WHAT MAY BE DONE AT CREEDMORE.

LETTER FROM QUARTERMASTER GENERAL MEIGS.

We are permitted to publish the interesting letter which follows, addressed to General Meigs, Quartermaster General, to the President of the National Rifle Association.

Colonel William C. Church, President National Rifle Association.

DEAR SIR,—Permit me to suggest that there be set up at Creedmore the fixtures necessary to enable every marksman to determine quickly, and with ease to himself, the actual path of the bullet from his own favorite rifle.

It is easy. Two or three trial shots through thin paper screens, all hung precisely in line whether vertical or horizontal, an observation and measurement of the position of the holes made by the passing bullet in each screen, and a projection on a paper or on a blackboard, and the thing is done—and done **forever.**

While all understand that the path of the bullet, the trajectory is a curved line, and that for different distances between elevations of the sight must be used, or different allowance for the rise or fall of the bullet above and below the line of sight must be made, very few in this country know exactly or approximately what is this curve; what are these elevations and depressions.

The theory of falling bodies tells us that a round ball moving in a vacuum with a velocity of 1200 feet per second, and occupying one quarter of a second in travelling 100 yards, 300 feet, will fall by the time it reaches the target at 100 yards 0.994 feet *i.e.* 12 inches.

At the 150 yard target, which it would reach in 3-8 of a second, its fall below the line of fire would be 24 inches. The velocity in a vacuum remaining uniform, it would reach the 200 yard target in half a second, and its fall in that time would be 47 and ¾ inches.

In a resisting medium, such as the air, the velocity is continually reduced, the time of flight increased, and therefore, the fall of the round ball below the line of fire should, with this velocity of 1,200 feet per second, be greater than the figures given above indicate. The curve, the trajectory, in air is also a figure of greater curvature than in a vacuum, and this curvature increases rapidly as the ball, longer exposed to the resistance is more and more retarded.

But there is something in the action of the air upon the conical bullet in common use which materially modifies these results.

The trajectory of the Springfield rifle to 300 yards has been determined experimentally by the officers of the Ordnance Corps of our army by firing through paper screens at intervals of 25 yards.

The bullet is .50 calibre, 480 grains weight. The charge of powder of 70 grains gives it an initial velocity of 1,225 feet per second. It may be assumed that it occupies ¼ of a second in reaching the screen at 100 yards, and at least 3-8 of a second in reaching that at 150 yards.

Plotting from the figures of the table given in the ordnance publication the ordinates of the first half of the trajectory, *i. e.*, to 150 yards, and laying down the curve, if we draw a line of sight to the point where this curve crosses a vertical ordinate 105 yards distant from the piece, and through a point one inch above the axis of the rifle at its breech, we find that the curve as determined by the Ordnance Department, departs between these limits from the straight line of sight nowhere as much as one inch. The trajectory, up to 120 yards—a good spotting limit—lies generally within a half inch of the line of sight. To give details: It lies below the line of sight until, at 40 yards, it crosses it; at 80 yards it is 48-100 of an in. above the line of sight; it crosses it again at 105 yards; at 120 yards it is only 4-10 of an inch below; at 130 yards it is 1 and 1 8 below. Thus the bullet itself, not being a mathematical point but having a certain thickness—viz., ½ inch—it will touch some part of a circle half an inch in diameter, if properly aimed at it centre, at all distances between 20 and 120 yards—and this shooting off the same sight unchanged. This is practically shooting, not in a curved trajectory, but in a straight line.

I think that the extraordinary flatness of this 120 yard trajectory, or rather of the first half of the 300 yard trajectory of the Springfield rifle, is due to the resistance of the air upon the lower side of the conical bullet and to the slight obliquity of the axis of the bullet to the line in which it progresses; so that the bullet actually sails like a kite in the air. The centre of gravity of the bullet is also behind the middle of its length. This may give the bullet a tendency to drop at the rear end like a boat trimmed by the stern. It is possible, nay, probable that there is a form of bullet, the effects of whose length, diameter, position of centre of gravity, arrangements of grooves to create resistance at the rear end, as in the feathered arrow, may so balance each other that, with a proper velocity, its path (its trajectory) may, to certain distances, be absolutely a straight line, or rather, may be contained in a horizontal plane. It will be subject to deviations to right and left, due to frictional resistances and its rapid rotative velocity. A clam shell thrown from the hand will frequently rise above the straight line, and have a trajectory convex downward. Careful and exhaustive experiments upon the effect of form of bullet upon the flatness and curvature of the trajectory, *i. e.*, upon the length of its effective killing range and its accurracy of fire, are much needed. It is form only which makes the clamshell's trajectory concave upwards and the round balls concave downwards. For have any idea of the commercial importance of such experiments. It is stated that a single factory once took an order for fifty million metallic cartridges. The bullets in those certridges will consume over one thousand tons of lead. It is worth something to know the best shape into which to put this quantity of metal. Consider, too, the cost of the copper, the gun powder, the fulminate used in these cartridges, and then the cost of equipping and maintaining the army which is to depend for the success upon the flatness and accuracy of the line of fire which this cartridge may develope—in action.

This discussion of the 150 yards flight of the Springfield rifle shows that, at least for that distance the bullet used in determining the 300 yard trajectory is as nearly perfect as can probably be hoped for.

Creedmore is devoted to the improvement of the people in rifle shooting. Give them the means of knowing how their guns shoot. It takes many shots, on different days, at different ranges, to determine this as ordinarily determined by each marksman who aims to become a good marksman.

All windy days are unfit for the trial, and it is long before the definite result is reached—and then the results at different distances do not hang together, are not collated.

I believe that little game is killed at beyond 200 yards; and the trajectory at all ranges up to 200 yards may be determined in half an hour upon a shooting ground properly prepared.

Let 9 stout posts be set in line at intervals of 25 yards, the tops all in exactly the same level. In each post there should be a horizontal mortice, into which a horizontal rod ¼ in. by 1 in. should be inserted so as to be easily replaced if broken by a bullet. This rod, 24 inches in length should be in the same level plane as the upper edge of all the others.

Sheets of thin paper—a newspaper page will answer—should be hung from each rod by tanks, or spring clothes pins, the upper edge of the sheet being folded down upon the upper edge of the supporting rod. The crease or fold thus formed in each sheet will be the base from which to measure the altitude of the bullet hole.

Then let the marksmen, aiming as nearly horizontally as possible, fire a shot through all these 9 screens. Each hole should be marked No. 1. Two or three successive shots, the holes made by each being duly numbered, will suffice to give with extreme accuracy the behaviour of the rifle. Upon a blackboard, or upon a sheet of paper, nine vertical lines being drawn at any convenient but equal interval—the lines of a sheet of ruled cap paper will do—a horizontal being drawn at the top, these lines being numbered from 1 to 9, lay off from the horizontal line the actual distances in each vertical between the fold or crease at top of the corresponding screen and the centre of each bullet hole in that screen.

Lines connecting the parts thus obtained will give the successive trajectories; the vertical scale being true, the horizodtal scale being greatly diminished, as say, 1 in., to 25 yards—or ¼in. to 25yards. If the rifle is a good one, and the ammunition good and uniform, the vertical projections thus obtained of the several trajectories will be very nearly identical curves. They will diverge, more or less, as the aim may have been more or less irregular; but any one curve when drawn, will be found, if laid over another, to very nearly coincide with it.

The nine sheets of paper, properly numbered and labelled, can be taken hence and preserved, and will be found a most useful record of the performance of a rifle, answering all sorts of questions as to range, elevations, accuracy, etc.

Thus half an hour's shooting will really give better knowledge of each marksman's rifle than can be had in a whole season's hunting or target shooting. I do not mean to say it will give skill or manual dexterity in aiming, but it will make plain what the aim should be, what should be sought or attempted at all distances under 200 yards, and in the woods and on the prairies this is all their information that the most successful hunter needs. Manual skill, correctness of hand and eye, can be obtained only by long practice. But knowledge guides practice.

Very truly yours, M. C. MEIGS.

Prussian military organs describe the siege operations at Grandeux, undertaken to destroy scientifically the fortifications of that place doomed to dismantlement, as highly instructive. About 1,500 tons of gun-powder have, been already expended. Gun cotton is to be used, in order that its efficacy may be compared with that of gunpowder.