THE INFANTRY SCHOOL
Fort Benning, Georgia

STUDENT MONOGRAPH
Advanced Infantry Officer Course
Class #1
1953-54

TITLE

FORWARD OBSERVATION OF INDIRECT FIRE BY THE INFANTRYMAN

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PREFACE

It is hoped that this study will help simplify one of the most difficult problems of forward observation we face today. If it in itself is not the answer to the problem, it is the desire of the author to stimulate thinking on the part of other Infantrymen vitally concerned with this problem.

Appreciation is expressed to the monograph advisers of the Weapons Department of The Infantry School and to the staff of The Infantry School Library for their assistance in the preparation of this study.

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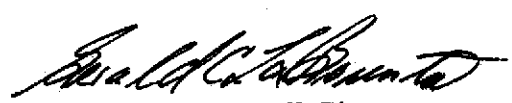

15 November 1953

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INTRODUCTION

"Crakys of War" was the name given the world's first cannon, believed to have been used by Edward III in his campaigns against the Scots in 1327. Since that time constant improvements have made today's cannon one of the most important weapons of war. Certainly, to the Infantryman, upon whose shoulders rests the responsibility for the enemy's final defeat, it is the most important of supporting arms.[1]

Edward III is definitely known to have used cannon in 1347 in the seige of Calais. However, their use was relatively ineffective due to the scarcity of gunpowder. For one hundred years following, men strived to develop a cannon with which the walls of a town could be knocked down in the conduct of seige warfare.[2]

In the year 1440, Henry VI used a cannon composed of fourteen long bars in a circle like the staves in a barrel (hence the word barrel as used today). The bars were welded together and strengthened by hoops of iron shrunk onto staves. A vent at the rear of the barrel was primed with loose powder and set off with a match. At this time the cannon was used more as a psychological weapon than as one of destruction, for its noise was considered to have a more adverse effect on the enemy than its projectile.[3] A. W. Wilson tells us of a book written by Nicholas Tartaglia in 1537-43 which was dedicated to Henry VIII. In it Tartaglia suggests means for causing "any great piece of artillerie to make in his discharge an exceeding great noyse and marvellous rore." Tartaglia also gives a table of ranges possible with two guns, the Faucon and Saker:

"Faucon: poynte blank 320 yards Utmost Random (extreme range) 1280 yards.

Saker: poynte blank 360 yards Utmost Random 1440 yards."[4]

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1. Wilson, A. W., Lt, "Story of the Gun," Field Artillery Journal, Dec 45, p. 722.
2. Ibid., p. 722.
3. Ibid., p. 724.
4. Ibid., p. 726.

Henry VIII obtained two gunmakers, Peter Bawd and Peter Van Collen, to make mortars for him in 1543. Some of these measured eleven inches and nineteen inches in diameter.[5]

The first exploding shells were used in mortars in 1543. The shells were stuffed with "wild fire or firewoorkes and a match (fuze) that the firewoorke might be set on fire for to break in small peeces, whereof the smallest peece hitting any man would kill or spoile him."[6]

By 1588 exploding shells were being used to good effect. A. W. Wilson states, "The method of igniting the fuze was either by placing the shell in the bore (fuze toward the charge so that on being fired it would ignite the fuze) or by placing the fuze toward the muzzle, when it was lighted by a match thrust down the bore. It needs no imagination to appreciate the high mortality among those gunners who had to perform this latter task."[7]

Artillery, however, was never used in an indirect fire role until the British, because of Boer tactics, were forced to use it in the Boer War. During the seige of Therouenne by the Burgundians in 1543 (not to be confused with Henry VIII's seige of 1513), the artillerymen of Therouenne observed that the enemy made use of a valley which was screened by a crest from the guns of the town. By the aid of bushes judiciously placed on the crest of the hill the guns were trained on vulnerable portions of the valley. Flank observers were placed on the crest and, by signals, indicated to the guns which bush to fire over. This, however, was used merely to overcome a local difficulty, and not as a regular practice.[8]

Prior to the time of the Boer War, because of the artillery's inability to shoot and run for cover, the gunners faced the enemy in the open, firing their pieces from exposed positions. The British, finding it necessary during the Boer War to conceal their guns, developed a system of indirect

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5. Ibid., p. 725.
6. Ibid., p. 725.
7. Ibid., p. 725.
8. Ibid., Apr 46, p.223

fire, from which has stemmed our modern methods. They used an improvised sight, known as the "Gunners Arc," which consisted of a piece of wood fastened to the forsight, into which holes were bored at one-half degree intervals. A match stick was then placed in the central hole and the sights aligned on an aiming point. Observation was carried out from a nearby crest. The observers gave corrections, such as, "Right two degrees." The match stick was then taken from its center hole and placed in the fourth hole to the left. The sights were once more laid on the aiming point, and the gun had thereby moved two degrees to the right.[9] This, of course, is the same principle we employ in the sighting of our indirect fire weapons today.

Indirect fire, at that time, was a fairly simple procedure, since the observer remained within view of the gun and on the gun-target line. This was possible because of the limited range of the weapons.

With the advent of longer range indirect fire weapons, the observer's remaining on the gun-target line, and within view of the guns, is no longer feasible if advantage is to be taken of the greatly increased capabilities of the weapons. This situation has brought about our modern fire direction centers, with their plotting boards, deflection fans, computers, and firing data sheets. It has also led to many changes in forward observer procedure. The procedures in use just a few years ago were very complicated, to say the least. However, primarily through changes in the fire direction procedure, forward observation has been simplified a great deal. Nevertheless, those of us who have had experience in forward observation will agree that it still leaves much to be desired.

Not only in the actual conduct of forward observation do we encounter many confusing difficulties, but also in the training of new forward observers. One of the greatest of these difficulties is the use of the "WORM" formula, which is the mil relation formula used to change mils to yards.[10]

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9. Ibid., p. 223.
10. Department of Army FM 6-135, Adjustment of Artillery Fire by the Combat Soldier, Government Printing Office, Washington, 1950, p. 8.

This is certainly an important item if the fire of an indirect weapon is to be placed quickly and accurately on a target. Although fairly simple, it has been the experience of the author that this formula is most often not used by an observer because it is somewhat confusing and, therefore, guesswork is resorted to. This guesswork is used at the expense of timeliness. Many Infantrymen have, at one time or another, had to sustain the adverse consequences of a forward observer's inability to place fire on a target quickly.

We are a "gadget-minded" people. Upon encountering difficulties of this nature, we ask - "There must be a gadget to take care of this problem - where is it?" The author proposes herein a "gadget" to help solve our "WORM" formula problem.

The "gadget" referred to would eliminate the necessity of the forward observer's having to use the "WORM" formula. Elimination of the necessity, without sacrificing accuracy, would greatly facilitate the placing of indirect fire on a target. The importance of quick, accurate fire in support of the Infantryman is obvious. In this study the construction and use of the "gadget" is explained.

It is the purpose of this study not only to explain its construction and use, but also to show just how valuable such an item can be to the average Infantryman in the adjustment of indirect fire.

DISCUSSION

The "WORM" formula has long been one of the most confusing aspects of forward observation of indirect fire by the Infantryman. This formula, although relatively simple, is easily forgotten by those who do not work with it daily, and neglected by many of those who do. As a method used to determine the number of yards a shell burst is off of the observer target line, it is simply W = RM. W meaning width in yards, R meaning range in thousands of yards, and M for the number of mils deflection, as measured with a pair of binoculars.[1] With this formula the observer determines the number of yards that the burst must be moved to bring it on the observer target line. Once on the observer target line, the observer continues to adjust fire by "bracketing" the target until a hit is obtained. Thus, at an estimated range of 2000 yards and a deflection measurement of 40 mils, the observer multiplies 2 (range expressed in thousands of yards) by 40 (mils). The result, 80, is the number of yards the deflection must be changed to get the burst on the target line.

FM 6-135 states, "In solving for any one of the elements M, W, or R, a simple rule for using the formula is to remember the word WORM, written $\frac{W}{RM}$ (W Over R M)."[2] That seems to be simple enough, but obviously, it is not, for the reasons stated above. Not only do observers easily forget it, or neglect it, but it also poses a problem in training, since it is very difficult to "get across" to students. Both officers and enlisted men, to whom this knowledge is "a must," fail to grasp it. This writer has personal knowledge of experienced officers in combat, with excellent combat records, giving commands to mortars, such as, "A little bit more to the left." Any Infantryman, at some time, may have occasion to control indirect fire in combat. The speed and accuracy with which they accomplish this may "save the day."

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1. Department of Army FM 6-135, Adjustment of Artillery Fire by the Combat Soldier, Government Printing Office, Washington, 1950, p. 8.
2. Ibid., p. 8

The need for some means with which we can overcome this problem is readily apparent. A small automatic range and deflection finder is out of the question at this time and the "WORM" formula must still be used for accurate fire direction. In order to eliminate, or at least simplify, the problems encountered in the use of the "WORM" formula, the item of equipment described herein is proposed for use by all Infantrymen who may have occasion to direct fire.

For want of a better name, let us call this "gadget" a "Deflection Guide." One of these in the hands of each forward observer, each rifle company officer, and each Infantry squad leader should help immeasurably.

The unit itself consists of three discs fastened together by a rivet, on which all discs can rotate in the same fashion as an M-10 Plotting Board. On one side of the inner disc, in a circular arrangement, are listed ranges in 100 yard increments. For purposes of illustration, as shown in Appendix A, the ranges will be graduated from 100 yards to 3600 yards. On this disc also will be listed the actual yardage deflections applicable to each range for the various mil sensings. They will be arranged vertically from directly underneath the respective listed range to the center of the disc. The outer disc on this side of the guide will be made of some opaque material with an opening wide and long enough to expose all yardage deflections listed under any one range. On this outer opaque disc, beside the opening, will be listed the various mil deflections. Each mil deflection will be so arranged as to be beside its respective yardage deflection listed on the inner disc.

Upon making his deflection sensing in mils, the observer would merely rotate the discs until the opening of the outer disc was aligned with the estimated range reading on the inner disc. Then, reading down the listed mil deflections, he would find the corresponding yardage deflection listed on the inner disc. Here, of course, his multiplication has been done for him. Moreover, his accuracy has been increased because he has neither

resorted to guesswork, nor made a simple error in calculation. For example, using Appendix A, assume that the observer has determined his observer target range to be 1000 yards and sensed his burst to be 40 mils off the observer target line. Rotate the outer disc until the opening is aligned on the 1000 yard indication on the inner disc. Then, reading down the side of the opening to 40 mils, note that the deflection reading is 40 yards on the inner disc.

As a second example, suppose the observer estimated the range to be 1500 yards and sensed his burst to be 80 mils off the observer target line. Again aligning the outer disc on the inner, reading down the mil listing to 80, he reads the yardage deflection of 120.

The third disc, on the other side of the Guide, would be used for deflections of over 150 mils. On this side the same ranges would be listed as are listed on the first side, but the mil deflection listings would merely be a continuation of those listed on the first side. For example: If the mil deflections on the first side are from 5 to 150, the reverse side would list mil deflections from 155 to 250. Another idea would be to list all deflections of over 100 mils in increments of 10 mils. This, for two reasons: Mil deflection readings, with the binoculars, of over 100 mils, cannot be measured accurately to within 5 mils; and secondly, we would thereby more fully utilize the limited space on the Guide.

Now the question is, of course, what do we do about extremely long ranges, or mil deflections. As was originally stated, the ranges and mil deflections as used here are merely for purposes of illustration. In the actual manufacture of this item, it is possible to increase both considerably. However, this should not be necessary. It is infrequent that the forward observer will adjust fire at ranges of over 3600 yards from himself. Also, the mil deflections as listed should take care of almost any situation. In those rare instances when firing at longer ranges or greater mil deflections than those listed, the observer need only find the range or mil deflection,

which is exactly half of the measured range or deflection. Taking his deflection yardage from this reading, he need only double it to arrive at his answer. For example, he measures a deflection to be 400 mils at 2000 yards. Since 400 mils is not covered on the Guide, but 200 mils is, use the latter, which is one-half of 400. He sees that the yardage deflection for 200 mils at 2000 yards is 400 yards. He needs only double 400 to arrive at his answer, 800 yards. This is also true of the ranges greater than those listed on the Guide. At a range of 4000 yards and mil deflection of 200, the observer takes one-half of 4000, or 2000, and finds the yardage deflection to be 400. Again, doubling this number, he knows his yardage deflection of 4000 yards to be 800.

It can be seen that this is a very simple procedure. However, for the benefit of those observers who feel that this, also, is too complicated, and will forget to use it, let us place a reminder on the face of the disc, such as, For Ranges or Mil deflections greater than those listed, take one-half the actual Range or Mil deflection and double its reading.

Also on the face of the Guide, let us put a sample initial fire request along with a sample subsequent correction. Although fire can be put on a target without the observer's adherence to these standardized procedures, we all agree that their use saves the time of the fire direction center and consequently the fire support is received more quickly. Field artillerymen tell us that one of their limitations is the time required for fire direction center to transform the fire request into firing data for the guns.[3] In the interest of timely fire support, let us not delay this procedure any longer with inadequate fire requests. The author thinks the value of this simple addition to the Deflection Guide needs no further explanation, as it is readily apparent.

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3. The Infantry School, Tactical Employment of Field Artillery, Problem #2673, Fort Benning, Georgia, 1 Sep 52.

The weight of the Deflection Guide would be practically negligible and would thereby be no extra burden to the Infantryman who must carry it. Its size could be such that it would easily fit in the field jacket or fatigue jacket pocket. It could be made of some durable plastic material that is flexible and not subject to damage by moisture. With these characteristics, it would be a satisfactory item of equipment for any Infantryman to carry.

Its cost should be relatively insignificant also. It should not cost more than a few cents to manufacture and the value received will compensate for the cost many times. It is similar in construction to the M10 Plotting Board, which costs less than one dollar to manufacture.

Large working models of the Deflection Guide could easily be produced by any Training Aids shop, as are large models of the M10 Plotting Board. An instructor using a large working model, and equipping each student with a Gufde, could put across the necessary information more easily than he could the "WORM" formula.

It has been the experience of the author that the average front line Infantryman is not enough mathematician to use the "WORM" formula mentally and consequently does not bother to use it, even though he may remember it from his basic training. Moreover, the average Infantryman does not carry a paper and pencil which he can use for calculations. The Deflection Guide would solve these problems also.

One Guide in each squad would be sufficient. It is a very extraordinary situation when one member of a squad can observe a portion of the front that another member of the same squad cannot observe.

CONCLUSION

The need for a device to assist the forward observer in directing the fire of indirect weapons is readily apparent from the very fact that it takes so long to adjust fire, normally. The author believes that this is due principally to the observer's failure in adhering to the correct procedures and neglecting to use the "WORM" formula. Consequently, often the target has moved before the guns can fire for effect. Even if our Research and Development branch of the Defense Department could produce an automatic calculator of some sort, in all likelihood, the cost and/or weight would preclude its general use by Infantrymen; and certainly, any Infantryman is liable to have to direct such fire at any time.

The Deflection Guide proposed herein would, until the advent of unimaginable scientific developments, assist immeasurably, not only in the actual conduct of forward observation, but also in the training of new observers.

The Guide contains all the information the Infantryman needs to accurately and quickly adjust fire. That is, both initial fire requests and subsequent corrections, as well as a guide for figuring corrections. The Guide itself would cover most of the extreme deflection requirements and, with the reminder printed on it, even the extraordinary deflections can be easily figured. The ranges covered by the Guide should cover almost any situation. Certainly, a target at a range of over 3600 yards is not usually visible, and from the front lines is most often out of range of any indirect fire weapon organic to the Infantry Regiment.

With the Deflection Guide, the forward observer need only do three things - find the target, estimate the range, and call for fire.

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