ARTILLERY FIRING

Lectures to The Staff and Line Classes
General Service Schools, Fort
Leavenworth, Kansas,
October,
1919

BY
Major L. J. McNair, F. A.

Line Class:

T. T. 30, October 10.
T. T. 41, October 16.
T. T. 54, October 23,

Staff Class:

T. T. 26, October 10.
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Contents

Artillery Firing

General

1. Artillery firing has changed as a result of the war. Contrary however to the general belief, the changes are not in the nature of discarding the old, but adding to it, developing and refining it, when time and the situation permit. The accomplished artilleryman of today must have a much larger technical repertoire than formerly. For example, corrections for atmospheric conditions have greatly developed, although applicable only under certain conditions. Again, when detailed maps of the *plan directeur* type are available, the newly developed artillery topography affords highly important advantages.

On the other hand, the older, cruder methods in use before the war are still sound, still necessary, and cannot be neglected without dangerously impairing fighting efficiency.

2. It is the aim and duty of the artilery to deliver *effective* fire *when* and *where* needed.

The problem of delivering effective fire on a *given point* at a *given time* is largely one of *technique.*

To insure that the given point and time meet the needs of the infantry and the situation in general is a *tactical* problem; in fact, it is the essence of artillery tactics.

3. This discussion of artillery firing will be confined wholly to technique, and will include the following:

(a) Preparation of fire:
Means of laying artillery.
Methods of laying.

Finding the deflection.
Complete firing data.

(b) Firing:

Dispersion.
Fire for adjustment.
Fire for effect.
Effect of fire.
Clearing a crest.
Reaching a reverse slope.

(c) The special auxiliaries of:

Aerial observation.
Sound ranging.
Flash ranging.
High burst ranging.

PART I

Preparation of Fire

4. The preparation of fire is finding the firing data, which are defined to be "the information and commands necessary to enable the gun squads to accomplish the orderly, rapid and accurate service of the pieces."

Therefore before one can intelligently proceed with the preparation of fire, it is necessary to understand the mechanism of laying a piece of artillery and how it is served.

5. *Mechanism of laying.* The object of laying is to give the piece such an elevation (or depression) in a vertical plane and such direction that the projectile will reach the target.

Formerly the elevation and direction were matters of guesswork and skill on the part of the gunner; with modern artillery the cannoneer executes commands mechanically by means of laying instruments. The cannoneer must have a certain degree of skill and dexterity, but responsibility for successful results rests mainly with those determining the data announced to the cannoneers.

6. *Kinds of laying.* Laying is *direct* and *indirect.*

For direct laying the piece is sighted for direction and elevation on the target itself which must be visible to the gunner.

For indirect laying the piece is given direction by sighting on any convenient designated point (aiming point), and elevation by a quadrant or level. The cannoneers do not see or know the target of necessity.

Indirect laying is easily the predominating method. It has a number of advantages.

The pieces can fire effectively from concealed and protected positions. An aiming point is distinct and definite; the target is generally vague and indefinite. Indirect laying is thus possible when direct laying would either be impossible or very difficult. Indirect laying affords decided advantages of collective control and eliminates difficulties of target designation. It operates to place the brain work of firing on the officer and makes the soldier's work more purely mechanical.

Direct laying is, however, decidedly superior for moving targets.

7. *Laying for direction.* This operation is the same for either direct or indirect laying. A *deflection* must be announced, which is the horizontal angle to be set on the sight in order that the piece when laid will give shots correct in direction.

The gunner, the cannoneer on the left of the trail near the breech, sets the sight at the deflection ordered and traverses the piece till the line of sight is on the aiming point or target for direction.

Laying for direction is not difficult, although errors in sight setting occur occasionally, and accuracy in sight setting must be insisted upon and checked.

8. *Deflection graduation of sights.* Sights are graduated so that all deflections from 0 to 6400 mils may be set. Unfortunately, however, among the various matériels now in our service, there is not uniformity in the method of graduating the deflection scale. The angular unit is generally the mil,* and all except the British howitzers are graduated clockwise; but in the matter of numbering the scale and its origin, there are the following principal systems:

Figure 1 is the old U. S. system, 0 to 6400 mils, with the gun axis at 0, that is, when the sight is set at 0 deflection, its axis is parallel to the gun axis. The limb is graduated in hundreds of mils; single mils are set by means of a micrometer graduated from 0 to 100 mils.

Figure 2 is the system of the French 75 gun now in our service. It is difficult to understand how the minds who conceived this remarkable weapon could also conceive so clumsy a system of deflection graduation; there is no defense for it. The gun axis is at 100. The circle is divided into four quadrants graduated alike. Each quadrant is divided into eight subdivisions of 200 mils each, called plateaux, and numbered successively 0, 2, 4, 6, 8, 10, 12, 14. Thus "Plateau 2" means any one of the four identical subdivisions between 200 mils and 400 mils. A micrometer subdivides the plateaux; it reads from 0 to 200 mils. Readings on the micrometer are referred to as "*Drum,* so and so." A complete deflection

*It is asumed that the student is familiar with the mil and its properties; if not, see par. 14 of the War Department manual "Artillery Firing," or other texts in which the matter is discussed. 1 mil=3.375 minutes, 3⅜ minutes; 18 mils (more exactly, 17.778) =1 degree.

The sight of the British 8-inch and 9.2-inch howitzers is graduated in degrees and minutes, one-half clockwise and the other half counter clockwise; the sight of the 155 Filloux gun (French) is graduated in decigrades.

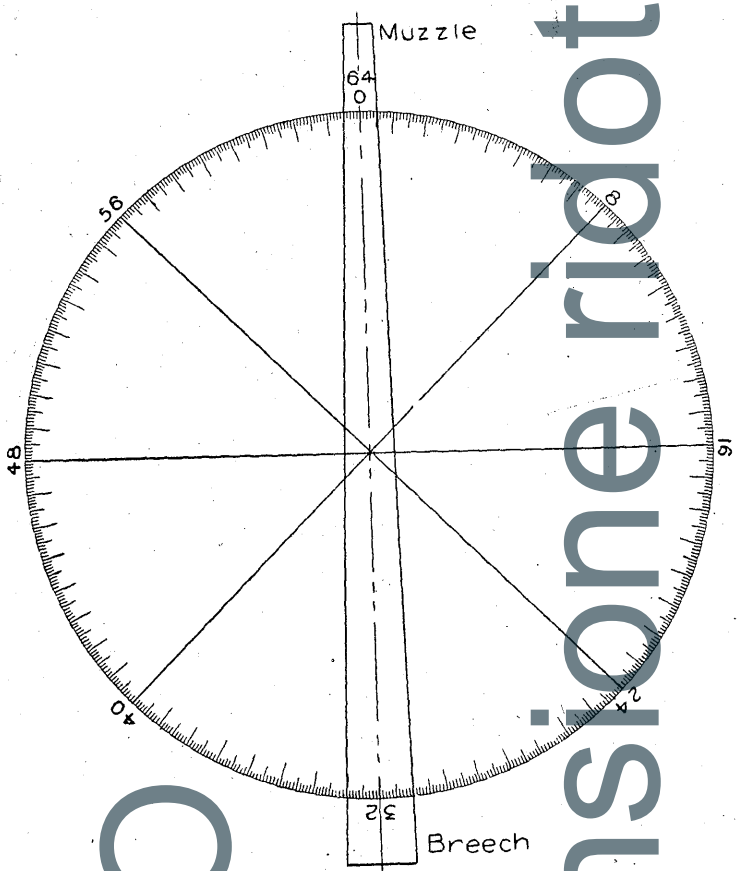
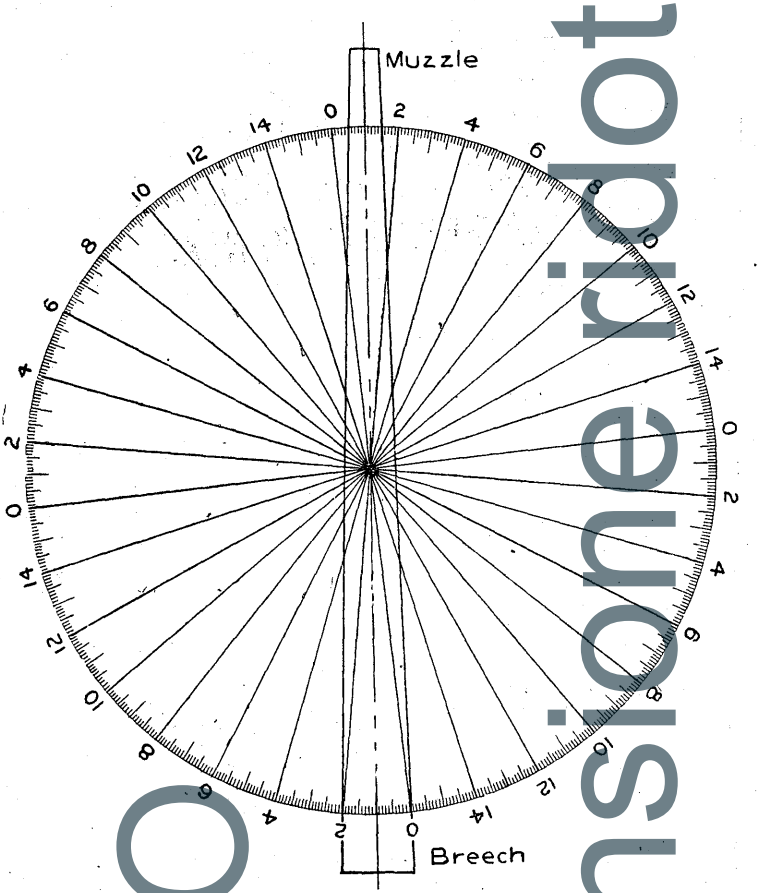


Fig I.
OLD U.S.

must therefore be expressed in two units, thus, "Plateau 4, Drum 175"; while in other systems one number is sufficient, thus, 1435.

Figure 3 is the system of the 155-mm. Schneider howitzer used in our division artilery. The gun axis

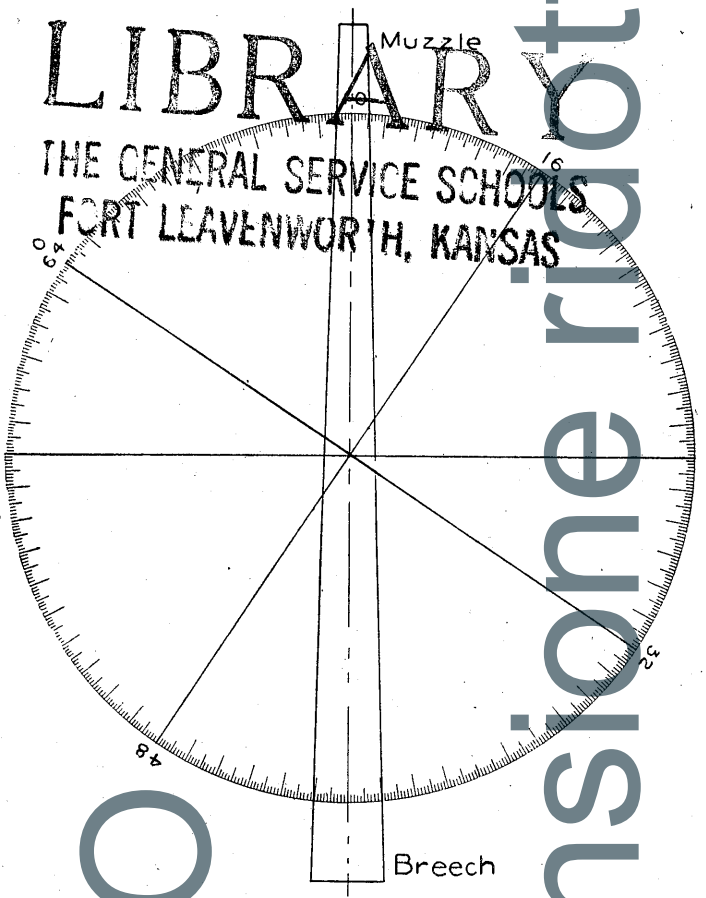


200's on limb - 0-200 on Micrometer

Fig 2

75 FRENCH GUN

is at 1000, that is, the 0 of the sight scale is 1000 mils to the left front. The graduation is from 0 to 6400. The limb is graduated in hundreds, and the micrometer from 0 to 100. No real advantage is derived from the position of the origin of graduation;



100's on limb - 0-100 on Micrometer

Fig 3.

155 SCHNEIDER HOWITZER

on the other hand, it causes considerable inconvenience.

Figure 4 is the new U. S. system. The gun axis is at 0. The scale is in two halves, each grad-

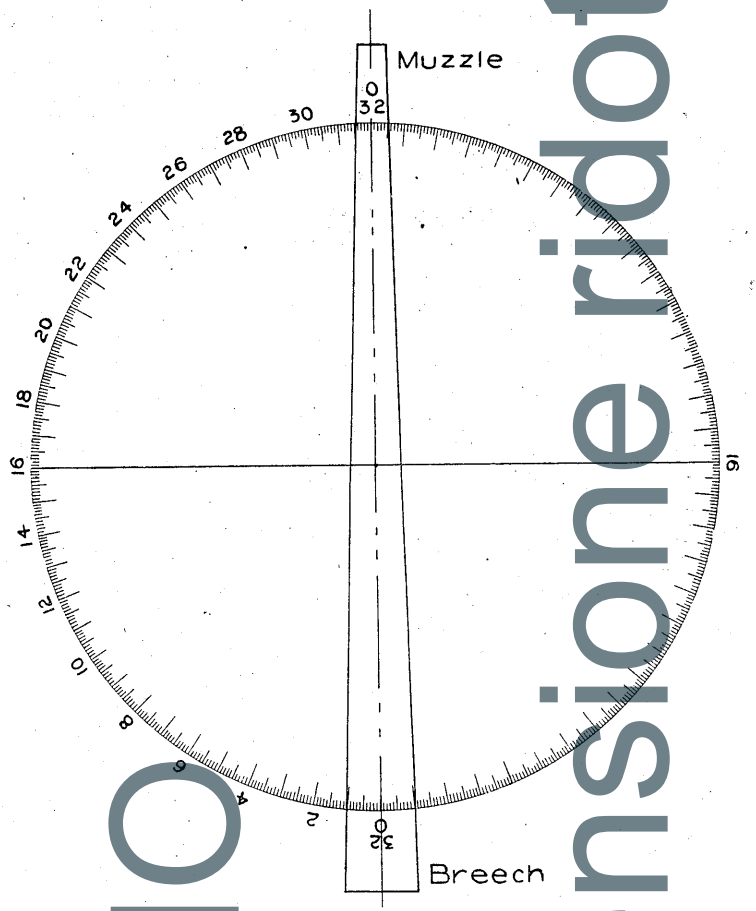


Fig 4.
NEW U.S.

uated from 0 to 3200. This is advantageous in reciprocal laying (par. 23). The limb is graduated in hundreds, and the micrometer from 0 to 100.

9. *Laying for elevation.* This operation is different for the methods of direct and indirect laying. But in both cases a range setting or elevation is announced to give the bore an elevation corresponding to the range of the target.

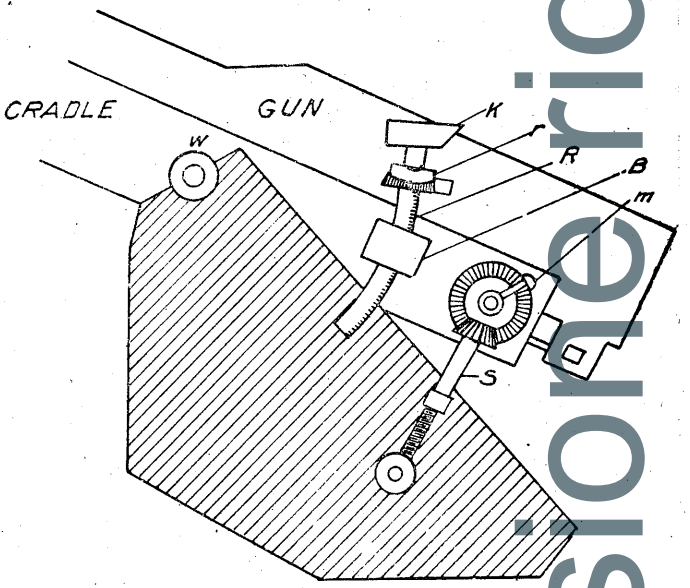


Fig 5.

SCHEME OF LAYING FOR RANGE

155 m.m. HOWITZER

10. *Systems of laying for elevation.* Two typical systems of laying for elevation are shown in Figures 5 and 6. Figure 5 is essentially that of the 155 howitzer and is the simpler. Figure 6 is that of the 75 gun and embodies the so-called *independent line of sight.*

11. In Figure 5, *K* is an optical sight for accurate laying. It is mounted on a shank *R* curved to a circumference having the trunnion *w* as a center. The sight and shank, *K* and *R*, slide up and down in a seat *B* fastened to the cradle. The sight shank is graduated for range. The graduation for a particular range is so placed that when the shank is set at this graduation, the sight axis makes a vertical angle with the gun axis equal to the elevation corresponding to the given range. *S* is the elevating screw fixed at the lower end of the trail of the carriage and at the upper end of the cradle. It is operated by a handwheel and suitable gears *M*.

12. If now any desired range be set on the shank *R*, and the piece then elevated by means of the elevating system *S* and *M* until the line of sight is at the height of the target, the operation will result in the piece being elevated above the target by an amount corresponding to the range. In other words, the piece will be *laid for range* (or elevation).

This case is *direct laying* (par. 6), and is the simplest.

It will be noted that as soon as the range is announced, the operations of setting this range and elevating the piece the proper amount are simple and easily performed by the gunner, a corporal.

13. As thus described, laying for elevation or range involves two operations, i. e.:

(a) Setting the range on the sight shank.
(b) Sighting on the target.

With this system, these operations must be performed successively and practically by one man. Moreover a change of range after the first shot involves a complete repetition of the process.

In view of these facts, the French introduced the *independent line of sight* shown in Figure 6. A sub-

cradle or rocker is placed between the cradle and trail—a mechanical complication, it is true. The lower end of the elevating screw *S* is mounted, not on the trail as in Figure 5, but on the rocker. This

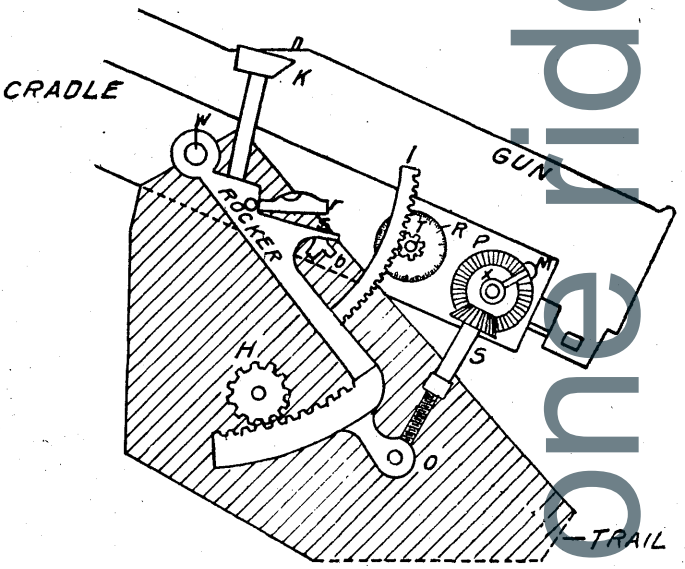


Fig.6.

INDEPENDENT LINE OF SIGHT
75 mm. FRENCH GUN
MODEL 1897

screw is operated by a cannoneer on the right of the piece, No. 1. The rocker can be elevated by the gunner on the left of the piece through the pinion *H*. The piece can therefore be elevated by either the gunner or No. 1, but in different ways.

A range scale *R* moves when the piece is moved with respect to the rocker, and thus indicates ranges