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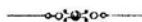
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Having thus fully explained the position which I hold in reference to the following pages, I lay them before the public, in the full belief that they merit and will receive a still more flattering reception than that which was accorded two years ago to my treatise on the shot gun.

J. H. WALSH ("STONEHENGE").

PUTNEY,





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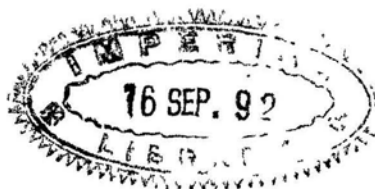
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THE  
MODERN SPORTSMAN'S  
GUN AND RIFLE.

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VOLUME II.  
THE SPORTING RIFLE AND ITS  
AMMUNITION.

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BOOK III.—DEFINITIONS, ETC

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CHAPTER I.  
INTRODUCTORY REMARKS

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IN pursuance of the plan adopted throughout the first volume of this work, I shall not attempt to give the history of the invention of rifling—the process by which a single projectile is made to rotate on its axis and thus maintain the accuracy of its flight though at a sacrifice velocity. In each division of the present volume it may be necessary to make some slight allusion to this subject, correct and full history of the invention and of successive stages down to its present perfect condition



## *THE MODERN SPORTSMAN'S GUN AND RIFLE.*

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would occupy far too much space, and, moreover, has already been fully given to the world by my predecessors.

Before, however, proceeding to describe the various kinds of rifles at present in use, it will be necessary to define numerous terms which must be constantly employed in their description, and also to discuss the modern theory of projectiles and other kindred subjects, which my friend "T." has kindly undertaken to supply.

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## CHAPTER II.

### DEFINITIONS OF TERMS USED IN REFERENCE TO THE RIFLE ITSELF.

THE RIFLE PURE AND SIMPLE—MODE OF PRODUCING ROTATION—THE MACLEOD BULLET—THE SPORTING RIFLE—THE EXPRESS RIFLE—WHAT IS A SPORTING RANGE.

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#### DEFINITION OF THE RIFLE PURE AND SIMPLE, AND ITS METHOD OF PRODUCING ROTATION.

EVERY rifle is a gun made nearly in the same way as for using shot (see Vol. I., Chap. IV.), but with the interior of the barrel afterwards cut away so as to form spiral grooves of varying shapes and depths, leaving certain portions of the original tube untouched, which latter are called "lands." This grooving is effected by a machine, which is so arranged that any depth may be cut at any angle or "pitch" as it is called. The depth varies from  $\cdot 100$ in. to  $\cdot 003$ in. or even less, and the pitch from one turn in 16in. to one turn in 6ft.

The object of this spiral grooving is to impart to a projectile (made either of pure lead or a harder alloy of that metal) a rotation on its line of flight, by which any tendency to depart from it, owing to a want of symmetry in its construction, is avoided. The arrow provided with spiral flutes is a well known example of this necessity—the necessary for its true flight being effected, however, by the bow, as it passes through the air, by means of the feathers placed obliquely on its foot. The same plan

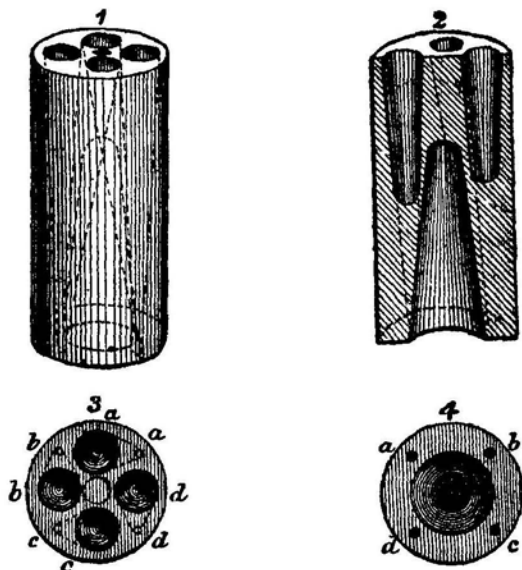
has been often attempted to be carried out with a ball used in a smooth-bore gun, and to a certain extent successfully, within the last few years, by Dr. Macleod. This gentleman has introduced spiral holes of a conical shape in a leaden cylinder two inches long, and by these means he can obtain a fairly accurate flight, up to about seventy yards. This will be better understood by the following description, which was given by me in the *Field* of Nov. 8, 1879, after a careful trial of the plan.

#### DR. MACLEOD'S NEW SMOOTH-BORE CYLINDRICAL BULLET.

During the last twenty years we have examined a great many plans for effecting the rotation of a cylinder of lead in a smooth-bore by means of internal or external rifling, but in every case without any good result. At length Dr. Macleod, a retired Indian medical officer, residing at Yockleton Hall, near Shrewsbury, has succeeded in effecting this object by the simple expedient of making the rifled or twisted internal tubes conical, each of the four being reduced from  $\frac{3}{32}$  of an inch at its mouth to about  $\frac{1}{64}$  at its exit on the breech end. The opposite engraving shows the form of his bullet of the full size. It weighs  $2\frac{1}{4}$  oz., and is at present cast of hardened lead; but the inventor proposes ultimately to make it by pressure, so as to eliminate the chance of air bubbles in the casting, by which he thinks the centre of gravity is thrown on one side, and the ball does not maintain its line of flight, as now happens occasionally. Behind the ball he places a thick wad of indiarubber, which effectually prevents the gas escaping through the four tubes, and also from entering the conical cavity at the base, which is intended to throw the centre of gravity forward.

Fig. 1 is a perspective view of the ball, showing the four openings of the tubes in its fore end and their conical form as indicated by the dotted lines. Fig. 2 gives the section of same, showing also the conical cavity in the base. Fig. 3 is of the fore end, *a a*, *b b*, *c c*, and *d d*, each indicating, by lines, a rifled or twisted tube, and the amount of obliquity in it. In Fig. 4, the four small openings of the tubes at *a*, *b*, *c*, and *d*, together with the large conical cavity lighten the base.

About six weeks ago we ourselves tried a few of these balls at 70 yards with  $2\frac{1}{2}$ drs. of powder, and made excellent shooting with them; but the trial was not sufficiently extended to induce us to report it. Last Monday, however, Dr. Macleod obtained the use of Messrs. Holland's range at Kilburn, and also the assistance of his "regulator," whose skill both with the shot gun and rifle is quite A 1. Messrs. Holland had in the interval re-bored the gun used chiefly by Dr. Macleod, which is a heavy single-barrelled 12-bore, weighing about 8lb.; but we also tried several shots from a double-barrelled 12-bore, with nearly equally good results. From



FIGS. 1 TO 4.

these guns a series of shots were taken with various charges of powder, the conclusion arrived at by all present being, that at 70 yds  $2\frac{1}{2}$ drs. will suffice to give excellent shooting, but that 3drs. required for 100 yards, and that beyond that range the firing is rendered wild and unreliable. Having settled these by sundry experiments, we determined to fire the last day seven balls with 3drs. of powder from the single barrelled gun, the result being that six out of the seven shots hit a wooden target screen, each with a perfectly round hole, in a square of 4in.; while one of them (the fourth) was

7in. from the centre of the square, and had turned over sideways, making a hole corresponding with its length in the wood. As to penetration, the ball pierced nine and a half 1-inch planks of the same wood as was used in Messrs. Holland's trial, recorded in the *Field* of Nov. 22, 1879. Here, then, we have shooting from a smooth-bore equal to that of an Express rifle, with a ball nearly double the weight of the spherical ball which must be used in the same bore, whereby, of course, the shock given would be greatly increased; but, whether or no the velocity would be sufficient for an elephant's skull we do not pretend to say, as with a spherical ball in a 12-bore it is admitted that 3drs. of powder are insufficient. In any case, Dr. Macleod's invention is of the highest interest, and opens out problems to be solved, not only with regard to sportsmen, but also for big guns in war, wherein the rifling seems now to be the main difficulty. The balls used fitted loosely but accurately in the gun, and the recoil is about equal to that of an ordinary charge of powder and shot.

Messrs. Greenfield and Son, of Queen's Buildings, Pancras-street, London, supply the bullets wholesale, and Messrs. Bland, of 106, Strand, are the retail agents.

In practice, however, it has been found that the ball must fit the barrel so exactly (neither too tightly nor too loosely) that it is beyond the scope of the ordinary sportsman, and hence it has not been at all generally adopted.

But it has been said by many good sportsmen that a smooth-bore may be made to shoot spherical balls so truly that for many kinds of game it is to be preferred, on account of the greater velocity, and consequent increase of smashing power. They allege the accuracy of the duelling pistol (which was a smooth-bore) in support of their opinion, and some even go so far as to assert that up to 50 yards, a six inch circle may be invariably hit by a spherical ball from an ordinary 12-bore gun if properly bored. As to the duelling pistol, there is no doubt that it could scintillate at 12 yards, but beyond this distance it was tested, and this is certainly not the range which it

man requires. If, however, the six inch circle at 50 yards could be depended on, I should be ready to admit that for large game it is a most useful weapon; and with this view I have repeatedly tested smooth-bores by various makers, but the trial has invariably ended in disappointment. Sometimes the first or second, but oftener further on in a short trial, a wild shot has occurred; and of course this wild shot may be the one to cost a sportsman his life, when charged by any kind of large game. The slightest defect in the ammunition or in the muzzle of the gun, will bring out this defect, the result being a very much wider circle than six inches, as was exemplified in the public trial of rifles recently carried out by me at Putney and Nunhead, to which I must refer my readers in a future chapter.

As I have before remarked, this superior accuracy of flight is not obtained without some sacrifice in bullet speed (shown at short ranges chiefly), but it is much more than compensated for, even at ordinary sporting distances by the great gain in accuracy of fire; and at anything approaching long ranges, no comparison of work done with the smooth bore is possible from its extreme inaccuracy. This rotation of the projectile during its flight is rendered necessary by the fact that it is practically impossible to obtain an absolutely symmetrical and concentric missile—that is, one in which the centre of gravity is coincident with its centre of figure; even with the simplest form of projectile, the spherical bullet, this cannot be obtained. Consequently, when discharged from a smooth bore, and exposed to the resistance of air, an oscillating or “wobbling” flight is produced, & a deviation from what should be the true path, and variation rapidly augments in proportion as the range

conical or elongated projectile, as the disagreement between the centres is more marked, the necessity for

the rotation given by rifling is even more imperative. Thus it will be seen that the main feature of the rifle is its power, of overcoming the defects of the projectile, by imparting to it a definite rotation, and thereby immensely improving the accuracy of fire. That this useful property of rifling was an early discovery in the history of small arms there is no doubt; but, in the absence of perfect mechanical appliances for producing true and well-finished barrels, the full value of the invention could not be realised; and, as a matter of fact, it is only during a very recent period that it has been found possible to produce rifled barrels free from such irregularities of construction as materially impaired their performance. This will no doubt account for the small estimation in which the rifle was generally held for a long time subsequent to its discovery.

#### CONSTITUTION OF THE SPORTING RIFLE.

By this term is of course to be understood any rifle, whether single or double, made with the intention of killing any kind of game, whether at long or short distances from the sportsman. It includes, therefore, all the following varieties—viz., the rook rifle, either single or double, with so small a bore as  $\cdot 220$  to  $\cdot 300$ ; the various medium bores from  $\cdot 400$  up to  $\cdot 577$ , which are now generally made up as double rifles, and are used, as we shall hereafter see, for various purposes with conical balls; larger bores from 16 to 1 gauge, generally used with spherical ball; and still larger bores, from 10 to 4 gauge, which are always used for large game, with heavy charges of powder and spherical ball.

These various kinds of sporting rifles may be divided (1) rook rifles, (2) small-bore rifles for long range shooting, (3) small-bore rifles confined to 150 or 200 yards usually called Express rifles; and (4) large bores for But, further than this, the term admits of several

varying more or less in detail ; but we must take a leading type of sporting rifle as the groundwork for the most obvious illustrations of this class of arm. That excellent writer, Capt. James Forsyth, in his book on "Sporting Rifles,"\* gives a tolerably good description of what a model sporting rifle should be, as then understood, to suit the requirements of a kind of sport of considerable importance, and with which he was personally most familiar. The then state of development arrived at by the rifle manufacturers of this country generally is well illustrated in his remarks, unfortunately too long for quotation in their entirety ; but his summary (arranged in tabular form on page 16), eliminating those points relating to muzzle-loaders as obsolete, and those treating of large calibres as partly so, will be found to cover and include the characteristics of a large and important class of sporting rifles. His table is arranged as follows :

- (1.) Moderate weight (not exceeding 9lb. unless for exceptional purposes.)
- (2.) Moderate recoil.
- (3.) Sufficient accuracy at sporting ranges.
- (4.) Sufficient penetration at sporting ranges.
- (5.) Lowest possible elevation at sporting ranges.
- (9 and 10.) Moderately short barrels and general handiness and simplicity.

<sup>t.</sup>  
g<sup>1</sup> We here find the qualifications of the average sporting rifle  
gilly defined, and nothing so satisfactorily fulfils Forsyth's  
conditions as that system of rifle, foreshadowed, it is true, in  
book, but completed and to a great extent perfected since  
<sup>a</sup> time, namely, the so-called "Express" rifle (of average  
<sup>2</sup> and calibre). Here we have a term requiring further

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<sup>a</sup>—  
<sup>30</sup> Sporting Rifle and its Projectiles" (Smith, Elder, and Co., London,  
<sup>1</sup> 1881.



definition, a task of some difficulty on account of the wide scope and numerous variations of the Express system, as we shall presently see.

#### WHAT CONSTITUTES AN "EXPRESS" RIFLE.

This term "Express" may be understood to mean a rifle of ordinary weight and small calibre, firing a large charge of powder and a light bullet, thus delivering the latter at a high rate of speed. This bullet is so constructed as to possess the power of expanding on impact, and thereby making as superficially large and severe a wound as the non-expanding bullet of a much larger calibre. This arrangement further admits of considerable accuracy and a flat trajectory up to a limited range, generally considered sufficiently extended for sporting purposes. It will hereafter be seen that every requirement which a sporting rifle should have for ordinary work is to be found in the Express type of rifle and ammunition; but the definition depends much more upon the proportions of the charge than on any marked peculiarity in the rifle itself.

In order clearly to settle the meaning of this term, I applied to the following gentlemen, whose reputations stand at the top of the tree in the estimation of modern sportsmen, for their several opinions, viz., Sir H. Halford, Mr. Metford, Mr. John Rigby, Mr. A. Henry, Mr. H. Holland, and Mr. F. Osborne. All of them have responded to my appeal in the most kind and careful manner, and I need scarcely say that a mass of highly valuable information is thus afforded, as will be evident to my readers on a careful perusal of the following pages. The opinions originally given were printed and circulated among these experts, who have severally criticised each other's remarks.

OPINIONS GIVEN ON THE MEANING OF THE TERM  
"EXPRESS."

1.—By MR. METFORD.

WHEN dangerous game is not to the front, it is a question whether a moderate load (not quite Express) is not better, from its greater accuracy and less noise, though less smashing in its effect—say 90gr. C. & H. No. 6. with 360gr. bullet.

Dangerous game is usually close enough for accuracy to be of less importance; but for other game, which may be a fair distance off, speed is valuable—for we must never lose sight of the fact that smashing power increases in about square ratio of speed, not merely with the speed.

### DEFINITION OF EXPRESS.

I agree with Sir H. Halford that about 1600ft. per sec. may be called the lowest Express rate, which I find will require, in usual bores, and usual length of barrel, about 1 of powder to 4 of lead (by weight).

### STANDARD RANGE FOR TRAJECTORY.

All my stalking friends tell me that nearly all shots are under 100 yards. If so, I should think 100 yards would be better than 15' yards, when trajectory height is to be the standard: but I mv prefer initial speed. I think it puts up more satisfactorily: *am a scientific gunner, and not a stalker.*

### LIGHT BULBETS.

think Purdey (years since, in muzzle-loading time) the greatest speed with the lightest bullet (270gr.) going to Sir H. Halford. It shot very prettily 150 yards and 200 yards its falling off, but was so serious that I determined on a m. as, although the greater number of shot a stalker does at times chance a long shot nicely. If I took to stalking, I shot a 360gr. bullet in this narrow case less speed. I see some even I can say is, that I ha

authentically heard of, a rifle of .500 using a 350gr. bullet shooting well at 100 yards.

#### DEFINITION OF SHOOTING "WELL" (see above).

I mean by "well" that ten shots out of a single-bore at 100 yards should be covered by the fist, not too tightly doubled up—say half doubled up—this being a sort of "rough and tumble" gauge of Express shooting at 100 yards. Now, one of my B.L. match rifles, in the hands of such a man as Major Young, will strike a two-shilling piece at 100 yards every time; but the short bullet in vogue for Express rifles is so subject to muzzle error that it will not start so accurately from the bore as the long match bullet. This is why I should go in for .420. Sir H. Halford even favours the .408, which he has been working with very much lately; and very possibly it will do very well. One I had made through Mr. Deeley (Westley-Richards and Co.), at Lord Henry's desire, .408—a miniature, in fact, of my military rifle in all respects—shoots beautifully up to 2000 yards (if calm), and at 100 yards like a match rifle.\*

I myself do not think a .500-bore should carry less than 130gr. powder, and 425 to 450gr. lead, which would give about 1730ft. speed; but is unnecessarily powerful for deer. Even tigers do not require .500-bore, if I may depend on Sanderson, who speaks with great care as to the value of life to sportsmen.

#### ON TRAJECTORY AND FALL COMPARED WITH SPEED.

values of the different speeds in trajectory are so little that not seem so striking as speed statements are—*e.g.* :

100 YARDS RANGE			
(not allowing for retardation of air).			
	Fall in 100 yds.	Trajectory.	
Initial will give about 6.78 inches	+ 4 = 1.7 inch nearly.		
" "	6.01 "	+ 4 = 1.5 "	
" "	5.35 "	+ 4 = 1.34 "	
" "	4.8 "	+ 4 = 1.2 "	
" "	4.34 "	+ 4 = 1.09 "	
" "	3.9 "	+ 4 = 1.0 "	
" "	3.5 "	+ 4 = 0.9 "	

As above, that the whole difference is 0.8 of an inch.

---

1 out of twenty shots at this range  
side, without a rest.

## 2.—By MR. RIGBY.

The Express has no definite meaning at present. It is applied to all rifles having a tolerably high initial velocity, and fitted with a projectile more or less hollowed out; sometimes also to rifles fitted with solid projectiles, if only the initial velocity be high.

The qualities which *ought* to exist in an Express rifle are low trajectory, to render judging distance easy; and sufficient remaining velocity in the bullet to flatten it out more or less, and so expend its entire energy on the animal.

A rifle with a very light hollow bullet may be Express (as above) up to 100 yards, but not so at longer ranges, the initial velocity of the light bullet being rapidly lost. A spherical-ball rifle even may for 50 or 100 yards have the same mean velocity as such an Express; but, owing to its shape and solidity, the bullet would penetrate without expanding sensibly, and so would miss the second quality of the Express.

## FINAL DEFINITION.

Any rifle calculated to send an elongated bullet which will flatten out more or less on striking flesh, and so expend its entire energy on the animal aimed at, and whose trajectory to 200 yards does not rise more than 12in. above line of aim, might be called an Express.

## MINIATURE EXPRESS.

Rifles carrying smaller and lighter bullets which flatten and fulfil the conditions as to trajectory might be called Express rifles.

## MAGNUM EXPRESS.

Those rifles which carry bullets heavier than 400 gr conditions might be called Magnum Express.

## RATE OF SPIRAL.

not proved that a slow spiral or an increase  
even favourable to the generation of T

## BOTTLE-SHAPED CARTRIDGE

re higher velocity from mode  
and also exert more strain on

## POINT BLANK.

This phrase has no definite meaning, and is interpreted so loosely by different authorities that it ought to be abolished, and some measure of the trajectory necessary for sporting rifles substituted. Why not fix 200 yards as a standard range, and class rifles by the height above line of aim to which bullet rises? This can be computed without screens.

## 3.—By SIR H. HALFORD, BART.

EXPRESS RIFLES. <sup>in</sup>

About thirty years ago the only sporting rifles known were those constructed to carry a round bullet propelled by a light charge of powder and having a slow spiral; but, with the invention of a plug bullet, a fresh departure was taken.

In 1859 Mr. Purdey, the well-known gunmaker, made for the late Lord Henry Bentinck three double rifles of 40 bore, taking 4dr. of powder; and the same year rifles of the same calibre for Capt. (now Col.) Bateson and Capt. the Hon. W. Wyndham (now Lord Leconfield); and also one of 50-bore, taking  $4\frac{1}{2}$ dr. powder, for the late Sir St. George Gore. Although previously Mr. Purdey

been increasing the powder charge, these rifles must be regarded as the first of the class now known as Express—a

believed to have been first used either by the late Lord Bentinck or by Lord Leconfield. In 1864 Mr. Purdey

made for the late Lord Henry Bentinck two double rifles of 40 bore, taking 4dr. of powder; and in 1865 an experimental rifle of 100-bore, taking  $4\frac{1}{2}$ dr. With this rifle Mr.

Morant, a stalker, killed seven hinds, and sent the bull

to Mr. Purdey. They were as flat as a pancake, and passed through the centre without being flattened; but the rifle was not a

very excessive. In 1865, 70-bore rifles, of the same general design, were made for the same general.

Mr. Purdey also fitted them with a small hollow in front for the bullet to pass through, but it must not be confounded with that

introduced to introduce the very rapid fire.

The system of heavy charges of powder with modifications as to bullet and bore was at once taken up by most of the leading gun-makers in this country, and is that most generally in use at the present time both in the deer forests of Scotland, and for soft-skinned game, as bear, tiger, and all kinds of deer, in India. It is also making steady progress in the United States of America.

As yet there seems to be no absolute definition of what constitutes an *Express rifle*, but I think it would be well to class under this head all those in which the initial velocity reaches 1600ft. per second; and, as it has been found roughly that this speed will be attained when the weight of the projectile is not more than about four times the weight of powder used, we may take four of lead to one of C. & H. No. 6 powder as a fair definition of an Express, irrespective of calibre of rifle.

The function of the hollow front to the bullet, used without any explosive filling, is that on striking an animal the bullet shall open out and become like a mushroom in shape—thus delivering the whole of the work done by the powder into the beast fired at; for the Express bullet does not as a rule pass entirely through an animal.

Those who have used these rifles are well aware of the fearful wounds made by them, due to the meat being driven aside so forcibly as in its turn to act destructively on the adjacent parts; but many are not aware that this destructive power is gained at the expense of accuracy, and that, after a proportion of about three of lead to one of powder, the accuracy of a rifle begins to fall off somewhat rapidly.

Having given a general idea of Express rifles, it will be well to describe a little more fully the proportions of those commonly in use, and for this purpose it will be convenient to give the calibre in fractions of an inch, and the weights of powder and bullet in grains.

The first to notice is—

- Calibre .500; powder 165; lead 350; initial speed about 2000ft. per second. Should shoot into six inches at 100 yards. Suitable for tiger, bear, and large deer.
- 2nd. .460 and .450; powder 123; lead 360; initial speed about 1830 for a 30-inch barrel. Should shoot into four inches. Suitable for bear, tiger, and all kinds of deer.
- 3rd. .460 and .450; powder from 110 down to 90; bullet 360. The lower charge would give about 1600ft. per second, and

exceedingly accurate. It will shoot into three inches at 100 yards. Suitable for all kinds of deer.

- 4th. .410 and .400; powder 90; bullet 350; speed 1600ft. per second. Will shoot into about  $2\frac{1}{2}$  inches at 100 yards, and in my opinion is the pleasantest and best rifle for deer; at the longer ranges, too, it is more accurate, and retains its speed better than the .450 or .460 bullet, and therefore has a flatter trajectory and more power. It has also another advantage, in disturbing less ground by its lighter report. As most game is shot at distances under 120 yards, I think it best to have a rifle sighted to shoot 3 inches high at 100 yards. If this is done one can be sure of a good hit up to 140 yards, by always aiming about the same place.

Up to 1859 Mr. Purdey used  $2\frac{1}{2}$ dr. in 40-bore, increasing spiral, final pitch, I think, 1 in 4ft., picket bullet with wings. When he increased his powder charges, he still used the picket bullet, and, I believe, all through with his smaller gauges; and only dropped the wings when he took to breechloaders. The 40-bore,  $2\frac{1}{2}$ dr., made most extraordinarily good shooting. The trajectory was of course high. The drop from 100 to 200 would be 2ft., but the fastest Express is 16in. People are deceived into thinking it less, from the habit gunmakers have of sighting their rifles 6in. or more high at 100 yards. This, at 200 yards, will make a rifle shoot only 4in. low at 200 yards, and then they claim that there is only a drop of 4in. from 100 yards to 200 yards. I do not like this plan, as more deer are shot at under 100 yards than over, and more are missed over than under. Moreover, it is almost impossible to make a clean head shot at from 50 yards to 100 yards with an oversighted rifle. This was one of the causes of bad shooting at the Boers with the Martini at close quarters.

The prints of bullets you send me are just what I have experienced, they are so acted on in rifles that are not Express.\* A winged ball would be equally an Express if its speed was high enough. I should not of course consider  $2\frac{1}{2}$ dr. in a 40-bore an Express; but 4dr. would give sufficient speed.

I think Mr. Osborne is wrong in saying anything about solid or hollow bullets in the definition. It is almost impossible to make a rifle shoot with both bullets to the same sight, on account of their

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\* This refers to the engravings of solid balls expanding into a mushroom form shot into a sand bank, published in the *Field* in 1858.

different weight. If the solid is shorter to bring it to the same weight they will do so; but the Express bullets are most of them so short now, that if shortened accuracy is lost. I think the 360gr. bullet far more effective than the 260gr. It is steadier, more accurate, and gives a more crushing blow.

#### 4.—By MR. HENRY.

As promised in mine of the 26th inst., I now send you some information bearing on the origin of what are known as "Express" rifles.

My first attempt in the direction of making such a weapon was in 1853, when, at the request of the late Robert Cheape, Esq., of Wellfield and Straththyrum, I made a number of experiments with the view of producing a rifle that could be used with a Standard backsight only, at all distances up to 150 yards, dispensing with the leaves for intermediate distances that had to be employed with the rifles then in use. In carrying out these experiments, I had under consideration the gauge of the barrel, the mode of rifling, the construction and component parts of the bullet, the lubrication, and the powder charge.

My early experiments were made with a .451 gauge muzzle-loading rifle and  $3\frac{1}{2}$  drachms of powder, and, though not quite such a success as regards lowness of trajectory as had been anticipated, yet the results were so much beyond anything that had previously been heard of that I named these rifles "Low Trajectory."

Having altered the spirality of rifling and increased the charge of powder to  $4\frac{1}{2}$  drachms, the results were greatly better—indeed, early equal to that obtained with the most improved rifles of the present day.

In the original experiments carried out at Mr. Cheape's desire, I used bullets of pure lead; but on these being tried practically in the forest, they were found to be objectionable, the wound being very large, consequent on the distortion that took place in the bullet on striking the animal. I then used lead bullets hardened with tin, which gave increased penetration, a smaller wound, and did not make quite such a large wound. A change in the shape of the bullet reduced the friction, and further in lowering the trajectory.

For part of the time that I was carrying out the experiments, it is very probable that Mr. Purdey was similarly