASTE COAL.

Dr. Clanny has contrived the means of Burning the small Waste Coal, called in the collieries *duff* coal, which has hitherto been burnt at the pit's mouth, or thrown away as useless. The object to be accomplished is to form the powdery coal into small lumps, so as to enable the heat of the fire to penetrate, and the air to have access to the heated coal. The readiest means that suggested for effecting this was to enclose the duff coal within a substance not readily destroyed by heat, and thus to make it into small parcels of the requisite size. After numerous experiments, Dr. Clanny found that coarse brown paper, soaked in a strong solution of muriate of ammonia (sal ammoniac), in the proportions of one ounce to ten of water, answered the purpose completely. He twists the paper into the form of sugar papers, each packet holding about one pound. These parcels of coals when put on the fire permit the air and the heat to circulate round them, and the surface of the coals soon becomes sufficiently converted into coke to hold the interior loose mass together before the paper is consumed. The fire produced by the combustion of these parcels of coals is very bright and blazing; the carburetted hydrogen issuing as it is generated through the interstices of the coating of the coke. When the gaseous combustion is ended, the remaining cinder is represented to be a capital article,—far superior to the cinder of ordinary coals. It forms, indeed, a kind of coke, for as the air is excluded by the crust of coke first formed, the carbon of the coal must remain nearly as intact as when heated in a retort. The advantage of this contrivance for using waste coal will of course depend on its expense, and it is estimated by Dr. Clanny that the kind of paper he uses, and the cost of the solution, are so trifling that there would be great economy even in the coal districts in burning the duff coal in this manner.—*Artizan*, No. 5.

NEW FUEL.

A compost of coal-dust and other material has been patented by a gentleman named Cooke, and from the satisfactory result of a series of experiments lately conducted at the Royal Polytechnic Institution, the following table will be read with interest:—

Material.	Time burning.	Average pressure on boiler per square inch.	Weight of material burnt.		
			cwt.	*qrs.*	*lbs.*
Coal, No. 1.	16 hours	25·9	4	3	14
Coal, No. 2.	Ditto.	24·25	4	2	0
Cooke's Fuel.	Ditto.	24·3	4	2	0

If the expectations of the patentee be realized, the economy in the saving of the fuel is very considerable: certainly giving a reduction, when compared with coal, of at least 25 per cent. on the cost price; and if made use of in a furnace similar to either William's or Kymer's, the saving would, we should imagine, be much greater.

SMOKE CONSUMER.

MR. RODDA has patented a simple plan for Consumption of Smoke. It is done by partitioning off a portion of the back of a furnace with fire brick, so that when the coal has been converted into coke in the outer part, it is thrust into the division at the back, by which means the smoke from the coal just put on being obliged to pass over the fuel already coked, is consumed. Thus a few bricks dividing a furnace will produce an effect which has been long desired but never yet attained.

NEW FURNACES.

MR. DICKS has read a paper to the British Association, "On the Prevention of Smoke by Mr. Williams's Furnace," the main principle of which consists in admitting atmospheric air at the ordinary temperature behind the bridge of the chimney, and thus supplying oxygen for the combustion of the heated gases. The furnace, and the principle of its action, were fully explained by Mr. Williams himself at the preceding meeting of the Association,

Mr. Chanter next described his Furnace for Economizing Fuel, which differs from Mr. Williams's in the two essential particulars of heating the air before it is admitted to the fire; and of giving a reciprocating motion to the fire-bars, for the purpose of freeing them from clinkers and ashes. The air is admitted into an air-chamber to be heated, and a "deflective arch," at the bottom of the boiler, turns the degenerated gases on to the hot fuel, supplied with its requisite portion of oxygen through the clear fire-bars.

IMPROVEMENTS IN CHIMNEYS.

M. EUGENE DE VARROC, of Bryanstone-street, Portman-square, has patented an "Apparatus to be applied to Chimneys to prevent their taking fire, and for rendering sweeping Chimneys unnecessary." This invention relates to the application of reticulated metal surfaces, at the commencement, or near the entrance, of the Chimney, in order to prevent the passing of the flame, and also to intercept the soot.

The apparatus consists of two cylinders of wire-cloth, one within the other, but so constructed that the surfaces of the two cylinders touch, or are in contact with each other. The inventor prefers to make the cylinders of wire-cloth, having sixty-four holes to the square inch, or closely perforated metal plates may be employed, but such will not be found as useful as wire-cloth. The cylinder, which is mounted upon an axis, is fixed in the chimney, as near the fire as convenient, the flue or chimney being so constructed as to prevent any passage for the smoke but through the double-wire cylinder, the wires forming the reticulate, or open work, of one cylinder, being made to cross those of the other cylinder. By this arrangement, the flames and soot will be prevented from passing through the eylinder; but there will be sufficient draught through the cylinder for the fire, and the chimney beyond the apparatus will not be coated with soot, the same being deposited on or about the apparatus, which will require to be brushed off every morning, and, if desired, the cylinder can be turned partially round, so as to present another part of its periphery. A modification of this apparatus, composed of a number of perforated plates, and arranged in a rectangular form, is shown, as being applied to the chimney of a steam-engine boiler; in which cases there are brushes constructed for clearing the same occasionally from soot.—*Record of Patents.*

LARGE CHIMNEY.

Mr. Brockbank has finished the erection of a large chimney, at the works of Messrs. Dewhirst and Co., Adelphi, Salford, which is stated to be the highest in Manchester. It is a plain circular shaft, on a square base, of fifteen yards high, and seven yards square. The total height of the chimney, from the foundation, is eighty-one yards (243 feet); and the thickness of the wall, at the bottom, three feet. The external diameter at the top is ten feet, and the thickness of the wall ten inches, the aperture being estimated to be of sufficient area for steam-engines of about 400-horse power. The principal singularity of this chimney is, that although such structures are usually built here in great part or wholly of brick, this one is constructed entirely of stone, of which it contains abouf 1700 tons. This material has, we understand, in this case been found to be somewhat cheaper than bricks; whilst, for durability and appearance, there can be no comparison.—*Artizan*, No. 7.

NEW MODE OF EXTINGUISHING FIRES.

Dr. Clanny proposes to apply the incombustible properties of muriate of ammonia as a means for Extinguishing Fires. Muriate of ammonia dissolved in the proportion of five ounces to each gallon of water, would be much more efficacious in extinguishing fire than double the quantity of water alone. The practicability of any such plan may, however, be questioned, for it would involve the necessity of each fire-engine carrying its supply of extinguishing liquid. It would also involve a complete alteration in the construction of the engines, to protect them from the actively corroding properties of the sal-ammoniac. Neither is the plan so novel as Dr. Clanny supposes, for it has long since been proposed to employ saline solutions for extinguishing fires. We are not aware, indeed, that muriate of ammonia has been previously proposed for the purpose, but the peculiar inconvenience attending its use, from its corrosive action, would render it, practically, much more objectionable than most other solutions possessing anti-igneous properties.—*Artizan*, No. 5.

OROPHOLITHE FOR ROOFING.

THIS patented improvement consists in preparing fabrics for covering floors, roofs, &c. by coating the former, on one or both sides, with a composition called "Oropholithe," which is produced by mixing to the 3 parts by weight of linseed oil, 4 parts of litharge or white-lead, 9 parts of whiting, and 36 parts of sand. The oil and white-lead, or litharge, are first mixed together, then the whiting is introduced, and lastly, the sand is added to the mixture. If the composition be wished of a light colour, boiled linseed oil, and pale litharge, or ground white-lead, are used; but when a light colour is not requisite, red litharge is employed. The whiting and sand are rendered perfectly dry, and passed through a fine sieve, before being added to the mixture: white or silver sand is preferable; but yellow sand, or finely-powdered bricks or tiles, may be used.

Canvas of an open texture is preferable for covering roofs, and is thus prepared:—Stretch the canvas upon a table or slab, of Roman cement or slate, supported by legs, and inclosed in a wooden frame; and a coat of the composition, one-sixteenth of an inch thick, is applied to one or both sides of it. The fabric is covered with the composition on one side only, when it is intended to be used in dry situations; but, if it be required for covering roofs, and other surfaces exposed to wet and damp, both sides are coated. The composition is polished with pumice-stone, fine sand, oil, or brown free stone; and it may be brought to any required tint, by the addition of a small quantity of colouring matter; it may likewise be ornamented with coloured patterns or designs.—*Magazine of Science*, No. 216.

FIRE-PROOF ROOFS.

MR. PETER HOGG has lately communicated to the Institution of Civil Engineers a valuable paper on this improvement.

The mixture invented by Lord Stanhope, and used by the late Mr. Nash, for covering the nearly flat Fire-proof Roofs of Buckingham Palace, is described in the paper as being composed of Stockholm tar, dried chalk in powder, and sifted sand, in the proportions of three gallons of tar to two bushels of chalk, and one bushel of sand, the whole being well boiled and mixed together in an iron pot. It is laid on in a fluid state, in two separate coats, each about three-eighths of an inch in thickness, squared slates being imbedded in the upper coat, allowing the mixture to flush up between the joints the whole thickness of the two coats, and the slates being about an inch. The object in embedding the slate in the composition is to prevent its becoming softened by the heat of the sun, and sliding down to the lower part of the roof, an inclination being given of only $1\frac{1}{2}$ inch in 10 feet, which is sufficient to carry off the water when the work is carefully executed. One gutter, or water-course, is made as near to the centre as possible, in order to prevent any tendency to shrink from the walls, and also that the repairs, when required, may be more readily effected. It is stated, that, after a fall of snow, it is not necessary to throw it from the roof, but merely to open a channel along the water-course, and that no overflowing has ever occurred; whereas, with metal roofs, it is necessary to throw off the whole of the snow on the first indication of a thaw. These roofs have been found to prevent the spreading of fires; and it is stated, that on one occasion, to test their uninflammability, Mr. Nash had a bonfire of tar-barrels lighted on the roof of Cowes Castle. Another advantage is stated to be the facility of repair which the composition offers; as, if a leak occurs, it can be seared and rendered perfectly water-tight, by passing a hot iron over it, and when taken up the mixture can be re-melted and used again. The author proposes to obviate the disadvantage of the present weight of these roofs, by building single brick walls at given distances, to carry slates, upon which the composition should be laid, instead of filling the spandrils of the arches with solid materials, as has been hitherto the custom. The reported failures of this species of covering at Mr. Nash's house, in Regent-street, and in other places, are accounted for by the composition having been used in one thin coat, laid upon an improper foundation of lath and tiles. The durability of the roofs, which were carefully constructed with good materials, has been, it is contended, fully proved at Lord Palmerston's house, which was covered with the composition in 1807; Lord Berwick's, in 1810; Sir James Langham's, in 1812; the Pavilion, at Brighton, in 1816 and 1823; and nearly the whole of Buckingham Palace, in 1826 and 1829. The latter roofs are said to be in perfect order at the present time, and have scarcely demanded any repairs since their completion.

The paper is illustrated by a drawing showing the mode of constructing the roofs, and the improved method proposed by the author, with specimens of the composition, with slates imbedded, taken from the roof of the palace during some recent alterations.

An interesting conversation followed the reading of this paper. Mr. Poynter presented a drawing of the mode of setting the pots for melting and preparing the composition, the proportions of which he stated somewhat differently from those given in the paper. Three measures of ground chalk, dried and sifted very fine, were mixed and kneaded up with one measure of tar; these ingredients were melted in an iron pot, set in such a manner that the flame should not impinge too violently upon it. The first, or "skimming" coat of the covering being laid on of a thickness of $\frac{3}{16}$ inch, the finishing coat was composed by adding to the former mixture three measures of hot sifted sand, well mixing the whole together; the composition was laid on with a tool, similar to a plasterer's trowel, but much stronger. Mr. Nash, when he first tried the composition, found that the surface became disintegrated by exposure to the weather; he therefore added the slates imbedded in the second coat, and subsequently never used the mixture without them.

Mr. Nixon stated that he was employed under Mr. Nash, when the palace roofs were executed, and he could bear testimony to their durability and soundness. The roofs at East Cowes Castle, which were covered with the composition in 1808, and those of the Pavilion, at Brighton, in 1816, were now in as good a state as when they were finished. The failure at Mr. Nash's house, in Regent-street, arose from the roof having been originally composed of mastic, which soon cracked. One coat of the Stanhope composition was spread over it to stop the leaks, but it was inefficiently done, and, ultimately, Mr. Rainy had a new roof properly constructed, with two coats of composition, which had remained sound to the present time. The price of these roofs, when well constructed by the person who did those of the palace, was about five guineas per square.

Mr. Hogg observed, that the chalk was only exposed to such a heat as would evaporate any moisture it contained. The weight of the two coats of Stanhope composition, including the slate imbedded in it, was about twelve pounds per superficial foot.

Mr. Sibley considered the Seyssel asphalte, when carefully laid, preferable to any composition of a similar nature; he had used it extensively, and was well satisfied with it, both for roofing and paving.

Mr. Hogg objected to the use of asphalte for roofing, as it was liable to injury, being of a brittle nature; it was not elastic, and it shrunk from the walls, thereby causing leaks. Lord Stanhope's composition did not possess these faults, and Mr. Hogg did not consider that it was superseded by asphalte.

Mr. Morland had covered the roof of the treadmill, at Giltspur-street Compter, with asphalte, and had found it answer perfectly. It was laid on in a thickness of $\frac{3}{8}$ inch, upon roofing-boards $\frac{3}{4}$ inch thick, with canvas nailed on them, with an entire fall of only nine inches; there was no appearance of leakage.

Mr. Davidson had caused a school-room to be floored with asphalte, four years ago, and up to the present time there was no symptom of wearing down, although the stones, which were let into the floor for supporting the desks, &c., were considerably abraded.

He believed that the only failures of the asphalte had occurred from the use of inferior ingredients. Gas-tar had been used instead of vegetable-tar, and in those cases the result had not been successful.

SUBSTITUTE FOR GLAZED FRAMES IN HOTBEDS.

In the *Rheinlandische Gartenzeitung* is described a Substitute for the Glazed Frames of hot-beds and green-houses, which deserves the attention of florists. Instead of glass the frames are covered with a fine white cloth of cotton. In order to render this more transparent, and enable it to resist moisture, it is covered with a preparation, the ingredients of which are four ounces of pulverised dry white cheese, two ounces of white slack lime, and four ounces of boiled linseed oil. These three ingredients having been mixed with each other, four ounces of the whites of eggs, and as much of the yolk, are added, and the mixture is then made liquid by heating. The oil combines easily with the other ingredients, and the varnish remains pliable and quite transparent. The expense of a forcing bed arranged in this manner is inconsiderable, and it yields at the same time many other advantages. Such a hot-bed needs not the anxious attention required by the ordinary one covered with glazed frames. During the strongest rays of the mid-day sun they do not require any particular covering or shade; the atmosphere therein preserves a nearly equable temperature almost the whole day, and requires only to be changed from time to time, according to circumstances. If such a bed is provided with a soil of horse-dung, and a proper thickness of some fertile, finely sifted heath mould is spread thereon, layers of all sorts of flowers, early vegetables, and other plants, may be reared from seeds in it.

IMPROVED PAVEMENT.

Sir John Scott Lillie has patented this improvement, which he thus describes:—"My several improvements in roads consist in covering the surfaces of roads with rails or fillets of wood or iron, or partly of wood and partly of iron, placed at such distances from each other as to form groves in a transverse direction to the line of traffic. These rails or fillets to be either imbedded in concrete, asphalte, or other cement, and thus attached to such surfaces; or they may be nailed or otherwise fastened to boards or planks, which boards or planks are to be also well secured to sleepers sunk and grouted into the materials of which such roads are formed, thus rendering the surfaces of existing roads available as foundations. I do not limit myself to any particular form or dimensions in respect to the materials to be used; but I am of opinion that the rails or fillets before mentioned, when of iron, should not exceed one inch, and when of wood, that they should not exceed two inches in width, and that the grooves or intervals in both cases should not exceed one inch; and that on steep inclines the iron rails, or wood faced with iron, should have an acute angle, or be sloped towards the upper end, with grooves at each side for carriage wheels, but not sufficiently wide to admit horses' feet. I do not claim any particular angle or inclination for the fibre of the wood of these fillets; but when the fillet is composed of one piece, the fibre should be perpendicular; if composed of two equal pieces joined together, the fibre of each should incline towards the centre, the better to resist the pressure. And my invention consists in constructing or covering the surface of roads with bars or fillets of wood, or iron, or of both materials, arranged and supported as above described."

This system of paving has been laid down in the Rue de l'Ecu, at Boulogne; and by the adoption of it on the public road from Boulogne to Amiens, it is thought that steam-carriages might be run upon it to great advantage.

Another specimen has been laid down opposite St. James's Church, in Piccadilly, and fully bears out the favourable accounts of its success in France and other places, where it has been subjected for some time to severe tests.

WEAR OF WOOD AND GRANITE PAVEMENTS.

Mr. Hope has communicated to the Scottish Society of Arts the following valuable information :—" On Wood Paving, being an experimental Inquiry into the best position of the fibre of the wood,—its durability and efficiency as a material for paving, under wet, dry, and frosty weather ; and in the value of animal power in draught on Wood Pavement." Mr. Hope gives in his communication the result of his experiments on wood and granite paving laid down in the same thoroughfare ; and the comparative durability, not only of wood and granite, but of wood paving with blocks laid with the fibre vertical and horizontal, and also at intermediate angles. The following table shows the result in a condensed form :—

Table, showing the relative Wear of Wood Paving, with the fibres vertical, and varying by fifteen degrees to horizontal, for the space of eighteen months ; also of Granite Sets for the same period.

Amount of Wear sustained.	Fibre vertical.	Fibre at 75 degrees.	Fibre at 60 degrees.	Fibre at 45 degrees.	Fibre at 30 degrees.	Fibre at 15 degrees.	Fibre Horizontal.	Granite Sets.
At the end of								
1 month . .	·017	·023	·032	·046	·065	·088	·109	·014
2 . . .	·030	·038	·051	·069	·093	·120	·154	·025
3 . . .	·040	·051	·065	·088	·114	·149	·189	·037
6 . . .	·062	·078	·101	·136	·178	·231	·294	·073
9 . . .	·078	·095	·120	·167	·220	·278	·363	·112
12 . . .	·096	·115	·142	·194	·253	·312	·390	·141
15 . . .	·111	·132	·164	·219	·282	·347	·433	·183
18 . . .	·125	·147	·182	·241	·312	·379	·480	·218
Proportions of an inch for the 18 months	$\frac{1}{8}$	6-40	3-16	bare $\frac{1}{4}$	full $\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	full 7-32

Mr. Hope also gives the results of his experiments on wood paving in wet, dry, and frosty weather ; and the increased value of animal power in draught on wood paving ; from all which he deduces the great superiority of wood paving with the fibre vertical, over that with the fibre lying horizontal, or at any angle betwixt the two, and also over granite paving.

Mr. Hope has likewise communicated to *Jameson's Journal*, No. 70, a series of experiments on Wood Paving, whence it may be inferred,—

That verticality of fibre is the most durable position of wood for paving, besides affording the means of obtaining as firm a structure as is requisite.

That wood is an efficient material for paving, whether subjected to wet, dry, or frosty weather.

That the moisture it constantly retains increases its strength, preserves it against dry rot, and undue expansion and contraction.

That wood for pavement is more durable than granite.

That the value of the horse is materially enhanced, and its power in draught considerably increased on wood pavement. And,

That, with its general adoption, steam power may be successfully employed.

STEREOPRISM PAVEMENT.

On April 12, Mr. Davis described to the Society of Arts his patent Stereoprism Combination, as applicable to wood pavements, and other purposes. This combination has already been applied in paving part of the carriage-way in Lombard Street. The mode of forming the paving blocks is by cutting a piece of timber 6 inches thick and $5\frac{1}{2}$ inches wide, into lengths of 9 inches, the angles at which the blocks are cut being 36°. In each side, and in the sloped ends, a rectangular groove is cut three-fourths of an inch in width, and of similar depth, the bottom of the groove being 2 inches from the bottom of the block: into these grooves are inserted wooden keys $3\frac{1}{4}$ inches in length, three-fourths of an inch thick, and $1\frac{1}{2}$ inch in width, the use of which is to tie the blocks together, both longitudinally and laterally. A triangular groove, three-fourths of an inch wide, and five-sixteenths of an inch deep, is cut in the upper surface, in the direction of its length; and each row is put together so as to break joint throughout the work.

WOODS OF THE PALM-TREE.

Two or three varieties only, of the four or five hundred which are said to exist, are imported into this country from the East and West Indies; they are known in England by the names, palm, palmetto, palmyra, and nutmeg, leopard, and porcupine wood, &c., from their fancied resemblances, as when they are cut horizontally, they exhibit dots like the spice, and when obliquely, the markings assimilate to the quills of the porcupine. The trunks of the palms are not considered by physiological botanists to be true wood; they all grow from within, and are always soft and spongy in the centre, but are gradually harder towards the outside; they do not possess the medullary rays of the proper woods, but only the vertical fibres, which are held together by a much softer substance, like pith or cement, so that the horizontal section is always dotted, by which they may be readily distinguished from all true woods. The colours and hardness of the two parts differ very materially, and the following are the distinctive names of three.

The *Areca catechu*, or betel-nut palm, is remarkably perpendicular; it grows to the height of about thirty feet, and rarely exceeds four or five inches diameter: it bears a small tuft of leaves, and the fruit is in clusters like grapes. The betel-nut is chewed by the Indians along with quicklime, and the leaf of the piper-betel, in the manner of tobacco. The general colour of the wood is a light yellow brown; the fibres are large, hard, and only a few shades darker than the cementitious portions.

The *Cocos nucifera*, or cocoa-nut palm, flourishes the best in sandy spots near the sea-beach; it sometimes grows to ninety feet in height, and three feet in diameter, but is generally less; it is rarely quite straight or perpendicular, and has broad pendent leaves, from twelve to fourteen feet long, in the midst of which is a sort of cabbage, which, as well as the fruit, the cocoa-nut, is eaten; the husk of the nut supplies the material for coir-rope, &c. No part of this interesting tree is without its grateful service to the Indian: the leaves are used for making baskets, mats, and the covering of his dwelling; he also obtains from this tree, oil, sugar, palm-wine, and arrack; and, although the upper part of the trunk is soft and stringy, the lower supplies a useful wood, the fibres of which are of a chesnut brown, and several shades darker than the intermediate substance; the wood is employed for joists, troughs for water, and many purposes of general carpentry, &c. The Asiatic Society has specimens marked, male, 1st, 2nd, 3rd, 4th sorts, and the same number of female varieties; no marked distinction is observable between them.

The *Niepere* palm is much darker than either of the preceding kinds; the fibres are nearly black, and quite straight, and the cement is of a dark brown; but in other varieties with these black fibres, the softer part is very light-coloured, and so friable that it may be picked out with the fingers. Colonel J. A. Lloyd informs us that, at the Isthmus of Darien, they use the fibres of some of the palms as nails for joinery-work.

Palmyra-wood, or that of *Borassus flabelliformis*, says Mr. Laird, is largely imported into Madras and Pondicherry, from the Jaffna district at the northern part of Ceylon, for the construction of flat roofs; the joists of which consist of two slabs, the third or fourth part of the trees, bolted together by their flat sides so as to constitute elliptical rafters, They are covered first with flat tiles, and then with a white concrete called *Chunam*, consisting of shell-lime, yolks of eggs, and *Jaggree*, (sugar,) beaten together with water, in which the husks of the cocoa-nuts have been steeped.

The prickly pole (*Cocos guianensis*) of Jamaica, &c., a palm growing forty feet high, and of small diameter, is said to be very elastic, and fit for bows and rammers. The palm-woods are sparingly employed in England, for cabinet and marquetry work, and sometimes for billiard cues, which are considered to stand remarkably well; they are also turned into snuff-boxes, &c. The smaller kinds are imported under the names of Partridge canes, (called also Chinese or fishing canes,) Penang canes, from the island of that name, and some others, for walking-sticks, the roots serving to form the knobs or handles. The knobs of these sticks exhibit irregular dots, something like the scales of snakes; these arise from the small roots proceeding from the principal stem, which latter shows dotted fibres at each end of the stick, and streaks along the side of the same.

The twisted palm-sticks are the central stems or midribs of the leaves of the date palm; they are twisted when green, and stretched with heavy weights until they are thoroughly dry: they are imported from the Neapolitan coast, but are considered to be produced in Egypt. The shells of the cocoa-nut and coquilla-nut, and the kernels of the areca or betel-nut, and of the corosos or ivory-nut, have likewise their uses in our workshops.—*Holtzapffell on Turning.*

INDIAN RUBBER PAVEMENT.

Although we have long been sensible of the versatility of Indian rubber, we never, even in our most abstracted moods, contemplated the feasibility of its adaptation to the purposes of paving. Here, however, we have it not merely in the shape of paving-blocks, but in that of planks for boat-building, and ship-linings to prevent splintering from cannon shot. It appears that the paving has been applied in stables and other places with every success. In the stables of Sir Francis Collier, at Woolwich, the plan has been for a considerable time in use; and from what Sir Francis Collier says, it appears to have given every satisfaction.—*Artizan*, No. 7.

TESSELLATED PAVEMENTS.

In 1840, Mr. Prosser, of Birmingham, discovered that if the material of porcelain (a mixture of flint and fine clay) be reduced to a dry powder, and in that state be subjected to strong pressure between steel dies, the powder is compressed into about a fourth of its bulk: it then undergoes a process of semi-vitrification, and is converted into a compact solid substance, of extraordinary hardness and density; much less porous, and much harder, than the common porcelain, uncompressed. This curious, and, as it has since proved, very important discovery, was first applied to the manufacture of buttons, to supersede those of mother-of-pearl, bone, &c. The buttons thus stamped out of porcelain powder are capable of resisting any pressure to which they are subject in use, and are more durable, as well as cheaper, than buttons of the materials ordinarily used.

The applicability of this ingenious process to the manufacture of tesseræ for pavements soon afterwards occurred to Mr. Blashfield, who made arrangements with Messrs. Minton and Co. (the manufacturers appointed to work Mr. Prosser's patent), for a supply of small cubes made according to the new process; these he submitted to various trials and experiments, and, having found them in every respect suitable for the purpose, he has recently, in conjunction with Messrs. Wyatt, Parker, and Co., carried on the invention on an extensive scale. Tesseræ of various colours and form—red, blue, yellow, white, black, brown; quadrilateral, triangular, rhomboidal, hexagonal, &c., have been manufactured on this principle in large numbers; pavements of considerable extent have already been constructed with them; and they have been found to possess the following advantages:—

First, being formed in similar steel dies, they are of uniform size and shape, so that they can be fitted together accurately in the laying down of the most complicated designs. Secondly, being all composed of the same material, variously coloured, they are all of precisely equal hardness, so that pavements made with them are not liable to fall into hollows in use. Lastly, owing to the effect of the intense pressure under which they are made, they are quite impervious to moisture, of a flinty texture throughout, and, in a word, to all intents and purposes absolutely imperishable. In these several respects, their superiority to the Roman tesseræ, (which, as we have seen, were shaped imperfectly by hand, and differed from each other in hardness,) must be manifest to the reader. Nor less conspicuous is the superiority of the modern process of uniting the tesseræ to form pavements. For this purpose, instead of spreading the cement on the surface to be paved, and laboriously setting each single tessera in it, (according to the directions of Vitruvius), the pavement is first put together, face downward, on a smooth surface, so that the tesseræ find their level without any trouble to the workman: and, as soon as a sufficient portion of the design is finished, it is backed with fine Roman cement, which is worked in to fill the crevices between the tesseræ: the pavement is thus formed into smooth flat slabs of convenient size, according to Mr. Singer's method, and these are laid down on a foundation properly prepared in the usual way.

One peculiar feature of this process is, that private persons, if so inclined, may set out their own pavements in the coloured tesseræ, leaving it for a workman afterwards to cement and lay down the slabs. Fine mosaic work for the tops of tables, for illuminated monuments, &c., may be made in the same manner with a superior kind of tesseræ, glazed on the surface, and richly ornamented in gold and colours. Pavements thus constructed are singularly beautiful. The outline of the design strikes clearly and sharply upon the eye, and the brilliant colours of the tesseræ are reflected from the level surface, uninterrupted by those broad uneven lines of cement, which, in the Roman pavements, detract so much from the general effect. The truth of every line and angle in the figure, and the just proportion of all its parts, however complicated and various, impress the mind with an agreeable sense of order and precision. Such, indeed, is the exactness and facility of the workmanship in these pavements, that the oblique and intricate intersections of the Mauresque designs are as readily executed as the simple rectangular patterns of the Pompeiian style. Even the scrolls and twisted guilloches, the quaint emblematical devices, and grotesque representations of horses, warriors, &c., found in the most elaborate of the Roman pavements, may be accurately imitated with the new stamped tesseræ.—*Magazine of Science*, No. 211.

PATENT ROAD AND STREET CLEANSING MACHINE.

This Machine, which is now in operation in Regent-street, and other parts of the metropolis, is the invention of Mr. Whitworth, of the firm of Messrs. Joseph Whitworth and Co., engineers, at Manchester, where it has been employed for several months past. The principle of the invention consists in employing the locomotive motion of rotatory wheels, moved by horse or other power, to raise the loose soil from the surface of the ground, and deposit it in a vehicle attached.

The apparatus for this purpose consists of a series of brooms suspended from a light frame of wrought iron, hung behind a common cart, the body of which is placed near the ground for greater facility in loading. As the cart-wheels revolve, the brooms successively sweep the surface of the ground, and carry the soil up an inclined plane, or carrier-plate, at the top of which it falls into the body of the cart. By the aid of this machine, the three operations of sweeping, loading, and carrying, are not only carried on simultaneously, but, as it were, blended in one operation; whilst each is so far simplified as to render the combination less complex and protracted than the single operation of either sweeping or loading by the usual mode. When going at the rate of only two miles an hour, with brooms three feet wide, the patent machine will clean nearly sixty superficial square yards per minute. This is about the average rate of work done by thirty-six men. Provision is made for letting off the water collected in the cart by means of a pipe, having its interior orifice some inches above the level of the mud after settlement. The cart when full is drawn to the side of the street, at some distance from a sewer-grid, and the pipe-plug being withdrawn, the water flows into the channel.

By a slight modification of the original form of the machine, it is enabled to sweep close up to the curb-stone along the side of the street. The action of the brooms is regulated by a series of weights, which counterbalance a certain portion of the sweeping apparatus, and relieve the pressure of the broms on the ground. The brooms, with the entire apparatus, may also be raised from the ground, by means of a handle turned by the driver, whenever it is necessary to discontinue sweeping; as when the cart is full, or the surface obstructed. The same handle will raise the sweeping apparatus into the horizontal position, when access is required to the hinder part of the cart for the purpose of unloading.

The Machine has been worked on every kind of street surface,—the round and square set stone, the macadamized road, and the wood pavement. Its peculiar advantage, as applied to wood pavement, is that it prevents the slippery state of the surface so much complained of. The wear of the brooms, which was at first considerable, has been diminished more than one half, by the action of the regulating weights. A product of South America, called by the Portuguese

Piassava, forms an excellent material for the beard of the brooms, having great pliancy and strength combined, and also a remarkable degree of durability.

An indicator, attached to the sweeping apparatus, shows the extent of surface swept during the day, and acts as a useful check on the driver. The cart is drawn by two horses. The economy effected by the contrivance is stated to be very considerable. The average of the present rate of cleansing varies from 3*s.* 6*d.* to 5*s.* per 1000 yards. By the aid of the patent Machine, it will be generally reduced to about 1*s.*; less on pavement (wood or stone,) and rather more on macadamized roads. In London, however, the expense will be greater, owing to the low value of manure, and the cost of transport, which varies from 1*s.* to 1*s.* 6*d.* per ton.

NEW BRICK AND TILE-MAKING MACHINE.

A MODEL of Mr. Hunt's Machine for Making Bricks and Tiles has been exhibited to the Institution of Civil Engineers, with several specimens of its produce. Its action was described to be, that the tempered clay is placed in a hopper, the front and back of which are formed by the peripheries of two drum-wheels covered by webs of endless cloth, which, in descending simultaneously, carry down a continuous supply of clay of the exact length and width of a brick, while a frame is projected forward at given intervals so as to determine and cut off the requisite thickness, which is received upon a pallet-board, brought forward by an endless chain. About 1200 bricks are made per hour, with the attendance of two men and three boys to attend to the machine.

A SPEAKING MACHINE.

AN ingenious mechanician at Hamburgh, named Faber, is stated to have invented a Speaking Instrument which imitates correctly the sounds of the human voice. It consists of an imitation in caoutchouc of the larynx, the mouth, and palate, and it is worked by the aid of bellows in the same manner as an organ. The inventor, by touching certain keys, can make the instrument speak (in German, of course), and even sing. The compass of the artificial voice is, however, very limited, and the sound rather disagreeable; but in subsequent trials the inventor hopes to overcome these defects. This invention, if the accounts can be relied on, is a great advance on any previous attempts of the kind, the highest attainment having been to produce two or three articulate sounds.

PROPELLING BALLOONS.

MR. MONCK MASON, who, it is known, has for some time been devoting his attention to the subject, has conceived the idea that the Archimedean screw, as it has been applied to move vessels through the water, may also be applied to move balloons through the air. He has, accordingly, submitted this idea to the test of experiment. He has constructed a balloon somewhat in the shape of an egg. Beneath this egg-shaped balloon he has placed a slender wooden frame, of the form of a canoe, to the centre of which he suspends an oblong shaped car. Out of that end of the car which is to go first he has placed an iron rod or axle, at the end of which is a short portion of an Archimedean screw, the surface of the spiral being made of very light material, and proportionally very large. It is placed at the most suitable angle for effectually pulling or sucking forward the balloon as the axle revolves, and for offering the least resistance to its progress. At the stern of the car is a large oval-shaped rudder, which can be placed vertically, and moved to the right hand or the left, to guide the balloon on either side, or horizontally, and then, by depressing or raising it, influence the balloon to rise or descend. How this Archimedean screw is to be set in motion and kept in motion for any length of time is an important problem not yet found out. Mr. Mason employed, to exhibit the effects of the screw, a piece of clock-work, acting by a spring, which, being wound up in the room, and placed in the car, set the screw in motion, and unquestionably the screw propelled the balloon round the room. It is certainly proved by this experiment that while floating in a tolerably calm atmosphere, like that of a room, a balloon may be propelled with considerable velocity, and probably guided. It is due to the ingenious adapter of the Archimedean screw to aerial navigation, to say, that he regards the experiment as merely establishing the possibility of applying this propelling power to balloons, and he leaves to future experiments, and perhaps to other inventors, to find out the machinery which may be most advantageous to give motion to the screw.

NIGHT TELEGRAPHS.

M. Louzoni, an Italian, has invented a system of Night Telegraphs consisting of three fixed luminous points, which may be eclipsed together or separately. These three points are disposed of at the extremities of a right-angled triangle, having two equal sides, one horizontal, the other vertical. If, by means of a screen, one of these lights be hidden, the other two indicate the direction of the side opposed to the eclipsed angle, and there will be thus three different signs. The three points shining simultaneously will form a fourth, and a fifth is given by a single light. By combining two by two, the numbers corresponding to each of these signs, M. Louzoni designates the different letters of the alphabet.

NEW NIGHT CLOCK, ST. NICHOLAS' CHURCH, LIVERPOOL.

A new mode of illuminating clocks has been brought into operation by Mr. H. Hughes, of Castle Street, Liverpool, in which gas is conveyed into the spindle, or shaft, on which the hands are fixed, and thence to the hands themselves. A light burns in the centre, and is red in colour. Two lights revolve with the hands, and one is green while the other is white.

The two revolving lights are further distinguished from each other, by one being placed at double the distance from the centre. By these three lights the time can be accurately told by those who are acquainted with the principle, and there is no difficulty in acquiring that acquaintance. But that the old dial should possess no exclusive advantage in any form, but that all belonging to it should be transformed to the new, *figures* are given in the usual way. These figures are seen about as far as the *hands* are seen in the old dials. How far the three lights, placed from two to four feet apart, can be seen, is easily conceived; and this is the precise distance at which the time can be told. The size of the dial alone limits the distance. The present dial, it is expected, will show the hour easily, in clear weather, in Cheshire, after the lights, by the help of a little experience, are properly regulated.—*The Builder*, No. 30.

NEW CLOCK.

A COMMUNICATION has been read to the British Association, from Mr. L. Cooke, of Parsonstown, describing a Clock movement of his invention, and a new mode of suspending the pendulum. In this contrivance the pendulum is detached from all parts of the clock movement, and is in contact only at the suspending needle points. The pendulum is made to vibrate in half-seconds, by which means the variations, owing to expansion and contraction, are greatly diminished; and that source of error is further corrected by a compensating mechanical pendulum.

MEASURING DISTANCES.

MR. P. LEAHY has read to the British Association, a paper on a method of ascertaining inaccessible Distances at sea or land, for which he claimed the advantages of greater accuracy and expedition than by the method of measuring a base line by the log. On his plan, two small telescopes are fixed at the greatest distance the vessel will admit of, and so as to form some multiple of 10 feet. This distance forms the base line on which the calculations are to be made.—Mr. Macneill being requested by Dr. Scoresby to state his opinion on the invention, the latter said that it was sound in principle, but he thought, with so short a base line, and with the difficulty of taking simultaneous observations at sea, it would be liable to inaccuracy.

A MONSTER BELL.

AN immense bell, the largest ever cast in England, weighing no less than 7 tons 11 cwt. 2 qrs. and 12 lbs., has been shipped on board the *Lady Seaton*, bound for Montreal. It is intended for the new Catholic cathedral at Montreal, and was cast at the foundry of Messrs. Mears and Sons, Whitechapel. It required 10 tons of fused metal to form the cast, and the casting itself weighs upwards of 7½ tons; its diameter at the edge is 7 feet 3 inches; the clapper weighs upwards of 3 cwt.; the wood work, which is composed of old English oak, 1 ton; the iron work more than half a ton, and the bell itself is heavier than the Great Tom of Lincoln by 32 cwt.: it is engraved in the *Illustrated London News*, No. 68.

MECHANISM OF PIANOS.

In one of Messrs. Broadwood's most improved six and a half octave Pianofortes (for which we believe a patent has been taken out), the mechanism connected with the "action" consists of about 3,800 pieces of ivory, ebony, cedar, sycamore, lime-tree, mahogany, beef-wood, oak, pine, steel, iron, brass, lead, cloth, felt, leather, and vellum. Every one of these has to be fashioned with the most scrupulous exactness, and as scrupulously adjusted to its place. Many of the pieces are not more than a quarter of an inch square, some even less. The qualities of all the varieties of wood are closely studied, in order to determine their particular aptitude for the different parts, and it is thus that so many as seven or eight kinds are used in the "action" alone. One kind is preferred, because slender rods made of it will not warp; another kind, because the grain is straight; a third, because it is hard and smooth; a fourth, because it is soft and smooth; and so on. Some of the rods are as much as three feet long, and only a sixth or seventh of an inch in thickness.

MUSICAL INSTRUMENTS.

A Lyons journal states that M. Marlaveau, a silk manufacturer of that city, has applied the principles of the Jacquard loom to Musical Instruments. His first trial has been on the accordion. A card is used to vary the tunes, as it is used in the weaving to change the pattern.

THE BIRMINGHAM ORGAN.

It is pretty generally admitted that even before the alterations made in the Birmingham organ, previous to the festival in 1840, that in power and tone it was scarcely, if at all, inferior to any organ in the world. A comparison of the powers of the Haarlem, York, and Birmingham organs, published about that period, places the latter nearly equal in power, if it cannot be said to be even equal in tone, to the first named instruments. The following brief description of the structure and power of this stupendous organ, as altered since the last festival, may not be uninteresting to the musical public:—The height of the case is 54 feet, and 40 feet in width. The bellows contains 300 square feet of surface, and upwards of 3 tons weight upon the bellows are required to give the necessary pressure. The trackers, if laid out in a straight line, would reach above five miles. The circumference of the C.C.C.C. metal pipe is 5 feet 3 inches. The largest wood pipe C.C.C.C. is 12 feet in circumference, and its interior measurement is 224 cubic feet. The organ has four sets of keys. The fourth is the combination, or solo organ, upon which, by an ingenious contrivance, can be played any stop or stops out of the swell, or choir, without interfering with their previous arrangement. There are several stops peculiar to this organ, and which are not to be found in any other, among which may be named the Grand Ophicleide, the invention of Mr. Hill, by whom the organ was originally built. This stop is of immense power, and equal to full one-half of the great organ, and distinguished for a peculiar richness of tone, having none of that harshness which belongs to the large reed stops on the continent and elsewhere.—*The Times*.

SUPERB UMBRELLA.

A SUPERB Umbrella has been manufactured by Mr. Taunton, of Norfolk Street, Islington, by order of his Excellency Ali Effendi, the Turkish Ambassador at the court of St. James's, and intended as a present to the Sultan Abdul Medjib. Its cost is stated at five hundred guineas; and the whole of the metal of which it is composed is (with the exception of the ribs and stretchers) of pure gold. The umbrella is covered with rich figured silk damask, manufactured expressly for the purpose in Spitalfields, at a cost of nearly £5 per yard. The umbrella shut up lies in a case, with the following articles, which are of pure gold. 1. A powerful microscope. 2. A comb, the star and crescent engraved on the handle. 3. A thermometer, the figures engraved in Turkish characters. 4. A knife with two blades, ornamented as the comb. 5. A pencil-case, the top of which contains the key of the chronometer. 6. The case for the pencil-leads, containing two dozen in three divisions. 7. A tooth-pick. These seven instruments are elaborately chased with scroll-work and flowers. The case is four feet six inches long, and nine inches wide; it is covered with morocco, elegantly embossed in gold, and contains in the centre the monogram of the Sultan, also in gold. The interior is lined with rich green Genoa velvet and white satin, and has six ornaments of the star and crescent of pure gold, of which also are the lock, key, and hinges of the case.

The end of the engraved handle opens with a secret spring, and then displays a gold chronometer, with a dial 1¼ inch in diameter, and figures engraved in Turkish characters. A compass and sun-dial, the characters upon the gold plate (in the centre of which is a brilliant of the first water) being also similarly engraved to those on the dial of the chronometer. The ivory portion of the handle is carved with military trophies; within it are contained in compartments the various instruments shown in the interior of the case 1 to 7. The eye-piece of the adjusting or sliding tube of the telescope, which extends throughout the rest of the stick (the ferrule being unscrewed), forms a perfect telescope with a twenty miles' range: the diameter of the tube is not quite one inch.

IMPROVED PRINTING.

MR. BOURLIER, of Sherbourn Street, Blandford Square, Engineer, has patented the following improvements in machinery used in Printing calicoes, silks, paper hangings, and other fabrics.

1. The operation of bringing the block in contact with the colour sieve, which has been heretofore produced by a jerking motion, the present patentee performs by means of two cams, or eccentrics.

2. By shortening the rods the block is kept back at intervals from the colour sieve and fabric—a movement which is stated to be parti-

cularly applicable to the printing of handkerchiefs and other fabrics where *several* blocks are applied in succession.

3. A method is described, whereby six blocks may be supplied simultaneously.

4. The fabric is kept stretched in passing through the machine by a leather pad fixed to the one end of a lever, upon the other end of which there is a moveable weight to keep the pad from pressing the fabric against the roller.

5. In passing off from the machine the fabric is dried by sliding over the surface of a plate which forms the upper side of a metallic case heated with steam ; this case is placed immediately over the machine.

PRINTING "CLOUDED."

On March 29, Mr. Kemp described to the Society of Arts, the process of "Printing on Warps to produce Fabrics clouded, or Chiné." The old mode of obtaining this appearance was to prepare the threads of the warp by binding in parchment all the parts which were not to receive a particular tint, and then immersing the whole in the dye ; then a second time repeating the parchment binding for a second tint, and so on. The expense and inconvenience attendant on this method was great, so that fabrics which can be brought into the market by Mr. Kemp for eight or nine pence, could not, by the old plan, be produced under four or five shillings. The mode adopted is this :—The warp is prepared and fixed in the loom, and bands of weft are woven in at intervals, in order to retain the threads in their places ; it is then removed from the loom, and printed on with the several colours ; and, after the processes of washing and fixing, is returned to the loom, where the woof is properly woven in, and the temporary bands are drawn out as they approach the shuttle."—*Illustrated Polytechnic Review*, No. 13.

EMBOSSING.

Mr. Kingdon, of Exeter, has patented the following improvements in Impressing and Embossing patterns on silk, cotton, and other woven or felted fabrics.

To produce a flock-embossed cloth.—The patentee takes any plain piece of cloth, and stamps it of the required pattern by means of a wooden block, on which the pattern is engraved in relief, and the raised parts of which have been previously done over with a solution of caoutchouc ; after this caoutchouc solution has become dry he spreads over it what is known by the name of flocking varnish, and then dusts the flock on the varnished parts, to which it permanently adheres.

To produce a bronzed or gilt cloth.—The cloth is done over first with a solution of caoutchouc, and then with a gold size made in the usual way, which may be either gilt or bronzed : the embossing is then effected either by means of flock, in the way before described, or by passing the cloth through engraved cylinders.

REGISTRATION OF DESIGNS.

THE calico-printers have made a present of three thousand ounces of plate to Mr. Emerson Tennant, M.P., for his successful exertions in procuring the passing of the last Copyright of Designs Act. At a public dinner, given on the occasion at Manchester, Mr. Tennant stated, "that, during the five months previous to the enactment of the New Bill for the more effectual protection of Designs, the number of patterns of all kinds for carpets, silks, shawls, and paper-hanging, amounted to but 53, but that the number of the same description of designs, registered in the five months since, had been no less than 425. But, in addition to goods of this class, printed designs upon cotton had now, for the first time, been admitted to register; and of these alone there had been deposited, since the passing of the Act, no fewer than 2,356. Its success, however, was still more apparent in the remarkable fact, that, whilst during the three years' existence of the former law, there were registered of every description of articles, metals included, but 1,421 designs, there had already been registered, within four months and three weeks since the passing of the measure, no fewer than 2,934 under the system which he had had the honour to introduce."

MI-TYPE.

AMONGST the fanciful novelties of the day is a patent, which has been taken out for a mode of printing called *Mi-type*, by means of which the expenses of printing, paper, and binding, would, according to the patentee, be diminished by half. The *mi-type* may be thus shown:—Take a flat rule, and place it on a line of print, so as to cover the lower half of the letters, and the line may be read with ease. The reason is, says the inventor, that we never look at the lower part of printed letters, but always the upper part. This, however, is not the case, if we cover the upper half. The patentee, therefore, only proposes to have a type composed of the upper half of the letters.—*Galignani's Messenger.*

OIL FOR MACHINERY.

MR. J. HAWKINS has described to the British Association, a practice which has lately been adopted in some parts of the United States, of procuring oil and spermaceti from pigs. The pigs are driven into the woods to feed, and after some months they are brought back and fattened with Indian corn. The animals are then killed and boiled altogether, for the purpose of extracting all the lard, which is then converted into *stearine* and *elain*. The oil thus procured is of a remarkably fine quality, and well adapted for lubricating machinery.

NEW ROASTING JACK.

AT the Senior United Service Club is a novel apparatus, used in the kitchen of that club, which is invented by the Secretary to the establishment, Mr. J. H. Willis. The fire-place or grate is so constructed as to diffuse the greatest possible extent of surface heat; and over it projects a light iron frame, upon which a series of clock-wheels worked by a spindle, moved by the smoke as in the common smoke-jack, revolve upon a disk. To the machinery connected with these the joints are suspended vertically in any number, according to the extent of the fire-place, and by the uniform motion of the wheels they are properly roasted, requiring, however, but little attention on the part of the attendants. The advantages thus obtained are, that the joints of meat are not disfigured by the marks of the spits, or cradle-spits; the meat swells more gradually; the rich juices are retained to the extent of 50 per cent. more than by the ordinary method, and no parts of the joints are exposed to undue heat; and several may be roasted at one time, each joint being basted with its own dripping. There is a great economy in fuel, and the cooking can be retarded or advanced, by a key which regulates the distance required to obtain any degree of heat. This invention is one of a very ingenious character, and is a vast improvement upon the common smoke-jack, to which the machinery is admirably adapted.

IMPROVED CARPET-LOOM.

THE Committee of the Franklin Institute of Pennsylvania, to whom was referred for examination an improvement in the Loom for Weaving Carpets, &c. invented by Mr. Alexander Calderhead, of Philadelphia, report this improvement to be a material modification and simplification of the Jacquard and other draw looms for weaving Carpets and other figured cloths. It dispenses with all machinery above the working parts of the common loom, and is thereby so reduced in height, that it may readily be placed in a common apartment without requiring the removal of the ceiling. The *harness* consists simply of heddles, or heilds, made of wires about twenty-four inches long; and each pierced with an eye, for a thread of the warp to pass through, in place of the mails, twine, and leads, of the Jacquard harness. The heddles work vertically, in holes through two boards, or plates, resembling cumber-boards, the upper of which may be called the *rest-board*, and the lower the *guide-board*. The heddles have each a head at the top, which prevents their falling through the rest-board, and enables it to raise them when raised itself. The *cylinder*, or trunk, is a four or six-sided long and slender box, with pivots at the ends, and it extends horizontally across the whole width of the loom directly beneath the heddles; it is pierced on each side with holes corresponding to those of the cumber-boards; and the *pattern-cards* or apron rest upon it, and revolve with it—so that when the cylinder is raised and the rest-board lowered, the blanks of the card raise the proper heddles, while the remaining ones drop through the holes of the card, and of the cylinder beneath it, to form the sheed, or opening, for the shuttle to pass through. Thus the width of the sheed is equal to the distance which the heddles penetrate into the cylinder, and the upper and under threads of the warp are stretched alike. The cylinder turns on bushes, in a frame which slides vertically, and which, being raised by levers connected with the treadle, raises the cylinder. But the cumber-boards slide vertically and separately in the same frame, and the cylinder as it rises lifts the guide-board, with a part of the heddles ; the sliding frame acts upon two levers supported from the cross-beam above, and thereby lowers the rest-board, and allows the proper heddles to descend into the cylinder. The guide-board is suspended from the rest-board, so that it cannot fall too far below it when the cylinder descends ; and by means of a wheel at the end of the cylinder—having as many inclined teeth as the cylinder has sides, and these teeth acted upon by a kind of ratchet hooking against them—the cylinder as it descends is turned, so as to bring the next side uppermost, and bring the next figure of the pattern cards into operation when the cylinder is raised again. By means of a like wheel on the other end of the cylinder, its motion may be reversed, and the pattern moved in the opposite direction.

The Committee believe the whole contrivance above described to be original, and exceedingly simple, ingenious, and effective ; costing less than the machinery for which it is proposed as a substitute in the outset, and producing a considerable saving in subsequent repairs of the twine required in other harnesses. The inconvenience arising from the stretching of the twine is in this loom entirely avoided. It is alike adapted for cumber-work, where the figure varies throughout the whole width ; and point-work, where the figure is symmetrical. It may be used for fabrics of two or more piles or thicknesses, and requires for them merely a single pattern.

PROCESSES FOR ORNAMENTING GLASS.

MESSRS. CARR AND RYLES, of North Shields, have patented the following invention :—First, for staining glass : instead of mixing the staining materials now employed for that operation, when levigated finely and dried with oil of turpentine, or other volatile oils, or water, as usual, the patentees mix them with boiled linseed or other oil, such as is now used to mix with enamel colours when printing on glass ; and, instead of floating the staining materials over the glass in a liquid state, as now practised, the patentees print them on, or transfer them as impressions from metal plates, in the manner now adopted in printing enamel colours ; and proceed, after the material transferred has been well dried, to fire it for the colour required, in the usual way. In operating with these staining materials on pot metal, or on pieces of glass, which are flashed, opaque and transparent shades are produced, leaving the surface of the glass quite smooth, and not raised in the parts, as in the common mode of applying body colour for shading.

Secondly, for stopping out, the patentees also mix the materials with boiled oil, and transfer printed impressions on to the glass with it, covering such parts as are not to be acted upon ; and then float over the whole surface, including the parts so stopped out, with liquid staining composition, and fire it as usual to produce the stain : after which, the glass being cleaned, the printed pattern is exhibited in the original colour of the glass, and distinct from the stained ground ; or printed impression being transferred to the glass in stopping out, the remainder of the ground may be obscured in the usual manner, thus producing transparent patterns on obscured ground.

Thirdly, for obscuring glass, they also mix the materials with boiled oil, and transfer impressions from engraved metal plates on to the glass, thus producing obscured patterns on transparent grounds. By the above processes, the patentees obtain the power of greatly improving, perfecting, diversifying, and multiplying patterns, grounds, and devices, while the aid of enamel colours to add to that diversity is not lost.

NEW SHOE MACHINE.

THE New York *Evening Post* gives the following description of a mode of making Shoes, by a machine owned by Mr. Ruggles, of 60, Gold-street, in that city:—The sole leather is first pressed between wooden rollers, which makes it extremely firm and compact, much more so than hammering can do. It is then placed under a cutting machine, which at one operation cuts it into the proper shape; meanwhile another machine is busy making steel wire into screws of about three feet in length, all of which is done with surprising celerity. A fourth machine punches the sole with holes, inserts the screw, and cuts it off at its proper length. All that is then necessary is to rivet the screws by a few blows with a hammer on an anvil.—*Mechanics' Magazine*, No. 1057.

PAPER CLOTH.

MR. H. CHAPMAN, of Arundel-street, Strand, engineer, has patented this new fabric for maps, charts, prints, drawings, &c. It consists of linen or calico, or any similar fabric, cemented to paper, either on one or both surfaces, the compound fabric being consolidated by passing it through rollers, and then steam-drying it. The cement employed is then prepared: 9 parts of yellow resin are dissolved by heat in a solution formed of 4 parts of soda and 15 of water; the mixture is then boiled for an hour, and 1 part of glue added; it is next diluted with one and a half times its weight of water, and strained; after which 1 part of flour paste, and 6 of paper pulp, are added to every 30 parts of the other ingredients. The mixture is used in a hot state.—*Mechanics' Magazine*, No. 1052.

THE LITHOTINT PROCESS OF HULLMANDEL.

THE drawing, having been finished by the artist on the stone with lithographic ink mixed with water to produce the various shades, is covered with gum-water, and weak nitric acid to fix it; after waiting a sufficient time to dry, a solution of resin and spirits of wine is poured over the stone, and, as this ground contracts by drying, it cracks into millions of reticulations, which can only be discovered by the use of a microscope: very strong acid is then poured over the aquatint coating, which, entering all the fissures, produces the same effect on the stone as the granulations of the chalk by the ordinary process. The resin protects the drawing everywhere but in the cracks, and having remained a sufficient time to act on the unprotected parts of the drawing, the ground is washed off, and all appearance of the subject on the stone vanishes, until ink being applied by the roller in the ordinary way, it is reproduced, and ready for taking off the required number of impressions, which, in some cases, have extended to the number of two thousand.—*The Builder.*

A SHEET OF PAPER.

Mr. Limbird, of the Strand, has a sheet of paper 4 feet 7 inches wide, 600 yards long, and weighs 137 lbs. It is of fine texture, and has been made for the purpose of taking impressions of monumental brasses.

PRESERVATION OF MEAT.

A memoir has been received by the Academy of Sciences, at Paris, from M. Dussourde, "On the Preservation of Meats by a syrup which undergoes no deterioration by keeping." Meat which has been steeped in this syrup dries with only a slight diminution of volume, and is not affected by putrefaction. When required for use, the meat is put into cold water, and it soon assumes its original size. Its colour and odour are then like those of fresh meat, of which it has all the properties. The syrup is made by boiling iron in an impalpable powder with common syrup, until the latter becomes impregnated with the iron.

CARSON'S INSTRUMENT FOR CURING MEAT.

This instrument is a species of syringe, or small force-pump, for salting meat under the most adverse circumstances, and in a few minutes' time, by forcing the brine into its pores. The plunger of the pump is very small—not of much larger diameter than a black-lead pencil, and around the barrel, in which the plunger works, a cylindrical reservoir is situated for containing the brine. Into this reservoir the brine is poured, and a few strokes of the pump send it from thence into the meat.

There are three great advantages afforded by the use of this instrument. 1st. The meat is very effectually cured, as the pressure forces the brine into the minutest pores. 2nd. The operation of curing is effected in a few minutes, instead of occupying days or weeks; and, 3rd. The curing must be successful under the most adverse circumstances. We hear thrifty housewives lament, that in hot weather meat will not take salt, but with this instrument it has no option: it *must* take it, for the pressure overcomes all opposition.

It is obvious that, by the use of this instrument, the meat may be impregnated with a variety of flavours, besides that of salt. Thus, by the injection of a suitable liquid, we might have smoked Yorkshire hams made in five minutes, or any other flavour imparted to the meat, which is due to the absorption of an adventitious material. Altogether, the instrument is a most sensible and useful one, and must, when known, come into very extensive use.

POTATO FLOUR.

Mr. Bowles, of Moorgate-street, London, has patented a new process for separating the farina from the residue of Potatoes, after they have been peeled by machinery; and for preparing the farina for the manufacture of bread, &c. by breaking the envelopes of the small globules which contain it. The potatoes are first cleansed, by being passed through a "washer," consisting of a cylindrical framing, partly immersed in a vessel of water, and revolving upon its axis in an inclined position; they are then stripped of their skins by a "peeler," which is a machine similar to the washer, but somewhat longer, and having its interior covered with metallic brushes; the skins, which will carry with them some portion of the farina, sink to the bottom of the vessel. When the skins have been removed, the potatoes are submitted to the action of a cylindrical rasp, and carried from thence, by chain-cups, to an endless travelling sieve, upon which a number of jets of water act, and divide the farina from the residue. The envelope, or case of the farina, is broken by a slight washing in acidulated water, and the acidity which it may imbibe during the process is removed by rinsing in cold water; it is then dried by cold or heated air. Instead of this method, the envelope may be broken by crushing it in a machine, with a metal roller or cylinder; or by submitting the farina to a heat of 150° Fahr. or more.

The residue may then be prepared for use, with other materials, in making bread and sea-biscuits. After the residue is removed from the bottom of the peeler, it is bleached, by washing in cold water, and passed through a press; from the press it is removed to a drier, and thus the disengagement of its carbon is prevented. When the residue is dried, it is reduced to flour, by a mill, consisting of a grooved cylinder, working in contact (or nearly so) with a grooved plate; the latter is kept cool by a current of water, or cold air, at the back of it, and thus the flour is prevented from becoming heated during the grinding.

If the operator prefer employing the residue in a moist state, as it comes from the peeler, it is passed through a press, and then mixed with the other substances used in making dough, before a sufficient time has elapsed for its carbon to become disengaged.

IMPORTANT IMPROVEMENT IN THE SUGAR MANUFACTURE.

A patent has been perfected for a most valuable improvement in the Sugar Manufacture. It relates to that part of the process which consists in expressing the juice from the canes after they have been cut and gathered. At present this is effected by means of crushing, or rather grinding mills, with horizontal fluted rollers, set in motion either by water, wind, or steam power. Each mill has commonly three rollers; but in some mills recently constructed, or proposed to be constructed, the number has been increased to five and six. To increase the number of rollers is, however, according to the patentees of the improvement of which we now speak, only to aggravate a great evil. They object to rollers altogether; and, we think, with good reason, as producing, at best, only a partial expression, to the extent of from 12 to 20 per cent. short of the saccharine matter actually contained in the canes,—as breaking up the canes unnecessarily, crosswise, lengthwise, and in all directions, and thereby expressing from the rind certain extraneous matters that have a most discolouring and deteriorative effect on the saccharine product, and are the chief cause of the tedious and expensive series of clarifying processes which the syrup has now to go through. By an ingenious, but simple, and unquestionably most efficient adaptation of the well-known hydraulic press, the present patentees do away with the rollers entirely; they get out of the canes all the saccharine juice which can be got out of them (by mechanical means at least, which are the only means available for this purpose on the large practical scale), and with as little intermixture as may be of other juices: they do not *grind* the canes, which, as far as regards the saccharine product, is wholly unnecessary, but they squeeze and compress them lengthwise, that is, in the direction in which the saccharine juice naturally runs, to the utmost possible extent. They save, in this way, not only the loss of from 12 to 20 per cent. consequent on the use of rollers, but all the expense of the water, wind, or steam power, now required to keep the rollers going, less the wages of a man or two to work the new hydraulic agent.—*Mechanics' Magazine*, No. 1039.

SUPERIOR GREEN TRANSPARENT VARNISH.

THE beautiful transparent Green Varnish employed to give a fine glittering colour to gilt, or other decorated works, may be prepared as follows:—Grind a small quantity of Chinese blue with about double the quantity of finely powdered chromate of potash, and a sufficient quantity of copal varnish thinned with turpentine. The mixture requires the most elaborate grinding, or incorporating, otherwise it will not be transparent, and therefore useless for the purpose to which it is intended. The "tone" of the colour may be varied by an alteration in the proportion of the ingredients. A preponderance of chromate of potash causes a yellowish shade in the green, as might have been expected, and *vice versâ* with the blue under the same circumstances. This coloured varnish will produce a very striking effect in japanned goods, paper-hangings, &c., and can be made at a very cheap rate.—*Mechanics' Magazine*, No. 1053.

NEW PROCESSES FOR MANUFACTURING WHITE LEAD.

Two new plans for the Manufacture of White Lead have been announced; one of which has been patented in this country by Mr. John Mullins, surgeon, of Battersea; the other is the invention of M. Gannal. In the former process, the oxidisement of the lead is facilitated by forcing currents of air, or of oxygen gas, through the melted metal; and it is subsequently carbonised by exposing the oxide thus obtained to the vapours of vinegar and to carbonic acid gas. M. Gannal proceeds by means of a mechanical division to expose a large surface of the metal to the action of atmospheric air, and diluted nitric acid. The oxide of lead which is thus procured is exposed to carbonic acid gas, and the white carbonate of lead is subsequently dried by means of pressure and hot air. White paint made from lead thus prepared is said to last much longer than the ordinary paint: the process has also the important advantage of being less injurious to the workmen.—*Artizan*, No. 7.

LIQUID BLUE.

MR. J. FUTZSCHE has communicated to the Imperial Academy a method of preparing indigo blue in the moist way, by pouring hot alcohol and a very concentrated solution of caustic soda on equal quantities of pulverized indigo of commerce, and grape sugar, contained in a flask. The ingredients are to be well shaken together; the flask is then to be filled with alcohol, corked and placed aside for a few hours. The clear contents are then to be decanted into a larger vessel, and to remain a few days loosely covered; when the oxidation will be complete, and the indigo blue will have separated in laminar crystals.

NEW PREPARATION FROM GUM COPAL.

MR. DAVIDSON has exhibited to the Scottish Society of Arts a specimen of a Semi-transparent Medium prepared from Gum Copal, by Mr. Francis Robison, painter, Edinburgh. This semi-transparent medium is prepared from gum copal, or from India rubber, treated in a particular way with drying oil, and painted on paper stretched on a frame. After a sufficient number of coats have been given, the paper is damped and easily removed, leaving the substance of the medium alone. It is calculated for receiving images thrown upon it from the camera obscura, or oxyhydrogen microscope, &c., and is an excellent substitute in this respect for ground plate-glass. In the course of the remarks upon it, Mr. C. H. Wilson stated that, in his opinion, with a little change in the ingredients, by mixing white lead with the gums, the medium might be applied in a very useful way, viz., it might be stretched upon canvas, a large picture painted upon the medium, and then the medium might be removed from the canvas and applied to the walls of the edifices to be decorated. This has long been a great desideratum for large pictures, and he hoped that Mr. Robison would turn his attention to the subject, and be able to produce such a ground for large historical pictures, which might then be painted in the studio of the artist.

METHOD OF COMMUNICATING A BEAUTIFUL CRIMSON COLOUR TO TINFOIL AND TINSEL.

THE colouring substance for foils is strictly required to be *perfectly* transparent, and the following recipe has answered admirably:—Break an ounce or two of *crimson* lake into fragments about the size of a split pea; put these into an earthen pan, and pour over them as much *saturated* solution of soda as will a little more than cover them. Put the vessel containing the mixture on a slow fire, or over a spirit-lamp, and keep it simmering there about ten minutes, when the supernatant fluid should be filtered from the sediment, and mixed with a little isinglass and a very small portion of loaf-sugar. This colour is laid evenly on the silver-paper by means of a flat brush, and allowed to dry. Sometimes it is covered with a thin coat of copal-varnish to protect it from damp.—*Mechanics' Magazine*, No. 1049.

WASHING LINEN.

THE supply of water in Paris is nearly seven times what it was in 1816. Washerwomen have increased in number in the capital, and washing by soap is substituted for the washing by ley. This is very injurious to the public health. All river or spring water holds in solution carbonate of lime, which is decomposed by alkaline soap, and the result is a soap having for its base insoluble lime. This calcareous soap attaches itself to the linen, and the heat of the ironing melts and drives it into the article washed with it. It is to the presence of this calcareous soap that the bad smell of the linen for which it is used, is due. When cotton or linen cloth has undergone the process of washing with soap twenty times, it becomes impermeable. It is, in fact, the secret means employed for rendering all cloths impermeable; not, indeed, by soap washing them twenty times, but by saturating them with a calcareous soap produced by the dissolving of a soluble calcareous salt. But though it may be useful to render a cloth coat impermeable, to save the wearer from being wet by rain, it is prejudicial to health to wear next to the body that which will not absorb the perspiration. In this respect, the substitution of soap for ley must be injurious. There is, however, a very simple mode of avoiding this inconvenience: it is by putting into each litre of water used for washing one or two grammes of potass, or soda, before dissolving the soap in it. By this, the calcareous soap will be precipitated, and the soap, meeting with no lime in the water, will not undergo any decomposition; consequently, no calcareous soap can remain in the linen. The use of soda or potass will not be at all expensive, because the alkali remains in the water, and contributes, with the soap, to the cleansing of the linen.—*La Presse.*

SELF-ACTING CIRCULAR DIVIDING MACHINE.

THE original graduation of a circle, notwithstanding the great improvements in the method invented by Mr. Troughton, is still attended with very great difficulties, requiring not only the greatest care on the part of the operator, but tending to injure his health by his labours required in it, and thus not admitting of frequent repetition. The necessary cost of an instrument produced by such an amount of severe labour is also another very serious objection. Mr. Simms had long been of opinion, that to copy the divisions of a circle which had been graduated with extraordinary care, upon work of smaller dimensions, would in general be more satisfactory than original graduation. The latter process consists of several successive steps, in either or all of which a certain amount of error may escape detection, which in general may go far to balance one another, although there will be parts in almost every work where errors appear, arising from an accumulation of those minute quantities.

Upon these principles, Mr. Simms has constructed an engine sufficiently large for the graduation of all circles, excepting those of the largest class.

The engine, in general arrangement and construction, is similar to that made by Mr. Edward Troughton, though there are several additions and peculiarities which are pointed out by him. The circle or engine-plate is of gun-metal, 46 inches in diameter, and was cast in one entire piece by Messrs. Maudslay and Field, teeth being ratched upon its edge. The centre of the engine-plate is so arranged that it can be entered by the axis of the instrument to be divided, and the work by this means brought down to bear upon the surface of the engine-plate, which arrangement prevents the necessity of separating the part intended to receive the divisions from its axis, &c., a process both troublesome and dangerous.

Upon the surface, and not far from the edge of the engine-plate, are two sets of divisions to spaces of five minutes; one set being in silver, and the other strongly cut upon the gun-metal face. There are also as many teeth upon the edge as there are divisions upon the face of the engine-plate, namely 4320; consequently, one revolution of the endless screw moves through a space of five minutes. The silver ring was divided according to Troughton's method with some slight variations. In this operation, it seems the safer course to divide the circle completely, and then to use a single cutter for ratching the edge; and Mr. Simms believes that the teeth upon the edge have been cut as truly as the original divisions themselves.

Another very important arrangement is, that the engine is self-acting, and requires no personal exertion or superintendence; nothing being necessary but the winding-up of the machine, or rather the raising of a weight, which, by its descent, communicates motion to the dividing engine. The machinery is so arranged that it can be used or dispensed with at pleasure, there being some cases in which a superintending hand is desirable.

The author then proceeds with a description of the machinery, as represented in the drawings accompanying his description, and draws particular attention to the contrivance by which the engine can discharge itself from action when it has completed its work.

The machinery of this contrivance is simple, and by no means expensive: it is adapted to all the engines now in existence, which are moved by an endless screw; while it lessens the labour of the artist, and increases the accuracy of the graduated instrument.—*Communicated by Mr. Simms to the Astronomical Society.*

MACHINE FOR WEIGHING SOVEREIGNS.

Mr. Cotton, the governor of the Bank of England, has invented a Machine for Weighing Sovereigns, and separating the light ones from those of standard weight. This machine is so delicate that it detects with precision a variation of the twelve thousand two hundred and fiftieth part of the weight of a sovereign. The coins are placed in a tube or hopper, from whence they are carried on to a small platform, which is suspended over a delicately poised beam, to the other end of which is appended the standard Mint weight. On setting the machine at work, a sovereign is placed upon the platform, and if it be full weight a small tongue advances and strikes it off into a till appointed to receive it; but if it be light, the platform sinks, and brings it within the reach of another tongue at a lower level, which advances at right angles to the former tongue, and pushes the coin into another till; other coins succeed in rapid rotation, so that the machine can weigh and sort ten thousand sovereigns in six hours; while an expert teller can at the utmost only weigh between three thousand and four thousand coins by hand scales in the same time; and even then the optic nerve, by incessant straining, becomes fatigued, and error occurs. The various ingenious contrivances of the machine can only be appreciated by careful examination; but it is declared to be one of the most satisfactory instances of automaton labour.—*Magazine of Science*, No. 216.

IMPROVEMENT OF BRIDGES.

MR. HOSKING has submitted to the Institute of British Architects his proposal to improve the designs of arched Bridges, by the introduction of a transverse arch, groined into the longitudinal arch, or series of arches; and he has shewn the effect of this and other suggestions which he had made for the Improvement of Bridges, in a design for remodelling Westminster Bridge.

Mr. Hosking had, on a former occasion, urged that the piers of bridges were built for the most part of much greater substance in thickness than was necessary for either safety or agreeable effect: that they might therefore be greatly reduced in bulk, both for economy and for their effect upon the water-way and the navigation, without diminishing their efficiency. It had been objected—with the too common fault of architects, who would sacrifice use to effect, instead of compelling the useful to be effective—that his proposal tended to destroy the due proportion, in appearance, of the pier to the opening. Mr. Hosking thought that the eye which had been accustomed to the bridges upon the Tiber at Rome, of which the piers are rarely less than one-third the span of the larger of the two arches resting upon them respectively, would be offended by the absence of that proportion of solid so void in London and Waterloo Bridges, in which the same relation is but one-sixth; whilst the eye accustomed to the bridges upon the Thames at London would condemn the bridge at Staines, and the bridges of Jena and Neuilly upon the Seine, of which the piers are but one-eighth, one-ninth, and one-tenth respectively of the span of the arches resting upon them. Nor had we yet reached the limit to which the solid might be reduced in proportion to the void with safety and with good effect. To justify further reduction was one of the ends to be answered by the arrangement he was then to explain, which had the effect of reducing also the weight to be sustained by the piers of an arched bridge. The proposed improvement in this respect, Mr. Hosking stated to consist in groining a bridge arch, or of carrying a groined transverse arch through the length of a series of arches, and the advantages derivable from this plan to be in lessening the weight of the bridging constructions; in reducing the thrust upon the abutments; in diminishing the liability of the bridging constructions to vibrate under the action of pulsating or of rolling bodies; and, generally, in greatly reducing the cost of construction. The weight is obviously lessened by the difference between the massive haunches of the main vaults and of the requisite backing to them throughout the extent of the transverse arch; also the thickness of the pier, and the comparatively light inner transverse arch, which, being of slight span, may be of stones of much less depth than the main vaults require. The thrust of the main vaults is dissipated throughout so much of the width of the bridge as the inner transverse arch occupies, and so that the abutments might be almost reduced to mere wing walls: the vibrations arising from the traffic would be checked at the groin points, as at nodal points in a vibrating cord; and the cost of construction would be lessened by the reduction in quantity of the materials of the piers and of the vaults, by the smaller amount of labour required for the softer stone available for the inner transverse arch, and by the greater lightness of the centering which would be sufficient for the same.

Mr. Hosking then stated that he had endeavoured to illustrate the suggestion as to an inner transverse arch groined to the longitudinal vaults, by applying what he proposed in that respect upon a compartment of London Bridge, as a familiar instance, and illustrated his views by reference to diagrams. He then proceeded, in further explanation, thus:—"The only indication of what I have suggested in any existing work with which I am acquainted, is in Perronet's Bridge of St. Maxence, where low arches are introduced over the divided portions of the piers, transversely of the bridge, to take the springings of the great longitudinal arches; but these have neither the intention nor the effect of what I propose, and are a source of weakness and expense rather than of economy and endurance. The transverse arches are low and flat, and the great vaults spring from the backs of these arches, so that no relief, either in weight or thrust, is obtained, as by the proposed mode of groining the one inner transverse arch with, and to the full height and extent of, the longitudinal arches; but the only possible injurious effect is retained to the fullest extent in the thrust of the low flat arches, tending to separate the already divided parts of the pier."

Mr. Hosking went on to justify, by example, the sufficiency of the provision he had made for restraining the thrust of the inner transverse arch, and to show the sufficiency of the area of bearing surface upon the piers at the springings of the main vaults: he next described his proposal to form more bold and effective cornices, and to extend the available surface upon a bridge by corbelling out the parapets, He then proceeded to show the effect of his suggestions in a design for remodelling Westminster Bridge, rendered, by circumstances which had grown up around it, altogether unfit, both in its design and arrangement, for the position it occupies; he mentioned that he had written the remarks in his Treatise, and sketched the design which he exhibited, in September last; and which coincided in a remarkable degree with the observations, upon the same subject, in the Report lately presented by Mr. Barry to the Commissioner on the Fine Arts. "It is true," Mr. Hosking went on to say, "that my suggestions stand alone in the particulars in which it was almost certain that mine would be peculiar; as it regards the introduction of the inner transverse arch groined to the main vaults; in the increase of the span of the arches upon the same piers, and thereby greatly reducing the piers (for I do not understand Mr. Barry, in his Report, to contemplate that), also in widening the approaches, and winding and dividing the roadway upon them, for the double purpose of use and delight."

STRENGTH OF IRON.

A REPORT has been read to the Institution of Civil Engineers by Mr. D. Mushet, on some experiments made at the Milton Iron-Works, to ascertain the relative Strength of the Cast and Malleable Iron produced at these works, both by the hot and cold blast processes. The results, which were arranged in tabular forms, showed, that although in some districts the introduction of heated air for smelting might have deteriorated the Strengh of the Iron, yet with minerals like those of Yorkshire and Derbyshire, it could be used with advantage, and the quality was improved. The table of breaking weights, from Mr. Fairbairn's experiments on Cast Iron, was given; and it appeared that the strongest quality quoted by him broke under a pressure of 581 lbs., whereas the Milton Hot Blast Iron only yielded at 610 lbs. The experiments on Malleable Iron were not considered so conclusive, as the force of the blows for breaking the bars being manual labour, could not be accurately increased; the impact of a weight falling from a given height would have been more satisfactory. Some specimens of Wrought Iron, of a fine quality, made from Hot Blast Pig Iron, at the Butterley works, were exhibited; and in the discussion which ensued, it appeared to be the opinion, that the use of hot air in smelting might be adopted with advantage; but that, from the facility it afforded of working up refuse ores, &c. it had been abused.

IMPROVEMENTS IN THE MICROSCOPE.

On Nov. 15, Mr. A. White read to the Microscopical Society a paper describing the application of a lever movement to the stage of a Microscope. It consists of a lever, to the shorter arm of which a ball is firmly screwed, moving in a socket formed by the upper plate of the stage, and a cap, which is a brass plate, secured by two screws to that plate. This lever passes through a perforated ball moving in a socket formed by an arm attached to an immoveable part of the microscope, and a cup formed and secured upon the arm, as in the former instance.

This lever is about five inches long, having the longer arm equal to three, and the shorter to one. The proportion, however, varies according to position; and hence the necessity of a perforation in the second ball to allow for it. This construction affords facility of motion in every way, and the range, in the instrument exhibited, was three-quarters of an inch.

Mr. Jackson has also read a paper describing an improvement in the mode of applying a divided glass micrometer to the measurement of objects under examination, described by him in a former paper. The micrometer is mounted in a thin brass frame, which slides easily (under a spring) through slits in the opposite sides of the eye-piece; which slits, when not in use, are closed by a quarter revolution of an internal tube, having similar slits. Its divisions are $\frac{1}{40}$ of an inch apart, with one of the spaces divided into five by finer lines, which, as they may be readily brought by the sliding of the micrometer into contact with the magnified edge of the object to be examined, afford great facility of measurement. He concluded with some observations relative to the method of using this instrument, and of finding the value of its divisions, under the various circumstances in which it may be employed.—*Athenæum*, No. 839.

APPLICATION OF THE LAWS OF SOUND TO THE CONSTRUCTION OF BUILDINGS.

Mr. J. S. Russell has read to the British Association a paper on the application of some known laws of Sound to the Construction of Buildings. Some of the laws of sound were not known till very recently: still, a great many of them were known always. He proceeded to explain a plan of construction by which twenty thousand persons can be accommodated in a single building, if necessary, in such a manner that each individual should hear with the greatest ease the voice of a single speaker. It was well known that sound proceeds in a straight line, not round angles. The first element of the construction was, that all the heads of the audience should form a certain curve, the focus of which was the head of the speaker, so that the head of each auditor should not interfere with another, and that each should imagine himself in as good a position as possible for both hearing and seeing the speaker. He (Mr. Russell) found by experiment that a person speaking in a moderate tone of voice in the open air could be heard at a distance of 280 feet. That distance in a building would accommodate fifteen thousand persons. Such buildings had not as yet been made to contain more than four thousand persons, but they were very successful. Mr. Russell then proceeded to explain the geometrical construction of the curve, which was almost semicircular; and from which it was clearly evident that the undulation of sound from the mouth of the speaker reached the auditor in a direct line, and without the slightest interruption. He had published a paper on it some time ago, which had not been attended to until a young architect adopted his mode of construction, and built twenty or thirty houses of the kind. After some further observations, he remarked that a speaker should always adapt the tone of his voice to the key-note of the room he was about to speak in, which could be easily done by a tuning-fork; for if he tried to speak in any other note, he would create inharmonious sounds, and render his voice very indistinct. If he took a room 32 feet long, its key-note would be C, the same as on an organ pipe of the same length; if $25\frac{3}{5}$ feet, the key-note would be E, and so on, and the speaker should pitch his voice to a tone most suitable to the room, and thereby he would speak with the greatest ease. Rooms ought not to be constructed in transverse parallelograms of a different size, for then the speaker could not possibly suit his voice to both, but would create an inharmonious jarring, or what he would call spontaneous oscillation in a room.

GLASS-PAINTING AT MUNICH.

THERE is a School of Glass-painting at Munich, fostered by the King with the utmost care. Professor Hess, one of the most distinguished of the Bavarian artists, is inspector, and under him there is another accomplished artist, who makes the principal designs, and directs the works.

The director first prepares full-size cartoons; these he paints in water-colour; other cartoons are then prepared, which may be termed maps of the colours; these are coarsely executed, but correctly tinted; the simple colours only are indicated; thus, a red robe is painted of a flat red, the shades being left out, and so on with the other colours. This map, so to speak, is put into the hands of the glass-cutter; he matches the tints from his stock of coloured glass, and cuts it to the shapes. This process requires much practice; many of the pieces are very small, and of somewhat complicated shapes; he must also allow for the leading, or uniting by means of strips of lead.

An ingenious instrument is used for cutting large portions of circles. The coloured and white pieces being now united with lead in the usual way, pass into the hands of the artist, and are painted. A mystery is made of the preparation of the colours; but this mechanical part of the art is well understood amongst ourselves. After the painting is completed the lead is taken out, and the pieces of painted glass are put into the stove. An old man from Nuremberg superintends this department, and is the only person in the establishment who has the requisite experience.

The encouragement given to the art just described has led to great improvements in the manufacture of glass; and the optical instruments of Munich have now a high reputation.

[From a paper of valuable observations on the Decorative Arts of Germany and France: by Mr. C. H. Wilson; read to the Royal Scottish Society of Arts, April 24.]

TODD'S PORTABLE HATCHING APPARATUS.

MANY schemes for hatching chickens, ducklings, and the young of other domestic poultry, have at various times been brought before the public. The advantages claimed for Mr. Todd's apparatus are portability, the little attendance required, and the small weekly cost of keeping up the required temperature. The whole contrivance is enclosed in a vessel of cylindrical form, made of sheet iron, whose diameter is 24 inches, and height 22 inches. It consists of the following parts:—The hatching tray, occupying the upper part of the vessel, which is 21½ inches in diameter and 2¾ inches deep, is lined with wool, and has around a central aperture, through which the steam passes from the boiler to the hatching department, a reservoir of annular form, 1½ inches wide and 1¾ inches deep, to contain water for the purpose of keeping the atmosphere of the hatching compartment in a sufficiently humid state. The boiler, of zinc, is placed 3¼ inches below the bottom of the hatching tray, is 22 inches in diameter, and 10 inches in extreme depth, the upper and lower sides being of a somewhat hemispherical form. The boiler is filled with hot water by a ¾ inch pipe, passing out on one side of the vessel into a vertical reservoir of 2 inches diameter and 5 inches high. In the centre of this reservoir is a cylindrical case, in which a thin copper wire, suspended from a float in the upper part of the reservoir, works freely, and which is connected with a valve at bottom, working in a small pipe communicating with the heating chamber. The use of the float and valve is to regulate the temperature of the water. The heating chamber is of copper, about 4 inches square, and 19 inches long, running in a central line through the boiler. It is furnished with a lamp tray having any number of burners that may be required, according to the temperature of the apartment in which the apparatus is placed. The lamp tray, in the present case, is 7 inches long, 4 in width, and 1½ in depth. The hatching process is simple, and may be thus described:—When the eggs are first placed in the hatching tray, it is necessary to mark 1 and 2, or A and B, or some other mark, by which to distinguish opposite sides; as also to write the date on each egg, so as to distinguish one batch of eggs from another. The tray will hold 100 eggs. Once in every 24 hours, for 21 successive days, it is necessary (for so Nature dictates) to turn the eggs: at the expiration of that time, when the chickens break forth from their shells, it is found advisable to leave them in the tray for about 24 hours, before they are transferred to the rearing compartment, the temperature of which is about 12° lower than that of the hatching room.—*Proceedings of the Society of Arts; Athenæum*, No. 800.

THE MONOCHORD.

On January 18, Mr. Higgs described to the Society of Arts an instrument called the Monochord, calculated to facilitate the study of vocal music. The Monochord is an oblong rectangular box, made of mahogany, 26 inches long, 2¼ inches wide, and 2⅓ inches high. On the upper surfaces are marked the diatonic and chromatic scales: a single wire is extended lengthwise over a bridge at either end of the instrument, and the different notes are produced by moving a third bridge along the top of the instrument with the right hand, while the wire is touched with one finger of the left hand. Unlike the tuning fork, which is capable of producing only one tone or note, the Monochord produces any of the notes, either of the diatonic or any other scale. It also gives a correct idea of vibration and the theory of sound.

METALLIC SAND.

On Nov. 29, was read to the Society of Arts, a paper by Mr. H. K. Dyer, on the Metallic Sand. This sand is produced by grinding copper slag by means of powerful machinery, and consists of iron, zinc, arsenic, and silica, the iron predominating; the slag is procured in abundance in Swansea. In chemical analysis, it is very similar to the pozzolano, and in point of durability is found to be equal to the latter. With blue lias lime, which is used for hydraulic works, the metallic sand readily enters into combination ; and these having been used together for external works, exposed to all the changes of the atmosphere, have proved the indurating qualities of the Metallic Sand, after an experience of eight years. Specimens were laid on the table :—1st. Brickwork of a fresh-water tank, which had been erected six years, was removed by a pickaxe, the bricks yielding to the strokes of the axe, but the cement remaining solid; 2d, imitations of marble executed by a painter on the face of stuccoed work, formed of metallic cement, in conjunction with common chalk, lime, and putty, and afterwards polished ; 3d, a specimen of fresco painting, also executed on a face similar to the above; 4th, a vase, the figures on which retain their original sharpness, although it has been exposed to the amosphere for many years.

FLOOD-GATES FOR BRIDGES.

On October 16, a communication was received by the Academy of Sciences, at Paris, from M. Fourneyron, relative to the application of Flood-gates to one of the bridges of Paris. A committee of the municipal council of Paris, of which M. Arago was president, was formed a long time ago, for the purpose of discussing the practicability of a plan for closing the arches of the Pont Neuf, or the bridge of Nôtre Dame, with gates, by which the current of the river could be regulated at will ; and which, by raising the level at a certain part, would give a fall of sufficient force to work powerful turbines for the supply of water to all parts of Paris. In 1841, M. Fourneyron submitted a plan of gates of such construction that they could be worked with ease by one man ; but as it was impossible to pronounce fairly on the merits of his invention without absolute experiments, the Academy and the committee of the city of Paris resolved to suspend the expression of opinion until experiments could be made. M. Fourneyron announces that for more than two months past one of his gates had been in use at Gisors, and that it had proved successful.—*Athenæum*, No. 835.

SELF-ACTING VENTILATOR.

Mr. Thomas Wroughton has invented a Self-acting Ventilator for hospitals, public schools, theatres, and other places of public resort. It consists of a ventilator connected with a mercurial valve, which is acted upon by heat; and by means of a float acting upon a sort of slide, a spring opens the ventilator, so as to admit precisely such a quantity of external air as will purify the internal atmosphere, and bring it down to a determined point. We will suppose, for instance, that it is desired that the temperature should be a fixed one of 60 degrees of Fahrenheit. The thermometer connected with his mercurial valve is fixed at sixty. As soon as the heat of the place, from the breathing of the persons assembled, or from any other cause, has raised the temperature beyond this point, the valve opens of itself, and admits as much pure air as will cool the temperature to the point desired, whilst the heated and foul air escapes.

BUILDING TIMBER.

On Nov. 20, a paper was read to the Institute of British Architects, by Mr. Bailey, the Honorary Secretary, "On the several species of Foreign Fir Timber and Deals supplied to the English Market, and their respective qualities for the purposes of Building." The professed object of the paper was to present to the members, in a condensed form, the more important portions of the information relative to the growth and manufacture of the timber of the North of Europe, and of our American colonies, derived from the evidence of practical men, given before the Parliamentary Committees on the timber duties, at different times and other sources; which might be useful in assisting the judgment of the young architect, in selecting from the several kinds of timber to be found in the market, the sorts most suitable for the various purposes to which wood is applied in buildings, either for roofs, floors, framing, the external portions, and internal finishings and fittings. The relative properties, as to strength, durability, facility of working, and economy in conversion of the Memel, Dantzig, Riga, St. Petersburg, and the several descriptions of Norwegian and Swedish timber and deals, were described, and their defects noticed; as likewise those of the red and yellow pine of Canada, the use of which is daily increasing in this country. The alleged tendency of the American timber to imbibe and communicate the dry-rot was noticed, and accounted for from the treatment to which that timber is usually subjected. The larger portion of the timber and deals from Canada is floated down the river St. Lawrence to the port of shipment on rafts, becoming in consequence saturated with water, and in that condition most commonly placed in the confined hold of the ship which is to convey it to this country; the result is, that by far the larger portion, both of the timber in log, as well as the deals, on their arrival here, exhibit symptoms of the dry-rot; and if means be not adopted to repress it, the timber becomes strongly infected, and, when placed in a building, not only rapidly decays, but communicates the rot to the timber in contact with it. *If it were not for the circumstances* above noticed, there is no reason to suppose that the fir timber of Canada is of a less durable nature, or inferior in quality to the European timber of the same description.

In the discussion which followed the reading of the paper, it was stated that impure pyroligneous acid still retaining the creosote had been employed with success on timbers affected with the dry rot.—*Athenæum*, No. 839.

A PORTABLE LIGHT-HOUSE.

An invention has been made for showing the position of a ship in danger, and thus directing the movements of persons attempting to give assistance from the shore. It consists of a composition, which, when ignited, gives a very distinct and brilliant light, and has been tried, it is said, with success at the Goldstone, where the *Pegasus* was wrecked.—*Athenæum*, No. 831.

DAY'S WINDGUARD.

Mr. Day has submitted an invention for preventing that greatest of nuisances—a smoky chimney. It consists of a cap to be placed on the top of the chimney, in which the openings whereby the smoke passes are guarded by plates of metal, in such a way that the smoke, instead of being driven by the wind down into the chimney, is blown out at the sides of these projecting plates. The contrivance seems to promise success; and its appearance is certainly an improvement on the variety of ugly fabrications for the prevention of smoke, which decorate the chimney-tops of our houses.—*Athenæum*, No. 831.

DEATH FROM STOVES.

In all cases of Death from Stoves, Leblanc has found there was more or less carbonic acid in the air. He has observed even one per cent. of this gas to destroy an animal in two minutes—a fact which explains many of the circumstances which appeared some years ago in the evidence of some London chemists, respecting the influence of Joyce's stoves. It is quite obvious that their structure was dangerous. Leblanc found that a candle was extinguished in air containing only from 4½ to 6 per cent. of carbonic acid. In such an atmosphere, life may be kept up for some time, but respiration is oppressive. Even 3 per cent. in the atmosphere killed birds; and yet we have seen statements which affirmed that upwards of 3 per cent. had been detected in the London theatres.—*Transactions of the Glasgow Philosophical Society.*

Natural Philosophy.

THE ORDNANCE SURVEY.

It is with no small satisfaction that we announce to our astronomical friends the appearance of a new volume of the *Trigonometrical Survey*. During the long interval of thirty-one years which has elapsed since the publication of the last volume in 1811, the sole fruits of this important and costly operation have been a series of county maps—admirably executed, we admit, and of the highest value in reference to the topography of the country—still in course of preparation and publication. No observations or results connected with geodesy have been officially communicated; and, indeed, if we except the few meagre accounts which have been occasionally furnished to parliament, the public, generally, has had no information respecting the state and progress of the work. The appearance of the present volume is therefore highly gratifying, not only on account of the observations it contains, but also by reason of the promise held out that the mass of valuable results which has so long been accumulating will, at length, be available for the better determination of the dimensions and figure of the earth. After all, it may ultimately be found that the delay which has taken place in completing the meridional arc is not greatly to be regretted. Within the last twenty years, the theory of computing geodetical observations has received considerable improvements in the hands of Gauss and Bessel; and advantage will, no doubt, be taken of the new methods to render the results as perfect as possible. The instruments which have been used in the Ordnance Survey, both for the astronomical and geodetical observations, have been far superior to those which were employed in the celebrated operation for determining the French arc of meridian, and, indeed, in any of the continental surveys; and it is very important that none of the advantages of this superiority be lost through the use of imperfect, or rather, not the most perfect, methods of reduction and computation.

The contents of the present volume are sufficiently indicated by its title*. They include all the observations for purposes connected with the survey made with Ramsden's zenith sector, the *chef d'œuvre* of that celebrated artist. The number of stations at which observations were made is ten: namely, Dunnose, Dunkirk, Greenwich (two series), Arbury Hill, Delamere, Clifton Beacon, Burleigh Moor, Kellie Law in Fifeshire, Cowhythe Hill in Banffshire, and Balta, the easternmost of the Shetland Islands. Those at Dunnose, Greenwich (first series), Arbury Hill, and Clifton Beacon, were made in 1802, and *partly* published in Mudge's "Account of the Measurement of an Arc of the Meridian extending from Dunnose (in the Isle of Wight) to Clifton (in Yorkshire)," printed in the *Philosophical Transactions* for 1803, and in the second volume of the *Trigonometrical Survey* in 1804.

* Astronomical Observations made with Ramsden's Zenith Sector, together with a Catalogue of the Stars which have been observed, and the Amplitude of the Celestial Arcs deduced from the Observations at the different Stations. By Order of the Board of Ordnance.

Those at Delamere Forest and Burleigh Moor were made in 1806, and partly published in the third volume of *Survey* in 1811. Of the remaining observations, which now appear for the first time, those at Kellie Law and Cowhythe Hill were made in 1813; those at Balta in 1817; those at Dunkirk in 1818; and those at Greenwich (second series) in 1836.

The reason assigned by Colonel Colby for the republication of the observations, is the following:—"As the observations which had been published by the late Major-General Mudge, in 1802 (1803) and 1811, formed but a very small proportion of the whole body of observations, most of which remained unpublished, and partial differences would result from the adoption of more rigid astronomical reductions, I deemed it most expedient to republish those observations in this volume, and thus to furnish a congruous work for future reference."

Although the practice of selecting a portion of the observations, which we are thus informed was adopted in the early part of the Survey, is one which cannot be too strongly discommended, it is proper to remark, that the changes which have now been made in the amplitudes in consequence of the insertion of the observations which were omitted, the correction of some errors of calculation, and the use of different elements in reducing the places of the stars, are extremely small; the greatest, that between Dunnose and Burleigh Moor, amounting only to 0″·65, while that between Dunnose and Clifton amounts only to 0″·04.

In the present volume, the amplitudes of the several arcs are first deduced from the observations of each star separately, and the most probable mean found by assigning to each partial result the weight due to the number of observations. The final results are contained in the following table: and it is only necessary to remark, that the latitudes are obtained by adding, consecutively, the amplitudes deduced from the sector observations to the latitude of Greenwich (51° 28′ 38″·3), as determined by the Astronomer Royal. The former results are added for the sake of comparison.

Station.	*Latitude.*	*Amplitude.*	As published in the volumes of the Trigonometrical Survey.	
			Latitude.	*Amplitude.*
	° ′ ″	° ′ ″	° ′ ″	° ′ ″
Dunnose . . .	50 37 7·03		50 37 8·60	
Dunkirk. . . .	51 1 57·93	0 24 50·90		
Greenwich (1)	51 28 38·30	0 51 31·27	51 28 40·00	0 51 31·39
Greenwich (2)	51 28 38·79	0 51 31·76		
Arbury Hill .	52 13 27·14	1 36 20·11	52 13 28·58	1 35 19·98
Delamere . . .	53 13 18·77	2 36 11·74	53 13 20·80	2 36 12·20
Clifton Beacon	53 27 30·45	2 50 23·42	53 27 31·59	2 50 23·38
Burleigh Moor	64 34 19·48	3 57 12·45	54 34 21·70	3 57 13·10
Kellie Law . .	56 14 50·51	5 37 43·48		
Cowhithe . . .	57 41 9·74	7 4 2·71		
Balta	60 45 2·31	10 7 55·28		

The difference, 0″·49, between the latitudes of Greenwich (1) and Greenwich (2), is owing to the circumstance, that the position of the instrument in 1802 was 50 feet south of its position in 1836.

It will be observed, that the amplitude of the whole arc from Dunnose to Balta is 10° 7′ 55″·28. In point of extent, this is the *second* arc which has been measured in Europe; but when we compare the instrument with which the astronomical amplitude was determined, with that which was used for the French are, we can have no hesitation in regarding it as, undoubtedly, the first in respect of probable accuracy. The amplitude of the French arc of meridian, between the parallels of Formentera and Dunkirk, is 12° 22′ 12″·74; and that of the Russian arc, measured by Struve and Von Tenner, 8° 2′ 28″·91. Balta, we believe, is situated about 52′ west of the meridian of Greenwich, and, consequently, only about 20′ east of the meridian of Dunnose.

The superb instrument with which the above determinations were made, having been deposited for safety in the long Armoury at the Tower, was most unfortunately destroyed by the fire which consumed that part of the edifice in 1841.

The volume concludes with the announcement, that the triangulation for connecting all the stations by geodetical distances, is in an advanced state, and will be given in a subsequent publication.—*Philosophical Magazine*, No. 142.

TERRESTRIAL MAGNETISM.

On Nov. 6 a communication was made to the Academy of Sciences, at Paris, by M. Aimé, on TerrestrialMagnetism. Magnetic declinations and inclinations are of two kinds; the one periodical, the other progressive. The first depend upon the position of the sun, and vary with the hours and seasons. Graham was the first to notice this fact in the year 1722, and Cassini confirmed his observations in 1783; and M. Arago, in 1818, ascertained that the magnetized needle, on the existence of an aurora borealis, was suddenly deranged, not only in the places where the aurora was visible, but also in countries where this was not the case. In order to throw light upon this phenomenon, he induced Mr. Kupffer to undertake at Kasan a series of magnetic observations simultaneously with those of Paris; and from the comparison of these two series, resulted the fact that the maxima and minima of the deviation observed at Kasan corresponded with the maxima and minima at Paris at the same moment. In order to follow up the discoveries, the Academy of Sciences, on the proposition of M. Arago, charged M. Aimé to make a series of observations at Algiers, and provided him with proper instruments for the purpose. His observations commenced in June, 1841, and were continued until the end of 1842. Amongst the results stated by him to the Academy are the following. He says there exists, between the temperatures of the surface of the globe and the magnetic declinations, so complete a correspondence, that he is led to infer that the variations of declination may be generally considered as the consequence of those of the temperatures of day and night; and if this mode of viewing the subject be correct, there must be found in eclipses of the sun a deviation in the normal diurnal course of the needle of declination. As to the annual variation, on comparing the observations of M. Aimé with those of Capin Bérart, made in August, 1832, it is seen that it was in nine years, 24 min. 36 sec., which gave per annum 2 min. 4 sec. of diminution of declination. M. Aimé found that the curves of declination varied little in winter and summer, and that it is towards the equinoxes that the most striking anomalies are manifested. M. Humboldt and other scientific men having expressed an opinion that it would be important to watch carefully the magnetic variations during the periods of the falling stars, M. Aimé did not fail to attend carefully to this suggest on during the month of November, 1841; but the periodical fall of these meteors was not visible at Algiers; and if it did take place, it had no action on the magnetic needle.—*Athenæum*, No. 839.

REGULAR VARIATIONS OF THE EARTH'S MAGNETIC FORCE.

PROFESSOR LLOYD has read to the British Association a paper "On the Regular Variations of the Direction and Intensity of the Earth's Magnetic Force." In this communication, the author has given the principal results of the series of observations which have been made at the Dublin Magnetical Observatory, as far as they have been yet reduced. These observations were commenced in the beginning of the year 1839, and have been continued, almost without interruption, to the present time. Since the beginning of the year 1840, they were taken every two hours, day and night, in accordance with the general plan of observation laid down by the Royal Society. The elements directly observed are the *declination* and the *two components* (horizontal and vertical) *of the intensity;* and from the variations of the latter, those of the *total intensity* and *inclination* are readily deduced. The means of observing the vertical component of the intensity having proved not altogether satisfactory, another instrument has since been contrived by the author, by which the changes of the inclination are given directly. Prof. Lloyd did not occupy the time of the meeting with any account of the instruments or methods of observation, which are now sufficiently known by all interested in the subject of terrestrial magnetism; but he proceeded at once to the results obtained, so far as they related to the regular changes of the magnetic elements, commencing with the *diurnal changes.* These variations were projected in curves, which represented the course of the mean daily changes for the entire year, for the summer and winter half years, and for each month separately.

Declination.—The mean daily curve of the changes of declination for the entire year exhibits a small easterly movement of the north end of the magnet during the morning hours, which reaches its maximum about 7 A.M. After that hour, the north end moves rapidly westward, and reaches its extreme westerly position at 1^h 10^m P.M. It then returns to the eastward, but less rapidly, the easterly deviation becoming a maximum about 10 P.M. The mean daily range = 9.3 minutes. During the summer months the morning maximum at 7 A.M. is more marked; the evening maximum, on the contrary, disappears, there being a slow and regular movement of the north end to the eastward from 7 P.M. until 7 A.M. In winter, on the other hand, the evening maximum is well defined, and the morning maximum disappears, there being a slow and regular westerly movement until 9 A.M., after which the movement becomes more rapid in the same direction. The epoch of the extreme westerly position of the magnet is nearly the same throughout the year. The greatest daily range, in summer, is about 13.7 minutes; the least range, in winter, about 7.2 minutes.

Horizontal Intensity.—The mean daily course of the horizontal force, for the entire year, has two maxima and two minima. The first minimum occurs between 1 A.M. and 3 A.M., which is followed by a maximum about 5 A.M., or a little after. These fluctuations are small. A second and principal minimum takes place at $10^h\,10^m$ A.M.; and a second, or principal maximum, about 6 P.M. The mean daily range = .0024 of the whole intensity. In the summer months the smaller maximum and minimum disappear, the intensity decreasing continually throughout the night, but slowly, until 5 or 6 A.M., after which the decrease becomes rapid. There are, consequently, but one maximum and one minimum in the mean daily curve, which correspond nearly in epoch with the principal maximum and minimum of the curve for the entire year. In the winter months, on the other hand, there are three maxima and three minima, the evening maximum appearing to break into two. The epoch of the morning maximum moves forward as the time approaches the winter solstice, appearing to depend upon the hour of sunrise, which it precedes by a short interval. The epoch of the principal minimum is nearly constant throughout the year. The daily range is greatest in the month of July, when it is about .0045 of the whole intensity; it is least in the month of January, being then about .0008 of the whole.

Total Intensity and Inclination.—The total intensity appears to vary very little throughout the day. It appears to be least about 9 A.M., and then to increase, attaining a double maximum in the afternoon. The total range, however, being very small, the variations of the two components of the intensity are dependent chiefly upon the changes of the inclination. The inclination is greatest between 10^h and $10^h\,30^m$ A.M., and least about 6 P.M., the epochs corresponding with those of the least and greatest values of the horizontal intensity. The daily range is about two minutes in the early part of the year, and increases to more than double of that amount in summer. If we combine the changes of declination and inclination, the former being multiplied by the cosine of the absolute inclination, we obtain the whole movement of the north end of the magnet in free space, or the curve formed by the intersection of the magnetic axis with the sphere, whose radius = unity. The whole movement during the first six hours of the day is inconsiderable. It appears, on a review of these facts, that the diurnal changes in the direction of the magnetic the deflections of the needle into quantities of current. The necessity of forming these tables was first insisted upon by M. Becquerel; and in his Treatise on Electricity he has pointed out the laborious experimental processes employed by himself and others in their construction. It is obvious that one table would suit all instruments possessing the same relative proportions. And the instrument which Mr. Joule lately presented to the notice of the British Association, was designed as a *type* for the construction of the galvanometers. It consisted of a needle, three inches long, suspended in the centre of a coil of six inches diameter. By a simple mechanical contrivance the coil could be removed from the instrument, and replaced by others adapted for the measurement of currents of different quantities and intensities; but in all cases their dimensions were to be exactly similar, and their diameter exactly twice the length of the needle. A most important part of the instrument was the needle, which was constructed on Dr. Scoresby's principle, and consisted of two straight and perfectly hard pieces of watch-spring, placed at a distance from each other of about three-eighths of an inch, the agate cap being fixed between them. The importance of this form of needle consisted in the facility it presented of constructing different needles perfectly similar to one another with regard to the distribution of magnetism in them, which is essential to the accuracy of the same table applied to different instruments.

CAUSE OF EARTHQUAKE.

It has long been known that electricity is generated in great abundance in the earth, and that it passes in various forms, though most frequently imperceptibly, into the atmosphere. Would it be an irrational conjecture, that the production of Earthquake shocks, at least in non-volcanic countries, is due to the states of the atmosphere relatively to each other? If, as there is reason to suppose, electricity is formed in the interior of the earth most abundantly during winter, does not this circumstance serve to explain the greater frequency of shocks in that season? And may the shocks not be caused by occasional *discharges* of electricity from the earth into the atmosphere, not unlike discharges from one cloud to another?—*Mr. Milne,* F.R.S.E., in *Jameson's Journal.*

RISING OF THE NILE.

A singular anomaly has been observed in Egypt, which has created a great sensation. From what has been observed from time immemorial the rising of the Nile has taken place immediately after the summer solstice, and the phenomenon is expected between the 1st and 10th of July. This year, (1843) on the night of the 5th of May, two months before the ordinary time, the rise of the river commenced, but lasted only three or four days, after which it sank gradually, and returned to the precise state at which it generally is at the summer solstice. Many superstitious and ridiculous customs have always marked this annual wonder of nature, and the certainty of the return has been observed from the highest antiquity. Bruce has mentioned two rises, but they have been one at the usual period, and another later; such was the case in 1837; the same thing occurred during the reign of Cleopatra. It is remarkable that we have had no account from Egypt from any of our consuls or agents, whilst M. Jomard has reported this singular event to the Academy of Sciences, and an extract from a letter from Cairo, dated 12th of May, was read at its meeting in June.—*Illustrated Polytechnic Review*, No. 30.

REMARKABLE TIDES.

On September 4, was read to the Academy of Sciences, at Paris, a paper on a remarkable phenomenon of the tides at the Sandwich Islands, on the 7th of November, 1837, as recorded by M. T. C. Byde Rooke. On the evening and night of the day above named, a commotion of the sea was witnessed at Honolulu. in many respects similar to that experienced at these islands in May, 1819. One inch and a half of rain had fallen during the previous 24 hours; the wind was fresh from the N.E., squally at intervals; the atmosphere was clear and cool; the thermometer 74·5; the barometer had gradually fallen during the four previous days, but this evening had again risen to 30·06. At six o'clock the alarm was given that the sea was retiring; the recession was somewhat more than 8 feet; the reefs surrounding the harbour were left dry, and the fish aground were mostly dead; the sea quickly returned, and in 28 minutes reached the height of an ordinary high tide; it then receded, and fell again 6 feet. On the third rising it attained the height of 4 inches above the high-water mark, and fell again 6 feet 4 inches. The rapidity with which the water fell varied in different parts of the harbour; on the east side the greatest rapidity noticed was 6 inches in a minute, but on the north, at one time during the third recession, it fell 12 inches in 30 seconds. At no time did the water rise higher than a common spring tide, but the fall was about 6 feet below low-water mark. The same occurrence is said to have taken place in 1819, when the tide rose and fell thirteen times in the space of a few hours, but on neither occasion was there any perceptible motion or trembling of the earth, or unusual appearance of the atmosphere. The same phenomena were observed at Mani and Hawaii. On the leeward side of Mani the same rise and fall took place as at Honolulu, but on the windward part of the island the sea retired about 20 fathoms, and quickly returned in one gigantic wave, sweeping every thing before it. At a village called Kahulin, district of Wailuku, on the sea retiring the inhabitants followed it, catching the fish, when all at once the sea returned, overwhelming the multitude, but fortunately their amphibious habits diminished the danger, and only two lives were lost; the canoes were, however, all destroyed. At Byron's Bay, Hawaii, the sea at half-past six retired at the rate of four or five knots an hour, reducing the soundings from 4 to 3½ fathoms at the anchorage, and leaving a great extent of the harbour dry. The inhabitants ran to the beach, when the same scene took place as at Mani, and had it not been for the assistance afforded by the British whale ship, *Admiral Cockburn*, many lives would have been lost, for the canoes were all destroyed. In Kanokapa and Kaahelu alone, 66 houses were destroyed, and 11 persons lost their lives; at Kauwali Swoman no shock of earthquake was felt, but the volcanoes of Kilawa were much disturbed the previous evening, yet nothing unusual was observed at sea at the same distance. That this apparent sub-marine volcanic action took place at some distance from the islands was proved by the waves striking the different islands simultaneously, but in what direction there are no means at present of determining. Perhaps the internal fires had found a new vent, which may lay the foundation of a new group of islands, as happened nineteen years and a half ago.—*Athenæum*, No. 129.

LAWS OF INDIVIDUAL TIDES.

On March 2, was read to the Royal Society, a paper by Professor Airy, Astronomer Royal, entitled, "On the Laws of Individual Tides at Southampton and Ipswich;" both which places present some remarkable peculiarities. The Professor explained in detail the nature of his observations, and the method he pursued in constructing tables of mean results, and deduced from them the conclusion, that the peculiarities in the tides which were the object of his investigation, were not dependent on variations in the state of the atmosphere, but were, probably, connected with the laws which regulate the course of waves proceeding along canals.

TIDES OF THE FRITH OF FORTH.

Mr. Scott Russell has read to the British Association, the concluding Report of a series of Observations on the Tides of the Frith of Forth and of the East Coast of Scotland. These observations extended over several seasons, and no complete report had been hitherto presented, as the observations of each former season had only shown the necessity of further extending the observations. The observations of the first season had proved the existence of certain anomalous tides, which had not formerly been accurately examined, and proved that these anomalies were more extensive than was at first conceived. Next season the observations were more widely extended, so as to comprise the whole phenomenon, including many adjacent places, to which the same anomalies were traced; and thus the general nature and extent of the phenomena were determined with accuracy and precision, and reported to the last meeting. But it was found that great differences of opinion existed with reference to the cause of these ascertained phenomena, and rendered it obvious that the observations required to be extended still further, in time and extent, in order to settle conclusively the questions which had arisen out of the former inquiries. But this last series, from their extent and completeness, had now been so fully examined and discussed, as to afford ample means of deciding on the nature of the phenomena, and determining their origin. Simultaneous observations had been made at nearly twenty stations on the east of Scotland, from Newcastle and Shields to Inverness, and as many as 2000 observations a day registered and discussed. The results of these were exhibited in the tables and diagrams accompanying the Report; and the result of the whole had been to elucidate, in a remarkable manner, the mechanism which propagates along our shores and rivers the great ocean-wave, which carries from one place to another the successive phenomena of the tides—in such a manner as could not have been attained by any system of observation less extensive than that which had been adopted. It is pretty generally known that the phenomena of the tides with reference to their generating cause, the influence of the mass of the sun and of the moon in the various relations of distance and direction of these luminaries, have recently been examined with great success in a series of researches carried on, first by Mr. Lubbock and then by Mr. Whewell, partly with the co-operation of this Society. By means of their labours we are now enabled to predict, with unlooked for accuracy, the time of high water, and the height of the tide in many of the harbours of Great Britain. But many of the local phenomena of tides remained unaccounted for, and these had been the object of a special series of researches, of which the present formed a part; the object being to determine in what way the conformation of the shores, and of the bottom of the sea, and the forms of the channels of rivers and friths, affect the phenomena of the tidal wave. The rivers Dee and Clyde had been formerly examined with this view. To these were now added the Forth, the Tay, and the Tyne, and the northern shores of the German ocean.

The manner in which these observations were conducted, is not the usual one, of noting down simply the hour at which high water occurs, and then the hour of low water, along with the height at which the water stands at these times. Such a method had been found quite inadequate to the purposes for which such observations are required, and, indeed, he thought it of importance that all tide observations should, if possible, be made in the manner he was now about to describe, especially all tide observations made for scientific purposes. This plan was, to carry on simultaneously at the places examined, a series of continuous observations, every five minutes night and day, by successive observers, without intermission, for the period of a month, or of several months, as might be required. Printed forms were sent to all the stations, and in them the observers simply noted down, every five minutes, the height of the tide on a graduated scale placed before them. Every day, at noon, all these papers were sent by post to the central station, and immediately on their arrival the papers of the different stations were compared, and their observations laid down on paper, so as to give a graphical representation to the eye of all the observations, by means of which they were at once verified and compared with great facility. From the examination of these tide-waves thus laid down, certain characters of the tide-wave peculiar to each locality had been discovered. As in the former observations of the Clyde and the Dee, it had been found in this series, that the form and dimensions of a channel produce important changes in the form of the tide-wave. Where the sea was deep and the shore open and abrupt, the form of the tide-wave was symmetrical, and of the form predicted by Laplace, where he says, that in rising and falling, the water covers in equal times equal arcs of a vertical circle. This is the form of the ocean tide-wave; but, on approaching a shallow shore, and travelling along a shelving coast, the tide-wave undergoes two changes—its summit becomes displaced forwards in time, its horizontal chords become dislocated, and the wave ceases to be symmetrical. This peculiar dislocation and displacement are characteristic of a littoral tide, and in the case of running streams, the currents still further affect the tide-wave, and give to it a peculiar distortion characteristic of fluvial tides. To these were further added the exaggeration and elevation of the tide, by means of narrow channels. All these phenomena were fully proved by the present series of observations.

The author of this paper also considers it to have been fully established by the observations on the Frith of Forth, that there exists on the eastern coast satisfactory evidence of the presence of a second tide-wave in that part of the German Ocean, and that the southern tide-wave, a day older than the northern tide-wave, sensibly affects the phenomena of that part of the coast. To this he attributes the double tides of the Frith of Forth, the nature of which he fully explained. Regarding these double tides, various theories had been formed; and there were various ways in which such tides might happen, whenever tide-waves arrive by different paths in different times. But this kind of double tide was, in this case, only to be explained by the method he had adopted, and which removed the difficulties in which the subject had formerly been involved. He then proceeded to explain the mode of discussion which had been adopted. It was the semi-diurnal inequality, so accurately examined by Mr. Whewell, which enabled us to decide on the ages of two tides. If the two tides which appeared together, presented opposite inequalities both in time and in height, regularly alternating, varying with the moon's declination, disappearing with it, and re-appearing with it, and following it regularly, without regard to other simultaneous changes of a different period, then it became plain that no other inference could be drawn, than that which he had mentioned; when, further, he had proceeded to treat these tides as compounded of two successive tides, one due to a transit $12^h\ 24^m$ later than the other, and had used for this purpose two simple river tides superimposed at a distance in time corresponding to that at which the northern and southern tides could enter the Frith, he had obtained a close representation of the double tides of the Frith of Forth; when these two methods of examination ended in the same conclusion, he conceived that it had obtained a very high degree of probability. By means of these observations tide-tables had been formed which were designed to afford a more accurate means of producing the local tides of the east coast of Scotland than any we now possessed.—*Athenæum*, No. 827.

RISE OF THE COAST OF SCANDINAVIA.

MAJOR L. BEAMISH has read to the British Association, a paper "On the apparent Fall or Diminution of Water in the Baltic, and Elevation of the Scandinavian Coast." During a journey to Stockholm, in the early part of the present summer, the author had occasion to see and hear much respecting the diminution of water in the Baltic; a practical and personal evidence of which he experienced in the harbour of Travemunde, on the 4th of May, by the sudden fall of water at the port, which took place very rapidly, and to a great extent. The steamer, which ought to have left Travemunde on the 18th, was detained by this cause until the 21st. It is well known, that, although without tide, the Baltic is subject to periodical variations of depth; but the water has fallen, during the present summer, to a degree far below these ordinary variations; and the fact was considered so remarkable as to be thought worthy of being brought before the notice of the Swedish Academy of Sciences, by Baron Berzelius, in July last. This fall or diminution of water was already perceptible in the summer of 1842, since which, the Baltic has never returned to its average mean height; but, on the contrary, has diminished, and there seems now no probability that the former level, or the height of 1841, will be again attained. Meantime, no perceptible change has taken place in the waters of the North Sea, and the unscientific observer asks, What has become of the waters of the Baltic? The answer is probably to be found in a simultaneous phenomenon apparent on the Swedish coast, the gradual elevation of which has been satisfactorily proved by the personal observation of Mr. Lyell. Recent observation, however, would seem to show that this elevation does not proceed at any regular or fixed rate, but, if he might use the expression, *fitfully* at uncertain periods, and at a rate far greater than was at first supposed. At the same meeting, when Baron Berzelius drew the attention of the Swedish Academy to the diminution of water in the Baltic, a communication was made from an officer who had been employed on the south-west coast of Sweden, in the Skärgard of Bohuslän, north of Gottenburgh, giving evidence of the recent elevation of that part of the coast, and stating, that during the present summer, fishermen had pointed out to him near the Halström, at Oroust, *shoals* which had never before been visible. The elevation of the Swedish coast forms a striking contrast with the unchanged position of the continuous coast of Norway, which, as far as observation has hitherto been extended, has suffered no change within the period of history, although marine deposits, found upon the Norwegian Hills, at very considerable elevations above the level of the sea, prove that those parts were formerly submerged. More accurate information, however, will, before long, be obtained on this interesting point, as a commission has been appointed by the Norwegian government to investigate the subject, and marks have been set up on the coast which will, in a few years, afford the desired information; meantime, the Scandinavian peninsula presents an extraordinary phenomenon; the western, or Norwegian side, remaining stationary, while the south and east, or Swedish sides, are rising, and that, as the author had endeavoured to show, at no inconsiderable rate.—*Athenæum*, No. 829.

SEA OF ARAL.

Of the Sea of Aral it is difficult to procure any particulars from a people so barbarous as the Kuzzauks, who alone are familiar with it. The water is too salt to be drunk by man or beast, excepting at the mouths of the rivers Oxus and Jaxartes. The water is shallow, but navigable by small craft. Its north-western shores are sometimes bounded by cliffs of chalk, marle, and shell-limestone, elevated about 200 feet above the level of the water. At the mouth of the Oxus are many islands, and near the centre of the sea is one of considerable extent. . . . . The boats upon the Sea of Aral are merely small fishing-craft, belonging to the Aral Oozbegs and Kara Kulpauks, dwelling on ita coasts: they are few in number. The name of this sea is Dungiz-i-Khaurism, or the sea of Khaurism. The name Aral is never applied to it by Asiatics, and belongs to a tribe of Oozbegs dwelling near that sea.—*Capt. Abbott's Khiva, &c.*

DEPRESSION OF THE DEAD SEA BELOW THE LEVEL OF THE MEDITERRANEAN.

Since the various conclusions regarding this depression deduced from the observations and experiments of Schubert, Moore, Beek, Berton, and Russegger, its amount has been estimated at 1200 feet, from data obtained by the late Sir Daniel Wilkie. We are glad to find, by the following remarks contained in Mr. Hamilton's address to the Geographical Society of London, that this interesting problem has now been completely and satisfactorily solved by Lieut. Symonds of the Royal Engineers:—"This officer, during the last year, carried a line of levels across from Jaffa to the Dead Sea by two different routes; and the results, corresponding to within an insignificant fraction, give 1311.9 feet for the depression of the Dead Sea below the level of the Mediterranean, being a very few feet less than that given by M. Bertou. Lieut. Symonds, by the same operations, found the level of the Lake of Tiberias to be only 328 feet below that of the Mediterranean, making an inclination of nearly 1000 feet beneath this lake and the Dead Sea, a distance of about 70 miles."—*Jameson's Journal*, No. 67.

HEIGHTS OF LOCALITIES IN THE HOLY LAND ASCERTAINED BAROMETRICALLY, BY RUSSEGGER.

Monastery of St. Catharine on Sinai 5115 Parisian feet above the sea; summit of Dschebel Horeb, 7097; summit of Dschebel Catharine, 8168; Jericho, 717 below the sea; bathing place of the pilgrims in the Jordan, 1291 below the sea; Catholic Convent at Nazareth, 1161 above the sea; summit of Tabor, 1755; surface of the Lake of Tiberias, 625 below the sea; Dschebel Makmel, above Tripolis, the highest point of Lebanon, 8800 above the sea; the Cedars of Lebanon, above Eden, 6000; mountain pass between Beirout and Baalbeck, 5485; Bseddin coal-mines, 2906; Makla-ain-el-Bed coal-mines, 2873; Mar-hanna-el-Kennise coal-mines, 1803; Room at Beirout, 60; mountain pass from Beirout to Damascus, 4886; town of Sebedäni, 4024; the Fall of Barada, at the Pass of el-Suk, 3346; town of Baalbeck, 3196; Damascus, 2304. The mountain elevations in Lebanon and Antilebanon are older than those in Southern Syria. The former belong to the chalk formation, but the latter to the tertiary deposits. This fact seems to correspond perfectly with the physical characters of the surface. — *Poggendorff's Annalen*, No. 5; *Jameson's Journal*, No. 67.

COMPOSITION OF THE ATMOSPHERE.

M. Lewy has communicated to the Academy of Sciences, at Paris, his researches, made at the request of the Academy, on the composition of atmospheric air obtained at Copenhagen and from the North Sea, comparing them also with analyses of air from Gaudaloupe, collected by M. Deville. This new series of experiments, conducted in accordance with the new process of MM. Dumas and Boussingault, fully confirms the views of some philosophers, that the composition of air is not constant over the whole surface of the globe: the conclusion that the oxygen varies may be drawn with considerable certainty; for if the variation is somewhat doubtful, as exhibited by the analysis of air collected over continents, it is greater and most decided when the air examined has been obtained at sea.—*Literary Gazette*, No. 1387.

FORMER LOW TEMPERATURE OF EUROPEAN WINTERS.

When speaking of winters sufficiently cold to admit of large icebergs floating in great numbers as far as latitude 50° (see Charpentier's Paper, at page 59 of the present number), M. E. de Beaumont says:—At first sight, this supposition appears contrary to the hypothesis so generally admitted, that the terrestrial globe was warmer during former geological periods than it is at present, and that it has been subsequently gradually cooled. This apparent opposition ceases, however, when we consider that the temperature of a given portion of the globe during a given time depends not only on the general temperature of the globe, but also on the manner in which the Isothermal Lines were disposed, during that same period, under the influence of seas and of mountains whose configuration was quite different from the configuration of the seas and mountains of the present day. The globe, during the period which preceded ours, may as a whole have been a little warmer than it now is, and yet central Europe may have had a climate similar to that of Canada, where the phenomenon of the transport of blocks of rock by ice has been observed in latitude 48° or 50°. This supposition of colder winters in Europe, during the geological period preceding our epoch, would, moreover, be in harmony with many other observations.—*Comptes Rendus*, vol. xiv.; *Jameson's Journal*, No. 67.

SAND VITRIFIED BY LIGHTNING.

Dr. Fiedler has communicated to the Academy of Sciences, at

Paris, a paper on lightning, and its action on sand. It is a general opinion at Paderborn, in Westphalia, that wherever a thunderbolt falls, vitrified tubes are to be found. In 1711, the Rev. Mr. Hermann, at Massel, Silesia, followed these tubes to a considerable depth in sandy hillocks, the description of which is to be found in his "Mastography," under the denomination of fossil shrubs or osteocolla. He thought that these tubes were formed in the earth, and came gradually up to the surface. Other persons have considered them to be petrified roots. M. Couerden dug one at the depth of 15 feet. In 1812, Mr. Irton, of Irton Hall, dug one up. Dr. Fiedler has seen them in Hungary, and at Harz, near Dresden. They have been found on the border of the desert of Sahara, in the Brazils, &c. M. A. de Humboldt sent to Dr. Fiedler a piece of porphyry which he broke from off one of the highest mountains of the chain of the Andes, and which contained a portion of a tube. On the 13th June, 1841, at 5 P.M., during a violent thunder-storm, a bolt fell on the right bank of the Elbe, near the village of Loschwitz, a league from Dresden, split a stake, burnt the leaves of a plum-tree, and buried itself in the earth at an angle of 66°. On digging a hollow tube was found, in which the sand was completely vitrified; it was simple for about four feet, and then divided itself into two branches, which disappeared on reaching a sandy, argillaceous, and ferruginous soil, containing a great deal of water. The electric fluid, on meeting several roots, went round them, simply blackening without destroying them.

METEOROLOGICAL OBSERVATIONS AT PLYMOUTH AND DEVONPORT.

MR. S. HARRIS has reported the several results of the Meteorological Observations made at Plymouth and Devonport, at the request of the British Association. The great mass of the results which these observations necessarily involved, had precluded the possibility of completing a full report, such as would be requisite for the next volume of the Association. The requisite documents are, however, sufficiently complete to insure this report for the next meeting. The first series of observations were those deduced from Mr. Whewell's Anemometer, by which a result has been arrived at not dissimilar from that laid before the meeting at Manchester, viz., the existence of a sort of trade-wind, or current of air, from south to north, in the place where these observations were made. This was exemplified by large typographical delineations of the aerial currents, by lines proportional to the velocity and direction for given times, laid down for the years 1841 and 1842. Mr. Harris made some observations on the nature and capabilities of this instrument, and the results which might be expected from it, in deducing the great annual movement of the atmosphere. The results of the discussion of the observations with Osler's Anemometer were next brought under consideration, which being regularly tabulated and discussed, had shown a mean hourly intensity of the wind, tending to follow an order similar, but inverse, to that of the barometer; a major and minor wave occurring in the day, so as to produce two maxima and two minima of intensity: the full discussion of these observations had not yet been effected to a sufficient extent to exhibit all the various relations of the wind required. The remaining observations on pressure and temperature were next considered; and graphical delineations of the mean hourly progress of the temperature, pressure, dew-point, and intensity of the wind, were brought under one point of view in a general diagram.

Dr. Scoresby next inquired from Mr. Harris how the mean lines, which appeared to be the final result of the observations with the anemometers, were obtained?—Mr. Harris replied, that these were merely laid down by the eye, that no deduction was grounded upon them, and that they were placed there merely to give the Section a general idea of the mean direction of the great aerial current which passed annually over Plymouth.—Dr. Scoresby suggested, that a mean result might, as he conceived, be very readily and accurately obtained, by laying down each day's work of the machine, something after the manner in which traverse sailing was worked by the masters of ships at sea. To this Mr. Harris assented. Dr. Scoresby stated, that so invariable were the relations existing between the temperature, pressure, the direction of the wind, and the general state of the weather in the Polar Seas, that when he sailed in them he found he could almost with unerring certainty predict the changes of wind, from north to south, and *vice versâ*. He had kept a record of these anticipations for thirty-two days, and twenty-nine of these turned out to be correct.—Mr. Beamish said, that the general result of the anemometer, obtained by Mr. Harris at Plymouth, seemed to indicate an atmospheric current tending towards the west; now this was opposed to a most familiar fact in the county of Cork, namely, that all the trees, particularly near the coast, had a leaning towards the east; indeed, it was well known that the prevailing winds here were westerly. —Mr. Harris replied, that the long continuance of a particular wind did not at all prove that the total atmospheric current set from that quarter; for a single day's violent blowing of a storm from the opposite quarter might be more than sufficient to counterbalance the long continued, but more gentle effect.

Prof. Lloyd availed himself of the opportunity afforded by the present discussion, to read an extract of a letter which he had that morning received from Mr. Osler, describing various improvements which he had recently made in the construction of his anemometer. These improvements consisted, chiefly, in a modification in the form of the vane, whereby its arc of oscillation was reduced in magnitude, and in the dimensions of the pressure plate, by which its indications were rendered more sensible. The writer stated, that he felt much confidence in the performance of his instrument in its present improved form.

ELECTRICITY OF THE ATMOSPHERE.

MR. NOTT has read to the British Association, a paper "On a new Electrical Machine, and upon the Electricity of the Atmosphere." This paper treated at great length of electrical currents and of the atmospheric electricity, by way of a preliminary to the consideration of terrestrial magnetism. The author insisted on the close analogy between the voltaic pile and a magnet. The difference between voltaic and frictional electricity he conceives to be, that the former is *in* the conducting wire, the latter *on* its surface, and therefore decomposed by whatever approaches it. Besides, the voltaic pile exhibits the two electricities and the current in which they unite; whereas the ordinary frictional machines develope and maintain but one electricity, and no current.

Among the novelties presented by the paper, may be mentioned the description of what the author calls the Rheo-electric Machine, in which both electricities are developed by friction. "It consists of a circular plate of glass and another of resin, both supported upon a horizontal axis, and set in motion by a winch handle; the rubber of the vitreous plate is connected by a metal rod with the rubber of the resinous one; and the conductor of the latter plate is also connected by a metal rod with that of the former, and thus a complete circuit is formed, as in the voltaic pile. The distribution of the electricity of this instrument is also analogous to that of the pile. For example, the electro-motive disturbance is produced by the plates; the rubber of the vitreous plate is rendered negative, that of the resinous one positive; and the conductors are also in opposite electric states, and their remote extremities are therefore analogous to the poles of the pile. When the conductors are connected by a conjunctive wire, it is natural to suppose that the accumulated electricities flow along its surface in opposite directions, for then an electric current is formed, which permanently deflects the magnetic needle, and the deflection is according to the direction of the current. The direction of motion of this current may be varied at pleasure; for instance, in order to fix our ideas, let us suppose the plates of this instrument and the axis of the conductors to be lying in parallel plates, perpendicular to what is called the magnetic meridian; the conjunctive wire connecting the conductors being bent at right angles, a portion of it will then be in the meridian, and the metal rod connecting the rubbers will be parallel to this portion. If now a magnetic needle be suspended above the conjunctive wire, and the resinous plate, which we will suppose to be placed north of the vitreous one, be connected with the earth, then a current of electricity passes from the resinous plate, and consequently flows along the conjunctive wire from north to south; the needle is then permanently deflected towards the west. If the needle be placed beneath the conjunctive wire, the deflection is towards the east. When the vitreous plate is connected with the earth, the current flows from the vitreous plate, and the deflections are in the opposite directions." In the course of his experiments with this machine, the author found that all the parts of it which were made of brass became, by electrization, highly magnetic, and retained their magnetism for some time.

The character of the magnetism thus produced will be understood by conceiving an orthographical projection of this instrument to be drawn upon a horizontal plane: it will be a parallelogram, of which the conjunctive wire will form one side, and the rod connecting the rubbers another; then all the brass parts of one half of this parallelogram, cut off by a diagonal line, will attract the north pole, and all of the other half the south pole. But if immediately after electrization, either pole of the needle be forced into contact with any part of the brass conjunctive wire, it will develope an opposite magnetism to its own, and adhere to the wire, as it would to a piece of iron. He also proved that water may be decomposed by the rheo-electric machine, as with the galvanic current. The two electricities, as developed by this machine, appeared to him to be visibly different: the resinous electricity was subject to remarkable changes of colour, according to the state of the atmosphere and the nature of the exciting body. It also struck him that electricity is radiated in a peculiar manner from magnetized bodies.

Combining this observation with an hypothesis respecting the electricity of the globe, viz., that the equatorial parts of the earth are in the resinous (in old language, negative) state of electricity, the poles vitreous (positive); while the atmosphere is, in its lowest strata, vitreous, and in the upper resinous; the author proceeded to exhibit the phenomena of the aurora borealis by direct experiment. "I procured a globe of steel and magnetized it. It may not be unnecessary to state how this was effected. I suspended the globe upon an axis, and by a multiplying wheel and pulley set it in rapid rotation; while rotating I made the magnetizing bars traverse from the equator of the globe to the poles. I then tested it with a proof needle, and found it to be regularly and perfectly magnetized.* The next object was to place this magnetic globe in similar electric circumstances to those which I conceived the earth to be in. Regarding that region of the atmosphere immediately over the torrid zone as the principal seat of atmospheric electricity, I conceived that if I surrounded the globe with a ring that would bear approximately the same proportion to the globe, as this region of the atmosphere does to the earth, and electrized them oppositely, that the action of the electricity of the ring upon the air immediately enveloping the globe, would place the latter in nearly similar electric circumstances to those of the earth. If, then, the aurora were an electric phenomenon, that is, a discharge of free electricity, taking place from the pole of the earth, rendering the vortex, which I supposed to be immediately over the pole, luminous, from the great rarefaction of the air within it, and passing over our atmosphere to the upper stratum of the equatorial region, that as I could increase the electric intensity of my artificial terrella as I pleased, an analogous effect would be produced. This result followed with the greatest precision, as I shall now describe. I insulated the ring, and connected it with the resinous conductor of the rheo-electric machine. I also insulated the globe, and connected one of its poles with the vitreous conductor, and placed it so that its equator was surrounded by the ring. These bodies being electrized differently, and at a very short distance from one another, one would expect that a discharge would have taken place between them; instead of this, they at once re-acted upon one another, so that the interior of the ring being resinous, the interior became vitreous; the equator of the globe resinous, and both its poles highly vitreous; and a truly beautiful and luminous discharge took place from the unconnected pole. The state of the atmosphere has a remarkable effect upon the appearance of this discharge. One evening that the atmosphere was very dense, it had the appearance of a ring of light, the upper part of which was very brilliant, and the under part, towards the globe, was comparatively dark, just as we see at the bottom of ignited vapour; and indeed a vapour of some kind seemed to be ascending from the globe; above the ring, all round the axis, were foliated diverging flames, one behind the other. When the atmosphere is very dry, it has merely the appearance of a beautiful electric brush. If the globe be moved towards any point of the interior of the ring, a discharge takes place in the line of shortest distance between them, and then there is a partial intermission of the auroral light. This experiment seems to point out the true cause of the aurora borealis."

This paper gave rise to a most animated but desultory conversation, in which the President, Dr. Robinson, Dr. Scoresby, Dr. Green, and Mr. Snow Harris, took part. In the course of this discussion, several questions were asked tending to elucidate the construction and peculiarities of action of the rheo-electrical machine as well as Mr. Nott's views. Mr. Harris then stated that he was about to publish, in the *Nautical Magazine*, the observed facts connected with more than 300 thunder-storms, from which he thought it would amply appear that thunder-storms were connected with, and in some manner caused by, opposing and violent currents of wind. That the wind, after blowing for some time from one quarter, changed, and at this crisis, first a calm, and then a flurry and confusion of the wind, blowing from every point of the compass, ushered in the change. It was in this confused state that the rapid decomposition of vapour seemed to take place, torrents of water pouring down, and sometimes hail and even large masses of ice, as in the late thunder-storm at Cambridge, by which, as the Dean of Ely had informed him, that immense destruction of property had taken place, the hail breaking even strong plate-glass.—*Athenæum*, No. 827.

CLIMATE OF MALTA.

Many of the remarks which have been made on the Ionian Islands, in relation to climate and seasons, are necessarily applicable to Malta. Situated farther south, its mean annual temperature is higher; its surface being less elevated, its highest hills not exceeding 600 feet; and being farther removed from lofty mountains, and surrounded by a greater expanse of sea, its temperature during the greater part of the year is more equable; and, lastly, being nearer to the coast of Africa, it is more liable to be invaded by hot winds, and in summer to experience an excessive degree of heat.

As regards temperature, in considering the climate of Malta, it is necessary to distinguish between the town and the country, the circumstances of the two being in many respects peculiar, and occasioning a marked difference in the results of the thermometrical observations. The town of Valetta, by its massive buildings and comparatively narrow streets, is well fitted to equalize temperature. The country, on the contrary, being almost entirely destitute of wood, its surface rocky, its soil scanty, is better adapted to radiate heat. This distinction is commonly neglected, and, in consequence, the observations which have been made in the city have been applied to the whole island; and an exaggerated idea has been formed of the equability of the temperature of Malta, and especially during the heats of summer.—*Jameson's Journal*, No. 68.

IGNIS FATUUS, (WILL-WITH-A-WISP, JACK-WITH-A-LANTERN,) OBSERVED NEAR BOLOGNA.

In the *Annali di Fisica, &c.* (vol. iii. p. 36), there is an interesting notice respecting this phenomenon, by Dr. Quirino Barillic Filepauti, from which we make the following extract:—The painter Onofrio Zanotti assured me, that one evening, as he was walking with some one in the street Lungo-Reno, he saw, near the house of Professor Santini, globes of fire, in the form of flames, issuing from between the paving-stones of the street, and even among his feet. They rose upwards and disappeared; he even felt their heat when they passed near him. According to the information I have collected from many individuals, I have ascertained that St. Elmo's fire is often seen in the neighbourhood of the town, and I have learned in what places it appears most frequently. I have therefore gone in the evening, sometimes to one place, sometimes to another, and continued my observations for many days, both during a clear and cloudy sky. I took up my station chiefly at the entrance to the cemetery, because I was assured that it was there in particular where it appeared, although, in fact, I did not notice one at this point. These researches were undertaken in the autumn, when, according to the general opinion, this luminous phenomenon shews itself more frequently than at any other season; perhaps on account of the rapid changes of the atmospheric pressure, which allow the gases enclosed in the earth to escape more easily, by favouring their natural elasticity.

I perceived only three of these lights, but on different nights. The first was one of those which issue from the ground, rise to a certain height, and then suddenly become extinguished. I can say nothing more respecting these than that they rise rapidly in a vertical line to a height of three or four metres, and then become extinct with a slight detonation. The second moved in a horizontal direction, and I could not long follow it. The wind carried it to the banks of the river Idice, where it disappeared. With regard to the third, which afforded me the opportunity of making the experiments I wished, I must enter into more circumstantial details.

A place fruitful of ignes fatui is the parish of San-Donino, particularly in the neighbourhood of the small church of Ascension, about two miles from Bologna, and especially quite close to a pool, in a rivulet where, three years ago, three sacrificial vessels of fine Roman workmanship were found. On many successive nights I have repaired to this spot, but in vain. However, one evening in October, which was succeeded by an aurora borealis and rain, I entered the house of a peasant on the field where the pool occurs. Shortly after, I opened the window, which overlooks the place where the phenomenon most commonly shews itself. About eleven o'clock I saw the light appear which I was desirous to observe; and I instantly seized the stick which I always kept ready for the purpose, and which had some flax attached to its extremity, and speedily repaired to the spot indicated. When I was not more than about twenty feet from the light, I stopped a moment to observe it. It had the form and colour of an ordinary flame, with a slight discharge of smoke. Its thickness was about a decimetre; and it was moving slowly in a direction from south to north. When I approached nearer it changed its direction, retired from me, and began to rise upwards. I hurried forward with my stick, and thrust it into the flame, which kindled the flax. Soon after, the jack-a-lantern became extinct at the height of about two or three feet above the stature of a man. It soon after reappeared of smaller size (for I was led to believe it was the same), on another pool placed at a little distance. I ran immediately towards it, but in vain, as it vanished in a few seconds. I saw no others that night. The remains of the flax had not the garlick-like smell peculiar to phosphorus, but a peculiar odour which I cannot define, and which appeared to me to be rather of a sulphureous and ammoniacal nature.—*L'Institut*, No. 471; *Jameson's Journal*, No. 68.

DIURNAL TEMPERATURE OF THE EARTH'S SURFACE.

A SIMPLE formula for ascertaining the above has been proposed to the Royal Society, by Mr. S. M. Drach. He first investigates the several causes which influence the daily temperature of any point of the earth's surface. He employs the term *Thernal establishment* to denote the retardation of the effects of solar light caused by atmospherical conduction and by local circumstances, in the same manner that the term *Tidal establishment* has been used to express the local constant by which the astronomical effects on the waters of the ocean are delayed. After explaining the formation of the tables and diagrams given at the end of the paper, and detailing the conclusions derivable from them, the author enters into a view of the perturbing causes, investigates the analytical expression for the daily heat, and concludes with some observations on isothermal lines, on the influence of the friction resulting from the rotation of the earth about its axis, and on the agency of electricity.

ELECTRO-MAGNETIC METEOROLOGICAL REGISTER.

PROFESSOR WHEATSTONE has reported to the British Association, that the Electro-magnetic Meteorological Register, constructed for the Observatory of the British Association, is nearly complete. It records the indications of the barometer, the thermometer, and the psychrometer, every half hour during day and night, and prints the results, in duplicate, on a sheet of paper in figures. It requires no attention for a week, during which time it registers 1,008 observations. Five minutes are sufficient to prepare the machine for another week's work,—that is, to wind up the clock, to furnish the cylinders with fresh sheets of paper, and to recharge the small voltaic element. The range of each instrument is divided into 150 parts; that of the barometer comprises three inches, that of the thermometer includes all degrees of temperature between —5° and + 95°, and the psychrometer has an equal range. The machine consists essentially of two distinct parts: the first is a regulator clock, to which is attached all the requisite recurring movements; the second is a train, having an independent maintaining power, which is brought into action at irregular periods of time by the contact of the plunging wires with the mercury of the instruments, as will be hereafter explained. The principal regularly recurring actions connected with the clock train are two:—1st. The plungers are gradually and regularly raised in the tubes of the instruments during five minutes, and are allowed to descend during one minute. 2d. A type wheel, having at its circumference 15 figures, is caused to advance a step every two seconds, while another type wheel, having 12 spokes but only 10 figures, is caused to advance one step when the former completes a revolution. The complete revolution of the second type wheel is effected in six minutes, —that is, in the same time occupied by the ascent and descent of the plungers. Thus every successive division of the range of an instrument corresponds with a different number presented by the two type wheels, the same division always corresponding with the same number. The two blanks of the second type wheel are presented during the return of the plungers, which occupies a minute, and during which time no observation is recorded. The breaking of the contact between the plunger and the mercury in an instrument obviously takes place at a different position of the type wheels, according as the mercury is at a different elevation; if, therefore, the types be caused to make an impression at this moment, the degree of elevation of the mercury will be recorded. This end is thus effected. One end of a conducting wire is connected with the mercury in the tube of the instrument, and the other end with the brass frame of the clock, which is in metallic communication with the plunger. In the course of this circuit an electro-magnet and a single very small voltaic element are interposed. The electro-magnet is so placed as to act upon a small armature of soft iron connected with the detent of the second movement. So long as the plunger is in the mercury the armature remains attracted, but at the moment the plunger leaves the mercury the attraction ceases, and the release of the detent causes a hammer to strike the types, and impress them by means of black copying paper on the cylinder. The armature subsequently remains unattracted until the plunger descends. Immediately before it reascends, a piece of mechanism, connected with the clock movement, brings the armature into contact with the magnet, which remains there, in consequence of the recompletion of the circuit, until the contact is again broken.

METEOROLOGICAL OBSERVATIONS AT KEW.

THE following is the "Report of the Committee, appointed by the Council, to superintend the establishment of Meteorological Observations at the Kew Observatory."—The limited funds at the disposal of the Committee have not allowed them to carry many of the contemplated objects into effect. The preliminary arrangements have, however, been completed, and a very perfect and efficient apparatus for making observations on the electricity of the atmosphere has been established. The committee has paid more immediate attention to this subject, on account of its importance in connexion with the system of simultaneous magnetic and meteorological observations now making on various points of the earth's surface, in the recommendation of which the Association has taken so prominent a part. The following is a brief notice of the present arrangements:—The dome in which the equatorial was formerly placed has been converted into the electrical observatory. A circular pedestal, about eight feet in height, is firmly fixed in the middle of the room, and a platform, which is ascended by a few steps, surrounds the pedestal, so that the operator, standing upon it, shall be at a convenient height to adjust and observe the various instruments. At the centre of the pedestal is fixed a strong glass pillar, supporting a vertical copper tube tapering upwards; the length of this conductor is twenty feet, sixteen feet being elevated above the dome in the open air. The lower part of the conductor, within the dome, carries four horizontal branches, placed at right angles to each other; these are for the purpose of bringing into connexion with the conductor the various electro-metrical intruments employed. The electricity of the atmosphere is collected by means of the flame of a lamp, kept constantly alight during night and day, and placed at the upper extremity of the conductor; by this plan, which Volta recommended, much more electricity is collected than by means of a metallic point: the lamp is lowered and elevated, when required, by means of a cord and pulley contained within the tube. The insulating glass support of the conductor has in its interior a hollow conical space, the base of which opens into the pedestal; beneath this opening is placed a small night lamp, which heats the air within the cone, and raises the temperature of the glass pillar. The upper part of the external surface of this pillar is not sufficiently heated to prevent the deposition of moisture, and is therefore, to a certain degree, a conductor; the lower part also conducts slightly, on account of its elevated temperature; but there is a zone between these two parts which insulates perfectly, on account of the temperature of that part of the surface being sufficient to expel all moisture, and yet not sufficient to enable it to conduct. A conductor thus insulated will retain its charge for hours together without sensible diminution. Another peculiarity and advantage of this method of insulation is, that the active parts of all the electrometers are suspended from the conductor, and are, therefore, uniformly charged, depending for their insulation on the warmed glass pillar only, and not, as usual, upon separate insulators, which dissipate the electricity unequally. Since the apparatus has been completed the conductor has remained constantly charged, unless purposely discharged, or during the momentary transition from one electrical state to the other. The electric tensions vary in serene weather between + 3° and + 90°, and the diurnal changes are indicated with great precision. This Report is accompanied by a sectional drawing of the Electrical Observatory, and by a register of observations commenced on July 1, and continued regularly for six weeks. Observations made during the same time with the barometer, pluviometer, thermometer, psychrometer, Daniell's and Saussure's hygrometer, &c. were annexed to the Report.

REDUCTION OF METEOROLOGICAL OBSERVATIONS.

COLONEL SABINE has read to the British Association, Sir J. F. W. Herschel's *Report of the Committee appointed for the Reduction of Meteorological Observations.* The Report stated that the Committee had made great exertions to complete the series of equinoxial and solstitial observations during the years 1835, 1836, 1837, and 1838, and had succeeded in obtaining 334 sets of observations made at 69 distinct stations, a synoptic statement of which, with the geographical elements of the stations, was annexed to the Report. These observations, however, by no means formed a connected whole, and promised no distinct or definite results, except as regarded barometric fluctuations, or the propagation of atmospheric waves, which by this method of inquiry alone can be traced over an extensive region. When the trifling depth of the ponderable atmosphere enveloping our globe is taken into consideration, with the number and magnitude of local circumstances which influence its movements, it will be manifest that we may disregard altogether the figure of our planet, and assume, for the purposes of our inquiry, that the atmosphere extends indefinitely in a plain, in portions of which the phenomena vary with local causes. The stations of observation have been divided into groups, grounded on this view of the subject; and two objects have been chiefly kept in view:—1st. The tracing, where it can be accomplished, the curves of one particular wave over the whole area embraced within one of our districts; and 2dly, Where this cannot be done, the observation of connexions between particular localities, with a view to the subdivision of the total area into barometric districts, in which the atmospheric fluctuations shall be, generally speaking, similar in their phases.

In discussing the observations in the European group, the following have been the principal results:—1st, Distinct barometric waves, of many hundreds of miles in breadth, have been traced over the whole extent of Europe; that is to say, at least over an area having Markree, in Ireland, Cadiz, in Spain, Parma, in Italy, and Kremsmünster, in Hungary, for its angular points: not only the breadth but the direction of the front, and the velocity of progress of such waves, have been clearly made out. 2nd. Besides these distinctly terminated waves, we have been able, if not to trace the rate and line of progress, at least to render very evident the existence of undulatory movements of much greater amplitude; so great, indeed, as far to exceed in dimension the area in question, and to require much more time than the duration of the term series (thirty-six hours) for their passage over a given locality. 3rd. In Europe, Brussels is clearly entitled to be regarded as a point of comparatively gentle barometrical disturbance. Very deep waves, it is true, and very extensive ones, ride over it; but with regard to smaller ones, it may be regarded as in a certain sense a nodal point, where inequalities are smoothed down, and oscillatory movement in general is more or less checked; and such movements increase in amount as we recede from Brussels and Cadiz, especially towards the north-west, as far as Markree. 4th. The diurnal oscillations are very conspicuous in a single day's observations, hourly continued; this being rather the general rule than the exception. In particular, the afternoon minimum (4 P.M.) stands forth as a prominent feature in almost all cases where there is not some violent barometric disturbance. 5th. Hanover offers barometric anomalies, separating it from the Belgian type (to which latter the south of England as well as Geneva belongs). Possibly it is connected with a Scandinavian or Polish system. Edinburgh is as remarkable for inequalities and abrupt fluctuations in its barometric changes as Brussels is for the reverse. Turin seems to be much affected by its proximity to the Alps, which gives its barometric curves frequently a very disjointed character. Between the Italian stations (Turin and Parma) and the Spanish (Cadiz, Gibraltar, Tangier,) no community of character and no mutual dependence prevails. Cadiz, Gibraltar, and Tangier, are subject to an anomalous rise and fall of the mercury between midnight and sunrise, which interferes with and often counteracts and overcomes the regular tendency to depression in that interval, a peculiarity which is probably owing to the proximity of the great surface of the African deserts. At Tangier the barometric fluctuations seem to be remarkably small. Markree is remarkable for the boldness and freedom of contour in its barometric curves, and the great range of their fluctuations, compared with stations to the south-east of it. The barometric curves derived from the Indian stations are remarkable for their general smoothness. In those from Mauritius the diurnal oscillations are conspicuously developed. In South Africa, the observations made at two stations exhibit much local disturbance: those made at Bathurst showing frequently an opposite tendency to those made at Cape Town. The American observations are as yet too incomplete to allow their apparent irregularities to be traced to laws.

The Report then proceeds to consider the utility of prosecuting these observations, and advises that the field of inquiry be somewhat narrowed by limiting it to some distinct point of meteorology, such as the tracing of atmospheric waves, and the determination of the coefficients of the diurnal periods. To the latter point the hourly system of observation alone is applicable; and monthly series (on the 21st of each month) of such observations from a vast number of stations, in which absolutely nothing else was set down than the hourly march of the barometer for twenty-five consecutive hours, so as to begin and conclude the twenty-four hours with an observation, would, in itself, if continued for a few years, leave nothing to be desired on this important head. All observations should be at once reduced, and there should be no omissions, as observations, defective in any way, cease to be comparable, and lose much of their value. The fluctuations already traced, by projecting the term observations, are those only whose total duration of rise and fall is comprised within, or does not much exceed, the twenty-four or thirty-six hours over which the term extends; but these are by no means those which, either theoretically, or, indeed, practically speaking, are to be regarded as most important. Mr. Burt laid down, from his own observation, barometric projections, in which the interval between two successive maxima of pressure occupied in the one case seventeen days without any intervening maximum, in another a similar period, with two subordinate maxima interposed, and another where a beautifully symmetrical wave of an extremely remarkable character occupied thirteen days for its complete rise and fall. When dealing with undulations of such extent, it is by no means a visionary speculation to consider the possibility of tracing them over the whole of our globe—nay, perhaps of obtaining evidence of their performing, tide-like, two or more revolutions round its surface; and in this most interesting inquiry Mr. Burt has stated his readiness to engage, should it be the pleasure of the British Association to assist the object of his inquiries by appointing him a Committee for that purpose.

The Report then passed to the consideration of the winds, which it divided into two classes,—winds of translation, and winds of oscillation, nearly in the way in which the movements of the ocean may be divided into oceanic current and tide streams, and these again (regarded as the results of oscillatory movements) may be referred to the general laws which regulate the molecular movements of water in contact with the bottom of the sea, when under the influence of the undulatory agitation. The trade winds and great aerial currents of a similar character, to which the name of monsoons is given, are winds of translation. They have a distinct barometrical origin in the diminution of pressure in approaching the equator, caused by the expansion of the equatorial atmosphere, and the overflowing of the upper strata outwards towards the poles. But this cause is not oscillatory, but permanent. Monsoons also arise in the same way, from local heating and cooling,—periodically renewed, it is true, but in long periods of six months in duration, so as to give rise to steady currents; with such winds the present research has little connexion, except in so far as their powerful influence mixes with and masks the effect of the other class of winds—those which arise from barometric oscillation, and which are connected with such oscillation in a more direct and intimate manner. The oscillations themselves, perhaps, take their rise in local and temporary causes, prevailing over great areas simultaneously; the principle, no doubt, depending on the prevalence of cloud or clear sky, rain or dryness, over great tracts for several days or weeks in succession. But once produced, and an extensive atmospheric undulation once propagated, a wind or system of winds dependent on such undulation necessarily arises also. Every wavelike movement in a fluid consists of two distinct things, an advancing form and a molecular movement. Now the advancing form is indicated to us by the barometer—the molecular movement by the wind, and between these two phenomena there subsists of necessity a close and purely dynamical connexion: and it would be no small meteorological discovery, if, by the study of the characters and progress of barometrical fluctuations, we could either make out any law of the greater ones which would enable us even roughly to predict them, or any peculiarity in their physiognomy, by which we could recognize them in their earlier stages, as by this we might possibly be led to the prediction of great storms. It is a fact which has of late been a good deal insisted upon, viz., that at certain stations the winds revolve in one uniform direction: the vane, for example, at Greenwich, (as is indicated by the Astronomer Royal,) makes five revolutions per annum in one uniform direction: may not this phenomena be, in effect, an indication of some atmospheric node, where a line perpendicular to the strata of the atmosphere may be regarded as describing a conical surface round the true vertical? If it be true (as the discussion of the Term Observation may lead us to suspect,) that Brussels is in effect such a nodal point, the examination in this view of its "Wind-Rose" would be interesting. On the subject of revolving storms, Sir J. Herschel states that he is not fully prepared to speak; but he adds, that there is certainly one point of view in which some of the principal of their phenomena would seem capable of explanation in this way of conceiving winds of oscillation, and in which they would become traced up, not into funnel-shaped revolving depressions, in the nature of waterspouts, but simply to the crossing of two large long waves, running in different directions; the progress of the tornado being made by their intersection. The way in which a rotatory movement in an elliptic or circle, or in some other partly oval and partly rectilinear figure, may result from the combination of two rectilinear movements of the ethereal movements of advance and recess, will easily be understood by the analogy of the circular and elliptic polarization of light, where rectilinear movements of the ethereal molecules are conceived to be similarly combined. This is the nature of a *vera causa*, which, resulting from dynamical considerations, perfectly general and indefeasible, cannot be without some influence, the only question being that of amount.

The Dean of Ely and Dr. Robinson testified the great importance of the reductions already effected by Sir J. Herschel, and offered several suggestions as to the best modes of complying with the wishes of Sir John Herschel for continuing the reductions, and having the grant renewed.

IMITATIVE CORONA.

The Rev. Baden Powell has communicated to the Royal Society an easy and convenient method of imitating the appearance of the *Corona*, or glory, that surrounds the body of the moon, during the time of total darkness in total eclipses of the sun; and also the appearance of the *beads* that occur, not only in total eclipses, just prior to the time of total darkness, but likewise in annular-solar eclipses. The method is merely this :—a candle is fixed in the focus of a lens fixed in a screen, with an aperture of about ¾ths of an inch in diameter; on the opposite side of which screen is placed an opaque circular disc, of equal (or even greater) diameter than the aperture, which may be set at different distances, so as to produce an eclipse of any magnitude, as the spectator shifts his position. When it is central and total, there is a brilliant ring, or glory, even when it is so much nearer to the eye as to subtend a much greater angle than the aperture. Also, when there are any cusps, minute irregularities on the edge of the disc produce distinct *beads*. Professor Powell has made a similar experiment with the circular opaque disc and the rays of the *sun* reflected from a small piece of glass, which produced a most brilliant ring, the disc being nearly double the apparent diameter of the sun; and he purposes to pursue the inquiry still further.—*Philosophical Magazine*, No. 148.

REFLEXION OF LIGHT.

On September 4, a communication was received by the Academy of Sciences, at Paris, from M. Breguet, announcing that he had completed an apparatus composed of three mirrors, which cause three successive reflections of the solar light, and are set in motion by a mechanism which imparts to them the enormous speed of 2,000 revolutions per second. The principal object of this instrument is to verify the hypotheses which have been advanced as to the nature of light, and more particularly the theory of Newton upon its emission, and that of Huygens, Young, and De Fresnel, on its undulations.

NEWLY DEDUCED PROPERTY OF CIRCULARLY POLARIZED LIGHT.

Some time since, Mr. Earnshaw *theoretically* deduced, that if circularly polarized light, *right*-handed, for example, fall on glass at a perpendicular incidence, the reflected ray will be *left*-handed, and *vice versâ*. Professor Powell has succeeded in *verifying* by experiment the above theoretical prediction.

His experiment was conducted by the use of Mr. Airy's "new analyser," described in the *Cambridge Transactions*, 1832, which does the same for *right*- and *left*-handed circular light, as the common analyser does for light polarized in opposite planes; that is, it stops one kind, and transmits the other. This affords a ready test whether any given ray is right- or left-handed. Prof. Powell procured the light by means of the Fresnel-rhomb, and on ascertaining that the light emerging from it was *stopped* by the Airy-analyser, he examined the same light after reflexion from glass at an incidence as near the perpendicular as possible, and found it *transmitted* by the analyser; thus proving its change from right- to left-handed.—*Communicated to the Philosophical Magazine*, No. 145.

SOLAR LIGHT.

M. E. Becquerel made, on Oct. 23, to the Academy of Sciences at Paris, a communication relative to Solar Light. It is known that the same ray has three distinct actions. The question to be determined is, whether they correspond to three elements or to one sole agent, whose action is modified according to the substances exposed to it. M. Melloni has succeeded in passing a solar ray through a medium in such a way as to retain the caloric, and allow only the light to escape. It remains, therefore, only to be ascertained whether a similar separation may be established between the luminous radiation and the chemical radiation. M. Becquerel's experiments would seem to prove that the luminous and chemical properties are inseparable.

CHANGES OF BODIES IN THE DARK.

At the last meeting of the British Association, great interest was excited by the announcement of a discovery by Möser, of Königsberg. This discovery was, that all bodies were capable in the dark of impressing their forms upon other bodies brought near them. Since that period, three papers have been published in the Scientific Memoirs, which fully set forth the views entertained by Möser; and the subject has occupied the attention of Prof. Draper, of New York, of Mr. Prater and others in England, and also of Fizeau in France. Both Professors Möser and Draper attribute the phenomena to the radiation in darkness of light which has been absorbed, and which remains latent in all bodies; while Fizeau seeks to explain them by the existence of films of organic matter, which are easily disturbed; and in this view he is followed by Sir David Brewster, by Prof. Grove, and to a considerable extent by Mr. Prater. For the purpose of testing these hypotheses, Mr. Hunt made the following experiment:—Three flat bottles, manufactured for Mr. Hunt's experiments on the influence of light on plants, were carefully prepared with three differently coloured fluids. An intense solution of carmine in ammonia, which admitted the permeation of the red rays; a strong solution of the sulphate of chromium, through which but a portion of the most refrangible red and the orange and yellow rays only passed; and the ammonio-sulphate of copper, which absorbed all but the most refrangible portion of the spectrum. Thus were obtained the means of isolating, with a tolerable degree of purity, the calorific, the luminous, and the chemical spectra. Having several designs cut out of white paper, these were placed on copper plates, and being covered with the above bottles of fluid, placed in the sunshine. After remaining exposed for different periods at different times, from half an hour to three hours, they were brought from the light, and the plates placed in the mercurial vapour box, and subjected to its influence. In no instance did any impression appear on the plates which were placed under the blue or yellow fluids, but in every case most decided impressions on those plates which were subjected to the influence of the red rays. Indeed, in some cases the impressions were beautifully visible without the use of mercurial vapour.

It does, therefore, appear, when we take into consideration, besides the above facts, also the fact, which has been admitted, that artificial heat, at least, accelerates this molecular change, that an amount of evidence has been obtained in favour of the hypothesis of calorific distubance, superior to the supposed evidences in favour of the absorption and radiation of any other solar emanation. From another series of experiments made with washed and unwashed plates, Mr. Hunt concluded that organic matter is not the cause of these images, but that the effect is due either to some disturbance of the latent caloric, which produces a molecular change, or to a thermo-electrical action, which is difficult to understand. Had the effect been due, as M. Fizeau has stated, to slight layers of organic matter of a volatile nature, it appears natural to suppose that these mysterious images would have been found only on the very surfaces of the plates. Now this is far from being the case. These images are often found to be impressed to a great depth into the metal. Mr. Hunt in many cases removed several surfaces of copper, and yet had been able to revive the images. He possessed copper plates rendered useless by the impressions, which he has in vain endeavoured to remove.

Mr. Nott thought it idle to call in the aid of Mr. Draper's Tithonic rays to perform an office for which the well-known and understood principles of electricity would, as he conceived, be amply sufficient to account, as there was always electricity developed upon the contact of two dissimilar bodies.—Mr. Hunt leaned to the opinion, that those who maintained that electricity was never developed by simple contact, come nearer to the interpretation of all the known facts.

NEWLY DISCOVERED PROPERTY OF LIGHT.

PROF. KANE has submitted to the British Association, Prof. Draper's proofs of a newly discovered Property of Light. The subject treated was chlorine gas. That a change is produced therein by exposure to the solar rays is well known; but the novelty disclosed is, that the gas absorbs the rays, or that they become latent, altering the character of the gas. After exposure to the sunbeams, chlorine gas, its electro-negative properties being increased thereby, unites readily with hydrogen. This state Prof. Draper terms the tithonic, and has given the same title to the ray of light which he says is absorbed, and which corresponds in refrangibility with the indigo ray. Two glass tubes of chlorine were mixed with hydrogen, the chlorine of the one having been previously exposed and tithonised, that of the other made and kept in the dark. The mixed gases were carefully placed in a light admitted at a window: the tithonised chlorine instantly united with the hydrogen, the untithonised not; but becoming slowly tithonised by the exposure, did at last combine with its hydrogen. This exaltation of the electro-negative properties of chlorine is not temporary; the change is permanent; and its nature is said to be the absorption of the tithonic ray, similar to the disappearance of heat in water to produce ebullition. If the disturbance were merely molecular, it would be transient; but this is not the case; for when once the gas is tithonised, it never loses it; the electro-negative property of the chlorine is permanently increased.

Dr. Robinson mentioned a circumstance which appeared to him to bear out the views of the absorption of rays from the solar light. He had hoped to succeed in obtaining accurate delineations of the irregularities of the lunar surface by means of the Daguerreotype process. He had prepared a plate after the process of Claudet, and placed it in the focus of a telescope directed to the moon. The light was so intense, that the eye could scarcely be employed to adjust the plate; and Dr. Robinson thought there would be no difficulty in obtaining a correct representation of Copernicus. There was also attached to the telescope a clock-movement, so accurate that no variation of position could occur. Notwithstanding this, and after an exposure of half an hour, there was on the plate no trace of Copernicus. It is to be inferred, then, that the chemical or tithonic power of moonlight is far less, in proportion to brilliancy, than that of solar light, as if these rays were absorbed on the surface of the moon.—*Literary Gazette*, No. 1388.

THE TITHONOMETER.

We have only space to call the reader's attention to a description of an instrument invented by Professor Draper, and described and illustrated in the *Philosophical Magazine*, No. 154. This instrument is called *the Tithonometer*, from its being employed for measuring the chemical force of the tithonic rays which are found at a maximum in the indigo space, and which from that point gradually fade away to each end of the spectrum. The sensitiveness, speed of action, and exactitude of this instrument, will bring it to rank as a means of physical research with the thermo-multiplier of M. Melloni.

The means which have hitherto been found available in optics for measuring the intensities of light, by a relative illumination of spaces or contrast of shadows, are admitted to be inexact. The great desideratum in that science is a photometer which can mark down effects by movements over a graduated scale. With those optical contrivances may be classed the methods hitherto adopted for determining the force of the tithonic rays by stains on Daguerreotype plates, or the darkening of sensitive papers. As deductions, drawn in this way, depend on the *opinion* of the observer, they can never be perfectly satisfactory, nor bear any comparison with thermometric results.

Impressed with the importance of possessing for the study of the properties of the tithonic rays same means of accurate measurement, I have resorted in vain to many contrivances; and, after much labour, have obtained at last the instrument which it is the object of this paper to describe.

The tithonometer consists essentially of a mixture of equal measures of chlorine and hydrogen gases, evolved from and confined by a fluid which absorbs neither. This mixture is kept in a graduated tube, so arranged that the gaseous surface exposed to the rays never varies in extent, notwithstanding the contraction which may be going on in its volume, and the muriatic acid resulting from its union is removed by rapid absorption?

The experimenter cannot help remarking, that on suddenly exposing the sentient tube to a bright light, *the liquid for an instant rises* on the scale, and on dropping the cap *in an instant falls.* This important phænomenon is strikingly seen under the action of an electric spark.

As to comparing the tithonometric indication at different times, if the gases have the same constitution, the observations will compare; and if they have not, the value can from time to time be ascertained by exposure to a lamp of constant intensity.

The preliminary adjustment of the Tithonometer can be made in five minutes, and with it an extensive series of measures obtained. Though surprisingly sensitive to the action of the indigo ray, it is as manageable by a careful experimenter as a common differential thermometer.

HOW TO MAKE BEAUTIFUL IRIDESCENT SILVER PAPER.

IT has been fully demonstrated, by the most able and learned philosophers, that the beautiful play of colours on mother-of-pearl (Ostræ Margaritifera) is produced by the very numerous grooves or furrows that cover its surfaces; and it is found that an analogous structure communicated to polished metallic bodies possesses the same peculiar property as the natural shell, of exhibiting iridescence. This artificial effect was first produced by Mr. Barton, who accomplished his object by ruling, with a kind of extremely true dividing-machine, a series of very minute and parallel lines, on a polished steel plate: the number of lines, occupying the distance of an inch, ought to be no less than 10,000, to bring out a good effect. Now, to produce the iridescent paper, ordinary silver paper is laid on the ruled steel plate, and both passed through a powerful rolling-press; on coming out, the silvered surface of this paper will be found to reflect the same brilliant rainbow lines as did the steel plate; which latter is in nowise deteriorated in its optical property, and can therefore be used again and again, for as many transfers as may happen to be required.—*Mr. Brazendale: Mechanics' Magazine*, No. 1053.

CAUSE OF THE COLOURS IN IRIDESCENT AGATE.

SIR DAVID BREWSTER has communicated to the *Philosophical Magazine*, No. 144, a paper on this beautiful inquiry, which he thus concludes:—"To the mineralogist this determination of the structure of the agate caunot fail to be interesting. The difference in the colour of the veins and their intervals, and their singular equality of thickness, is very remarkable. In the structure of mother-of-pearl, the succession of strata or veins marks the period of rest during which the animal has ceased to labour; and in the structure of *nacrite*, the artificial mother-of-pearl formed upon the dash-wheel at the cotton-works at Catrine, the passage of one stratum into another indicates the daily rest of the wheel, and of the operations to which it gives rise; but it is not easy to understand how an aqueous solution of silex contained in the cavity of a solid rock, should deposit its solid contents with that uniformity and regularity which are found in structures depending on the periods of animal life or human labour."

LIGHT FROM CHARCOAL AND PLUMBAGO.

On January 9, was read before the Royal Society of Edinburgh, a paper "On the Property of Transmitting Light, possessed by Charcoal and Plumbago, in fine plates and particles." By John Davy, M.D., &c. The charcoal of the pith of the elder consists of plates of extraordinary thinness. It was in examining this charcoal, that the author first observed the property which is the subject of his paper. He detected it by means of the microscope, using a high magnifying power. By analogy, he was led to infer that the power of transmitting light must belong to charcoal in general, in all its varieties, when reduced to the state of fine powder or filaments,—an influence which he found confirmed by experiment in a number of different instances, as the charcoal of the pith of the sycamore, of the pith of the rush, the fibre of cotton, flax, &c. He also found it to belong to lamp-black, to cork in very fine powder, to anthracite, and plumbago.

The light transmitted he found to vary in its hues, from almost white, as in the instance of the thinnest plates of the charcoal of the pith of the elder, to brown and red of various shades, in the instances of lamp-black, anthracite, and plumbago.

He considers the property of translucency belonging to charcoal and plumbago, in their finely divided state, as favourable to the opinion now commonly received, that these substances and diamonds owe their marked peculiarities not to a difference of chemical mixture, but of mechanical structure. Incidentally, he notices the specific gravities of these substances,—stating, as the result of his own experiments, that the specific gravity of charcoal, cork, and anthracite, is about 1·5; and that of plumbago about the same, making allowance for the ferruginous and earthy matter with which the carbon in this mineral is mixed.

In conclusion, he offers the conjecture, that the coloured tints of vapour and fluids in which carbon is suspended, may be connected with the translucency of this substance, and that other bodies, hitherto considered opaque, may be found capable of transmitting light, when examined in a manner similar to that which he has employed.—*Jameson's Journal*, No. 68.

LIGHT OF LAMPYRIS ITALICA.

The Lampyres have been the subject of a great number of researches in reference to their luminous organ; but in regard to the *Lampyris Italica* we scarcely possess more than the observations of Carrara, according to whom this species is provided with a peculiar aërial sac, which, proceeding from the mouth, conducts the air to the luminous organ. This particular apparatus ought to be the cause of the differences in the luminous state, since the species of the North of Europe diffuse a continuous, equal, and tranquil light, while that of the Italian species is emitted in sparks. "It is on account of this difference," says M. Peters, "that I had a great desire to find an opportunity of examining the last-mentioned animal. This I at last obtained, during a long stay at Nice, and I did not allow it to escape, in the hope that with a good microscope I should succeed in discovering something positive, both respecting the structure of the phosphorescent part itself, and its relations with the other organs.

"From the middle of May till the middle of the month of July, when walking in the vicinity of Nice after sunset, one is surprised at the curious spectacle then presented by the millions of small scintillating lights creeping about in every direction, sometimes illuminating the point of a rock—sometimes lighting a deep cavity—sometimes suddenly producing, as with a magician's wand, a brilliant illumination on the dark trunks of the olive trees,—a scene which, continually shifting and changing, is of the greatest interest. This appearance is renewed every evening; but it appears to me to be the more brilliant the greater the degree of humidity in the air. The interval between the scintillations is variable, sometimes longer, sometimes shorter; and if one of these animals be examined while in a phosphorescent state, it is soon seen that the luminosity is intermittent, and that it only appears when the animal has traversed a space of one or two feet; but that while it traverses that space, it emits a permanent light, which produces a band of very brilliant fire. When the animal is in repose, I have often counted from 80 to 100 luminous discharges in a minute; it then remains for a pretty long time without phosphorescence. There always remains a slight luminosity, which is never wholly extinguished, at the point of the body from which the luminous discharges are made. The luminous region, in the male, extends along the under side of the belly, between the fifth segment (from the anal extremity) and the penultimate one, with very nearly an equal degree of intensity; but, in the female, it scarcely occupies more than the fifth segment, and is even concentrated at its sides. If we observe this phosphorescent organ with a glass while it is emitting sparks, we notice in it a tremulous or undulatory movement, as when molecules are in motion. If we remove the luminous organs, and expose them to the air free, they shine with the same intensity as in the living animal, until their light becomes gradually extinguished. If they be rubbed against some body, the place shines for an instant with a greenish light, which can be made to reappear after becoming extinct by pouring a little water upon it. When the belly of the insect is opened, and the adjacent portions of the intestines removed without injuring the phosphoric organs, the latter continue to shine as before; but this luminosity ceases on the instant that the head is separated from the trunk.

"According to these observations, are we not permitted to conclude —1st, that it is not necessary that a globule of air should proceed from the head in order to produce these sparks, since the removal of the anterior and most essential parts of the trunk exercises no influence on the phosphorescence; 2d, since the removal of the head immediately causes the luminosity to disappear, is this not a proof that the phenomenon depends on the will of the animal.

"I believe it is quite unnecessary," continues M. Peters, "to refute in this place the opinion of some observers, such as Roda and Murray, who affirm that many Coleoptera enjoy the same faculty of absorbing the solar light, and emitting it again at pleasure, since the Lampyris shines in the night, even when it has been protected all the day from the solar light. Nay more, I kept some individuals in darkness for upwards of eight days, and they shone with as much intensity and splendour as before.

"In order to study the *organa lucifera* more at my leisure, I carefully removed all the dorsal part of the skeleton, and exposed the intestines, which were filled with air. In the females, the ovaries immediately appear, as they fill a large portion of the interior of the body; while, in the males, we notice behind the posterior canal the deferential and semeniferous canals rolled upon themselves. Neither the bodies nor fluids in these canals possess luminous properties; and these two organs, very distinct from those of the phosphorescence throughout their whole extent, both open into a rectum of a very delicate structure. It was probably this delicate structure of the intestinal canal that made Carrara suppose that it communicated with the luminous apparatus; but with the exception of the alternate dilatation of this conduit, we find no bubble of air throughout its whole extent. The phosphorescent organ is even separated from the intestines by a cushion of white fat, which can be easily raised, when we get a view of this organ, the colour of which is sulphur-yellow. On the two penultimate segments, and partially even on that which precedes them, we notice a multitude of tracheal ramifications converging; and these, when examined with the glass, appear to consist of round corpuscles closely pressed against each other in such a way that the whole present some resemblance to the electrical organ of the torpedo, although I am unable to determine the degree of resemblance that may exist between the two organs. If a stronger magnifying power be used, we notice in the luminous part regular series of brownish corpuscles, having a silvery white point in the middle, which, seen with a still higher magnifying power, presents itself under the appearance of small ramifications. When a compound microscope is used, we can distinctly see that the whole organ consists of a regular bed of small spheres, into which the tracheal ramifications penetrate, and then spread themselves in the most elegant manner, forming, so to speak, the skeleton. Besides that, we see developed in this delicate membrane of small spheres a quantity of molecules, to which is attached a luminous extremity; the latter, by means of the considerable interlacement of aërial vessels, may receive an enormous quantity of air at once.

"The luminous substance itself is of a yellow colour; the intensity of the light is in the direct ratio of the change of the yellow colour of the organ, which can be easily shown when we bring the latter in contact with water. I was unable to trace the progress of the nervous system in it, because the principal branch consisted of a filet of extreme tenuity.

"It must not be here supposed that we witness, in these spheres producing the phosphorescence, a transformation of the ordinary corpuscles of the fatty matter, for the former are completely different from the latter, as well in respect of form as of colour; the same in all their contours, such as they are observed by the microscope; but it appears to me likely that the principal matter entering into their structure, independently of the ramifications of the tracheæ, is a fatty matter, and that it is to the latter the luminous and phosphorescent substance is attached."

"It therefore appears to me demonstrated," says M. Peters in conclusion, "that the luminous organ in *Lampyris Italica* has the most intimate relation with the organs of respiration; but I cannot determine if this is equally the case with the sexual organs."

[From *L'Institut*, No. 432; where the paper is translated from *Archiv. für Physiol.*, &c. 1841; quoted in *Jameson's Journal*, No. 67.]

LIGHT OF THE GLOW-WORM.

M. Matteucci lately addressed a notice to the Academy of Sciences, at Paris, containing the results of experiments which he has made on the phenomena constituting the Phosphorescence of the Glow-worm. The following is the substance of his communication:—Carbonic acid and hydrogen are the media in which the phosphorescent matter ceases to shine after a space of 30 or 40 minutes, if the gases are pure. In oxygen gas, the light is more brilliant than in atmospheric air, and it remains brilliant for nearly triple the length of time. When it shines in the air or in oxygen, it consumes a portion of oxygen, which is replaced by the corresponding volume of carbonic acid. In the same media, when there is an impossibility of light being emitted, there is no oxygen absorbed, and no carbonic acid developed. Heat augments to a certain extent the light of the phosphorescent matter, whereas cold produces the opposite effect. When the heat is too great, the substance is altered. The same thing takes place when it is left in the air, or in some gases, for a certain time; that is, when the substance is separated from the animal. This matter, so altered, is no longer capable of emitting light or of becoming luminous. According to these facts, it would seem that the phosphorescence of the glow-worm is a phenomenon of combustion, the result of the combination of the oxygen of the air with carbon, which is one of the elements of the phosphorescent matter.—*L'Institut*, No. 503; *Jameson's Journal*, No. 70.

EFFECT OF LIGHT ON PLANTS.

The results of some curious experiments on the attractive powers of different rays of Light on Plants have been laid before the Academy of Sciences, at Paris. It appears that plants exposed to red, orange, yellow, or green light, are not attracted; but that towards the blue or violet rays of the spectrum, they are very speedily inclined. These are the rays which act most powerfully as chemical agents, and are chiefly operative in producing the effects of the Daguerréotype.

ASCENT AND MOTION OF SAP.

A PAPER has been read to the Royal Society, entitled "An Experimental Inquiry into the Cause of the Ascent and Continued Motion of the Sap; with a New Method of preparing Plants for Physiological Investigations." By George Rainey, Esq., M.R.C.S.

The ascent of the sap in vegetables has been generally ascribed to a vital contraction either of the vessels or of the cells of a plant: the circumstances of that ascent taking place chiefly at certain seasons of the year, and of the quantity of fluid, and the velocity of its motion being proportioned to the development of those parts whose functions are obviously vital, as the leaves and flowers, have been regarded as conclusive against the truth of all theories which professed to explain the phenomenon on purely mechanical principles. The aim of the author, in the present paper, is to show that these objections are not valid, and to prove, by a series of experiments, that the motion of the sap is totally independent of any vital contractions of the passages which transmit it; that it is wholly a mechanical process, resulting entirely from the operation of endosmose; and that it takes place even through those parts of a plant which have been totally deprived of their vitality.

The lower extremity of a branch of *Valeriana rubra* was placed, soon after being gathered, into a solution of bichloride of mercury. In a few hours a considerable quantity of this solution was absorbed, and the whole plant, which had been previously somewhat shrunk from the evaporation of its moisture, recovered its healthy appearance. On the next day, although the lower portion of the branch had lost its vitality, the leaves and all the parts of the plant into which no bichloride had entered, but only the water of the solution, were perfectly healthy and filled with sap. On each of the following days additional portions of the stem became affected in succession; but the unaffected parts still preserved their healthy appearance, and the flowers and leaves developed themselves as if the plant had vegetated in pure water, and the whole stem had been in its natural healthy state. On a minute examination it was found that calomel, in the form of a white substance, had been deposited on the internal surface of the cuticle; but no bichloride of mercury could be detected in those parts which had retained their vitality; thus showing that the solution of the bichloride had been decomposed into chlorine, calomel, and water, and had destroyed the vitality of the parts where this action had taken place: after which, fresh portions of the solution had passed through the substance of the poisoned parts, as if they had been inorganic canals. Various experiments of a similar kind were made on other plants, and the same conclusions were deduced from them.

As the addition of a solution of iodide of potassium converts the bichloride of mercury into an insoluble biniodide, the author was enabled, by the application of this test to thin sections of the stems of plants into which the bichloride had been received by absorption, to ascertain, with the aid of the microscope, the particular portion of the structure into which the latter had penetrated. The result of his observations was, that the biniodide is found only in the intercellular and intervascular spaces, none appearing to be contained within the cavities of either cells or vessels.

As the fluids contained in the vessels and in the cells hold in solution various vegetable compounds, their density is greater than the ascending sap, which is external to them, and from which they are separated by an intervening organized membrane. Such being the conditions requisite for the operation of the principles of endosmose, the author infers that such a principle is constantly in action in living plants; and that it is the cause of the continual transmission of fluids from the intervascular and intercellular spaces into the interior of the vessels and cells, and also of the ascent of the sap.

VEGETABLE AND ANIMAL MEMBRANES.

M. PAYEN has read to the Academy of Sciences, at Paris, a paper on the distinctive properties which exist between vegetable membranes and the coverings of insects and crustacea. The more prominent facts and conclusions are the following, derived from the treatment of the tissues of caterpillars, spiders, flies, &c., and cray-fish, cleansed from all foreign matter by boiling alkaline solutions, water, alcohol, and ether, and by muriatic acid when incrusted with a calcareous carbonate:—1. Sulphuric acid, with 1·5 of water, instantly separated and dissolved the insect-cases, but did not affect the vegetable epidermic tissue for some hours: with 3 proportions of water animal tissue was dissolved in a few hours, whilst vegetable epidermis resisted it for fifteen. 2. In ordinary nitric acid, with 3 of water, the insect-coatings volume for volume disappeared immediately; but the structure and external forms of the vegetable pellicle remained in it for more than a month. 3. Muriatic acid at 21°, or 6 proportions of water, penetrated, rendered transparent, broke up, and dissolved the teguments of insects in a few minutes; but it acted very slowly on the epidermis of plants. 4. All the foregoing solutions of animal matter, extended and neutralised with a soluble base, were precipitated by tannin; the deposit, washed and dried, yielded, on calcination, alkaline vapours: nothing similar occurred in the like treatment of vegetable tissue. 5. A solution, almost saturated, cold, of powdered chloride of lime, put into contact with each of these two substances, and then made to boil for some seconds, separated and burned rapidly the coverings of insects; whilst it attacked slowly the epidermis of a *Cactus peruvianus*, affecting more the cuticle than the subjacent cellular tissue.

The distinctive properties given above may, however, be attempted to be explained by peculiar cohesion, and not by real difference of composition. Elementary analyses, however, give three and four times more nitrogen to the animal than to the vegetable tissue.—*Literary Gazette*, No. 1387.

EXAMINATION OF TARTAR AND THE MUCOUS COATINGS OF THE TONGUE AND TEETH.

These coatings, which, according to Laugier and Vauquelin, are chiefly formed of carbonate and phosphate of lime, agglutinated by a little cement, have been studied microscopically by M. Mandl, who, having macerated them, in a fresh state, in distilled water, discovered a large quantity of *vibrious bayuettes*. This observer consequently believes, that such coatings are formed of calcareous skeletons of these infusoria. Leuwenhoek long ago indicated the presence of infusoria in the same products.—*Report of Proceedings of the Academy of Sciences, in "L'Institut."*

STRUCTURE OF THE SKIN, AND NEW PROOF OF THE COMMON ORIGIN OF ALL THE VARIETIES OF THE HUMAN SPECIES.

The following is an abstract of the results of M. Flourens's researches on the comparative Structure of the Skin in the different human races, which he has communicated, with illustrative drawings, to the Academy of Sciences, at Paris. One of the figures represents the skin of an individual of the white race, which is seen to be composed of three layers or distinct membranes, the dermis and the two epiderms; and, between the second or internal epidermis and the dermis, there is no trace visible of a pigmental layer—no trace of a pigmentum. Other figures represent the skin of a Kabyle, a Moor, and an Arab. All these skins are of a bistre colour, but in general this colour is deeper in the Arab than in the Moor, and in the Moor than in the Kabyle. Except in this respect, every thing in their structure is similar: in all there are two epiderms and a dermis, and in all there is a layer of pigmentum, and a pigmental membrane between the second epidermis and the dermis. There is also a representation of the skin of a cross of an Arab and a Negress; and another of the skin of a Negro. They exhibit the same structure as the skin of the Kabyle, the Arab, and the Moor. One drawing of the skin of an Arab, affected by partial albinism, is specified by M. Flourens as meriting particular attention. Upon that skin there are many white spots; and at the side of these spots the skin preserves its ordinary colour, which is blackish or bistre-coloured. Now, where the skin is black, there is a well-marked pigmentum, but where the white spots occur, there is no pigmentum. Judging, then, from this example, the malady termed albinism would only tend to produce the absence—the non-secretion of the matter which constitutes the pigmentum. With regard to all these preparations of the skin, M. Flourens makes the following general remarks:—If we compare the structure of the skin in all these cases, viz. the Kabyle, the Arab, and the Moor, on the one hand, and, on the other, the American and the Negro, we find that it is every where the same. So that the Kabyle, the Arab, and the Moor, who probably belong to the Caucasian race, but certainly do not belong either to the red or to the black race, have, nevertheless, a pigmental apparatus perfectly similar to that of the black and the red races. The white man himself has his pigmental apparatus, very circumscribed it is true, but still quite distinct, in the nipple, particularly in the female. Having submitted the coloured portion of the skin of the breast to his anatomical processes, M. Flourens found, first of all, two epiderms, and then, between the second epidermis and the dermis, a pigmental membrane and a layer of pigmentum; in a word, the whole pigmental apparatus. One of the figures represents this. Thus, he continues, we have a portion of the skin of the white man, in which we find the whole structure of the skin of the coloured races. Have we not in these facts a new proof, a direct proof, of the common origin of the various human races, and of their original unity? To this proof, derived from the study of the skin, M. Flourens intends adding another, deduced from the study of the skeleton, and especially of the cranium.—*L'Institut*, No. 504; *Jameson's Journal*, No. 70.

ON THE NERVES.

Dr. Stark has communicated to the Royal Society, a paper, in which he gives the results of his examinations, both microscopical and chemical, of the Structure and Composition of the Nerves; and concludes that they consist, in their whole extent, of a congeries of membranous tubes, cylindrical in their form, placed parallel to one another, and united into fasciculi of various sizes; but that neither these fasciculi nor the individual tubes are enveloped by any filamentous tissue; that these tubular membranes are composed of extremely minute filaments, placed in a strictly longitudinal direction, in exact parallelism with each other, and consisting of granules of the same kind as those which form the basis of all the solid structures of the body; and that the matter which fills the tubes is of an oily nature, differing in no essential respect from butter, or soft fat; and remaining of a fluid consistence during the life of the animal, or while it retains its natural temperature, but becoming granular or solid when the animal dies, or its temperature is much reduced. As oily substances are well known to be non-conductors of electricity, and as the nerves have been shown, by the experiments of Bischoff, to be among the worst possible conductors of this agent, the author contends that the nervous agency can be neither electricity, nor galvanism, nor any property related to those powers; and conceives that the phenomena are best explained on the hypothesis of undulations or vibrations propagated along the course of the tubes which compose the nerves, by the medium of the oily globules they contain. He traces the operation of the various causes which produce sensation, in giving rise to these undulations; and extends the same explanations to the phenomena of voluntary motion, as consisting in undulations, commencing in the brain, as determined by the will, and propagated to the muscles. He corroborates his views by ascribing the effects of cold in diminishing or destroying both sensibility and the power of voluntary motion, particularly as exemplified in the hybernation of animals, to its mechanical operation of diminishing the fluidity, or producing solidity, in the oily medium by which these powers are exercised.

MINUTE STRUCTURE OF THE SKELETON OF INVERTEBRATA.

Dr. Carpenter has read to the Royal Society, a memoir, which is the first of a series which the author intends to communicate to the Society, and relates only to the Mollusca; and he proposes, hereafter, to extend his inquiries to the skeletons of the Echinodermata, and the various classes of articulated animals. After adverting to the classifications of shells proposed by Mr. Hatchett and Mr. Gray, from the propriety of which he finds reason to dissent, he proceeds to state the results of his microscopic examination of the texture of shells under the several following heads:—1st. Shells having a prismatic cellular structure, as the Pinna, and which are composed of a multitude of flattened hexagonal calcareous prisms, originally deposited in continuous layers of hexagonal cells, and thus constituting a calcified epithelium, analogous with the enamel of the teeth. 2dly. Those consisting of membranous shell substance, the basis of which, after the removal of its calcareous portion, presents nothing but a membranous film, of greater or less consistence, composed of several layers, but without the appearance of any cellular tissue: this membrane the author regards as being derived from the mantle, of which it was originally a constituent part, by the development of nucleolated cells; and the various corrugations and foldings of which it is susceptible in different species, introducing many diversities into the structure of the shells of this class. 3dly. Shells having a nacreous structure, and exhibiting the phenomena of iridescence; a property which the author ascribes to the plicated form of the membrane of the shell, combined with a secondary series of transverse corrugations. 4thly. Shells exhibiting a tubular structure, formed by cylindrical perforations occurring among the several layers, and varying in diameter from about the 20,000th to the 3,500th part of an inch; but measuring, on an average, about the 6,000th part of an inch, and presenting a striking analogy with the dentine or ivory of the teeth. The last sections of the paper relate to the epidermis and the colouring matter of shells.

TEMPERATURE LIMITING THE DISTRIBUTION OF CORALS.

Mr. James D. Dana, Geologist of the United States Exploring Expedition, on April 29th, read before the Association of American Geologists and Naturalists, a paper on this interesting subject.

Mr. Dana had before stated to the Association, that the temperature limiting the Distribution of Corals in the ocean is not far from 66° F. On ascertaining the influence of temperature on the growth of corals, he was at once enabled to explain the singular fact, that no coral occurs at the Gallapagos, although under the Equator, while growing reefs have formed the Bermudas in latitude 33°, four or five degrees beyond the usual coral limits. The anomalies which the Gallapagos and Bermudas seemed to present, Mr. Dana attributes in the *latter* case to the influence of the warm waters of the Gulf Stream; in the *former* to the influence of the southern current up the South American coast, whose cold waters reduce the ocean temperature about the Gallapagos to 60° F. during some seasons, although, twenty degrees to the west, the waters stand at 84° F. *Extra-tropical* currents, like that which flows by the Gallapagos, are found on the western coasts of both continents, both north and south of the Equator, and *intratropical* currents are as distinctly traceable on the eastern coasts. In consequence of these currents, the coral zone is contracted on the western coasts and expanded on the eastern; it is reduced to a width of sixteen degrees on the western coast of America, and of but twelve degrees on the east coast of America; while in mid-ocean it is at least fifty-six degrees wide, and about sixty-four degrees on the east coast of Asia and New Holland. The peculiar bend of the east coast of South America carries off to the northward much of the usual south intratropical current, and it is therefore less distinct in its effects than the *northern* intratropical or Gulf stream.

We have hence the remarkable fact, that the coral zone is fifty degrees wider on the eastern than on the western coasts of our continents. Such is the effect of the ocean currents in limiting the distribution of marine animals. The important bearing of these facts upon the distribution of fossil species is too apparent to require more than a passing remark. The many anomalies which have called out speculations as to our globe's passing through areas in space of unequal temperatures, are explained without such an hypothesis. Instead of looking to space for a cause, we need not extend our vision beyond the coasts of our continents.—*American Journal of Science and Arts*, vol. xlv. No. 1; *Jameson's Journal*, No. 70.

CARBONIC ACID EXHALED FROM THE HUMAN BODY.

PROFESSOR SCHARLING, of Copenhagen, with the view of ascertaining the quantity of Carbonic Acid exhaled during the twenty-four hours, as well from the lungs as from the general surface of the body, undertook the following experiments on six individuals—viz. four males and two females.

The subjects of experiment were confined in an air-tight box, wherein they were perfectly at their ease, being enabled to speak, eat, sleep, or read, without inconvenience; a constant current of atmospheric air was admitted into the box, and the deteriorated gases abstracted by means of an air-pump. The air withdrawn was conducted into a proper arrangement of bottles, some containing sulphuric acid, others a solution of caustic potash. The quantity of carbonic acid, both previous to and subsequent to each operation, was carfully ascertained, by being received into three graduated tubes.

The results were as follows:—

1st. The Professor himself, aged thirty-five years, exhaled 219 grammes during twenty-four hours, seven of which were spent in sleep.

2nd. A soldier, twenty-eight years of age, exhaled 239·728 grammes = 8·45 oz.

3rd, A lad of sixteen, 224·379 grammes – 7·9 oz.

4th. A young woman, aged nineteen, 165·347 grammes = 5·83 oz.

5th. A boy nine years and a half old, 133·126 grammes = 4·69 oz.

6th. A girl of ten, 125·42 grammes = 4·42 oz.

In the two last cases the period allotted to sleep was nine hours.

From these experiments the Professor deduces that males exhale more carbonic acid than females, and children comparatively more than adults. He also finds that less of this gas is given off during the night than during the day; and that in certain cases of disease, which he does not specify, less carbonic acid is formed than during the healthy state. He is thence induced to hope that attention to this point may ultimately throw some light on certain forms of disease.

It will be interesting to compare these results with Liebig's views, as well as with the experiments which have recently emanated from the Academy of Sciences at Paris.—*Proceedings of the Chemical Society.*

HEAT OF MELTING ICE.

Some experiments have been made by Messrs. de la Provostaye and Desains to ascertain the latent Heat of Melting Ice. Their experiments, which have been confirmed by those of Messrs. Biot, Pouillet, and Regnault, agree in fixing the latent heat at 79° of the centrigrade scale, which is equal to 174° of Fahrenheit. It would appear, therefore, that the real zero, or the point which indicates the absence of all heat, is 142° below freezing.

LARGE MASS OF NATIVE GOLD FOUND IN THE OURAL MOUNTAINS.

Humboldt lately transmitted to the Academy of Sciences, at Paris, a notice by M. de Koscharoff, an officer of the Russian mines, regarding a mass of gold of large size, recently found in the Oural. The largest mass of native gold which had previously been found in the Oural Mountains, weighed upwards of 22lbs. avoirdupois; and it is that of which there is a plaster model in the Museum of Natural History at Paris. On the 7th of November, 1842, however, there was found in the same mountains a mass of native gold, weighing about 80lbs. avoirdupois.

The mines of Zarevo-Nicolaefsy and of Zarevo-Alexandrofsy, situated in the alluvial auriferous deposits of Miass, on the Asiatic side of the southern portion of the Oural, have already afforded more than 13,300 avoirdupois pounds of gold. It was in this alluvium that, in 1836, the large mass of 22lbs., and several others of from 8 to 14lbs., were found at the depth of a few inches under the surface.

Subsequently to the year 1837, the mines of Nicolaefsy and Alexandrofsy seeming exhausted, new explorations were made in the neighbourhood, and especially along the river Tashnow-Targanna. Great success attended the search for gold in the marshy plain, and the whole valley had been searched, except that part of it occupied by the building in which the washing operations were carried on.

In 1842, it was resolved to move the houses, whereupon sands were met with of immense richness, and lastly there was discovered, under the corner of a building, at a depth of three yards, a mass of gold weighing more than 72lbs. avoirdupois. This mass is placed in the collection of the *Corps des Mines*, at St. Petersburgh. According to the information given by M. de Humboldt in the third volume of his *Examen Critique de la Géographie du nouveau Continent*, the mass of gold found in the Oural, in 1826, was inferior in weight to that discovered in 1502 in the alluvium of the island of Haïti, and inferior also to that found in 1821 in the United States, in the county of Cavarras, and described by M. Zoehler, a pupil of the Freyberg School of Mines. The mass found at Miass, fifteen years ago, weighs 22¼lbs.; that of Cavarras, 27¾lbs.; that of Haïti, from 30 to 34lbs.; but the mass of gold found in November 1842, in beds of alluvium reposing on diorite, is more than twice the weight of the largest of these, as it weighs nearly 80lbs. Such has been the prodigious increase of the quantity of gold obtained by washing in Russia, and especially in Siberia, to the east of the southern chain of the Oural, that, according to very accurate data, the total produce during the year 1842 amounted to upwards of 35,000lbs. avoirdupois.—*L'Institut*, No. 472; *Philosophical Magazine*, No. 147.

FORMATION OF THE DIAMOND.

Dr. A. Petzholdt, of Dresden, has arrived at a view of the Formation of the Diamond, which coincides completely with that of Newton, Jameson, and Brewster; but the Doctor bases it neither on its strong refractive power, nor on the great hardness which the carbon has acquired in the diamond, nor on its polarising properties, for he is supported by entirely different considerations. He believes that, according to our present state of knowledge, the diamond is a product of the newest geological period, resulting from the slow decomposition of a vegetable substance. He thus shortly adduces the proofs of this opinion.

That the diamond must be a product of the youngest geological epoch, of the so-called historical epoch in a geological sense, appears from the fact, that hitherto it has only been met with in stony deposits, which decidedly belong to the youngest formations. Its primary repositories, that is to say, the places where it was formed, cannot be very different nor very remote from its secondary repositories, that is, from those places where we now meet with it; and all the mineral bodies which we are in the habit of regarding as the more or less constant associates of the diamond in diamond sands, are merely accidental. There is not the slightest reason for assuming that the formation of the gold or platina, &c. stands in any nearer connection with the diamond, for platina and gold are found in many localities without diamonds. These bodies were either at the locality when the diamond was formed, or they were transported along with that substance by water. And although it cannot be denied in regard to some of the other ingredients of the diamond-sand, such as some of the minerals belonging to the quartz genus, viz. quartz, calcedony, and hornstone, and also brown ironstone, that they were formed contemporaneously (in a geological sense) with the diamond; yet this circumstance by no means tends to support the idea of any sort of connection between their formation and that of the diamond, because the recent formation of these bodies can be observed every where, and where no diamonds are to be met with. The association of all these substances, which we have termed accidental, is merely caused by the geognostical constitution of the district through which the river-course of the present day extends, by the nature of that course itself, by specific gravity, and by many other circumstances having not the smallest concern with the formation of the diamond. The strongest proof, however, of the recent origin of the diamond, is its occurrence in the loose rolled matter in which and with which it was formed, combined with the want of success that has hitherto attended the search for the diamond embedded in those rocks, regarding which it is so easy, on the other hand, to prove that from them all the other rolled bodies had their origin. We leave entirely aside the question whether the prevalent popular belief in the East Indies and Brazil, that diamonds are still produced, be an instinctive perception of the truth, or a deceptive notion.

Further, the diamond must have been formed in the moist way from a liquid, because otherwise it would have presented none of the included splinters of quartz, of which some even exhibit the vegetable cellular texture.

Lastly, from all that we know, the material from which the diamond was formed, by the separation of crystalline carbon, could only have been a substance rich in carbon and hydrogen, such as, owing to the requisite chemical properties, can only be looked for in the vegetable kingdom; and we are forced to consider the diamond as produced from this substance, consisting of carbon and hydrogen, by means of decomposition. The determination of the nature of this process is solely a chemical matter; and Liebig, who has, undeniably, rendered the greatest service to our knowledge of the decomposition of organic bodies, makes the following remarks* :—"If we suppose decay to proceed in a liquid which contains both carbon and hydrogen, then a compound containing still more carbon must be formed, in a manner similar to the production of the crystalline colourless naphthalin, from a gaseous compound of carbon and hydrogen. And if the compound thus formed were itself to undergo further decay, the final result must be the separation of carbon in a crystallized form. Science can point to no process capable of accounting for the origin and formation of diamonds, except the process of decay. Diamonds cannot be produced by the action of fire, for a high temperature, and the presence of oxygen gas, would call into play their combustibility. But there is the greatest reason to believe that they are formed in the humid way, that is, in a liquid; and the process of decay is the only cause to which their formation can with probability be ascribed."

As yet we are ignorant of the nature of the vegetable substance, rich in carburetted hydrogen, by whose decomposition the diamond was formed, and as to what were the particular conditions necessary for the appearance of crystalline carbon. This only we know, however,

* Liebig's Organische Chemie in ihrer Anwendung auf Agricultur and Physiologie. Braunschweig, 1840, p. 285; and Playfair's Translation, p. 143.

that the whole process was an extremely slow one, and that it could not in any way be hastened by an increased temperature; for in that case the carbon could not have crystallized, but must, on the contrary, have been separated in the form of a black powder.

The conclusion deduced by Newton from certain optical properties of the diamond, viz. that it has been produced from an oily body, is very beautifully confirmed by the newest and most accurate investigations of chemistry; for, according to them, the so-termed oily bodies are proved to be the richest in carburetted hydrogen; and chemistry, which can alone explain the decompositions of bodies, and their formation from their elements, just requires for the formation of the diamond the decomposition of a substance rich in carburetted hydrogen. There are two different phenomena connected with the above explanation of the origin of the diamond, which cannot be left unnoticed, as they are well calculated to place the truth of our assertions in a clearer point of view. Diamonds not unfrequently exhibit at their surface blackish spots, which disappear on the application of heat; and, moreover, they very frequently present in their interior perfectly black, amorphous bodies, which cannot be considered as any thing else but uncrystallized carbon—a fact observed in the course of Parrot's investigations, as well as Dr. Petzholdt's own. This phenomenon can only be explained by assuming a somewhat accelerated decay of the matter containing carbon and hydrogen; in the course of which the carbon has been produced in the form of a black powder, instead of being separated in a crystalline state. On the other hand, the Doctor has, on several occasions, had an opportunity of convincing himself of the tendency of carbon to crystallize, when the combustion (the accelerated decay*) of a substance rich in carbon and hydrogen is retarded. Thus, on the wicks of badly burning tallow candles, the Doctor has seen the well-known accumulations of carbonaceous matter (soot), which have generally globular or semi-globular forms, assume distinctly an octahedral shape; and he believes that this appearance has long been observed by others, for it is only by the resemblance of an octahedron to the envelope of a letter that the Doctor can explain the popular saying of there being a letter in the wick of a candle. He has even preserved, for some time, one of these tolerably well-defined octahedrons, and exhibited it to his class; but it was at last broken, and it then appeared that the fragments were harder than the ordinary soot, although they could still be easily bruised between the fingers.—*Jameson's Journal*, No. 68.

ACTION OF TWO BLUE OILS UPON LIGHT.

SIR D. BREWSTER having lately received, through the kindness of Dr. Gilbert, two remarkable Oils of a deep Blue colour—namely, the oil from the *Matricaria chamomilla*, and that from the *Achillea*

* That combustion is only a rapid decay, and decay only a slow combustion, is known to all chemists. Above all, see Liebig's remarks on this subject in the second part of his Organic Chemistry.

millefolia, was desirous of ascertaining the nature of their action upon the solar spectrum. Without entering into details respecting the general action of these oils upon the different coloured portions of the spectrum in their specific action, they differ from all the various bodies which Sir David has yet examined. Between the two lines A and B of Fraunhofer's Map of the Spectrum, there are two groups of lines shown in that map. The *two* oils absorb the light in these portions more powerfully than the portions adjacent to them. No other fluid or solid body on which Sir David has hitherto made experiments acts in a similar manner; but, what is very remarkable, the earth's atmosphere exercises a similar action when the sun's light passes through its greatest thickness at sunrise or sunset.

LIGHT OF A PECULIAR AND UNKNOWN CHARACTER, EMANATING FROM THE OUTER EDGE OF THE SUN.

MR. ROBERT HUNT, in the Tenth Annual Report of the Royal Cornwall Polytechnic Society, Part 1, states, about two years since, Sir John Herschel and myself, independently of each other, noticed the singular phenomenon of a band of light encircling the sun, which not only possessed no chemical influence, but exerted a protecting power upon some photographic preparations, even when they were exposed to the chemical influence of dispersed light. Upon Daguerréotype plates, and upon paper spread with the tartrate of silver, this singular band was observed whenever they were exposed to the prismatic spectrum. It has, however, been found that this band of light has a very powerful chemical action on several of the compounds of silver and cyanogen; and from the circumstance that the particularly luminous or central portion of the sun has the same effect as this external band, we may probably conclude that the sun is surrounded by a band of distinctly luminous matter.

The peculiarity alluded to will be better understood by describing an experiment, and its results. If we receive an impression of the solar spectrum upon paper covered with the iodide of silver, we procure an impressed image of the spectrum, with a singular inversion of its colours. This was first noticed and described by Sir John Herschel, in the Transactions of the Royal Society.

I find by washing this paper covered with the iodide of silver, with a saturated solution of the ferro-cyanide of potash, that the first action of the prismatic rays is the same as above described, but infinitely more rapid. In a very short space of time, that portion of the paper on which the rays of least refrangibility fall, is bleached, and this action gradually extends over the whole of that portion occupied by the calorific and luminous rays. The paper now exhibits the natural colour of the rays, the red portion giving a red impression, and the blue rays a blue one. Although in the first action there is no evidence of the protecting power to which I have alluded—the paper beyond the spectrum darkening equally—yet in the second action an extended portion all round the spectrum is subjected to a decidedly chemical influence, the oxidation of the silver being greatly heightened, and a band very much darker than any other part of the paper very rapidly produced. In the present state of this very elaborate inquiry into the chemical and physical characters of light, it would be idle to attempt to account for this peculiarity; I only now state the fact in corroboration of previously published statements, but I hope, when we are favoured with good sunshine, to pursue the subject farther; in the meantime it appears to me that these lateral bands most convincingly prove the emanation from the edges of the sun of some elementary agent possessed of very distinguishing characteristics.

POLARIZATION OF LIGHT.

On March 22d, Dr. Pereira delivered to the Pharmaceutical Society, a lecture "On the Polarization of Light, and its application to Pharmacy." He explained the wave theory, and the distinction between common and polarized light, the latter being a portion only of a ray, the other portion being absorbed. Biot's polariscope was described, and was shown to furnish a test for polarized light. Polarizing plates, those which absorb a part of the ray; and analyzing plates, those which examine the character of the remaining part, were next noticed. Lecourt's polariscope was described. A polished mahogany table was instanced as being a good extemporaneous polarizing plate; and a couple of pill boxes, joined together, and having their bottoms removed, and containing seventeen plates of window glass, placed obliquely, as an analyzing instrument. The annoying effects of polarized light to fishermen were explained; the rays coming from the surface of the water interfere with the rays proceeding from the bottom, and prevent his seeing into the water: the analyzing plate would remedy this. The double refractive power of the tourmaline, and the polarizing power, confined to the coloured variety, were in succession introduced. The waved theory of light was preferred by the lecturer to that of Newton; but Newton's numerical valves of monochromatic light were accepted as expressive of facts, exclusive of any theory. According to the wave theory, the vibrations of the molecules of either are rectilinear or curvilinear; their nature is shown by Professor Powell's instrument. Fresnel's theory admits of two transverse vibrations of light; and this alternating action is shown by experiment. Cauchy considers a third plane of vibration necessary. The polarizing action of the tourmaline was shown by zinc plate containing parallel slits. Light may be polarized by double and single refraction, and by reflection. The doctrine of interference was then unfolded, and its existence in acoustics was shown by means of two pitch-pipes. The interference of monochromatic light produces light and dark rings; that of ordinary light, coloured rings; that of two systems of polarized light, circular polarization. This was shown by Professor Wheatstone's instrument. Sir John Herschel has compared a ray of common light to a round stick; and one of polarized light to a flat lath. A number of illustrative experiments were then given, showing coloured polarization by means of mica, selenite, and hydrated sulphate of iron.—*Illustrated Polytechnic Review*, No. 13.

METALLIC REFLEXION.

PROFESSOR LLOYD has read to the British Association, a brief account of some investigations in which he had been recently engaged, with the hope of explaining theoretically the phenomena of Metallic Reflexion. The physical hypothesis from which he sets out is, that the elasticity of the ether (which is usually assumed to change abruptly to the confines of transparent media) varies *gradually* at the surface of a metal, so as to constitute, in fact, an infinite series of thin plates of infinitessimal thickness. In such a medium, it is natural to suppose that there will be an infinite series of infinitessimal vibrations, reflected at every point in the course of the ray, the sum of which will constitute the resultant vibration. On pursuing the inquiry, however, the author found reason to conclude that there could be no sensible intensity in the reflected light without a sudden change in the elasticity of the medium; and he was accordingly driven to combine this hypothesis with that already referred to, the ether varying continuously up to a certain plane, at which an abrupt change took place. On this principle he has obtained expressions for the magnitudes of the reflected vibrations corresponding with those of Fresnel, the *two* angles which enter the formulæ being connected with the original angle of incidence by the known law of the sines by means of two constants. These expressions seem to explain, generally at least, the variations in the intensity of light reflected from metals; but it remains to account for the difference of phase depending on the plane of polarization.

Dr. M'Cullagh then alluded briefly to some recent researches of his own on the same subject. He endeavoured to connect the laws of metallic with those of crystalline reflexion, by a *mathematical* generalization, which brought out the empirical laws of the phenomena; but he did not give the particulars of his investigation, as it had not proved satisfactory to his own mind. The method of Prof. Lloyd, on the contrary, had the merit of proceeding on a *physical* hypothesis; and his results were certainly deserving of great attention, as the problem was one of the most difficult that could be proposed in the present state of science, and the cause of the peculiar action of metallic bodies upon light seemed to be involved in mystery.

POLISHING THE SPECULA OF TELESCOPES.

DR. GREEN has read to the British Association a paper, "On polishing the Specula of Telescopes." His process, for which he received the gold medal of the Society of Arts, ten years ago, closely resembles, on a small scale, that which has been adopted and perfected by the Earl of Rosse.

Lord Rosse expressed his pleasure at finding that Dr. Green had turned his attention to this subject, in which so much remained for trial. The model which had been exhibited had in it all that was required to obtain perfect results; but the most perfect machinery was insufficient, without minute and scrupulous attention to detail in every part of this most delicate process. With respect to this theory, he did not attempt any rigorous development, but was rather guided by general laws; of which the most important is, that in polishing there is a progressive lessening of curvature, the degree of which changes with the lateral motion of the polisher; and that by a proper adjustment of it he had obtained a surface not differing sensibly from the parabolic. It might be described as being in a state of transition, but its character was always the same; and he had found this the case by experiments on mirrors of very different magnitudes, so that he conceived it to be practically established. He hoped Dr. Green would continue his researches, and he offered whatever information he had to any one disposed to engage in the same pursuit.—Dr. Robinson remarked on the similarity of Dr. Green's model to Lord Rosse's machinery. In fact, they had found in their practice the necessity of satisfying the same conditions, only one important difference being between them. Dr. Green, as all others with whom he was acquainted, had placed the speculum on the polisher. Lord Rosse, by reversing this arrangement, had obtained many important advantages, of which one of the most striking is the power of keeping the mirror at a given temperature. Dr. Robinson feared that it would be impossible to give any rigorous demonstration of the parabolic form obtained by certain proportions of the motions, for it depended, not merely on the amount of rubbing surface, but also on the toughness of the pitch and the elasticity of the polisher and specula, which obviously were called into play when one overhung the other, in a way that could scarcely be brought under analysis. All these results, he feared, must be experimental. In illustration of what Lord Rosse had said respecting the surface being in a state of gradual curvature, he might mention that he had found, by extending the stroke of the second excentric to (if he recollected right) 0·45 of the breadth of the mirror, he had figured the convex speculum of his large Cassegrain (fifteen inches aperture) to be hyperbolic, or at least to be aplanatic, with a sensible improvement of the instrument's performance. The speculum was three inches diameter, and took forty minutes to polish it.

TERRESTRIAL MAGNETISM.

Mr. Nott, in a paper read to the British Association, denies the existence of magnetic poles. The situation of the points of greatest intensity, (commonly called poles,) in magnets, he conceives to be merely a result of figure. On a globular magnet the maximum intensity is, according to his experiments, situate about 75° from the equatorial zone. He maintains that the earth is a globular magnet, the maximum intensity of which is in lat. 75°, and that the magnetic poles of the earth have never yet been found. Terrestrial magnetism being considered as the effect of electric currents which move on the surface, will be affected by the irregularities of that surface, and hence the anomalies of the earth's magnetism. The author denies the conclusiveness of the arguments used to show that the earth is an oblate spheroid. He asserts that globular magnets, if freely suspended, would, by their mutual attraction, rotate and revolve round each other; and, finally, that the doctrine of gravitation must ultimately give way to that of universal magnetism.

CONTOURED MAPS.

CAPTAIN LARCOM has reported to the British Association:—It is important that Maps constructed by the Government should exhibit the levels of the country in the most intelligible manner; showing heights not merely on the tops of hills, but round their sides, and through the valleys which traverse them. Such a system is offered by these Contours. They are a series of horizontal lines, at a certain distance asunder, and at a certain height above a fixed datum. The datum most commonly used is the level of the sea, doubtless from the shore line being the limit of the land, and the point at which roads must cease, as well as from an impression that it is itself a level line; and therefore, as the first Contour, the most appropriate and natural zero, from which to reckon the others. The Section were aware that it has been a point much discussed, whether the high water, the low water, or the mean state of the tide, offers the most level line. This is a point which it would be out of place to discuss here, but it may be stated that, in order to determine it, as far as Ireland is concerned, a series of lines has been very accurately levelled across the island in various directions, and permanent marks are left in all the towns, and on numerous public buildings; and at the end of each of these lines on the coast, tidal observations have been made every five minutes during two complete lunations. These observations, and the connecting lines of level, are now in process of reduction—the degree of accuracy attained is such that a discrepancy of ·2 an inch is immediately apparent—and from them we may expect many points of interest. The steeper the natural slope of the ground is, the closer together the contours, of course, will be, and the more oblique the road; where, on the contrary, the ground slopes very gently, the contours are farther asunder, and the road may be proportionally more direct. By examining the maps of the Irish Survey, on which contours have been drawn, it will be seen that they tell sad tales of the existing roads, every one of which ascends and descends frequently, instead of keeping on a gradual slope for its whole length. In order to exhibit these lines, it is proposed, instead of adding them to the original copperplate, which has a peculiar value as an official record of boundaries, to make a copy of the plate by the electrotype, for the purpose of receiving these lines. Contour maps were thought of early in the progress of the survey, but means were wanting for their execution; at present, however, the outline survey being complete, and the general map, or map of the surface, being in progress, affords a convenient opportunity, which it is hoped will not be lost.

Dr. Robinson inquired of Capt. Larcom whether the process of contouring the maps was proceeding, and how soon he supposed it would be completed for Ireland. Capt. Larcom replied, that for the present it had been suspended. Dr. Robinson observed, that whether he considered the value of this process in relation to the general interests of science, or the most important practical economies of the country at large, he could not but deeply deplore the suspension, temporary though he hoped it would be, of this great national undertaking. He begged to inquire from Capt. Larcom, what the expense would probably be? Capt. Larcom replied that he should certainly estimate it at less than a farthing an acre. Dr. Robinson: And the original cost was probably sixpence or eightpence.—Capt. Larcom said, perhaps sevenpence or ninepence. Dr. Robinson: Then, at a cost of about one thirty-second part of the original expense, this invaluable addition to that splendid work, the Trigonometrical Survey of Ireland, could be accomplished.

ON WAVES.

THE Report of the Committee on Waves has been presented to the British Association, by Mr. S. Russell, along with a short account of the Researches with which he had been engaged since the period of the former Report. He has reduced the whole subject of inquiry into a more systematic and complete form than it had at an earlier period in these inquiries, and has found that the arrangement adopted has the effect of removing many of the seeming contradictions of wave phenomena, by showing that phenomena formerly identified are actually the result of conditions essentially distinct from each other, and that there exist orders of waves heretofore confounded, but now ascertained to differ in their origin, nature, and successive phases of existence. These different orders he has separately examined; he has determined their characteristic properties, and registered their phenomena, and proposes to arrange them in the following system:—

Orders: Waves of translation—of oscillation—capillary waves—corpuscular waves. *Characters:* Solitary—gregarious. *Species:* Positive or negative—stationary or progressive. *Varieties:* Free—forced; of which distinctions the instances are: wave of resistance, tide wave, aerial sound wave, stream ripple, wind waves, ocean swell, dentate waves, zephyral waves, water sound wave.

The phenomena of these different orders have been examined; and in their mode of genesis, their laws of motion, their form, the nature of the forces by which they are transmitted, their duration, and the manner of their final extinction, they are found to differ essentially from each other. These various properties were then illustrated by a few examples. In the first order, the velocity is dependent on depth and height alone; in the second, on length alone, being perfectly independent of depth and height; in the third case it is constant; and constant also in the fourth case. In the first, also, the nature of the motion of each individual particle of water during wave transmission, is, that the particle describes a semi-circle or semi-ellipse, and then relapses into repose, all the water particles to the bottom having an equal range of horizontal translation. In the second case, there is no permanent translation, but a continuous series of revolutions in a series of complete circles, or rather in a spiral, and these revolutions to not extend to great depths below the surface. In the third case, the disturbances of the particles do not extend deeper than the range of the capillary forces, excited by the disturbance of the superficial film on the surface of the liquid. And in the fourth class, the motions of the particles are only made sensible through the organ of hearing.—*Athenæum*, No. 829.

THE NERVOUS SYSTEM.

M. Longet, in his new work on the Nervous System of Men and Animals, confirms, by a variety of experiments, the correctness of the opinions of Bell on this interesting, but still imperfectly understood, subject; he throws out many ideas which may lead to other researches, and to results of more practical utility than any that have yet been obtained as to the precise influence of the nerves on the human body, whether in its normal state or otherwise. One of the facts mentioned by M. Longet, is, that the motive force of the nervous system, brought into action by galvanism, is always centrifugal, while the passive or sensitive condition of the nerves takes an opposite direction.

THE POWER OF OIL TO ALLAY THE VIOLENCE OF WAVES.

The existence of this property in oil has been so often asserted, that a commission was lately appointed by the Royal Institute of the Pays Bas to make experiments on the subject:—"The commission assembled at Zandvoort, on the shore of the North Sea. Some of them proceeded a short distance from the shore, in order to pour the oil upon the water, and observe the results; the others remaining on land, and not knowing either what moment or how many times the oil was poured out, were to keep their eyes fixed on the waves, which rolled from the boat towards the shore; by these means their opinon, exempt from all influence, might be considered as so much the more impartial. The wind was south-west, and of moderate force; the quantity of oil poured out at four different times, namely, at 43, 45, 50, and 54 minutes past nine o'clock, amounted to 15 litres (upwards of 3 imperial gallons); the tide was flowing, and would not reach its full height till 21 minutes past eleven o'clock. The commissioners who remained on the shore, not having remarked any effect which could be ascribed to the effusion of the oil, and the same thing being the case with those engaged in pouring it, we might already consider the question, if oil, poured at a little distance from our piers, could protect them from the fury of the waves, as answered in the negative. Nevertheless, the commissioners thought it incumbent upon them to make a second trial at a somewhat greater distance from the shore. Two of them were rowed beyond the rocks, and then cast anchor. The distance was calculated by the boatmen at 300 yards; the sounding line indicated a depth of about three yards; and the waves were rolling considerably. More than the half of 15 litres of oil was poured out in the space of five minutes (from 15 to 10 minutes before twelve o'clock), and the commissioners did not observe the slightest effect in relation to the object of their mission. They saw the oil swimming on the surface of the water, partly united in spots of an irregular form, partly extended and forming a pellicle, and partly mingling with the foam of the waves, and sharing in their oscillatory movements. When returning to the shore, at the moment of passing the rocks, the commissioners caused the rest of the oil to be poured on the water, and they can testify that it had no effect in diminishing the motion of the waves, for they were many times abundantly sprinkled with the spray. It is unnecessary to add, that those who remained on land had remarked nothing at all which could be attributed to the effusion of the oil. After all that has been said and written on this subject, the commissioners are astonished at the negative result of their experiments, and, limiting themselves to the account of them, they add no observations. They believe themselves, however, authorized to assert as their personal opinion, that the idea of protecting our piers by means of oil is not a happy one."

CHEAP INSTRUMENT FOR MEASURING HORIZONTAL ANGLES.

In Mr. Simms's admirable Treatise on Astronomical and Surveying Instruments, it is shown how to divide a circle, or lay off an angle with the beam compasses; in the same way shall the instrument now about to be described divide a circle in the field, or find the angular distance between any two objects. The radius chosen by Mr. Simms is 5 inches, mine is 50 inches; therefore, in principle and practice, the two instruments are identical.

The instrument is adapted to a table of natural sines, and consists, principally, of two radial arms, that open and close upon a joint, very much like a carpenter's rule; there is a sight-vane set up upon each arm, at the distance of 50 inches from the centre of each joint. The instrument, when in use, is mounted upon three staves stuck fast into the ground; one of these staves has a hole in its top, to receive the shank of the centre sight-vane, and the two forward staves are fitted with short T heads, so as to admit of a little lateral motion in setting the arms, with a simple contrivance for clamping. The forward sight-vanes are very thin and narrow slips of brass, let into the wood with the point of a knife; the centre sight-vane is a piece of sheet brass, with a fine slit in it; to this is riveted a round shank, for the convenience of turning it at right angles with either limb; the joint is put together with a single tongue of sheet brass, inserted into the middle of its thickness.

There is another jointed instrument similar to the above, but rather more slightly made; this has five ten-inch divisions laid off from the centre of the joint upon each limb, and the value assigned to each of these divisions is 1000. This part is used in connexion with a ten-inch scale, for measuring the chord, or distance between the forward sight-vanes, after they are correctly adjusted to the angle between two objects. The scale may be divided to inches and tenths, and let an inch at one end be divided into 100 parts—or 50, for sake of distinctness—and half a division may be estimated. Now, the radius of the instrument being 50, the chord of an arc will be equal to the natural sine of half that arc, and, as the chord can be measured to four places of decimals, it will be seen, upon inspection of a table of natural sines, that an angle may be measured by this instrument to one minute of a

As a pocket companion to the instrument, the inventor uses a set of tables recently published, the joint production of Dr. Gregory and Messrs. Woolhouse and Hann; in which is a table of natural sines to every degree and minute of the quadrant, also tables of the logarithms of numbers, and of the trigonometric functions, quite sufficient for ordinary purposes. It contains, also, numerous other nautical and astronomical tables.

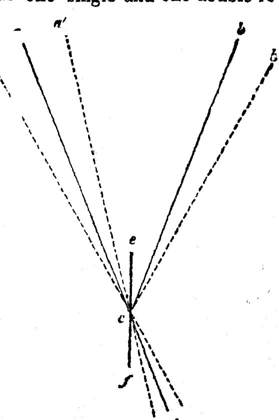
This instrument can be made (except the scale) by almost any person, for a few shillings. When set up for use, it looks very typical of triangulation, and when the sight-vanes are removed—which can be done in an instant—it will tie up very close, presenting a small bundle of straight pieces of deal, weighing altogether 8½ lbs. I have tested it by an ordnance map of my own locality, and find it will make a very close approximation.—*Mechanic's Magazine*, No. 1031.

BAROMETRIC COMPENSATION OF THE PENDULUM.

At the Manchester Meeting of the British Association, Professor Bessel made a communication on the Improvement of the Astronomical Clock, which, with other valuable matter, contained a proposal to compensate for the changes of rate produced by the varying density of the atmosphere. This appears in the Report of the Sectional Proceedings, and also at much greater length in No. 455 of the *Astronomische Nachrichten*. At the time, Professor Stevelly remarked that Dr. Robinson had not merely proposed, but applied this compensation twelve years ago, and Dr. R. should not have reverted to it, but that he thinks his method possesses certain advantages over that proposed by the illustrious astronomer of Königsberg, which entitle it to the preference in practice. It was long believed to be demonstrated, that the rate of a pendulum was influenced by the air's density only as far as it lessened the arc of vibration and diminished its gravity by buoyancy. The researches of Kater on the length of the second-pendulum are all vitiated by this mistake, which was discovered by Bessel during a similar investigation, in which he found, by using balls of different specific gravities, that the received buoyancy correction is too small. As early as 1825, and without any knowledge of what Bessel was doing, Dr. Robinson had ascertained the same fact by comparing the rates of his transit clock with the barometric indications; and Colonel Sabine gave the final proof of it by swinging the pendulum in a vacuum apparatus in the year 1829. The amount of it is far from inconsiderable; even with the mercurial pendulum of my transit clock, which weighs 21 lbs., and presents a very small surface, it is 0".36 for an inch change of the barometer. Now the remedy for this is obvious. If we attach a barometer to the pendulum, its fall transfers a cylinder of mercury from a point near the axis of motion to a greater distance from it; the time of vibration may thus be made to increase by the same amount that it decreases in consequence of the diminished density of the air. By placing the clock *in vacuo*, as Bessel proposes, (and as Sir James South has actually done for several years past,) the effect of resistance can be determined exactly, and the *diameter* of tube selected, which will nearly correct it. This is not mere speculation, for Dr. Robinson has verified it by trial. The diameter selected for his tubes (0·1 inch) is not far from the truth. In the autumn of last year a fall of 1·6 inch produced *no appreciable change of arc.* The temperature, however, was then nearly stationary; but notwithstanding its changes during the interval from that time till my leaving Armagh, the arc has been between 1° 36′ and 1° 39′. Before the tubes were applied, the limits for the same period were 1° 42′ and 1° 51′. The changes in Bessel's own clock, though made by Kessel, a first-rate artist, are still greater, being from 1° 25′ to 1° 39′, an excess owing in part, probably, to the greater severity of a German winter. From what Dr. Robinson has seen of the vacuum apparatus used by Sabine or South, he cannot refrain from expressing a wish that the experiment were tried of mounting a transit clock permanently *in vacuo:* such a clock would have many advantages, besides its exemption from changes of barometric pressure.

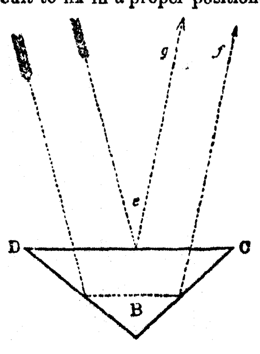
NEW MERIDIAN INSTRUMENT.

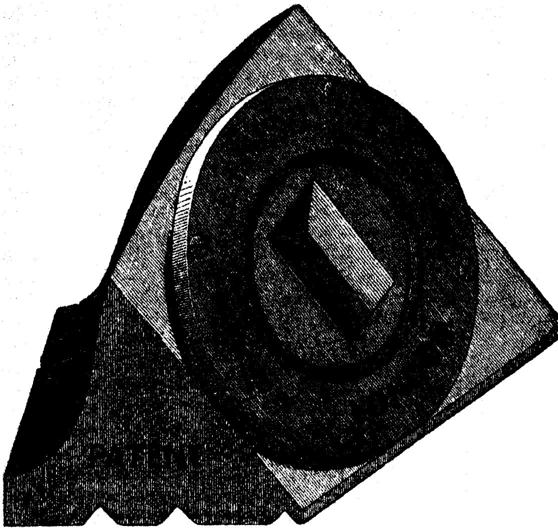
This simple and beautiful invention consists of a combination of three reflecting planes, to be used as one single and one double reflector; and in such manner that an observer may see two images of a distant object when that object is near to an imaginary plane passing through the instrument; and by the coincidence of those images the observer may know when the distant object is in that plane. To render this more clear, and with a view to describe the principles on which the instrument is constructed, let *a*, *c*, *d*, and *b*, *c*, represent two rays of light proceeding from *two* stars and meeting at the point *c*; and let *e*, *f*, represent a transparent surface and reflecting plane perpendicular to the plane *a*, *c*, *b*. If the reflecting plane bisect the angle *a*, *c*, *b*, an observer looking in the direction *d*, *c*, will



see one star and the reflected image of the other as if they were both at d. Moreover, if the reflecting plane have an angular motion, or if the plane be supposed to be fixed and the stars to move as from a and b to a' and b', the reflected image of the star b will appear to move in the opposite direction, or from a to a''; consequently, if the transparent and reflecting plane be fixed in such a position that at some period of the day one star and the reflected image of another may appear in the same place, the following observation may be made:—If an observer look in a proper direction towards the plane, two stars or images will appear to come into the field of view from diametrically opposite points, and move in opposite directions across the field of view, meet at or near the centre, and disappear at the points opposite to those at which they entered; the two images appearing to be in the same place at the moment when that point in the heavens which is midway between the two stars corresponds with the plane of the reflecting surface. The exact position of the observer is not material; for, if he shifts his position, the coincidence of the two images will take place at a different part of the field of view, but at the same time. The recurrence of the coincidence of the two images at intervals of exactly twenty-four sidereal hours will furnish the means of regulating or ascertaining the rate of a clock; and if the time of the coincidence be once known, it will also afford the means of setting the clock or finding its error on any future day. It is to be stated, however, that the reflecting plane must not be placed parallel, or nearly so, to the earth's equator; for if it be so placed, the two images will never separate, or will do so very slowly; the nearer parallel to the earth's axis the plane is, the better, and suitable stars should be chosen accordingly.

The above supposed instrument, described with a view to facilitate the understanding the principles of the invention, cannot be used for observing a single object unless furnished with adjusting screws, and even then it would require nice adjustment, besides being very difficult to fix in a proper position. Fig. 2 will explain the arrangement of the reflectors in the complete instrument. There are three reflecting planes, D C, B C, and D B. The angle B may be placed in such a position that the rays of light falling on the plane D B will be reflected in the direction of the arrow f; and other rays from the same distant object falling on the plane D C will be reflected in the direction of the arrow g; and the observer looking in the reverse direction of the arrows, that is, by placing his eye (or a telescope) at f, g, would see two images of the same object as if they were both at e. The angle B in this arrangement being a little more than





90°, affords the opportunity of making two observations of the same object at short and equal intertals, before and after the object is on the meridian. The first observation is made when the rays of light proceed in the direction of the arrows, and the second when the object is in such a position that the rays of light pursue the same path, but in the opposite direction. If both limbs of the sun or moon be observed by this arrangement of the instrument, it will furnish no less than four observations, the mean of which will give a very accurate result. In the arrangement of the planes in the subjoinod full-sized figures the angle B is rather less than 90°, which affords the opportu nity of making only a single observation. For meridional observations the instrument requires no other fixing than being placed on a level surface with the face towards the meridian sun. After being adjusted by trial, its position may be made permanent by any suitable cement.—*Literary Gazette*, No. 2358.

MR. BABBAGE'S CALCULATING ENGINES.

MUCH misapprehension having arisen as to the circumstances attending the invention and construction of Mr. Babbage's Calculating Engines, it is necessary to state *from authority* the facts relating to them.

In 1823, Mr. Babbage, who had previously invented an engine for calculating and printing tables by means of *differences*, undertook, at the desire of the Government, to superintend the construction of such an Engine. He bestowed his whole time upon the subject for many years, refusing for that purpose other avocations which would have been attended with considerable pecuniary advantage. During this period, about £17,000 had been expended by the Government in the construction of the Difference Engine. A considerable part of this sum had from time to time been advanced by Mr. Babbage for the payment of the workmen, and was, of course, repaid; but it was never contemplated by either party that any portion of this sum should be appropriated to Mr. Babbage himself; and in truth, not one single shilling of the money was in any shape whatever received by Mr. Babbage for his invention, his time, or his services; a fact which Sir Robert Peel admitted in the House of Commons in March 1843.

Early in 1833, the construction of this engine was suspended on account of some dissatisfaction with the workmen. About twelve months after the progress of the Difference Engine had been thus suspended, Mr. Babbage discovered a principle of an entirely new order, the power of which over the most complicated arithmetical operations seemed nearly unbounded.

In the engine for calculating by differences, such simplifications affected only about a hundred and twenty similar parts; while in the new, or Analytical Engine, they might affect several thousands. The Difference Engine might be constructed with more or less advantage, by employing various mechanical modes for the operation of addition. The Analytical Engine could not exist without inventing for it a method of mechanical addition possessed of the utmost simplicity. In fact, it was not until upwards of twenty different modes for performing the operation of addition had been designed and drawn, that the necessary degree of simplicity required for the Analytical Engine was ultimately attained.

These new views acquired great additional importance from their bearings upon the Difference Engine already partly executed for the Government; for if such simplifications should be discovered, it might happen that the Analytical Engine would execute with greater rapidity the calculations for which the Difference Engine was intended; or that the Difference Engine would itself be superseded by a far simpler mode of construction.

Though these views might, perhaps, at that period, have appeared visionary, they have subsequently been completely realized.

To have allowed the construction of the Difference Engine to be resumed while these new views were withheld from the Government, would have been improper; yet the state of uncertainty in which those new views were then necessarily involved, rendered any written communication respecting their probable bearing on that engine a matter of very great difficulty.

From the year 1833 to the close of 1842, Mr. Babbage repeatedly applied to the Government for its decision upon the subject. These applications were unavailing. Years of delay and anxiety followed each other, impairing those energies which were now directed to the invention of the Analytical Engine.

Amid such distractions the author of the Analytical Engine has steadily pursued his single purpose. The drawings and the notations have been freely shown; and the great principles on which the Analytical Engine is founded have been explained and discussed with some of the first philosophers of the present day. Copies of the engravings were sent to the libraries of several public institutions; and the effect of the publicity thus given to the subject is fully proved by its having enabled a distinguished Italian geometer to draw up from these sources an excellent account of that engine*.

Throughout the whole of these labours connected with the Analytical Engine, neither the Science, nor the Institutions, nor the Government of his country, have ever afforded him the slightest encouragement. When the invention was noticed in the House of Commons, one single voice † alone was raised in its favour.

During nearly the whole of a period of upwards of twenty years, Mr. Babbage had maintained, in his own house, and at his own expense, an establishment for aiding him in carrying out his views, and in making experiments, which most materially assisted in improving the Difference Engine. When that work was suspended, he still continued his own inquiries, and having discovered principles of far wider extent, he ultimately embodied them in the Analytical Engine.

The establishment necessary in the former part of this period for the actual construction of the Difference Engine, and of the extensive drawings which it demanded, as well as for the formation of those tools which were contrived to overcome the novel difficulties of the case, and in the latter part of the same period by the drawings and notations of the Analytical Engine, and the experiments relating to its constructions, gave occupation to a considerable number of workmen of the greatest skill. During the many years in which this work proceeded, the workmen were continually changing, who carried into the various workshops in which they were afterwards employed the practical knowledge acquired in the construction of these machines.

To render the drawings of the Difference Engine intelligible, Mr. Babbage had invented a compact and comprehensive language (the Mechanical Notation), by which every contemporaneous or successive movement of this machine became known. Another addition to mechanical science was subsequently made in establishing principles for the *lettering* of drawings; one consequence of which is, that although many parts of a machine may be projected upon any plan, it will be easily seen, by the nature of the letter attached to each working point, to which of those parts it really belongs.

* Of M. Menabrea's treatise, which appeared in the Bibliothèque Universelle de Génève for October last, a translation is given in the 12th part of the Scientific Memoirs, with copious and valuable explanatory notes by the translator.

† That of Mr. Hawes, M.P. for Lambeth.

By the means of this system, combined with the Mechanical Notations, it is now possible to express the forms and actions of the most complicated machines in language which is at oncce condensed, precise, and universal.

At length, in November 1842, Mr. Babbage received a letter from the Chancellor of the Exchequer, stating that Sir Robert Peel and himself had jointly and reluctantly come to the conclusion that it was the duty of the Government, on the ground of expense, to abandon the further construction of the Difference Engine. The same letter contained a proposal to Mr. Babbage, on the part of Government, that he should accept the whole of the drawings, together with the part of the engine already completed, as well as the materials in a state of preparation. This proposition he declined.

The object of the Analytical Engine (the drawings and the experiments for which have been wholly carried on at Mr. Babbage's expense, by his own draftsmen, workmen, and assistants) is to convert into numbers all the formulæ of analysis, and to work out the algebraical development of all formulæ whose laws are known.

The present state of the Analytical Engine is as follows :—

All the great principles on which the discovery rests have been explained, and drawings of mechanical structures have been made, by which each may be carried into operation.

Simpler mechanisms, as well as more extensive principles than were required for the Difference Engine, have been discovered for all the elementary portions of the Analytical Engine; and numerous drawings of these successive simplifications exist.

The mode of combining the various sections of which the Engine is formed has been examined with unceasing anxiety, for the purpose of reducing the whole combination to the greatest possible simplicity. Drawings of almost all the plans thus discussed have been made, and the latest of the drawings (bearing the number 28) shows how many have been superseded, and also, from its extreme comparative simplicity, that little further advance can be expected in that direction.

Mechanical Notations have been made both of the actions of detached parts and of the general action of the whole, which cover about four or five hundred large folio sheets of paper.

The original rough sketches are contained in about five volumes.

There are upwards of one hundred large drawings.

No part of the construction of the Analytical Engine has yet been commenced. A long series of experiments have, however, been made upon the art of shaping metals; and the tools to be employed for that purpose have been discussed, and many drawings of them prepared. The great object of these inquiries and experiments is, on the one hand, by simplifying as much as possible the construction; and on the other, by contriving new and cheaper means of execution, at length to reduce the expense within those limits which a private individual may command.—*Taylor's Scientific Memoirs*, vol. iii. part 12.

SIMULTANEOUS MAGNETICAL AND METEOROLOGICAL OBSERVATIONS.

THE following is Sir J. W. F. Herschel's Report of the Committee appointed to conduct the co-operation of the British Association in the system of simultaneous Magnetical and Meteorological Observations. The report commences with referring to the proceedings of the Antarctic Expedition. Three seasons, in which the ships have forced their way at different points far within the higher latitudes of the southern hemisphere, have furnished a magnetic survey of these regions, equalling, or rather surpassing, both in completeness and accuracy, all those sanguine expectations which led the Association to urge on the government the prosecution of this great enterprise. The magnetic observations of the Expedition which had been sent home, were in course of publication by the Royal Society. In the last of these contributions to terrestrial magnetism, the important subject of the corrections due to the iron of the ships is fully considered, and by the aid of formulæ, furnished by Mr. Archibald Smith, of Trinity College, Cambridge, and founded on the theory of M. Poisson, delivered in his Memoir of 1838, " Sur les déviations de la Boussole produites par le fer des vaisseaux," the constant co-efficients of their corrections for each ship are investigated. The corrections deduced from these elements are found to agree admirably with the results of experiment, thus affording ground for the fullest confidence in the corrections depending on them, as well as in the theory from which they are derived, and in the general approximation to truth of the hypotheses necessarily made as to the distribution of the iron in the vessels. All the results being tabulated and projected in charts, the inspection of these gives room for the following interesting remarks:— 1st. As great discordances are to be looked for, and must frequently be experienced in magnetic surveys conducted on land, as in those at sea, and even greater. In effect, the chief and worst cases of accordance occur in observations made on islands. 2d. The general form of the curves of higher inclination in the southern hemisphere is much more analogous to that in the northern, than appears in M. Gauss's maps. 3d. Capt. Ross's observations of intensity lead also to the conclusion of a much closer analogy between the two hemispheres than M. Gauss's maps would appear to indicate. No higher intensity than 2·1 has been anywhere observed. 4th. In examining the observations of declination, particularly those which point out the course of the lines of 0° and 10° east, a more westerly position is indicated than that assigned by M. Gauss for the spot in which all the lines of declination unite. The Report then mentioned that the government of the United States has assigned funds for a magnetic observatory at Washington, as well as for a further three years' continuance of that already established at Philadelphia. The Bavarian government also has consented, on the application of the Royal Society, to maintain for an additional three years the observatory at Munich. The first part of the volume of Disturbance Observations has been completed, comprising those made in 1840-41. Col. Sabine has prefaced this volume with a synoptic statement of the general conclusions, which it has been found practicable to deduce from the observations in their actual uncorrected state, of which conclusions thefollowing is a brief outline:—At Toronto the march of the regular diurnal movements in declination does not consist in a simple uninterrupted progress and regress of the needle. Commencing from 2 P.M., its movement is continuous to the eastward till 10 P.M.; it then returns westward (through a comparatively small angle) until 2 A.M., when its eastward movement is resumed and continued till 8 A.M., after which its return is continuous to the west until 2 P.M. This second eastward progression is more decided in summer than in winter, and in the total range of diurnal fluctuations is also more considerable. At Van Diemen's Land (a station, it is to be borne in mind, almost antipodal to Toronto), the course of diurnal oscillation agrees with that above stated in all but one feature—viz. that the hours (in mean time at the station) of easterly movement of the north end of the bar at the one station are those of its westerly movements at the other; that the diurnal range is nearly the same in both, with a similar inequality in its summer and winter amount; a similar alternate progression and recess also prevails, and at the same hours. These are certainly very remarkable features, showing a regular connexion between two stations so remote, carried out into what may be regarded as minute particulars, Falling in, however, with the generally received impression of the universality of the causes (whatever they may be) which produce the periodical fluctuations of the magnetic elements, they can only be regarded as contributions to our knowledge of details. It is otherwise with the results deduced, by a comparison of the observations recorded in this volume, not only at these two stations, but also at St. Helena, with each other, and with those made by M. Kreil at Prague, as respects cases of unusual magnetic disturbance which occur (as far as we can yet perceive) casually, or at least not periodically. Such comparison has enabled us, at length, unequivocally to state it as a general proposition, that the whole magnetic system of our globe is affected, in the majority of cases of great disturbance; for it is found that if a list of days of great disturbance, independently noticed as such, and marked by extra observations on each station, be made out, these lists will be found to coincide in at least a majority of days, and more especially in those days when the recorded disturbance has been greatest. Of twenty-nine principal disturbances recorded in Col. Sabine's synoptic table, some confined to a single day, others running through two or three successive days, and comprehending altogether forty-nine days, by far the greater part are shown to have manifested themselves at Toronto, Van Diemen's Land, and Prague, and fifteen are marked by extra observations at St. Helena. But though it is thus rendered certain that the whole globe is affected in many and great magnetic storms, it is equally shown that the minute identity of particular shocks, which seemed to result from the earlier observations of this nature in Europe, is not in general traceable on any thing like so extensive a scale. Not the least interesting part of this volume consists in the notices at Toronto of auroral phenomena accompanying the extraordinary magnetic disturbance; they are many and remarkable, and can hardly fail to throw great light on this branch of the present subject. The difficult subject of the determination of the earth's magnetic force in absolute measure has been subjected to a further investigation by Dr. Lloyd. The difficulty which it presents is of a practical rather than a theoretical nature, and arises from this, that the expression for the tangent of the angle of deflection of one magnet by another involves co-efficients, which have to be determined in Gauss's method by observations of deflection at two different distances and by elimination, in which process serious errors are introduced in the result by small errors in the observations. The object of Dr. Lloyd has been to point out a method by which the quantity sought may be obtained without elimination by observations at one distance only, thus both diminishing the trouble of the observation, and increasing the accuracy of the result. This method depends on the assumption of an empirical law in the distribution of free magnetism in a magnetical bar, inferred by Biot from Coulomb's researches. Dr. Lloyd adduces several experiments confirmatory of these results. The Report next mentioned Lieut. Lefroy's intended course for magnetic survey in North America as far north as the Great Slave Lake. He crossed the line of no variation between La Cloche and Sault St. Marie, up to which point little change of dip had been experienced, his course leading nearly along the isoclinal line of 77°. The second series of Sir E. Belcher's observations, determining the magnetic elements of 32 stations (the two series embrace 61 stations) in the Pacific Ocean, the Indian and Chinese Seas, are now printed in the Philosophical Transactions.

Electrical Science.

ELECTRICITY OF STEAM.

On June 9, at the Royal Institution, Prof. Faraday illustrated the extent of our knowledge of the Electricity which accompanies the formation of Steam, previous to showing that when water is poured into a heated metal cup electricity was set free; and that if the vessel, into which the water was placed, was above a certain elevated temperature, no electricity was evolved, in consequence of the water being prevented from contact with the containing vessel by a stratum of steam. The Professor then detailed the first observations made at Newcastle by one of the workmen in attendance on a boiler belonging to the Newcastle and Carlisle Railway, and whose report, that the boiler was full of fire, from the fact that when he placed his hand near it an electric spark was communicated, drew the attention of Mr. Armstrong to the subject, the result of whose investigations was then given.* A boiler having been arranged for the purpose of illustrating this subject, the Professor exhibited the production of the spark during the emission of the steam, and showed most conclusively that the boiler and appendages were charged with negative electricity, while the issuing steam was in the opposite or positive state; that it was necessary that the boiler should be insulated; that the steam should issue through a small aperture; that the material of which this aperture was constructed modified materially the quantity of electricity, wood and the metals having been found by experiment to be the best fitted for the purpose; that the introduction of a small portion of saline matter, as sulphate of soda, into the exit chamber, prevented entirely the elimination of electricity, and even when common water was introduced it had the same effect; that by long continuance of the issuing current of steam, electricity was gradually developed, from the condensed steam displacing and driving out the saline matter, pure water being a necessary element for its production; and that the whole phenomena arose from the rubbing of the condensed water against the tube from which the steam was issuing. The Professor also proved that the introduction of ammonia reversed the electrical states, what was before negative becoming positive, and that as the ammonia was expelled the original states were gradually restored; that turpentine and acids acted in the same way as saline substances, from their enveloping the particles of water in a film of their own substance. The lecturer considered, from these facts, that the view advocated by Mr. Armstrong, that the electricity arose from the passage of water into the aeriform state, was not tenable, and that the thunder-cloud and the lightning's flash could not be attributed to this origin.

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* See Year-Book of Facts, 1841, p. 132; Year-Book, 1842, p. 133; Year-Book, 1843, p. 169.

HYDRO-ELECTRIC MACHINE.

Mr. Armstrong has fitted up a high-pressure boiler, for the purpose of exhibiting the phenomena of the development of Electricity by effluent Steam, which was discovered by him and by Mr. Pattison. The apparatus, as it is exhibited at the Polytechnic Institution, consists of a cylindrical boiler, made of rolled iron plate, 3 feet 6 inches diameter by 6 feet 6 inches long, without the smoke chamber, which is one foot additional. The furnace is within the boiler, and heated air is conveyed through the water in tubular flues to the smoke chamber, to which the chimney is attached. The boiler is supported, at a height of 3 feet from the ground, by strong pillars of green glass, and the steam is discharged through 46 jets, to which it is conducted by iron pipes, for the purpose of producing a partial condensation of the steam into water to be blown out with the steam, as that is supposed to add to the effect. The jets are each 1-8th of an inch in diameter, and they are made of partridge wood, from the notion that the friction of the water and steam is the exciting cause of the electricity developed. The steam is raised to a pressure of 75 lbs. to the square inch before it escapes through the jets, and it is received on a number of metallic points in connexion with the earth. The electrical effects of this apparatus are most powerful, and far surpass those of the gigantic plane machine which was recently exhibited as one of the wonders of the Polytechnic Institution. The sparks obtained are 20 inches long, and a large Leyden jar is charged about four times as rapidly by the issuing steam as by the large plate machine.

The rationale of the excitement of electricity by effluent high-pressure steam was misunderstood by Mr. Armstrong and by the French philosophers when the phenomenon was discovered; nor does it appear to be freed from mystification at present. Mr. Armstrong at first conceived that the cause was attributable to the quality of the water, as the steam from one locomotive boiler exhibited electricity, and that from another did not; but it was soon ascertained that the difference was caused by the forms of the apertures whence the steam escaped. The philosophers of the French Academy, however, discarding the subsequent experience, insisted that the assumed saline particles in the water produced the electricity. Dr. Faraday has recently ascribed the cause to friction of the hot water against the sides of the jet-pipe. Dr. Faraday is good authority on the subject, otherwise his opinion would be laughed at; and the phenomenon seems to be so readily and simply explainable by the different capacities of water and steam for electricity, and all the experiments performed by Mr. Pattison, in 1840, so fully confirmed that view of the subject, that to seek for any other cause seems to be deserting the plain track merely to seek a more devious one in the regions of fancy. In the original experiments, the issuing steam was condensed in insulated conductors from which the electricity was drawn; in the new arrangement the electricity is obtained from the boiler. We do not at present see that this mode of developing electricity can be applied to any useful purpose; for the electricity thus developed, though in a high state of tension, is actually much less in quantity than can be excited by the chemical action of a pair of the smallest zinc and copper plates. Every new development of power has, however, some beneficial tendency; and though at first it may appear to be useless, subsequent discoveries may render it applicable to important purposes.—*The Artizan.*

From the "Report of Mr. Armstrong's Electrical Steam Apparatus," by Mr. Boscawen Ibbetson, this instrument had power, under the unfavourable circumstances of a wet day, to produce a 15-inch spark, and to give 120 spontaneous discharges per minute to a Leyden jar 5 inches diameter, and coated to the height of 6¾ inches.

An illustrated description of the Hydro-Electric Machine, constructed for the Polytechnic Institution, by Mr. Armstrong, will be found in a letter to Professor Faraday, in *The Philosophical Magazine*, No. 151.

GALVANIC BLASTING.

THE Galvanic apparatus made by Messrs. Kemp, of Edinburgh, has been successfully applied to the simultaneous ignition of a number of shots, for the disintegrating a large mass of stone in the quarry of Rosyth Castle. The shots were arranged in a line along a ledge of rock 70 feet long, 9 feet broad, and between 7 and 8 feet thick. Being loaded with moderate charges of gunpowder, and connected by the conducting wires with a large and powerful galvanic battery, and all the other preliminary preparations effected, immediately on completing the galvanic circle, 11 shots, which had been charged with about 35lbs. of gunpowder, were instantaneously fired, and so great was the concentrated power of the simultaneous explosions, that the whole mass in front of the bores was instantly separated from the contiguous rock; the separated portion containing a mass of not less 3,780 cubic feet of stone, and weighing upwards of 260 tons.—*Edinburgh Witness.*

THE GREAT EXPLOSION AT DOVER.

SIR JOHN HERSCHEL gives the following account of this *Explosion*, in a letter, addressed to the *Athenæum*:—

Having witnessed the great explosion at Dover, on Thursday,* the 26th of January, from the summit of the cliff next adjoining it to the southward, and from the nearest point to which any access was permitted, I would gladly place on record, in your valuable journal, some features of its magnificent operation, which struck me at the time as extremely remarkable, and which have not, I think, been adequately placed before the public in any account that I have seen. These features are, the singular and almost total absence of all those tumultuous and noisy manifestations of power which might naturally be expected to accompany the explosion of so enormous a quantity (19,000lbs.) of gunpowder, and which formed, I have no doubt, the chief attraction of many who came from great distances to witness it, viz. noise, smoke, earthquake, and fragments hurled to vast distances through the air.

* See page 25 of the present volume.

"Of the noise accompanying the immediate explosion, I can only describe it as a low murmur, lasting hardly more than half a second, and so faint, that had a companion at my elbow been speaking in an ordinary tone of voice, I doubt not it would have passed unheeded. Nor was the fall of the cliff (nearly 400 feet in height, and of which no less than 400,000 cubic yards were, within an interval of time, hardly exceeding ten seconds, distributed over the beach, on an area of eighteen acres, covered to an *average* depth of fourteen feet, and in many parts from thirty to fifty) accompanied with any considerable noise; certainly with none which attracted my own attention, or that of several others similarly stationed, with whom I afterwards compared notes. A pretty fresh breeze from the south-west might be regarded as influential in wafting it away, were it not that the fall took place under the lee of the cliff on whose edge we were stationed.

The entire absence of *smoke* was another and not less remarkable feature of the phenomenon. Much *dust*, indeed, curled out *at the borders* of the vast rolling and undulating mass, which spread itself like a semi-fluid body, thinning out in its progress; but this subsided instantly; and of *true smoke* there was absolutely not a vestige. Every part of the surface was immediately and clearly seen—*the prostrate* flagstaff* (*speedily re-erected in the place of its fall*)—the broken turf which a few seconds before had been quietly growing at the summit of the cliff, and every other detail of that extensive field of ruin, were seen immediately in all their distinctness. Full in the midst of what appeared the highest part of the expanding mass, while yet in rapid motion, my attention was attracted by a tumultuous and somewhat upward-swelling motion of the earth, whence I fully expected to see burst forth a volume of pitchy smoke, and from which my present impression is, that gas, *purified from carbonaceous matter in passing through innumerable fissures of cold and damp material*, was still in progress of escape; but, whether so or not, the remark made at the moment is sufficient to prove the absence of any impediment to distinct vision.

"As regards the amount of tremor perceived, I must confess having speculated with some little anxiety on the probable stability of the abrupt and precipitous ridge on which I stood; and might, therefore, have somewhat underrated the exceedingly trifling movement which actually reached that point, and which I think I have felt surpassed by a heavy waggon passing along a paved street. The impression, slight as it was, was single and brief, and must have originated with the first shock of the powder, and not from the subsequent and prolonged rush of the ruins, which I can positively say communicated no perceptible tremor whatever.

"I have not heard of a single scattered fragment, flying out *as a projectile*, in any direction; and altogether the whole phenomenon was totally unlike any thing which, according to ordinary ideas, could have been supposed to arise from the action of gunpowder. Strange as it

* "It has been stated, that the flagstaff continued erect, but this (if I can credit the distinct evidence of my own senses) is incorrect."

may seem, this contrast between the actual and the expected effects gave to the whole scene a character rather of sublime composure than of headlong violence, of graceful ease than of struggling effort. How quietly, in short, the gigantic power employed performed its work, may be gathered from the fact, that the operators themselves, who discharged the batteries, were not aware that they had taken effect, but thought the whole affair a failure, until re-assured by the shout which hailed its success.

"The remarkable absence of noise and tremor which characterized this operation is explained by the structure of chalk as a material, and by the rifty state of the cliff as a body. Of all substances, perhaps, chalk is the worst adapted for conveying sound, and the best for deadening the vibration propagated through it by a heavy blow. The initial hammer-like impulse of the newly-created gas on the walls of the chambers of the mines (of which it must be recollected there were *three*, simultaneously exploded) was doubtless thus deadened by traversing at least seventy-five feet of chalk, even in the shortest direction, or line of least resistance; and *this* must have taken place before the mass could have been sensibly moved from its seat by the expansive force generated, which, however vast, proved incapable (as, indeed, it was expressly provided it should be) to communicate to its enormous load any greater velocity than barely sufficient to rift and bulge it outwards, leaving gravity to do the rest. Nothing can place in a more signal light the exactness of calculation which, basing itself on a remarkably simple rule, the result of long practical experience, could enable the eminent engineer (Mr. Cubitt), by whom the whole arrangements are understood to have been made, so completely to task to its utmost every pound of powder employed, as to exhaust its whole effort in useful work, leaving no superfluous power to be wasted in the production of useless uproar or mischievous dispersion, and thus saving at a blow not less than £7000 to the Railway Company."

NEW MODE OF BLASTING.

SEVERAL interesting experiments have been made at the cliffs at Dover, with a new invention for exploding gunpowder. The apparatus used, although merely a model, or small machine for showing the principle of the invention, is capable of exploding several charges simultaneously, at distances of from 100 to 200 feet. The agent employed in this plan is common electricity, collected in Leyden jars. It will occur to those who know any thing of electricity, that it cannot be produced save in very dry weather. The inventor, Mr. R. W. Thompson, a young Scotch engineer, has overcome this difficulty by a truly ingenious discovery, He surrounds the battery and cylinder by an atmosphere kept dry by art: in other words, he encloses the apparatus in an air-tight box. The provision for drying, and keeping dry, the air in this box, is extremely simple—a small vessel containing some dried chloride of calcium being placed inside, is all that is required. So great an affinity has this substance for water, that it absorbs all the moisture from the air in the box, and quickly renders it perfectly dry. The box being air-tight, the air contained in it, of course, remains dry, notwithstanding the dampness of the atmosphere. The wires being previously arranged, the electricity is discharged through the bursting cartridges, one of these being placed in each bore or mine. In this plan of blasting, unlike the galvanic method, the whole of the electricity goes through each bursting cartridge, the conducting wires being cut and the ends placed a little apart. Of course a spark takes place, and explodes the substance of which these cartridges are made. The expense and inconvenience of working galvanic batteries have altogether prevented their general introduction; and although by their means the advantages of simultaneous blasting have been clearly established, yet they have proved too complicated to be used in this way in ordinary excavating or quarrying operations. —*Dover Chronicle.*

ASSAYING BY GALVANISM.

A PAPER was read to the London Electrical Society, on Jan. 17, on Assaying by Galvanism, by Mr. Martyn J. Roberts. This consists in employing a simple galvanic pair, the positive element of which is the metal next in affinity for oxygen to that to be extracted; as a pair of silver and copper to be employed in extracting silver from a solution containing silver, copper, and iron: this method was perfected and practised many years ago.

IMMENSE RAY.

The fishermen of Cape Cod and New York have long been familiar with a species of Electric Ray. Dr. Storer has lately succeeded in procuring a fine specimen, which was captured at Wellfleet, U.S.: it was 4 feet 2 inches long, and has been identified as the *Torpedo nobiliana.* It perfectly agrees with Dr. Thompson's description of a specimen taken on the Irish coast in 1838.—*Silliman's Journal.*

THE TORPEDO AND GYMNOTUS.

M. MATTEUCCI has completed some "New Experiments on the Torpedo." They were experiments in illustration of the author's ideas concerning the parallelism between muscular contraction and electric discharge. He poisoned two torpedos, and placing prepared frogs on their back, he touched the fish, producing strong convulsions in the limbs of the frog. He exposed the brain of a torpedo, and applying a solution of potash to the fourth lobe, the fish died, giving powerful shocks. He removed the organ from a live fish; and, on placing a knife in, and severing the nervous filaments, prepared frogs were violently affected. He again exposed the brain, and obtained discharges every time it was touched on the fourth lobe. His inference is, "That it is impossible to admit the least analogy between piles, secondary coils, batteries, and the electric organ."

On Jan. 17, a paper was read to the London Electrical Society, on the "Dissection of a second *Gymnotus Electricus;* and the Anatomy of the Torpedo," by Mr. Letheby. The author follows out the views developed in his former paper, and touches on those points which were not accessible to him from the condition of the former specimen. The Society are indebted for this, as well as for several other specimens, to the liberality of Walter Hawkins, Esq., who has expressed his determination to persevere until he succeeds in presenting to the Society a *living* specimen of the Gymnotus.

PRACTICAL ELECTRIC TELEGRAPHS.

On May 17, a paper was read to the Society of Arts, "On Mr. Cooke's Practical Electric Telegraph as now used on the Great Western Railway," which was illustrated by a complete telegraph in the Society's rooms. Mr. Cooke first adopted the plan of laying the telegraph wires in iron tubing. This plan, though successful, was costly, and difficult to repair when injured. More recently he has carried out, on the Great Western Railway, a plan of suspending the conducting wires in the open air, from lofty poles, the leading advantages of which are—1. diminished cost; 2. superior insulation; and, 3. facility of repair. The cost of the original plan may be stated at about £300 per mile; while, by the improved system, it is reduced to £150, with a still greater advantage in favour of the permanency of the work. The present method of proceeding in laying down the telegraph is first to fix firmly into the ground, at every 500 or 600 yards, strong posts of timber, 16 to 18 feet in height by 8 inches square at bottom, and tapering off to 6 by 7 inches at top, fixed into stout sills, and properly strutted. Attached to the heads of these posts are a number of winding apparatus, corresponding with the number of conducting wires to be employed, and between every two of such posts upright wooden standards are fixed about 60 or 70 yards apart. A ring of iron wire (No. 7 or 8), which had been formed by welding together the short lengths of which it is made, is then placed upon a reel, carried on a hand-barrow, and one end being attached to the winder at one draw-post, the wire is extended to the adjoining draw-post, and fixed to its corresponding winder; by turning the pin of the ratchet wheel with a proper key, the wire is tightened to the necessary degree; thus the greatest accuracy may be attained in drawing the wires up till they hang perfectly parallel with each other. To sufficiently insulate the wires so suspended at the point of contact with the posts is an object of indispensable importance, as the dampness of the wood during rainy weather would otherwise allow the electric fluid to pass off freely into the earth, or into an adjoining wire, and thus complete the circuit without reaching the distant terminus at which the telegraphic effect is to be produced. In this lies an important feature in Mr. Cooke's invention, as the mere idea of supporting wires in the open air from poles, trees, or church steeples, is the oldest on record. For long distances, Mr. Cooke employs earthenware or glass for his insulation, and cast-iron standards with ash tops as drawing and suspending posts. Another point in connexion with this step in the invention is the perfect insulation from the earth: this allows of the employment of the earth as half of the conducting circuit, without risk of the current finding a shorter course through some imperfectly insulated point. For two years Mr. Cooke has tried this plan successfully on the Blackwall Railway, and lately on the Manchester and Leeds line. Two advantages arise from the employment of the earth as a conductor; 1st. one wire is saved in each circuit, thus diminishing complexity and cost; and, 2d. the earth acting as a vast reservoir of electricity, the resistance offered to the transmission of the electricity is vastly diminished, and the battery is able to work through a much greater distance with a smaller conducting wire. Thus, each telegraph can be made to work with two wires. —*Magazine of Science*, No. 217.

A pair of Professor Wheatstone's Electro-magnetic Telegraphs have been constructed for the Aix-la-Chapelle Railway. The principle of this signal telegraph is the same as Professor Wheatstone's last electro-magnetic telegraph, in which a dial or hand is caused to advance by the alternate attractions and cessations of attraction of an electro-magnet, occasioned by corresponding alternate completions and interruptions of the circuit by means of a peculiarly constructed apparatus placed at the opposite end of the telegraphic line. Only a limited number of signals being required for this special service, the instrument is confined to six elementary signs, which combined two and two, form twenty-five indications. The peculiar construction of this signal telegraph enables a magneto-electric machine to be substituted for the voltaic battery; this source of electric action not being subject to cessation or diminution, the alteration necessary for keeping a voltaic battery in order is dispensed with, and the instruments are always ready for use without any previous preparation.

Professor Morse uses for his Electro-Magnetic Telegraph, a battery which is said to surpass in constancy any heretofore made. It is a Grove's arrangement, with a second porous cell, containing strong sulphuric acid, placed between the usual electrolytes.—*Silliman's Journal.*

NEW VOLTAIC INSTRUMENTS.

On June 15, Professor Wheatstone described to the Royal Society several new Instruments and Processes for determining the contents of a voltaic circuit. Among the instruments the *Rheostat*, which may be usefully employed as a regulator of a voltaic current, in order to maintain for any required length of time precisely the same degree of force, or to change it in any required proportion; its advantages in regulating electro-magnetic engines and in the operations of volta-typing, electro-gilding, &c., are pointed out.

Among the instruments and processes described in the subsequent part of the memoir are the following:—1. An instrument for measuring the resistance of liquids, by which the errors in all previous experiments are eliminated, particularly those resulting from neglecting the contrary electromotive force arising from the decomposition of the liquid. 2. The differential resistance measurer, by means of which the resistances of bodies may be measured in the most accurate manner, however the current employed may vary in its energy. 3. An instrument for ascertaining readily what degree of the galvanometric scale corresponds to half the intensity indicated by any other given degree. 4. A means of employing the same delicate galvanometer to measure currents of every degree of energy, and in all kinds of circuits. 5. Processes to determine the deviations of the needle of a galvanometer corresponding to the degrees of force, and the converse.

APPLICATION OF THE ELECTROTYPE PROCESS IN ORGANIC ANALYSIS.

An application of the Electrotype Process has been made by Dr. Mallet, which appears of some value to those engaged in the pursuit of Organic Analysis. When very high temperatures are required to effect or complete difficult combustions with oxide of copper or chromate of lead, as in the determination of carbon in certain varieties of cast iron (which, indeed, suggested the application to me), the glass tube is liable to soften and get distorted, though of Bohemian glass, and it has been usual to cover it by lapping a spiral strip of thin copper round the tube. This, however, is never in close contact, even when cold, and the tube is liable to be broken either in the lapping or during the combustion.

The method as a substitute for this consists in brushing over the outside of the combustion tube with a very thin coat of Canada balsam and turpentine, dusting it over with fine powder of plumbago which adheres thereto, connecting one end of the combustion tube with a copper wire, and plunging the whole into a cell of sulphate of copper in the common electrotype arrangement. In a few hours the whole exterior of the tube is found covered with a perfect, close, and coherent jacket or tube of copper, and may now be at once put into use.

The copper covering adheres so close to the glass tube, and is so completely itself an *air-tight* combustion tube of copper, that should the glass-tube burst in the combustion it is of little importance.

The film of Canada balsam between is so indefinitely thin that its decomposition has no injurious effect. A combustion tube of 18 inches long is only increased in weight about $\frac{1}{10}$th of a grain by this coating, when dry (without the plumbago of course). For the latter, Dutch gold-leaf may be substituted with advantage.

The glass combustion tube is best filled with the oxide of copper, &c. and subject of analysis, before the precipitation of the copper upon it, and the tube is best drawn out to a neck at the end next the kali apparatus, as well as at the remote one, the former being done immediately after the filling; the latter neck is opened on commencing the combustion, and the union with the train of absorbent vessels is made by cork in the usual way, but in inverse order; that is, the first cork is not inserted *into* the combustion tube, but placed *upon* the drawn-out neck. The whole tube being covered with copper, the passage for the gases is ensured by a sharp blow or two on a table of the combustion tube as usual.

This mode of precipitating copper upon glass is also susceptible of many other useful applications in the arrangement of chemical apparatus when heat or pressure is concerned.—*Philosophical Magazine*, No. 153.

EVER-ACTING VOLTAIC BATTERY.

Mr. Bain has discovered that a plate of zinc and a plate of iron buried in the ground, and connected by an external wire, form an Ever-acting Terrestrial Voltaic Battery. It appears that a series of experiments have been prosecuted in the Pennance copper-mine, near Falmouth, for the purpose of developing electricity from the veins of metallic ore contained in the bowels of the earth. At a recent meeting of the Cornwall Polytechnic Society, the results of these researches were communicated by Mr. Were Fox. On connecting, by means of wires, veins of copper with veins of iron pyrites, situated from fourteen to eighteen fathoms asunder, sufficient electricity was developed not only to deflect the needle of the galvanometer, but to decompose solutions of metallic oxides, and to complete the electrotyping process. Thus, it appears there exists a natural Voltaic Battery in the earth capable of producing most powerful effects when called into action.

NEW VOLTAIC BATTERY, BY SCHŒNBEIN.

This consists of zinc and passive iron, or of active and passive iron, in either case excited after the manner of a Grove's battery. The power of such arrangement is said to be very great. Its economy is a matter of importance; and the value of the salt produced (sulph. ferri) is not to be overlooked.

NEW BATTERY, BY SILLIMAN.

Mr. Silliman, jun. has constructed a nitrc acid Battery of *carbon* and zinc. The carbon is described as " an artificial mixture made at the crucible works, and crowded into moulds of the proper shape, and bakéd." But, " the form of carbon most efficient in voltaic circuits is" said to be " that exceedingly hard and pure carbon which is deposited from coal-gas on the heated inner surface of the retorts of the gas-works; but it is so difficult to work it into shape."

NEW BATTERY FOR ELECTRO-GILDING AND METALLURGICAL PROCESSES.

In a valuable memoir, recently communicated to the Academy of Sciences, at Paris, M. De la Rive has shown that, by constructing a simple Battery in which the nitric acid is replaced by a peroxide, and especially by peroxide of lead, it is capable, even when charged only with one liquid, acidulated or salt water, of decomposing water with very great energy; at the same time giving off the gases separately.

As this promises to be of great advantage in many processes in which electricity is employed in the arts, we have thought the following extract might prove interesting to our readers. Speaking of Grove's battery, M. De la Rive states that he attempted to substitute a peroxide in powder for nitric acid, which would have two advantages; first, that of diminishing, like the nitric acid, the resistance; secondly, of obtaining a current by the reduction of the peroxide, the direction of which, being similar to that of the current resulting from the oxidation of the zinc, would considerably increase the electro-chemical power of the pair. There is moreover a great practical advantage in the substitution of a peroxide for the nitric acid, as but one liquid only is then requisite for charging the battery.

The experiments were made with the peroxide of manganese and of lead; the latter was found to be decidedly superior. The peroxide, reduced to the state of a fine dry powder, is heated with care in a porous porcelain vessel, and the plate of platinum placed in the middle of it, so that it is completely surrounded by the peroxide. This plate has an appendage, to which is fixed a copper conductor. The liquid in which the porous vessel, filled with the peroxide, and the zinc plate, are immersed, may be either salt water or sulphuric acid diluted more or less with water.

With the peroxide of manganese only two cubic centimetres of gas were obtained per minute, and the effect became very quickly weaker. With the peroxide of lead even ten cubic centimetres of gas were obtained per minute, and the effect did not cease, although it became somewhat more feeble. Its energy may be entirely restored by changing the direction of the current in the voltameter; the polarization of the electrodes of platina, which is the cause of the apparent diminution of the intensity of the current, is thus destroyed. A pair of Grove's construction gives rise under the same circumstances to a scarcely perceptible decomposition; the difference is much less with regard to calorific effects. A pair of Grove's indicate 425° on Breguet's helix; a perfectly similar pair, but in which peroxide of lead was substituted for nitric acid, produced 450°. Several comparative experiments made with a pair of Bunsen's (Grove's Battery, in which charcoal is substituted for platinum), with a pair of Daniell's, &c., have all proved the vast superiority of the peroxide of lead battery, especially for chemical effects. These effects with the other batteries are either null or almost insensible.

The length of the action is considerable with the peroxide of lead battery, if care be taken to depolarize now and then the electrodes. This Battery is extremely convenient, as it only requires the employment of one liquid, which is very easily procured, *i. e.* of salt water or weak sulphuric acid; so that, both in this respect, as well as with regard to economy, it will replace the compound batteries, which are always dearer and more complicated, in the application of electricity to gilding, silvering, and to metallurgical processes in general.

The superiority of the peroxide of lead batteries is not sustained when several are arranged in a series. A single pair afforded 14°

on a calorific galvanometer formed of a platinum wire 12 centimetres in length and half a millimetre in diameter, which the current had to traverse. Two pairs in a series indicated 18° on the same galvanometer, and afforded 24 cubic centimetres of gas per minute. Two pairs of Grove's gave under the same circumstances 19° on the calorific galvanometer and 27 cubic centimetres of gas per minute. But it is very curious that a battery constructed with a pair of Grove's with nitric acid, and of a pair with peroxide, gave effects surpassing those which had been obtained with a Grove's battery of two pairs, or of two pairs with peroxide of lead. It afforded 24° on the calorific galvanometer instead of 18°, and 32 cubic centimetres of gas per minute instead of 24 or of 27. This superiority is founded on the reciprocal chemical action of each pair on the other pair. A battery of 3 pairs of peroxide of lead gave 72 cubic centimetres of gas per minute. It heated the platinum wire of the calorific galvanometer to redness; and lastly, it gave a beautiful light with the charcoal points. But employed in series, the peroxide of lead batteries have not a very constant power, and a deposit of oxide of zinc is formed on the sides of the porous vessels, which must now and then be removed.

It would seem, from what precedes, that in order for a pair to produce such chemical effect, for instance to decompose water with platinum electrodes, it is requisite that there exist two chemical actions in the pair, giving origin to two currents, the effects of which are combined, the oxidation of the zinc and the reduction of the peroxide.—*Comptes-Rendus*, April 17; *Chemical Gazette*, No. 15.

THE GRAND MAGNETIC MACHINE AT THE POLYTECHNIC INSTITUTION.

It consists of ten magnets placed in juxtaposition, having a combined weight of 156lbs.; in connexion with which are two inductors, encircled by insulated copper wire 1-28th of an inch in diameter. On motion being given to these inductors by means of a treadle, causing them to revolve at a rapid rate, and coming alternately within striking distance of the two poles of the magnets, the points are brought in contact with a small cup of mercury, when beautiful azure sparks are emitted, which are sufficiently powerful to ignite spirits of ether, &c.—*Illustrated Polytechnic Review.*

CHEAP GALVANIC BATTERY.

A correspondent of the *Glasgow Practical Mechanic* states, in consequence of the expense, and for other reasons, he has modified the arrangements of De Moleyns, Grove, and Silliman, so as to do away with the diaphragms altogether, and make the plumbago element the containing vessel for the nitric acid. He supposes this modification to possess another advantage in this, that it brings the elements into closer contact, and makes it equal, if not superior, to a platinized battery of the same surface. The cost of a battery of this description he states to be as follows:—plumbago 2*d.*, zinc 1¼*d.*, jar 1¼*d.*, in all 4½*d.* With this battery a great variety of electro-magnetic experiments may be worked, and phenomena produced; as giving shocks with coals, deflagrating metals, &c.

ELECTRIC LIGHT—SUBSTITUTE FOR GAS.

A highly interesting experiment with the Galvanic Light, proposed by M. Archereau as a substitute for that of gas, has been made lately, on the Place de la Concorde, at Paris. The light exhibited appeared to be about an inch and a half in diameter, and was enclosed in a glass globe of about twelve inches in diameter. In the first instance, the gas-lights of the Place de la Concorde, which are one hundred in number, were not extinguished. The appearance of those nearest the galvanic light was quite as faint, and had the same dull hue, as the ordinary oil-lamps, when near a gas-light of the full dimensions. When the gas-lights of the place were put out, the effect of the galvanic light was exceedingly brilliant, eclipsing even, in the opinion of many present, that of the hydro-oxygen light. It was easy to read small print at the distance of one hundred yards, and it was only necessary to look at the shadow of the objects in the way of the light to be convinced of its great illuminating power. The single light exhibited did not replace the whole of the gas-lights which had been put out, but we may fairly estimate it as equal, at least, to twenty of the gas-burners of the Place de la Concorde, where they are larger in volume than in most of the other parts of Paris. It would, therefore, require five of these galvanic lights to light the whole of the place; but the rays of these five lights meeting each other, would, in all probability, give a much more intense light.—*Mechanics' Magazine*, No. 1057.

ELECTRIC PHOSPHORESCENCE.

On Feb. 21, Mr. Pollock communicated to the London Electrical Society, a series of experiments on electric phosphorescence, which led him to infer that this phenomenon is due to induction, that it is the return of the induced particles to their normal condition, and that conduction, chemical change, and colour, operate against its production.

REDUCTION OF METALS.

On March 9, a paper was read to the Royal Society, entitled, "On the Cause of the Reduction of Metals from Solutions of their Salts by the Voltaic Circuit," by Mr. Alfred Smee.

The reduction of a metal from its solution by the agency of voltaic electricity has, the author states, been explained in three different ways. By Hisinger, by Berzelius, and by Faraday, it has been ascribed to the liberation of hydrogen in this process: Davy and others considered it as resulting directly from the attraction of the metal to the negative pole: and Daniell conceives that the metal [solution?] is directly electrolysed by the action of the voltaic circuit. The author found that the ends of copper wires, placed in a solution of sulphate of copper between two platina poles in the circuit, manifest electric polarity; so that while one end is dissolving, the other is receiving deposits of copper: he also found that platina was, in like manner, susceptible of polarity, although in a much less degree than copper, when placed in similar circumstances. With a view to determine the influence of nascent hydrogen in the voltaic reduction of metals, he impregnated pieces of coke and of porous charcoal with hydrogen, by placing them, while in contact with a metal, in an acid solution, when they thus constituted the negative pole of the circuit; and he found that the pieces thus charged readily reduced the metals of solutions into which they were immersed; and thence infers that the hydrogen is the agent in these reductions. From another set of experiments he concludes that during these decompositions, water is really formed at the negative pole—a circumstance which he conceives is the chief source of the difficulties experienced in electro-metallurgic operations when they are conducted on a large scale, but which may be avoided by a particular mode of arranging the elements of the circuit so as to ensure the uniform diffusion of the salt.

The author obtained the immediate reduction of gold, platina, palladium, copper, silver, and tin, from their solutions by the agency of hydrogen contained in a tube, with a piece of platinized platina in contact with the metallic salt: nitric acid and persalts of iron, on the other hand, yielded their oxygen by the influence of the same agent.

The general conclusion which he deduces from his experiments is, that, when a metallic solution is subjected to voltaic action, water is decomposed, its oxygen passing in one direction, and its hydrogen in the opposite direction; the latter element performing at the moment of its evolution at the negative pole the same part with respect to a solution of sulphate of copper, that a plate of iron or zinc would perform to the solution.

ELECTRO LACE.

A SPECIMEN has been exhibited to the Polytechnic Society, Cornwall, and is thus described in the Report:—"Electro lace is made by stretching common net on a frame of stout copper wire, and then brushing it over with plumbago, until its surface has acquired an uniformly black colour. It is then connected with the negative pole of a galvanic battery, and subjected to the voltaic action, between two plates of copper positively electrified, which causes it to be rapidly and effectually coated with metal, each thread being enclosed in a tube of copper. When it is desired that the sheets of lace be of large size (several feet square, for instance), it will be necessary to divide the large frame by fine wires into squares of seven or eight inches, which forming nuclei for the deposit of metal, enables the sheets to be made of any extent, and at the same time tends to strengthen the work. The uses of electro lace are similar to those of common wire gauze, but when silvered or gilt it forms a beautiful material for fancy work."

PROCESSES OF ELECTRO-PLATING AND GILDING.

AT a meeting of the Society of Arts, a paper has been read descriptive of the above processes of Plating and Gilding. The lecturer commenced by adverting to the well-known action which occurs when zinc and copper are immersed in a solution of sulphuric acid, as illustrative of the principle on which all electro deposition takes place. He then proceeded to explain the construction of the batteries used in the process of electro-plating, and pointed out the advantages derived from them when it was necessary to overcome the resistance of a particular solution, because intensity of power, as well as quantity, were then required. It was also necessary to have a correct balance of power, otherwise the articles exposed to the action of the metalic solution would be wanting in the smoothness of surface which it is necessary they should possess.

For the purpose of showing the rapidity and accuracy with which the electro-plating was effected, several small articles were placed for a few moments in a solution of silver, subject to the action of a model battery which the lecturer had before him. When the articles were withdrawn, they were completely covered with a thin coating of the metal: several pieces of manufacture, such as vases, shields, tea-urns, &c., were shown to the meeting as samples of plating with silver and gold by this galvanic agency. Among the rest, a bread-basket was pointed out which a short time since was so much worn as to be comparatively useless and of little value. It had been completely renovated by this process at a cost of about 28*s*., and looked equal to a new piece of plate of 8*l*. or 10*l*. value.

The lecturer then proceeded to observe, that as it is necessary the articles should be well cleansed from dirt, grease, and other impurities which interfere with the process of electro-plating, they are first boiled in caustic alkali, scoured with sand, and well dried before being placed in the solution. As soon as the required quantity of metal has been deposited on the old article, it is taken out and submitted to a hard rubbing with brushes made for the purpose, by which means any grease or other matter which may have been left on it is immediately discovered, in consequence of the newly-deposited metal being rubbed off the part by the active friction of the brush. When the article has been thoroughly cleansed, it is again placed in the metallic solution, so that *a* fresh deposit may take place on the part which has been found imperfectly plated.

According to the old method, no other metal than copper is available for the purpose of plating; by the galvanic process any kind of metal is applicable; but the metal hitherto generally used is composed principally of nickel, which is as white and about the same density as silver. When proper care has been taken in depositing the metal, the union with the surface below is so much more secure than by any other process, that experienced silversmiths cannot distinguish the difference between such articles and those made of solid silver. When the article is required to be plated with silver, it is placed in a solution produced by dissolving silver in nitric acid and water. A copper wire is then attached to it, and connected with the negative pole of the battery. A piece of silver is also placed in the solution in connexion with the positive pole of the battery. Articles required to be plated with gold are placed in a solution of that metal, and similarly prepared to those required to be plated with silver.

But useful as this process of gold and silver plating is, there are other important purposes to which it can be applied. This process opens a new field for the manufacture of solid silver and gold. If a model of an article is furnished, an exact copy of it can be made with the greatest facility, and instead of an article being made in forty or fifty pieces, it can be easily made in one solid whole, whatever the extent of its superficies, and however elaborate the nature of the workmanship may be. Hitherto, large works cast in the precious metals have been placed beyond the means of the majority of the people, but by the process of electro-plating any work can be executed at comparatively little expense. Copies of wax mould can be easily taken by first precipitating a certain quantity of copper on the mould; the wax can then be melted away, and a deposit of silver, or whatever other metal is required, should be afterwards placed on the copper. By the new process, however, moulds of plaster, wax, and similar materials, are generally disused, and an elastic moulding substituted. A sample of this composition was shown to the meeting. It was stated to be made of glue and treacle, and its flexible nature rendered it superior to the substances generally used for the purpose of moulding, because it can be used in one solid piece or in several pieces, and, if necessary, it can be put together in such a manner that the joinings are scarcely recognized.

The process is not only applicable to the plating of forks and spoons, and articles of that description, but saucepans and other vessels used for culinary purposes may be coated with silver; and as this metal is a greater conductor of heat than iron or tin, a great saving in the consumption of fire will result from the adoption of this plan. The taps of beer-barrels also might be coated with silver, and the accumulation of verdigris would thus be prevented.

Having said thus much of gold and silver, the lecturer next proceeded to refer to the more ordinary and more useful metals, one of the most important of which is zinc. Experiments show that some metals resist the action of water better than others, and it so happens that those which are most generally used are most liable to destruction; such is particularly the case with iron; but zinc is found to be indissoluble in water, and although zinc is now often substituted for iron, yet it has failed to realize the expectations which were at first formed of it, owing, no doubt, to the many impurities which this metal contains. Speaking of the purposes to which zinc had not yet been generally applied, the lecturer observed, that if used by means of the electro-plating process, it would always preserve iron and other metals from oxidation; for instance, iron railings might be preserved from destruction, if the exposed parts were covered with zinc, which might easily be effected at a trifling expense. It may be urged that the application of this process is limited, because, if zinc, copper, and silver, come in contact with each other, they will turn black. But under no ordinary circumstances would they be subjected to this action. By the process of electro-plating, every description of iron-work can be coated with zinc, and thus be protected from the certain ruin which must attend its exposure to the atmosphere. In evidence of this fact, the lecturer produced a piece of zinc which had been exposed to the various changes of the seasons for six months, without showing any signs of decay.

As, therefore, zinc is insoluble in water, as any article can be readily re-coated, and the iron or other metal of which it is made can be by this process completely protected, it must be admitted that this is one of the most valuable metals. In illustration of this part of the subject, and as a proof of the preservative qualities of zinc, the lecturer observed that he knew an extensive manufacturer who had a large water-mill. A few years ago, the expense of keeping the wheels in repair was very great; indeed, he was generally compelled to have new ones every four or five years; at length, he was advised to place some pieces of zinc on the parts of the wheels most exposed to the action of the water; the experiment was completely successful, the oxidation of the iron was prevented, and the expense of keeping the machine in repair is now comparatively trifling.

The lecturer concluded by urging the applicability of electro-plating to the various branches of art to which we have briefly adverted. With respect to gold and silver gilding, he contended for the superiority of the new process. The old mode, irrespective of its imperfections, was so detrimental to human life, in consequence of the quantity of mercury used in the preparations, that hundreds of workmen in the trade were yearly consigned to a premature grave. With regard to zinc plating, he observed that it might be advantageously applied to almost all the purposes where iron was used in maritime affairs, to the prevention of oxidation in iron balustrades, and the ornamental parts of buildings, and to the preservation of the bronze statues in the metropolis, which were rapidly decaying from exposure to the action of the atmosphere.

An equally remarkable application of science to this branch of art has been made by Mr. J. S. Woolrich, of Birmingham. It consists in the accomplishment of the same purposes by means of *Magnetism*. Every one is acquainted with the property which the magnet possesses of attracting steel needles, and of communicating the magnetic property to iron and steel, but it will no doubt surprise most persons to see the same power employed in the art of plating metals. Referring the reader for a full explanation of the details of the process to the inventor's specification, we shall here content ourselves with pointing out some of the more prominent advantages which this process of *magneto-plating*, as it is appropriately termed, appears to possess over electro-plating. Being effected without the aid of galvanism, neither acids nor salts are employed, and there is no wear and tear of galvanic batteries. In fact, when the apparatus is complete, the cost of which is moderate, it will last for an almost unlimited period of time; for as there is no destruction in working it of any of its parts, except by friction, it must be long before any renewal of them can be required. The apparatus, too, may be relied on for working with the greatest certainty and regularity, in both which respects the galvanic battery is greatly deficient. The facility with which it may be managed is also remarkable, the same machine being capable of plating articles from the size of a pin's head to that of a candelabra.—*Mechanic's Mag.*

Mr. W. H. Fox Talbot has patented the following important processes. The first of these improvements consists in preparing the surfaces of metallic articles, intended to be gilt, by giving them a very thin coating of silver. This may be done by dipping them in a weak solution of silver in hypo-sulphite of soda; but any other suitable method may be adopted. The second improvement consists in a method of preparing the surfaces of metallic articles, which are to be gilt or silvered. When the article to be coated has been well cleaned, it is attached to one of the poles of a voltaic battery, and then both the poles are plunged into a vessel, containing a mixture of water with any suitable acid or salt. The battery is so arranged that decomposition of the water ensues, and the article gives off hydrogen gas for some time; it is then quickly detached from the battery, and being thrown into a vessel, containing a proper solution of gold or silver, it receives a coat of one of those metals. It is after this washed in pure water; and this process is repeated until a coating of sufficient thickness is obtained.

The patentee claims preparing the surface of articles, intended to be gilt or silvered, by causing them to give off hydrogen, being connected with the poles of a voltaic battery as aforesaid. The third improvement consists in gilding metallic articles by dipping them into a mixed solution containing gold, and one of the baser metals; those metals being excluded which would precipitate gold. The patentee claims, under this head, employing a mixed solution of gold, and one of the baser metals, (with the exception of mercury,) for the purpose of gilding metallic articles. The fourth improvement consists in using a solution of chloride of gold, mixed with a solution of boracic acid, for the purpose of gilding articles of brass or other metal; by which means a more pleasing colour is produced than when the chloride is used alone. Boracic acid may also be added to other solutions of gold. The fifth improvement relates to a method of removing the dark tint which metallic articles acquire after being dipped into a solution of gold not altogether suitable for gilding. It is removed by dipping the articles into a very weak solution of nitrate of mercury, in water, which soon causes the surface to brighten; the articles may then be dipped into the solution of gold, and again into the solution of mercury, and so on, alternately, until the desired coating is obtained. Any excess of mercury may afterwards be removed by an acid, assisted by voltaic action. The patentee claims the use of a solution, containing mercury, for the purpose of improving the appearance, or brightening the surface of articles which have been gilt imperfectly, or of too dark a colour; and the method, above described, for removing the excess of mercury from gilt articles by voltaic action.

The last part of this invention has reference to the fact, that if metallic articles are dipped into a solution of silver, they only receive a coating of limited thickness; the effect ceasing after a time, and no more silver being deposited, in consequence of the metal on the surface of the article having become similar to that in the solution; but, if made again dissimilar, the effect is, to a certain extent, renewed. The improvement consists in creating such dissimilarity, by dipping the article into a different solution of silver, or into a solution of some other metal, and then replacing it in the first solution of silver; these dippings are to be repeated alternately. This method, of alternate dipping, may also be applied to the solutions of gold. The improvements, above described, are more especially applicable to the coating of brass, copper, silver, German silver, iron, and steel.

PALMER'S PATENT GLYPHOGRAPHY, OR ENGRAVED DRAWING.

THE term Glyphography is derived from two Greek words, *glupho, I engrave*, and *graphein, to draw*, and signifies that art by which an engraving is produced by the simple mode of drawing; or, in other words, drawing and engraving, which have hitherto been two distinct operations, are here combined in one.

The description of the process is as follows:—

A piece of ordinary copper plate, such as is used for engraving, is stained *black* on one side, over which is spread a very thin layer of a *white* opaque composition, resembling white wax both in its nature and appearance: this done, the plate is ready for use.

In order to draw properly on these plates, various sorts of points are used (according to the directions here given), which remove, wherever they are passed, a portion of the white composition, whereby the blackened surface of the plate is exposed, forming a striking contrast with the surrounding white ground, so that the artist sees his effect at once.

The drawing, being thus completed, is put into the hands of one who inspects it very carefully and minutely, to see that no part of the work has been damaged, or filled in with dirt or dust; from thence it passes into a third person's hand, by whom it is brought in contact with a substance having a chemical attraction or affinity for the remaining portions of the composition thereon, whereby they are heightened *ad libitum*. Thus, by a careful manipulation, the *lights* of the drawing become thickened all over the plate equally, and the main difficulty is at once overcome; a little more, however, remains to be done. The depth of these non-printing parts of the block must be in some degree proportionate to their width; consequently, the larger breadths of *lights* require to be thickened on the plate to a much greater extent, in order to produce this depth. This part of the process is purely mechanical, and easily accomplished.

It is indispensably necessary that the printing surfaces of a block prepared for the press should project in such relief from the block itself as to prevent the probability of the inking-roller touching the interstices of the same whilst passing over them; this is accomplished in wood engraving by cutting out these intervening parts, which form the lights of the print, to a sufficient depth; but in Glyphography the depth of these parts is formed by the remaining portions of the white composition on the plate, analogous to the thickness or height of which must be the depth on the block, seeing that the latter is in fact (to simplify the matter) a cast, or reverse of the former. But if this composition were spread on the plate as thickly as required for this purpose, it would be impossible for the artist to put either close, fine, or free work thereon; consequently the thinnest possible coating is put on the plate previously to the drawing being made, and the required thickness obtained as described.

The plate thus prepared is again carefully inspected through a powerful lens, and closely scrutinized, to see that it is ready for the next stage of the process, which is, to place it in a trough, and submit it to the action of a galvanic battery, by means of which copper is deposited into the indentaticns thereof, and, continuing to fill them up, it gradually spreads itself all over the surface of the composition until a sufficiently thick plate of copper is obtained, which, on being separated, will be found to be a perfect cast of the drawing which formed the *clichée.*

Lastly, the metallic plate thus produced is soldered to another piece of metal to strengthen it, and then mounted on a piece of wood to bring it to the height of the printer's type. This completes the process, and the glyphographic block is now ready for the press.

It should, however, have been stated previously, that if any parts of the block require to be lowered, it is done with the greatest facility in the process of mounting.

Mr. Palmer prefers confining to himself the process and the manipulation by which he has succeeded. We are only made acquainted with the fact, that it is by the immediate agency of electro-galvanism he has arrived at the results we have seen.

ETCHING BY ELECTRICITY.

Dr. Price, of Bath, has communicated to the *Philosophical Magazine*, No. 150, the following method of Etching on Hardened Steel Plates, and other polished Metallic Surfaces, by means of Electricity. Having six batteries of the kind invented by Mr. Smee, the platinized silver plate of each being about three inches square, Dr. Price attaches the steel plate to be etched upon to the zinc extremity of the batteries, a coil of covered wire, of considerable length, being previously interposed between the steel plate and the zinc; then taking the wire connected with the platinized silver in his hand, he uses it as an etching-tool on the steel plate; an electrical spark of great brilliancy, accompanied by a slight indentation on the steel, is the result of each contact of the wire with the plate.

The wire by which the etching is made is of platina; the part at which it is held is carried through a glass tube for the purposes of affording a more convenient handle, and of protecting the hand from shocks to which it may otherwise have been exposed.

By using the wire connected with the zinc of the batteries as the etching-tool, and attaching the steel plate to the platinized silver, a very different effect is produced. With the apparatus thus arranged, the spark that results from the contact of the wire with the steel plate is accompanied by a deposition of a minute portion of the substance of the wire on the steel; by using different wires, therefore, as of gold, silver, platina, &c., a variety of ornamental designs may, probably, be formed on polished steel surfaces.

The effect of the electrical agency here described is not, however, confined to steel; a somewhat similar one may be obtained by substituting plates of other metals. By augmenting the quantity and intensity of the electrical current, it seems probable that the effect on the steel, or other metals, would be proportionally increased; and it may be anticipated that, by other modifications of the process, its applications may be advantageously extended.

Dr. Pring has forwarded to the Editors of the *Philosophical Magazine* a steel plate, on which the words "Etched by means of Electricity, Bath, 30th June, 1843, I. H. P.," together with some ornamental devices, had been produced by the above method. It gave only a faint, just legible impression, by the copper-plate press.

ANIMAL ELECTRICITY.

On Feb. 18, a lecture was delivered before the London Electrical Society, by Mr. H. Letheby, "On Animal Electricity," in illustration of the reasons advanced in a paper read at a recent meeting in favour of the theory which recognizes a closer connexion between nervous energy and the electrical power of certain fishes. This theory is strongly confirmed by the abundant supply of nerves furnished to the electric organ; by the necessity of integrity in the nerve for producing the electric effect; by the nervous exhaustion consequent on exercising the power; by cessation of the animal functions during extraordinary developments of electricity; and by the muscular effects consequent on passing electricity along the nerves of recently killed animals.

NOVEL EXPERIMENTS IN ELECTRICITY, BY SIR GRAVES C. HAUGHTON.

If a needle of any of the malleable metals, or of other substances, such as wood, ivory, quill and straw, or even of glass or sealing-wax, be placed in a galvanometer of the simplest form, and one end of the wire be fixed in *metallic* contact to the hook of the prime conductor of an electrifying machine, less than a quarter of a revolution of the handle will, if the machine be in good working order, cause the needle to stand at an angle of 90°. If the proper needle of the galvanometer be employed instead of one of the foregoing, it will place itself at an angle of from 75 to 80°, and will preserve that position as long as the machine is kept in operation. The needles with which these experiments were tried varied in length from three inches to five-eighths of an inch. The galvanometer stood at first simply on a mahogany table, but the results were not certain with every kind of needle, owing apparently to their faulty construction; when, however, it was placed on a good insulator, the experiments never failed. It is worthy of remark, that whenever the state of the atmosphere was unfavourable to the working of the machine, which has been uniformly the case during the present month, in consequence of the dampness of the weather, a singular difference occurred between two needles, one of which was of brass and the other magnetic, and both of them five-eighths of an inch in length. The brass one invariably placed itself at right angles, while the magnet remained uninfluenced, though it was the more delicate of the two, as it had an agate socket. This fact, as well as what I have just stated of the other magnetic needle, showed that there was a struggle between the polarity of the needle and the influence of the electric current. It was observed that whenever there was a powerful stream of electricity employed, it was seen to escape in a beautiful pencil of light from the point of the other end of the wire, which was kept coiled up and unemployed. The machine used in these experiments is of the plate construction, and eighteen inches in diameter, but is at present in very indifferent working order.

M. Becquerel mentions in his History of Electricity that he thought he had made needles of various substances move in a galvanometer when under the influence of a *voltaic* current, but that he afterwards found that the slight movements he had observed were owing to currents of air occasioned by the heat evolved. The present experiments, however, are so decisive and unequivocal, that they cannot be attributed to such a cause; still my own convictions are, that they are not dependent upon magnetic influence.—*Philosophical Magazine*, No. 144.

ACTION OF WEAK ACIDS ON COPPER VESSELS PLATED BY THE ELECTROTYPE PROCESS.

Mr. Warington, of Apothecaries' Hall, had brought under his notice a fact of great importance in domestic economy and practical pharmacy, viz. that Copper Vessels, as saucepans, extract-pans, &c., silvered by the Electrotype Process, are acted upon by weak acids, as lemon-juice and vinegar, if allowed to remain in them for a short time. This must arise from the deposited silver being so porous as to allow the acids to permeate its substance, and the action is most likely assisted by the formation of a galvanic circuit. The presence of copper was strongly evidenced by the usual tests.—*Communicated to the Philosophical Magazine.*

Chemical Science.

HEAT OF COMBINATION.

Dr. Andrews has communicated to the British Association, a paper announcing the following general principle, as a consequence of previous researches of the author on the same subject, and a general account of some recent experiments which appear to him to establish its accuracy. The law may be thus stated: "When one base displaces another from any of its neutral combinations, the heat evolved or abstracted is always the same when the base is the same; or, in other words, the change of temperature which occurs during the substitution of one base for another in any neutral compound, depends wholly upon the bases, and is in no respect influenced by the acid element of the combination." To test the accuracy of this principle by direct experiment, equivalent solutions of various neutral salts were decomposed by the addition of a dilute solution of the hydrate of potash. When the strength of the solutions and their temperatures were properly adjusted, the same variation of temperature always occurred during the decomposition of salts of the same base. If the base (in the state of a hydrate) developed, when alone, less heat than the hydrate of potash in combining with the acids, an elevation of temperature occurred during the decomposition of its salts by the latter; if the reverse were the case, the decomposition of the salts was attended by a diminution of temperature. Thus the decomposition of equivalent solutions of the salts of the oxide of copper, was attended by the evolution of the same amount of heat, as was also the decomposition of the salts of the oxide of zinc; but the heat extracted by the former was about twice as great as that extracted by the latter, because the oxide of copper produces less heat in combining with the acids than the oxide of zinc. The salts of lime furnish an example of an absorption of heat when their solutions are decomposed by potash,—a circumstance easily explained by the fact which has been before established by the author, that the hydrate of lime, when combining with the acids, developes more heat than the hydrate of potash. But, in accordance with the principle before stated, the diminution of temperature is the same with equivalents of all the salts of lime. In an inquiry of this kind many precautions are requisite, in order to obtain accurate results. Among the most important may be mentioned, the exact neutrality of the salt to be decomposed, a perfect equality of temperature in the solutions before mixture, and the precipitation of the oxide in the state of a pure hydrate, and not of a subsalt.

Professor Kane thought it highly probable that the law propounded by Dr. Andrews will eventually be judged by chemists to be the most important communication made to this Section of the Association. Professor Apjohn observed, that the hydracids and oxyacids developed the same amount of heat in combining with a base. Professor Kane observed, that if we mix an atom of the oil of vitriol with an atom of water, a considerable degree of heat is developed. Now, the concentrating of this dilute acid was not simply a case of evaporation, but one of decomposition; and it would appear that the same quantity of heat was necessary to effect that decomposition as was developed during the combination.—*Athenæum*, No. 826.

PRODUCTION AND PREVENTION OF SMOKE.

Mr. Dircks, in a paper read by him to the Chemical Section of the British Association, thinks it important to distinguish between open fires, and close fires or furnaces. Open fires would always allow an escape of absolute coal gas, and admit atmospheric air to the chimney; whereas the contrary would be the result with the close fires of engine-boiler furnaces. He said that the leading fact of consequence, in reference to the smoke, was, that it differed materially from the impure gas evolved from the coal in the furnace. The plans hitherto adopted by manufacturers were chiefly intended to burn *smoke*, and the great principle of all such plans is to burn the largest quantity of fuel with the least quantity of air. The error of this method must appear to every one conversant with chemistry. Smoke may be considered as mere carbonaceous matter floating in an atmosphere of the ordinary incombustible products of combustion; the admission of air to this smoke is of no value, as it will only cool it, and make it more readily deposit its sooty particles. The impure gas of the coal, on the contrary, may be inflamed by a due admixture of air. In conclusion, Mr. Dircks begged to state as a general principle, that on the large scale of the furnace, air should be supplied to the impure gaseous products of the fuel by a source independent of that supplying air by the ash-pit to the solid fuel.

Professor Apjohn inquired whether Mr. Dircks spoke of Mr. Williams's plan of admitting air to furnaces, and on his replying in the affirmative, he said that he had read Mr. Williams's Treatise on the "Combustion of Coal," which gave a correct view of the chemistry of the subject, and, indeed, seemed to have almost exhausted it. Mr. West made some remarks on smoke consuming. Mr. Dircks, in reply, said that he agreed with Mr. West in the possibility of burning smoke, agreeably to popular phraseology, but he did not think it possible in a scientific sense. The Chairman explained that Mr. Dircks was correct in his statement, as to the propriety of supplying the air before the gaseous products assumed the state of smoke, at which period only it was available for the proper chemical prevention of smoke.—*Ibid.* No. 827.

INFLUENCE OF LIGHT ON METALLIC AND OTHER COMPOUNDS.

Mr. R. Hunt has detailed to the British Association the results of his experiments, made with nearly every variety of chemical combination. It was not in the view of establishing any theory relative to the solar agency that this matter was brought before the Section, but merely to put upon record a great number of facts, which appear to prove the constant acting of the sun's rays upon all bodies, and to show the boundless extent of this inquiry. It has been shown, by

Petit, that light influences the arrangement of crystals. Labillardière and Michellotti have shown the necessity of light to the development of pores in plants, and its injurious influence on young plants and animals. The experiments of Ritter, and others, down to the time of Niepce and Daguerre, have shown many peculiarities in the action of this agent. But since that period the list has been wonderfully increased by the researches of Wollaston, of Davy, of Fox Talbot, and, above all, by the extraordinary discoveries of Sir John Herschel. We are now acquainted with combinations of silver, of gold, of mercury, and of iron, with many non-metallic bodies, which are speedily changed under the sun's influence, and which are sufficiently sensitive to be used as photographic agents. The author has been successful in adding platinum to the list of photographic agents; which metal gives considerable promise of utility in the art. He has also been successful in producing photographic images on the salts of manganese, of tin, of antimony, of lead, of cobalt, and of arsenic. He has produced pictures with chlorine, iodine, and chromine vapours received upon the surfaces of a great variety of metals, and even on wood and on leather; and many of the alkaline and earthy salts have given evidence of this extraordinary property of the sun's rays. The author contended, that from the extensive series of results which he had obtained, he was fully warranted in expressing it as his opinion that all bodies were constantly, under the influence of the solar emanations, undergoing a change of state; that, indeed, photographic images were always formed, on whatever body a shadow fell: we were ignorant of the immediate agency by which these images were called forth; but we were rapidly arriving at the knowledge we desired.

Many of the photographic specimens on the table were remarkable for the extreme fidelity with which the images were delineated, and the variety of tints they had assumed.—*Ibid.* No. 827.

ACTION OF WATER ON LEAD.

Mr. West has read to the British Association, a paper "On a remarkable case of Corrosion of Lead by Spring Water, after passing through an Iron Pipe." In the case related, the water of a spring, which had flowed into and from a leaden reservoir for sixty years without injury to either, and which passed through leaden pipes without metallic impregnation, when further conveyed a long distance, through iron pipes, contained lead in solution, and was so destructive to the bottoms of the leaden cisterns, into which it next flowed, that some of them had to be renewed in five or six years. Mr. West stated the analyses of the water in question, which, except as to the lead, were the same when taken from all the three situations; he imputes the mischief to contact with oxide of iron from the pipes, and considers that the remedy must be mechanical, by coating the iron pipes or the leaden cisterns with some other substance, so as to preserve the lead itself from contact with peroxide of iron.

FORMATION OF FAT.

A PAPER has been read to the Chemical Society, "On the Formation of Fat in the Animal Body," by Dr. Justus Liebig. The carnivorous races of animals thrive on azotized food, which supplies material to replace their wasted tissues, and these wasted tissues again afford material to be oxidated or burned in respiration, and support the animal heat. But besides azotized matter, the food of the graminivorous races contains sugar, starch, and gum, which are not employed in the proper nourishment of their bodies, but solely for the generation of animal heat by combustion at the expense of the oxygen of the air. The disappearance in like manner of fat in the animal system, in circumstances where rapid oxidization is known to occur, seems to point out a similarity in the use of the latter, which thus becomes burned in the body into carbonic acid gas and water, in the absence of the vegetable principles above mentioned. It is well known that graminivorous animals, abundantly supplied with food containing starch or saccharine matter, and whose respiration is, to a certain extent, checked by want of motion and exercise, become in a short time loaded with fat, which the above consideration indicates to have been formed out of the excess of non-azotized food over and above that required for respiration. This is supposed to take place by a metamorphosis analogous to that by which alcohol and carbonic acid are produced from sugar. This opinion of the origin of fat has recently been called in question by M. Dumas, who contends, that the whole fat of an animal has been furnished ready formed, in that state, by the food itself, and cites an experiment in which a goose has been fed for some time upon maize, supposed to be free from fatty matter, the starch of the grain appearing to have generated the fat found in the bird, an inference which he rejects by showing that maize itself contains a large quantity of oil: it therefore became desirable to obtain additional evidence on the subject. In an experiment at Giessen, three young pigs were fed, during thirteen weeks, on peas and potatoes, the quantity of fat contained in these vegetables being calculated from the researches of Braconnot and Fresenius. It was found, at the expiration of that time, that the bodies of these animals contained no less than about seventy pounds more fat than could possibly have been given in the food, and which was therefore inferred to arise from an alteration of the starch. An equally satisfactory experiment is described by Boussingault, in which the butter furnished by a cow was found to exceed greatly the fat of the food. The author then states the result of a chemical examination of hay and straw, with reference to fatty matter, and describes them to contain about 1·5 per cent. of a crystalline waxy matter, mixed with chlorophyll, altogether different from ordinary fat. The excrements of a cow, fed on those substances, corresponded very closely to the whole quantity contained in the food; so that it appears quite evident that the fat of the butter does not arise from this source. The author concludes with observations on the composition of maize, which contains very different quantities of oil, from 1 to 9 per cent. in different localities.—*Athenæum*, No. 800.

FATTENING ANIMALS.

On February 13, was read to the Academy of Sciences, at Paris, a memoir, by MM. Dumas, Boussingault, and Payen, "Of Researches on the fattening of Animals, and on the formation of milk." These philosophers announce their belief that fatty matters are formed in plants alone; that they thence pass, ready formed, into the bodies of herbivori, entering the chyle duct by the lacteals, and so passing into the blood; that the first degree of oxidation forms stearic or oleic acid; a further degree produces the margaric acid, which characterizes fat; a still further degree the volatile fatty acids—in opposition to Liebig, who traces the origin of fat to the sugar or starch of the food. In confirmation of their views, they show that hay contains more per cent. of oleaginous matter than is produced in the butter from a cow fed on this hay; and that cows fed on potatoes, or other roots poor in fat, produce much less butter. They advance an inference, which bears much on rural economy, that a cow eliminates twice as much fat from a given quantity of food as does an ox; and hence that the commerce of milk and butter deserves a high degree of attention. Some relative experiments on fattening pigs bear out the same general principles.—*Illustrated Polytechnic Review*, No. 12.

COMPOSITION OF MILK.

A paper has been read to the Chemical Society, "On the Changes in Composition of the Milk of a Cow, according to its Exercise and Food," by Dr. Lyon Playfair. The principal object which the author had in view in this paper is to draw the attention of practical men to the conditions which effect a change in their dairy produce. An improved mode of analysing milk is described and followed. The cow being in good milking condition, and at the time fed upon after-grass, he ascertained the average amount of her milk for five days, and then proceeded to analyse it. In the first day it was observed that the milk of the evening contained 3·7 per cent. of butter, and of the following morning 5·6 per cent. The deficiency in the first observation is referred to the consumption of a greater portion of the butter or its constituents, from respiratory oxidation during the day when the animal was in the field, than during the night when it was at rest in the stall. When confined during the day, and fed with after-grass in a shed, the proportion of butter rose to 5·1 per cent.; when fed with hay, the butter was 3·9 and 4·6 per cent.; when fed with portions of potatoes, hay, and bean flour, the butter was 6·7 and 4·9 per cent.; with hay and potatoes, 4·6 and 4·9 per cent. The author then examines Dumas' theory of the origin of fat in animals, in reference to the foregoing experiments, and concludes, in opposition to that theory, that the butter in the milk could not have arisen solely from the fat contained in the food, while it may reasonably be referred to the starch and other unazotized elements of the food, as maintained by Liebig. Experiments of Boussingault are quoted in favour of the same conclusion, and observations of dairymen in different localities. Potatoes are particularly favourable to the flow of milk and increase of butter, from the starch they contain; so is malt-refuse. Porter and beer are also well known to be favourable to the production of butter, both in the milk of woman and of the cow, although these fluids do not contain fat. The quantity of caseine (cheese) in the milk, is shown to be dependent on the quantity of albumen in the food supplied on different days to the cow, and to the supposed destruction of the tissues by muscular exercise. Peas and beans are the food which yield most caseine. Pasturing in the open field is more favourable to the formation of caseine, while stall-feeding is more favourable to the formation of butter. It is also shown, that the proportion of butter, in the milk of woman, is increased by rest and the diminution of the respiratory oxidation.—*Athenæum*, No. 800.

THE LACTOSCOPE.

M. DONNE has introduced "A new instrument designed to indicate the proportion of cream contained in milk," to which he has given the name of Lactoscope. The principle of the instrument is based on the inherent property of milk, which derives its opacity from the globules of fatty matter it contains, in being more opaque as the cream is more abundant. The construction is so arranged that the degree of opacity may be examined in layers of various thicknesses. The milk is placed between two parallel plates of glass, the distance between which can be varied at pleasure, and the flame of a taper is employed as a test; a graduated circle indicates the thickness of the layer of milk, and a corresponding table of reference gives the amount of cream. The sensibility of the instrument is such as to indicate dilution with one-twentieth the bulk of water.

Upwards of ten years since was invented a cream-gauge, for the same purpose as M. Donné's Lactoscope: it is a graduated glass tube, and has, we believe, been found very useful.

ABSORPTION OF NUTRITION IN FOOD.

ON Feb. 25, MM. Sandras and Bouchardat detailed to the Academy of Sciences, at Paris, some experiments made, with a view to ascertain the mode of Absorption of the different elements of Nutrition contained in the principal articles of food used by man or the lower animals. Taking as a basis that soluble aliments are absorbed by the veins, and insoluble aliments by the chyliferous tubes, it remained to be ascertained in what way nature had provided the means of rendering certain aliments soluble, or of separating them to such a degree as to enable them to pass through the chyliferous tubes. MM. Sandras and Bouchardat divided their experiments into two series: one chemical, the other physiological. The chemical experiments showed the action which water, slightly acidulated by chloridic acid, exercises upon the fibrine, albumine, caseum, gluten, and the gelatinous tissues. All these substances enlarge and become translucent, and some of them dissolve. It is sufficient, in order to produce most of these phenomena, to add to 10,000 grammes of water 6 grammes of hydrochloric acid, but it was found necessary, in order completely to dissolve the fibrine, to add a few drops of rennet. Hydrochloric acid, therefore, is not the sole dissolving agent in the gastric juice; the animal matter, called pepsine, or chymosine, must also be present. This being admitted, it appears probable, from the experiments of MM. Sandras and Bouchardat, that neutral azotized animal substances, when once dissolved in the stomach, pass directly into the veins. This is the case with gluten. Starch and fecula are wholly or partially converted into lactic acid in the stomach, and are absorbed in this form. Neither starch nor sugar is found in the chyle during a course of feculent alimentation. Greasy substances resist the action of the stomach; and pass into the intestinal canal, where they form a sort of thick cream, and at the same time the chyle, under their influence, developes itself in extraordinary abundance in globules capable of rendering them milky and opaque. According to MM. Sandras and Bouchardat, therefore, greasy substances are the main agents in the production of chyle, so necessary for the process of digestion.—A communication was read relative to some experiments on the blood, by MM. Andral and Gavairet. These gentlemen, struck with the fact that a professor had succeeded in precipitating albumine in the form of globules, by adding a sufficient quantity of water to serum neutralized by an acid, repeated M. Liebig's experiment, and found that the globulous bodies, which developed themselves in the serum of the blood, were nothing less than the first rudiments of vegetable fermentation. Their experiments were repeated on the white of an egg, and on various serosities produced by disease, and the result is, that, whatever may be the albuminous liquid, the alkaline property of which is removed by an acid, the same phenomenon presents itself.—*Athenæum*, No. 800.

EFFECTS OF SUGAR IN DIET.

M. C. CHORAT has stated to the Academy of Sciences, at Paris, that he made seventeen experiments on dogs, and ascertained that in some cases the Sugar tended to fatten the animal, and in others turned to bile. In the first case there was in general a tendency to constipation; in the other, the bowels were relaxed. The author observes that milk as well as sugar has the tendency of fattening or creating bile, according to the systems of the persons who use it exclusively, or make it the principal article of food; and where bile is thus created, a diarrhœa ensues, which causes a wasting of the solids. The value of his experiments consists in their having been made under circumstances favourable to the elucidation of the question as to the degree to which this article may be used in diet with due regard for health. Few of our own species have ever made sugar exclusively their diet; and we have had comparatively but uncertain evidence as to its effects. The reporter in *Galignani* observes, that the celebrated Bolivar had, by fatigue and privations, so injured the tone of his stomach, that he was unable at times to take any other food than sugar, which in his case was easy of digestion. It has been stated by his personal friends that in some of his last campaigns he would live for weeks together upon sugar alone as a solid, with pure water as a liquid; but, probably, in

999 cases out of 1000, this diet would have soon brought the person adopting it to the grave; for although the nutritive powers of sugar are well known, inasmuch as saccharine matter forms one of the bases of our sustenance, yet it is equally true that with many the excessive use of sugar brings on indigestion in its worst forms. Where the digestion is feeble, excess of nutriment, instead of being absorbed generally in the system, turns to bile, and causes debility and wasting to a high degree.—*Athenæum*, No. 835.

NUTRITIVE VALUES OF BREAD AND FLOUR.

Dr. R. D. Thomson concludes an important paper "On the Results of the Pannary Fermentation, and on the Nutritive Value of the Bread and Flour of different Countries," with the following table, the results of the analyses, collected so as to exhibit the comparative value of each specimen. The first column gives the amount of azotized principles contained in each, and the second column represents their equivalent value in the nutritive scale.

	Azotized principles. per cent.	Equivalents.
1. Naumburg bread	16·49	100·00
2. Dresden bread	14·30	115·31
3. Berlin bread	14·21	116·04
4. Canada flour	13·81	117·23
5. Essex flour	13·59	121·33
6. Glasgow unfermented bread	13·39	123·15
7. Lothian flour	12·30	134·06
8. United States' flour	11·37	145·03
Ditto, by mechanical analysis	10·99	150·00

This table shows that the German and Canada flour contain most nutritive matter; the Essex flour being only a slight degree lower in the scale. It must be borne in mind, however, that this result may not be in consonance with the opinion of the baker in reference to the capacity of the flour for making good bread, because it takes in another element, the albumen, which is omitted in the baker's estimate. It is therefore quite possible that the specimen holding the lowest position in the table may answer the purpose of the baker in an equal or superior manner to those placed above it; but the method of determining the comparative value of flour by the estimation of the azote may furnish us at once with data of utility both in commerce and economy.—*Philosophical Magazine*, No. 153.

SALINE MANURES CONTAINING NITROGEN.

Mr. W. M. F. Chatterly has reported to the Chemical Society, some experiments with Saline Manures containing Nitrogen, conducted by him on the Manor Farm, Havering-atte-Bower, Essex. We have not space for the details, but merely for a few of Mr. Chatterly's conclusions. He is led to believe that no cheaper top-dressing than sulphate of ammonia can be applied to wheat or oats on this land, which is generally a heavy clay upon a subsoil of London clay, when the plant requires it, either from its being sickly or thin on the ground, in consequence of the land being somewhat out of condition, whether from unusual wet, bad seed-time, uncongenial spring, or any such-like cause. It should be added, that equal benefit appears to have been derived from its use upon a light gravelly soil upon a subsoil of gravel, upon the same as the London clay formation.

Attention has been particularly directed to sulphate of ammonia on account of its low price as compared with other nitrogenous manures —a point upon which the extensive practical application of any manure must chiefly depend. The price was 17s. per cwt.; it is prepared at the Gasworks in Brick Lane, by a patent process for purifying coal-gas by means of dilute sulphuric acid, and is very free from impurity.

A specimen of manure sold as Daubeny's sulphate of ammonia at 12s. the cwt. did not give any traces of ammonia when mixed with caustic lime, but consists almost entirely of sulphate of lime, and is worth no more to the farmer than gypsum, which may be obtained at £2 a ton.

This manure is said to be prepared according to the directions of Dr. Daubeny of Oxford, by pouring the ammoniacal liquor of the gas-works upon finely-powdered gypsum: even if it were so, the per centage of sulphate of ammonia to be thus obtained cannot make its value, as compared with pure sulphate of ammonia, as 12 to 17; and its name, "Daubeny's Sulphate of Ammonia," unqualified as it is by any explanation of its composition, is liable to lead the agriculturist, unable to detect its nature, into serious loss and error*.

The nitrogen of coal is the store accumulated by the vegetation of past ages, before man converted it to his use; but now that this inexhaustible source of a material so necessary to increase the quantity of food to be obtained from the present race of plants is opened, it is proper to examine the most advantageous mode of employing it, that so great a boon be neither neglected nor wasted.

AMMONIACAL GAS.

On Nov. 13, there was received, by the Academy of Sciences, at Paris, a communication from M. Schattenham, on the Use of Liquid Manure and Ammoniacal Salts for corn fields, and the advantages of rolling. The author states, that the cost of manuring a hectare (two and a half acres) of land with ammoniacal salt, dissolved in water, amounts to 240 francs, but that the produce is increased in a proportion larger than the expense. He dissolves two kilogrammes of sulphate and hydrochlorate of crystallized ammonia in 100 litres of water. The use of the roller in young wheat fields he describes as of the greatest importance. The wheat grows, he says, steadily and strong after this operation, and none of the roots fail.

SELF-GENERATING GAS.

A COMMUNICATION has been received by the Academy of Sciences,

* See Year-Book of Facts, 1843, p. 214.

at Paris, from MM. Rouen and Busson, on a "Mode of Lighting by means of a Self-generating Gas." The substance employed is coal naphtha, an essence obtained from the distillation of the coal tar, which is one of the products of the distillation of coals for gas-lighting, producing a more perfect combustion of the naphtha than was ever before obtained by the apparatus of the lamp or burner; the gas is projected to some distance in the air before it takes fire, there being, however, within the tube of the burner a constant flame, which serves the double purpose of igniting the gas and decomposing the naphtha with which the lamp is supplied, generating new gas for continued combustion. The gas, being consumed at a short distance from the burner, is thoroughly supplied with air, and this free supply causes perfect combustion, and a brilliant light without smoke. The use of this light is attended with an economy of five-sixths as compared with oil, an equal quantity of light being furnished at a sixth of the expense.

PORTABLE GAS.

THE *Censeur* of Lyons states, that at one of the sittings of the Municipal Council, a trial was made of a new portable gas, to which its inventor has given the name of *hydroluminous*. The apparatus, says this journal, is very simple, and applicable to the smallest candlesticks as well as to the largest and most splendid candelabra. The light it gives is very fine, and it is so portable that it may be carried about with the commonest hand-candlestick.

PROTECTION FROM ACCIDENT BY DELETERIOUS GAS.

AN invention is described in the French papers, which will, it is said, give such timely notice of the presence of deleterious gas in mines, or other places, as will enable persons to take the necessary precautions to guard against explosions. An explosion from the admixture of carburetted hydrogen with atmospheric air can only take place when the former exists in a certain and known proportion. When the quantity has reached or exceeded this point, the contact of a light instantly causes an explosion. The instrument recently invented has a sort of tell-tale to show the existence of danger; is simple, ingenious, and effectual. Connected with a chemical solution is a kind of float, nicely graduated, and attached to a counterpoise. The solution is of such a nature that it undergoes a change when acted upon by the admixture of carburetted hydrogen, and when saturated to a certain point the float changes its position, and acting in its turn upon the counterpoise, a spring is let loose, and strikes upon a bell or drum, giving out a loud sound, and thus indicating the presence of danger. This ingenious test is not liable to derangement, and the whole apparatus is comprised within a small compass, and of little cost. The solution can be varied, so as to be adapted to every kind of deleterious gas.

CHANGE IN IRON.

MR. W. LUCAS has mentioned to the Chemical Section of the

British Association an exceedingly curious and interesting fact connected with the change which iron undergoes by hammering, showing the necessity of applying science to such things; and that smiths, when they wish to forge a piece of iron very well, strike it often on the anvil, thus rendering it exceedingly brittle.

NEW METHOD OF OBTAINING PURE SILVER.

On Feb. 7, Dr. Gregory has communicated to the Chemical Society, the following method:—The cupreous solution of silver is precipitated by common salt, while hot, and the chloride of silver well washed by decantation with hot water. It should also be broken down with a spatula of platinum or a glass rod, during the washing, but not ground in a mortar, which causes it to cake, and impedes the action of the potash. The chloride, *while still moist*, is covered to about half an inch with a solution of caustic potash, sp. gr. 1·25 at least, and then boiled. During the boiling, which is best performed in a capsule of clean iron, silver, or platinum, the chloride is to be well stirred, in order to bruise all curdy or lumpy particles. In five or ten minutes the powder has become black. If a small portion, taken out and washed, do not dissolve without residue in dilute nitric acid, the potash is to be decanted off, and the powder, still moist, is to be well rubbed down in a mortar, which may *now* be done with advantage. It is then returned into the capsule, and again boiled for five minutes with the same, or with fresh potash. It will now dissolve entirely in nitric acid; but if not, a second grinding will infallibly succeed. It is now only necessary to wash the oxide, which is completed by decantation in a few minutes, as the powder, from its great density, sinks at once to the bottom. The first two or three washings are made with hot water, the remainder with cold water; for when the oxide is nearly washed, it rises partially to the surface, *with hot water*, and thus a loss is occasioned in decanting. Of course, the whole washings (except the first, owing to the strength of the potash) may be conducted on a filter. But the powder is so fine, that probably a good deal would adhere to the paper when dry.

This oxide of silver appears in a form quite distinct from that of the oxide precipitated by potash from the nitrates, and is hitherto undescribed. It is very dense, homogeneous, and has a pure black colour, which has, if any thing, a tint of blue; whereas the common oxide is bulky, far less dense, and of a grayish-brown colour. They appear, however, to be chemically identical. Dr. Gregory suspects, from its appearance in the liquid in which it is formed, that the new oxide is crystalline.

It is obvious that the above process furnishes an easy method of procuring a very pure oxide of silver, and of course the action of heat gives us the silver in the state of metal. It is applicable both to the manufacture of nitrate (in a state of absolute purity) and to the metallurgic process for obtaining pure silver. For both objects, it is a matter of no consequence if some chloride should have escaped the action of the alkali. This chloride is left undissolved by the nitric acid, and is separated by filtration; while if the oxide (not quite free from chloride) be mixed with a little nitre or carbonate of potash, and fused, the whole silver is obtained with the utmost facility. In order to give an idea of the ease with which the whole is performed, Dr. Gregory mentions that he dissolved a half-crown, and obtained the whole of the silver it contained, within a very trifling fraction (chiefly decanted in the *first* washing of the chloride, *but not lost*), by the above process, *within two hours*, in a fused state. The silver was quite pure. There is no doubt that to chemists, also, an easy method of obtaining quickly pure oxide of silver, in a form much less hygrometric than the usual one, will be acceptable.

It is particularly to be noticed, that if the chloride have once been dried, it is with great difficulty decomposed, even by a long boiling with potash.

ACTION OF GALLIC ACID ON PER-SALTS OF IRON.

In a paper read to the Academy of Sciences, at Paris, on Nov. 13, M. Persoz says:—Having remarked that the per-sulphate of iron is very soluble in alcohol, whilst the proto-sulphate is insoluble, I was led to verify the remark made by M. Chevreul, that when Gallic Acid is mixed with a solution of the Per-sulphate of Iron, not only does the oxide combine with the gallic acid, but at the same time a reaction takes place between the two, the per-oxide losing part of its oxygen, which unites with the gallic acid, and a protosel is the result. In order to demonstrate this, dissolve some pure gallic acid in alcohol, then add anhydrous per-sulphate of iron, previously dissolved in the same vehicle. This mixture heated from 140 to 158° F., becomes of a bright blue colour, and then a white crystalline deposit is formed, easily recognizable as the proto-sulphate of iron.

POISONING WHALES.

M. Ackermann has recommended the destruction of Whales by prussic acid, which is to be contained in a phial attached to the harpoon. He cites only one case in which it was employed, and that is not very satisfactory.

RIENCH'S TEST FOR ARSENIC.

In Silliman's *American Journal*, No. 90, is an important paper, "On the application of M. Riench's Test for the detection of Arsenic, to Medico-Legal Enquiries," by Dr. D. P. Gerrard, of New York. The results of the Doctor's examination made on this subject may be condensed under the following heads:—

1st. In consequence of the occasional failure of Marsh's test, as shown by Messrs. Danger and Flandin, and the length of time necessary to carry on the process, when minute quantities of arsenic are present, it has become a desideratum to possess some more certain means of collecting the poison out of solution. The process recommended by M. Riench is the best yet discovered; but it is not a good test for the metal, because many other substances produce deposits which resemble that of arsenic to a great extent. *But, by subliming* *always from the precipitate collected, the test is increased in value and certainty.*

2nd. When the solids or coagulable substances are submitted for examination, the addition of dilute hydrochloric acid is recommended as the most promising means of dissolving out the arsenious acid.

3rd. Copper strips should be added until no stain is produced after thirty minutes' ebullition.

4th. Antimony and mercury are the only probable sources of embarrassment. The first is separated from the mixed precipitate by never raising the heat to 800° Fah. Large quantities of mercury are first removed by the copper alone; and when it is mixed with arsenious acid in the sublimate, the solution of the acid by pure water separates it from the metallic globules.

5th. The simplicity of the manipulation and the certainty of the result, are exceedingly strong recommendations. But the facility with which a large number of examinations can be made with only a small quantity of matter is the most valuable feature of the process. If all the operations be conducted in small tubes, an ounce of the suspected fluid will be sufficient to yield ten or more portions of sublimate.

6th. All the difficulty and loss of collecting common precipitates are removed by using the test, and it is liable to fewer sources of failure than those already known.

In view of these advantages, Riench's test is a valuable contribution to toxicology. It is incidentally recommended, that every sample of glass in toxicological experiments should be carefully examined; as glass not unfrequently contains arsenic.

DETECTION OF ARSENIC.

MM. Danger and Flandin have reported to the Academy of Sciences, at Paris, as the result of experiments they have recently made, that Arsenic is equally a poison to herbivori as it is to the dog and to man; that the flesh of sheep which have had a strong dose of arsenic is not fit for food before six weeks from the time of administering the poison, or six or eight days after the disappearance of all signs of its presence. One of these chemists has been occupied for some years in a course of experiments, and now thinks himself on the eve of being able "to indicate a preparation of arsenic which, while fit for all domestic purposes, can never be employed with a criminal intent." M. Fizeau writes to M. Arago, that a series of experiments have induced him to believe that Moser's thermographs are due to the presence of fatty and volatile matters on the surface of the bodies. His conclusions are based on the following facts:—The power to produce these impressions is diminished at each successive experiment; compact bodies lose the power sooner than porous; the power is restored by merely rubbing the finger over the surface of the body; when the temperature of the body is raised, the image is more speedily produced; the image, or the polished plate, is capable of producing a second image on another plate, and this a third, and so on.—*Illustrated Polytechnic Review*, No. 12.

DETECTION OF AZOTE.

On Feb. 13, was read to the Academy of Sciences, at Paris, by M. Lassaigne, "A Memoir on a Simple Process for detecting the presence of Azote in very minute quantities of Animal Matter." The method is based upon the facility with which cyanuret of potassium is formed when potassium in excess is calcined in a very close vessel, with animal matter containing very little azote. He places a piece of potassium, the size of a grain of millet, in a glass tube, and on it the animal matter. The tube is then gradually heated over a spirit-lamp, till the excess of potassium is volatilized: a few drops of distilled water are added after the product has become cool, and in the decanted liquor is dropped one drop of ferroso-ferric sulphate; this produces a greenish precipitate, which, when placed in contact with a drop of hydrochloric acid, becomes a deep blue—that is, if the animal matter contains the smallest quantity of azote. The application of this simple method will be very useful to solve questions in animal and vegetable physiology, without its being necessary to submit the products to multiplied experiments.

OPIUM OF ALGERIA.

M. Payen states that the qualities of Opium vary according to locality, and the mode of culture and collecting it; they vary also, and frequently in a still higher degree, by mixture and adulteration. The general opinion is, that the opium the richest in morphine comes from Asia Minor by Smyrna, and that the opium derived from the neighbouring provinces, *viâ* Constantinople, is greatly inferior. M. Hardy, the Director of the Central Nursery of Algeria, sent to Paris the produce of his crop of opium. It amounted to rather more than an ounce and a half, from 990 poppy-heads, and had been carefully extracted by means of incisions on the capsules. This opium, says the reporter, presented all the character of the best samples from Smyrna. On being analyzed it was found to contain 5 per cent. of crystallized morphine, deprived of the narcotine by ether. Two samples from Smyrna being analyzed for the purpose of comparison, they were found to contain—one 3.925 per cent.: the other 4.1 per cent. of morphine. Some samples from India were, however, found to be much more rich than either of the samples operated upon as above stated. They yielded 10.7 of pure white crystallized morphine. It would appear, however, by a communication from M. Lieutaud, that as much as 12 per cent. of morphine has been obtained from the opium of Algeria.

SUGAR FROM MAIZE.

Professor H. Croft, in a letter to the Chemical Society, states that experiments have been made in the State of Indiana, which seem to prove that the stalks of the Maize (*Zea Mays*) may be employed advantageously for the manufacture of Sugar. It is well known that the sugar-cane, as grown in Louisiana, does not produce above one-third as much saccharine matter as when raised in Cuba, and other tropical situations. In Louisiana, one acre yields from 900 to 1000lbs. of sugar, and it appears that 1000lbs. may be obtained from the stalks of the maize. The juice of the latter contains more than three times as much sugar as the juice of the beet-root, and five times that of the maple. By plucking the ears of the maize as they begin to form, the saccharine matter of the stalk is greatly increased. The maize-stalks require less pressure, and the whole stalk can be used, afterwards affording fodder for cattle. The plant can be raised with the greatest ease in from seventy to ninety days, whereas the sugar-cane does not arrive to maturity in less than eighteen months.

EUCALYPTUS SUGAR.

PROFESSOR JOHNSTON, of Durham, has read to the Chemical Society a paper, "On the Sugar of the *Eucalyptus* of Van Diemen's Land." This is an exudation of sugar, or manna in tears, or drops, which may be collected in considerable quantity. When crystallized from alcohol, it gave the same composition as grape sugar, but differs from it in relation to heat and other properties, and is considered by the author to be a new and distinct species of sugar, and not mannite, as hitherto supposed.

VEGETABLE WAX FROM CHINA.

A REPORT has been received by the Academy of Sciences, at Paris, from M. Lewy, on the analysis of a specimen of Wax obtained from China. This wax, which is of vegetable origin, is of a beautiful white colour, crystallized, and resembles spermaceti in its external character. It melts at a heat of 82.5 of Centigrade; its boiling point is superior to that of mercury. The produce of the distillation is white, and differs in its nature from the substance when undistilled. It is very soluble in boiling alcohol and ether, and is completely dissolved by the oil of naphtha. When subjected to a boiling solution of potass the wax becomes a soluble soap, and it also mixes freely with barytes. When acted upon by nitric acid, it appears to yield the same products as those obtained with this acid from bees-wax. Amongst other products is a voltaic acid, possessing the principal characters of butyric acid. There is every reason to believe, from the analysis, that this wax is obtained from the *Rhus succedaneus.*

MALIC ACID FROM GARDEN RHUBARB.

ON February 7, was read to the Chemical Society, a paper detailing the process of obtaining Malic Acid from the leaf-stalks of garden Rhubarb.

From data, and experiments, an imperial gallon of juice (specific gravity 1·022), contains nearly of

Malic acid dry	11,139·2 grains
Oxalic acid dry	320·6 "
Potassa combined with organic-chloride, soda, sulphuric, and phosphoric acids, traces of silicon and a little vegetable extract	229·6 "

If to obtain malic acid be the only object, slaked lime made into a sort of cream with water might be added to the expressed juice, till the solution became slightly alkaline; it might then all be boiled and filtered, then proceed with the nitrate of lead, and the rest of the steps above described. To procure the malate of lead in good crystals, some precautions are necessary. From the precipitate suspended in water and heated, a few grains only fall on cooling; from two pints Mr. Everett only obtained five grains and a half; but if about two per cent. of acetic, or of some free malic, be added to the water, and finely divided malate of lead be added, and the whole warmed by a water bath, with constant stirring, the quantity of crystals will be doubled for the same bulk of liquid. It is proper not to raise the temperature higher than 160° Fahrenheit; if boiled, the salt loses two or three atoms of its water of crystallization, and then is quite insoluble in water hot or cold. The composition of malic acid is exactly the same as that of citric acid.

NEW ACID.

Two young French chemists, MM. J. Fordos and A. Gélis, have discovered a New Acid, resulting from the union of oxygen and sulphur; they call it *bisulphuretted hypo-sulphuric acid.* It contains four equivalents of sulphur, and five of oxygen; is colourless and inodorous; it has but little stability; its elements separate at ordinary temperatures, and become sulphur, sulphurous acid, and sulphuric acid.—*Illustrated Polytechnic Review*, No. 12.

VOLATILE ORGANIC ACIDS.

M. CAHOURS has succeeded in showing that a substitution of chlorine for hydrogen takes place in carbonic and succinic ethers under the influence of light, similar to that in simple ether. In conclusion, M. Cahours classifies volatile organic acids into three groups. In the first are arranged acids with four atoms of oxygen, such as formic, acetic, and benzoic. They lose all their oxygen when heated with an excess of base: the result is carbonic acid, which unites with the base, and carburetted hydrogen, which is disengaged. These acids are monobasic, cannot be obtained in an anhydrous state, and the molecule of their ethers, which are neutral, gives four atoms of vapour. The second group includes acids with six atoms of oxygen; they are all monobasic—the salicific and anisic, for example; their ethers play the part of acids; distilled with excess of base, they give rise to compounds with two atoms of oxygen; they yield also four atoms of vapour. The third group contains acids with eight atoms of oxygen: they are tribasic, as the succinic and siberic.—*Literary Gazette*, No. 1359.

CHROMIC ACID.

M. MALAGUTI obtains the two following general propositions from his experiments on the Chromic Acids:—1st. Oxide of chromium, and probably all the oxides of the same formula, in combining with organic acids, give rise to compounds which, far from being salts, are true acids. 2d. Oxide of chromium, in combining in the nascent state with certain organic acids, under the influence of deoxidising actions, may take the place of four equivalents of hydrogen, which is eliminated under the form of water.—*Illustrated Polytechnic Review*, No. 13.

TEST FOR NITRIC ACID.

M. Berthemot, from *Berzelius's An. Rep.*, states a few drops of the suspected liquid are placed in a drachm of concentrated sulphuric acid: after stirring, a small piece of brucine is introduced, which, if nitric acid is present (but not otherwise), dissolves and produces a red colour that changes to yellow: 1-10,000th part may be thus detected.—*Pharm. Trans.*

NEW PROCESS FOR PREPARING CYANOGEN.

On mixing together cyanide of potassium and bichloride of mercury, both in powder, and leaving them for a few days, Mr. Kemp observed that the mixture became of a greenish colour, which at first led him to suspect the presence of iron in the bichloride of mercury; but as he failed in detecting it, he next proceeded to make a few experiments with the substances, the result of which was, that cyanogen might be more easily and economically obtained by the following method than by any of the usual processes:—

Take six parts perfectly dry ferrocyanide of potassium, and nine parts of bichloride of mercury, both in fine powder, and mix them intimately together, then apply heat to the mixture, in a glass retort, when cyanogen gas will be disengaged; mercury at the same time distils over, and a dark-coloured matter is left in the retort, being a mixture of chloride of potassium and cyanide of iron.—*Philosophical Magazine*, No. 151.

BLUE COLOUR OF LAPIS LAZULI.

Elsner has made some experiments on the Blue Colour of the Lapis Lazuli, and has ascertained that it is caused by a silicate of alumina and soda, which may be replaced by lime, combined with a double sulphuret of sodium and iron, in which the amount of iron is very small, but is essential for the production of the colour. The colouring matter in artificial ultra-marines is partly of a fine blue, and partly of a fine green tint. The latter, by continued heating in an open vessel, passes into the former; which, Elsner says, takes place, because the blue colour requires the combination of a larger quantity of sulphur with the sodium. This is effected when a portion of the sulphur is converted into sulphuric acid, which removes soda from the sulphuret, by which means the latter becomes comparatively richer in sulphur. On this account the natural as well as the artificial ultramarine always contains sulphuric acid.—*Jameson's Journal*, No. 67.

SUBSTITUTE OF WHITE LEAD.

On Nov. 13, was read to the Academy of Sciences, at Paris, a very interesting paper on the means of abolishing the use of White Lead for general purposes, and thus preventing the distressing and frequently fatal diseases which attack those who prepare and those who use this production. At various periods, many substitutes for white lead have been proposed, but none of them have found public favour. Not long ago, in England, a discovery was made on this subject by a young lady, an artist, which was submitted to the test of scientific men, and pronounced perfect. This substitute was said to be more durable, much cheaper, and of more beautiful appearance than white lead, but it failed. The substitute offered by M. de Ruolz is the oxide of antimony, commonly called the flowers of antimony. Its advantages he enumerates as follows:—In colour, it rivals with the most beautiful silver white; it forms with oil an unctuous and cohesive mixture, and as a coating to wood, or any other article, is superior to white lead. When dry, it preserves its brilliancy, and mixed with other colours produces a much better effect than white lead. Added to all this, it is two-thirds cheaper than white lead. But the question will naturally arise, in getting rid of one poisonous substance, are we not adopting another? This question has been anticipated by M. de Ruolz. He declares that in the preparation of the flowers of antimony there is no danger to the operator, and that in using it as a paint, none of those emanations take place which make the use of white lead so dangerous.

NEW SYMPATHETIC INK FOR CHEMICAL LANDSCAPES, ETC.

THE following gives a colourless mark to paper, but on the application of a gentle heat, a deep *brown* colour appears, and gradually resumes the colourless state again on cooling.

Put into a convenient phial half an ounce of distilled water, one drachm of bromide of potassium, and one drachm of pure sulphate of copper (blue vitriol), gently warm the mixture until the salts appear to be completely dissolved, when the liquid is fit for use. The bromide of potassium and the sulphate of copper act upon each other in solutions: bromide of copper and sulphate of potash result; and it is the bromide of copper that exhibits the chemical phenomena above mentioned. It may be thought better, perhaps, to remove the sulphate of potash from the solution, which may be very readily done by adding about half an ounce of alcohol, when the salt immediately precipitates, leaving the bromide of copper in union with the alcohol and water, nearly pure.—*Mechanics' Magazine*, No. 1049.

SEA-WATER.

DR. GUASTALLA, of Trieste, concludes that the internal use of Sea-water is beneficial only when persevered in for several months; that it never gives rise to serious accidents—that to be useful, it is not necessary that it should act as a purgative; on the contrary, such an effect had better be wanting in disorders accompanied with prostration and weakness—that the practitioner must not rely on its purgative, but on its antiphlogistic and discutient properties—that it is useful in glandular swellings—that the best mode of administering it is in its natural state—that the dose for children is from 4½ drs. to 6 drs., in two doses per day, gradually increased to ʒxij., and for adults from ℥xij. to ℥xxiv. or ℥xxxvj. per diem, in two or three doses.

NEW INSTRUMENT FOR EXTRACTING SEA-WATER.

A NEW Instrument, by M. Aimé, for extracting Sea-water at enormous depths for philosophical experiment, has lately been experimented with. This instrument contains a reservoir filled with mercury. On being thrown to the depth required by a line and other apparatus, the mercury is displaced by a spring, and the reservoir is filled with water. In one of the experiments performed by M. Aimé, he drew some water from the sea at the depth of 2,000 metres, or half a league. He was desirous of ascertaining whether the quantity of air contained in the water of the sea increased with the depth. It results from the trials made, that the quantity does augment down to a certain depth, and then decreases gradually, till the quantity of air is no greater than that at the surface.

MINERAL WATER BOTTLES.

A PAPER on this subject, by M. Beaude, has been read to the French Academy of Sciences. For some time past there have been several complaints as to the quality of the Eau de Vichy, sold in bottles of this description, and the deterioration was supposed to have been caused by the decomposition by the contents of the substances of which the vessels in which it is contained are composed. M. Beaude states that he has analyzed the waters contained in earthenware bottles, and has found no trace of the decomposition which was supposed to exist. He concludes that these bottles are quite as good for the purpose for which they are used as glass. This opinion is in opposition to that of M. Rognetta, who asserts that several kinds of mineral waters, which are sold in earthenware bottles, are deteriorated by the reaction of the mineral elements of the water upon those of the bottle, the mixture of the produce of this reaction in the liquid, and the mechanical infiltration of the liquid in the pores of the bottle. He concludes that it is improper to send mineral waters from the sources which supply them in any other way than glass bottles of the best quality.

ARTIFICIAL DIAMONDS.

ALL the experiments to form Artificial Diamonds may be referred to two methods, viz. the attempt to fuse carbon, and the endeavour to separate carbon in a crystalline state from a highly carbonaceous compound, by means of decomposition. It need hardly be remarked that all the trials have hitherto been in vain. The experiments made with the first view have been rendered unsuccessful by the infusibility of carbon, and the others proceeding on the second idea have always resulted in the production of carbon in the form of a black substance*.

* A pretty extensive collection of the experiments on this subject, together

If any one should be of opinion that, by the assistance of a constantly operating electrical stream, highly carbonaceous bodies might be decomposed so slowly that carbon might be separated in a crystalline condition, that is, in the form of diamond, just as copper and the other metals have been recently obtained, in a crystalline state, from solutions, by Jacobi's method, such an expectation will prove to be a vain one; for, on the one hand, the substances most suited to galvanic decomposition are non-conductors of electricity; as, for example, sulphuret of carbon, oil of turpentine, copaiva balsam, &c.; and on the other hand, if we should be successful in separating, from any compound, crystalline carbon on the conducting wire, yet, according to theory, at the very moment when even the most delicate covering of crystalline carbon should be deposited, all further action on the decomposing liquid would be interrupted, for the matter of diamond itself is known to be a non-conductor of electricity *.

ARQUERITE.

In a Report made to the Academy of Sciences, at Paris, by MM. Berthier, Elie de Beaumont and Dufrenoy, on two memoirs by M. Domeyko, on the mineral products of the silver mines of Chili, there is an account given of a new native amalgam, which constitutes almost exclusively the riches of the silver mines of Arqueros, in the province of Coquimbo, in Chili. This amalgam consists of six atoms of silver, and one atom of mercury, a composition presented by no mineral previous analysed. Its composition is constant; and its title to be regarded as a new mineral species is, according to M. Dufrenoy, undoubted, for it is founded both on composition and crystallographic characters. It occurs in a dendritic form, or in small octahedral crystals; it is of a silver-white colour, like the amalgam of Moschel-Landsberg, but differs from it in being malleable. It can be extended by the hammer, and cut by the knife. The proportions of its constituent parts are 86.5 silver, and 13.5 mercury; while those of the Moschel-Landsberg species are 36 silver and 64 mercury, The name of Arquerite is proposed for the new mineral.—*Jameson's Journal*, No. 61.

BROMIDE OF SILVER IN MEXICO AND CHILI.

Berthier has discovered the Bromide of Silver in a perfectly pure condition in the mineral kingdom. In the district of Plateros, in Mexico, there is a silver mine where the chief ore is chloride of silver. This substance is there termed *Platu azul* (blue silver), and, along with it, grains and small crystals occur, which receive the name of *Plata verde* (green silver); the latter, which are green only externally, are internally of a beautiful yellow colour, and, according to

with the references, is to be found in Ersch and Gruber's *Allgemeine Encyclopädie der Künste und Wissenchaften*, under the article *Diamant*. See also in *Gmelin's Handbuch der Theoretischen Chemie*, vol. i. the chapter on Carbon.

* From Petzholdt's *Beiträge zur Naturgeschichte des Diamantes*, 1842; *Jameson's Journal*, No. 67.

Berthier's analysis, are pure bromide of silver. The mine from which the analysed ore was extracted bears the name of *San Onofre*. It is mixed with chloride of silver, carbonate of lead, oxide of iron, and a little quartz containing alumina. Its powder is yellow, but exposure to light soon produces the superficial green tint. Berthier has subsequently found traces of bromide of silver in a silver ore containing chloride of silver from Huëlgoat in France.—(*Berzelius' Jahres-Bericht*, 1842.)

M. Berthier has also recognized in the argentiferous minerals from Chanaveillo, designated *Pavos* and *Colloraños*, the bromide of silver, which he had previously discovered in the ores of Peru. The proportion of the bromide is very variable, but it is at least equal to that of the chloride, so that this new species holds an important position in the mineral riches of Chili and of Peru.—*Jameson's Journal*, No. 67.

FATTY SUBSTANCE IN BEER.

According to the admirable investigations of Professor Liebig, the fat in the animal body derives its origin from the non-nitrogenous articles of food, which undergo such a metamorphosis in their digestion that the carbon of these substances remains in the body as fat. In opposition to this view, the French chemists, MM. Dumas and Boussingault,* assert that animals, of whatever kind they be, produce no fat, but obtain it direct from the vegetable kingdom; consequently, that only in those animals which take fat in their food do we find fat to be deposited in the cellular tissue.†

Professor Liebig ‡ showed to the contrary by the quantitative determination of the fat in several vegetable articles of food, for instance, in peas, beans, rice, maize, &c., that the small amount of fat contained in these substances was in no proportion to that of the animals which had been fed on them.

Among the substances which, according to general experience, have a very decided influence on the formation of fat, is beer. As no observations have hitherto been published on the amount of fat contained in this beverage, I have made some experiments on the subject.

Beer affords, as is well known, on slow evaporation, a brown viscid residue. This was dried in the water-bath at 212° Fahrenheit, and reduced to a fine powder. Treated several times with boiling æther, this brown substance gave a yellow oily fat, having a peculiar odour resembling that of malt. This fat forms soluble soaps with the alkalies, and leaves a fat stain on blotting-paper.

With respect to the quantity of fat in the beer, it was found in three experiments, which agreed well with each other, that one hundred parts of the extract contained 0·1605 substances soluble in æther.

* Ann. de Chimie et de Physique, vol. iv. p. 208.

† Such were their published opinions, but these views appear to change with each succeeding Number of the "Comptes Rendus."—Ed. *Chemical Gazette*.

‡ Ann. der Chem. und Pharm. Jan. 1843; also Philosophical Magazine for July 1843.

Since one quart of Munich winter beer leaves on an average when evaporated eighteen drachms of extract, we find that 1·728 grains of a fatty substance is conveyed into the frame in one quart of beer.

Supposing a man to drink daily two quarts of beer, then, according to this calculation, there would in the course of a year be an increase of two ounces and a half of fat, an increase in weight which by no means agrees with the frequent corpulence of beer-drinkers.

Since beer contains so small an amount of constituents soluble in æther, and as an article of food has, according to the experience of physicians, an undoubted influence on the formation of fat, the effect must necessarily be ascribed to the decomposition of the other constituents of the beer, thus affording a further confirmation of the theory of the formation of fat advanced by Professor Liebig.—*Ann. der Chem. und Pharm.; Chemical Gazette*, No. 18.

DETECTION OF COPPER POISON BY CARBONIZATION.

MM. FLANDIN and DANGER have applied to the Detection of Copper, in cases of Poisoning, the process of Carbonization, which had already served them in their researches for arsenic and antimony. The process consists in carbonizing the animal matter with a third of its weight of concentrated sulphuric acid, heating the carbon to a dull red, and reducing it to powder, wetting the latter with sulphuric acid, and boiling it with water, which dissolves the sulphate of copper found: this solution is to be then submitted to the action of the proper re-agents, to evidence the presence of the metal. By this process, MM. Flandin and Danger have detected the hundred-thousandth of copper. They have also experimentally negatived the existence of copper or lead in a normal state in the human body. The excretion of poisons is different for different poisonous compounds—the intestines, the kidneys, the lungs, &c.; and the organs by which they naturally tend to escape should have the principal attention in cases of poisoning. For instance, gold and silver pass off both by the kidneys and the lungs: the chloride of silver more abundantly by the latter; the chloride of gold in much greater proportion by the former. After death it is in the intestines and in the liver that copper exclusively accumulates. Fifty or sixty grammes of the latter suffice to afford proof of poisoning by preparations of this metal.—*Literary Gazette*, No. 1358.

DEATH FROM PRUSSIC ACID.

DEATH caused by prussic acid, says a German paper, is only apparent; life is immediately restored by pouring acetate of potash and common salt, dissolved in water, on the head and spine. Some time since, Mr. Rogerson, a chemist, instituted a series of experiments on animals for the purpose of observing the effects of prussic acid, and of discovering the means to be pursued in case of poisoning by that fluid. He then, if we mistake not, invited the attention of the medical profession to the fact, that rabbits poisoned with prussic acid could be at once recovered from apparent death by merely pouring cold water over the head and spine.—*Morning Chronicle.*

ZINC MILK VESSELS POISONOUS.

THE following extract will show the danger and the folly of the practice of keeping Milk in Zinc bowls—a custom which has lately become very prevalent: these articles being sold with the recommendation of a larger quantity of cream being produced, owing to the galvanic action. "I would scarcely have believed (say L. Elanes, of Berlin) that zinc vessels would again have come into use for alimentary purposes, as Vauquelin, forty years ago, proved that such were certain, after a short time, to hold a certain quantity of zinc in solution. I have found by experiment that a solution of sugar, which had stood only a few hours in the summer in a zinc vessel, contained a considerable amount of zinc salts. It has often been stated that the cream will separate more easily from milk, if the latter be kept for a short time in a zinc vessel. As, however, it is known that milk will turn acid much sooner than a solution of sugar, it is the more to be apprehended that some zinc will be dissolved, and such zinc will be the more noxious, as it is well known that even a small amount of zinc will cause spasmodic vomiting."—*Pharmaceutical Journal.*

POISONOUS NATURE OF THE YEW.

ALTHOUGH doubts have been expressed by several writers respecting the Poisonous action of the Yew, yet a case of poisoning which occurred recently sufficiently proves the contrary. A countryman who had brought a load of turf to town placed his three horses in the neighbourhood of a yew-tree; two of these horses, which had eaten of the young shoots, died, one in a quarter of an hour, the other on its return home; the third, which had been placed so that it could not reach the yew, remained in perfect good health. On examination, distinct traces of poisoning were perceptible. — M. Röttscher: *Archiv. der Pharm.*

PREPARATION OF NITRIC ETHER.

BY the addition of urea to a mixture of alcohol and nitric acid, M. Millon has effected the union of these two latter bodies. The production of nitric acid is prevented by being decomposed by the urea as fast as it appears, and the result obtained is equal volumes of azote and carbonic acid. In consequence of adding urea, the distillation is easily conducted at an open fire; instead of being violent, the action is regular; and the nitric ether passes into the recipient, taking with it a small quantity of water and of alcohol, the residue of the operation being crystallised nitrate of urea, pure and very acid. Nitric ether has a sweet and fragrant smell, which does not at all resemble that of nitrous ether; its taste is saccharine and slightly bitter; its density at $+ 17°$ is about 1·112; it boils at $85°$; and, being ignited, it burns in contact with air with a white flame. An aqueous solution of caustic potash has no effect upon it, but an alcoholic solution decomposes it even cold, and crystals of nitrate of potash, unmixed with nitrite, result. Iodine dissolves in nitric ether, and colours it violet; chlorine attacks it with energy, disengaging abundance of nitrous vapour; nitric, chloro-hydric, and sulphuric acids, decompose it.—*Literary Gazette*, No. 1358.

ANALYSIS OF GUNPOWDER.

Bolley proposes a new method for the Analysis of Gunpowder, of the advantage of which he has assured himself. It is founded on the property of sulphur to dissolve in sulphurous acid in order to form sulphites. Sulphite of soda is first prepared by passing sulphurous acid into a solution of carbonate of soda, until the whole of the carbonic acid has been expelled. After the dried and weighed gunpowder has been extracted with water, the residue is dried and weighed, and is then brought into a solution of sulphite of soda (20·24 parts sulphite of soda and 1 part of the mixture of charcoal and sulphur), and is boiled for one or two hours in a flask, the evaporated water being replaced. It is then filtered, the charcoal well washed and weighed; the loss indicates the amount of sulphur. Heating a portion of the carbonaceous residue on platinum foil will shew whether the whole of the sulphur has been removed.—*Journ. für Prakt. Chem.; Chemical Gazette*, No. 13.

CHEAP METHOD OF PREPARING SCHWEINFURTH GREEN.

50 lbs. of sulphate of copper and 10 lbs. lime are dissolved in 20 gallons of good vinegar, and a boiling-hot solution of 50 lbs. white arsenic conveyed as quickly as possible into the solution; it is stirred several times, and then allowed to subside. The supernatant liquor is employed the next time for dissolving the arsenic.

The colour is collected on the filter, dried, pounded, sifted, and again rubbed up with a little muriatic acid.—*Mittheilungen des Böhm. Gewerbevereins; Chemical Gazette*, No. 23.

HOW TO DISTINGUISH BETWEEN REAL AND SPURIOUS GILDING.

In many cases in which it is difficult to employ the usual test for Gold, especially for distinguishing between real and spurious gold leaf, gilt paper, &c., M. Altmüller recommends the application of mercury, which rubbed in on true gilding immediately produces a white spot, while it has no action on spurious gold (consisting of alloys of copper). On the other hand, an acid solution of mercury in nitric acid leaves untouched real gold, and produces a white spot on the spurious. The thinnest layers of gold, which it is frequently impossible to detect by means of *aqua regia*, are immediately recognized by this test. The coating of varnish must be removed previous to its application.—*Allgem. Wien. Polytech. Journ.; Chemical Gazette*, No. 27.

AVANTURINE GLASS.

Avanturine glass is a species of brown glass, full of small metallic spangles, which in former times was in great request in the manufacture of the numerous ornaments for which Venice was celebrated. The revolutions of fashion many years ago put an end to the demand for it in any large quantities, and as the mode of composing it had always remained a secret, the art became extinct. In a late number of *Jameson's Journal*, Professor F. Wohler gives the result of a careful analysis of this interesting substance, by which it appears that 100 parts of it contain:—

Silicic acid, with traces of tin	65·2
Phosphoric acid	1·5
Oxide of copper	3·0
Oxide of iron	6·5
Lime	8·0
Magnesia	4·5
Soda	8·2
Potash	2·1
Alumina and sulphic acid	·1
	100

It would thus appear that Avanturine glass is an ordinary glass, which owes its peculiar appearance to copper, probably in the form of a protoxide.—*Artizan*, No. 10.

NEW METHOD FOR TAKING IMPRESSIONS OF MEDALLIONS, ETC. IN COPPER.

M. Osann has described a method of taking impressions of medallions, seals, &c. in copper, which is founded on the following principle:—Finely pulverized oxide of copper is reduced in a current of hydrogen at a temperature below redness. The powder obtained is sifted through crape, and placed on the model, which is arranged so as to receive from four to five inches of it in thickness, and to be then pressed in a vice, or first with the hand and then with a hammer. The impressions thus obtained are perfect, but have little cohesion unless heated to redness previous to being exposed to contact with the atmosphere. After this operation they acquire more tenacity than melted copper, and as their volume retracts somewhat, the impression becomes much more distinct.

M. Böttger has shown that copper powder for this purpose is obtained far more easily, of a better quality, and without loss of time, by precipitating a solution of sulphate of copper with zinc, and boiling. The precipitate of copper is then boiled for a few instants in weak sulphuric acid to remove the last traces of oxide or zinc; then washed with water, and dried in a tubulated retort over the water-bath by passing over it a current of hydrogen. This precipitate of copper has so strong an affinity for oxygen that it is difficult to prevent it changing into protoxide; and if mixed with half an atomic weight of precipitated sulphur and rubbed together, they combine in a few instants with evolution of light, forming protosulphuret of copper.—*Berzelius's Jahresbericht; Chemical Gazette*, No. 13.

CEMENT FOR PORCELAIN AND GLASS.

The best and most beautiful Cement for fractured Porcelain and Glass is, according to M. Keller, the following:—Two parts isinglass, cut into fine pieces, are left for twenty-four hours covered with sixteen parts water, then boiled down to eight parts, mixed with eight parts alcohol, and strained through linen. This liquid is mixed while hot with a solution of one part mastic in nine parts alcohol, and to the whole one-half part gum ammoniacum, finely pulverized, added gradually, and the liquid rendered perfectly homogeneous. This cement while hot is quite liquid, but on cooling becomes hard. In using it both cement and the fragments are made as warm as possible, both pieces allowed to dry, then again rubbed over with the cement, and pressed together. After five or six hours the cement is perfectly hard. It is not applicable to vessels of porous earthenware; the best cement in this case is a thick solution of shell-lac in spirits of wine.—*Polyt. Cent. Blatt.; Chemical Gazette*, No. 24.

CLEANSING OF CASKS FROM MOULD.

M. Huenerwadel recommends concentrated sulphuric acid as the best means for purifying casks from mould and mouldy smell. So much is poured into the vessel that the acid on rolling the cask is sufficient to moisten every part. After a quarter of an hour the vessel is washed out with water. Large vessels, which cannot be rolled, are rubbed over with the acid.—*Schweiz. Gewerbeblatt.*

A NEW SIGNAL LIGHT.

A very useful firework for signals has been invented and patented by Mr. Hay, a chemist at Portsmouth. It resembles the blue light long in use in the navy, but is more brilliant, and burns longer. Its peculiarity, however, consists in its being kindled by percussion on a chemical preparation so placed that when properly struck it catches fire instantly; but at the same time so secured that it is almost, if not altogether, impossible to inflame it when struck in any other way. For example:—It may be dashed against the ground, or trampled on with impunity, and is therefore as safe in its conveyance as effective in its use. It is like a Roman candle in appearance, the lower end being hollow; into this a stick is put, which being struck smartly with the hand, or on the ground, fires the mixture, and causes the flame to burst forth from the other end; it burns, according to the size used, from four to twenty minutes, and may be seen ten miles off. Being also of various colours, a code of signals is easily formed. A copper case, large enough to hold one firework, is supplied, if desired, with each box of them. One end has a wooden plug, fitted to the hollow end of the firework for lighting it, as above stated. Having one of these in the pocket, a brilliant light is at command in any place, in all weathers, and at a moment's notice.

NEW METALS.

M. Mosander has discovered a fifty-sixth element, Didymium.

The same chemist has discovered another new metal, which accompanies cerium, lanthanium, and didymium, and to which it bears great resemblance, in the mineral gadolinite.

PHOTOGRAPHY.—THE DAGUERREOTYPE.

The following are the more important results obtained during the past year :—

Sir John Herschel concludes a long series of elaborate experiments and new facts "On the Action of the Solar Spectrum on the Vegetable Colours," with the following curious and interesting photographic results, to which, under the genial influence of such a summer, as, possibly, has never before been witnessed in England, Sir John has been conducted. In this result, "a line or dot engraving of any degree of delicacy is imitated, line for line, and dot for dot, in a manner which might deceive any but a practised artist to the point of rendering him unable to declare that the photograph had *not* been struck off from the original plate with common printing ink, by the ordinary process of copper-plate printing. The details of this process, which are delicate and somewhat tedious, cannot properly be stated here; if for no other reason, because I have not yet obtained a complete command over the result: but a microscopic examination of the specimens, though somewhat marred by the accidents of manipulation, will, I think, suffice to justify the terms employed as above.—See *Philosophical Magazine*, No. 145, *et ante*.

M. Ulex, of Hamburgh, lately subjected some Daguerréotypes to a series of experiments for the purpose of determining their durability. He states, in a communication published in the *Annals of Chemistry*, "for the purpose of ascertaining the manner in which they would be affected by light, I covered one-half of one of these impressions with paper, and hung it up, so as to afford a direct southern aspect, thus exposing it for weeks to the continued action of the sun's rays. When, after this time, the protecting cover was removed, not the slightest difference could be perceived in the two several halves of the impression. The same impression was then exposed, in the water-bath, to a temperature of + 60° E. = 167° F., without, however, its undergoing, in this instance, the slightest alteration. Other impressions were then exposed to steam, to the action of carbonic acid, ammonia, and even for some time to the action of sulphuretted hydrogen gas, and to the gas of hydrosulphate of ammonia, without, however, the impressions losing in the slightest degree the distinctness of their outlines, or being destroyed. A pure silver plate in contact with the air, if only for a short time exposed, is, as is well known, rapidly blackened by the action of sulphuretted hydrogen. In the manner, however, in which these impressions are generally kept, that is to say, between paste-board and glass, both pasted together, not even the slightest tinge of brown will be produced by the presence of sulphuretted hydrogen. If a photographic impression is completely rubbed away by means of a piece of leather and rotten-stone, so that the bright surface of the silver alone is apparent, and the silver plate is then heated, the impression will reappear distinctly with all its outlines. This experiment serves likewise as an additional confirmation of the statements given by Moser. At the present time the photographic impressions are, almost without exception, gilt, according to the method introduced by Fisot. In the case of an impression treated in this manner the gold coating defies all noxious influences. We arrive, then, at this result—that the preference, as regards durability, must justly be given to photographic impressions over paintings in oil.—*Athenæum*, No. 796.

MM. Choiselat and Ratel think that in photography the accelerating substances only act by seizing on the iodine left bare by the action of the light, and the transformation of the iodide of silver into the subiodide. They have found, by experiment, that bodies deprived of sensibility within themselves greatly exalt the sensible layer, and especially carbon. Thus, by adding to bromine, employed as an accelerator, essential oils, naphtha, alcohol, &c., they have succeeded in obtaining pictures in two seconds. Their method of applying the accelerating vapour is very simple: they mix bromine and alcohol, for instance, in the proportion of 5 to 2; they draw, with a small glass syringe, about a demi-centilitre of the vapour which escapes from the mixture, and inject it into the box with the bromine: the plate exposed to this vapour is covered again with it very uniformly and with great rapidity.

M. Daguerre, being struck with the variations in his photographic plates, although all prepared in the same way, has endeavoured to ascertain the cause, and found it was owing to the presence of greasy emanations, which prevented the uniform action of the vapour of the iodine. To obviate this inconvenience, he heats the plate, and covers it with a small quantity of water; the greasy matter rises to the surface, and is poured off. M. Arago announced that M. Daguerre is following up his experiments, to accelerate the photogenic action, by the intervention of electricity.

A patent has been granted to Mr. Beard for improvements in the means of taking likenesses. It consists in *colouring* the pictures, and the process is thus described in the *Mechanics' Magazine*. After a picture has been obtained, a tracing is made upon glass, and from this copy on glass as many other copies are taken on tracing-paper as there are different colours intended to be used. From the tracing appropriated to each colour those parts are cut out which are to be represented of that colour, so that, when superposed on the face of the picture, it covers all but those places where the colour is to be applied, (exactly in the same way as stencilling.) The colours are applied in the state of an impalpable powder, mixed with just as much gum arabic or isinglass as suffices, when the colours are breathed upon, or otherwise gently heated, to fix the colours.

M. Arago, on Oct. 23, at the Academy of Sciences, at Paris, in alluding to the recent discoveries of Dr. Belfield Lefevre in photography, observed: the processes now made use of are empirical, and the results obtained are not to be explained in the present state of chemical science. Sir John Herschel has, indeed, pointed out the fact that ioduret of silver was, by the action of light, reduced or transformed into a sub-ioduret; but whether such reduction took place in the camera obscura, by what chemical mechanism that reduction was effected, in what manner the *accelerating substances*, brome and chlorine, intervened to precipitate the action of light, are problems which Dr. Lefevre is supposed to have solved; and, in so doing, to have shown that the process, as at present instituted, is founded on a wrong principle, so that success must necessarily be the exception, and failure the rule. Our readers will form some idea of the minute nature of these investigations when we inform them that, according to Dr. Lefevre, no less than six elementary substances, viz. silver, iodine, chlorine, carbon, oxygen, and hydrogen, compose the sensitive coating which is to be submitted to the action of the light; and that these substances, by their mutual re-actions, successively form seven distinct compounds; whilst the entire thickness of the coating does not equal one ten-thousandth part of that of a sheet of silver paper, and its weight, though extended over an area of forty-eight square inches, is not equal to the tenth part of a grain.

M. Becquerel, jun., in the application of the Daguerréotype process to the study of the solar spectrum, has demonstrated that the obscure lines of the spectrum correspond with the gaps which are rigorously equivalent in chemical radiation. In mentioning the curious results of the experiments, M. Arago goes into considerable details as to what remains to be done on this subject, in order to follow up the discovery of M. Daguerre, and arrive at a solution of the long-pending discussion on the undulations of light. M. Arago then alludes to the experiments made by M. Fiscau, with a view of ascertaining the correctness of those of M. Moser, on the extraordinary transmission of images without the aid of light. He states that M. Fiscau has satisfied himself of the reality of the results.

Dr. Draper attributes the frequent failure of the Daguerréotype process to the accidental presence of the vapour of iodine, or other electro-negative bodies, in the chamber, or about the apparatus; and to prevent this, he recommends that neither iodine, bromine, nor chlorine, should have access to the apartment in which Daguerréotype operations are being conducted.

CHROMATYPE.

Mr. Hunt has detailed to the British Association, a new photographic process, named Chromatype. Mr. Hunt, after describing the process introduced by Mr. Ponton, by which negative photographs were produced on paper by the use of the bichromate of potash, and the improvements introduced by M. E. Becquerel, with a view to the production of positive pictures, but which process was tedious and very uncertain, exhibited very interesting specimens of pictures produced by chromatype. The process, which is exceedingly simple, is as follows :—Paper is washed over with a solution of the sulphate of copper, dried, and then washed with a solution of bichromate of potash. When dry, these papers are fit for use, and will keep for any length of time unimpaired, if preserved in the dark. The strength of the solutions may be considerably varied, by which the shades of colour of the finished picture are pleasingly changed. This paper is not recommended for use in the camera obscura, but for all other purposes it is exceedingly useful. An engraving, botanical specimens, or the like, being laid on the paper in a proper manner, it is exposed to the sun's rays for a period, varying with the intensity of the light, from five to fifteen minutes. A very faint picture results from this exposure. It is then washed over with a tolerably strong solution of the nitrate of silver, which brings out a very intense orange-coloured image, the lights and shades being correct as in nature. The only fixing required is simple washing in pure water, and drying. If one of these chromatype pictures is placed in a very weak solution of common salt, it rapidly fades out, and the paper is reduced to its original whiteness. The picture, however, is not obliterated; if the paper is held in the sunshine for a few minutes, the images gradually come out, and the picture is restored; but instead of being of an orange colour, it is now a fine lilac. This variety requires no fixing.

Mr. Hunt's second communication was simply a statement of the results he had obtained since the report which was made by him and published in the last volume of the Transactions of the Association. Most of the results were in confirmation of those already arrived at; and all went to prove the injurious effects of the luminous and calorific rays upon the young plant, and the energetic and healthful action of the chemical rays. The author had, however, discovered that the continued action of those chemical rays in a pure state, exerting a most powerful stimulating influence upon the plants, occasioned the production of an extraordinary amount of leaves, and these of a fine dark colour; but that the energies of the plant being thus exhausted, it could not be brought to flower, and speedily decayed. This influence of the chemical rays on the vegetable world was similar to that exerted by pure oxygen gas upon animals. The author also noticed a remarkable property which he had observed in the luminous rays, namely, that under their influence agarics grew very rapidly, but not at all under the agencies of the other rays; which fact appears to correspond with the experience of gardeners, who attribute great power to the moon's rays in producing this variety of plants.—*Literary Gazette*, No. 1388.

TITHONOTYPE.

Dr. Draper has communicated to the *Philosophical Magazine*, No. 146, a practical paper "On the Tithonotype, or Art of Multiplying Daguerréotypes." We have not space for the entire communication, but quote the process:—

The Daguerréotype image in all its forms may be transferred by any copying process to other suitable surfaces. In other words, it may be printed from.

To carry this process into effect, the operator proceeds as follows: —The Daguerréotype, which he designs to copy, is to be covered with a thin film of gold in the usual way, care being taken that the film is neither too thick nor too thin. If it be too thick, the resulting copy is injured, and difficulties are more liable to arise in effecting the separation of the gelatinous coat; if too thin, the plate itself will suffer injury by having the figure torn off.

A clear solution of isinglass is next to be prepared; it must be of such a consistency that a drop of it poured on a cold metallic plate will speedily set. Much of the success of the process depends on this solution being properly made. There is a substance in the market which goes under the name of Cooper's Isinglass, which I have found much better than any other for these purposes.

The plate is to be arranged horizontally, with its face upwards, on some proper support, in the current of hot air that rises from a stove. The isinglass is to be poured on until a stratum about one-sixth of an inch deep is upon the plate. It is then suffered to dry, the process being conducted so as to occupy two or three hours. When perfectly successful, as soon as the drying is complete, the film of isinglass now indurated into a Tithonotype splits off, and on being examined either by reflected or transmitted light, will be found to bear a minute copy of the original.

The following is, briefly, the theory of the images:—

The Daguerréotype film, which has been under the influence of light, is polarized throughout its structure previous to mercurialization.

In a subsequent number of the *Philosophical Magazine*, No. 151, Dr. Draper states: A very important improvement on the Tithonotype, an improvement which, indeed, has brought it almost at once to perfection, has been effected: this is, to copy the surface in copper by the Electrotype after it has been previously fixed by the agency of a film of gold.

The beautiful Tithonotypes are made in the following way:—The Daguerréotype is carefully gilt by M. Fizeau's process, taking care that the film of gold is neither too thick nor too thin. The proper thickness is readily attained after a little practice. The plate is then kept a day or two, so that it may become enfilmed with air. The back and edges being varnished, copper is to be deposited on it in the usual way, the process occupying from twelve to twenty hours. If the plate has been properly gilt, and the process conducted successfully, the Tithonotype readily splits off from the Daguerréotype.

The reader will understand that when the process succeeds, the Daguerréotype will be uninjured, and the Tithonotype a perfect copy of it. If any portions are blue, or white, or flesh-coloured, they will be seen in the same colours in the Tithonotype; the intensity of light and shadow is also given with accuracy, and indeed the copy is a perfect copy in all respects of the original. A great advantage is also obtained in the reversal that takes place. The right side of the Tithonotype corresponds to the right side of the original object, and the left to the left: in the Daguerréotype it is not so.

There is no great difficulty in obtaining from these Tithonotypes duplicate copies. An expert artist can multiply them from one another.

The problem of multiplying the beautiful productions of M. Daguerre is, therefore, solved.

ERUPTION OF MOUNT ETNA.

ETNA has been in terrific eruption for three weeks. In a letter from Palermo, we find the following:—"A new eruption took place on the western side of Etna on the 17th of November. The crater opened near Monte Rosso, not far from the eruption of 1832."

In a subsequent letter, dated Catania, Dec. 5—"Inquiries have been instituted immediately by Government as to the cause of the unexpected and sudden explosion which, on the 25th of November, when the lava reached a pond or morass, occasioned the death of many persons; it is, however, more than likely that nothing positive will result from it, as it is impossible as yet to approach the disastrous spot. Thus far it appears to be proved, that the glowing mass, composed of so many ingredients, falling from a not inconsiderable height into the water mentioned, spread itself, instead of being extinguished, foaming in every direction, burning to death some 30 persons, who had considered themselves protected by that sheet of water, and wounding 25 others so dangerously, that 15 of them have died since, and the remaining few give very little hopes of recovery. For the last few days the volcanoes (three were in activity) had been more quiet. On the highest cone, the eastern part, or the side wall of the crater, has fallen in, and the opening is greatly enlarged. The crater is without intermission throwing out clouds of black smoke; and on the eastern wall a small stream of lava is flowing down, partly visible only during the night, and losing itself under the snow, which lays more than three feet high. The new eruption of the 17th November is likewise not yet extinguished, but continues to send forth smoke, stones, ashes, and dross, although with less vigour than at the commencement; also from this crater continues to flow some lava; it, however, soons turns to clods, and it is no longer able to push forward the lower stream, which has not yet reached the bed of the Simeto. The third eruption, more to the north of the Mount, which commenced on the 23d of November, in the evening, still throws out smoke and dross; but, upon the whole, the eruptions appear to be over. The top of Mount Etna is covered by a thick layer of snow, and it would be useless to try an ascent at present*."

* This report more properly belongs to the GEOLOGICAL Section, but is inserted here for convenience.

Natural History.

ZOOLOGY.

CORPUSCLES OF MAMMIFEROUS BLOOD.

Dr. Barry has communicated to the Royal Society the following recapitulation of his views on the Corpuscles of Mammiferous Blood.

No observer can learn the structure of the Blood-Corpuscles who does not carefully investigate their mode of origin, and patiently follow them through all their changes. Where are these changes to be seen? Not in blood taken from large vessels, which are merely channels for conveying it, but in that contained, and almost at rest, in the capillaries, and especially in the capillary plexuses and dilatations; a remark which I believe is new, though many figures published by myself in the *Philosophical Transactions* show the observations on which it is grounded to have been long since made. But there is another source from which every information has been obtained—the large cells in the ovum. From these the Corpuscles of the Blood seem to have descended; and they undergo changes essentially the same.

1. The mammiferous blood-corpuscle, like one of the cells of the ovum, is at first a disc, or what is now called a "cytoblast;" *i. e.* a cell-germ. It is not a flattened vesicle or cell. Like other discs or cytoblasts, however, it may and does become a cell; but then it is no longer flat. In the blood-disc you see a central, colourless, concave portion, around which lies the red colourless matter.

2. As usually met with, the blood-disc is round, with the exception of two or three instances, in which, from the observations of Mandl, in France, and Gulliver, in this country, it has been discovered to be elliptical. I have since found that even in mammals, where the blood-disc is usually met with round, its original form is elliptical. I have seen this to be the original form of the blood-disc in man.

3. The discs first become round, continuing flat; subsequently they pass into an orange-shape, and lastly become globular. They also very much increase in size.

4. Along with these alterations in the form and size of the blood-discs, there takes place another change. Instead of a mere concavity, there is now seen a colourless, pellucid, semi-fluid substance; which, as the corpuscle becomes orange-shaped, is found to be, not in the centre, but on one side. It is the nucleus of the corpuscle—the corpuscle itself having become a cell. This pellucid substance, or nucleus, divides and gives off globules. Each globule, appropriating to itself new matter, becomes a disc; and each disc, undergoing changes like the first, gives origin to other discs, a group of which constitutes the colourless corpuscle of the blood: for, with the changes now mentioned, the red colouring matter is consumed. Thus, as the red pass into the colourless corpuscles, there must exist all intermediate stages; between them no line of distinction can be drawn*.

5. The corpuscles of the blood are propagated by means of parent cells. A parent cell has its origin in a colourless corpuscle; this colourless cor-

* The colourless corpuscles in other vertebrata, for instance the batrachians, being much smaller than their red corpuscles, cannot be these red corpuscles in an altered state. Nor is any such change to be expected here. The red corpuscles usually seen circulating in these animals are not, as in mammalia, discs, but nucleated cells. Some of these nucleated cells, how-

puscle being an altered disc. As the parent cell is forming, the new discs within it gradually become red, and are at length liberated to give origin in like manner to new discs, or to be appropriated in some other way.

6. From Section 4 it will be seen that the disc, or so-called "cytoblast," is originally a pellucid globule; which globule therefore is the true cell-germ.

7. Sometimes the quantity of the pellucid substance in the blood-cell is very much increased. This takes place at the expense of the red colouring matter which surrounds it. The blood-corpuscles, now cells, I have seen in various parts collected until the capillaries were completely filled with them, and until they had become pressed together into many-sided objects. I have met with vessels at the edge of the crystalline lens, some parts of which presented no other than the pellucid semi-fluid substance, arisen in the manner now described, and no longer contained within the cells.

8. This originally colourless substance, derived from the nuclei of blood-cells, and nearly filling the capillaries as I have found it, appears to constitute the essential part of coagulable lymph, to organize the same, and to give origin to the tissues, &c. in the manner I have elsewhere described. It seems to be this same originally colourless substance, derived from the nuclei of blood-cells, that forms the exudation-corpuscles of authors, the fibres of false membrane, and the filaments in coagulating blood—filaments which, as I have shown, here and there arise while this substance is still within the cells.—*Philosophical Magazine*, No. 146.

Abstracts of Dr. Barry's Memoirs will be found in the *Year-Book of Facts*, 1841 and 1842.

FUNCTIONS OF NUTRITION IN ANIMALS.

On Feb. 17, Mr. Fownes lectured at the Royal Institution, on this subject. The bodies of animals were described as made up of elements with which the chemist is familiar, but that, in consequence of their union with the mysterious principle which we call *life*, they suffer much modification, and are not so easily studied as is mere inorganic matter. The three great constituents of animal matter—albumen, fibrine, and casein—were severally described. The first was contained in white of egg, and obtained as a precipitate from solution in acetic acid, by adding water; the second, obtained in a white stringy form, by whipping blood with twigs; and the third is found in milk only, and developed by adding rennet. They all exist in soluble as well as insoluble states: they may change into each other, and are all composed of the same elements—carbon, hydrogen, nitrogen, oxygen, sulphur, and phosphorus; and each appears to possess the same quantity of the four first named, but to vary in the quantity of the last two. Experiments were introduced in illustration of this similarity of constitution. The blood was then described as the food or source whence the supply of these materials was drawn; and in reference to its red hue, and to the iron it contains, which is the cause of this hue, the lecturer said that the use of this metal in the animal economy has been long a mystery; but M. Liebig very ingeniously considers it to be the vehicle whereby oxygen is carried from the lungs to every part of the system. He reasons thus:—The arterial blood, in consequence of its

ever, give origin to discs having very much the same form, size, and general appearance, as the blood-discs of the mammalia. In the frog I saw such discs passing into the state of colourless globules, which, acted on by acetic acid, presented just the same appearance as the colourless corpuscles of the human subject.

having entered the lungs, becomes supplied with oxygen, and assumes the characteristic bright colour; this is due to the *per*-oxide of iron; as it reaches the capillaries a portion of the oxygen unites with the carbon of the system, forming carbonic acid, and literally, by a slow combustion, burning away the old material to give place for the new; and the iron, in the form of *prot*-oxide, remains, giving the dark character to the venous blood. We can readily see the source whence the blood of carnivorous animals obtains the three constituents, for they are part and parcel of the very flesh they eat; but they are not so manifest in the food of herbivorous creatures. However, a very simple process enables the chemist to obtain from grain the very fibrine found in blood; from vegetable juices the very albumen found in egg; and from beans the very caseine found in milk. The difference of opinion now existing between Liebig and Dumas, relative to the origin of fat, was alluded to,—the one thinking that animals fed on meal develope more fat than can be accounted for in the food they have eaten; the other thinking they do not. The consumption of material was stated to be in proportion to the amount of nervous energy developed; but how the two are linked as cause and effect, it is impossible to determine. The quiet easy man becomes fat; but deep-thinking and active men remain thin: fat is, as it were, a store of fuel against contingencies; and hence, in cases of starvation, is first to disappear. —*Polytechnic Journal.*

SECRETION OF ANIMALS.

On March 24th, was read to the Royal Society of Edinburgh, a paper "On the Ultimate Secreting Structure of Animals," by John Goodsir, Esq. The author infers from the whole inquiry, 1. That secretion is a function of the nucleated cell, and takes place within it; and, 2. That growth and secretion are identical—the same process under different circumstances.

Among other general conclusions deducible from these observations, it appeared that ducts are to be considered as intercellular passages, into which the secretions formed by cells are cast.

For details, see *Jameson's Journal,* No. 67.

STAMMERING.

M. Colombat has detailed to the Academy of Sciences, at Paris, the process which he employs for the cure of Stammering; the chief of which are, inspiration before speaking; elevation of the tongue to the roof of the mouth, to depress the base of the tongue and larynx, and to diminish the convulsive tension of the glottis; position of the lips like during laughter, to prevent their protruding, before pronouncing the labials; and the following in speech a rhythm measured and graduated by means of an instrument which the author calls a *muthonome*, constructed on the principle of the *metronome* in use amongst musicians.

VOCAL PHENOMENON.

The *Times* informs us that in a recent number of the *Zeitschrift* appears an account of an extraordinary Vocal Phenomenon. The new musical wonder is a Boy, who has the power of emitting three vocal sounds at a time, and can therefore execute pieces in three parts. The fact is attested by two names of considerable weight, Kalliwoda and Mayer, from whom letters are published describing the exhibition, and warranting the genuineness of the prodigy. His voice, we are told, extends over two full octaves, from A flat below the line to A flat above, in the key of G; the lower notes being generally weak, those in the middle stronger, but of harsh quality, while the upper notes are soft, and flowing as those of a flageolet. When singing more than one part the lad is unable to pronounce any words, and can only sing songs of the utmost simplicity as regards the harmony.

NAVIGATORS ISLANDERS.

Mr. Heath has read to the British Association, a paper "On the Physical Character, Languages, and Manners of the People of the Navigators Islands." The islanders were described as a fine race of people, the average size rather above that of Europeans—the colour brunette, the face oval, the hair black and rather crisp, and the eyes a fine black. Their language is at present scarcely known to philologists. It is spoken by about 60,000, and is a dialect of the wide-spread Polynesian. One of its marked peculiarities is, its reciprocal conjugation of the verb. Mr. Heath had entered very fully into a comparison of the Samoan with the Malay, and of several of the Polynesian languages among themselves, and of some of the Papuan dialects, and had obtained extensive vocabularies. With regard to individual and family life, the child is named after the god whose name is last invoked prior to the moment of birth. The mothers slightly press the forehead so as to give it a conical form: they rear their children tenderly. Circumcision is practised. They believed in a future state, but had rather loose and inconsistent notions as to what sort of state it is; some, they said, became gods, some were eaten by the gods, and the chiefs became living pillars in a large temple. The tradition with them is, that they came from the eastward, and their elysium is Pulo-tu. Since Pulo is the name for island, this also indicates their origin. They are an intelligent people, and manifestly capable of improvement. The people of Tanna and the neighbouring island are in stature about five feet six, or five feet eight, the legs rather short and ill-formed: they are neither so well-formed nor well-featured as the Samoans and other Polynesians. The complexion is the colour of dirty or worn copper coin, and they make their skin still darker by a deep purple dye; they also daub their faces with red, black, and other pigments. There is a mixture of the Papuans and Polynesians, for the people of Erranan and Immer have dialects very similar to the Samoan, and there are intermarriages between the tribes, so that the Polynesians are now nearly as dark-coloured as the Papuan. Various dialects were found, not only in the group, but even on one and the same island. The language spoken at Port Resolution is in some respects peculiar; it has a conjugation of the verb by prefixes, and not only a dual but a triple personal pronoun. The people of Tanna sometimes bury their dead in shallow graves, sometimes tie a stone to them and sink them in the sea. At Anatom, the widow is tied, alive, to the dead body of her husband, and sunk together with it in the sea.

The reading of these papers was succeeded by a great number of inquiries being made of Mr. Heath, on various points in the habits, languague, &c. of the people with whom he had mixed. As specimens of the spoken languages of the people of the Navigators Islands, he read over the Lord's Prayer in the two languages they employ, the plebeian and the aristocratic. Prof. Owen stated that there was every encouragement for this committee to prosecute its labours. Many copious volumes had been written without eliciting so much information as had been gained in this instance by the queries issued by the Committee.—*Athenæum*, No. 838.

NEW QUADRUPED.

AUDUBON, the celebrated naturalist, in a letter dated from the Rocky Mountains, details his discovery of a Quadruped, somewhat resembling, in shape, a kangaroo, but varying in many particulars. It sits on its hind legs the same way, but not shaped in the abdominal regions the same; its front legs or arms are short, but armed with sharp claws, and they bound or jump with their hind legs. They have a tail something like that of a sheep, about 10 inches long, and round the middle of the body they have a ring of flesh about 12 inches wide and 8 inches thick in the middle or centre, which produces a great quantity of oil. On their heads they have two horns, very similar to the horns of the deer, but not more than 18 inches long; the head is shaped also very much like that of the deer, and has the same kind of teeth; but what is more remarkable than all the rest, their coat is of a most beautiful fur, of a dark brown colour. The proportions of the one we killed were very great; it weighed, to the best of our calculations, upwards of 600 lbs., and it measured from the top of the head to the end of the tail, 9 feet 4 inches, which appears to be their full-grown size: the Indians said, that in these woodlands these animals were in great abundance. They called it, in their tongue, the ke-ko-ka-ki, or jumper; they feed on grass, herbs, and foliage. Upon observing us take off the skin, the Indians expressed a desire to have some of the flesh, which we gave them. We cooked some of the same, and found it delicious; it was very white and tender, tasted very similar to veal; but the ring on the body was nearly all oil, and the whole upper part will produce a great quantity.

THE SIX-BANDED ARMADILLO.

DR. ALLMAN has read to the British Association, a paper "On certain Peculiarities in the Arteries of the Six-banded Armadillo." The structural novelties in this communication consist in a remarkable arrangement of vessels analogous to what has been already observed in the sloths, in the two-toed ant-eater, and in the lorises, and is characterised by the arteries having a tendency to *divide* rather than ramify, from which it results, that instead of a profusely branched arterial distribution, the larger branches suddenly break themselves up into a number of small vessels, which anastomosing but sparingly, give rise to a series of vascular pencils, from which the ultimate supply of blood to the organs is derived. This remarkable arrangement is chiefly displayed in the arteries of the posterior extremities, in the caudal and in the epigastric arteries.

Professor Owen observed, that this structure in the armadillo was not like that in the Cetacea, which was used as a reservoir of blood for those animals when under water. This was a valuable addition to our knowledge of the comparative anatomy of mammalia.—Mr. Ball observed, that this arrangement had been supposed to be peculiar to slow-moving animals, but the armadillo was a very quick-moving creature.

THE DANGER-BIRD.

One of the greatest attractions at the late meeting of the British Association, was Professor Owen's interesting lecture on the Danger-Bird, (*Dinorius*). This bird is one of the most extraordinary additions to Zoology which modern times have seen. The causes which led to the discovery were, that about three years since a person called at the museum of the Royal College of Surgeons with the fragment of a bone for sale, which he said was that of a gigantic eagle of New Zealand. At the first inspection, however, which he made of it, Professor Owen decided that it was part of a bone that belonged to a bird, but not a bird of flight, as it wanted the air-cells with which such are furnished. It is much larger than the bone of the ostrich, and differs very much from that of the apteryx, a bird whose wings are reduced to the lowest rudiments. In the course of three years Professor Owen obtained further information on the subject, through a gentleman who had gone out to New Zealand, and who, at the house of a church missionary, saw large collections of the bones of these birds, of which the aborigines possessed some traditionary knowledge. They said that their grandfathers formerly hunted them, and ascribed to them several healing virtues. The largest ostrich is 9 feet high, but the dinorius, comparing the bones in existence, must have been 16 feet high. This bird is confined to New Zealand, and it appears only in the north of that island. In other parts of the world large birds have also been found, and the footsteps of birds as gigantic as that of the dinorius have been discovered—birds so gigantic, that their existence has been received with a considerable degree of doubt and hesitation. It was thought that they belonged to some extinct reptile race, but the light which science has shed upon the subject, attests the truth of their real origin. (See also the Geological Section.)

ORTOLANS.

Perhaps, the greatest refinement in fattening is exhibited in the manner of feeding Ortolans. The Ortolan is a small bird esteemed a great delicacy by Italians. It is the fat of this bird which is so delicious; but it has a peculiar habit of feeding, which is opposed to its rapid fattening; this is, that it feeds only at the rising of the sun. Yet this peculiarity has not proved an insurmountable obstacle to the Italian gourmands. The Ortolans are placed in a warm chamber, perfectly dark, with only one aperture in the wall. Their food is scattered over the floor of the chamber. At a certain hour in the morning the keeper of the birds places a lantern in the orifice of the wall; the dim light thrown by the lantern on the floor of the apartment induces the Ortolans to believe that the sun is about to rise, and they greedily consume the food upon the floor. More food is now scattered over it, and the lantern is withdrawn. The Ortolans, rather surprised at the shortness of the day, think it their duty to fall asleep, as night has spread his sable mantle round them. During sleep, little of the food being expended in the production of force, most of it goes to the formation of muscle and fat. After they have been allowed to repose for one or two hours, in order to complete the digestion of the food taken, their keeper again exhibits the lantern through the aperture. The rising sun a second time illuminates the apartment, and the birds, awaking from their slumber, apply themselves voraciously to the food on the floor; after having discussed which, they are again enveloped in darkness. Thus the sun is made to shed its rising rays into the chamber floor four or five times every day, and as many nights follow its transitory beams. The Ortolans thus treated become like little balls of fat in a few days.—*Playfair;* in the *Journal of Agricultural Society.*

TETRAO MEDIUS IN SCOTLAND.

THERE exists in several northern countries a peculiar kind of Grouse, called by foreign naturalists *Tetrao medius*, on account of its exhibiting, as it were, a combination of the characters of the wood-grouse or capercailzie on the one hand, and of the black-cock on the other. It is never found except in countries inhabited by the two species last named; and as it presents a union of their characters, several naturalists have inferred that it is not itself a distinct kind, but a hybrid, resulting from the casual intercourse of the other two. But most naturalists have maintained that it is a distinct species, chiefly upon the principle, that, in the wild state, birds of different species do intermingle sexually with each other. Mr. Wilson, however, having discovered that, in certain districts of Scotland into which Lord Breadalbane has lately introduced the capercailzie, and in which the black-cock previously existed in abundance, this so-called intermediate grouse has also now made its appearance, he draws the conclusion that is not a distinct species, but a hybrid or mule. "It had not been previously known in Scotland, at least in our times; it has not been introduced by any one from abroad; and yet here we now find it in the very districts inhabited by the other two." Mr. Wilson has exhibited to the Royal Society of Edinburgh, a specimen recently killed on the estate of Dunira, and shewed its entire agreement with the foreign Tetrao Medius, by comparing it with a specimen from Norway.

GUANO.

GUANO is the Peruvian name for a sea fowl, and is also the term used by the Indians for the dung of the bird. The latter has been used for manure by the Peruvians, from time immemorial, and is highly prized by them, on account of its fertilizing properties, which are very great. The guanos have hitherto existed on the coast of the Peru, in numbers which would appear incredible, except to those persons who have seen them. They live on fish, and are expert fishers, for which they are beautifully formed by nature. The bill is three or four inches long, according to the age or size of the bird, and it is about one inch broad at the extremity, much curved, and altogether well adapted for hooking up the food, which rarely escapes. The quantity of guano manure accumulated on the Peruvian coast must have been immense.

Guano is likewise found in vast quantities in the British Isles. A Correspondent of the *John o' Groat's Journal*, says: "I wonder you have not taken up the subject of guano, and explained to your readers, that there is a great abundance of it to be found in Caithness, Sutherland, Orkney, and Zetland, amongst the islands, stacks, and cliffs of the rocks. There must be immense deposits of birds' dung on these coasts, which could be collected at a trifling expense. I last year made trial of it from an island near Inchcolm; I took a boat in the morning, and, with some small spades, masons' trowels, and some bags, clambered to the top, about thirty feet high, to the resort of the sea fowl; from which, in an hour's time, three of us nearly filled the boat with excellent stuff resembling dirty lime. The season was past to try it on vegetables, and, not being a farmer, I used it in top-dressing a flower garden, where it had an astonishing effect. The feeding fibres of the plants came to the surface, and laid hold of the small pieces as greedily as a hawk would his prey; it was interesting to observe the feeders of the dahlias coming to the surface—a hundred at a time, as small as threads, attached to a small piece not bigger than a walnut. I had a delightful show of them, but will not have the pith of the guano until next summer." The Editor of the above journal then asks: Why go to Africa for what may be procured at home? We believe that heavy rain reduces the strength of this manure, which may be one objection against what is found in this country.—*John o' Groat's Journal.*

LOCOMOTION OF FISHES.

ON June 12, the Rev. Dr. Buckland made to the Ashmolean Society, a communication on other modes of Locomotion than swimming in the family of Fishes, and showed that the fins in certain genera perform the functions of feet and wings. Several fishes of the *Lophius* family, or fishing frogs," have the fins converted into feet, or paddles, by means of which some species have the power of crawling and hopping on sand and mud, whilst the *Lophius histrio* can live three days out of the water, and walk upon dry land. The climbing perch, *Pevca*, or *Anabas scandens*, of the Indian rivers, is known to live a long time in the air, and to climb up the stems of palm-trees in pursuit of flies, by means of spinous projections on its gill-covers. Fishes of the *Silurus* family have a bony enlargement of the first ray of the pectoral fin, which is also armed with spines, and this organ is not only an offensive and defensive weapon, but may also give ambulatory movements along the bottom of the fresh waters which these fish inhabit. The flying fishes are notorious examples of the conversion of fins into an organ of movement in the air. M. Deslongchamps has published in the *Transactions of the Linnæan Society of Normandy*, 1842, an account of his observations on the ambulatory movements of the gurnard (*Trigla*) at the bottom of the sea. In 1839, he had an opportunity of observing these movements, in one of the artificial sea-ponds, or fishing traps surrounded by nets, on the shore of Normandy. He saw a score of gurnards closing their fins against their sides, like the wing of a fly in repose, and without any movement of their tails, walking along the bottom by means of six free rays, three on each pectoral fin, which they placed successively on the ground. They moved rapidly forwards, backwards, to the right and left, groping in all directions with these rays, as if in search of small crabs: their great heads and bodies seemed to throw hardly any weight on the slender rays or feet, being suspended in water, and having their weight further diminished by their swimming-bladder. During these movements the gurnards resembled insects moving along the sand; when M. Deslongchamps moved in the water, the fish swam away rapidly to the extremity of the pond; when he stood still, they resumed their ambulatory movement, and came between his legs. On dissection we find these three anterior rays of the pectoral fins to be supported each with strong muscular apparatus to direct their movements, apart from the muscles that are connected with the smaller rays of the pectoral fin.

Dr. Buckland stated that Miss Potts, of Chester, had lately sent to him a flagstone from a coal-shaft at Mostyn, bearing impressions, which he supposed to be the trackway of some fish crawling along the bottom by means of the anterior rays of its pectoral fins. There were no indications of feet, but only scratches symmetrically disposed on each side of a space that may have been covered by the body of the fish whilst making progress by pressing its fin-bones on the bottom. As yet, no footsteps of reptiles, or of any animals more highly organized than fishes, have been found in strata older than those which belong to the Triassic or new red-sandstone series, of which the *Cheirotherium* of Germany and Cheshire, and the *Ornithicnites* of Connecticut, are notorious examples. The abundant remains of fossil fishes, armed with strong bony spines, and of other fishes allied to the gurnard, in strata of the carboniferous and old red-sandstone series, would lead us to expect the frequent occurrence of impressions made by their locomotive organs on the bottoms of the ancient waters in which they lived. Dr. Buckland proposes to designate these petrified traces or trackways of ancient fishes by the term *Ichthyoicnites*, or fish-tracks.—*Oxford Herald.*

GROWTH OF THE SALMON.

MR. ANDREW YOUNG, Invershin, Sutherlandshire, has taken up the subject of the Salmon's Growth where it was necessarily left off by Mr. Shaw*. So far as the earliest or fresh-water state of the fish is concerned, he entirely agrees with the observer just named. He then states the various opinions which prevail regarding the more or less rapid growth of smolts and grilse, and shows by tabular lists (the results of frequently repeated experiments), that the increase in their dimensions is extraordinary so soon as they descend into the salt water. So far back as the months of April and May, 1837, he marked a number of descending smolts, by making a peculiar perforation in the caudal fin, by means of small nipping irons constructed for the purpose. He re-captured a considerable number of them ascending the rivers as grilse, in the course of the ensuing months of June and July, and weighing several pounds each, more or less, according to the difference in the length of their sojourn in the sea. Again, in April and May 1842, he marked a number of descending smolts, by clipping off the little adipose fin upon the back. In June and July he caught several of them returning up the river, and bearing his peculiar mark,—the adipose fin being absent. Two of these specimens were exhibited to the Society. One marked in April, and recaptured on the 25th of July, weighed 7lb.; the other, marked in May and recaptured on the 30th July, weighed 3½lb. As the season advances grilse increase in size, those being the largest which abide the longest in the sea. They spawn in the rivers after their first ascent, and before they have become adult salmon.

Mr. Young also described various experiments instituted with the view of showing the transition of grilse into salmon. He marked many small grilse after they had spawned in winter, and were about to re-descend into the sea. He re-captured them in the course of the ensuing summer as finely-formed salmon, ranging in weight from 9 to 14lb., the difference still depending on the length of their sojourn in the sea. He has tried these experiments for many seasons, but never twice with the same mark. A specimen marked as a grilse of 4lb. in January 1842, and re-captured as a salmon of 9lb. in July, was exhibited to the Society. It bore a peculiarly twisted piece of *copper* wire in the upper lobe of the caudal fin. Those marked and re-taken in 1841 were marked with *brass* wire in the dorsal fin. With these and other precautions Mr. Young avoided the possibility of any mistake as to the lapse of time. Both grilse and salmon return uniformly to their native streams; at least it very rarely happens that a fish bearing a particular mark is found except in the river where it was so marked. Salmon in the perfect state as to form and aspect, also increase rapidly in their dimensions on again reaching the sea. A

* See Year-book of Facts, 1839, p. 181; 1841, p. 206.

spawned salmon weighing 12lb. was marked on the 4th of March, and was recaptured on its return from the sea on the 10th of July, weighing 18lb. Mr. Young is of opinion that salmon rather diminish than increase in size during their sojourn in rivers; and he illustrates this and other points of his subjects by numerous experiments and observations.—*Proceedings of the Royal Society of Scotland.*

SHELL-FISH AND POLYPI OF THE RED SEA.

A French naturalist at Cairo offers to go to the Red Sea and collect specimens of the Shell-fish and Polypi of every description, when he shall have procured twenty subscribers at £1 per month for a year. For this sum he proposes to give each subscriber a certain number of specimens of each shell polypus, which is to be sent monthly to Cairo, to a committee, formed of the most respectable resident subscribers. I have seen a collection already made by him from the north end of the Red Sea, in which are most rare and curious shells. I believe the man to be honest, and that his subscribers will possess, at the end of the year, for the sum of £12, a valuable series of shells and polypi from the whole western coast and islands of that sea, from Suez to Abyssinia.—*Letter in the Athenæum.*

ORGAN OF HEARING IN CRUSTACEA.

Dr. Farre finds that in the Lobster (*Astacus marinus*), the organ of hearing consists of a transparent and delicate vestibular sac, which is contained in the base, or first joint of the small antennæ; its situation being indicated externally by a slight dilatation of the joint at this part, and also by the presence of a membrane covering an oval aperture, which is the fenestra ovalis. The inner surface of the sac gives origin to a number of hollow processes, which are covered with minute hairs, and filled with granular matter, apparently nervous. A delicate plexus of nerves, formed by the acoustic nerve, which is a separate branch supplied from the supra-œsophageal ganglion, is distributed over the base of these processes and around the sac. Within the sac there are always found a number of particles of siliceous sand, which are admitted, together with a portion of the surrounding water, through a valvular orifice at the mouth of the sac, being there placed apparently for the express purpose of regulating the size of the grains. Dr. Farre considers these siliceous particles as performing the office of otolites, in the same way as the stones taken into the stomachs of granivorous birds supply the office of gastric teeth. The Doctor describes several modifications of this structure exhibited in the organs of hearing of the *Astacus fluviatilis*, *Pagurus streblonyx*, and *Palinurus quadricornis*, and an explanation is attempted of the uses of the several parts, and their subserviency to the purposes of that sense.

The Doctor describes another organ situated at the base of the large antennæ, which it appears has been confounded with the former by some anatomists, but which the Doctor conjectures may possibly constitute an organ of smell.—*Proceedings of the Royal Society.*

ANIMALS OF THE ÆGEAN SEAS.

Prof. Forbes has read to the British Association, a lecture "On the Dredging of the Ægean Seas, to determine their Marine Animals," which had never before been satisfactorily done. With respect to the cause affecting their distribution, a few of the results arrived at were, that the species found in the lesser depths are those common to all countries, while the deep yield the exclusively local; and the species diminish in number as we descend. The regions of depth are proportioned to the latitude, so that as we descend, the fauna assumes a more northern character, more colourless and dusky. Now, combining all these facts with the well-known one, that the Ægean is filling up with sedimentary deposits, were the process complete, we should find a varied fauna at the top, becoming more and more simple in its character as we descend in each layer, until we reach the zero of animal life, where no traces of living fauna could be found. In some localities, land and sea shells will be found mingled. The Professor thought the application of this to geology evident.

IRISH LIMAXES.

A paper, by the Rev. J. Clarke, "On the Irish Species of the Genus Limax," has been read to the British Association. Two species were described in detail, which had not been included, by previous writers, in the British catalogue—the *Limax aboreus* of Bouchard, and the *L. Gagates* of Draparnaud and Ferussac. The *L. aboreus* is not uncommon in the wooded districts of Ireland, especially on the ash and the beech; concealing itself during the day-time under the moss and the trunk. *Limax Gagates* (Draparaund), the Irish specimens of this limax, agree with Ferussac's variety β. The only British species with which it can be compared, as to form, is *L. Sowerbii*. In some districts of Ireland the species is not uncommon; frequenting gardens and thick herbage. In the course of the paper, all the British Limaxes were mentioned as occurring in Ireland, with the exception of *Limax brunneus* (Draparaund), which had not as yet come under the notice of the author.

Prof. Forbes considered this as one of the most valuable papers that had been written on the genus Limax, which had been little attended to, though forming an important link in the scale of creation. Mr. Thompson observed, that this paper was interesting, as recording two forms of Limax in Ireland, which were not only new to Ireland, but did not at present exist in the British Fauna.

ARANEIDÆ.

A report has been read from Mr. Blackwall to the British Association, "On the Functions of the Palpi of the Araneidæ," which had been called for at the last meeting of the Society. After stating all the opinions hitherto formed, as to the functions of the palpi of the Araneidæ, the author detailed a series of experiments on the subject, and the conclusions derived from them. Prof. Owen acknowledged the pleasure with which he had listened to this paper, and gave a complete view of the difficulties attending the assignment of the true function to the palpi of spiders. In alluding to a portion of Mr. Blackwall's paper, he gave an account of the structure and functions of the ovarial sac of aphides, accounting for the well-known fact of the anomalous reproduction to which they were subject.

BEES.

In a note to the French Academy, M. Muston mentions a fact, which he did not observe directly, but which had been attested to him by different inhabitants of the country, that a Bee, which goes out of its hive, from the commencement to the end of its excursion only rests on flowers belonging to the same species, or to species closely allied. —*Illustrated Polytechnic Review*, No. 13.

ZOOPHYTES OF IRELAND.

Dr. Allman has read to the British Association, a "Synopsis of the Genera and Species of Zoophytes inhabiting the fresh waters of Ireland." The fresh-water Zoophytes of Great Britain have hitherto been all included under the following four genera:—Hydra, Cristatella, Alcyonella, and Plumatella. Of these, Hydra is made to include four British species,—Cristatella one, Alcyonella one, and Plumatella has been described as containing three species. Of the above nine species, the author was of opinion that two must be erased, viz. the *Hydra verucosa* of Templeton, which appears identical with *H. fusca*, and the *Plumalella gelatinosa* of Flemming, which is evidently the same with Blumenbach's *Tubularia sultana.* To the seven species which remain, Dr. Allman was enabled to add five, of which four do not appear to have been before noticed, and the other is only found described in the Fauna of the Continent. The Zoophytes at present included under Plumatella were distributed in the synopsis between two genera—those with crescentic disks being retained under Plumatella; while those whose disks are circular were removed to Fredericella, a genus established by M. Gervais for this form of ascidian zoophyte. An important addition now made to the British zoophytes is Paludicella, discovered by W. Thompson, Esq., at Lough Erne, in the autumn of 1837, and since obtained abundantly by Dr. Allman in the Grand Canal near Dublin. In October, 1842, a hydroid zoophyte of much interest was discovered by Dr. Allman in the Grand Canal, Dublin; it is referable to no known genus, and occupies a position between Coryne and Hermia. For the reception of this zoophyte, therefore, he has been obliged to form a new genus, to which he has given the name Cordylophora. The synopsis, therefore, embraced several new species and two genera, now for the first time added to the British Fauna.

Prof. Forbes remarked on the value of this paper. In Fredericella, we had the analogue of the marine genus Coryne, as we had in Hydra, that of Sertularia. This paper pointed out the impossibility of the existence of such a genus as Hassell's Echinochorium.

NEWLY-DISCOVERED PARASITIC ANIMALCULE OF THE HUMAN SKIN.

On March 30, were read to the Royal Society, some "Researches into the Structure and Development of a newly-discovered Parasitic Animalcule of the Human Skin, the *Entozoon folliculorum*," by Mr. Erasmus Wilson, Lecturer on Anatomy and Physiology at the Middlesex Hospital.

While engaged in researches on the minute anatomy of the skin and its subsidiary organs, and particularly on the microscopical composition of the sebaceous substance, Mr. Wilson learned that Dr. Gustow Simon, of Berlin, had discovered an animalcule which inhabits the hair follicles of the human integument, and of which a description was published in a memoir contained in the first Number of Müller's *Archiv* for 1842. Of this memoir, the author gives a translation at full length. He then states that, after careful search, he, at length, succeeded in finding the parasitic animals in question, and proceeded to investigate more fully and minutely than Dr. Simon had done the details of their structure, and the circumstances of their origin and development. They exist in the sebaceous follicles of almost every individual, but are found more especially in those persons who possess a torpid skin; they increase in number during sickness, so as in general to be met with in great abundance after death. In living and healthy persons, from one to three or four of these entozoa are contained in each follicle. They are more numerous in the follicles situated in the depression by the side of the nose; but they are also found in those of the breast and abdomen, and on the back and loins. Their form changes in the progress of their growth. The perfect animal presents an elongated body, divisible into a head, thorax, and abdomen. From the front of the head proceed two moveable arms, apparently formed for prehension: and to the under side of the thorax are attached four pair of legs, terminated by claws. The author distinguishes two principal varieties of the adult animal; the one remarkable for the great length of the abdomen and roundness of the caudal extremity; whilst the other is characterized by greater compactness of form, a shorter abdomen, and more pointed tail. The first variety was found to measure, in length, from the one-100th to the 45th, and the second, from the one-160th to the 109th part of an inch. The author gives a minute description of the ova of these entozoa, which he follows in the successive stages of their development.

BOTANY.

CARBON AND NITROGEN IN PLANTS.

MR. RIGGE has communicated to the Royal Society, "A statement of Experiments showing that Carbon and Nitrogen are compound bodies, and are made by Plants during their growth." The author, finding that sprigs of succulent plants, such as mint, placed in a bottle containing perfectly pure water, and having no communication with the atmosphere except through the medium of water, or mercury and water, in a few weeks grow to more than double their size, with a proportionate increase of weight of all the chemical elements which enter into their composition, is thence disposed to infer that all plants make carbon and nitrogen; and that the quantity made by any plant varies with the circumstances in which it is placed.

RESPIRATION OF THE LEAVES OF PLANTS.

MR. W. H. PEPYS has detailed to the Royal Society a series of experiments on the products of the Respiration of Plants, and more particularly of the leaves; selecting, with this view, specimens of plants which had been previously habituated to respire constantly under an inclosure of glass; and employing, for that purpose, the apparatus which he had formerly used in experimenting on the combustion of the diamond, and consisting of two mercurial gasometers, with the addition of two hemispheres of glass closely joined together at their bases, so as to form an air-tight globular receptacle for the plant subjected to experiment.

The general conclusions he deduces from his numerous experiments conducted during several years, are, first, that in leaves which are in a state of vigorous health, vegetation is always operating to restore the surrounding atmospheric air to its natural condition, by the absorption of carbonic acid and the disengagement of oxygenous gas: that this action is promoted by the influence of light, but that it continues to be exerted, although more slowly, even in the dark. Secondly, that carbonic acid is never disengaged during the healthy condition of the leaf. Thirdly, that the fluid so abundantly exhaled by plants in their vegetation is pure water, and contains no trace of carbonic acid. Fourthly, that the first portions of carbonic acid gas contained in an artificial atmosphere are taken up with more avidity by plants than the remaining portions; as if their appetite for that pabulum had diminished by satiety.

THEINE IN ILEX PARAGUYENSIS.

RECENT chemical researches have proved that the bitter tonic substance called *Theine*, found in the leaves of tea, is identical with *Caffeine*, obtained from the seeds of coffee. On this subject, Liebig remarks—"We shall never, certainly, be able to discover how men were led to the use of the hot infusion of the leaves of a certain shrub (tea), or of a decoction of certain roasted seeds (coffee). Some cause there must be, which would explain how the practice has become a necessary of life to whole nations. But it is surely still more remarkable that the beneficial effects of both plants on the health must be ascribed to one and the same substance, the presence of which in two vegetables, belonging to different natural families and the produce of different quarters of the globe, could hardly have presented itself to the boldest imagination."

It is curious to remark, that a beverage called Guarana, used by the people on the banks of the Amazon, and in all probability procured from the leaves of *Paullinia sorbilis*, should yield a crystalline matter also identical with Theine, and that Theobromine, or the principle yielded by chocolate, should be in many respects analogous. Mr John Stenhouse, of Glasgow, has recently detected Theine in the leaves of the *Ilex paraguyensis*, Yerba Maté, or Paraguay Tea, which is the common beverage of a large portion of the inhabitants of South America.

This is a fact of great interest, when taken in connexion with the previous discoveries above alluded to, as tending to shew that the same principle is found in many of those substances which are employed by mankind in different parts of the world to furnish a tonic and refreshing beverage. Theine is procured easily, according to Mr. Stenhouse, by making an infusion of tea, precipitating by acetate of lead, filtering, evaporating the clear solution to a thickish consistence, and then subliming (?) from a sand-bath. In this way he has been able to procure $1\frac{1}{8}$ per cent. from Assam tea without the use of alcohol or æther. The best test for Theine is ammonia, which, when added and heated to dryness, gives a beautiful rose-colour precisely similar to murexide. From the facility with which Theine is obtained, and its tonic qualities, it is probable that it may be ere long used medicinally as a substitute for quinine and other remedial agents of a similar nature.—*Annals of Nat. Hist.* March 1843.

UNSEASONABLE COLLECTION OF VEGETABLE REMEDIES.

Vegetable physiology has demonstrated that, during the progress of vegetation, most remarkable changes occur in succession, in the chemical composition, as well as in the sensible qualities of the plant. Take, as an example, the aromatic and spicy qualities of the unexpanded flowers of the *Caryophyllus aromaticus* (cloves), the flower-bud of which, if it be fully developed, loses these properties altogether, and the fruit of the tree is not in the least degree aromatic. So the berries of pimento, when they come to maturity, lose their aromatic warmth, and acquire a flower very analogous to that of juniper. The *Colchicum autumnale* may be adduced as another example, in which the medicinal properties of the vegetable are entirely changed during the natural progress of its development. To secure the virtues of *Valerian*, its roots should be dug up in autumn, when the leaves begin to decay. The root of the *Taraxacum* should be taken up in April; at any other season its virtues are questionable. The root of *Hyoscyamus*, which some persons have considered as the most active part of the plant, is all but inert in the spring; the juice of 3 lbs. of the root, collected near the end of April, when the plant had hardly begun to shoot, killed a dog in somewhat less than two days, while a decoction of 1½ oz. from the root, collected on the last day of June, proved fatal in 2½ hours. Experience has also shewn that, in the bark of the oak, the quantity of tannic acid varies considerably according to the season; thus, that cut in spring contains, according to Beguin, four times more of the astringent principle than that which is obtained in winter. The medicinal powers of *inspissated juices* are greatly controlled both by soil and season. Dr. Fothergill says, "I know, from repeated experiments, that the extract which has been prepared from *hemlock*, before the plant arrives at maturity, is much inferior to that which is made when the plant has acquired its full vigour, and is rather on the verge of decline: just when the flowers fade, the rudiments of the seeds become observable, and the habit of the plant inclines to yellow, *is the proper time* to collect it." The lettuce, when young, scarcely possesses any narcotic property; and in the poppy the narcotic principle is not apparent until the petals fall and the germen enlarges.

The leaves of *Digitalis* should be gathered just before, or during the period of inflorescence; and those of *Hyoscyamus* when the plant is in full flower, and not until the second year of its duration. Great attention should be paid to such rules, and wild and native plants should always be preferred to cultivated specimens.—Dr. Paris's *Pharmacologia*, 9th edit. 1843.

COCA AND MATICO.

Dr. Martius has obtained a small sample of the famous *Coca* or *Ypadu* of the Brazilians. It consists of the leaves of *Erythroxylon Coca*, which herb appears to be as highly valued in Peru as the *Maté* in Paraguay. The *Coca* is the leaf of a shrub which grows especially in Bolivia beyond the Andes. The Indians chew the leaf nearly in the same manner as tobacco is used in Europe; they just take so much as they can conveniently hold between the thumb and two next fingers, moisten it sufficiently with saliva, them mix a little unslaked lime with it, and form the mass into a ball or pellet, which they place in the mouth, and on which they subsist sometimes for days, now and then renewing the ration. Messengers who undertake journeys, which frequently last from ten to twelve days, and during which the Indian seldom lays himself down to sleep, but merely leans himself, sometimes for half an hour, against a tree or rock, have only their *Coca*, besides which they take once or twice daily a spoonful of meal of roasted maize mixed with water. Thus, for instance, a journey of 530 miles has been accomplished by messengers in 175 successive hours, and with no other sustenance. Among the wild Indians, the chewing the fresh *Coca* has become a vice, as among the Chinese the smoking of opium; it renders them imbecile, drives them into the woods, so that they can no longer remain under roof, and at last die in the open forest, naked as the beast, in wild madness.

The *Matico* is a tree which grows wild in the interior of Peru, the other side of the Andes, the leaf of which possesses great medicinal virtues, and the use of which has been learned from the Indians, and is as follows:—The leaf is dried or roasted on the fire, but must not be touched by the flame, or burnt. It is then powdered, passed through a fine sieve, to remove all the larger particles, and the fine powder is the remedy for external wounds.

The Indians, a very sensual race, are also said to prepare a beverage from the fresh leaves, which they give to the women as an aphrodisiac, and further infusions of the male and female flowers, which they give for that purpose reciprocally to each sex. The Indians are also said to assert, that the fresh leaf has virtue sufficient to stop bleeding at the pulse, even if cut through, instantaneously, and to staunch the vein; but this latter report is merely from hearsay.—*Pharm. Central. Blatt.; Chemical Gazette*, No. 8.

COCCULUS INDICUS.

THIS article, which is scarcely ever used in medicine, and is of no importance, is extensively imported for the purpose of adulterating beer. To such an extent is this the case, that writers on brewing openly acknowledge the fact, and give regular formulæ for its employment. One author states that it is impossible to brew a strong-bodied porter from malt and hops alone; and almost all concur in deliberately recommending it, on the ground that it "increases the apparent strength of the beer, and improves its intoxicating properties." About 1818, numerous prosecutions were instituted by the Excise against parties for selling or employing this substance. In many instances, convictions were obtained, the persons pleading guilty, with the view of escaping any investigation into the more serious charge of selling or using *nux vomica* for the same purpose. There can be no doubt that the latter is still employed to a certain extent, but it is beyond dispute that the Cocculus is used to an extent totally unsuspected by the public or the government. Unfortunately, no separate account of the quantity on which duty is paid is kept at the Custom House; but, it is believed, for reasons hereafter given, to be extremely small, and in many years *nil*. In 1832, duty was paid on 12,000lb.; and in 1834, Dr. Pereira states that a single druggist sold 2,500 bags. Cocculus Indicus, in doses of two or three grains, will produce nausea, vomitings, and alarming prostration. In ten or twelve grain doses, it kills strong dogs by tetanic spasms and convulsions. In still larger doses, death, both in man and animals, is speedily produced. The drug also kills plants. In small doses, it causes symptoms resembling intoxication, and is believed to be the substance used in cases of what is called hocussing. Opium, which has been thought to be what is employed, will not produce the effects experienced by parties who have been hocussed. Taking the known deleterious powers of the substance into account, and the proved fact of its being very extensively used by brewers, it would be evident that the public health must be injured by the practice of drugging beer. Indeed, it is probable that the disease and death, often sudden, said to result from beer drinking, ought in many cases to be ascribed to the drugs with which it is impregnated. Mr. Mowbray stated that the Cocculus Indicus was principally used by the small brewers, to whom it was supplied by a class of druggists styled brewers' druggists; one of these told him he sold about half a ton weekly. It was sent to the brewers packed up in casks, and covered over with soda, a part of the latter being used in brewing, to assist the solution of the Cocculus. A very small portion of this drug paid the Customs duty: it was passed as merchandize, and occasionally in the form of powder, under the name of linseed-meal. The proper mode of discovering it in the adulterated liquid would be by the tests for its active principle, picrotoxine, the chief difficulty depending on the small quantity that would be present.—*Dr. Cooke; Proceedings of Medico-Botanical Society.*

MATURITY OF GRAPES.

M. Payen has read to the Academy of Sciences, at Paris, the report of the commission on a memoir by M. Oscar Leclerc-Thonin, who sought by direct experiment to solve the question—what influence had the leaves of the vine in relation to the development and maturity of the grapes? The following results exhibit an explanation of the difficulty of cultivating the vine in latitudes where temperature may be suitable, but where the atmosphere is frequently foggy. The total suppression of the leaves prevents the development and the maturity of the grapes. The partial suppression of these organs in the spring provokes the appearance of axillary buds, which replace the leaves taken away; later, when the buds can no longer be produced, this suppression arrests the development of the kernels, diminishes the quantity of the flesh, retards the maturity and injures the elaboration of the saccharine principle. Want of evaporation, and privation of the solar rays, enervate the organs of fructification. Superabundance of water, and consequently defective evaporation, in a luminous atmosphere, incites a luxuriant vegetation of leaves, but checks the elaboration of the juices, which remain acid and unsavoury: maturation is not accomplished. Finally, in a warm atmosphere, moist and dull, the leaves may increase greatly; but the juices are insipid, scarce, and the embryo is not formed.—*Literary Gazette*, No. 1359.

ASSAMESE TEA.

Dr. Christison has exhibited to the Royal Society of Edinburgh, specimens from the Government Superintendent of Tea Culture in Assam, illustrating the several ages at which the leaves of the Assam and China Tea-plants are used for making the different commercial varieties of black and green tea.

An examination of these specimens seemed to prove, that the leaves of the China tea-plant, cultivated at the same plantation with the tea-plant of Assam, are considerably less, and somewhat thicker, but otherwise so exactly similar, that the two plants may well be mer varieties of the same species,—an opinion now generally adopted by botanists in India. The specimens further illustrated the doctrine deduced from recent investigations in India, that the different kinds of green and black tea are made from the leaves of one species of plant, collected at different periods of their development. The specimens were collected in April, 1841. The unexpanded shoots and very young leaves are marked as yielding Pekoe, a black tea, and Young Hyson, a green tea, by different modes of preparation. The fully-expanded, but still young leaves, are stated to produce Pouchong, Souchong, and Campoi, among the black teas, and Imperial, Gunpowder, and Hyson, among the green teas. Older and firmer leaves produce Congo, a black tea, and Twangkay and Hyson-skins, two of the green teas; and the oldest and coarsest of the leaves produce Bohea, the lowest in quality of the black teas.

PARAGUAY TEA.

The tea tree, called the *Yerva Mate*, grows spontaneously, intermingled with the vegetable productions of the country, in the magnificent forests which abound in the neighbourhood of the streams which fall into the Parana and Uruguay. Paraguay is rich in its forests, which contain numerous species of fine timber trees, many of which yield gums, cautchouc, materials for dyeing; and in the midst of these the Maté rises to the size of the common orange-tree. These forests, from their production of this herb, are called yerbales; the country in their immediate neighbourhood is without cultivation, and is overgrown with thorny Acacias and underwood of every kind. The tree becomes stunted when the leaf is regularly gathered, for the limbs are cut every two or three years. The leaf is from four to five inches long, is elliptic, cuniform, crenated, of a dark green above, and paler below. The method of preparing the tea is as follows:—A hurdle of long poles is constructed in the form of a cylindrical vault, which they call barbagua; under this a large fire is made, and the branches, being placed on the hurdle, remain there till the leaves are dry; after this, they remove the fire, and on the hot and hard platform, after being swept clean, they throw the branches, which they beat to separate the leaves. In this each is assisted by a boy, who receives the proportion of 25lbs. of leaves for every bundle he cleans. The leaves, being separated from the branches, and prepared sufficiently, are next put into a large bag made of hides, which has the four upper corners fixed to four large stakes placed in the ground, fitted to support a considerable weight; into this they put the leaves, and beat them down with a pole in the same way as the negroes of the West Indies pack their cotton bags. When the bag is filled and packed hard, the mouth is sewed up; and in this state, without further preparation, the leaves are fit for use, but not considered as seasoned till they are a few months

* For details of the culture of tea in Assam, from its commencement, see Year-Book of Facts, 1839, 1840, 1841, 1842.

old. In the form in which the tea is imported into this country, it is quite impossible to trace the minutest form of a leaf, for it has the appearance of a highly comminuted powder; and indeed this is one of the reasons that it must be quaffed, and not drunk. The infusion is made by putting into a sort of tea-pot a handful of the maté; when this is poured into a cup, the tea-drinker is furnished with a little instrument, a tube with a bulb perforated with a number of small holes. This bulb is placed in the liquid, and then the process of suction is commenced. Many individuals who have been in the habit of using it, ascribe singular virtues to it: some it renders tranquil under circumstances of agitation, whilst others feel a slight degree of excitement; but few seem to agree upon the subject. It would appear, from an analysis lately made of the leaves of the *Ilex Paraguyensis*, that the virtue resides in an alkali, which is not dissimilar to theine.—*Illustrated Polytechnic Review.*

AFRICAN GRAIN CALLED FUNDI OR FUNDUNGI.

THIS Lilliputian grain, which is described by Mr. Clarke as being about the size of mignonette-seed, is stated to be cultivated in the village of Kissy and in the neighbourhood of Waterloo by individuals of the Soosoo, Foulah, Bassa and Joloff nations, by whom it is called "hungry rice." The ground is cleared for its reception by burning down the copse-wood, and hoeing between the roots and stumps. It is sown in the months of May and June, the ground being slightly opened, and again lightly drawn together over the seed with a hoe. In August, when it shoots up, it is carefully weeded. It ripens in September, growing to the height of about eighteen inches, and its stems, which are very slender, are then bent to the earth by the mere weight of the grain. They are reaped with hooked knives. The patch of land is then either suffered to lie fallow, or planted with yams or cassada in rotation. Manure is said to be unnecessary, or even injurious, the plant delighting in light soils, and being raised even in rocky situations, which are most frequent in and about Kissy. When cut down it is tied up in small sheaves, and placed in a dry situation within the hut, for if allowed to remain on the ground, or to become wet, the grains become agglutinated to their coverings. The grain is trodden out with the feet, and is then parched or dried in the sun, to allow of the more easy removal of the chaff in the process of pounding, which is performed in wooden mortars. It is afterwards winnowed with a kind of cane fanner on mats.

In preparing this delicious grain for food, Mr. Clarke states that it is first thrown into boiling water, in which it is assiduously stirred for a few minutes. The water is then poured off, and the natives add to it palm oil, butter, or milk; but the Europeans and negroes connected with the colony stew it with fowl, fish, or mutton, adding a small piece of salt pork for the sake of flavour; and the dish thus prepared is stated to resemble kous-kous. The grain is also made into a pudding with the usual condiments, and eaten either hot or cold with milk: the Scotch residents sometimes dressing it as a milk-porridge. Mr.

Clarke is of opinion that if the fundi grain were raised for exportation to Europe, it might prove a valuable addition to the list of light farinaceous articles of food in use among the delicate or convalescent.

Specimens of the grass have been examined by Mr. Kippist, Librarian to the Linnæan Society. It is a slender grass with digitate spikes, which has much of the habit of Digitaria, but which, on account of the absence of the small outer glume existing in that genus, must be referred to Paspalum. Mr. Kippist regards it as an undescribed species, and distinguished by the name of Paspalum exile.—*Proceedings of the Linnæan Society.*

CASTOR OIL TREE.

According to M. Siller, the Ricinus is sown in Armenia among the cotton seed. It does not thrive in high and bleak places. The seed, the entire annual produce of which amounts in Armenia to about 10,000 cwt., is roasted in copper pans, then ground on flat stones, the thick mass which results boiled in water, and the oil skimmed off. In this manner about 25 per cent. is obtained, which is consumed for the greater part as burning oil. A better kind is prepared from the shelled seed. The chemists of Tiflis purchase the seed and press it in screw-presses, which method is also followed in Sarepta; and this Russian oil is of a brighter colour, and far superior in purity, smell, and taste, to any of the Armenian.—*Archiv der Pharm.; Chemical Gazette*, No. 8.

NEW RESIN FROM PINUS ABIES.

At the late meeting of the Scandinavian Naturalists, in Stockholm, M. Berlin communicated a notice of the occurrence of a resin in the cavities of *Pinus Abies* in Noorland, which the country people chew, and therefore call *tugghada* (chew resin). It contains an aromatic essential oil, quite distinct from oil of turpentine, and resins differing entirely from those which generally exude from that tree, and moreover a new crystalline acid, which may be extracted with water.—*Augsb. Allgem. Zeitung; Chemical Gazette*, No. 8.

BEBEERU TREE OF BRITISH GUIANA.

At a recent meeting, Dr. Douglass Maclagan brought before the Royal Society, of Edinburgh, a notice regarding the Bebeeru Tree of British Guiana, of which we present a brief sketch.

The plant bearing the above Indian name, and also called Sipeeri by the Dutch colonists, furnishes the hard and heavy timber known by the name of Greenheart. The object of the present paper was to state the result of experiments made by the author on the bark and seeds of the tree, which had been found by Mr. Rodie, late surgeon R.N., to contain a vegetable alkali possessed of the power of checking intermittent fevers. Dr. Maclagan stated that the tree was unknown to botanists. Sir William Hooker and Dr. Lindley had seen the fruit, and declared it to be lauraceous, but the author had been unable to find in Nees v. Esenbeck's "Systema Laurinarum" any genus, or even suborder of lauraceous plants, to which he could refer it. With regard to its chemical qualities, Dr. Maclagan stated that he had obtained, both from the bark and seeds, two distinct alkalies, both uncrystallizable; to one of which he applied Mr. Rodie's name Bebeerine; to the other he gave the name of Sipeerine. They could be separated by anhydrous æther, the Bebeerine being soluble in that menstruum, whilst the Sipeerine was not. Dr. Maclagan had likewise obtained, especially from the seeds, a peculiar crystallizable and deliquescent acid, which he called bebeeric acid, and which seemed to be distinct from every vegetable acid hitherto described.

The author stated that he had instituted experiments with a view to ascertain if a soluble salt of the alkalies could be procured which might be used as a substitute for sulphate of quinine when dear. He stated, as the results of his trials, that the produce did not amount to more than one and a half of sulphate per cent. from the bark; but he still calculated that if the bark could be got at a moderate price, the salt of the alkalies might be prepared at a cost inferior to that of sulphate of quinine. Dr. Maclagan stated that the bark appeared to be better suited for the purposes of manufacture than the seeds. The author mentioned that sulphate prepared under his directions had been sent out to Demerara, and had been tried there with marked success in intermittent fever, by Dr. Watt. He had likewise used it with success in a few cases of ague in Edinburgh, and also in periodic headache; so that he had no doubt of its possessing considerable power as an antiperiodic remedy. Lastly, he mentioned that a secret preparation, sold under the name Warburg's Fever Drops, reputed a good antiperiodic, appeared to him to be a tincture of Bebeeru seeds.—*Annals of Natural History.*

CEYLON MOSS.

On Jan. 25, was read to the Medico-Botanical Society, a paper by M. Guibourt, "On the Ceylon Moss," a large quantity of which had been sent to him by M. Saillant, a pharmacien at Nantes. The moss has been described and figured by Turner under the name of the *Fucus lichenoides*, by Agardh as the *Sphærococcus lichenoides*, and by Lamaroux, as the *Gigantina lichenoides*. This moss, or alga, is in whitish ramifying filaments about three or four inches long, and about the thickness of strong sewing thread. It appears to be cylindrical to the naked eye, but under the microscope it offers an unequal, and, as it were, nervous or reticulated surface. Its branches are either dichotomous, pedulated, or simply alternate. It has a slightly saltish savour, and is scarcely, if at all, soluble in cold water. Iodine colours it of a blackish hue, mixed with a red tint; it therefore contains amylaceous matter. The Ceylon moss affords by boiling an abundant nutritious jelly, well suited for invalids. The residue of the decoction may be employed as food; it may be prepared in the same manner as the leguminous vegetables. Such, in fact, is its principal use in the countries where it is indigenous.

RARE PLANT.

Mr. Hincks has described to the British Association, the singular and *àpropos* re-discovery of the *Neottia gemmipara*, one of the rarest plants in the world, of which two specimens were exhibited. It was first found in 1810, in a bog at Berehaven, by Mr. Drummond, and was quite lost sight of until 1841, when it was re-discovered; it found its way to Dr. Woods, of Cork, who had it sent to him in London. It is a curious plant, as this bog is the only place in the world in which it is known to have grown. It was next incidentally mentioned, in a discussion on saxifrages, that the London pride of the English gardens is incidental with the London pride of the Pyrenees.

RARE POISONOUS PLANT.

Dr. Pickells has read to the British Association a paper on *Œnanthe crocata*, one of the most virulent poisons of the indigenous British Flora, and which grows in great abundance, particularly in Cork. Dr. Pickells collected nearly thirty cases of death by eating the root, the quantity in one instance not exceeding "the top of the finger;" he described the symptoms as exhibited by those cases—insensibility, convulsions, locked jaw, delirium, and insanity; and pointed out the proper mode of treating such cases. He thought that this might have been the plant used to destroy Socrates, and not the *conium maculatum* of modern botany; and from the symptom of insanity, he thought that this was the plant designated as the "insane root," by the poet. This plant, Dr. Pickells stated to be equally injurious to black cattle and horses, as to man; he believed there was no direct antidote known; melted butter was given in some of the cases which recovered, and is popularly deemed a preservative against its effects.

PRUSSIC ACID OF THE PRUNUS LAURO CERASUS.

Dr. Houlton has stated that a patient of his, who had been engaged several hours in collecting the *Prunus lauro cerasus*, was, after a time, seized with all the symptoms of poisoning by prussic acid, from which he recovered by the use of medicinal and dietetic stimulants.

LIGHT FROM THE MARIGOLD.

Mr. R. Dowden has read to the British Association, an account of a Luminous Appearance on the Common Marigold, *Calendula vulgaris*. This circumstance was noticed on the 4th of August, 1842, at 8 P.M., after a week of very dry warm weather; four persons observed the phenomenon; by shading off the declining daylight, a gold coloured lambent light appeared to play from petal to petal of the flowers, so as to make a more or less interrupted corona round its disk. It seemed as if this emanation grew less vivid as the light declined; it was not examined in darkness, which omission shall be supplied on a future occasion. It may be here added, with the view to facilitate any other observer who may give attention to this phenomenon, that the double marigold is the best flower to experiment on, as the single flour " goeth to sleep with the sun," and has not the disk exposed for investigation.

Dr. Allman believed that the phenomenon related by Mr. Dowden was not at all due to phosphorescence, but that it was referable to the state of the visual organ. This phenomenon had been thus, he thought, satisfactorily explained by Sir David Brewster. If it were phosphorescence, it would appear brightest at night, and it would be expected to occur in other plants than those of an orange or flame colour. Mr. Babington stated, that the cause of luminosity in plants was ill understood. He had seen, in the south of England, a peculiar bright appearance produced by the presence of the *Schitostega pennata*, a little moss, which inhabited caverns and dark places. A member present stated, that Prof. Lloyd had examined the moss referred to by Mr. Babington, and had found that the peculiar luminous appearance of that moss arose from the presence of small crystals in its structure, which reflected the smallest portion of the rays of light. —*Athenæum*, No. 828.

THE RHODODENDRON A THERMOMETER.

THE following singular statement appears in the *American Agriculturist*:—" There are few persons who would see, on first scrutiny, in the Rhododendron maximum, a complete thermometer. There have been for the last five years several very large specimens of this shrub close by our dining-room windows, and, by protracted observations by various members of the family, they have been so infallible in showing the temperature of the atmosphere, that the thermometer, which hung without the door, became in some measure useless, unless he wished to ascertain to a degree the state of the air. When the weather is cold, and the thermometer about zero, the leaves are rolled so tightly together, that it seems almost impossible for them again to become unrolled, at the same time they are turned nearly black; and the expansion as the weather moderates is so gradual, that, by the degrees of their colour and shape, a person is enabled to form a pretty accurate opinion of the weather; and when mild, the leaves assume a light and very rich green."

NEW METHOD OF STEEPING SEEDS.

MR. J. F. W. JOHNSTON has published a valuable paper " On the Manuring and Steeping of Seeds;" which enters briefly, but lucidly, into the recently announced discovery of a method of so manuring, or otherwise "doctoring," the seeds of our usual grain crops, before they are put into the ground, as to do away with the necessity of manuring the soil itself. This discovery, it appears, was made in Germany, about twelve years ago, by Franz Heinrick Bickes, of Castel, near Mayence, who has written a pamphlet on the subject, recently published at Dusselthal, near Dusseldorf. The substance of this is, that the experience of twelve years has established its value; that the cost of the steeping process is very trifling, a shilling or two per acre;

and the supply of the substances used instead of manure inexhaustible. If the testimonials are to be believed, the discovery is, indeed, invaluable; for we are told that, through it, potatoes may be grown in the sand on the sea-shore. Mr. Bickes, however, does not divulge his secret.

Another German pamphlet, on the same subject, has lately appeared from the pen of Mr. Victor, an apothecary at Niederholm, in Hesse Darmstadt, on "The Manuring of Seeds; or a simple and cheap cultivation of the Soil by the artificial Manuring of Seeds; by which, at the same time, the Rust and other Diseases of the Corn Crops are prevented; practically tried for five years, and proved on a large scale." The substances and mode of using them are as follows: —1. Blood, in the liquid state, is mixed with one-eightieth of its weight of Glauber salts, dissolved in a little water; when thus mixed it may be kept for a long time in a cool place, without congealing, or undergoing decomposition: or clotted blood may be dried, either alone or mixed with a little earth, or powdered clay, and thus reduced to fine powder. 2. Wool, hair, parings of leather, horns, hoofs, and bones, are charred in close vessels, until they are capable of being reduced to powder. Oil-cakes are also powdered for use. He makes up a semi-fluid mixture, with which he mixes the seeds, and then he dries up the whole by the addition of the powerful manures already prepared. His semi-fluid is thus composed:—For a bushel of wheat, or other grain, take twenty to thirty pounds of clay in fine powder; one pound and a half of pounded sal ammoniac, or three pounds of common salt; three to five quarts of whale, rape, or other cheap oil; fifteen to twenty quarts of fresh blood, or blood kept in a fluid state by means of Glauber salts; or, in the absence of blood, as much water; three to five pounds of linseed meal, or pounded oil-cake. These are mixed together intimately, and water added, if necessary, to make a half-fluid mass. The seed is then to be poured in, and stirred about till every seed is completely enveloped in the mixture. A layer of one of the following dried mixtures is then spread on the floor, over it the manured seed, and then another layer of the dry powder. The whole is then stirred together, and left to dry.

Dry mixtures consist chiefly of powerful clay, mixed with one or other of the dry powders already mentioned. Thus he recommends mixtures of seventy-five parts of powdered clay, eight of horn shavings, and seventeen of bone-dust; or eighty-five of clay, with fifteen of fluid, or five of dried blood; or eighty-five of clay, two of charred hair, and ten of oil-cake; or sixty of clay and forty of powdered dung; or seventy of clay, twenty-five of charred leather, and five of bone-dust; or eighty of clay, one of fat, tallow, or oil, and two of powdered dung. These are all to be finely powdered, and intimately mixed. The principal alleged use of the clay is, to make the substances adhere together, and to attach them more strongly to the grain. When the mixture of grain and manure is dry, it is broken up with the hand and thrown upon a fine sieve, which allows the loose powder and the uncovered grain to pass through, and then a coarser sieve, through which the dressed seeds pass, leaving the lumps, in which two or three seeds may be present, and which are to be carefully broken up. He prescribes further, that much caution is to be used in completing the operations so quickly that the grain may not be permitted to sprout, and thus become liable to injury during succeeding operations. When it is wished to grow corn after corn in corn-fields manured in the usual way, M. Victor recommends mixing, for each bushel of seed, two or three pounds of sal ammoniac, or four to six pounds of common salt, with ten to fifteen pounds of rye meal, adding a little water, stirring the seed well amongst it, and drying the whole in a stove.

At the August Agricultural Show of the Royal Highland and Agricultural Society of Scotland, Mr. Campbell exhibited specimens of wheat, barley, oats, and rye-grass plants, raised from seed chemically prepared, as follows:—"I steeped the seeds of the various specimens exhibited in sulphate, nitrate of soda, and potass, and in combinations of these, and in all cases the results were highly favourable. For example, seeds of wheat steeped in sulphate of ammonia on the fifth of July, had, by the 10th of August, the last day of the show, tillered into nine, ten, and eleven stems, of nearly equal vigour; while seeds of the same sample, unprepared, and sown at the same time, in the same soil, had not tillered into more than two, three, and four stems. I prepared the various mixtures from the above specified salts exactly neutralized, and then added from eight to twelve measures of water. The time of steeping varied from fifty to ninety-four hours, at a temperature of about 60 degrees Fahrenheit. I found, however, that barley does not succeed so well if steeped beyond sixty hours. Rye-grass, and other gramineous seeds, do with steeping from sixteen to twenty hours, and clovers from eight to ten, but not more; for being bi-lobate, they are apt to swell too much and burst. The various salts were prepared by me from their carbonates." The event of the experiments, in October, realized Mr. Campbell's most sanguine expectations.—*Abridged from the Farmers' Journal.*

Geology.

THE GLACIAL THEORY*.

THE following are among the more important illustrations which this Theory has received during the past year:—

Mr. Murchison, in his valuable paper on the Geological Structure of the Ural Mountains, observes that, "in reference to the question of the transport of the northern blocks, he conceives that his last survey has tended very materially to strengthen the opinions which he previously expressed, that such materials were carried to their present position by floating icebergs liberated from ancient glaciers in Scandinavia and Lapland, at a period when Russia in Europe was submerged. The examination of the Ural has in the meantime convinced them of the utter inapplicability of a terrestrial glacial theory, even to all mountainous tracts of the earth; for these mountains, the peaks of which rise to upwards of 5000 feet above the sea, though situated in so cold a climate as to be now covered with snow during eight months in the year (and some peaks are never uncovered), show none of those signs insisted on by Glacialists, of their having been at any period the residence of permanent glaciers. With the total absence of such proofs, so it is a striking confirmation of the connexion between glaciers and the blocks which in Russia in Europe are supposed to have been floated from Scandinavia and Lapland, that the flanks of the Ural chain and the adjacent plains are entirely void of all such far-transported detritus.

On June 7, a letter was read to the Geological Society, from Mr. W. C. Trevelyan, giving an account of polished and scratched surfaces of rocks observed by him in Greece, on the way from Megara to Corinth, and resembling the surfaces seen in the Jura, attributed to the action of glacial phenomena. In this case, however, he considers the fact observed as the effect of an earthquake. The appearance of moraines, which he saw in the gorge of Mount Parnassus, he refers to storms bringing down masses of rocks, rubbish, and trees.

Professor Forbes concludes a paper on the leading Phenomena of Glaciers, as follows:—These observations have been made, and the result is the viscous or plastic theory of glaciers, as depending essentially on the three following classes of facts, all of which were ascertained for the first time by observations in 1842, of which the proofs are contained in this work.

1. That the different portions of any transverse section of a glacier move with varying velocities, and fastest in the centre.
2. That those circumstances which increase the *fluidity* of a glacier —namely, heat and wet—invariably accelerate its motion.
3. That the structural surfaces occasioned by fissures which have

* For details of this Theory, from its introduction to the British Association, see *Year-Book of Facts*, 1841, p. 233; 1842, p. 228; 1843, p. 252.

traversed the interior of the ice, are also the surfaces of *maximum tension* in a semisolid or plastic mass, lying in an inclined channel.

There is another point bearing on the doctrine of semi-fluid motion, and the comparison of a glacier to a river; for which see Professor Forbes's contribution to *Jameson's Journal*, No. 70.

On February 27, Prof. Forbes read a memoir before the Royal Society of Edinburgh "On the Motion of the Mer de Glace of Chamouni," in which he detailed the methods of observation by which he was enabled to ascertain the *daily* and *hourly* motion of different parts of the glacier.

From the observations made, the author concludes, that "the variation of velocity diminished as the season advanced; and that it was proportional to the absolute velocity of the glacier at the same time."

The variation of the velocity with the breadth of the glacier is least considerable in the higher parts of the glacier, or near its origin.

The motion of the glacier generally varies with the season of the year and the state of the thermometer.

Perhaps, the most critical consideration of any for the various theories of glacier motion is the influence of external temperature upon the velocity.

The author also deduced from various indirect considerations, that it is very improbable that the glacier *stands still* in winter. On the contrary, he supposes that though its velocity is less than in summer, it still bears a considerable proportion to it.

On March 20, Professor Forbes read a memoir to the Royal Society of Edinburgh, on the structure of glaciers and the cause of their motion. With reference to his former paper of the 27th Feb. the author stated that he had received a most satisfactory confirmation of his opinion respecting the motion of glaciers in winter. From observations made by his direction on the Mer de Glace of Chamouni, and in which he places entire confidence, it appears that the ice moved no less than 76 feet between the 12th December 1842 and 17th February 1843, or at the rate of 13½ inches *per diem*, whilst its mean motion during the summer was 17½ inches.

The author then explained the manner in which he conceives the conoidal structure of glaciers to be due to the varying velocity of different points of their section producing discontinuity by minute fissures, which are infiltrated and ultimately frozen.—*See Jameson's Journal*, No. 68.

Professor Forbes recapitulated his proofs that the glacier moves as a plastic mass, the friction of whose parts is less than their friction upon the surface over which they tend to slide; and he bases his theory upon three classes of facts, which he considers that he has demonstrated. 1. That the glacier moves like a stream, fastest at the centre. 2. That its velocity is immediately governed by the external temperature and the state of infiltration of the ice by water at the time. 3. That the forms which its veined structure assumes are those due to the movement of a semi-solid mass in the manner supposed.

Mr. Hopkins, in a paper read to the British Association, considered the sub-glacial currents as powerful agents in the disintegration of the lower surfaces of Glaciers, especially near their lower extremities. The results of Professor Forbes's observations on the motion of the Mer de Glace of Mont Blanc, afforded, as regards that glacier (and, by inference, as regards all other glaciers) a complete refutation of the theories which attribute glacial movements to any expansion or dilatation of the ice. The Professor had, however, put forth a new theory, which agreed with that offered by Mr. Hopkins in attributing glacial motion to the action of gravity, but differed from it entirely as a mechanical theory, in other respects. The Professor appeared to reject the sliding theory of De Saussure, on account of the difficulties already mentioned (which were now removed by the above experiments), and assigned to the mass of a glacier the property of *plasticity*, or *semifluidity*, in a degree sufficient to account for the fact of its descending down surfaces of such small inclination. Sufficient, he trusted, had been advanced to prove that the sliding theory assigned a cause adequate to the production of the observed phenomenon of glacial movements.

Col. Sabine related, in illustration of the agency of Glaciers in transporting rocks, that when the Antarctic Expedition had reached 79° S. lat. the vessels were stopped by a barrier of ice, from 100 to 180 feet in height, and 300 miles in extent from east to west; beyond these cliffs of ice they discovered a range of lofty mountains, 60 miles from the sea, the westernmost of which appeared to be 12,000 feet in height. From the face of these ice-cliffs, vast masses were constantly breaking off, and floating northward, bearing with them fragments of the rocks which they had derived from the mountains. In the latitude of 66° and 67°, a distance of 700 miles from the glacier, these floating icebergs appeared to be usually arrested, so as to form a floating barrier, at which ships were often stopped; and it had been observed that between this zone and the cliffs the sea deepened considerably. Over all this area the icebergs would be constantly strewing masses of rock and detritus, particularly at their northern limit, where they would probably form mounds resembling terminal glacial moraines. Colonel Sabine then described similar phenomena in Baffin's Bay, which he stated to be, in most parts, deeper than the thousand-fathom line, but shallow at the strait which forms its entrance.

SUBTERRANEAN TEMPERATURE.

Mr. W. J. Henwood, in a paper on the Temperature of the Mines of Cornwall and Devon, observes: "From the surface of 150 fathoms deep, the rise of temperature, for equal increments of depth, seems to be in a diminishing ration—a fact previously known. But deeper observations disclose the curious, and, as it would seem, almost anomalous circumstance, that at more than 150 fathoms deep, the progression again becomes more rapid; and that the ratio at about 150 fathoms in depth is at a minimum, and increases both at greater and smaller depths.

"Whether further experiments may confirm or disprove the generality of this fact, I do not pretend even to conjecture; but the number of observations I have made at more than 150 fathoms deep is very considerable.

"The various ramifications ofthe great adit in the Gwennap mining district, have an aggregate extent of between 30 and 40 miles. It drains a tract of 5550 acres in area, and discharges nearly 1500 cubic feet of water per minute. Rather less than one-third of this stream is collected at the adit level, whilst the remainder is pumped up from a mean depth of about 190 fathoms. Its temperature varies between $60^{\circ}\cdot5$ and $68^{\circ}\cdot0$, and is, on an average, more than 13° above the mean of the climate."—*Jameson's Journal*, No. 70.

PHENOMENA IN THE ÆGEAN SEA.

PROF. FORBES has read to the British Association, the Report drawn up at their request, "On the Mollusca and Radiata of the Ægean Sea, and on their Distribution, considered with reference to Geology." This report is the result of eighteen months' research in the Ægean Sea, and on the coasts of Asia Minor, during the greater part of which time daily observations were made, and numerous explorations of the sea-bottom conducted by means of the dredge in all depths of water between the surface and 230 fathoms. The objects of the inquiry were, firstly, to collect and define the several species of Mollusca and Radiata inhabiting the Eastern Mediterranean; secondly, to ascertain the conditions under which those animals live, and the manner in which they are associated together; thirdly, to ascertain whether species known only as fossil exist in a living state in depths and localities hitherto unexplored; and to compare species and the associations of species now living in that sea, with the fossil species found in the neighbouring tertiary strata.

Among the Geological phenomena now in progress in the Ægean, the following are remarkable and important. The filling of the eighth region in depth by the white sediment which forms its sea-bottom, will produce above 700 feet of cretaceous strata, uniform in mineral character and organic contents; whilst, as the zero of animal life is but little below that region, and the Ægean is probably in a great part of its extent more than a thousand fathoms deep, we may have thousands of feet of strata having a uniform mineral character, and without a trace of animal existence. Any oscillations of level, however slight, would produce alternations of strata containing distinct groups of organic beings, with others void of such; and partial alternations of marine and fresh-water beds would be formed—a phenomenon now in progress on the coasts of Asia Minor. All this would occur without convulsions or violent catastrophes of any kind. Changes of level, however slight, might cause the extinction of whole genera of animals and plants, of which only such as had hard parts would be preserved. Were the present sea-bottom of the Ægean to be upheaved, whole classes of animals would disappear, and leave not a trace behind to assure the future geologist of their having existed.

[For the detailed Report, see the *Athenæum*, No. 830.]

ANCIENT FABLE OF COLOSSAL ANTS PRODUCING GOLD.

One passage will satisfactorily explain the extravagant fable related by the Greeks, and repeated by travellers in the middle ages, of ants, as big as foxes, which produce Gold. The passage states, that the tribes of various names who dwell between the Meru and Mandara Mountains, brought lumps of gold, of the sort called paipilika, or ant gold—so named, because it was dug out by the common large ant or pipilika. It was, in fact, believed that the native gold found on the surface of some of the auriferous deserts of northern India had been laid bare by the action of these insects—an idea by no means irrational, although erroneous, but which grew up, in its progress westward, into a monstrous absurdity. The native country of these tribes is that described by the Greeks, the mountains between Hindoostan and Thibet ; and the names given are those of barbarous races still found in those localities.—*Professor Wilson ; Proceedings of the Asiatic Society.*

GOLD MINES OF SIBERIA.

On May 15th, was read to the Academy of Sciences, at Paris, a paper " On the Progressive Increase of the Results obtained from the Operations on the Auriferous Sand of Siberia." The produce has been as follows :—

	Pouds of gold.		Pouds of gold.		Pouds of gold.
1830	5	1835	93	1839	183
1831	10	1836	105	1840	255
1832	21	1837	132	1841	358
1833	36	1838	163	1842	631
1834	65				

and, according to all probability, the result of 1843 will show a great increase on that of 1842. The workmen employed in the extraction of the gold are almost exclusively convicts, of whom there were not less than 11,000 in Eastern Siberia in 1842. They are allowed the proceeds of one day in the week for themselves, but they are not permitted to dispose of the gold as they please. They are bound, on the contrary, to sell it to the persons who hold the privilege of the extraction, and are, consequently, paid less than its value.

GOLD-DUST.

The Russian journals give the following particulars relative to the progress of discovery of Gold-dust, &c. in that empire. During the summer of 1842, the arrondissement of the mines of Wiask was explored by five several expeditions commissioned to seek for deposits of gold-bearing sand, and one sent in search of precious stones. The former discovered 22 different beds of sand yielding gold, situate partly in new localities and partly in the neighbourhood of the beds already in course of being worked. The whole of the sites discovered in that year contain a mass of 18,375,269 pds. of sand, yielding 34 pds. 39 lb. $8\frac{46}{96}$ zol. of gold. In the mines of Zlatoust was found a remarkable crystal of colourless topaz, vulgarly called Siberian diamond, weighing 61½ zolotricks; and in the mines of Wiaste, a lump of gold of the weight of 25 zol.—*Athenæum.*

DISCOVERY OF NATIVE LEAD IN IRELAND.

In the March Number of the *Philosophical Magazine*, Mr. Austin states, that in the autumn of the year 1839, whilst engaged in a mineralogical examination of a part of the country in the neighbourhood of Kenmare, County Kerry, he discovered a few specimens of this rare mineral in the carboniferous limestone of that district; and more recently, when surveying in the vicinity of Bristol, he has succeeded in obtaining it in tolerable abundance from the same formation in several localities. It occurs either coating the faces of the minor joints, or filling up small crannies at the points where several joints intercept each other; in the latter situations the pieces sometimes weigh nearly half an ounce, in others it appears merely as a fine film.

This interesting mineral has been described as occurring in small masses in the lavas of Madeira and other volcanic districts, and also as existing under very dubious circumstances at Alston, in Cumberland, in minute globules in the interior of small lumps of *slaggy* galena within reach of the surface.

AN AVALANCHE.

The French papers give the details of a calamity which has occurred, in the department of the Isère—the destruction of the village of Valsenestre by an Avalanche. The snow-fall buried 26 houses, containing 82 inhabitants,—72 of whom were, however, subsequently restored to the light of day, by means of ropes and ladders let down the chimneys of the houses, from wells dug through the snow which covered them.

THE ORDNANCE GEOLOGICAL MUSEUM.

The Ordnance Museum has for its object two purposes, both bearing on geological science. The first of these is to procure, during the progress of the Ordnance Geological Survey, now under the direction Sir Henry De la Beche, an accurate delineation of the boundaries of all the strata; not laid down conjecturally, but from actual observation and exact measurement. For this purpose there is attached to the Trigonometrical Survey a staff of active geologists, who walk over the boundary lines and draw sections, in which every part is measured and laid down on a scale true to nature. The practice of making the vertical scale of sections greater than the horizontal, had led to much mischief and many mistakes, especially in mining operations, and in working for coal. The second object of the Museum was to form a collection of the fossils of every stratum in every possible locality, with a view to ascertain the law of geographical distribution of species, and their geological distribution in successive strata. It was usual for geologists to collect only fine and beautiful specimens; but this system would never enable them to trace the exact areas of distribution of organic life in former epochs. In connexion wtth this system of collecting organic remains, a method of drawing them had been proposed: each species, as soon as sufficient information could be procured, was to be drawn by good artists, with magnified views of minute structure; and these were to be engraved on steel, a separate plate being given to each species, and published at so low a price as to place them within the reach of all persons interested in the science. Collectors of fossils were invited to give their aid in forwarding this work, by lending specimens of rare or new fossils, and it was announced that in such cases electrotype impressions would (if approved) be taken of them, so as to supply museums and collectors with correct representations of unique or valuable fossils. The Ordnance Museum is open to the public as freely as any institution of the same nature.—*Mr. Phillips*, F.R.S.; *Proceedings of the British Association.*

DOBBS'S MAPS.

At the last meeting of the British Association, Mr. Murchison, as President of the Geological Society, exhibited a relievo Map of England, by Dobbs and Co., and commended the manner in which the elevations and depressions of the country had been so accurately represented, as well as the geological colours which had been used.

Mr. Murchison also exhibited a Relievo Map of England and Wales, coloured geologically under his own direction. He pointed out the accordance between the physical features of the country and the boundaries of particular strata, and stated generally the dependence of geographical contour upon the geological structure of any region and the mechanical forces to which the rocks had been subjected.

THE PERMIAN SYSTEM.

The word *Permian*, when first proposed by Mr. Murchison, was intended to distinguish a natural group of deposits lying between the well-known carboniferous strata beneath, and the less perfectly defined trias above it. The author at first suggested that the group (so designated from the ancient kingdom of Permia, which is exclusively occupied by it), should combine those deposits known under the name Rothe-todte-liegende (lower new red of England), Kupfer Schiefer, Zechstein, &c. (magnesian limestone, &c.) Subsequently, however, he was disposed to doubt whether it might not be more correct to class the Rothe-todte-liegende with the coal-bearing deposits beneath it, than with the Zechstein, because the plants of the lower red sandstone could not be distinguished from those of the coal measures. Revisiting Hesse, Saxony, Silesia, the Thuringerwald, and other parts of Germany, Mr. Murchison has obtained what he considers proof that the Rothe-todte-liegende is part and parcel of the same natural group as the Zechstein, and must therefore be considered part of the Permian system. He has also convinced himself that the great deposit hitherto known under the denomination of Bunter-sandstein, Grès bigarré, or new red sandstone, should be divided into two parts, the lower of which ought to be classed with the Permian, and separated from the trias, with which it had been merged. To prove the first of these positions, or that the Rothe-todte-liegende is a part of the Permian group, Mr. Murchison cited the order of succession in numerous sections in Germany, showing an uninterrupted sequence from the lower red conglomerate sandstone and shale into the overlying Zechstein. It is a question whether the plants of these lower red rocks can be distinguished, as a whole, from those of the subjacent coal measures, plants being, as yet, the only organic remains found in them. From his observations in Saxony, and particularly from an inspection of the fossil plants collected and partly described by Captain Gutbier, Mr. Murchison believes that such a separation exists.

Among the coal plants of Saxony are forms of Neuropteris closely approaching to, if not identical with, those species which occur in the Permian rocks, whilst there is no trace of the common plants of the under-lying coal. These plants being imbedded in a whitish or cream-coloured finely levigated clay-stone, and their leaves being brought into beautiful relief by being invariably as green as if they had peculiarly and happily dried in an herbarium, form admirable subjects for the most precise distinctions of the fossil botanist. In Silesia (at Ruppendorf, and other localities west of Waldenberg, between Breslau and Glatz) there is a fine development of strata from the base of the Rothe-todte-liegende (where that deposit overlies a productive coal-field based upon true mountain limestone) into other red sandstones and shales, which have a marked aspect, from being interlaced with bands of black, bituminous, thin, flaggy limestone. Though doubts had been entertained as to the age of this limestone, Mr. Murchison does not hesitate to consider it as the equivalent of the Zechstein, and the whole red group of which it forms a member as the counterpart of the Permian system; for, besides its very clear position, this calcareous flagstone contains plants and fishes similar to those of the Permian rocks of Russia. Among the former the *Neuropteris conferta, nov. spec.*, of Göppert, has been identified with the most common fern brought from Russia. The most abundant fish is the *Palæoniscus Wratislaviensis*, Ag. On this occasion Mr. Murchison passed rapidly over the zoological proofs that the Zechstein and Kupfer Schiefer of Germany are the equivalents of the calcareous beds of the Permian system of Russia, as these had been given in detail in memoirs read before the Geological Society. He stated, however, that his opinion was now perfectly in harmony with that of Professor Phillips; namely, that the Fauna of the Zechstein, or magnesian limestone, has so much of the same general zoological type as the carboniferous limestone, that it must also form a part of the palæozoic series.

Mr. Murchison then proceeded to consider the age of these lower beds of the Buntersandstein, which had been hitherto included in the trias, on lithological evidence only. They contain no fossils, either in Hesse, Saxony, or Thuringerwald, where the Zechstein and Kupfer Schiefer are most developed; and from all Mr. Murchison's inquiries and observations, it appears that the upper mass only of the Bunter-sandstein contains the remains of animals and plants analogous to those of the Muschelkalk which rests upon it. The footmarks of the Cheriotherium appeared also to be confined to the beds of sandstone, at a very little depth below the Muschelkalk. From these circumstances Mr. Murchison was induced to regard the upper beds alone of the Bunter-sandstein as belonging to this trias, whilst the lower portion, which, though generally unfossiliferous, contained in Russia the same groups of fossils with the Permian rocks, he proposed henceforth to separate from the secondary system, and consider it, together with the Zechstein and Rothe-todte-liegende, as the upper member of the palæozoic series, supposed to be represented by a thin band of dolomite.

The plants of the Permian system of Russia appear, from the opinion of M. Adolphe Brougniart, to possess a peculiar character; but they are still closely allied to carboniferous forms, like the plants of the Rothe-todte-liegende of Saxony; and this evidence is in complete harmony with that afforded by the molluscs, corals, and ichthyolites. In conclusion, Mr. Murchison remarked that the English strata ranging under the synonym of Permian formed a well-defined tract, separating the coal-fields from the newer deposits of red sandstone and marl; and as the magnesian limestone does not often appear in the form of a continuous deposit, it was the more desirable to give a certain latitude to this group, and not to define it too narrowly by mere mineral characters. Thus considered, Mr. Murchison believed the Permian system had a real existence in Ireland, being represented by those beds containing the *Productus aculeatus*, and probably also by the red sandstone with the *Palæoniscus catopterus*, at Rhoan Hill, near Dungannon.

ARTESIAN WELLS.

THE following are the principal Artesian Wells commenced or completed within the past year.

Paris.—It is pretty generally known that the water from the Artesian well at Grenelle is, with occasional exceptions, clear and limpid. By an ingenious mechanical arrangement, the sand, which is thrown up with the water, is prevented from entering the conduit pipes, but the cause of this derangement of the limpidity of the water was not ascertained. M. Lefort having resolved to discover whether some of the periods at which the changes occurred coincided with the slight shocks of earthquake which had been experienced in Normandy and Britanny, for this purpose compared the register of the action of the well, of which he has the superintendence, with the accounts of these earthquakes. In the register of the service of the well, for the 25th of December, is the following: "The water having brought up a large quantity of mud and sand during the night of the 23rd, the apparatus for correcting this derangement was put into operation, and the water became clear." Since then M. Lefort has watched the journals, and found that a shock of earthquake was felt at Cherbourg and St. Malo on the 22nd December. As this is the only instance of earthquake that has occurred corresponding with any recorded derangement of the water of the Artesian well at Grenelle, M. Lefort abstains from regarding the cause as proved, but he has very properly called the attention of the Academy of Sciences to the fact, as one which its learned members will do well to discuss.

A *précis* of the history of the Grenelle well, illustrated with a sectional engraving, will be found in *The Year Book of Facts*, 1843.

M. Arago has announced the intention of the French government to make an Artesian well in the Jardin des Plantes of a depth of 900 mètres, viz. 200 mètres more than that of Grenelle. The water from the Artesian well of the Jardin des Plantes will, it is supposed, be of a temperature of 31° Centigrade, and will be employed to serve to heat the hot-houses of the gardens, and supply the hospitals of La Pitié and La Salpetrière, and thus effect a great economy as to fuel.

Westphalia.—It is intended to bore in Westphalia to a depth of 2,000 mètres (a mile and a quarter English), and at that depth it is supposed that the water will be of the great heat of 70° Centigrade. The borers have reached a depth of 622 mètres. To that depth the augmentation of temperature had not followed the ordinary law, which, according to M. de Humboldt, was owing to the cooling of the column of air by the waters of filtration from above; but once arrived at 622 mètres, the ascensional force was so great as to drive back the water of the upper sources, and the ordinary law was re-established.

Aberdeen.—The greatest of these interesting works yet existing in Aberdeen has been successfully completed at the tape-works of Messrs. Milne, Low, and Co., Woolmanhill. The bore is 8 inches in diameter, and 250 feet 9 inches deep. It required nearly 11 months working to complete the excavation. The temperature of the water at the bottom of the well, when completed, was found to be within a fraction of 50° Fahrenheit; and the average temperature of the locality, deduced from 23 years' observation, by the late George Innis, F.R.S., is 47° 1′: hence, nearly 3° of increase appear as the effects of central heat. The supply of water obtained is excellent in quality, and sufficient in quantity for all the purposes of the works.—*Aberdeen Herald.*

Middlesex.—An Artesian well has been completed at the Middlesex Pauper Lunatic Asylum, at Hanwell, under the superintendence of Mr. F. Bullen, of London; which, from the quantity and quality of the water which it yields, as well as the height to which the water rises, may be reckoned as one of the most powerful in the kingdom. The shaft to a depth of 31 feet is 10 feet in diameter, and thence to a further depth of 200 feet is 6 feet in diameter, making 231 feet. At that point a small auger was driven below into a sand stratum, strongly charged with water, through which it was found necessary to force cast-iron cylinders into the clay beneath, a depth of 12 feet. The whole of the shaft is constructed of brickwork in cement, and the cylinders are also lined with the same material. At the depth of 243 feet a guide-rope was inserted, and secured with brickwork, and the boring commenced with pipes of 14 inches internal diameter, which are carried down into the flints immediately overlaying the chalk, a depth of 290 feet, whence the water now rises and overflows the surface at the ratio of 100 gallons per minute, and at 26 feet above the surface at the ratio of 23 gallons per minute. The following is a description of the strata through which the well has been sunk and bored, with the exception of a few veins of septasia:—vegetable soil, 1ft. 6in.; gravel, 7ft.; sand, 2ft. 6in.; gravel and sand, 9ft.; brick clay, 2ft.; blue or London clay, 169ft.; indurated mud, sand, and clay, with pieces of wood and shells embedded, 24ft.; pebbles and shells, 3ft.; plastic clay, 22ft.; sand, 2ft.; plastic clay, 4ft.; indurated mud, sand, and clay, 8ft.; dark brown clay, 9ft.; green sand and clay, 7ft.; oyster bed, 2ft. 9in.; pebbles and yellow clay, 2ft. 3in.; bed of flint stones into which the bore is carried, 3ft. The temperature of the water as it overflows the surface is 55° Fahrenheit.

Brighton.—An attempt has been made to bore at the Chain-Pier, Brighton; when the workmen succeeded in getting about 8 feet below the solid bed of grey-stone, a rock peculiar to Brighton, which some time before had resisted their further progress, fresh water, or water only slightly brackish, was found. Above this bed of rock, the chalk was separated about every three feet by thin strata of flint: but beneath it 8 feet of solid chalk have been passed without meeting any other substance. The work has, however, we believe, been discontinued.

Southampton.—The Artesian well at the Royal Hospital, Haslar, sunk by Mr. T. Docwra, manager of the large Artesian well now in progress for supplying Southampton with water, has resulted in producing a most abundant supply of water, which has been analysed by order of the Board of Admiralty, and is found to be of the purest and softest quality. What is most surprising is, that the water rises through 125 feet of shingle and running sand, which is full of salt water, being affected by the tides. The difficulty in stopping the salt water out has been entirely overcome. The quantity of water obtained from the spring, 156 feet deep, was 59,328 gallons per day.—*Hampshire Independent.*

FOSSIL ANIMALS OF THE CHALK FORMATION.

PROF. EHRENBERG thus concludes a "Summary of Results on the Fossil Animals of the Chalk Formation still found in a living state:"—Thus, then, there is a chain, which, though in the individual it be microscopic, yet in the mass a mighty one, connecting the organic life of distant ages of the earth, and proving that it is not always the smaller, or most deeply lying, which is the base and the type of those which are larger and nearer the surface on our earth; and, moreover, that the dawn of organic nature, co-existent with us, reaches farther back into the history of the earth than had hitherto appeared.

GEOLOGICAL POSITION OF THE MASTODON GIGANTEUM IN THE UNITED STATES.

Mr. Lyell concludes a paper on this important inquiry with the following observations:—

1. That the extinct animals of Bigbone Lick and those of the Atlantic border in the Carolinas and in Georgia, belong to the same group, the identical species of Mastodon and elephant being in both cases associated with the horse, and while we have the Mylodon and Megatherium in Georgia, the Megalonyx is stated by several authors to have been found at Bigbone Lick.

2. On both sides of the Appalachian chain, the fossil shells, whether land or fresh-water, accompanying the bones of Mastodons, agree with species of Mollusca now inhabiting the same regions.

3. Under similar circumstances Mr. Darwin found the Mastodon and horse in Entre Rios, near the Plata, and the Megatherium Megalonyx and Mylodon, together with the horse, in Bahia Blanca in Patagonia; these South American remains being shown by their geological position to be of later date than certain marine Newer Pliocene, and Post-pliocene strata. Mr. Darwin also ascertained that some extinct animals of the same group are more modern in Patagonia than the drift with erratics.

4. The extinct quadrupeds before alluded to in the United States lived after the deposition of the northern drift, and consequently the coldness of climate, which probably coincided in date with the transportation of the drift, was not, as some pretended, the cause of their extinction.

DISCOVERY OF A SKELETON OF THE ZYGODON.

Mr. S. B. Buckley has detailed in *Silliman's Journal*, No. 90, the discovery of a nearly complete Skeleton of the *Zygodon* of Owen (*Basilosaurus* of Harlan), in Alabama. The entire vertebral column is nearly perfect, except two or three of the cervical, which are much broken, and it is possible that others from the same part of the skeleton are lost, since the vertebræ near the head were disjointed and scattered over a surface of several feet, but the remaining portion of the vertebral column was in an almost unbroken series to the extreme tail. The entire length of the skeleton, including the head, is nearly seventy feet! Some of the ribs must have been upwards of six feet in length, but of these we only have fragments, including their extremities and central parts. We have also other long bones belonging to its paddles, as the animal was probably an inhabitant of the water. These are small in proportion to the size of the other bones. The principal organ of locomotion of the animal seems to have been its tail, which is short and thick. Many of the dorsal vertebræ are sixteen or eighteen inches long, and upwards of twelve inches in diameter. The transverse processes are from three to six inches long. The spinal and also the lateral processes are of about the same length. These last three are united at the base, where they form an arch, through which the spinal marrow ran. This arch, with the lateral and spinal processes, is easily detached from the main body of the vertebræ. The head is much broken; yet we have portions of both jaws with the teeth inserted in nearly a perfect state.

The bones have been sent to New York, where several scientific gentlemen are ready to testify that they "have a unique and veritable skeleton of the Zygodon."

NEW TRILOBITE.

Dr. Locke describes, in *Silliman's Journal*, No. 90, a new species of Trilobite, evidently of the genus Ceraurus of Green. It is one of the smallest, and, at the same time, one of the most elegant of this family of extinct crustaceans. Dr. L. has named this new species *crosotus*, from the Greek word, signifying fringed. Dr. Green's description of his species—"Clypeo, postice arcuato, angulo externo in mucronem valde producto, occulis minimis remotis, post abdomine in spinam arcuatam utrinque extenso,"—applies quite well to the *crosotus;* but this last differs from the former in having the shield pectinate or fringed anteriorly. The spines of the shield and of the several ribs are more nearly straight. Besides the spines terminating the ribs, there are six slender teeth, similar to those of the anterior fringe, attached, not to ribs, but to the terminal margin of the tail, four of them between the two last costal spines, and the other two outside or anterior to the same. Each of the costal arches is marked by two tubercles or "pimples," (one in the other species,) one on its middle, and the other at the commencement of the free spine in which each costal arch terminates. These tubercles form four rows or lines down the body, two on each lateral lobe, the inner one being in the direction of the distant eyes.

ANOPLOTHERIUM AND GIRAFFE.

On Nov. 18, was read to the Geological Society, a paper "On some Fossil Remains of an Anoplotherium, and two species of Giraffe, from the tertiary strata of the Sewalik Hills in India;" by Dr. Falconer and Capt. Cautley. The Anoplotherium is an undescribed species, differing from those of the Paris basin, and much larger, its size being between that of the horse and of the Sumatran rhinoceros. It is founded on two upper jaws, with the near molars perfect. It is a true Anoplotherium, as distinguished from the subgenera of Xiphodon and Dichobune. The discoverers have named it *Anoplotherium Sivalense*. The remains were dug out of a bed of clay in the tertiary strata of the Sewalik Hills, mixed up with bones of Sivatherium, Camelus Sivalensis, Antelope, Crocodile, &c. The authors describe two species of giraffe. The first, which they designate *Camelopardalis Sivalensis*, is founded on the third cervical vertebra of an old animal; and they infer it to have been one-third smaller than the existing species. The bone is very perfect, and completely silicified. It measures 8 inches, while the same vertebra of the existing species is 11½ to 12 inches. The bone is more slender in its proportions than the existing one, and exhibits a series of specific differences in addition to the size. The second species they name *Camelopardalis affinis*, provisionally, from its close resemblance to the existing Cape Giraffe, in form and size of teeth, &c. The species is founded on two fragments of the upper jaw, with the back molars, and a fragment of lower jaw containing the last molar. The dimensions agree to within the tenth of an inch with those of a female head in the Museum of the College of Surgeons. The giraffe bones were found along with those of Anoplotherium Camel, *Crocodilus biporcatus*, &c. in a clay bed in the Sewalik Hills.

FOSSIL HUMAN BONES FOUND IN SOUTH AMERICA.

Dr. Lund, of Logoa Santa, S.A., has, for some years past, been engaged in examining the animal remains found in the chalk caves of the interior of Brazil. He has already discovered in 200 of these caves 115 species of mammalia, of which not more than 88 are now known to exist there. He has also found several skeletons of both sexes, being the first instance of the discovery of human bones in a fossil state. This information, however, is not decisive as to the existence of the human species contemporaneously with those great extinct animals whose remains are found fossilized in the earth's strata.

[See a paper in *Silliman's Journal*, No. 90.]

ICHTHYOPATOLITES.

On June 7, was read to the Geological Society, a paper "On Ichthyopatolites, or petrified trackways of ambulatory fishes upon sandstone of the coal-formation;" by the Rev. Dr. Buckland. In September 1842, Dr. Buckland received from Miss Potts, of Chester, a sketch of impressions resembling a succession of scratches by long claws, copied from a flag-stone discovered by that lady near the shaft of a coal-pit, at Mostyn, in Flintshire. She afterwards forwarded the slab itself; from an examination of which Dr. Buckland comes to the conclusion, that the impressions are not foot-marks of a reptile, but made by the ambulatory organs, or bony rays, of the fin of some unknown species of walking fish. They consist of curvilinear scratches, disposed symmetrically at regular intervals, on each side of a level space about two inches wide, which may represent the breadth of the body of the fish, to the pectoral fin-rays of which Dr. Buckland attributes the scratches. They follow one another in nearly equidistant rows of three scratches in a row, at intervals of about two inches from the point of each individual scratch to the points of those next succeeding and preceding it. They are all slightly convex outwards, three on each side of the supposed place of the fish's body. Each external scratch is about an inch and a half in length, the inner ones about half an inch, and the middle scratch about one inch long. These proportions are pretty nearly constant throughout a series of eight successive rows of triple impressions on the slab from the Mostyn coal-pit. The impressions of the right and left fin-rays are not quite symmetrically opposed to each other on a straight line of progression, but the path of the animal appears to have been curvilinear, or trending towards the right. Each impression, or scratch, is deepest in its supposed frontal side, and becomes more shallow gradually backwards. Dr. Buckland enumerates several instances of such a mode of progression among existing fishes, and points out the great analogy between these fossil impressions and those which the gurnard makes when walking on sand under water, as observed by Prof. Deslongchamps.

FOSSIL PINE FOREST IN AUSTRALIA.

On March 8, was read to the Geological Society, the description of "a Fossil Pine Forest at Kurrur-kurran, in the inlet of Awaaba, on the Eastern Coast of Australia;" by the Rev. W. B. Clarke. The inlet of Awaaba occupies a portion of that formation of conglomerate and sandstone, with subordinate beds of lignite, which extends from the Hunter River southwards towards Brisbane water. It is the lignite of this formation which constitutes the so-called Australian coal. On a flat tract of the sandstone, covered by alluvium, the fossil forest described by Mr. Clarke is seen; the stumps and stools of fossilized trees, standing out of their soil, seeming as if the trees of a living forest had all been cut down to a certain level. In the adjoining lake also, to the distance of from eighty to two hundred feet from the shore, similar stumps are seen peeping above the surface of the water, like a reef of rocks. The greater part of these stems stand vertically, and many have remains of their roots in the sandstone. The stools on shore stand from two to three feet above the surface of the ground, and are from two to four feet in diameter, but one in the lake is at least four feet above the level of the water, and is five or six feet in diameter. Sections of these stools exhibit the identical appearance of slices of modern pine wood, the rings of growth being as distinctly marked as in recent trees. In several of the stumps, sixty to one hundred and twenty concentric rings of growth may be counted. Many of the stems have the bark adhering firmly to the trunk, and the bark in one instance was of the thickness of three inches. Its appearance in one or two cases was such as to show that it had been partly torn from the tree while yet standing: as if they had been broken down, and the bark had been rent by the fall. The upper extremities of the fossil stumps present clean horizontal sections; which shows that they were not broken off while recent, since no mode of fracturing recent pine-wood could have occasioned such neat, plane, and parallel sections as the summits of these stumps exhibit. Mr. Clarke enumerates other localities in Australia in which similar fossil forests are to be seen, and observes that it is probable that the bed of sandstone containing trees in a vertical position, which is found nearly at the same level above the sea at Kurrur-kurran, and other places, is the true geological position of that ancient forest, from which the enormous quantities of fragments of wood which occur spread over the surface, or embedded in the sandstone above and below the lignite, have been derived. He infers from the present position of the fossil trees that the land must have been alternately depressed and elevated.

GEOLOGICAL CHRONOMETER.

MR. LYELL, in a paper read to the Geological Society, affords some data for guessing at the period when the Mastodon lived, the gigantic quadruped whose bones are found in the soil in various parts of North America. Near Goat Island, which is close to the Falls of Niagara, and at the Whirlpool, which is four miles further down, Mr. Lyell found a fluviatile deposit, forty feet thick at the latter locality, consisting of beds of sand, and containing many recent shells, with remains of the Mastodon. When the deposit was formed by the river its waters must have been three hundred feet higher than at present. It follows that the deep channel from the Whirlpool to Goat's Island was then uncut, and that the Falls were below the Whirlpool. Hence, it appears, that since the bones of the Mastodon were deposited in these beds, the Falls have receded (according to maps in our possession) four miles, and possibly much more, for when the deposit was formed, the Falls may have been, not at the Whirlpool, but some miles below it. According to an estimate made some years ago, the Falls recede (by undermining the rock) about a yard per annum, but Mr. Lyell assigns a foot as the more probable amount; and as they have receded in this case four miles, or twenty thousand feet, we may infer that twenty thousand years have elapsed since the bones were deposited in the fluviatile sediment, and since the animal lived. If the estimated rate of recession is accurate, the time cannot be less than this, but it *may be* more. The result, though wanting precision, is not without its value; and there is little doubt that by the aid of such natural Chronometers as Niagara Falls, and other means, we shall by and by be able to measure by centuries geological periods of the length of which at present we can form no distinct conception. Mr. Lyell also describes "the boulder formation on the borders of Lakes Erie and Ontario, and in the valley of St. Lawrence, as far down as Quebec. Marine shells were observed in this drift, in several localities at Montreal, attaining a height probably exceeding five hundred feet above the level of the sea. Similar shells were found as far south as the western and eastern shores of Lake Champlain. They are all northern species, and imply a former colder climate. Rocks in contact with the drift are smoothed and furrowed, as beneath the drift in Northern Europe."—*Scotsman.*

BRITISH FOSSIL MAMMALIA.

PROF. OWEN has read to the British Association a continuation of his Report on the Fossil Mammalia of Great Britain*. In the previous parts of the Report, he had treated of the Carnivora and Marsupiata: in this he confined himself to an examination of the vegetable-feeders. Remains of the mammoth, of which he believed there was only one species, the *Elephas primogenitus* of Cuvier, had been found in abundance in various parts of Great Britain, and not less than three thousand teeth had been found in various places. These teeth varied

The first portion of this valuable Report will be found in the *Year-Book of Facts*, 1843, p. 265.

in appearance with age, and had thus led to the supposition that there were other species of mammoth. The remains of the mastodon found in Suffolk and Yorkshire were undoubtedly identical with those of the miocene beds of France, thus making but one European species, the *Mastodon angustidens*. Bones of an extinct species of rhinoceros had been found in various parts of Great Britain. It possessed two horns, and was undoubtedly different from existing species. The teeth also of a species of hippopotamus had often been found, as in the cave at Kirksdale, and other limestone rocks. In the Isle of Wight two distinct genera of pachyderms had been found; the Palæotherium and Anoplotherium. Of the former genus, there appears to have been six or seven species, and of the latter three. The teeth and fragments of bones of more uncommon forms still, had been found in the Isle of Wight and in Suffolk, which had been referred to animals of distinct genera, and called Chæropotamus and Hyracotherium. Remains of species of the genus Sus had also been found by Dr. Buckland. Of the Ruminantia, the Irish elk, as it had been called, has been also found in England. In structure this animal resembled the fallow deer, but was larger. The remains of a cervus, not differing from the red-deer, were frequently found with the mammoth and other animals. Remains also of the roebuck, and the goat and sheep, had been found associated with those of the mammoth. Remains of the aurochs, or European bison, had been found in various parts of England, and also of Ireland. According to Mr. Ball, these remains should be looked upon as those of an extinct species. In concluding his Report, Prof. Owen stated, that he never should have commenced these labours, nor could he have continued them, but for the suggestions and assistance of the British Association.

THE DANGER-BIRD (*Dinornis*).

THE remains of this gigantic Bird have been noticed in the Zoological Section of the present volume. In his Anniversary Address to the Geological Society, the President thus referred to the discovery. From the examination, in 1839, of a single fragment of a bone brought from New Zealand, Professor Owen, though at first startled by its enormous size, at length pronounced it to belong to a gigantic form of the lowest organized bird, analogous to the diminutive Apteryx of the same island, in which the lungs approach more closely than in any other bird to the structure of those in reptiles. To this monstrous winged animal he assigned the name of *Dinornis*, and many of its bones, in a very perfect condition, having been subsequently found in New Zealand and deposited in the Museum of the College of Surgeons, his opinion has been completely confirmed*. When it is known that *the tibia of this bird is so huge that the femur of the Irish giant is of pigmy dimensions when compared with it*, some conception may be

* The inhabitants of New Zealand believe that the Dinornis was in existence with their progenitors. On this point, however, doubts may still be entertained, as we know that in many uncivilized countries, where the bones of extinct quadrupeds occur, the natives connect them with their ancestors.

formed of its entire size, which must have far exceeded that of the ostrich*.

Now, to apply this discovery to our Ornithichnites, one of the great difficulties which many of us had to overcome was the gigantic size of the largest American footsteps, which measured fifteen inches in length; and it is a most curious fact, that upon placing the fossil cast alongside of the metatarsal bone and tibia of the largest individual of Dinornis, Professor Owen is of opinion, that if the feet of this great tridactyle bird be found, they will, from the usual proportions maintained in such animals, be fully as large as those of the American Ornithichnite. From this moment, then, I am prepared to admit the value of the reasoning of Dr. Hitchcock, and of the original discoverer, Dr. James Deane, who it appears, by the clear and modest paper lately brought before us by Dr. Mantell, was the first person who called the Professor's attention to the phænomenon, expressing then his own belief, from what he saw in existing nature, that the footmarks were made by birds. Let us now hope, therefore, that the least vestiges of doubt may be removed by the discovery of the bones of some fossil Dinornis; and, in the meantime, let us honour the great moral courage exhibited by Professor Hitchcock, in throwing down his opinions before an incredulous public.

FOSSIL ORGANIC REMAINS FOUND IN 1843.

The Ox.—At Chelsea, near the site of the late Episcopal Palace of Winchester, workmen have dug up, at about twenty feet deep, a variety of bones, chiefly of the genus *Bos*, with horns of the Elk, the Ox, &c.

Large Ruminantia.—M. Duvernoy has published a second memoir on the subject of the fossil jaw discovered at Issondun (Indre). From the examination of the learned academician, he concludes, that it is the lower jaw of an animal of the genus cameleo-pardus, which shews that formerly it was not confined to one part only of the ancient continent, but that it existed in Europe and in Asia.

Bristol.—Dr. Riley has discovered a bone-cavern in the Mountain Limestone of Durdham Down, near Bristol, the opening of which has been conducted by Mr. Stutchbury, who has described its contents. Distinguishing, as Dr. Buckland had formerly done, the cavities formed by fissures in the rock, into which bones had been washed with detritus of rocks and soil, or into which whole animals had fallen, from cavities inhabited by extinct species of canine animals, Mr. Stutchbury shows, that the facts observed in this case entirely favour the latter hypothesis, the bones (among which those of the hyæna vastly preponderate) being fractured into small bits without the admixture of any rolled or far-transported detritus. The most novel point connected with this cavern is, that several of the hardest bones and teeth have been split across, and their parts relatively moved, as if the detrital mass had been affected by faults posterior to its original deposit,

* See a most graphic sketch of this monstrous bird and its analogies, from the pen of Mr. Broderip, Penny Cyclopædia (*Unau.*)

which movements may, Mr. Stutchbury supposes, have been connected with the operations which closed the orifice of the aperture.

Birds' Footmarks.—Dr. Mantell has read to the Geological Society a "Notice on a Suite of Specimens of Ornithroidicnites, or Footprints of Birds on the new Red Sandstone, Connecticut, United States." These specimens were accompanied by a letter from Dr. Deane, of Greenfield, Massachusetts, the original discoverer of these curious footmarks, of which more than thirty varieties have been found, mostly bearing a striking resemblance to the tracks of living birds. They are invariably those of a biped, and in some instances the progress of the animal may be followed over as many as ten successive steps. One example is fourteen inches in length.

Ichthyolites.—A letter has been read to the British Association, from Mr. W. C. Redfield, to Mr. Lyell, "On newly-discovered Ichthyolites in the new Red Sandstone of New Jersey," narrating his discovery of two distinct fish beds, both containing remains of the genus Palæoniscus in that formation, and also of Ornithroidicnites, in the sandstone between the beds.

Mollusca.—Dr. Mantell has communicated to the Geological Society, a "Notice of the Fossilized Remains of the Soft Parts of Mollusca." Substances resembling coprolites in general appearance and composition, but destitute of the spiral structure which those bodies present, have been classed with them under the name of pseudo-coprolites. In the upper green sand at Southbourne, in Sussex, such concretions are thickly interspersed among remains of mollusca, and they are frequently found within the cavities of shells. Dr. Mantell considers them as having originated from the soft bodies of the mollusca. They had been observed in the Kentish rag, near Maidstone, by Mr. W. H. Bensted, who, communicating with Dr. Mantell on the subject, expressed his belief that the carbonaceous matter filling the shells was derived from the soft bodies of mollusca, and that the concretionary and amorphous portions of the same matter, dispersed through the sandstone of that bed, were fossilized remains of the soft bodies of the animals which had become disengaged from their shells, and had floated in the sea, till enveloped in the sand and mud which is now concreted into coarse sandstone. Some of the substances of these bodies being submitted to chemical examination by the Rev. J. B. Reade, animal carbon was detected. Dr. Mantell proposes to name such fossils *Molluskite.*

Tree.—At the late meeting of the British Association, Mr. Binney announced the discovery of an upright Tree, nine feet high, in the coal strata at St. Helen's, near Liverpool, identical in species with some of the trees (*Sigillariæ ?*) at Dixonfold and Manchester; the roots were remaining to the length of eight feet, these roots being undoubted *Stigmariæ* (the ordinary *S. ficoides*), with their radicles or "leaves" attached, and spreading out in all directions to the distance of two or three feet.

Ecrinites.—On March 8, was read to the Geological Society, the Description of a new form of Ecrinite, from the Dudley Limestone, by Mr. J. Chaning Pearce, F.G.S. These remarkable fossils were communicated to Mr. Pearce by Mr. John Gray, of Dudley. The generic name of *Pseudo-crinites* is proposed for them, and two species are described, both characterized by the arms and fingers being inserted in bands, which commence just above the column, and pass over the plates of the head, to its summit. One species has two, the other four, of these bands of fingers.

Fruits.—Dr. Mantell has described to the Geological Society Three Fossil Fruits from the Chalk Formation of the South-East of England. These additions to the Flora of the cretaceous era, at present very limited, are:—1. *Zamia Sussexiensis*, from green sand, near Wellingdon, Sussex; 2. *Abies Benstedi*, discovered by Mr. Bensted in the green sand near Maidstone; and 3. *Carpolithes Smithiæ*, from the white chalk of Kent.

MiddleRhine.—Mr. Murchison has read to the British Association an account of "the Recent Important Additions made to the Fossil contents of the Tertiary Basin of the Middle Rhine." Mr. Murchison gave an account of the recent discoveries made by M. H. von Meyer, M. Kaup, of Darmstadt, and M. Braun, of Heidelberg. Of the animals of this tertiary basin, M. von Meyer had catalogued and was preparing for publication, 68 mammifers, 30 reptiles, 13 birds, and 8 batrachians —nearly all being undescribed species, and most of them of small dimensions. Amongst the new animals discovered by M. Kaup, were mentioned the Chalicotherium, a genus allied to Anoplotherium and Lophiodon; the Hippotherium, differing from the recent Equus in the possession of an additional metacarpal bone, and a minute saurian, named *Pisodon Colie.* M. Kaup had determined from an examination of the various species of rhinocerous, tapir, &c. occurring in this deposit, that the Fauna of the period presented a close affinity to the types of the Indian and Sumatran archipelago, and were entirely distinct from all known European mammalia. He had also collected a large series of mastodontoid remains, which completely proved the views of Professor Owen, respecting the identity of the American Tetracaulodon with the true Mastodon. The invertebrata of the deposit have been examined by M. Alexander Braun, and have been found to comprise 450 species, 303 of which are mollusca, and 103 shells,—of which, ten species only were identical with living forms. Many of the shells approach closely in form to those in the Calcaire Grossier of Paris, and this circumstance, together with the occurrence of the Anthracotherium and of an animal intermediate between the Anoplotherium and Palæotherium, makes it probable that the deposit belongs to the same age as the gypsum beds of Montmartre, and the Ryde and Binsted strata of the Isle of Wight. These tertiary beds are covered with gravel, sand, and löss, containing 96 species of shells, 56 of which are terrestrial, and 40 fluviatile. Of these, 7 belong to species now living, and 9 others are probably varieties of existing species: the most abundant species are very rare in a living state, whilst those now common are of unfrequent occurrence in the löss. With the shells are associated the remains of mammoth, rhinoceros, tichorinus, &c., the bones of which have evidently received very little injury from diluvial action; and from the frequent occurrence of entire skeletons, Mr. Murchison infers that these superficial deposits were formed by very tranquil operations, and that the great mammalia inhabited tracts immediately adjacent to the spots where they are now entombed. Mr. Owen stated, that the Mastodon of the Mayence basin was identical with the species found in the Norwich Crag, which was likewise a fluvio-marine deposit. He had not seen any bones in the English tertiary or drift, which could be distinguished from the ordinary horse or zebra, excepting a few teeth, which were more curved than usual, and might possibly have belonged to the Hippotherium.—*Athenæum*, No. 828.

Ireland.—Mr. Griffith states, that in the progress of the Ordnance Survey of Ireland he has obtained 950 species of fossils in the carboniferous series alone, 200 of which are new or undescribed. All these have been, or will be, engraved and published at his own expense; but the Silurian fossils, which he has also collected, will be forwarded to the Museum in London, to be published by the Director of the Ordnance Survey.

On Nov. 1, the magnificent collection of drawings of fossil fishes, being the originals of the great work of Prof. Agassiz, from whom, in order to aid their publication, they were purchased by Lord Francis Egerton, was presented by his lordship to the Geological Society.

THEORY OF EARTHQUAKES.

One of the most striking papers read to the Geological Section of the British Association, at their late meeting, was that on Earthquakes, by the Professors Rogers, of Philadelphia and Virginia, in which the authors infer that, when earthquakes produce any *permanent* elevation or depression of the land, the tracts so affected will generally have the shape of elongated parallel belts, as exemplified in the Ullah Bund in the Delta of the Indus, the elevation of the coast of Chili, and the local arching of the surface across the bed of a river in Chili, mentioned by Darwin. Referring to their memoir on the Appalachian chain, the authors contend that the structure of those mountains (and, by analogy, those of other countries) implies the operation of far greater and more sudden forces than the gentle secular changes observed in modern times; and they consider it impossible to avoid the conclusion, that all the more extensive revolutions of the earth's crust have involved, to a greater or less extent, the *agency of vast earthquake waves*. To the action of these waves, in different geological epochs, they attribute the formation of the vast masses of conglomerate and detrital deposits distributed in the various groups of strata;

and also the transports of the great northern drift, and the polished and furrowed surfaces of rocks both in Europe and New England.

EARTHQUAKE IN GUADALOUPE.

On Oct. 30, a paper was read to the Academy of Sciences, at Paris, on the Earthquake at Guadaloupe, in 1839; by M. Lherminier. He states :—1st. That there is nearly as much variety and irregularity in the distribution of atmospheric electricity and earthquakes in the Antilles, as in the heat and humidity of clouds, winds, and luminous meteors, aerial and aqueous. 2nd. That the months of July, August, September, and October, are the periods of the greatest accumulation of caloric and vapour in the basin of the sea of the Antilles, and thus constitute the period when thunder is most frequent. 3rd. That the average of the observations, made during a period of nine years at Martinique and Guadaloupe, gives thirty-eight days of thunder annually, whilst the observations made at Guadaloupe during a period of rather more than three years, gives thirty-nine days annually for thunder, and four for earthquakes.

EARTHQUAKES IN 1843.

There has been read to the British Association, "An Account of the late Earthquake at the Islands of Antigua and Guadaloupe, on the 8th of February, 1843," by the Hon. Capt. Carnegie, M.P. The earthquake is described by the author of the communication as having been felt, generally, among the Leeward Islands, but more particularly at Antigua and Guadaloupe. At both these islands, the shock took place at twenty minutes before eleven o'clock A.M., and it does not appear to have been preceded by any of the usual signs of earthquake; the weather was clear and fine, the sea-breeze blowing as usual, and the inhabitants engaged in their daily avocations. At Antigua, the earth heaved and undulated suddenly; the hills oscillated, and huge masses of rock were detached from their summits, and precipitated into the valleys; large fissures opened in the ground, and closed immediately. The water in the harbour whirled round and round, enveloping the islands in a cloud of dust, which shut them from view, and in the space of two minutes and a half all Antigua was laid in ruins. In this island only eight persons lost their lives, owing to the black populatinn being employed, as usual, among the canes, but the loss of property was immense. At Point-à-Pitre, in the island of Guadaloupe, the effects were much more fearful. In magnitude, this was the second town in the West India islands; it was situated upon a piece of low ground, surrounded on three sides by the sea, and entirely built of stone to avoid the hurricanes. At the time of the earthquake, most of the inhabitants appear to have been at their late breakfast, in consequence of which 4,000 perished among the falling houses, or in the fire which broke out immediately after; the destruction of the whole town was so completeas, to present, after the earthquake, the appearance of a vast stone quarry. The landslips were very numerous, and all the springs in the vicinity of Point-à-Pitre were instantly dried up. The shock was felt slightly as far as north Washington and Bermuda, and southward, to Demerara, travelling in a N.N.E. and S.S.E. direction; several slight shocks were subsequently felt at different periods.

Earthquakes are either more common, or we are more observant of them, than formerly. There has been another in Lancashire, felt pretty generally throughout the county, and as far as Carlisle. The force of the shocks was such that many persons were shaken in their beds, whilst windows and furniture rocked to and fro in every direction, and the very houses trembled to their foundations. The river is likewise reported to have been considerably agitated. Considerable damage has been done amongst the china, glass, and other brittle materials, in many dwellings. The fetters and other prison implements hung up in the gateway tower of the Castle, clanked against each other with great violence. This was on Friday, the 10th of March, and the shock was felt, according to the *Manchester Guardian*, at from *five to three minutes to one o'clock*. There is a probability that its influence reached much further than anticipated, for the Guernsey Paper of the 13th observes:—" A shock of an earthquake was distinctly felt in this island at *a little before one of the clock in the morning of* Friday last. It was accompanied by a noise resembling the rumbling of a carriage. A gentleman residing near Mount Durand states that he distinctly saw the furniture in his bed-room agitated by the shock. The Jersey papers state that the shock was felt at that island nearly at the same time." The *Pilote du Calvados* states that several shocks of an earthquake were felt in the department in the Manche, on the night of the 10th, about half-past twelve.—*Athenæum*, No. 804.

Guernsey.—On the afternoon of Dec. 29th, at a few minutes before four o'clock, the shock of an earthquake was felt throughout the whole of the island: the sky was partially overcast, and had a rainy appearance, the wind blowing in slight squalls from the southward and southwestward. At the time above mentioned, a loud rumbling, or *undulating* noise, was heard in every part of the island, accompanied by one or two shocks, which, the account states, had much less affinity to the concussion, produced by an explosion, than to the benumbing effect created in electricity. This phenomenon, it is generally agreed, lasted about four seconds, and was evidently subterranean. We learn from Sark that the shock was felt in that island at about the same time and in the same manner as in Guernsey.

Scotland.—The "Committee on Earthquakes in Scotland," appointed by the British Association, have reported that, from the end of June, 1842, to the 1st of July, 1843, thirty very slight shocks of earthquakes have occurred at Comrie, in Perthshire, and have been registered by Mr. M'Farlane, who has the charge of the instruments belonging to the Association. The last autumn he stated to have been particularly dry, and the barometer seems to have been unusually low at the time of the shocks. The first shock took place on the 24th of September, 1842: the inverted pendulum in the steeple of Comrie Church was moved one-eighth of an inch to the south-east, and the common pendulum to the same distance eastward. The instruments were slightly affected on two other occasions. Earthquake shocks were also felt on the 19th of August, 1842, at Pitlochey, near Dunkeld, and on the 25th of February, and 3d of March, 1843, at Oban and Lochgilphead, in Argyleshire. Shocks were also stated to have been noticed in North Wales, on the 22nd of August, 1842, and near Manchester, on the 10th and 17th of March, 1843.

A VOLCANO

Of a novel kind has broken out in the neighbourhood of Kœnigshutte, a town in Silesia. For twenty years past, a slow fire, which occasioned no alarm, has burnt in the coal-mines of that district; but recently it has assumed an alarming character, shooting out immense volumes of flame, which threaten destruction to the surrounding buildings, and to the vast forests of the country. A steam-engine has been established for the purpose of discharging water into the mines.

VOLCANIC ERUPTION IN THE SANDWICH ISLANDS.

On Jan. 10, at day-break, the great volcano of Mauna Lŏa, in Hawaii, burst forth near the summit, at an elevation of 14,000 feet above the sea. The eruption increased, from day to day, for several weeks, pouring out vast floods of fiery lava, which ran down the side of the mountain, and flowed in broad and burning rivers, till the molten flood had progressed 20 or 30 miles across a high plain which stretches between the bases of Mauna Loa and Mauna Kea. The Rev. Titus Coan, in a letter dated Hilŏ, May 16, states, that it was not until after many weeks that he was able to visit the volcano, when he traced the stream to the top of the mountain, and found its source in a vast crater, amidst perpetual snow: the lava had ceased to flow down the sides of the mountain upon the surface, but had formed for itself a subterranean duct, at the depth of 50 or 100 feet, vitrified like glass; and down this fearful channel a river of fire was rushing, at the rate of 15 or 20 miles an hour, from the summit to the foot of the mountain. This subterranean stream the writer saw distinctly through several large apertures in the side of the mountain, while the burning flood rushed beneath his feet.—*Abridged from the Auburn (United States) Journal.*

The detailed account of a terrific eruption of this volcano in 1840, will be found in *The Year-Book of Facts*, 1842, p. 245.

Astronomical and Meteorological Phenomena.

THE GREAT COMET OF 1843.

A Comet, or supposed Comet, became visible in our hemisphere on the 17th of March, and, from its unexpected appearance, excited extraordinary interest among all classes of observers: especially as one of the most distinguished of them, hesitating to pronounce it a true comet, stated, that if were not one, it was *some phenomenon even yet more remarkable.*

The following communication from the Rev. W. R. Dawes, R.A.S. was made to the *Philosophical Magazine*, No. 145:—

"A large Comet has become visible in the evening, soon after sunset. It appears to have been first seen in this country on Thursday, the 16th inst. by Mr. Shorts, of Christchurch, Hants; but it had been observed on board the Tay, West India Mail Steamer, on her homeward voyage, as early as the 6th, and at Nice, by Mr. Cooper, on the 12th. On the 14th Mr. C. detected the nucleus, which he found to be stellar, and equal to a star of the sixth magnitude; but its situation could not be correctly ascertained. At Paris it was first noticed on the 16th. On that day Mr. Cooper obtained, at Nice, a rough observation of the nucleus, from which he concluded that its right ascension was about 2 hours 30 minutes, and south declension 15 degrees. He also determined its *geocentric* motion to be *direct*, and *northward.*

"Its appearance is remarkable; the tail being of great length, nearly uniform in brilliancy, and its lateral limits almost exactly parallel, while its breadth scarcely exceeds one degree and a half. On the 17th it was observed by Sir J. Herschel as a vivid luminous streak, commencing close beneath the stars *kappa* and *lambda Leporis*, thence stretching obliquely westward and downward between *gamma* and *delta Eridani*, till the vapours of the horizon rendered it invisible. On Friday, 24th, it was well seen. At about 8 o'clock it was distinctly observed to extend from a little to the west of the star 3 *Monocerotis*, between *Rigel* and *iota Leporis*, nearly in the direction of *delta Eridani*: and Sir J. Herschel obtained a view of the head, which he concluded to be near one of the stars of *rho Eridani*; its appearance being that of a star of fifth magnitude, but dim, and having no sharp nucleus. The star 63 *Eridani* was *in* the tail, a trifle north of its axis. No bifurcation could be perceived; the axis being throughout rather the brightest part. Its direction is very nearly parallel to the equator, though a slight curvature may be suspected, the convexity being northward. By comparing the observed place of the tail on the 24th with that noticed by Mr. Cooper on the 14th (when it passed over *gamma Eridani*), it appears to have advanced northward about 4 degrees in the interval of ten days. This direction and quantity of motion was confirmed by an observation on the 25th, when 63 *Eridani* was found to be still *in* the tail, but near its *southern* border."

Sir John Herschel, in a letter to *The Times*, dated March 19, from Collingwood, in Kent, describes the comet of enormous magnitude, in the course of its progress through our system, and not far from its perhelion. Its tail was conspicuously visible, both on the night of the 17th and 18th, as a vivid luminous streak, commencing close beneath the stars *kappa* and *lambda* Leporis, and thence stretching obliquely westward and downward between *gamma* and *delta* Eridani, till lost in the vapors of the horizon. The direction of it, prolonged on a celestial globe, passes precisely through the plane of the sun in the ecliptic at the present time, a circumstance which appears conclusive as to its cometic nature. As the proportion of the tail actually visible on the 17th was fully 30° in length, and the head must have been beneath the horizon, which would add, at least, 25° to the length, it is evident that, if really a comet, it is one of first-rate magnitude; and if it be not one, it is some phenomenon beyond the earth's atmosphere of a nature even yet more remarkable. Sir John adds: "8 P.M., March 19. The tail of the comet, for such it must now assuredly be, is again visible, though much obscured by haze, and holding very nearly the same position."

Sir James South writes from the Observatory, Kensington, Tuesday, at 11 at night, March 21: "The brilliant train of light, of which notice is given in *The Times* of this day, was seen here on Friday evening at a little after 7, and had very much the appearance of the tail of the comet of 1811. Its highest point when I first saw it nearly reached *theta Leporis*, and passing through the constellation *Eridanus*, became invisible to me from interposed trees, when about 2° from the horizon. More than 45° of tail were measurable; stars of the fifth magnitude were visible through it by the naked eye; and with a 42-inch achromatic, of 2¾ inches aperture, those even of the eighth were perceptible. At 7h. 33m. 22sec. (sidereal time) a bright meteor issued from the very tip of the tail. No trace of the above light could be detected here either Saturday, Sunday, or Monday nights, in consequence of cloudy weather.

"This evening (Tuesday), at about ten minutes before eight, the clouds cleared away; but no vestige of the train could be perceived in the neighbourhood which it had illumined on Friday night; though a diffused and amorphous light, commencing at the *Pleiades*, and spreading over the entire constellation *Aries*, even through the haze, was too conspicuous to escape observation. If this be the tail of the comet it indicates a very rapid motion of it northward."

On March 20-27, communications were received from M. Arago, by the Academy of Sciences, at Paris, relating to the Comet. Unfortunately, the atmosphere at Paris, he stated, had been so clouded, that what was known relating to the comet came from other places. The intelligence from England was unimportant. It had been seen at Nice, on March 12, 13, and 14; at Toulouse, on the 18th; at Marseilles, at the same time as at Paris, and the united observations of the two places would be sufficient to determine its orbit. At Geneva the weather had enabled very excellent observations to be made, the comet having been examined on three successive occasions. It appeared certain, from the information derived from this quarter, that not only had the present comet approached the nearest the sun of all others known, but that it had even penetrated into the luminous matter of that body. The tail was presented in an oblique direction, and could not be less than 63 millions of leagues. He had taken some observations with a view of deciding the disputed point as to whether comets shine by their own light or by a light reflected by the sun, and he was decidedly of opinion that they shine by a light of their own. The appearance of the comet at this particular moment would, he said, have the effect of strengthening the old belief that such phenomena are always productive of dreadful calamities to man. Thus, that which was seen at Rome in the year 373 before Christ coincided with an earthquake and inundations which overturned two cities in the Peloponnesus. The terrible disaster at Guadaloupe would be quoted by many as the dire effects of the present heavenly visitant. It was also generally believed that comets produced an extraordinary elevation in the temperature; and this year the weather had certainly been particularly mild; but, remarked M. Arago, this could only be a coincidence, for it was impossible that the immense heat of comets—and Cassini calculated the heat of that seen in 1702 as 2,000 times greater than red-hot iron—could have any effect on our temperature; and calculations made at the Board of Longitude had even proved that the heat in the years when comets appeared have not been, on an average, greater than others, and sometimes was even less.

On April 10, M. Arago read to the Academy some further correspondence, shewing that in no place was the Comet observed with more care and precision than by the young astronomers at Paris under the direction of M. Arago. According to the conclusions of MM. Laugier and Mauvais, the curve described is a parabola. The comet of 1843 is, of all the comets known, the nearest to the sun. On the 5th, when it was at its nearest point to the earth, it was still distant from us 32 millions of leagues. The nebulosity, which formed the head of the comet, had the diameter of 38,000 leagues, and was therefore 1700 times larger than the earth.

Subsequent observations made by M. Arago, and those of other learned astronomers in various countries, left no doubt on their minds that the celestial phenomenon was really a comet of considerable magnitude, and not an effect of the zodiacal light, as many persons were at first inclined to suppose. The discovery of the nucleus deprives this latter supposition of all weight; and the only material point upon which astronomers differ is, as to whether this comet has ever before been seen. Mr. Cooper seems to be of opinion that it is the comet which was seen in 1702, and the revolution of which was estimated at 34 years; but if this be the same comet, there must have been an error in the computation. Mr. Cooper, however, finds that a slight difference of only a quarter of a year would rectify this computation. M. Arago estimates the rate of speed at which this comet travels as 104 leagues per second, or 15 times swifter than the earth.

In the meantime, Dr. Forster and some other meteorologists unhesitatingly pronounced the light, which had been regarded as the tail of the great Comet, to be nothing more than the zodiacal light. Sir John Herschel, in a letter dated March 31, repudiates the above assertion, and states, that on every evening when he had observed the comet, the zodiacal light had also been displayed in the most striking and perfectly characteristic manner, and occupying its usual place among the stars; while the comet, in no part of the extent of its tail, so much as touched upon the region occupied by it. Furthermore, Mr. Cooper distinctly saw the nucleus at Nice; and Sir John Herschel himself, on one occasion, saw the head with its so-called nucleus. Sir John concludes thus:—"But now comes the most remarkable circumstance attending the appearance, or rather disappearance, of this comet. The next night (Saturday) I prepared a 7-feet Newtonian reflector, of 6 inches aperture, on the roof of my house, expecting to obtain a good view of the nucleus. To my amazement, though the night was clear, and the horizon good, I could not find it; but I did find, in the very central line of the train, near no star, nor in any identifiable place, a dim, pretty large, oval nebula, but very little condensed towards the centre, but with no appearance whatever of a nucleus. This nebula I also several times swept over, so that I have not a suspicion remaining on my mind of the possibility of an illusion. Now, there are nebulæ in that region of the sky; but, on referring to a catalogue of them, I do not find one which I consider it would have been possible to have seen with such an instrument, and under such circumstances of remaining twilight and vicinity to the horizon. Moreover, the next night (Sunday), taking up the observation earlier and pursuing it later, with the same reflector and an equally good sky, this nebula was also missing. These facts I consider as well worthy to be placed on record, and to indicate a rapidity of diminution in point of lustre only to be explained on the supposition that the comet is receding from us with great velocity. The train, too, is diminishing rapidly in brightness, though it retains its position with remarkable pertinacity; at least, it did so on Wednesday night."

A variety of communications respecting this comet will be found recorded in the *Proceedings of the Royal Astronomical Society*. The phenomenon was seen in the United States, the East Indies, New Zealand, &c.

PHENOMENA OF JUPITER'S SATELLITES.

On October 21, the planet Jupiter, from his nearness to the orbit of the earth, was seen to great advantage. On that occasion, the Satellites visible were the second, fourth, and third; the first being eclipsed. The aspect of Jupiter was singularly beautiful. Near the bottom, a dusky haze, clearly distinguishable in colour and texture from the belts, gave sphericity to his figure, and indicated the position of the sun. Above this was a narrow and uniform belt below the principal belt. The bottom of the principal belt was straight, but its upper edge had the appearance of two mountains (the right hand one being the higher), with a depression between them, sensibly lower than the other parts of the belt. A little depression was also observable to the left of the second mountain. The right hand mountain was all that apparently remained of the great spot which had recently been a subject of much discussion—its form had totally changed, as at first it was a round spot, adhering to the top of the belt. Above this was a well defined narrow belt; and towards the right hand there was a small lump on it. Above this came a single belt, with a bright space evidently over it; and then the collection of belts at the top, quite different from the duskiness at the bottom. None of the belts were visible quite to the edge of the planet. An engraving of these phenomena, drawn at the Royal Observatory, at Greenwich, will be found in No. 79 of *The Illustrated London News*.

SPLENDID AURORA BOREALIS.

SIR JOHN HERSCHEL, in a letter to the *Athenæum*, describes one of the most brilliant displays of Aurora Borealis which it had ever been his good fortune to witness. This was on the night of Saturday, May 6. Sir John relates:—

"The day had been overcast and showery, and between 5 and 6 P.M. a heavy fall of rain took place, after which the sky cleared gradually, and at length became perfectly serene and cloudless, a calm, or very gentle air from the westward, prevailing. It was at 10 P.M., or a few minutes after, that, looking out towards the south, my attention was attracted by a small luminous patch, unlike an ordinary moon lighted cloud, in the constellation Leo, and going out where an uninterrupted view of the north horizon could be obtained, a pretty strong auroral glow was observed, in spite of the bright moonlight. But what chiefly attracted my attention was a large and exceedingly luminous white nebulous mass, in form something like an inverted comma, occupying a space from about the altitude of α Cassiopeiæ (which its eastern border nearly touched), to the Pole Star. At a cursory glance it might have been taken for a cloud, but that its light was much stronger than any cloud simply illuminated by a moon in the first quarter could have emitted. It differed also from any ordinary cloud in the exceeding softness of graduation of its light, and the regularity of its condensation towards the middle, but, above all, in the continual changes it underwent of general form, size, and brightness, without perceptibly shifting its place (at least, in a short time, though, on the whole, it kept slowly ascending)."

SPLENDID METEOR.

A LITTLE after 8 in the evening of Sunday, February 5th, a Meteor passed over a considerable part of the county of Nottingham. Its course was from the N.W. It greatly resembled a large body of fire of a blood red colour, assuming various shapes. Its apparent height was trifling, but its velocity could not be less than 50 or 60 miles a minute. In its course it was seen by numbers at a distance from each other, yet those who observed it, although so many miles asunder, fancied it fell within a short distance.—*Nottingham Journal.*

HALO ROUND THE SUN.

At Boston, on June 16, at $2^h\,30^m$ P.M., was seen a Halo round the Sun, with prismatic colours on the north-east and south-west; and a much larger circle, well defined, of a pale white, having the sun in the south-west of its circumference.

The interior of the halo, except the sun's disc, was of a much darker colour than the surrounding atmosphere.

The centre of the larger halo was very near, if not in the zenith.

AERONAUTICS.

The veteran aëronaut, Mr. Green, has communicated to the *Times* the following interesting meteorological observations, made during a recent balloon ascent.

"My ascent being made under circumstances favourable for meteorological observations in the upper regions of the atmosphere, and being furnished (by my friend and companion Captain Currie) with an excellent hygrometer, invented by Dr. Major, and admirably adapted for aëronautic observation, the following experiments were made between the hours of 7 and 8 P.M. To these there is added, a set of observations made at the earth's surface by Mr. Jones, of Charing Cross, with a similar instrument, and the requisite calculations.

"August 1, 1843, at 20 minutes past six P.M., barometer on the earth, 29·90; thermometer, 69°.

Barometer.	Elevation.	Dry Bulb.	Wet Bulb.	DewPoint	Moisture.	Grains
	Feet.					
27·7	2,591	63·5	61·5	58·8	·875	5·990
		63·	59·	53·7	·748	4·989
26·2	3,622	61·5	60·	58·0	·904	6·440
		65·	64·	62·7	·924	6·651
		60·	60·	60·	1·000	6·222
24·2	5,706	50·	50·	50·	1·000	4·535
23·2	6,814	41·	41·	41·	1·000	3·371
23·7	6,758	40·	40·	40·	1·000	3·239

Observations made at the earth's surface by Mr. Jones.

	Dry Bulb.	Wet Bulb.	Dew Point.	Moisture.	Grains.
At 6 P.M..	70·6	60·5	47·3	·490	3·982
At 9 P.M..	59·0	55·5	50·8	·774	4·566

"The weight in grains is that quantity of vapour contained in a cubic foot of air, and from the foregoing experiment it will be seen that at the elevations between 5,000 and 7,000 feet above the earth the atmosphere was completely saturated with moisture."

METEOROLOGICAL SUMMARY FOR 1843.

(Communicated by DR. ARMSTRONG, *South Lambeth.)*

Months.	Temperature.						Atmospheric Variations.			Hygrometer.		Modifications of Cloud.						
	Fahrenh.		Mean.			Fahr.												
	Max.	Min.	Reaumur.	Centigrade.	De Lisle.	Ext.mon.diff. compared with 1842.	Mean Pressure in inches.	Extra monthly difference.	Prevailing Currents.	Rain in inches.	Monthly diff. of quantity compared with 1842.	Cirrus.	Cirro-stratus.	Cumulus.	Cumulo-stratus.	Cirro-cumulus.	Nimbus.	Stratus.
Jan.	58	23	+3·5	+4·75	143	+12	29·45	2·80	NW. SW.	1·250	+0·290	:	*	:	:	:	:	
Feb.	55	20	0·00	0·00	150	+2	29·54	1·39	SW. NW. NE.	2·52	+1·425	:	*	:	:	:	:	
March ..	64	24	+1·00	+0·75	148	+10	30·06	1·08	N. SW. NE.	0·465	—1·560	:	*	:	:	:	:	
April ..	65	28	+6·5	+8·25	137·5	—14	30·15	0·97	SW. NE.	1·730	+1·665	:	*	*	*	:	:	
May	70	35	+9·24	+11·5	133·5	+4	30·17	1·35	NE. SW.	4·000	+1·785	:	*	:	:	:	*	
June....	72	42	+11·5	+14·00	129	—3	29·87	0·85	SW. NE.	1·345	—2·560	:	*	*	:	*	:	
July	88	45	+15·24	+19·00	121	+7	30·15	0·70	SW. NW.	2·790	—0·066	*	*	*	:	:	:	
Aug.....	84	47	+14·75	18·75	122	+6	30·10	0·80	SW. NE.	4·10	+3·720	*	*	*	:	-		:
Sept.....	84	35	+12·5	15·5	127	+10	30·35	0·70	NW. SE.	0·40	—2·814	*	*	*	*	*	:	:
Oct.	76	27	+8·75	+11·00	133·5	+9	30·45	1·40	SW. NW.	3·600	+0·01	*	*	:	:	:	:	
Nov.....	58	26	+4·5	+5·5	142	—1·5	30·02	1·35	NW. SW.	2·14	—2·481		*	:	:		:	
Dec.	52	32	+6·24	+8·5	139	—3	30·64	0·52	SW. SE.	0·30	—0·42		*				:	

Number of Days *rainy* throughout, or nearly, 59 ‖ Number of Days *clear* throughout, or nearly, 67.

Least atmospheric pressure on Jan. 13, being 28·05: in some thermometers the mercury sank into the bulb: on the 15th it rose to 30·85, showing a difference of nearly three inches. The greatest pressure, for many years back, was from Dec. 25 to 29, being 30·90. Thunder and lightning on Jan. 13; May 23, 28; July 23; Aug. 3, 4, 9, 15; Sept. 10.——Highest tides on Jan. 1, 15, 16, 20; Feb. 1, 4, 14, 17, 19; March 19; Apr. 3, 16, 17; May 15, 18, 19; June 11, 12; July 31; Aug. 1, 28, 30; Sept. 25, 26, 27; Oct. 24, 25; Nov. 24.——Highest winds on Jan. 8, 13, 14, 29; Feb. 2; March 25, 26; Apr. 4; June 8, 9; Oct. 7, 8, 27, 28; Nov. 6, 7, 20, 21, 23. The wind on Jan. 13 was the most disastrous; that on Nov. 6 was preceded by a large lunar halo.——Asteroids visible on almost every clear night throughout the year, especially in August and September. A fire-ball on Sept. 20, south, with motion slow and eastward; period 3″.——On the last day of the year the voice of the mavis was heard repeatedly.

The modification of cloud of most frequent appearance is signified by an asterisk; of rarest, by a colon.

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