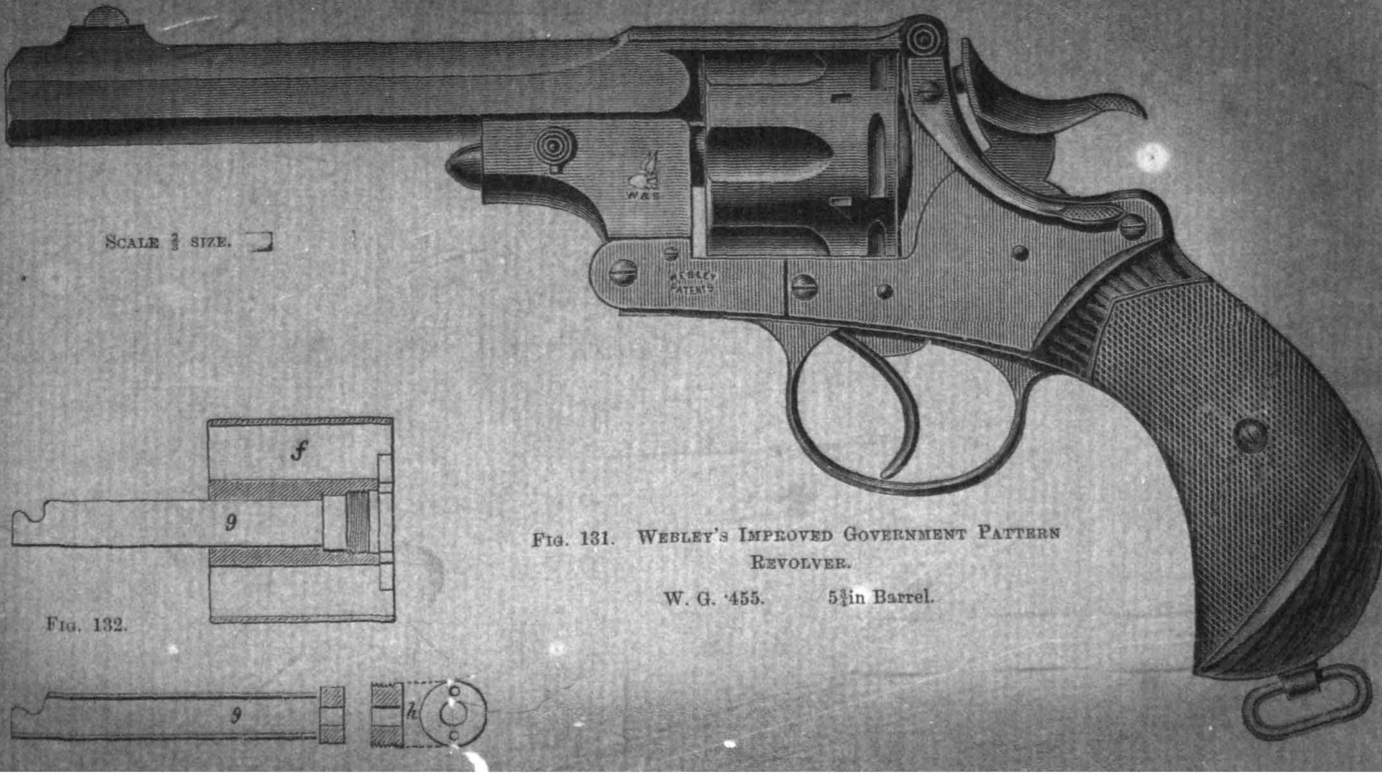
wires, so as to form a St. George's cross, and on the other was stretched a sheet of stout paper. The horizontal wires of the six screens were, by means of a dumpy level, ranged exactly even with the middle of the black bullseye on the target, and the centre of the muzzle of the rifle, placed in the machine rest, was made level with the horizontal wires of the screens. When the accuracy of the bearing of the rifle upon the target had been ascertained, the paper-covered frame was put in position, and the second, or wired frame, working upon a hinge, was, after the wires had been painted, raised so as to stand upright against the paper. The pressure of the wires against the paper printed on it a black cross-bar, +, after which the wired frame was let down level with the ground in order that the wires might not be cut by the bullets. Six shots from one rifle having been fired, the perforated sheets of paper and the cardboard target were removed for measurement, new sheets of paper and cardboard being substituted for the next rifle. The necessity for the precautionary removal of the wired frame was shown towards the end of the trials, as the wind became so strong on Thursday that the wires had to be put up as the only way of keeping the paper screens in position; but eventually a bullet cut the wires and stopped further progress—fortunately, however, when the trajectory of only one shot remained to be taken.

In measuring the height of the trajectory at the various ranges, it is obvious that it would not do merely to give the height of the bullet holes in the paper screens, because the bullets do not all strike the targets at the same level, and the bullet-hole represents the height of the trajectory *plus* or *minus* any fluctuations arising from difference in jump of rifle on being fired, or from variation in weight of powder or bullet, or any other disturbing cause. Thus the height of the trajectory itself might in each case be only three or four nches, whereas some bullet-holes would be almost on or near the horizontal black line, and others might be a foot above or below. Consequently, a straight line had to be taken from the muzzle of the rifle to the centre of each bullet-hole on the target, thus cutting off all the adventitious variation, and leaving only the actual trajectory for measurement. Two modes of effecting this were adopted, the whole of the screens being measured by both methods, so that the one served as a check to the other, and any discrepancies between the two caused a repetition of measurement, so as to determine which was the more accurate.

The first measurement was by fastening down on the floor of a long room the cardboard target and six paper screens, forming the series of trajectory records of one rifle. A piece of strong twine, strained tight, was pegged down from one end of the room to the other; under this was laid the paper screens and target, so that the black horizontal lines on the screens ranged immediately under the cord, which also cut the bullseye on the target exactly in the centre. The black vertical lines on the paper screens were placed at a measured distance of 5ft. apart, instead of 25 yards, and consequently the 80ft. screen was only one foot from the 75ft. screen, so as to be in accordance with the same scale. The sheets and cardboard having been tacked down to the floor, a second cord was tightly stretched from one point representing the muzzle of the rifle, to the bullet-hole on the cardboard target 30ft. distant; and from this cord the measurement was made to the position of the bullet on each screen—the level of the bullet being marked by means of a square on the vertical black line of each sheet, so as to make that the actual point of measurement. This was done in order to avoid the error which otherwise would arise from the screens being changed from a vertical plane, as they stood in the range, to a horizontal plane, as they lay on the floor; for two bullet-holes in the same sheet would be equally distant from the rifle as it stood in the range, but they would not be equally distant from the wall (or supposed position of the rifle) when the sheet was nailed down flat on the floor.

Having been furnished with the figures thus obtained, I checked them by another process, which, although it has not the advantage of giving a graphic curve or bird's-eye view of the trajectory, as seen by the method just alluded to, has advantages of another kind, inasmuch as it enables each sheet to be taken up separately, and all the measurements on it to be completed at once; while any sheet can at all times be laid on the table again and re-measured without trouble, should apparent divergences in the figures lead to a doubt as to their accuracy. This method is as follows: A sheet of paper having been ruled into the requisite number of columns for the screens and target, the first screen is laid on the table and the measurement taken from the centre of each bullet-hole to the horizontal black line printed by the wire; the entries for the six shots having been made in one column, the next screen is taken, and the results entered in the second column; and so on until the target is reached, when the measurements are made from a line drawn through the centre of the bullseye. The series of measurements being thus completed, the adventitious variation previously alluded to has to be cut off; and in this case it is done by arithmetic, instead of by a cord. Supposing No. 1 bullet is 6in. above the line on the target (150 yards), it would be a proportionate part of 6in. at all shorter distances, viz., 1in. at 25 yards, 2in. at 50 yards, and so on; if the number is a fractional one, it will have to be divided by 6 in a similar way to get the result for every 25 yards. By this means, the deductions from the whole series can be made in a few minutes, with a similar result to that obtained by the process previously alluded to. Of course, it is desirable to allow several lines of space in writing the entries, so as to give room for making these deductions.



SCALE ⅔ SIZE.

FIG. 131. WEBLEY'S IMPROVED GOVERNMENT PATTERN REVOLVER.

W. G. ·455. 5¾in Barrel.

FIG. 132.

I have entered rather fully into detail on these points in order to show not only the course adopted, but that, where they may seem curious divergences of result, they are not likely to arise from carelessness in measurement. It is not improbable that those which most conflict may have been closely examined and measured half a dozen times over, with a view to account for apparent discrepances. I will not say, however, that at the first screen (25 yards) the measurement is absolutely to be relied on in all cases, for the paper is in some instances so cut about by the bullets being placed one upon another, that it is almost impossible to say where the measurement ought to begin for every bullet. Fortunately, however, a slight error at 25 yards is of little import. For practical purposes, too, I do not think very minute measurements essential. If a sportsman finds the trajectory of his rifle accurate to within the tenth part of an inch, he is not likely to trouble himself about smaller fractions; and the representation of hundredths of an inch are rather confusing to the eye, so that I propose only to resort to them when I have a particular purpose to illustrate; and accordingly, although I have made the measurements as accurately as I could do to hundredths, I shall, as a rule, give the figures only to the nearest tenth.

Taking the rifles as they were tried, the smallest bores first, we begin with—

TRAJECTORY OF MESSRS. HOLLAND'S ·400 BORE.

	25 yds	50 yds	75 yds	80 yds	100 yds	125 yds.	150 yds.
1st Shot	1·6	3·0	4·2	4·3	3·2	2·2	0
2nd "	2·0	3·2	4·5	4·6	3·4	2·4	0
3rd "	1·7	3·1	4·3	4·4	3·2	2·2	0
4th "	1·9	3·2	4·4	4·5	3·3	2·3	0
5th "	1·6	3·1	4·4	4·5	3·3	2·3	0
6th "	1·8	3·1	4·3	4·4	3·3	2·3	0
Average..	1·77	3·12	4·35	4·45	3·28	2·28	

There is not very much to remark on this series of trajectories, except that the first shot seems to have had greater velocity than the rest, its height being less than the others throughout the range, whereas the second shot is higher throughout, which apparently must have resulted from its being below the average in speed. The remaining shots do not vary greatly as compared with one another.

The most remarkable of the whole series of trajectories is that next given; and in this case, in order to show the marvellous uniformity of result obtained, I shall give the figures to hundredths of an inch.

TRAJECTORY OF MESSRS. HOLLAND'S ·450 BORE.

	25 yds.	50 yds.	75 yds.	80 yds.	100 yds	125 yds.	150 yds.
1st Shot	2·06	3·38	4·65	4·68	3·50	2·40	0
2nd "	2·01	3·29	4·65	4·66	3·52	2·46	0
3rd "	2·05	3·30	4·65	4·66	3·55	2·44	0
4th "	2·02	3·31	4·65	4·68	3·55	2·46	0
5th "	2·03	3·32	4·65	4·67	3·57	2·47	0
6th "	2·04	3·38	4·67	4·71	3·61	2·46	0
Average	2·03	3·33	4·65	4·68	3·55	2·45	

If the hundredths were removed, and only the inches and tenths given, there would scarcely be any variation throughout the whole series. This indicates, to my mind, not only great truth in the rifle, but a remarkable degree of accuracy in the weight and the loading of the charges. Had these measurements been taken off successively by a pair of compasses, it might not unnaturally be supposed that, the distances being very much alike, the compasses were never shifted. In fact, however, they were all separate measurements of bullets at different heights on the target, and proportionate allowances had to be made for every screen, as previously described. The following examples, from the 75 yards screen, will show the actual measurement, and the proportionate allowance in each case, as well as the height of trajectory remaining when the deduction has been made:

Shot 1.	Shot 2.	Shot 3.	Shot 4.	Shot 5	Shot 6.
7·65	7·45	7.50	6·25	6·80	6·35
3·00	2·80	2·85	1·60	2·15	1·68
4·65	4·65	4·65	4·65	4·65	4·67

These bullets struck the target (150 yards) at the respective heights of 6in., 5·6in., 5·7in., 3·2in., 4·3in., and 3·36in. above the centre of the bullseye, and the allowances for half the distance, or 75 yards, is therefore one-half of these respective heights.

The next rifle, of the same bore as the last, would need no hundredths of an inch to demonstrate the amount of variation; but I give them as affording a better means of comparison in some remarks which I wish to make.

TRAJECTORY OF MESSRS. BLAND'S ·450-BORE.

	25 yds.	50 yds.	75 yds	80 yds.	100 yds.	125 yds.	150 yds.
1st Shot	1·78	2·95	4·20	4·52	2·80	2·00	0
2nd "	2·00	3·10	4·17	4·40	2·95	2·19	0
3rd "	2·04	3·28	4·17	4·43	3·28	2·45	0
4th "	2·16	3·37	4·24	4·60	3·23	2·44	0
5th "	1·73	2·92	4·15	4·32	3·08	2·16	0
Average..	1·94	3·12	4·19	4·45	3·06	2·26	

Here the trajectories of five shots only are given, the sixth being off the card at 150 yards, and consequently the height could not be estimated at intermediate distances. It will be observed that the average height at all the screens is less than with Holland's rifle, which indicates a higher velocity in the bullet; but, although there is a fair amount of regularity at some screens, there are considerable divergences from screen to screen, and the variations between 75 and 80 seem to show great vagaries on the part of the bullets. In Holland's trajectories it will be seen that in these five yards (75 to 80) the rise was only about three or four hundredths of an inch, which is so close to the theoretic difference as to indicate that the bullets must have spun with great steadiness during their flight. In Bland's, on the contrary, the difference in the same five yards was nearly ten times as great; and there are strong indications in certain cases that the bullet was not revolving truly on its axis; but probably had a wabbling or corkscrew-like motion, the point rising and dipping from screen to screen. Thus, taking the fourth and fifth shots, there are only ·09 of an inch difference between the height of the two bullets at 75 yards, but the difference at the end of another five yards is ·28; at 100 yards the difference is reduced to ·15, but at 125 yards rises to ·28 again.

The differences were so erratic that I imagined at first that the bullet-holes must have been wrongly numbered, and I accordingly traced each bullet carefully from screen to screen, and the result was to show that certain bullets, after getting beyond the culminating point of the range, and beginning to drop, rose again to the next screen. This, I thought, must be an impossibility, so I measured and re-measured, compared and re-compared, but could find no inaccuracy in the measurement nor any wrong numbering of the bullet-mark. Then I thought the screens might be affected by the wind, the sheet of paper being possibly blown to and fro, and so made to belly like a sail, and thus effect a variation; but this would not meet the case, as Holland's and Bland's rifles were both tried on Tuesday, under similar conditions, there being little or no wind.

Mere differences in height throughout the range, if regular, would indicate difference of velocity, but these fluctuations appear to show irregularity of motion in the bullet. This might arise from the rifle having too slow a twist, and the velocity not being sufficient to give the rapidity of rotation requisite to keep the bullet point foremost; or it might arise from the loading of the cartridge not been carried out with sufficient care, for if a short bullet be not accurately seated in the shell, it is not likely to come out at the muzzle with its point exactly in the centre of the bore, and, instead of rotating with a steady motion, the point will gyrate in a corkscrew fashion, and move up and down as well as deviate to the right and left. That such was the case in some of these instances appears to me to be clear from examination of the screens.

Tracing the respective bullet-marks from screen to screen, I noticed that whereas, generally speaking, the divergences of the bullets from the upright black line made by the vertical wire were pretty regular—so that, if you found two bullets at say 1in. and 1½in. from this line at one distance, they would each be about double as far away from the line at double the distance, and so on—yet in certain cases this regularity was not maintained. Thus, two bullets were several inches apart as to height, but about equally distant from the vertical line, except that they zigzagged about, sometimes one of them being nearest to the line and sometimes the other, as will be seen by the following figures :

DISTANCE FROM VERTICAL LINE ON SCREENS.

	At 50 yds	75 yds	80 yds.	100 yds.	125 yds	150 yds.
Bullet 1	2·5 ...	3·6 ...	4·1 ...	5·5 ...	7·9 ...	9·0
„ 3	2·4 ...	3·8 ...	4·0 ...	5·6 ...	7·2 ...	8·0

In another case, a group of three bullets formed an equilateral triangle on one of the screens, but on the next screen the apex of the triangle was a good deal to the right, and on the third it was rather to the left; and the divergence of one of the three bullets was so much greater than the others that it did not strike the target-card at all at 150 yards.

If, then, certain bullets rotated irregularly from side to side, they would move in a similar fashion up and down, but such differences are not so obvious, as they are masked by the changes that are produced in the height of the bullet by gravitation , and when the trajectories are given in figures, as in the foregoing tables, certain differences may be observed, but the cause of them is by no means apparent. Thus, taking shots 2 and 3 in the table of Bland's trajectory, it will be seen that, although both are of exactly the same height at 75 yards, shot 3 is the higher of the two both before and after; and that although shot 1 is highest at 75 and 80 yards, it is below the others at 50, 100, and 125 yards. It is much clearer, however, when the actual heights on the targets are shown, as in the following instance from shot 1:

DISTANCES ABOVE THE HORIZONTAL LINE ON SCREENS.

	At 50 yds.	75 yds.	80 yds.	100 yds.	125 yds.	150 yds.
1st Shot	5·75	... 8·40	... 9·00	... 8·40	... 9·00	... 8·40
2nd „	5·22	... 7·36	... 7·80	... 7·20	... 7·50	.. 6·38
3rd „	5·20	... 7·05	... 7·50	... 7·12	... 7·25	... 5·75
4th „	4·75	... 6·30	... 6·80	... 5·98	... 5·88	... 4·12
5th „	2·75	... 3·90	... 4·05	... 2·75	... 1·75	... 0 50

Here it will be seen that there is always a rise up to 80 yards, and the fluctuations are not apparent, but after the bullet has got beyond 80 yards, it drops, in the case of shot 1, from 9·00 to 8·40, then rises to 9·00 again, and then drops once more to 8·40. In shots 2 and 3 similar divergences occur, but on a smaller scale. The rest of the bullets drop throughout from 80 yards, in the regular way, though not in equal proportion.

All such divergences must necessarily tell most at long ranges, and it is not surprising that, although Messrs. Bland did very well at 50 yards, they fell off at 100, and were nowhere at 150 yards. Whether the fault was in the rifle or the cartridge I cannot say for certain, but my impression is that the cartridges were less carefully loaded than those of their competitor; and, with a lighter bullet and higher velocity, the result was much more obvious at long than at short ranges.*

The next on the list is the ·500-bore, of which it will suffice to give the differences in tenths of an inch:

TRAJECTORY OF MESSRS. HOLLAND'S ·500-BORE.

	At 25 yds.	50 yds	75 yds	80 yds	100 yds.	125 yds	150 yds
1st Shot ...	2·0 ...	3·4 ...	4·7 ...	4·8 ...	3·6 ...	2 5 ...	0
2nd „ ...	2·2 ..	3·5 ...	4·9 ...	5·0 ...	3·9 ...	2·6 ...	0
3rd „ ...	2·1 ...	3·3 ..	4·4 ...	4·5 ..	3·4 ...	2·1 ..	0
4th „ ...	2·1 ...	3·4 ...	4·7 ...	4·8 .	3·5 ..	2.4 ...	0
5th „ ...	2·2 ..	3·5 ...	4·8 ...	4·9 ...	3·7 .	2·6 ...	0
6th „ ..	2·1 ..	3 5 ..	4·8 ...	4·9 ...	3·7 ...	2·6 ...	0
Average. .	2·12	3·43	4·72	4·82	3·63	2·47	

* All the cartridges used in the trial, except those of Messrs. Holland, were loaded by Eley.—ED.

This rifle, although performing very well on the whole, was not nearly so regular as the ·450-bore of the same maker. The differences in the height of the trajectory—in the second and third shots, for example — indicate a considerable difference in velocity; and the variations in other respects appear to show that there was some of the wabbling motion so apparent in the rifle just alluded to, though in very much less degree. Comparing the screens, I find the following to be the relative distances of two shots from the vertical line, at the ranges stated:

	At 50yds.	75yds.	80yds	100yds.	125yds.	150yds.
Shot 1	1·0	1·5	1·6	1·4	1·6	2·1
Shot 5	0·7	1·4	1·6	1·7	2·0	2·9

It is clear that these two shots, which were nearly one over the other on the same screens, could not be rotating with equal regularity; for one moves inwards towards the line between 80 and 100 yards, and outwards between 100 and 125.

The ·577-bore was the last of the batch, and this series comprises only five shots, as, owing to the strength of the wind on the last day, the wired frames, as already stated, had to be put up to keep the sheets in position, and one was damaged by the last bullet fired. Whether the wind had detrimental effect on the trajectory results I cannot say with certainty, but think it very probable. At any rate, there are differences not found in any of the other records, as may be observed by comparing the following figures:

TRAJECTORY OF MESSRS. HOLLAND'S ·577-BORE.

	At 25yds.	50yds.	75yds.	80yds.	100yds.	125yds.	150yds.
1st Shot	1·7	3·7	5·0	4·8	3·8	2·9	0
2nd "	2·0	3·5	4·7	4·8	3·7	2·5	0
3rd "	2·2	3·5	5·0	5·2	4·0	2·8	0
4th "	2·0	3·5	5·0	5·0	3·7	2·7	0
5th "	1·7	3·0	4·5	4·4	3·4	2·5	0
Average	1·92	3·44	4·84	4·84	3·72	2·68	

Here, in the column for 80 yards, it will be seen that in two instances the height of the trajectory is less than at 75 yards, and in one instance the height is the same in both. With bullets flying truly, if there were no movement in the screen, this would be impossible; and in the case of shot 1, where the height at 80 yards appears to be two-tenths of an inch less than that of 75 yards, I find on the screens no indication of irregularity of flight. In shot 5, however, there is a little irregularity. My impression, however, is that these differences are produced by the effect of the wind on the screens; and as it blew up the range from the target, the paper of the screen at 80 yards might be bellied forward, whereas that at 75 yards, being sheltered by the close proximity of the other screen, was not similarly effected, and a difference of a quarter of an inch or so, might easily be thus produced.

Since working out the above results, I have seen Major McClintock's figures giving the trajectories as ascertained by him from trials with the chronograph, and I find that the heights indicated on the screens are generally about half an inch greater than those calculated from the chronograph times. It seems to me very probable that this increased height may be due to the fact that in the former case the projectiles had to pass through a succession of screens of stout cartridge-paper before reaching the target, and that, as the bullet would not be moving at right angles to the screens, it would during its ascent, receive a slight cant upwards at every contact. We know that the touch of a very small twig will turn the course of a bullet to some extent, and a hairsbreadth at one screen amounts to something more considerable by the time the bullet gets to the next screen, where the process is repeated. This might, I think, easily produce a difference of half an inch in the height of the bullet about mid range. Such appears to me to be highly probable, for I noticed an apparently similar effect produced in the way of lateral deviation. In cases where bullets struck exactly on the upright black line, they kept on the line for several successive screens, and never got far away from it; but if they struck wide, they went away towards the sides more rapidly at times than the mere divergence alone seemed to warrant. This lateral deviation would go on increasing throughout the whole 150 yards, for the course of the bullet would not be changed at mid-distance by the drop. I consider this explanation the more likely, because at the first screen, where there can have been no deflection from such a cause, the height is usually less as taken from the screens than as calculated from the chronograph; and the fact of its thus being less is due, I think, to the allowance made (either by cutting off by a cord, or by arithmetical deduction, as explained at the beginning) being larger, owing to the increased rise, than it would have been had there been no deflection caused by contact with the paper.

In conclusion, I may say that the barometrical variations, and the differences of dry and wet bulb thermometers during the trial were so small, that no appreciable difference could result in so short a range as 150 yards." T.

Tables of Trajectories, Times, &c.

(Calculated by Major W. McClintock, R.A., Assist. Supt., Royal Small Arms Factory, Enfield Lock.)

The heights of trajectory, &c., given in the following tables have been calculated from the mean muzzle velocity, obtained by firing five rounds from each rifle, and from the mean weights of the bullets, found by breaking up and weighing three rounds of each sample of ammunition.

The diagrams of the curves are drawn with the heights on a scale of 2in. to the foot, and the range on the scale of 2in. to 20 yards.

VELOCITIES.

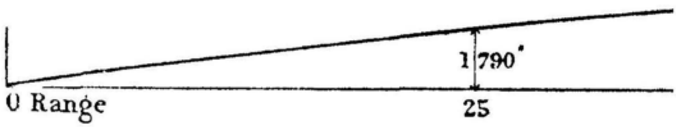
Nature of Rifle	No of Rounds.	Charge.		Muzzle Velocity	Mean Muzzle Velocity.
		Powder	Bullet.		
		Grains	Grains	f s	f s
·400″ double Express, by Messrs. Holland and Holland, weight 7lb. 14oz., length of barrel 26in.	1	82	209	1870	
	2	,,	,,	1881	
	3	,,	,,	1866	
	4	,,	,,	1861	
	5	,,	,,	1890	1873·6
·450″ double Express, by Messrs. Holland and Holland, weight 8lb. 4oz., length of barrel 26in.	1	110	322	1785	
	2	,,	,,	1739	
	3	,,	,,	1788	
	4	,,	,,	1804	
	5	,,	,,	1764	1777
·500″ double Express, by Messrs. Holland and Holland, weight 9lb. 1oz., length of barrel 28in.	1	138	444	1786	
	2	,,	,,	1773	
	3	,,	,,	1784	
	4	,,	,,	1784	
	5	,,	,,	1793	1784
·500″ double Express, by Mr. Jeffries, weight 8lb. 4½oz., length of barrel 28in.	1	138	342	1949	
	2	,,	,,	1961	
	3	,,	,,	1934	
	4	,,	,,	1936	
	5	,,	,,	1950	1946
·577″ double Express, by Messrs. Holland and Holland, weight 11lb. 10oz., length of barrel, 26in.	1	164	591	1670	
	2	,,	,,	1655	
	3	,,	,,	1676	
	4	,,	,,	1657	
	5	,,	,,	1659	1663 4

MESSRS. HOLLAND'S ·400″ DOUBLE EXPRESS RIFLE.

Range	Velocity.	Striking Energy	Time of Flight	Height of Trajectory	
				For 150 Yards	For 100 Yards
Yards	f.s	ft-lb	Seconds	Inches.	Inches
At Muzzle.	1874	1628	0	0	0
25	1772	1455	0·04134	1·9596	1·10376
50	1675	1300	0·08472	3·3060	1·5516
75	1581	1159	0·1311	3·9396	1·2252
100	1492	1032	0·1795	3·7164	0
125	1406	916·0	0·2315	2·4684	...
150	1326	814·9	0·2867	0	
Highest point of trajectory				3·9720	1·5552

0 Range

M!



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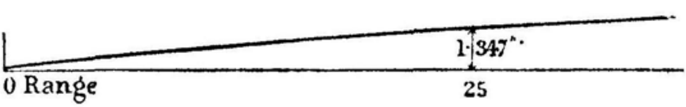
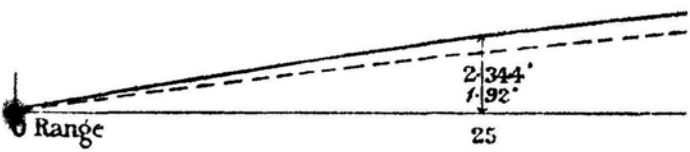




MESSRS. HOLLAND'S ·450″ DOUBLE EXPRESS RIFLE.

Range.	Velocity.	Striking Energy.	Time of Flight.	Height of Trajectory.	
				For 150 Yards.	For 100 Yards.
Yards.	f.s.	ft.-lb.	Seconds.	Inches.	Inches.
At Muzzle.	1776	2254	0	0	0
25	1696	2055	0·04301	2·0772	1·18656
50	1618	1869	0·08847	3·4932	1·6644
75	1543	1700	0·1358	4·1244	1·3116
100	1470	1544	0·1858	3·8436	0
125	1400	1400	0·2383	2·5128	...
150	1335	1274	0·2929	0	...
Highest point of trajectory				4·1436	1·6680

MESSRS. HOLLAND'S ·500″ DOUBLE EXPRESS RIFLE.

Range.	Velocity.	Striking Energy.	Time of Flight.	Height of Trajectory.	
				For 150 Yards.	For 100 Yards.
Yards.	f.s.	ft.-lb.	Seconds.	Inches.	Inches.
At Muzzle.	1784	3134	0	0	0
25	1712	2887	0·04270	2·0148	1·15872
50	1641	2653	0·08798	3·3816	1·6188
75	1573	2436	0·1346	3·9600	1·2636
100	1507	2237	0·1832	3·6696	0
125	1443	2051	0·2340	2·3916	...
150	1382	1939	0·2869	0	...
Highest point of trajectory				3·9768	1 6212

MR. JEFFRIES' ·500″ DOUBLE EXPRESS RIFLE.

Range.	Velocity.	Striking Energy.	Time of Flight.	Height of Trajectory.	
				For 150 Yards.	For 100 Yards.
Yards.	f.s.	ft.-lb.	Seconds.	Inches.	Inches.
At Muzzle.	1946	2872	0	0	0
25	1846	2584	0·03967	1·7904	1·01388
50	1750	2323	0·08139	3·0192	1·4244
75	1658	2085	0·1254	3·5844	1·12872
100	1569	1867	0·1720	3·3696	0
125	1484	1671	0·2210	2·2368	...
150	1402	1490	0·2734	0	...
Highest point of trajectory				3·6108	1·4292

MESSRS. HOLLAND'S ·577″ DOUBLE EXPRESS RIFLE.

Range.	Velocity.	Striking Energy.	Time of Flight.	Height of Trajectory.	
				For 150 Yards.	For 100 Yards
Yards.	f.s.	ft.-lb.	Seconds.	Inches.	Inches.
At Muzzle.	1663	3625	0	0	0
25	1594	3332	0·04623	2·3448	1·3476
50	1527	3056	0·09448	3·9108	1 8732
75	1463	2806	0·1440	4·5840	1 4772
100	1400	2569	0·1971	4·2504	0
125	1341	2357	0·2519	2·7684	.
150	1286	2169	0·3088	0	..
Highest point of trajectory				4·6068	1·8756

RIFLES FOR LARGE GAME.

THE TRAJECTORIES, TIMES OF FLIGHT, REMAINING VELOCITIES, AND STRIKING ENERGIES OF BULLETS FIRED FROM LARGE BORE AND EXPRESS RIFLES.

(Calculated by Major W. McCLINTOCK, R.A., Assist. Supt., Royal Small Arms Factory, Enfield Lock.)

To any one who is about to purchase a battery of rifles for large game shooting, it will no doubt be interesting to know the trajectories, and smashing power (striking energy), which the bullets fired from such rifles have, when suitable charges are used. It is with the object of supplying such information that the following tables have been drawn up, which give the remaining velocity, the striking energy, time of flight, and heights of trajectory for every 20 yards, up to a range of 150 yards. The heights of trajectory for 100 yards range have also been given.

In addition to the heights of the trajectories given in the tables, diagrams of the curves have also been drawn, having the heights exaggerated for the sake of clearness—the height being given on the scale of 2in. to the foot, and the range on the scale of 2in. to 20 yards.

From the two heavy rifles (4 and 8 bore) both conical and spherical bullets were fired, so the reader can form his ow opinion as to the relative merits of these projectiles.

The observed velocities were found by means of the Boulengé chronograph, and the muzzle and remaining velocities, times of flights, and heights of trajectory, were calculated with the aid of Professor Bashforth's tables.

Curtis and Harvey's "treble strong" powder was used for all the charges (Martini-Henry cartridges excepted), No. 7 powder for the 4-bore rifle, and No. 6 for the other calibres.

Although the Martini-Henry rifle was not designed for sporting purposes, similar information respecting its powers is given. In order to estimate the superiority of the Martini-Henry rifle, the comparison should have been made with a greater range than 150 yards.

The accuracy of rifle bullet trajectories calculated by means of Professor Bashforth's tables has been tested by firing a large number of rounds through paper screens placed at different points along the range. The rifle used in the experiment was the Martini-Henry, and the screens were erected at intervals along a 500 yards and a 1000 yards range.

0·45in., Single-Barrel, Martini-Henry Rifle (Conical Bullet).

Powder, 85grs. Bullet, 480grs.

Range	Velocity	Striking Energy	Time of Flight.	Heights of Trajectory	
				150 Yards Range	100 Yards Range
Yards	f s	ft lb	Seconds	Inches.	Inches.
At Muzzle.	1315	1841	0	0	0
20	1283	1752	0·04555	2·9076	1·7280
40	1252	1669	0·09287	5·0772	2·6712
60	1222	1590	0·1419	6·4128	2·7384
80	1194	1518	0·1911	6·8208	1·8720
100	1167	1450	0·2418	6·2628	0
120	1141	1387	0·2944	4·6356	
140	1116	1325	0·3484	1·8516	
150	1104	1297	0·3759	0	

Arms	Weight		Length of Barrel	Charge.		Proportion of weight of powder to weight of bullet.	Muzzle Velocity.
				Powder	Bullet		
	lb	oz	in	grs	grs.		f. s
0·45 single barrel Martini-Henry Rifle	9	0	$33\frac{3}{16}$	85 R. E. F. 2	480 conical	1 : 5·64	1315
4-bore single barrel Elephant Rifle	20	0	$25\frac{1}{8}$	328·08 or 12drs. C. and H. No. 7*	1882 conical 1250 spherical	1 : 5·73 1 : 3·81	1330 1460
8-bore double barrel Elephant Rifle	16	4	26	233·4 or 10drs. C. and H No. 6	1257 conical 862 spherical	1 : 4·59 1 : 3·15	1500 1654
0·45in. double barrel Express Rifle	10	0	26	150·37 or $5\frac{1}{2}$drs. C. and H. No. 6	274 conical	1 : 1·822	2000
10-bore double barrel smooth bore Jungle Gun	10	2	$25\frac{3}{4}$	136·7 or 5drs. C. and H. No. 6	698 spherical	1 : 5·106	1316

* The gunmakers (Messrs. J and W Tolley) from whom the arms (except the Martini-Henry rifle) and cartridges were obtained for the purpose of ascertaining the velocities, state that the powder with which the cartridges were loaded was of Messrs. Curtis and Harvey's manufacture.

4-BORE CONICAL BULLET OF 1882GRS., POWDER, 12DRS.

Range	Velocity	Striking Energy	Time of Flight.	Heights of Trajectory	
				150 Yards Range	100 Yards Range.
Yards	f s.	ft. lb	Seconds	Inches	Inches
At Muzzle.	1330	7387	0	0	0
20	1293	6981	0 04516	2·8860	1 7232
40	1257	6597	0 09268	5 0736	2·6880
60	1223	6244	0 1413	6 4056	2·7708
80	1191	5923	0 1908	6 8280	1·9164
100	1160	5619	0 2428	6 2472	0
120	1131	5342	0 2954	4 5996	
140	1104	5088	0 3485	1 8516	
150	1091	4969	0 3760	0	

4-BORE SPHERICAL BULLET OF 1250GRS, POWDER, 12DRS.

Range	Velocity	Striking Energy	Time of Flight	Heights of Trajectory	
				150 Yards Range	100 Yards Range
Yards	f s	ft lb	Seconds	Inches	Inches
At Muzzle	1460	5912	0	0	0
20	1375	5242	0 04234	2 7840	1 6056
40	1296	4659	0 08744	4 9908	2 5524
60	1224	4155	0 1349	6 4632	2 7000
80	1158	3718	0 1854	7 0692	1 9008
100	1099	3351	0 2385	6 6516	0
120	1047	3039	0 2946	5 0208	
140	1001	2777	0 3538	1 9812	
150	981	2869	0 3828	0	

8-BORE CONICAL BULLET OF 1257GRS, POWDER, 10DRS

Range	Velocity	Striking Energy	Time of Flight	Heights of Trajectory	
				150 Yards Range	100 Yards Range.
Yards	f s	ft lb	Seconds	Inches	Inches
At Muzzle.	1500	6273	0	0	0
20	1451	5870	0 04032	2 3400	1 3800
40	1403	5487	0 0825	4 1172	2 1516
60	1357	5135	0 1261	5 2308	2 2272
80	1313	4807	0 1714	5 6124	1·5276
100	1272	4511	0 2175	5·1792	0
120	1233	4237	0 2652	3 8724	
140	1196	3989	0 3150	1 5696	
150	1178	3870	0 3408	0	

8-BORE SPHERICAL BULLET OF 862GRS.; POWDER, 10DRS.

Range.	Velocity.	Striking Energy.	Time of Flight.	Heights of Trajectory. 150 Yards Range.	Heights of Trajectory. 100 Yards Range.
Yards.	f. s.	ft. lb.	Seconds.	Inches.	Inches.
At Muzzle.	1654	5232	0	0	0
20	1546	4569	0·03736	2·2548	1·2828
40	1446	3998	0·07741	4·0764	2·0592
60	1354	3505	0·1203	5·3400	2·2044
80	1270	3084	0·1662	5·9016	1·5696
100	1193	2720	0·2151	5·6052	0
120	1125	2419	0·2665	4·2996	
140	1065	2169	0·3213	1·7820	
150	1038	2069	0·3500	0	

10-BORE, DOUBLE-BARREL, SMOOTH-BORE, JUNGLE GUN (SPHERICAL BULLET).

Powder, 5drs. Bullet, 698grs.

Range.	Velocity.	Striking Energy.	Time of Flight.	Heights of Trajectory. 100 Yards Range.
Yards.	f. s.	ft. lb.	Seconds.	Inches.
At Muzzle.	1316	2681	0	0
20	1226	2328	0·04731	2·0316
40	1146	2033	0·0980	3·2484
60	1077	1797	0·1515	3·4548
80	1017	1601	0·2096	2·4300
100	966	1445	0·2696	0

0·45IN., DOUBLE-BARREL, EXPRESS RIFLE (CONICAL BULLET).

Powder, 5½drs. Bullet, 274grs.

Range.	Velocity.	Striking Energy.	Time of Flight.	Heights of Trajectory. 150 Yards Range	Heights of Trajectory. 100 Yards Range.
Yards.	f. s.	ft. lb.	Seconds.	Inches.	Inches
At Muzzle.	2000	2431	0	0	0
20	1917	2234	0·03063	1·3932	0·8100
40	1837	2051	0·06256	2·4588	1·2672
60	1759	1880	0·09612	3·1560	1·3260
80	1684	1724	0·1309	3·4176	0·92568
100	1611	1578	0·1675	3·1908	0
120	1541	1443	0·2053	2·4108	
140	1472	1317	0·2456	0·97248	
150	1439	1258	0·2661	0	

BOOK VI.

MODERN RIFLED PISTOLS.

CHAPTER I.

REVOLVERS.

By whom and where was the first revolver pistol made? This is a question easy to ask, but impossible to answer. If a satisfactory reply could be found, the interest excited would possess more antiquarian than practical value. Following out the purpose of this book, I shall content myself with such reference to the earlier types of revolver as may be necessary to an intelligent understanding of the process of mechanical evolution by which the modern revolvers have come into existence. As the pistol was developed from the previously existing gun, so the revolver seems to have sprung from an early invention of a revolving cylinder applied to a musket. Samples of muskets, having a fixed barrel, with a revolving cylinder containing several chambers, date as far back as the early part of the sixteenth century. To reduce these shoulder weapons to the size of a pistol would be so easy, that we may take it for granted that the first attempts at producing revolver pistols would follow closely on the introduction of revolver muskets. The first idea—common alike to the revolver musket and the revolver pistol—was simply to supply a weapon which should carry several charges. The inventors of these early weapons, therefore, contented themselves with the production of arms in which the several chambers were brought in succession to the barrel by rotating the cylinder by hand; the cocking of the lock being performed by a separate operation. As, however, the object of the revolver principle was greater quickness and facility of fire than was obtainable with the single loading weapons, a desire naturally arose to find means to do away with the need of rotating and adjusting the cylinder by hand. The result sought for was achieved in two distinct ways. One was to cause the pull of the trigger to rotate the cylinder, the other to cause the cocking of the hammer to effect this purpose. In this way the revolver principle started on two separate paths of development; and the differences arising from this divergence are very noticeable in the English and American revolvers of the present day. The English makers chiefly produced revolvers of single action worked by the trigger; while the Americans made single-action revolvers, in which the rotation of the cylinder was performed by cocking the hammer, and the trigger merely discharged the weapon. With the English makers, therefore, the careful study of the position of the centres, and the smoothness of the pull, were matters of the first importance, if accurate shooting was to be obtained. With the Americans, on the other hand, the force required for cocking was of no moment as affecting the shooting; and, in American revolvers, little care was bestowed on the pitch of the centres, and the arrangement of the mainspring and its adjuncts. Until a comparatively recent period few knew of, much less troubled themselves about, this difference between the two leading types of revolvers. One man fancied and bought a trigger-action pistol, another preferred the cocking action; and the merits and defects of each were accepted as part and parcel of the weapon chosen. But, when the call for double-action revolvers arose, a new light was shed on the subject. The English makers already had developed a well-designed and smooth trigger action, and had only to add a cocking action to produce a good double-action revolver. The Americans added a trigger action, but, in so doing, they signally failed to produce a good double action, and made evident the faulty design of their revolving mechanism. It will, therefore, be seen that the English and American revolvers approached the double action stage of development from different directions; and the keeping of this fact in mind will greatly facilitate the understanding of the merits and faults of the various modern types of revolvers.

The first application of the revolver principle of construction, where several chambers were rotated behind one barrel, dates back to the days of matchlocks. Of this type of arm an example exists in the Tower collection, and its period of construction may be set down as previous to 1550.

The flint lock was applied to revolving firearms very soon after its application to single barrelled weapons. Great ingenuity was displayed in the construction of both matchlock and flintlock revolvers, and one cannot fail to be struck by the talent and perseverance of the early inventors, who worked uphill under difficulties that are now almost beyond our comprehension. Triumphs of mechanical ingenuity are to be found in still existent arms of early date, where the makers had more or less successfully tried to cope with the hard problem of producing an efficient type of revolver carrying the necessary flash pans and priming for match or flint locks. The introduction of the percussion system of ignition greatly smoothed the path of the revolver maker, but the exploded cap was apt to clog the revolution, and it was not until the invention of the gas-tight cartridge, carrying its own ignition, that a perfectly reliable weapon for defence became a mechanical possibility. Little profit would ensue from following out the use of rim and pin-fire cartridges in revolvers. All those of the present day are made for use with the central fire cartridge, and practical, as apart from antiquarian, interest does not require an examination extending beyond those weapons which have been the immediate predecessors of the central fire revolvers now used. To Messrs. Smith and Wesson, of Springfield, Massachusetts, is assigned the merit of first producing metallic cartridges for use in revolver pistols, though Flobert, of Paris, used a powerful copper breech cap, containing a bullet, for his pistols in 1853. The development of the modern revolver may therefore be considered as embraced within the last thirty years.

It is true that Colonel Colt patented his revolver in 1835, but this was practically a muzzle loader fitted with nipples for ordinary caps, and it was of the cocking action type. For years previously English makers had turned out considerable numbers of six-barrelled revolvers of the type known as the "pepper-box." The old pepper-box pistol is worthy of note, because the trigger action rotated the barrels. At this time, therefore, we see the revolver separate into the two different types of construction of which I have already spoken, namely, those weapons in which the rotation of the cylinder was effected by cocking the hammer, and those in which the pull of the trigger rotated the cylinder and discharged the pistol. This period therefore affords the best starting point for a purely practical consideration of the modern revolver.

Amongst English makers the above-mentioned actions were not long left separate, for about 1855 the double-action revolver was produced, Adams's being probably the first, or, if not the first made, certainly the first well known. Quickly following came Tranter's double-trigger revolver, an arm of great merit and ingenuity. And in any work dealing with revolvers or other pistols the name of Tranter should hold a place of honour, as belonging to a man who, by many improvements, has done as much as anyone to advance the art of pistol making. Since his time the improvements, numerous and important as they are, have been chiefly in matters of detail, as we shall hereafter see.

The modern revolvers which are being made by the leading manufacturers may be classified as follows:

I.—Solid Frame, Non-Extracting.

Single action, cocking by thumb. Examples: Colt's ·44 Frontier, Colt's ·44 cal.

Double action, cocking by trigger or thumb. Examples: Adams's Double Action, Tranter's Double Action, Colt's Double Action, Webley's No. 5, Webley's Royal Irish Constabulary, Webley's Metropolitan Police, Webley's British Bulldog.

II.—Jointed Frames, Extracting.

Single action, cocking by thumb. Example: Smith and Wesson.

Double action, cocking by trigger or thumb. Examples: Smith and Wesson, Tranter's, Webley's W.G., Webley's British Army Model, and the Liege Revolver, sold by Messrs. Bland and others in England.

Beyond doubt public opinion is running very strongly in favour of double-action extracting revolvers, and the single-action revolver will soon be a thing of the past; and for home use probably even the double-action non-extracting type cannot long continue to hold its own against the double-action extracting weapon.

The revolver is pre-eminently a weapon for quick work at close quarters, and all other considerations must eventually yield to rapidity of fire and quick reloading. Next to these two paramount conditions come accuracy of fire, length of range, quick sighting, penetrating power, stopping power, safety to the user, endurance of the pistol, and facility for cleaning. These requirements can only be met by a double-action revolver with extracting and ejecting mechanism, and provided with some trustworthy safeguard against the discharge of the weapon until securely bolted. As the greater includes the less, a consideration of the points of such a revolver will cover all those *other* types of arm which perform only a part of the above-mentioned functions.

(*a*) Rapidity of fire. So far as the discharge of that number of shots contained in one loading of the chamber, non-extracting double-action revolvers may be fired as rapidly as the extracting and ejecting weapons; but, as soon as the reloading question comes in as part of the attainment of quick fire, the latter weapon leaves the former hopelessly in the rear, and in *situations of continued* peril the user's life may depend on the facility for reloading.

(*b*) Accuracy of fire. No single trigger action revolver can give the same accuracy that can be obtained with a pistol that can be cocked by the thumb, although rapidity may be secured. Accuracy can be obtained with a single cocking action, but rapidity is entirely wanting. We are therefore compelled to have the double-*action* extracting revolver if we are to secure a combination of accuracy and a capability of extreme rapidity when required.

(*c*) Length of range. This quality depends upon the weight and form of the bullet, the charge of powder, the proper design of the chambers and barrel, and the accuracy and general solidity achieved in the fitting of the pistol. Each type of revolver must be judged by its actual performance.

(*d*) Quick sighting. This is a most important point in a revolver, but too generally neglected. It is well known to those experienced in revolver shooting that the deep and narrow V usually cut for a backsight, is useless for any but the most leisurely aiming. What is wanted is an arrangement of backsight such as shall enable the shooter to see his foresight plainly for elevation before centring for lateral accuracy.

(*e*) Penetrating power depends on the velocity, weight, shape, and hardness of the bullet, and must not be confused with stopping power. Mere penetrating power should not be sought in a revolver to the neglect of other qualities.

(*f*) Stopping power is one of the most important qualities that a revolver can possess. Most revolvers are wanting in this requirement, as they are too light and of small calibre. A heavy bullet of large calibre, propelled at a moderate velocity, will give the maximum stopping power of which a revolver is capable, because the recoil arising from attempting too much in a revolver soon puts the weapon beyond the use of ordinary men.

(*g*) Safety to the user. This very important quality depends on the design, workmanship, and materials of the revolver. The most fertile source of danger has arisen from the liability of extracting revolvers to be fired without being securely closed. So far I have only met with one safety contrivance to make this impossible.

(*h*) Endurance of the pistol depends, to a great extent, on the design, but still more on the materials and the perfection of the hardening and fitting; and each manufacturer's revolvers must be judged by results.

(*i*) Facility for cleaning is very important if revolvers are to be kept in good shooting condition. In all the modern types this condition seems to have been fairly well studied.

I. Solid Frame Non-extracting Revolvers.

The following may be taken as examples sufficient to cover all of note: Adams's; Webley's British Bulldog; Webley's

Metropolitan Police, the Royal Irish Constabulary, and the Webley No. 5; Colt's ·45 and Frontier ·44.

All these pistols possess the common features of a solid frame, and a rod for extracting the fired cases.

Webley's "British" Bulldog (built on the lines of the

SCALE ¾ SIZE.

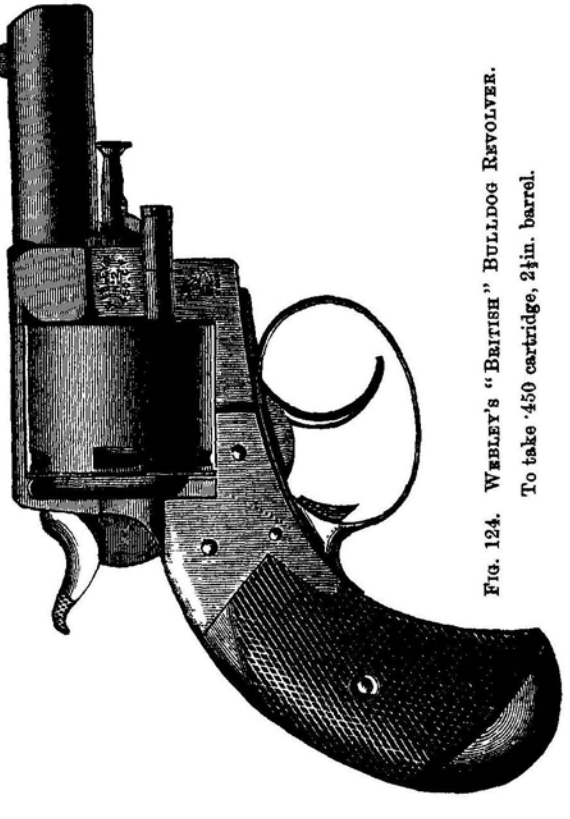
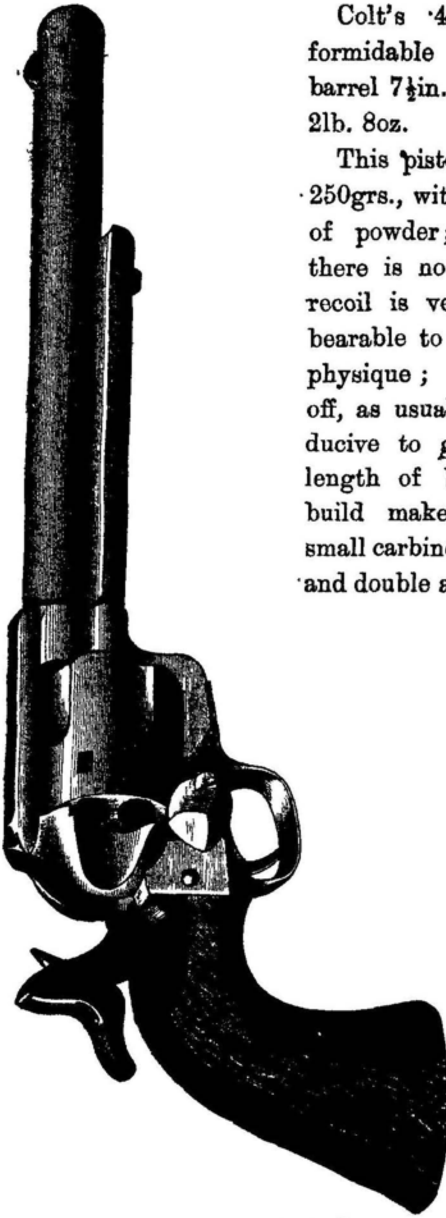


FIG. 124. WEBLEY'S "BRITISH" BULLDOG REVOLVER.
To take ·450 cartridge, 2¼in. barrel.

American single action Bulldog) is double action, designed for the ·450 service cartridge, and is the most powerful pocket revolver in the market. A good shot can make a 2in. diagram at 10 yards with this pistol, though it has but a 2¼in. barrel.



Colt's ·45 pistol is a very formidable weapon, having a barrel 7½in. long, and weighing 2lb. 8oz.

This pistol shoots a bullet of 250grs., with a charge of 38grs. of powder; and of its power there is no question. But its recoil is very great, and only bearable to men of very strong physique; moreover, its pull-off, as usually sold, is not conducive to good shooting. Its length of barrel and general build make it almost like a small carbine. It is both single and double acting.

Fig. 127. Colt's Single Action Revolver, 7½in. Barrel.

Both the single and double action Colt revolvers are made with the two lengths of barrel, and to take either American or English cartridges; but the same revolver will not use both.

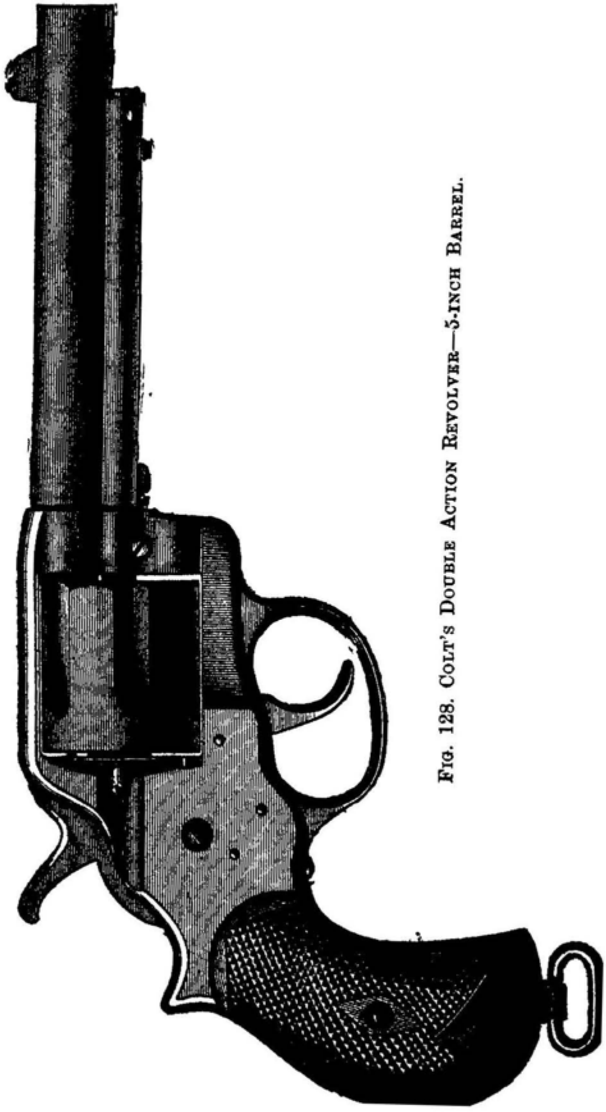


FIG. 128. COLT'S DOUBLE ACTION REVOLVER—5-INCH BARREL.

SCALE $\frac{2}{3}$ SIZE.

FIG. 129. WEBLEY'S NEW MODEL ARMY EXPRESS, NO. 5 PATTERN, ADOPTED BY THE TRANSVAAL GOVERNMENT.

To take ·455 Cartridge. $5\frac{1}{2}$ in. Barrel.

The Colt ·44 Frontier differs only from the above in its cartridge, which contains 40grs. of powder, propelling a bullet of 200grs. The recoil of this pistol is very heavy. Webley's Metropolitan Police Revolver—adopted by the authorities in Nov. 1883—is a weapon of ·450 calibre, with a 2½in. barrel, designed for close quarters and great stopping power. This pistol is double-acting. Webley's Royal Irish Constabulary is also a double-acting weapon, similar to the above, but with a 4½in. barrel, and, therefore, suited for longer ranges than the Metropolitan Police model. This is the pistol used by the Cape Mounted Police, and adopted by the Queensland and Victorian Governments. The latest models of this pistol are ·455 cal. Webley's Army Express, No. 5, which is the revolver adopted by the Government of the South African Republic, is a very powerful weapon, having a 5½in. barrel, and carrying either a ·455 cartridge, or the U.S. ·45 service cartridge. It is of the double-action type. In point of rapidity these double-action pistols have a great advantage over the American single action, and they have also the advantage of a better pull-off when cocked, for the reason already pointed out (see Fig. 129).

The Adams' revolver, though first produced as a muzzle-loader, has been for many years a breech-loading pistol. It is a powerful weapon of the solid frame, non-extracting class, and gives fairly good shooting with the trigger action; but it has not kept pace with the march of improvement in details of design.

II. Jointed Frame Extracting Revolvers.

With single action, the best known type is the Smith and Wesson. This is a powerful pistol, but slow in action, and its pull-off is not suited for accurate shooting. In reloading it comes up to the standard of other extracting revolvers.

Smith and Wesson produce an excellent type of double-action extracting revolver, quick in action, and very handy for reloading, but not so good on the trigger action as the English revolvers.

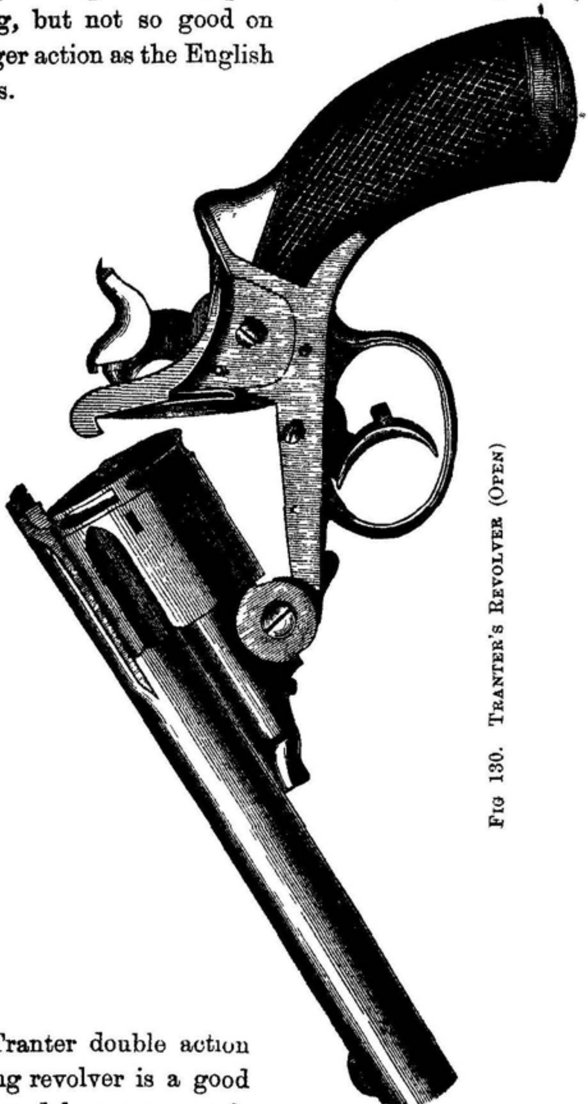


FIG 130. TRANTER'S REVOLVER (OPEN)

The Tranter double action extracting revolver is a good weapon, and has a very safe and efficient arrangement for locking the strap to the body (see Fig. 130).

Scale ⅔ size.

Fig. 131. Webley's Improved Government Pattern Revolver.

W. G. ·455. 5¾in Barrel.

Fig. 132.

Of the Webley double-action extracting revolvers I give illustrations, showing their No. 4 or 4½ ·455 cal., and also a detailed description of their W.G. revolver, which embraces the latest features of revolver development. A recent improvement in these revolvers is the addition of the automatic safety block, which prevents the possibility of discharging the pistol unless securely bolted.

Webley's Improved Government Pattern Revolver.

In this weapon the conditions which have been pointed out, as appertaining to a perfect revolver, are more nearly approached than in any other pistol yet introduced. The following description of this revolver will render its construction and capabilities as understandable as may be without practical experience of the pistol on the part of the reader. Before discussing the very ingenious peculiarities of the lock mechanism, it may be well to describe the general features of the arm. Fig. 131 shows a revolver ·455 calibre, of the double-action extracting type. Taking the body movements, as apart from the lock mechanism, the cylinder rotates upon a hollow spindle (*g*), Fig. 132. It is held in position on this spindle by the anti-friction nut (*h*), which fixes the horizontal position of the cylinder. This anti-friction nut is entirely removed from the influence of the fouling of the flash; and thus this pistol will fire almost any number of rounds without sticking. In fact, as many as 2000 rounds have been fired from one of these pistols; and, after this test, the cylinder was found to be quite free, although the shooting was as rapid as possible, and no cleaning was allowed. This nut also affords a very handy means of attaching and detaching the cylinder from the hollow spindle. The extension rib of the barrel is bolted to the body in a simple and ingenious manner, and one possessed of great strength, inasmuch as nothing less than the double shearing of a steel pin could permit the

Of the Webley double-action extracting revolvers I give illustrations, showing their No. 4 or 4½ ·455 cal., and also a detailed description of their W.G. revolver, which embraces the latest features of revolver development. A recent improvement in these revolvers is the addition of the automatic safety block, which prevents the possibility of discharging the pistol unless securely bolted.

WEBLEY'S IMPROVED GOVERNMENT PATTERN REVOLVER.

IN this weapon the conditions which have been pointed out, as appertaining to a perfect revolver, are more nearly approached than in any other pistol yet introduced. The following description of this revolver will render its construction and capabilities as understandable as may be without practical experience of the pistol on the part of the reader. Before discussing the very ingenious peculiarities of the lock mechanism, it may be well to describe the general features of the arm. Fig. 131 shows a revolver ·455 calibre, of the double action extracting type. Taking the body movements, as apart from the lock mechanism, the cylinder rotates upon a hollow spindle (*g*), Fig. 132. It is held in position on this spindle by the anti-friction nut (*h*), which fixes the horizontal position of the cylinder. This anti-friction nut is entirely removed from the influence of the fouling of the flash; and thus this pistol will fire almost any number of rounds without sticking. In fact, as many as 2000 rounds have been fired from one of these pistols; and, after this test, the cylinder was found to be quite free, although the shooting was as rapid as possible, and no cleaning was allowed. This nut also affords a very handy means of attaching and detaching the cylinder from the hollow spindle. The extension rib of the barrel is bolted to the body in a simple and ingenious manner, and one possessed of great strength, inasmuch as nothing less than the double shearing of a steel pin could permit the revolver to fly open, when once bolted. In the body at the right side is a short spring bolt to engage in the hole in the strap. In the strap is a steel bolt or pin, just filling its entire width. In the body, at the left side, is a third bolt or pin. When the pistol is shut, these three bolts form *one* bolt in three parts, and the action is as follows: Commencing from the right, number one, urged by the spring, enters partly into the strap, bolting that side of the strap. The central division of the bolt—that in the strap—is thus forced towards the left, and one end of it enters the left side of the body; and thus the strap is bolted to the body right and left. The third division of the bolt—that in the left side of the body—is thus caused to protrude from the outside to the left, as much as the spring has moved the three components. Pressure on this third component affords the means of unbolting the pistol. Thus it will be seen that this pistol is double bolted by a mechanical arrangement which acts as one bolt. The snap action is secured by suitable inclines on the right hand and middle components. By means of the side lever, the compound bolt is actuated for opening the pistol by the thumb of the right hand while holding the pistol as for firing. This is a great convenience—especially on horseback—as it enables the user to eject fired cases by the use of one hand only.

In the fore part of the pistol is an effective arrangement for causing the extractor to perform its function, and snap sharply back into its place. There is the ordinary lever of the tumbler type, having a ratchet tooth on which a small pawl catches, and holding the lever, causes the movement of the extractor as the pistol is opened. At the right moment a snail cam pushes the pawl out of gear, and the extractor is smartly flipped back into its place. It will be seen that all the above described mechanism is neat and well suited to the functions required.

Passing to the lock mechanism, by means of which the cylinder is rotated and locked, and the arm fired, we find safety and efficiency secured by a combination of limbs very few in number, but performing all the necessary functions. The limbs of the lock proper are only five in number (see Fig. 133), namely: The hammer (*b*), trigger (*c*), lifter (*d*), central lever (*e*), and mainspring (*a*). The following limbs used in other revolvers are dispensed with: The scear and

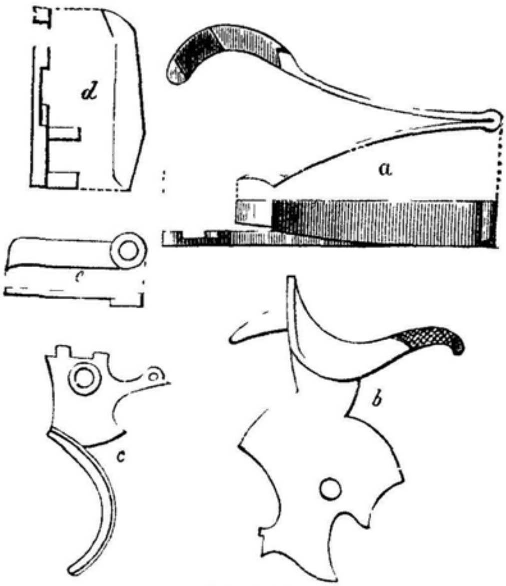


Fig 133

scear spring, the catch and catch spring, the trigger spring and lifter spring.

Therefore, when firing by means of the trigger action, the only resistances to be overcome are the elasticity of the mainspring and the very slight friction of the cylinder and limbs of the lock. Hence the trigger action of this pistol is lighter and smoother than that of any other, and closer shooting can be made with it. To understand the action of this lock it is necessary to thoroughly comprehend the peculiarities and functions of the mainspring. It will be seen that, while the play side of the mainspring performs the ordinary function of propelling the hammer against the cap, what is usually the stand side is set to do important work. Its extreme end bears on the central lever, and the central lever bears in a slot in the lifter, the lifter being also pivoted to the trigger. Hence this end of the mainspring plays the parts usually assigned to the scear spring, trigger spring, and lifter spring. Further than this, the lower end of the lifter passes under the toe of the hammer to perform the office of the ordinary catch; and, as this action is also due to the mainspring, no catch spring is required.

Somewhat further back on this limb of the mainspring is a step which bears on the heel of the hammer when the pistol is discharged and the trigger released, so bringing back the hammer to a position of safety, and locking it there.

When the pistol is shot with the trigger action the movements of the various limbs are as follows: The travel of the trigger raises the lifter, rotating the cylinder as usual. The lifter raises the central lever, and so compresses the under side of the mainspring, moving its safety projection sufficiently away from the heel of the hammer to allow a clear fall on to the cap. At the same time the lower end of the lifter, which is engaged with the toe of the hammer, performs the cocking of the hammer, and compresses the top limbs of the mainspring. As the trigger approaches the point of discharge a tooth on its upper side, a little behind its axis, engages with the cylinder and locks it for firing. At the point of discharge the lower end of the lifter slips from the toe of the hammer.

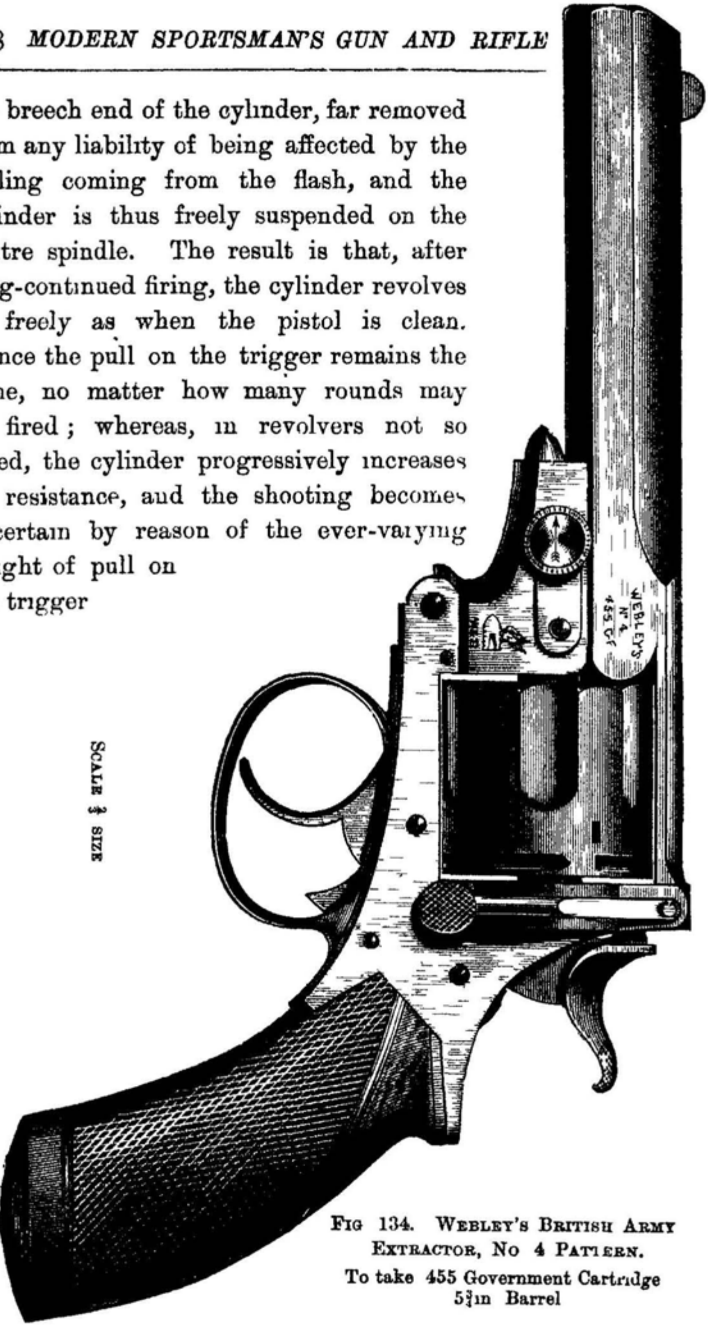
When the cocking action is used, the bent above the toe of the hammer engages with the scear nose on the trigger.

Complaints have been made from time to time that extracting revolvers have blown open when fired. With a well-made revolver such an accident can only happen by the inadvertence of the user; but, in great hurry on bad light, such inadvertence may happen to the most careful of men. Of course, when this accident happens the revolver is disabled by the bending of the spindle, and the consequent setting fast of the cylinder. To render such an accident impossible, Messrs. Webley and Son are now fitting their revolvers with Carter's Patent Safety Cylinder Locking Bolt. The construction is very simple, but the purpose served by it is very important in a revolver. In front of the usual trigger stop is this cylinder locking bolt. When the cylinder is stopped in the usual way by the trigger stop and the lifter, this cylinder locking bolt is operated by the fall of the hammer, and remains engaged with the cylinder until the hammer is again raised. The result is that the cylinder is doubly locked at the moment of discharge, *and remains locked during the return of the trigger,* and for whatever time may elapse until its next revolution. Amongst the advantages obtained are these:

The cylinder is always doubly locked for firing. It is locked during the return of the trigger and when the revolver is being carried, and an accidental displacement of the chambers is rendered impossible.

These two improvements are of great value, the first entirely doing away with the risk, attaching to jointed revolvers, of blowing open, and the second enabling a perfectly free cylinder to be used without any tendency to its going round too far, or turning back during the return motion of the trigger. The attainment of the free cylinder means securing that smoothness of action which is necessary for fine shooting with the trigger action, and, with revolvers so fitted, very nearly as good diagrams can be made with the trigger action as by the cocking.

The free cylinder spoken of is obtained in the Webley revolvers by means of the anti-friction nut. This nut is at the breech end of the cylinder, far removed from any liability of being affected by the fouling coming from the flash, and the cylinder is thus freely suspended on the centre spindle. The result is that, after long-continued firing, the cylinder revolves as freely as when the pistol is clean. Hence the pull on the trigger remains the same, no matter how many rounds may be fired; whereas, in revolvers not so fitted, the cylinder progressively increases its resistance, and the shooting becomes uncertain by reason of the ever-varying weight of pull on the trigger



SCALE ¾ SIZE

FIG 134. WEBLEY'S BRITISH ARMY EXTRACTOR, NO 4 PATTERN.
To take 455 Government Cartridge
5⅜ in Barrel

The Liege revolver, sold by Messrs. Bland at about half the cost of the corresponding Webley arm, is a good weapon

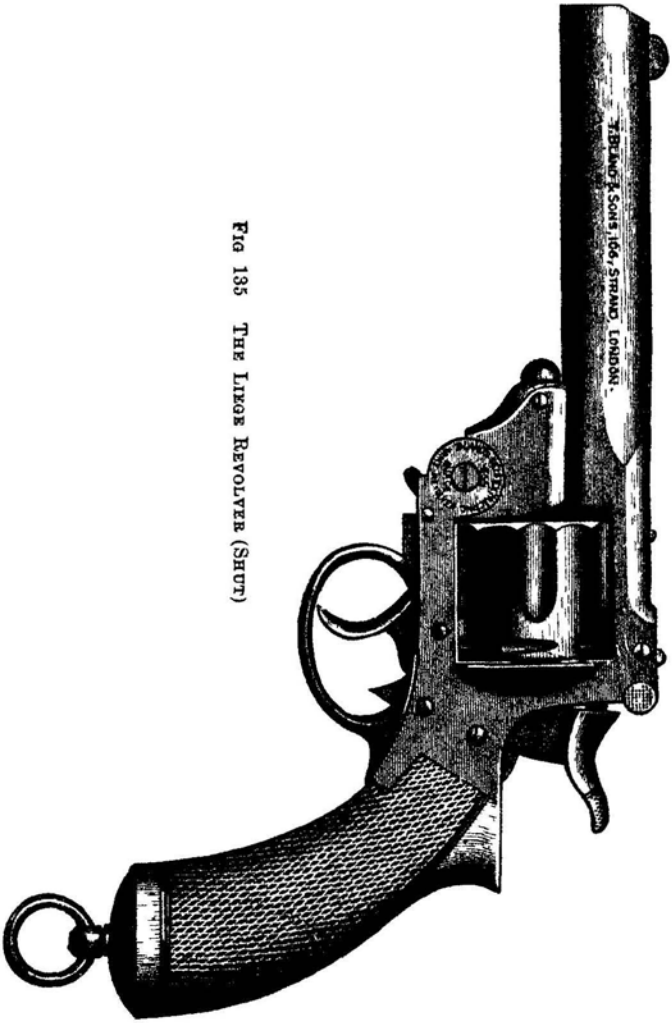


Fig 135 The Liege Revolver (Shut)

at the price, but in material and finish will not compare with the English weapon, though rifled and finished in this country. I have made very good shooting with it, but not up to the form displayed by Mr. H. Webley and Mr. Ira Paine in the trials to be presently described. This was owing, no doubt, to some extent, to my having previously shot the Colt with the full charge of 40 grains powder, which had

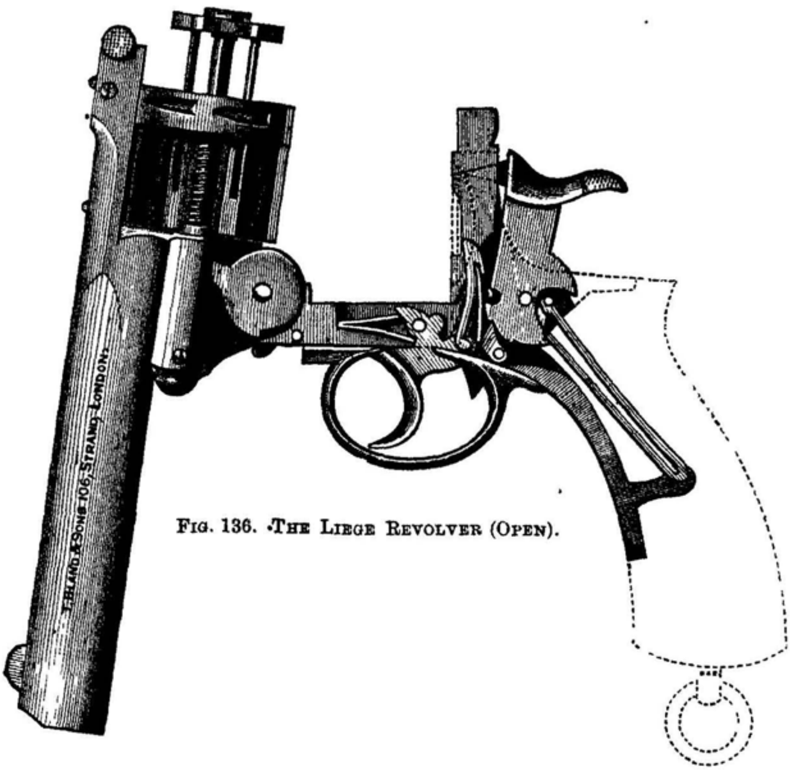


FIG. 136. THE LIEGE REVOLVER (OPEN).

completely upset my shooting. To those who cannot afford the larger sum, this pistol may no doubt be a boon; but, irrespective of price, I should certainly advise the choice to be made between the work of Messrs. Webley and that of the Colt Company.

TRIAL OF REVOLVERS.

In order to test the accuracy of the most prominent modern revolvers, I recently carried out a series of trials at Nunhead, in which Mr. H. Webley fired the new revolver of his firm at 12 and 25 yards, and, in competition with him, Mr. Ira Paine exhibited the powers of the Colt arms a fortnight afterwards, the weather on both days being all that could be desired. The following reports, written by myself, were published in the *Field*, and I now append them entire :

TRIAL OF WEBLEY'S ARMY REVOLVER.

With a view to arrive at something like a standard of the shooting of the revolver, similar to that of the sporting rifle which we obtained at Putney last summer, we have lately seen several kinds tested in private, and have also shot some of them ourselves. Among these trials the best we have seen was the performance of an improved army revolver, made by Messrs. Webley, of Birmingham, with their new safety-bolt, which prevents the possibility of the action blowing open, inasmuch as, unless it is acted on by the closing of the top strap, the hammer cannot be pulled. In other respects the revolver resembles that described by us on the 10th of March last year (see Fig. 131).

By the courtesy of Mr. Brown, the proprietor of the Nunhead rifle range, we were permitted last Monday afternoon to use his fifty-yards ground at the back of his high butt, so that full safety from an erratic volunteer ball was insured. The weather being all that could be desired, Mr H. Webley duly appeared with the pistol, prepared to show its shooting for more than a hundred rounds without cleaning the action, and fifty rounds at twelve and twenty-five yards without wiping out the barrel, which intention he more than carried out, producing the excellent diagrams which we have since had engraved, and which at present we take to be the full standard of excellence, as far as our experience goes. His shooting with the trigger action is especially noticeable at twelve yards, but he did not come out so well at the longer range as might be expected To produce this good shooting with the trigger action is a most difficult problem; but the object of the maker has been secured by a cylinder bearing, free in movement, steady, and safe from being clogged by the fouling of the escape backwards as well as forwards. In the Webley revolvers these three requirements are attained by the peculiar mode of, as it were, suspending the cylinder from the breech, and by the anti-friction nut. This mode of construction gives a remarkably smooth pull of the trigger, and enables first-class shooting to be achieved with the trigger action, while the cylinder remains free on its bearings after long-continued firing; at all events up to 200 rounds, to about which number we tested it.

Fig. 137 is a diagram of Mr. H. Webley's shooting at 12 yards, using the trigger action.

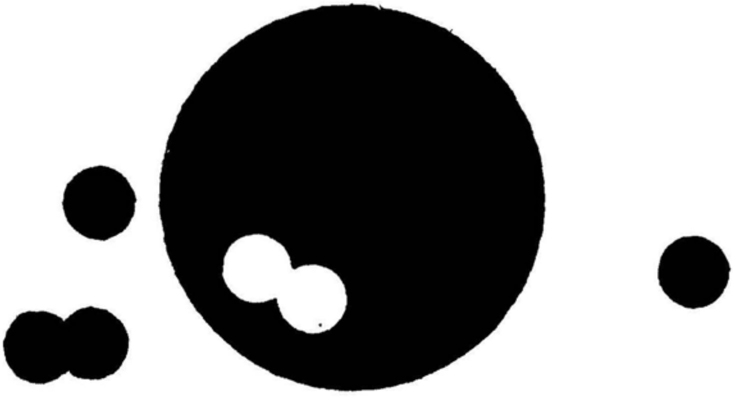


FIG. 137. TRIGGER ACTION, 12 YARDS, CLEAN.

Fig. 138 is the result of six shots with the cocked action at 12 yards. This, it will be seen, is not only not better than that with the trigger, but is a trifle worse.

Fig. 139 is by no means an average performance, and, as far as it goes, reverses the comparative shooting at 12 yards.

Fig. 140 is an extraordinary diagram considering the range, and is the best we have seen at the distance. We have ourselves obtained a diagram measuring 4½in. × 4in. at 18 yards, using the cocked action, but of course it will not at all compare with this of Mr. H. Webley professes to be able to make as good shooting with the trigger action as with the cocked pistol, and venturing to publish the second—which must be my excuse for the long interval between them.

The first thing to be done was to admit my ignorance, and at the same time to ask for the information required from the recognised authorities on the subject. Accordingly I appealed to Sir H. Halford, Mr. Metford, Mr. Henry, Mr. J. Rigby, Mr. F. Osborne, and Mr. H. Holland for their opinions on several vexed questions; and to these gentlemen I am greatly *indebted for their courteous compliance with my requests.* With their aid, supplemented by a public trial, which I held in the autumn of last year, I have been enabled to satisfy myself as to all the points referred to them, and I hope my readers will be able to agree with my conclusions. In the general details of manufacture I have also been greatly assisted by Mr. Osborne, whose thorough knowledge of all matters connected with the manufacture and use of rifles has been fully placed at my disposal. To my friend "T." was entrusted the theoretical portion of the work, and his signature will, I am sure, be accepted as a sufficient guarantee for its being fully up to the mark; indeed, I may congratulate myself as well as my readers on the manner in which he has accomplished his task.

From these remarks it may be gathered that the part which I have taken in compiling this second volume has been rather that of an editor than an author, and if the results are satisfactory to my readers I can only take credit for the careful selection of reliable information from the large mass which has been placed at my disposal. In every case I have

PREFACE TO THE SECOND VOLUME.

ALTHOUGH, as I stated in my Preface to the First Volume of this work, I began to examine into the subjects connected with the shot gun and rifle a quarter of a century ago, I had not kept my knowledge on a level with the great progress made in the latter arm during the last few years. When Sir Joseph Whitworth promulgated the results of his experiments in 1858, I took considerable pains to ascertain their value, not only from a military point of view, but also from that of the sportsman; and for some years after the institution of the annual trial of small bores by the National Rifle Association, I carefully attended them at Woolwich, and duly reported the results in the *Field*, as well as the shooting of the selected rifle at Wimbledon. After some few years, however, they ceased to be of much value to the sportsman, and the pressure of other matters induced me not only to forego all allusion to the trials, but also to discontinue the reports of the Wimbledon Meetings. The result was that, when, after the publication of the first volume, on the shot gun, I had to turn my attention to the rifle, I found that I was several years in arrear; and it was necessary to work this up before

Trial of Colt's Revolvers.

(From the *Field* of April 12.)

On Wednesday, April 9, we were present at a trial of the above at Nunhead, in the hands of the celebrated American pistol-shot, Mr. Ira Paine. On the average, they were about equal to those made by Mr. H. Webley, as reported by us on the 28th of March. His shooting at 12 yards was certainly better, but, though he had several trials, he did not come up to Mr. H. Webley's 25 yards diagram. At 50 yards the six shots made a square of 18in.. or

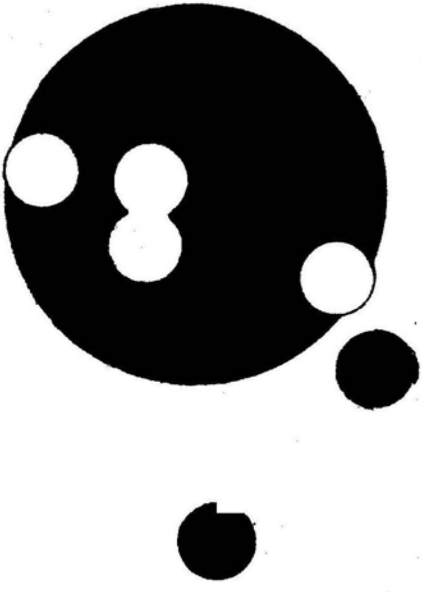


Fig. 142. Eley's Cartridges, 12 Yards, Short Army Revolver, 5½in. Barrel, Cocked.

thereabouts, while at 100 yards twelve shots were barely within a space of 4ft. 6in. by 3ft. 6in. Curiously enough, Mr. Paine succeeded in firing forty-eight shots in 2min. 15sec., being 50sec. faster than Mr. H. Webley with his self-extractor, but his accuracy was not to be compared with that of the latter, the space covered being nearly four times as great. The actions all worked perfectly well. but the barrels of the pistols, several of which were used, will compare favourably with Mr. H. Webley's performance at the same distance; but, on the other hand, out of six diagrams made by Mr. Ira Paine at 25 yards, not one will compare with that of Mr. Webley with the cocked action, which measured only 3¾in. by 1½in., whereas Mr. Ira Paine's first diagram (numbered now Fig. 146) measures 7¼in. by 4¼in., while his short pistol diagram, fired No. 8, which we now place as Fig. 147, measures 4½in. by 3½in. His diagram No. 7 measures 7¼in. by 7in. No. 9 measures 6½in. by 4in., No. 10 5¼in. by 2½in., and No. 11 8¼in. by 7½in. On the whole, therefore, it may be alleged that there is little or no difference between the two kinds of revolvers at these distances, assuming that the two performers are equal in skill, which we believe to be the case.

It will be remembered that Mr. Webley did not shoot at any distance beyond 25 yards, so that no comparison can be here made. We may, however, state that Mr. Ira Paine's diagrams at 50 yards vary from 7in. by 3in. to 12in. by 5in. At 100 yards, as we stated before, 12 shots were included in a parallelogram measuring 4ft. 6in. by 3ft. 6in.

As to the diagram made in rapidly firing 48 shots, Mr. Webley's is far the best, the whole being included in a space measuring 16in. by 13in., whereas Mr. Ira Paine's occupy a space 18½in. high by 16in. wide. This diagram was made with the short army pistol, using Eley's cartridges, and in the short space of 2min. 15sec. as against Mr. Webley's 3min. 5sec.

In conclusion, I may state that in describing all the revolvers mentioned in this chapter I have avoided any attempt to settle the claim to originality of invention; indeed, in some cases three or four patents have been combined into one perfect whole.

CHAPTER II.

NON-REVOLVING PISTOLS.

IN order to avoid the escape at the junction between barrel and chamber, two or three kinds of four-barrelled pistols have been invented, in which the striker revolves instead of the chambers, by which means the cartridge can be

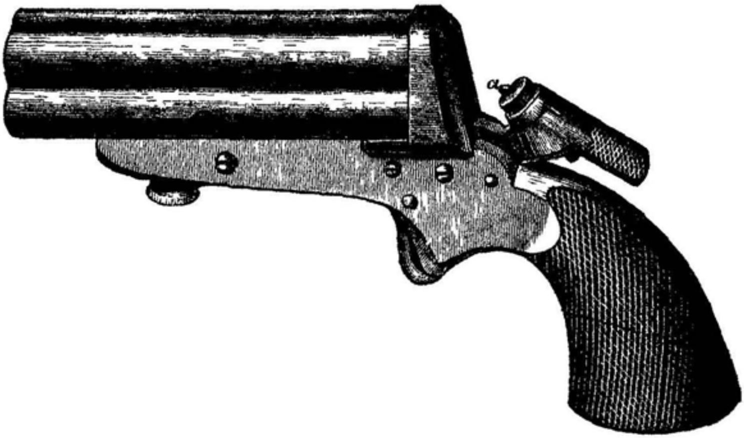


FIG. 148. SHARPS' TRIUMPH.

inserted in the barrel itself. Among these an excellent one is that of C. Lancaster and Co., New Bond-street, which will be presently described. But before proceeding to the Lancaster pistol it will be necessary to note the fact that the germ of his invention is contained in the pistol invented about twenty years ago in America by Colonel Sharps, and long known as "Sharps' Triumph." In it, however, the revolving of the striker is effected by the working of the hammer, which is done by the thumb, as indeed was the case with all the revolvers of that day. The cartridge was of the "rim" kind, and the pistol (one of which, made at Birmingham twenty years ago, is now before me) is of course behind those of the present day. Fig. 148 gives an exact representation of it (two-thirds size), the revolving projection on the hammer being shown at *a*. The barrels slide forward from the "break off" for loading, and the empty cases are pushed back by a rod, in the usual way. We will now compare this original idea with the new plan worked out by C. Lancaster and Co., as described by the head of that firm:

CHARLES LANCASTER'S PATENT FOUR-BARREL BREECHLOADING HAMMERLESS PISTOL.

This ingenious invention is constructed on the principle of the ordinary revolver, with this difference, that, instead of the chambers taking a turn before each discharge, a revolving cylinder with a striker attached is made to perform a similar office by the pull of the trigger, the said striker being brought to bear in turn on the centres of the four barrels, which are drilled out of the solid and machined so as to form a square, and which are hinged at the bottom, through which a cross-pin passes to keep them to the breech action on the lower side, and are fastened at the top by a projection when closed ready for use, which said projection is raised from the barrel by a lever placed on the left-hand side, being the most convenient position, as the thumb, in passing the stock, readily works the lever to allow the connection to be lifted, and so cause the barrels to drop either for loading or unloading. The action of the lock is very simple, and is fully described in the *Field* of Jan. 14 and June 24, 1882, also in Vol. I. of present work, pp. 231-236.

The advantages which this new pistol possesses over the old form of revolver are, chiefly, increased accuracy and strength of shooting, owing to its dispensing with the escape between the revolving chambers and the stationary barrel, which not only acted prejudicially in the above directions, but made it impossible to rest the weapon on the left hand when aiming except at the risk of serious injury.

There is in this pistol no opening through which any gas can escape, so the weapon can be used like a gun when aiming (that is to say, with the left hand on the barrels); and there are no screws, hammers, or projections to catch the clothing, reins, &c.

Above all, there is no fear of a jam or the weapon becoming unserviceable from over heating or other accident. The mechanism is covered up, and dirt, damp, wet, and ill-usage hardly affect the pistol at all, as many officers who used them during the Egyptian campaign have testified.

The extractor is self-acting, and ejects all the fired cartridge cases at once.

The lock is rebounding, and the revolving cylinder and striker being jointed, there is no possibility of the striker protruding, thereby causing an accidental discharge, in the act of closing the barrels to the action. The lockwork is well made and is carried on metal, so that, should the stock become damaged, its perfect action is insured, the said stock only acting as a cover, no part of the said work being fastened to the stock (see Fig. 150).

These pistols are all rifled on Charles Lancaster's non-fouling smooth oval-bore system, thereby allowing shot to be used from them (as well as ball cartridges), from which very good practice is obtained up to 20 paces.

The four barrels are made to converge to a common centre at 40 yards, so that in aiming no allowance need be made to insure either of them covering the object in sight. They are made of the following sizes, viz.:

1. Full size, bore ·455 C.F.; total length of pistol, 12in.; length of barrels, 6in.; weight, 2lb. 8oz.

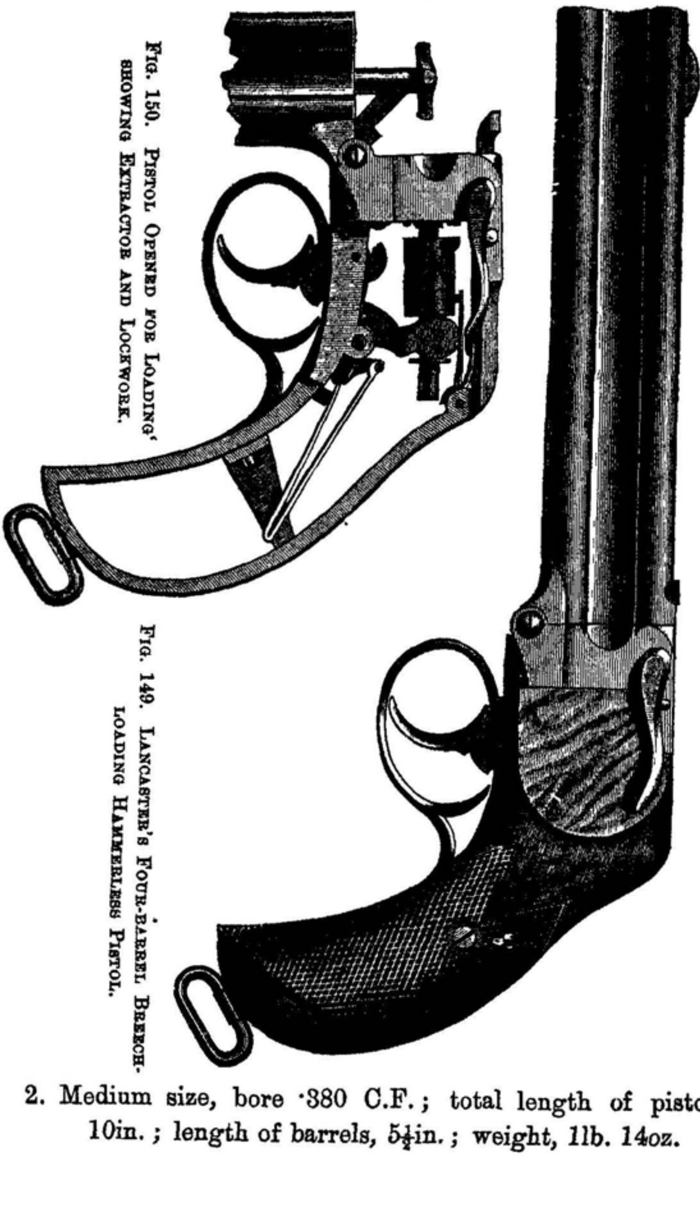


FIG. 150. PISTOL OPENED FOR LOADING' SHOWING EXTRACTOR AND LOCKWORK.

FIG. 149. LANCASTER'S FOUR-BARREL BREECH-LOADING HAMMERLESS PISTOL.

2. Medium size, bore ·380 C.F.; total length of pistol, 10in.; length of barrels, 5¼in.; weight, 1lb. 14oz.

3. Small size, bore ·380 C.F.; total length of pistol, 8in.; length of barrels, $3\frac{5}{8}$in.; weight, 1lb. 9oz.

Full size takes the Government Regulation ·455 C.F. cartridge, and gave an average velocity of 970 ft.-s. at 75ft. from muzzle of pistol when tested at Messrs. Curtis and Harvey's Boulengé chronograph.

Medium size takes the ordinary rook rifle cartridge, ·380 C.F., Messrs. Eley's make.

Small size takes the ordinary revolver cartridge, ·380 C.F., Messrs. Eley's make.

These pistols can be supplied nickel plated to prevent rust.

Mr. Charles Lancaster has a new model in course of production, viz., first a 4-barrel B.L. hammerless pistol to take the ·577 revolver cartridge, and also double-barrel B.L. hammerless pistols constructed on the same principle.

Movable shoulder skeleton stocks can be fitted, which give a very great assistance where very accurate practice is required.

I have not tried this pistol myself, or seen it tried, but I have no reason to doubt that the admirable shooting with which it is credited by several correspondents of *The Field* is well founded, and, from the non-escape of gas, no doubt the initial velocity is greater than with the same cartridges fired from a revolver.

Single and Double Pistols.

These are not now much in use in this country; but in America they are employed either for carrying in the pocket, or for saloon practice, or sometimes as a double-barrelled horse pistol, on the Lefaucheux principle, which is made of all sizes, and to take various kinds of ammunition. It is not much used in this country.

The Saloon Pistol.

Long-barrelled (12in.) pistols, of very small bore, and with very shallow grooves, are made for use in the American shooting galleries. They are very accurate up to 30 yards, or thereabouts. With this pistol Mr. Ira Paine has for some time exhibited his skill and nerve, as well as the courage of his wife by shooting at nuts, oranges, &c., on her head from a distance of 12 yards. Of course, this is nothing more than was formerly done with the smooth-bore duelling pistol with which in my young days every good shot could snuff a candle five times out of six at twelve paces; but no one ever heard of the most practised duellist exhibiting his skill by firing at an orange on the head of his wife. *Tempora mutantur*, however; and we must take the world as we find it. Knowing the uncertainty of the human eye and hand, my own opinion is that such exhibitions ought not to be allowed; indeed, the accident which happened to Mr. Ira Paine abroad, when his assistant lost a portion of his thumb, for which he obtained damages in England, shows that this opinion is well founded.

The Deringer.

In America the most common form is the Deringer, as made by the Colt's Fire-arm Company. Its mechanism will be

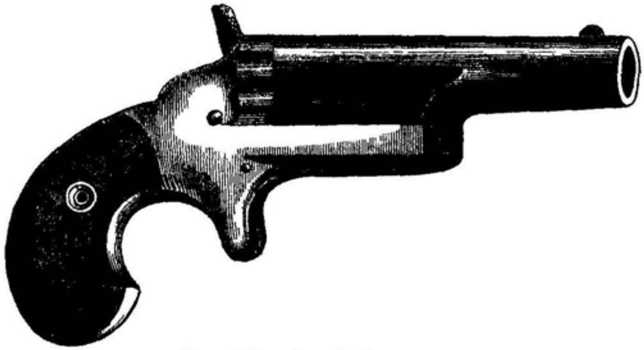


Fig. 151. Colt's Deringer.

readily understood by reference to the annexed engraving (Fig. 151).

BOOK VII.

THE MATCH OR TARGET RIFLE AND ITS AMMUNITION.

CHAPTER I.

INTRODUCTORY.

IT will be readily conceded that one marked result of the Volunteer movement in this country has been that of familiarising a large proportion of our effective male population with the use of the rifle, mainly of course as a military arm. As a necessary outcome of the above state of things, the custom of shooting competitions and matches among riflemen has become quite general; and, independent of its value from a military point of view in bringing out the merits, both of the weapon and the shooter, there is no doubt that this class of shooting has attained the position of a recognised branch of sport; and, therefore, this work would be incomplete without some notice of the rifles, ammunition, &c., most generally approved of and in use for this purposes.

Though the term sport may be cavilled at as applied to rifle shooting matches, there can be no doubt whatever that most of the benefits to be derived from active out-door recreation with sufficient mental work and excitement to give it interest, are to be found in this pursuit as in all true sport: but the training obtainable in following what may be for the time a mere amusement, has in this particular matter a much more grave and important bearing upon our national ability for either attack or defence; since there can be no question that any nation that can venture to familiarise its sons with probably the most effective weapon the art of man has been able to devise, largely augments its fighting value against any assailant whatsoever.

The cultivation of an intimate acquaintance with the "bulls-eye" may lack the thrilling incidents of the tiger hunt, or the absorbing interest afforded by the protracted stalk of the red deer, but to a large and increasing class in this country it is exceedingly attractive; and, therefore, I think no further apology is needed for this section of the volume than perhaps may be conveyed in the following remarks made some century and a half ago by Robins, one of our earliest investigators into the mysteries of small arms. "I shall, therefore, close this paper with predicting that whatever state shall thoroughly comprehend the nature and advantages of rifled-barrel pieces, and, having facilitated and completed their construction, shall introduce into their army their general use, with a dexterity in the management of them, they will by this means acquire a superiority which will almost equal anything that has been done at any time by the particular excellence of any one kind of arms; and will, perhaps, fall but little short of the wonderful effects which histories relate to have been formerly produced by the first inventors of fire-arms."

I shall in this section of my work first consider the long range rifle with aperture sights that existed so long as a muzzle loader, and that is used for the highest class of rifle competitions, and known among riflemen as the "Any" rifle or "Match" rifle, *par excellence*. I shall then devote some little space to the more generally known army service rifle, following with an examination of the leading types of those rifles of a similar class known as M.B.L. or Military Breech-loaders, and shall conclude this branch of my subject with some remarks upon the proper manipulation of these rifles at the shooting range.

CHAPTER II.

HISTORY OF THE MODERN TARGET RIFLE.

I FIND it will be advisable and of assistance to my readers, in enabling them to fully understand the present state of the modern *target rifle*, if I depart from the rule observed in my treatment of both the shot-gun and sporting rifle, because in this case some account of the development of these weapons is almost indispensable before their present value as arms of precision can be fully realised. I therefore propose to give a slight sketch of the history of this class of arm from such a date as will not involve mere antiquarian research. This is necessarily given in a condensed form, but I have endeavoured to be as accurate in my statements as possible, though, through the rather imperfect form in which some of these interesting matters have been placed upon record, some slight amount of error, almost impossible to avoid, may have crept in. The chief authority consulted has been the annual reports of the National Rifle Association, a complete set of which from its commencement have been placed at my disposal. I have also availed myself of such other sources of information as will from time to time be found quoted in the margin. I trust the reader will find within the following pages as fair a statement of the origin and progress of the modern target rifle as it is possible now to obtain.

1852-3.

During this period was carried on a series of investigations that resulted in the production of the so-called **Enfield rifle,** elaborated from the best features of the existing Minié rifle and several other types designed by some of the leading gunmakers of the day.* The chief points arrived at seem to have been (*a*) a reduction in bore (from ·702 to ·577); (*b*) the use of a paper-covered elongated bullet, with a deep cavity in the base containing a plug or cup, which, being forced in by the blow of the explosion, expanded the bullet, and so caused it to engage with the rifling. (*c*) The fact that an odd number of grooves gave the best results with such a bullet, and that "grooves with only one side" (ratchet shaped?) were tried, but the experiments were not sufficiently exhaustive to enable any decided conclusions to be arrived at. (*d*) The depth of groove decided upon was at this early stage no less than ·014, or rather more than *double* the depth of the most approved modern styles, though this was subsequently modified, as will appear in due course. (*e*) Mr. C. Lancaster's contribution to this inquiry was an oval-bored rifle (since so intimately connected with his name); and, though this method of grooving was by no means novel, having been described in a work published about the beginning of the present century,† still it attracted some considerable amount of attention.

Along with this form of groove Mr. Lancaster adopted the American plan of a "gaining twist" or increasing spiral, together with a groove of varying or "progressive" depth, that is, deeper at the breech than at the muzzle, and in this particular model he used an exceedingly shallow grooving. No advantage in either accuracy or trajectory appeared in the trial of this rifle; on the contrary, a similarly grooved barrel, but with an uniform twist of spiral, gave rather better results.

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* Report of Experiments with Small Arms at Enfield. By the Hon. A. Gordon, Lieut.-Col. London, 1853.

† Scloppetaria. By Col. Beaufoy. London, 1808, pp. 87-88.

certainly the trigger cocking of his revolver is so smooth that one could almost expect it; but a public or semi-public trial does not

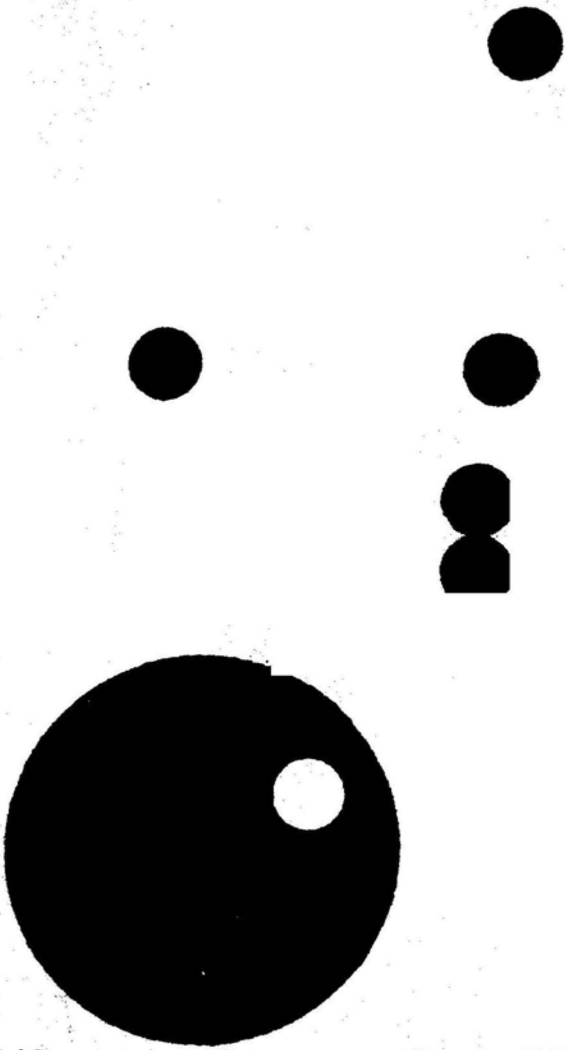

FIG. 138. COCKED ACTION, 12 ROUNDS, AFTER 6 SHOTS, AT 12 YARDS.

always come up to anticipation, and, though he fully realised his wishes at 12 yards, the contrast was very great at 25 yards.

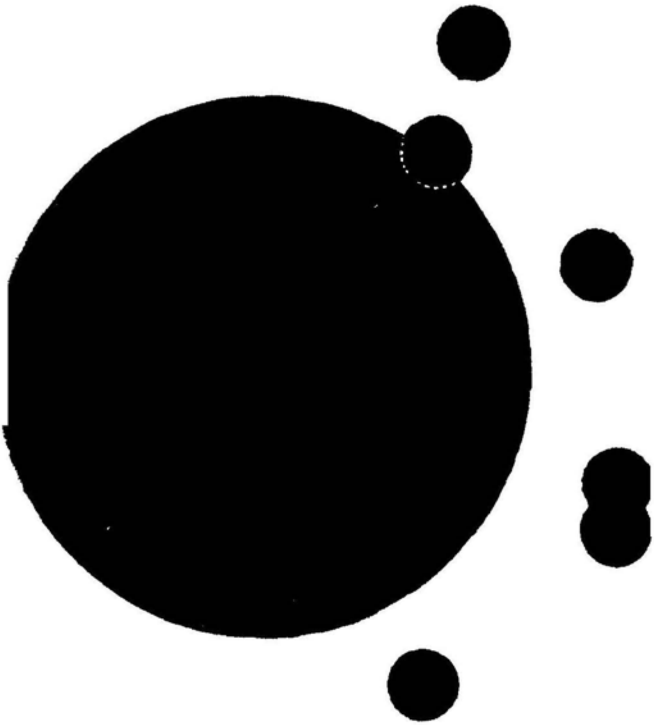

Fig. 140. Cocked Action at 25 Yards after 24 Shots.

Having carried out the above experiments, Mr. H. Webley proposed to fire forty-eight shots as rapidly as possible, showing what may be done in a short time by the reloading of an extracting revolver, in conjunction with reasonable accuracy. Taking the loaded pistol, and having previously wiped out the barrel, but not even oiling the action, and with forty-two cartridges on a table by his side, he fired forty-eight shots at 12 yards in 3min. 5sec., producing the annexed diagram (see Fig. 141). When it is remembered that this cartridge will penetrate nine half-inch deal boards at 12 yards, this wonderful shooting shows what may be done by men only armed with revolvers if attacked at close quarters; and notably if the smoke could be prevented by the use of a smokeless powder, which we hope soon to see accomplished, even at the cost of diminished accuracy.

1854-7.

A gradual progress was made during this period, inasmuch as the Enfield rifle was the subject of improvement in details chiefly affecting the barrel and ammunition. The Lancaster rifle, too, was benefiting by a similar process. It is here that allusion may be made to the efforts of General Jacob toward the improvement of small arms in range and precision of fire. This gallant officer had experimented upon this question for a number of years, and had finally arrived at the conclusion that a plan involving the following details was calculated to give the most generally satisfactory results. A short barrel was preferred, 24in. only in length, of rather less calibre than the Enfield (·530 only), rifled with four deep grooves having the rapid twist (for the calibre) of one turn in 30 inches. The projectile used was a conical bullet (or shell), having a long and sharp point and four projecting wings or snugs on its cylindrical portion to engage with and fit the grooving. This plan never came into general use, the severe recoil and exceptionally high trajectory seriously discounting the fair degree of accuracy obtained.

This period is, however, most noticeable on account of its having been occupied by the experiments of Sir Joseph Whitworth, to whom must be ascribed the entire credit of having thus established the main principles upon which is founded every form of modern small bore rifle; his work will be found fully described at the end of this chapter.

1858-9.

No particularly marked step in the farther development of the rifle took place, excepting that gunmakers and others were busily engaged in inventing and perfecting rifles differing from the Whitworth, more or less, in points of detail, but, almost without exception, retaining the leading features of that weapon. About this time, several plans of breechloading rifles were introduced, all with the paper cartridge, and depending more or less upon a wad for rendering the breech gas-tight. These devices were all more or less short lived, excepting that of Mr. Westley Richards, which has existed down to recent times, though of course, since the introduction of the metallic cartridge, it has been forced into a subordinate position by the modern type of breechloader.

1860.

A most important chapter in the history of the rifle, was opened by the inauguration in this year of the National Rifle Association "for the encouragement of rifle corps and the promotion of rifle shooting throughout Great Britain," also "by establishing rifle shooting as a *national pastime* to make the rifle what the bow was in the days of the Plantagenets, the familiar weapon of those who stand forth in the defence of their country." That this admirable institution has had considerable influence, and generally of the happiest kind, upon all rifle matters is well known, and in fact the N.R.A., as it is familiarly called, has thoroughly identified itself with the history of target rifle shooting wherever the English language has penetrated. The chief winning scores at this meeting were made with Whitworth rifles, excepting in those cases where the competitors were restricted to the use of the Enfield rifle.

A rifle by Ingram, of Glasgow, with the ratchet shaped groove, and using a cylindrical hardened expanding bullet, secured a position in the prize list.* The B.L. rifle of Westley Richards, before alluded to, also made its mark on this occasion as on many subsequent ones, the barrel of this rifle was grooved on a modification of the Whitworth

* *Volunteer Service Gazette*, Vol. XV., page 761.

plan calculated to facilitate the use of a cylindrical bullet *not* mechanically fitting the grooves, as this latter arrangement is obviously unsuitable to a B.L. rifle.

1861.

At the N.R.A. meeting this year first appeared the since well-known "Henry" rifle, the grooving of which is shown on p. 251 of this volume. This modification of the Whitworth system was professedly brought out for the purpose of rendering the use of a cylindrical bullet less objectionable than it was with the Whitworth rifling, and to a great extent was successful, though the inventor, when requiring great accuracy, did not scruple to use a mechanically fitting projectile—so strong was the desire to profit by the researches of Sir Joseph. Subsequently Mr. Henry, by remodelling some of the details of his grooving, as pointed out on p. 252, succeeded in obtaining for his barrel considerable notoriety as a breechloader, and finally, as we shall see, its adoption for the service arm. Several other rifles by different makers, one of the most prominent being Mr. Turner, came into notice at this meeting, but no marked advance was perceptible. This year the first official notice of an improvement in the Enfield rifle that had been slowly arrived at during the previous years, appeared in the form of a statement by General Hay, and was to the effect that the modified groove was quite altered in its proportion; instead of being of one uniform depth from breech to muzzle of ·014 of an inch, it now was made ·015 deep at the breech end, diminishing to only ·005 at the muzzle. This is worth noting, as these proportions have held good to the present time, even through the change of the arm from the M.L. to the B.L. Snider.

1862.

The preliminary trials of rifles early in each season, first established by the N.R.A. in 1860, for the purpose of dis-