

	MARCH 18.	MARCH 24.
C. Price & Co.'s patent engine oil (per gal.)	0 3/6	0 3/6
OIL CASES (per ton)		
Linseed, India	11 0/11 5/11 0/11	11 0/11 5/11 0/11
American bla.	10 5/10 12 0	10 5/10 12 0
Do. bags	0 5/0 5/0	0 5/0 5/0
Marselles	5 0/5 0/5	5 0/5 0/5
Rape, English	6 0/6 0/6	6 0/6 0/6
Do. Foreign	6 0/6 0/6	6 0/6 0/6
Green Cotton	6 0/6 0/6	6 0/6 0/6
TALLOW-PVC.		
S. American Beef	41 0/41 0/41	41 0/41 0/41
Do. Sheep	38 6/38 6/38	38 6/38 6/38
Australian Beef	34 5/34 5/34	34 5/34 5/34
Do. Sheep	37 0/37 0/37	37 0/37 0/37
Rough Town Fat	14 0/14 0/14	14 0/14 0/14
PETROLEUM		
Pine (per gal.)	0 6/0 6/0	0 6/0 6/0
Do. spirit	0 0/0 0/0	0 0/0 0/0
TURPENTINE-Spirit		
French	1 15/1 15/1	1 15/1 15/1
American (casks)	1 15/1 15/1	1 15/1 15/1
WALRUS (per ton)		
Davis Straits	1100 0/1100 0/1100	1100 0/1100 0/1100
Arctic	1000 0/1000 0/1000	1000 0/1000 0/1000
Southern	500 0/500 0/500	500 0/500 0/500
BRIMSTONE (per ton)		
Rough, 24s Ind.	7 0/7 0/7	7 0/7 0/7
Do. 24s do	5 10/5 10/5	5 10/5 10/5
Roll	9 13/9 13/9	9 13/9 13/9
SULPHUR, FINE	10 15/10 15/10	10 15/10 15/10
ACID (per lb.)		
Acetic, fine	0 0/3/0 0/3/0	0 0/3/0 0/3/0
Do. common	0 0/3/0 0/3/0	0 0/3/0 0/3/0
Citric	0 2/10/0 2/10/0	0 2/10/0 2/10/0
Muriatic fine (per cwt.)	0 4/0 4/0	0 4/0 4/0
Do. common	0 4/0 4/0	0 4/0 4/0
Nitric	0 0/4/0 0/4/0	0 0/4/0 0/4/0
Oxalic (per lb.)	0 0/5/0 0/5/0	0 0/5/0 0/5/0
Sulphuric, concentrated	0 0/1/0 0/1/0	0 0/1/0 0/1/0
Do. Brown	0 0/4/0 0/4/0	0 0/4/0 0/4/0
Tartaric Crystal	0 1/8/0 1/8/0	0 1/8/0 1/8/0
Do. Pulv.	0 1/8/0 1/8/0	0 1/8/0 1/8/0
AMMONIA		
Carbonate, per lb.	0 0/6/0 0/6/0	0 0/6/0 0/6/0
Sulphate, White & grey (per ton)	10 6/10 6/10	10 6/10 6/10
ANTRACITE		
Powdered, do.	23 10/23 10/23	23 10/23 10/23
Bleaching powder, do.	0 8/0 8/0	0 8/0 8/0
BORAX, Rfd., do.	3 5/3 5/3	3 5/3 5/3
COPPERAS (ton)	2 15/2 15/2	2 15/2 15/2
BI-SULPHIDE CARBON (per ton)	24 10/24 10/24	24 10/24 10/24
PORTLAND CEMENT		
1st quality, in cks 400 lb. gross, inc. cks., f.o.b.	0 9/0 9/0	0 9/0 9/0
Do. in cks, 200 lb. net (per ton)	9 0/9 0/9	9 0/9 0/9
Sacks extra 1/6 each.	1 13/1 13/1	1 13/1 13/1
Charlton White Paint (per cwt.)	0 30/0 30/0	0 30/0 30/0
Calley's Torday Paint, brown	0 30/0 30/0	0 30/0 30/0
Do. Red	0 30/0 30/0	0 30/0 30/0
HYPOPHOSPHITES (per lb.)		
Iron	0 0/3/0 0/3/0	0 0/3/0 0/3/0
Lime	0 0/3/0 0/3/0	0 0/3/0 0/3/0
Magnesia	0 0/9/0 0/9/0	0 0/9/0 0/9/0
Manganese	0 0/9/0 0/9/0	0 0/9/0 0/9/0
Soda	0 0/3/0 0/3/0	0 0/3/0 0/3/0
LEAD (per cwt.)		
Acetate, best	2 0/2 0/2	2 0/2 0/2
Nitrate	1 15/1 15/1	1 15/1 15/1
Red (per cwt.)	1 3/1 3/1	1 3/1 3/1
White	1 4/1 4/1	1 4/1 4/1
LITHARGE (per cwt.)	1 1/1 1/1	1 1/1 1/1
LIME (per ton)		
Acetate, Grey, 83 Y.	10 0/10 0/10	10 0/10 0/10
Do. Brown 70 Y.	14 0/14 0/14	14 0/14 0/14
POTASH		
Bichromate (lb.)	0 0/6/0 0/6/0	0 0/6/0 0/6/0
Chlorate (pr. lb.)	0 0/7/0 0/7/0	0 0/7/0 0/7/0
Muriate, 80 Y. ton	6 15/6 15/6	6 15/6 15/6
Frass, Red (lb.)	0 1/8/0 1/8/0	0 1/8/0 1/8/0
Do. Yell. lb.	0 0/11/0 0/11/0	0 0/11/0 0/11/0
Sulphate, 80 Y. (per ton)	9 0/9 0/9	9 0/9 0/9
SALTETTER (per cwt.)		
Engl. refud. kgs.	1 7/1 7/1	1 7/1 7/1
Do. barrets	1 6/1 6/1	1 6/1 6/1
Do. Bengal	0 10/0 10/0	0 10/0 10/0
SODA		
Ash, deg.	0 0/11/0 0/11/0	0 0/11/0 0/11/0
Bicarb. (per cwt.)	0 12/0 12/0	0 12/0 12/0
Caustic, 60 Y.	0 12/0 12/0	0 12/0 12/0
Do. 72 Y.	0 13/0 13/0	0 13/0 13/0
Nitrate (per ton)	18 15/18 15/18	18 15/18 15/18
Crystals (per ton)	4 0/4 0/4	4 0/4 0/4

* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

PRICES CURRENT OF MANUFACTURED GOODS

BIRMINGHAM AND DISTRICT.

* This List being compiled exclusively for the pages of IRON, all rights of reproduction are reserved. The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material. The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

March 23rd, 1880.

Last week we reported the iron and metal trades weaker all round, notwithstanding this, however, we had to chronicle the price of malleable rails up 20s. per ton. This week finds the market both for iron and metals still weaker. In brass, house and other bells have been reduced 1d. per lb. Brass wire, sheets and tubes were reduced last week. Brass jelly-pans are also reduced 1d. per lb., and the discount off pewter measures is increased 2d. per cent. equal to a nett reduction of about 4 per cent. At present, although heavier goods are easier on account of the recent fall in iron, we have had no alterations to any extent by makers of heavy manufactured steel, but large specifications are, no doubt, to be placed easier than they were a month ago. The only reductions noticeable are in toy pieces, which some makers are now offering at 2d. per cent. more discount than last week,

and the same may be said of other sheet-iron goods, such as water-bowls and common goods of this class. First-class makers show no signs of giving way, and fully adhere to the opinion that the present is only a reaction for a short time, consequent upon the realisation of speculative lots of iron which have been lately placed on the market, and after the elections and Easter holidays are over we may look for the present quotations to become strong again. The next fortnight we do not anticipate anything but electioneering and idleness, as far as business is concerned. Next week being Easter week, even when the excitement of a political contest of unusual magnitude is not about to be decided, most works are stopped for repairs and business is quite at a standstill. The present will be no exception to the rule, and commercial news will, no doubt, for some time be void of interest to either buyers or sellers; and till all is over, and work once again the subject of thought, we cannot predict what the course of prices will be. The holidays, however, will land us close on quarter-day, which will no doubt be looked forward to with much interest at a time when prices are just on the balance.

ABRIDGED LIST.

Axles, 15 to 25; coach ironwork, 10 to 15; coach and waggon springs, 15 to 20; Angers, 10 to 20. Axes—Ship carpenters' 5/3 to 7/6 per lb.; Kent and house carpenters' 5/3 to 6/1 ditto, steel polished, 5/3 to 7/7; felling axes, 4/1 to 4/4; polished, 4/3 to 6/1; bright and blued solid steel, 5/3 to 7/8; American teller or wedge Axes, steel polished, 1/1 to 1/4 per lb.; common Anvils, 8/1 lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27 to 35/.

Basins, shallow galvanised, 10 inch, 7/ to 7/6 per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard Bellows, 42 1/2 to 50; Best extra nailed Bastard, 37 1/2 to 45; Best improved long Bristol, 35 to 40; casters or moulders', best extra nailed, 12 inch, 30/ per doz. net; common Smith's Bellows, 45 to 50; Best warranted, extra leather double nailed, 30 to 40; with movable pipe for shipment 25 less discount. Bed screws, 6 and 7-16 and 1/2 inch, 10/0 to 11/6 per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and 1/2 inch nuts, 12/0 to 13/0; Black welded heads, 9/3 to 10/3; common slit heads, 6 and 1/2 inch, 9/3 to 10/3; Bright turned notched heads, 6 and 7-16 and 1/2 inch, 12/0 to 13/0; black notched heads, 10/6 to 11/6 per gross; Brass head nails, 40 to 42 1/2; star head, 15 to 40; Brass plated countersunk head, 25 to 30; Blacksmiths' tongs, 26/ to 28/ per cwt.; real fine wrought Box irons, 20 to 25; fine cast, 42 1/2 to 60; middle cast, 42 1/2 to 60; charcoal box irons—Victoria, 42 1/2 to 50; ordinary charcoal box irons, 55 to 70; Bolts—Straight tower; solid end tower, 65 to 67 1/2; end Best solid tower, 60 to 65 1/2; solid end barrel brass knob, 60 to 62 1/2; Japanned Scotch tower bolts, 45 to 50; painters' brushes, 45 to 50; Best, 10 to 40; light galvanised Buckets, 12 inch, 38 lb. to the doz., 10/ per doz. net; Blind cord, list price net; Bed hooks and eyes, 50 to 55 malleable, 62 1/2 to 67 1/2; Brass chain Banding, 30 to 35; Brass and plate coach heading, 30 to 35; ashpun moulding, 20 to 30; Bottle Jacks—Linwood's, 15 to 20; Salter's, 30 to 35; Nicholas's, 15 to 20; common painted Beams, 15 to 20; Bright rounded beams, 40 to 55; Bright box end beams, 40 to 55; deep Copper scales, 45 to 55; Steelyards, 40 to 60; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30; common, with round copper scale, 7 lb., 3/ to 5/; 14 lb., 3/6 to 5/0; 28 lb., 5/ to 8/ each, net; Bedsteads, cheap stump, 6 feet by 3 feet 6 in., 7/6 to 9/6 each; cheap French, 6 feet by 3 feet 6 in., 8/6 to 10/6 each, rising 1/6 for every 6 inches. Brass—Rolled brass, 2 to 12 inches wide, to 30 W.G., 10/ to 10/6 per lb.; Brass sheets, 24 by 48 in., 8 lb. and upwards or 27 W.G., 10/ to 10/6 per lb.; House bells, brass rough, 10 to 1 1/2 per lb.; turned edge, 11/ to 1 1/2; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3 to 1/6 per lb.; clock bells, 1/9 to 1/10; ship and turret bells, best, 1/4 to 1/5 Battery kettles, 150/ per cwt.; composition sheathing and slating nails, 100 to 110 per lb.; Brass Escutcheon pins, 1/2 to 1 inch, W.G., 10/ to 11; Brass Jolly pans, with balls, 11/ to 1/2; without balls, 1/2 to 1/2 per lb. Maslin kettles, cast, 4 to 16 inch, 10/ to 1/2 per lb. Pinpoints, 1/3 to 1/4. Brass Rivets for boots, 12 to 17, W.G., 10/ to 11; per lb. Brass Shoe Bolts, 1/4 to 1/2 per lb. Brass Scale pans, 1/11 to 2/; Brass Taddy kettles, 15 to 20; Brass Tubes, plain rough, 1 inch and above, 10/ to 11 per lb. Locomotive and marine boiler tubes, seam less from 1 1/2 to 4 inch outside diameter, to 14, W.G., 7/6 to 8/6.

Copper—Copper boat nails, wrought 1 1/2 by 12 inch, W.G., and upwards, 10/ to 1/2 per lb. Copper 1 boat Rovers, 4 inch and upwards, 1 1/2 to 1/2 per lb. Copper Brads and bills, same price as tacks. Light round Copper Kettles, bare rivets, 1/11 to 2/ per lb. Light round covered rivets, 1/10 to 1/11; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/10 to 2/4 per lb.; oval bare rivets raised down, 2/5 to 2/6 per lb. Copper Rivets and washers, 1/10 to 1/2 per lb.; Copper Slating nails, cut, 1 to 1 1/2 inch and upwards, 1/14 to 1/2 per lb.; Copper Scale pans, 1/11 to 2/ per lb.; cut Copper Nails and tacks, 1 inch and upwards, 1/2 to 1/2 per lb.; wrought Copper nails and tacks, 1/4 to 1/5 per lb.; Copper Wire, 20 to 20 W.G., 10/ to 11. Brass cupboard turns, 45 to 50; Chair webbing, No. 9, 4/5; No. 4, 8/; No. 4, 1/2; Cio, 4/6; per gross of 60 yards; Carpet rings 1/2 to 1/6 per gross; Cornice poles, 2 1/2 inch, brass best burnished 4/6 per foot, 25 to 35; 3/4 covered; brass poles, 1/2 per foot, 25 to 35; imitation mahogany cornice poles with ends and rings complete, 27 inch, 1/2 per foot; light birch ditto, 1/2 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2 1/2 inch, light, 2/9; middle, 2/7; strong, 4/2 per doz., 25 to 35; wood cornice pole rings, 2 1/2 inch, imitation mahogany, 16/ to 18/ per gross net; light birch, 17/ to 19/; real mahogany, 20/ to 25/ per gross net; machine made wire Chain, single link, iron, 42 1/2 to 47 1/2; double link, iron, 37 1/2 to 42 1/2; single link, brass, 37 1/2 to 42 1/2; registered double link, brass, 38 1/2 to 43 1/2; close link brass Chain, 5 to 102 brass oval lamp Chain, 22 1/2 to 27 1/2; brass Clock Chain, 22 1/2 to 27 1/2; Japanned pillar Chains, 1 yard, 10 by 6, 6/8 to 7/6 per doz.; Japanned manger, 13 yard 16 by 6, 8/3 to 9/6; Japanned rack, 1 yard, 18 by 6, 5/6 to 6/6; Japanned dog, 14 yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 11/ to 12/; Cattle, a chain, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/; close ring, 7/ to 8/ per doz.; Japanned watering chains, 14 by 6, 4/6 to 5/6; 12 by 6, 4/6 to 5/6; 10 by 6, 4/6 to 5/6; 8 by 6, 4/6 to 5/6; 6 by 6, 4/6 to 5/6; 4 by 6, 4/6 to 5/6; 2 by 6, 4/6 to 5/6; 1 inch hook at each end, 10/ to 20/ backbands, 10/0 to 20/0; short link Chain, plain or twisted, 1 inch, 18/ to 20/ 1/2 inch, 10/ to 18/; 1 inch, 14/ to 16/ per cwt.; Cart and plough traces, 21/ to 25/ per cwt. Chesthandles, improved Japanned, 75 to 77 1/2; broad plate, strong and extra strong, 15 to 55, according to strength; railway Cotterpins, 55 to 60; Brass Curtain rings, 37/ to 42 1/2; Brass Chair nails, 40 to 45; square box Coffee mills, 25 to 30; Common post Coffee mills, 20 to 30; best brass bushed mills, 40 to 45; London mills, 35 to 40; registered Coffin turniture, 45; Common, 30.

Door springs, X, 75 to 80; XX, 70 to 75; XXX, 65 to 70; XXXX, 55 to 60; brass circular and iron circular, 55 to 60; brass, 10 to 15; climax, 5 to 10; universal, 50 to 60; paragon, 10 to 15; smith's, 10 to 15; O'Connor's vertical spring hinge door spring, 15 to 25; Gerish's spring hinges, iron, 20 to 25; brass, 10 to 15; Japanned Door chains, 30 to 60.

Fires, 25 to 50; Fryng pans, best, 4/3 to 5 1/2 common, 35 to 42 1/2; kitchen Fireirons, in sets, 70 to 75 per lb.; tongs only, 10/ to 12/ pokers only, 15/ to 16/ per lb. Fish hooks, 30 to 35; best, common, 50 to 55; light kitchen Fenders, 5 inch assorted, 2 feet 6 inches to 3 feet 6 inches, black fronts, 28/ to 29/ per doz.; bright fronts, 31/6 to 31/; Manchester pattern kitchen Fenders, 5 feet 1 inch top, black front, 2 feet 6 inches to 3 feet 3 inches, 37/6 to 41/ per doz.; 3 feet 3 inches to 3 feet 9 inches, 42/6 to 46/.

Cut wire Fencing staples, 0 to 6, 22 to 24/ per cwt. Gridirons, London pattern, sluted, 62 1/2 to 65; light ditto, 62 1/2 to 65 1/2; hanging round bar, 50 1/2 to 55; doublet, 37 1/2 to 42 1/2; round bar 14 per bar, 57 1/2 to 62 1/2; best sluted bar, 55 to 62 1/2; flat bar, 57 1/2 to 62 1/2; common flat bar, 57 1/2 to 62 1/2; common Gridirons, 17, 19 and 1/2 per bar, 62 to 70; Goffering tongs, two prongs, 5/6 to 6/6 per doz.; Gimblets, 10 to 15.

Holdfasts, Japanned, 10 to 21/ per cwt. Hammers, plate-layers' keying, 31/ to 35; miners', 27/6 to 28/6; sledge, 27/6 to 28/6; stone sledge, 27/6 to 28/6; stone, hand, 28/6 to 30/6; stone-

masons' hand, 2 to 6 lb., 28/6 to 30/6; pin mant, 2 to 6 lb., 35/ to 37/ per cwt.; sledge hammers, 6 lb. and upwards, 28/6 to 30/6 per cwt.; riveting hand-hammers, 28/6 to 30/6; miners', not sluted, 22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50; patent hasps and staples, 20 to 25. Cast hinges, polished joint light patent tariff butts, 200, 45 to 50; 313, 42 1/2 to 47 1/2; 504, 35 to 40; polished joint, best best butts, best best, 45 to 50; ditto light tariff, broad butts, 45 to 50; best heavy, broad butts, 30 to 35; Patent Hinges, edge butts, light, 60 to 62 1/2; strong, 40 to 50; patent Scotch butts, 53 to 55; same off broad and narrow. Patent table, bed and back-flap hinges, 50 to 52 1/2; extra strong bed hinges, 42 1/2 to 55; patent chest, 45 to 47 1/2; patent strap, 45 to 55. H Hinges, 40 to 55; H Hinges, 40 to 55; Japanned and garnet hinges, double washered, light and strong, 35 to 40; best best patent London or Lancashire tees, 53 to 60; patent light Japanned Scotch tees, 35 to 62 1/2; light patent hooks and hinges on plate and to drive, 20 to 25; weighty patent hooks and hinges, weighty Gothic, 21/ to 26/; scolloped edges, not Japanned, 27/ to 24/; Scotch Japanned, Tees double washered, 20/6 to 21/6; Gothic Scotch Japanned, Tees 21/ to 28/; Gothic Scotch, Tees self colour, 17/6 to 25/.

Wrought hinges, common and best, 25 to 40; best best, 30 to 35; heavy wrought hinges, common black, 14 to 16/ per cwt.; common bright, 16/ to 18/; filed edges, 17/ to 10/; Japanned Gothic fancy, 16/ to 20/ per cwt. common bright, broad eye, 19/ to 22/; Japanned broad eye fancy, 21/ to 22/; best bright, 22/ to 24/; best broad eye, 23/ to 25/; best self-colour frog hooks 25/ to 29/ per cwt.; Lancashire hinges wrought, 30 to 35; Pressed hinges, common, 62 1/2 to 65; best, 52 1/2 to 57 1/2; common brass butt hinges, 18 inch and 15/ to 18/ per gross, 20/0 to 21/; very light, 11 inch, 9/6 to 12/ per gross; 9 inch, 8/6 to 10/; horseshoes, fullered fore, 12 to 20/; fullered hind, 19/ to 21/ stamped, fore, 18/6 to 20/6; hind, 18/6 to 20/6. Hollow ware, 45 to 50; common to best, enamelled, 20 to 25, delivered in Liverpool, London.

Ironfoundry, general.—Ash graters, 11/ to 12/; air bricks, 2/6 to 3/6, half, single, 3/6 to 4/4; double, 6/3 to 7/1; bars and bearers, 9/6 to 10/6 per cwt.; barrow wheels, 10/6 to 11/6; bake pans, 2/6 to 10/; cart bushes, 11/6 to 13/6; camp ovens, 12/ to 11/; cooking stoves, 12/6 to 13/6; cogs for racks, 17/ to 19/; cellar grating, 10/6 to 12/6; clock weights, 9/ to 11/; Dutch stoves, 17/ to 13/; dumb bells, common, 9/ to 11/; best best Japanned, 10/ to 21/; frying pans, cast handles, 18/6 to 14/6; frying pans with wrought handles, 10/ to 18/; furnaces, up to fifty gallons, 35 to 44; 44 to 50; galvanised furnaces up to fifty gallons, 35 to 44; per gallon; furnace doors, 15/ to 14/; furnace graters, 9/6 to 11/6; forge backs, 12/6 to 13/6; heaters for box irons, 8/6 to 10/6; heaters for urns, 10/ to 11/; Jack wheels, 18/ to 20/; oven doors and frames, 12/ to 14/; pots, three legged, Danish, plumbers', and Negro, 10/ to 12/; plumb bobs, 13/6 to 15/6; pudding pans, 13/6 to 15/; pump spouts, 14/ to 16/; sash weights, 8/6 to 9/6 ditto, with pulleys, 11/ to 13/; shoe anvils, 11/6 to 12/6; slippers 12/6 to 13/6; Italian irons, 35 to 50.

Knitting pins, iron, 7/4 to 5/5 per lb.; steel knitting pins, 15 to 24 W.G., 1/ to 2/6 per lb.; brass knitting pins, 1/4 to 1/6 per lb.; keys and banks, 50 to 55; extra strong plate, 30 to 32 1/2; extra strong Banbury, pin'd keys, 30 to 35; brass shutter knobs, 52 1/2 to 57 1/2; brass cupboard turns, 52 1/2 to 57 1/2; brass drawer knobs, 52 1/2 to 57 1/2; brass pin knobs, 52 1/2 to 57 1/2; brass range knobs, 35 to 40; kettle ears, 7 1/2 to 8/6.

Oddwork, tinned and black, 15 to 20; list: Paris pointers, best English, 15/6 to 16/6; foreign, 12/ to 13/; planons, 25 to 30; iron axle pulleys, 11 inch, 12/6 to 18/; brass face axle pulleys, 28/ to 40/ per gross; H. F. and wheel, 48/ to 60/ per gross; brass escutcheon pins, 1 inch to 10 W.G., 1/ to 1/2 per lb.; bright gimps, 1/4 to 1/2 W.G., 1/6 to 7/8 per lb.; black, 7/ to 6/; brass 1/6 to 1/8 per lb. Japanned cut gimps, 1 inch, 7/ to 8/ per lb.; tinned, 8/ to 9/ per lb.; cut clog or coffin pins, Japanned, 1 inch, 5/ to 6/; tinned, 7/ to 8/; brass pin pointers, 1/4 to 1/6; plate locks, fine 40 to 50; strong, 30 to 35; Lancashire plate locks, 25 to 30; pewter measures, 30 to 35.

Riddles, 30 to 35; Rivets, iron boot rivets, 11/3 to 14/ per lb. patent made Rivets, 30 to 35; wrought tinners' Rivets, 30 to 35; round or panhead boiler Rivets, 1 inch, 21/ to 22/; 1 inch, 28/ to 19/ 1/2 inch, 17/ to 18/; 1 inch, 10/ to 11/; Delivered in London or Liverpool; machine-made wire Rivets, 1 inch, 14/6 to 15/6 per cwt. Rakes, light garden Rakes, 50 to 60; light solid end Rakes, 47 1/2 to 50; bolstered teeth garden Rakes, 50; solid end bolstered iron garden Rakes, 40 to 45.

Spades and Shovels, common, 53/ to 55; second, 15 to 40; best 30 to 35; best strong country Shovels, 25 to 30; best hammered Spades and Shovels, 5 to 10; Ship Borers, black steel blades, 45 to 50; bright, 42 1/2 to 47 1/2; cast-steel black, 42 1/2 to 47 1/2; bright, 42 1/2 to 47 1/2; best cast-steel black, 35 to 42; bright, 30 to 35; iron Wood Screws, 62 1/2; brass Wood Screws, 60 to 62 1/2; copper, 35 to 35 1/2; Screw Drivers, 30 to 35; 3/4 inch, 21/ to 22/; 1 inch, 28/ to 19/ 1/2 inch, 17/ to 18/; 1 inch, 10/ to 11/; Delivered in London or Liverpool; machine-made wire Rivets, 1 inch, 14/6 to 15/6 per cwt. Rakes, light garden Rakes, 50 to 60; light solid end Rakes, 47 1/2 to 50; bolstered teeth garden Rakes, 50; solid end bolstered iron garden Rakes, 40 to 45.

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Spades and Shovels, common, 53/ to 55; second,

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AND
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For Sale in all parts of the country, also Bessemer Billets and Blooms of any size and for all purposes, Old Steel Tyres either whole or broken, Old Springs, Old Files, Cut Bessemer Scrap and Spring Ends for remelting, English and German Spiegeleisen, Swedish and Russian Steel Iron and Box Ends, Swedish Nail Rods and Bundling Iron.

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CREDIT of half the first five Annual Premiums allowed on whole-term Policies on healthy Lives not over 60 years of age.
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The Reversionary Bonus at the Quinquennial Division in January, 1877 (amounting to £157,014), averaged 50 per Cent., and the Cash Bonus 30 per Cent., on the Premiums paid in the 5 years.

The Next Division of Profits will take place in January, 1880, and Persons who effect New Policies before the end of June next will be entitled at that Division to one year's additional share of Profits over later Entrants.

REPORT, 1879.

The 55th Annual Report, and the latest Balance Sheets rendered to the Board of Trade, can be obtained at either of the Society's Offices, or of any of its Agents.

GEORGE CUTCLIFFE, ACTUARY AND SECRETARY.

THE DUTY ON STEEL RAILS.—The protectionists have triumphed in the Congressional Ways and Means Committee. That committee, by a vote of six to seven indefinitely postponed consideration of the Covert Bill, reducing the duty on steel rails from \$28 to \$10 per ton. Bills altering the tariff on other commodities were also postponed, and it is considered probable that this action retires tariff reform from the issues of this session.

BARBED-WIRE FENCES.—It is said that the Gantier Steel Company, at Johnstown, Pennsylvania, has made contracts since January 1st to supply barbed-fence manufacturers before June with wire to the amount of \$1,000,000. It is said that over 50,000 miles of plain wire will be barbed and put on the market this year.—*Bulletin.*

THE STATUS OF A MINING ENGINEER.—At the dinner of the Institution of Mining Engineers, at Philadelphia, recently, in reply to General Porter, Mr. E. B. Coxe said: "I am most pleased by the evidence that you appreciate the mining engineer. What we were supposed to be several years ago may be inferred from what was said in Philadelphia to a friend of mine who was on his way to our meeting: 'Now, look here; don't you fellows go to getting up any strikes.' He was supposed to run a locomotive in a coal mine. Another man to whom I recommended a friend as a good mining engineer said: 'I know what they are; they charge you \$1000 and then bust up your mine.' The true mining engineer is a protection to the public against ignorance and fraud. I thank you for your welcome. I was asked to-day where this meeting of the Bully Club was to be.' I now see my questioner knew more about you than I at first supposed."

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MACHINERY AND LAMPS

UPON THE BRUSH SYSTEM FOR LIGHTING UP

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The Anglo-American Electric Light Company (Limited) is also willing to enter into negotiations with responsible parties for the sale of licenses for the British Colonies. The superiority of the Brush system over all others in economy and simplicity has been now established in the United States as beyond question, and its rapid development in this country, now that it has been introduced, may be regarded as a certainty.

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6 x 6	3 x 3	3 x 3 1/2 = 5 "	5 x 4 1/2 = 23 "	7 x 3 1/2 = 20 "	9 1/2 x 4 1/2 = 29 "
6 x 3 1/2	2 1/2 x 2 1/2	4 x 1 1/2 = 7 "	6 x 2 = 11 "	8 x 4 = 22 "	10 x 4 1/2 = 32 "
5 x 3 1/2	2 x 2	4 x 3 = 12 "	6 x 3 = 16 "	8 x 5 = 25 "	10 x 5 = 36 "
4 x 3	1 1/2 x 1 1/2	5 x 2 = 8 "	6 x 5 = 29 "	8 x 6 = 34 "	10 x 6 = 44 "
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The colours most approved for GASHOLDERS, PURIFIERS, SCRUBBERS, and all the plant and machinery used in and about Gas-Works, are—

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No.	per Cwt.	No.	per Cwt.
11. Torbay Red	34s.	8. Bronze Green	36s.
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1. Torday Brown	30s.		

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No.	per Cwt.	No.	per Cwt.
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29. Portland Stone	38s.	30. Bath Stone	38s.
31. Gray Stone	38s.	38. Buff	35s.

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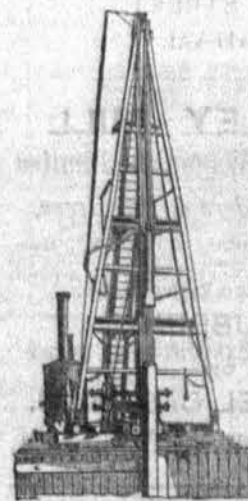
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Used in the Principal Government Harbours, Docks, and Railways in France, Italy, and Spain.

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The winch is only used for placing the pile in position, the monkey being operated by steam direct from the boiler.

The monkey can be readily fitted to the frame of an ordinary Pile Driver.

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Illustrated Pamphlet and Price List Free.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—A new professional organisation, the American Society of Mechanical Engineers, was instituted at New York on the 17th ult. Hitherto American mechanical engineers have had no national society; and this branch of the engineering profession has lacked in consequence the mutual aid and professional coherence which has characterised the departments of civil and mining engineering, whose powerful associations have proved so beneficial to the members of them. Accordingly, by invitation of Professors Thurston, Sweet, and other prominent mechanical engineers, some thirty gentlemen of eminence in the profession, from most of the Middle and Eastern States, met as above stated to take the preliminary steps for organising a national society. Letters were also read from a dozen or more prominent engineers encouraging the project. Professor John E. Sweet,

formerly of Cornell University, presided, and Messrs. A. L. Holley and Samuel S. Weber were chosen chairman and secretary. The objects of the society as set forth in the original draught of the by-laws and rules for the government of the association, is to enable mechanical engineers to meet and compare notes, and to facilitate the interchange of ideas respecting improvements in the various branches of mechanical science by the publication of papers, &c. The members are to be divided into four classes—regular members, associates, honorary members, and junior members. The initiation fees are fixed at \$15 and \$10, and the annual dues \$10. Payment of \$150 will entitle eligible candidates to life membership. Seven years' practice as mechanical engineer is a condition of membership, provision being made in junior membership for such as have served for a shorter period.

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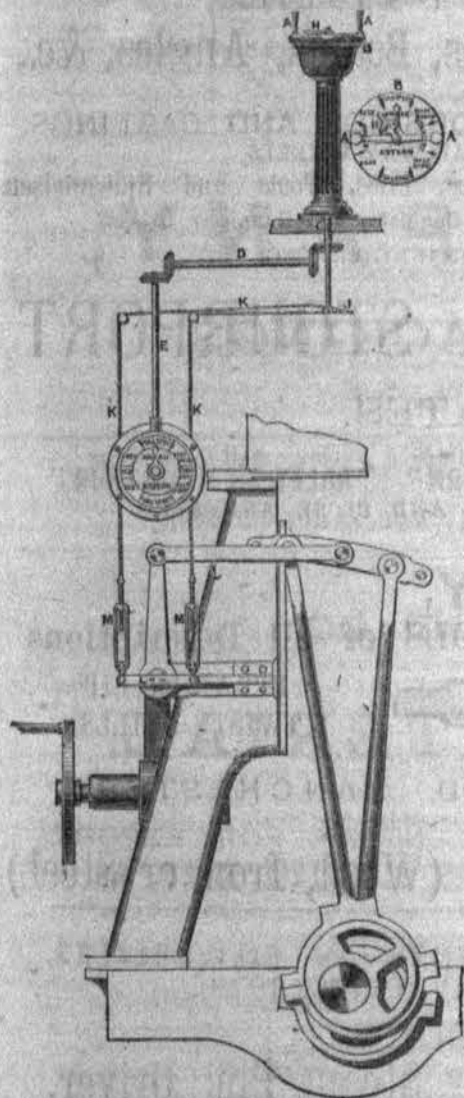
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COLMAN'S AUTOMATIC ENGINE-ROOM AND BRIDGE TELEGRAPH.



This is the only BRIDGE
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By Royal Letters Patent.

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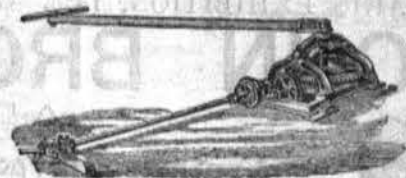
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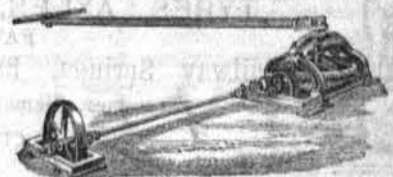
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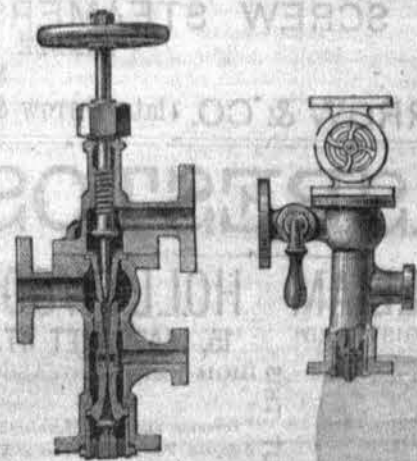
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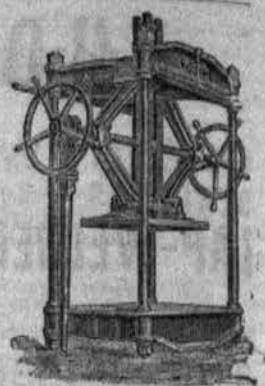
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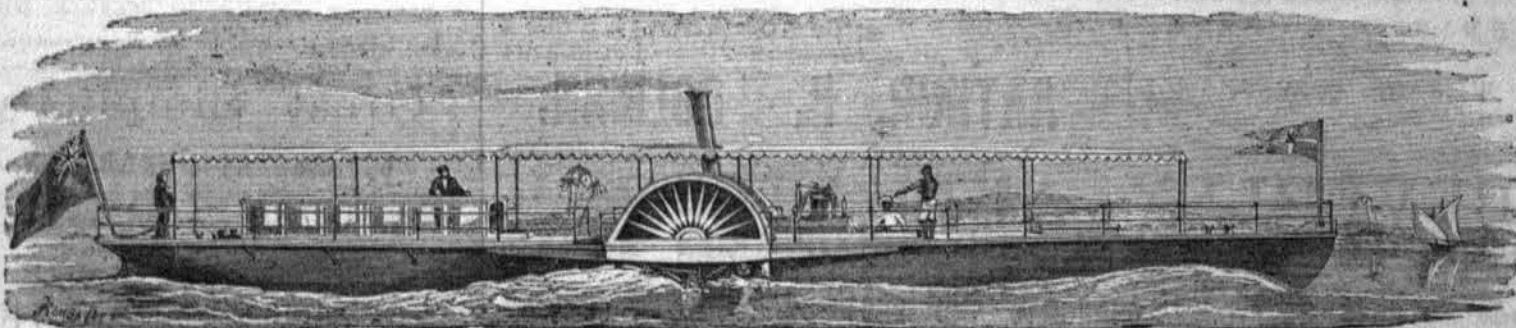
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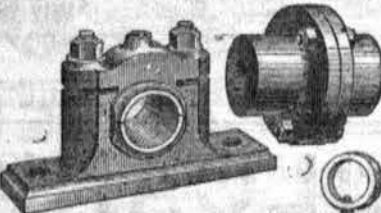
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For each extra 1 inch in width
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Diameter in	8	10	12	15	18	21	24	28	32	36	42	48	54	60
Width, ditto	2	2	3	3	3	3	4	4	4	5	5	5	6	6
Price, Split,	8	9	10	11	14	17	20	25	32	38	46	55	66	110
Do. Plain do.	5	6	7	8	10	13	16	20	25	30	38	45	55	80


Plummer Blocks, with brasses and bolts, planed, bored, &c. Couplings, bored, faced, keywayed, and with turned bolts. Loose Collars of wrought iron bored, turned, and steel screws.
STOCK, SIZES, and PRICES, delivered here.

Bore, in inches to standard	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	10 1/2	11	11 1/2	12	12 1/2	13	13 1/2	14	14 1/2	15	15 1/2	16	16 1/2	17	17 1/2	18	18 1/2	19	19 1/2	20	20 1/2	21	21 1/2	22	22 1/2	23	23 1/2	24	24 1/2	25	25 1/2	26	26 1/2	27	27 1/2	28	28 1/2	29	29 1/2	30	30 1/2	31	31 1/2	32	32 1/2	33	33 1/2	34	34 1/2	35	35 1/2	36	36 1/2	37	37 1/2	38	38 1/2	39	39 1/2	40	40 1/2	41	41 1/2	42	42 1/2	43	43 1/2	44	44 1/2	45	45 1/2	46	46 1/2	47	47 1/2	48	48 1/2	49	49 1/2	50	50 1/2	51	51 1/2	52	52 1/2	53	53 1/2	54	54 1/2	55	55 1/2	56	56 1/2	57	57 1/2	58	58 1/2	59	59 1/2	60	60 1/2	61	61 1/2	62	62 1/2	63	63 1/2	64	64 1/2	65	65 1/2	66	66 1/2	67	67 1/2	68	68 1/2	69	69 1/2	70	70 1/2	71	71 1/2	72	72 1/2	73	73 1/2	74	74 1/2	75	75 1/2	76	76 1/2	77	77 1/2	78	78 1/2	79	79 1/2	80	80 1/2	81	81 1/2	82	82 1/2	83	83 1/2	84	84 1/2	85	85 1/2	86	86 1/2	87	87 1/2	88	88 1/2	89	89 1/2	90	90 1/2	91	91 1/2	92	92 1/2	93	93 1/2	94	94 1/2	95	95 1/2	96	96 1/2	97	97 1/2	98	98 1/2	99	99 1/2	100	100 1/2	101	101 1/2	102	102 1/2	103	103 1/2	104	104 1/2	105	105 1/2	106	106 1/2	107	107 1/2	108	108 1/2	109	109 1/2	110	110 1/2	111	111 1/2	112	112 1/2	113	113 1/2	114	114 1/2	115	115 1/2	116	116 1/2	117	117 1/2	118	118 1/2	119	119 1/2	120	120 1/2	121	121 1/2	122	122 1/2	123	123 1/2	124	124 1/2	125	125 1/2	126	126 1/2	127	127 1/2	128	128 1/2	129	129 1/2	130	130 1/2	131	131 1/2	132	132 1/2	133	133 1/2	134	134 1/2	135	135 1/2	136	136 1/2	137	137 1/2	138	138 1/2	139	139 1/2	140	140 1/2	141	141 1/2	142	142 1/2	143	143 1/2	144	144 1/2	145	145 1/2	146	146 1/2	147	147 1/2	148	148 1/2	149	149 1/2	150	150 1/2	151	151 1/2	152	152 1/2	153	153 1/2	154	154 1/2	155	155 1/2	156	156 1/2	157	157 1/2	158	158 1/2	159	159 1/2	160	160 1/2	161	161 1/2	162	162 1/2	163	163 1/2	164	164 1/2	165	165 1/2	166	166 1/2	167	167 1/2	168	168 1/2	169	169 1/2	170	170 1/2	171	171 1/2	172	172 1/2	173	173 1/2	174	174 1/2	175	175 1/2	176	176 1/2	177	177 1/2	178	178 1/2	179	179 1/2	180	180 1/2	181	181 1/2	182	182 1/2	183	183 1/2	184	184 1/2	185	185 1/2	186	186 1/2	187	187 1/2	188	188 1/2	189	189 1/2	190	190 1/2	191	191 1/2	192	192 1/2	193	193 1/2	194	194 1/2	195	195 1/2	196	196 1/2	197	197 1/2	198	198 1/2	199	199 1/2	200	200 1/2	201	201 1/2	202	202 1/2	203	203 1/2	204	204 1/2	205	205 1/2	206	206 1/2	207	207 1/2	208	208 1/2	209	209 1/2	210	210 1/2	211	211 1/2	212	212 1/2	213	213 1/2	214	214 1/2	215	215 1/2	216	216 1/2	217	217 1/2	218	218 1/2	219	219 1/2	220	220 1/2	221	221 1/2	222	222 1/2	223	223 1/2	224	224 1/2	225	225 1/2	226	226 1/2	227	227 1/2	228	228 1/2	229	229 1/2	230	230 1/2	231	231 1/2	232	232 1/2	233	233 1/2	234	234 1/2	235	235 1/2	236	236 1/2	237	237 1/2	238	238 1/2	239	239 1/2	240	240 1/2	241	241 1/2	242	242 1/2	243	243 1/2	244	244 1/2	245	245 1/2	246	246 1/2	247	247 1/2	248	248 1/2	249	249 1/2	250	250 1/2	251	251 1/2	252	252 1/2	253	253 1/2	254	254 1/2	255	255 1/2	256	256 1/2	257	257 1/2	258	258 1/2	259	259 1/2	260	260 1/2	261	261 1/2	262	262 1/2	263	263 1/2	264	264 1/2	265	265 1/2	266	266 1/2	267	267 1/2	268	268 1/2	269	269 1/2	270	270 1/2	271	271 1/2	272	272 1/2	273	273 1/2	274	274 1/2	275	275 1/2	276	276 1/2	277	277 1/2	278	278 1/2	279	279 1/2	280	280 1/2	281	281 1/2	282	282 1/2	283	283 1/2	284	284 1/2	285	285 1/2	286	286 1/2	287	287 1/2	288	288 1/2	289	289 1/2	290	290 1/2	291	291 1/2	292	292 1/2	293	293 1/2	294	294 1/2	295	295 1/2	296	296 1/2	297	297 1/2	298	298 1/2	299	299 1/2	300	300 1/2	301	301 1/2	302	302 1/2	303	303 1/2	304	304 1/2	305	305 1/2	306	306 1/2	307	307 1/2	308	308 1/2	309	309 1/2	310	310 1/2	311	311 1/2	312	312 1/2	313	313 1/2	314	314 1/2	315	315 1/2	316	316 1/2	317	317 1/2	318	318 1/2	319	319 1/2	320	320 1/2	321	321 1/2	322	322 1/2	323	323 1/2	324	324 1/2	325	325 1/2	326	326 1/2	327	327 1/2	328	328 1/2	329	329 1/2	330	330 1/2	331	331 1/2	332	332 1/2	333	333 1/2	334	334 1/2	335	335 1/2	336	336 1/2	337	337 1/2	338	338 1/2	339	339 1/2	340	340 1/2	341	341 1/2	342	342 1/2	343	343 1/2	344	344 1/2	345	345 1/2	346	346 1/2	347	347 1/2	348	348 1/2	349	349 1/2	350	350 1/2	351	351 1/2	352	352 1/2	353	353 1/2	354	354 1/2	355	355 1/2	356	356 1/2	357	357 1/2	358	358 1/2	359	359 1/2	360	360 1/2	361	361 1/2	362	362 1/2	363	363 1/2	364	364 1/2	365	365 1/2	366	366 1/2	367	367 1/2	368	368 1/2	369	369 1/2	370	370 1/2	371	371 1/2	372	372 1/2	373	373 1/2	374	374 1/2	375	375 1/2	376	376 1/2	377	377 1/2	378	378 1/2	379	379 1/2	380	380 1/2	381	381 1/2	382	382 1/2	383	383 1/2	384	384 1/2	385	385 1/2	386	386 1/2	387	387 1/2	388	388 1/2	389	389 1/2	390	390 1/2	391	391 1/2	392	392 1/2	393	393 1/2	394	394 1/2	395	395 1/2	396	396 1/2	397	397 1/2	398	398 1/2	399	399 1/2	400	400 1/2	401	401 1/2	402	402 1/2	403	403 1/2	404	404 1/2	405	405 1/2	406	406 1/2	407	407 1/2	408	408 1/2	409	409 1/2	410	410 1/2	411	411 1/2	412	412 1/2	413	413 1/2	414	414 1/2	415	415 1/2	416	416 1/2	417	417 1/2	418	418 1/2	419	419 1/2	420	420 1/2	421	421 1/2	422	422 1/2	423	423 1/2	424	424 1/2	425	425 1/2	426	426 1/2	427	427 1/2	428	428 1/2	429	429 1/2	430	430 1/2	431	431 1/2	432	432 1/2	433	433 1/2	434	434 1/2	435	435 1/2	436	436 1/2	437	437 1/2	438	438 1/2	439	439 1/2	440	440 1/2	441	441 1/2	442	442 1/2	443	443 1/2	444	444 1/2	445	445 1/2	446	446 1/2	447	447 1/2	448	448 1/2	449	449 1/2	450	450 1/2	451	451 1/2	452	452 1/2	453	453 1/2	454	454 1/2	455	455 1/2	456	456 1/2	457	457 1/2	458	458 1/2	459	459 1/2	460	460 1/2	461	461 1/2	462	462 1/2	463	463 1/2	464	464 1/2	465	465 1/2	466	466 1/2	467	467 1/2	468	468 1/2	469	469 1/2	470	470 1/2	471	471 1/2	472	472 1/2	473	473 1/2	474	474 1/2	475	475 1/2	476	476 1/2	477	477 1/2	478	478 1/2	479	479 1/2	480	480 1/2	481	481 1/2	482	482 1/2	483	483 1/2	484	484 1/2	485	485 1/2	486	486 1/2	487	487 1/2	488	488 1/2	489	489 1/2	490	490 1/2	491	491 1/2	492	492 1/2	493	493 1/2	494	494 1/2	495	495 1/2	496	496 1/2	497	497 1/2	498	498 1/2	499	499 1/2	500	500 1/2	501	501 1/2	502	502 1/2	503	503 1/2	504	504 1/2	505	505 1/2	506	506 1/2	507	507 1/2	508	508 1/2	509	509 1/2	510	510 1/2	511	511 1/2	512	512 1/2	513	513 1/2	514	514 1/2	515	515 1/2	516	516 1/2	517	517 1/2	518	518 1/2	519	519 1/2	520	520 1/2	521	521 1/2	522	522 1/2	523	523 1/2	524	524 1/2	525	525 1/2	526	526 1/2	527	527 1/2	528	528 1/2	529	529 1/2	530	530 1/2	531	531 1/2	532	532 1/2	533	533 1/2	534	534 1/2	535	535 1/2	536	536 1/2	537	537 1/2	538	538 1/2	539	539 1/2	540	540 1/2	541	541 1/2	542	542 1/2	543	543 1/2	544	544 1/2	545	545 1/2	546	546 1/2	547	547 1/2	548	548 1/2	549	549 1/2	550	550 1/2	551	551 1/2	552	552 1/2	553	553 1/2	554	554 1/2	555	555 1/2	556	556 1/2	557	557 1/2	558	558 1/2	559	559 1/2	560	560
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THE HOWE WEIGHING MACHINES.

ADAPTED TO ALL STANDARDS.

For all Commercial, Manufacturing, Railway, Mining, and Household Uses, &c., &c., &c.

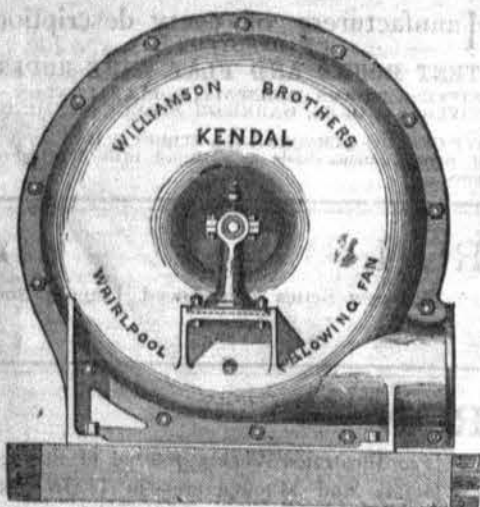
HIGHEST AWARDS AT PARIS, 1878.

OVER 600 SIZES AND STYLES, AND ALL GUARANTEED.

CATALOGUE ON APPLICATION IN ANY LANGUAGE.

FACTORY, RUTLAND, VERMONT, U.S.A.

J. FRED. DENNIS, General Manager, 8 & 9, Holborn Viaduct, London.



BLOWING FANS,

FOR CUPOLAS OR SMITHS' WORK.

These Fans are strong, well made, and require the least power to give any required blast.

CENTRIFUGAL PUMPS.

VORTEX TURBINES,

The best means of utilising water-power.

STEAM ENGINES, CORN MILL MACHINERY,

Illustrated price lists on application.

WILLIAMSON BROTHERS, CANAL IRONWORKS, KENDAL.

RANSOMES, SIMS AND HEAD,

ORWELL WORKS, IPSWICH, ENGLAND,
ENGINEERS AND MANUFACTURERS OF THE BEST

AGRICULTURAL MACHINERY,

ADAPTED
FOR ALL COUNTRIES, CROPS AND SOILS,
INCLUDING

PORTABLE STEAM ENGINES
EXPANSION ENGINES,
STRAW-BURNING ENGINES,
STEAM THRESHING MACHINES,
CORN SCREENS AND WINNERS,
SINGLE FURROW PLOUGHS,
DOUBLE FURROW PLOUGHS,
FOREIGN & COLONIAL PLOUGHS,
HORSE RAKES AND HAYMAKERS.

ILLUSTRATED CATALOGUES FREE BY POST ON
APPLICATION.

London Office: 9, GRACECHURCH STREET.

GAUNTLETT'S

Patent Pyrometer or Heat Gauge.

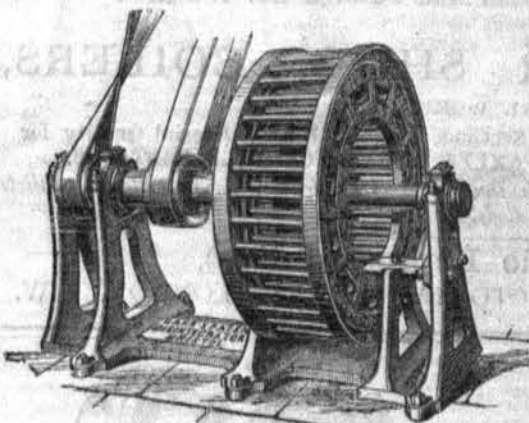
Recent improvements have rendered this Gauge extremely sensitive and durable. It is now made to register to 1500 deg. Fahrenheit. It is applied to Ovens, Heating Stoves, Boiler Flues, Heated Air, Hot Liquid Steam, Gases, &c. Testimonials on application.

W. H. GAUNTLETT, Middlesbrough-on-Tees.

Awarded Bronze Medal, Paris Universal Exhibition, 1878.

REVISION OF PRICES. ABOLITION OF ANNUAL LICENSE CHARGE.

CARR'S PATENT DISINTEGRATOR.



This Machine effectually pulverises by the combined influences of percussion and of centrifugal force, Iron, Zinc, and other Ores, Asphalte, Artificial Manures, Phosphates, Fire Clay and many other substances. It is also largely in use for the pulverisation of coal for the manufacture of Coke, Patent Fuel, &c.; and is very effective for mixing Sugar.

These Machines are capable of reducing to a fine granular powder from 50 to 200 tons per day (according to size) of any unfibrous material. Machines made to order from 18 inches diameter, to suit special requirements of purchasers; these small machines being specially adapted to the requirements of Chemical Manufacturers for Mixing and other purposes.

A Descriptive Pamphlet will be sent free on application to the Managing Trustee of the Estate of the late Patentee.

PHILIP TRIGGS, 39, Broad Street, Bristol.

VULCANISED FIBRE, PATENTED.

The FLEXIBLE is a Substitute for Leather, Rubber, Gutta Percha, &c., and is extensively used by Plumbers, Brass Founders, Axle Makers, Hydraulic, Sanitary, and other Engineers Railway Companies, Carriage Builders, Pump Makers, &c.

It makes the best insertion sheet, and for axle-washers of all kinds it is unequalled.

Mr. George Howe, Engineer at the Clay Cross Collieries, says:—

"That a pump clack faced with Vulcanised Fibre one half inch thick, was put into work January 13th, 1879, and was taken out July 3rd, 1879, having been in work 171 days. During this time the pump made 741,827 strokes, and raised 74,182,700 gallons. The clacks were previously used with leather facings; these only lasted in work about 40 days; when faced with gutta percha, they last in work about 150 days, but gutta percha is 5s. per lb., whereas the fibre is only 2s."

The HARD is a Substitute for Metals, Ivory, Vulcanite, Ebony, &c., and is used for Journal Bearings and Bushes, Condenser Ferrules, Railway Fish-plate Washers, Pneumatic Carriers, Electric Machines, &c.

Mr. T. A. Edison, the great electrician, writes:—

"I esteem it very highly, and use larger quantities of it than Vulcanised Rubber, and, in its present condition, find it very satisfactory."

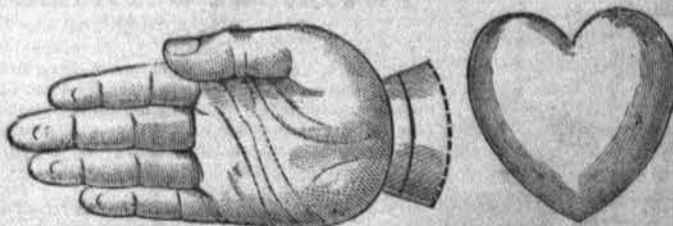
Both qualities of the Vulcanised Fibre are uninjured by the action of Hot and Cold water, oils, spirits, grease, ammonia, and many other chemical agents which utterly destroy leather, metals and rubber.

Sold in sheets about 66 inches and 42 inches and varying in thickness from 1-32 to 1 inch.

SOLE AGENTS:—

MOSES AND MITCHELL, 62, Queen Victoria Street, London, E.C.

CORPORATE MARK.



Granted according to Act of Parliament, 1777 by the Cutlers' Company, Sheffield.

TOOLS, STEELS, FILES, R. MUSHET'S SPECIAL STEEL.

Railway Springs, Steel Castings, Shear and Spring Steel, &c., &c

SAMUEL OSBORN AND CO.

CLYDE STEEL AND IRON WORKS, SHEFFIELD.

LONDON: 16, PHILPOT LANE, E.C.; BOSTON (U.S.): 10, OLIVER STREET;

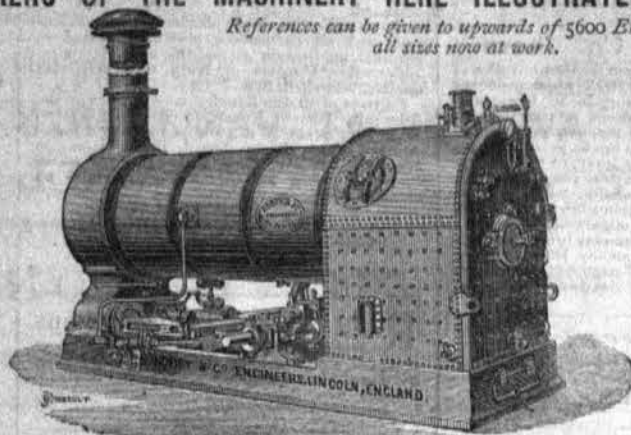
MONTREAL: 470, ST. PAUL STREET; BERLIN: 48, NEUE FRIEDERICH'S STRASSE.

ROBEY AND CO., ENGINEERS, LINCOLN,
SOLE MANUFACTURERS OF THE MACHINERY HERE ILLUSTRATED.

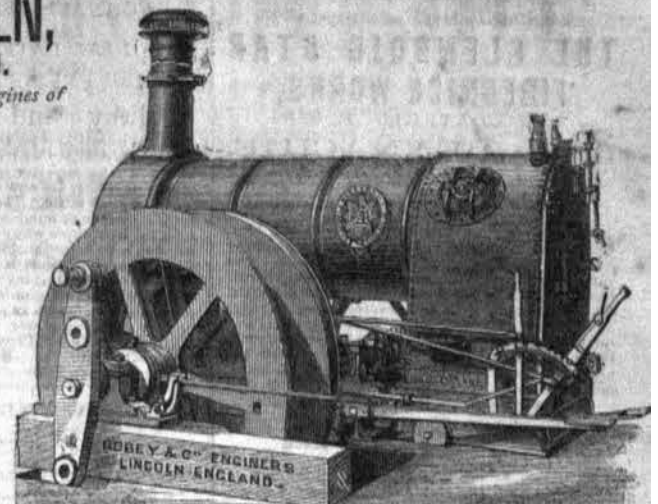
References can be given to upwards of 5600 Engines of all sizes now at work.



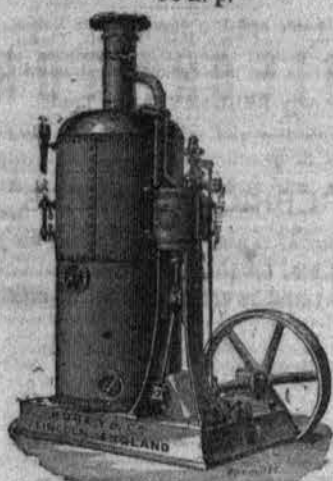
Superior Portable Engines, 4 to 60 h.p.



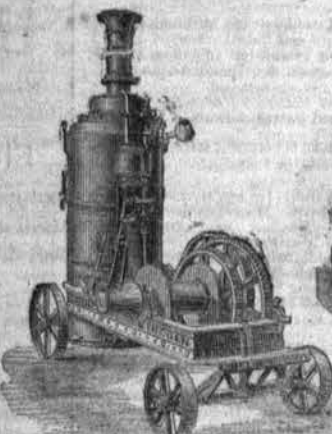
The Patent "Robey" Fixed Engine, 4 to 50 h.p.



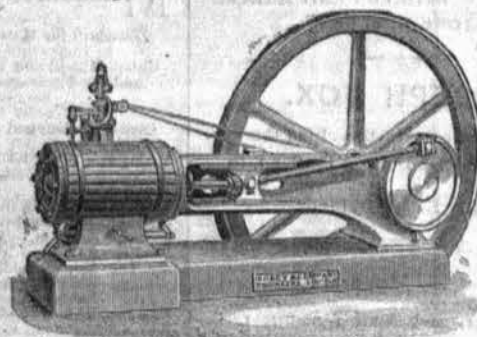
Patent "Robey" Mining Engine, 4 to 200 h.p.



Vertical Engines, 1 to 12 h.p.

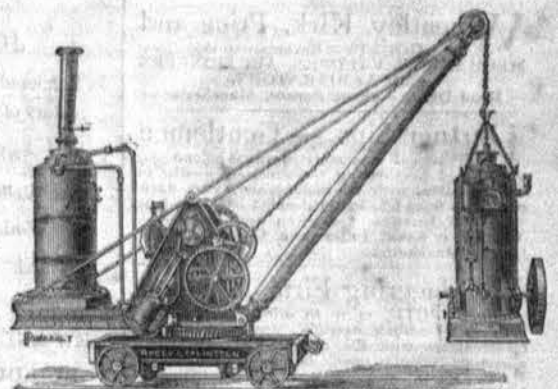


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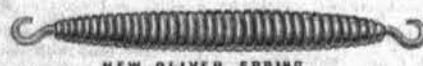
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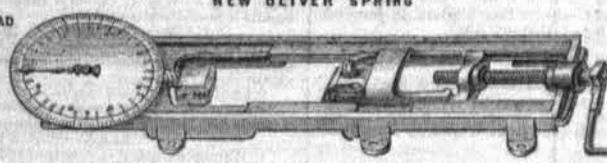
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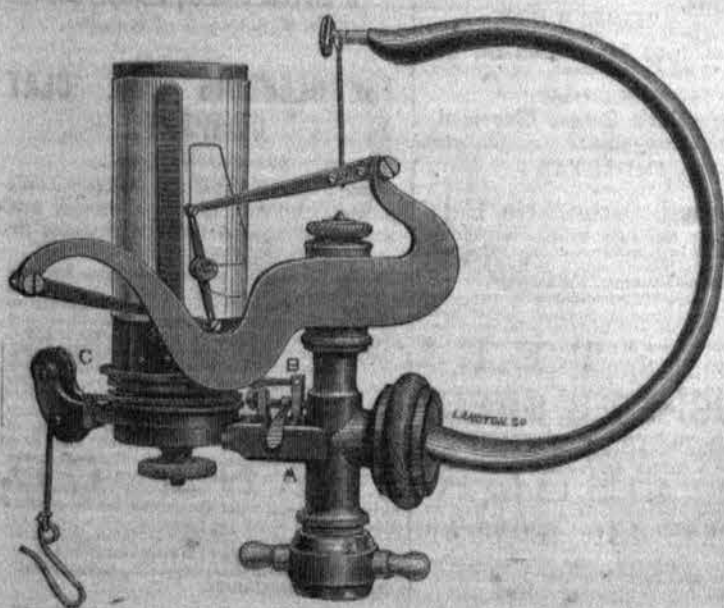


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1879.—Apply to E. K. SALWEY, Bryngarw,
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LONDON, FRIDAY, APRIL 2, 1880.

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CONTENTS.

	PAGE
THE NEW GATLING GUN	235
THE JABLOCHOFF ELECTRIC LIGHT	235
OUR TRADE SUMMARY	235
DEEP BORING FOR SALT	235
FRENCH DISTILLING APPLIANCES	(Illustr.) 237
OCCASIONAL NOTES	238
STEAM ROAD ROLLING	238
BOILER EXPLOSIONS IN 1879	(Illustr.) 239
SCIENCE AND ART—	
Royal Society	250
Scottish Meteorological Society	261
Chemical Society	242
Manchester Geological Society	242
RAILWAYS AND TRAMWAYS	243
NAVAL ARCHITECTURE	244

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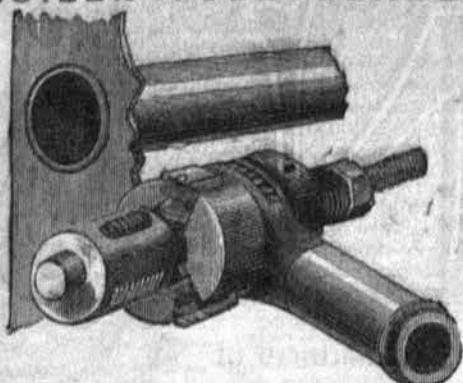
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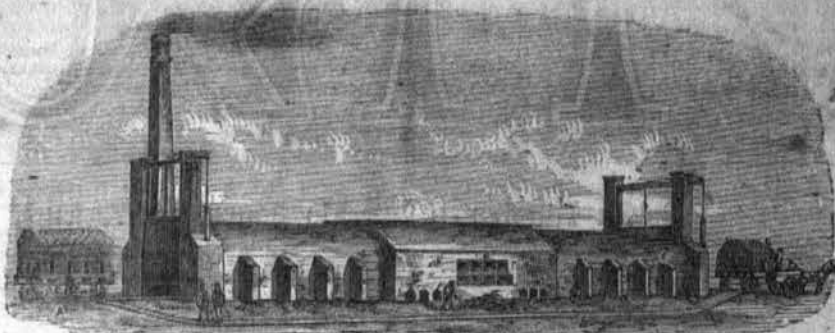


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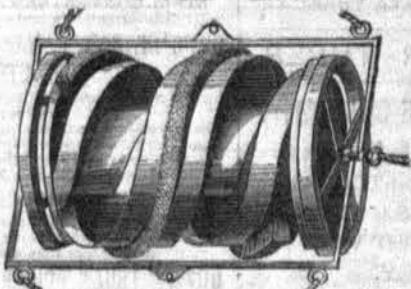
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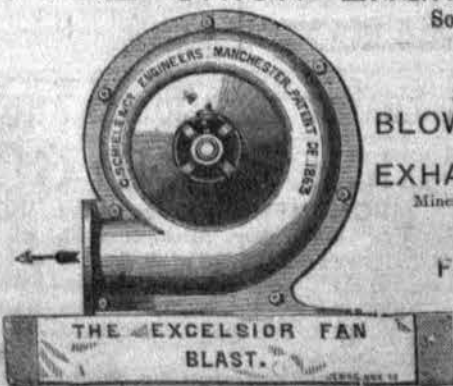
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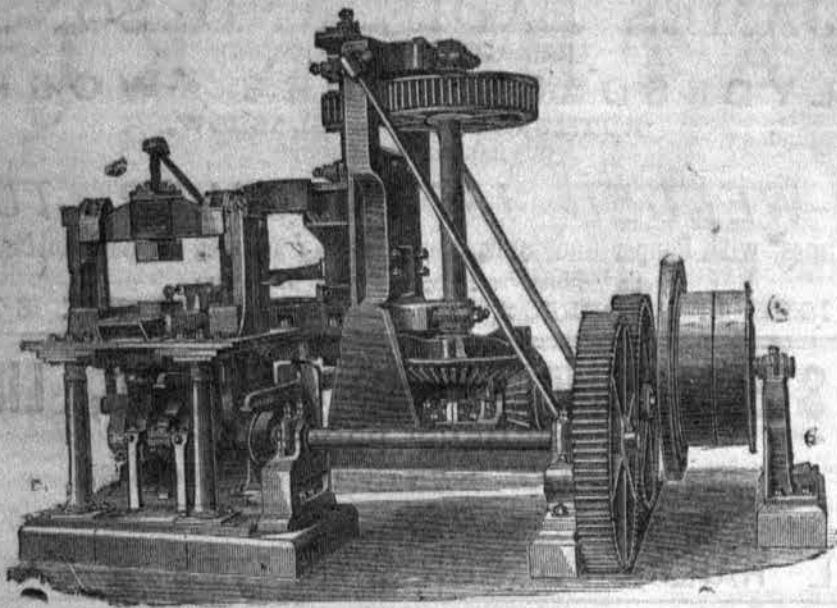
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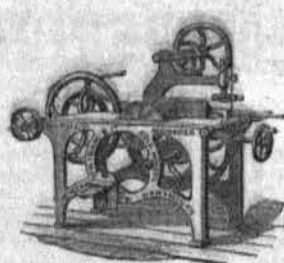
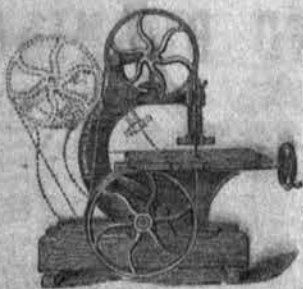
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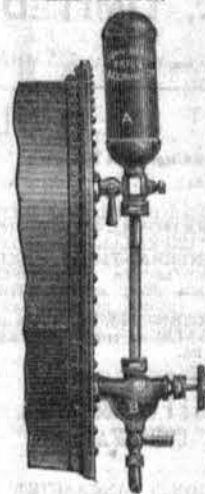
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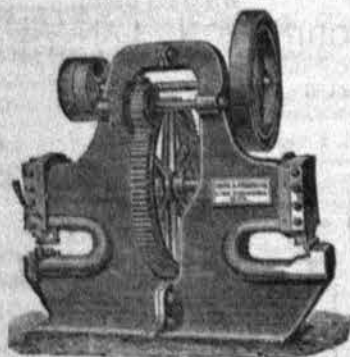
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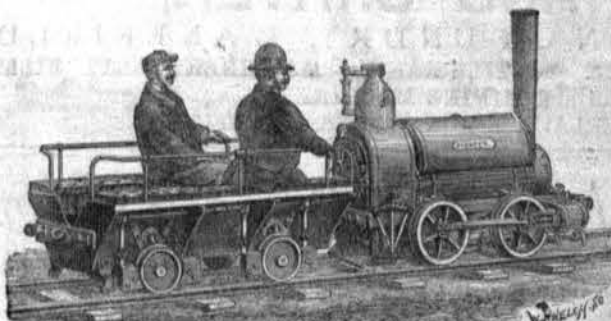
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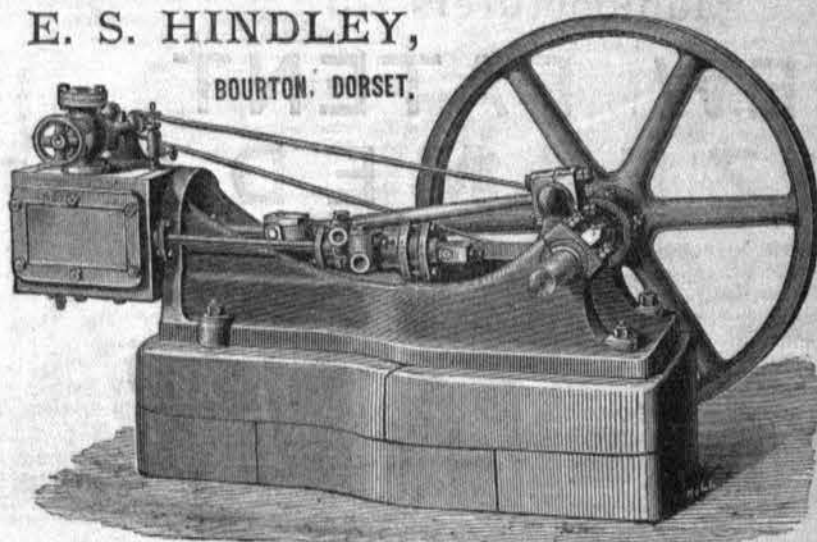
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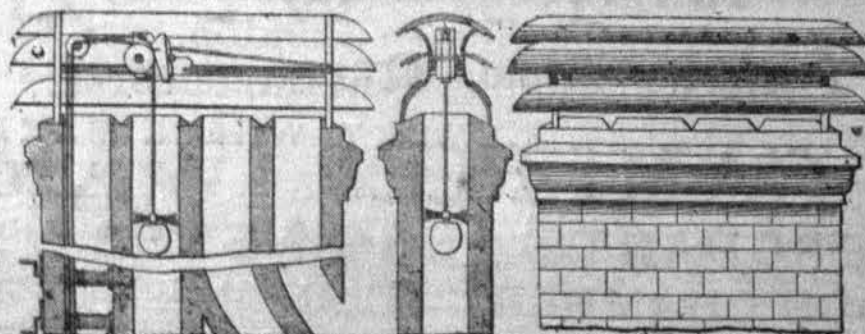
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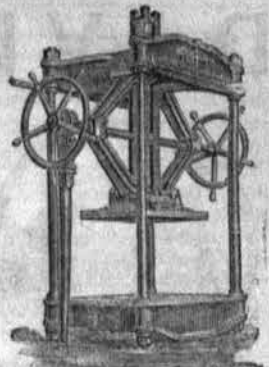
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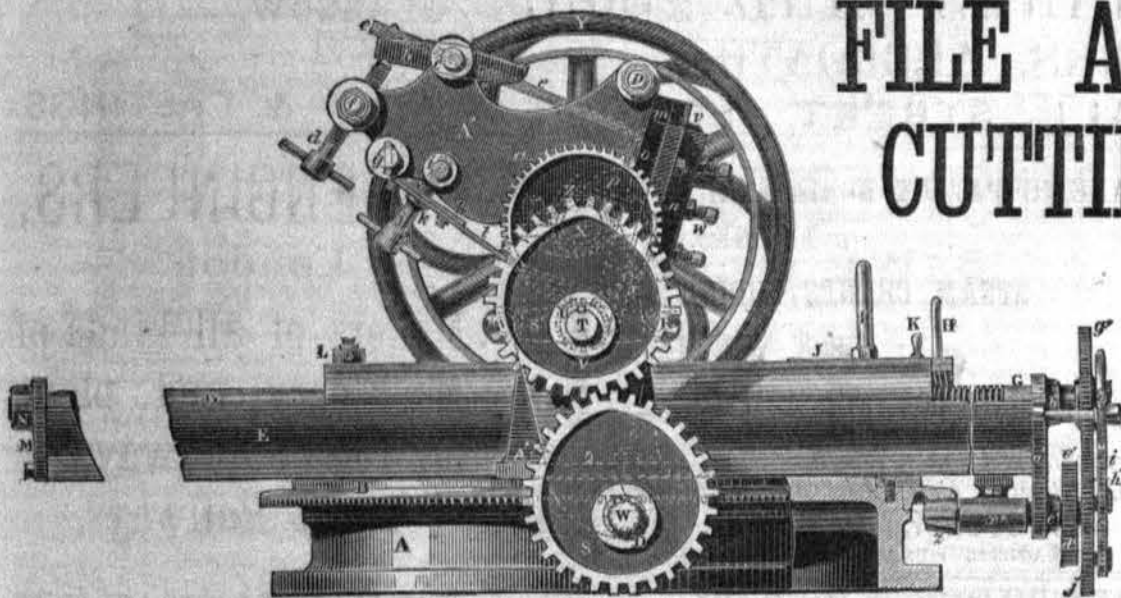
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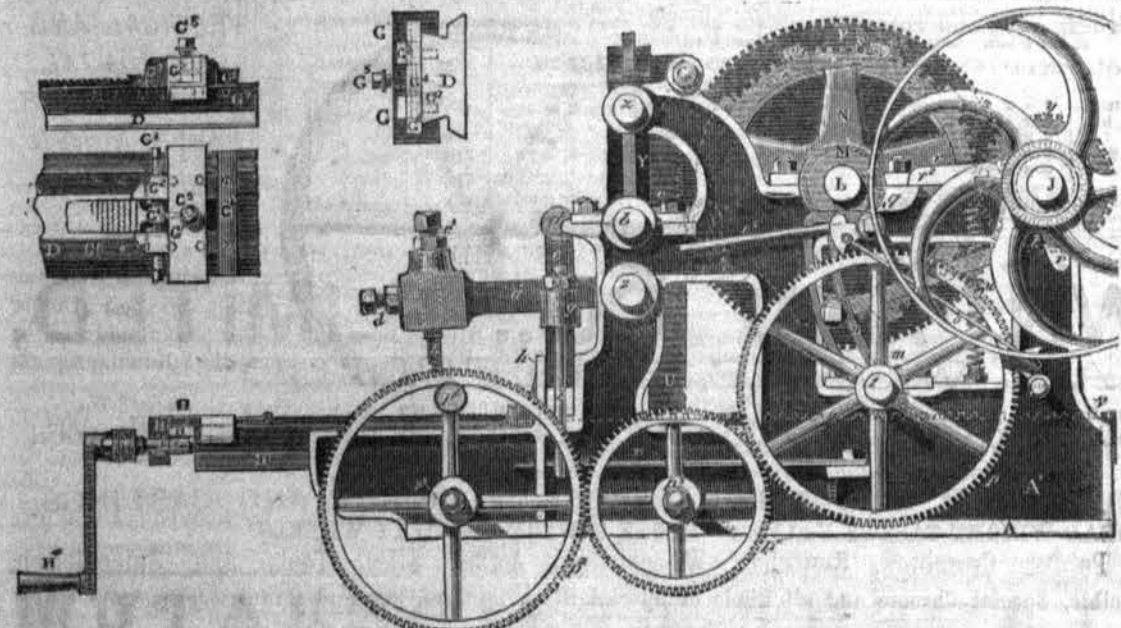
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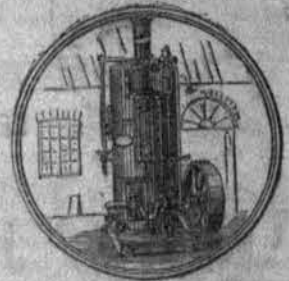
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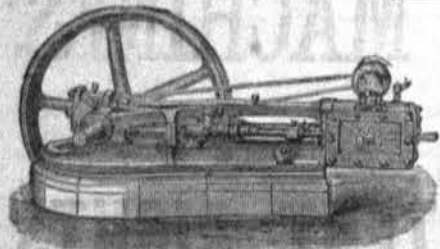
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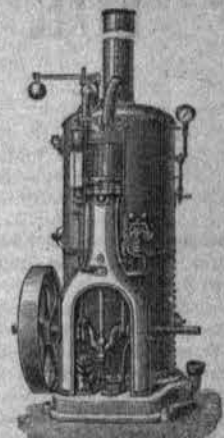
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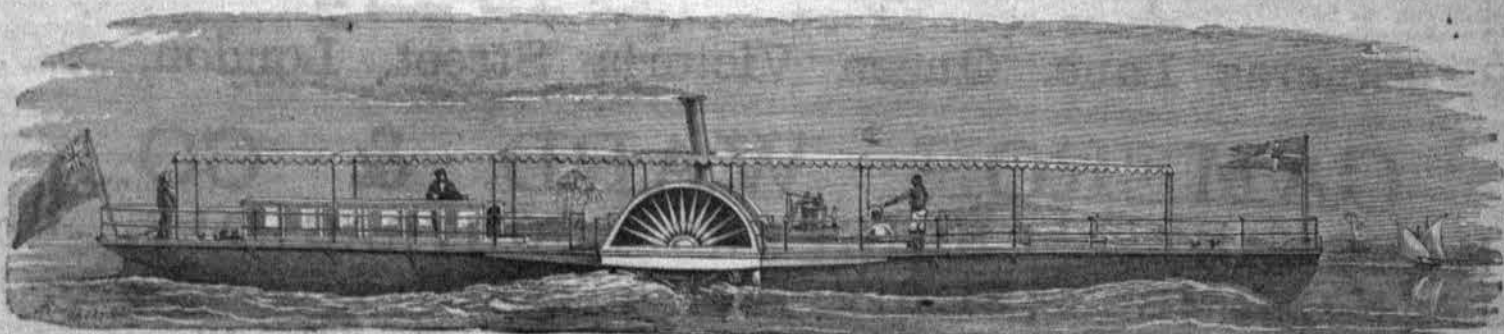
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LONDON, FRIDAY, APRIL 2, 1880.

THE NEW GATLING GUN.

THE Gatling gun is now so well known that it needs no further description here than that it consists of a cluster of barrels with mechanism for firing by hand with the utmost rapidity. Since this weapon was first introduced, however, it has been considerably modified in its details by its inventor Dr. R. J. Gatling. We have lately had the opportunity of inspecting the most recently modified example of this useful weapon at the offices of Messrs. Sir William Armstrong and Co., 8, Great George Street, Westminster, where its action and details were explained by Dr. Gatling. The new gun has ten barrels, each 18 inches in length and each having its corresponding lock. The barrels and locks revolve together; but in addition to this action, the locks have a forward and backward motion of their own, which is communicated to them by means of a cam path. The forward motion places the cartridges in the chambers of the barrels and closes the breech at the time of each discharge, while the backward motion extracts the empty cartridge-cases after firing, the cases being thrown out to the left of the gun. The gun can be fired only when the barrels are in motion from left to right; thus as long as the gun is revolved and fed with cartridges the several operations of loading, firing and extracting are carried on automatically, uniformly and continuously. The crank handle is now attached to the rear instead of the side, thereby increasing the speed of revolution of the gun and the rapidity of its fire. The drum is abolished, and a new pattern feed-case substituted for it. It stands vertically over the centre of the lock-chamber, and thus ensures the direct fall of the cartridges into the receivers. Each case contains forty cartridges, and the cases fit into a hopper communicating with the chambers. As soon as one case is emptied another takes its place, and thus continuous firing can be maintained at the rate of over one thousand shots per minute. All the working parts, as well as the barrels, are encased in bronze to afford protection from rust and dirt, and the appearance of the weapon is now that of a brass howitzer 27 inches in length and 6½ inches mean diameter. The arrangement of the locks has been much simplified, and the size of the whole breech arrangement reduced by about one-half. The rapidity of fire has been more than doubled, and the traversing arrangement has been improved. This gun has been fired at the rate of one thousand rounds per minute, but the ordinary rate of rapid firing is about seven hundred rounds per minute. Fired deliberately at a target 10 feet long by 11 feet high, range 1000 yards, it scored 665 hits out of 1000 shots in some trials which took place with it in America. In some recent practice with this gun on board the *Excellent* the shots are stated to have been fired at the rate of forty-four per second. We understand that a gun of this pattern has been supplied to the British Government. It fires the Boxer cartridge, but Dr. Gatling greatly prefers the solid-cased cartridges of the American type for use in his gun.

THE JABLOCHKOFF ELECTRIC LIGHT.

THE Metropolitan Board of Works has recently had under consideration the question of the desirability of continuing the electric lighting on the Victoria Embankment and Waterloo Bridge, by means of the Jablochkoff system, the existing contract for which will expire on the 10th of April next. The result was that the Board has renewed the contract with the Société Générale d'Electricité for another year on modified terms, and the new contract will expire on the 10th of April, 1881. The Jablochkoff system has now been in successful operation for more than fifteen months on the Thames Embankment, and in view of the further extension of the contract it may be interesting if we gather up the history of its application to the illumination of this public thoroughfare. Our readers will doubtless remember that in October, 1878, the Metropolitan Board of Works contracted with the Société Générale for the lighting by means of twenty lights of that portion of the Thames Embankment lying between Westminster and Waterloo Bridges. The inauguration of the lighting of that section took place on the evening of the 13th December, 1878. On the 10th May, 1879, the lighting of the Embankment was extended from Waterloo to Blackfriars Bridge, twenty lights being added to the twenty already burning. A further extension took place on the 10th October, 1879, ten lights being placed on Waterloo Bridge, thus bringing the total number of

lights to fifty. Since these various dates—that is to say, for fifteen months for the first series of twenty lights; 10½ months for the second series of twenty; and 5½ months for the last series of ten—the whole of the lamps have been uninterruptedly kept lighted every night, Sundays included, for six hours, which is the contract time for keeping the lights burning. These facts are worthy of consideration when it is borne in mind that the plant was originally laid down for twenty lights only. The extension of the electric lighting not having been contemplated at the time of the plant being laid down, no provision was made for such extension. This necessitated the manipulating and altering of the plant each time in the best way that could be done under the circumstances. It is also to be remembered that another ten lights—those at the Victoria Station of the Metropolitan District Railway—were subsequently added to the fifty already burning, thus making sixty altogether. The price paid by the Metropolitan Board of Works was originally 6d. per light per hour. That price was reduced to 5d. per light per hour on the Board increasing the number of lights to forty; then to 3d. on the number of lights being further increased to fifty, and on the contract being renewed for six months. The new contract is to be carried out at 2½d. per light per hour, the duration of the contract having been extended to one year. The Société Générale contemplates extending the number of lights to certain private concerns from the centre at Charing Cross.

The Jablochkoff system of electric lighting is now in use under almost every possible condition and in every variety of establishment. It is used in streets, on bridges, in railway stations, theatres, circuses, engineering and every variety of industrial works, docks, basins, on board steam-vessels, in hotels and private residences. Crowned and uncrowned heads have also adopted it. King Thebaw, of Burmah, has had sixty lights fitted up in his palace at Mandalay; Shah Nasser ed Deen, of Persia, four in his palace at Teheran; Prince Agaklan, six in his palace at Bombay; King Dom Luis I., of Portugal, six in his royal palace of Caséneo, and the Queen Isabella of Spain, six in the conservatory of her beautiful residence in Paris. At the present time there are 465 lights on the Jablochkoff system burning in Paris, 428 in the French provinces and 823 in foreign countries, making a total of 1716 lights, 108 of which are in use in this country. This all denotes progress, and as regards its application in London the Metropolitan Board of Works is to be commended, for the spirited way in which they are practically testing the question of electric lighting.

OUR TRADE SUMMARY.

BETWEEN the holidays and the general election the iron trade in most of its departments has been brought almost to a standstill, a condition which has been further aggravated by the natural reserve of both buyers and sellers pending the approaching quarterly meetings. In the Glasgow warrant market there has been continued decline, the latest prices ranging from 55s. 7½d., to 55s. 1½d. cash. The manufactured trade is quiet, few new orders coming in; and the shipbuilders and engineers are in a similar case. Scarcely any business was transacted in pig-iron at Middlesbrough on Tuesday, greatly owing to the uncertainty as to how prices will rule in the immediate future, and intensified, of course, by the prevailing pleasure-seeking, and the political excitement which runs high in the north. Manufactured iron is scarce, and most of the makers are well sold forward. Quietness also generally prevails in the finished-iron trade as well as in the foundries and engineering works, which have been partially laid off during the holidays. In the Tyne district the crude iron trade is reported weaker, No. 3 pig-iron having been brought at 50s. The shipbuilding yards are full of business and the rolling mills and forges working to their utmost capacity. The engine manufactories and foundries are also in a thriving way. The report from the Durham district is of the same character as those from the other parts of the north-east, except that there seems to be a larger quantity of pig-iron going away, while finished is being turned out in great quantity. The demand for hematite iron in the north-west appears to have somewhat revived, and a further extension of the demand is expected as soon as the election fever shall have subsided. The spring season at Barrow has opened under very favourable auspices, a great number of large steamers and sailing ships having already entered that port to load with pig-iron and steel for ports in America, Australia and the Continent. Very large deliveries for both home and foreign account have been arranged to be made throughout the spring and summer. Prices have to some extent recovered themselves. From £5 12s. 6d. to £6 is asked for Bessemer steel. The steel trade of the district appears to be in a peculiarly healthy condition. Engineers and shipbuilders are still well employed, and are negotiating for new contracts, in many cases successfully. Iron ore is steadily rising in value. The attendance at the Manchester market on Tuesday was, as might

have been expected, much below the average, and scarcely any business was done. The makers of pig-iron in the district are still working on old orders and practically out of the market; nominal quotations are a little under 70s. a ton. There is no change worth notice in the rates for finished iron, and makers are still engaged for forward delivery. In the iron-founding and engineering industries there is some, but slight improvement. From North Lincolnshire and Staffordshire there is not much to report; but the general dullness seems scarcely to have affected them so deeply as in the case of the more important centres. Throughout Yorkshire the political excitement has obviously affected business; but competent observers consider that when the people settle down again to steady industry, a continuance and extension of the improvement in trade may be confidently looked for. The South Wales district seems to be in a very satisfactory condition, although a great deal of the work being done is in fulfilment of past orders. The Sheffield cutlery branches are slowly improving, the orders being principally on colonial account. The special hardware trades of Birmingham are still dull, what orders there are going being almost solely on foreign account. The colonial orders for the South Staffordshire staples have been somewhat numerous, but the home trade in this instance also is remarkably dull, chiefly, however, owing to the unsettled nature of the passing time. There is no change to report in the markets for coal and coke.

DEEP BORING FOR SALT.

THE following particulars respecting some boring operations which have recently been carried out by the Continental Diamond Rock-Boring Company of London, at Probst Jesar, near Lüthten, for salt, under contract with the Government of Mecklenburg-Schwerin, may be interesting to our readers. In order to bring the advantages of the diamond boring system to bear in cases where, besides having to bore through compact rock, a diluvium of shifting sand and pebbles is met with, this Company has combined its method of boring with the best of other known methods and has thereby obtained results which cannot be expected when any one special system alone is employed. In the case of the operations under notice it was a question of boring through a superincumbent diluvial bed of unknown thickness, consisting mainly of drift sand and coarse gravel. The boring was therefore commenced on Köbrich's system on the 6th July, 1879, with an opening of 12-inch diameter, and was finished on the 24th August, 1879, with an opening of the same diameter. The duration of boring on Köbrich's system was 34 days of 24 working hours; accounted for as follows: In progressive boring 31 days, and in sundry works 3 days. The total depth reached by this system was 98'050 metres. Thus the average result produced in one day of progressive boring was 3'163 metres. The greatest progress made in one day, namely on the 11th August, 1879, was 7'496 metres. When the above depth had been reached, boring with diamonds in the gypsum and salt rock was commenced. Until a depth of 509 metres had been reached no firm footing could be found on which to rest the tubing and thereby to shut out the loose sand which fell in from the fissures in the gypsum bed. Consequently the works had constantly to contend with an infall, which at times acquired such proportions, that when the boring rod was drawn the bore hole would be filled in again to a height of 130 metres from the bottom. The results were as follows: The boring commenced 25th August, 1879, with an opening of 10½ inches diameter, and ended the 6th February, 1880, with an opening of 3 inches in diameter. The duration of boring with diamonds was 163 days of 24 working hours; accounted for as follows: In progressive boring, 70 days; reaming up, 8 days; sundry works, i.e., getting rid of infall, 13 days; preparing and repairing tools, 42 days; preparing lye, 6 days; letting down tubing, 22 days; making good an accident, 2 days; total 85 days. The depth of boring with diamonds was 1109'200 metres. There were reamed up: in 0'5 days from 9 inches to 10½ inches, 10'950 metres; in 3 days from 8 inches to 9 inches, 87'555 metres; in one day from 7 inches to 8 inches, 98'000 metres; in 0'5 days from 3 inches to 5 inches, 39'700 metres; in 3 days from 3 inches to 4 inches, 63'000; 299'205 metres. Borings of all kinds in 78 days 1408'405 metres. Thus the average result produced in one day of progressive boring was 15'845 metres; one day of reaming up, 37'400 metres; one day of boring of all kinds, 18'056. The greatest progress made in one day, the 27th January, 1880, was 29 metres (95 feet) at the depth of from 1037 to 1066 metres. The entire length of tube inserted was 1010'550 metres. The greatest length of tube inserted in one piece was 456'424 metres long consisting of 7-inch and 8-inch tubes. There were bored on Köbrich's system 98'050 metres, and on the Diamond Rock-Boring system 1109'200 metres, the total depth of boring being 1207'250 metres, or nearly 4000 feet. In this entire depth 100 per cent. of cores were drawn, of which some were salt cores, 620 millimetres long, in one piece.

FRENCH DISTILLING APPLIANCES.
BY MESSRS. SAVALLE FILS ET CIE., PARIS.

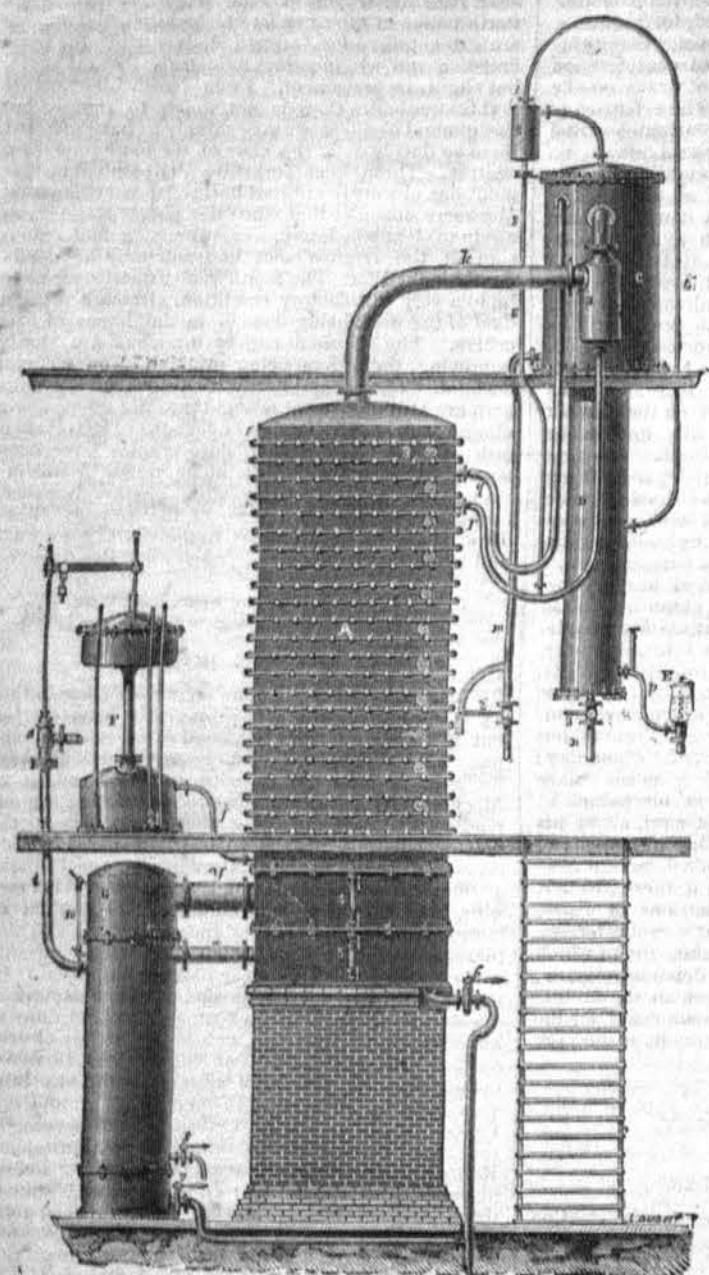


FIG. 1.

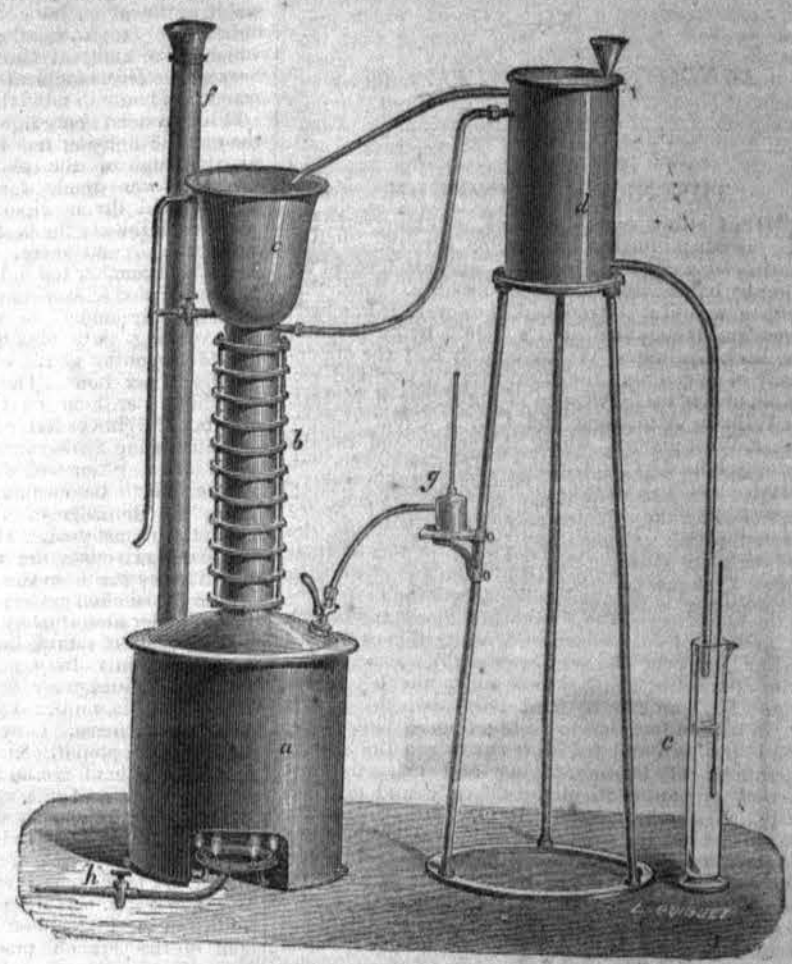


FIG. 3.

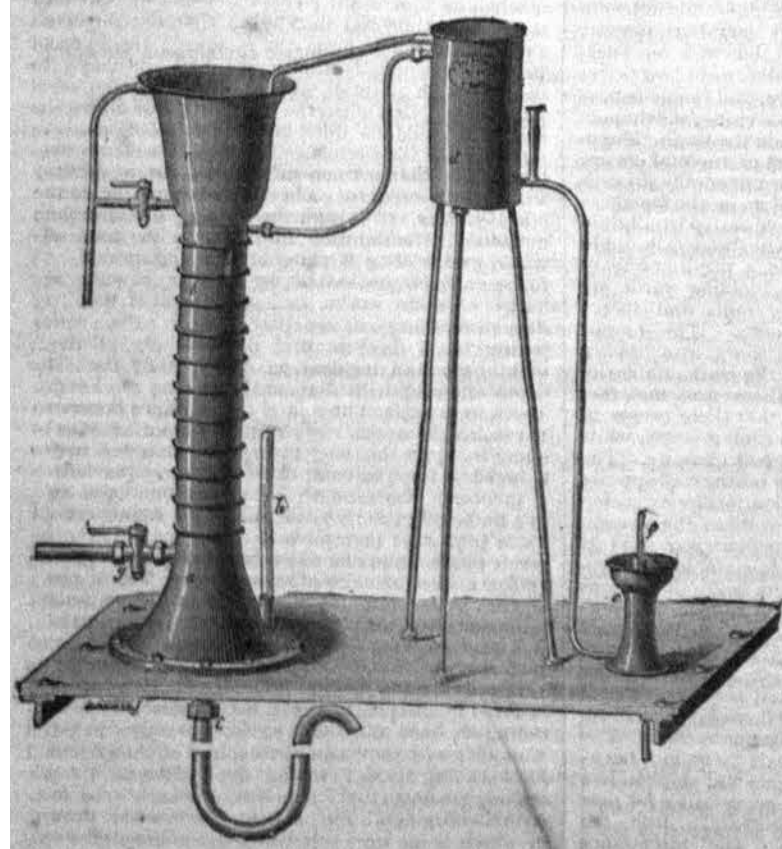


FIG. 4.

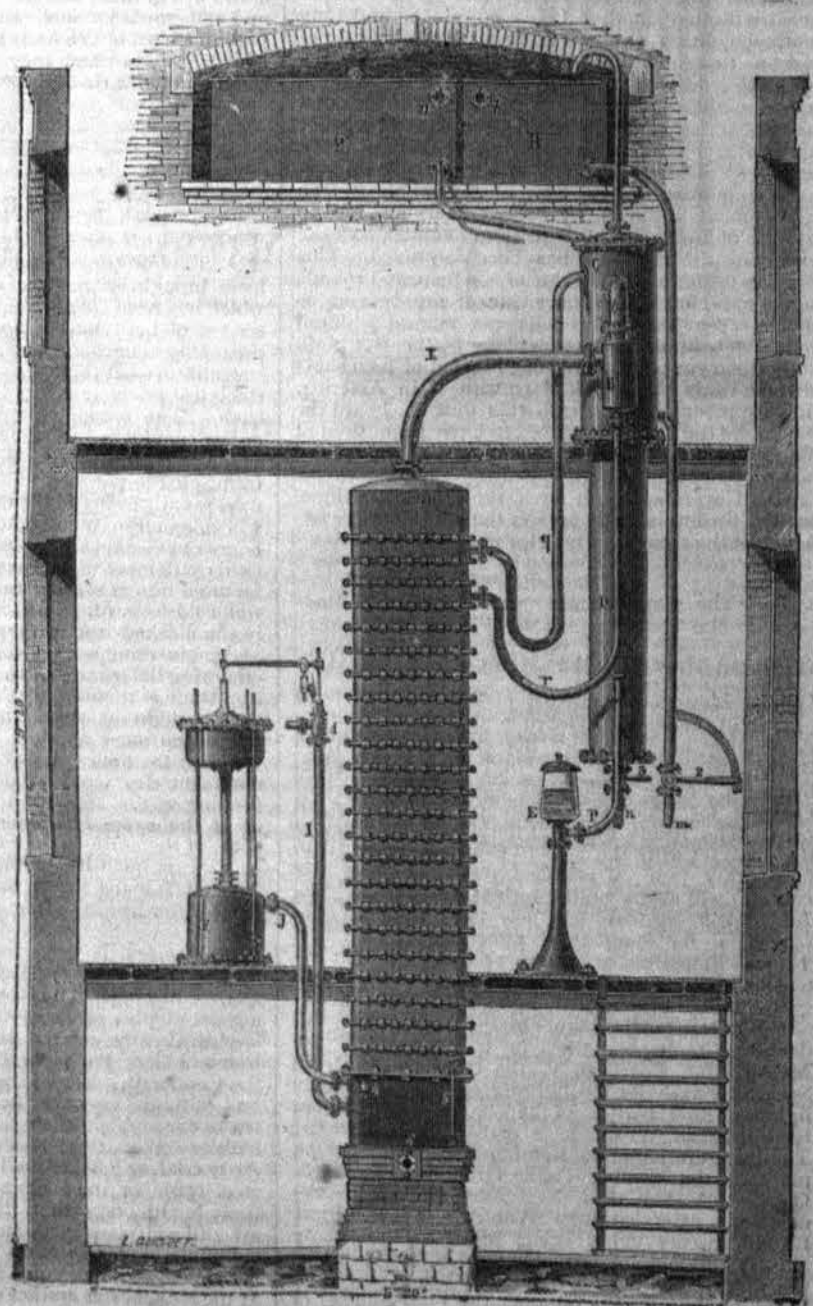


FIG. 5.

FRENCH DISTILLING APPLIANCES.

SOME time since we described and illustrated a portion of the modern distilling appliances of Messrs. Savalle Fils et Cie., of Paris,* promising detailed particulars on a future occasion, which promise we now fulfil. We may premise that the simplest way to heat distilling columns is to admit the steam direct from the boiler to the bottom of the column. This method is in fact preferred for the distillation of all products, with the exception of the syrup ingredients obtained from the beetroot-sugar industry, where it is absolutely essential to dispense with any mixing of the watery vapours which would tend to dilute the liquid portion of the distiller's wash. In fact, prior to the concentration of the wash, in order to be able to extract the potash salts from the latter, the quantity of water which it already contains must not be increased.

For many years it has been the practice in syrup distilleries to heat the columns by passing the steam through more or less perfect coils or serpentine pipes. The latter have, however, the defect of soon filling up with impurities, and of soon wearing away. Moreover, as these pipes were placed underneath the column in a kind of boiler, the whole apparatus had to be taken to pieces when repairs became necessary, and the boiler had to be made excessively strong, in order to allow the columns to stand firmly on it. It was with a view of remedying these serious defects that the plant shown in figs. 1 and 2 was designed. Figure 1 shows a front view of the apparatus, fig. 2 being a transverse section. It may be

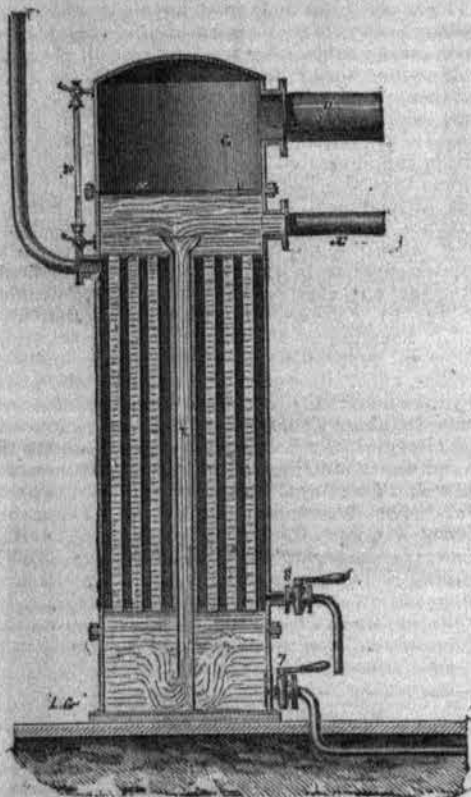


FIG. 2

described as a tubular boiler placed at the side of the distilling column. The cleaning and repairing of the internal tubes can be easily done by removing the top casing, *z*, *z'*. The action of this boiler is as follows: The boiler-steam passes through the pipe, *i*, to the steam regulator, *F*, and impinging against the outside of the tubes, it heats the wash contained therein, after which it passes out by the blow-off cock, *8*, where it is either passed back again direct or indirectly into the steam boiler. The wash is supplied in a continuous stream from the distilling column by the pipe, *x*, and passes off through the tap, *7*; the supply of wash can be regulated by referring to the gauge, *10*, which shows the level of the wash in the boiler. The steam generated passes into the distilling apparatus through the pipe, *y*. The central pipe, *z*, of the boiler is made larger and longer than the others, with its top end in the form of a funnel; this is done with a view of promoting circulation of the wash. In certain cases the exhaust engine-steam, may be used for the forementioned heating purposes.

We are informed that this heating system is not at all costly, in comparison with the copper boilers and coiled piping which it is designed to supplant. The rectangular distilling column is entirely of copper in the apparatus under notice. Some distillers prefer this metal, so as to be able to distil wine from the syrup-mass which is so highly impregnated with acid. It must not, however, be inferred that no other metal is applicable, for cast iron has been found to render good services, even in this distilling process.

Fig. 3 represents an improved apparatus for determining the alcoholic volume of the wash, and for ascertaining the loss of alcohol attending the use of

other older distilling columns. This apparatus, intended as it is for laboratory purposes, consists of a gas-heated boiler, *a*, with chimney, *f*; a distilling column, *b*, for taking up the generated vapours and analysing them. This is surmounted by a water-analyser, *c*. A cooler, *d*, standing tripod-fashion, is connected with the graduated test-glass, *e*. Lastly, the apparatus is furnished with manometer, *g*, and gas-pipe, *h*.

This improved apparatus is used in the following manner:—The boiler is charged with ten litres of the wash through a suitable opening provided in its cover. Water is poured into the manometer, *g*, the analyser, *c*, and the cooler, *d*, after which the gas jets are lighted. The contents of the boiler, *a*, soon begin to boil, the steam generated thereby passes into the column, *b*, and is condensed in the vessel, *c*. The condensed steam now passes through the ten tubes of the column, *b*. The water in the vessel, *c*, soon becomes warm, and the vapours containing the greatest quantity of alcohol condense in the cooler, *d*. The condensed vapour is collected into the test-glass, *e*, as it drops from the pipe shown in the engraving. The volume of the product so gained depends on the alcoholic volume of the liquid mass under test. When working with distillers' wash, the alcoholic volume may, for example, amount to 100 cubic centimetres in the ten litres under test. Thus 1 cubic centimetre alcohol may be easily found again in 10,000 cubic centimetres wash; consequently the accuracy of the apparatus is as 1 : 10,000.

In fig. 4 we illustrate an apparatus adapted for continuous tests. In this case, a steam-jet, proceeding from the wash, feeds the apparatus through the tap, *g*, whilst the liquid portion taken from the wash and condensation is carried away through the bent pipe, *i*. In order to ensure accurate tests, it is absolutely necessary to regulate the condensation water in such proportions that only from one to two litres of the end product be allowed to pass per hour into the test-glass. Several distillers have learnt by this experience that they lost much alcohol. But, in addition, Savalle's testing apparatus is also useful, because the quantity of alcohol contained in wines and similar fermentations may be equally determined thereby. This apparatus is distinguished from other testing appliances, inasmuch as the alcoholic product is obtained in a very concentrated state, allowing it to be easily and accurately weighed by the areometer. By way of example, supposing we were working with a wine containing 8 per cent. of alcohol, the first products obtained would indicate 93° and 94°, and as an average we should get 75°. If we worked on a liquid containing 2 per cent. of alcohol the resulting average would show 50°. Doubtless, the use of such an apparatus for distillers must be very advantageous to them; for it affords the means of controlling the work and of preventing heavy pecuniary losses.

With regard to the steam required for heating purposes, it is mostly obtained from the factory. The chief expense incurred is the distilling apparatus, one of which is represented in our fig. 5 as adapted for the making of guilvine and rum.

(To be continued.)

THE PRODUCTION OF MARTIN STEEL RAILS FROM WORN-OUT IRON RAILS.

By N. LILIENBERG.*

THE greater part of the worn-out iron rails which railways annually yield were converted by re-rolling partly into steel-headed rails partly into ordinary iron, until it was shown that the content of phosphorus even in ingot metal might without detriment to its quality be under certain circumstances very high, since which time the melting down of iron rails in the Martin furnace has come more and more into use.

In the following paper I shall endeavour to state the observations I have made concerning the manufacture of Martin ingot forrails at Graz, in Styria, in accordance with a commission which I received from the Swedish Iron Board, and the conclusions that may be drawn from them.

THE CHARGE.

The sorts of pig-iron used at Graz for this purpose have the following composition:—

	A.	B.	C.	D.	E.	per cent.
Combined Carbon	0.70	0.40	0.50	3.14	3.00	"
Graphite	4.10	3.00	3.00	—	—	"
Silicon	2.30	2.27	2.00	0.60	2.16	"
Sulphur	0.02	0.015	trace	0.015	—	"
Phosphorus	0.05	0.029	0.05	0.037	0.06	"
Manganese	3.00	2.82	2.00	1.02	2.40	"

A. Grey coke pig from Schwechat near Vienna.
B. Grey charcoal pig from Lölling in Krain.
C. White " " Sissek in Styria.
D. White " " Vordenburg in Styria.
E. Grey coke pig from Bettlau in Hungary.

Iron rails from the South Railway, to which the ironworks Graz belongs, contain 0.38 per cent phosphorus in the head, 0.22 per cent in the middle, and 0.05 per cent. in the foot, or, on an average, 0.25 per

cent. In mixture with these are used iron rails from Prävali in Carinthia which have the uncommonly low content of phosphorus of 0.01 per cent. (?) Further there are melted down steel scrap and ends of steel rails all which contain about 0.1 per cent. phosphorus. Finally there is added a portion of malleable iron scrap (plates, bolts, &c.) equal in quality to the Prävali rails, and containing only about 0.01 per cent. phosphorus.

The spiegeleisen used comes partly from Hungary, partly from Krain, and contains in general:—

Manganese	..	..	11.5 per cent.
Carbon	..	..	4.4 "
Silicon	..	..	0.3 "
Phosphorus	..	..	0.2 "

Ingot metal is made from rails at Graz, in three furnaces, of which one is a 6-ton furnace, and two are 10-ton. These furnaces are charged in the following way:—

	No. 1. kilog.	No. 2. kilog.	No. 3. kilog.
Schwechat pig	700	1000	1000
Lölling "	500	500	600
Sissek "	200	600	600
Bettlau "	100	—	—
Malleable iron scrap	500	800	—
Steel scrap	—	500	1300
Vordenburg pig	—	—	300
Sissek "	—	400	—
Steel scrap	—	1000	1000
Chairs*	—	—	100
Graz iron rail	2000	1900	1900
Graz iron rail	—	—	—
Bettlau pig	—	400	400
Malleable iron scrap	—	400	—
Graz iron rails	—	—	1100
Prävali iron rails	1000	2000	1800
Graz iron rails	—	500	—
Lölling pig†	130	—	—
Spiegeleisen	250 250	350	350
	6380	10,350	10,450

The quantities of manganese, carbon and phosphorus that enter into these charges are accordingly as follows:—

Per cent.	IN FURNACE NO. 1.			Per cent.
	Manganese.	Carbon.	Phosphorus.	
Pig ..	25.55	0.691	1.088	0.011
Iron rails ..	63.09	—	0.069	0.126
Scrap ..	8.21	—	0.008	0.008
Spiegeleisen	2.55	0.479	0.185	0.005
	100.00	1.170	1.350	0.150
Per cent.	FURNACE NO. 2.			Per cent.
	Manganese.	Carbon.	Phosphorus.	
Pig ..	28.02	0.737	1.140	0.0139
Iron rails ..	42.54	—	0.044	0.0618
Scrap ..	26.09	0.020	0.047	0.0147
Spiegeleisen	3.38	0.345	0.132	0.0060
	100.00	1.102	1.363	0.0964
Per cent.	FURNACE NO. 3.			Per cent.
	Manganese.	Carbon.	Phosphorus.	
Pig ..	28.7	0.716	1.163	0.023
Iron rails ..	46.0	—	0.048	0.076
Scrap ..	22.0	0.021	0.030	0.009
Spiegeleisen	3.3	0.402	0.154	0.007
	100.00	1.139	1.395	0.115

The ingot metal produced contains on an average:—

Carbon	..	..	0.3 per cent.
Phosphorus	..	..	0.1 "
Manganese	..	..	0.2 "

It appears that scarcely any phosphorus is driven off during the process. The diminution in the contents of carbon and manganese is nearly the same for the three furnaces, viz., 1.05 to 1.09 per cent. of carbon, and 0.9 to 0.95 per cent. of manganese.

The composition stated for these rails may be altered to some extent without detriment, but at Graz it has been found that Martin rails, with 0.29 per cent. carbon, 0.16 per cent. phosphorus, and 0.21 per cent. manganese, do not stand the test of a falling weight, the ball used weighing 400 kilog. the height being 5 metres, and the distance between the supports 1 metre. With this content of manganese the limit that ought not to be exceeded may be stated as 0.25 per cent. carbon and 0.15 per cent. phosphorus. Rails of this composition have an ultimate tensile strength of 60 kilog. per square mm. and 14.5 per cent elongation.

It would be impossible to produce from the English puddled rails used in Sweden containing from 0.4 to 0.6 per cent. phosphorus Martin rails so poor in phosphorus as those made at Graz, without using at the same time large quantities either of scrap poor in phosphorus or of rich iron ore, whereby again the consumption of old iron rails is diminished. Above, however, the content of manganese has been assumed so low as only 0.21 per cent. If this be increased the content of phosphorus may also be raised. Among the ironworks where this plan has been tried Terro-Noire perhaps occupies the foremost place. The Martin steel made there

* Vide vol. xii., page 485.

* From *Jernkontorets Annaler*. Vol. xxiv.

* These contain about 1 per cent. phosphorus.
† This addition of pig varies and is sometimes left out.

contains, according to communications directly made to me:—

	a	b	c
Manganese ..	0.45	0.64	1.01 per cent.
Carbon ..	0.245	0.275	0.24 "
Phosphorus ..	0.204	0.291	0.323 "
Limit of elasticity.	Breaking load.		
kilogram per sq. mm.	kilogram per sq. mm.		
a	30.60	53.90	28.0
b	33.73	58.10	25.5
c	34.80	58.50	24.0

This corresponds also with the results communicated at the Paris Exhibition from the same works, from which it appears that a steel with 0.398 phosphorus, 0.31 per cent. carbon, and 0.693 per cent. manganese has an ultimate tensile strength of 59.7 kilogram per sq. mm., and 25.25 per cent. elongation.

The iron rails melted down at Terre-Noire contain 0.3 to 0.6 per cent. phosphorus. The pig-iron used for this purpose is of the same quality as that employed in the Bessemer works, and contains—

Manganese ..	..	..	1.2 per cent.
Carbon ..	..	..	3.5 "
Silicon ..	..	..	1.5 "
Sulphur ..	..	..	0.05 "
Phosphorus ..	..	..	0.06 "

In order that the final product may contain 1 per cent. of manganese, 1.6 per cent. must be introduced in the ferro-manganese, which for this purpose ought not to contain less than 50 per cent. manganese.

According to communications received from Terre-Noire, the charge for their rail ingots lies within the following limits:—

	Manganese.	Carbon.	Phosphorus.
Pig-iron ..	20.0	0.24	0.70
Iron rails with } 0.3 p.c. P. }	60.0	—	0.180 "
Steel scrap ..	16.8	0.16	0.066 "
Ferro-mang. ..	3.2	1.60	0.160 "
	100.0	2.00	0.238 "
Pig-iron ..	25	0.30	0.875
Iron rails with } 0.6 p.c. P. }	40	—	0.24 "
Steel scrap ..	32	0.32	0.001 "
Ferro-mang. ..	3	1.50	0.150 "
	100.0	2.12	1.026 "

The Terre-Noire method ought also to be applicable for an advantageous utilisation of iron rails in Sweden, and in order to have distinct figures for use in the calculations of expenses to be given below we may assume the following charge for iron rails containing 0.5 per cent. phosphorus.

	Manganese.	Carbon.	Phosphorus.
Pig-iron ..	32.5	0.244	1.13
Iron rails ..	55.0	—	0.275 "
Steel scrap ..	10.0	0.065	0.025 "
Ferro-mang. ..	2.5	1.250	0.125 "
	100.0	1.559	1.280 "

The steel made from this charge ought to contain 0.25 per cent. carbon, 0.316 per cent. phosphorus and 0.65 per cent. manganese. For from the foregoing it appears that about 0.6 per cent. of the manganese existing in the ferro-manganese is lost by oxidation. Spiegeleisen cannot be used in this case, because there would be required 8 per cent. of it with 14 per cent. of manganese, with which there would be brought into the mixture about 0.36 per cent. of carbon.

In these calculations it is assumed that the silicon is almost completely driven off, which is generally the case when the quantity of pig-iron is so small.

Rail-metal of this composition has an ultimate tensile strength of 58 kilogram per square mm., and 25 per cent. elongation. The latter is greater than that of the Graz metal,* therefore such rails ought to be suitable for the northern part of Europe.

The most usual requirements for steel rails in middle Europe are 60 to 65 kilogram per square mm. breaking load, and 13 to 16 per cent. elongation. In Southern Europe, on the other hand, they are sometimes allowed to have a breaking load of 84 kilogram, with 14 per cent. elongation.

(To be continued.)

OCCASIONAL NOTES.

M. LESSEPS' NEW UNDERTAKING.

THE Panama Canal will be a bigger thing than the canal across the Isthmus of Suez, but it will also be greatly more productive. It has been estimated that a ship canal between the Gulf of Mexico and the Pacific would eventually command twice the tonnage that now passes between the Red Sea and the Mediterranean. The increasing traffic between the eastern coast of Asia and the United States would pass along it, as well as the greater portion of the timber, breadstuffs, provisions, metals and other heavy freights from Western America to the Eastern

* That rails with 0.25 per cent. carbon, 0.116 per cent. phosphorus, and 0.65 per cent. manganese, should show a greater percentage of elongation than rails of other respects similar, but with 0.3 per cent. carbon, 1 per cent. phosphorus, and 0.2 per cent. manganese, may at least be considered doubtful, even if a single test may be quoted as a foundation for this statement.—Ed. *Jernb. Ann.*

States and Europe. The trade between Europe and Australia would also probably pass through the same channel. While, therefore, the success of M. Lesseps' undertaking would greatly benefit this and other European countries, it would probably confer still greater advantages upon the United States, both in their foreign and coasting trade; so that it is difficult to believe that any sentimental objection will be allowed to stand in the way of its prosecution.

MORE SHIP CANALS.

A ship canal across the neck of Cape Cod, which was projected more than 200 years ago, has at last been commenced. It is estimated to cost between six and seven hundred thousand pounds, and expected to improve the harbours at either mouth. The proposed canal from Kiel, on the Baltic, to the estuary of the Elbe is still under discussion. At a recent meeting of the Central Association for the Promotion of German River and Canal Navigation, held at Berlin, Count Moltke rather threw cold water on the project, observing that in his opinion it would be wiser to spend the money required on the national fleet than on a canal. At the same time, if the necessary sum could be found without State help he, for one, should not oppose the scheme. The capital required will be about three millions sterling, and the canal can be completed in six years. A short cut across Holstein, as proposed, would save the passage through the Sound and the Sound dues, and be of service, not only to the Germans, but to all the neighbouring nations.

RECLAMATION OF ARID LANDS BY ARTESIAN WELLS.

Oases in the African and other deserts depend upon springs which render vegetation possible, and the growth of palms gives shade and prevents undue evaporation. By irrigation the fertile tract is extended as far as the supply of water serves. The French, by sinking artesian wells, have multiplied these green spots, and it would probably be possible in that way to make a useful track for commerce through the Sahara. In the south-western regions of the United States there are no less than nine hundred million acres of arid lands which must remain practically desert unless some method can be found of supplying them with water on a large scale. More than the half of these now barren tracts only lack moisture to become susceptible of high cultivation, and the Government is asked to appropriate a comparatively small sum for the purpose of sinking experimental artesian wells to furnish water for irrigation. Should the experiment succeed, abundance of private capital to continue and extend the work is confidently expected.

AMERICAN RIVER ENGINEERING.

Owing to the much greater volume of the American rivers and the nature of their banks, transatlantic engineers have frequently to encounter problems which seldom if ever present themselves to those of Europe. The western rivers are in many parts of their course bounded by alluvial cliffs or bluffs, sometimes considerably over a hundred feet in height, and where the substrata consist of gravel or sand, and, as is often the case, the upper layers of clay, great landslips are not uncommon, imperilling the residents on the bluff and interfering more or less with the navigation of the stream. Some few weeks ago several acres of the north bank of the Fraser river in British Columbia, over a hundred feet in height, were undermined by the washing out of the underlying gravel and sand, and slid bodily into the river, which at the spot is fifty feet in depth and a quarter of a mile wide, throwing up a wave that flooded the level country for miles and did much damage. The breadth of the Fraser was reduced by a half, and more of the bank is expected to follow. The prevention of landslips of this description is attempted by more than one expedient. The most satisfactory appears to be a revetment of brush, mat or willow, the revetment being put in so as to extend from the ordinary high-water limit down the bank and out along the river bed to a certain distance. The effect is to thoroughly protect the bank over which it is placed, and to cause a deposit of sediment over it which throws the current off towards the middle of the stream. Some modification of this arrangement might possibly be applied to the protection of our own eastern coasts from the sea, as on the Essex seaboard, where many feet of surface are being gnawed away yearly. Occasionally, during a flood, the river forces its way across the neck of a bend, shortening its course, increasing its velocity, and not only impairing the navigation but wasting the fruitful soil down stream. Now that the valuable land of their banks is converted into farms and the sites of towns, it is highly important that these rivers should be kept within bounds; and although continuous embankments are out of the question, the ingenuity of American engineers has been found equal to the occasion. In the Missouri floating brush obstructions have been applied, we are told, with marked success. The floating brush dike is formed by nailing scraggy brush to saplings from 20 to 30 feet long, which are anchored in the stream from 10 to 20 feet apart. They check the current gradually without producing scouring, and occasion a deposit

which is often sufficient in one season to raise the river bed up to the limits of ordinary high water.

CITY GUILDS AND CHARITIES.

There was a gathering the other day of livermen, ostensibly to discuss the "critical position" in which the City Guilds were described as being at present placed. It appears, however, from the proceedings to have been an electioneering affair, intended to attract support to a party which is supposed to be favourable to the continuance of abuses, in opposition to another which is believed to be prepared, when it gets the chance, to reform the City Corporation and restore the property in the possession of the Companies and the "charities" to its lawful owners. Mr. Hubbard, who was the principal orator, enlarged on the great antiquity of the Guilds; but antiquity cannot be held to sanctify wrong, and the argument against the present possessors of the wealth of the City Companies is that they do not truly represent those to whom the property was originally bequeathed. They are almost in every case strangers to the different crafts for whose benefit the endowments were intended, and the revenues they administer were, until quite recently fear caused a partial disbursement, simply wasted and embezzled. In the circumstances of the case Mr. Hubbard's subsequent invocation of the sanctity of property was as ludicrously misapplied as if it had been used by a burglar in defence of his spoil. The City charities are a smaller affair, the total amount being within a hundred thousand pounds a year, while the others reach an unknown amount, probably above a million sterling. Nevertheless the administrators of these doles have managed their trust in an equally scandalous manner. In the report of the Royal Commission on the subject, we read of a churchwarden who drew the charity dividends and said he distributed them; but becoming a defaulter to a large extent, when pressed, declared himself bankrupt. The sum of 5s. left to defray the cost of a "love feast," has been supplemented by the charitable funds of a parish so that the love feast has become an annual dinner at Richmond costing £60. In St. Botolph, Aldersgate, the churchwardens give an annual dinner costing about £100, mostly out of the parish funds, which sum is entered on the parish books as "spent on visiting the tombs"—equivalent, probably, to getting "down among the dead men." Something of this sort appears to go on once a year in nearly every parish. In St. Sepulchre, eight wine merchants supply the parish wine vaults under the church—their bills last year amounted to about £70. Of this £3 12s. was entered as for sacramental wine. The rest was credited to the poor and vestry meetings. The share of the poor is not stated. There are loud complaints of the pressure of School Board and other rates. The money thus wasted would lighten these somewhat. But, after all, the money of the poor thus squandered is as nothing in amount compared with what the City Guilds make away with. A Royal Commission to let daylight into these dark places would evoke astonishing revelations. And properly urged, no Government could long refuse such an inquiry.

STEAM ROAD ROLLING.

MR. EDWARD BUCKHAM, C.E., the Borough Surveyor of Ipswich, has issued the following important report to the Street Committee of that town upon steam road rolling. Mr. Buckham says:—In accordance with your instructions I have communicated with thirty-one towns, and obtained information on the subject of Steam Road Rolling from thirty where these machines are in use, and now submit them in a tabulated form for your consideration, together with a pamphlet on the subject published by Messrs. Aveling and Porter, engineers, of Rochester. The answers and opinions given vary considerably, but in every case steam rolling is recommended as being in every way better and more economical than horse rolling. The reason of this (to those having had experience of both) is obvious. With a horse roller there is always a certain displacement going on by the action of the horses' feet, and although the stones disturbed in this way are all eventually consolidated by the roller, it destroys the evenness of the surface. With a steam roller there is no displacement, hence a perfectly even surface. Their use is more particularly applicable to roads repaired with granite and other equally hard stones; with our local pit stone (gravel flints) the gain would not be the same, because they do not possess the power like stones of angular form of interlocking under heavy pressure.

- The advantages of steam-rolling over horse are:—
- (1) Economy.
 - (2) Facilities of perfect construction.
 - (3) Less inconvenience to the public, by the roads being repaired more expeditiously.
 - (4) Comfort to persons travelling.
 - (5) Greater consolidating power than would be possible with a horse roller.
 - (6) That roads can be made equally well at all seasons of the year.

Then there is the indirect saving caused by the improved road surface, which, of course, must diminish the wear and tear on horses and vehicles.

The printed replies will speak for themselves, but I should like to direct attention to a few of the most important points respecting them. With a few exceptions no definite figures are given of the saving of steam rolling over horse rolling. In many towns no record showing the comparison has been kept; but at Birmingham it is put at two-thirds the cost of horse rolling, at Bristol one-half. From Islington the reply is, "that you cannot compare the two, for the

reason that steam rolling is altogether so vastly superior to horse rolling." At Leeds 25 per cent. is given as the saving. At Marylebone the difference between 4½ tons horse and 15 tons steam roller is given at 1·6 farthings per square yard for the former and 2·0 for the latter. At Merthyr Tydvil it is given at one-third of horse rolling.

The replies in answer to the question as to whether "Steam-rolled roads are more durable than those made by the ordinary traffic" are, with two exceptions, in favour of the former; and some surveyors state that there is no comparison between them. The Surveyor of Birmingham, however, states that "they are generally considered so, but are certainly not more durable." The City Engineer of Norwich states, "No, I think not. The best roads are made by the action of the traffic." In reply to the question, "Would you advise the adoption of a steam or horse roller in a town where the main streets are narrow, with considerable traffic?" the answers are all in favour of steam. I omitted in my queries to ask whether much damage had been done to gas or water mains, but have since written to several towns for information; and, with the exception of Brighton, there has been no accident of any consequence. I believe, with a 10-ton roller, with the weight equally distributed on three wheels, there would not be much probability of accidents of this kind; and in this opinion I am supported by the surveyors of other towns. Indeed, frequently, traction-engines of about this weight pass through the town.

The repairs and making of macadamised roads generally were dealt with in my report of December, 1877, in which I gave the relative values of different kinds of stone, the cost per square yard laid on the streets, the advantages and disadvantages of granite, and the comparative cost of repairing two given lengths of street with local stone and granite was there shown, the conditions being equal in each case. In the same report I stated that after a granite street had been well made, it would require to be thoroughly picked up once in two years, with a sprinkling of new material to take out the undulations common to such roads. If done every year it would make granite more expensive than pit stone. Tavern Street has been three years without picking up, and St. Matthew's nearly two; and Tavern Street, although a year older, is now in better condition than St. Matthew's, which arises, I have no doubt, from the fact that the former has a better foundation than the latter. The majority of our streets have no sufficient foundations and this (to some extent) is the cause of the unequal consolidation; but even good foundations and heavy rolling do not prevent those irregularities of surface common to granite streets. Every case was taken by constant rolling to prevent such defects in Carr and Tacket Streets; and although it is only nine months since they were repaired, both streets are full of little holes, which are apparent on any wet day.

BOILER EXPLOSIONS IN 1879.

THE following is a report of the boiler explosions which occurred during the year 1879, for which, together with the accompanying illustrations,* we are indebted to the courtesy of Mr. E. B. Marten, the Chief Engineer of the Midland Boiler Inspection and Insurance Company. It will be seen that the explosions for 1879 are much below the average, both in the numbers of explosions and of those killed and injured. They are of only average interest, the greatest number occurring as usual at ironworks. None of the exploded boilers were under the care of Mr. Marten's company. The records of 1879 confirm the oft-expressed opinion that inspection is the best means of preventing explosion, and more than one case during the year showed the need of owners giving every facility for inspection. During the year 1879, records were obtained of 30 boiler explosions, causing the death of 38 and the injury of 53 persons. Of the 91 persons killed or injured, 3 were owners or managers; 28 enginemen or stokers; 53 men employed on the works; 1 woman and 3 men, strangers who happened to be near; and 3 not ascertained. Slight particulars are given, in the form of an appendix, of 17 accidents connected with steam apparatus, and not fairly included in the list of boiler explosions, which caused the death of 6 and the injury of 35 persons.

The exploded boilers were used for the following purposes:—

	No.	Killed.	Injured.
Ironworks	6	15	11
Marine	4	0	0
Mills, various	3	9	21
Collieries	3	3	5
Railways	3	1	6
Farming	2	2	1
Hay and straw	2	0	2
Saw mill	2	0	1
Canal boat	1	2	0
Chemical	1	0	3
Hoisting on board ship ..	1	0	2
Mineral-water works ..	1	0	1
Cabinet works	1	0	0
Total	30	38	53

The causes of explosion are arranged under the following heads, as in former years:—

A. Faults of construction which may be prevented by inspection before starting or after repair—			
	No.	K.	I.
Bad construction or material	3	7	2
Bad repair	2	7	4
Total	5	14	6
B. Faults only to be detected by inspection—			
External corrosion ..	8	8	10
Internal corrosion ..	7	7	7
Total	15	15	17
C. Faults which could be prevented by attendants—			
Shortness of water ..	4	2	12
Over-pressure	5	7	18
Total	9	9	30
Not ascertained ..	1	0	0
Total	30	38	53

* See next page.

The exploded boilers were of the following kinds:—
The causes are stated as in the summary, the general heads being indicated by the letters A B C.

No. K. I. No. K. I. No. K. I.						
Cornish or Lancashire—						
B.	{	External corrosion	4	3	2	
		Internal corrosion	1	4	5	
						5 7 7
C.	{	Shortness of water	1	1	6	
		Over-pressure	1	2	13	
						2 3 19
						7 10 26
Plain Cylinder—						
A	{	Bad construction or material	1	0	0	
		Bad repair	2	7	4	
						3 7 4
B	{	External corrosion	2	0	4	
		Internal corrosion	1	0	0	
						3 0 4
C	{	Shortness of water	1	1	2	
		Over-pressure	1	1	3	
						2 2 5
						8 9 13
Marine—						
B	{	External corrosion	1	4	0	
		Internal corrosion	2	2	0	
						3 6 0
Not ascertained		..				1 0 0
						4 6 0
Locomotive and Multitubular—						
B	{	External corrosion	1	1	4	
		Internal corrosion	2	0	2	
						3 1 6
C		Over-pressure	..			1 2 0
						4 3 6
Vertical—						
C	{	Shortness of water	..	2	0	4
		Over-pressure	..	2	2	2
						4 2 6
Tubulous—						
A		Bad construction	..	1	1	0
B		Internal corrosion	..	1	1	0
						2 2 0
Return-tube—						
A		Bad construction	..	..	..	1 6 2

DETAILS.

No. 1. January 8th, none injured.—Plain cylinder, oval shape, flat ends, 13 feet long, 2 feet 11 inches vertical, 3 feet 2 inches horizontal diameter, 5·16 and ¾ inch plates, 50 lb. pressure. The front end was blown out, the boiler itself not being moved from its seat. As there were no stays, the drum-head action of the ends had caused them to be deeply grooved all round.

No. 2. (See fig. 1 of Engravings). January 30th, two killed, three injured.—Plain cylinder, nine years old, 25 feet long, 4 feet diameter, 7·16 inch plates, 35 lb. pressure. The boiler was torn into three pieces, the first rupture taking place on the left-hand side near the bottom over the fire, where an irregularly-shaped patch had been placed against a former patch and the strength considerably reduced by the old rivet holes being strained and cracked. The rent extended across two rings of plates and then passed in each direction round the boiler, until the two rings were separated and spread out over a furnace to the right. The front end and one ring of plates being thus suddenly liberated were shot to a great distance to the front, while the back end was driven back through the stack and shop, into a garden behind. The position of the cold feed entering just over the fire had aggravated the strain by depositing the scale in the hottest place and had led to the need of frequent repair.

No. 3. February 27th, two injured.—Plain cylinder, flat ends, 6 feet long, 2 feet 4½ inches diameter, 3·16 inch plates, 45 lb. pressure. The shell rent open from end to end, and opened out flat, the ends being blown in opposite directions. The plates were generally reduced ¾ inch thick, and where formerly resting on the brickwork to 1·16 inch.

No. 4. (Fig. 2). March 1st, two killed, thirteen injured.—Lancashire, one of four, 16 years old, 23 feet 6 inches long, 6 feet diameter, ¾ inch plates, 50 lb. pressure. Tubes 2 feet 4 inches diameter. The shell rent open from end to end along the top through the line of fittings, and was flattened out on its seat. The dome was blown a distance of nearly 200 yards, and fell on the roof of a house, and into the room beneath, whilst the tubes were thrown forwards, and each broken into two pieces. The safety-valve of two of the boilers, worked in conjunction with this, had been removed and placed on some new boilers, and the three boilers were left with only one valve. On the morning of the explosion this valve had been cut off to permit of some repairs, fires, however, being left under the boilers, so that the pressure gradually accumulated until it was more than the boiler could bear.

No. 5. March 15th, none injured.—Plain cylinder, flat ends, 4 feet long, 2 feet diameter, ¾ and 5·16th inch plates, 60 lb. pressure. The back end, which was flanged to the shell, was blown out. The boiler was quite unfit for steam purposes.

No. 6. (Fig. 3). March 16th, 1 killed, 3 injured.—Plain cylinder, one of ten, six being thrown from their seats, 35 feet long, 5 feet 6 inches diameter, ¾ inch plates, 50 lb. pressure. The end boiler on the left-hand side appeared to have given way first the primary rent running along the top of the boiler through the line of fittings, and then round the boiler in various ways, the boiler being torn into no less than thirteen fragments, which were scattered in all directions, except to the right. The other five boilers all parted at the ring seams of rivets, three of them being divided into two nearly equal portions, and the other two boilers into three. All these pieces, with one exception—two belts of plating, which were thrown to the right—were blown either backwards or forwards, one piece to a distance of 250 yards. The cause appeared to be most probably overpressure, as there was no signs of corrosion or shortness of water. The boiler which first gave way had been

cleaned on the morning of the explosion, and as it had been usual to drive a wooden plug into the outlet to the stop valve, it had probably been so used that morning and left in after cleaning; and as the safety-valve was on the same pipe as the stop-valve, there was no escape for the accumulated pressure, and when the first boiler gave way the shock caused the other five boilers to explode also.

No. 7. April 3rd, none injured.—Cornish, 5 feet 6 inches diameter, 20 lb. pressure. A piece of plate about 2 feet long and 10 inches wide, was blown out just above the water line, where the plates were greatly reduced by corrosion.

No. 8. April 7th, 2 injured.—Vertical, 60 lb. pressure. Used for hoisting purposes on board ship. The greater part of the external shell, with the flue tube, and a part of the firebox, was blown away into the water, and the remainder of the firebox which had collapsed from top to bottom, was forced through the deck into the hold below. As the outer shell could not be examined, the cause of explosion was not ascertained, but it was most probably overpressure.

No. 9. (Fig. 4.) May 13th, 5 killed, 1 injured.—Plain cylinder, one of three, 3 years old, 30 feet 6 inches diameter, ¾ inch plates, 60 lb. pressure. The boiler had been repeatedly repaired over the fire, which had been necessary from the poor quality of the iron and the great strain it was exposed to by the cold feed entering immediately above. These repairs had been very roughly executed, the rivet holes being askew and the plates thereby cracked. The boiler gave way at the repaired seams, the patches being blown out in one piece to the left, and the first two rings of plates also thrown to the left, and the front end a distance of 170 yards to the front; the remainder of the shell was moved backwards about 10 yards, and left standing on its back end against the stack.

No. 10. May 14th, 1 injured.—Cornish, 15 years old, 16 feet long, 6 feet diameter, 25 lb. pressure. Permission to see this boiler was refused by the owner, but information was obtained that it had given way at the back end at the bottom, over the midfeather wall, where it was reduced by external corrosion. The rent extended all along the bottom, and the shell opened out.

No. 11. May 23rd, 1 injured.—Vertical, 7 feet 6 inches high, 4 feet 7 inches diameter, ¾ inch plates, 30 lb. pressure. The crown of the firebox collapsed and rent open, owing to overheating of the plates from shortness of water. The reaction of the issuing contents blew the boiler up to a great height to some distance, over a farm house.

No. 12. June 16th, 1 killed, 6 injured.—Lancashire, one of eight, 26 years old, 34 feet long, 7 feet diameter, 7·16th inch plates, 50 lb. pressure. Tubes 2 feet 8 inches diameter, 7·16 inch plates. Both tubes completely collapsed and rent asunder at several of the ring seams. The shell was broken into many pieces, which were scattered in all directions doing great damage to the works. As permission to see the boiler was refused, the fragments could not be examined. The cause was alleged at the inquest to have been overheating of the tubes from shortness of water, due to the breaking of the blow-off pipe.

No. 13. June 29th, 4 killed.—Marine, Cylindrical Multitubular, 8 years old, 55 lb. pressure. A plate at the back of the combustion-chamber gave way making an opening about 7 inches wide, through which the steam and water escaped into the stokehole. The plate was considerably reduced by corrosion, and also further weakened by cupped patches being placed over the ends of some of the stays.

No. 14. (Fig. 5.) July 17th, 4 killed, 5 injured.—Cornish, second-hand seven years before, 18 feet long, 5 feet 6 inches diameter, ¾ inch plates, 50 lb. pressure. Tube 3 feet 1 inch diameter, ¾ inch plates. The tube, which was very considerably corroded and also unstrengthened in any way, collapsed from end to end and was broken into several pieces. The first four rings of plates were left in the shell, and with it were blown forwards about 35 yards; the remainder, with half of the back end plate, being blown backwards about 50 yards.

No. 15. July 24th, 1 killed.—Tube Boiler, tubes 10 feet long, 9 inches diameter, 120 lb. pressure. A steel socket connecting the vertical and horizontal pipes opened out allowing the latter to escape, which shot forwards and buried itself in the coal opposite, the escaping steam and water fatally scalding the fireman.

No. 16. July 27th, 1 injured.—Cornish, 4 feet long, 2 feet 9 inches diameter, ¾ inch plates, 32 lb. pressure. Tube 2 feet diameter, ¾ inch plates. A piece of plate, 12 inches by 9 inches by 6 inches, was blown out of the tube where it had been reduced to 1·32nd inch by external corrosion, owing to leakage from a patch.

No. 17. August 5th, 1 killed, 2 injured.—Plain cylinder, about 25 years old, 25 feet 4 inches long, 6 feet diameter, ¾ inch plates. The plates over the fire burst open from overheating through shortness of water. The front end was blown out a distance of 20 yards, while the rest of the shell was carried a distance of 150 yards in the opposite direction.

No. 18. August 6th, 2 injured.—Plain cylinder, 8 feet 6 inches long, 2 feet 9 inches diameter, ¾ inch plates, ends ¾ inch, 24 lb. pressure. The boiler gave way near the bottom on the left-hand side where touching the brick-work, and where it was reduced by an external corrosion, in some places to a thickness of 1·32nd inch. The rent extended from end to end, the shell opening out flat; the ends being liberated, one was blown 160 yards forwards, and the other 18 yards backwards, and the shell 12 yards sideways.

No. 19. August 9th, 1 killed.—Marine, 8 years old, 41 lb. pressure. A piece of plate 21 inches by 24 inches was blown out of the side of the dome. It was found to be seriously corroded both inside and out, though chiefly on the inside being only 1·16-inch thick in some places, and much too weak to bear the ordinary working pressure.

No. 20. August 10th, 1 killed.—Marine, 16 years old, 14 feet long, 7 feet diameter, ¾ inch plates, 25 lb. pressure. A small piece about 5 by 2½ inches was blown out of the plate beneath the bridge in the centre of the tube, where it was reduced to a thickness of 1·16-inch by internal corrosion, and where the plates had never been examined.

No. 21. August 16th, none injured.—Locomotive, 31 years old, 10 feet 6 inches long, 3 feet 10 inches diameter, 7·16-inch plates, 120 lb. pressure. Three rings of plates. Boiler gave way at the first ring seam beyond the firebox, where the plates were reduced by internal corrosion to a

BOILER EXPLOSIONS IN 1879.

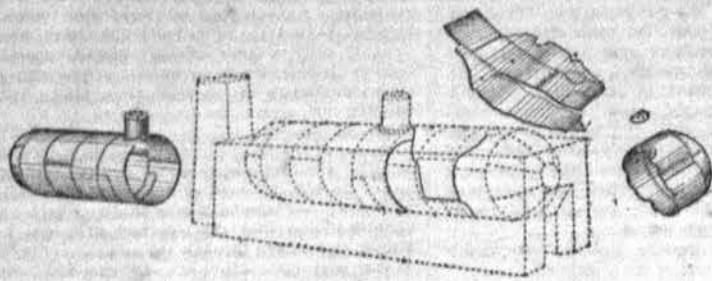


FIG. 1.



FIG. 3.

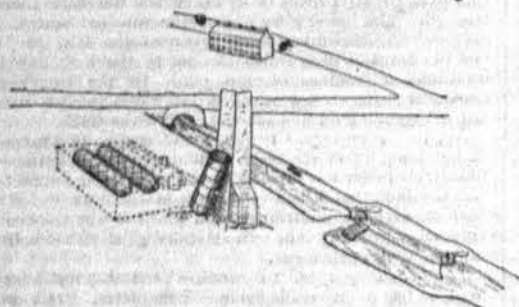


FIG. 4.



FIG. 8.

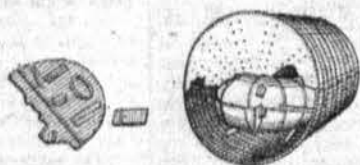


FIG. 9.



FIG. 6.

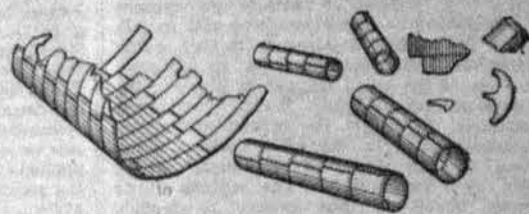


FIG. 2.

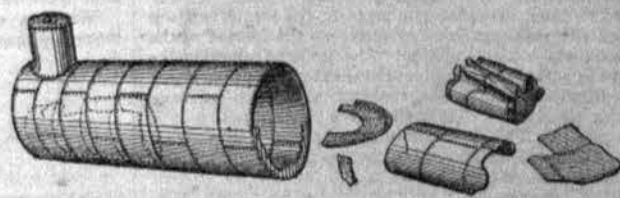


FIG. 5.

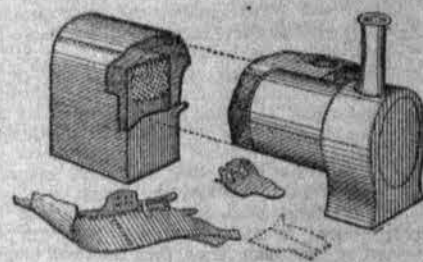


FIG. 7.

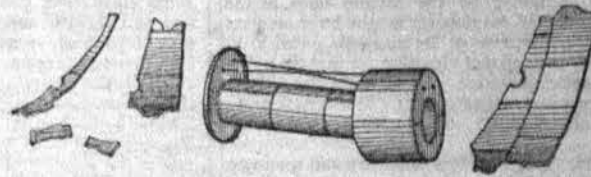


FIG. 10.

depth of $\frac{1}{4}$ to $\frac{1}{2}$ inch. The whole of the centre plates, which had previously been patched, and the greater portion of the plates next the firebox were blown out.

No. 22. August 31st. None injured.—Marine. No particulars could be obtained as the tugboat was sunk immediately by the force of the explosion.

No. 23. (Fig. 6.) September 9th. 2 killed.—Vertical, with internal fireplace and annular smoke-box, 7 feet high, 4 feet 4 inches diameter, 70 lb. pressure. The boiler had lately been repaired and had been tested by hydraulic pressure. It was being further tested by steam when it gave way from excessive pressure. The outer shell was torn into several pieces, which were scattered in all directions, one piece being found 210 yards away.

No. 24. (Fig. 7.) September 9th. 2 injured.—Locomotive, 8 years old, 12 feet 6 inches long, 4 feet diameter, $\frac{1}{2}$ inch plates, 130 lb. pressure. The boiler gave way on the right side of the firebox where one of the hanging brackets was attached to the outer shell, and where, on account of the rigidity of the bracket, the plate having been grooved by the expansion and contraction of the boiler shell. The ring plates next the firebox was blown out in three pieces to the right, and the middle ring opened out and turned over to the left.

No. 25. September 27th. 1 killed, 4 injured.—Locomotive, 120 lb. pressure. The boiler gave way on the left side of the firebox, where the plates were reduced by corrosion to a thickness of 1-16 inch. The engine, which was greatly shattered, was thrown off the rails with the tender and adjoining van, and the driver was blown a great height into the air, falling on a carriage fifty feet away.

No. 26. (Fig. 8.) October 3rd. 3 injured.—Vertical, 6 years old, 6 feet, 6 inches high, 4 feet diameter, $\frac{3}{4}$ inch plates, 70 lb. pressure. Owing to overheating from shortness of water the crown of the firebox was forced down and rent at the base of the chimney, which was on one side instead of being in the centre, where it would have acted as a stay. An opening 20 inches by 6 inches was made, through which the steam and water rushed, and the reaction made the boiler shoot upwards through the floor of the office above, though it fell back almost into its original position.

No. 27. (Fig. 9.) October 9th. 6 killed, 2 injured.—Return-tube boiler, one of four, 30 feet long, 7 feet diameter, 7-16 inch plates. Tube 2 feet 9 inches diameter. The lower half of the front end was blown out, and the boiler thrown backwards 34 yards, doing a great amount of damage on its way. It was found that the six stays by which the lower half of the front plate should have been secured were totally useless owing to some of the rivets being broken, and others never having been riveted at all. The alternate expansion and contraction of the shell and tube had fractured two of the stays, and in another it had worn away the rivets till they had dropped out. The boiler had not been examined internally for some time or the danger would have been detected and the explosion prevented.

No. 28. November 12th. 1 killed.—Combination Boiler. Six horizontal cylinders 2 feet 6 inches diameter in two rows one above the other, the upper ones, which were 35 feet long overhanging the lower ones about 8 feet, 5-16 inch plates,

60 lb. pressure. The upper left-hand tube gave way over the fire, about four or five inches below the water line, the rent extended longitudinally for 5 feet making an opening 2 feet 6 inches wide. The intense heat of the fire and the corrosive nature of the water had caused the plates immediately exposed to the flames to be corroded to a thickness of less than 3-16 inch.

No. 29. November 14th. 2 killed.—Portable Multitubular. 120 lb. pressure. The boiler was being caulked under steam when it gave way at the top of the front end plate.

No. 30. (Fig. 10.) December 31st. 3 killed.—Cornish, 10 feet 4 inches long, 4 feet 3 inches diameter, $\frac{3}{4}$ inch plates, 60 lb. pressure. Tube 2 feet 2 inches diameter. The primary rent took place on the right hand side near the back end where resting on the seating wall, the plates being reduced by external corrosion to a thickness of 1-32 inch. The tube with the first ring of plates and the front and back end plates was turned over and thrown to the front, while the other three rings of the shell were broken into several fragments and scattered in various directions.

APPENDIX.

Slight explosions or accidents with Steam Apparatus, not fairly included in the general list.

No. 1. January 11th. 1 killed, 4 injured.—Domestic. Exploded from over-pressure, on account of the pipes being frozen.

No. 2. January 12th. 1 injured.—Domestic. Exploded from over-pressure, on account of the pipes being frozen.

No. 3. January 30th. 1 killed.—Tape-Drying Cylinder, 6 feet 6 inches diameter, 5 feet long, charcoal iron plates $\frac{1}{4}$ inch thick. The cylinder was new, and whilst being tested, gave way at a pressure of 16 lb.

No. 4. February 14th. 1 injured.—Rag Boiler, 9 feet diameter. The large cast-iron door on top was secured by two wrought-iron bars, and the bolts securing one of the bars giving way, the door, which was then held only on one side, fractured right across, more than half being blown away.

No. 5. July 30th. 1 injured.—Greenhouse boiler. No particulars obtained.

No. 6. July 30th. 1 injured.—Locomotive. Two of the tubes burst, the steam and water escaping through the firebox, and scalding the driver.

No. 7. October 3rd. 5 injured.—Farm boiler. No particulars could be obtained.

No. 8. October 11th. None injured.—Portable Multitubular. One of the tubes, which were much reduced in thickness, gave way, and the escaping steam blew the fire-door out.

No. 9. October 18th. None injured.—Locomotive. Some of the tubes burst. No further particulars obtained.

No. 10. October 22nd. 3 injured.—Cornish, new, 12 feet 2 inches long, 4 feet 6 inches diameter, 147 lb. on safety valve. The top of the dome was blown out whilst being tested by steam from defective angle iron.

No. 11. November 13th. 11 injured.—Rag Boiler, 9 feet long, 10 feet diameter, 6 lb. pressure. The manlid which was of very large size, 4 feet 8 inches by 3 feet 8 inches, was blown out and broken into many pieces, the

metal, which varied in thickness from 7-16 inch to $\frac{1}{4}$ -inch being defective. The boiler itself was not moved.

No. 12. November 19th. 1 killed, 3 injured.—Logwood Kettle, 10 years old, 8 feet 6 inches high, 8 feet diameter, 7-16 inch plates, 30 lb. pressure. The ends which were cambered about 6 inches, were attached by angle rings, the top by an internal, and the bottom by an external ring. The bottom end was torn out and left on its seat, the rent passing round partly through the rivet holes and partly through the solid plate close to the angle ring. The remainder of the shell was blown 120 yards away, falling on to a cottage. There being no stays whatever the boiler was of very weak shape and unable to bear the usual pressure.

No. 13. November 26th. 2 killed, 5 injured.—Tar Distiller, 10 feet high, 10 feet 3 inches diameter, $\frac{1}{2}$ -inch plates. The bottom of the boiler, which was secured by six stays, was blown out, owing to over-pressure, caused by the stopping-up of two of the coils of the escape pipe by crystallised naphthaline.

No. 14. December 4th. None injured.—Domestic. The boiler had not been used for some time, and the pipes had become frozen, so that soon after the fire was lighted, the boiler burst from over-pressure.

No. 15. December 8th. None injured.—Domestic saddle, 20 years old, 2 feet 1 inch long, 1 foot 6 inches wide, $\frac{1}{2}$ -inch plates. Exploded from over-pressure in consequence of the pipes being frozen. All the under side was blown out, except about 7 inches on the left side.

No. 16. December 10th. 1 killed.—Domestic. A plumber lighted a fire in an empty house, when the boiler at the back of the grate exploded, and a piece struck him on the head killing him instantaneously.

No. 17. December 31st. None injured.—Rag Boiler. Exploded at night when all the workpeople were away. A great amount of damage was done to the works. No further particulars obtained.

SCIENCE AND ART.

PROCEEDINGS OF SOCIETIES.

ROYAL SOCIETY.

At the meeting of the Royal Society on the 18th ult., the following paper on "Magnetic Circuits in Dynamo- and Magneto-Electric Machines," by Lord Elphinstone and Charles W. Vincent, F.R.S.E., F.C.S., F.I.C., was read.

A large amount of magnetism is retained by the soft iron cores of electro-magnets when arranged, so as to form a complete magnetic circuit; and sparks and other indications of the passage of an electric current can be obtained at the ends of the helix wires surrounding those soft iron cores, each time the masses of iron are separated and the closed magnetic circuit opened. In order to procure a spark the breaking of the circuit must be effected suddenly, either by

a jerk, tilt, or sliding movement. In the case of the 58 lb. magnet described in our former note, the current that is capable of causing a spark, although only momentary in duration, is found to be sufficient in quantity and intensity to magnetise a small electro-magnet, weighing with its coils between 5 and 6 lb., enabling it to sustain its own weight for any indefinite time when suspended by its armature. When the armature of the small magnet is placed at the distance of $\frac{1}{2}$ of an inch from its poles, in such a manner as to be free to move, the instant the armature of the large magnet is suddenly tilted or slid off it darts to them, the completion of the circuit of the small magnet being signalled by a smart click. The rupture of one closed magnetic circuit is thus caused to produce another closed magnetic circuit. But when the interval between armature and magnet, whose circuit it was intended to close, exceeded $\frac{1}{2}$ of an inch, the former was not attracted with sufficient force to overcome the friction of the table upon which it was resting. The mode of removing the armature from the large magnet appeared to be of no moment, but the time occupied by the removal had much influence upon the amount of magnetic force manifested in the smaller circuit. This was particularly the case if there were an interval, no matter how small, between the armature and the poles of the magnet round which the electric current was sent. For example, if with an interval of 1-16th of an inch between the armature and the poles of the small magnet, the armature of the large magnet was slowly slid off, the magnetisation of the small magnet never rose to a sufficient intensity to draw its keeper to itself, whereas, when the sliding took place rapidly, the small armature was strongly attracted as above mentioned. The largest amount of magnetisation was bestowed upon the small electro-magnet by the interaction, when it was held upright, its poles being completely covered by a closely-fitting armature. And it was also found that when once set up in preparation for the formation of a closed magnetic circuit, the magnetisation was produced by a much slower motion of the large armature than when the small magnet had its circuit partly open. When the circuit was completely closed, if the large armature were twisted off by a slow equable motion, in such a manner that both poles were uncovered at the same time, then the small magnet could be made to sustain not only its own weight (between 5 and 6 lb.) but an additional 3 lb. also. During the passage of the electric current, obtained by the forcing open of the closed circuit, the fall of magnetism in the large magnet itself is checked, the direction of its magnetic polarity remaining unchanged, the current checking or opposing the fall being in the same direction as that from the battery which caused the primary magnetisation. If the ends of the helix wires are not connected together this effect is not obtained.

Electric currents, though of less intensity and quantity, can be produced in the helices of electro-magnets, without altogether breaking up the closed magnetic circuits. For instance, with the 58 lb. electro-magnet, the circuit being completely closed by its armature, and the helices being connected with a galvanometer, a very slight pull applied to the armature produces a current of electricity giving a considerable deflection of the needle in the same direction as the battery current; and the stronger the pull the greater the deflection of the galvanometer needle, up to the point at which the magnet is lifted from the ground, after which no further motion of the needle is produced, unless the magnet is subjected to additional strain. Thus, hanging a 4 lb. weight upon the uplifted magnet, produced deflections in the same direction as the pull on the armature, and on removal of the weight produced reverse deflections. Trying the same set of experiments with a very small electro-magnet, so that we might proceed to absolute rupture of the closed magnetic circuit without danger to the galvanometer, we found that the addition of successive weights to the magnet while hanging suspended by its armature, produced successive deflections of the galvanometer, the needle coming to rest at zero after each addition, as in the case of the large magnet. When the maximum weight which the magnet was capable of sustaining was reached, and a real movement of the armature commenced, the induced current in the helix of the electro-magnet was very greatly increased by the addition of even the smallest weight.

From these experiments it may be inferred that in like manner as the passage of an electric current round a bar of iron produces elongation of the bar, so the elongation of the bar produces in its turn an electric current in the helix, which current tends to strengthen the magnetisation. It appears also that a magnet is absolutely stronger under tension than when at rest. On the other hand, pressure on the armature, either continuous or sudden and momentary (a blow, for example), causes an electric current in the helices in the opposite direction to original magnetisation, or, in other words, against magnetisation; tending thereby to weaken the power of the magnet.

The 58 lb. magnet in closed circuit was hung by its armature, and on afterwards connecting its helices with the galvanometer no current could be detected, but on lowering it until it rested with its whole weight on the ground a current in the direction of demagnetisation was produced, giving a deflection of 15° . In the same way a current in the direction of magnetisation was obtained, giving a deflection of 15° , by the application of sufficient strain to lift the magnet off the ground, and this result was invariable. The degree of swing, however, depended upon the rapidity with which the magnet was either raised or lowered. It may be remarked that whereas any very slight application of force by pulling on the armature was sufficient to cause a current in the helices giving a deflection of 50 to 100° of the galvanometer needle, a great amount of pressure is necessary to produce a similar deflection. A slight pull with the finger and thumb in the one case was equal to the pressure of a hundredweight in the other. By the momentary removal of the armature, the closed magnetic circuit is broken, and though by its immediate restoration a new closed circuit is formed, nevertheless the tension on the molecules of iron by the magnetic stress is very greatly reduced. Under these conditions a very slight pressure upon the armature produces a great swing of the needle, whilst a pull produces scarcely any effect at all until actual movement of the armature takes place.

If the pressure on the armature is great and continuous, a point is soon reached at which a slight pressure is no

longer effective. The effects produced are somewhat different if pressure is applied unequally. For instance:—A weight of 7 lb. placed on the armature over the north pole of the 58 lb. magnet caused a current in the helices giving a deflection of 20° at the galvanometer. The same weight on the south pole gave the same deflection in the opposite direction. Pressure with the hand produced like swings of the needle proportionate to the force used, and the amount of swing can be easily controlled, and the needle brought to rest by judicious pressure on either pole of the magnet. If a lateral pressure be applied to one side of the armature between the poles, and the needle swings say 5° on removal of the pressure, a current is produced in the opposite direction, and the reverse swing in place of being 5° will be 8° , and so on in proportion to the amount of force made use of.

With the small magnets, pressure gave no recognisable current without actual movement of the armatures.

(To be continued.)

SCOTTISH METEOROLOGICAL SOCIETY.

THE GREAT STORM OF DECEMBER 28TH, 1879.

At the meeting of the Scottish Meteorological Society on the 10th ult., a paper was read on "The Storm of December 28th, 1879," the day on which the Tay Bridge fell, by Mr. A. Buchan. In two respects, the author said, that was the most remarkable British storm he had ever examined. These were (1) the extraordinary large fluctuations of the barometer that occurred during the time it lasted, and (2) the rapidity with which the cyclone advanced along the surface of the earth. The barometrical fluctuations were quite extraordinary along the central path of the storm from Barra Head to Wick. The barometric readings at Dhu Heartach Lighthouse, twelve miles south-west of Iona, reduced to 32° and sea-level, were in inches, 29.615 at 10 a.m., 29.405 at noon, 29.205 at 1.30 p.m., 28.905 at 4 p.m., 28.705 at 5.5 p.m., 28.645 at 6 p.m., 29.105 at 7 p.m., and 29.342 at 9 p.m. Thus in one hour, from 6 to 7 p.m., the barometer rose 0.460 inch, or nearly half an inch. That this extraordinary fluctuation was no isolated phenomenon is shown by what was noted at the other lighthouse in the vicinity. Thus the barometer rose, from 4 to 9 p.m., 0.790 inch at Barra Head, from 5 to 9 p.m., 0.681 inch at Monach, 0.760 inch at Ushenish, and 0.660 at Skerryvore; from 5.30 to 9 p.m., 0.700 inch at the Point of Ardnamurchan; and from 6.15 to 9 p.m., 0.590 inch at Kyleakin. To north and south of the central path of the storm the fluctuations, though unusually large, fell far short of these amounts. The path of the storm was from Barra, in the west, across Ross-shire, towards Orkney and Shetland. The average rate of the progress of the storm in the United States was about 26 miles an hour. In Great Britain and in Western Europe generally, 20 miles an hour was the ordinary rate of progress; it was often less, though sometimes it rose to 40 miles. The storm in question, from four to five p.m., travelled 30 miles; from five to six, 45 miles; from six to seven, 53 miles; from seven to eight, 70 miles; and from eight to nine, between 60 and 70 miles. It thus appeared that between seven and nine o'clock the storm advanced 140 miles. This had no connection with the velocity of the wind; it was merely the progressive movement of the storm. Along with the storm there came a rise of temperature from 49 to 55° , which was the mean temperature of a night in June. This was another point which made the storm stand out as a most remarkable one. As to the velocity of the wind, Mr. Buchan mentioned that at Bidston Observatory, near Liverpool, in a storm twelve years ago, a new pressure anemometer, which registered up to 70 lb. to the square inch, was driven up to its full pressure and damaged. Here, then, was a case of wind with a force of 70 lb. to the square inch at least, and it must have been above that. About four years ago there occurred a gust of wind at Sydney, Australia, which lasted two minutes, and during that time had a velocity of 150 miles an hour. Taking ten or twelve minutes, its rate was 112 miles an hour. As to the storm of December 28th last, the following facts had been communicated by Mr. Scott, of the Meteorological Office, London:—At Glasgow, between 6.20 and 7.20 p.m., the maximum velocity of the wind was 71 miles an hour; at Aberdeen, the maximum registered was 63 miles, between 8.50 and 9.50 p.m. At Aberdeen from 7.15 to 7.20, the velocity was 76 miles per hour. At Seaham, near Sunderland, the hourly velocity was 40 miles at the time when the wind had its greatest strength. At 6.50, during a squall, the rate must have been 150 miles an hour. Mr. Buchan remarked that there could not be said to be any pressure anemometer in action in Scotland, that being the only instrument which could record with accuracy gusts of wind, and he hoped they might soon have a number of such instruments in various parts of the country. The force of the wind was comparatively little felt to the north of the central path of the cyclone, owing to the low gradients in that direction, no notice of a storm being recorded, for example, at Cape Wrath, Stourhead, or the Butt of Lewis; but in the path of the centre and for some distance to southward, the storm swept onwards with destructive and uncontrolled fury, raising the spray in what seemed solid masses of water against the lantern of the Dhu Heartach Lighthouse, 145 feet high, which struck the glass with a sound like that of road metal, and completely overturning whole forests of Scotch firs 200 years old, so that not a single tree was left standing, and where the trees were fast rooted in the rock prostrating them along the ground after forming a joint near the roots by splintering this part of their trunks to a bundle of matches. At Dundee, according to the local observer, the greatest violence of the gale was experienced at a quarter-past seven o'clock. There were two things connected with the storm which struck him—one was a crackling, rumbling noise in the upper air, which seemed to descend to the earth; and the other the great force which the wind exercised on standing objects, such as trees, chimneys, &c. That crackling noise, said Mr. Buchan, was observed in the great Edinburgh hurricane of twelve years ago. He had a note from Mr. Harvie Brown, of Dunipace House, Stirlingshire, who said that about 7.20 p.m. about 1800 cwt. of lead, weighing 8 lb. to the square foot, was torn from the roof of his house like a sheet of paper. A part of that, weighing $\frac{3}{4}$ cwt., was

carried 32 feet clear of the house, and the remainder was wrapped like an Ulster coat with a hood round one of the chimneys. The steepest gradient afforded by the barometric observations which were made is about one inch to 110 miles. Steeper gradients were noted during the great Edinburgh hurricane of January 24th, 1868, when a gradient of one inch to 72 miles occurred, and in accordance therewith an amount of damage was done to structures of solid masonry of which the storm of December last affords no parallel.

Mr. St. John Vincent Day, C.E., spoke upon the great importance to engineers and bridge builders of having accurate records of the velocity of the wind. Having seen remarks in the newspapers that the Forth Bridge had been passed by the railway authorities and the Board of Trade, he had made inquiries respecting the calculations on which it had been based, and he had found on the authority of the Astronomer-Royal, that only 10 lb. per square foot had been allowed for wind pressure. Engineers had considered the matter, and he believed they had reported that with regard to wind-pressures they had found nothing upon which they could place any dependence, except the old tables of Smeaton, which put down the pressure of the wind at from 7 lb. to 12 lb. and 13 lb. to the square foot. Numerous wind-pressures, Mr. Day showed, had been recorded since then by Professor Rankine, Professor Piazzi Smith, and Dr. Robinson, Armagh, the last mentioned of whom had stated that the gusts of one particular storm, which was half a mile in breadth, blew at the rate of 125 miles an hour for six minutes continuously. What would become of the Forth Bridge in such a gale as that? But of course the bridge as at present devised was not going on. He had that from the Board of Trade. The report of the engineers had been set aside, and the strains as yet were still unsettled. As to the pressure on the Tay Bridge on the night when it fell, the wind would, of course, blow with much greater force down the conical valley of the Tay than it would in the open; and, according to Dr. Robinson, nearly one-third would fall to be added to its velocity near the bridge, owing to the contraction there of the Firth. Dr. Robinson had also said he had no doubt that the vertical effect of the wind resisted by the water below and by the pressure of the head above would tend to lift up the whole bridge off the piers. On February 20th, 1877, a storm was recorded at Holyhead, the gusts of which blew at the rate of 200 miles an hour, and on November 16th of the same year there was a storm which blew at 180 miles an hour.

CHEMICAL SOCIETY.

At the meeting of the above Society on March 18th, Mr. Warren De La Rue, President, in the chair, Professor Tidy read a paper on River Water.

The author discusses the subject under three heads. I. Analytical Details of River Waters. II. The various Sources of Impurity to which River Water is Subject, and the Means whereby Purity is Maintained by Nature or may be Effected by Art. III. The extent to which Statistics warrant us in Condemning or in Approving the Supply of River Water for drinking purposes.

I. Analytical Details of River Waters. River Thames: The author gives table showing the composition of the Thames water as supplied to the metropolis from January, 1876, to December, 1879. The details given are: total solid matter, oxygen required to oxidise the organic matter, organic carbon and nitrogen, as determined by Dr. Frankland, nitrogen as nitrates and nitrites, lime, magnesia, chlorine, sulphuric anhydride, hardness before and after boiling. The solid matter is at its highest in February, 21.63 grains per gallon, descending regularly to August, 18.24 grains per gallon, whence it again rises. Boiling reduces the hardness to less than one-third. From September to January the chlorine is under 1 grain per gallon, from February to August it is over 1 grain per gallon. The quantity of solid matter is no gauge as to its organic purity as judged by the oxygen required. The testimony of the results obtained with the oxygen process agree remarkably with those obtained by the combustion process as has already been pointed out by the author; the same story being thus told by two absolutely independent experimental witnesses. The author regrets the frequency with which cases occur where conclusions of great importance sanitarily are based on experimental determinations as incapable of arrangement or of interpretation as they are outside the sphere of scientific accuracy. The nitrates and nitrites do not accord with the results indicating the organic matter. It may be that the organic nitrogen of one month becomes the inorganic nitrogen of the next. The author has estimated the gases dissolved in filtered Thames water on twenty-seven different occasions. The oxygen in solution during the winter months (2 and 19 cubic inches per gallon) was found to be very nearly double the amount held in solution during the summer months (1.19). The author intends to turn his attention to a further examination of this part of the subject. Some analyses of unfiltered Thames water from Hampton are then given. River Lea: Monthly analyses (1877 and 1879 inclusive) of the water from this river are given. The total solid matter is again highest in February, 23.34 grains per gallon, sinking to a minimum in September, 17.99 grains per gallon. The chlorine is slightly higher than in the Thames. As far as organic matter is concerned this river is slightly purer than the Thames. The results of the oxygen and combustion processes again exhibit a remarkable correspondence. River Nile: Monthly analyses of this river, taken during one year at Cairo, are given. The total solid matter ranged from 9.5 to 14.3 grains per gallon, the chlorine from 0.145 to 1.395, the oxygen ranged from 0.08 to 0.27. All the samples but that of May were thick. During April, May and June, when the Nile is lowest, the water is worst as regards total solid matter, 12.73 to 14.33, chlorine 0.64 to 1.39, &c.; the month of July is the transition month, the river rapidly rising; during September to October the condition of maximum flood persists, during the fall the river attains its maximum purity. The Severn: Analysis of samples of water collected from the Severn at various spots in January, 1878, from Worcester above the sewage outfall down to Tewkesbury, a distance of 16 miles, together with analyses of the river Teme, are given. The Severn water contains about 16 grains of solid matter per gallon, the chlorine being double

the amount of that present in the Thames. The quantity of chlorine varies remarkably at different spots, probably from the influx of brine springs from the New Red Sandstone. The Shannon: The samples were collected in October, 1879, the river being about 2 feet above summer level. This river was selected because it drains a larger area than any single river of the British Islands, because though uncontaminated with animal impurity it contains a large quantity of dissolved peaty matter, and because it is a type of the Irish rivers which so often pass through lakes in their course to the sea. The analyses include samples taken at the extreme ends of one of the lakes, Loch Derg. The solid matter varied from 15.3 to 20.2 grains per gallon, there was but a trace of nitrogen as nitric-acid, the chlorine was remarkably constant, about 1.0 grain per gallon.

II. The various Sources of Impurity to which River Water is Subject, and the Means whereby Purity is Maintained by Nature or may be Effected by Art. The pollution produced by trade refuse is not considered in the present paper. Flood Water: During the first few days of a flood the drainage, called by the author "primary flood water," materially affects the river for the worse, as all the soluble and some of the insoluble matters accumulated in the soil during the period when the rainfall was insignificant pass into the river. The river becomes heavy in total solid matter, excessive organic matter and turbid. The velocity of the river is increased, and carries down accumulations, organic and mineral, from the higher reaches of the river. The author then gives analyses of the Thames water before, and after two heavy floods, November 18th, 1875, and January 11th, 1877. The rise in the total solid matter is not so great as was expected, the rise in the organic matter was well marked; the high-flood water requiring 0.173 grain of oxygen per gallon against 0.064 grain ten days before. Further analyses of ordinary floods are given, which show similar results. Primary flood water is therefore inferior to normal river water as regards organic purity and general clearness. By "secondary flood water," the author implies the water that comes down after some considerable period of flood, when the drainage area has been washed clean, the river passing slowly from the state of maximum impurity to one of maximum purity. The total solid matter of secondary flood water being only 17.28 grains against 22.84 grains in primary flood water, the oxygen required being reduced to about a sixth, the hardness by three degrees, whilst the suspended matters are too small to be capable of estimation. Although the Thames, when at or below summer level, is brighter and clearer than at any other time, the water is not of such good quality as during the period succeeding a flood. The author then discusses the influence of floods, as exhibited in the river Nile, and shown in the analyses already referred to; the influence of the geological nature of the drainage area, of the time of the year at which the floods occur, of the interval between one flood and the next, and the exact time occupied by a given rainfall, on the flood-water carried into river. He then takes up the subject of peat. Peat exists for the water analyst as old peat or recent peat, the latter giving a yellowish green, the former a coffee-brown tint, the colour passing through all gradations according to the age and quantity of peat present. The author then insisted on the value of the "two-foot tube," i.e., a tube 2 feet long, 2 inches in diameter, with white glass ends, as a most valuable adjunct to analysis. Thus 0.4 per 100,000 of organic-carbon would have a very different significance to the chemist if the tint exhibited by a large bulk of the water was brown, indicating vegetable matter, to what it would if the water was colourless. Professor Tidy has never known in practice a case where the water of a river became colourless simply through the bleaching of peat, and thinks that it is quite possible to compare the depths of colour in two waters though the tints are different. The oxidation of peat has been carefully studied by the author in the Shannon; he has analysed the water at various places. The most notable instance of oxidation being at the falls of Castle Connell, a short distance above the organic-carbon being 0.84 parts per 100,000, a short distance below 0.593 per 100,000. Another instance of this diminution of carbon was noticed in the north of England, where the water is peaty, and is delivered from a storage reservoir to the supply reservoir, 6820 yards distant, by two channels, one a closed iron pipe, the other an open brick conduit. The water delivered by the iron pipe has distinctly a peaty tint, the same water delivered from a conduit is clear and nearly colourless. The water in the storage reservoir contained 0.46 organic-carbon per 100,000, that from the iron pipe 0.49, that from the open conduit 0.23. This, says the author, is a perfect experimental proof of the oxidation of peat. The quantity of peat can also be considerably reduced by admixture with water containing much suspended mineral matter, which causes a precipitation of the peat. Thus the entrance of the turbid river Mulcaire brings down the organic carbon in the Shannon from 0.914 to 0.16. This action was also confirmed by shaking up a peaty water with turbid Mulcaire water in the laboratory. Thus the quantity in running water is kept in check (1) by the inherent power which water possesses of self-purification, owing to the oxidation of the peat by the oxygen held in solution in the water; the process being enormously helped by certain natural and physical conditions, whereby the more complete aeration of the water and the intimate contact between the oxygen and the peat is effected, and (2) by mechanical precipitation by admixture with coarse mineral suspended matter. From peat the author passes to animal impurity. He agrees entirely with Dr. Frankland as to the vital importance of this subject. No one, says Professor Tidy, should be required to drink his own excreta, much less the excreta of his neighbours. The two important questions are: does the water of a river, having been once polluted by admixture with sewage, again, after a moderate flow, assume its original state of purity? And, secondly, if such a natural process of self-purification exists, what are the conditions requisite for its fulfilment, and what are the circumstances affecting these conditions? The author answers the first question in the affirmative, and considers that self-purification depends upon three things. (A) The subsidence of the coarser suspended impurities. (B) The presence of animal life after the water has assumed a certain degree of purity. (C) The oxidation of the organic matter, the dissolved oxygen being derived partly from the

air and partly from plant life. The rapidity of this oxidation depends on the degree of dilution of the sewage, the distance of run, the velocity of the current, the temperature, and certain natural or artificial physical conditions, such as the mixing of the water and air at locks, weirs, &c. The author then proceeds to enumerate the proofs of this oxidation; from analogy we should expect water to purify itself, as the air, which is constantly receiving masses of organic debris, eliminates by oxidation, &c., its sewage matter. Are men never to drink water because it has been once contaminated by sewage? As well might we say that air which has once received scales from a person suffering from scarlet fever, or the infected breath of a measly patient must never be breathed again. If oxidation purifies in the one case, may not oxidation be expected to act in the other? The proofs of this oxidation are threefold. A: The naked eye inspection of rivers receiving sewage. The sewage at the outfall is probably offensive; as it passes down the river it blackens from the formation of sulphide of iron; further on this black colour decreases, disappears, and the river at last exhibits no signs of odour, colour or turbidity. Again, soon after the sewage has been turned into the river, the sewage fungus appears, all other vegetable life being absent; no fish are seen; the banks are black; a short distance further on the fungus vanishes, vegetation is luxuriant, fish abound, the river clears, and no trace of black deposit can be seen. Thus the river Soar, at Leicester, is black with sewage; at Loughborough, 13 miles distant, the river is perfectly clear and fish are abundant. The Irwell, at Manchester, is polluted with every form of filth; in nine miles the offensive character of the stream has entirely disappeared; and so on, in many cases. Such examples prove the power of self-purification possessed by rivers. B: Analysis. The Thames, at Lechlade, may be taken as pure river water. After flowing a distance of 110 miles, and receiving the sewage of many towns, &c., the water at Hampton contains rather less organic carbon and nitrogen than at Lechlade; what has become of this sewage if it has not been oxidised? The same is true of many other rivers, the Severn, the Wear. The author then refers to the diametrically opposite conclusions in the sixth Report of the Rivers Commission, in which Dr. Frankland states that organic matter is not appreciably oxidised by the flow of a few miles. Professor Tidy does not for one moment question the accuracy of the results, but strongly dissents from the conclusions, and submits that analyses indicating a reduction of organic carbon and nitrogen between two spots are of much greater value than any analyses indicating the reverse. Because Dr. Frankland cannot say that the organic matter found at B, where he collected his second sample, is the same as that found at A, where the first sample was taken, and between the two spots, A, and B, a fresh quantity of organic matter may have been introduced. Thus, to take an illustration, six passengers enter a carriage at station No. 1, at station No. 3 six passengers are still in the carriage, but unless there is evidence to show that they are the same six passengers there is nothing to prove that the whole of the six passengers who got in at station 1, did not get out at station 2, and six fresh passengers get in; but if at station 3 only two passengers are found, it is absolutely certain that at least four must have got out at station 2. The author then criticises experiments in which Dr. Frankland shook up a mixture of water with 10 per cent. of sewage, and thus imitated the flow of a polluted stream for 96 and 192 miles, the author contends that these experiments did not imitate at all accurately the flow of a stream and the results obtained are therefore valueless. C: The author set up an apparatus which did to some extent represent the action of a running stream, it consisted essentially of a series of about twenty V-shaped wooden troughs lined with glass. The troughs were placed one over the other and were inclined alternately in opposite directions, so that the water flowed from a cistern into the upper trough, and thence gradually down the twenty troughs into a cistern beneath from which it was pumped up into the higher cistern. After many difficulties from the smoky atmosphere in London, the author, with the assistance of Mr. Hart, obtained results with various mixtures of New River water with sewage from Abbey Mills which proved satisfactorily a decided decrease of organic matter after a run of one mile. After two or three runs the offensive sewage smell disappeared; the last traces of sewage matter seemed to be the most difficult to oxidise. From these considerations the author concludes by paraphrasing a well-known passage in the sixth Report of the Rivers Commission, p. 138: "I am led to the inevitable conclusion that the oxidation of the organic matter in sewage when mixed with unpolluted water, and allowed a certain flow, proceeds with extreme rapidity, and that it is impossible to say how short a distance such a mixture need flow under favourable conditions before the sewage matter becomes thoroughly oxidised. It is certain to my mind that there is no river in the United Kingdom, but what is many times longer than is required to effect the destruction of sewage by oxidation." Some of the methods for purifying water are then considered. A water which is impure, from the presence of sewage, should be unhesitatingly rejected. In urging the claims of rivers as one of the sources for water-supply the author means always rivers free from sewage, i.e., rivers the purity of which at the suggested intake can be proved by chemical analysis. Having such a water, however, much may be done by art to improve it by storage subsidence and filtration. These methods are considered in detail. Pure sand of uniform medium fineness is recommended as the best filtering medium on the large scale; the rate of filtration should be two gallons per hour, per square foot, the filter bed should be changed about every two years.

III. How far do Statistics Warrant us in Condemning or in Approving the Supply of River Water for Drinking Purposes? In the opinion of the author, peaty waters have not been proved to produce diarrhoea. As regards animal pollution the author admits that disease has been produced by drinking impure and polluted water, but the arguments against the use of a river water is based (1) on the existence of germs; (2) on the supposition that the oxidation process which might affect organic matter would probably leave organised bodies untouched. Germs would probably be destroyed by oxidation and caducousness after a run of ten or twelve miles in a river. If they are not destroyed as organic matter they ought as organised bodies to increase, and as we pass down the river each town should exhibit an increasing death-rate from the multiplication of the disease germs. Statistics, however,

show a very different state of things. A disease usually spreads up, not down a river. From an examination of numerous statistics it is seen that the death-rate of towns in which the water is obtained from wells is 'practically identical with that in towns supplied by rivers; and that in London, as regards mortality, there is very little to choose between districts supplied by well water and those supplied by river water; so that it is clear that the *materies morbi* is subject to the same laws of destruction as ordinary organic matter. As a matter of sentiment the author would prefer well water. If all the mischief be laid to an undiscoverable germ, a terrible doubt is cast on the value of all chemical analysis. There is no well-authenticated case where river water having received sewage, the dilution being considerable and circumstances favourable for oxidation, has after a flow of ten or twelve miles been manifestly the cause of an outbreak of disease. In all well proved cases of outbreaks of disease resulting from the use of drinking water, such water would have been unhesitatingly condemned on analysis by the chemist. The author protests most strongly against the startling statement in the Report of the Rivers Commission "that the supply of deep well water would confer on the metropolis an absolute immunity from epidemics of cholera." Regarding all the above facts the author submits the two conclusions. (1) That when sewage is discharged into running water, provided that the dilution of that sewage with pure water be sufficient, the whole of the organic impurity will be got rid of after the run of a few miles. (2) That facts indicate that, whatever may be the actual cause of certain diseases the *materies morbi* that finds its way into the river at the sewage outfall is destroyed along with the organic impurity after a certain flow.

This paper was listened to with great interest by a crowded meeting of the Society.

The President said that the large assemblage that evening evinced the great interest taken by chemists in this vital question of a suitable water-supply. This interest had been increased by the forcible yet courteous way in which Professor Tidy had supported his views. He would call on Dr. Frankland for any remarks he would like to make.

Dr. Frankland said that at that late hour it was quite impossible to do justice to the discussion of this important paper. He did not know any subject of greater moment to the health of towns. He had listened to many statements founded on opinions, surmises, and casual observations, but they had made but little impression as they lacked the quantitative element. The present paper differed entirely from such statements. Professor Tidy had furnished us with a large number of facts which deserved serious consideration. As far as he could see there was no fundamental difference between the facts of Professor Tidy and previous results of his own, but considerable explanation was necessary to understand how such diverse opinions could be drawn from identical facts. He would therefore propose that the discussion be deferred until after the paper had been printed, which was agreed to.

MANCHESTER GEOLOGICAL SOCIETY.

A FIREDAMP INDICATOR FOR MINES.

THE ordinary meeting of the members of the above society was held on Tuesday, at Manchester, Mr. E. W. Binney in the chair, and there was a large attendance. Lord Lindsay, the President of the Society, had intended to be present at the meeting to deliver an address, but a letter was received from his lordship to the effect that election engagements prevented his carrying out this intention.

Professor G. Forbes, of Anderson's College, Glasgow, exhibited and explained an invention of his own called the "dampscope," or firedamp indicator for mines. He said his object had been to devise an instrument simple in its action and sufficiently portable to be carried into any part of a mine, for the purpose of detecting and indicating the extent of fire-damp should it be existing; and he was sure they would agree with him that if any step could be taken to prevent the occurrence of those disastrous explosions in mines of which they had heard so much recently it would be a great thing. In the instrument he had produced he believed he had found a means of preventing some of these explosions. The principle was this, that where they had a tuning-fork which was made to sound, its sound might be almost inaudible unless if in its neighbourhood they had a tube of air, and the length of the tube depended upon the kind of air within it; if the air were pure or mixed with fire-damp the tube would be of different length, and the length of the tube would indicate the quantity of fire-damp. Professor Forbes then explained the instrument which, it may be briefly described, consisted of an air-tube in connection with a tuning fork, the length of the air-tube being regulated by a wheel. By this wheel the length of the tube was regulated until they got a maximum sound from the fork, and then by an indicator in the instrument the quantity of fire-damp in the air was at once shown. The instrument would indicate fire-damp to one-half per cent., and any one could easily read the instrument to one per cent.

Mr. Dickinson, H.M. Chief Inspector of Mines, said he had much pleasure in moving a vote of thanks to Mr. Forbes for having come so far to show and explain to them his instrument, and he thought the large gathering which had come to hear him must convince every one that if there were any instrument or any invention which would conduce to the safe working of mines, that those interested in their management would not be slow to avail themselves of it. It might be said that there had been previous workers in this field, and that they had not availed themselves of their inventions, but in these cases the instruments had not been sufficiently reliable or applicable to mines, to secure their adoption. But if the instrument which Professor Forbes had exhibited would do what he stated and enable them to measure gas up to one-half, or even one per cent., it would be a very valuable instrument, particularly in mines where powder was used and there was much coal-dust, because it was found in these mines that a very small admixture of fire-damp, which the safety lamp would not indicate, mixed with coal-dust was liable to create an explosion. Many of the public seemed to think that it was only recently they had discovered in mining that coal-dust would aggravate an explosion. It had certainly been brought into prominence of

late, but the knowledge of the fact was by no means new. The evil of the admixture of coal-dust with a small quantity of fire-damp had been long known, and if they could get an instrument which would indicate the existence of a small quantity of fire-damp, there was no doubt it would come into general use.

The vote of thanks having been seconded by one of the members, a short discussion took place, in which it was stated that the instruments of this description which had previously been brought forward, had generally either been too cumbersome or too delicate for practical work, but the simplicity of the instrument exhibited by Mr. Forbes appeared to commend itself to all; and Mr. Jackson observed that it would be of very great value in such mines as the Wigan nine-feet, where he had seldom or never seen a "cap" upon the lamp before there was an explosion in the lamp.

THE LONG-WALL SYSTEM OF WORKING COAL.

Mr. W. J. Grimshaw, F.G.S., next read the second part of a paper prepared by himself and Mr. Herbert Phillips, on "The Long-wall System of Working Coal." In the course of the second paper, which dealt principally with zones of gas-generation, the writers stated that if part of a resisting body were subtracted or extracted the remainder would undergo a more lively molecular action than prior to the weakening. In the post-and-pillar system part of the coal being subtracted, the remainder was subject to the sum total of pressure of the upper strata. The result would, therefore, be an increased molecular action and quicker generation of gas. The generation of gas might be said to be influenced by two causes—the removal of lateral pressure and the increase of vertical pressure. This liveliness would continue until a zero point was reached, which would be when the excess of pressures had forced out all the gas due to its increment, or the pillar had become pulverised to such an extent as not to be in resisting contact to the roof. The zone of gas-generation would extend over all the field of pillars left, so that to nullify risk or to dilute to harmlessness, simultaneously with generation, it was necessary that all the pillar surfaces should be scoured with wind. However large the pillars might be left they would be subject, more or less, to a proportionate increase in molecular action, equal to the increase of pressure thrown upon them. In the long-wall system the zone would be limited to a sphere bound on one side by the coal wall, and on the other by that point at which the super-pressure had become so great upon the goaf as to resist or subdue the expansive force of the gas. Where the mine was deep and the roof flexible the zone would be small, but where shallow and rocky it would of course be larger. Then there was the consideration that if the goaf were open for the generation of gas it would be also open to the circulation of wind. But should the goafs rise to the faces or banks the gas would, as generated, rise into the air-currents and be carried away. Should the goafs dip towards the banks allowance of wind to go up and down the gateway would be necessary. In long-wall working the point most to be feared was the upper end of a line of faces. The discussion on the paper was adjourned until the whole series had been printed, and the proceedings then closed.

SOCIETY OF ENGINEERS.—The next meeting of this society will be held on Monday the 5th of April next, in the Society's hall, Victoria Street. A paper will be read on "Distilling and Hoisting Machinery in Sea-going Vessels," by Mr. H. W. Pendred, the leading features of which are as follows:—Description of a distiller capable of yielding from 80 to 100 gallons of water per day of 10 hours, suited for a ship of, from 1000 to 1500 tons, combined with a cooking hearth. Description of a distiller capable of yielding from 500 to 2000 gallons per day of 10 hours. Description of a larger distiller and fittings, with gearing for weighing anchor, and sundry pullings and haulings. Details of boilers and engines for each distiller, and the hoisting machinery attached to each. Description of windlasses and gearing connected with distillers. Description of arrangements for letting water into boilers, disposal of fresh water, and pumping out arrangements. Description of a distillery apparatus for use on land, of various distillers connected with winches and windlasses, with data of rates of loading, unloading, speeds of machinery, consumption of fuel and production of fresh water.

YORKSHIRE COLLEGE STUDENTS' ASSOCIATION.—At the meeting on Tuesday evening, last week, Mr. B. Holgate, F.G.S., read a paper on "Coal Plants." After explaining that our knowledge of the fossil plants of the coal-measures is far from complete, notwithstanding the attention which has been given to the subject, owing to the imperfect way in which the majority of the specimens found had been preserved, the lecturer compared the vegetation of the present time with that which flourished at the time of the formation of the coal found in this country. He showed that the two were essentially different in their general character, hardwood trees, fruit trees, cereals, and other plants common at the present time being absent from the coal-measure fossils. The lecture was illustrated by a large number of specimens, including many carefully-prepared microscopic slides. The chair was occupied by Prof. A. H. Green, M.A.

MANCHESTER SCIENTIFIC AND MECHANICAL SOCIETY.—At a recent meeting of the Manchester Scientific and Mechanical Society an interesting paper on the application of automatic valve gear to rolling mill engines was read by Mr. C. Bolle. After pointing out the necessity, in the face of the present keen foreign competition, of adopting every possible means of economy in the manufacture of iron, the writer dealt at length upon the economical use of steam in rolling mills, and set forth the following conclusions at which he had arrived:—(1) Economy of steam was essential for the profitable working of most rolling mills, and could best be obtained by using automatic expansion gears; (2) such gears could be and had been applied to mill-engines; (3) for small engines flat slide-valve gears were suitable, for large double beam or equilibrium valve gears; (4) the economy of steam was increased by the use of condensers, and in connection therewith of compound engines where coal was dear; (5) clutch reversing engines were to be preferred to coupled reversing engines without fly-wheel; (6) in laying out new works a high

steam-pressure ought to be adopted. In conclusion, he pointed out that our Continental rivals were fully alive to any economies obtainable in the manufacture of iron, and it behooved us to watch every point therein as sharply as possible in order to maintain our leading position.

THE GREAT TELESCOPE OF THE PARIS OBSERVATORY.—The work of casting the lenses of the great refracting telescope of the Paris Observatory has already begun at Feil's establishment. The founding of the flint disc has taken five days, and the annealing a full month. A like operation will soon take place for the Bishofsheim Observatory instrument.

TECHNICAL EDUCATION.—Mr. Philip Magnus, B.Sc., B.A., has been appointed organising director and secretary of the City and Guilds of London Institute for the Advancement of Technical Education. Mr. Magnus graduated in honours in Arts and Science at the University of London in 1863 and 1864, is author of "Elementary Mechanics, &c." (Longmans), and editor, jointly with Professor Carey-Foster, of the "London Science-Class Books" and of the "Education Library," which is preparing for publication.

LOCH KATRINE WATER.—The monthly report of the quality of Loch Katrine water, prepared by Professor E. J. Mills, D.Sc., F.R.S., Anderson's College, has been issued. The results are returned in parts per 10,000:—Total solid impurity, 2.90; organic carbon, 0.158; organic nitrogen, 0.017; ammonia, 0.000; nitric nitrogen, 0.008; total combined nitrogen, 0.025; chlorine, 0.63; hardness, 1.15. The water was sampled on March 16th. It was light-brown in colour, and contained little suspended matter.

THE CLOCKMAKERS' COMPANY.—The court of assistants of this company, to encourage the highest excellence in the production of the marine chronometer, have determined to award annually two prizes to the makers of the two chronometers which shall perform with the greatest accuracy under the conditions prescribed by the Astronomer Royal at the annual trials at the Royal Observatory, Greenwich. The first prize will consist of ten guineas and the freedom of the Company, and the second prize five guineas.—*City Press.*

ROYAL INSTITUTION.—On Tuesday next, April 6th, Professor Huxley will give the first of a course of two lectures on "Dogs and the Problems connected with Them"; on Thursday, April 8th, Professor Tyndall will give the first of a course of six lectures on "Light as a Mode of Motion"; on Friday evening, April 9th, Professor Huxley will give a discourse on "The Coming of Age of the Origin of Species"; and on Saturday, April 10th, Mr. James Sully will give the first of a course of three lectures on "Art and Vision."

A TELEPHONE ON THE DRACHENFELS.—As an experiment, the German Postal and Telegraph Department is about to open for use during the coming summer a telephone connecting the top of the Drachenfels with the charming riverside resort of Königswinter, on the Rhine. The wire is laid along the foot road by way of Hardtberg and Kuckstein to the refreshment house beneath the ruins. The project which was started some time ago of a railway up the Drachenfels, like that on the Rigi, is given up for the present, if not entirely abandoned.

EXHIBITION OF GERMAN AND AUSTRIAN TURNERS' AND CARVERS' WORK.—On the 19th ult., an exhibition of the products of the turners' and wood carvers' art was opened at Leipzig. The exhibition comprises contributions from all parts of the German and Austro-Hungarian Empires. At the opening ceremony, which was conducted by the chief burgomaster, Dr. George, the Austro-German alliance and its importance as affecting the economic relations of the two empires and the general peace of Europe was especially dwelt upon by the Austrian Consul-General. The exhibition is pronounced a complete success.

DISCOVERY OF RARE ANCIENT GOLD COINS.—On the Goldberg, at Mardorf, near Marburg, in Hesse, a large number of rare ancient gold coins have just been discovered. They are so-called Bracteates. On the hollow side there is a picture in relief, having three, five, seven, or nine elevated points, of a snake-like animal; while the raised side shows a pear-shaped elevation in the centre surrounded by two or three points and a wreath of leaves. The size of the coins is about that of a half-sovereign, but thicker, the weight being 7½ grammes, the value, therefore, amounting nearly to a sovereign. A cross, bracelet, brooch, and some other objects have likewise been discovered at the same spot.

EXHIBITION OF PRINTING MACHINERY.—On Monday, July 5th, next, will be opened at the Agricultural Hall, London, an exhibition and market of machinery, implements and material used or sold by printers, stationers, paper-makers, and in kindred trades. The exhibition, which enjoys distinguished patronage, will remain open till July 10th. It will be of a distinctly trade character, and is projected with a view to affording makers and manufacturers an opportunity of bringing their articles immediately under the notice of those interested in gaining a knowledge of them. Liberal arrangements are therefore made for the admission of members of the trades represented, the general public being admitted by payment.

MARBLE IN JAPAN.—Signor Gagliardi, an Italian professor at the Polytechnic Institute in Tokio, who was lately commissioned by the Japanese Government to explore the Ibaraki mountain range, reports that he has found several veins of marble of different colours. One mountain, Suvoyama, seemed to him to be a mass of white statuary marble; and he also declares that he came upon some black marble equal to the finest in Europe. He anticipates that if care be taken in quarrying and facilities of transport be provided, Japan will become the great marble market for the world. Marble has been known in Japan for centuries, but it was not much prized, being considered too difficult to polish.

THE PETROLEUM FIELDS OF RUSSIA.—The owners of American petroleum deposits will before long have to encounter a considerable amount of opposition in view of the discoveries of this valuable oil on the Continent, and especially in Hanover and Russia. The beds in the latter country are comparatively boundless, extending for a distance of 1500 miles along the Caucasus range, from the Caspian to the Black Sea. At the present time, however, there are but two districts in this large area where any systematic efforts are being made to obtain the petroleum. One is in

the valley of the Kuban river (which flows into the Black Sea), where two wells have been sunk by a French company under the superintendence of an American manager; this company has a refinery at Taman. The other and most productive district is near Baku, on the Caspian Sea. Many wells have been sunk here to the depth of 300 feet, having a daily yield of 28,000 barrels of crude petroleum. An extraordinary amount of sand flows out with the oil, and is heaped up near the orifice of the wells in banks at least 30 feet high. Large refineries exist at Baku, though the refined oil at present produced there is not as good as the American oil.

TECHNOLOGICAL EXAMINATIONS.—The arrangements for the Technological Examinations of the City and Guilds Institute are now complete, and notice has been issued to all Secretaries of Science classes throughout Great Britain and Ireland of the system to be adopted. These examinations are worked concurrently with, and on the same system as, those of the Science and Art Department. They will be held on May the 12th, on which day also part of the Science examination is held. By thus availing itself of the existing organisation of the Government, the City Institute is enabled to hold its examinations all over the kingdom, as there are now no places of importance at or near which there is not a centre for the Government system. There are thirty-two subjects of examination, covering all the chief industries of the country, all at least in which the application of science is such as to enable theoretical knowledge to be tested by examination. Any workman, or any person connected with any manufacture included in the scheme, wishing to obtain a certificate testifying to his knowledge of that manufacture, has merely to apply to any one of the numerous local secretaries of the Science and Art Department, and ask him to return his name as a candidate to the office of the Institute at Gresham College. When the day for examination arrives, the candidate will have to present himself at the centre where he has sent in his name, and he will find a paper of questions ready for him. If he succeeds in answering these, he will in due course receive a certificate. There are now over fifty classes in different parts of the kingdom, in which students are being prepared for these examinations, but the examinations are also open to any person whoever who likes to try for a certificate or for one of the prizes given by the Institute. Further information can be obtained on application at the halls of the companies of Mercers, Drapers and Clothworkers.

MEETINGS FOR THE WEEK.

MONDAY, APRIL 5.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.—Mr. J. P. Seddon, Suggestions for the Polychromatic Decoration of Various Buildings. **SOCIETY OF ENGINEERS.**—7.30 p.m. **INSTITUTE OF ACTUARIES.**—7 p.m. **SOCIETY OF ARTS.**—8 p.m. **CARLIS Lecture.** M. R. W. Edis, on Art, Decoration and Furniture, Schools of Art, Truth, Fitness and Beauty, Moral Influence, Art not necessarily costly. Ancient Furniture.

TUESDAY, APRIL 6.

ST. GEORGE'S HALL.—Hibbert Lecture.—5 p.m. M. Ernest Renan, on the Influence of the Institutions, Thought and Culture of Rome on Christianity. **PHOTOGRAPHIC SOCIETY.**—8 p.m. **SOCIETY OF ARTS.**—8 p.m. Foreign and Colonial Section. Mr. C. Pfundner, on Art in Japan. **INSTITUTE OF CIVIL ENGINEERS.**—8 p.m. Discussion on Explosive Agents applied to Industrial Purposes.

WEDNESDAY, APRIL 7.

ROYAL AGRICULTURAL SOCIETY.—Noon. **BRITISH ARCHEOLOGICAL ASSOCIATION.**—8 p.m. **SOCIETY OF ARTS.**—8 p.m. Mr. E. C. Robins, on Buildings for Secondary Educational Purposes.

THURSDAY, APRIL 8.

ROYAL INSTITUTION.—3 p.m. Professor Tyndall, on Light as a Mode of Motion. **ROYAL SOCIETY CLUB.**—6.30 p.m. **INVENTORS' INSTITUTE.**—8.15 p.m. **SOCIETY FOR ENCOURAGEMENT OF THE FINE ARTS.**—8 p.m. Mr. Roland, on the Influence of Dramatic on Pictorial Art. **ROYAL SOCIETY.**—8.30 p.m. **SOCIETY OF ANTIQUARIES.**—8.30 p.m. **SOCIETY OF ARTS.**—8 p.m. Applied Chemistry and Physics Section. Mr. E. J. Friswell, on Recent Improvements in Benzine Colours.

FRIDAY, APRIL 9.

CITY OF LONDON COLLEGE.—6 p.m. Dr. Heinemann on Political Economy. Incidence of Taxation on Rent, Profit, Wages, Gifts, Expenditure, Investments, House Tax, Railway Passenger Duty, Excise. **ARCHITECTURAL ASSOCIATION.**—8 p.m. Solids. **ROYAL ASTRONOMICAL SOCIETY.**—8 p.m. **SOCIETY OF ARTS.**—8 p.m. Indian Section. Mr. B. Haughton, C.E., on the Best Route for a Railway to India.

SATURDAY, APRIL 10.

ROYAL INSTITUTION.—3 p.m. Mr. James Sully, on Art and Vision. **PHYSICAL SOCIETY.**—8 p.m. **GEOLOGISTS' ASSOCIATION.**—2.30 p.m. British Museum. Professor Owen, C.B., Demonstration on Extinct Elephants.

RAILWAYS & TRAMWAYS.

THE TAY BRIDGE.—The half-yearly meeting of the North British Railway Company was held in Edinburgh on Tuesday. The report proposed that £120,000 be laid aside to cover the loss by the Tay Bridge disaster. The report was adopted after considerable discussion.

JAPANESE RAILWAYS.—The railway system is extending rapidly in Japan, two lines having been recently completed in the island of Nippon, and a third in the island of Yesso, the most northerly of the Japanese group. The rails are of English make, but the rolling stock and engines have been ordered in America—the former being supplied with Westinghouse brakes, and the latter with spark-arresters, a very proper precaution on the part of the Japanese authorities; for were a chance spark to light upon one of the shingle roofs by the side of the railway, whole villages would be swept away, and a very natural feeling of hostility be developed towards railway enterprise. The two first engines are to be named Benkei and Yoshitsze, after two celebrated early Japanese heroes. It is the first order of the kind that has been given by Japan to American houses. An exhibi-

tion of cotton and sugar is soon to be opened at Osaka, which is exciting a good deal of interest.

ST. GOTTHARD TUNNEL.—The engineers have ascertained that the difference of level between the two sections of this extraordinary work was only five centimetres, or rather less than 2 inches—more exactly, 1.9685 inches. It was only by this practically very unimportant difference that the Göschenen half was higher at the meeting point than the Airolo half of the tunnel. With reference to the discrepancy between the actual and the calculated length and the cause of the error, the engineers have not as yet concluded their investigations, as it has not been found possible to make an exact measurement of the length of the tunnel. None of the deviations are of more than scientific interest: of how little practical importance they are is best evidenced by the fact that on enlarging the meeting point of the two sections of the tunnel to its full width it was found necessary, for the purpose of future identification, to mark the point of junction with a line of white paint. The temperature in the interior of the tunnel is a subject which continues to occupy much attention. The heat in the middle is tropical—the thermometer marking from 80° to 100° Fah. This is considerably modified during the hours when there is a draught of air through the tunnel. Contrary to what might have been expected, the draught is neither constant nor does it move in one uniform direction. The engineers, when making their observations with a view to determine the deviations of the axis of the tunnel, found that in the morning there was a strong stream of air moving from north to south, from the Göschenen to the Airolo end; so strong, indeed, that they found it advisable to put their shirts on again, although at the time the thermometer showed the heat to be 80 degrees Fah. After a time the draught entirely ceased, and the heat again became extremely oppressive. A little later their work of taking observations was impeded by the draught, which came this time from the Airolo end of the tunnel, and brought with it so much smoke that they could not see the lights at a hundred metres distance. The same phenomenon of a draught from the Göschenen end in the morning, and from the Airolo end in the evening, has been observed several times. The engineers are, therefore, compelled to postpone making the further investigations required to settle several questions of practical and scientific interest until a future opportunity, as the alternating directions of the draught keeps the middle full of smoke from the blasting operations still going on in the enlargement of the sides in both sections of the tunnel.

NAVAL ARCHITECTURE.

LAUNCHES. ENGLISH.

Canton.—On March 27th the *Canton* was launched from the Neptune Works of Wigham, Richardson and Co., at Low Walker. She is 290 feet long over all by 34 feet beam, teak spar deck, and engines of 1100 indicated power. She is intended for a special service in the East requiring a speed of 11 knots. She will carry 2000 tons of deadweight on a very light draught, and nearly 3000 tons of measurement cargo. Her engines, of the builders' own make, are nearly the same, but of reduced size, as the Messageries engines, which are erected alongside in the same erecting shop. The tubes of the condenser are held with contracted screwed ferrules; the circulating pump is double-acting; the starting gear, and also the turning gear, are worked by steam-power; and the boilers are of ample size, and made throughout of steel. The *Canton* is to be commanded by Captain J. C. Jacques, to whose order she has been built, but the owners (with the exception of a few shares allotted to Newcastle) are a few gentlemen of influence in London and Glasgow.

Helen Newton.—On the 25th March, there was launched from the shipbuilding yard of Mr. Robert Thompson, Southwick, Sunderland, an iron screw-steamer, of the following dimensions, viz.:—Length, 240 feet; breadth, 32 feet; depth, 17 feet; about 1300 tons gross. The vessel has been built to the order of Messrs. Newton Bros., Hull, under special survey to class 100 A 1. She is constructed on the two-decked rule; has a full poop extending 30 feet past amidships, with large galley and chart-house, and accommodation for engineers; also full topgallant forecastle for the accommodation of crew, the cabin being fitted up aft for the accommodation of captain and officers, in the usual style. She is schooner-rigged, has iron lower masts, three steam winches, patent windlass, and patent midship steering apparatus; has four cargo hatches and water ballast, together with all the most recent improvements. The engines are on the compound direct-acting-surface condensing principle, with cylinders 28 by 54 by 33 stroke, by Messrs. Blair and Co., Stockton-on-Tees. On leaving the ways she was named the *Helen Newton*.

Titania.—On the 25th March, Messrs. Raylton, Dixon and Co. launched from their Cleveland Dockyard an iron screw-steamer, built to the order of Messrs. C. T. Bowring and Co., of Liverpool and London, and specially constructed for the Atlantic trade, being strengthened in excess of Lloyd's Rules, with large carrying capacity, and in every way fitted for this important branch of trade. The vessel is 275 feet long by 35 feet beam, by 24 feet 6 inches depth of hold, and of a gross tonnage of about 2000 tons. She has main and upper decks of iron, sheathed with timber; water-ballast in after hold and engine-room, and in large chamber in forehold; has four steam winches, and every convenience for rapid loading and discharging of cargo; has steam steering gear on the bridge, and protection for steering gear aft. Accommodation for captain and officers is placed amidships under the bridge. She will be engaged by Messrs. Thomas Richardson and Sons, of Hartlepool, with engines of 170-horse power nominal. On leaving the ways she was christened the *Titania*.

SCOTCH.

Charles Quint.—On March 25th there was launched from Messrs. A. and J. Inglis's shipyard at Pointhouse, the first of a fleet of ten steamers ordered by the Compagnie

Generale Transatlantique for the new postal service between Marseilles and Algiers. She is of the following dimensions: 373 feet and 6 inches by 33 feet 6 inches by 25 feet, and will be fitted by the builders with engines of 2000 indicated horse-power. The vessel was named *Charles Quint*.

Prins Hendrik.—On the 25th March Messrs. John Elder and Co. launched from their shipbuilding-yard at Govan a paddle-steamer called the *Prins Hendrik*, intended to augment the fleet of the Zealand Company trading between Flushing and Queenborough. The dimensions of the vessel are:—Length over all, 300 feet; breadth of beam, 35 feet; depth (moulded) 24 feet 3 inches. Her gross tonnage is 1652, and the engines, which are nearly completed in the yard, are 600 horse-power nominal, and constructed on the builders' compound oscillating principle, with all the newest adaptations. The internal fittings of the vessel will be of the most complete description, with accommodation of 150 and 40 second-class passengers. The *Prins Hendrik* is a sister vessel to the *Prinses Marie* and *Prinses Elisabeth*, built by the same firm.

Soto.—On the 27th March, Messrs. Napier, Shanks and Bell launched at Yoker an awning-decked steamer of about 950 tons, being the first of two constructed to the order of Robert M'Andrew and Co., London, for Messrs. J. Roca and Co., Barcelona. This firm already possess a fleet of nearly thirty steamers, to which the new vessels built by Messrs. Napier, Shanks, and Bell will form an addition, being adapted throughout to the special requirements of their trade. On leaving the ways the vessel was named the *Soto*.

Vanadis.—On the 27th March, Messrs. Ramage and Ferguson launched the *Vanadis*, a steam yacht, of 300 tons measurement, the property of Messrs. Hankey and M'Yer, of London and Liverpool. She will have compound engines of 60-horse power by Messrs. Walker, Henderson, and Co., Glasgow, a steam windlass by Napier Bros., and steam steering gear by J. H. Wilson and Co.

A new steamer, named *Elcano*, of about 1000 tons, was launched on March 31st, from the dockyard of Messrs. A. M'Millan and Son. This vessel was built to the order of Messrs. Olano, Larrinaga and Co., of Barcelona and Manilla, for trading between these two ports, and is in all respects a duplicate of the *Forge Juan*, which Messrs. M'Millan launched a few weeks ago for the same owners. Mr. Rowan, Glasgow, is supplying both vessels with engines, having cylinders 29 inches and 56 inches, with a piston stroke of 3 feet, the first of which is now almost completed, and is expected to have her trial trip early next week.

TRIAL TRIPS.

Copenhagen.—The paddle-steamer, *Copenhagen*, built and engaged by Messrs. Lobnitz, Coulborn and Co. in 1867 for the mail service between Copenhagen and Aarhus, having been found by her owners too small for their rapidly-increasing traffic, has been lately returned to the builders for lengthening by 33 feet, and to receive new boilers and increased passenger accommodation. On Saturday last she went her trial between the Cloch and Cumbre Lights, and easily attained a speed of 16 miles on two consecutive runs. This vessel is the property of the United Steamship Company, of Copenhagen. It was formed in 1867, and has proved so successful that the company has now fifty-six steamers running in different trades and on various mail routes, viz., from Copenhagen to Great Britain, Iceland, Russia, France, Belgium, Norway, Sweden, Holland and various ports in the Baltic, and is the largest steamship company in the north of Europe.

Corebo III.—The new Italian steamer *Corebo III.*, which was launched some weeks ago from the dockyard of Messrs. A. M'Millan and Son, went down to Clyde on March 26th, for a trial of her engines. She had 1000 tons deadweight on board, with which her draught in salt water was 10 feet 11 inches mean. Her engines are compound direct-acting, having cylinders 26 inches and 47 inches, with a piston stroke of 3 feet, and have been constructed by Messrs. M. Paul and Co., Dumbarton. The speed on the mile was 10.287 knots, which was considered by Messrs. M'Millan, the contractors in every way satisfactory. The *Corebo III.* has been built by Messrs. M'Millan to the order of Signor Piaggio, of Genoa, and as the builders have undertaken the delivery of this vessel in Italy, she goes there immediately after adjusting her compasses, under the charge of Captain Greig, of Glasgow.

Litoral.—On the 20th March the new steamer *Litoral*, 600 tons, built by Messrs. H. M'Intyre and Co., Paisley, having completed her equipment in Kingstons Dock, went on trial for the purpose of adjusting compasses and running the usual trip at the measured mile. This was considered satisfactory, the vessel's speed being ten knots, and the engines working smoothly. She returned to Glasgow in the evening to take in coal, preparatory to starting for the River Plate, where she is to be employed in passenger and cargo traffic, for which she has been specially constructed.

THE DOCK EXTENSION AT HARTLEPOOL.—A number of the directors of the Great Eastern Railway Company assembled at Hartlepool on Wednesday last week, on the occasion of the admission of water into the new docks, now in the course of completion. These docks will connect the two harbours, and will enable vessels drawing twenty feet of water to enter at neap tide, and drawing thirty feet at spring tide.

NEW DOCKS AT SWANSEA.—The foundation stone of the new east docks at Swansea was laid on Wednesday. The ceremony was performed by Mr. H. H. Vivian, and a large concourse of spectators assembled to witness it. The Friendly Societies turned out, and the day was one of general rejoicing. After the ceremony a distinguished party sat down to luncheon, under the presidency of Mr. F. A. Yeo, chairman of the Harbour Trustees. Between 600 and 700 were present. Among the guests were the Duke of Beaufort, Lord Aberdare, Mr. C. R. Talbot, Lord Lieutenant of the county, the Earl of Jersey, Mr. Hussey Vivian, Mr. Dillwyn, and the principal nobility of the county.

RAPID PASSAGE TO AUSTRALIA.—The steamer *Sorata*, whose arrival at Adelaide has been announced by telegraph, left Plymouth at 1 p.m. on Feb. 21st, calling at St. Vincent to coal on the 28th. Leaving St. Vincent on the morning of Feb. 29th, she reached Table Bay on March 12th, sailing

again on the 13th, and arriving at Adelaide on the morning of the 30th. Allowing for the difference of longitude, the total actual time occupied in the voyage was 37½ days, and the steaming time 35 days 20 hours. The *Sorata* is 4014 tons register gross; she was built and engaged by Messrs. John Elder and Co., of Glasgow; is owned by the Pacific Steam Navigation Company of Liverpool, and forms one of the Orient Line of steamers running fortnightly to Australia.

THE COMING WAR SHIP.—Prof. Loewenthal, a German, thinks that the coming war ship will be made of indiarubber. His idea is to make the entire hull of rubber one foot in thickness, strengthened below the water line by a light steel frame. The vessel will be driven by an ordinary steam engine, and will have no masts. At the bow will be a projecting spar, to which torpedoes will be affixed, and the entire crew, including the helmsman, will be on the lower deck out of the range of shot. When a cannon ball strikes the indiarubber ship, it will pass directly through it above the heads of the crew, and the hole made by it will instantly close. Paying no attention to such futile attacks, the indiarubber vessel will steam toward her adversary and explode her torpedo. The doomed vessel will instantly sink, whilst her elastic destroyer will be driven hundreds of yards backward by the recoil following the explosion. Such a vessel, says the inventor, could destroy all the navies of the world, and after her work was done she could be made as strong as ever with the aid of two or three bottles of cement.

THE BALTIC AND NORTH SEA SHIP CANAL.—According to the plans prepared by Herr Dahlstrom, to whom a preliminary concession for the enterprise has been granted, the proposed ship canal from the Baltic to the North Sea will be traced from the Bay of Kiel to Brunsbüttel, in the estuary of the Elbe. Its depth throughout is to be 20 feet 9 inches; its width at the surface of the water 160 feet, and at the bottom 64 feet, the banks consequently having a very gentle slope. Provision will moreover be made, by the adoption of a peculiar system of locks and reservoirs, for increasing the depth of the water, to 25 to 26 feet, whenever it may be desirable to do so; and this depth will allow of the passage through the canal of the heaviest German ironclad afloat—the *König Wilhelm*, a vessel of 9603 tons displacement, and the largest ship in the German navy, drawing only 26 feet. The canal can, it is calculated, be completed in six years, and will, it is estimated, cost £3,750,000, or about two millions and a quarter less than the estimates made a few years ago of the cost of constructing a canal 31 feet deep and 224 feet wide at the surface of the water. In size, it may be added, the proposed Baltic and North Sea Canal does not compare unfavourably with the Suez Canal, the width of this at the surface of the water being 172½ feet, the width at the bottom 70 feet, and the depth about 26 feet 3 inches.

THE NEW CORVETTES.—It is satisfactory to hear that the *Comus*, the first of the so-called "C" class of unarmoured corvettes commissioned for service on a foreign station, has proved herself during her passage to the Cape, touching at Ascension and Tristan d'Acunha, to be an excellent sailer. In these vessels, of which six—namely, the *Comus*, *Constance*, *Champion*, *Carysfort*, *Conquest* and *Coroaca*—have been already completed, while two more, the *Canada* and *Cordelia*, are now being built, facilities for keeping the sea for long periods have not been sacrificed for the sake of high speed; but at the same time they are provided with sufficiently powerful engines to drive them at a very fair speed through the water. Their engines, namely, work up to 2300 indicated horse-power; while the engines of such old corvettes as the *Challenger*, which has almost exactly the same displacement as the *Comus*, can only develop 1261 horse-power. Of moderate size—their displacement is 2385 tons—armed with two 7-inch guns, which throw a projectile with a velocity sufficient to penetrate eight inches of armour; of great structural strength; with an armoured deck three feet below the water-line, and fitted with a ram and arrangements for discharging Whitehead torpedoes below the surface of the water, it was universally admitted that the new vessels would be an exceedingly serviceable class of ships for service on foreign stations, provided they proved to be good sailers. That this is the case may now be taken to have been demonstrated by actual experience.

AMERICAN INTEROCEANIC CANAL.—The corps of engineers left at Panama by M. de Lesseps, having finished some office work pertaining to the proposed canal, resumed work in the field on the 24th of February as follows, under the direction of Mr. P. J. Sosa, of Panama, chief of the corps:—To make new levels of the line of the railroad, to serve as a basis for the execution of the work, and to complete everything relating to its topography; to continue the series of borings already commenced, and to make others wherever they may be considered necessary; to continue the series of observations on the tides; to make transverse profiles, and, as far as time will permit, to take the longitudinal profile of the corrected line for the canal. As the possibility of constructing a canal on the isthmus has already been scientifically demonstrated, the present labours have no other purpose than to revise the preliminary surveys, with a view of reducing the estimate of work necessary, and the consequent expense, as is usual in undertakings of this class. The amount of excavation necessary, as fixed by the International Commission, was put at the highest figure, and it is believed the further surveys now in progress of the neighbourhood of Culebras, which is the most expensive of the route, will result in a reduction of the estimates, particularly when all the details of the topography of the region are known. M. de Lesseps, in the statement he made on the 8th of March before the select committee of the United States House of Representatives, said that the company would be controlled by its stockholders, like any other business enterprise. There was no official control by any Government contemplated. If a majority of the stock of the company was subscribed for by United States citizens, the head-quarters of the company might be placed at New York, Washington, or elsewhere. That was allowed by the concession. The assembly of shareholders would be sovereign, and could dispose of that question. The clause declaring that the judicial decisions in regard to the canal shall be at Paris, and that the Courts there shall take cognizance of all questions that shall arise, was inserted, he said, merely to cover the case of any question arising among the stockholders, but was not intended to effect any governmental question touching the canal.—*New York Times*.

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CORRESPONDENCE.

THE BURSTING OF A 100-TON GUN.

To the Editor of IRON.

SIR,—With your permission I will make a few remarks on the bursting of the 100-ton Armstrong gun on board the *Duilio*. It is not my intention to criticise the way in which the gun was built up, but to draw attention to a most important question with regard to guns made on any form of what is known as the "Coil System." The question is: what experiments have been made to find out the force of contraction exerted by good wrought iron during the period of cooling down from a high temperature? There have been a great variety of experiments carried out, with different kinds of metal, but all these experiments have been made only to try the various tensile strengths, and also the resistance to crushing. But how very rarely do we see or hear anything on the contractile forces exerted by metals during the period of cooling down. Now this is the very point or question of all others to which most attention should be given in the manufacture of heavy ordnance on the coil system. The gun which burst on board the *Duilio* ought to afford a lesson to those interested to devote a little more attention to this question. In this gun, the contractile force of the coils on each other was the only, or nearly the only, means of keeping them in their proper places. For they were not made with grip ends. Now as regards the question of what experiments have been tried to test the force of contraction exerted by metals during the period of cooling, there may have been some minor ones; but what is the use of minor experiments in this direction? It is a very different thing to test the force of contraction exerted by a bar of wrought iron one inch square, and to test and find out the force exerted by the contraction of a coil of wrought iron say twelve inches square. Has any experiment on a large scale ever been tried? If not, is it right to go on making guns on the present system and yet have no certain information as to what are the various resisting forces contained in the gun. It is very well to say that the various wrought-iron coils are in a state of tension around each other and the steel tube, but what is the exact amount of tension present? Some may ask what does it matter as to what is the exact amount of tension present? It matters a very great deal, and for the reason that if the coils are in too great a state of tension it is quite as bad as their being too loose; for if they are at a such a state of tension as to be at all near their breaking strain, the shock to the gun on being fired may cause them to rupture. If the coils are too loose, the steel tube being unsupported gives way, and the sudden shock of its doing so may rupture the wrought-iron coils. In fact, it is to the last degree important that more attention should be given to this question of the force of contraction of metals during the period of cooling down from high temperatures. Some attention has no doubt been given to cast iron in this respect, but it is (even in this case, I fear) rather perfunctory, the chief attention having been given to the mere question of preventing castings breaking owing to unequal contraction. But this is very different to a long and thorough series of trials and experiments with various brands of good wrought iron.—I am, &c., M. E. P.

March 29th.

NOTICES OF BOOKS.

Oesterreichisches Montan-Handbuch für das Jahr 1880. Wien: Manz.

THE Austrian Ministry of Agriculture deserves the thanks of all those who, from scientific or commercial motives, wish to form an idea of the actual condition of mining in the dominions of the Austrian emperor. The "Montan-Handbuch," which is published at the beginning of the present year, is substantially a list of mining undertakings throughout the empire; but, although it is merely a catalogue, the

information given is so full and extends to so many articles that it is within its own limits a model of completeness. It is a visible proof of the excellent organisation of the official service of mining engineers. The principal groupings are those of the mining districts overseen by the State inspectors appointed to them. The districts comprise, and are coterminous with, certain sub-groupings of provinces. In each province each mining undertaking, even when, as in the case of several graphite mines, the working staff consists of one man only, is entered on the official register, with number of galleries, names of owners and engineers and a detailed catalogue of the appliances existing at each mine. This year the number of hands employed in each undertaking is given. We rather regret that all totals and summaries, as well as all the statistics of production, are in the hands of a separate department, and form the subject of a separate publication. We note that there are seven mining associations in Austria and eight mining schools. The latter are situated in Leoben, Styria (144 students); in Příbram, Bohemia, with 27 students, while there is a lower school with 48 students; Wieliczka, Galicia (11 students); Leoben, Styria, (a lower school with 21 students); Klagenfurt, Carinthia (12 students); Mährisch-Ostau, Moravia (17 students); and Dux, Bohemia (13 students).

Scientific and Practical Geometry. By ROLLA ROUSE. London: Maxwell and Son.

WE do not think the author would have done the world much service had he succeeded in his attempt to give to the science of geometry the practical complexion which he thinks it alone ought to wear. The tendency of the present age is to regard science as merely the handmaid to the material uses of life, and to resolve the generalisations of past thinkers into a mass of concrete particulars capable of immediate material applications. The author, because Euclid is not at once and directly a land surveyor and artillery, renounces the methods of the Euclidean geometry while retaining the truths revealed by it. We have read one or two of the new proofs given of truths established for all time by the great Greek geometer and find them extremely clumsy and involved, and, of course, unintelligible. To give some idea of practical geometry before entering on abstract investigations of the relations of figures is not necessarily an innovation on Euclid, and is now commonly practised in good schools. It is quite another matter to "adopt parallels as the scientific base, and from that base to deduce all the leading propositions in geometry," with a view to harness them at once to problems in mensuration.

Wave and Vortex Motion. By THOMAS CRAIG, Ph.D. (Van Nostrand's Science Series, No. 43.)

Linkages. By J. D. C. DE ROOS. (Ditto, No. 47.)

Theory of Solid and Braced Elastic Arches. By WM. CAIN, C.E. (Ditto, No. 48.)

On the Motion of a Solid in Fluid. By THOMAS CRAIG, Ph.D. (Ditto, No. 49.) London: Trübner and Co.

FOR the reading of works of abstract science there seems to be growing up a popular taste in America which will give to the general American public one point of contact with that of France. The four little volumes, the titles of which are above given, form part of a long issue of works on science which Mr. D. Van Nostrand, of New York, finds it profitable to continue. They are limited in extent, and succinct in treatment; but no effort is made to popularise them, in the ordinary sense of the word, while they are free from any colouring of specialism. It is impossible to discuss hydrodynamics without reference to what we are pleased to term the higher mathematics, and a familiarity with trigonometry and analytical geometry is accordingly taken for granted by Dr. Craig in his two works (Nos. 43 and 49 above). The latter form a compact course of hydrodynamics, in which are discussed the more important points in the mathematical theory of fluid motion.

M. De Roos' work is substantially an examination of Peaucellier's rhombus, in which prominence is given to the direct practical application of the invention, such as the tracing of conic sections, rather than to its uses in applied mechanics. This essay first appeared in the *Revue Universelle des Mines*. In its present form it is capable of improvement on revision.

A claim to originality is made on behalf of part of his work by Mr. Cain, who states that the methods given in it apply to any style of arch loaded in any manner, the treatment laid down for the solid arch being more thorough and general than it has received before. Exact and new solutions are given of certain cases of the vousoir arch, and a correct graphical determination of temperature strains and of the arch hinged outside of the centre line are supplied for the first time.

Annuaire de l'Académie Royale de Belgique. 1880. Bruxelles: F. Hayez.

THE present is the forty-sixth year of publication of this official annual, which is interesting from a good many points of view. It contains, in addition to all official information, a full and excellent biography of Ernest Quetelet, who died at Ixelles on September 6th, 1878, after twenty years of assiduous work spent on re-cataloguing the stars; and a notice of Felicien Chapuis, whose contributions to biological science are well worth the details given concerning them.

NEW BOOKS.

Artistic Conservatories and Other Horticultural Buildings, Designed on the Patent System of Messrs. Messenger and Co. By E. W. Goodwin and M. B. Adams. 8vo. Batsford.

Export Merchant Shippers (The) of London, Manchester, &c. 1880. 8vo. Dean.

Handbook (A) of Pottery and Porcelain. By H. M. Westropp. Chatto.

Instances of Accessory Art. By L. F. Day. Folio. Batsford.

Treatise (A) on the Theory of Determinants and their Application in Analysis and Geometry. By R. F. Scott. 8vo. Cambridge Warehouse.

FACTORY NOTES.

THE TIN TRADE.—The Cornish smelters have reduced the tin standards £3 per ton. The standards now are—Superior common, 84s.; superior fine, 85s. per cwt.

THE ATLAS WORKS, COLENE.—Messrs. Hunt and Tawell's new catalogue of agricultural implements has just been published in a very neat form. The machines made by this company are very numerous, they are generally simple in design, and thus less liable to get out of order; and the firm claim that the utmost care is taken in their manufacture and in the quality of the materials used.

CHARGE OF FRAUDULENT BANKRUPTCY.—On Wednesday, at the Wolverhampton Quarter Sessions, before Mr. Rupert Kettle (Deputy-Recorder), Thomas Brookes, iron-hurdle manufacturer, was convicted of fraudulent bankruptcy. Just before filing his petition he concealed a large quantity of iron in some pit shafts, and paid money and gave mortgages to relatives. He was sentenced to nine months' hard labour.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending 27th March:—On Monday, Tuesday and Saturday (free), from 10 a.m. to 10 p.m., Museum, 12,168. Mercantile Marine, Building Materials, and other Collections, 2309. On Wednesday, Thursday and Friday (admission 6d.), from 10 a.m. till 5 p.m., Museum, 1084; Mercantile Marine, Building Materials, and other Collections, 47. Total, 15,608. Average of corresponding week in former years, 15,698. Total from the opening of the Museum, 18,790,484.

ANGLO-AMERICAN ELECTRIC LIGHT.—The company which is now established at 74, Hatton Garden, is prepared to receive orders for the supply of electric light by apparatus on the Brush system, for use in factories, railway stations, docks, and other suitable establishments. The Brush system is very extensively employed in the United States. The company is also open to receive applications for licenses, either from corporations or private individuals, or to enter into negotiations for the introduction of their method in the British colonies.

THE EMPLOYERS' AND WORKMEN'S ACT.—At Consett Petty Sessions on Monday, twenty-two lads were charged with a breach of the Employers' and Workmen's Act. Last week the Defendants, who are potters, employed at a colliery belonging to the Consett Iron Company, resolved to restrict the number of shifts to eleven per fortnight, and one of their number having been called on to work twelve, the whole struck work, which caused 450 more men to become idle for three days. Seven of the defendants were ordered to pay 80s. each compensation and costs, but the charges against the other fifteen were withdrawn, they having expressed their regret.

SUBSIDENCE OF GROUND FROM MINING OPERATIONS.—At Lindal, on the Furness Railway, a railway bridge has dropped several inches, owing to the subsidence of an iron mine. The engineer of the company, however, has filled up the workings, and taken such precautions on the surface by means of girders, &c., as will ensure the safety of the traffic. A large subsidence of ground occurred near Crowgarth pit on Thursday last about eleven o'clock. The ground over which the old Cleator and Egremont branch line of railway is laid went in suddenly, taking with it two waggons of iron ore which were standing at the place at the time. Fortunately no other damage was done. The shrinkage has been caused by working for iron ore beneath.

HEAVY LOSSES ON WORKING A COLLIERY.—The directors of the Thorpes Gawber Hall Colliery Company have just issued their annual report. The company, it may be stated, work two large collieries near Barnsley. The statement of accounts, which has been audited, shows a loss on the half-year's workings of £4258 1s. 3d., which, with a deficit on the previous half-year, shows a deficit on the year of £9974 9s. 5d. The company have paid £24,751 6d. in wages, stores, &c., and had in the same period received for coal sales only £20,616 18s. 3d. The report then goes on to show how these figures are made up, and concludes by stating that notice is given to cancel, according to the Companies' Acts 1867 and 1877, the sum of £52,477 lost or unrepresented by available assets; also as to other means to raise additional capital. The state of the coal trade in this district is vividly shown by this statement.

CHARLES CAMMEL AND COMPANY (LIMITED).—The sixteenth ordinary general meeting of this company was held at the company's offices, in Sheffield the 31st ult. Mr. Wilson having taken the chair, Mr. Robinson, the secretary of the company, read the usual notice convening the meeting. The Chairman in his address alluded to the depression which had prevailed during, at least, nine months out of the twelve to which the accounts applied, and the improvement in prices consequently had not been felt to any very appreciable extent. The prospects of a better return during the current twelve months were decidedly cheering, and, although it was undesirable for him to indulge in prophecy, he believed a more satisfactory result would be shown when the shareholders again assembled. The usual resolutions approving of the declaration of a dividend after the rate of five per cent. per annum, free of income tax, inclusive of the instalment on account of dividend paid in October last; the accession of Mr. John Whitehead, of Manchester, and Mr. Henry Edmund Watson, of Sheffield, to the directorate; the re-appointment of three directors retiring by rotation (Mr. T. Vickers, Mr. A. Peck, and Mr. T. Dymond); and the re-appointment of Messrs. Adamson and Collier as auditors for the current year, were unanimously passed, and a cordial vote of thanks to the directors and officers of the company concluded the proceedings. The meeting was well attended, and undisturbed harmony prevailed throughout.

STEAM BOILER EXPLOSIONS.—At the annual meeting of the Manchester Steam Users' Association, held on Tuesday last week, Mr. Hugh Mason, the president, moved the adoption of the report, which was seconded by Mr. Samuel Rigby, Warrington. Attention was called to the fact that the association was not established for profit; that it had no shareholders, and paid no dividends; but that it was carried on for the public good, to prevent the sacrifice of human life from steam-boiler explosions; and that, through faithful periodical inspection, its members enjoyed practical immunity from more explosions. It was stated that the association had more boilers and more engines under in-

spection than at any previous time. During the year 1879 there had occurred throughout the country 25 explosions from steam boilers, killing forty persons, and injuring 52 others; added to which there had been 22 miscellaneous explosions from the bursting of keirs, kitchen boilers, &c., killing 15 persons and injuring 36 others. There had also been an explosion from an economiser or feedwater heater, which was the eleventh the association had recorded; and as most of these were attended with violence, and some with fatal consequences, it was recommended that economisers should be placed periodical inspection as well as boilers. Mr. John D. Hutchinson, M.P. for Halifax, moved, and Mr. John Ramsbottom, C.E., late locomotive superintendent, London and North-Western Railway, seconded a resolution, stating that the association considered it imperative that the Government should interfere and enforce the general adoption of competent inspection by local boards formed by steam users themselves, or by private voluntary inspecting agencies duly authorised and registered, and that there ought to be an inquiry in the case of every explosion. This resolution was carried unanimously.

AMERICAN GLEANINGS.

AMERICAN IRON IMPORTS.—Upon inquiry at the Bureau of Statistics we learn that the imports of iron ore into the country for the six months ending December 31st, 1879, were 180,721 tons, and for the month of January, 1880, 32,366. This is at the rate of over 300,000 tons a year.—*Iron Age.*

CREMATION.—The body of the late Dr. Hahn was cremated at Washington, Pennsylvania, on the 9th of March. A slight odour, as of burning hair, pervaded the vicinity. In twenty minutes the bones of the feet could be seen devoid of flesh. At the end of an hour the friends went away perfectly satisfied. Orders were given to have the ashes sent by express to New York.—*New York Times.*

A COSTLY BRIDGE.—The total cost of the Brooklyn (New York) Bridge, up to the present time, including the land damages and the purchases of real estate, has been over \$11,500,000. Deducting everything except the cost of actual structure, the outlay on the bridge has been about \$3,000,000. The original estimate of the expense made in 1867 was \$7,000,000. Its central span across the East River, from tower to tower, is 1595 feet long.

WAGES SLIDING SCALE IN AMERICA.—The Pittsburgh rolling-mill proprietors and certain of their employes have, with one exception, finally agreed upon wages scale for scrapping, knobbing, rolling and shingling. The exception is the plate and tank-mill scale, the consideration of which has been postponed indefinitely. The basis of the scales adopted is upon \$10 for 24-gauge at 3½ cents card rate for finished iron and the wages will go up or down as the card-rate changes. The average advance in wages since the revival of the iron business has been, it is said, 45 per cent.

A MINE OWNER'S MISTAKE.—A man, now a prominent merchant of Virginia City, won at poker an undeveloped gravel claim near Nevada City, worth in the neighbourhood of \$200. His friends had the laugh on him for several days regarding his "investment," and asked him what proportion of the taxes he would pay in case they accepted the property as a gift. He finally got mad at their incessant galling, and told them they would see he was not such a fool as they took him for before he got through with that mine. He then wrote to some capitalist acquaintances that he had a claim worth a fabulous sum, which he would sell for \$2,000, being hard pressed financially. The bank was next visited, \$500 worth of gold dust and nuggets bought, and the claim thoroughly "salted." When the intending purchasers arrived they prospected the ground a little, and panning out was attended by big clean-ups. They paid the \$2,000 the same day, and got possession of the ground. Work was at once begun, and they took out \$8000 inside of three weeks. The "salter" was so taken aback that he did not smile for a month, and the parties to whom he confided his shrewdness at the time of its perpetration, never meet him to this day but they ask him if he has another gravel mine to sell.—*Nevada Transcript.*

MINERALS IN THE UNITED STATES.—Mr. Davis, of West Virginia, chairman of the Congressional Committee on Appropriations, presented to the United States Senate on the 5th of March a letter from Clarence King, director of the geological survey, to be printed in connection with the joint resolution authorising the extension of the survey. The communication is a reply to several inquiries made by Senator Davis. Mr. King says:—"Practically the States are not keeping up their surveys. A few states have lately made re-surveys, but to-day there are not eight active State surveys, and not one in the territories. After seventeen years of continuous service on State and Government surveys, I am firmly of the belief that the mineral wealth of the country will never be reasonably well known till studied by a national survey. With the understanding that the passage of the resolution under consideration will leave the geological survey free to work, not only (as at present) over the public lands, but over the whole United States, and to study its whole economical geology, I answer confidently that I shall be able to make an incomparably better series of reports on the mineral resources and products of the whole country than is possible under existing law. To-day the Government and the people do not know within a hundred million dollars the annual value of our mineral product. It would, in my opinion, be the duty of the geological survey to present a yearly volume giving a statistical analysis of all mineral products. Unless the advance of our industries shall be checked by some unexpected cause, we are likely, within a few years, to reach an aggregate mineral yield of \$1,000,000,000 yearly, and the passage of the joint resolution will enable the survey to familiarise the country with all the features and bearings of this great source of wealth and power, to keep pace with and report the facts of its rapid progress by the prompt publication of correct information, to actually and directly aid in its development, and promote the wise and guarded influx of foreign capital. Briefly and finally, in my belief, the question of the passage or defeat of the resolution under consideration is the question whether it is or is not desirable and

needful for the people of the United States to thoroughly know the nature, extent, and uses of their mineral possessions."

THE LABOUR DIFFICULTY IN THE UNITED STATES.

The Philadelphia correspondent of *The Times* writes as follows on this subject:—"The uneasy movement of the working classes in the United States consequent upon the advance in prices and demand for goods continues. Strikes and movements for advanced wages are numerous. The piano-makers' strike in New York is going on. They want 10 to 15 per cent. advance for the different trades engaged in that manufacture, and have refused a compromise offered at a lower rate of advance. The threatened "lock-out" in this trade will begin this week if the dispute is not settled. A strike of cabinet-makers and carpenters has also begun in a large New York establishment. The New York marble polishers demand an advance from \$1 75c. per day to \$2, about 150 men engaging in this movement, most of whom have already obtained it. The journeymen lathers of New York have struck for 25 per cent. advances. About 300 men belong to this trade, and this will seriously inconvenience the builders who are entering upon contracts for spring work. The stevedores on East River piers, New York, last week struck against an attempt to reduce their wages, and the employers abandoned it. They are getting 40 cents an hour for loading and unloading vessels. The strike at Cohoes, New York, among the cotton-spinners for 10 per cent. advance continues, and the employers are firm in their refusal to grant it. The brush-makers of Lansingburg, New York, have succeeded in getting the advanced wages demanded and have returned to work. The painters at Troy, New York, will advance wages 50 cents per day on April 1. A strike at the Troy nickel-plating works has caused a conflict, in which a workman was so badly wounded by the strikers that he has since died. At Fall River, the Board of Trade of the millowners have determined to advance all wages 10 per cent. on April 1. This is done to avoid a strike, for the operatives have already started a movement to get 15 per cent. advance, the petitions for which are addressed to the respective mill-owning corporations, and ask an answer by March 12. At least 20,000 operatives are affected by this movement. The uneasiness is also shown among the metal-workers and colliers. The 200 hands employed by the Bayonne, New Jersey, zinc works have struck for 10 per cent. advance, and it has been conceded. At Beaver Falls, Pennsylvania, the cutlers are on strike for 15 per cent. advance. I have already reported the general advance conceded to the many thousands of workmen employed in the iron and steel trades at and near Pittsburgh. The rail mill at Allentown, Pennsylvania, has been shut because of a strike for 10 per cent. advance, and 200 men are thrown out of work. At Birdsborough, Palo Alto, and other furnaces in Eastern Pennsylvania, there have been strikes resulting in about 10 per cent. advanced wages, and considerable uneasiness is reported among the workmen in iron mills in other parts of this State. Two hundred moulders at Reading ask 25 per cent. advance. There is a general strike among the colliers in the Clearfield coal region of Pennsylvania, which curtails the output of bituminous coal. This strike affects about 7500 colliers at present, and they are endeavouring to secure the co-operation of the men in adjacent regions, notably the Westmoreland coal district, which if they succeed will make a strike among 20,000 colliers. The coalowners are firm, saying the condition of the market does not warrant increased wages at this time. This strike has caused a riot near Osceola, in which one man was killed and two wounded. At Fairmount, West Virginia, 800 colliers are also on strike, and strikes are reported at neighbouring coal pits. It will be seen that the movement for advanced wages is general, covering all classes of labour. In many trades advances are already conceded, for business is too prosperous for employers to think of stopping work. A curious illustration of the strike mania is recorded in the *Iron Age*, as one of the many examples now occurring in Pennsylvania. The coal miners at Houtzdale are now on strike for an advance of 10 c. per ton, and this is resisted by the masters on the ground that there have been in this one locality nine strikes in three months. First the men struck for the appointment of their own checkweighmen, stating their belief that they were being cheated in this respect. This was granted with the proviso that the men should pay their own checkweighman. Strike 2 was to insist upon this official being paid by the employers, and was also won by the men. Then the miners struck for an advance of 25 c. per day, which was conceded, followed by a fourth strike on the part of the trappers for an advance of 10 c., a fifth by the miners themselves, a sixth by the drivers again, who demanded another instalment of 25 c., and also a ten hours' day. All these points have been won by the men, and the masters have now declined to move a step further in concessions, declaring that it would be less ruinous to themselves to make a present of the pit to the men than work it under such disastrous conditions.

THE LABOUR MARKET.—On Monday last a meeting of ironworkers' representatives from South Staffordshire, East Worcestershire, North Staffordshire, Warrington, Shropshire, South Yorkshire and Lancashire, was held at Wednesbury to consider the formation of an association. 20,000 operatives were represented. Twenty lodges have been established already. It was resolved to form a society, entitled the "Associated Iron, Steel and Tin Workers of the Midland Counties." The object is to afford mutual trade protection and social benefit. The subscriptions are regulated by the price paid for puddling. The Association, it is hoped, will act in concert with the northern union. The wages dispute in the Sheffield file trade, which has now lasted several months, has been settled by the masters, agreeing to the workmen's demand for the advance of 10 per cent., to take effect on the 1st of May next. A manifesto has been issued by a section of the Durham colliers, condemning the doings and management of the officials at the Miners' Association. They say thousands of men are refusing to contribute to the Association, owing to the absolutism of its officials, and appeal to their fellow-workmen all over the country to break the fetters with which they are at present bound by establishing a separate association.

IRON AND COAL TRADE REPORTS.

BARNESLEY AND SOUTH YORKSHIRE.—There is not much change to note with respect to the iron trade of this district. Since our last notice the works devoted to the make of manufactured iron have been to a great extent closed by the holidays, consequently the output of merchant iron has not been so large. The furnaces, on the other hand, have been kept in full blast, and a good tonnage of pig-iron has been turned out. There is a large tonnage of Lincolnshire iron ore received into the district, which, in some cases, is mixed with ironstone got from the native beds. Makers of Bessemer steel (thres rails and axles are doing a good business, which enables the works to be run full time. The position of the coal trade is a very perplexing one, and as the year advances it appears to become even more depressed than it was a month or two ago. The London trade, on which the coalowners have in a great measure to depend, is very quiet, the district coalowners being almost shut out from the metropolitan. It is stated, on good authority, that seaborne coal from the north has of late been offered on the London Coal Exchange at little more per ton than is demanded by the railway companies for tonnage rates and waggon hire, so that if they were prepared to give the coal away their success would be questionable. The feeling is getting stronger daily that something extraordinary will have to be put forth either to provide an independent route or some relief from the existing rates. The state of trade, so far as regards house-coal for the eastern counties and other places, is very quiet indeed. Steam-coal is in better request for shipping purposes, and a good tonnage is being sent via Doncaster to Hull and Grimsby, which has the effect of making the returns at that junction pretty fair. Small coal and slack is in only moderate request, at low prices. A fair tonnage is being dispatched to the Yorkshire and Lancashire manufacturing districts. A progressive business is being done in coke, prices of which hold very well up. The output is being increased on all hands. The Thorpe Gawber Hall Collieries (Limited), have expended during the past half year £1154 11s. 10d. on 22 coke ovens, sidings and tramways; are still busy erecting more. Although the company received £2116 for coke, together with £6314 15s. 10d. for steam-coal, £3710 17s. 4d. for house-coal, £6618 14s. 5d. for engine-coal, £1019 1s. 11d. for gas-coal, and £835 17s. 5d. for smudge, it lost £4258 1s. 3d. on the half-year's working, or nearly £10,000 on the year's transactions. This may seem heavy, but it is said that there are collieries in the district on the working of which £30,000 were lost last year, whilst the present period is declared to be fully as disastrous. The district, so far as the labour market is concerned, is pretty quiet. The old hands which struck work at the Monk Bretton Colliery in September, are seeking an interview with the manager, who turns a deaf ear to their supplications, having sixty or seventy non-unionist men at work. The miners' unions are having a quiet time of it, the pits only working three or four days per week; few men care to pay their subscriptions. The Hemsworth Fitzwilliam Main Colliery has been turned into a limited liability company, with a capital of £10,000. The pit has been sunk but a few years, and formerly belonged to Mr. Fosdick, who is still retained as commercial manager with a thorough knowledge of the trade, being a noted coal merchant.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—A good inquiry is experienced for all qualities of hematite pig-iron; and makers, who all along have been well employed and still have large contracts in hand, are confidently anticipating a revival in the demand so soon as the elections are decided, and so soon as business men can again find time to devote themselves to buying and selling. The spring season has opened under the best of auspices, for already a large number of large steamers and ships have come into Barrow to take away a considerable tonnage of pig-iron and steel to America, Australia, the Continent, and elsewhere. There are indications that great activity will prevail during the whole of the season, industrially speaking, as very large deliveries have to be made, not only on foreign but on home account. There is a considerable request for Bessemer iron from makers of steel; and forge and foundry iron are again finding more favour. The fall in the demand noticed a few weeks ago has given way to a rather more active market, as was expected when the shipping season was fully opened; and prices have to some extent returned to late quotations. The demand for iron ore is well maintained at from 25s. to 30s. per ton, and many raisers have sold forward to the end of the year the output of their pits. Bessemer qualities of iron are worth £5 12s. 6d. per ton, and some makers are asking £6; forge-iron of No. 3 quality is selling at £5 7s. 6d. per ton at mines, but chiefly for forward delivery. The steel trade is probably the best-employed branch of industry in the district; for not only are orders largely held for rails, but merchant qualities of steel are in considerable request, and in many instances makers are behind with their deliveries. Engineers and shipbuilders are still fairly employed, and are negotiating for new contracts. Shipbuilders are in receipt of a large number of orders, but do not yet employ their full complement of workmen. There is still a large number of skilled and unskilled workmen finding their way to this district in search of work; but, although local works are fully employed, there is a too plentiful supply of workmen.

BIRMINGHAM.—This has been altogether a broken week in the leading branches of local industry, two distinct causes operating simultaneously in diverting the usual course of business operations. In the first place the Easter holidays have been very generally kept throughout the district, the engines in the majority of the important works having been stopped during Monday and Tuesday, while in some cases work has been literally suspended for the whole of the week. The elections, too, have had a material influence in checking trade operations, quite as much in reference to effecting sales as in carrying on the work of manufacture. Factors and merchant's travellers report that they have rarely experienced so much difficulty in obtaining orders, and, in some cases, so hopeless has been the outlook, that they have come off the ground until the elections are over, con-

vinced that it is a mere waste of time to solicit orders while principals are so engrossed with local political matters, as to have neither time nor inclination to inspect patterns or make up orders for the replenishing of stocks. The result has been that so far as the home trade is concerned, the new orders booked by manufacturers of finished goods have been few in number, and limited in extent. The slight improvement recently reported in the orders coming to hand from the building trade has to a large extent died away, immediate requirements appearing to have been fully met. A check has also been experienced in the furnishing ironmongery branch. In few, if any, of the family goods departments is there any special activity so far as the home trade is concerned, and in several there is a complaint of orders being badly wanted. A somewhat improved demand for curtain hooks, safety pins, furniture nails, and other small goods is reported alike for home and export, considerable quantities being required for the French market just at present. A better demand has also been experienced for horticultural tools, consequent upon the favourable weather of late, and there has been a very fair run of orders for travelling boxes. In the export trade generally, the quietude which ordinarily characterises the close of the quarter has been very distinctly manifested, but local manufacturers have nevertheless some fair orders in hand for the leading South American markets and the Cape, while a better run has marked recent Australian orders, and it is confidently anticipated that we are on the eve of an important and much-needed revival of trade in this leading colonial market, the depression in which has so seriously affected many industries for some time past. The West India mail to hand this week has also brought a very fair supply of orders. For the Eastern markets and Australia, some local engineers and machinists have been fairly busy, and have just completed for the latter some large hauling and other engines. Tube manufacturers are fairly well engaged on old contracts for export. New business is only limited, but orders are dropping in from Canada, South America and the Australian colonies. For the Cape saddlery and harness manufacturers have been busily employed. The result of the recent tenders for Government hardware contracts for army and navy store purposes has been fairly satisfactory to manufacturers in this district with whom a fair proportion of the contracts have been placed, although work on this account has not yet been commenced. As usual, during the Easter holidays, a number of firms are engaged upon repairs, renewals and extensions, but the work in this direction is scarcely up to the ordinary average. The Birmingham Hollow Ware Company, of Lancaster Street, manufacturers of cast-iron saucepans, oval and round pots, kettles, &c., reduced all discounts on Wednesday 5 per cent. from the gross, and all other makers of the same class of goods have adopted a smaller course. The condition of the local iron trade has not been so strong within the last week or so. Orders in some branches are running out, and there is considerable difficulty in placing orders on the books to a like extent. The sales effected at something under makers' prices by middlemen have assisted in weakening the market, but the existing depression is believed to be purely of a temporary character, and manufacturers are increasing stocks as they confidently look for better trade as soon as the election excitement is over, and the advent of the coming quarter-day has settled prices. There have been plenty of enquiries from the colonies and South America, but buyers are also waiting the result of quarter-day before closing transactions. No alteration in the standard for marked bars is anticipated at present, but in some descriptions of unmarked iron the present low prices are likely to be advanced. Galvanisers are hopeful in view of the improving aspect of the Australian market, and the demand for the better makes of pig-iron continues active with firm quotations.

THURSDAY EVENING.—Very few buyers present at 'Change to-day, and enquiries made led to scarcely any transactions. Eagerness to sell manifested; but not quotable reduction announced. General tendency of unmarked iron easier, this was partially due to the reduction of one shilling per ton in Lord Dudley's coal, which governs market. Slack reduced sixpence, and colliers' wages' threepence per day. Marked iron steady. It is understood no alteration from list price of £9 for bars will be made on quarter-day, Thursday next. Merchants, however, are receiving orders. Pig-iron firm, and foundry goods are rising in value. Messrs. Kenrick and Sons, of West Bromwich, notified to-day a reduction of 5 per cent. in discounts on tinned and enamelled hollow ware and butt hinges, and also that they had ceased manufacturing shoe bills and various kinds of cast nails. Other manufacturers have taken same step.

CARDIFF.—It is a gratifying feature in the position of the iron trade here that the great works continue to strain their appliances to meet their demand. The Elba Vale Company is busy in every department, without exception, full power returns being exacted from them all, the same is true of the Rhymney Iron Company which is lighting new furnaces as fast as they can be got ready. The Dowlais Works have never ceased to be full of activity and the numerous tin-plate factories are also turning out full complements notwithstanding the largely increased power. It must be said, however, of all this make of steel and iron that it is not due to an influx of new orders, but to the heavy character of past transactions which requires a daily effort to maintain the stipulated rate of delivery. When the time comes, be it in six months or less, when new business must be looked for—it is anticipated that prices will sustain a decline, and the efforts are therefore directed to the reduction of cost. In regard to coke the withholding of orders has procured an abatement, though this commodity still fetches a very high figure. Ores are also manipulated with a view to rates more in favour of buyers, and in short the tendency is to the trade assuming a quieter character uninfluenced by existing profits and unprejudiced by excessive cost. Rumours have been again set on foot as to the restarting of the Plynouth and Abernant Ironworks, but these may have been precipitated, if not entirely begotten, by the candidature of Mr. W.T. Merwyn, that gentleman exercising a potent influence in the management of the estate. The coal trade presents no striking feature. Some firms are exceedingly well off for ships and orders; others again are easy. Prices for the last coals are fully £5 a ton above what they were at the

close of last year, and the volume of trade much greater. The tendency, as the year advances, must be to increased firmness. The coke-making still secures for bituminous small of the best seams a fancy price, but the prices of the lumps are conversely affected, and the house-coal trade is not brisker. The need of further dock accommodation has become such a pressing necessity that the trade is renewing its representations to the Marquis of Bute's trustees to carry out the works that Parliament has long since sanctioned. The new Alexandra Dock at Newport is said to have as much as it can do, and on Wednesday the new dock scheme at Swansea was inaugurated. The trade of Cardiff, present and prospective, urgently demands a development of her docks, proportionate to the lead she has always taken among the ports of the British Channel.

CLEVELAND.—The usual weekly meeting was held upon 'Change on Tuesday, but there was little or no business done. The parliamentary election is absorbing the attention of almost all. In addition to the excitement of politics acting as a drawback, there is a lull of uncertainty as to which way prices are inclined to move. Buyers at 5 per cent. can find no sellers. Few makers, if any, are in the market; they are pretty well sold forward. Another furnace has been blown in at the Carlton Ironworks. The finished iron trade is as quiet as the pig-iron. The foundries and engineering works have been partially laid off during the Easter holidays. The coal and coke trade is unchanged.

DERBYSHIRE.—There is not much new to report in connection with the iron trade, except that prices of the raw material are easier. During the week the whole of the available district furnaces have been kept going, and a good deal of capital pig-iron is turned out. A good deal of activity is observable at the works near Wingfield, on the Midland line, where two large furnaces have been idle for several years. These having been secured by the Dodworth and Silkstone Iron and Coal Company (Limited), whose pits are situated near Barnsley, they are now being put into a thorough state of repair, and will be blown in as early as possible. The foundries and other works connected with the iron trade have been partly closed during the Easter holidays, but very little inconvenience has arisen from the stoppage. Lead mining is carried on to about the same extent as when last noticed, so that no change can be noted respecting the output. The coal trade has to some extent been curtailed by the holidays, but the output is still in excess of the demand. The district colliery owners are doing more than an average business with London, but this is chiefly on account of large contracts secured and held at very low prices. Engine fuel and steam-coal are in fair request, but prices have to be quoted at a low figure in order to ensure sales. There is a very fair demand for coke and coal; owners are now turning their attention to its manufacture, it being undoubtedly the most profitable way of turning smudge and small coal to account.

DURHAM.—Trade has been largely at a standstill during the last week because of the influence of the holidays and the elections. In the extremely small amount of business transacted, prices of all classes of iron have been, to a large extent, nominal. People are waiting till the quarterly meetings next week, when some of the election excitement will be over, and business will have assumed more normal conditions. Makers of pig-iron are not offering at the present time as there are no buyers at prices which they can take, or indeed scarcely at any prices. The merchants have been offering iron at 50s. to 51s. No. 3, in limited quantities, but everybody at present shows a disposition to wait. There are some satisfactory features about the trade, however. The iron is fast going away—faster, it is believed, than it is made—while finished iron is also being rapidly turned out at the various works, save and except the break of the present holidays. There are also good hopes held out by those in the trade of a return of better trade after the present lull has passed over. At the meeting of the Darlington Iron Company (Limited), last week, great encouragement was held out, both with regard to iron and steel manufacture. The quieter tone of the trade has made the labour market less restless. Nothing is heard of the Durham collieries, who some time since threatened a revolt, and ironworkers are likely to stick to work better under present conditions than they seemed inclined to do a short time back. The quietude of trade is rather shown prospectively as regards demand than in relation to present circumstances and conditions. This is exhibited by the returns of the North-Eastern Railway Company, which are increasing at an enormous rate. This week the increase in receipts, as compared with the corresponding week of the previous year, amounts to £23,558, nearly £11,000 of this amount being for mineral traffic. The coal trade is quiet. In some cases household coals have been inactive. Coke is also less firm, except for special brands.

FOREST OF DEAN.—The Easter holiday has but little affected the Forest district. Work has been for so long a period scarce that the mining classes are in too straitened circumstances to permit of pleasure. The political battle occupies exceptional interest, and seldom has a Parliamentary contest evoked so much interest among the Foresters, who believe their long period of troubles has been aggravated by foreign affairs. The bulk of the local employers are partisans on the Liberal side, and where this is not the case, the colliers and miners are to be uninfluenced, which, to say the least of, is a very commendable resolve. It is unfortunate that the house-coal trade continues so depressed, because, both in respect to masters and men, their endurance of the long extent of bad times must be almost of a crushing character. The dark cloud which has been hanging over the Forest by the recent stoppage of collieries in West Dean District, is to-day giving signs of the proverbial rift by a restart at one of the collieries, viz., the Royal, there being, it appears, some prospect of another, and the chief pit, restarting before long. Prices of coal are uncertain, and difficult, without tending to mislead, to quote. The season has passed whereby to hope for improvement, and all that can be done is to wait patiently until the tide again turns. The Messrs. Crawshaw have been unable to secure their additional 20s. per ton for pig-iron as was anticipated before the end of March. On the contrary the firms expect to have to make a concession of 15s. per ton on quarter day (8th of April). Buyers are not expecting so great a drop, believing that the circumstances of trade will render this

necessary. Present appearances verify the opinion I gave a short time ago, that rash adventurers who in November and December essayed to net large sums by speculation, now find themselves in the unfortunate position of being obliged to realise in order to meet their engagements, and that this would cause a temporary lull. To the initiated this appears with a vengeance. Hardware manufacturers in the Forest are experiencing the reaction with a severity no body could have anticipated a short time ago, having clean books and no orders. They, however, are calculating a marked revival after the Easter holidays, and are looking forward to an active summer's trade. On the subject of the railway facilities, the hardware and tin-plate manufacturers have just succeeded in making advantageous arrangements with the Severn and Wye, Severn Bridge and Midland Railway Companies for the conveyance of the whole, or any portion of their production to the Birmingham districts, and bring in raw materials. They regard this as a blow destroying the monopoly of the Great Western Railway Company at whose hands, it is alleged, these traders have been handicapped and very prejudicially. The firms in question, state the Great Western Railway Company laid the last feather which broke the camel's back, and therefore the invading companies have been heartily welcomed. It is not improbable that this arrangement will affect the new railway belonging to the Great Western Railway Company to be opened shortly at the northern part of the Cinderford Valley, affording a more direct route than hitherto commanded to the midland districts.

GLASGOW.—The warrant market continues to decline, but the elections and the Easter holidays are interfering materially with business. Operators at present prefer a waiting and watching policy, and decline to commit themselves to transactions in which there is such a decided element of uncertainty. On Thursday, business was done from 55s. to 55s. 6d. cash. On the reopening of the market on Tuesday a fair business was done, from 55s. 4½d. to 54s. ¾d. cash, and 55s. 9d. to 54s. 9d. a month, afterwards declining to 55s. 6d. cash. On Wednesday 55s. 7½d. to 55s. 1½d. cash, and 50s. to 55s. 6d. a month was accepted. Closing, sellers, 55s. 3d. cash and 55s. 7½d. a month. Buyers 1d. per ton less. There is almost no demand for makers' iron, and the considerable reductions have been submitted to in order to stimulate business; nothing as yet is resulting, and buyers persistently hold off. No. 1 Gartsherrie is now 65s., No. 3, 57s.; No. 1 Coltness, 68s., No. 3, 62s.; No. 1 Eglinton, 60s.; No. 3, 55s. per ton. The shipments of pig-iron from Scotland last week were, foreign 17,555 tons (of which 12,512 tons went to America), coastwise 6042 tons, total 23,597 tons, against 9463 tons in the corresponding period of last year. The increase in shipments for the past three months amounts to 80,286 tons. The imports of Middlesborough pig-iron into Grangemouth last week were 1725 tons, against 660 tons in the similar period of last year. The total imports till March 27th, 1880, are 62,187 tons, against 64,040 tons till March 28th, 1879. The manufactured iron trade is quiet. Although most of the mills are running full, no new orders of any consequence are coming to hand, and the outlook for the next few months is not encouraging. The exports last week were large, including for the East machinery valued at £13,630, wrought iron at £513, cast iron at £4325, galvanised iron at £2755; for the Continent, machinery at £3587, wrought iron at £1666, cast iron at £1099; for America, wrought iron at £1368; for Australia, galvanised iron at £1960; for Fiji, sugar-making machinery at £5901. There is little change in the stock of pig-iron in Connal's store, the amount being now 439,013 tons. Business is quiet with both shipbuilders and engineers, and the local trade shows no signs of improving, though very low prices are ruling.

LANCASHIRE.—During the past week business in both the iron and coal trades of this district has to a considerable extent been practically suspended, owing to the holidays and the elections. The Manchester Exchange, in consequence of the holidays, was closed from Thursday until Tuesday, and the absorbing interest taken in the local Parliamentary contest has naturally stood in the way of very much attention being paid to business during the remaining portion of the week. The attendance at the Manchester market on Tuesday was much below the average, and prices were scarcely tested. So far as makers are concerned their quotations are nominally the same as last week, but at present they are practically out of the market, any business doing being almost entirely confined to second-hand parcels, which are still offered for prompt delivery at extremely low figures, and with regard to these the market may be said to be weaker. The transactions reported have been mostly in Scotch irons; G.M.B.'s being offered by merchants for delivery here at about 64s. to 64s. 6d. per ton, with north-country irons offering at about 60s. per ton net cash. Lancashire makers of pig-iron are still working on old orders, with very few new ones coming in; nominally their quotations for delivery into the Manchester district remain at about 70s. per ton, less 2½ per cent.; but good orders would be booked at a trifle under this, although local producers have as yet only a small quantity of iron to offer. Pretty much the same may be said with regard to Lancashire and Derbyshire makers, some of whom are prepared with small concessions upon late rates, but as they are not willing to follow the downward movement in the market to the extent expected by buyers they are securing little or no new business. In the finished-iron trade secondhand parcels of bars are still being offered for delivery into this district at about £8 per ton, and, if anything, there is less firmness on the part of makers; but forge proprietors, as a rule, are still sufficiently well supplied with orders to prevent them exhibiting any anxiety to press rates at present, and their quotations remain at about £8 10s. to £9 per ton. With regard to founders, engineers and merchants there is no material change to notice, and although in these branches trade is reported to be better the improvement is very slow. There has been very little doing at the collieries in this district during the past week, most of them having been closed for three or four days, and so far as round coal is concerned what little has been raised, has to a great extent been going into stock, the demand for both house, fire and steam purposes having been extremely small. Nominally prices are the same as last week, but if sales were to be pressed less money would have to be taken, and there are scarcely any fixed rates where anything like quantities for quick delivery

can be sold. In some cases reduced lists have been sent out, but the average quotations at the pit mouth may still be given as under:—Best coal 8s. to 8s. 6d., seconds 6s. to 6s. 6d., and common round coal 5s. to 5s. 6d. per ton. With the supplies of slack now below the requirements of the market prices of this description of fuel have naturally a hardening tendency. In some cases prices have already been put up, and generally an advance equal to about 6d. per ton upon February rates is being put into force at the close of this month. For good slack 3s. 6d. to 4s. per ton is asked, and for common 2s. 9d. to 5s. 3d. per ton; burgy is firm at 4s. to 3s. 6d. per ton at the pit. There has been very little doing in the shipping trade during the week.

LEEDS AND WEST YORKSHIRE.—There is but little to report this week, as very little work of any kind has been done, because of the holidays, and no less because of the excitement of the election. On Wednesday there was at some of the forges and workshops what amounted to be little better than a pretence to resume the old groove of steady work. The day after being the polling day at Leeds, Bradford, Wakefield, &c., the impossibility of keeping steadily to work was at its climax, and the next day was not sufficient for the complete restoration to composure of the steady-going working men, who take an ever vigilant and intelligent interest in the government of their country. So that this week has been partly one given up to pleasure, and the other moiety has been devoted to patriotism. Next week, however, all grades, employers as well as employed, will have to make amends. There is sufficient to be done at the forges to demand that there shall be no longer delay. A year ago furnaces might have been damped down, and mills thrown out of gear, and hammers reduced to solemn silence for a month at a spell, and no one would have felt the inconvenience—so habituated had everybody become to enforced idleness; but now the case is very different. There are shipbuilders' and railway orders to be executed with all expedition, and there is the likelihood that when these are exhausted, the political agitation which has been going on throughout the length and breadth of the land, and the national decision as to who in future shall govern us, will have so reanimated trade and commerce that a prolonged period of prosperity may be confidently relied upon. There is no doubt that considerable quantities of manufactured iron, both best and common, are now wanted from this district; and the recent firmness of our forge-masters in the matter of quotations has not deterred consumers. Prices of best Yorkshire iron, proverbially immutable as they are, are now more than ordinarily firm, notwithstanding recent fluctuations in the prices of raw material. A maker of best Yorkshire iron cannot be more grievously offended than by a suggestion that he should assent to fluctuations in his prices. It is the quality of his iron that he piques himself upon, and if you will have that super-excellent article you must pay for it and be thankful. Some of the makers of large tools are getting anxious for fresh orders, and though small toolmakers are busy, this is a branch in which there is plenty of room for fresh and ampler development. The coal-pits have been nearly altogether idle this week, and this holiday week has afforded no basis for any information as to the current nature of the demand or as to the future of prices.

LONDON.—We have a quiet market here. The election and holidays intervening since our last has left but a few working days; nevertheless there has been time to see some prices very materially altered. In iron we have pretty much the same values. Scotch pigs close 55s., or a shade lower. Copper.—A good business has been done at prices varying from £66 to £65. Chili bars. Tin.—A fall of some £3 to £4 per ton for foreign is noted, although the figures for last month turn out favourable. There seems some disposition to buy for forward delivery, Australian and Straits, £85 to £87, three months. Lead.—Second-hand lots have lowered the price a good bit; but immediately these seemed to be cleared off, rates went up, and we now quote Spanish £16 15s.; English lead, £17 to £17 5s. Tinplates quiet, but a better feeling is manifesting itself. The drop seems to have been too rapid to last. Quicksilver, £7 per bottle.

NEWCASTLE AND THE TYNE DISTRICT.—Holidays, and the excitement of the general election, have this week combined to unsettle business and temporarily stop work in this locality. Most of the collieries and manufactories were closed from Thursday week until Tuesday and Wednesday, when shipments, both in the docks and in the river, were briskly resumed, the supply of tonnage in this port being very large at the present moment; but after the first of the Baltic trade is completed, a slight lull may be looked for. The iron trade here is weaker, notwithstanding the large export there has been of late. No. 3 pig-iron has been bought of merchants as low as 50s., but makers won't sell at that figure. Buyers seem to be awaiting the result of the election before operating, except to supply immediate requirements. No. 4 forge is easier to buy, 50s. being about the highest price. Bar iron brings about £7 10s. to £7 15s., ship plates £8 10s. to £8 15s., and angles about £7 15s., with the usual terms. Shipbuilding is carried on vigorously in our river. Messrs. T. and W. Smith have just laid the keel of a large steamer that is to be built under contract for Messrs. Gobling, of Newcastle, and they have others in various stages of construction. At the large shipyard of Messrs. C. Mitchell and Co. there are no less than ten vessels, several of which are of very large tonnage, in progress; and Messrs. J. Wigham Richardson and Co., and Messrs. Swan and Hunter have launched vessels this week, and prepared immediately to fill the vacant places. The number of men employed in the Tyne shipbuilding trade has largely increased in the past six months, and it is pleasant to sail down the river and observe on all sides the many evidences of increasing trade. Rolling mills are working to their utmost capacity, and forges also are still kept very busy; but the chainmakers, and especially those at the well-known works of Messrs. Hawkes, Crawshaw and Sons, are not so well employed. Engine manufactories and foundries in this neighbourhood are kept steadily going. Some very large castings have been turned out from the foundry in connection with Messrs. R. Stephenson and Co.'s engine-building establishment. Marine and other engines are also being pushed rapidly forward at Messrs. R. and W. Hawthorn and Co.'s, and their boiler

works at St. Peter's are very brisk. But little change has taken place in the condition of the bolt and rivet branch of the iron trade, which remains fairly active. Our steel works have a sufficiency of orders to keep them going steadily. The market for steam-coals is firm, and all the collieries are certain to be fully employed during the present month if a rise in price put in force on the 1st of April does not materially check business. Old contracts at low figures have all run out, and the price for best Hartley coal is now 10s. per ton, and in some cases forward contracts have been closed at 10s. 6d. A good demand exists for small and manufacturing coals for export, and the home consumption also is improving daily. There is a slight improvement in the gas-coal business; prices are from 7s. to 7s. 6d. per ton, less 2½ per cent. Coke sells freely at the full advance. House-coals are extremely quiet, some of the best mines only working half to two-thirds time. Not a great deal is being done in the chemical market; the home trade is dull, but the demand for America is better than it was a few weeks ago. Prices on the whole are steady, and stocks in the makers' hands are not large. Soda ash 48 to 52 per cent., is 1½d. less 5 per cent.; refined alkali, 52 per cent., 2½d. less 2½ per cent.; bleaching powder, £7, less 3½ per cent.; soda crystals, £3 10s., less 2½ per cent., and other articles in proportion. It is confidently believed that in a few weeks there will be a renewal of the briskness that a few months ago prevailed in this important trade. Since the great revival of the iron and chemical trades the demand for Tyne-made firebricks has much increased, the wear and tear consequent on the activity of puddling furnaces and chemical processes being of course much enhanced. Cowen's and Ramsay's bricks remain at 50s. per thousand, but other brands, which have for some time been as low as 38s. to 40s. are on the rise. Those of the Walbottle Coal and Firebrick Company, in consequence of the plenitude of large orders, have been advanced to 45s. per thousand. There are no new features in our glass and other trades.

NORTH LINCOLNSHIRE.—The close of the quarter finds the iron and ironstone trade of this district fully as active as the opening. Activity is evident on every hand, but prices do not keep up, and quotations are now 10s. per ton lower than they were a few months ago. Nevertheless, a feeling is entertained that, with a steady business, the activity of the district will be further prolonged. The output of the district is very large, and as the demand holds well up, efforts are being made to blow-in additional furnaces. Six months ago only two out of the twenty-one furnaces erected in the district were in blast, but sixteen are now at work. The Messrs. Cliffe are preparing to blow in another furnace as early as possible. At the Trent works the operation for reconstructing two new furnaces in the place of three old ones are progressing, but some time must elapse before the work is accomplished. On the other hand, the production of the raw material for which the district is so extensively noted, is very large. The output of ironstone was scarcely ever so large as at the present time, for in addition to the home requirements, a large tonnage is despatched daily to various parts of the country, including Yorkshire and other places. This, together with the coke trade, has a tendency to greatly increase the revenue of the railway companies, as many as forty waggons of coke being required daily at one works. The requirements are pretty fairly divided between Yorkshire and other districts. Durham makers sending a very large quantity daily.

NORTH STAFFORDSHIRE.—The Easter holidays, coming with a general election, have caused almost a suspension of business between buyers and sellers, and less work has been done at the mills and forges during the week. The order books are getting emptied, and manufacturers will soon have to look for a replenishment, which is expected will come after the country has once more settled down into its usual quiet. The quarterly meetings begin this week, and it will not be long before the future 'of the trade will shape itself, as to which there seems to be little fear that the improvement which set in some months ago will have another lease, though not perhaps to the same extent as before. Merchants are holding back orders to see how prices go, and as these have already fallen some 5s. to 10s. per ton, it is anticipated that a further decline is not far off. Advices from America indicate an early revival of the demand for that country, but the home market is still inactive. A falling off in the sale of hoops and small sections is reported, but large engineering sections are in good request, and more trade might be done in this department if rates were more favourable to the customer. Transactions in pig-iron and ironstone are limited, and the coal trade is very quiet. The quarterly meeting of the North Staffordshire Iron and Coal Masters' Association was held on Wednesday, at Hanley. Very little business was done, and it was reported that trade was very quiet in every department. Prices were easier of finished-iron, pig-iron and ironstone. The coal trade was stated to be remarkably dull, and both sales and prices were declining. A letter from the secretary of the North Staffordshire Miners' Association was read, reminding the employers of a promised meeting with a deputation of men at the end of March, and the chairman's reply, deferring the meeting until after the election, and stating that the men's interest would not suffer from delay, as trade had gone back ever since the last meeting.

NOTTINGHAMSHIRE.—The district, which in a great measure may be designated a modern coalfield, is just now assuming a quieter aspect than it has done for some time past. Like some other important coal-producing localities loaded waggons may be seen at many of the collieries evidently awaiting orders. Some of the pits are not over well worked, and prices are very low owing to the active competition which prevails. It is said that good locomotive coal is being supplied at from 5s. to 5s. 6d. per ton, whilst household qualities are also low. Hard coal, suitable for smelting purposes, meets with a rather better demand, and on the whole the enquiry for coke holds up very well. The output in the district is not over large, but makers, finding a ready sale, are turning their attention to increasing the output. The labour market here bears a peaceful aspect, the men not being so frequently disturbed by paid agitators. Although not so active, but more regular in price, the iron trade progresses favourably. The make of pig-iron is maintained, and the output will be shortly increased by the blowing-in of

additional furnaces at the works owned by the Answorth Company. The chief topic of interest is the pending elections, two, if not more, of the candidates contesting seats in the town and district being connected with mining operations.

SHEFFIELD.—Owing to the excitement produced by the election, business in the town during the present week has been exceedingly stagnant. It is certain now that the quietness in trade is due to political influences. The iron market has been weak and realisations have been made on some stocks at figures below those quoted last week. These remarks, however, only refer to small lots of raw iron. The general aspect of trade is reassuring, smelters refusing to make any concessions for forward deliveries, and likewise declining to commit themselves to the highest figures of the day for a period of more than two months. It is well known that after the elections heavy orders both for raw and manufacturers' irons will be placed with local makers. The mills are running almost full time now, and more hands are being employed. An attempt has recently been made amongst the ironworkers to revive the local union which existed amongst them in the prosperous year of 1874. This has failed, but it is understood that payments are to be ruled by the rates paid to the "hands" in Staffordshire. There is some grumbling at the decisions of Mr. Chamberlain, who has arbitrated between masters and men, and we hear that the men in this locality are inclined to take private measures for the protection of their own interests. Should trade improve there is sure to be some trouble with the men on the wages question. Trade this week is almost at a standstill owing to the elections, and we cannot hear of any heavy orders having been received in any branches. The cutlery branches are slowly improving, orders being principally in colonial, &c., but there are no market movements of importance this week.

SOUTH STAFFORDSHIRE.—This week there was nothing doing at the shops and factories up to Thursday morning, and at many places work will be entirely suspended. In no part of the country, travellers report, will ironmongers give out orders until it is known what will be the result of the elections, but promise when these are over to give some good lines. Traders in this district have been very successful in tendering within the last few weeks for the supplying of the needs of the Admiralty in the hardware line. Orders in the chandelier and gas-fitting trades are irregularly distributed, for while some makers are keeping their places going full time, others are only working four days a week. Australia, New Zealand, the Cape, and South America, are the chief foreign markets for these traders, Australia being the best and showing just now somewhat of an improvement. One or two of the leading lock furniture manufacturers have as much as they can do, but this circumstance is more owing to the energy which they display than to the actual demand for goods of the ordinary patterns. The West Indian mail delivered this week has been fairly satisfactory, but further than this no mails of much note have come to hand. The iron trade quarterly meetings to be held next week are anxiously looked forward to, and pending those gatherings, new business in iron is practically suspended.

WEST CUMBERLAND.—There is a better tone in the market this week. There is an earlier season than was anticipated and already preparations are being made for large shipments to America and the colonies. Makers a few weeks ago, when the demand was very brisk, accepted more responsibilities than they are able to perform unless they can bring about, as many of them hope to do, an increased production of metal. There are but about a half a dozen furnaces in the district out of blast, and in all cases preparations are being made to put these in blast at an early date, while on the other hand several new furnaces are being built. Prices have not varied much during the week, but all-round qualities of Bessemer are now quoted at £5 15s. per ton, No. 3 forge at £5 10s. per ton at makers' works. Iron ore is in steady demand and raisers, although they have been selling for forward delivery at cheaper prices lately, have in hand large contracts, and many of them have the output of their pits sold forward for the remainder of the year. The value of iron ore in the market varies according to quality from 25s. to 30s. per ton at the mines. Steel rails are in considerable output in the district, there being a weekly make little short of 3000 tons. Prices are steady at from £9 10s. to £10 per ton according to the weight of the section. Merchant qualities are in good request, and Siemens steel is also enquired for. There are better prospects in the shipbuilding trade, and it is thought that during the year there will be several large iron vessels built on the Solway. Engineering works and machine shops are briskly employed, and the finished-iron workers, who work night and day, have in hand a very considerable number of contracts for rivet iron, bars and other classes of finished iron. The coal trade is quiet comparatively speaking, and sales are confined to a very great extent to the immediate district, the Irish demand being small. A considerable part of the time of business men is devoted to the elections, and so soon as they are over a better trade is looked for.

CONTINENTAL MINING AND METALLURGY.

FRANCE.

THE French Forgemasters' Association (Comité des Forges) held its last meeting on the 8th and 9th ult., and passed several important resolutions. A draft project of reconstitution was submitted and approved, and a new set of officers was elected in conformity with its provisions. M. A. Jullien, the manager of the Terrenoire works, was elected president; MM. de la Martelière, Martelet and Reverchon were elected vice-presidents; and M. Aclouque was made treasurer. The next meeting is fixed for the 19th inst. The official declaration of the situation of the market at the date of the meeting was that generally it was good, but that there was no immediate prospect of a rise in prices any more than there was any great probability of a fall. As the Comité is always cautious in its statements this declaration is of value in confirming the view of the market taken

by observers less well placed than the members of the Comité.

French imports and exports during January and February of the present year were as stated below, the figures being compared with those of the corresponding period of 1879:—

	1880.	1879.
Imports :	Tons.	Tons.
Pig	20,775	26,151
Irons	9138	7231
Steels	1011	875
Total	30,924	34,257
Exports : All classes ..	23,334	19,109
Imports of ores	134,119	138,929
Exports of ores	7936	7162

The falling off in the metallurgical imports shown above is at the rate of 9·7 per cent. ; the increase of exports at the rate of 12 per cent. This increase is due to exports under importation warrants (acquits a caution). Direct exports show a slight decline. The imports of ironstone have fallen by 3·4 per cent. ; the exports have increased by 10 per cent.

The metal consumed by Paris during January of this year and last was as follows:—

	1880.	1879.
Irons	2274	794
Castings	2265	1105

The difference in favour of the present year, it can plainly be seen, is very considerable. During the whole year 1879, Paris consumed 35,744 tons of irons against 31,109 in 1878, and 25,961 tons of castings against 21,349 tons—in all, more than 8000 tons of metal were absorbed by Paris in 1879, than in the preceding year.

During the months of December, 1879, and January and February of the present year, over 42,000 tons of rails were given out by the Eastern of France, and the State Railways, and principally by the former, as the State specifications did not reach to 10,000 tons. Of the total, 9000 tons, going to the Eastern of France, were in iron, taken at 220 fr. and 224 fr. per ton. The lowest quotation for steel rails was £10 (December 25) ; the highest, £12 (Schneider and Co., Feb. 26).

The Comité compares certain articles of the customs tariff as proposed by the tariff commission and as rectified by the Government, viz. :—

	Comité.	Government.
Plates more than one millimetre thick	£3 8 0	£3 4 0
Wire, under one millimetre in diameter	4 0 0	4 0 0
„ other	3 4 0	2 8 0
Bar steel rails	3 0 0	2 8 0

and states that for rails the maintenance of the treaty duty of 90 fr. (£3 12s.) is indispensable. A junta of Loire forgers-masters have been at the trouble of working out the first cost of iron and steel in the Centre districts, taking their figures from the books of a typical establishment in that region, and comparing them with English items of prime cost. If free trade were established, English iron could be brought to French ports at £3 2s. per ton lower than French iron from the Centre, and steels at £3 10s. cheaper. The necessity of the maintenance, therefore, of the conventional rates of 1860, £2 8s. for iron, and £3 12s. for steel, is self-evident.

Our contemporaries of the French technical press continue firm in the belief that the present feebleness of the French market will soon pass away. *L'Ancre* finds no reason to doubt that the whole year will be a good one, seeing that makers are engaged forward to the end of it for at least two-thirds of their production. *La Métallurgie* argues that the new establishments which have been called into existence by the revival are as yet without any influence on the general supply, and by the time their weight of make is grown to any appreciable amount it will be absorbed by the new demands now in course of development. Building is exceedingly active both on private and public account, both at Paris and in provincial towns ; while at Bordeaux, Lille, Toulouse, Tours, le Havre, and elsewhere, there are projects on foot for city improvements, reorganisation of water and gas supply, the establishment of tramways, &c. As for works for the improvement of ports, canals, roads and bridges, and railway extensions and completions, they have been so often cited that it is wearisome to recall them. The resolution of the Northern forgers-masters not to lower rates has been corroborated by the inflexibility of Creusot in maintaining them ; and the prices contained in recent tenders for supplies to the State show that producers are not at all in fear of the turn of the market. Raw material, too, has not yet become plentiful again, and prices are got for crop ends, scrap, &c., only at little below those paid during the very heat and fury of the revival. On the 24th ult., the Orleans Railway Company opened tenders for the purchase of 10,000 tons of old rails. M. Sirot, of Trith-St-Léger, took 2000 tons at 140 fr. (£5 12s.), delivery at Irvy, and a London firm took 8000 tons at 138 fr. (£5 10s. 6d.), delivered at Bordeaux. Five weeks previously the Northern of France got 152 fr. (£6 18s. 7d.) ; a fortnight later the Lyons and Mediterranean got 148 fr. (£5 18s. 6d.) crop ends being as much as, or a little more than, rails.

At Paris rates have declined to 250 fr. (£6) for cramp irons used in building, 265 fr. (£6 12s. 6d.) for merchant irons and 275 fr. (£7) for beams. Plates keep up at 310 fr. (£12 8s.), and are being worked up in large quantities for constructional purposes in Paris engineering shops. The second attempt at sale of the Alfortville Steelworks on the 16th ult. remained, like the first, without result, in spite of the reduction of the upset price to £18,000.

The region of Meurthe and Moselle, which now makes the largest weight of pig of any region of France, will have its metallurgical capacities much enlarged by the new establishments about to be founded in it. The site of one of the steelworks about to be erected is said to be just outside Montmédy, leaving the village of Grand-Verneuil towards Ecovicq. This site has been chosen by reason of its nearness to the Viron junction and the new Chiers Canal. Ground for the erection of steelworks on a considerable scale has been bought by the firm of Labbé, of Gorcy, who would be in communication with Gorcy by the Longuyon and Longwy lines, the new Chiers Canal, and the Viron

and Athus-Givet lines. The Wendel Works will probably be ready before those of the two other undertakings just referred to. The compagnie de Wendel has been formed with a capital of £240,000, for the purpose of building furnaces, forges and steelworks at Joef, arrondissement of Briey (Meurthe-et-Moselle), and the erection of other metallurgical works in the north-east of France, and the construction and working of railways and other engineering works necessary to the general enterprise of steelmaking. The company is constituted for 25 years.

The Centre, where the patience of steelmasters was so sorely tried during the long crisis, is setting an example of continuance in well-doing to the rest of France. Forgers-masters are booked ahead for the remainder of the year, and if they send out tenders quote full rates. The Eastern of France has given out 3000 mounted wheels to Fourchambault, de Dietrich and Brunon, at rates varying from £24 to £25. The scarcity of raw material has put the Forge de la Marine on utilising masses of bear it had lying by. Grooves were cut on the top and two of the sides of these masses, some of which weighed as much as 40 tons ; cartridges of dynamite were lodged in the grooves and connected with each other, and the explosion sliced up the bear according to the track made by the grooves.

The Prefect of the Seine has appointed a commission of 25 gentlemen to study the means for adding workshop drill (exercises in manual skill) to the elementary instruction given in the schools of the city of Paris, and to determine the nature of these exercises, and to draw up proposals for the organisation of new apprentice schools.

The Vulcan Steelworks, Carondelet, near St. Louis, which were to have started a short time since, have been compelled to defer doing so by the refusal of the men to be paid by a sliding-scale proportioned to the price got for steel, and to engage not to become members of any trade union.

BELGIUM.—Makers are beginning to take heart of grace, seeing that consumption has not really slackened. The outside speculators who in many cases bought beyond their means and are compelled to sell to realise enough to meet their bills, are blamed with the perturbation which has been caused in the market. It cannot, however, be foreseen when this influence for evil will have ceased. Some believe that the middle of April will see many contracts cleared out, and others defer the resumption of direct buying to September. The Charleroi Forgers-masters' Association issued the following circular on the 23rd inst. :—“The Association met on the 22nd to deliberate on the condition of the market, and found that a certain indecision has been noticeable in orders during the fortnight preceding the meeting. Forced sales on the part of speculators gave the first impetus downwards, which was increased by the report of weakness in the United States, in England and in Belgium. The same movement has had very narrow limits in France. This breathing-time has been merely the natural and inevitable speculative reaction from the extremely rapid rise of values in the iron trade. The rapidity of that rise caused speculators to conceive extravagant hopes which have now been falsified, and speculators are compelled to make abatements in price with which producers have no concern. The indecision noted, therefore, has been merely due to a single abnormality which will soon have ceased to exist. During the last few days, indeed, orders have been coming in more freely, in accordance with the usual course of the market at this time of year. Important customers in India, China, Japan, and the States of South America, who had discontinued their orders at the beginning of the revival, have come into the market again ; and the presence in the country of the agents of foreign firms is a characteristic and satisfactory sign. The Association has pleasure in pointing out the new and favourable tendency of the market, and the renewal of the trade revival, which has been checked for a moment by accidental and external causes.” We are not quite certain of the motive of this publication, while we are very sure indeed that the Charleroi Forgers-masters' Association has been denied any large share of the gift of prescience ; but so far as the testimony of the Association is worth anything, it is parallel to other testimony given by less impeachable witnesses.

The American demand for scrap and rails, which has been for some time in abeyance, gives signs of returning vigour. All further discussion of tariff questions in Congress is put off till the spring of 1881, and so far uncertainty is at an end. Old irons maintain their price, and railmakers have no stocks on hand. Prices are nominally on the basis of 180 fr. for irons, which corresponds (adding 60 fr. duty) to the base price of iron in the north of France. English pig is said to have been lately offered at 70 fr. (£2 16s.) Dealers' hands, both in Belgium and Holland, are said to be very full, but the official quotation for Luxembourg pig for the quarter, April to June, is 85 fr. (£3 8s.).

The giving out of the 2000 railway carriages which the State was to have “adjudged” on the 31st, has been deferred till April 21st, by which time the State hopes to have got a credit of £200,000 through the Chamber. The idea of buying second-hand locomotives from the Roumanians has been given up, and “nos nationaux” are to have the balance of the 53 wanting to complete the 100 which will be shared out amongst them on the passing of the same vote.

The millowners of Marchienne-au-Pont are credited with the intention of forming themselves into a syndicate for the manufacture and sale in common of heavy profiles of beam irons. Nails are in good demand at steady rates ; nail hands frequently leave their trade at this time of the year to go brickmaking, and labour is getting scarce.

The Cockerill Works has put on blast a fourth furnace for smelting Spanish ores. In about six months two large furnaces commenced last summer, and built for an output of 70 tons a day, will probably be ready to set on blast. The severity of the winter had stopped work at them. In some six months the Cockerill Works will thus possess the means for smelting 100,000 tons of its Somorostro ironstone. The fourth ore boat belonging to the Cockerill company, the *Altura*, gauging 1200 tons, is now being finished at the company's dock at Hoboken, Antwerp.

The death has been announced of M. Blondiaux, late general manager of works at Thy-le-Chateau.

The latest issue of the *Revue Universelle des Mines* contains, among other matter, the continuation of Dwelshauvers-Dery's study of recent discoveries connected with the steam-engine ; a paper on the recent changes in the Royal School of Mines in London, in which the general

view of their witlessness is agreed with ; and a paper on the mechanics of soft bodies.

GERMANY.—A proof of the striking international solidarity of the iron markets of Europe is given by the participation of Germany in the reaction. The revelation of this solidarity is not particularly welcome in Germany, which has a strong idea that it ought to be able to make fair weather at its pleasure. The same influences have been at work to bring about the reaction in Germany as in other countries, and the oppression of the market is said to be due to the weight thrown on it by dealers. But makers are in many cases now beginning to compete with them, and quotations have receded all round by from 10s. to 20s., merchant irons, indeed, quoted in February at 220s. have lately been offered at 180s. Yet the majority of works are reported to be very busy, and the prospects of employment are good. Railways have been taken over by the State to a very large mileage, and both the permanent way and rolling stocks of these railways need additions and improvements, since, during the period that their acquisition by the State was being discussed, their managers naturally kept working expenses down at the lowest point. And in consequence of the general adoption on German railways of metallic superstructure, the arming of a German line brings more to the mill than is the case with an English one. The reaction will, it is supposed, be presently at an end, and comfort is taken meanwhile that even at 180s. an average profit is made.

The Upper Silesian forges and foundries, employing a total of over 50,000 men, are reported well occupied.

The Royal Testing Institution (mechanisch-technische Versuchsanstalt) at Berlin, which has been formed in connection with the Berlin Technical High Schools, is now fully constituted, and its statutes have been published. Its first is as follows :—“The Royal Testing Institution, for proving the strength of iron and other metals and materials, is placed under the control of the Ministers charged with the oversight of the Technical High School, and is connected therewith. Its purpose is to carry out tests and experiments in the strength of materials in the general scientific and public interest, and on the demand of the civil authorities and private persons.” The statutes are twenty-six in number, and are dated January 23rd.

Professor Bauschinger contributes to the *Polytechnisches Journal* a paper on a subject of great interest—The supposed liability of iron employed in constructions in which it is exposed to continuous shock, to assume a crystalline structure. In the summer of 1878 the suspension bridge at Bamberg, first put up in 1829, was overhauled, and three of the chains were tested for strength, elasticity, &c. The results obtained from these were compared with those got from a reserve chain made at the same firm and place as the three first mentioned, but kept carefully by, and also with those got from a new chain manufactured at the same works, and under conditions as similar as possible with those of the four foregoing. No ground could be found for concluding a change of structure or loss of elasticity during the half-century that the three first chains had been in use. Similarly, bridge-bolts, tested by Paul in 1852, before being put up, and by the same experiments in 1878, after twenty-five years' strain, showed no structural or other alteration or any loss of strength.

Cast-iron roofing, in the shape of various styles of slates, has been successfully introduced in Germany by the Gröditz Ironworks, which, during the last three years, has supplied roofing equal to a total area covering 55,000 square metres. Some are enamelled as a protection against rust, and for the sake of ornament. In other cases a covering of asphalt is used. Iron lathing and framing is made for use with them, and they can be laid on wood, being lighter than earthen tiles.

Professor Gronemann, of Göttingen, has propounded a theory of the aurora borealis resting on the presence of masses of iron dust in the polar regions. Polar snow has been found to contain fine particles of iron, evidently precipitated from the atmosphere, and it is Gronemann's supposition that these masses of particles describe a path round the sun, and when the earth crosses it particles are attached by it, and more especially by its poles. Being carried swiftly through the atmosphere, they ignite by friction against it and so become luminous, as is the case with meteorites. Norden-skjold has found metallic iron, cobalt and phosphorus in snow north of Spitzbergen.

NEW PATENTS.

ALL the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 1235 to No. 1293, being the entries from March 23rd, to March 29th.

NEW APPLICATIONS.

- Bank Cheques.—J. B. Fenby, Wyde Green, Warwickshire. [1238]
- Bankers' Cheques.—G. Davis, London. [1241]
- Bankers' Drafts, &c.—A. H. Robinson, Dublin. [1270]
- Beer Drawing Apparatus.—A communication.—W. R. Lake, London. [1288]
- Braid and Lace Machines.—A communication.—A. Biedenbender, London. [1296]
- Carriage Springs.—W. Edwards, Birmingham. [1278]
- Centrifugal Machines.—A communication.—W. R. Lake, London. [1260]
- Composition for Decorative Purposes.—G. Brown, jun., London. [1277]
- Cranes for Working Buckets, &c.—J. H. Wilson, Liverpool. [1246]
- Crickot Apparatus.—J. Jeffery, Epsom. [1279]
- Dough Knading Machine.—J. Turnbull, jun., and J. Allen Donald, Glasgow. [1262]
- Drafts, Cheques, &c.—A. H. Robinson, Dublin. [1242]
- Electro-Magnetic Motors.—A communication.—J. H. Johnson, London. [1244]
- Electro-Magnetic Motors.—A communication.—J. H. Johnson, London. [1259]
- Extinguishing Apparatus for Lamps.—A communication.—C. Quistmann, London. [1257]
- Feedwater Heater.—A communication.—R. Langenstien, Buchau, Magdeburg, Germany. [1263]
- Fire Bars.—C. Mace and J. Brewster, Sunderland. [1260]
- Fishing Reels.—P. D. Malloch, Perth. [1273]
- Flying Targets.—R. Mansell, London. [1265]
- Galleries or Globe Holders.—C. W. Morley, London. [1263]
- Gas-Heating Apparatus.—A communication.—W. P. Thompson, London. [1252]
- Heel Tips.—C. Neil, Sheffield. [1258]

Horse-shoe Manufacture.—A communication.—W. R. Lake, London. (1880)
 House Stairs.—S. S. Haller, London. (1866)
 Ice Manufacture.—A communication.—J. H. Johnson, London. (1866)
 Intrenching Tools.—A. Macdonell, in Her Majesty's Army. (1864)
 Knitting Machines.—A communication.—E. de Pass, Elberfeld, Prussia. (1868)
 Leather Manufacture.—A communication.—A. C. Henderson, London. (1868)
 Meat Preserving Apparatus.—C. H. F. Schaeffmann, J. C. H. Bonn, and C. H. F. Muller, Hamburg, Germany. (1873)
 Metal Bending Machinery.—A communication.—W. R. Lake, London. (1854)
 Mining and Cooking Apparatus.—J. Kennedy, Strabane, Ireland. (1880)
 Miners' Safety Lamps.—J. Taylor, Tyldesley, Lancashire. (1850)
 Motive Power.—R. Stephens and F. Brinchlow, London. (1871)
 New Explosive Matter.—A communication.—C. Pieper, Berlin, Germany. (1885)
 Protection.—A communication.—C. Pieper, Berlin. (1885)
 Punks.—A communication.—C. A. Parsons, Elswick, Newcastle-upon-Tyne. (1867)
 Railway Brakes.—A. C. Boothby, Kirkcaldy, Fifeshire. (1867)
 Railway Carriages.—I. A. Timmis, London. (1850)
 Railways.—J. H. Fell, Sparke Bridge, Lancashire. (1849)
 Refractory Bricks.—A communication.—W. R. Lake, Southampton Buildings, London. (1897)
 Respirators.—T. McCulloch, Devonport, and D. Morrison, Slough, Devonshire. (1899)
 Safety Lamps.—A communication.—C. Kessler, Berlin. (1840)
 Sawing Machines.—A communication.—S. W. Worham, London. (1874)
 Smelting Ovens.—R. P. Wilson and C. H. Woodbury, New York, U.S.A. (1855)
 Soluble Compound of Corium.—J. B. Macby, London. (1875)
 Stays and Corsets.—E. Langdon, Kingstons. (1881)
 Steam Boilers.—C. H. Roebuck, Newcastle-upon-Tyne. (1837)
 Steam Traps.—F. W. Ann, London. (1851)
 Substitutes for India-rubber.—E. Quin, Leyland, Lancashire. (1861)
 Suction-Bolling Apparatus.—A communication.—C. D. Abbott, London. (1860)
 Telephones.—A communication.—J. H. Johnson, London. (1880)
 Tramway Locomotives.—H. P. Holt, Leeds, and F. W. Crossley, Manchester. (1876)
 Tricycles.—W. Hartcliffe, Salford, Lancashire. (1847)
 Velocipedes.—A. and M. Weight, Reading. (1864)
 Velocipedes.—H. H. Hodgkinson, London. (1850)
 Velocipedes.—W. Hillman, J. K. Starley and G. Singer, Coventry. (1872)
 Velvet Manufacture.—R. S. Collinge and R. Collinge, Oldham, Lancashire. (1882)
 Wine Cooler.—L. Dee, London. (1845)
 Wire Springs.—N. Jenkins, New Haven, U.S.A. (1835)

COMMERCIAL.

ALLNUTT AND WOOD'S IRON FREIGHT REPORT.

FREIGHTS continue to weaken outwards for America; but scarcely anything has been done since our last report. Sailing ships have been fixed from London to Baltimore to load old rails at 12s. per ton; and from Barrow to a United States port a ship has accepted 13s. per ton to carry 2000 tons of pig-iron. A part cargo of iron has been placed at 7s. per ton from the Tyne to Helsingfors. Tonnage has been chartered to load ore from Lisbon to Hull at 8s. per ton, and Elba to the Tyne at sixpence per ton more; and from Porman or Polomares to the Tyne at 9s. per ton.

13, Lime Street, London, March 31, 1880.

JAMES H. WEAGER AND CO'S METAL REPORT.

SOME unexpected changes have taken place in the metal market since our last, without much apparent reason. Certainly the excitement of a general election asserts a temporary distracting influence, which, to an extent, has paralysed activity and caused a relapse. This again reacting upon the fears of small operators, brought about an anxiety to get quit of their holdings at the best possible price, thus further depreciating values. We have this well demonstrated in most descriptions of metals. Iron: Since the beginning of March pigs have declined about 2s. per ton, which is by no means as marked as the previous month, when a difference of about 8s. was registered. Market closes 55s. buyers. Scotch warrants: Makers' iron quiet, prices easier. Copper has fluctuated somewhat, but closes flatter. Chili bars 65 10s. The charters for the last half of March are telegraphed 1000 tons. A quantity of ore has been sold at 13s. 9d. English copper remains about the same as our last, although with definite offers, a trifle under list prices would probably be accepted. Tin: A further decline has taken place owing to the forced realisation of speculative parcels, 84 10s. having been touched for foreign on the spot, forward deliveries, however, are now fetching 87s. The Dutch Trading Company's sale in Holland on the 31st of March, realised for 15,000 slabs Banca 51-25 guilders, equal to about 86s. and 5300 slabs Billiton 50 guilders, or 84s. in Holland. The stocks of Australian and Straits tin in London on 31st March were 8022 tons, against 8054 29th February; landing 229 tons, against 280 29th February. Quantity afloat 31st March, Australian and Straits, 1454 tons, against 1818 in February. These figures certainly do not account for the sudden relapse which has taken place, and we should not be surprised to see heavy buying very shortly. English tin seems timid of following too closely upon the heels of foreign. We give prices below. Lead: A great many parcels have been pushed on the market, and prices, in consequence, declined. Spanish was sold as low as 45 10s., but now little is to be obtained under 46 10s. We still are of opinion that manufacturers would do well to look to their stocks. March shipments have certainly yet to come in, but most of this has already been sold. English, to-day, 47 10s. Tinplates: Although needy speculators are offering a few hundred boxes here and there at prices that will tempt buyers to relieve them of their responsibilities, we find a better feeling about. Makers are still well employed, and from the general appearance of things, consumers might make a good profit on present prices. Our quotations are:—Iron: Bars, Staffordshire, 48 to 48 10s. per ton; hoops, 49 10s.; sheets, 49 10s. to 50 10s. per ton. Copper.—Chili slabs for 96 per cent., 45 10s. per ton; English ingots and blocks, 47 10s.; English sheets, sheathing and rods, 47 10s. per ton; yellow metal sheets and sheathing, 64d. per lb. Tin:

English ingots and blocks, 49 10s. per ton; English bars, 4 cwt. barrels, 42 10s.; foreign, Straits, 48 10s.; Australian, 48 10s. per ton. Lead: Spanish pig, 46 10s. per ton; English pig, 47 10s. to 47 15s.; bars, 47 15s.; pipe, 48 10s.; sheets, 48 10s. per ton. Zinc, 23 10s. per ton. Spelter, 20 10s. per ton. Antimony, 72 per ton. Quicksilver, 47 per bottle. 26, Leadenhall Street, E.C.

J. BERGER SPENCE AND CO'S WEEKLY REPORT.

CHEMICALS.—It is impossible to chronicle any important increase of business as yet. Politics continue to keep the commercial mind preoccupied, and now that the additional detraction of the Easter holidays is present, it is not to be expected that the full tide of trade will be resumed until these interruptions are removed. Notwithstanding this, the indications are more favourable, and doubtless in a week or two there will be an increase of business, judging from the additional inquiries on the market during the week from the Continent. American prospects also seem slightly improved, but they do not as yet assume any pronounced type. The home trade is still dull and difficult to persuade that the height of the improvement is not passed. Consumers are to a great extent engaged in working from stock. Prices, however, are slightly firmer, particularly in the Newcastle market, and this new tone has in its turn created a better feeling among sellers. Caustic soda is in somewhat larger demand, but there are numbers of odd parcels on the market seeking placement on terms in favour of buyers. Bleaching powder is dearer, and closes firm. Soda crystals are a shade firmer. Acids are in increasing request, and with few sellers. Metallic salts are neglected. Arsenic is sustained. Acetate of lime has more buyers at full prices.

MINERALS.—No important change has occurred in the general position of minerals during the week. Though large transactions have been the exception, a steady and sustained trade has been done in the principal articles. The deliveries of iron ore are fairly maintained, and there is still an active demand for the best qualities from both English and foreign mines. Sellers maintain the firmness of their quotations, though in isolated cases rather easier terms are conceded in order to sustain the output. A sale of copper ores, &c., took place at Swansea on the 23rd inst., when 1244 tons were sold, realising 7776 12s. 6d. gross. The average produce was 9½ per cent., and the average price per unit 13s. 4½d. Brimstone is yet without animation, though a regular and steady trade is being done. China clay is in improving demand, and ochres are also obtaining a shade more attention.

METALS.—The aspect of the pig-iron trade continues disappointing to makers, and the week has not developed any encouraging prospect. Prices in the Glasgow market have been steadily downward, and on Tuesday there was every indication that the "ring" which has so long ruled the market, was broken. Since then, however, more steadiness is observable, and warrants are quoted at 56s. 7½d. per ton, prompt cash. Very little business was done at Middlesbrough on Tuesday, the market being without the least animation, in sympathy with the condition of affairs at Glasgow. No. 3 was sold under 53s. for prompt, and as far ahead as June next. It would appear that there are large orders in hand for placement as soon as some degree of steadiness is restored. Hematites continue to move downwards, and makers become more pressing daily in their efforts to make sales. No. 3 is being freely offered at 45 per ton at their works, and prices are hardly firm at this figure, nevertheless buyers still hold aloof. Lancashire iron is tolerably steady, producers being yet fairly sold forward. Derbyshire iron is cheaper by some 5s. per ton. Copper has become slightly easier. Tin also has a weaker tendency. Lead has given way a shade. Spelter remains moderately firm at 21 5s. per ton at the outports.

GENERAL ITEMS.—The amount of gold coin issued from the Melbourne Mint in 1878 was 703,709 oz., valued at £2,740,000. The population of Glasgow a hundred years ago was under 4300; it is now nearly a million. It is estimated that there are upwards of 375,000,000 tons of ironstone yet to be raised in the Cleveland district, which at the present rate of output will last 130 years.

Manchester, March 27th, 1880.

NEW COMPANIES.

ANGLO-ESPAÑA.—Upon terms of an agreement of 18th ult. this company proposes to acquire and work certain copper and sulphur mines situate in the province of Coruna, in the North of Spain, known as the Dos Amigos and Guillermo Mines. It was registered 20th ult., with a capital of £150,000 in £10 shares. The purchase consideration is £75,000 in cash, and £75,000 in fully paid up shares.

BRIMBOROUGH STEEL.—On 10th ult., this company was registered with a capital of £50,000 in £50 shares to acquire the steel, iron, tin plate, and block plate works, and the coal and iron mines situate at Birchgrove, in the parish of Llanmalet, in the county of Glamorgan.

CARLETON WATERWORKS.—Registered 22nd ult., with a capital of £2000 in £2 shares, to construct works and supply water to the village of Carleton, Yorkshire.

CLEVELAND IRON MINES.—Registered 20th ult., to acquire the interest of the lessee in an ironstone royalty situate at Kettlewell, in the parish of Lythe, county of York. The capital of the company is £60,000 in £4 shares.

HENRY REES AND CO.—This is the conversion to a company of the business of metal printers and decorators, and tin plate merchants, carried on by the above firm at 696, Westminster Bridge Road, and Addington Street, Lambeth. It was registered 18th ult., with a capital of £25,000 in £5 shares.

THE SURINAM GOLD MINING.—This is another company brought out to take advantage of the present speculative mania for gold mining. This company proposes to acquire and work gold mines, lands, and properties in Surinam, Dutch Guiana, and elsewhere. It was incorporated 20th ult., with a capital of £300,000 in £1 shares. An unregistered agreement of 18th ult., between Percy Tarbutt and Edward Faulkner Tremayne is to be adopted.

TOOKE'S ASSURANCE.—This company proposes to acquire and work the business and patents of Messrs. Charles Tooke and Co., of Walworth. The patents are for an "Improved covering for preventing the radiation or transmission of heat," and for "Improvement in pulleys for machine belts." It was registered 20th ult., with a capital of £25,000 divided into 10,000 shares of £2 10s. each, bearing a preferential dividend of 4½ per cent., and 2000 deferred shares of £2 10s. each.

PARTNERSHIPS DISSOLVED.

Richardson and Webb, Manchester, wholesale ironmongers.—Moore and Co., Nottingham, machine builders.—Adnam and Povey, West Bromwich, ironfounders.—Improved Lock Stitch Sewing Company, Manchester.—Snell and Dyer, Birmingham, general platers.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

Metal Market, City, Thursday Afternoon, 4 P.M.
(April 1, 1880.)

METALS AND ORES.	MARCH 24.		APRIL 1.	
	£ s.	d.	£ s.	d.
COPPER (per ton)—				
Chili, for 90 per cent.	66 0	—	65 10	—
Wallersee	79 0	80 0	80 0	—
Burma Bunt	79 0	—	79 0	—
English Tough	23 0	74 0	23 0	74 0
English Ingot, best	74 0	75 0	74 0	75 0
Sheets sheathing and rod	79 0	—	79 0	—
Bottoms	84 0	—	84 0	—
Ore per unit	0 13 1/4	0 13 9	0 13 9	—
PHOSPHOR BRONZE				
Special Bearing Metal (p. 10)	116 0	—	116 0	—
Other alloys (per ton)	123 0	130 0	123 0	130 0
TIN (per ton)—				
Straits (Cash)	84 10	—	85 0	—
Do. for arr.	—	—	—	—
Billiton	—	—	—	—
Banco	—	—	—	—
English Ingots	92 0	—	91 0	—
Do. Bars	93 0	—	92 0	—
Do. Refined	93 0	—	94 0	—
Australian	84 10	—	85 0	—
TIN PLATES, per box, i.c.				
coke f.o.b. London	0 25	0 28	0 23 6	0 26
IX. do.	0 30	0 33	0 28	0 31
I.C. charcoal	0 28	0 30	0 26	0 30
IX. "	0 34	0 36	0 32	0 36
LEAD (per ton)—				
Soft English pig	16 15	—	17 0	—
Do. W.H.	—	—	—	—
Spanish soft	16 10	—	16 15	—
Do. with silver	17 10	—	17 10	—
Sheet mill	17 10	—	17 10	—
Red lead	22 0	—	22 0	—
White	22 0	—	22 0	—
Patent shot	20 10	—	20 10	—
ZINC (per ton)—from No. 9 Gauge.				
Sheets, rolled	23 0	—	23 10	—
Do. foreign	24 0	—	24 0	—
SPLITTER (per ton)—				
Silesian, com.	20 15	—	20 15	—
Rhenish	—	—	—	—
English	—	—	—	—
QUICKSILVER, bot.	7 0	—	7 0	—
ANTIMONY ORE (per ton)—				
Australian	11 10	14 10	11 10	14 10
Spanish	—	—	—	—
French Star	72 0	—	72 0	—
REGULUS—				
Crude (per cwt.)	1 14	—	1 14	—
NICKEL (per lb.)	0 3	—	0 3	—
BRASS (per lb.)				
Sheets, 48 x 24	0 0 8	—	0 0 8	—
Tubes	0 0 11	0 1	0 0 11	0 1
Wire	0 0 8 1/2	—	0 0 8 1/2	—
Yellow metal	0 0 6 1/2	—	0 0 6 1/2	—
ASBESTOS (per lb.)	0 0 3	0 0 3	0 0 3	0 0 3
PLUMBAGO (per ton)—				
Ceylon lump	0 17 6	—	0 17 6	—
Do. chip	0 10 6	—	0 10 6	—
Do. dust	8 6	—	8 6	—
COALS (per ton)—				
East Hartlepool	1 2	—	1 2	—
Lambton	1 4	—	1 4	—
Tees	1 4	—	1 4	—
Hartley	1 2	—	1 2	—
Helton	1 4	—	1 4	—
Hawthorn	1 3	—	1 3	—
Tunstall	1 2	—	1 2	—

IRON.

IRON, per ton	MARCH 24.		APRIL 1.	
	£ s.	d.	£ s.	d.
(at works)—				
Bars, Welsh, common	7 5	7 10	7 5	7 10
Do. Best	8 10	8 15	8 10	8 15
Scotch, Common	9 0	—	9 0	—
Do. Best	9 10	—	9 10	—
South Stafford, common	7 15	—	7 10	—
Do. Best	8 5	—	8 0	—
Sheets, singles, Cleveland	10 0	10 5	9 15	10 0
Staffordshire	10 10	—	10 0	—
Do. doubles, Staffordshire	12 0	—	11 10	—
Do. Lattens, Staffordshire	13 10	—	13 0	—
Plates, Ship, Stafford	9 15	—	9 10	—
Do. Scotch	10 10	—	10 10	—
Do. Boiler, Stafford	10 10	—	10 10	—
Hoops, Stafford	9 0	9 10	9 0	9 10
Nail Rods, Stafford	9 0	—	8 10	—
Swedish in Lond.	11 10	—	11 10	—
Angle Iron, Welsh	—	—	—	—
Do. Stafford	8 15	9 10	8 15	9 10
Pud. Bars, Welsh	—	—	—	—
Do. Stafford	6 5	6 10	6 5	6 10
Do. Scotch	—	—	—	—
Rails, Welsh	8 0	8 10	8 0	8 10
Do. Stafford	8 10	9 10	8 10	9 10
North England	8 5	—	8 5	—
Light Rails, Welsh	8 5	8 15	8 5	8 15
Do. Stafford	8 15	9 15	8 15	9 15
Pig Iron at Glasgow	2 15	—	2 15	—
Scotch warrants.	3 0	—	3 10	3 5
Do. No. 1	2 18	3 5	2 18	3 0
Cleveland, Tyne or Tees	—	—	—	—
Indian Charcoal, London	18 0	24 0	18 0	24 0
Wrought Iron Girders	18 0	21 0	18 0	21 0
Bolts and Nuts	18 0	21 0	18 0	21 0
Fish Bolts	18 0	21 0	18 0	21 0
Washers	18 0	21 0	18 0	21 0
Rivets	18 0	21 0	18 0	21 0
Spikes	18 0	21 0	18 0	21 0
SWEDISH IRON				
f.o.b. Gottenburg, nett cash.	8 0	—	8 0	—
Pig	11 10	12 0	11 10	12 0
Bar, rolled	12 0	12 10	12 0	12 10
Do. hammered	12 0	—	12 0	—
Billon	12 0	—	12 0	—
Horse Nail Rods	—	—	—	—
Belgian Iron				
f.o.b. Antwerp, less 2½ per cent.	8 0	—	8 0	—
Bars and Silt Rods, common	—	—	—	—
Best	—	—	—	—
Best Best	—	—	—	—
Hammered	—	—	—	—
Puddled Steel	—	—	—	—
Bessemer	—	—	—	—
Hoops	—	—	—	—
Rails	—	—	—	—
Roller Girders	—	—	—	—
STEEL—				
Best cast	40 0	42 0	40 0	42 0
Do. dbl. shear	45 0	—	45 0	—
Do. single do.	38 0	40 0	38 0	40 0
English spring med. quality	14 0	15 0	14 0	15 0
Blister	31 0	34 0	31 0	34 0
Swedish bog	16 0	—	16 0	—
Milan	18 0	19 0	18 0	19 0
Bessemer rails	10 5	10 10	10 5	10 10
SCRAP (per ton)—				
Old rails for remanufacture	6 10	—	6 10	—
D.H.	4 10	6 0	4 10	6 0
Disto flange or bridge	3 0	4 0	3 0	4 0
Engineers' scrap	3 0	—	3 0	—
Light scrap	3 0	—	3 0	—
Scrap metal	3 0	3 0	3 0	3 0
Old steel scrap	3 15	4 10	3 15	4 10

	MARCH 24.		APRIL 1.	
	£ s.	d.	£ s.	d.
WIRE—				
Best best drawn killed				
gal. tel. Nos. 6 to 6	18 10/	—	18 10/	—
Do. 7 & 8	19 10/	—	19 10/	—
Do. 9	20 5/	—	20 5/	—
Do. 10	21 0/	—	21 0/	—
Do. 11	21 10/	—	21 10/	—
Do. 12	22 10/	—	22 10/	—
Rolls black fencing wire				
(per ton) 1 to 4	10 10/	—	11 10/	—
Do. 5	12 0/	—	12 0/	—
Do. 6	12 10/	—	12 10/	—
Do. 7	13 0/	—	13 0/	—
Bright Iron Wire (Charcoal				
wire, 48. 6d. per bundle				
extra per bundle	0 14 6	—	0 14 6	—
Do. 7 to 8	0 15/	0 15 3	0 15/	0 15 3
Galvanised, 60s. per ton extra.				
Best best annealed drawn				
fencing wire, per ton				
Do. 6 to 7	13 15/	—	13 15/	—
Do. 8	14 0/	—	14 0/	—
Castings (per ton) at works—				
Chairs	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12 6	—	5 12 6	—
Pipes, 12 to 18 in.	6 12 6	7 0/	6 12 6	7 0/
Do. 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100	6 2/6	6 5/6	6 2/6	6 5/6
Do. 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100	6 1/6	6 4/6	6 1/6	6 4/6
Do. 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100	6 0/	6 2/6	6 0/	6 2/6
Do. 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100	5 17 6	6 0/	5 17 6	6 0/
Boils and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	10 10/	21 10/	10 10/	21 10/

* The entire ton consists of ten times 100 kilogrammes, or about 35 lb short of an English ton.

OILS, CHEMICALS, &c.

	MARCH 24.		APRIL 1.	
	£ s.	d.	£ s.	d.
Oils (per ton)—				
Olive, Malaga	—	—	—	—
Do. Gioja	45 0/	—	45 0/	—
Do. Levant	40 10/	—	40 10/	—
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Sicily	45 0/	46 0/	45 0/	46 0/
Seal, pale	30 0/	30 10/	30 0/	30 10/
Seal, yellow	27 0/	—	27 0/	—
Seal, brown	25 0/	—	25 0/	—
Sperm head	71 0/	75 0/	71 0/	75 0/
Cod	20 0/	20 10/	20 0/	20 10/
Whale, pale	20 10/	—	20 10/	—
Do. yellow	25 10/	—	25 10/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	30 15/	—	30 15/	—
Do. brown	28 10/	—	27 15/	—
Foreign Pale	—	—	—	—
Ground nut and Gingelly				
Madras	30 10/	31 0/	30 10/	31 0/
Palm oil, fine	31 0/	—	31 0/	—
Palm oil, 1st	31 0/	—	31 0/	—
Linseed oil	40 10/	27 0/	40 10/	27 0/
Cotton seed oil	20 15/	27 5/	20 15/	27 5/
Lard	42 0/	44 0/	42 0/	44 0/
Cocconut, Ceylon	36 0/	38 10/	36 0/	38 10/
Do. Ceylon	33 0/	33 10/	33 0/	33 10/
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent				
engine oil (per gal.)	0 3 6	—	0 3 6	—
Oil CARR (per ton)—				
Linseed, India	11 0/	—	11 0/	—
American lds.	10 5/	—	10 5/	—
Do. bags	10 12 6	—	10 12 6	—
Marcellus	0 5/	—	0 5/	—
Rape, English	5 0/	—	5 0/	—
Do. Foreign	—	—	—	—
Green Cotton	6 0/	7 12 6	6 0/	7 12 6
TALLOW—PVC.	41 0/	—	41 0/	—
S. American Beef	41 0/	—	41 0/	—
Do. Sheep	38 6/	—	38 6/	—
Australian Beef	34 0/	35 0/	34 0/	35 0/
Do. Sheep	30 0/	—	30 0/	—
Rough Town Fat	14 0/	—	14 0/	—
PETROLEUM—				
Refined (per gal.)	0 0 5 1/2	0 0 5 1/2	0 0 5 1/2	0 0 5 1/2
Do. spirit	0 0 7/	0 0 7/	0 0 7/	0 0 7/
TURPENTINE—Spirit				
French	—	—	—	—
American (casks)	1 15/	—	1 15/	—
WHALEFIN (per ton)—				
David Straits	1100 0/	—	1100 0/	—
Arctic	1000 0/	10 0 0/	1000 0/	—
Southern	500 0/	—	500 0/	—
BEIMSTON (per ton)—				
Rough, sub Ind.	7 0/	—	7 0/	—
Do. rds, do.	5 10/	—	5 10/	—
Roll	9 10/	12 5/	9 10/	12 5/
SULPHUR, Flour	10 15/	12 0/	10 15/	12 0/
Acid, (per lb.)				
Acetic, fine	0 0 1/2	0 0 3 1/4	0 0 1/2	0 0 3 1/4
Do. common (per gal.)	0 0 1/2	0 0 3 1/4	0 0 1/2	0 0 3 1/4
Citric	0 2 10/	—	0 2 10/	—
Muriatic (per cwt.)	0 4/	0 7/	0 4/	0 7/
Do. common	0 4/	0 5/	0 4/	0 5/
Nitric	0 0 4/	—	0 0 4/	—
Oxalic (per lb.)	0 0 5/	—	0 0 5/	—
Sulphuric, concentrated	0 0 5/	—	0 0 5/	—
Do. Brown	0 0 6/3	0 0 4/	0 0 6/3	0 0 4/
Tartaric Crystal	0 1 0/	—	0 1 0/	—
Do. Pulv.	0 1 8/3	0 1 0/	0 1 8/3	0 1 0/
AMMONIA—				
Carbonate, per lb.	0 0 6/3	0 0 6/3	0 0 6/3	0 0 6/3
Sulphate, White & Grey (per ton)	19 0/	—	19 0/	—
ARSENIC—White Lump (per ton)	23 10/	—	23 10/	—
Powdered, do.	11 0/	—	11 0/	—
Fluorine powder	0 8 6/	0 8 0/	0 8 6/	0 8 0/
BORAX, Kid., do.	3 5/	—	3 5/	—
COFFEAS (ton)	2 15/	3 5/	2 15/	3 5/
Hi-SULPHIDE CARBON (per ton)	24 10/	25 0/	24 10/	25 0/
PORTLAND CEMENT—				
1st quality, in cks 400 lb.				
Thames, inc. cks., f.o.b.	0 9/	—	0 9/	—
Do. in cks, 200 lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/6 each.	1 12/	—	1 12/	—
Charlton White Paint (per cwt.)	0 30/	—	0 30/	—
Calley's Torbay Paint, Brown	0 34/	—	0 34/	—
HYPOPHOSPHITES (per lb.)				
Iron	0 0 3/	0 10/	0 0 3/	0 10/
Lime	0 0 5/3	0 7/	0 0 5/3	0 7/
Magnesia	0 0 9/	0 9/	0 0 9/	0 9/
Manganese	0 0 9/	0 9/	0 0 9/	0 9/
Soda	0 0 5/3	0 6/	0 0 5/3	0 6/
LEAD (per cwt.)—				
Acetate, best	2 0/	—	2 0/	—
Nitrate	1 15/	—	1 15/	—
Red (per cwt.)	1 3/	—	1 3/	—
White	1 4/	—	1 4/	—

	MARCH 24.		APRIL 1.	
	£ s.	d.	£ s.	d.
LITHARGE (per cwt.)	1 1/	—	1 1/	—
LIME (per ton)—				
Acetate, Grey, 85 %	19 0/	—	19 0/	—
Do. Brown 70 %	14 0/	—	14 0/	—
POTASH—				
Nichromate (lb.)	0 0 6/	0 0 7/	0 0 6/	0 0 7/
Chlorate (pr. lb.)	0 0 7/	—	0 0 7/	—
Muriate, 80 % ton	6 15/	—	6 15/	—
Pruss. Red (lb.)	0 1 8/	0 1 10/	0 1 8/	0 1 10/
Do. Yellow, lb.	0 0 11/	0 1/	0 0 11/	0 1/
Sulphate, 80 % (per ton)	0 0 11/	0 1/	0 0 11/	0 1/
SALTPETRE (per cwt.)				
Engl. refined, cwt.	1 7 6	—	1 7 6	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 16 6	1 1 6	0 16 6	1 1 6
SODA—				
Ash—	0 0 15 1/2	0 2/	0 0 15 1/2	0 2/
Bicarb. (per cwt.)	0 12/	—	0 12/	—
Caustic, 60 %	0 12/	0 12 6	0 12/	0 12 6
Do. 75 %	0 13/	—	0 13 6	—
Nitrate (per ton)	18 13/	—	18 0/	18 5/
Crystals (per ton)	3 15/	3 17 6	3 15/	3 17 6

* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

PRICES CURRENT OF MANUFACTURED GOODS

OF

BIRMINGHAM AND DISTRICT.

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The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material.

The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

ABRIDGED LIST.

AXLES, 15 to 25½; coach ironwork, 10 to 15½; coach and waggon springs, 15 to 20½; Augers, 10 to 20½. AXES—Ship carpenters', 15 to 20½; Kent and house carpenters', 15 to 20½; ditto, steel polished, 15 to 20½; felling axes, 14 to 14½; polished, 14 to 14½; bright and blue solid steel, 7 to 8; American polling or wedge axes, steel polished, 15 to 14½; common Anvils, 84 lb. and upwards, 18 6/ to 20½ per cwt.; best warranted, 22 to 24½; ditto, and ends warranted not to break off, 27 to 35½.

BASINS, shallow galvanised, 10 to 12½; 7 to 7½ per doz.; deep Basins, galvanised, 12 inch, 10½ to 12½ per doz.; Bastard Bellows, 12½ to 20½; Best extra nailed Bastard, 17½ to 20½; Best improved long Bristol, 35 to 40½; casters or moulders', best extra nailed, 12 inch, 30½ per doz. net; common Smith's Bellows, 15 to 20½; Best warranted, extra leather doubled, 35 to 40½; with movable pipe for shipment 2½ less discount. Bed screws, 6 and 7-16 and 1 inch, 10½ to 11½ per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and 1 inch, 12½ to 13½; Black welded heads, 9½ to 10½; common slit heads, 6 and 1 inch, 9½ to 10½; Bright turned notched heads, 6 and 7-16 and 1 inch, 12½ to 13½; black notched heads, 10½ to 11½ per gross; Brass head nails, 40 to 42½; star head, 35 to 40½; Brass plated countersunk head, 25 to 30½; Blacksmiths' tongs, 20 to 25½ per cwt.; real fine wrought Box irons, 20 to 25½; fine cast, 14½ to 16½; middle cast, 14½ to 16½; charcoal box iron—Victoria, 14½ to 16½; ordinary charcoal box iron, 15 to 16½; Best extra nailed Bastard, 17½ to 20½; Best improved long Bristol, 35 to 40½; casters or moulders', best extra nailed, 12 inch, 30½ per doz. net; common Smith's Bellows, 15 to 20½; Best warranted, extra leather doubled, 35 to 40½; with movable pipe for shipment 2½ less discount. 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Bed screws, 6 and 7-16 and 1 inch, 10½ to 11½ per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and 1 inch, 12½ to 13½; Black welded heads, 9½ to 10½; common slit heads, 6 and 1 inch, 9½ to 10½; Bright turned notched heads, 6 and 7-16 and 1 inch, 12½ to 13½; black notched heads, 10½ to 11½ per gross; Brass head nails, 40 to 42½; star head, 35 to 40½; Brass plated countersunk head, 25 to 30½; Blacksmiths' tongs, 20 to 25½ per cwt.; real fine wrought Box irons, 20 to 25½; fine cast, 14½ to 16½; middle cast, 14½ to 16½; charcoal box iron—Victoria, 14½ to 16½; ordinary charcoal box iron, 15 to 16½; Best extra nailed Bastard, 17½ to 20½; Best improved long Bristol, 35 to 40½; casters or moulders', best extra nailed, 12 inch, 30½ per doz. net; common Smith's Bellows, 15 to 20½; Best warranted, extra leather doubled, 35 to 40½; with movable pipe for shipment 2½ less discount. 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Bed screws, 6 and 7-16 and 1 inch, 10½ to 11½ per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and 1 inch, 12½ to 13½; Black welded heads, 9½ to 10½; common slit heads, 6 and 1 inch, 9½ to 10½; Bright turned notched heads, 6 and 7-16 and 1 inch, 12½ to 13½; black notched heads, 10½ to 11½ per gross; Brass head nails, 40 to 42½; star head, 35 to 40½; Brass plated countersunk head, 25 to 30½; Blacksmiths' tongs, 20 to 25½ per cwt.; real fine wrought Box irons, 20 to 25½; fine cast, 14½ to 16½; middle cast, 14½ to 16½; charcoal box iron—Victoria, 14½ to 16½; ordinary charcoal box iron, 15 to 16½; Best extra nailed Bastard, 17½ to 20½; Best improved long Bristol, 35 to 40½; casters or moulders', best extra nailed, 12 inch, 30½ per doz. net; common Smith's Bellows, 15 to 20½; Best warranted, extra leather doubled, 35 to 40½; with movable pipe for shipment 2½ less discount. 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Bed screws, 6 and 7-16 and 1 inch, 10½ to 11½ per gross for London black heads; London heads with bright turned collar, 6 and 7-16 and 1 inch, 12½ to 13½; Black welded heads, 9½ to 10½; common slit heads, 6 and 1 inch, 9½

RICHARD HOLLIDAY,

HYDRAULIC AND GENERAL ENGINEER,
 'NEWTON STREET WORKS, BIRMINGHAM.
 Maker of the "SPECIAL" Horizontal and Vertical Steam Engine, &c.
 AGENT FOR THE PATENT "BISSCHOP" GAS ENGINE.
 ALSO FOR "HEAP'S PATENT" SCREWING MACHINE FOR TUBES AND BOLTS.

B. M. RENTON,

Iron and Steel Merchant, Savile Street, Sheffield,
 HAS ALWAYS A LARGE STOCK OF
BESSEMER RAIL ENDS
 AND
OLD BESSEMER DH RAILS

For Sale in all parts of the country, also Bessemer Billets and Blooms of any size and for all purposes, Old Steel Tyres either whole or broken, Old Files, Cut Bessemer Scrap and Spring Ends for remelting, English and German Spiegeleisen, Swedish and Russian Steel Iron and Box Ends, Swedish Nail Rods and Bundling Iron.

JOSEPH PARKIN,

IRON AND STEEL MERCHANT, SHEFFIELD.

Importer of Spiegeleisen, Russian and Swedish Iron.

OLD STEEL RAILS.
 A large stock always on hand of the following Materials:—Double-sawn Rail-Ends of all sections, Old Steel Tyres (whole and broken), Old Rail-ways, Bessemer Blooms and Billets, Plating Bars and ordinary Bessemer Bars, for all purposes; Cut Bessemer Scrap, Spring Ends, &c., for crucible melting. Also large quantities of Bessemer Scrap Rail Ends, Bloom Ends, &c., for (Martin-Siemens) re-melting kept in stock at various Ports for shipment.

NOZZLE AND STOPPER

FOR ORDINARY AERATED WATER BOTTLES.

(Horner's Patent).

The only Patent for utilising old Bottles. Converting them into Patents, saves Corks, Wire and Labour.
 No Leakages. Easily fitted to any Bottle. Nozzle and Stopper can be used again if Bottle breaks. Cost saved in one season.

HOME PRICES.
 Nozzles, Stoppers, and Washers, 14s. per gross.
 Extra, if Nickel Plated Nozzles, 6s.
 Bottling Machines, £5 5s., £10 10s., £10 16s.
 Royalty, £5 5s. per annum.

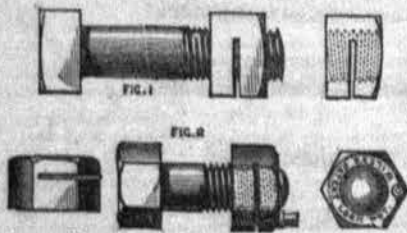
EXPORT PRICES.
 Nozzles, Stoppers, and Washers, 16s. per gross.
 Extra if Nickel Plated Nozzles, 6s. 6d. "
 Bottling Machines same as Home.
 No Royalty.

SOLE PROPRIETORS—DAVENPORT & CO.,

SODA-WATER AND ICE-MAKING MACHINISTS, 99B, HIGH HOLBORN, LONDON.
 Illustrated Catalogues Post Free to all parts of the world.

WILES'S PATENT LOCK NUT.

ESPECIALLY SUITABLE FOR RAILWAY FISH BOLTS.



The advantages of this Lock Nut are as follows:—Simplicity, cheapness, strength, locking on any portion of the bolt without injuring the thread. Fig. 1A shows a RAILWAY FISH NUT with saw-cut partially closed, having been previously tapped, and it is only necessary to screw it upon the bolt in the ordinary manner, when the cut opens and exerts a sufficiently strong spring friction to secure the nut from slacking back by vibration. Fig. 2 shows a nut fitted with set screw, which is more applicable to steam engines and other machinery, especially when the nuts are above 1 inch in diameter, but below that size it is recommended that they should be of steel and applied in the same manner as the fish nut, thereby dispensing with the set screw.

For further Particulars apply to

JOHN F. WILES AND CO.,

18, FINCH LANE, CORNHILL, E.C.

N.B. A large assortment always in stock at Messrs. MOSER & SONS, 178, High St., Southwark, S.E.

JOHN KNIGHT & CO.,

COOKLEY IRON AND TINPLATE WORKS, NEAR KIDDERMINSTER.

Manufacturers of BEST, BEST BEST, and CHARCOAL IRON in Bars, Rods, and Sheets; Charcoal and Coke Tin and Terne Plates. Tinned Sheet Iron in all gauges and dimensions up to 96 by 48 inches. Special qualities of Stamping Sheets, Cold Rolled and Close Annealed Iron, Black Taggers, &c., &c.

BRANDS ON IRON AND TERNE.

KNIGHT'S CHARCOAL. KNIGHT'S PLOUGH. KNIGHT'S B. B. KNIGHT'S KBC.

BRANDS ON TIN AND ON TINNED SHEET IRON.

COOKLEY
K
CHARCOAL.

KNIGHT
P
CHARCOAL.

COOKLEY
COKE.

C.O.
COKE.

LONDON AGENT—ARTHUR BIRD, 81, GRACECHURCH STREET E.C.

Wood Screws, 65; brass wood screws, 60 to 62; copper, 35 to 45; Stove Screws, 50 to 55; dowel screws, 60 to 65; brass headlock screws, 40 to 45; gilt, silvered and plated head screws, 40 to 45; jute Sash cord, 54 to 57; flax Sash-cord, 25 to 30; best flax, 5 to 10; super flax, 7 to 10; extra super flax Sash-cord, 5 to 10; patent steel ribbon Sash-line, 25 to 35; copper Sash-chain, 54 to 57; zinc Sash-chain, 47 to 52; iron prepared, 40 to 45; copper Sash-cord, 15 to 20; Sad Irons, common, 10 to 15 per cwt.; best japanned, 14 to 16; best best japanned, 18 to 20 per cwt.; Shoe heels, York, No. 1, 3/5 to 3/6; No. 2, 4 to 4/3; No. 3, 8 to 8/6 per gross net; Dandles hot turned, 5/2 to 6/3; bright-edge imperial or solid Scotch, 9/6 to 10/1; bright York or B, 8 to 8/6; bright solid, 6/6 to 7/1; toe plates, 6/6 to 10/1 per gross. Stair rods, turned ends, 7/5 to 8/7; solid fancy ends, 6/6 to 6/7; cased tube, 30 to 35; patent solid ornamental, 35 to 40; Sofa Springs, coppered, 8 by 6 inches, 25 to 27 per gross; 9 by 7 to 22/6 to 23/6; 7 by 7 inches, 17/6 to 19/6 per gross; galvanised Waterloo Scoops and hods, 17/6 per doz.; japanned

Waterloo scoops and hods, 16 inch, 15 to 16; japanned scoops and hods, light, 16 inch, 15 to 16 per doz.; Shutter bars, common spring, broad and double, 75 to 77; Scotch iron drop, 77 to 80; brass drop, 70 to 72; brass drop and catch, 67 to 70; registered brass spring box shutter bars, 35 to 67; double-handed brass spring box, 57 to 65; Saddlers' tools, 5 to 10; Stocks and Dies for smiths' use, 35 to 40; ditto for engineers, 10 to 20; Steel toys, 10 to 30.

Traps, bow spring, sham Dorset and real Dorset rabbit traps, 45 to 65, list prices; common traps, 4 inch, 5/6 to 8 per doz. net; run traps, 25 inch, 4 to 8/6 per doz.; bird traps, 3/9 to 4 per doz.; wolf and other double-flap spring, common bridge, 1; axle bridge, 1/4 per lb., 40 to 45; hawk or pole traps, 54 to 60; wrought mole traps, 32. Timmen's machines and tools, 3; brass Bell Tube, 1 inch and upwards, 1 to 1/1 per lb.; copper bell Tube, 1/2 to 1/4 per lb.; zinc bell Tube, 45 to 50; list; Patent cased Tube, 45 to 50; cut to lengths, 40 to 45; burnished and lacquered brass tube, 30 to 35;

BUSINESS CARDS.



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Falcon Works.

SMETHWICK NEAR BIRMINGHAM,
 Manufacturers of all kinds of En-
 gineers', Machinists', Carriage and
 Coach

BOLTS AND NUTS;

Set Screws; Patent Pointed Coach Screws;
 Patent Boiler Ship, Tank and Girder Rivets,
 Anvils, Vices, Washers, &c.

GENERAL SMITHS.

S. MOULTON & CO.,

KINGSTON INDIA-RUBBER MILLS,
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Manufacturers of their Patent Steel Embedded and other India-
 rubber Springs for Locomotives, Railway Carriages and Trucks,
 India-Rubber Valves, Sheet Packing, Washer Rings, Hase Pipes,
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 Sheet, Elastic Hot Water Beds, Cushions, Patent "Moss" Ink-
 ing Rollers for Printers, Truss Pads, and Umbilical Cones, &c. &c.

ASBESTOS

FINE SPUN YARN AND PLAITED ROPE AS SUPPLIED
 TO THE ADMIRALTY FOR STEAM PACKING.

MILLBOARD, IN SHEETS,

Or Cut to Shape for Steam Joints,
 AND FOR GAS ENGINES.

Hell's Patent Asbestos Boiler and Pipe Covering for Preventing
 the Radiation of Heat.

All Asbestos Goods of the best quality manufactured by

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"If you have an efficient automatic cut-off valve and an auto-
 matic steam-tight piston, you are bound to have an economical
 engine."—Science Lectures.

No more Throttle Valves. No more Leaky Pistons. No Addition
 to Prime Cost.

For full particulars of the "Turnbull" Cut-off Valve Gear and
 the Double-action Piston Packing, apply to

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MANUFACTURERS OF

ROOFING FOR SHEDS, &c.

(Entirely superseding the Felt Roofing).

Tarpaulin and Railway Waggon Covers

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GARNKIRK WORKS, NEAR GLASGOW.

OFFICE: 243, BUCHANAN STREET, GLASGOW.

Manufacturers of
 FIRE BRICKS and BLOCKS for the highest heats for Iron blast-
 furnaces, large, rolling, puddling and steel furnaces, pottery, bottles
 and flint glass furnaces, copper, calcining, roasting, and refining
 furnaces, chemical works, coke ovens, boiler seat blocks, locomotive
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Special Bricks made for Siemens' Patent Rege-
 nerative Gas Furnace. Registered Trade Mark,
 "GARNKIRK."

NO MORE INCRUSTATION

BY USING THE

Globe Steam Boiler Powder.

For Testimonials and Particulars, apply to

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31, LOMBARD STREET, LONDON, E.C.

polished and lacquered twisted tube, 30 to 35; patent taper
 iron tube, 30 to 35; patent cased taper iron tube, 30 to 35;
 parallel iron braced tube, 30 to 35; twisted iron parallel tube, 30
 to 35; patent cased twisted iron parallel tube, 30 to 35; iron
 Gas Tubes, 60 to 62; fittings, 62 to 65; iron Water Tubes,
 30 to 52; fittings, 54 to 55; iron Steam Tubes, 45 to 47; fittings,
 47 to 50; galvanised iron gas Tubes, 45 to 47; fittings,
 47 to 50; lap-welded Boiler Tubes, 36 to 40; ditto, im-
 proved brass follow, 20 to 25; wrought japanned Tea kettles, 50
 to 60; galvanised Turnip skips, 21 inches, light, 25 to 26 per
 doz.

Vices, common black, 19 to 34 per cwt.; common bright, 40 to
 42 per cwt.; black staples vices, solid box black, 42 to 48; bright, 41 to
 47; solid box, black staple, with spherical washer, 40 to 45; bright 41 to
 45.

Washers, light iron, 70; heavy washers, 13 to 16 lb., W.G.,
 12/6 to 14 per cwt.; 1 inch thick, 2 per cwt. extra; 5-16 inch, 3/1;
 1 inch 4/1; shock bright washers, 3/10 to 3/6 per cwt. extra; Wall hooks,
 23 to 25 per cwt.; Washing tubs, galvanised oval, 21 inch, 10/1
 to 30; 24 inch, 34 to 38; round, 22 inch, 38 to 40; Water bowls,
 hammered, list price, 55; 37 to 57; light seamed 9 inch, 8 per
 dozen; light wired 9 inch, stamped, 11 to 12; Wove wire list
 price, iron, copper and brass, 45 to 50; iron Wire, bright, 0 to 6,
 14/6 to 15/6 per cwt.; galvanised, 18/6 to 19/6; fine galvanised iron
 wire, No. 23, 5/3 to 5/6 per stone 14 lb.; annealed tinned wire No.
 18, 4/10 to 4/3 per stone 14 lb.; cut-tinned bottling wire, No. 22, 4/11 to
 5/4 per stone 14 lb.; weaving and binding wire, No. 23, 4/10 to 4/3 per
 stone 14 lb.; bright or annealed fine wire, 23, 5/7 to 5/9 per stone
 14 lb. net; cast steel wire, 0 to 6, 19/6 per lb.; 10 to 20; metallic or
 horticultural wire, 6 to 14, 7/5 to 8/6 per lb.; No. 15, 5/1 to 6/1; 16 to
 20, 5/6 to 6/1; in 1 lb. rings, 15 inch diameter, 2/3 per lb. extra;
 prepared bright fencing Wire, 0 to 6, 14/6 to 14/3 per cwt.;
 annealed drawn fencing wire, 0 to 6, 13/3 to 14/3; annealed
 drawn galvanised, 0 to 6, 17/6 to 18/6. Bright or annealed steel, 0 to
 6, round or oval 10/9 to 17/9 per cwt.; black rolled, 1 to 4, 11/6 to 12/6
 per cwt.; galvanised rolled, 1 to 4, 14/6 to 15/9 per cwt.

THE ANGLO-AMERICAN ELECTRIC LIGHT COMPANY, LIMITED,

IS NOW PREPARED TO
BOOK ORDERS FOR THE SUPPLY OF
MACHINERY AND LAMPS
UPON THE BRUSH SYSTEM FOR LIGHTING UP
Factories, warehouses, railway stations, docks, and other
places for which such illumination is suitable.
All orders received will be executed, so far as is practicable,
in rotation.

The Company is also prepared to receive from Corporations
or private persons applications for licenses, or for
concessions for defined districts.

The Anglo-American Electric Light Company (Limited)
is also willing to enter into negotiations with responsible
parties for the sale of licenses for the British Colonies. The
superiority of the Brush system over all others in economy
and simplicity has been now established in the United
States as beyond question, and its rapid development in this
country, now that it has been introduced, may be regarded
as a certainty.
G. R. DAVIES, Secretary.
Office, 74, Hatton Garden, E.C.

Clerical, Medical, and General Life ASSURANCE SOCIETY.

13, St. James's Square, London, S.W.
City Branch: Mansion House Buildings, E.C.

DISTINCTIVE FEATURES.

CREDIT of half the first five Annual Premiums allowed on whole-
term Policies on healthy Lives not over 60 years of age.
ENDOWMENT ASSURANCES granted, without Profits, payable at
death or on attaining a specified age.
INVALID LIVES assured at rates proportioned to the risk.
CLAIMS paid thirty days after proof of death.

BONUS.

The Reversionary Bonus at the Quinquennial Division in January,
1877 (amounting to £357,014), averaged 50 per Cent., and the Cash
Bonus 30 per Cent., on the Premiums paid in the 5 years.
The Next Division of Profits will take place in January,
1882, and Persons who effect New Policies before the end of
June next will be entitled at that Division to one year's ad-
ditional share of Profits over later Entrants.

REPORT, 1879.

The 55th Annual Report, and the latest Balance Sheets rendered
to the Board of Trade, can be obtained at either of the Society's
Offices, or of any of its Agents.

GEORGE CUTCLIFFE, ACTUARY AND SECRETARY.

BUSINESS CARDS.

LLOYD HARGREAVES, GENERAL PATTERN MAKER.

Maker of all kinds of SPUR, BEVEL, SKEW and ECCENTRIC
GEARING.

GAIL LANE, HALIFAX.

JOHN PEMBERTON, (From W. and J. Galloway and Sons),

ELLESMERE BOILER WORKS,
WATER STREET,
MANCHESTER

Maker of all kinds of STEAM BOILERS of the
Latest Improvement.

ALL DESCRIPTIONS OF GIRDERS, BEAMS, &c.

CONICAL and PARALLEL TUBES

Of all descriptions made to order and fitted to existing Boilers without
removal or inconvenience.

Repairs promptly attended to.

SOLE AGENTS:

JOHN DONALD AND SON, 42, Cadogan Street, Glasgow.

SIGNS OF THE IRON TRADE.—The statistical indications
in the iron trade which we are enabled to collect at the
opening of the spring of 1880 contain many points of interest.
The month just closed has developed several features which
warrant the inquiry whether it is not the halting point in the
remarkable upward movement of iron which has been
chronicled and wondered at in alternate intervals throughout
the past eight months. During February a slight falling off
has been noticeable in the prices for pig-iron, while the
demand has been still more decidedly restricted. The bar-
iron trade, since the card was put up to 4 cents, has dragged
visibly, and it is an open secret that the card is not in all
cases deemed inviolable. Only the nail trade retains the
booming upward tendency which a month ago was the uni-
versal characteristic of every form of product of iron. This
is directly traceable to the fact that the enlargement of pro-
ductive capacity is not so easy in that branch of the industry
as in the others. The advance in the leading staples of the
iron trade is pretty well known, but it will do no harm to
repeat the extraordinary comparisons of the lowest prices
reached during the early part of 1879 and the highest
attained last month, as follows:—

	Lowest, 1879.	Highest, 1880.
No. 1 foundry bituminous	\$17 50 to \$19 50	\$53 to \$45 00
No. 1 mill iron ..	16 50 to 18 50	43 to 45 00
No. 1 Bessemer ..	19 00 to 20 00	45 to 50 00
Bar iron ..	1 65 to 1 75	4c card
Nails per keg ..	1 90 to 2 00	\$5 25
Bessemer steel rails ..	42 00 to 45 00	85 to 90 00

After an advance of 100 to 150 per cent., as shown in these
figures, it is not more than is to be expected that the market
should make a halt. Indeed, in the opinion of the conserva-
tive, the stoppage of the advance is the most encouraging
sign of the times.—*Pittsburgh Commercial Gazette.*

PHOSPHOR BRONZE.

(BY ROYAL LETTERS PATENT.)

THE BEST METAL FOR
BEARINGS, SLIDE VALVES, PUMPS, STEAM FITTINGS, &c
SUPPLIED IN INGOTS OR CASTINGS, WIRE, SHEETS, RODS, &c.

For Ingot Quotations, see Price List of Metals in this Paper

Sole Manufacturers,

THE PHOSPHOR BRONZE COMPANY, LIMITED,
10, SUMNER STREET, SOUTHWARK, LONDON, S.E.

JOHN H. AUSTIN AND CO.,

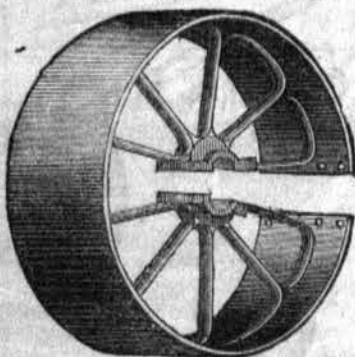
90, CANNON STREET, LONDON, E.C.,

SUPPLY EVERY DESCRIPTION OF

RAILWAY MATERIAL.

MINING COMPANIES, CONTRACTORS AND OTHERS are requested to send full particulars of their require-
ments, large or small.

OLD RAILS AND WROUGHT OR CAST SCRAP FOR EXPORT.
STEEL OR IRON RAILS, BESSEMER CROP ENDS, OLD STEEL RAILS, &c.



HALF-SPLIT PULLEYS OR SPRING DRUMS.

Simple, Light, Elastic, Strong, Durable & Cheap (Mackie's Patent).

WILLIAM LINCOLNE & Co.

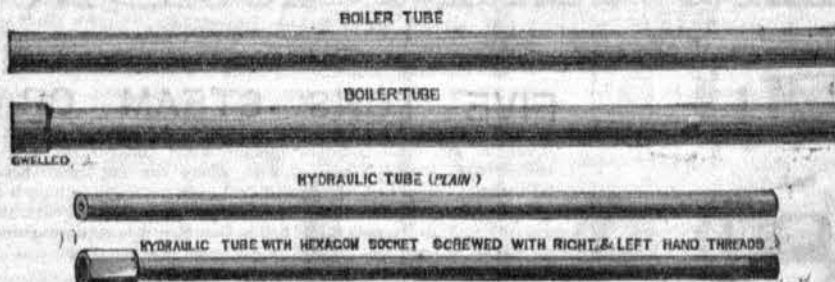
13, Dundas Street,
GLASGOW.

32, Ludgate Hill,
LONDON, E.C.

* To Save Both Bands and Belting Use "L" Belting Syrup.*

The Weldless Steel Tube Company, Icknield Port Road, Birmingham.

MANUFACTURERS OF



Patent Weldless Steel Tubes

For Boilers for Hydraulic Presses, for Bushes and Collars, Ferrules, Boring Rods,
Couplings, Axles and Shafting, Coils, Air Reservoir and other uses.

ITALIAN ASBESTOS MANUFACTURE.

PRIZE MEDAL AWARDED, PARIS EXHIBITION, 1878.



ROPE and PACKING of Asbestos of Strong Fibre.

MILLBOARD, Plain, and Patent with Wirecloth.

FIBRE and POWDER.



Indestructible and Self-lubricating, for Stuffing Boxes and all kinds of Joints of Steam-engines, supplied of the first quality and at
moderate prices by the manufacturers.

DEVALLE, PELLI & CO., 11, Via Alfieri, Turin, Italy.

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NEAR VICTORIA STATION, MANCHESTER,

(ESTABLISHED 1790).

JOHN STANIAR & CO.,

Manufacturers by Steam Power of all kinds of Wire for

RICE & FLOUR MILLS, RICE & FLOUR MILL MACHINERY,

Extra Treble Strong Wire for

LEAD AND COPPER MINES,

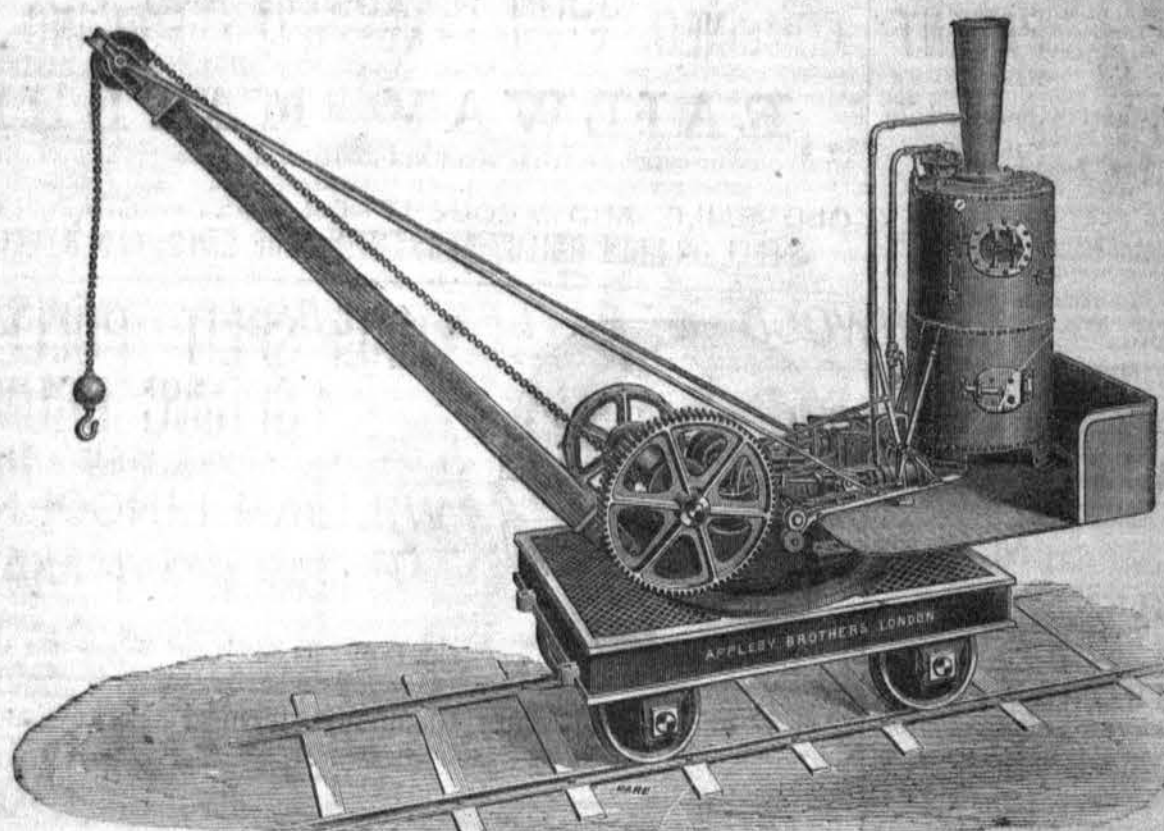
Jigger Bottoms, Cylinder Covers, woven any width. Extra Strong Riddles and Sieves, and Strong
Perforated Zinc and Copper.

Shipping Orders Executed with the Greatest Despatch.

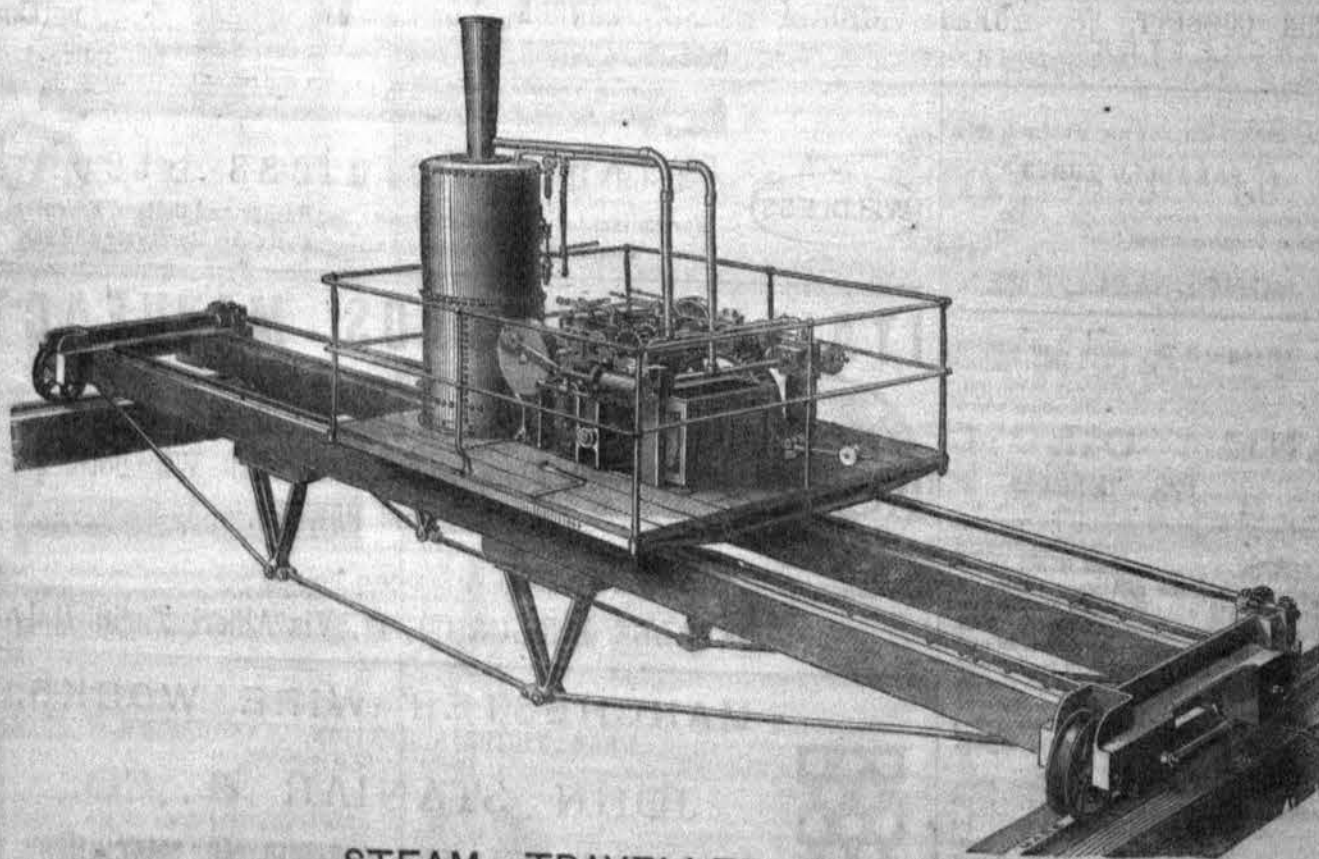
APPLEBY BROTHERS, ENGINEERS, BOILER MAKERS, BRIDGE BUILDERS, &c.

MAKERS OF STEAM AND HAND CRANES,

Hydraulic Machinery, Steam and Hand Travellers, Steam Pile Drivers, Dredgers,
Ships' Winches, Bridges, Roofs, Girders, Railway and Contractors' Plant.



FIVE TONS STEAM CRANE.—FIG. 116.



STEAM TRAVELLER.—FIG. 151.

Offices : 89, CANNON ST., LONDON, E.C. Works: EAST GREENWICH, S.E.

APRIL 2, 1880.

IRON.

IX.



ASBESTOS ENGINE PACKING AND MILLBOARD JOINTING



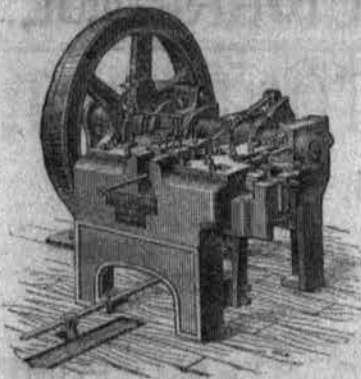
For STUFFING BOXES and ALL KINDS of JOINTS, give perfect satisfaction.

No higher compliment could be paid to the value of these goods than the fact that they have been more imitated than any article of the kind hitherto in use. Engineers, however, are cautioned that all such imitations are a direct infringement of the Company's Patent Rights, and all parties offering such Packing for sale render themselves liable to proceedings at law.

The Packing and Jointing Manufactured by the Company bear their Trade Mark, without which none is genuine.

PRICE LISTS and all INFORMATION from the PATENT ASBESTOS MANUFACTURE CO., Limited, 31, St. Vincent Place, Glasgow.

GOLD MEDAL, PARIS UNIVERSAL EXHIBITION OF 1878.



HORSFALL'S

PATENT COMBINED BOLT AND NUT FORCING MACHINE.

Makes BOLTS with Square, Hexagon, or Cheese Heads which do not require any DRESSING or FINISHING by HAND, and which are GUARANTEED EQUAL, if not SUPERIOR in STRENGTH and every other particular, to the BEST HAND-MADE.

Makes NUTS, either SQUARE or HEXAGON, without any LOSS of MATERIAL in PUNCHING: GUARANTEED EQUAL to the BEST HAND-FORGED NUTS.

NO SKILLED LABOUR REQUIRED TO WORK THESE MACHINES.

Over 60 of these Machines have been supplied to Bolt and Nut Manufacturers, Engineers, &c.

FOR PRICE AND PARTICULARS APPLY TO THE

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GREENWOOD & BATLEY, ALBION WORKS, LEEDS.

MAYBURY, MARSTON AND SHARPE,
REGISTERED BRAND.
M.M. & Co.

PERSEVERANCE IRONWORKS,
PENDLETON, MANCHESTER.

MANUFACTURERS OF BEST PACKING, BALE & HINGE STEEL, & IRON HOOPS, COOPERS' HOOPS, PLAIN & SPLAYED, & HORSE SHOE IRON, MADE FROM BEST SELECTED SCRAP ALSO MAKERS OF ALL KINDS OF IRON WASHERS.

REVOLUTION IN MACHINE BELTING.

SCANDINAVIA PATENT COTTON MACHINE BELTING
FROM ONE-HALF TO ONE-FIFTH THE PRICE OF LEATHER.

W. WILLSON COBBETT, 60, QUEEN VICTORIA STREET, LONDON, E.C.

Short length for trial supplied at wholesale prices. (No post samples.)

THE **OAKBANK**
Steam Cylinder  *and Valve Oils,*

For the Internal Lubrication of Surface-

Condensing Marine and Land Engines.

RECEIVED HONOURABLE MENTION PARIS EXHIBITION, 1878.
Pure Mineral Oils, Greatest Lubricating Power in the Market, and not decomposed at 600° Fahr.

HOME AGENTS:—Messrs. D. Nicolson and Co., 34, Leadenhall Street, London; D. Taylor, 1, Goree Piazzas, Liverpool; J. B. Grier, 29, Waterloo Street, Glasgow.

SOLE MANUFACTURERS,

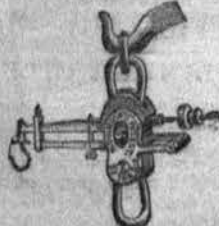
OAKBANK OIL COMPANY, LIMITED,
128, INGRAM STREET, GLASGOW.



Thomson's Screw Pulley Block.



MEDAL.



Thomson's Patent Winch, Block or Hoist, will raise a load ten times quicker than his Patent Screw Block, where light lifts are required, say 5, 10, 15, or 20 cwt. The Suspended Lever Weighing Machine is now largely used in all countries.

COMPAGNIE.



Thomson's Patent Winch Block.

WILLIAM THOMSON AND CO., ENGINEERS,
KINNING PARK, GLASGOW.

Wholesale Agent in London, ALEXANDER R. WRIGHT, 10, St Mary Axe, E.C.

NORTON'S PATENT

"ABYSSINIAN" TUBE WELLS.

LE GRAND AND SUTCLIFF,

ARTESIAN WELL ENGINEERS,

100, BUNHILL ROW, LONDON, E.C.

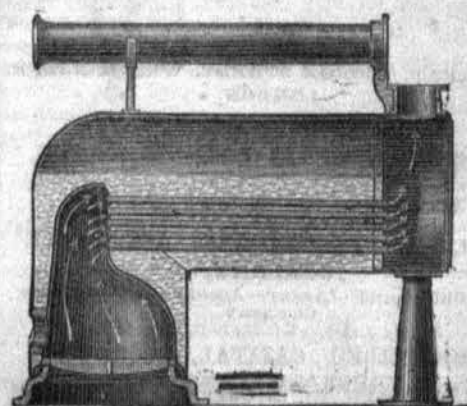
C. RUSSELL & CO.,
2, TALBOT COURT, GRACECHURCH ST.,
LONDON.



2HP { ENGINE and BOILER } £45.

Descriptive Lists of larger sizes on application.

PATENT LAUNCH BOILERS,
With Circular Fire-boxes.
NO STAYS IN FIRE-BOX.



Advantages.—Less First Cost. Great Strength. Increased Facility for Cleaning. Freedom of Expansion.

J. BLAKE,
BRIDGEWATER IRON WORKS,
Prussia St., Oldham Road, Manchester.

X.

IRON.

APRIL 2, 1880.

FOR

MINING,

ENGINEERING

AND GENERAL

MECHANICAL
PURPOSES

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INDIA-RUBBER

GUTTA-PERCHA

GEO. ANGUS & CO

NEWCASTLE-ON-TYNE

LIVERPOOL.

E. P. & W. BALDWIN, WILDEN WORKS, NEAR STOURPORT.

SHEET IRON.

BRANDS—

"BALDWIN-WILDEN" AND "SEVERN."

"EP & WB"
WH

TIN PLATES.

BRANDS—

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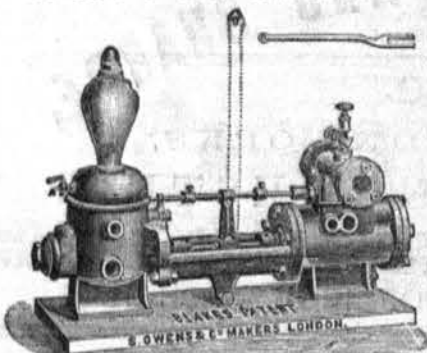
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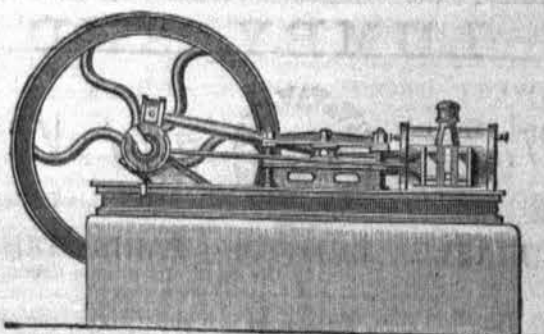


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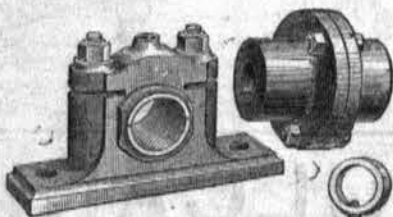


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Bore, in inches to standard	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4	5
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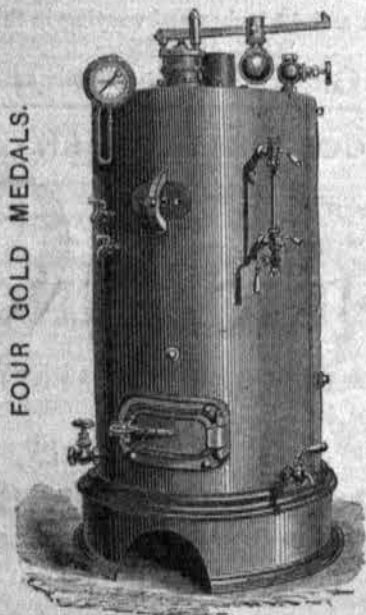
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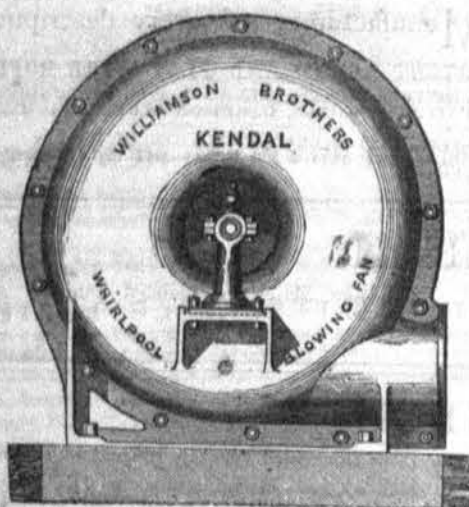
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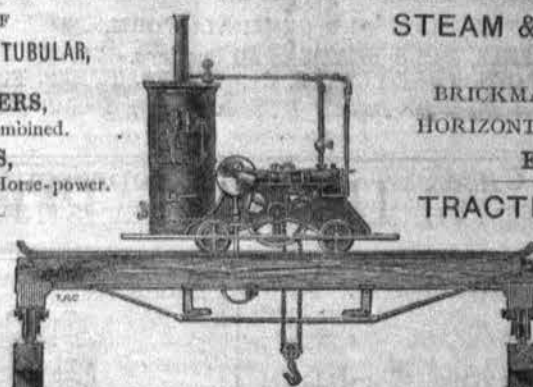
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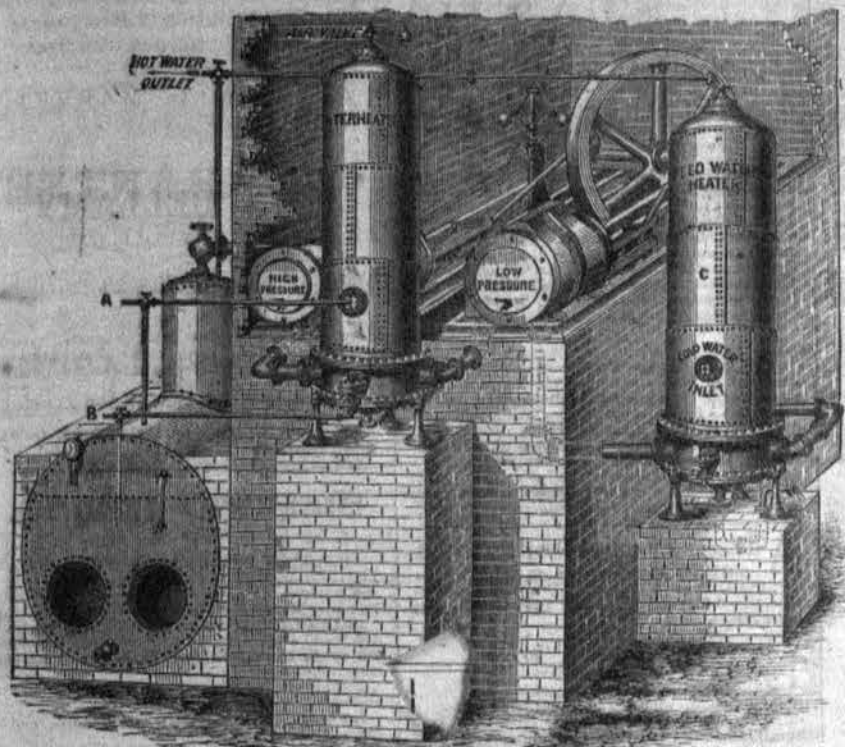
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particulars of the plant may be had and further
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1878.—Apply to E. R. SALWEY, Bryngarw,
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**Society of Engineers.—The
THIRD ORDINARY MEETING** of this
Society for the year 1880 will be held on MON-
DAY, the 5th of April, in the Society's Hall, 6,
Westminster Chambers, Victoria Street.
A paper on "Distilling and Hoisting Machinery
in Sea-going Vessels," by Mr. H. W. FENNELL,
will be read and discussed.
The Chair will be taken at half-past seven
o'clock.

ALFRED ELGAR, Secretary.
6, Westminster Chambers, S.W.

AVIS IMPORTANT.

Le Journal "Iron" (le Fer)
A traite de toutes les matières relatives au
Commerce et à la fabrication du fer. Il donne
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ciaux publiés sur les métaux et sur la quincaillerie
de tous les pays du monde. On y trouvera des
comptes rendus et des appréciations étendues sur
la fabrication du fer et sur toutes matières ayant
rapport à la métallurgie, aux hauts-fourneaux,
etc., ainsi que des descriptions variées sur les
diverses usines. Le journal "le Fer" ayant une
circulation considérable parmi les manufacturiers,
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CONTENTS.

	PAGE
POLYCHROME PRINTING ...	253
OUR TRADE SUMMARY ...	253
MINING PROSPECTS OF THE CAPR ...	253
THE "IMPERIAL" REAPER ... (Illustr.)	253
BRAY'S SYSTEM OF STREET LIGHTING (Illustr.)	255
OCCASIONAL NOTES ...	256
TOLLET'S METALLIC FRAMING FOR LIGHT STRUCTURES ...	256
SCIENCE AND ART—	
Royal Society ...	257
The Society of Engineers ...	257
METALLURGY AND MINING ...	258

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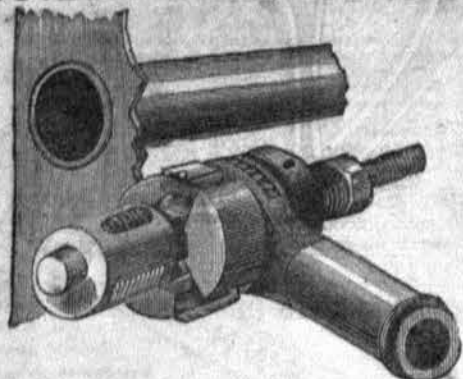
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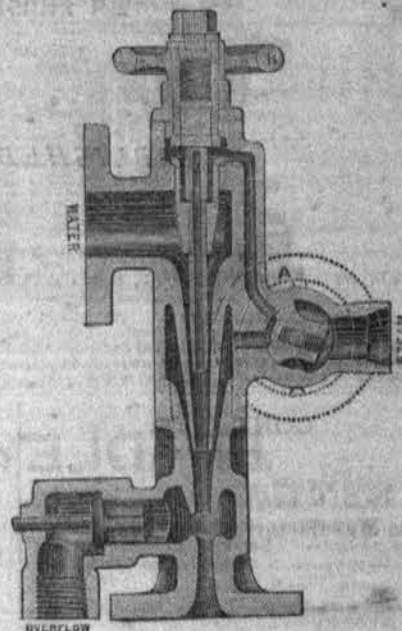
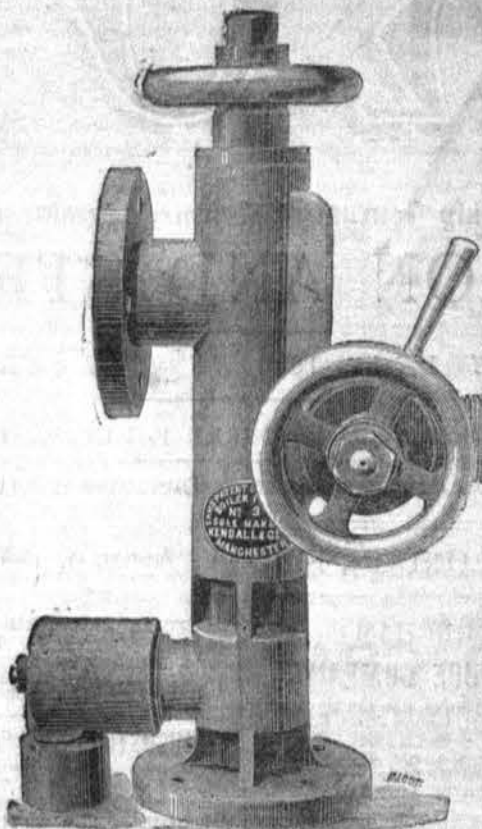
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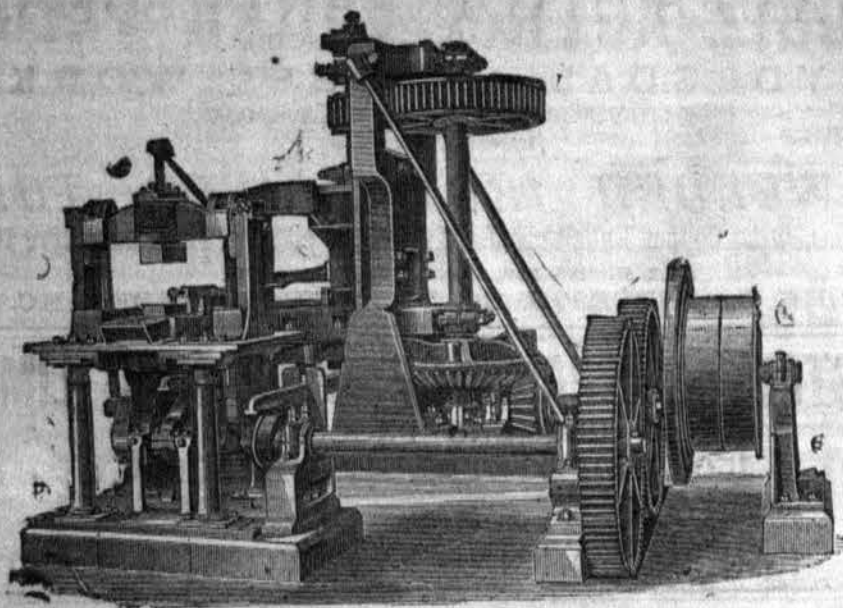


APRIL 9, 1880.

IRON.

III

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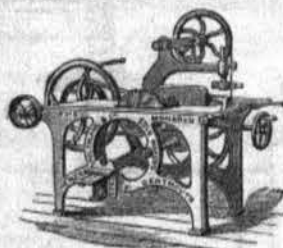
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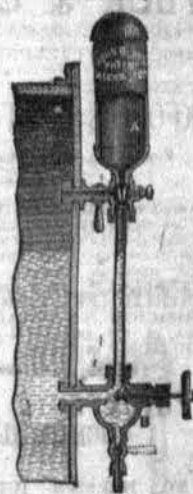
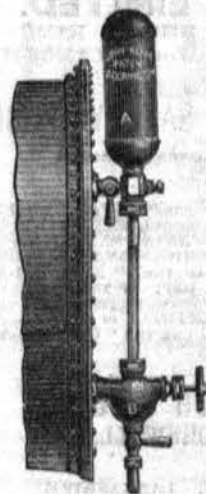
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A is a cylindrical copper vessel supplied with steam through the top gauge cock, and being exposed to the atmosphere it is constantly condensing the steam, thus causing a downward flow of clean water into the glass tube and bottom gauge cock, and so excluding dirt or sediment which would otherwise enter from dirty water in the boiler. When the blow-off tap is opened the clean water is ejected, and on closing it any dirt or sediment that may have entered whilst blowing through settles in the dirt box, B, which dirt is immediately discharged the next time the blow-off top is opened.

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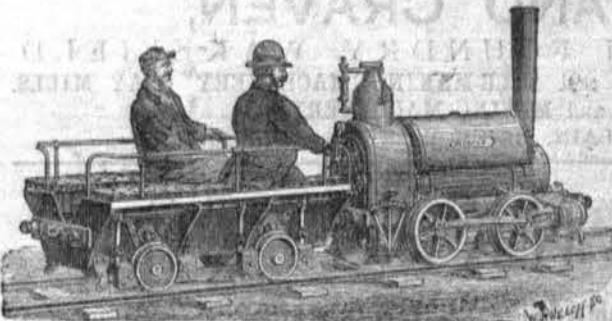
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This is the only BRIDGE
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By Royal Letters Patent.

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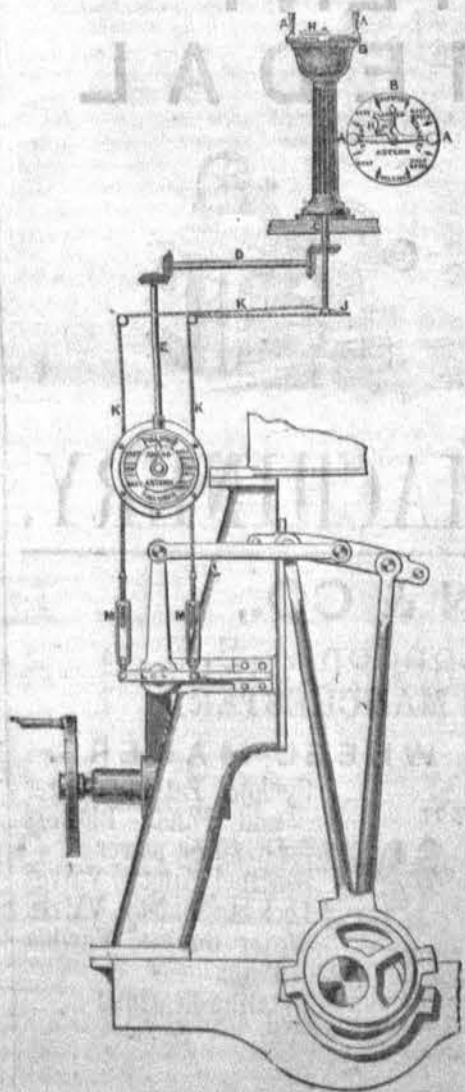
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NEWCASTLE-ON-TYNE.



APRIL 9, 1880.

IRON.

V.



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AWARDED FOUR MEDALS.

ADOPTED BY H.M. GOVERNMENT—OVER 5,000 IN USE.

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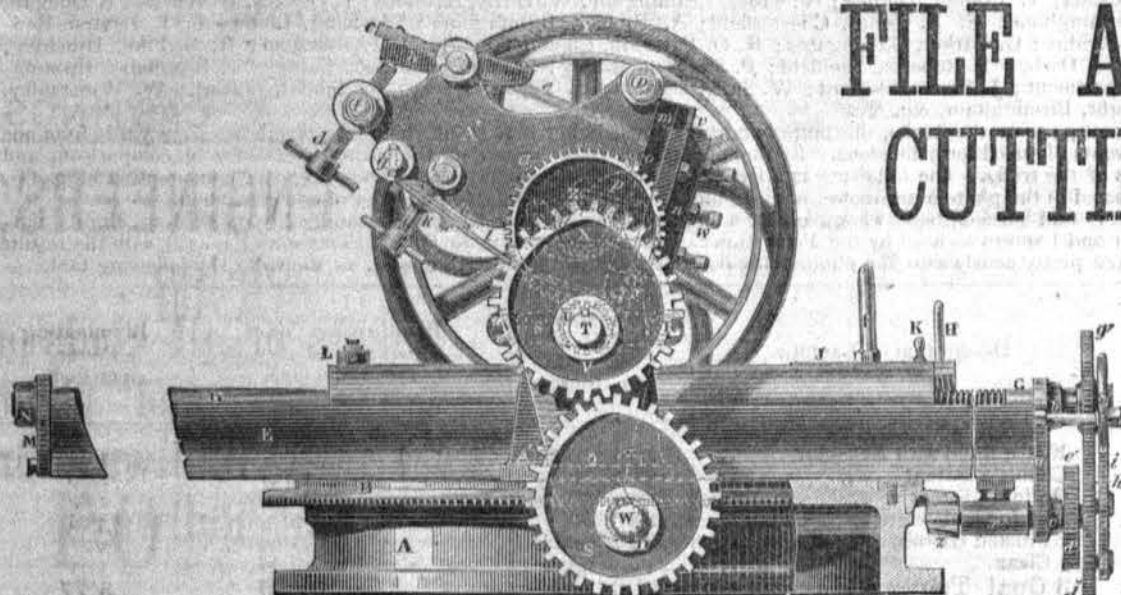
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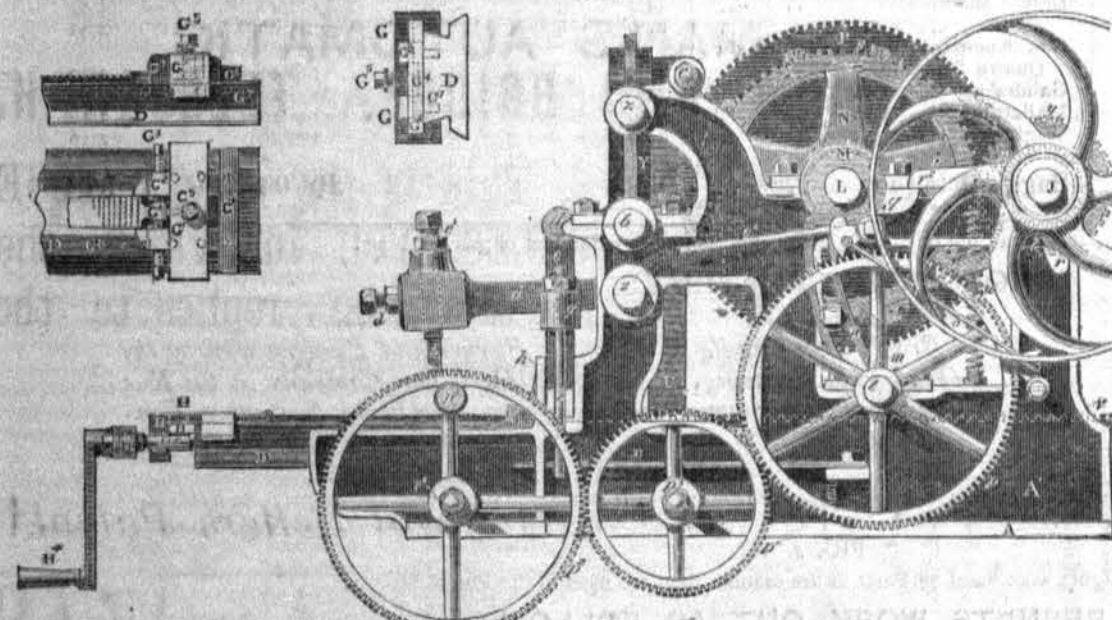
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File Cutting Machine.



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Taken out in January, 1878,
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C. W. & Co. beg to intimate they are prepared to treat for purchase of Patents or the working of the same on Royalty,

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DRAWINGS, ANALYSES, &c., CAREFULLY PREPARED. PATTERNS AND MODELS MADE.

WILLIAM SUGG'S
IMPROVED SYSTEM OF STREET LIGHTING,

SUITABLE FOR CANNEL OR COMMON GAS.

EXTRACT FROM THE JOURNAL OF GAS LIGHTING, &c., MARCH 16TH, 1880.

Experiments in Improved Street Lighting at Birmingham.
PUBLIC TRIAL, WEDNESDAY, MARCH 10, 1880.

ON Wednesday last, at the invitation of Mr. Charles Hunt, Engineer of the Birmingham Corporation Gas Department, a number of Gas Engineers, principally from the Midland Counties, and others interested in the subject of improved street lighting by means of gas, assembled at the Windsor Street Works of the Corporation, for the purpose of viewing a collection of lanterns and burners of large power which had been got together by Mr. Hunt for the purposes of comparative trials of their efficiency. Among those who were present were Messrs. J. Annan, Wolverhampton; T. Arnold, Borough Surveyor's Office, Birmingham; J. C. Bent, Birmingham; G. Bray, Leeds; T. Collett, Dudley; W. Cross, Leamington; W. Davis, Hereford; J. Deakes, Worcester; A. Dougall, Kidderminster; H. Hack, Saltley; T. Jackson, Birmingham; C. E. Jones, Chesterfield; A. P. Ker, Birmingham; W. King, Liverpool; T. Layton, Redditch; J. Mudie, Burton-on-Trent; W. North, Stourbridge; G. Parker, Oakengates; R. O. Paterson, Cheltenham; J. Peaty, Burslem; H. S. Pike, Hinckley; T. Proud, Birmingham; J. S. Reeves, Bilston; J. Reid, Derby; T. Roberts, Sheffield; P. Simpson, Rugby; S. Y. Shoubridge, Saltley; J. Slocombe, Birmingham; E. Smith, Secretary of the Corporation Gas Department; J. Storer, Stafford; W. Sugg, London; C. Taylor, Derby; J. Tindal, Walsall; W. Winstanley, Newcastle-under-Lyme; H. Woodall, Leeds; J. Bright, Birmingham, &c. &c.

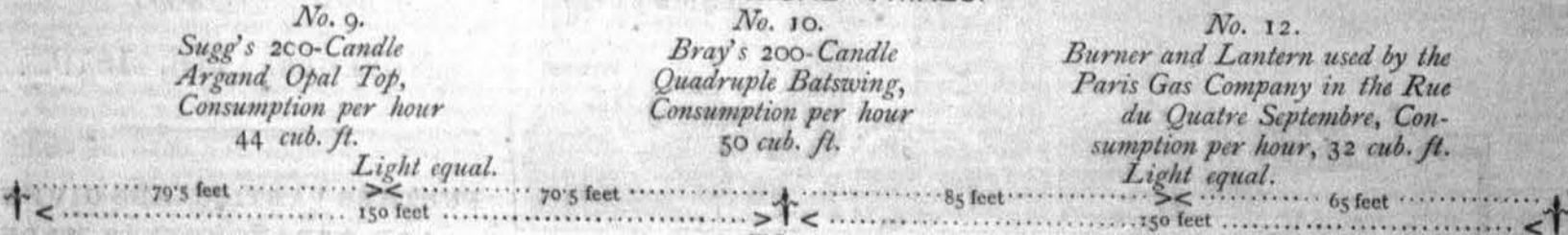
The burners and lanterns were arranged in different parts of the works, the more important ones being placed at distances of about sixty yards from one another on a large tract of unoccupied land to be eventually used for extensions. By this means the effectiveness of the burners was easy of comparison, and much satisfaction was expressed at the completeness of the trials. The following is a list of the burners and lanterns used, showing the consumption of gas by each burner, the illuminating power afforded (when tested in the photometer room), and the illuminating power obtained per foot of gas consumed.

After a prolonged inspection of the various lanterns and burners, tests were made by a shadow meter between Sugg's 200-candle Argand (No. 9), Bray's 200-candle Quadruple Batswing (No. 10), and the Burner and Lantern as used by the Paris Gas Company in the Rue du Quatre Septembre (No. 12), with the results shown on the diagram, Fig. 2. These appear to agree pretty nearly with the photometrical results obtained from each burner, as shown in the following table:—

No. of Lamp.	Description of Burner.	Description of Lantern.	Consumption of Gas. Cubic Feet per Hour.	Illuminating Power in candles, tested with 17-Candle Gas.	Illuminating Power per Foot.
1	Batswing	Kitt's, fitted with Reflector ..	2'5	each without } 4'62 each	1'85
2	"	Collias's Patent	6'	burner reflector } 10'90 "	2'80
3	"	Ordinary Street	5'0	" 14'00 "	2'80
4	Sugg's 80-candle Argand	Sugg's Shadowless	22'8	" 74'55 "	3'26
5	Bray's 60 " Triple Batswing ..	3 Frosted Globes, 24 in. diam. ..	26'4	each 85'00 "	3'21
6	" 60 " " " " " " "	3 Clear	24'0	globe 73'00 "	3'04
7	Sugg's 100-candle Argand	3 Opal Top " 30 in. diam. ..	27'0	101'70 "	3'77
8	" 80 " " " " " " "	1 " " 26 in. diam. ..	23'4	79'87 "	3'41
9	" 200 " " " " " " "	1 " " " " " " " "	45'6	180'20 "	3'95
10	Bray's 200-candle Quadruple Batswing ..	Bray's Shadowless	44'4	134'40 "	3'02
11	" 60 " Triple Batswing ..	" " " " " " " "	21'6	63'00 "	2'92
12	Burner and Lantern used by the Paris	Gas Company, in the Rue du			
		Quatre Septembre	48'0	139'40 "	2'90
13	Gaudet's, Paris	Gaudet's	52'8	158'10 "	2'99
14	Mallet's	Mallet's	43'0	141'10 "	3'28
15	Wigham's	Wigham's	60'0	150'00 "	2'50
16	Sugg's 200-candle Hollow-top, Flat Flame ..	Sugg's Octagon	66'0	201'00 "	3'04*

* A better result—viz., 3'24—was obtained with a consumption of 45 cubic feet of gas per hour.

PHOTOMETRICAL TRIALS.



NOTE.—The Lights were fixed on Posts in the manner they are used in the Public Streets.

THE RESULTS WORK OUT AS FOLLOW:—

No. 9. 27 Per cent. better than No. 10. = 191.7 Candles. Add 24 Candles for the extra 6 ft. of gas required to equal the consumption of No. 10.	No. 10. = 151 Candles or 8 per Cent. better than No. 12.	No. 12. = 92.8 Candles. If the consumption had been 50 ft. the Illuminating power would have been at the same rate—138 Candles.
--	---	---

Total 215.7 Candles or 42 per cent. better than No. 10 for the same quantity of Gas.

The next best on the List is Sugg's 100-candle Argand Burner, as adopted for the Refuges by the Vestries of Lambeth, St. George's, St. Mary, Rotherhithe, England and Lewisham Board of Works, St. Giles' Board of Works, and all the large Railway Companies in London, as well as by most of the principal towns throughout Scotland, and on the Continent of Europe, America, Australia, and the English Colonies in general. The fact that over 1200 of these large burners and lanterns have been supplied to Gas Companies and Municipal Authorities in England alone within a very short time, speaks significantly of the excellence of my improved system of street lighting.

PRICES, PARTICULARS, PHOTOGRAPHS, &c., ON APPLICATION TO

WILLIAM SUGG, Gas ENGINEER,
VINCENT WORKS, VINCENT STREET, WESTMINSTER, S.W.

IRON.

LONDON, FRIDAY, APRIL 9, 1880.

POLYCHROME PRINTING.

THE large number of separate printings required in chromo-lithography, the drying after each impression, the "registering," and the many expensive stones that must often be kept idle, have, for a long time past, led inventors to seek for some method whereby all the colours, of a chromo-lithograph for instance, may be produced by one impression. There are, however, many practical difficulties to be contended with in such an arrangement. The pigments must all be brought to a uniform degree of hardness and consistency, and the colours, when printed, must be permanent and not liable to "set off." None of the attempts in this direction, though promising fair results at the outset, have, we believe, ever passed the experimental stage, owing to the numerous difficulties encountered in practice.

In the latest invention in polychrome printing, we are glad to find that the practical difficulties have been overcome, that the invention has reached the commercial stage, and that orders are being received faster than they can be executed, until some new plant that is in course of erection is in working order. We allude to the process of Mr. W. G. White, of 1, Rue Lafayette, Paris, who is now establishing large works with steam and hydraulic machinery in the Rue du Ranelagh, Paris. After much experimenting, Mr. White has hit upon the combination of chemicals most suitable for mixing with the colours he employs, and which are all of the best quality. The pigment for the ground colour is formed into a solid block of the required thickness, to the surface of which the design, traced on artificial talc, is transferred by mere pressure. All the parts of the block that do not form the ground are then cut out by hand with a sharp knife set in a jointed parallelogram resembling a pentagraph, so as to be capable of moving in all directions in a horizontal plane, but at the same time kept rigidly vertical. The spaces thus cut out are then filled by pouring in the hot liquid pigments corresponding to the colours or shades that are to be reproduced, pieces of wood soaked in water serving to complete the sides of the temporary mould. When cold, the recently added colour is trimmed off by the knife, and another poured in. In the case of a large design, several operators are engaged at the same time on different parts, which are afterwards fitted together; and the method is being tried of cutting out the pattern in wood or metal by the band saw, and then forcing the dies, so cut out, into the block of ground colour by means of an hydraulic press, and thus cutting the pattern out bodily, to be fitted in with the different pigments as before described.

When the whole mosaic, as it may be called, is complete, it is placed in a press, somewhat resembling that for lithography, and the upper surface is shaved off with a steel knife, so as to render it perfectly true and level. The surface is also slightly moistened with a suitable combination of chemicals, and the material to be printed on is placed thereupon face downwards. A frame, carrying six steel rollers, is then passed once or twice backwards and forwards over the material resting on the block, when a perfectly clear impression is obtained, which, in the case of textile fabrics, goes completely through the substance. After exposure for a few minutes on a hot plate, for driving off the fumes of the chemicals employed, the material is found to have received an accurate fac-simile of the design.

The colours are, moreover, so permanent that exposure to the sun does not affect them; and some printed corduroy, after being boiled in strong potash ley for eight hours, was found to still retain a portion of its colour. The colours may be either dull in imitation of old work, or as bright as may be desired. There appears to be no practical limit to the list of substances that can be printed on by this process. We have seen a variety of materials, from the finest silk and velvet to the coarsest jute sacking, all bearing well-defined impressions, while paper, wood, cork, tin, leather, indiarubber and other dissimilar materials, have all been dealt with successfully. In the case of a coarse corduroy, with ribs about $\frac{1}{8}$ th of an inch wide, the block, or "type" as it is called, is corrugated to correspond, and a perfect impression is the result, which could not be obtained by any other known process. We think that the most extended application will be in the reproduction of the far-famed Gobelins and Aubusson tapestries and designs of that nature, for curtains, hangings, chair and sofa covers, &c. We saw at Mr. White's factory an imitation of a piece of tapestry that recently deceived even a dealer and connoisseur, so like the genuine article does it appear. No small amount of progress has been achieved in so multiplying highly artistic designs, in permanent colours, as to render them accessible to the community at large.

OUR TRADE SUMMARY.

THE disturbing effect of the general election has continued evident throughout the past week, although more, certainly, in some districts than in others. Causes of a local nature made, in the beginning of the week, a slight improvement in Glasgow warrants, but it was one merely speculative, for there has been no better demand either for home consumption or shipment. The closing prices on Wednesday were: sellers 57s. cash, 57s. 3d. a month; buyers, 1½ per ton less. Makers sell with great difficulty, but in sympathy with the rise in warrants prices of some brands have slightly advanced. Quietness prevails in the Glasgow manufactured trade, makers having now got pretty well through with their old orders and no new ones coming in. This has resulted in the reduction of prices to some extent. The shipbuilders are still busily engaged on old contracts, but with them also there are no new enquiries to speak of, of which scarcity the engineers and foundries likewise complain. There was a short attendance at the Middlesborough market on Tuesday, notwithstanding its being quarter-day. There has, however, been a gradual rise in prices during the last few days, and on Tuesday the market closed at 57s. for No. 3 G.M.B. The ironmasters' returns show an increase in the March shipments from the district of 12,802 tons over those of the previous month; but the make exceeded that of February by upwards of 15,000 tons, so that there is more remaining in stock than was expected. The finished-iron trade is reported to be steady. There has been little done in pig-iron in the Tyne district; but both in that and the Durham district the tone of the market is evidently better. The shipbuilding industries of the North-east are apparently in a thriving condition, and orders are plentiful at the forges, iron foundries, and boiler and engine works. Stagnation marks the Manchester iron market, which is amply accounted for when the energy with which political aims are followed in the county is considered; but an improvement is generally anticipated when the elections are over. The local consumption is much greater than it was but a short time ago, the leading engineers and boiler-makers being pretty well supplied with orders. In the North-west the comparative dullness continues, but there also it is expected that the close of the electioneering excitement will be followed by renewed activity. Bessemer qualities of hematite iron are being produced in considerable quantity, and large shipments of forge and foundry of the same description are being made in fulfilment of old contracts. Prices, are unsettled, but makers, as a rule, decline to sell under £5 10s. for Bessemer, and for No. 3 forge £5 5s. per ton. Makers who have good orders on hand refuse to quote in the present condition of the market. The iron industries of the district generally appear to be well employed. In Staffordshire and Derbyshire the iron trade, as far as new business is concerned, is very quiet; but an improvement is looked forward to, as numerous enquiries are about for local brands which are expected to be followed by orders. In Staffordshire, in the manufacturing department, the chief run is on merchants' qualities, while the plate trade is fairly good; but prices of finished iron are slowly declining. There is a fair average output of pig-iron in the South Yorkshire district, and in other respects there is no alteration to notice. In the Leeds district, also, there seems little change from last week; the larger ironworks are very busy, but some of the lesser ones are not fully employed. It is much the same with the other iron industries of the district, but, on the whole, a fair amount of business appears to be doing, and the outlook is also favourable. In Sheffield a slight fall in Bessemer steel has been experienced, but prices are slowly recovering, and best steels maintain their value. Fresh orders for armour-plate have been received, and a new demand for rails has set in. The staple trades of the town seem to be in rather a flourishing condition, a good indication of which is that the "hands" are taking measures to secure an advance in wages, which in some instances has been granted at once. The local trades of Birmingham remain in the same stagnant condition. It is, however, believed that as soon as the country settles down into the usual quiet routine a decided improvement in the home trade will take place. In South Staffordshire the state of similar industries is more satisfactory, and in both cases there are favourable advices from the Australian markets. The condition of the iron trade of South Wales continues favourable. In the steam-coal trade also, orders are plentiful and clearances heavy. In various districts throughout the country manufacturing qualities of coal and coke are in somewhat more active demand; but generally the trade continues very depressed.

MINING PROSPECTS OF THE CAPE.

ALL that was known in the mineral way there was the display of mineral springs with which that colony is peculiarly favoured. The official list of them is a long one. They are present in most of the divisions of the country, and have been proved to be as efficacious in the cure of disease as the best of German spas. They are resorted to for a

variety of complaints, as liver, rheumatism, skin affections, &c. The purity of the atmosphere in their neighbourhood, and the relief from the oppression accompanying excessive moisture, aid the waters not a little in curative operations. But minerals of utility and value are now obtained there. The king of metals has fixed one of his thrones just outside of the northern boundary, which supplies the auriferous export of Cape Town. But the well recognised signs of gold are seen in the mountains of metamorphic slates, where they come in contact with igneous rocks. In the hills of Knysna, not far from the southern shore, the real thing has been found, though not in large quantities. But other golden lands took time to realise their hidden sources of wealth. Cape diamonds are too well known and valued to need but passing notice. Silver was observed in the Lion's Head, over Cape Town, as early as 1677. Large deposits are known at Banghoek, on the Orange River. The formation in which these two precious metals are observed elsewhere exist in Cape colony. The Dutch, devoted to pastoral work, gave little heed to the mineral constitution of their colonial home. But the presence of Silurian rocks, as in the Australian diggings, and porphyritic ones, as in Hungarian silver mines, is hopeful for future development.

Manganese, in the Paarl district, not many miles from Table Bay, exists in paying quantities. In a cleft of the mountains, called Du Toit's Kloof, the mine may be seen. The ore is conveyed to port by means of a wire tramway and the help of stationary engines. Its importance may be estimated from the fact of as high a rate as 70 and even 90 per cent. Lead has been obtained, in association with silver, at the Maitland Mines, situated fifteen miles from Port Elizabeth, of Algoa Bay. Iron is not very abundant, though it has during past ages furnished the native blacksmith with material for his spear heads. The Cape, however, is too near the iron foundries of England and Scotland to attend to ferruginous deposits at home.

Copper, however, came so boldly to the front as to command attention, and so well rewarded the early adventurers that others plunged into the rich veins. Several localities have yielded the metal. In 1683, during the reign of our Charles II., there was Copperberg, near Carolusberg, and the mine is still in operation. A fine deposit was found at Fanning River, near the Orange River, in 1835. The Spoktakel mine followed in 1853. The Cape Copper Mining Company was formed in 1863. The great cupriferous deposit occurs in Namaqualand. This extreme north-western division of Cape Colony contains 20,635 square miles, one-third the area of England. Though bordered by the South Atlantic, it is one of the driest regions in the world. Occasional thunder-storms form the only supply for the scanty pastures and fields, yet the climate is singularly healthful, and the soil grows excellent wheat. The population is very limited. Missions have been long successfully established there among the natives.

Geologically, Namaqualand is a granite region. Metamorphic rocks abound among the primary formations, and porphyries are very conspicuous. The Spoktakel mine is at the junction of the Buffels and Schaap Rivers. This has turned out 250 tons a month, averaging 35 per cent. from a gneiss country, employing 600 men. But the O'okiep mine, five miles north of Springbok, has 12,000 tons a year of ore over thirty per cent., with the labour of 900 Europeans and natives. The Concordia workings are eight miles north-east of O'okiep, under a Glasgow company. The Cape Association has constructed a light railway, of thirty inch gauge, from O'okiep to Port Nolloth, a distance of ninety-three miles, which cost £1250 a mile. The port, in lat. 29° S., is 400 miles north-west of Cape Town. The company paid £4 dividend on £7 paid-up shares. Between 1863 and 1873 the revenue was £1,580,000. Smelting on the spot was tried, but found too expensive. The ore is of all sorts. The copper export for 1878 was £303,645. The company have 300,000 acres, utilising most of the area for pasture. The Government mineral law allows forty morgen, about eighty acres, at a rental of 5s. the morgen, and the payment of a trifling royalty, the lease is cancelled if less than fifty tons a year be drawn after the first three years. The term is for thirty-one years.

Coal is not unknown in the colony, though not yet coming forward. It has been found in several parts towards the mountainous sources of the Orange River, in the far north-east. In Wodehouse, by the Indivi River, it has been wrought at a cost of eighteen pence a hundred-weight; but the difficulty was to get 168 tons down to the coast. Albert division, also in the north-east, has good beds. The year before last 250 tons were brought out from Moltena, but at a charge of ninety shillings a ton. Seams are known in Aliwal North, as well as in Queenstown. The Drakensberg and Stormberg ranges abound in the mineral. Some capital stuff was procured from near Aberdeen, 150 miles from Port Elizabeth. In the Camdeboo mountains, Graffreiniet, a central part of the colony, the ash was only five per cent. The railway will pass near the place. The Stormberg veins leave an excess of ash, and are sometimes too charged with clay bands to be very profitable. The Uitenhage coal, on analysis, gave 37 per cent. of carbon, 37 of volatile

THE "IMPERIAL" REAPER.

BY MESSRS. SAMUELSON AND CO., BANBURY.

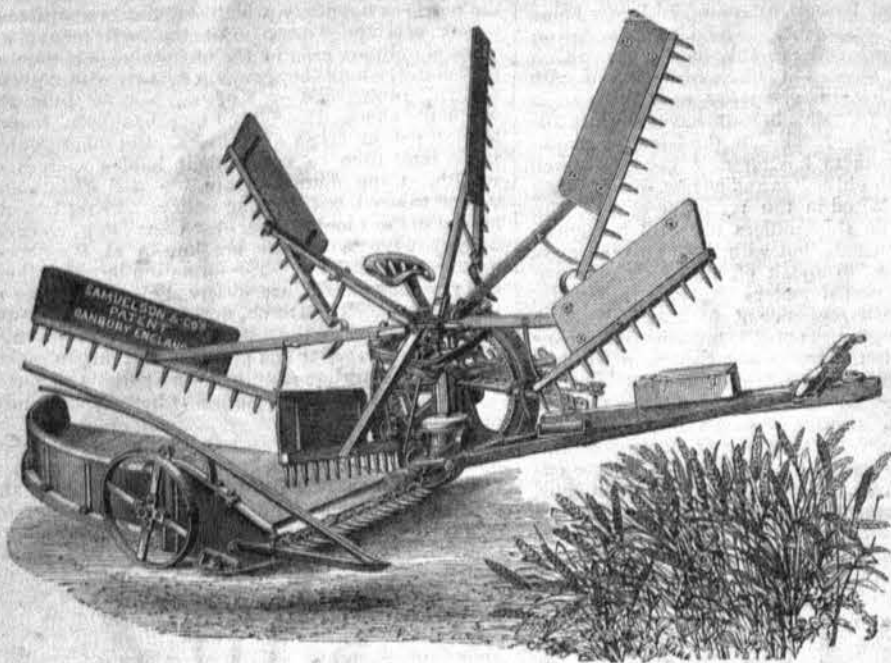


FIG. 1.

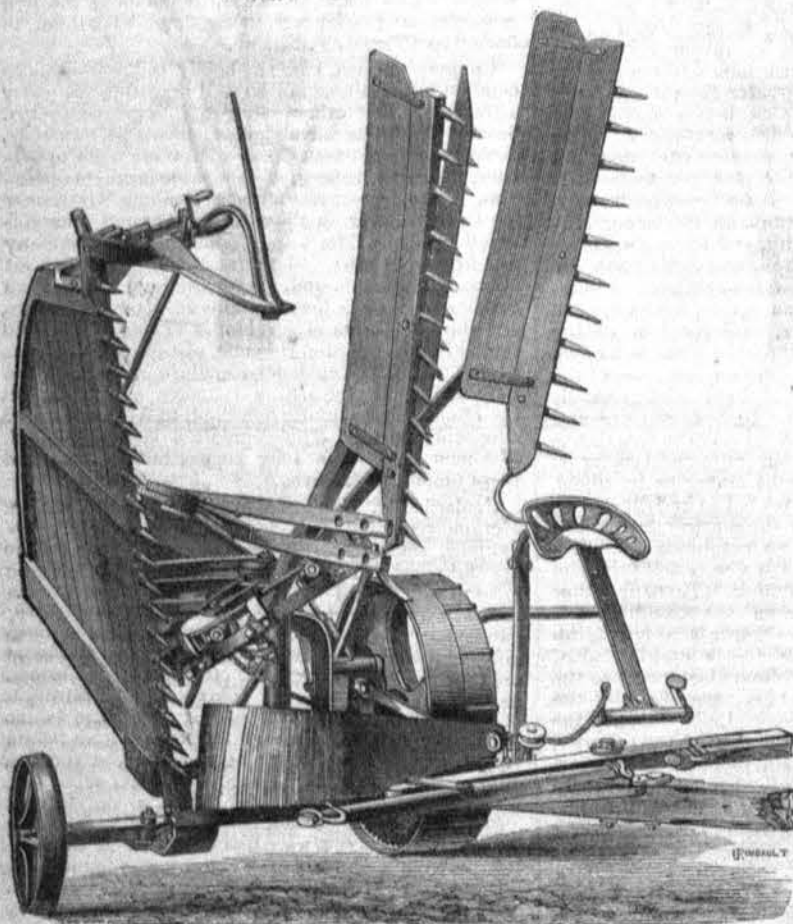


FIG. 2.

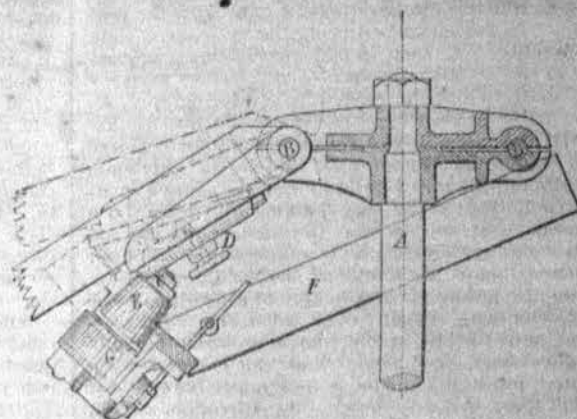


FIG. 3.

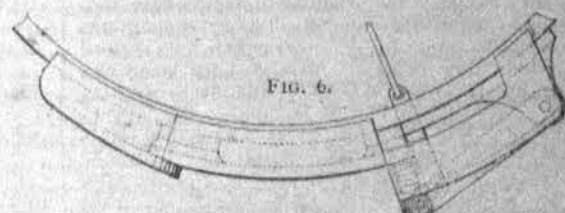


FIG. 4.



FIG. 5.

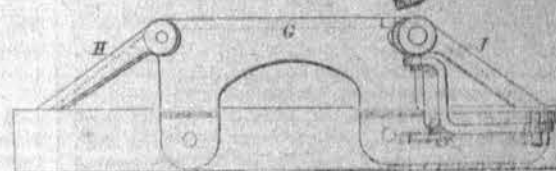


FIG. 6.

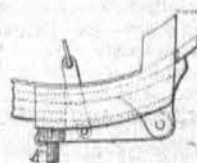


FIG. 7.



FIG. 8.

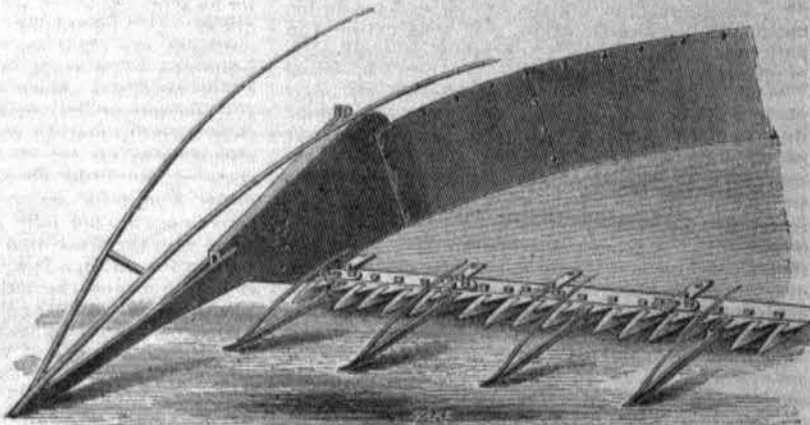


FIG. 9.

matter, and 25 of ash. Mr. Noble ventures to assert that 24 millions of the Cape acres are carboniferous. Carboniferous limestone, 1000 feet thick, exists not far from Grahamstown. The upper coal-beds of Sneeuwberg, Stormberg, and other ranges in the interior, were estimated to be 1805 feet deep. The lower beds at 1500 feet thickness. The latter exhibit themselves in force on the Fish River. The middle beds of coloured shales and sandstones are 1700 feet thick, being found mainly on the Karroos, and called Dicynodon rocks, from the reptilian forms so commonly seen in them. The Upper Karoo shale beds, 1200 feet thick, are carboniferous, like the lower ones, which are 800 feet. As the railways are steadily advancing into the colony, especially from New London port to the Stormberg coal-measures, the day is not far distant when coal will become a profitable industry there.

The Cape Colony, thanks to the Zulu war, has fairly awakened to a conviction that it has something attractive for British emigrants. To those who are not absolutely penniless it offers a free passage out, and carries them without expense up to one of their new agricultural areas, where land is obtained on the

easy terms of ten annual payments of one shilling an acre. Mining speculators can reckon upon cheap native labour, and liberal leases. The easy distance and remarkably healthy climate are great recommendations.

THE "IMPERIAL" REAPER.

IN self-delivering reapers the rake-arms are jointed to the top of a vertical shaft, and the rakes are either made to sweep the cut corn off the platform, or simply incline it towards the knives, and then rise clear of the platform without removing the cut corn; while another arrangement, known as the controlling rake-apparatus, enables the driver, at his will, to perform either operation. In the "Imperial" reaper of Messrs. Samuelson and Co., of Banbury, which we noticed as being exhibited at the Smithfield Show, the controlling of the rakes is effected by the use of a roller path of about 18 inches in diameter on the nearly horizontal plane formed by the edge, on which the anti-friction rollers of the rake-arms travel when the rakes are required to sweep the platform, and

rise on a kind of supplementary bridge when desired to pass without raking; but, at the same time, the rakes may be so set that any one of them shall pass over the platform without removing the cut corn, as we hope to make clear with the aid of the accompanying illustrations.

Fig. 1 shows a reaper with six arms in working order, and fig. 2 the same having the platform turned up on its hinge, so as to pass through a narrow gateway, and for travelling. The smaller land wheel then runs on a supplementary axle bolted on to the frame near the platform-hinge, and in this position the machine is less than 5 feet wide. The large land-wheel has internal teeth cast upon it, which give motion to a pinion on a short horizontal shaft. This shaft carries at its other end a bevel wheel and a bevel pinion, cast in one back to back. The wheel takes into a bevel pinion on a horizontal shaft at right angles to the former, and carrying at its other end the crank disc which gives the reciprocal motion to the knife. The bevel pinion takes into a bevel wheel also keyed on to a short horizontal shaft, which, by means of bevel gear, communicates motion to the vertical shaft carrying the rake arms. The working

parts are thrown into and out of gear by a lever close to the hand of the driver, and the height of cut is regulated by a chain attached to a nut working on a long screw which is easily operated, when standing behind the machine, by the socket wrench provided.

Fig. 3 shows this shaft, A, with a section of the head to which the rake-arms are jointed by the pins B B. In the sockets carrying the rake-arms, slide the brackets C C, seen in end view at fig. 4, adjustable to two positions, nearer to and farther from the rake shaft, and there secured by the spring stud, D. Attached to these sliding plates are the anti-friction rollers, E E, which roll on the annular path, F, except when made to rise on the bridge, G, bolted outside the roller path, as shown in fig. 5, which is an elevation, and in fig. 6, a plan. When the anti-friction rollers are in the position shown by full lines in fig. 3, they run on the edge of the cam path and underneath the flange of the bridge-piece, G, raising the guide, H, and in this case sweep the cut corn from the platform. But when the rollers, by being made to slide in the plates to which they are attached, have been placed in the position shown by dotted lines in fig. 3, that is to say, are brought out farther from the rake-head, they travel on to the guide, J, pass over the bridge-piece, G, down the guide, H, and then along the roller path as before, the rakes being lifted by the rollers passing over the bridge, so as to rise clear of the platform leaving the cut corn thereon. The principle of the "Imperial" Reaper is applied to machines having four or six rakes, and in either case the rollers may be set so that all the rakes shall sweep the corn off, all pass without raking, or any number of them rake or pass, according to the weight or lightness of the crop. But if, when all or any of the rakes are set for raking, the driver should find it expedient to allow any one of them to pass without raking, all he has to do is to depress the treadle to the left of his seat, shown in fig. 2, which, by pulling the chain passing round the small guide pulley, draws the guide, J, in a lateral or horizontal direction, from the position shown in fig. 6 to that shown in fig. 7, when the rake-head rises on the guide, J, passes over the bridge, G, and down the guide, H, thus raising the rake clear of the platform. A spiral spring, on the pin, K, between the guide, J, and the roller path, causes the guide to return to its normal position, on pressure being taken off the treadle. The clearance between the rakes and the platform is regulated by set nuts on two vertical screws which attach the roller path to the machine; and the rakes are made to sweep parallel with the platform by shifting them on the rake arms, to which they are jointed by pins, links provided with a series of holes determining the angle between them.

A handle, like the reversing lever of a locomotive, seen in fig. 2 on the driver's right, serves to adjust the machine so as to suit the nature of the ground; that is to say, raise the fingers on going up hill, and depress them on descending. The platform is particularly free from vibration, owing to the efficient manner in which it is stayed. The finger-beam is so placed that the cut is on a line with the main axle, and therefore more perfect than usual over undulating surfaces. Messrs. Samuelson now fit all their reapers with new patent steel and iron welded fingers, shown at fig. 8, which are lighter and proportionately stronger than the old form. This arrangement permits of closer cutting and better penetration of the crop, while no accumulations gather under the sickle as formerly. The surface on which the knife sections run has a centre portion of wrought iron with steel sides, the wrought iron being shown shaded in the figure, and the steel left white. By this arrangement, the friction of the knife always maintains sharp-cutting edges. Moreover, the absence of the riveted steel plates obviates the annoyance caused by these latter working loose. The guard or cross-bar is of wrought iron; and advantage is taken of the grain of the metal, so as to secure the maximum of toughness, and render the fingers proof against breakage from contact with stones. When the corn is much laid, the firm recommend that four fingers be taken out at distances of about a foot apart, and the "corn lifters," shown at fig. 9, affixed in their place. The effect of the lifters is to raise the ears above the cutting apparatus, and bring the stems between the fingers; they are especially useful in bad seasons, enabling the machine to cope with tangled crops. The weight on the off-side is balanced; and the equilibrium is so perfect that the machine goes backwards or forwards, or turns with great ease. The draught is very light, a patented arrangement being added for equalising the strain and reducing side draught. The seat is carried by the body of the machine, where the driver can see distinctly everything connected with his work, and also perform the various operations of throwing in and out of gear, tipping the fingers, controlling the rakes, &c. The gear is thoroughly encased, and thus effectually protected from clogging by dirt or straw. Gun-metal bushes are provided for all important bearings, to which are attached efficient lubricators, properly capped.

The proper harnessing of the team for working a reaping machine is so important, and at the same time so seldom carried out properly, that Messrs. Samuelson and Co. think it advisable to offer some special suggestions on this subject. They advise that a good set of double harness be provided without

BRAY'S SYSTEM OF STREET LIGHTING.

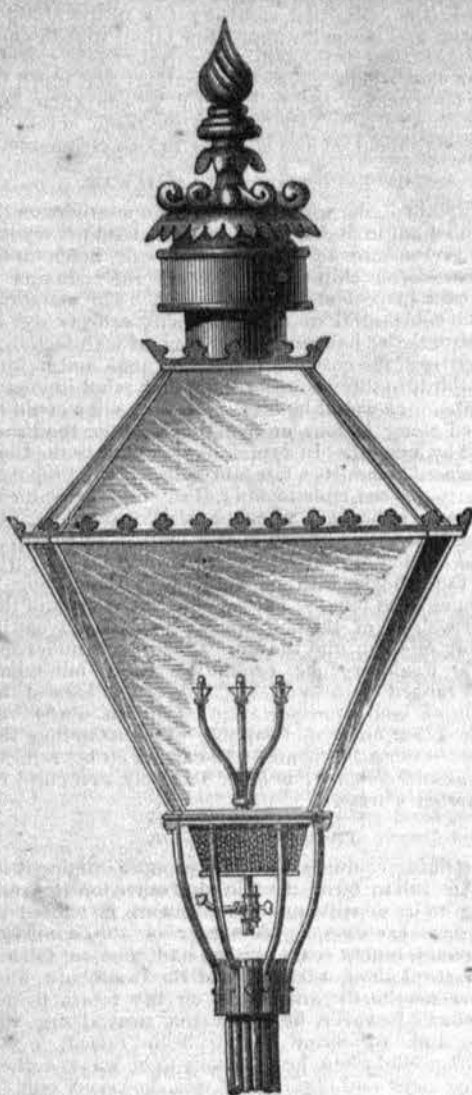


FIG. 1.

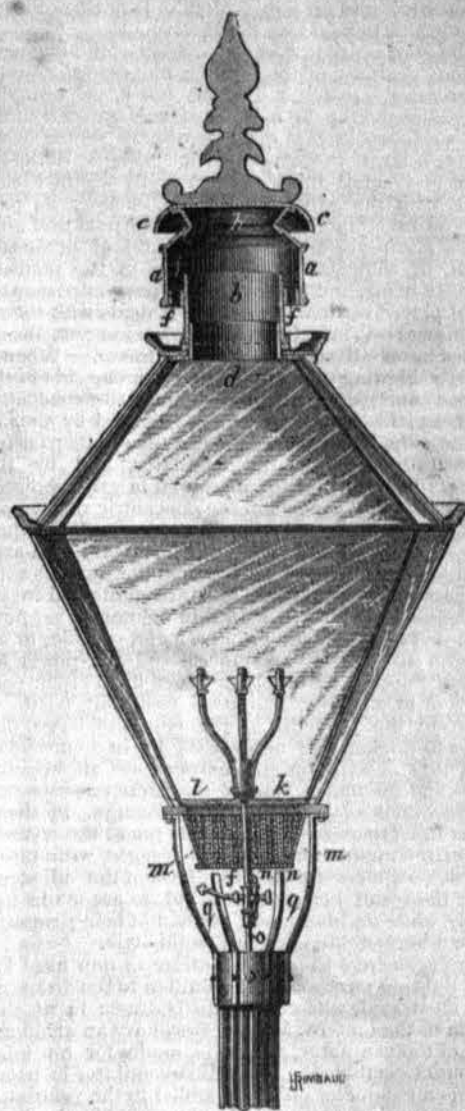


FIG. 2.

breechings; that each set of harness be provided with a backband, a small bellyband and a martingale; and that there be also a strong pair of pole straps. In harnessing, the bellyband should go from trace to trace; the martingale should be buckled round the crossbar to the pole, and go from thence to the bellyband; and the pole-straps should bring the crossbar well up to the collars. When the team is thus harnessed, the pole cannot rise in backing, and the machine will back easily; but if the pole be not thus prevented from rising by the martingale, backing becomes awkward for both horses and driver. We think that the interposition of spiral traction springs, like those exhibited at the last Smithfield Show, between the collar and the draw-chains, would be a useful addition, diminishing the effort at starting, and relieving the horses' shoulders from the shocks caused by inequalities in the ground. The "Imperial" reaper was thoroughly tested in various districts last autumn, under the supervision of local agents and their customers; and the result would appear to be highly satisfactory, to judge from the demand created.

BRAY'S SYSTEM OF STREET LIGHTING.

THIS system, which we illustrate herewith, consists of an arrangement of flat-flame burners of large capacity and high illuminating power as designed and manufactured by Messrs. George Bray and Co., of Blackman Lane, Leeds. The firm hold that, with common gas the flat-flame burner will yield as much light in actual use, and much more with cannel gas, than the argand; and that, for street lighting, it is the only practicable burner. Being convinced of this they instituted a number of experiments with the view of developing the lighting power, and increasing the consuming capacity of the flat-flame burner for use in street lanterns. Having achieved success with their burners, they were under the impression that there would be no difficulty in finding lanterns that would do them full justice; but in that they were mistaken, as, after trying lanterns from the best makers, the result was failure. Instead of steadying, reducing the smoking tendency, and increasing the brilliancy of the flame, the reverse was the case. The difficulty to contend with in the flat flame is its susceptibility to atmospheric currents, and tendency to smoke when agitated by them; and this difficulty increases with the size

of the flame, but in a far greater ratio. The problem, therefore, Messrs. Bray had to solve was how to overcome these difficulties. At an early stage of their experiments they came to the conclusion that success could best be achieved by controlling the flame in a moving column of air, similar to that produced by the argand chimney, but of greater area. They were convinced that anything placed round the flame, in the lantern, of the nature of a chimney would be detrimental to its efficiency for street lamps. They therefore determined to make the lantern itself serve as a chimney. This was the difficulty to be overcome. There was the requisite large volume of air to be passed through the lantern from bottom to top, and this required to be placed under complete control as to constancy, quantity, perfect verticality, and freedom from eddies and ruffles, as the slightest unevenness in the current is reproduced in the flame. All these difficulties were first overcome in the quiet atmosphere of the laboratory, but it was found to be another matter to solve the problem in the agitated outside atmosphere. To perfect the apparatus for outside atmospheric conditions experiments were commenced with the lantern fixed in an elevated position outside Messrs. Bray's works. These at once showed that a new arrangement was required before final success could be achieved, and these improvements were finally embodied in the lantern we have now to describe.

Our illustrations show the lantern and burner in elevation at fig. 1, and in vertical section at fig. 2. The top ventilator is composed of two cylinders, *a* and *b*, and a cover, *c*, at the top. The chimney, *b*, is open at top and bottom, and terminating at the top of the lantern, *d*, opens directly into it; its top, terminates in such a position in the interior of the outer chimney, *a*, as, with the aid of the top cover, *c*, to completely prevent the wind getting into the interior of the lantern, at whatever angle it strikes the ventilator. Between the inner and outer chimneys, *a* and *b*, is an annular space, *f*, of about the same capacity as that of the inner chimney. The outer chimney, *a*, is completely open at the top, and is fixed a sufficient distance from the top of lantern to allow of perfect freedom of downward exit of the products of combustion and air. The top of the outer chimney, *a*, is partly closed at *h*, leaving an aperture of about the same area as that of the inner chimney. This closed portion is carried to a sufficient distance above the top of the inner chimney, *b*, to allow of the products of combustion and air to escape down through the annular space, *f*, when the

top of the outer chimney, *a*, is almost sealed as it is by a strong wind. It will be seen that the inner and outer cylinders, with the top cover, are so arranged that, while perfect freedom of exit for the products of combustion and air is provided, it is not possible for any current to pass into the lantern.

The inlet ventilator at the bottom of the lantern is composed of two distinct parts, namely—the intake or diffuser, and the bed of tubes, *k*, which is covered at the top by a sheet of wire gauze, *l*. The diffuser takes in the air in its usually ruffled state, and, to a large extent, quiets it down or diffuses it, while the small tubes set vertically against each other, with the gauze on the top, ensures its passage into the lantern in a perfectly vertical and quiet state. The intake or diffuser, is made of perforated metal, of sufficient depth to take in the requisite quantity of air, and has concentric rings of perforated metal placed vertically inside. It deals with the air as follows:—When the atmosphere is at rest, the air passes in on all sides in a quiet stream. When a wind is blowing the air rushes in on one side of the diffuser only, and, striking against the concentric rings, has its force and eddies reduced by a small portion only, being turned up at a time in its passage horizontally through the ventilator, and by the currents being mixed up and turned in various directions by the perforations in the concentric rings.

By a proper proportioning of the respective capacities of the inlet and outlet, the necessary area and speed of the column of air required for dealing with the flames, are obtained, and are protected in all weathers by the lantern. In this column of air flat-flame burners are set either single, double, or in clusters, to suit circumstances and the power of flame required. All the burners are fixed either vertically or at a slight inclination from that position. To avoid the tendency of the edges of large flat flames to thicken and become smoky in a current of air of this description, the burners are slightly inclined and the under side of the flame is protected by projections as shown in the engravings. By these means the flames are made to curl round the reverse way of the inclination, and are brought within the influence of more air and the heat of the adjacent flame, the result being that the edges are made intensely white and luminous, instead of being smoky, as when burners are used in the old style.

The engravings show the lantern as now used for street lighting purposes. In addition to the arrangement illustrated, whereby the air is drawn in at the bottom of the lantern, Messrs. Bray have an arrangement of top ventilator, which is made for an inlet and outlet combined. When this ventilator is used, there is a conductor chimney added to the ventilator having a conical bottom projecting into the lantern. This takes the products of combustion to the top of the interior cylinder or chimney, whence they escape into the air, whilst the fresh air, admitted through the perforations at the bottom of the outer cylinder, passes over the conductor and enters the lantern down its sides. The air is then conducted up to the burner, but below the flame, by a cylinder or chimney of sufficient capacity for the purpose. There is also an improvement in the ribs of which the lanterns are made, which give a maximum of strength with a minimum of light-obstructing surface. It consists of a doubled strip of metal being placed lengthwise, edgeway up, along the centre or gutter of the inside of the lamp ribs, to which it is soldered. It is sufficiently high above the rib sides, upon which the panes of glass rest, to form a separating barrier between the panes, and to prevent each pane encroaching upon the other portion of the rib.

Though the introduction of these lanterns to the public is comparatively recent, and though they have had to compete with other systems of lighting, we are informed that they have been supplied to nearly all the principal towns in the Kingdom; and the towns of Leeds, Birmingham and Bolton have adopted them for lighting their Municipal Buildings, requiring for this purpose nearly one hundred. The Parish of St. George's, Hanover Square, have adopted them for all their refuges, and other parishes in London have them in use and we understand are reporting favourably upon them. Messrs. Bray deserve every credit for their endeavours to promote the science of gas illumination.

OCCASIONAL NOTES.

SHIP CANALS.

THE project for connecting the Atlantic and Mediterranean by a ship canal from Bordeaux to Narbonne, has entered on a new phase. The report of M. Lepinay, to whom was committed the task of investigating the scheme, has just been issued under the auspices of M. Duclerc, the Vice-President of the French Senate, who describes it as a work of national preservation, and one from which France would derive immense advantages, military, economical and commercial. M. Lepinay estimates that the gain in time, in the case of steamers, in the voyage from Brest to Malta, would, in some cases, amount to four days. The cost of construction would be something over three millions sterling. A recent traveller reports that the Suez canal, contrary to

anticipations at the time of its construction, maintains its depth with very little help from dredging, and that the current from the Red Sea, which it was apprehended would interfere with its efficiency, has turned out to be no danger at all. On the other hand, it is with great difficulty that at the Mediterranean end it can be kept from filling with the mud brought down by the Nile and carried by the currents in an easterly direction. It is curious that whilst the chief opposition to M. Lesseps' scheme came from this country, fully four-fifths of the traffic across the isthmus should be furnished by British commerce.

CAPTAIN EADS' SHIP-RAILWAY.

Captain Eads, whose successful operations on the channel of the Mississippi have extended his reputation everywhere as an engineer, still holds to his scheme of a ship-railway across the isthmus of Panama in preference to a canal. He maintains that a substantial and durable ship-railway can be constructed at half the cost of a canal with locks, at a quarter of the cost of a tide-level canal, and in from two-thirds to three-fourths of the time; that its cost of maintenance would be less, and that ships could be moved along it four or five times faster than they could by a canal. In explaining his plan to the Congressional committee, Captain Eads said he proposed to carry the sea-ends of his railway into the water to the depth of 30 feet, where a cradle would be submerged for the reception of the ship. The railway would consist of twelve steel rails 70 lb. to the yard, and the wheels with capacity of withstanding a pressure of 20 tons. The number of rails and the great weight of the ship would, he held, prevent its getting off them, and the number of wheels under the cradle would reduce oscillation to a minimum. With regard to the power of ships to withstand the strain of land transportation, Captain Eads remarked that any vessel capable of withstanding the storms of the Atlantic might be carried on his railway with absolute safety; indeed, as safely as a child in its mother's arms.

LOST IN THE BUSH.

A striking example of a danger more imminent in the Australian bush than in any other forest land, owing to its density and other causes, is related in a Sydney exchange. A settler of the name of McDonald, ninety years of age, had gone out for his usual stroll along a tributary of the Goulbourn, and was seen shortly afterwards on his return home. Somehow, however, he afterwards strayed into the bush, and an alarm having been raised, every foot of ground where he was likely to be was searched for five days and nights. It was, however, only at the end of that period that he was found, and alive, although delirious. Still he was able to give a tolerably clear account of himself, although he had fallen into the river several times, once overhead, and had wandered about night and day for so long a period, under a burning sun by day and with one night excessively cold, with frequent rain. After being rested and taken care of he proved to be little the worse of all the hunger, exposure and fatigue. Many persons have been lost in an Australian thicket, and perished almost within earshot of their comrades; others, perhaps less frequently, have been restored to their friends, but it is doubtful whether an infirm old man of ninety ever before passed so little injured through such an ordeal.

THE TYPICAL AMERICAN.

Owing to the immense accession of fresh blood from Europe, it is not easy to understand what will be the ultimate ethnological type of the North American continent. Where, however, the English strain has been kept pure, as it has in most parts of the New England States, there is obviously a change for the worse. The abstinence from alcoholic drinks in these regions is a necessity. An eminent American psychologist says, "We cannot bear alcohol as the English can, or as our fathers could a quarter of a century ago." The Eastern Americans are also more sensitive to cold than Europeans, their teeth decay more rapidly, and they are even more than their English progenitors liable to pulmonary disease, notwithstanding the dryness of the climate. There is something, however, in that climate which tends to weaken the nervous system. Even the phlegmatic German is Americanised in constitution, and becomes liable to nervous exhaustion in the second or third generation. The frequently recurring periods of political excitement may not be without their effect in adding to the widely prevailing nervous debility. Perhaps, when the soil is more extensively settled, and the climate ameliorated by cultivation, the Americans may become more healthy, mentally and physically. It is said, indeed, that in New York the people are beginning to fatten, and that at a recent charity ball in that city stoutness was the rule, and attenuation the exception. Perhaps the guests belonged to some of the numerous rings, political and commercial, which abound in the Empire City, and had fattened on corruption.

OATHS.

There is a story of an American justice who was greatly exercised over the administration of a judicial oath to a man who had lost his arms, and was consequently unable to hold up either his right or alter-

natively in the last resort his left hand, in accordance with the form employed alike in Scotch and American law-courts. The English practice is more catholic, and witnesses in our home and colonial courts are permitted to make oath or affirmation in the form most binding on their consciences. In China the popular cult is a sort of secularism perhaps more nearly resembling the new creed of Positivism than any of the varieties of what is known here as religion; and in the English courts the usual way of swearing a heathen Chinese is by handing him a willow-pattern plate, which he breaks after promising to tell the truth, and the whole truth, possibly imprecating the same destruction upon himself if he should bear false witness. A New South Wales contemporary says that in the early days of the mining town of Sandhurst, when Celestials came before the commissioners' courts, it was the custom to swear them by cutting off a cock's head, and at that time there was a scandal to the effect that when mutton became monotonous at the camp mess it was the habit of the police to run in a batch of Chinamen and call a number of heathen witnesses, which generally assured a supply of poultry for the week. The Government at length objected to the enormous expense, and the plate-breaking formula was had recourse to. In a very short time the camp crockery was smashed, and the authorities declined to replace it. In this emergency the Chinese interpreter was summoned and threatened with six months' hard labour if he failed to find or invent some cheaper method of swearing his countrymen. After a while, concludes our contemporary, Ah Chow's face brightened. "Blow 'em out matchee," he grinned. The idea was gladly adopted, and it has been "Blow 'em out matchee" in Sandhurst ever since.

SELF-MADE MEN.

The *Hudson Star and Times* states that the three most prominent men connected with the St. Paul, Omaha and Chicago Railway Company, namely its president and two of its leading directors, all began life poor, and were the architects of their own fortunes. The chairman, who is scarcely more than forty years of age, started in life as a cabin boy on board a steamship, and was for some time a conductor or guard on a railway. One of his colleagues left home in boyhood, and at eighteen was hired by the month to work in the woods. He is now one of the richest lumbermen, bankers, and railway men in his State. The third of the trio, and the wealthiest, was the son of the cultivator of a small and poor farm in Vermont. Thanks to the free education which every American boy receives, there are very many such in the United States, and the majority of them are not at all ashamed of having carved out their fortunes with their own hard hands. Self-made men, also, are far from uncommon in England; but here they are not so much in the habit of ostentatiously parading the share they themselves have had in the improvement of their condition, rather preferring, by the aid of ancestral portraits from Soho, and by connecting themselves with some noble family whose name sounds like their own, to escape the invidious position of having outrun their neighbours in the race for wealth.

A RAILWAY ROUTE TO INDIA.

An important paper on this subject was read a few nights ago before the Society of Arts, by Mr. B. Haughton, C.E. The main feature of the route proposed by Mr. Haughton is that it passes through Northern Persia instead of along the Euphrates valley, which, in a commercial point of view, is greatly to be preferred, as it would touch several important centres of trade and lines of traffic along its course, while a great portion of the Euphrates valley, notwithstanding its natural wealth, is inhabited by a scanty and impoverished population. Constantinople is proposed as the western terminus, the eastern being at Shikarpore, on the Indus, 250 miles from Kurrachee. The line would run through Herat and Candahar, joining the railway now being constructed at the latter town. The cost of construction from Constantinople to Candahar is estimated at £38,000,000, on which an income of £10 per mile would pay a five per cent. dividend. The charge for first-class passengers at 3d. a mile, and to include the expenses of food *en route*, would reach £60, and the time occupied in the journey need not exceed a week. This line was also held up as greatly superior strategically for the defence of India than any others that have been proposed.

TOLLET'S METALLIC FRAMING FOR LIGHT STRUCTURES.

AMONG modern applications of iron to constructive purposes the system of metallic framing for light structures, patented by M. C. Tollet, a distinguished member of the engineering profession in Paris, deserves the attention of our readers. Of the many attempts that have been made to press iron into the service of the architect, M. Tollet's is, in its way, as complete in theory as it has proved successful in practice; and both on account of its success and the interest that it has for the ironmaster, the architect, and the sanitary reformer, we propose to give a few details concerning it.

It is no secret that, backward as we are ourselves in sanitary matters, the French are still more behindhand.

By the adoption of improved systems of ventilation and sanitation generally, the mortality has been reduced in English barracks from 19.50 per 1000 to 9.52, and our hospitals are much more wholesome than they used to be. In French barracks and army hospitals the mortality is, as a rule, unduly high, and this fault has given great concern to successive administrations. In searching for a remedy for this grave evil, M. Tollet acquired the conviction that one thing to do was to break up masses of beings living together into small groups, and to house them, sick or well, in structures which, by reason both of their form and the constructive element adopted, should afford the smallest possible opportunity for the lodgment and harbouring of germs of disease. He was led, therefore, for the form of his structure to adopt that of a single chamber roofed with an ogival arch, and for his principal element of construction to adopt iron.

The employment of iron as a framework for portable hospitals and barracks is not without its drawbacks. Iron is sonorous, and in an hospital the maximum of quiet is a necessity; iron is a conductor of heat, and habitations in which iron is not applied skilfully are too hot in summer and too cold in winter. This has proved disadvantageous in the model lodging-houses in Glasgow, in which an endeavour has been made to introduce iron freely, and in the cells at Portland. Cleanliness and freedom from infection are both attained, but the coldness of the structures just mentioned has formed a serious argument against the method on which they are built. M. Tollet uses iron for his framework only, for purposes of strength, covering the metallic skeleton with suitable non-conducting material. The structural unit adopted not only gives the maximum of transverse section for the minimum surface enveloping the materials employed; but secures freedom from a multiplicity of angles, and thus gives to ventilation its fullest effect. A Tollet hospital barrack consists of a number of small detached pavilions, with pointed roofs; there is no second-floor, and the skin of the structure, if of wood, can be burnt on breaking up the temporary camp or hospital. The iron ribs forming the substantial part of the structure are of course all rolled to one pattern, are of a light make, and if meant for boarded structures are fitted with grooves to receive the planking. The section adopted is an ordinary T section, two T pieces being bolted together at the feet to form ribs. These ribs are placed four or five feet apart, and are tied together at the upper part by light ties, which form slats for receiving the roofing material. When the structure is not temporary the walls are made hollow for the sake of equalising temperature. No special skill is required on the part of the workmen who have to put up the structure. The form of the roof permits the suppression of cross beams, and while favouring ventilation does not interfere with warming.

In first cost, as compared with wood, iron is on the same level; but its duration is indefinite, while its light weight and easily packed form fit it for making part of the equipment of an army on the march. In permanent structures iron represents only one five-hundredth part of the cube of the materials generally employed.

The expansion and contraction of iron is another difficulty which has to be overcome in most metallic structures. In the majority of M. Tollet's erections the difficulty does not occur, the framework being usually protected from the direct influences of the atmosphere by the internal and external linings adopted for them. And from the same cause vibration is not reckoned on as an evil having to be met.

The economy realised by M. Tollet's combinations will be best illustrated by an example. The Eighth Army Corps of the French army has adopted them, and finds an economy as against the ordinary barracks of £12 per man, and from £3 to £4 per horse, a regiment from £16,000 to £20,000, the cost of repairs being a mere trifle. In 1874 M. Tollet began to build barracks for the artillery at Bourges, and these were partially occupied during the winter following. Statistics for 1877 showed a mortality in the new barracks of 7.6 per 1000, as against 11.88 per 1000 in the rest of the artillery. At Cosne there are infantry barracks on the Tollet system, in which the mortality shows 0.01 per 1000 as against 10.80, the average of the mortality in the infantry taken all together.

At Autun are other barracks on the same system, in which the health results attained confirm those just given. So effective have been the proofs thus furnished that the inventor is now rebuilding hospitals and barracks all over the country. He has a large hospital in hand at Montpellier, and another at Courbevoie, near Paris. At Bourges he has built a military hospital for 300 patients, and his system has been adopted for the engineers' barracks at the fort of Cormeilles, for the cavalry and infantry at Macon, the artillery at the fort of Langres, &c., &c. If, therefore, M. Tollet has borrowed any idea from England, we see that he is perfectly able to pay it back again, and with interest.

SCIENCE AND ART.

PROCEEDINGS OF SOCIETIES.

ROYAL SOCIETY.

(Continued from page 241.)

UNDER certain circumstances the attractive force of electro-magnets in closed magnetic circuit is found to increase with lapse of time. For example:—A small U-shaped-electro magnet with limbs 6 inches long, having a score of $\frac{1}{4}$ -inch iron, and helices consisting of four layers of No. 16 covered copper wire, when excited by four Bunsen cells, supported as an armature a similar U-shaped iron bar, but without a helix upon it, this latter remained firmly attached after the voltaic current had ceased, but the hanging on to it of an additional weight of 3 lb. 6 oz. instantly wrenched it away from the electro-magnet, and broke the closed magnetic circuit. The magnet was then re-excited, the armature being fixed to the electro-magnet by being held in contact with the poles whilst an electric current, of a few seconds' duration, passed through the circulating wire. In

place of immediately attempting to add any additional weight, the two iron U's were left hanging face to face in the form of the link of a chain, for twenty-four hours, at the end of which time the weight of 3 lb. 6 oz. was hung on and sustained. Forty-eight hours later, an additional weight of 3 lb. 10 oz. was carefully added, making in all 7 lb. sustained. Twelve hours afterwards 1 lb. more was added, bringing up the entire weight to 8 lb. beyond that of the armature; this was suffered to remain for five days, when the system was taken to pieces. On a subsequent occasion the same magnet sustained an entire weight of 10 lb. beyond that of the U-shaped armature, the weight sustained being reached by beginning with an amount well within the sustaining power of the electro-magnet wire in closed circuit, and increasing it by small additions made with intervening intervals of time varying from twelve hours to several days. Another and smaller U magnet was likewise experimented on; this weighed with its coils 3 lb. 6 oz. Its armature was a strip of soft iron completely covering the poles, and having a hook in the centre, to which weights could be easily attached. This electro-magnet was excited by the passage, for a few seconds, of the current from two one-pint bichromate cells. On breaking battery contact, the armature failed to sustain 4 lb. The electric current was again sent round the electro-magnet, and the armature was pressed against the poles, being carefully adjusted so as to cover them completely, and at the same time to place the hook precisely in the centre, so that the pull should be fair and equal when a weight was hung upon it. By this careful manipulation, on breaking contact with the bichromate cells, the closed magnetic circuit was found capable of sustaining the 4 lb. weight. By successive additions of 2 oz. weights, made at intervals of a few minutes, the weight hanging to the armature was raised to 5 lb., after which the attempted addition of 2 oz. caused the disruption of the system. The experiment was repeated under similar conditions, but with slightly extended intervals of time between the additions of the 2 oz. weights. The magnet in closed circuit was made to hold 4 lb., $\frac{1}{4}$ lb., $\frac{1}{4}$ lb., 4 lb. 14 oz., 5 lb. 2 oz., the time taken in all, for the successive additions, being ten minutes. The system was then left for twelve hours, when by additions of 4 oz. at intervals of a few minutes the weight sustained was increased to 6 lb. 4 oz. Eleven hours later, this was further increased to 7 lb. 6 oz., and two hours afterwards to 8 lb. 2 oz.

A still smaller electro-magnet, weighing, with its coils, 5 oz., and having an armature consisting of a very thin slip of soft iron, when excited by one of the bichromate cells, could not be made when in closed circuit to sustain $\frac{1}{4}$ lb. at the moment of breaking the voltaic circuit. It, however, sustained 1 lb. with ease. The latter weight was therefore suspended, and the cell wires removed after the closed magnetic circuit was completed. By successive additions of 2 oz. weights at short intervals of time (five minutes to ten minutes each) this small magnet could be made to sustain 2 lb. 2 oz., but the addition of 1 oz. beyond this weight at once separated the armature and magnet. It was thought that a longer interval of time should, as in the former instances, enable the magnet to sustain a still greater weight. It was, therefore, brought into closed circuit, as before, and made to sustain 2 lb. 2 oz. in the manner just related, and was thus left for twelve hours. Successive additions of 2 oz. were then made to the hanging weight until it reached 2 lb. 14 oz. Twenty-four hours afterwards 4 oz. more were added, bringing the entire weight suspended to 50 oz. This small, soft iron magnet which, at the instant the voltaic current was withdrawn, was totally unable to sustain five times its own weight, was thus, by gradual growth of its magnetic force, enabled to hold ten times its own weight. In the course of these experiments it was remarked that the longer the period the soft iron remained in closed magnetic circuit the more magnetically ductile did its molecules appear to become. An electro-magnet, which had been for a few days in closed circuit, could, after rupture of the circuit, be made to sustain weights in a fresh closed circuit at much shorter intervals of time than if it was magnetised, after being for some time with its poles uncovered. The direction of the battery current with reference to the residual magnetism of the electro-magnets appeared to be of no moment. A magnet which had been left for some time with its poles uncovered had less residual magnetism after a momentary current had passed through its helices, than another magnet which had been in active closed circuit, even if the battery current had, in the latter case, to overcome a considerable amount of residual magnetism. We found, moreover, that soft iron magnets retain their residual magnetism longer, and are capable of acquiring increased magnetisation much more rapidly after having been bearing weights (thereby keeping the iron in a state of strain) than if they have been left in their normal condition and without bearing any weight at all. The conditions under which the closed magnetic circuit retains its force are not yet clearly established. With the 58-lb. magnet a succession of gentle taps struck vertically with a wooden mallet upon the centre of the armature, while resting on the magnet in closed circuit, in a very few moments completely dissipated the magnetic force so far as the sustaining power of the magnet was concerned. Removal of any portion of the weight suspended to the armature of a magnet hung up in closed circuit likewise tends to dissipate the force of the circuit. For example:—Half an hour after the removal of a weight of 10 lb., which had been suspended to the armature of a U-magnet for twenty-one days, the armature fell off on receiving a slight touch. In another experiment, a U-magnet, which was capable of sustaining 7 lb., and which had actually been suspending 4 lb., was left for two months with the armature on only, the weight having been removed; at the end of that time a very slight shake was sufficient to cause the armature to fall off. Many other examples might be quoted to show that release from strain diminishes the magnetic force of the circuit. In these experiments, in which the closed magnetic circuits had given way, the soft iron had been in a state of strain from which it had been released by the removal of the suspended weights. But when no weights were hung upon the armature, and the iron had never been in a state of magnetic tension, the closed magnetic circuit so far from diminishing, increased in force. The 58 lb. magnet was excited with a voltaic current so feeble that although the magnet could be lifted by the armature in closed circuit, yet great care was necessary that the lift

should be exactly vertical; and very little force was required to slide the armature off the poles. After the lapse of a month the armature was so firmly held that the utmost exertion of manual force could not stir it by a sliding movement, and the whole magnet could be raised from the ground, even if tilted as much as 15° from the perpendicular. The magnetism of the closed circuit of the 58 lb. magnet disappears after repeated up-and-down movements of either one or both of its helices, provided the ends of the helix wires are connected together either singularly in two separate circuits, or together in one continuous circuit. Every up or down movement of either of the helices produces currents in the wires, either for or against magnetisation, which currents apparently so disturb the molecules of the iron that the fixity of their original magnetic direction is lost. In like manner as the movements of the armature, or the increased or diminished tension of the iron, produce currents of electricity in the helix wires surrounding the magnets so that the movements of the helices produce currents of electricity which may either magnetise or demagnetise the iron. With the 58 lb. magnet in closed circuit, the two ends of one of the helices being connected to the galvanometer, and the two ends of the other helix being connected with each other, the latter helix is moved towards the armature, a current is produced in the galvanometer helix which shows a fall of magnetisation. On moving the same helix away from the armature, a current is produced in the direction of magnetisation. In another experiment 30 yards of No. 16 covered copper wire, with its ends connected together, and so coiled that it could be moved freely from pole to pole over the armature, was placed on one limb of the 58 lb. magnet and the closed circuit established. Both helices were then brought into continuous circuit through the galvanometer. On movement of the coil of wire from south limb to north limb of the magnet, a current was produced showing an increase of magnetisation. On moving the coil in the opposite direction, i.e., over the north limb pole, and on to the south one, the current is reversed, and is in a direction which would cause demagnetisation. It appears, therefore, that any interference with the lines of force about a magnetic circuit, means an interference with the magnetic circuit itself, and points to the possibility of building up magnetic force of magnets by the mere movement of wires in these lines of force, though the coils moved need not of necessity be connected with the helices surrounding the magnets.

THE SOCIETY OF ENGINEERS.

At a meeting of the Society of Engineers, held on Monday evening last, Mr. Joseph Bernays, President, in the chair, a paper by Mr. H. W. Pendred on distilling and hoisting machinery for sea-going vessels was read:—The branch of engineering dealt with in this paper, though less important than some others, is still useful to a maritime nation, and as it possesses some features peculiar to itself the author thinks a short description of its appliances may prove interesting to the Society. At first sight the title of this paper might be taken to denote two different subjects; but such is not really the case, because, as will presently be shown, though the class of the machinery with which the paper deals is usually divided into independent arrangements, still the hoisting machinery is often combined with the distilling apparatus. The author regrets that he has been unable to obtain diagrams or particulars from more than two firms beside the one with whom he himself acquired his own knowledge of the subject.

Sea-water distillers either resemble those used for other purposes, consisting of a worm and a tank, or else they are ordinary multitubular surface condensers, the steam passing through the tubes, and the condensing water circulating through a tank containing them. Graveley's distiller is combined with a cooking hearth which has two 14-inch ovens, a hot plate, and at one end a copper or iron boiler unequally divided by a partition, the largest part for soup, &c., the other making tea. The distiller consists of a plain square boiler, sometimes with one cross tube in it dropped into the hearth, being supported by two angle-irons riveted to its side. The front of the hearth is dipped down over the fire-door, to admit of a water gauge. A grate and ash-pit are in the hearth beneath the boiler, and the flue is taken off either inside past the oven, or outside the back to the uptake. Hence the processes of cooking and distilling may go on either together or separately. In small hearths but one distiller is fitted on the boiler, but on large hearths a pair are provided. Distillers for such hearths consist of a cylinder, either of copper or galvanised iron, 10 to 12 inches in diameter and 18 or 20 inches high. It has a tube-plate carefully soldered or brazed a little way from each end. Up the centre is a tube of 3 or more inches in diameter, whose lower end projects some inches below the cylinder, passing through a plate which forms the bottom of the cylinder, situated some 2 inches from the tube-plate. A number of $\frac{1}{4}$ -inch tubes are fixed between the tube-plates, into which they are soldered or brazed; the condenser is covered with a dome top. A supply of cold water from a sea-cock, where the hearth is below the water-line, and where above the water-line pumped for the purpose, is circulated through the cylinder outside the tubes. The steam rises from the boiler through the central tube above the upper tube-plate, and then returning through the small tubes is condensed. The fresh water thus produced is received in the bottom chamber, and is drawn off to the store tanks by gravitation or pumping. The same stand pipe conveys away the circulating water, and also supplies the boiler, cocks being fitted to regulate both. These distillers are sometimes made separate from the hearths.

The larger apparatus, consists of a horizontal donkey engine with a condenser at its end. The cylinder is 4 inches in diameter with a stroke of 5 inches, the plunger 3 inches in diameter. This will distil from 500 to 2000 gallons per ten hours. The condenser is 2 feet 10 inches high over the dome, with an outside diameter of 1 foot 3 inches. It contains sometimes simply a worm, but more often a cluster of $\frac{1}{4}$ -inch tubes, as in the condenser last described. Steam is supplied by a return tube boiler, either flat-sided or cylindrical; the flat-sided boiler is usually 4 feet in length, 4 feet 6 inches in height, and 2 feet 9 inches in width, with one fire tube, twelve or fourteen tubes $\frac{1}{4}$

inches diameter, and one steam box; the cylindrical boiler is 3 feet 6 inches by 5 feet, with one fire tube 1 foot 9 inches in diameter, and eighteen or twenty return tubes 2½ inches in diameter; it has two steam-boxes 1 foot 9 inches in diameter by 18 inches high. A glass water-gauge is sometimes fitted on the lower part of one of the steam-boxes; the steam does not enter it direct but through a tube from its fellow, as some provision against priming, for, if any takes place, it will be caught in the second steam box—and its presence detected by the gauge—from which it can be blown out. The steam from the boiler flows to the valve chest, which is provided with a regulator of its own; on the condenser is a cock through which steam can be admitted direct to the condenser. The exhaust steam from the engine passes to the condenser, furnishing its quota of distilled water. The engine works the circulating pump, and the suction. The delivery in is at the bottom of the condenser; the water from the screw union is brought into service in case of fire, for washing decks, or any other requirements. In the larger apparatus the engines is mounted on a tank containing the condensing tubes, which with their plates, are secured to the door, and can be withdrawn when requisite. The leading dimensions of this engine are: cylinder, 7 inches diameter by 10 inches stroke; pump plunger, 4 inches diameter by 10 inches stroke. The condenser consists of eighty tubes 3 feet 10 inches in length by 1 inch outside diameter between plates, giving a total external surface in round numbers of 1 foot per tube. The external size of the condenser casing is:—Length 4 feet 9 inches; width, 1 foot 11 inches; and height, 1 foot 5½ inches. The piston rod is prolonged into the plunger, and withdrawing a key enables the engine to be worked alone. The crank shaft is mounted behind the pump, two connecting rods and a cross-band join it to the piston rod. It has an eccentric for the slide, and one for the feed pump. The delivery is through the air-vessel into the side of the casing. The discharge has a union fitted either as a permanent discharge pipe overboard or for the use of the water for various general purposes. The steam from the boiler enters the valve casing, and exhausts, into the condenser. A small pipe allows a flow of steam direct to the condenser; cocks are provided to regulate the steam. The steam is caused to traverse the tubes in sets, moving twice forward and once back by deflections in the tube plate covers. On the end of the crank shaft is mounted a pinion 7½ inches diameter, fifteen teeth 1½ inch-pitch, gearing into a spur-wheel of sixty-eight teeth, 3½ inches wide, and a pitch diameter of 2 feet 9½ inches; this is mounted on a shaft 2½ inches diameter, running across the ship's deckhouse, so as to have the bit ends, *o o*, clear of its sides. On this shaft is a winding barrel of 3 feet in length, and 2 feet 7 inches on the barrel, which is 6 inches to 7 inches in diameter. A brake and clutch gear is provided; bit ends for sundry pulling and hauling are fitted at the ends of the shaft, the latter being supported by A frames bolted to the deck or to the combings of the deckhouse. On one of the bit ends is a chain wheel, and a pitch chain is led from this to the windlass to weigh the anchor, and it is also used to work the deck-pumps when needed. A clutch is fitted to the spur-wheel, so that, if the engine is only making fresh water, the main shaft spur is put out of gear with the shaft. The boiler to work this engine may be 3 feet 9 inches in diameter, 5 feet in length, with twenty tubes of 2½ inches inside diameter, a fire-tube of 1 foot 7½ inches diameter, and a grate 2½ feet in length by about 4 square feet area. Assuming this to burn 20 lb. of coal per foot per hour, and to evaporate 9 lb. of water per pound of coal, it would give, neglecting waste, seventy-two gallons of fresh water per hour. The door of the condenser is secured by studs and nuts, a guide for the piston-rod is provided beneath it, and a gun-metal "eye-lug" is bolted to the crosshead, and works on the guide. The pressure of steam is usually about 45 lb. The water, of course, is filtered subsequently; but the Granby system did not include special appliances for aerating the fresh water—the patentee arguing that, as air was pumped into the boiler with the feed, it must pass off with the steam, and that the subsequent filtering, storing and pumping into tanks also aerated it.

It has been said a chain was led from the chain wheel to the windlass. A windlass, such as ships of 1500 and 2000 tons have, has a double set of powerful spur gear, the windlass spur being a sort of ring with an octagonal centre, which embraces the end of the port side of the windlass. Iron bearings bolted to the carrick bits carry the ends of the first and second motion shafts, being borne by a frame secured to the deck. The windlass spur is 3 feet in diameter, the pinion 9½ inches in diameter, the pitch of teeth 1½ inch, and pinion 7 inches diameter. A clutch gear places the windlass under independent control. The author went on to describe a distiller, by the same firm, with a donkey circulating pump attached, and a distilling engine and boiler intended for land purposes, which, if provided with a boiler capable of burning any vegetable substance available, would be a valuable machine in some wild and new countries. It is well-known that there are wide tracts in the Australian Bush where the water is so brackish that it is very unwholesome, either for animals or human beings. There such a machine would be invaluable. It consists simply of a vertical boiler or condenser and enclosed worm, a donkey circulating pump and a boiler feed pump to supply the boiler with water. The whole is mounted on a frame and wheels for transport.

(To be continued.)

LIVERPOOL ENGINEERING SOCIETY.—The usual fortnightly meeting of this society was held on Wednesday, the 7th inst., at the Royal Institution, Colquhitt Street, Mr. Alexander Ross, President, in the chair; when a paper on "The Sinking of a Shaft in Flintshire under exceptional difficulties, with a description of the pumping gear as fixed therein," was read by Mr. William C. Pagao. The author, after a few observations on the subject of the paper, described generally the site and dimensions of the shaft, which was stated to be 110 × 100 by 485 feet deep, and gave some familiar illustrations by which to compare the magnitude of the pit work which had occasionally to raise 12

cubic yards of water per minute to a height of 366 feet. After these introductory remarks, he arranged the subject into three divisions, the first being a description of the pumps with their weights (which, in their case, amounted to about 160 tons), the methods taken in fixing them both as sinking pumps, and also as permanently fixed with a few remarks upon the engine, engine-house, boiler and chimney. The second division treated of the sinking of the shaft describing the different strata passed through the extraordinary hardness of some of these, and the difficulties caused by the influx of water, amounting at one period to upwards of 1000 gallons per minute. He then made some remarks upon the use of dynamite in wet sinking, and brought this division of his subject to a conclusion by describing the phenomena of the presence of a large body of water in immediate proximity, and the bursting in of this water. The third division was devoted to an account of the submerging and loss of the pumps, very full details being given of the various devices and expedients used in their recovery, all the more interesting from the fact that it was found eventually that the bulk of water and the inflow together were such as to test most severely the endurance and capacity of the pumps. The paper was brought to a conclusion by a graphic description of the final operations for recovery of the pumps, and a few observations upon the anxieties attendant upon superintending works of this class, when life and property were at stake.

ROYAL INSTITUTION OF GREAT BRITAIN.—At the general monthly meeting, held on Monday last, Mr. George Busk, F.R.S., treasurer and vice-president, in the chair, Professor James Dewar, M.A., F.R.S., Mr. Walter Hills, Rev. William Thomas Houldsworth, Mrs. W. T. Houldsworth, Mrs. William Huggins, Mr. George Kelly, F.R.M.S., Mr. Cecil Paget, Captain Matthew Henry Purcell, R.E., Mr. Stephen A. Ralli, Mr. Peter Wyatt Squire, F.L.S., and Captain Henry J. L. Turnbull, R.A., were elected members of the Royal Institution. The members thanked Mr. Warren De La Rue, the secretary, for his present of Bertin's Decomposition Apparatus (for Electrolysis).

CHEMICAL SOCIETY.—The anniversary meeting of this society was held at Burlington House on Tuesday last week, Mr. Warren De La Rue, president, in the chair. The president, in his annual address, contrasted the condition of the society during the past year with its position in 1869. The number of Fellows had increased from 522 to 1034, the income from £1100 to £2700, and the number of papers read from 31 to 75. A rapid glance was then taken of the recent progress of chemistry, especial reference being made to the decomposition of the elements chlorine, bromine, &c., by Meyer; the photographs of the whole of the spectrum recently made by Captain Abney; the artificial production of the diamond by Hannay; the synthesis of vegetable colouring matters and alkaloids; the discovery of a new element, scandium, &c. The officers for the ensuing year were then balloted for, the president elected being Professor Roscoe.

ROYAL SOCIETY.—At a late meeting of the Royal Society Mr. C. W. Siemens made further observations "On the Influence of Electric Light on Vegetation," which strikingly confirm his former statement on the same subject. He exhibited two pots of strawberries which had been grown in the usual way until the fruit buds appeared, when one of the pots was exposed to continuous light—that is, daylight through the day, and electric light during the night, the other being left to the influence of ordinary daylight. The contrast between the two pots, as exhibited at the meeting, was remarkable: one bore a cluster of large, red, fragrant strawberries, the other a bunch of still green, with the exception of one slightly red spot. The ripe fruit was the result of the combined light, from which the conclusion is drawn that electric light may be found useful in the ripening of fruit generally. The ripe strawberries were tasted by the President and pronounced very good.

SURVEYORSHIP OF THE ELY LOCAL BOARD.—Mr. E. W. C. F. Schmidt, late Surveyor to the City of Ely Local Board, has been appointed Building Surveyor to the Eastbourne Local Board under the Eastbourne Improvement Act of 1879.

TECHNICAL EDUCATION.—The Goldsmiths' Company are about to make an annual grant of £300 for three years in order to provide suitable practical and technical instruction at the Horological Institute for apprentices and improvers; and the City Guilds are also subscribing a sum of £500 as a donation, with a promise of more if the results be satisfactory.—*City Press*.

NEW METEOROLOGICAL OBSERVATORY.—Sir James Ramsden, proposes to establish and maintain a meteorological observatory, with a telegraph reporting station, at Barrow-in-Furness. The Meteorological Council have, of course, accepted Sir J. Ramsden's generous offer, which is peculiarly acceptable, seeing that between Liverpool and Ardrossan they have no telegraphic station.

EASTBOURNE.—PROPOSED TOWN HALL COMPETITION DRAWINGS.—In answer to advertisements, designs have been sent in, and on the 5th inst. the Board awarded the first premium, motto "Forward," £75, to Wm. Tadmans Foulkes, Town Hall Chambers, New Street, Birmingham. The second premium, motto "Labore," £50, has in like manner been awarded to Thomas D. Barry and Son, Commerce Court, Liverpool. The whole of the drawings are on public view between the hours of 2 and 5 p.m. in the afternoon up to the 19th inst.

THE BRITISH MUSEUM AND THE ELECTRIC LIGHT.—On Saturday morning last orders were received to remove all the lamps in the reading room of the British Museum and the approaches, which have been used during the last three months in conveying the electric light, and enabling readers to remain in the Museum Library up to seven p.m. During the month of April, therefore, the reading room will be closed at six o'clock every evening, to which hour the galleries will also remain open. The electric light has, however, been such an eminent success as an experiment that the temporary lamps will be substituted by permanent ones, and these will be extended to all parts of the Museum, so that during next winter the public can be admitted up to six or seven o'clock every evening. Great disappointment has been expressed by the authorities at the

delay in removing the Natural History and Zoological Departments from the British Museum to the new museum at South Kensington, which was specially built for this purpose, and was ready for their reception in February last; but orders were received from the Treasury, and repeated on Saturday, that matters must remain *in statu quo*, from the simple fact that no money had been voted to cover the extra expense of removal.

PROGRESS OF PUBLIC HEALTH.—In consequence of the general election, it has been considered advisable to fix the date for the Conference on this subject—which has been held annually by the Society of Arts since 1876—somewhat later than was originally intended, or than has been the case in former years. It will, therefore, be held in the beginning of June. As at the previous Conferences, the Right Hon. James Stansfeld, M.P., late President of the Local Government Board, will be in the chair. A programme of subjects for discussion has been drawn up by the executive committee, and will be submitted to the conference. The following are the subjects included:—(1) The development of local government administration, especially by the constitution of county boards. (2) The extension of the powers of the local authorities of urban and rural sanitary districts. Amendments in the Public Health Act. (3) Sanitary inspection and classification of dwellings. (4) Amendments in the Rivers Pollution Prevention Act. (5) The advisability of strengthening the administrative organisation of the Local Government Board. Local Government Board Administration Areas. (6) Further suggestions by sanitary authorities. It is announced that the detailed programme will be issued shortly, and that copies can be obtained, when ready, from the Secretary of the Society of Arts, by any person who applies. The programme will also be issued to sanitary authorities throughout the kingdom. It is not proposed to make any attempt to procure papers which may be read and discussed; but the committee state that they will be glad to receive any communications containing fresh information, or giving accounts of progress made since the last conference. Such communications, if approved by the committee, will be printed and circulated at the Conference; but it is probable that time will not admit of any discussion being taken upon them.

MEETINGS FOR THE WEEK.

MONDAY, APRIL 12.

LONDON AND MIDDLESEX ARCHÆOLOGICAL ASSOCIATION.—8 p.m.
ROYAL GEOGRAPHICAL SOCIETY.—The Rev. Chauncey Maples, M.A., on Masasi and the Rovuma District in East Africa.
INSTITUTION OF SURVEYORS.—8 p.m. Mr. C. G. Saunders, on Quantity Practice.
SOCIETY OF ARTS.—8 p.m. Cantor Lecture. Mr. R. W. Edis, on Art Decoration and Furniture. Floors, Walls and Ceilings. Mosaics, Tiles, Parquetry. Tapestry, Wall-papers, Figure Decoration.

TUESDAY, APRIL 13.

ROYAL HORTICULTURAL SOCIETY.—1 p.m. Scientific. 3 p.m. General Meeting.
INSTITUTION OF CIVIL ENGINEERS.—8 p.m. 1. Discussion on Explosive Agents as used for Industrial Purposes. 2. Mr. C. F. Gower, on Abingdon Sewerage. 3. Mr. G. Chatterton, on the Main Drainage of Torquay.
ROYAL DUBLIN SOCIETY.—Annual Spring Meeting. (Four days).

WEDNESDAY, APRIL 14.

GRAPHIC SOCIETY.—8 p.m.
AMATEUR MECHANICAL SOCIETY.—8 p.m.
SOCIETY OF TELEGRAPH ENGINEERS.—8 p.m.
GEOLOGICAL SOCIETY.—8 p.m. 1. Professor W. Boyd Dawkins, M.A., on the Classification of the Tertiary Period by means of the Mammalia. 2. Mr. A. H. Stokes, on the Coal found at Sudores Faros Islands. 3. Mr. W. H. Twelvetrees, on a new Theriodont Reptile *Cleorhinodon orenburgensis*.
SOCIETY OF ARTS.—8 p.m. Mr. H. B. Wheatley, on the History of the Art of Bookbinding.
ROYAL MICROSCOPICAL SOCIETY.—8 p.m. 1. Dr. M. C. Cooke, on the Genus *Ravenella*. 2. Messrs. G. Hoggan, M.B., and F. E. Hoggan, M.D., on the Development and Retrogression of Blood vessels. 3. Mr. A. Greenow, on Some New Species of Nitzschia. 4. Mr. W. Webb, on A New FINDER.

THURSDAY, APRIL 15.

ROYAL INSTITUTION.—3 p.m. Professor Tyndall, on Light as a Mode of Motion.
ROYAL SOCIETY CLUB.—6.30 p.m.
NUMISMATIC SOCIETY.—7 p.m.
CHEMICAL SOCIETY.—8 p.m. 1. Dr. Mills, on the Lecture Illustration of Chemical Curves. 2. Mr. W. H. Perkin, on the Analysis of Organic Bodies Containing Nitrogen.
ROYAL SOCIETY.—5.30 p.m.
SOCIETY OF ANTIQUARIES.—8.30 p.m.

FRIDAY, APRIL 16.

CITY OF LONDON COLLEGE.—6 p.m. Dr. Heinemann on Political Economy. An Historical Survey and Summary Statement of the Leading Principles of Political Economy.
ROYAL UNITED SERVICE INSTITUTION.—3 p.m. Major Wilkinson Shaw, on the Organisation and Tactics of Military Convoys in War.
SOCIETY OF ARTS.—8 p.m. Indian Section. Professor Vambary, on Russia's Influence over the Inhabitants of Central Asia during the last ten years.

SATURDAY, APRIL 17.

ROYAL INSTITUTION.—4 p.m. Mr. James Sully, on Art and Vision.

METALLURGY AND MINING.

IRON PRODUCTION IN CLEVELAND.—The production of pig-iron during the first quarter of the year is higher than has ever been known since the iron manufacture was commenced in the Cleveland district. During the three months no less than 575,000 tons of pig iron have been made, of which 450,000 tons were smelted from the local ironstone of Cleveland, whilst the remainder was from richer ores imported from Spain and other parts. In spite of this very large output of iron, the demand has been so great that a very sensible reduction of stocks in the hands of makers has taken place. During the three months the shipments have amounted to 236,000, or more than one-half of the production, from the port of Middlesbrough alone, and stocks of Cleveland iron have now fallen to 247,000 tons. A further fall during the current month is expected, as there are now contracts in course of execution for large quantities of pig-iron for the United States. It is expected that about 18,000 tons will be sent off during the current month to that country alone. The production of iron will also be increased

by the blowing-in of about half a dozen blast-furnaces during this month.

SOUTH STAFFORDSHIRE MINES DRAINAGE COMMISSION.—At a meeting of the Commissioners held at Wolverhampton on Wednesday, the proposed draft award of the arbitrators for altering the boundaries of the Bilston and Tipton districts was considered. It was reported that the Committee, which had the matter under consideration had not arrived at any satisfactory conclusion at present. They felt that they ought to see the effect of the surface works before coming to a decision as to the amalgamation. The surface works would be pushed forward as rapidly as possible; but it was impossible to say when they would be so far completed as to enable the Committee to arrive at a conclusion. The Chairman (Mr. W. Williams) stated that a stream of water was running out of the Birmingham Canal, and two pits near the Pothouse Bridge, Bradley, not many yards from the canal, had for years been receiving as much of the water as they could take, and from those two pits it was finding its way into other mines. The company were at last making the necessary repairs, and they promised to cut off the supply. There were leakages in other parts of the district, though not of so large an extent.

COAL AND IRON INTERESTS IN PARLIAMENT.—Although the coal and iron interests of the kingdom were largely represented in the last Parliament, the returns on the present election go to show that they will be fully as largely represented, if not more so, than they have been. Mr. Brogden, so well known in connection with the iron trade, has been returned for Wednesbury. Mr. C. Seeley who, with Mr. Wright, represents Nottingham, is largely interested in collieries there; but Mr. S. Isaacs, the lessee of the Clifton Collieries, has been rejected, although he sat in the last Parliament. North Nottinghamshire has returned two gentlemen whose families are interested in the coal trade: Viscount Galway's family being the lessees of the Monkton Main Colliery estate, whilst Mr. C. S. Follam is the son of Mr. Follam of Osberton, the member for East Relford, the latter of whom owns a mineral royalty in South Yorkshire. Mr. G. N. Newdigate, the member for North Warwickshire, has a colliery at Nuneaton. Stalybridge has returned the son of a large iron merchant at that place, whilst Mr. S. Wortley, the Conservative member for Sheffield, is related to the Earl of Wharfedale, lessee of the Wharfedale Silkstone Colliery Estate, in South Yorkshire. Mr. E. Barnes, who is connected with the well-known Clay Cross Collieries, has been returned for East Derbyshire, his candidature being largely supported by Mr. Markham, manager of the Staveley Works, Mr. J. S. Smith, and other leading gentlemen connected with the trade. The Hon. C. Fitzwilliam, the member for Malton, is the lessee of the Fitzwilliam-Hemsworth Main Colliery, which has just been turned into a limited company. Hartlepool has returned Mr. Richardson; Stockton-on-Tees, Mr. Jos. Dodds, both of whom are largely interested in the iron trade. On Wednesday, South Durham chose Mr. J. W. Pease, one of the largest coal owners in the North of England, and Mr. F. W. Lambton, brother of the Earl of Durham, who is largely interested in vast royalties in that district. Whitby has selected Mr. A. Pease, brother to Mr. Pease, the member for South Durham. Middlesbrough, Mr. I. Wilson, one of the firm of Messrs. Hopkins, Gilkes and Co. (Limited). At Darlington, Mr. A. Fry, the head of Messrs. Fry, Janson and Co., ironmasters of that place, has been elected; whilst Banbury has made choice of Mr. B. Samuelson, of Middlesbrough, the owners of large ironworks there. The Hon. J. C. Dundas, brother of the Earl of Zetland, who owns large royalties in Cleveland, has found a seat at Richmond. York has selected as one of its representatives Mr. G. Leeman, whose family is interested in works on the Tees. The member for Kendal (Mr. J. Whitwell) is interested in ironworks at Barrow, whilst Sir E. Colebrooke, who represents Lanarkshire, is an ironmaster. Amongst the defeated candidates are to be found Mr. J. C. Pope, Chairman of the Denaby Main Colliery, near Mexborough, son of the late Mr. Pope, the head of Messrs. Pope and Pearson, the noted colliery owners. Pontefract rejected Mr. F. C. Shaw, of Darrington Hall, a large district coalowner, and Mr. Green, of Heath Hall, the well-known maker of smoke economisers. At the time of writing a number of gentlemen interested in the coal and iron trades are before various constituencies. Mr. W. B. Beaumont, of Bretton Hall, Yorkshire, is a candidate for South Northumberland, he being the largest owner of lead mines in the county. The Marquis of Hartington is a candidate for one of the seats in North-east Lancashire; and his brother, Lord Edward Cavendish, for North Derbyshire. They are both the sons of the Duke of Devonshire, Chairman of the Barrow Colliery Company, and the lessee of the Staveley coalfield, as well as a local coalowner. Mr. W. S. Stanhope and the Hon. W. H. Fitzwilliam, candidates for the South-west Riding, are both interested in the coal trade, and Mr. R. Winn, one of the candidates for North Lincolnshire, in ironstone.

RAILWAYS & TRAMWAYS.

THE ST. GOTHARD TUNNEL.—A Berne journal has watched the number of casualties which has happened during the boring of the St. Gothard tunnel. From the beginning of the work up to December the number of workmen killed was 106, and that of the seriously injured about 300. Further, up to the 28th of February last, when the wall between the two tunnels were pierced, the casualties had amounted to 150 killed and 400 disabled. In proportion to the total number of workmen employed the killed form 1 per cent. and the injured 2½ per cent. A plan has been set on foot to assist the disabled men and the families of the killed.

THE INNER CIRCLE RAILWAY.—At a meeting of the City Commissioners of Sewers on Tuesday, a letter was read from Sir E. Watkin, M.P., and Mr. J. S. Forbes, on behalf of the joint Committee of the Metropolitan and District Railways, in reference to the construction of the works authorised to be carried out between the King William statue and Trinity Square, and inquiring whether

some further efforts might not yet be made by the companies and the public bodies to ensure the construction of the street improvements simultaneously with the Inner Circle Railway. After a discussion, the Commission, with but one dissentient, resolved to reply to the communication by stating that they did not see their way to alter their former decision on the subject.

SOUTH AUSTRALIAN RAILWAYS.—South Australia has now 533½ miles of railway in working, and 475½ miles either in course of construction or authorised. Alterations and additions are being effected at the Adelaide station-yard, with a view to accommodate the traffic, which will be increased as soon as the Holdfast Bay Railway, now in course of construction by a private company, is connected with the Government lines. An additional line of rails has been authorised to be laid between Adelaide and Port Adelaide. The requisite permanent way material is expected to arrive shortly, and the culverts and earthworks are in hand. Designs have been submitted for a new passenger station at Port Adelaide, in which the present building will be utilised as far as is practicable. One mile of the railway has been relaid with 61 lb. steel rails. At the Adelaide Station, which has been almost entirely rebuilt during the year, an hydraulic lift has been erected. An arrival platform, with additional luggage room and engine traverser, to meet the extra traffic caused by the Holdfast Bay and Nairne lines, are fast approaching completion.

PRUSSIAN RAILWAYS.—The total receipts of the railways of Prussia in 1879 were 550 million marks, or £27,500,000. The working expenditure was 310 million marks (£15,500,000), leaving 240 million marks, or £12,000,000, for distribution among the shareholders. This is equivalent to an average dividend of 4·9 per cent. on the capital invested. According to the statistics of the Prussian Ministry of Public Works, during the year 1879 the additional length of railways opened for traffic amounted in the aggregate to 1175 kilometres, or about 730 miles. Of this increase, 798 kilometres were in railways belonging to the State; 54 kilometres in private railways worked by the State; 290 kilometres in private railways worked by private companies; and 36 kilometres on Prussian soil, but belonging to non-Prussian companies. The number of passengers killed in accidents on the railways of Prussia in 1878 was 12, while 46 was the number of the injured. The cause in 8 of the fatal and in 16 of the non-fatal cases was imprudence or want of caution on the part of the victims or sufferers themselves in entering or alighting from the carriages. The deaths were only one in every 9½ million passengers, and the cases of injury only one in every 2½ million passengers. This result shows an improvement in regard to the safety of travelling on Prussian lines. The average of five normal years before the last showed that there had been one passenger in every 5½ millions killed, and one injured in every 1½ million passengers. Of the railway servants and officials there was an accident last year to one in every 174, while among the railway labourers there was an accident to one in every 120. There were 93 persons who attempted suicide by laying themselves on the line, and 86 of these cases were attended with fatal results.

THE TAY BRIDGE DISASTER.—After months of labour, the whole of the carriages and the engine forming the train which fell into the River Tay, by the giving way of the Tay Bridge on the night of the 28th December last, were recovered on Wednesday last. Three carriages which were next to the engine are lying at Broughty Ferry, beached inside one of the girders; and a third and second class carriage, with the guard's van, were on Wednesday recovered from the Dundee Docks, and conveyed on trucks to the North British Goods Station, where they are to be photographed for the Board of Trade inquiry. The wrecked carriages are fearfully shattered, and present a melancholy sight. The second carriage seems to have suffered most, as only a part of the bottom is left and two of the wheels. It was of lighter construction than the others. One of the third-class carriages is comparatively entire. The four wheels are standing, with part of the end of a carriage and a door. Of the guard's van nothing remains save the lower frame and the brake apparatus and guard's seat. The brake is uninjured, and does not seem to have been applied. The whole of the iron work is broken and twisted, and the axles of the carriages are in some cases bent into semi-circular form. The coupling links are all broken and the buffers smashed, and the general state of the ironwork presents evidence of the terrible force of the shock caused by the fall. Not a trace of the unfortunate occupants was found in or near any of the carriages. The engine and tender were raised on Wednesday evening, and beached at Tayport, but there has not yet been time to make a complete examination into their condition. Hundreds of persons inspected the remains of the carriages, and the interest in the sad disaster has been to some extent revived.

COMMUNICATION WITH THE ISLE OF WIGHT.—On Monday last a short line of railway was opened to the public which will eventually prove an important factor in the revolution which is being effected in the means of access to Ventnor and the other southern watering-places of the Isle of Wight. When the scheme originated by the South-Western and South-Coast Railways, acting on the advice of their respective general managers, Mr. Archibald Scott and Mr. J. P. Knight, has been entirely completed, the visitor will enjoy the advantage of a greatly improved steam-packet service, for the steamers have lately become the property of the joint railway companies. He will be landed at a fine pier, where the train will be waiting to convey him to any part of the island; and he will be enabled to arrive at his destination within three hours of leaving London, with only those changes of conveyance that are absolutely necessary. The complete scheme will cost the joint companies about £250,000—as it includes, besides the steamers, the execution of some heavy works through the town of Ryde, involving the purchase of valuable properties, in addition to the construction of an iron pier half a mile long, with a pier-head giving accommodation to five or six steamers at one time, and amply provided with waiting and refreshment rooms. It is the portion of the railway through Ryde which was opened on Monday, and the remainder (on the new pier) will be ready for work this summer. This last part of the line has presented some peculiar engineering features. Starting from the old pier gates, the rails dip down through what were two dock basins into a tunnel or covered way 400

yards long, which takes them under the Esplanade and three of the principal streets of the town, and then by a rising gradient brings them out on the low land lying between Ryde and St. John's Park, where they make a junction with the existing Isle of Wight Railway system. The line runs either through or on the top of most treacherous ground, and it required a considerable amount of engineering skill and patience to carry the railway through, not only without a single mishap to the works themselves, but also without injury to any of the workmen. The engineers-in-chief of the new line were Mr. W. Jacomb, of the South-Western, and Mr. F. Dale Bannister, of the South-Coast Railway Companies, their resident engineer being Mr. Ernest Benedict. The contractors were Messrs. Perry and Co., of Bow; and the works have been carried out satisfactorily.

THE RAILWAY UP VESUVIUS.—The *Daily News* Naples correspondent writes:—"At the foot of the cone of Vesuvius there is now to be seen the new station of the railway which ascends to the summit of the old crater, and in future will spare the lover of natural phenomena a wearisome climb. The station is situated on a level spot on the west side of the mountain, about half an hour's walk from the Observatory. As before, the traveller must reach the Observatory from Resina by carriage or on horseback, but he need no longer dismount or leave his vehicle until he has arrived at the new station, to which the broad road has been continued. The constructors of the railway have adopted the American double iron rope system. There are two lines of rails, each provided with a carriage divided into two compartments, and capable of holding six persons. While one carriage goes up the other comes down, thus establishing a counterpoise which considerably economises the steam of the stationary traction engine. The incline is extremely steep, commencing at 40 degrees, increasing to 63 degrees and continuing at 50 degrees to the summit. Every possible precaution has been taken against accident, and the railway itself is protected against possible flows of lava by an enormous wall. The ascent will be made in eight to ten minutes, while before it required from one to two hours. To obtain the necessary supply of water, large covered cisterns have been constructed, which in winter will be filled with the snow that often falls heavily on Vesuvius. This snow will be quickly melted by the internal heat, and, besides the water thus obtained, the frequent rainfall will also be conducted into the cisterns. An elegant café-restaurant, capable of accommodating a hundred persons, will be attached to the station. Above the entrance to the latter is an ample terrace supported on columns, whence an enchanting view is obtained not only of the gulf of Naples, but also of those of Baie and Gaeta, each dotted with its islands, while to the north spreads the luxuriant plain of Caserta, bordered by the distant Apennines. Though the iron road may take away some of the poetry and adventure connected with an ascent of the fiery mountain, it must not be imagined that the charm of risk will be entirely lost. On reaching the top there is still the new and smaller cone to be ascended, and no longer ago than last Sunday an acquaintance of mine was there nearly struck down by a large block of glowing lava, which fell at his side with a terrible noise. With a very little extra exertion of his strength, the Titan Vesuvius can at once put an end to all our puny attempts at conquest, and destroy in an hour the labour of months. For the sake of the enterprising originators of the new railway, let us hope that this may never be the case."

ELECTRICITY, TELEGRAPHY

THE ANGLO-AMERICAN CABLE.—The cable laid by the Anglo-American Telegraph Company in 1873 between Ireland and Newfoundland was broken on Friday evening last week, at about thirty-six miles from the landing place on the Irish coast, in eighty fathoms of water. A steamer has been despatched to effect the repair.

THE TELEPHONE BETWEEN WESTMINSTER HALL AND THE TEMPLE.—The several chambers in the Temple will shortly possess the advantage of having communication by telephone with the law courts at Westminster and the Houses of Parliament. The telephonic apparatus is at present being laid down between the Temple Gardens (immediately in front of the recently-erected Harcourt and Plowden Buildings) and Westminster Hall, the Metropolitan District Railway being utilised for the purpose. The apparatus, after having been connected with several of the chambers and offices in the Temple, enters the underground railway line, which it is carried along immediately under the crown of the railway arch, until arriving at the subway leading into Palace Yard, and is thence carried forward in the direction of Westminster Hall and the Houses of Parliament.

TELEGRAPHY IN INDIA.—We gather from the last administration report of the Indo-European Telegraph Department for 1878-9 that the net revenue of the year amounted to £7328, a decided improvement on the previous year's working, when there was a net loss of 40,182, the length of lines working being the same in both years. The director, Lieutenant-Colonel J. U. Bateman-Champain, R.E., considers that these figures show a favourable state of working as can reasonably be expected. In the Persian Gulf on several occasions the cables were interrupted, but the cable and land-line were never simultaneously stopped. The distance between London and Teheran is some 3800 miles; the average time of transit of all messages is given as 17 min., 30 sec.; while the time occupied in transmitting messages between Teheran and Bushire is stated at 2 min. 58 sec. In all about 35,000 messages, comprising 700,000 words, were sent; of these 32,000 were through messages between Europe and India and the Far East.

THE ELECTRIC LIGHT.—The *Telegraphic Journal* of April 1st, contains a description of a new form of lamp for the electric light, which has recently been invented by Mr. Charles Stewart, M.A. It consists of a number of square carbon rods placed radially upon a disc of wood or metal in such a manner that the inner ends of the carbon rods form a complete circle. There is a circular opening in the wooden

disc through which the electric light is seen from underneath. The carbons which are all forced towards the centre by a uniform pressure move forward as they are consumed and together form the positive electrode of the lamp. The negative electrode consists of a covered hemispherical cup of copper which before the current enters the lamp rests upon the ring formed by the carbons. On the current entering the lamp an electro-magnet raises the metal electrode and the electric arc is then formed between the circle of carbons and the metal electrode. There is a flow of water through the latter to keep it cool. The advantages which this lamp possesses are:—(1) It is automatic in its action. (2) It is capable of burning for a very considerable period. (3) It does not throw any shadows. (4) It is of simple and comparatively inexpensive construction. (5) The intensity of the light may be increased if so desired. This is the second lamp for the electric light which Mr. Stewart has recently invented.

THE DIAPHOTE.—The following account of experiments with this instrument, is condensed from the *Reading (U.S.) Eagle*. The Diaphote is an instrument by which you can see by telegraph. Dr. H. E. Licks, of Bethlehem, Pennsylvania, has invented an instrument which he calls by this name, from two Greek words, *dia*, through, and *phos*, light. He read a paper in Reading, the other day, and exhibited his instrument. This consists of a receiving mirror, the wires, a battery, and a reproducing speculum. The receiving mirror is an amalgam of selenium and iodide of silver; the reproducing speculum is a compound of selenium and chromium. The wires are numerous, as it is necessary to distinctness that a wire should not be required to affect but a very small space. The instrument exhibited had a mirror six inches by four, composed of seventy-two small plates to each of which a wire was attached, the whole being wrapped by a fine insulated covering. These wires run to a common galvanic battery and thus connect with the reproducing plate. When the circuit is closed, the rays of light are conducted through an ordinary camera, and the accompanying heat produces chemical changes in the amalgam of the mirror, which, modifying the electric current, cause similar changes in the reproducing speculum. In the experiments at the close of the explanatory lecture, an instrument was taken to a lower room of the building and operated from there to the stage in presence of the audience. Before the mirror in the lower room the committee held in succession an apple, a pen knife, and a trade dollar, which were distinct on the platform above. The date on the trade dollar, thrown on an enlarged screen, was plainly visible, as well as the goddess of liberty. A watch was next used, and the audience could see the movement of the hands. An ink bottle, a flower, parts of a theatre hand-bill, were also shown, and when the head of a live kitten was exhibited, there was great applause, and the inventor warmly congratulated on his success. The *Reading Eagle* represents the opinions entertained of its practical value as very high—it being possible for a signal officer on a railroad to see hundreds of miles of track at the same instant.

NAVAL ARCHITECTURE.

LAUNCHES.

ENGLISH.

Brantford City.—On the 29th March, at West Hartlepool, Messrs. W. Gray and Co. launched from their yard an iron screw-steamer, built specially for the American cattle and provision trade, to the order of Messrs. T. Furness and Co., of the same town. The vessel was named the *Brantford City*, after the American depot, of her owners, Messrs. Furness and Co.

SCOTCH.

Diana.—On the 6th April, at Scotstown, Messrs. Charles Connell and Company launched the *Diana*, an iron sailing barque of 750 tons, built to the highest class at Lloyd's. This fine vessel is a duplicate of the *Comus*, built by the same firm in the middle of last year for Messrs. Barton and Co., merchants, Glasgow. Immediately after the launch she was towed to her berth to be loaded by Messrs. Thos. Skinner and Co., for Singapore and Penang.

Harley.—On March 30th Messrs. Russell and Co. launched at Port Glasgow a steamer of the following dimensions:—Length, 170 feet; breadth of beam, 24 feet; depth of hold, 12 feet; to be classed too A 1, and fitted with an iron deck and water ballast, built especially strong to carry 500 tons in light ballast. This steamer is fitted with steam winches for quick discharge of cargo. She has been specially designed and built for the coal trade between Newport (Mon.) and Cork, having long hatches and clear holes, enabling her to carry the soft Newport red-ash house coal used at Cork, free from small. She is the property of Messrs. James Harley and Co., Cork. The vessel is named the *Harley*, and will be engaged by Messrs. Walker, Henderson and Co., Glasgow.

Leathoe.—On March 26, Messrs. H. M'Intyre and Co. launched from their shipbuilding yard at Paisley, the *Leathoe*, an iron screw-steamer of 250 tons, built to the order of Messrs. Wm. M'Lachlan and Co., fish salesmen, Glasgow, and intended for the herring trade. The vessel will be fitted with compound self-condensing engines of 300 effective horse-power.

Miramar.—On March 20th Messrs. Murdoch and Murray launched from their shipbuilding yard at Port Glasgow, an iron screw steamer named the *Miramar*. The following are her dimensions:—230 by 21 by 31 feet, 1200 tons gross. This vessel has been built to the order of Messrs. Raeburn and Virel, Glasgow, and will be furnished with compound engines of 130-horse-power by Messrs. Kincaid, Donald, and Co., Greenock.

Yanduara.—The launch of the new 90-ton cutter yacht *Yanduara*, designed by Mr. G. L. Watson, naval architect, for Mr. J. Clark, Paisley, took place on March 30th, from the yard of Messrs. D. and W. Henderson, shipbuilders, Partick. The model of the boat marks a considerable departure from the usual style of yacht build, with what success has yet to be proved, but the sailing authorities present all agreed that she was exceedingly handsome, and should reflect further credit upon Mr. Watson, who so successfully de-

signed *Madge*, *Quiraing*, *Verve*, *Viril*, and other noted boats.

Vincenzo Florio.—On March 29th Messrs. Alex. Stephen and Sons launched from their yard at Linthouse a mail steamer of about 3000 tons, constructed under special survey to the highest class in Lloyd's, and fitted, before launching, with compound surface-condensing engines of 370 horse-power nominal. This steamer has been built for Messrs. I. and V. Florio and Co., of Palermo, and was named the *Vincenzo Florio*, after the founder of that firm. The *Vincenzo Florio* has first and second class passenger accommodation, provision for water ballast in double bottom on bracket principle, and throughout her whole fittings and arrangements the most modern improvements are introduced.

IRISH.

Winnebuh.—On March 29th a screw steamer of about 3000 tons register was launched from the shipbuilding yard of Messrs. Harland and Wolff, Queen's Island, Belfast. She is called the *Winnebuh*, and is built to the order of the South African Steamship Company, and will be placed in that trade in conjunction with the fleet of ships belonging to the same company, some of which have been constructed on the Queen's Island. As the *Winnebuh* was leaving the launchways, through some misadventure one of the plates in her bottom received injury by coming in contact with, it is thought, a bar of angle-iron which had been projecting unobserved from the ship.

TRIAL TRIPS.

Kameruka.—On March 30th this twin screw-steamer, which was recently launched by Messrs. Russell and Co., Greenock, for the Illawarra Steam Navigation Company of Sydney, had a preliminary trial previous to leaving the Clyde for the Antipodes. The *Kameruka* is the first steel-built steamer launched at Greenock, and has been constructed to meet the special requirements of the traffic on the Australian coast, embracing as she does light draught of water, great carrying capacity, high rate of speed, with a moderate consumption of fuel. Her engines, which have been supplied by Messrs. Rankine and Blackmore, Eagle Foundry, Greenock, are double, with a nominal power equal to about 90-horse. At the official trial on Wednesday a speed slightly over twelve knots was easily obtained, and this was declared to be satisfactory by Mr. Manning, the managing director of the company, from Sydney. The engines worked with great smoothness, and the performance of the steamer throughout the trial was recognised as being highly successful.

Lismore.—The new screw steamer *Lismore*, recently launched by Messrs. Gourlay Brothers and Co. for Messrs. G. and B. Nicoll, of Sydney, New South Wales, proceeded down the river from Dundee on the 30th March to test the efficiency of her engines. The result was most satisfactory, scarcely any vibration being experienced, the measured mile being passed three times, giving a mean speed of 10 knots per hour. The *Lismore* is a steamer of about 490 tons d.w. capacity, and has a saloon amidships fitted up for passengers with all modern appliances. She is the fourth steamer which has been built by the Messrs. Gourlay for Messrs. G. and B. Nicoll for their coasting trade in New South Wales.

Lord Jeffrey.—On April 5th this vessel, built by the Tyne Iron Shipbuilding Company, Wellington Quay, on Tyne, and engaged by Messrs. R. and W. Hawthorn, of Newcastle-on-Tyne, for the firm of Messrs. Charles Tully and Co., had a successful trial. The vessel, whose dimensions are 270 feet by 35 feet by 24 feet 6 inches, realised a mean speed of 11½ knots per hour. The engines have cylinders of 62 inches and 52 inches diameter and 40 inches stroke. With a steam-pressure of 90 lb., they developed 1020 ind. h.p. The engines are the first that have been fitted with Mr. F. C. Marshall's "patent slide valve gear," which, owing to its simplicity and novelty, excited considerable interest; its working was perfect, and gave every satisfaction. She is fitted for general trades, having Messrs. Donkin and Nichol's patent steam steering gear, and all modern appliances and is to be employed at the present time by the West African Steam Navigation Company.

Ulrecht.—This splendid mail steamer, which has just been completed by Messrs. Raylton Dixon and Co. for Messrs. W. Ruys and Sons, of the Rotterdam Lloyd's line, between Holland and Java, made her trial trip from Hartlepool, on the 26th March, and was inspected by a large number of visitors, as she lay in the Middlesborough dock, on Saturday. This is the fourth or fifth boat of the same size which has been built by Messrs. Raylton Dixon and Co. for this line, and in each succeeding one there appears to be greater beauty of finish and luxuriance of accommodation for passengers. The ship is 312 feet long over all, 36 feet 3 inches breadth of beam, and 26 feet depth of hold, and her gross tonnage is about 2200, having engines of 200 horse power nominal, built by Messrs. T. Richardson and Sons, of Hartlepool; but it is with the deck fittings and accommodation for passengers that we are most interested. Her main-deck is of iron sheathed with pine, and her upper deck throughout is of teak, as well as all the deck houses. She has a short poop right aft, in front of which is a large teak deck house, which does not extend to the sides, and which contains all the first-class passenger accommodation. A spacious saloon of 24 feet square is approached through a vestibule which has steward's pantry on one side, and smoking cabin on the other. The walls of the saloon are covered with white marble panels, with gilt incised ornaments, divided by gray pilasters and white marble columns, with richly-gilded Corinthian capitals and cornice. The swing doors at fore and after ends, and the panels of the skylight are filled with stained glass, set in lead, in the church window style. A rosewood and maple sideboard occupies one side of the end, and a piano will be placed at the other. The seats are upholstered in dark green, and a rich Turkey carpet covers the middle of the clean teak deck. From the after end of the saloon is a passage along the middle of the ship, with state-rooms for passengers, 38 in number, on each side. These are all of polished pitch pine, handsomely carpeted; each room accommodates three passengers, and is lighted with a large window and has perfect ventilation. At the further end of the passage are two bath rooms, lavatory and offices, as well as stewards' berth and large linen presses, while down below is a large

store room for provisions, &c. The smoke room is particularly neat and comfortable; it is panelled in light polished oak and ebony, and has a border of blue and white tiles around the top of the seats. The deck projecting over the front of this house, supported on handsome columns of teak, forms a charming verandah, and from here two broad flights of steps, furnished with brass rails, form the approach to a promenade deck above the house. This is very large, and comfortably fitted with benches and seats for passengers, and is protected from the heat of a tropical sun by double awnings. Amidships there is a doctor's cabin and rooms for the officers and engineers, and a large ice-house lined with lead, double walled and the space between packed with charcoal, while above, on the bridge, are the chart-house and captain's cabin, and still higher on the hurricane bridge, the steering gear and a standard compass of Sir Wm. Thompson's patent. Right for'ard, under the topgallant fore-castle, is the second-class passengers' saloon and berths, all of polished pitch pine, and the 'tween decks is well lighted and ventilated, so as to be able to carry 400 troops, for whom there is a special hospital. The engine-room is large and airy, and the engines are fitted with Messrs. T. Richardson and Sons' patent steam starting gear, which enables the engineer in charge to start, reverse or alter speed instantaneously. All the hand rails, and handles of valves, &c., are nickel plated, the boilers are fitted with patent fire-doors, and there is a double bottom for water ballast under the engine and boiler-room. Altogether the vessel has been turned out in the well-known style of finish and good taste for which her builders are famous, and which would bear comparison with the highest class Transatlantic liners which are built on the Clyde.

IRONCLAD FOR THE ARGENTINE REPUBLIC.—A powerful armour-clad, building in Messrs. Samuda's yard, at Poplar, for the Argentine Republic, is to be protected by steel-faced armour-plates of Sheffield manufacture. The ship is of the broadside type, and her guns are being made by Sir W. G. Armstrong and Co.

CHRISTENING OF A RUSSIAN SHIP.—On Tuesday afternoon last the ceremony of christening and blessing the yacht *Livadia*, which is at present being built by Messrs. John Elder and Co., Glasgow, for the Emperor of Russia, took place in their yard at Fairfield, in presence of a number of Russian officials, Admiral Popoff, president of the Russian Council of Naval Construction, and a select company of ladies and gentlemen were present. The ceremony was performed by the Rev. Mr. Livirnof and assistants of the Russian Embassy.

SHIPPING DISASTERS IN FEBRUARY.—The direction of the Bureau Veritas has just published the following statistics of maritime disasters reported during the month of February, 1880, concerning all flags:—Sailing vessels reported lost: 54 English, 17 French, 10 American, 10 Norwegian, 8 German, 8 Italian, 5 Portuguese, 3 Greek, 3 Swedish, 2 Austrian, 2 Spanish, 1 Dutch, 4 of which the nationality is unknown—total 127. In this number are included 16 vessels reported missing. Steamers reported lost: 9 English, 2 German, 2 French, 1 Spanish, 1 Dutch, 1 Norwegian—total 16. In this number are included two steamers reported missing.

SHIP BOILER EXPLOSION.—The official report on the explosion of a boiler on board the steamship *Jones Brothers*, of Newport, Monmouth, at Bilbao, on the 27th of January, 1880, whereby three lives were lost, states that the boilers were worked at too high a pressure considering the state in which they were; that the cause of the bursting was the total neglect to which the boilers had been subjected for some time, and to the consequent reduction of the plate at the place of fracture to a bare 16th of an inch thick; that the owners are to blame for the explosion and loss of life resulting therefrom. The Court condemned William Jones, of Newport, Monmouth, shipowner, the managing owner, in the sum of £100—£50 to go towards the expenses of the Court and £50 towards the expenses of the Board of Trade.

ACCIDENT TO A TORPEDO BOAT.—An accident, happily unattended with loss of life, occurred on board No. 3 first-class Thorneycroft torpedo boat at Portsmouth on Monday afternoon last. It appears that an experiment was being tried with a view of determining the evaporative capacity of the boiler, for purposes connected with the *Polyphemus*, a torpedo boat on a large scale, which is fitted with locomotive boilers. No. 3 was accordingly taken into the harbour just outside the north wall, where the experiment was conducted. An iron tank, capable of holding 200 gallons of water, was fitted on the deck and connected with the feed apparatus below, the water being of the ascertained temperature of 56 deg. Fah. The furnace and boiler were in charge of a couple of stokers and a fitter, and when the requisite degree of heat had been obtained the boiler was fed from the tank, the steam being allowed to blow off at the escape valve at a uniform pressure of 115 lb., or about 15 lb. per square inch below the maximum working pressure. It was found that the 200-gallon tank was emptied in a quarter of an hour, and with an expenditure of 340 pounds of coal. While the process was going forward the men on board were alarmed by the roaring of steam up the funnel, which showed that something connected with the boiler had given way. Without a moment's loss of time the men were got out of the stokehole, the fans kept going, and the extinguisher, which is made to throw jets of water from the outside upon the fire by means of a steam vacuum, put into operation. The fire was promptly extinguished, and as soon as the smoke, caused by the back draught, had been cleared away, it was found that one of the boiler tubes had burst. This will take about a month to repair, but otherwise no further damage was done. The result of the accident has been to increase the confidence of the officers and men in charge of these boats, since it has proved that the extinguisher is fully able to perform its work, and that there can be no danger from scalding so long as the fan, which drives the escaped steam up the funnel, can be kept in action.

THE TURRETS OF THE "INFLEXIBLE."—The whole of the armour having been affixed to the fore turret of the *Inflexible*, the turning machinery was tried for the first time on Tuesday afternoon, at Portsmouth. The turret having been advanced almost to completion, the turret leathers, which span the space between the ship proper and

the armoured wall, are about to be taken in hand. As these leathers slide over the glacis plates, it is necessary that the latter should be reduced to a smooth surface, so that a proper adjustment may be attained and the entrance of water prevented. In order to accomplish this it is intended to make the turret as it rotates perform the duty of a planing machine, and thereby polish its own glacis plate. The turrets of the *Inflexible* have an internal diameter of 28 feet and an external diameter of 33 feet 10 inches; and though the two 80-ton guns with which each will be armed are not yet placed on board, it was estimated that the mass which was moved for the first time on Tuesday weighed about 320 tons. The power by which the turrets of the *Inflexible* are turned is hydraulic, and thus differs from both the *Thunderer* and the *Dreadnought*, the turrets of which are rotated by steam, which is not so certain nor obedient. In the larger ship the same silent, docile, and rigid force which loads, elevates, and depresses the gun is also called into requisition to rotate the turrets, the special advantage being that it can be stopped dead without locking gear, and can be made to perform its work so creepingly and uniformly that the movement of the gun in the turret may be said to resemble the movement of the minute pointer of a watch. The hydraulic power is furnished to each turret by a pumping engine worked up to 170 horses, and of the same type as those supplied by the Elswick firm to the *Duilio* and the *Dandolo*, and to the Chinese gunboat flotilla. The power thus generated is applied to turn the turret by two hydraulic engines, one being used as a reserve in case of an accident happening to the other. The motive power is transferred to a crank shaft by three oscillating rams, the plungers of which are 4½ inches in diameter and have a stroke of 1 foot 6 inches. This crank actuates a pinion which runs in a rack around the base of the turret, and turns the mass. At the trial the turret was rotated by the port engine in one minute eight seconds with 32 revolutions of the engine, and was then reversed in one minute ten seconds with 40 revolutions. The port engine was then disconnected, and with the starboard hydraulic engine in action the turret was turned in 1 min. 16 sec. with 37 revolutions, and reversed in 1 min. 18 sec. with 36 revolutions. The pressure on the plungers was 750 lb. on the square inch, and the pressure of the steam at the pumping engine 68 lb. The turret was subsequently rotated at a creeping pace, and was thoroughly under the command of the engineers.

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To the Editor of **IRON**.

SIR,—To blow 5000 cubic feet of air per minute against 12 inches of water-pressure, or say half-an-inch of mercury, seems to be above the power of any fan I can hear of. To do the work with ordinary rotary blowers requires a good deal of engine-power. Can any of your readers inform me what is the best apparatus for the purpose?—I am, &c.,

WM. TURNER.

3, Cross Street, Wilderness Row, London.

NOTICES OF BOOKS.

Builder's and Contractor's Price-Book for 1880. Revised by **F. T. W. MILLER**. London: Crosby Lockwood and Co. Pp. 348.

In the preface to this work attention is called to the careful manner in which the prices for the various descriptions of work and material have been prepared, and to the thoroughly reliable character of the book as a whole. No other claim beyond that of completeness could be made on its behalf, and this is made as well. If, in addition, the book is handy, arranged so as to make reference easy, and clearly printed, we hardly know what other claim could be made on its

behalf, except that of low price, which should not be thought of in connection with a counting-house tool, the make and quality of which are the only things to be regarded.

We think it a serious disadvantage to the work that it should be stereotyped, as it is undoubtedly. The dead weight of stereotype plates we have known to pull against the public much to its disadvantage. Were the present work printed from type its appearance would be much improved, confidence in prompt alterations would be enhanced, and the work could be brought out at more frequent periods, especially if it were freed from such encumbrances as wage-tables and abstracts of Acts of Parliament. Reference, too, would certainly be facilitated by the entire omission of all advertisements. In a volume of classified advertisements we might possibly find profit, but it is unpleasant to have one's inevitable groping in the present work worse confounded by a mass of irrelevant and entirely dead matter. The figures given for wages would be more welcome if those paid at past dates were also affixed; and as such things as trade unions do exist it would not be amiss to publish local scales as fixed by those disagreeable corporations. And a large-paper edition, with room in the margin for a careful-minded builder to note alterations, insert private marks, &c., would, we should think, be sometimes of use. Markets change rapidly nowadays; our own columns scarcely keep pace, week by week, with the changes that supervene in Birmingham and other manufactures.

While, therefore, we are very glad to see the present work once again, we hardly think that its editorship is a sinecure.

Acoustics, Light and Heat. By **T. W. PIPER**. London: Phillip and Son. 1880.

WHILE covering the ground of the elementary examination of the Science and Art Department in the popular sciences of which it treats, the author of this very complete hand-book aims at rendering it a useful introduction to the whole range of physics. His method is unfortunately a somewhat unusual one even in elementary scientific treatises, which generally start by assuming much too high a standard of acquirement in the learner. Mr. Piper commences with facts which are almost self-evident, stated in the simplest terms, and gradually, by slow but consecutive stages, passes to the more complex phenomena. His preliminary chapter is appropriated to the atmosphere and the conditions under which its gaseous and aqueous constituents exist, and the two succeeding ones to vibratory and rectangular motion in connection with the phenomena of sound, light and heat, which include the essential portions of his subject. Full and clear expositions of the more abstract questions involved in the conservation or indestructibility of matter and in energy follow; and the probability of the unity of matter and energy is hinted at—that all energies are but different forms of energy and all matter but different forms of the same matter. The closing chapter treats of sensation as illustrated by the phenomena of sound and light, and in it the structure of the eye and ear and the mode in which they probably transmit the impressions they receive to the brain are discussed. The book is very copiously illustrated by good and mostly original engravings.

The Theory and Practice of Ventilating Coal Mines. By **W. FAIRLEY, M.E., F.S.S.** London: Colliery Guardian Office.

THE great and unnecessary waste of life in coal mines from explosions of fire-damp, as well as the damage to property these occasion, renders the question of colliery ventilation a most important one; and the author asserts that he has by personal observations been forced to the conclusion that it is a subject upon which many otherwise efficient mining engineers are not sufficiently well informed. Whether, as he seems to expect, such knowledge will, in their present educational condition, be acquired by the ordinary miners is another matter. Still, there can be no doubt that it is highly important that it should be, for the safety of all his fellow-workmen in a fiery mine may be imperilled at any moment by the ignorant or careless workman. There is, however, nothing in this very complete and accurate manual that may not be easily understood by the higher class of colliery workmen. In the first chapter, the cause of motion in the air is explained, and the friction of air in the second; in the third and fourth, the splitting of the current is discussed. Ascensional ventilation and velocity form the subjects of two of the succeeding chapters, and the closing ones contain a note on the coefficient of friction, as estimated by Atkinson, Clark and Deville, and a collection of miscellaneous exercises of a practical character. The formulae throughout the work are expressed according to the simple rules of arithmetic, the most that will be required of the student in working out the examples being a practical acquaintance with the manner of extracting the square and cube roots.

An Essay on Colliery Explosions and Safety Lamps. By **WILLIAM PURDY**. London: Colliery Guardian Office. 1880.

THE author of this treatise starts, like the author of Genesis, with the creation. His first chapter is entitled "The Formation of the Earth," and he at once proceeds to quote the opinion of Sir David Brewster, that of the primary formation of the earth there is no reliable knowledge. This is suggestive of the chapter on snakes in a certain History of Iceland. He then goes on to describe the origin of coal, and the dangerous gases in coal-mines, and to paint in vivid colours a typical colliery explosion. The nature and methods of colliery ventilation are next discussed; after which the author proceeds to consider the question of the lighting of mines, and the merits and demerits of safety-lamps. These are fairly criticised, their advantages and drawbacks balanced, and the opinions of eminent inspectors adduced to the effect that an absolutely safe safety-lamp which will give a good light has not as yet been invented—of which there can be little doubt. With regard to his own lamp, of which an engraving showing its external form and inner construction is given, Mr. Purdy fully explains its principles, and claims for it many important advantages, among which are, that it gives a good light; that its flame

cannot be drawn or forced through it; that it cannot be burst by any mixture of fire-damp, at however great velocity; that it is sensitive to gas, and self-extinguishing in an explosive mixture. The lock, he also claims, is practically unpickable. These and other characteristics are of great importance, and many of them are not possessed by the safety-lamps in ordinary use.

The Secret of a Good Memory. By **J. MORTIMER-GRANVILLE**. London: David Bogue. 1880.

THE fundamental fact upon which the author of this brochure proceeds is that every mind takes in and treasures with especial readiness impressions received through one special sense agency, that is, one person acquires and retains best the information which comes through the eye, another that which he gets through the ear. The first step then in strengthening the memory is to ascertain through which avenue of sense the person learns easiest and recollects best. In the author's own case, he remembers best by sound, but he has formed the habit of remembering by conjuring up visual phantoms, owing to having practised a system of mnemonics by which matters to be recollected were placed in squares. This is the mistaken course of which he warns his readers. The secret of a good memory, he concludes, consists in ascertaining the nature of the process by which thought makes its records, and the will must then recall them. It is useless trying to remember by sound if the memory has been made by pictures, or the reverse. And bearing his idiosyncrasy in mind, the student must, by constant practice, strengthen his faculty of recollection, for which practice numerous instructions may be drawn from the book.

Remarks on the Rating of Gas and Water Works and the Principles of Compensation involved in their Transfer to Public Authorities. By **JOSEPH QUICK, Jun., M. Inst. C. E.** London: E. and F. N. Spon. 1880.

THE question of the rating of gas and water is an important one; but at a time when a strong Government has been overturned in considerable part owing to a proposed transfer of waterworks from private to public hands, the publication of a well-informed treatise like the present is well-timed, and will afford the general public a means of coming to an impartial decision on the subject; for, although there are in existence several comprehensive and learned works on the law and practice of rating, they are published at a price which places them beyond the reach of the multitude for whom this cheap manual is intended; and, so far as we know, the question of transfer of these undertakings has had no manual exclusively devoted to it. The practice as to the rating of public works in private hands is still in many respects in a loose and unsettled state, and several weak points in the system are referred to by the author, the result of which is to reduce the taxation paid by public companies lower than what it ought to be. Another important point not yet quite settled is as to the liability of corporations carrying on such works for the common benefit and without profit. In the recent case of the Corporation of Worcester and the Droitwich Union Assessment Committee, the non-liability of the corporation to pay on the city waterworks was declared by the court and confirmed on appeal by the court of highest resort; but the decision is challenged by many experienced authorities, and the point at issue appears to have been raised in both courts in a very imperfect form. In discussing the principles of compensation involved in the transfer of waterworks undertakings to public authorities, the author, passing by the desirability of the proceeding, lays down a general basis on which valuations of such property ought to be made. The principal points are that the accounts of the selling company, for at least three years previous to the proposed purchase, should be subjected to independent examination and analysis in order to see that the dividends are fairly earned; that the condition and capabilities of the works should be accurately ascertained; that the prospective income, with or without additional outlay, should be gauged; and that inquiry should be made whether any payment is due to the shareholders to make up the deficiency of previous dividends. The purchase money should then consist of compensation in respect of present and of future additions to net income, of arrears of former dividends, of surplus works and property, of capital authorised and not issued and of compulsory sale, the first two items being capitalised at their present value, and the remainder at present value of deferred values. In an addendum Mr. Quick discusses approvingly Mr. Cross's provisional arrangement for the purchase of the London waterworks, regarding which he holds, with Mr. Price Williams and other eminent experts, that whilst the shareholders in the companies would have reason to be satisfied with the arrangements suggested, the ratepayers would reap a considerable pecuniary advantage. He thinks, moreover, that the Government acted wisely in refraining from a resort to arbitration, which, in any case, would have involved enormous expense, besides resulting, in all probability, in the companies obtaining the extreme value of their property, instead of a margin being left for the benefit of the community, which would be the case were Mr. Cross's proposed arrangement carried out even as it stands. The gain in economy of management alone, the author calculates, would be immense—at least £100,000 a year; and he shows that by 1893 there would be a net annual surplus from all sources of £757,000. Had the metropolitan works, however, been acquired for the public thirty years ago, before the companies raised seven millions and a half additional share capital, there would have been a still greater gain. The prices at which a number of provincial waterworks have been taken over by corporations are given in the work. These range from 22 to 36½ years' purchase.

LETTS'S POPULAR ATLAS. PART II.—The second part of this excellent and extremely cheap atlas, fully realises the promise of the first. It comprises railway and statistical maps of the three divisions of the United Kingdom, and gives at a glance an immense amount of information in these departments. The clearness of the printing, the liveliness and distinctness of the colouring, and the judicious curtain-

ment of the number of places laid down, so as to prevent overcrowding, are as marked in the present as they were in the first part.

NEW BOOKS.

Elements of Indian Hygiene. By J. C. Lucas. Crown 8vo. Churchill.
Healthy Life and Healthy Dwellings. By Dr. George Wilson. Foolscap. Churchill.
Introduction to the Study of Chemistry. By A. P. Luff. Crown 8vo. Churchill.
London Geographical Series: A Physical, Historical, Political and Descriptive Geography. By Keith Johnston. 8vo. Stanford.
Pocket-Book of Mechanics and Engineering. By J. W. Nystrom. New Edition. Foolscap. Trübner and Co.

BOOKS RECEIVED.

Science Primers, Introductory. By Prof. Huxley. London: Macmillan and Co.
Geodesy. By Colonel A. R. Clarke, C.B. Oxford: at the Clarendon Press.

OBITUARY.

MR. PHILIP GRANT, one of the earliest pioneers of factory legislation and the Ten Hours Bill, died on Tuesday, at an advanced age, at Manchester.

COUNT JOHN DZIALYNSKI died on 31st ult. at his seat Kurpiak, near Posen. He belonged to an ancient and opulent family, which played a conspicuous part in the history of Poland, and was a son of Count Titus Dzialynski, a profound scholar. He was one of the organisers of the Polish insurrection of 1863, for which he made considerable sacrifices, and in which he took an active part. In several battles he distinguished himself by personal bravery and determination. Condemned to death for this conduct, and his estates having been sequestered, he went to Paris and devoted himself entirely to scientific pursuits. He was the editor of a Polish publication called "Library of Technical Sciences," and for the higher development of the Polish youth he founded and liberally supported a special institution. After the promulgation of the general amnesty he returned to his estates, where in retirement and amid great bodily sufferings he continued his studies.

By the death of Mr. Collinson Hall, whose long and industrious career has so recently drawn to a close, the country loses one of its most far-seeing and enlightened agriculturists. For some time his health had been failing, and he breathed his last, at the ripe age of seventy-nine, at Dytheleys, near Brentwood, Essex, the residence of his son. Born in 1800, Mr. Collinson Hall, a son of the Mr. Collinson Hall who in 1818 received from the Society of Arts the medal for the adaptation of the percussion cap to the flint gun, at an early period of his life devoted his studies to improvements in agriculture by means of chemical and mechanical agencies. From the age of thirty-three until the close of his long and useful career his whole time and a very large amount of capital were expended in developing his ideas on this important branch of industry. Mr. Hall's long labours were fully recognised in 1871 by the agricultural engineers and farmers of England, who took steps to provide a testimonial in acknowledgment of his services. It was at Havering Atte Bower that Mr. Hall commenced his career as a farmer on 500 acres of light soil, and he at once devoted his time to the study of chemistry and its application to agriculture. In the course of his experiments he discovered that the gasworks of London were discharging into the rivers valuable chemical matter in the shape of sulphate of ammonia, thereby wasting a precious material, whilst polluting the streams. This substance was utilised by him, and has since been found of immense benefit. He was one of the first to adopt the horse-power thrashing machine, subsequently substituting the steam thrashing machine now generally in use. In 1854 his attention was drawn to Fowler's steam plough, which he tried with success, and since that period he introduced eleven different patents for inventions of his own to the agricultural engineers of this country.

FACTORY NOTES.

THE PRICE OF TIN.—On Tuesday the Cornish smelters raised the price of tin standards 3s. per cwt., prices now being—common, 87s.; refined, 88s. per cwt.

FALL IN COAL.—On Thursday, last week, the South Staffordshire and East Worcestershire colliery proprietors reduced furnace coal 1s. per ton and slack 6d. per ton. Consequent upon the reduction, the colliers would according to the Birmingham agreement, have to submit to a "drop" of 3d. per day in their wages.

LOSSES IN STAFFORDSHIRE IRONMAKING.—At the annual meeting of the Chillington Company (Limited), held the other day in Wolverhampton, the report showed a loss of £6700. The average selling price of iron had been 22s. 10d. below the previous year's price. The chairman said that during the first few months they had made a considerable profit, and works which stood all last year were now restored. The report was adopted, and a committee appointed to consider the advisability of reducing the capital.

SOUTH KENSINGTON MUSEUM.—Visitors during Easter week ending 3rd April:—On Monday, Tuesday and Saturday (free), from 10 a.m. to 10 p.m., Museum, 27,580. Mercantile Marine, Building Materials, and other Collections, 9625. On Wednesday, Thursday and Friday free from 10 a.m. till 6 p.m., Museum, 4712; Mercantile Marine, Building Materials, and other Collections, 1772. Total, 43,689. Average of corresponding week in former years, 49,125. Total from the opening of the Museum, 18,834,172.

THE MINES REGULATION ACT.—On Friday, last week, the magistrates at Seaham convicted Henry Stratton, Lord Londonderry's colliery manager, in a penalty of 20s. for contravening the 18th section of the Coal Mines Regulation Act by not giving proper facilities to the pitmen's check weighman in weighing the coals brought to the surface. The accused had moved a weighing machine from the surface into the mine, which was proved to result in a financial benefit to the owner and the reverse to the miners. The proceedings were instituted by the Durham Miners' Association.

THE TIN PLATE TRADE.—The quarterly meeting of this trade was held on Wednesday evening last at the Queen's Hotel, Birmingham, and there was a large attendance. It was shown that makers held but little stock, and that orders on their works were fewer than work for the ensuing two months. It was consequently decided to adhere to the price of 25s. Liverpool for ordinary brands of I.C. cokes. The question of juvenile labour in the works was dismissed, and a feeling was expressed that the masters of the trade should unite in efforts to secure the return of at least one representative of the trade to the House of Commons.

NETTLEFOLDS (LIMITED).—This important company has been formed for the purpose of acquiring and carrying on five large works in the iron trade, those of the Messrs. Nettlefolds, the Birmingham Screw Company and Mr. John Cornforth at Birmingham, the Manchester Steel Screw Company and Messrs. Lloyd and Harrison's screw business, at Stourport, with the goodwill and all the patent rights, machinery, and trade property belonging to them. The capital is fixed at £750,000 in £10 shares. The directors are also empowered to issue deferred profit debentures to an amount not exceeding £420,000 and bearing interest at 6 per cent. A portion of the preference and ordinary shares of the company will be offered to the public to the amount of £250,000. The services of Mr. Joseph Nettlefold have been secured as chairman and managing director, with a salary in the latter capacity of £3000 a year.

THE BOILER INSURANCE AND STEAM POWER COMPANY.—The report of the chief engineer of this company for 1879, which has just been published, is a mine of useful information to all persons using steam power. Besides an account of the transactions of the company, there is a review, with details and particulars, of the year's explosions. The most important part, however, is the section in which the question of compulsory inspection is discussed, and the parliamentary action with regard to it compared with the German practice. In a *resumé* of the report the chief engineer says:—"1974 boilers have been accepted for insurance in 1879, being 177 more than for the previous year; the total number of boilers proposed for insurance having amounted to 2055 in the year, or 175 more than during the year before. It is also satisfactory to note that although one-fifth of the estimated number of stationary boilers in the whole of the United Kingdom (including nearly 400 boilers belonging to the War Office and other Government Departments) are now insured and inspected by the company, only one boiler for which we were liable has exploded during the year—this boiler being one of four similar boilers of defective construction which had been unfortunately accepted for insurance previous to my joining the company. This exceptionally good result is no doubt due to the trouble taken in inspection—44,173 visits having been paid to firms during the year, and no less than 80,457 examinations of boilers having been made; being an increase of 1034 over the previous year. It is intended for the future, that while conveying the usual information regarding the transactions of the company, and giving particulars of interest as to the explosions which have occurred during the year—at the same time to render this report of practical value to our clients, by using it as a medium to disseminate information of interest in regard to the forms and proportions of various types of engines and boilers which appear to me, from close observation of the results of the vast experience of this company and of the most approved modern practice, to entitle them to adoption. As a commencement, a copy of working drawing of an ordinary Lancashire boiler designed to work at 80 lb. pressure accompanies this report, together with information in detail, which will be found of service for guidance in entering into a contract with any boiler-maker for the construction of a boiler of this kind."

AMERICAN GLEANINGS.

THEFT OF A RAILWAY WAGON.—The Chicago *Railway Magazine* notices the fact that a freight car has been stolen, and gives the working of the car-record system in tracing it up. After following it from east to west, it was found a considerable distance from the track, away out on the plains, and occupied as a residence of a granger and his family. The *Pittsburgh Chronicle* notices another singular case in tracing a car: A live-stock car belonging to the Pennsylvania Company was traced to Colorado, Dakoto, San Francisco, and was finally found away up in the lumber regions of Maine.

THE PROBABLE DEMAND FOR RAILWAY IRON.—Mr. John I. Blair, one of the most extensive owners and constructors of North-western railways, when recently interviewed in regard to the policy of the Sioux City and Dakota, said that there would not be so much railroad building done the coming year as last, on account of the great advance in iron. The railroads were now built in advance of the demands of settlement, and it would be as well to wait a year and let the settlement catch up. When the railroads were pushed so far in advance of the needs of the frontier, large tracts of unsettled land were left behind, and this was a bad thing for the railroads and the settlers. By building but little the coming year the furnaces and iron works would have time to overtake their orders, and the prices of iron would settle back to a more reasonable rate. As it was now, most of the mills were running on contract; and extension, except by roads that had the iron contracted, was almost out of the question.—*Bulletin*.

MORE LABOUR DISPUTES IN THE UNITED STATES.—The Philadelphia, correspondent of *The Times* writing on the 23rd ult. says:—Strikes are numerous. At East St. Louis the railway labourers on the great lines leading to the seaboard,

who load and unload the goods trains, struck on March 20th for higher pay. Five railways granted it and three refused. This movement was supplemented by a mass-meeting of working men in St. Louis advocating eight hours for a day's work. The feeling in favour of higher wages among the Pennsylvania colliers, which caused the strike that is still pending in the Clearfield bituminous region, is extending to the anthracite region. In the great coalfields of Luzerne and Lackawanna, the colliers contemplate a demand for more wages on April 1st, and a strike if it is not granted, and they will hold a meeting at Pittston, March 26th, to consider the subject. The Pennsylvania puddlers and moulders' strikes in the iron trades continue as heretofore, neither side yielding, though the employers offer a compromise. The employees in the machine shops of the Missouri Pacific Railroad, at St. Louis, to the number of four hundred, have struck for an advance of ten per cent. in their wages. The superintendent, when waited upon by a committee from each department, refused to treat with them as a body, and would have nothing to do with any union. Our railways are generally making voluntary advances of wages of 5 to 10 per cent. to prevent strikes and pacify their employees, and on the 1st of April several such advances will go into effect. In many other trades the men are out or locked out, their demands ranging from 10 to 20 per cent advance.

A LUCKY FALL.—The *Sonora Independent* says:—The most singular manner of being struck with a fortune in prospecting that we ever heard of occurred above Spring gulch on Sunday last. Mr. Snow, late of San Francisco, now prospecting in this vicinity for other parties, was out on a quartz hunt with Dr. Drake, of San Francisco. They were returning home, it being stormy, when Snow (who was riding a horse along the trail) was suddenly missed by his companion. Snow's horse had slipped off the bluff, and down he went at an angle of 45°, horse, rider and rifle (which he gripped firmly in his hand), rolling over and over in the snow, until he brought up against a mass of stone standing out of the snow, its top covered with moss. He was not hurt, as the cold, soft cushion had saved his bones from the hard ground beneath. Scrambling up against the rock, he noticed that it was quartz, and where the horse had accidentally kicked up the moss something glittered. His eyes "bugged" out, but he did not stop to brush them off, his hands were too busy clawing off the moss. Darkness coming on he had only time to break off a few specimens, which are filled with pure ore. One small piece exhibited in town was estimated to be three-quarters gold. Tons of it are apparently still awaiting. Snow says the vein is about 30 feet thick, and in his impulsive generosity he gave away several shares soon after its arrival. He told us that he "would not look at \$25,000 for his interest." It is without doubt the richest mass of quartz ever discovered in this county, except the Divoli bonanza, recently opened here in Sonora. Of course, he told us to keep it out of the paper; but the caution we find to be getting monotonous. Mr. Snow is very well known in San Francisco as an actor of merit, and a gentleman well-deserving the good fortune he has "tumbled to." Some men are born rich, others have riches thrust upon them, but Mr. Snow has drifted through air and snow, right slap up against a pile of richness that would make old Rothschild's keen eyes turn green with envy.

THE ELECTRIC LIGHT IN FACTORIES.—Although the electric light has not yet come into use for domestic purposes, its success for lighting large spaces such as depôts and factories seems assured beyond question. The *Riverside Worsted Mills*, at Providence, Rhode Island, have used the light for over a year, with an estimated economy of \$14,000 over gas light. Five dynamo-electric machines with 80 lamps are employed, lighting all of the principal rooms. An extract from the report of the treasurer of the company is as follows: They could not have a severer test than we give them, as our mill runs night and day the year through, and we have not had a moment's delay from, or a dollar's worth of repairs on, any of the machines or lamps. The light is all we expected. It is strong and steady, clear and white. It is universally liked by both overseers and helps—so much so that we doubt if we could get along now with the helps if we were to return to the old gas lighting. Certainly we should not get so good work, nor so much of it. We use porcelain globes pretty generally throughout the mill, and we have less complaint of trouble to the eyes than we used to have with gas. The air of the rooms, too, shows a marked difference. In our weaving-room, with its 250 gas-lights, the air became almost unbearable after midnight in summer, and the faded appearance of the men showed how they felt it. With the electric light there is no such trouble, as the air at night is as good as in the daytime, and noticeably cooler. Owing to some changes preparatory to setting up new machinery, all our 80 lamps are not at this moment doing full service; but by actual count we have 71 lamps permanently placed, and these displace 578 gas-burners. That is, there are 578 gas-burners already placed that would be lighted were the electric lights stopped. Estimating these burners at 6 feet an hour, we have 3468 feet of gas at \$2 per 1000 feet, equal to \$6.93. The total cost per hour of 71 lamps is \$2.20, making a saving of \$4.73 per hour; and this saving for the 3000 hours the machines run in the year amounts to \$14,190, and nearly pays for the machines.—*American Manufacturer*.

THE LABOUR MARKET.—The labour market has been unusually quiet of late. There is only one dispute of any moment reported. About eighteen hundred pitmen, employed at the South Hetton and Murton Collieries, struck work on Wednesday morning. They had been restricting their labour for a fortnight past, so that their earnings were below the county average. The managers, in consequence of this action, refused on Monday to put out the usual average board, showing each man's earnings, and this led to the strike. The miners employed at Messrs. W. Baird and Co.'s, Kilsyth, Twechar, Gartsherrie and Crox pits commenced work on a reduction of wages this week. Miners are reduced from 10d. to 1s. per ton; enginemmen and labourers from 1s. to 1s. 6d. per week. The average rate of miners' wages in the district is now from 4s. 6d. to 5s. 6d. per day.

IRON AND COAL TRADE REPORTS.

BARNSELEY AND SOUTH YORKSHIRE.—The position of the iron trade is much the same as when last noticed, but at some of the foundries devoted to light work and repairs there is less doing than was the case a short time ago. This in some measure arises from the quiet state of the coal trade, owners not caring to lay out much in repairs. There is, however, a full average output of pig-iron produced at the various furnaces in the district, whilst the Bessemer steel works are run full time. A very active business is being done in the Yorkshire Moors between Penistone and Manchester in the getting of gannister for lining Bessemer steel vessels. The stone, which is of good quality, is easy to get, and there are large tonnages sent away weekly from the Hazlehead Station to Sheffield and other places. The collieries with few exceptions are only partly worked, there being but a limited demand for house-coal. Although the Great Northern Railway, which carries most of the coal to London, has done very well during last month, coal owners attribute the slack state of trade to the high tonnage rates. This company carried during the month of March 89,395 tons to the metropolis, being an increase over the month of January of more than 9000 tons; but it must have been drawn largely from other coalfields. The business doing in steam-coal holds pretty well up. A good tonnage has been sent to Hull, from which port the shipments were larger last week than during any week of the year. There was also an increase in the shipments from Grimsby, to which the district coalowners send largely. On the other hand there was a marked decrease from Goole, which port is for the most part supplied by the West Yorkshire collieries. About an average demand continues to exist for hard coal for smelting purposes. Locomotive and gas coal meet a fair sale, being as a rule largely supplied by contract. Great efforts are being put forth with regard to the coke trade, additional ovens being in course of erection at many of the leading collieries. Messrs. Cammell and Co. (Limited), the owners of the Oaks Collieries, are erecting additional ovens at their new pits. The Hoyland Silkstone Colliery Company, who are working several large ranges of ovens at Silkstone Common, are repairing twenty disused ones, with a view of putting them to work as early as possible. A very large tonnage is being sent to North Lincolnshire for the use of the furnaces there. There is but little new to report with regard to the labour market. The old hands at the Monk Bretton Colliery forced an interview with the manager on Thursday last, but no other terms than those offered when the men left work in September last were mentioned. The old hands are still begging throughout the district under the pretence that the strike is still pending, whereas the pit is in regular work. The old miners' association are arranging a series of meetings in the district with a view of augmenting their numbers, as soon as the elections are over.

BARROW-IN-FURNESS AND NORTH LANCASHIRE.—For some days past there has been a very quiet demand for hematite pig-iron, and makers have done but little business. There is much election excitement and this militates considerably against business, but this can only now continue a few days. Business men, generally are sanguine we shall soon have improved trade, and that the present lull in the demand will soon give place to renewed activity in the market. Bessemer qualities of iron are in considerable production owing to the large requirements of steel makers, and a very considerable tonnage of hematite forge and foundry iron is now being delivered on account of contracts entered into some time ago. Foreign exports of metal are large and there is no doubt from present appearances there will be a much larger shipment of iron and steel from local ports during this year than for many years past. Prices of iron are not firm, though many makers will not sell at under £5 10s. per ton for Bessemer qualities, and £5 5s. for No. 3 forge iron. Other makers, who are specially fortunate in having secured several orders when prices were good, are refusing to quote at all till there is a return to the value lately held, or until there is some new improvement of which they can take advantage. The steel trade is very busily employed, and every effort is being made to secure as great an output as possible. Prices are steady, as also are the prices of iron ore, which remain at 25s. to 30s. per ton at the pit. Shipbuilders are finding employment for a large number of workmen, but hundreds of skilled and unskilled workmen are coming to Barrow in search of work which it is impossible to get. Engineers, machinists, ironfounders, boiler makers and railway rolling stock manufacturers are busily employed, and throughout the district there is considerable activity. The coal and coke trades are well employed, and large deliveries are still required by manufacturers and others.

BIRMINGHAM.—Local trade during the past week has been in just the same unsettled—almost stagnant—condition as was reported last week. Most of the leading firms only recommenced work on Monday, and what little there is on hand is chiefly on account of orders booked during the opening weeks of the year. As prices in these cases were based on the standard of the value of raw materials at the date, they are scarcely remunerative when current quotations are taken into account. So far, it is true, manufacturers have not suffered to any material extent, having protected themselves by good forward contracts at dates when prices were still at a low range. These, however, are now gradually expiring, and as makers are unable to renew, except at the advance in the market value of iron, a general movement in the direction of revising discounts may be expected. Already the principal heavy iron hardware firms are taking this step, the notices quoted in these columns last week having been very generally followed in similar branches of trade. Changes of lesser degree, but still in the same direction, have also been announced by some manufacturers of brass ware, and certain classes of pewter goods. Some few export orders have been placed in the town district from the colonial markets, chiefly for saddlers' ironmongery, coach furniture and axle-springs, and the Willenhall lock-makers report an improved demand from America and some other foreign markets. As to the home trade, little that is definite can be said till the election excitement has altogether passed away. There are

some slight indications of the usual season's improvement in the demand for baths and toilet-ware in the tin-plate branch, but the volume of trade is below the average. The birching gun trade has a decidedly better aspect, and there is a fair request for buttons and military ornaments. The japanning and tin-plate workers of Wolverhampton report trade steady, though not active, while the makers of stamped goods at Bilston are fairly well employed. The local tube manufacturers continue steady at work, but little new business of any extent is being booked. The fender and fire-iron trade is quiet, but engineers and ironfounders have a fair amount of work on hand. A firm belief is entertained throughout all the local hardware branches that as soon as the country has settled down a decided improvement in the home trade will manifest itself. The favourable weather cannot fail to exercise a beneficial influence on the state of things in the agricultural districts, and the progressive improvement in the industrial centres noted at the commencement of the year will certainly be renewed. The latest from our Australian colonies also affords good reason to hope that a revival is imminent in the market—one of the most important in relation to our local exports. Among the commercial incidents of the week has been the publication of the detailed prospectus of the New Great Screw Manufacturing Company, which will absorb the five leading firms of the Birmingham Screw Company, the Manchester Steel Screw Company, Mr. Hornforth, and Messrs. Lloyd and Harrison, of Stourport. The capital represents over a million of money. Mr. J. H. Nettlefold acts as chairman and managing director with a salary of £3000 per annum. Another event, which has exacted considerable attention in local trade centres, is the filing of a petition in liquidation by Mr. C. G. Mountain, trading here as Messrs. May and Mountain, of 1, Suffolk Works, engineer, ironfounder and millwright, with liabilities estimated at £40,000. The firm had a considerable local reputation. The assets are of considerable value. There was a well-attended general meeting at Wolverhampton on Wednesday, but little business was done, makers' prices not approximating sufficiently to those which buyers were disposed to give. Neither as to pig or finished iron was any change declared by the leading firms. The meeting closed with considerably less firmness than the last quarterly meeting, although confidence in an early improvement was generally expressed, and preparations for ensuring an increased output was reported.

THURSDAY EVENING.—Quarterly meeting to-day well attended by leading local firms, and producers, merchants and consumers from all parts. Buyers not numerous, good specifications still more rare. No change in list prices for marked iron which remains on basis of nine pounds per ton for bars, with usual 12s. 6d. extra for Lord Dudley's make. Sheets, £10 to £11. Unmarked iron offered as low as £7 5s. Coal steady, at 10s. for furnace. Pig-iron £4 10s. for hot-blast, and £1 extra for cold. Inferior descriptions both iron and coal weak and irregular.

CARDIFF.—The full power of the Cyfarthfa Works is as yet not fully employed. Three of the blast-furnaces are unlighted, but preparations are being made for a start. Three rolling mills are also being got ready. The total make of rail and bar is over a thousand tons weekly, but will soon be exceeded. The day of iron rails is evidently not over. There has been brisk work at the docks in the shipment of steam-coal; orders are plentiful and clearances heavy. The Mediterranean is receiving largely, and now the opening of the Baltic is admitting of shipments there, constant good work at the collieries is telling on the daily production—that is to say, the collier does not make such exertions as in slackier times. The demand for household lumps is comparatively sluggish, but for the small there remains the same active demand and difficulty in filling requirements. During the election contest decided this week by the return of Mr. E. J. Reed, and the rejection of Mr. Arthur E. Guest, the latter gentleman was criticised for having spoken of "spontaneous combustion" as a casualty attendant upon cargoes of Welsh steam-coal. This criticism was as just as necessary. The best smokeless steam coal is known not to be liable to "spontaneous combustion." That is a possible danger only in the case of bituminous coals. The explosions Mr. Guest was thinking of were due to the ignition of gas by contact with a naked light, a totally different thing from spontaneous combustion, because capable of prevention. The simple precautions necessary in the shipment and carriage of steam-coal, are a surface ventilation of the cargo and the abjuring of any exposed flame in descending the hold or its precincts.

CLEVELAND.—There was but a poor attendance on 'Change at Middlesbrough on Tuesday, considering that it was quarter-day. However, the stirring character of the time in reference to political matters may account for the absence of many of the usual attenders. The dulness caused by the absorption of interest otherwise has been in a good measure removed by the unexpected successes of the Liberal party. Every succeeding day strengthens the assurance of a strong government getting into power. This has had great influence in increasing confidence. Prices have gradually risen, so that the market opened at 50s. and closed at 51s. for No. 3 G.M.B. The ironmasters' returns for the month of March have been issued, and show a net decrease in stocks of 7133 tons. The shipments for March amount to 84,000 tons, being an increase on the previous month of 12,802 tons. A greater decrease in stocks was expected, but there was a make-up of 1500 tons more than in the previous months, and the consumption, especially the local, had rather flagged during the holidays. The finished-iron trade is steady. The coal trade is rather quiet. There is a good demand for steam-coal and screened nuts. Coke is easier, and may be had at from 14s. 6d. to 15s. delivered. There were a few exhibitions on 'Change on market-day, as is usual at the quarterly meeting. Mr. J. Butler, of the Rosebery steelworks, showed a number of steel castings of varying degrees of hardness, all good specimens of their kind. Mr. Howson, of Howson and Wilson, showed a model of Simon's and Carve's coke ovens for the manufacture of coke and the utilisation of waste products. Mr. Charles Wood showed his iron sleepers, which seem to be giving satisfaction wherever they are used.

DERBYSHIRE.—In some departments of the manufactured iron trade a somewhat quieter business is being transacted whilst prices are lower. It is stated that the

owners of the Langley Mill Iron and Steel Works have got an American contract for 5000 tons of steel flange rails, 56 lb. to the yard. The make of pig-iron holds well up, there being a full complement of furnaces in blast. Lead mining on the whole exhibits but little change. A goodly number of mines are worked, but the output is not large the operations being on a limited extent. There is not so much doing at some pits in coal, and although a large number of contracts are in course of being executed in connection with the metropolis the tonnage is not so large as it was early in the year. As an evidence it may be stated that the Midland Railway Company, which takes the bulk of the coal to the metropolis, only carried 154,588 tons, last month being the lowest quantity carried in any month during the quarter, and less by 36,000 tons than the quantity conveyed in the month of January. There is also a somewhat quieter business passing in small coal and slack suitable for engine fuel. A good deal of coke is being made, and this to some extent interferes with the sale of smelting coal which a few years ago was more largely raised than at the present time. There is nothing new to note in connection with the labour market which on the whole is quiet.

DURHAM.—The trade of the district has shown a better tone this week. The strain which has existed so long relative to the elections, and the results which will flow therefrom has been in large measure removed, and those engaged in business feel more free to follow their ordinary avocations. The influence of the Scotch market and other causes, amongst them being more inclination to buy pig-metal, have caused more stiffness in the prices of pig-iron. There does not, however, appear to be much in the present condition of trade to encourage very sanguine hopes, unless the American demand should be very much enlarged beyond present prospects. The late reports from America have shown no improvement upon those which preceded them for a week or two previously, and there is unfortunately nothing as yet to indicate an enlargement of the demand for other foreign markets sufficient to atone for the American demand should that fail. The quotations for pig-iron have been about 51s. 6d. No. 3, with 6d. to 1s. more for No. 4 forge, as quoted by the middlemen. There is not much change to note in the prices of manufactured iron during the week, the declining tendency having been rather checked. The prices of manufactured iron have been about:—Ship-plates, £8 10s. to £8 12s. 6.; bars, £7 10s. to £7 12s. 6d.; angles, £7 15s.; and iron rails, £7 15s., less 2½ per cent. Puddled bars, £5 7s. 6d. to £5 10s. nett. The local ironmasters at Darlington, Bishop Auckland, Consett, &c., have been fairly employed. In some cases the work has been in excess of the men to do it. There is, however, a complaint that fresh orders are scarce. The Durham coal trade continues very dull. Household coals find an exceedingly poor sale, and there is not such a brisk demand for manufacturing sorts. The prices of coke have gone back. Best coke is now sold to be delivered at the Cleveland furnaces at 15s. to 15s. 6d., and secondry sorts at less money.

FOREST OF DEAN.—The election contest raging this week is completely disarranging industrial pursuits, and few battles of the kind have plunged the Forest in so great a fever of excitement. Among the employers are to be found supporters of either parties, nevertheless the bulk of them are on the side opposed to Her Majesty's Government, and the miners, to a very large extent apparently, adopt the same line of action. If the long depression is in any way traceable to political considerations, the Foresters have been the victims to an abundant share of hard times, and on the theory of praising the bridge that carried them safe over, they are attributing their prosperity a few years ago to the Gladstonian reign as against the misfortunes endured by them of recent times. Whatever may be the result of the contests throughout the country, it is hoped we may settle down once more and resume our legitimate position in the industrial world from which we may anticipate prosperous times, so much needed by the rapidly growing population of the United Kingdom. If any difference can be notified in regard to the coal trade, some of the proprietors are experiencing a little more activity. This is doubtless due to the giving way of prices, and the anxiety to get orders if possible, though profit may not be a great consideration. The "Fancy" Colliery has not yet been restarted, and the pitmen in some instances—respectable men—are begging bread for their families, the local shopkeepers having already supplied them to a limit which, if pursued, might lead to troubles of an undesirable and undeserving character. The iron trade is "hanging fire" for the quarterly meetings this week. It is rather unfortunate that the fixtures should clash with political arrangements, because the gatherings may lose some of their interest and object. Pig-iron stocks are accumulating at the local furnaces. The tin-plate and other hardware people are heavily bought in respect to crude iron, and several cargoes of North of England pig have been recently imported. This appears to be very much on all fours with "carrying coals to Newcastle," and at any rate it is a misfortune that with our coal and iron ore beds we are not able to shut out opponents. Messrs. Crawshaw confine themselves to a superior class of iron making, hence it is that inferior qualities find their way into the Forest for plate and other manufacture. As a result of the reaction in the iron trade this industrial barometer has already affected the mines, and in some instances where these were reopened a few months ago, they are being, it is hoped, only temporarily suspended. The tin-plate trade is also slackening, and orders are again coming in but slowly. With the unfavourable position of trades the mechanical industries of the Forest are still unemerged from the cloud which has for so long a time hung over these branches.

GLASGOW.—Some improvement has been manifested in the warrant market this week, rumours of a miners' strike having caused an upward tendency in prices; many operators were induced to begin buying, but as yet the movement is speculative, as no better demand exists either for home consumption or shipment. Last week 8496 tons went to America, but no new orders are being received from that quarter; indeed, it is reported that many lots intended for that destination are now being forced on this market. The Continent is not buying nearly so much as usual. On Thursday business was done from 54s. 10½d. to 55s. 3d.

cash, and 55s. 8d. a month; next day transactions took place from 54s. 8d. to 55s. 4d. cash. On Monday there was an advance from 55s. 3d. to 57s. 14d. cash, declining again on Tuesday from 58s. a month, and 57s. 7d. cash to 54s. 7d. a month, and 56s. 3d. cash. On Wednesday 56s. 7d. to 57s. 3d. cash, and 57s. to 57s. 4d. a month were paid. Closing sellers 57s. cash and 57s. 3d. a month. Buyers 14d. per ton less. Makers are finding the utmost difficulty in making sales. In sympathy with the rise in warrants prices of some brands have been slightly advanced, but iron for consumption can be bought at much lower prices from merchants. The shipments of pig-iron from Scotland last week were foreign 12,750 tons, coastwise, 372 tons, total 13,122 against 12,053 tons in the corresponding period of last year. The imports of Middlesborough pig-iron into Grangemouth last week were 2643 tons against 8267 tons in the similar period of last year. The total imports till April 31st, 1880 are 64,830 tons against 70,207 tons till April 31st, 1879; showing a decrease for this year of 5377 tons. The stock of pig-iron in Connal and Co's. store is now 438,183 tons, 831 tons having been taken out during the week. The manufactured iron trade is quiet, makers have now got their old contracts well worked off, and as new orders are very scarce there is considerable competition, and some brands have been officially reduced to 2s for common bars, but good specifications could be placed on more advantageous terms. The exports last week were considerable the chief items, being for the East; iron manufactures valued at £13,388, machinery at £10,566, for Brazil. Cast-iron goods at £7042, for America manufactured iron at £2680, for the West Indies machinery at £2080, and for the Continent machinery at £2287. The shipbuilders are steadily employed on the contracts made some months, but there are now almost no enquiries, the engineers and foundries are also complaining that there is a complete dearth of new orders. The coal trade remains in an inanimate condition, and attempts are likely to be made to effect a reduction in wages.

LANCASHIRE.—The iron trade of this district continues in a very stagnant condition, and it is impossible to say how business will shape until after the elections are over. Generally, however, an improved demand is anticipated, as consumers have been showing more desire to buy forward, and the actual consumption of iron in the district is considerably larger than it was a few months back, the majority of the merchants being now fairly busy, whilst the principal toolmakers are tolerably well employed, and the leading engineers and boiler makers are pretty well supplied with orders, although amongst the smaller firms in the district the improvement has scarcely yet made itself felt. Just at present, however, the quantity of iron changing hands is very small, the excitement consequent upon the elections having during the past week again considerably interfered with business, whilst in addition to this buyers have been holding back orders until the result of the quarterly meetings at Middlesborough and Birmingham this week are known, and there was but little doing at the Manchester weekly meeting on Tuesday, both the limited amount of business passing. Prices have scarcely been fairly tested, but so far as the tendency of the market could be ascertained it has certainly not been towards more firmness, notwithstanding the better reports from Middlesborough and Glasgow, and where buyers have to ask for orders generally very low prices have to be taken. Lancashire makers of pig-iron who are now beginning to look through the orders in their books, are showing more anxiety to effect sales, and in some cases would be willing to take about 2s. 6d. per ton less than they have been getting of late. With regard to outside hands it is difficult to say what prices are ruling, and nominally they may be given at about the same as last week. Finished iron is rather easier to buy, and the average price now quoted by makers for bars delivered into the Manchester district is about £8 10s. per ton, with second-hand parcels offering at about £8 per ton. The coal trade has been very dull, and at many of the collieries work has been considerably interfered with by the holidays. Housefire classes of fuel have been in very poor demand, and steam coals are still plentiful in the market. For engine-fuel the advanced prices announced last week are being obtained without difficulty, and slack is very firm with a continued upward tendency. Round coal, generally are weak in price, but quoted rates are without material change, and at the pit mouth may be given about as under:—Best coal, 8s. to 8s. 6d.; seconds, 6s. to 6s. 6d.; common, 5s. to 5s. 6d.; burgy, 4s. to 4s. 6d.; good slack, 3s. 6d. to 4s., and common, 2s. 9d. to 3s. 3d. per ton.

LEEDS AND WEST YORKSHIRE.—It seems that less time was allowed for holidays last week than was expected, and several forges were again at work even on the Leeds pulling-day. The output of best Yorkshire iron consists principally of bars and railway material. Some orders have just come to hand for axles of broader than the usual gauge, from which it is to be inferred that they are intended for abroad, probably India. For engine as well as ordinary waggon tires there is also a great demand. But with the completion of some fair orders for boiler-plate there appears to have come a pause. There is, however, a good prospect of resumed activity in this district before long. Pending the usual quarterly meetings of the trade, there is less speculation in pig-iron, and there is less anxiety here as to future prices, which, so far as the present moment is concerned, may account for the fact that our ironmasters have ample stocks beforehand. There is only a piecemeal sort of business doing in steel castings. The cut-nail trade is on a more satisfactory footing, especially as regards prices. Large machinery in connection with public works, both at home and abroad, keeps two or three firms in a state of considerable activity. Machinery for the textile trades is in steady request. There is no fresh acquisition of orders for special tools. Some establishments, which have never yet caught the breeze of the trade revival, are anticipating a still further prolongation of slackness. In the coal trade there is no substantial change. The production is regulated as much as possible on the hand-to-mouth principle. The consumption of engine-coal is much larger than it was at the beginning of the year, but there is no gradual expansion. Contract prices are less variable than they were. The domestic trade, and the export also, keeps quiet.

LONDON.—We have to report rather an unsteady market for most metals. In iron buyers seem to have been waiting the result of the Birmingham meeting, which we are glad to learn has gone off with a better feeling. Pig-iron is stronger and large transactions have taken place at 1s. and 1s. 6d. in advance of last week's prices. Manufactured steady. Copper advanced to £66 for Chili bars but has since receded to £64 10s. Tin looks better, a good business done at £87 10s. to £88 with eager buyers. Market classes slightly easier. Lead, quiet £16 10s. for English, 5s. less for Spanish. Tinplates, needy holders are pressing parcels on the market, and makers seem waiting until these are cleared off. Cokes, 22s. to 24s. Quicksilver £6 15s.

NEWCASTLE AND THE TYNE DISTRICT.—Business generally has returned to its former condition in a great measure, since the partial result of the elections leave no doubt as to the government of the country for some time to come. There is but little doing in our local iron market; No. 3 pig would be eagerly bought this week at 52s., but holders stand out for 52s. 6d., and this shows a considerable improvement on last week's transactions, when some fine sales were reported as low as 50s. Much of this better tone is of course due to the encouraging reports received of Tuesday's quarterly meeting at Middlesborough. No. 4 forge is sparingly offered here at 52s. 6d. net. Manufactured iron has an easier tendency this week, but quotations remain little altered; bars bring £7 12s. 6d., angle iron, £7 10s. to £7 15s.; ship plates, £8 10s.; and boiler plates, £9 10s. per ton. The increased make of iron has greatly improved the iron-ore trade between the Spanish ports and the north of England; steamers are daily discharged in quick succession at the Tyne Dock—the best place in the district for quick dispatch—and the ore is at once sent off to the large iron-works by the numerous branches of the North Eastern Railway. The quantity of Spanish ore received since April began is the largest yet experienced in the history of this trade. Work in the iron shipbuilding yards of the Tyne has been carried on with all possible vigour since the holidays. At the Tyne Shipbuilding Company's place the plating of a vessel has been commenced, and there is another almost ready for launching. Messrs. Schlesinger, Davis and Co.'s establishment at Wallsend is full of work; the firm has five vessels in various stages of progress, and good forward contracts in hand. Messrs. Palmers' and Messrs. A. Leslie and Co.'s, and indeed every shipyard on the river, are as busy as they could possibly be. A good deal of repairing work is also being done at the slipways. At Blyth, a small seaport to the north of the Tyne, iron shipbuilding has recently been re-commenced, after having been suspended upwards of three years, and about 200 workmen are there employed in the trade. Orders are still plentiful at our forges and foundries, and engine and boiler works maintain their briskness, with the exception of those of Messrs. Abbot and Co., at Gateshead, which are reported slack, but the rolling mills and metal pipe departments of these extensive works are well employed. In the coal trade of our district there is a feeling of steadiness that augurs well for the future. When the general election gets over and the upper Baltic ports are free of ice, and this is not quite the case yet, it is certain that there will be a great pressure for shipments of coals for commercial purposes, most especially steam-coal. Latest advices from abroad state that stocks are about exhausted, and merchants here have pressing orders to hasten shipments for all the chief Baltic ports as soon as the ice is reported to be away. There is therefore every probability that the rise in the price made last week will be maintained. Gas and manufacturing coals are also in good request both for home use and for export, but house-coals are still in the background, most of the collieries where this class of coal is produced working little better than half time. The result of the sliding scale audit in the coal trade of Northumberland has just been made known, and from the fact that the average rise for the quarter is only 0.40d. per ton to the end of February, no advance of wages is necessary. In our chemical market there has been more strength this week, but prices for immediate shipment are not changed. Makers, however, hold out for higher prices for forward delivery, as orders are plentiful and stocks moderate. The copper trade has improved considerably this week, and the Tharsis and other establishments are worked to their full extent. Large shipments of firebricks are being made, and manufacturers are stiff as regards price. Lead works also are actively employed. In the labour market there is a nearer approach to a balance between supply and demand in this district than has been experienced for five or six years.

NORTH STAFFORDSHIRE.—The works resumed operations on Monday, after the Easter holiday and the election for Stoke-on-Trent, and most of the mills and forges are at work. Trade, however, so far as new business is concerned, is still very quiet, but although orders are few, inquiries are numerous, and these not only include some good lots, but specify local brands, so that they are almost sure to be followed by orders placed in the district. Reports for the United States also are encouraging, and hold out hopes of a resumption of the recent heavy demand. The heavy import duties, however, militate against this district doing the business it would otherwise do with America. The orders in hand are the remainder of those received some time back, and cannot last much longer. The chief run is on the merchant mills, and the plate trade is fairly good, but hoop and puddled bars are not in much demand. Large sections used for engineering purposes are in better request. Prices of all descriptions of finished iron are declining, though slowly. Merchants are withholding orders until they see the course which is taken with regard to prices at the Birmingham meeting, but it is not likely that any reduction will then be decided upon, and a good deal of underselling is now going on. The pig-iron trade is quiet, and will no doubt continue so until after the quarterly meetings. A similar remark applies to ironstone. The demand for manufacturing fuel is brisker this week at the collieries nearest the centre of the district, but the outside pits are doing very little, in some cases not more than two days' work a week being done, and prices are very low.

SHEFFIELD.—During the past few days there has been but little business transacted in Sheffield, owing to interruptions of a political nature. Bessemer steel has fallen in value, but the market is slowly recovering. Picked Bessemer ingots, which a month ago commanded £10 per

ton, have been on offer at £9 10s., and steel made under the Siemens-Martin process, which realised £13 per ton, has been offered at £12. This decadence in trade has arisen from two causes. Firstly, because of the elections; and, secondly, because realisations which had to be made on stock to meet bills given for forward purchases during the latter months of last year. Best brands of steel maintain the figures last quoted, and the following is a fair quotation for the day with 5 per cent. for cash: Bessemer ingots, £9 15s.; best, £10 5s.; special makes for wire, &c., £12; Siemens-Martin, £12 5s. to £14; cast steels, common, £12; file steel, £24 to £30; tool steel, £40 to £45; scissors steel, £27 to £38 5s.; special tool steel, 1s. 10d. per lb. It will be noticed that there has been no advance in the prices of best class steels. The demand for them is, however, increasing, and this points to the fact that the home trade is improving. Coke has gone up a little in value, consequent on the demands which are made by the steel manufacturers, but another "coke famine" cannot take place as half the coke ovens in the district are unemployed. Prices of coke at the present time for cash are as follows:—Local made, 17s. to 18s. per ton, and North-country 19s. to 19s. 6d. The latter are in rather short supply, and, as the Bessemer trade is improving, may become dearer. A new demand for rails has set in, and one firm which has had its rail-mill closed for more than five years will next week re-open it. The output from it will be nearly 1000 tons per week. The customers which have remitted the orders are principally home railway companies, but some of the material is going to India. As an instance of how wages have decreased in the district we may state that five years ago a rail-roller obtained 7s. 6d. per ton from the rails rolled and 2s. 6d. per ton on scraps. Now the rate is 4s. 6d. per ton of rails rolled and no charge on scrap allowed. In the armour plate department some fresh orders have come in, and we believe that in a few days Messrs. John Brown and Co. will be busily employed. The coal market is stagnant, and there has been a slight fall of prices. Best Silkestones (picked) are procurable on the wharves at 10s. 6d. per ton—a fall of 60 per cent. on the rates of four years ago. There is no fear of a coal famine now; although trade is improving, the supply by much is in excess of the needs of the market. The old staple trades of the town are, on the whole, doing much business. File manufacturers find larger orders coming in, and the "hands" are taking measures to secure an advance. In some instances the employers have granted concessions to the forgers and grinders without the unions having had to make a formal demand. This branch of trade is certainly once more prosperous. Razor manufacturers are finding plenty of work, and some of the leading edge-tool manufacturers have heavy orders in from America. The advent of this class of work is a peculiar sign of the revival which has set in. The demand from the States for better class goods is daily becoming heavier, and in spite of heavy tariffs Sheffield has not yet lost her hold in that direction. Spring knife cutlers are again on full time, and prospects are encouraging. A peculiarity of the revival, however, is that the men are patiently waiting for better terms, and the word "strike" is for the present absent from their programme.

SOUTH STAFFORDSHIRE.—The week has been one of considerable activity, for many of the factories did not until last Monday resume operations after closing for the holidays. Hence, energy has been necessary in some cases to overtake business. The Australian mail delivered since last report has brought more orders for shelf-iron-mongery than of late has been customary, and private advices from Melbourne report trade prospects as very favourable. Corrugated galvanised sheets realised, when the mail left, from £25 10s. to £26 10s. for 26 w.g. Home business is checked by the election turmoil, but when this cause of disquiet shall have subsided, a steady improvement is looked for. Our Government are buying hollow wares and enamelled ware in Wolverhampton. The japanners and tin-plate workers report themselves only quietly engaged. Business lies mainly in the satisfying of home requirements for trunks, toilet sets, baths, and such like season goods. The demand for chandeliers and gas-fittings is not large just now, and orders are somewhat irregularly distributed. At Willenhall increasing numbers of iron padlocks are being sent to the United States and other foreign markets, and currycombs are selling better on American account. The quarterly meeting of the iron trade was held at Wolverhampton on Wednesday. Prices were declared unchanged upon the basis of £9 for marked bars, and £4 10s. to £4 15s. for hot-blast all-mine pigs.

WEST CUMBERLAND.—Although there is a quieter request for hematite pig-iron than for some time past, makers have such large orders in hand, that the industrial position of the district is not in any way affected by it. On foreign account there are several inquiries, and there seems a probability of a fair trade being done with Russia, and with other Continental nations, so soon as politics receive less attention and business is again resorted to by buyers and sellers. On home account the enquiry is small, and the Americans have lately shown little disposition to renew contracts, which, in some instances, have been completed. Prices have gone down to some extent; but it is difficult to open a reliable quotation, owing to the varied circumstances and conditions under which sales are made. There are no stocks of iron held in the district worth speaking of, nor are there likely to be any stocks so long as makers are so largely sold forward, while it is a well known fact many of them are behind in their delivery engagements. In the steel trade the greatest activity prevails, and orders already in hand will furnish work for a considerable time to come, even if no new business is brought into the market. There is a tendency every week towards a further improvement in iron shipbuilding, and now that the new company at Whitehaven is formed and the Messrs. Williamson and Sons are entering on new works, it may be expected that this industry will, as in the past, contribute greatly to the industrial activity of West Cumberland. The works for the production of finished iron are especially busy, and although with the past few weeks the output has been greatly increased by the re-starting of old work which for a length of time have been lying idle, the makers have difficulty in meeting demands.

Prices are steady. There is no change to note in the iron ore trade, values are steady, and the demand is well maintained. The coal trade is in an unsatisfactory position, inasmuch as the demand on Irish account is small, and household descriptions are not in large request. Small quantities and some of the best round coal are, however, selling in fair parcels.

[BY TELEGRAPH.]

The accountants appointed by the Cleveland mine owners and the Cleveland Miners' Association issued their statement for the past quarter this (Thursday) afternoon, in which they certify that the net average selling price of pig iron for the three months of January, February and March, was 42s. 8d. to 58s. per ton. This leaves miners' wages for next three months as before, the men being paid at this rate in accordance with the advance granted when the sliding-scale was adopted. The accountants appointed by blast-furnace men have also issued their report, which is of the same nature, so that their wages will remain as at present.

CONTINENTAL MINING AND METALLURGY.

FRANCE.

OF those who have the market of France under their survey, the more optimistic in mind are trying hard to persuade themselves that the period of reaction has attained its maximum. Speculators, both buyers and sellers, have had the market under their thumb for some six or seven weeks, and have done their best to depress rates. Yet these have lost only the few francs which late and eager buyers were willing to pay. In February the quotations for merchant irons were brought up to 240 fr. in the Nord, 250 fr. in Champagne and the Centre, and 260 fr. at Paris. These quotations remain official, although both at Paris and in the Nord a certain weakening of them has been lately perceptible.

It is very natural that attempts should continue to be made to gauge the effect of American buying on European markets. It would be well perhaps to take into account the difference that exists between American and European modes of thought and action. If America has lines of railway to construct it is tolerably certain that she will build them rapidly, and will not buy in regard of them in the dilatory and routine fashion proper to the slowness with which French lines struggle into being. The *reventant* appearance of America in the European market at all was a startling event, it was rendered more impressive by the time of the appearance, which took place when that market was preparing for its usual winter sleep. She bought largely, in the swift and energetic manner which is her habit, but with the least possible intention of remaining a permanent buyer. The importance of her purchases, both absolute and relative, being exaggerated by that imposing method of doing business to which the Old World is not accustomed, too great weight has been given to their influence, and America has been allowed what seems to us a disproportionate share in the task of sustaining European trade. If, as is probable, the European wheat crop is this year a good one, the exports of American wheat will decline, and so, it is supposed, American metallurgical imports will decline. But other articles of American export are not likely to decline; while a good harvest in Europe will be followed by that inevitable improvement in trade in which iron will have its share. American purchases of old material, we may mention, have not quite ceased. The Chatillon Commeny Company recently sold 2500 tons of crop ends on American account, from its works at Beaucarre, at 170 fr. (£6 10s.) per ton free at Marseilles. Our contemporary *L'Ancre* guarantees the fact, "however incredible it may seem that such a price has been paid for rail ends."

Contracts have been concluded lately both at Paris and in the Nord at 5 fr. under established rates. Building operations, the season for which is full late by reason of the severity of the weather, are now exceedingly brisk, and building irons of all profiles are tolerably firm. To Commeny-Fourchambault was last week let a tender for a metallic railway bridge across the Seine. Rails, especially iron rails of light sections for local lines, are in good demand, and their prices show no tendency to fall. There is at Paris a "Road Railway Company," which has begun to lay a narrow gauge line of rail at one side of the high road between Epône and Versailles. This short line will consume 2400 tons of rails.

The Nord remains in its previous condition; there is work in hand, and fresh orders are booked; we shall shortly learn the decision as to rates taken at the last meeting of Nord forgemasters. The *Routegut*, an ore boat of 1000 tons, built last year for the Denain and Anzin Works is reported to have gone ashore off Guernsey.

The two syndicates of pig-makers, respectively seated at Longwy and Nancy, maintain rates unchanged. Foreign offers of forge pig have been made at £4. The fall in Scotch and English foundry pig has been without influence in the region; some of the furnaces which used to run on grey pig are now making forge numbers under pressing contracts. The No. 2 furnace at Passages is being put on blast.

From Haute-Marne news are of a very cheerful complexion. Attempts to force prices down are stoutly resisted by forgemasters, who are paying full rates for materials and labour. Building irons, wire and points are all in demand; the output of the latter two articles in the department is double of what it was at the beginning of the revival. Some of the smaller furnaces and forges are being again set to work, after being idle for long periods, and the price of charcoal has risen. The foundries are well occupied, and rates have slightly improved, large foundries asking £12 for machine castings, and £12 10s. for ornamental castings—balconies, &c. A good many orders are in hand from Paris for builders' castings and stove-work.

The Centre retains the firmness it has succeeded in acquiring, and takes no notice of the present period of slack water. Rail prices are indeed, it is thought, held too high;

they discourage the execution of local lines for which Bills have been obtained. An amalgamation of the Horne Forge with the Firminy Steelworks is announced as having taken place.

The Marseilles Scientific Society offers this year again the Beaujour prize of £80 for the best paper on the improvement of the trade of Marseilles by the establishment of any new industry. The competition is open till May 1st.

A gentleman who follows in Paris the profession illustrated in London by Messrs. Edward Moses and Son, has invented a sort of dog treadmill for the supply of power to sewing machines. It is figured in *La Nature* of April 3rd.

House-coal has come down to 48 fr. at Paris, and even manufacturing coal has lost firmness.

BELGIUM.—Belgian imports and exports for January and February last are tabulated as follows by the Ministry of Finance, the weights being, as usual, compared with those for the corresponding period of the two preceding years:—

	1880.	1879.	1878.
Imports:—	Tons.	Tons.	Tons.
Steel (all classes) ..	633	429	360
Pig-iron ..	30,053	—	—
Scrap ..	3,352	—	—
Wire ..	453	274	403
Rails (iron) ..	12	703	13
Plates ..	49	13	21
Section irons ..	1,104	505	602
Nails ..	128	52	65
Unclassed irons ..	601	307	488
Castings ..	395	198	144
Ores, borings, &c. ..	104,420	100,205	133,017
Coal ..	106,923	120,379	133,203
Coke ..	2,469	1,714	19,38
Exports:—			
Steel (all classes) ..	215	135	995
Pig-iron ..	3,043	—	—
Scrap ..	5,282	—	—
Wire ..	873	423	235
Rails (iron) ..	3,197	2,799	1,566
Plates ..	3,904	2,406	2,319
Section irons ..	21,733	19,659	13,215
Nails ..	1,812	926	726
Unclassed irons ..	2,595	1,576	1,975
Castings ..	395	190	474
Ores ..	42,076	37,730	44,147
Coal ..	789,810	658,514	523,516
Coke ..	124,994	89,674	80,379

There is nothing in these figures to call for remark, except the steady rise shown in the exports of section irons, the excess being mainly taken by England. While the total import of ironstone is of normal weight, there is a great decline in the importation of Algerian and Spanish ores. During February nothing was received from either of these countries, although the Meuse was open during part of the month. The scrap exported was shipped to America.

A large house in the Liège district has given the note of reaction by sending out circulars announcing a fall of 20 fr., bringing irons down to 180 fr. for Liège. This is only level with common rates, but it is said on 'Change that mills are beginning to run out their old contracts, and would take 160 fr. to have them promptly replaced. Plates nominally quoted at 250 fr. can in the same way be had for 230 fr. The rigidity of the market is broken. Beams are still a favoured article, and 190 fr. is quoted for them; but for heavy export business, such as we now and then get from England, much less would be taken. Steel seems firm, but it must be on its way down, following the fate of hæmatite pig. The Brussels *Interests* hears of an Italian contract for rails having been concluded with a non-Belgian firm at 215 fr. (£8 12s. 6d.) delivered at a Mediterranean port.

The Jupille Mill was sold on the 30th ult. for £5200.

Industrial shares show some variation, mostly in decline. We give quotations in francs:—

	Nominal value.	March 1.	March 29.
Cockerill ..	1000	147.50	1055
Esperance ..	500	195	108
Selessin ..	325	362.50	315
Angleur Steelworks ..	500	850	765
Athus Ironworks ..	1000	1800	1750
Acoz Forge ..	500	365	310
Monceau-sur-Sambre ..	500	870	867.50
Ougrée Ironworks ..	1000	1075	1015
Providence ..	1000	1650	1450
Thy-le-Chateau ..	1000	1900	1950

A serious explosion took place at 1.45 on the morning of the 1st inst. at the Bois de la Haie Colliery at Anderluis, near Biiche, lying between Mons and Charleroi. Some forty-two victims are supposed to have perished; thirty-three bodies have been recovered.

HOLLAND.—There is a report that a find of ironstone of high quality has been uncovered at Dalheim, in the province of Drente, in the far north of Holland. Sales at a good price are said to have been made in Germany of the new-found ore, but we have not yet seen any analysis of it.

GERMANY.—A curious indication of the position of affairs in Germany is afforded by the advertising columns of one of our German contemporaries. This displays, with an energy of solicitation very unusual in Germany, the wish of A. B. and Co. to find customers for beams of certain brands, boiler and cistern plate from certain mills, Silesian and Rhenish bar iron of the best makes in large quantities. Supplies are guaranteed "from the extensive contracts secured by A. B. and Co." If, as has happened in the coal trade very frequently, the firm advertising is really good for only a tenth or twentieth of its contracts, we can understand both the anxiety it has to sell and the interest that its creditors have in not impeding its sales by any briskness of competition. In spite of the severe lessons taught by the great crisis we see that the late revival has been accompanied by its proportionate share of recklessness and infatuation.

The lesson of the reaction has come, however, in time to be useful; and the present is looked on as an interval between a past period of unsound business and a future period of rational conditions. The tone is hopeful both in Westphalia and Silesia, to say nothing of South Germany. If prices can be kept at their present level in Western Ger-

many a fair amount of profit will be realised. At present the fall seems to have come to a standstill, mills are busy, and the number of hands engaged in the iron trade increases from week to week. Quotations (maximum) at Dortmund on the 30th were as follows:—

	8.
Spiegel ..	120
German foundry pig ..	100
German Bessemer pig ..	115
Bars ..	185
Angles ..	105
Beams ..	185
Boiler plates ..	255
Bessemer rails ..	250

The trade of Eastern Germany seems to have been less unsteady than that of the Rhine. The improvement which began last autumn has made steady progress, and it is only recently that this onward movement has been somewhat checked. A slight advance in pig was obtained in February, but the bulk of demands had been satisfied by the end of that month, and inquiries have been scarce since then. Contracts for delivery in the third, and even the last quarter of the present year, at 84s., had formed part of the business transacted in February. It is supposed, however, that there are heavy stocks accumulating. Merchant-iron fell off in February, most dealers being pretty full, and the attitude of foreign markets having become such as to prescribe caution. At the end of January £8 was got; at the end of the following month there was a fall of 5s. Mills are generally supplied with orders up to June, but the railways and machinery works are not now so pressing for contracts as could be desired. A fortunate concern is that of the Maximilianshütte, in Bavaria, which makes an excellent pig remarkable for its freedom from phosphorus. It has secured contracts which reach into 1881, at better than current quotations.

The wire-point, rail chairs, and axle factories at Hamm, in Westphalia, are also cited as examples of prosperity. The Westphalian Drahtindustrie Vereins and the Westphalian Union, are booked forward for several months—the former concern is all sold forward up to the end of July, next. These branches are deeply interested in the dephosphorisation question. The new process is regarded very anxiously by those engaged in these branches of trade, as its common adoption will force them, in order to meet competition, to alter their own works. In Upper Silesia the wire mills are fairly well engaged on contracts, but the probable proximate consumption has been so far discounted that new contracts are rare. Prices, too, have gone up 75 per cent. from their lowest point in 1879, and a hesitation in buying very far ahead is therefore natural.

H. J. Vygen and Co., of Duisburg, are putting up, as rapidly as it can be done, says *Glaser's Annalen*, special apparatus for the manufacture of basic bricks according to Thomas's patent. Some thirty-six furnaces and 200 hands will be employed at the first start in the exclusive manufacture of these bricks, the demand for which is growing rapidly very considerable.

A blacksmiths' exhibition is to be opened at Görlitz from May 5th to May 10th, the fifth German blacksmiths' congress being held between the same dates.

On behalf of the whitesmiths' school at Ave, in Saxony, £5150 has been collected, the Saxon Government contributes £2200 of the total amount. In Thuringia the Mechanical School, opened in 1874 by Professor Jeep, has been taken up by the authorities at Sulza.

The Royal Testing Institution, which we spoke of last week as being fully constituted, is, we learn, one of three institutions of similar character, the management of which is entrusted to a Royal Commission, on which Dr. Wedding has a seat. These three comprise the one already mentioned, an institution for chemical testing, and a testing station for building materials. The chemical institution is connected with the Berlin School of Mines, the two others with the Berlin Technical High School. A testing laboratory has also been opened, at the cost of the Saxon Government, at Chemnitz. Metals and building materials are tested for the public at a small expense. Professor Berndt has the metallic, and Professor Gottschaldt the other section.

NEW PATENTS.

ALL the Patents are placed Alphabetically, with the official numbers attached. The New Applications range from No. 1294 to No. 1392, being the entries from March 30th, to April 5th.

NEW APPLICATIONS.

Apparatus for Preventing the Running Away of Horses.—A communication.—W. R. Lake, London.	1327
Apparatus for Raising Loads.—A communication.—H. E. Newton, London.	1328
Attachment of Hose to Pipe.—A communication.—W. H. Chase, London.	1328
Bottle Stoppers.—A communication.—W. R. Lake, London.	1328
Bottle Stoppers.—F. W. Durham, New Barnet.	1328
Boot Heels.—W. J. Murgatroyd, Bradford.	1330
Buttons.—A communication.—P. H. P. Engel, Hamburg.	1331
Caloric Apparatus.—A communication.—C. D. Abel, Chancery Lane, London.	1334
Carding Engines.—J. Tattersall, sen., and J. Tattersall, jun., Preston, Lancashire.	1335
Clothes Hooks.—A communication.—W. A. Barlow, St. Paul's Churchyard, London.	1335
Cocks or Valves.—J. C. Bichells, Newton Heath, near Manchester.	1334
Colliery Explosions.—A communication.—A. Budenberg, Manchester.	1337
Combustion of Fuel.—A communication.—G. W. von Nawrocki, Berlin.	1335
Convertible Chairs.—A communication.—Paris.	1334
Corsets.—W. H. Symington, Market Harborough, Leicestershire.	1301
Digging Furf.—A communication.—H. Simon, Manchester.	1321
Double-Grip Anchor.—J. B. Linder, Brockley, Kent.	1325
Door Knobs.—A. Bell, Edinburgh.	1340
Dress Fabrics.—R. W. Morrell and W. Walker, Bradford.	1370
Drilling Machines.—A. C. Kirk, Glasgow.	1361
Drilling Metal Rings.—S. Dixon, Marple, Chester.	1370
Dynamo-Electric Machines.—A communication.—W. R. Lake, London.	1329
Electric Apparatus.—J. L. Pulvermacher, London.	1343
Electric Motor.—A communication.—J. C. Newburn, Fleet Street, London.	1339

Electrical Conductors.—A communication.—E. M. Allen, London.	1295
Elimination of Sulphur from Irons.—A communication.—W. R. Lake, London.	1329
Emery Wheels, &c.—J. Pearson, J. Whitestone and R. K. Gubbins, London.	1337
Exhaustion Apparatus for Locomotives.—A communication.—W. R. Lake, London.	1339
Fans.—O. Thage, London.	1326
Fare-Collecting Apparatus.—A. E. Adlard, London.	1356
Fireworks.—C. T. Brock, London.	1325
Flour-Dressing Apparatus.—F. Thompson and W. H. Williams, Wakefield.	1319
Flour Purifying Apparatus.—E. Davies, Liverpool.	1347
Frames for Holding Cups, &c.—G. C. Wildman, Walsinghampton.	1299
Fuel and Furnaces.—A communication.—B. Hunt, London.	1304
Glove Fastenings.—A communication.—H. J. Haddon, Strand, London.	1354
Harness Composition.—J. J. Taylor, Harpurhey, Lancashire.	1360
Incubating Apparatus.—A communication.—W. R. Lake, London.	1307
Iron Manufacture.—A communication.—C. D. Abel, Chancery Lane, London.	1298
Kaleidoscope Effects.—J. O. Spang, London.	1355
Knife-Cutting Machine.—C. Covedy, Newent.	1390
Lace Machinery.—J. Cropper, Nottingham.	1350
Lawn-Tennis Poles.—F. H. Ayres, London.	1307
Life-saving Apparatus.—A. Gray, London.	1343
Lime-Making.—A. McAvoy, Glasgow.	1317
Looms.—J. Holding, Manchester.	1342
Lubricating Apparatus.—A communication.—A. M. Clark, London.	1308
Lubricating Pads.—A communication.—B. J. B. Mills, London.	1326
Machine for Wetting Woven Fabrics.—A communication.—W. R. Lake, London.	1344
Magneto-Electric Machines.—T. A. Edison, Menlo Park, New Jersey, U.S.	1385
Manure.—T. Croxall, Whitley Bridge, Yorkshire.	1324
Metallio Pintons.—W. Potter, London.	1320
Military Defences.—A communication.—B. J. B. Mills, London.	1302
Moulds for Sugar Ware.—A. E. H. Lane, Liverpool.	1303
Mushroom Anchor.—J. E. Lardel, Brockley, Kent.	1374
Oil Cloth Manufacture.—C. E. and W. H. Searle, Kingston-upon-Hull.	1369
Oil Lamps.—A. M. Silber, London.	1380
Ordnance.—J. J. King, London.	1387
Ordnance.—L. H. Morley, Nottingham, and R. C. Hepper, Birmingham.	1332
Paint Manufacture.—J. C. Martin, London.	1318
Paper Manufacture.—A communication.—H. J. Haddon, London.	1358
Pens and Stylus.—H. B. Binko, London.	1350
Photography.—J. W. Bailey, London.	1294
Picture Holder.—A communication.—W. R. Lake, London.	1303
Potters' Machinery.—J. Simpson, Heaton Chapel, Lancashire.	1348
Printograph.—H. B. Binko, London.	1358
Preserving Wood.—A communication.—S. Pitt, Sutton, Surrey.	1365
Propellers.—J. B. Ward, San Francisco, U.S.A.	1326
Pulleys.—T. James and J. Jackson, Reading.	1372
Railway Carriage Wheels.—A communication.—F. C. Glaser, Berlin.	1315
Registered Ticket Punches.—C. E. Davidson, Twickenham, Surrey.	1366
Rotary Engine.—S. Mellor, London.	1311
Safety Mine Cages.—F. Leonard, Handsworth, Stafford.	1381
Safety Rod.—J. L. Pulvermacher, London.	1309
Scarfolding.—R. Robinson, Gateshead-on-Tyne.	1308
Securing Windows.—W. P. Bonwick, London.	1312
Sewing Machines.—A communication.—H. J. Haddon, London.	1353
Sodium Chloride.—R. J. T. Hawksley, A. F. Hawksley and H. L. Hawksley, Oldham, Lancashire.	1341
Stay Corners.—J. Ulmer, Wendenburg.	1381
Steam Circulating Apparatus.—A communication.—J. A. R. Hilderbrandt, Manchester.	1384
Steam Engines.—A communication.—C. Kessler, Berlin.	1324
Sulphate of Ammonia.—W. C. Young, London.	1320
Thrashing Machines, &c.—C. Middleton, East Dereham, and P. Beverill, Great Ryburgh, Norfolk.	1340
Thread-Cutting Machines.—R. Weiss, Nottingham.	1386
Telegraph Wires, &c.—G. P. James, Salford.	1333
Telegraphic and Telephonic Apparatus.—A communication.—W. R. Lake, London.	1328
Torpedo Boats.—A communication.—W. R. Lake, London.	1346
Utilisation of Bamboos.—A communication.—W. R. Lake, London.	1304
Valvet.—R. S. Collinge, E. Collinge and R. Collinge, Oldham, Lancashire.	1379
Ventilation.—A communication.—B. J. Barnard, London.	1382
Wagon-Tilt.—J. Tilly, North Shields.	1352
Water Heater.—J. McIntyre and S. Saunders, Manchester.	1313
Waterproof Coverings.—B. Birnbaum, London.	1297
Web-Folding Machinery.—A communication.—H. Simon, Manchester.	1336
Windlass.—J. E. Lardel, Brockley, Kent.	1373
Wire-Drawing Machinery.—A communication.—W. R. Lake, London.	1389
Wire Drawing Plates.—A communication.—W. R. Lake, London.	1324
Woven Fabrics with Photographs.—A communication.—W. R. Lake, London.	1308
Wood-working Machinery.—A communication.—W. R. Lake, London.	1345

COMMERCIAL.

J. BERGER SPENCE AND CO.'S WEEKLY REPORT.

CHEMICALS.—As far as the home trade has been concerned during the week, business, through the twofold interruption of the Easter holidays and the excitement of the Parliamentary elections, has practically been at a standstill, nor can we hope for an earnest attention to business for another week or two. The chief interest, therefore, has been centred in the export account, on which manufacturers continue to be fairly actively employed, though the influx of new orders show some diminution. Nevertheless, strong hopes are expressed in American demands being maintained through the remainder of the spring at least. The Continental requirements are a shade improved, sufficiently so, at least, to create a firmer tone in the Newcastle district. Transactions on account of contract have been few and unimportant, and sellers have generally succeeded in obtaining full forward prices. The less firmer position of the market, taking in its entirety, has engendered more speculation among merchants, many of whom seem disposed to operate in view of a fall. Values, with but slight alteration, may be taken as per last week.

MINERALS.—As during last week no important change took place in respect to minerals, this week has been even more dull and uninteresting. The general range of articles, however, continues in steady demand, and the prices obtained are fairly satisfactory, though several of them have lost much of their firmness. Brimstone has been in sustained request, but buyers are more eager after concessions, and these have in many cases to be made to secure business. Lead ore does not show quite so favourably as late sales.

Iron ore develops evidences rather unfavourable. The requirements are by no means so pressing as they were, and the rates asked seem weaker daily. This is particularly the case in respect to the better qualities of the ore, both foreign and English. China clay continues rather to improve than otherwise, though very slowly.

METALS.—Business in pig-iron has been characterised by a considerable amount of quietness during the week, but in this the trade has been in no way singular, under the existing political excitement. Nevertheless, as far as values are concerned, the tendency has been towards some degree of improvement, certainly many of them have for the present lost that appearance of alarming weakness observable last week. Glasgow warrants have recovered perhaps 6d. per ton on the week, being now quoted at 56s. In Middlesbrough numbers transactions have been less numerous, and for smaller parcels. Makers and merchants too, however, are not so disposed as hitherto to make sacrifice in order to effect sales, but rather to hold in expectation of better prices. Number 3 may be quoted at 52s. 6d. at the works. Hematites have received but limited attention. Copper has become steady. Tin also, if anything, is a little firmer. Lead on the other hand is easier. Spelter remains moderately firm.

GENERAL ITEMS.—For the year ending March 31st, 1880, the gross produce of the revenue of the United Kingdom was £81,205,055, being a decrease of £1,850,917 on that of the previous year. For the quarter just ended the receipts were £27,118,226 against £28,520,188 or a decrease of £1,401,962.

Manchester, April 3rd, 1880.

ALLNUTT AND WOOD'S IRON FREIGHT REPORT.

A FAIR amount of chartering has been done this week, but rates of freight for the United States are slightly weaker, but for the Mediterranean and Eastern ports they are very firm. The following charters have been effected:—

Steamers.—Liverpool to Baltimore, 15s. per ton ore, Galatz to New York 32s. per ton old rails, and for iron ore steamers have accepted 15s. per ton from Bona or Elba to Philadelphia for May loading, and Bilbao to Stockton 11s. 5d. per ton. A boat has taken a cargo of railway iron from Newport to Bombay, and a similar cargo has been shipped from Cardiff to Kurrachee. Sailing vessels have been fixed from London to New York at 10s. per ton old rails, and for Baltimore at 12s. rails and 13s. per ton old railway chairs. From Cardiff to New York 11s. 5d. accepted for 1000 tons new rails, but for a small cargo 13s. per ton old rails and 15s. per ton light scrap has been paid; and Newport to Figueira 14s. per ton railway iron has been done.

London, 17th April.

JAMES H. WEAVER AND CO.'S METAL REPORT.

THERE have been more fluctuations than one might have expected in the metal market this week. In most descriptions we have had a better feeling gaining ground, but as the Birmingham iron masters' meeting approached, less activity has been noticed, pending the result. Transactions at this meeting have been better sustained than was generally anticipated, and more confidence seems to obtain amongst operators. In pig-iron there is a good demand, and prices have advanced 1s. 6d. and 2s. since our last. Manufactured more enquired after. Copper: A large quantity has changed hands the last few days at as high a rate as £66 for Chili brands, but market has dropped some 20s. We give prices for bars and manufactured below. Tin: A smart business has been done in foreign at £87 10s., £88 spot, £89 10s. forwards. There are certainly more buyers than sellers at closing prices, and statistics are all in its favour. We must confess that no specific reason is forthcoming for the recent drop. The American stock serves as a convincing argument according to some speculative depreciators, but when we learn that the probable consumption in America, at the rate of the last three months, will reach from 15 to 20,000 tons for the year, we need not fear any important return shipments. Lead quiet: English, £16 10s.; Spanish, £16 5s. Tin plates dull, but better prices looked for. Iron: Bars, Staffordshire, £8 10s. to £9; hoops, £9 10s.; sheets, £10 10s. Copper.—Chili slabs for 90 per cent., £64 10s. per ton; English ingots and blocks, £72; English sheets, sheathing and rods, £78 per ton; yellow metal sheets and sheathing, 6½d. per lb. Tin: English ingots and blocks, £91 to £92 per ton; English bars, 4 cwt. barrels, £92 10s.; foreign, Straits, £87 10s.; Australian, £87 10s. per ton. Tinplates: Coke, 2½s. per box; charcoal, 26s. per box. Lead: Spanish pig, £16 5s. per ton; English, £16 10s.; bars, £17; pipe, £17 10s.; sheets, £17 per ton. Zinc, £23 10s. Antimony, £71. Quicksilver, £6 15s. per bottle.

26, Leadenhall Street, E.C.

LONDON PRICE LIST OF METALS, ORES, OILS, CHEMICALS, &c.

[FOR THE PRESENT AND PAST WEEK.]

Metal Market, City, Thursday Afternoon, 4 P.M.
(April 8, 1880.)

METALS AND ORES.				
	APRIL 1.	APRIL 2.	APRIL 3.	APRIL 4.
COPPER (per ton)—				
Chili, for 90 per cent.	65 13/4	—	64 10/4	—
Wallaroo	80 0/4	—	79 0/4	—
Burma	70 0/4	—	77 0/4	—
English Tough	73 0/4	74 0/4	74 0/4	73 0/4
English Ingot, best	74 0/4	75 0/4	74 0/4	75 0/4
Sheets sheathing and rod	79 0/4	—	78 0/4	—
Bottoms	84 0/4	—	83 0/4	—
Ore per unit	0 13/4	—	0 13/4	—
PROSPECTOR BRONZES				
Special Bearing Metal (p. in)	116 0/4	—	116 0/4	—
Other alloys (per ton)	123 0/4	129 0/4	123 0/4	129 0/4
Tin (per ton)	—	—	—	—
Straits (Cash)	85 0/4	—	87 0/4	—
Do. for art.	—	—	—	—
Bismuth	—	—	—	—

	APRIL 1.	APRIL 2.	APRIL 3.	APRIL 4.
Banco	—	—	—	—
English Ingots	91 0/4	—	91 0/4	91 0/4
Do. Bars	92 0/4	—	92 0/4	92 0/4
Do. Refined	94 0/4	—	94 0/4	—
Australian	95 13/4	—	97 0/4	—
TIN PLATES, per box, L.C.				
Coke f.o.b. London	0 21/6	0 20/4	0 22/4	0 24/4
IX. do.	0 28/4	0 31/4	0 27/4	0 29/4
L.C. charcoal	0 26/4	0 30/4	0 25/4	0 30/4
L.X.	0 32/4	0 30/4	0 32/4	0 30/4
LEAD (per ton)—				
Soft English pig	17 0/4	—	16 10/4	—
Do. W.B.	—	—	—	—
Spanish soft	16 15/4	—	16 5/4	—
Do. with silver	—	—	—	—
Sheet milled	17 10/4	—	17 0/4	—
Red lead	17 10/4	—	17 10/4	—
White	22 0/4	—	22 0/4	—
Patent shot	20 10/4	—	20 10/4	—
ZINC (per ton)—from No. 9 Gauge.				
Sheets, rolled	23 0/4	—	23 10/4	—
Do. foreign	24 0/4	—	24 0/4	—
SPELTZ (per ton)—				
Silesian, com.	20 15/4	—	20 15/4	—
Rhenish	—	—	—	—
English	—	—	—	—
QUICKSILVER, bot.	7 0/4	—	6 15/4	—
ANTIMONY ore (per ton)—				
Australian	11 10/4	14 10/4	11 10/4	14 10/4
Spanish	—	—	—	—
French Star	72 0/4	—	71 0/4	72 0/4
Regulus—				
Crude (per cwt.)	1 14/4	—	1 14/4	—
NICKEL (per lb.)	0 3/4	—	0 3/4	—
BRASS (per lb.)—				
Sheets, 48 x 24	0 0/8	—	0 0/8	—
Tubes	0 0/11	0 1/4	0 0/11	0 1/4
Wire	0 0/8 1/2	—	0 0/8 1/2	—
Yellow metal	0 0/6 1/2	—	0 0/6 1/2	—
ASHES (per lb.)	0 0/3	0 0/6 1/2	0 0/3	0 0/6 1/2
PLUMBAGO (per ton)—				
Ceylon lump	0 17/6	—	0 17/6	—
Do. chip	0 10/6	—	0 10/6	—
Do. dust	8 6/4	—	8 6/4	—
COALS (per ton)—				
East Hartlepool	1 2/4	—	1 2/4	—
Lambton	1 4/4	—	1 4/4	—
Tees	1 4/4	—	1 4/4	—
Hartley	1 4/4	—	1 4/4	—
Hetton	1 4/4	—	1 4/4	—
Hawthorn	1 4/4	—	1 4/4	—
Tunstall	1 2/4	—	1 2/4	—

IRON.

	APRIL 1.		APRIL 2.	
IRON, per ton	£ s.	£ s.	£ s.	£ s.
(at works).....				
Hars, Welsh, common	7 5/	7 10/	7 5/	7 10/
Do. Best	8 10/	8 15/	8 10/	8 15/
Scotch, Common	9 0/	—	9 0/	—
Do. Best	9 10/	—	9 10/	—
South Stafford, common.....	7 10/	—	7 10/	—
Do. Best	8 0/	—	8 0/	—
Sheets, singles, Cleveland...	9 15/	10 0/	9 15/	10 0/
Staffordshire	10 0/	—	10 0/	11 0/
Do. doubles, Staffordshire ..	11 10/	—	11 10/	12 10/
Do. Lattens, Staffordshire ..	13 0/	—	13 0/	14 0/
Plates, Ship, Stafford.	9 10/	—	9 10/	—
Do. Scotch	—	—	—	—
Do. Boiler, Stafford.....	10 10/	—	10 10/	—
Hoops, Stafford.....	9 0/	9 10/	9 0/	9 10/
Nail Rods, Stafford.....	8 10/	—	8 15/	9 0/
Swedish in Lond.....	11 10/	—	11 10/	—
Angle Iron, Welsh	—	—	—	—
Do. Stafford.....	8 15/	9 10/	8 15/	9 10/
Pud. Hars, Welsh.....	—	—	—	—
Do. Stafford.....	6 5/	6 10/	6 5/	6 10/
Do. Scotch.....	—	—	—	—
Rails, Welsh	8 0/	8 10/	8 0/	8 10/
Do. Stafford.....	8 10/	9 10/	8 10/	9 10/
North England	5 5/	—	5 5/	—
Light Rails, Welsh	8 5/	8 15/	8 5/	8 15/
Do. Stafford.....	8 15/	9 15/	8 15/	9 15/
Pig Iron at Glasgow	—	—	—	—
Scotch warrants.....	2 15/	—	2 10/	—
Do. No. 1	2 10/	3 5/	2 10/	3 5/
Cleveland, Tyne or Tees ..	2 18/	3 0/	2 18/	3 0/
Indian Charcoal, London ...	—	—	—	—
Wrought Iron Girders.....	18 0/	24 0/	18 0/	24 0/
Bolts and Nuts	18 0/	21 0/	18 0/	21 0/
Fish Bolts	18 0/	23 0/	18 0/	23 0/
Washers	18 10/	19 0/	18 10/	19 0/
Rivets	15 0/	18 0/	15 0/	18 0/
Spikes	17 10/	19 10/	17 10/	19 10/
SWEDISH IRON	—	—	—	—
f.o.b. Gottenburg, nett cash.	—	—	—	—
Pig	—	—	—	—
Bar, rolled	11 10/	12 0/	11 10/	12 0/
Do. hammered	12 0/	12 10/	12 0/	12 10/
Billets	12 0/	—	12 0/	—
Horse Nail Rods.....	—	—	—	—
BELGIAN IRON—				
f.o.b. Antwerp, less 2 1/2 per cent.	8 0/	—	8 0/	—
Bars and Slit Rods, common	—	—	—	—
Best	—	—	—	—
Best Best	—	—	—	—
Hammered	—	—	—	—
Puddled Steel	—	—	—	—
Bessemer	—	—	—	—
Hoops	—	—	—	—
Rails	—	—	—	—
Roller Girders.....	—	—	—	—
STEEL—				
Best cast.....	40 0/	42 0/	40 0/	42 0/
Do. dbl. shear.....	45 0/	—	45 0/	—
Do. single do.....	38 0/	40 0/	38 0/	40 0/
English spring med. quality...	14 0/	18 0/	14 0/	18 0/
Blister	24 0/	34 0/	24 0/	34 0/
Swedish keg.....	16 0/	—	16 0/	—
Milan	18 0/	19 0/	18 0/	19 0/
Bessemer rails	20 5/	20 10/	20 5/	20 10/
SCRAP (per ton).....				
Old rails for remanufacture,	—	—	—	—
D.H.	6 10/	—	6 10/	—
Ditto flange or bridge	4 10/	6 0/	4 10/	6 0/
Engineers' scrap.....	3 0/	4 0/	3 0/	4 0/
Light scrap	3 0/	—	3 0/	—
Scrap metal.....	2 0/	3 0/	2 0/	3 0/
Old steel scrap.....	3 15/	4 10/	3 15/	4 10/
WIRE—				
Best best drawn killed	—	—	—	—
gal. tel., Nos. 6 to 8	18 10/	—	18 10/	—
Do. 7 & 8	19 10/	—	19 10/	—
Do. 9 & 10	20 5/	—	20 5/	—
Do. 11	21 0/	—	21 0/	—
Do. 12	22 10/	—	22 10/	—
Rollad black fencing wire	—	—	—	—
(per ton) 1 to 4	10 10/	—	11 10/	—
Do. 5	12 0/	—	12 0/	—
Do. 6	12 10/	—	12 10/	—
Do. 7	13 0/	—	13 0/	—
Bright Iron Wire (Charcoal	—	—	—	—
wire, 42. 0d. per bundle	—	—	—	—
extra) per bundle	—	—	—	—
of 63 lb. 6 to 8	0 14 6	—	0 14 6	—
Galvanized, 60s. per ton extra,	0 15/	0 15 3	0 15/	0 15 3
Best best annealed drawn	—	—	—	—
fencing wire, per ton	—	—	—	—
0 to 6	13 15/	—	13 15/	—
Do. 7	13 15/	—	13 15/	—
Do. 8	14 0/	—	14 0/	—

	APRIL 1.		APRIL 8.	
	£ s.	£ s.	£ s.	£ s.
CASTINGS (per ton) at works—				
Girders	6 10/	7 10/	6 10/	7 10/
Chairs	4 10/	5 0/	4 10/	5 0/
Floor plates	5 12/6	—	5 12/6	—
Pipes, 15 to 24 in.	6 12/6	7 0/	6 12/6	7 0/
Do. 3 to 4	6 2/6	6 5/	6 2/6	6 5/
Do. 5 to 8	6 1/6	6 4/	6 1/6	6 4/
Do. 10 to 16	6 0/	6 3/6	6 0/	6 3/6
Do. 18 to 24	5 17/6	6 0/	5 17/6	6 0/
Boils and Nuts	17 10/	20 0/	17 10/	20 0/
Fish Bolts	18 10/	21 0/	18 10/	21 0/
Spikes	17 10/	18 10/	17 10/	18 10/
Rivets	14 10/	21 0/	14 10/	21 0/
Washers	10 10/	21 10/	10 10/	21 10/

* The entire ton consists of ten times 100 kilogrammes, or about 50 lb. short of an English ton.

OILS, CHEMICALS, &c.

	APRIL 1.		APRIL 8.	
	£ s.	£ s.	£ s.	£ s.
OILS (per ton)—				
Olive, Malaga	—	—	—	—
Do. Gioia	45 0/	—	45 0/	—
Do. Levant	40 10/	—	40 10/	—
Do. Mogador	—	—	—	—
Do. Tunis	—	—	—	—
Do. Seville	45 0/	46 0/	45 0/	46 0/
Do. Sicily	45 0/	46 0/	45 0/	46 0/
Seal, pale	30 0/	30 10/	30 0/	30 10/
Seal, yellow	27 0/	—	27 0/	—
Seal, brown	25 0/	—	25 0/	—
Sperm head	73 0/	75 0/	73 0/	75 0/
Cod	20 0/	20 10/	20 0/	20 10/
Whale, pale	26 10/	—	26 10/	—
Do. yellow	25 10/	—	25 10/	—
Do. brown	20 0/	—	20 0/	—
E.I. Fish	—	—	—	—
Rapeseed, English, pale	30 15/	—	30 15/	—
Do. brown	27 15/	—	27 10/	—
Foreign Pale	—	—	—	—
Ground nut and Gingelly	30 10/	31 0/	30 10/	31 0/
Palm oil, fine	31 0/	—	31 0/	—
Palm oil	34 0/	—	34 0/	—
Linseed oil	27 0/	—	27 5/	—
Cottonseed oil	26 15/	27 5/	26 15/	27 5/
Lard	49 0/	44 0/	48 0/	44 0/
Cocconut, Ceylon	36 0/	38 10/	36 0/	38 10/
Do. Ceylon	33 0/	33 10/	33 0/	33 10/
Mauritius	37 10/	—	37 10/	—
C. Price & Co.'s patent engine oil (per gal.)	0 3/6	—	0 3/6	—
Oil Cake (per ton)—				
Linseed, Ldn.	11 0/	—	11 0/	—
American bls.	10 5/	—	10 5/	—
Do. bags	10 12/6	—	11 12/6	—
Marseilles	9 5/	—	9 5/	—
Rape, English	5 0/	—	5 0/	—
Do. Foreign	—	—	—	—
Green Cotton	6 0/	7 10/	5 17/6	7 0/
TALLOW—F.Y.C.	43 0/	—	43 0/	—
S.American Beef	41 0/	—	41 0/	—
Do. Sheep	38 0/	—	36 0/	—
Australian Beef	34 0/	35 0/	30 0/	34 0/
Do. Sheep	30 0/	—	35 0/	—
Rough Town Fat	14 0/	—	14 0/	—
PETROLEUM—				
Fine (per gal.)	0 0 5/2	0 0 6/4	0 0 5/2	0 0 6/4
Do. spirit	0 0 7/	0 0 7/8	0 0 7/	0 0 7/8
TURPENTINE—Spirit—				
French	—	—	—	—
American (casks)	1 15/	—	1 15/	—
WHALFINS (per ton)—				
Davis Straits	1100 0/	—	1100 0/	—
Arctic	1000 0/	—	1000 0/	—
Southern	500 0/	—	500 0/	—
BALMSTOCK (per ton)—				
Rough, ad ind.	7 0/	—	7 0/	—
Do. grade, do.	5 10/	—	5 10/	—
Roll	9 12/	10 5/	8 15/	—
SULPHUR, Flour (per cwt.)	10 15/	12 0/	10 10/	12 0/
Acid, (per lb.)				
Acetic, fine	0 0 3/4	0 0 3/4	0 0 4/	—
Do. common (per gal.)	0 1 5/	0 1 6/	0 1 5/	0 1 6/
Citric	0 2 0/	—	0 2 0/	—
Muriatic fine (per cwt.)	0 4/	0 7/	0 4/	0 6/
Do. common	0 4/	0 5/	0 4/	0 5/
Nitric	0 0 4/	—	0 0 4/	—
Oxalic (per lb.)	0 0 5/	—	0 0 4/	—
Sulphur, concentrated	0 0 6/	—	0 0 6/	—
Do. Heavy	0 0 6/3	0 0 7/	0 0 6/3	0 0 7/
Tartaric Crystal	0 1 8/	0 1 9/	0 1 9/	—
Do. Pulv.	0 1 8/	0 1 9/	0 1 9/	—
AMMONIA—				
Carbonate, per lb.	0 0 6/3	0 0 6/3	0 0 6/3	0 0 6/3
Sulphate, White & grey (per ton)	10 0/	—	10 0/	10 5/
ARSENIC—White Lump (per ton)	23 10/	—	24 0/	—
Powdered, do.	11 0/	—	11 0/	—
Bleaching powder	0 8/6	0 8/6	0 8/6	—
MORAX, Kid, do.	3 5/	—	3 5/	—
COPPERAS (ton)	2 15/	3 5/	2 10/	—
Bi-SULPHIDE CARBON (per ton)	24 10/	26 0/	24 10/	26 0/
POTASH—				
1st quality, in cks 400 lb. gross, inc. cks., f.o.b., Thames, per csk.	0 9/	—	0 9/	—
Do. in cks, 200 lb. net (per ton)	2 0/	—	2 0/	—
Sacks extra, 1/6 each.	1 12/	—	1 12/	—
Calley's Torbay Patent, Brown Do. Red	0 30/	—	0 30/	—
HYPOPHOSPHITES (per lb.)				
Iron	0 0 3/	0 0 10/	0 0 3/	0 0 10/
Lime	0 0 3/	0 0 7/	0 0 3/	0 0 7/
Magnesia	0 0/	0 0/	0 0/	0 0/
Manganese	0 0/	0 0/	0 0/	0 0/
Soda	0 0 3/	0 0/	0 0 3/	0 0/
LEAD (per cwt.)				
Acetate, best	2 0/	—	2 0/	—
Nitrate	1 15/	—	1 15/	—
Red (per cwt.)	1 3/	—	1 18/	—
White	1 4/	—	1 4/	—
LITHARGE (per cwt.)	1 1/	1 2/	1 1/	—
LIME (per ton)—				
Acetate, Grey, 85 %	10 0/	—	10 0/	—
Do. Brown 20%	14 0/	—	14 0/	—
POTASH—				
Bichromate (lb.)	0 0 6/3	0 0 7/	0 0 6/3	—
Chlorate (pr lb.)	0 0 7/	—	0 0 7/	—
Muriate, 80% ton	6 15/	—	6 15/	—
Pruss. Red (lb.)	0 1 8/	0 1 10/	0 1 11/	—
Do. Yel. lb.	0 0 11/	0 1/	0 0 11/	0 1/
Sulphate, 80% (per ton)	9 0/	10 0/	14 0/	10 0/
SALTPETRE (per cwt.)				
Engl. refined, kgs.	1 2/6	—	1 8/3	—
Do. barrels	1 6/	—	1 6/	—
Do. Bengal	0 19/6	1 2/6	0 19/6	1 2/6
SODA—				
Ash	0 0 15-16	0 0 15-16	0 0 15-16	0 0 15-16
Bicarb. (per cwt.)	0 12/	—	0 11/6	—
Caustic, 60 %	0 12/6	—	0 11/6	14 0/
Do. 72 %	18 0/	18 5/	18 3/	—
Nitrate (per ton)	3 15/	3 17/4	3 15/	—
Crystals (per ton)	3 15/	3 17/4	3 15/	—

* Per ton extra in London, Staffordshire, 15s.; Scotch, 10s.; Lancashire, 15s.; Welsh, 10s.

THE BOARD OF TRADE RETURNS

OF the exports of iron, steel, and other metals, with coal, coke, and patent fuel, from the United Kingdom during the month of March, 1879, as compared with that of 1880. Also the exports for the month of March 1880.

ARTICLES, AND TO WHAT COUNTRIES EXPORTED.	March, 1879.	March, 1880.	1 months, 1880.
IRON—FIG.			
To Russia	300	795	1,231
Germany	35,512	21,127	31,002
Holland	43,383	17,800	37,359
Belgium	7,207	12,500	45,439
France	7,921	9,646	24,855
United States	3,489	100,302	232,583
British N. America	597	810	2,180
Other countries	10,313	11,780	25,111
Total	108,489	180,756	400,189
BAR, ANGLE, BOLT AND ROD.			
To Russia	98	218	822
Germany	466	373	1,074
Holland	465	421	840
France	2	26	59
Italy	1,146	1,168	3,009
Turkey	1,217	383	2,575
United States	524	10,482	23,827
British N. America	1,017	3,042	7,804
India	2,810	2,806	10,035
Australia	2,866	2,613	7,278
Other countries	7,680	11,348	27,603
Total	18,171	32,893	81,996
RAILROAD, OF ALL SORTS.			
To Russia	20	1	65
Sweden & Norway	1,295	31	278
Denmark	25	21	22
Germany	367	—	—
Holland	32	954	914
Spain and Canaries	567	717	2,613
Italy	1,583	1,218	2,953
Turkey	3	95	3,621
Egypt	04	—	—
United States	372	15,108	41,307
Brazil	5,512	1,579	5,935
Peru	551	—	417
Chili	59	1	336
British N. America	59	330	1,421
India	50	1,694	2,842
United States	14,464	10,602	30,980
Australia	9,784	3,153	10,126
Other countries	2,160	5,609	15,057
Total	37,102	46,650	120,411
WIRE OF IRON OR STEEL (except TELEGRAPH WIRE)			
To Russia	3,573	4,815	15,243
Germany	464	660	1,646
Holland	371	744	1,509
France	582	960	1,076
Spain and Canaries	198	331	494
Italy	605	434	1,402
United States	849	948	3,056
British N. America	146	4,679	14,421
India	304	697	2,139
Australia	2,908	2,370	7,306
Other countries	2,509	4,765	10,915
Total	14,492	22,330	62,921
TIN PLATES.			
To France	540	318	792
United States	14,801	14,801	42,071
British N. America	314	245	1,750
Australia	243	234	417
Other countries	2,780	1,697	4,607
Total	18,693	17,896	49,676
CAST OR WROUGHT IRON (except ORDNANCE).			
To Russia	235	206	780
Germany	870	720	1,577
Holland	738	753	1,013
France	579	47	1,035
Spain and Canaries	1,102	780	1,781
United States	845	418	2,201
Peru	159	11	333
Brazil	5,410	2,617	5,023
British N. America	658	1,660	1,785
India	1,535	9,529	3,747
United States	4,891	3,140	12,791
Australia	5,177	3,140	9,078
Other countries	5,177	4,558	12,123
Total	27,728	25,684	59,180
OLD IRON (for re-manufacture).			
To United States	1,034	44,861	99,362
Other countries	3,352	3,390	6,800
Total	4,386	48,250	106,162
STEEL, UNWROUGHT.			
To France	244	360	916
United States	657	5,723	11,125
Other countries	1,610	1,698	4,754
Total	2,511	7,781	16,895
MANUFACTURES OF STEEL.			
Total of Iron & Steel...	236,141	387,305	927,536
HARDWARE AND CUTLERY.			
To Russia	4,030	4,481	13,417
Germany	14,240	15,87	36,810
Holland	4,417	8,26	20,838
France	10,621	13,134	35,240
Spain and Canaries	7,179	9,821	22,231
United States	30,935	43,170	117,859
Spanish West India	5,589	3,158	12,300
Islands	10,015	10,001	60,514
Argentina Republic	9,680	5,199	14,101
British N. America	10,084	13,005	27,027
India	21,924	12,131	40,636
United States	21,790	99,384	23,045
Australia	47,01	33,048	85,509
Other countries	70,575	58,779	109,040
Total	279,608	264,627	744,016
MACHINERY AND MILLWORK.			
STEAM ENGINES.			
To Russia	9,850	2,840	10,206
Germany	20,672	13,656	27,658
Holland	4,169	12,730	18,178
Belgium	1,203	2,426	4,001
France	4,021	12,826	20,150
Spain and Canaries	2,630	5,914	33,743
Italy	5,400	7,088	22,900

IMPORTS OF METALS AND ORE

For the month of March, 1880, as compared with the corresponding months of 1879. Also the imports for the three months of 1880 as compared with 1879.

ARTICLES.	QUANTITIES.			
	March, 1879.	March, 1880.	3 Mths., 1879.	3 Mths., 1880.
Copper:—Ore—				
From Chili	167	1,048	1,098	4,325
From Good Hope	743	1,948	2,050	1,000
From N. America	4,637	5,469	13,660	18,738
Other countries	—	—	—	—
Total	5,447	7,411	18,955	24,759
Regulus (incl. Precipitate)				
From Portugal	190	875	679	1,541
Spain	3,412	1,941	4,697	4,910
Chili	9,411	971	4,801	2,428
Other countries	549	4	1,023	1,151
Total	4,614	3,791	16,799	10,630
Unwrought or part wrought				
From Chili	2,805	4,653	8,379	7,841
Australia	1,002	64	9,017	1,917
Other countries	108	361	401	785
Total	3,915	5,668	11,697	10,543
Iron and Steel—				
Iron: Ore	97,737	320,719	366,250	654,868
Bar	7,394	11,434	9,582	26,515
Manufactures	200,101	340,053	478,534	880,766
Steel: Unwrought	539	525	631	1,640
Lead, pig and sheet	7,905	7,908	23,957	22,160
Pyrites of Iron or Copper, or Sulphur ore	45,091	81,136	135,318	184,121
Quicksilver	67,810	108,713	1,010,370	2,739,045
Tin, in blocks, ingots, bars, or slabs, and regulus	31,771	43,693	88,255	187,867
Zinc, crude, in cakes	2,016	3,701	5,082	9,238
Manufactures of, unenumerated	97,604	95,374	50,095	102,523

ARTICLES.	VALUE.			
	March, 1879.	March, 1880.	3 Mths., 1879.	3 Mths., 1880.
Copper:—Ore—				
From Chili	1,145	2,575	2,575	9,085
From Good Hope	12,738	48,920	54,245	6,848
From N. America	38,207	53,618	117,299	175,153
Other countries	—	—	—	—
Total	46,090	65,288	186,604	287,086
Regulus (incl. Precipitate)				
From Portugal	5,700	35,280	24,090	61,593
Spain	54,284	35,360	170,570	212,447
Chili	57,138	31,040	102,681	70,542
Other countries	42,453	150	33,368	35,635
Total	189,775	151,730	331,470	369,419
Unwrought or part wrought				
From Chili	137,731	320,075	480,702	547,056
Australia	92,410	51,038	187,493	13,710
Other countries	6,708	25,044	24,730	59,131
Total	237,045	397,057	692,925	760,166
Iron and Steel—				
Iron: Ore	98,084	336,834	368,045	698,053
Bar	51,580	107,071	84,100	217,860
Manufactures	156,307	254,460	378,043	641,309
Steel: Unwrought	3,353	5,959	7,068	18,777
Lead, pig and sheet	111,013	134,307	358,948	414,047
Pyrites of Iron or Copper, or Sulphur ore	104,895	184,227	209,443	413,014
Quicksilver	55,692	39,560	154,328	398,504
Tin, in blocks, ingots, bars, or slabs, and regulus	101,948	209,839	275,031	600,705
Zinc, crude, in cakes	31,525	16,012	23,720	38,808
Manufactures of, unenumerated	99,990	36,879	55,138	121,284

SCOTCH PIG-IRON.

ANNEXED is a weekly statement of the shipments during this and the previous three years:—

	1880	1879	1878	1877
Week end.	Tons	Tons	Tons	Tons
Jan. 3 ..	6672	4655	2441	3454
10 ..	6680	6609	6685	6500
17 ..	12,288	6291	4532	5141
24 ..	7566	6331	6170	7040
Feb. 7 ..	13,383	4909	6550	5207
14 ..	14,190	6130	5937	6183
21 ..	10,612	7272	5722	5839
28 ..	15,152	8996	5124	6559
March 6 ..	12,603	8318	7836	8030
13 ..	17,968	13,910	6816	8048
20 ..	20,985	10,743	8662	7280
27 ..	20,987	11,107	7725	9312
April 3 ..	23,598	9,403	11,499	10,246
10 ..	15,722	12,653	7448	9071
Total ..	201,420	116,967	92,247	96,890

NEW COMPANIES.

CHESTER COLLIERY.—Incorporated 25th ult., with a capital of £100,000 in £1 shares, to adopt and carry out an unregistered contract of 25th ult., between Robert Plant and William Molyneux.

CLYDESTEAMSHIP.—Registered 30th ult., with a capital of £50,000 in £5 shares, to purchase from Mr. Philip Morel the steamship *Clyde* belonging to the port of Cardiff.

METROPOLITAN EXPRESS OMBUS.—This company was registered 25th ult., with a capital of £3000 in £1 shares, to carry on the ordinary business of an omnibus company.

MINERAL STEAMSHIP.—This company was registered 24th ult., with a capital of £20,000 in £1 shares, to transact the ordinary business of a steamship company.

PARTNERSHIPS DISSOLVED.

J. and J. Harrison, Birmingham, jewellers.—Smith and Collinge, Salford, ironmongers.—G. Gould and R. Macdonald, Vineyard Walk, Clifton, glass silvers.—H. and W. Fletcher, Little Lever, Lancashire (under the style of John Fletcher), colliery proprietors.—J. Woodcock and J. J. S. Loope, Plymouth, brass founders.—Pryn, Stephens and Miller, Bettistone Street, Long Acre, stove manufacturers.—Sir William George Armstrong and Co., Elswick, Newcastle-upon-Tyne, and elsewhere, manufacturing engineers; as far as regards S. Kendal.—E. Roberts and Son, Rotherham and Denbigh, coal merchants.—W. H. Royton and Co., Dalton, near Huddersfield, brickmakers.—Knight and Hawkes, Clerkenwell Close, stereotypers.—Litterton, Smith and Co., Aston-juxta-Birmingham and Birmingham, various manufacturers.—Harrow Chemical Paint and Colour Company, Great Suffolk Street, Southwark, paint manufacturers.—T. Gayler and Co., Cleveland Road, Downham Road, Islington, boiler composition manufacturers.—R. B. Salisbury, Son and Co., Rotherhithe Dry Dock, Rotherhithe, shipwrights.

IRON AND STEEL RAIL EXPORTS

During the month of March, 1880, as compared with March 1879; also for first three months of 1879 and 1880. The Board of Trade make the usual reservation as to accuracy.

ARTICLES.	QUANTITIES.			
	Month ended March, 1879.	Month ended March, 1880.	Three months ending March, 1879.	Three months ending March, 1880.
IRON RAILS:—				
To Russia	5	—	5	—
Sweden and Norway	—	—	—	—
Germany	293	—	293	—
Spain	11	78	802	381
Italy	208	1,041	444	1,521
United States	—	10,518	301	25,667
Brazil	—	—	97	187
Chili	—	—	26	10
British North America	—	—	21	66
British India	7	181	2,280	1,750
Australia	1,070	101	3,666	714
Other Countries	1,805	773	2,294	3,080
Total	3,382	12,812	10,505	32,706
STEEL RAILS:—				
To Russia	—	—	—	—
Sweden and Norway	1,952	—	4,780	220
Germany	—	—	187	—
Spain	290	533	2,864	1,558
Italy	1,267	—	1,267	918
United States	372	4,710	878	17,532
Brazil	4,730	264	8,238	4,440
Chili	50	—	527	286
British North America	20	271	477	1,236
British India	5,895	13,666	13,731	30,480
Australia	7,203	2,385	13,165	7,172
Other Countries	2,316	6,014	6,582	13,172
Total	23,111	26,553	52,504	76,955
TOTAL OF IRON AND STEEL RAILS	26,713	39,365	63,009	109,751

ARTICLES.	VALUE.			
	Month ended March, 1879.	Month ended March, 1880.	Three months ending March, 1879.	Three months ending March, 1880.
IRON RAILS:—				
To Russia	64	—	64	—
Sweden and Norway	—	—	—	—
Germany	1,517	—	1,517	—
Spain	100	680	4,555	2,708
Italy	1,493	8,369	2,237	10,799
United States	—	67,822	1,808	149,212
Brazil	—	—	801	1,556
Chili	—	—	230	81
British North America	40	180	585	519
British India	6,684	805	14,452	12,760
Australia	7,587	235	18,602	5,109
Other Countries	1,727	6,472	14,595	10,805
Total	19,509	85,953	60,284	162,577
STEEL RAILS:—				
To Russia	—	—	—	—
Sweden and Norway	8,138	—	32,544	3,216
Germany	—	—	1,440	—
Spain	2,020	4,084	17,231	10,030
Italy	7,602	—	7,602	4,595
United States	9,976	29,422	6,056	116,295
Brazil	29,703	7,637	52,830	28,476
Chili	317	—	3,656	2,287
British North America	155	1,837	3,383	9,904
British India	35,000	66,101	84,819	107,157
Australia	42,160	13,145	86,186	39,482
Other Countries	14,140	53,749	39,919	404,88
Total	143,135	205,362	327,586	514,483
TOTAL OF IRON AND STEEL RAILS	169,644	291,315	387,870	717,060

PRICES CURRENT OF MANUFACTURED GOODS

OF

BIRMINGHAM AND DISTRICT.

* * This List being compiled exclusively for the pages of IRON, all rights of reproduction are reserved. The quotations given are merchants' and factors' average prices, dependent, of course, on terms of payment as well as the quality and quantity of goods ordered, and fluctuations in cost of raw material. The Prices and Discounts quoted are carefully revised every week, and great pains are taken to render this List thoroughly reliable.

April 8th, 1880.

THERE has been little doing the last fortnight owing to electioneering and the holidays. The latter are now over, and the former a so foregone conclusion that we may look again now for a stir to be made at the quarter day's meeting of ironmasters, which will be held here to-day, and a resumption of business once more. We have had little to report the last fortnight except reductions in metals and the advance by the hollow ware makers, who have reduced their discount 5 per cent., being an advance of 10 per cent. on tinned cast iron hollow ware and about 7 per cent. on the enamelled cast-iron hollow ware. This advance at the time when pig-iron is on the decline points to the opinion that there is a belief that the temporary downward movement of the iron market will only be for a short time. The great feature of interest just now in hardware is the amalgamation in the screw trade, and the issuing of the prospectus, under the title of "Nettefelds (Limited)," of the firms of Nettefelds, the Birmingham Company, Mr. John Cornforth, the Manchester Steel Screw Company and Messrs. Lloyd and Harrison. It will be remembered, especially by those buyers who were fortunate enough to have placed their orders at 75 per cent., that at soon as the agreement between the companies was settled that screws were advanced to 65 per cent., and that directly after a circular was issued saying orders would be delivered subject only to discount ruling at the time of delivery. Last week the following circular was issued:—"We hereby withdraw our circular of the 1st inst. and also all quotations for terms, either written or verbal, but discounts remain the same as per list of January 20th, 1880, a copy of which is enclosed. The discount off screws

will be now as follows:—iron wood screws 65 per cent., brass 62½ per cent. and stove screws 60 per cent." At the quarterly meeting to-day it is expected that no alteration will be made in the price of "marked" Staffordshire iron and that 2/9 for bars will still rate that portion of the trade. Of course the late fall in common iron, which has been from 15s. to 20s. per ton, has had the effect for the time of bringing heavy goods, such as gas tubes, down in price, and those which could a month ago be had at 62½ per cent. are now quoted at 67½ per cent. delivered. Other heavy goods, for large specifications, can be bought on equally favourable terms; but hardware proper is not yet affected by it, as the consumption of the raw material forms so small a part in proportion to the labour. Our list, therefore, except for hollow ware and gas-tubes, shows no further alteration. Tin has this week recovered the 2½ per ton lost last week, and the downward reaction of the iron markets appears, by yesterday's report at the Wolverhampton meeting, to have been checked. The quotation for common bars is 27 10s., sheets 2/10 and cinder pig-iron as low as 50s.

ABRIDGED LIST.

Axles, 15 to 25½; coach ironwork, 10 to 15½; coach and wagon springs, 15 to 20½; Augers, 10 to 20½. Axes.—Ship carpenters' 5½ to 7½ per lb.; Kent and house carpenters', 5½ to 6½; ditto, steel polished, 5½ to 7½; felling axes, 4½ to 4½; polished, 4½ to 6½; bright and blued solid steel, 7½ to 8½; American felling or wedge axes, steel polished, 1½ to 1¼ per lb.; common Anvils, 8½ lb. and upwards, 18/6 to 20/ per cwt.; best warranted, 22/ to 24/; ditto, and ends warranted not to break off, 27/ to 35/.

Basins, shallow galvanised, 10 inch, 7/7½ per doz.; deep Basins, galvanised, 12 inch, 10/0 to 12/0 per doz.; Bastard Hollows, 4½ to 5½; Best extra nailed Bastard, 3½ to 4½; Best improved long Bristol, 3½ to 4½; casters' or moulders', best extra nailed, 12 inch, 10/ per doz. net; common Smiths' Hollows, 4½ to 5½; Best warranted, extra leather double nailed, 36 to 40½; with movable pipe for shipment 2½ less discount. Bed screws, 6 and 7-10 and 1 inch, 10/6 to 11/5 per gross for London black heads; London heads with bright turned collar, 6 and 7-10 and 1 inch nuts, 12/0 to 13/0; Black welded heads, 9/3 to 10/3; common slit heads, 6 and 7-10 and 1 inch, 12/0 to 13/0; Black notched heads, 10/6 to 11/6 per gross; Brass head nails, 40 to 45½; star head, 35 to 40½; Brass plated counter sunk head, 25 to 30½; Blacksmiths' tongs, 20/ to 28/ per cwt.; real line wrought Box Irons, 20 to 25½; fine cast, 42½ to 60½; middle cast, 42½ to 60½; charcoal box irons—Victoria, 45 to 50½; ordinary charcoal box irons, 55 to 70½; Bolts—Straight tower, solid end tower, 65 to 67½; end best solid tower, 60 to 65½; solid end barrel brass knob, 60 to 62½; Japanese Scotch tower bolts, 45 to 50½; painters' brushes, 45 to 65½; Best, 10 to 40½; light galvanised Buckets, 12 inch, 38 lb. to the doz., 10/ per doz. net; Blind cord, list price net; Bed hooks and eyes, 50 to 55½ malleable, 60½ to 62½; Brass chain Bending, 30 to 35½; Brass and plate coach heading, 30 to 35½; ashpans moulding, 30 to 30½; Bottle jacks—Linwood's, 15 to 20½; Salter's, 30 to 35½; Nicholas's, 15 to 20½; common painted Beams, 15½ to 65½; Bright round end beams, 40½ to 55½; Bright box end beams, 40 to 55½; deep Copper scales, 45 to 65½; Steelyards, 40 to 60½; pocket steelyards, best counter weighing machines, Avery or other best make, 25 to 30½; common, with round copper scale, 7 lb., 3/5 to 14 lb., 3/0 to 5/9; 28 lb., 5/6 to 8/12; net; Bedsteads, cheap stumps, 6 feet by 3 foot 6 in., 7/6 to 9/6 each; cheap French, 6 feet by 3 foot 6 in., 8/6 to 10/6 each, 1/12 to 2/12; Brass—Rolled brass, 2 to 15 inches rising 6 for every 6 inches. Brass—Rolled brass, 2½ by 38 in., 5 lb. wide, to 30 W.G., 1/0 to 1/0 per lb.; Brass sheets, 2½ by 38 in., 5 lb. and upwards or 27 W.G., 1/0 to 1/0 per lb.; House bells, brass rough, 1/0 to 1/1 per lb.; turned edge, 1/1 to 1/1½; turned, and lacquered on edge, 1/8 to 2/ per lb.; cattle and sheep bells, with brass loops, 1/3½ to 1/6 per lb.; clock bells, 1/9 to 1/10; ship and turret bells, 1/4 to 1/5; Battery kettles, 150 per cwt.; composition sheathing and Slatting nails, 1/10 to 1/11 per lb.; Escutcheon pins, 1 by 10 inch, W.G., 1/0 to 1/1; Brass jelly pans, with balls, 1/1 to 1/1½; without balls, 1/1 to 1/1½ per lb.; Maslin kettles, cast, 4 to 10 inch, 1/0 to 1/1 per lb.; Pinpoints, 1/1 to 1/4; Brass Rivets for boots, 12 to 17; W.G., 1/0 to 1/1 per lb.; Brass Shop Bill, 1/1½ to 1/2 per lb.; Brass Seal pans, 1/1 to 2/1; Brass Tubs, 1/1 to 2/1; Brass Tubs, plain round, 1 inch and above, 1/0 to 1/1 per lb.; Locomotive and marine boiler tubes, seam less from 1½ to 4 inch outside diameter, to 14 W.G., 1/8 to 1/9.

Copper.—Copper boat nails, wrought 1½ by 12 inch, W.G., and upwards, 1/0 to 1/1 per lb.; Copper 1 boat Rivets, 4 inch and upwards 1/2 to 1/3 per lb.; Copper Brads and bills, same price as tacks. Light round Copper Kettles, bare rivets, 1/1½ to 2/ per lb.; Light round covered rivets, 1/10 to 1/11½; loaded, 1/8 to 1/9; oval Copper kettles, bare rivets, 2/1 to 2/2 per lb.; oval bare rivets raindown, 2/5 to 2/6 per lb.; Copper Rivets and washers, 1/1 to 1/1½ per lb.; Copper Slatting nails, cut, 1 to 1½ inch and upwards, 1/10 to 1/11 per lb.; Copper Seal pans, 1/1 to 2/1 per lb.; cut Copper Nails and tacks, 1 inch and upwards, 1/1 to 1/1½ per lb.; wrought Copper nails and tacks, 1/4 to 1/5 per lb.; Copper Wire, 10 to 20 W.G., 1/0 to 1/1; Brass cupboard turns, 45 to 50½; Chair webbing, No. 0, 4/5; 10, 4/8; Co, 4/1; Cio, 4/6; per gross of 60 yards; Carpet rings, 1/1 to 1/6 per gross; Cornice poles, 2½ inch, brass best burnished 4/6 per foot, 25 to 35½; 3/4 covered; brass poles, 1/2 per foot, 25 to 35; imitation mahogany cornice poles with ends and rings complete, 2½ inch, 1/2 per foot; light birch ditto, 1/1 to 1/2 per foot; real mahogany, 2/1 to 2/6 per foot; cornice pole rings, brass, 2½ inch, light, 2/9; middle, 3/7; strong, 4/2 per doz., 20 to 30½; wood cornice pole rings, 2½ inch, imitation mahogany, 1/6 to 1/8 per gross net; light birch, 1/7 to 1/10; real mahogany, 1/8 to 2/25 per gross net; machine made wire Chain, single link, iron, 2½ to 4½; double link, iron, 3/2 to 4½; single link, brass, 3/4 to 4½; registered double link, brass, 3/2 to 3/2½; close link brass Chain, 5 to 10½ brass oval lamp Chain, 2/2 to 2/2½; brass Clock Chain, 2/2 to 2/2½; japanned pillar Chains, 1 yard, 10 by 6; 6/8 to 7/6 per doz.; japanned manger, 12 yard 16 by 6, 8/3 to 9/6; japanned rack, 1 yard, 18 by 6, 5/6 to 6/6; japanned dog, 14 yards, 12 by 7, 6/6 to 7/6; 2 yards, 14 by 6, 1/1 to 1/1½; Cowties, a-hin, or Derbyshire, 8/ to 10/; open ring, 8/ to 10/; close ring, 7/ to 8/ per doz.; japanned watering chains, 14 by 6, 4/9 to 5/9; tinned watering chains, 5/ to 6/; ballock chains, 1 inch hook at each end, 10/ to 20/ backbands, 10/6 to 20/6; short link Chain, plain o' wisted, 1 inch, 18/ to 20/ 1/2 inch, 16/ to 18/; 1 inch, 14/ to 16/ per cwt.; Cart and plough traces, 6/ to 25/ per cwt.; Ghenthandles, improved japanned, 75 to 77½; Brad plate, 1 inch and upwards, 15 to 55, according to strength; railway strong and extra strong, 15 to 55;

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CLYDE TUBE WORKS, GLASGOW AND COATBRIDGE.

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WROUGHT IRON WELDED TUBES AND FITTINGS,

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Have been awarded to Clayton and Shuttleworth for their

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AT THE PARIS EXHIBITION, 1878

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per cwt.; sledge hammers, 5 lb. and upwards, 28/6 to 36/6 per
cwt.; riveting hand-hammers, 28/6 to 36/6; miners, not steeled,
22/ to 24/ per cwt.; common Kent hand hammers, 20 to 50/;
patent hammers and staples, 20 to 25/; Cast hinges, polished joint
light patent tariff butts, 200, 45 to 50/; 331, 499 to 475/; 504,
35 to 40/; polished joint, best best butts, best best, 45 to 50/;
ditto light tariff, broad butts, 45 to 50/; best heavy, broad butts,
30 to 35/; Patent Hinges, edge butts, light, 60 to 65/; strong,
40 to 50/; patent Scotch butts, 52 to 55/; same off broad and
narrow. Patent table, bed and back-flap hinges, 50 to 55/; extra
strong-bed hinges, 45 to 55/; patent chest, 45 to 47/; patent strap,
45 to 55/; H Hinges, 40 to 55/; H Hinges, 40 to 55/; japanned
and garnett hinges, double washered, light and strong, 35 to 40/; best
best patent London or Lancashire tees, 52 to 60/; patent light
japanned Scotch tees, 55 to 65/; light patent books and hinges on
plate and to drive, 20 to 25/; weighty patent books and hinges,
weighty Gothic, 21 to 26/; scolloped edges, not japanned, 22 to
24/; Scotch japanned, Tees double washered, 22 to 24/; Gothic
Scotch japanned, Tees 25/ to 28/; Gothic Scotch, Tees self colour,
17/6 to 25/; Wrought hinges, common and best, 15 to 16/; best
best, 30 to 35/; heavy wrought hinges, common black, 14 to 16/
per cwt.; common bright, 16 to 18/; filed edges, 17 to 19/;
japanned Gothic fancy, 16 to 20/ per cwt.; common bright,
broad eye, 16 to 20/; japanned broad eye fancy, 21 to 22/; best
bright, 22 to 24/; best broad eye, 23 to 25/; best self-colour frog
hooks 25 to 26/ per cwt.; Lancashire hinges wrought,
30 to 35/; Pressed hinges, common, 20 to 25/; best, 52 to
55/; common brass butt hinges, 12 inch sandred, 15 to 18/ per gross,
pairs set; very light, 12 inch, 9/6 to 12/ per gross, pairs set.
Hornshoes, fullered fore, 18 to 20/; fullered hind, 10 to 21/;
stamped, 10/6, 18/6 to 20/6; hind, 18/6 to 20/6. Hollowware, 40 to
45/; common to best, enameled, 15 to 20/; delivered in Liver-
pool, London.

Ironfoundry, general.—Ash grates, 11 to 12/; air bricks, 2/9 to
3/6, half, single, 3/6 to 4/3, double, 6/3 to 7/; bars and bearers, 9/6 to
10/6 per cwt.; barrow wheels, 10/6 to 11/6; bake pans, 9/6 to 10/6; cart
bushes, 11/6 to 13/6; camp ovens, 10 to 11/; cooking stoves, 12/6 to
13/6; cogs for blocks, 17/ to 19/; cellar gratings, 18/6 to 12/6; clock
weights, 6 to 11/; Dutch stoves, 11 to 13/; dumbbells, common,
9 to 11/; best best japanned, 10 to 21/; frying pans, cast handles,
12/6 to 14/6; frying pans with wrought handles, 10 to 12/; furnaces,
up to fifty gallons, 13 to 14/; galvanised furnaces up to fifty
gallons, 13 to 14/ per gallon; furnace doors, 12 to 14/; furnace
grates, 9/6 to 11/6; forgo backs, 12/6 to 13/6; heaters for box irons,
8/6 to 10/6; heaters for urns, 10 to 11/; jack wheels, 18 to 20/; oven
doors and frames, 12 to 14/; pots, three legged, Danish, plum-

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W.G., 1 to 2/6 per lb.; brass knitting pins, 14 to 1/6 per lb.; keys
and banks, 50 to 55/; extra strong plate, 30 to 32/; extra strong
Banbury, pin'd keys, 30 to 35/; brass shutter knobs, 52 to 57/6;
brass cupboard turns, 52 to 57/6; brass drawer knobs, 52 to 57/6;
brass ash pan knobs, 52 to 57/6; brass range knobs, 35 to 40/;
kettle ears, 77/6 to 80/.

Lock furniture, brass, 60 to 106/; buffalo, 25 to 102/; china
lock furniture, 37 to 42/; ebony lock furniture, 24-inch, Wukes'
spindles, 15 to 18/ per dozen sets; sham ditto, 8 to 9/ per
dozen sets; Norfolk latches, comp. on best, 55 to 65/ common
Suffolk latches, 70 to 72/6; best Suffolk latches, 45 to 55/; tinned

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REPORT, 1879.

The 55th Annual Report, and the latest Balance Sheets rendered to the Board of Trade, can be obtained at either of the Society's Offices, or of any of its Agents.

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struck ladle bowls, 4-inch, 15/6 to 16/6; 4 1/2-inch, 18/6 to 20/; 5-inch, 21/ to 25/ per gross net.

Oddwork, tinned and black, 15 to 20¢ list; Paris pointers, best English, 15¢ to 18¢; foreign, 18¢ to 20¢; planes, 25 to 30¢; iron axle pulleys, 12 inch, 12/6 to 15/; brass face axle pulleys, 28/ to 40/ per gross; B. F. and wheel, 48/ to 60/ per gross; brass excutcheon pins, 1 inch to 1 1/2 W. G., 1/ to 1 1/2 per lb.; bright gimps pins, 1/ to 10 W. G., 5/6 to 7/6 per lb.; black, 7/ to 9/; brass 1/6 to 1/8 per lb.; japanned cut gimps pins, 1 inch, 7/ to 8/ per lb.; tinned, 8/ to 9/ per lb.; cut clog or coffin pins, japanned, 1 inch, 5/ to 6/; tinned, 7/ to 8/; brass pin pointers, 1/4 to 1/6; plate looks, fine 40 to 50¢; strong, 50 to 55¢; Lancashire plate looks, 25 to 30¢; pewter measures, 30 to 35¢.

Rivets, 30 to 35¢; Rivets, iron boot rivets, 1/3 to 1/4 per lb. patent machine-made Rivets, 30 to 35¢; wrought iron Rivets, 30 to 35¢; round or roundhead boiler Rivets, 1 inch, 23/ to 24/; 3/4 inch, 18/ to 19/; 1/2 inch, 17/ to 18/; 1/4 inch, 15/ to 16/; Delivered in London or Liverpool; machine-made wire Rivets, 1 inch, 14/6 to 15/6 per cwt. Rakes, light garden Rakes, 40 to 60¢; light solid end Rakes, 47 to 50¢; bolstered teeth garden Rakes, 50¢; solid end bolstered teeth garden Rakes, 40 to 45¢.

Traps, bowwring, sham Dorset and real Dorset rabbit traps, 45 to 60¢ list prices; common traps, 4 inch, 5/6 to 8/ per doz. net; run traps, 2 1/2 inch, 4/ to 5/6 per doz.; bird traps, 3/9 to 4/ per doz.; wolf and other double flat spring, common bridge, 1/; axle bridge, 1/4 per lb., 40 to 45¢; hawk or pole traps, 54 to 60¢; wrought mole traps, japanned, 2/6 to 3/; galvanized, 3/6 to 4/9. Tin plates, 1 C, 30 to 32. Timmer's machines and tools, 32; brass Bell Tube, 1 inch and upwards, 1/ to 1 1/4 per lb.; copper bell Tube, 1/2 to 1 1/4 per lb.; zinc bell Tube, 45 to 50¢ list; Patent cased Tube, 45 to 50¢; cut to lengths, 40 to 45¢; burnished and lacquered brass tube, 30 to 35¢; polished and lacquered twisted brass tube, 30 to 35¢; patent taper iron tube, 30 to 35¢; patent cased taper iron tube, 30 to 35¢; parallel iron braced tube, 30 to 35¢; twisted iron parallel tube, 30 to 35¢; patent cased twisted iron parallel tube, 30 to 35¢; iron Gas Tubes, 65 to 67 1/2¢; fittings, 65 to 70¢; iron Water Tubes, 55 to 57 1/2¢; fittings, 55 to 60¢; iron Steam Tubes, 50 to 52 1/2¢; fittings, 54 to 55 1/2¢; galvanized iron gas Tubes, 50 to 52 1/2¢; fittings, 54 to 55 1/2¢; lap-welded Boiler Tubes, 52 1/2 to 55¢; delivered in London, Liverpool or Glasgow; table catches, 30 to 40¢; ditto, improved brass follow, 20 to 25¢; wrought japanned Tea kettles, 30 to 60¢; galvanized Turnip skippers, 21 inches, light, 25 to 26/ per doz.

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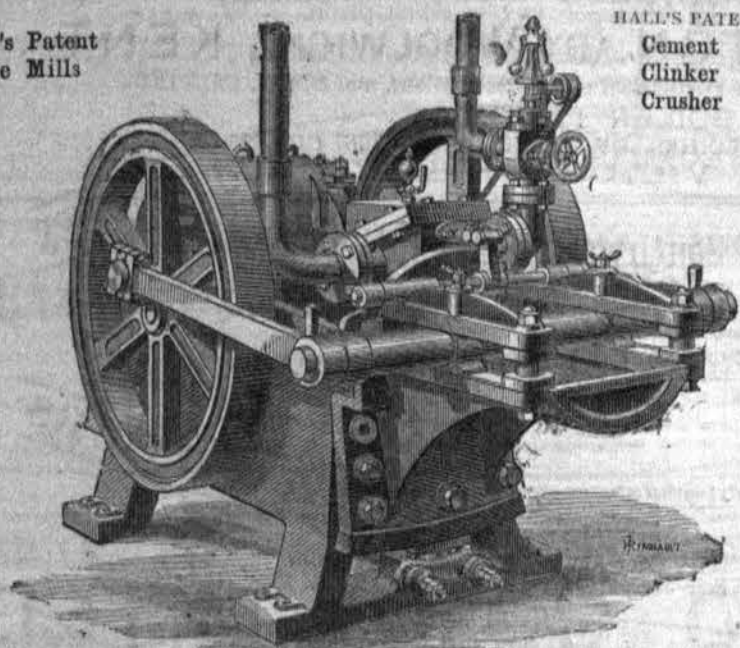
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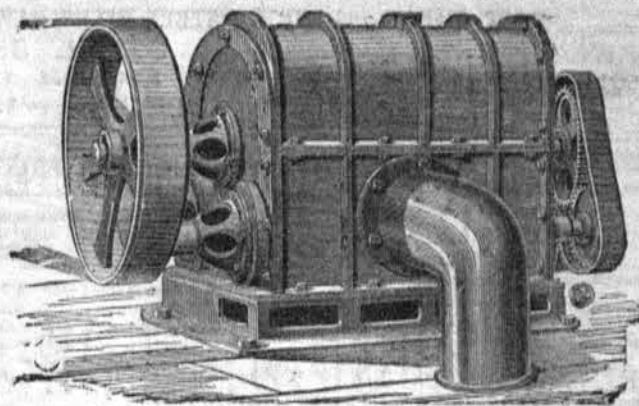
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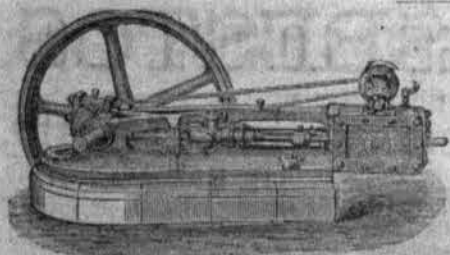
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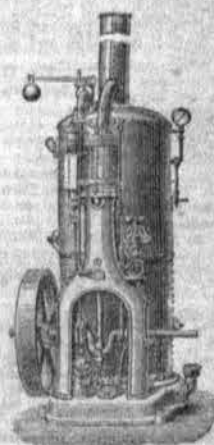
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3 x 6	3 1/2 x 3 1/2	3 x 4 = 11lbs.	5 x 4 = 15lbs.	7 x 3 = 20lbs.	9 1/2 x 4 = 29lbs.	12 x 6 = 56lbs.	4 x 4 1/2	9 1/2 x 3 1/2	8 x 8	12 x 3	12 x 3	4 x 4 1/2	9 1/2 x 3 1/2
6 x 3 1/2	2 1/2 x 2 1/2	4 x 4 = 12lbs.	6 x 5 = 18lbs.	8 x 4 = 22lbs.	10 x 4 1/2 = 32lbs.	14 x 6 = 60lbs.	6 x 5	9 1/2 x 4	8 x 10	12 x 3	12 x 3	6 x 5	9 1/2 x 4
6 x 6	2 1/2 x 2 1/2	4 x 5 = 13lbs.	6 x 6 = 20lbs.	8 x 5 = 25lbs.	10 x 5 = 36lbs.	16 x 6 = 72lbs.	8 x 6	9 1/2 x 5	8 x 12	12 x 3	12 x 3	8 x 6	9 1/2 x 5
4 x 3	1 1/2 x 1 1/2	5 x 6 = 22lbs.	6 x 7 = 25lbs.	8 x 6 = 30lbs.	10 x 6 = 40lbs.	18 x 6 = 84lbs.	10 x 6	9 1/2 x 6	8 x 14	12 x 3	12 x 3	10 x 6	9 1/2 x 6
4 x 4	1 1/2 x 1 1/2					19 1/2 x 7 = 100lbs.	14 x 7	9 1/2 x 7	8 x 16	12 x 3	12 x 3	14 x 7	9 1/2 x 7

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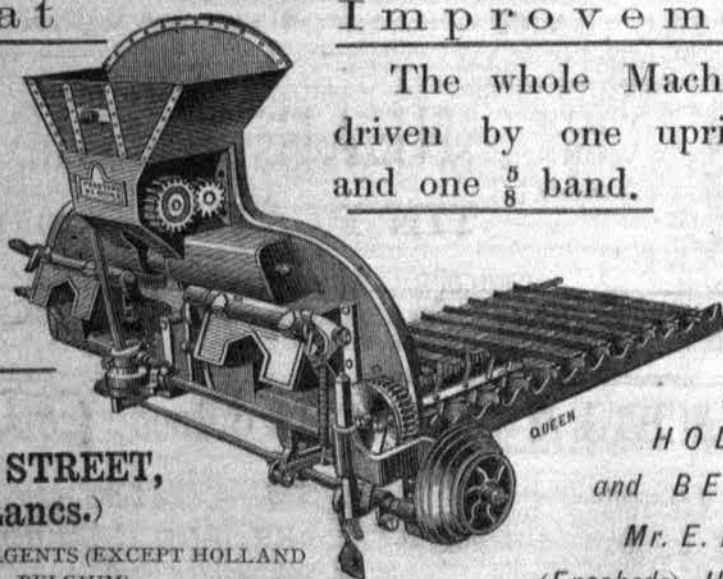


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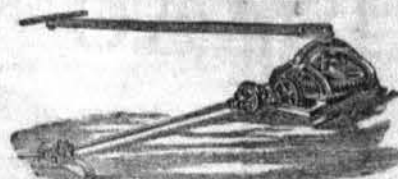
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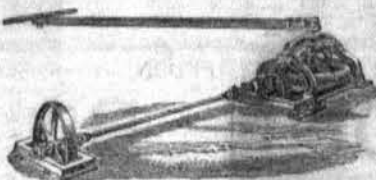
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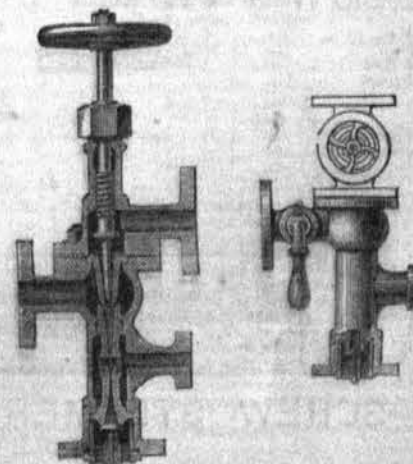
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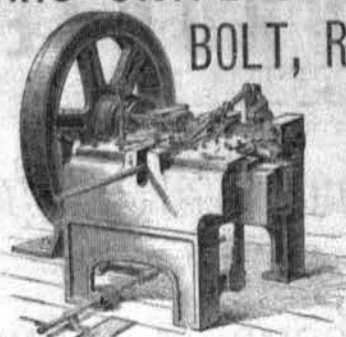


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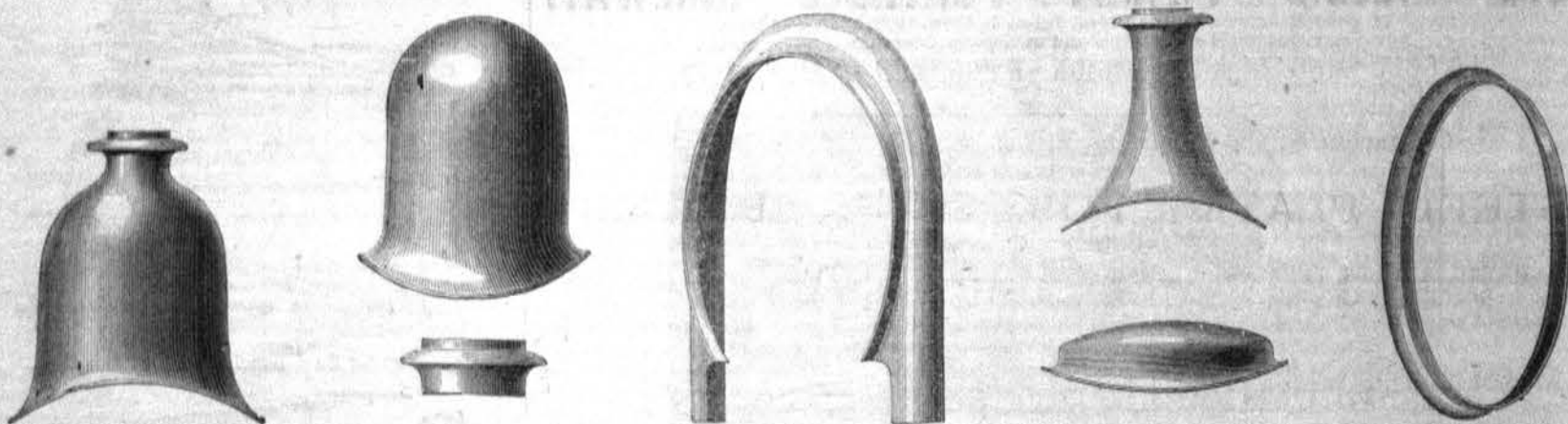
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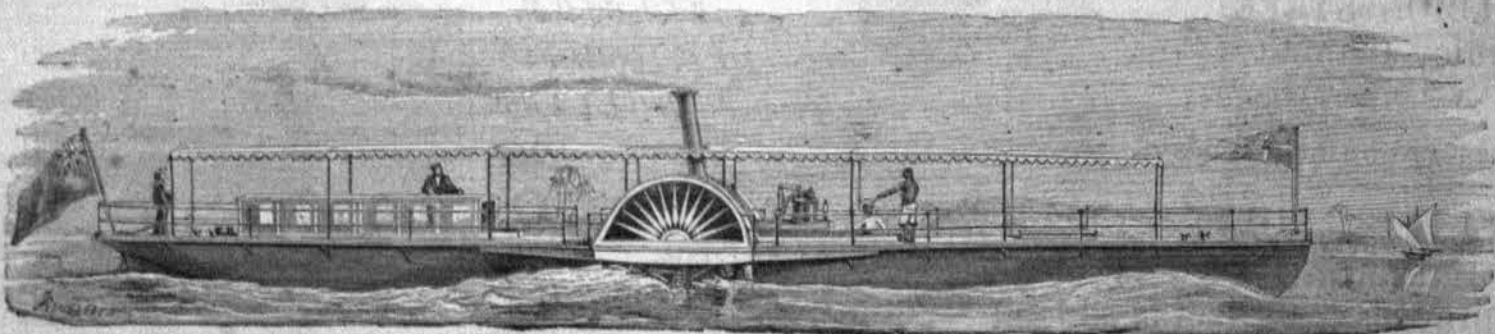
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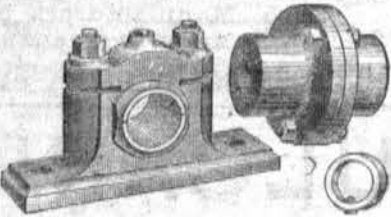
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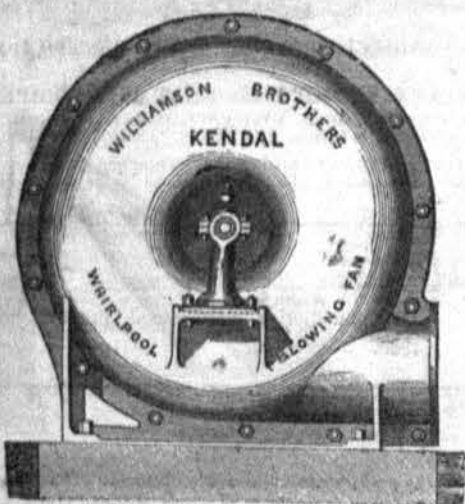
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The HARD is a Substitute for Metals, Ivory, Vulcanite, Ebony, &c., and is used for Journal Bearings and Bushes, Condenser Ferrules, Railway Fish-plate Washers, Pneumatic Carriers, Electric Machines, &c.

Mr. T. A. Edison, the great electrician, writes:—

"I esteem it very highly, and use larger quantities of it than Vulcanised Rubber, and, in its present condition, find it very satisfactory."

Both qualities of the Vulcanised Fibre are uninjured by the action of Hot and Cold water, oils, spirits, grease, ammonia, and many other chemical agents which utterly destroy leather, metals and rubber.

Sold in sheets about 66 inches and 42 inches and varying in thickness from 1-32 to 1 inch.

SOLE AGENTS:—

MOSSSES AND MITCHELL, 62, Queen Victoria Street, London, E.C.

CORPORATE MARK.



Granted according to Act of Parliament, 1777 by the Cutlers' Company, Sheffield.

TOOLS, STEELS, FILES,
R. MUSHET'S SPECIAL STEEL.

Railway Springs, Steel Castings, Shear and Spring Steel, &c., &c

SAMUEL OSBORN AND CO.

CLYDE STEEL AND IRON WORKS, SHEFFIELD.

LONDON: 16, PHILIP LANE, E.C.; BOSTON (U.S.): 10, OLIVER STREET;
MONTREAL: 470, ST. PAUL STREET; BERLIN: 48, NEUE FRIEDERICHS STRASSE.

APRIL 9, 1882.

IRON.

XXII.

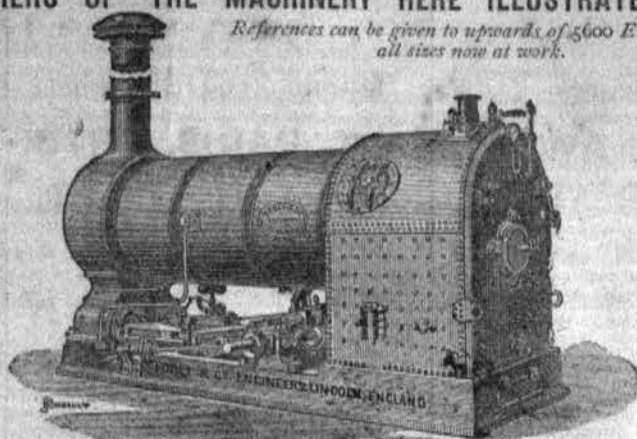
ROBEY AND CO., ENGINEERS, LINCOLN,

SOLE MANUFACTURERS OF THE MACHINERY HERE ILLUSTRATED.

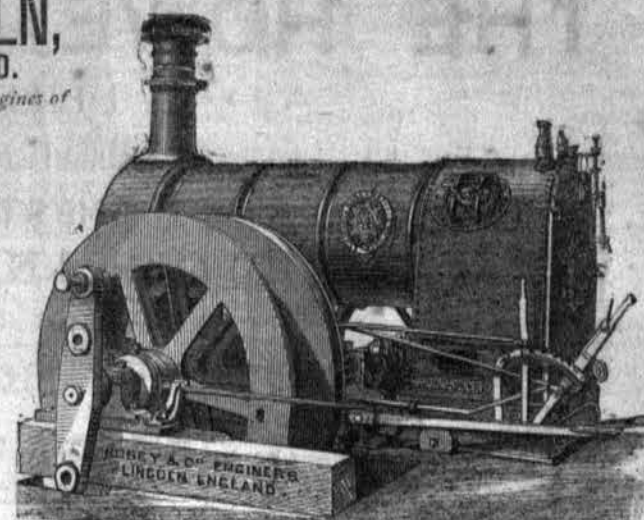
References can be given to upwards of 5000 Engines of all sizes now at work.



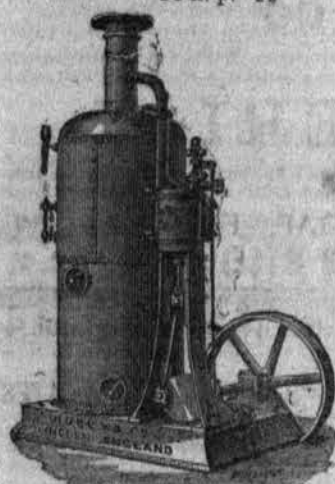
Superior Portable Engines, 4 to 50 h.p.



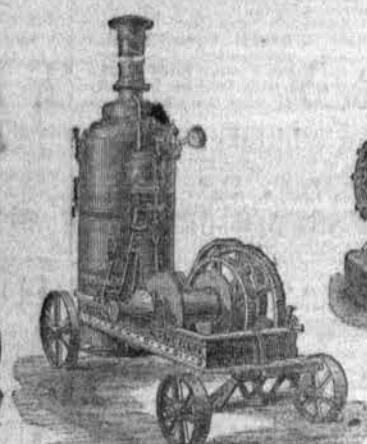
The Patent "Robey" Fixed Engine, 4 to 50 h.p.



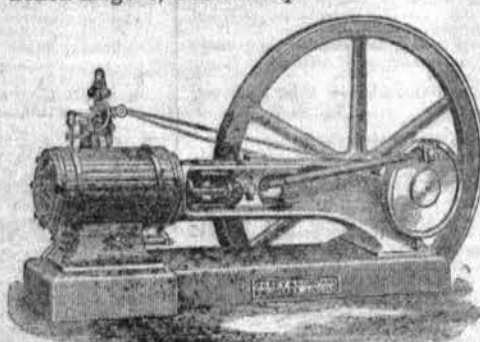
Patent "Robey" Mining Engine, 4 to 200 h.p.



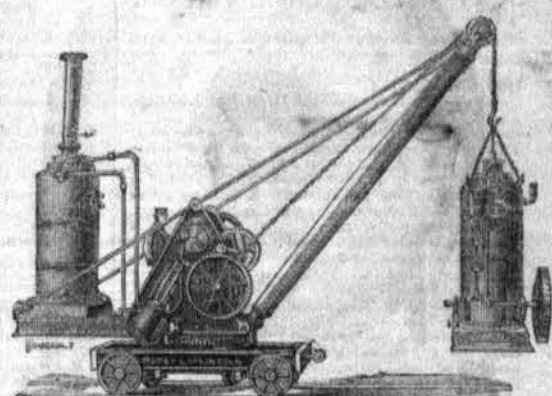
Vertical Engines, 1 to 12 h.p.



Improved Steam Travelling Crane



Horizontal Fixed Engines, 4 to 60 h.p.
ROBEY & CO.,
ENGINEERS,
LINCOLN, ENGLAND.



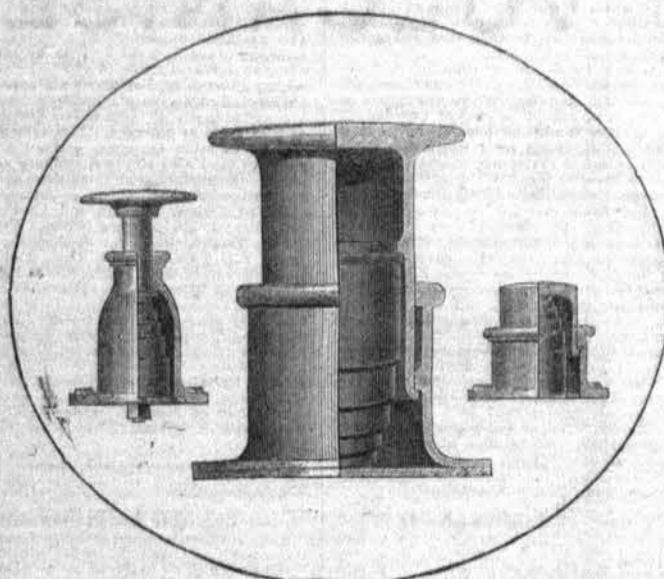
Improved Barrow Hoist.

JOHN SPENCER AND SONS, Newburn Steel Works, Newcastle-on-Tyne.

**STEEL
CASTINGS.**



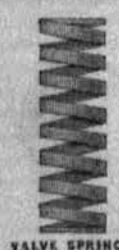
ORIGINAL MANUFACTURERS OF
VOLUTE SPRINGS.
BEST CAST STEEL FILES.



**STEEL
FORGINGS.**



RAILWAY
SPRINGS AND BUFFERS
BEST CAST STEEL FOR TOOLS.



VALVE SPRING



SCHAEFFER GAUGE

GEORGE SALTER & CO., West Bromwich,
Manufacturers of SPRING BALANCES,
Roasting Jacks, Sad Irons,
Bourdon's, Schaeffer's and Silvester's
PRESSURE GAUGES
COLLIERY SIGNAL BELLS, RASTRICK'S TUBE SCRAPERS,
Conical, Spiral, & all kinds of Coiled Springs
MADE TO ORDER.



BOURDON GAUGE



VALVE SPRING



COLLIERY BALANCE
UP TO 1 TON



SILVESTER'S PATENT SAD



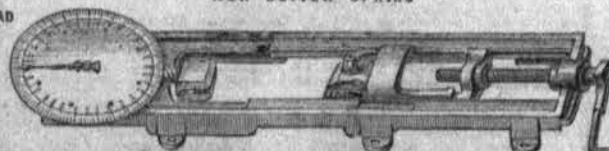
NEW OLIVER SPRING



LOOSE HANDED SAD



KELLY'S DOOR SPRING



WIRE TESTER ANY PRESSURE UP TO 3 TONS
GOODS SUPPLIED THROUGH MERCHANTS AND FACTORS.



RASTRICK'S PATENT SCRAPER

Wheatley Kirk, Price and Gaulty. ESTABLISHED 1850.
MECHANICAL VALUERS, AUCTIONEERS
AND ARBITRATORS.
Head Office—Albert Square, Manchester.

Partnerships. — Gentlemen
(Practical Engineers) desirous of entering
established Engineering concerns, are invited to
communicate with the undersigned, who have
managers' bona fide establishments open to admit
such. References are given and required.
—WHEATLEY KIRK, PRICE AND GAULTY, Albert
Square, Manchester.

Engineering Firms of Good
REPUTATION, open to admit partners, or
desirous of selling outright, are requested to
communicate with the undersigned, who have
numerous clients open for such. —WHEATLEY
KIRK, PRICE AND GAULTY, Albert Square,
Manchester.

By order of the Devisors in Trust under the will of
the late Wm. James, Esq., of Gloucestershire, in
the Forest of Dean. Valuable Mining Properties,
extending over an area of about 200 acres
(of which about 25 acres have been partially
worked), and containing an abundance of hematite
iron ore of rich quality, yielding a very high
percentage of pure metal, together with the joint
ownership with Messrs. Henry Crawshaw and
Sons of a private tramway, communicating direct
with the Severn and Wye Railway.

Messrs. Debenham, Tewson,
FARMER and BRIDGEWATER, will
SELL, at the Mart, on TUESDAY, May 12th, at
2, in three lots (unless an acceptable offer or offers
be previously made), the following important
IRON MINES:—

Lot 1.—The Oakwood Mill Deep Level, situate
near Hereford, in the hundred of St. Briavels, about
two miles from Ludlow, and three from Coleford.
Held under an award from the Crown for 500 years
from March, 1855, at a dead rent of £15 per annum
and a royalty of 4d. per ton, on all ore raised in
excess of 200 tons per annum. A portion of this
lot—viz. the Upper and Lower Sandstone Levels,
is sub-leased for seven years, at a dead rent of
£200 per annum, and a royalty of 1s. 6d. per ton
upon all in excess of 200 tons per annum. The
remainder is in hand. Also an undivided moiety
of the Oakwood Tramway, a valuable property,
1½ mile in length, from which a considerable in-
come is derived in the shape of tolls.

Lot 2.—The Scar Pit, a freehold grant or gale
from the Crown, overlying a portion of the Oak-
wood Deep Level Mine. This lot is subject to a
dead rent of £5 per annum, and a royalty of 4d.
per ton on all over 300 tons per annum. With
possession.

Lot 3.—The Frog Pit, a freehold grant or gale
from the Crown, overlying a portion of the Oak-
wood Deep Level Mine. Dead rent £5 per annum,
royalty 4d. per ton on all exceeding 300 tons per
annum. With possession.

The mines are adjacent to the extensive works
of Messrs. Henry Crawshaw and Sons, at Park-
side, Particulars, W. Calster, Esq., Solicitor, 8,
New-inn, Strand; and of the Auctioneers, 30,
Cheapside.

IN LIQUIDATION.

To be Sold by Private
TREATY, as a going concern, on the
Great Northern Line of Railway, a well-estab-
lished ENGINEERING BUSINESS, com-
prising the following branches, viz:—

The Manufacture of Stationary Engines and
Boilers.

Portable and Combined do.

Agricultural Implements of all classes.

And especially the Manufacture of Wrought Iron
Cranks, for which a complete Plant of Patent
Machinery has been put down; also General Iron
Founding with all the Appliances for carrying on
and extending a first-class trade.

The Machinery and Tools are by well-known
makers, and the new Buildings are erected upon
land secured on a 999 years' lease.

Full particulars can be obtained from Mr. Isaac
Jenks, of Wolverhampton; Mr. Thomas Leman,
Accountant, Nottingham; or Messrs. Corser,
Fowler and Langley, Solicitors, Wolverhampton.

To be Sold, by Private

TREATY, a compact ENGINEERING
WORKS at Stockton-on-Tees, consisting of
Foundry, Fitting, Pattern, and Smiths' Shops,
two large Yards and Offices, standing on nearly
4000 yards of land, adjoining the N. E. Railway.
About one half of the premises are let on lease for
£150 per annum. There are buildings on the
remaining ground for carrying on a large business
in Castings, Engine and Machine Building, &c.

As a large portion of the purchase-money may
remain on mortgage, only a limited capital is
required for entering on a first-class property both
as an investment and as a business premises.—
Apply, GEO. A. CROFT, Engineer, Stockton-on-
Tees.

To be Let or Sold, the Iron-

STONE on the Brumby Estate, belonging
to the Earl Beauchamp, near Frodingham Station,
in North Lincolnshire.

The Frodingham Red extends over 500 acres of
this property, and lies immediately below the
sea. It is estimated that these 500 acres contain
upwards of 3,000,000 tons of Ironstone. The
analysis give a high percentage of iron. The
estate is only one yard distant from the Doncaster
and Grimsby Branch of the Manchester, Sheffield,
and Lincolnshire Railway, a connecting line with
which Lord Beauchamp has power to make.

For further particulars, apply to Messrs. WAL-
POUN, 27, Bolton Street, Piccadilly, London.

Waterside Premises. —

WAREHOUSES to LET with or without
frontage to River Thames, in portions to suit
applicants.—Apply, 4, Upper Thames Street,
London, opposite "Times" Office.

Engineering. — A Mechan-

ICAL and Civil Engineer, with experience
in England and on the Continent, desires to enter
an engineering establishment (London preferred),
with a view to partnership. Could introduce at
once capital against mortgage security.—Address,
A. W. CAREY of Amesbury, Esq., 2, Lawrence
Fountain Hill, Cannon Street, E.C.

Nettlefolds (Limited), In-
CORPORATED under the Companies
Acts, 1863 to 1879. Capital £250,000, in 25,000
Shares of £10 each.

DIRECTORS.
Mr. JOSEPH HENRY NETTELFOLD, Bir-
mingham (Chairman and Managing Director);
Mr. FREDERICK NETTELFOLD, London.
Mr. ALFRED FIELD, Birmingham.
Mr. THOMAS GLADSTONE, Birmingham.
Mr. JOHN THURWELL JOHNSON, Manchester.
Mr. SAMUEL ZACHARY LLOYD, Stourport.

BANKERS.
The Birmingham and Lancashire Bank (Limited),
The London Joint Stock Bank,
Manchester and County Bank (Limited).
SOLICITORS. Messrs. Ryland, Martineau,
Carrisale, and Goodwin, 7, Cannon Street,
Birmingham.

AUDITORS. Messrs. Carter and Carter, Water-
loo Street, Birmingham.

SECRETARY. Mr. Reginald Parker.

This Company has been formed for the purpose
of acquiring from their several Proprietors the
various Manufactories and Works mentioned
below, with the Businesses carried on there, and
all the Patent Rights, Machinery, and Trade
Property belonging to such Businesses, namely:—

1.—MESSRS. NETTELFOLDS—

Freehold Works at Heath Street, Bir-
mingham and Cranford Street, Smethwick (for
the manufacture of Wood Screws, Wire,
and other articles), with adjoining Land.

Freehold Works at King's Norton, Wor-
cestershire, for the manufacture of Wood
Screws and other articles.

Leasehold Works, Warehouses, and Offices
in Broad Street and Attwood Passage,
Birmingham.

Leasehold Wireworks in Princip Street,
Birmingham.

Freehold Works at Hadley, Shropshire,
known as the Castle Ironworks.

Leasehold Colliery in Ketley, Shropshire,
known as the Ketley Collieries.

2.—THE BIRMINGHAM SCREW COMPANY
(LIMITED).

Freehold Works at Smethwick (for the
manufacture of Wood Screws), and ad-
joining Property.

3.—THE MANCHESTER STEEL SCREW
COMPANY (LIMITED).

Freehold Works at Bradford, Manchester,
for the manufacture of Screws.

4.—MR. JOHN CORNFORTH—

Leasehold Wire and Wire Nail Works, in
Herkley Street, Birmingham.

5.—MESSRS. LLOYD and HARRISON—

The Screw Business carried on by this Firm at
Stourport.

For the above purposes the Company has been
registered with a Share Capital of £250,000,
divided into 25,000 shares of £10 each. It is not
intended, in the first instance, to issue more than
65,000 of these shares, 21,000 of the shares to be
so issued will be Preference Shares, bearing a
fixed cumulative dividend of five per cent. per
annum. The remainder will be Ordinary Shares
of the Company.

In addition to the Share Capital, the Directors
are empowered, by the Articles of Association, to
issue to the Vendors of the works purchased, or
other persons having claims on the Company,
securities for £100 each, to be called Deferred
Profit Debentures, to an amount not exceeding
£420,000.

These Debentures will bear a rate of interest
(not exceeding 6 per cent. per annum) equal to
the dividend from time to time declared on the
Ordinary Shares of the Company.

They may be redeemed at any time by the Com-
pany at one month's notice, but, if not so redeemed,
they will not fall due before the expiration of
ninety-nine years, except in case of liquidation,
when the amount would be payable only out of
assets that might remain after full return of the
capital of the original Preference Shares.

In order to provide for the gradual reduction
and discharge of the Deferred Profit Debentures a
provision has been inserted in the Articles of
Association that no dividend on Ordinary
Shares shall exceed 6 per cent. per annum until
such Debentures are paid off. There is also a
provision for the establishment of a Fund, to be
called the "Deferred Profit Debenture Fund," to
be formed by the appropriation and accumulation
of surplus profits, and to be applied in discharge
of the Debentures.

It is intended to issue the Debentures in twenty-
one series, of not more than £20,000 in each series,
and to redeem the whole of a series whenever the
available funds are sufficient for the purpose.

The Company has entered into Agreements
with the different Vendors for acquisition of their
several properties, enumerated above, at the
following prices, namely:—

Messrs. Nettlefolds £750,000

The Birmingham Screw Company 141,000

The Manchester Steel Screw Company 50,000

Mr. Cornforth 21,000

Messrs. Lloyd and Harrison 21,000

In each case (except that of purchase from Mr.
Cornforth) the business will be taken as a going
concern, as on the 1st of January, 1880, the com-
pany paying all trade debts due by, and receiving
all book debts owing to the Vendors on that date.
In Mr. Cornforth's case the business will be taken
as on the 10th of February, 1880, the Company
neither receiving nor paying debts then owing.
From these respective dates the profits will belong
to the Company, subject to a payment to the
Vendors of interest at five per cent. per annum up
to the completion of the purchases.

The whole of the purchase moneys are payable
by allotments of Preference and Ordinary Shares,
and Deferred Profit Debentures, except that in
most of the cases the Company has an option of
subsisting for any part a payment in cash.

An arrangement has been made with Mr. Joseph
H. Nettlefold, under which he is to act as Chair-
man and Managing Director of the Company.
This engagement is terminable by his death or
resignation, by his becoming disqualified under the
provisions of the Articles, or by his removal by a
resolution of the Company. His salary as Man-
aging Director is to be £3,000 a year.

The Directors have decided to offer to the
public a portion of the Preference and Ordinary
Shares of the Company, by arrangement with
the Vendors they also offer a portion of the
Deferred Profit Debentures issued to them. The
above-mentioned Shares and Debentures so offered
will not, in the whole, exceed in amount £250,000.
Applications are to be made to the Bankers of the
Company.

The various Contracts entered into by, or on
behalf of, the Company are enumerated in the
Schedule. The agreements with the different
Vendors, and the Memorandum and Articles of
Association of the Company may be seen at the

Offices of the Solicitors. Prospectuses and Forms
of Application may be obtained from the Secre-
tary, No. 15, Broad Street, Birmingham, and from
the Bankers and Solicitors.

SCHEDULE OF CONTRACTS.

PARTIES.
22nd March, 1880.

Agreement made between Joseph Henry Nettlefold
and Frederick Nettlefold, of the one part, and
Nettlefolds (Limited) of the other part.

22nd March, 1880.

Agreement made between the Birmingham Screw
Company (Limited), acting by William Henry
Bullock, of the one part, and Nettlefolds
(Limited), of the other part.

22nd March, 1880.

Agreement made between the Manchester Steel
Screw Company (Limited), acting by John
Galloway Meller, of the one part, and Net-
tlefolds (Limited), of the other part.

22nd March, 1880.

Agreement made between John Cornforth, of the
one part, and Nettlefolds (Limited), of the
other part.

22nd March, 1880.

Agreement made between Sampson Zachary Lloyd
and Charles Harrison of the one part, and
Nettlefolds (Limited), of the other part.

5th November, 1879.

Agreement made between Alfred Field, Henry
Cromwell Field, William Field, and Alanson
Henry Saxton, of the one part, and Joseph
Henry Nettlefold, of the other part.

Upset Price £30,000.—In the High Court of
Justice, Chancery Division: Forster v. Forster.

—Durham. — Important Leasehold Seaside
Collieries, known as East Hetton and Trimdon
Grange, extending under about 1600 acres,
and intersected by the North-Eastern Railway, and
situate about 7½ miles from Durham, five miles
from Ferry Hill, and 14 from the port of ship-
ment at Hartlepool.

Mr. John Whittaker Ellis (of

the Firm of Farebrother, Ellis, Clark, and
Co.) will SELL the above by AUCTION, as
going concerns, in one lot, at the Mart, Tene-
ment Yard, London, on WEDNESDAY, 19th
May, 1880, at 2 o'clock precisely (pursuant to an
order in the above action, and with the approbation
of the Master of the Rolls). The EAST HETTON
COLLIERY, comprising 2740 acres, includes the
Town Kellie, Kellie Glebe, and Garmondway
Moor Royalties. The Colliery has every facility,
by means of appropriate shafts, buildings, and
works, and by ready communication with all the
best markets by its own branch line, in connection
with the North-Eastern Railway, to the iron-
works of Cleveland, and to the southern markets,
or to the Tyne, Sunderland, Middlesborough, and
also by the Hartlepool Branch Railway, which
places it in a direct route to the shipping ports for
the home and export trades. The engines are of a
most powerful description, capable of raising an
output of 250,000 tons per annum, and there is
sufficient coal unworked (it is estimated) to supply
a vend for the next thirty years. The adjacent
Trimdon Grange Colliery, comprising 854 acres,
includes Trimdon Grange, Town Kellie (part of),
and North-side Royalties. The Colliery is situate
about three-quarters of a mile from the Trimdon
Station of the Hartlepool and Ferry Hill branch
of the North-East Railway Company's system, and
in connection with the main line at Ferry Hill.
The Colliery is in first-rate working order, and is
capable of raising an annual output of 180,000 tons
of excellent household coal, known as Ralsby
South Hartlepool and Trimdon Grange Wallend.
The available unworked coal (it is estimated) is
sufficient to supply a vend to the extent named for
the next 30 years; also a Freehold Property, com-
prising a plot of land of about six acres, on which
are erected 60 workmen's cottages; and about an
acre of land, situate close to the Trimdon Station,
on which are 33 cottages. The sale comprises a
number of other cottages, erected on leasehold
property, and also ample machinery and working
plant. Particulars, with conditions of sale, plans,
and further information may be obtained on ap-
plication to Messrs. Trinder and Curtis Hayward,
Solicitors, 4, Bishopgate Street, Within, E.C.
T. W. Denby, Esq., 8, Frederick's Place, Old
Jewry, E.C.; J. Anderson Rose, Esq., 11, Salis-
bury Street, Strand, W.C.; G. B. Forster, Esq.,
Backworth, Newcastle-on-Tyne; W. O. Wood,
Esq. (the Viewer), East Hetton Colliery, Coxhoe,
County Durham; Matthew Forster, Esq., 1 Temple
Gardens, Temple, E.C. (the Receiver); R. F.
Matthews, Esq., Seaton Carew, West Hartlepool;
and of Messrs. Farebrother, Ellis, Clark, and Co.,
5 and 6, Lancaster Place, Strand, W.C., and 18,
Old Broad Street, London, E.C. Orders to view
may be had of Messrs. Trinder and Curtis-Hay-
ward, and of Messrs. Farebrother, Ellis, Clark,
and Co.

Northamptonshire.—The Woodford House Estate,
a highly important Freehold Residential Prop-
erty, of upwards of 750 acres, possessing great
mineral value, as some of the richest beds of iron
ore and limestone underlie the greater portion of
the Estate, parts of which are now being worked.
It is connected by a siding with Fenny Stratton
Station, and is only three miles from Thrapston,
which has stations on the Midland and North-Western
Railways, and it is believed there is no district
where these minerals can be found under more
favourable circumstances or put into the market
at a cheaper rate.

Messrs. Farebrother, Ellis,

CLARK, and Co. beg to announce that
the above valuable RESIDENTIAL and
MINERAL PROPERTY was NOT SOLD at the
recent Auction, and may now be treated for.

DIAMOND BORING.

*ARTESIAN WELLS bored STRAIGHT and
TRUE—Large and small diameters—easy to line
and put down Pumps—Tenders given for Wells,
Pumping Machinery, and Engines, complete.

PROSPECTING FOR MINERALS to any
depth.—The only system by which a true section of
the strata can be obtained from the cylindrical
cores taken out.

Total boring by this system in Great Britain to
end of last year, 104,000 feet.

For terms apply to JOHN VIVIAN, C.E., White-
haven, Cumberland.

New Edition.

"How to Make Money by

H PATENTS." Free, by post, 12 stamps.—
BARLOW and YOUNG, Patent Agents and Consult-
ing Engineers, 23, Southampton Buildings, W.C.

Galvanised Ironwork

Tanks, &c.
PORTOUS & CRAWFORD,
ANDERSON GALVANISING WORKS,
94, ELIOT STREET,
GLASGOW.

COATBRIDGE OIL WORKS.

ON TUESDAY AND WEDNESDAY, 13th AND 14th
APRIL, AT THE COATBRIDGE OIL WORKS, NEAR
COATBRIDGE.

IMPORTANT SALE

OF
DISTILLING, REFINING, AND PARAFFIN
PLANT, STEAM ENGINES, and BOILERS,
KIRK'S FREEZING MACHINE by Norman,
DONKEY and PUMPING ENGINES,
HYDRAULIC PRESS and PUMPS,

54 TANKS (many nearly New), including a Large
Circular Tank, 9ft. dia. by 11ft. dia. high; 2
4ft. dia. by 14ft. dia. high; C. J. Plate Tank,
36ft. by 16ft.; 3 Rectangular Tanks; 6 upright
Tanks; and 10 Boiler Tanks, several suitable for
Steam, capacities from 100 to 50,000 Gals.

14 C. J. and M. I. STILL'S, CONDENSERS,
RETORTS, SMALL GASOMETER,
EXPERIMENTAL STILL.

About 500 C. J. FLOORING PLATES, 4 by 2,
Large Quantity M. I. and C. I. STEAM and OIL
PIPES.

Two-Ton CRANE, SIDING RAILS,
Lot IRON COAL HUTCHES,
TRUCK-WEIGHING MACHINE,
Several PLATFORM WEIGHING MACHINES

By Pooley and Smith,
Whole BRICK and SEALED BUILDINGS,
CARTS, COUNTING-HOUSE FURNITURE,
&c.

BY AUCTION.

J. and R. Edmiston are in-
STRUCTED to SELL as above, the whole
Plant, Utensils, and Buildings of the Coatbridge
Works on TUESDAY and WEDNESDAY, 13th
and 14th April.

Catalogues on application.
J. and R. EDMISTON, Auctioneers,
City Sale Rooms, 45, West Nile Street,
Glasgow.

Borough of Liverpool.—

TRAMWAYS RECONSTRUCTION and
EXTENSION.

TENDERS are invited for the SUPPLY of the
following MATERIALS required for the RE-
CONSTRUCTION and EXTENSION of the
Liverpool Corporation Tramways (except the Inner
Circle), comprising 15 miles 3 furlongs, or there-
abouts, viz:—

(a) BESSEMER STEEL RAILS.

(b) CAST IRON SLEEPERS, POINTS, and
HOLDING-DOWN JAWS.

(c) PHOSPHOR BRONZE SCREWED
BOLTS and WROUGHT IRON NUTS.

Tenders will be received for the whole, or for any
of the parts separately, in accordance with speci-
fications, drawings, and forms of Tender, which can
be seen, and copies obtained, on application to the
Borough Engineer, Municipal Offices, Liver-
pool, on and after Monday, the 5th April next, on
payment of one guinea, which will be returned on
receipt of a bona-fide Tender and the return of the
documents.

Tenders, which are to be on the printed form,
and endorsed "Tramways Reconstruction, Tender
for (a), (b), or (c)," to be addressed to the Chair-
man of the Health Committee, and delivered at the
Borough Engineer's Office, Municipal Offices,
Liverpool, not later than Wednesday, the 21st day
of April, 1880.

The person whose Tender is accepted will be
required to enter into a contract to be prepared by
the Town Clerk.

The Corporation do not bind themselves to accept
the lowest or any Tender.

By order,
JOSEPH RAYNER,
Town Clerk.

NOTICES.

ORES, MINERALS & METALS,
IMPORT AND EXPORT.

The only house in America giving
Special Attention to Manganese
and Manganiferous Iron Ores.

ADDRESS:
WILLIAM D. MARVEL,
NEW YORK.

Telegrams: "Marvel, New York."

JOHN BELLAMY,

BYNG STREET, MILLWALL, LONDON, E.

MANUFACTURER OF
WROUGHT IRON TANKS and CISTERNS.

Cattle, Sheep, and Pig Troughs, Cart Bodies,
Corn, Flour, and Sack Bins, Funnels, Shoots,
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CONTENTS.

	PAGE
GEOLOGY OF THE CAPE COLONY	271
OUR TRADE SUMMARY	271
ENGINE INSURANCE	271
LONGWORTH'S GOVERNOR AND AUTOMATIC VALVE-GEARING	272
THE ESCHERICH KILN	272
THE PISTONLESS INDICATOR	274
THE PRODUCTION OF MARTIN STEEL RAILS FROM WORN-OUT IRON RAILS	274
OCCASIONAL NOTES	275
EXHIBITION OF BUILDING APPLIANCES, AGRICULTURAL HALL	275

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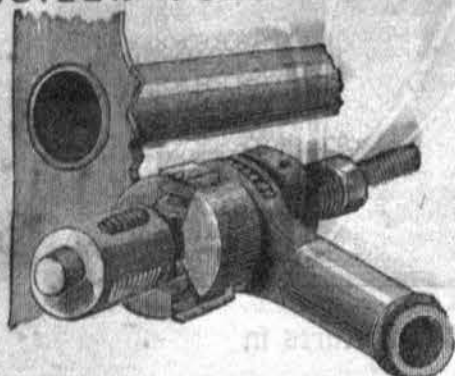
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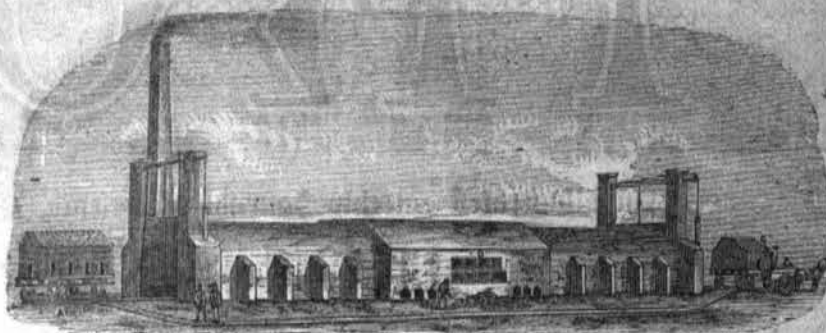


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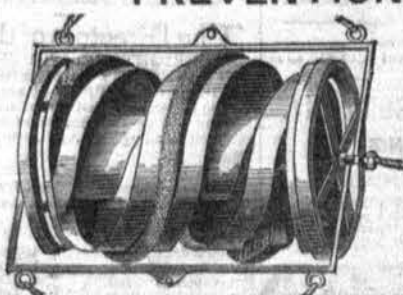
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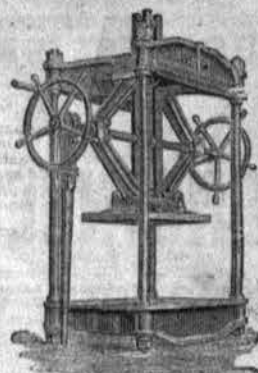
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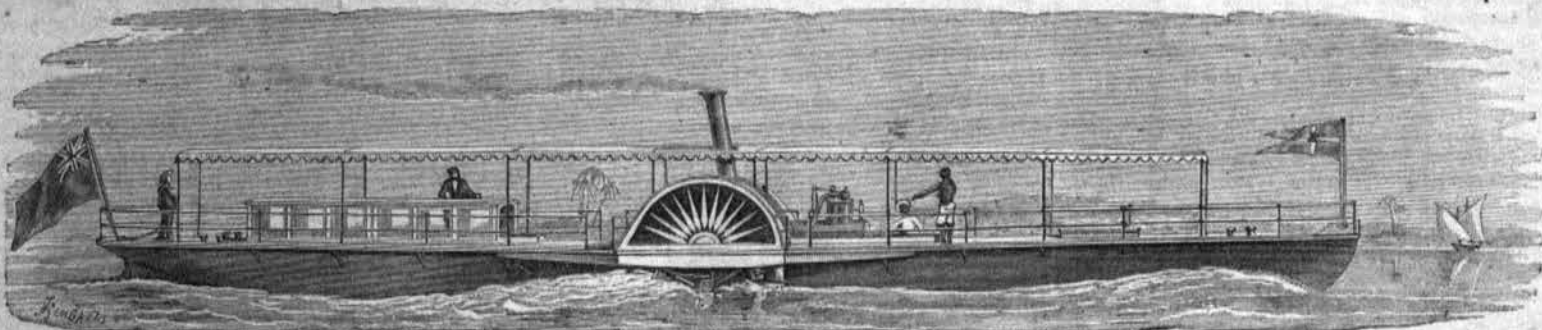
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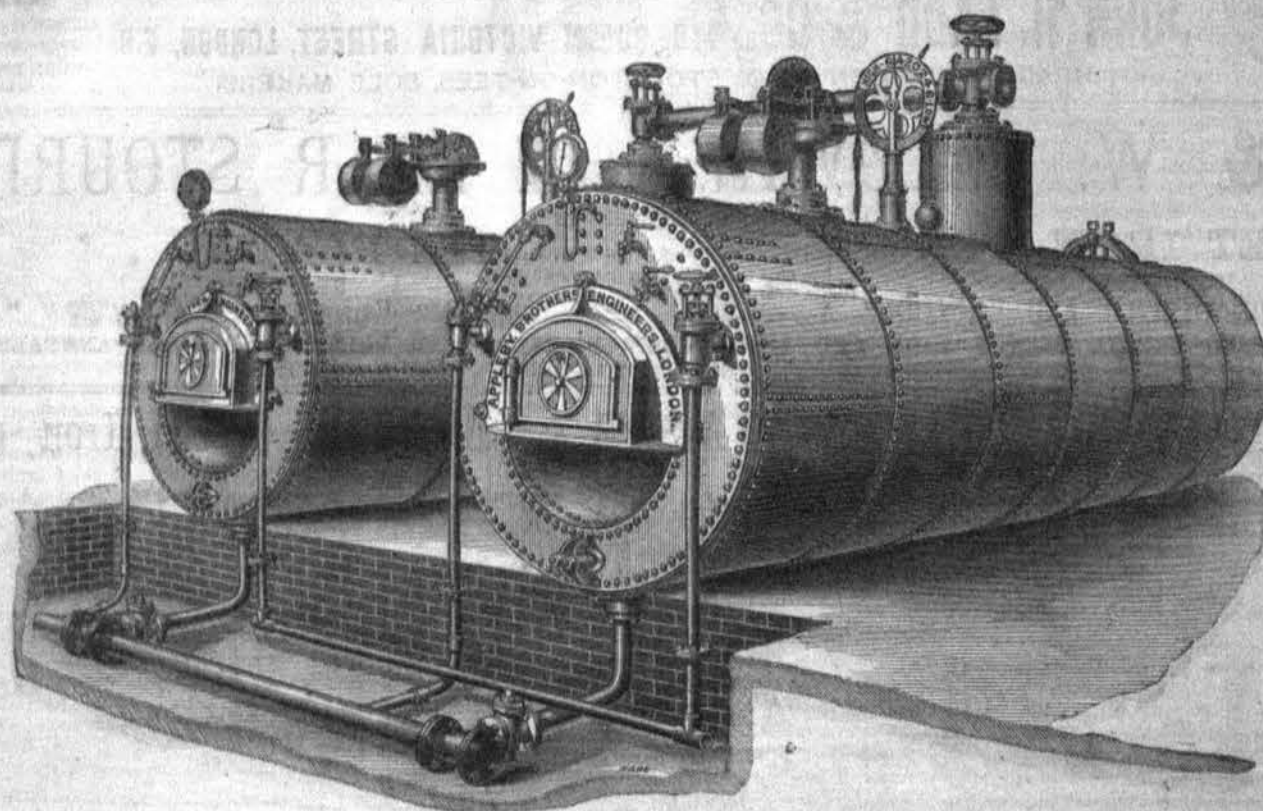


Fig. 46, see Appleby's Handbook of Machinery.—Section 1.

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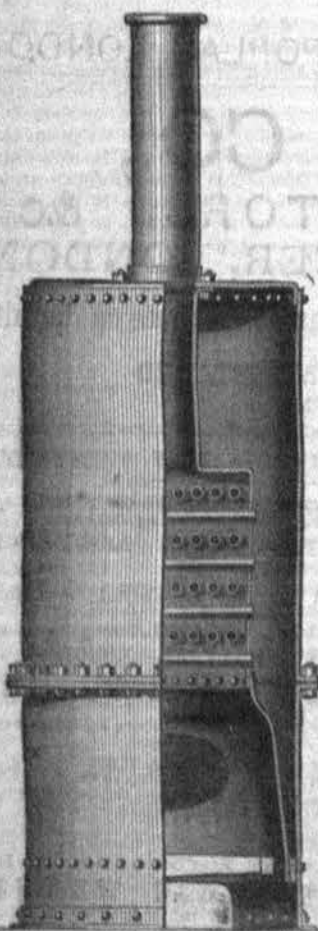
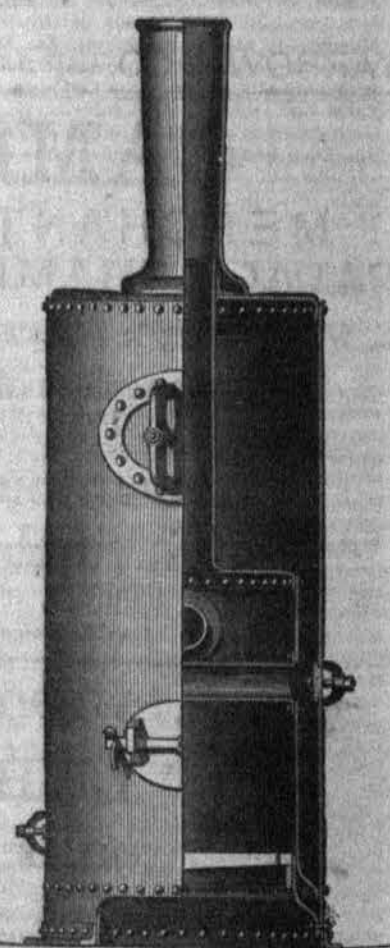


FIG. 52.



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IRON.

LONDON, FRIDAY, APRIL 16, 1880.

GEOLOGY OF THE CAPE COLONY.

ALTHOUGH there are many interesting stories to be told of the South African geology, with its vast Kalahari Desert, its gold-fields, its coal-beds and its diamond diggings, it is here proposed to keep within the boundary of Cape Colony itself, from the Orange River on the north to the ocean-bound eastern, western and southern sides. British civilisation has grown from the rude times of those cave men who hunted here the hyena, the reindeer, the elephant and the mammoth, and has reached, after many an ebb and flow, the grand level of present days. British geology, in like manner, rings the changes from the remote Laurentian age, down through Cambrian, Silurian, Devonian, Carboniferous, Triassic, Oolitic, Cretaceous and Tertiary beds, stopping only with the last oozy mud of streams, or the sand which the last wave has left upon the beach. Cape Colony, that through the long revolving centuries showed little or no progress in its human inhabitants, has few changes to record in its physical history. As tribe after tribe rose and fell like successive forests, and like them, also, preserving nearly always the same old forms, so have the rocks undergone few mutations, and the country from one end to the other tells pretty much the same tale. The west of England has the ancient beds; the east has only the new. But east and west, north and south at the Cape, the land has scarcely undergone a geological transformation since ever so long ago. The very trees thereof, by their uncouth, old-world look, declare the same unprogressive type.

Although one great range of primitive rocks runs from west to east, being continued from the central parts of the Cape north-eastward to Natal, yet high plateau land exists all the way north to the Orange River. Some hills may be 8000 or 9000 feet high, but the far-spreading treeless plains are from 3000 to 5000 feet above the sea level. Thirsty and cheerless as these look under the glare of the sun, they sustain great flocks and herds—cattle, sheep, ostriches and Angora goats—while the health-giving breezes passing over them make the whole region a sanatorium for consumptives. This central watershed is known under the names of the Roggeveld, the Nieuwveld, the Sneeuwbergen, the Stormberg, the Winterbergen and other ranges. The Drakensberg, or Quahamba, carry on the heights by Orange State, Natal and Transvaal to Zululand. Southward of the main chain are several more or less parallel ranges. The Zwartberg, the Winterhoek, the Bokkeveld, and others might be mentioned, running up to 7000 feet. Table Mountain, near Cape Town, is but 3850 feet. These mountains have a base of slates, limestones and sandstones of primary age, subjected to much transmutation from eruptive matter, especially the granites. Shales and coarse red sandstones repose in a conformable way upon the quartzose sandstone. While the latter shows no fossils, the life of the former displays the Devonian types, which succeed the Silurian. A remarkable traplike formation, which puzzles geologists, is spread over the Devonian, reaching upward as far as Zululand. Some call it trappan, others a volcanic conglomerate, while an eminent authority regards it as akin to the boulder clay of Britain and the product of ice action. Upon that breccia are the so-called carboniferous rocks.

The Karroo beds particularly distinguish the Cape, constituting, in fact, the greater part of the interior, and going far beyond the boundary of the colony. They form the great plains and plateaus. Covered less with grass than sheep-bush and other shrubs, they smile with flowers and verdure after a thunderstorm, though the red loam on the blue rock has a desert aspect at other times. Both soil and base contain all the elements fitted for vegetation; and, with waters now found beneath, the Karroos are the hope of the Cape. But the formation is considered by Messrs. Wyley and Rubidge a part of the great Carboniferous system of the south. The horizontal Karroo beds, shales and sandstones, have been so pierced and permeated by dolerite and other igneous veins as to become intensely hard, with a structure occasionally resembling masses of greenstone, basalt, &c. Found over the Devonian, they are older than the Lias and Oolite. Mr. Dunn speaks of eruptions of the Triassic age, identifying even the volcanic centres of that ancient outburst and flow; the Karroo beds have, therefore, been styled Permian and Trias. But Mr. Bain, followed by Dr. Livingstone, would regard them as vast lacustrine deposits. The surface far exceeds that of the lakes of Central Africa, and the operations must have continued through an extensive period as well as over so considerable a space. How different the condition of climate in South Africa, when the water covered the

sites of the Kalahari desert and the dry Karroos! The rocky gates for the outlet of the lakes may still be seen in the ranges. The Karroo shales and quartzose sandstones are recognised as Dicynodon beds, from the immense number of the Dicynodon reptile remains they contain. Some of the creatures were the size of a walrus, with great tusks from the upper jaw, but having no teeth. Several species were two-tusked; others, looking like tortoises, were destitute of tusks. There were huge herbivorous dragons there, something like the Iguanodon, with a close-set series of equal-sized teeth, to crush and pound vegetable substances. Of these Dinosauria, Prof. Owen wrote, that the "bodies of the vertebrae retained more of the fetal structure than has been met with in any post-triassic herbivorous reptile." Some bore teeth of the bi-dental character of the kangaroo. There were cold-blooded reptilia, of a carnivorous kind, larger than the lion, with mammalian teeth "now manifested at the Cape," says Mr. Owen, "with a higher condition of cerebral, circulating, respiratory and tegumentary systems."

The coal-measures of the Stormberg ranges occur conformably with, and resting upon, the Upper Karroo beds. The latter, called Eccra, are seen 1200 feet thick; the Koomap are 1500; the Stormberg are 1800. The Glossopteris of the coal is found with the fossil Dicynodon in beds of sandstone and clay 3000 feet thick. Cave sandstone upon mountain tops adds to the picturesqueness of the scenery. It is often surmounted by volcanic rocks, whose decomposition adds to the colony's fertility. There are Cainozoic limestones 50 feet in thickness. The granite is very extensive in the west, as the Paarl, Malmesbury, George and Namaqua districts. The Devonian Table Mountain has a less proportion of it than the Lion's Head of Table Bay. The Tertiary beds are very limited. The Cape Flats are of clay and lignite. With gold, diamonds, silver, copper, lead and coal, the colony is rich in minerals. In spite of drought, the agricultural and pastoral prospects are excellent. The soil is productive; and, under irrigation, returns a handsome profit to the farmer in one of the healthiest of our colonies.

OUR TRADE SUMMARY.

IT is now becoming apparent that political excitement and preoccupation have not been the sole cause of the slackness in the iron trade that has been for some weeks apparent; but that over-production, speculation, and the contraction of the demand, have had a good deal to do with it. Complaints are rife from every quarter of the dull tone prevailing in the markets, and of a downward movement in prices, greater in some departments than in others; although at the same time a good many firms are still busy upon orders obtained during the more active period of the revival, and there are indications pointing to an increase in home requirements. A decidedly downward tendency, which set in on Friday, has characterised the week's transactions in Glasgow warrants, consequent on the report of a serious drop in rates in the United States that produced considerable panic in the market. On Wednesday heavy selling took place, the market closing, buyers, 52s. 9d. cash and 53s. a month; sellers, 3d. per ton more. Notwithstanding prices have been reduced from 3s. to 4s. a ton there is nothing doing in makers' iron. The manufactured trade is also quiet, with no new orders coming in, buyers being believed to be waiting for a further fall. The shipbuilding, engineering and iron-founding interests are considerably depressed, with no sign of speedy improvement. The steel manufacture is apparently the only one of the Clyde iron industries at all active. With a fair attendance at the Cleveland market on Tuesday, prices of pig-iron were flatter than they have been for some time, owing, doubtless, in great part, to the state of matters on the Glasgow Exchange. The labour difficulty is again cropping up among the Cleveland miners, who are dissatisfied with the result of the sliding-scale arrangement. In the finished-iron trade there is no change to report, and its prospects are anything but lively. The minor iron industries participate in this discouraging condition. Prices for pig-iron have been very much weaker in the Durham district, with little if any inquiry, and disappointment is expressed that the cessation of political agitation has brought with it no change for the better. In manufactured iron there is no change to report, and there seems to be no slackening of production. To the fall in the Scotch and Cleveland markets is locally attributed the weakness in pig-iron in the Newcastle district, where also the former buoyancy in the rates of finished have lately given way slightly. The shipbuilding trade of the Tyne continues flourishing, and it is remarked that on the occasion of nearly all the recent numerous launches keels have been laid in the vacant berths. Engine and boiler works continue brisk, and extensions are being carried out in some of them. In several other minor departments there is also considerable activity. The most notable feature of this week's review is the retrogression in the hematite iron trade of the north-

west, which seems to be going backwards as quickly as it advanced a few months ago. At present there is very little demand, and prices have fallen considerably. Of course makers generally are so well sold forward that they will have work for a long time to come; while the output is being everywhere increased. Shipbuilders are fairly employed, but fresh orders are scarce. Engineers and iron-founders have no cause to complain. The Manchester market is very flat and prices for manufactured have also fallen; but the improvement of the local branches of industry is giving indication of increased requirements. Prices in West Yorkshire have been falling for several weeks, until they now remain about what they were last Christmas, and at the same time orders are falling off, although the works are generally fairly employed on old contracts. The blast-furnaces of the district are busy, but the forges have been quieter. Some of the larger tool and machine makers are fully occupied. There has been a heavy fall in Bessemer steel in the Sheffield district, but there are signs of a revival. The special trades of the town appear to be improving considerably. The file-manufacturers are very busy, and there are symptoms of a rapid improvement in every department, the number of inquiries from Australia, the Levant, West Africa and India pointing to a brisk trade during the summer months. Many orders for cutlery are also coming in from America, where the higher class goods still sell well, notwithstanding the high protective duties which they have to meet. In the heavy hardware branches also there are indications pointing to a speedy recovery. The local hardware trade of the Birmingham district still appears backward, but here as elsewhere the effects of the recent election contest probably still linger. Prices, however, have remained tolerably steady. In South Staffordshire, the chief branches of the hardware trades appear to be steadily employed, but at the same time business is not so active as was expected. The coal trade remains everywhere in the depressed state in which it has continued so long.

ENGINE INSURANCE.

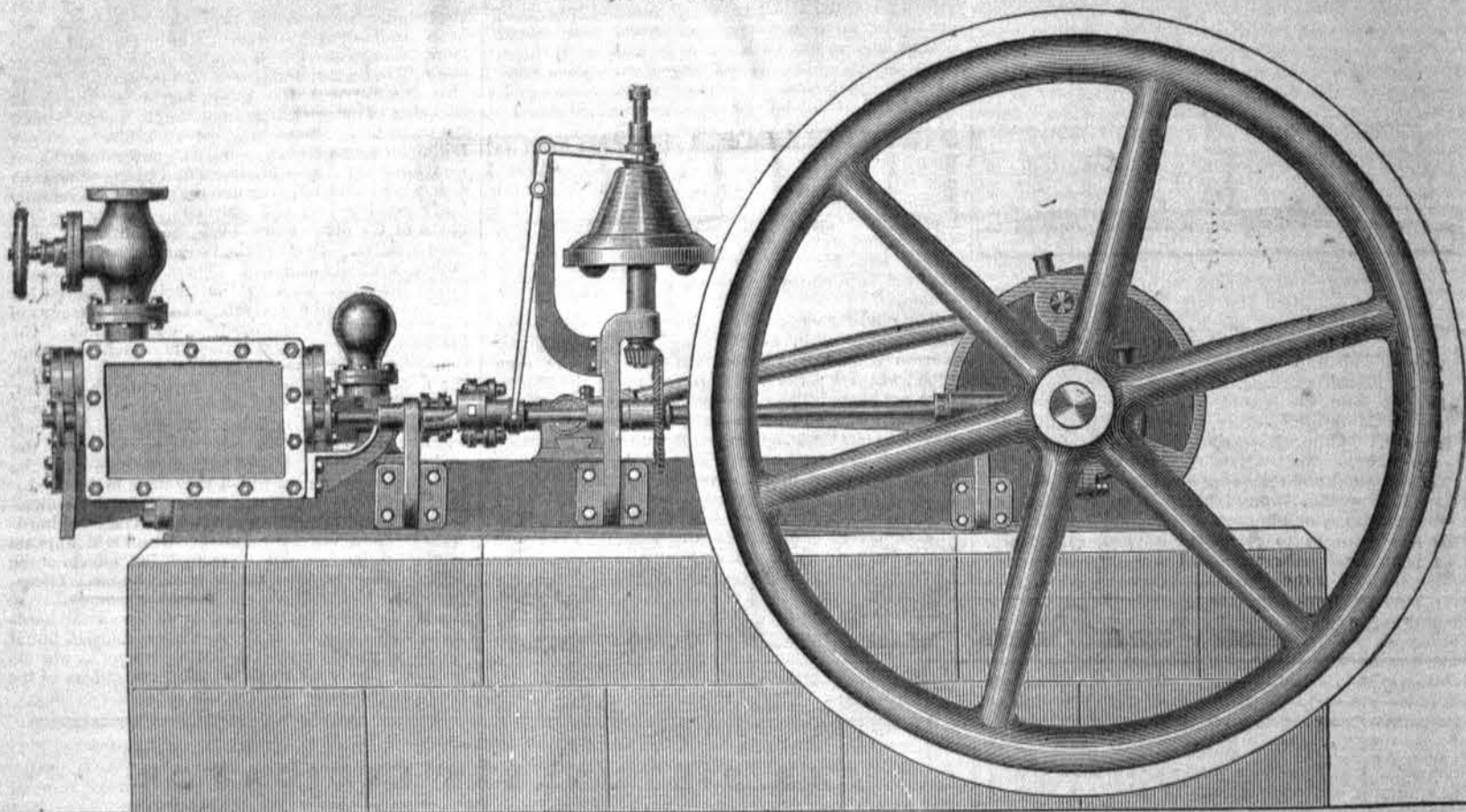
ABOUT seven months since* we referred to the then recent commencement of operations by a company formed for the purpose of insuring engines and boilers. This was the "Engine and Boiler Insurance Company," which insures engines against breakdowns as well as boilers against explosions. We pointed out at the time the complicated nature of engine insurance, and observed that we should watch with interest the results of the experiment. The first published report of Mr. M. Longridge, the chief engineer to the company, has just reached us, and it is satisfactory to find from it that so far good progress has been made. It appears that the number of engines proposed for insurance has exceeded what was anticipated, while the number of proposals for the insurance of boilers is also a matter of congratulation. A large proportion of the engines proposed have been insured, but some had to be declined, being either of insufficient strength, or so much out of repair as to be in danger of breaking down. In each of these cases a report was sent to the owner pointing out the alterations or repairs required. In some instances the advice given was followed, and the engines have since been insured; in others nothing has been done, the owners either declining to incur the expense of replacing weak or defective parts, or denying the necessity for doing so, on the ground that the fact of the engine driving the load was a sufficient guarantee of its fitness to do so. Not one dispute has arisen as to the Company's liability to make good the damage. The breakdowns of insured engines are roughly classified as follows:—49 per cent. due to accidental causes, 14 per cent. to negligence of attendants, 23 per cent. to old defects or flaws and ordinary wear, and 14 per cent. to weakness and faulty construction. The report goes on to give examples illustrative of each class. An important part of the company's business consists in indicating and reporting on steam-engines, and copies of a few of the indicator diagrams taken during the year are given in the report, with such remarks as they suggest.

With regard to Boiler Insurance it is observed that among the boilers proposed for insurance a number were found to be in bad condition, making it necessary, in some cases, to decline the proposals absolutely, and in others to defer their acceptance. The defects were all of the ordinary character, and do not require particular notice. A few illustrations, however, are given in the report, which goes on to notice the boiler explosions which have happened during the year and to give particulars of them. The report contains a number of facts and figures which will be found useful to steam-users, and to them we commend its perusal. On the whole it would seem that the progress made by the Engine and Boiler Insurance Company during the time it has been in active operation affords evidence of the utility of its work, and we wish it all the success it deserves.

* Vide IRON, vol. xiv. p. 289.

GOVERNOR AND AUTOMATIC VALVE-GEARING.

BY MR. D. LONGWORTH.

LONGWORTH'S GOVERNOR
AND AUTOMATIC VALVE-GEARING.

EVER since the expansion of steam was first utilised by Watt in the working of engines many master minds have been at work devising schemes by means of which the economy thus introduced might be still further increased. It was an obvious absurdity to work steam expansively, and at the same time to retain the former crude arrangement of throttle-valve. Meyer's system, introduced as long ago as 1842, still retains its place, despite the introduction of the Corliss valve from America. The heavy first cost of the Corliss valve, the slow speed at which it can with safety be worked (viz., from 50 to 60 revolutions per minute), and the great wear and noise of the mechanism, have stimulated English engineers to produce an equally efficient system which shall at the same time be noiseless, cheap and durable. The subject is of the greatest importance, and in view of this we illustrate herewith the application of a design having the same object as the patents above referred to, but combining also an improved form of governor. Mr. Daniel Longworth is the inventor of these novelties, which, although they were exhibited at the Kilburn Show last year by the manufacturers, Messrs. May and Mountain, of Birmingham, have not hitherto received the notice to which their merits entitle them.

The new features in the governor itself consist first in the introduction of a cast-iron bell or hollow cone, suspended on the vertical governor-spindle, rotating with it, and capable likewise of an up-and-down movement on the spindle by means of a slot in the latter. This hollow cone acts as the counterpoise to the centrifugal force of the balls, replacing the weight in the well-known Porter governor. Within the cone revolve the governor-arms, suspended from the spindle in the usual manner. The specialty of the governor-balls themselves is that instead of being rigidly connected to the arms, as is usually the case, they are free to revolve upon pins, and the surface of the hollow cone upon which they act can be varied in form, and the governor thus rendered as isochronous as required. As the counterpoise is mounted on the spindle above the point of suspension of the ball arms, the bearing in which the governor spindle revolves can be brought quite close to the point of suspension of the arms. The spindle is thus effectually steadied without the aid of a top bearing, there is much less vibration and wear than in the old methods, and the governor is therefore more durable. The balls being completely covered in by the counterpoise, all risk of accidents is entirely avoided. It will be seen by reference to the illustration that the governor, although running at a high speed, is driven by gearing instead of a belt. We would direct special attention to this point, as many accidents have occurred, both to engines and machinery, through the breaking of the belts which drive the governor.

The main slide-valve is actuated by an eccentric and slide-rod in the usual manner, and is of the usual construction as regards the ports which communicate with the steam-cylinder. On the back of the main slide-valve is mounted the expansion valve. This is of the plate or flat type, though other kinds may be employed. By means of guides on the back of the main slide-valve, the expansion valve is made to partake of the longitudinal motions of the former. The expansion valve is, however, free also to move at right angles to the direction of travel of the main slide-valve. There are two sets of horizontal gridiron ports in the back of the main slide-valve, one set communicating with one end of the steam-cylinder, the other set with the other end. Corresponding ports are formed in the expansion valve, but they are so arranged that when the steam has admission through one set of ports, it is cut off from passing through the other set, and *vice versa*. As the expansion valve is moved up and down by the spiral cam, to be afterwards described, the steam is thus alternately cut off from either end of the cylinder. When the valve remains in mid-stroke steam can be admitted to either end of the cylinder. This point is obviously of great importance on many occasions. In the case of rolling mills for example, when a bar gets jammed in the rollers, the expansion valve can be rendered inoperative by a slight modification in the spiral cam, and the engine can then be reversed by the usual hand gear. As the total travel of the expansion valve is only $\frac{1}{4}$ inch in a 20 horse-power engine, it will be readily seen that the wear, as well as the power required to move the valve, is reduced to a minimum. The expansion valve remains in whatever position it is moved into, whilst, as its travel is at right angles to that of the main valve, the cut-off can take place as early or as late as is required.

The connection between the governor and the valves is formed as follows:—On the back of the expansion valve are cast two horizontal ribs, the space between them forming a groove in which is freely fitted the end of a toothed lever attached to a rocking shaft, which is placed parallel with the main slide-valve rod, and passes out of the steam-chest through ordinary stuffing boxes and glands. On this rocking shaft, and outside the steam-chest, is keyed a forked lever having a weight attached to counterbalance the expansion valve. This lever carries two rollers. Between the rollers, and mounted on the horizontal shaft shown for driving the governor, is placed the before-mentioned spiral cam. This revolves at the same speed as the crank-shaft of the engine, while it is capable of being moved along the shaft by the bell crank lever connecting it with the governor. As the spiral cam revolves it acts alternately on the rollers, and through them to the expansion valve. As the cam acts upon the rollers during only one-third of its revolution, it is quite free to assume any new position consequent on a change of speed in the engine during the remaining

two-thirds, and there being thus no resistance of any kind, the maximum of sensitiveness is obtained.

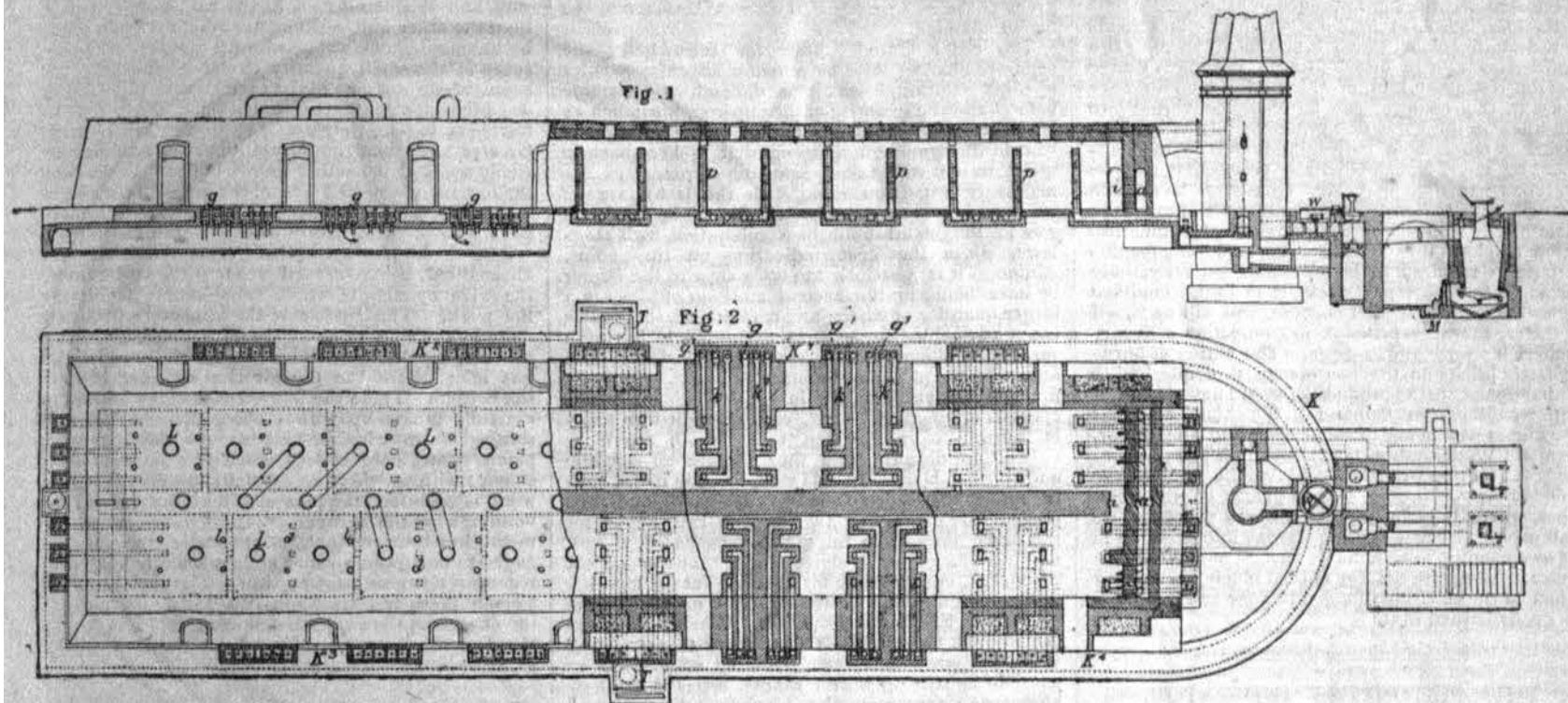
The working of the automatic mechanism can now be readily understood. When, owing to a lightening of the load on the engine, the speed of the governor is increased above its normal rate, the augmented centrifugal force of the balls forces the hollow counterpoise to move up the spindle. Coming into contact with the bell crank lever, it acts through this upon the spiral cam, causing the latter to move to the right hand, and thus bringing a more advanced section of its spiral into the same place as that of the rollers on the forked lever. The steam is thus cut-off earlier in the stroke. When, owing to an increased load on the engine, the speed is diminished, and the counterpoise moves down the spindle, an effect takes place opposite to that just described, and the cut off is later. The peculiarity of the spiral cam consists in this:—Its eccentricity is so slight that the angle with which it acts on the rollers is within the angle of repose of the acting surfaces, so that there is no tendency in the cam to resist the action of the governor. Experience has shown that in point of durability the cam will outlast the engine itself. It also gives a quick cut-off, and the gear works quietly at 200 revolutions per minute. It can thus be seen that without springs, air-cushions, or catches, an automatic expansion gear can be produced which is cheaper and more durable than the Corliss or kindred systems. In fly-wheel pumping engines for hydraulic accumulators the cam can be connected direct with the accumulator, so that the engine may be worked expansively instead of throttling the steam according to the usual practice. Taking into consideration the several points of improvement which we have pointed out, it will be seen that Mr. Longworth has materially contributed towards the advancement of this class of appliances connected with steam-engines.

THE ESCHERICH KILN.

SOME important improvements in connection with kilns for burning porcelain, china-ware, bricks, and other similar goods, have recently been brought under our notice. They have been devised by Mr. Hermann Escherich, Managing Director of the Thonwaarenfabrik Schwandorf, of Schwandorf, in Germany. The main advantages gained by these improvements over the Hofmann Kiln affect the quality of the goods burned in them, which, not being in contact with the flames, are far superior in character and appearance to those which are exposed directly to the action of the flame. The improved kiln consists of a system of tunnel canals connected with and running into each other. The kiln is provided with removable doors, the number of which is regulated according to the length of the kiln. The burning is effected by means

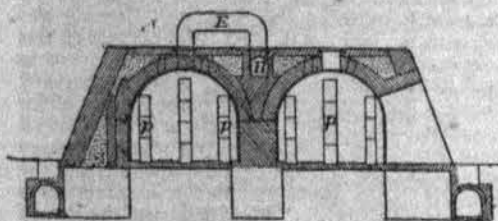
THE ESCHERICH KILN.

BY MR. HERMAN ESCHERICH, OF SCHWANDORF, GERMANY.



of gas made from any material in a generator. Around the kiln is placed a canal which is subdivided into a number of divisions, each of which is alternately connected with the chimney or gas generator. Each division of this canal is connected to subdivisinal canals which lead to the compartments of the kiln, and terminate in pipes. The pipes are placed vertically, and are provided with holes. These pipes, as also the canals, serve not only to introduce the gas but to carry off the smoke, which

Fig. 3.

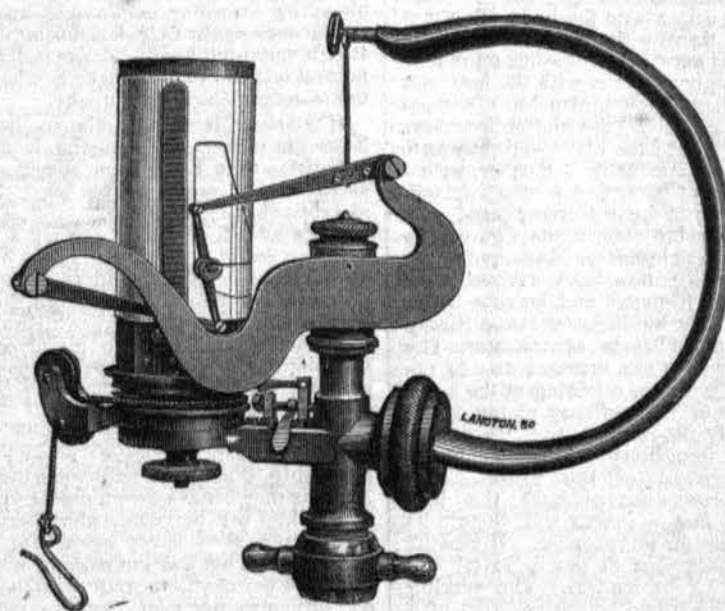


can be effected without any relaxation in the working, as the two operations take place in separate compartments, and are quite distinct from each other. Each branch canal is provided with a regulating apparatus and valve, by which the introduction of gas and the drawing off of smoke can be commenced, regulated, or stopped at any time. The air required for combustion passes through the burnt ware and so mingles with the gas in a highly heated state, thus producing a rapid combustion. The products of combustion pass, as in the Hoffmann circular kiln, between the ware placed in position to be burnt until they have lost their heat; they are then drawn into the canals by the pipes. The fire moves as in a circular kiln, always forwards, the time occupied to go round the kiln being from four to twenty-four days.

These improvements are embodied in the kiln illustrated in the accompanying engraving in which fig. 1 is a longitudinal section; fig. 2 a sectional plan, and fig. 3 a transverse section. In these views W represents the change valve; K is the chief canal, and K¹, K², K³, K⁴, are its branches. The bell valves connecting the branch canals with the main are shown at g, the connecting spaces connecting the chief canals with the branches are shown at G, and the pipes at p. The gases are carried from the generator through the change valve into the compartment K¹ of the chief canal, and passing through the bell valves, g¹, enter the branch canals, K¹, and pipes, p, within the kiln. The air for combustion enters a compartment of the kiln from which the burnt ware is being removed, and passing through the still hot ware arrives at the gas-pipes. The products of combustion are drawn in by the pipes, and passing through the branch canals arrive in the chief canal K¹ by which they are conducted to the chimney, passing on their way through the other half of the change valve, W. If the change valve be reversed the gases will take the opposite direction. By the use of the regulating valves in the cross canals the draught can be exactly regulated and the flame drawn to the right, left, or down the centre of

THE PISTONLESS INDICATOR.

BY MESSRS. ISAAC STOREY AND SONS.



the compartment. The passages *i* and *a* serve to conduct the flame from one half of the kiln to the other, the passage *a* taking that part of the flame drawing along the outside wall, and the passage *i* the flame drawing along the inside partition wall. As both these passages can be regulated with slides the flame can be drawn to the inside or outside as desired. In order to thoroughly hot-dry the goods before the fire reaches them, a hot-air canal, H, is placed at the top of the kiln connected with each compartment by a pipe, E.

The hot-drying is accomplished as follows: A compartment of unburnt ware is placed in connection with the hot-air canal, H; at the same time the valves connecting the same with the chimney are opened, a connection between the hot-air canal, H, and a burnt-out but still hot compartment having been effected, the hot is drawn through by the draught in the chimney. This arrangement is particularly used when china ware is being burnt, as the large quantity of air drawn through the burnt goods cools them rapidly and to advantage. The hot-air canal, H, is also connected directly with the chimney by the slide, S, so that in case more air is used for cooling than for hot drying the surplus is passed direct up the chimney. An important feature in this kiln consists in the canal, M, constructed to carry cold fresh air to the gas-generators, also the metal separators, N, which take up the dust and gases caused by slacking the generator fires. Observation holes, Z, are provided for watching the progress of the

fire. Larger openings, L, are also provided, serving to introduce slides to observe the burning, and to connect any compartment of the kiln with the hot-air canal, H, by fitting on pipes, E, as shown in fig. 3. Tar pots, T, are connected with the canal, K, and serve to receive the tar deposited by the gases in their progress through the canal.

It is to be observed that in the Escherich kiln the operator can, at will, burn the goods either with an oxidising or a reducing flame, according as the nature of the clay under treatment may render it desirable. Some roofing tiles which we inspected and which were burnt in this kiln, were made from two qualities of clay, the one rich in iron and free from chalk, and the other rich in both iron and chalk. In these the red tint becomes lighter in proportion to the superior presence of the chalk. All the articles we inspected were, we are informed, burnt with an oxidising flame with three times the volume of air required for combustion at a temperature of 1000° Celsius, the gas used being generated from peat. Some yellow bricks, made from a chalky clay similar to the English gault clay, had been burnt with an oxidising flame, with double the volume of air by 1050°, and in that case the gas was produced from lignite. In other samples which we examined some yellow bricks had been burnt with an oxidising flame and some brick of a reddish brown colour with a reducing flame at temperatures varying from 1200° to 1400°. In Mr. Escherich's kiln, at his own works in Bavaria, the fuel used consists of a mixture of