CHAPTER II.

THE RIFLE.

WHILE drills, dress parades and guard-mountings make up the rudiments of a soldier's education, the rifle and rifle practice should form the subjects of the first and most important chapter.

I will not here go into the details of this interesting study, but will confine my remarks to some of the errors and inaccuracies of fire, susceptible of practical correction, chief among which is that resulting from the miserable sights forced upon the service rifle.

When firing in vacuo, the trajectory is easily traced and its properties simply discussed. Considering its position with reference to the line of sight it will be seen that near the muzzle it is below the line of sight for some distance, then it cuts it; beyond this point it rises above the line of sight for some distance, then falls and cuts it again. This second point of intersection is the point blank and determines the point blank range. With a good rifle, up to 175 or even 200 yards, the line of fire will not cut the line of sight; or, in other words, it will not shoot high.

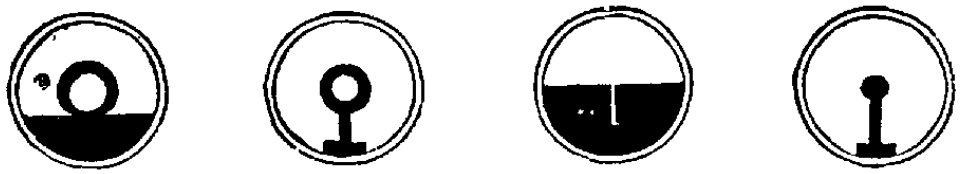
In my practice with a 50 calibre Remington in a still and light atmosphere, this point was found to be at an average distance of 183 feet from the muzzle. Now, inasmuch as it is necessary, in order to hit an object within or beyond the point blank, to aim below or above it certain distances, it is readily seen how indispensable are the contrivances (sights) which will so alter the point blank as to make it coincide with any object directly aimed at. The range in vacuo equals $\frac{2xy}{g}$ in which x and y are the horizontal and vertical components of the im-

pulsive force, and g the acceleration due to the force of gravity. From this we see that (velocity being constant) the range will be the same when the angles of fire are equally distant from 45° ; thus, angles of fire 36° and 54° will give the same range. It is also seen that the range will be a maximum when xy is a maximum, or when $x=y$, or when the angle of fire is 45°. Also, that when the angle of fire is 45°, the height of the culminating point of the trajectory is equal to one-fourth the range and is a maximum—that it is o when the angle of fire is o or 90°. These simple laws of motion of a projectile in vacuo are greatly modified when the movement is through air. For instance, in air the maximum range with our service rifle is attained with an elevation of about 30° (while it is 45° in vacuo).

The progressive velocity of fall of the bullet being so much less than its initial velocity, the air resistance opposed to its descent will be inappreciably small in comparison with that in the direction of its motion of translation (the resistances being proportional to the squares of the velocities). Hence, when the bullet would have been at certain points, in vacuo, it will in reality be at points below and in rear of them, by distances increasing from the point of departure (since the resistance of air causes the spaces passed over in equal times to become progressively smaller and smaller), thus causing the trajectory in air to be constantly below and in rear of its place in vacuo and changing its curvature, so that the left branch presents a flattened form while the right branch approaches the vertical. From thus destroying the symmetry of this curve, there results that the angle of fall is greater than the angle of ascent, and more considerably so as it is distant from the origin, that the point of culmination is lowered, and that the range is greatly diminished.

In practice the object aimed at has a certain height ; hence, it will not only be struck when at point blank, but also when at points in rear or in front of the point blank where the vertical

service is more on the order of hunting than range practice). The globe of this sight is so constructed as to permit the use of all descriptions of sights, detachable pieces of the various forms in use being slipped into a slot in the globe and held by a screw



The four sights represented seem to be favorites with the best long-range shots.

A spirit-level and wind gauge adjustment may be attached to this sight, and insure any degree of nicety.

Then replace the open rear-sight by such a sight as is found on the Remington-Creedmore rifle and represented on the following page—one provided with a vernier scale operated by a screw that will accurately mark an alteration of less than the one-hundredth of an inch in the elevation, each minute of elevation on the scale corresponding to about one inch for each 100 yards of range,—and we will have a system of sights in keeping with our rifle and the efficiency of the arm will be assured. There is nothing objectionable in such sights, and their adjustment is extremely simple. To adjust the rear sight, the eye-piece is first loosened, then after the sight is properly set by means of the screw, the eye-piece is tightened and holds the slide firmly, irrespective of the screw, which is intended only for convenience in adjusting the eye-piece.

We have an excellent rifle, handy in itself and a hard shooter, but its sights have annoyed every officer who has had occasion to use it.

Before proceeding I will call attention to a rear sight made by William Lyman, of Middleford, Conn., which is most excellent. I can do better shooting with it than with any other, when the target is a moving object.

When aiming, it has the appearance of a ring or hoop, which shows the front sight and the object aimed at, without inter-

when passing clouds intercept portions of the sun's light and heat. It is readily seen how this disturbance might set up currents in the air which would tend to carry the bullet from its course, and how the rays of light deflected from their course before reaching the eye would cause the target to apparently occupy a false position. It will be well to diminish the elevation should the sun suddenly appear and light up the target while the firer still remains in the shade, and to increase it should the target remain in the shade while the sun shines on the firer.

14. Bright sights and barrels are obviously objectionable. The reflection of the sun's light on the sights causes them to appear as brilliant points and precludes the possibility of an accurate aim. If the sun's rays come laterally the trouble will be yet greater, inasmuch as they will brighten the rear side of the front sight and the opposite side of the rear sight notch and cause a tendency to shoot away from the sun.

The refraction of the sun's rays from the polished barrel causes the target to become indistinct and to assume the appearance of motion. The sights and barrel about the muzzle should be blackened with smoke if nothing better is at hand.

15. The effect of the wind upon the trajectory and the allowance to be made therefor are most troublesome questions for the marksman. Winds are generally classified as follows :

Gentle, 4 miles per hour.

Moderate, 10 miles per hour.

Fresh, 20 miles per hour.

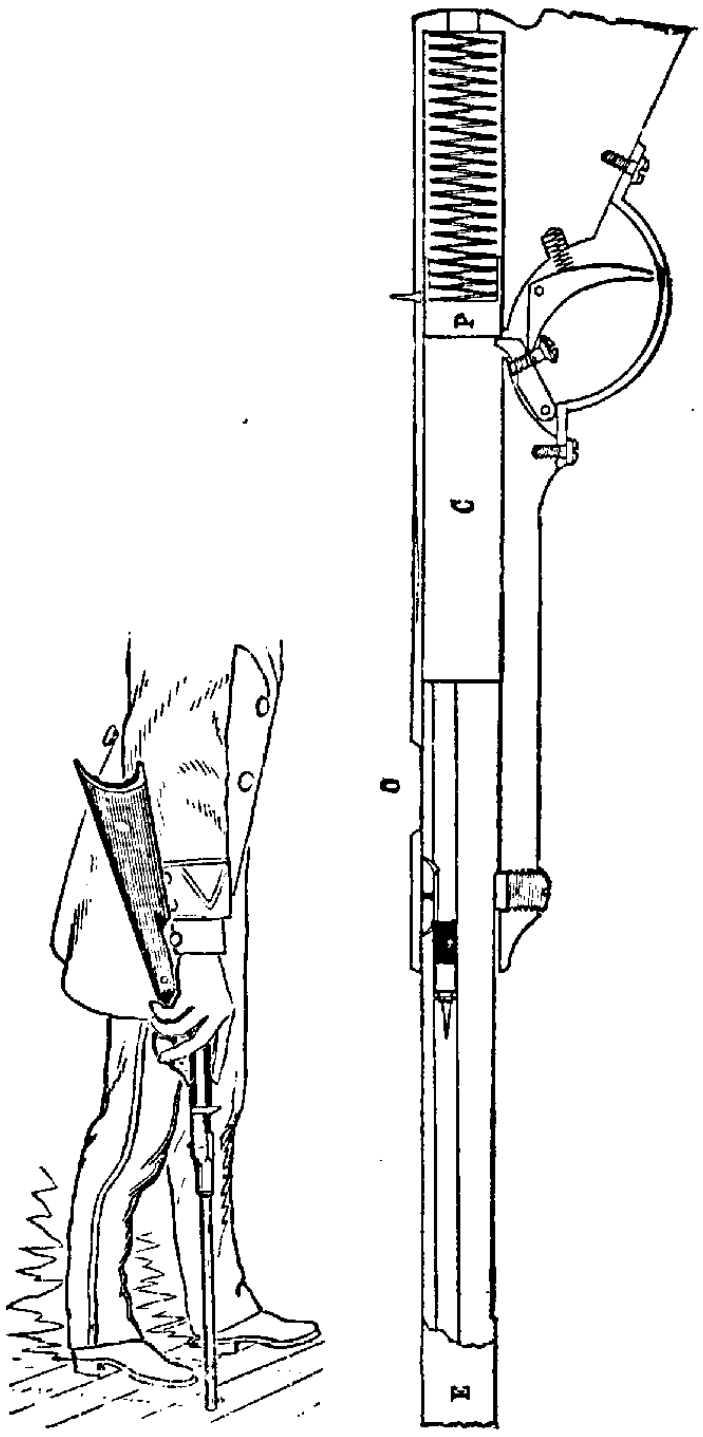
Strong, 35 miles per hour.

Very high, 50 miles per hour.

Gale, 80 miles per hour.

Inasmuch as the wind is continually changing in intensity and direction, it is almost impossible to make tables of allowances for it. The best skill and judgment of the marksman are brought into play when firing in mountain districts, where there are many cross-currents with which to contend. All

air from the chamber (*C*) through the barrel (*E*) with great force, carrying the dart or slug before it. To load, the barrel (*E*) is pushed into the chamber (*C*) which re-sets the piston



and compresses the spring, as above shown. The barrel is then withdrawn until the opening (*I*) in it corresponds with the opening in the head at (*O*) so that the dart or slug may

In case the rear sight is replaced by one with a more accurate graduation, care should be taken not to place it too near the eye, else it might become out of focus and indistinct when the eye is directed at the object aimed at.

It is a good rule to carry the rifle at half-cock, and never allow it to point at any one, whether loaded or not.*

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* Those desiring a more thorough knowledge of this subject are referred to the excellent work of General George W. Wingate.