

Order of the Day, 1st Indian Cavalry, 1st Indian Division, 1st Indian Army

NOTES ON SOUND RANGING.

Issued by General Staff I (c), G.H.Q.

No. 38.—Notes on Ranging our Own Guns.

24th JULY, 1918.



PRINTED BY
PRINTING COMPANY, R.E., GENERAL HEADQUARTERS.

1918.

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Examples of circumstances in which successful map shoots have been done are

- (i) Trench junctions, cross-roads, dumps which tactically it was necessary to engage on days (as in Winter) when the visibility both from ground and air was poor.
- (ii) Registration on M.G. and T.M. emplacements previous to opening fire for effect during a raid at night or on a dull day.
- (iii) Checking sights of a howitzer or a gun's line.

Ideal intervals are computed. These are corrected for wind and temperature and used with an ellipse (or other) graph.

Corrections for plotting the results of a record on a plotting board in the ordinary way are worked out. The procedure is then as described in A, or B, for N.F. targets according to the circumstances of the shoot.

NOTE by G.H.Q.

"T" Section has enjoyed in a particular degree the confidence of the C.B.S.O. and of the batteries with which it has had dealings.

The excellent co-operation which has resulted has led to the fullest possible value being made of the Section as a fighting unit.

For these reasons the opinions and methods of the Officer in charge carry exceptional weight, and should be noted by all concerned.

No. 38.—Notes on Ranging our Own Guns.

By Captain RUSSELL, R.G.A., "T" Section.

INTRODUCTION.

This paper deals with some aspects of ranging, and is the outcome of the experiences of two years' Sound Ranging in the line, and of ranging batteries for nearly a year and a half. It is strongly urged that more attention should be given to ranging in all Sections than has been in the past, and it is hoped that the notes below on procedure, etc., even if not applicable in their entirety to the work of another Section, will be found helpful.

The amount of time and energy spent on ranging relative to that spent on locating, when both are possible, depends at the present moment almost entirely upon the keenness of the Section officers for the former. It may be stated here that ranging, *if carried out regularly*, is harder and more trying work than gun-finding. Need for careful work and accuracy is greater. Bad records may not be so easily rejected. There is, moreover, more criticism of one's results; and alteration of conditions, and, on occasion, telephone and microphone line difficulties, make the work sometimes disappointing. But ranging is so useful tactically, so often successful, and compares so well with other ranging methods as regards quickness and accuracy that these considerations should outweigh the others. Without discussing the relative importance of gun-finding and ranging, it may be said that with one apparatus and the existing personnel it is entirely a matter of organisation to prevent one branch of the work from interfering with the other.

DIFFICULTIES.

Causes which make ranging difficult or impossible may be conveniently described in three classes:—

1. *Unavoidable*.—These are: Bad hearing weather; too much noise; lines too frequently cut, as when a Section is on a noisy or battle front; the absolute necessity to concentrate on gun-finding and determining of Calibres.
2. *Avoidable*.—These are: Small base; insensitive apparatus; lines cut unnecessarily often; poor telephone communication with batteries to be ranged; imperfect knowledge of wind corrections.
3. *Poor co-operation and liaison with the Heavy Artillery*.

Remedies for (2) are suggested at once by describing the trouble. It is obvious that the utmost attention should be paid to the routes along which the lines go and to their protection from shelling. We have always been lucky in having most of our cable in places where it can rarely be hit. It is necessary to have a base of at least $4\frac{1}{2}$ seconds. The larger the base of course the better. At present we have the equivalent of a 5.4 seconds base on a 25 seconds circle and this works very well. It is essential for all ranging work, other than firing on N.F. targets, that Wind messages come through regularly from a Wind Section or other source of a Sound Ranging wind. Further, Section Headquarters should be among the batteries and near the line of microphones if this be possible, for this not only reduces microphone line resistance, enables breaks more speedily to be repaired, and direct lines to be run from Section Headquarters to batteries, but undoubtedly stimulates one's interest in the war and increases one's desire to help in it.

CO-OPERATION WITH ARTILLERY.

Successful co-operation with artillery is to some extent a personal matter and must depend to some degree on the keenness of the Section and the way it goes about things. For good work it is essential that the O.C. Section has a perfectly definite understanding with the C.B.S.O. regarding (a) the batteries, or section of batteries he may at once call up in the event of the possibility of a shoot on an N.F. target, (b) the times these batteries are available and (c) the amount of ammunition these batteries severally may expend. On days good for ranging

these batteries or sections should stand by and should be excused aeroplane shoots, Corps salvoes, etc., if this is possible. The highest calibre battery offered should be chosen. Two sections of a battery apart, sited to cover most likely targets on the front, and standing by on good days, is probably the best arrangement. To these sections direct lines should be laid if this be possible.

It is not essential but it is sometimes advisable to have a battery officer present at Section Headquarters during a shoot. Some B.C's. prefer to do the shoot from Section Headquarters and this is a good method. It is good too if sometimes a S.R.S. Officer is at the battery during a shoot. At the conclusion the Officers of the Section and of the Battery who did the shoot should meet to discuss it.

This is important, and often the discussion leads to helpful and interesting results.

The procedure of the shoot, the accuracy of the fall of the rounds, the reason for insisting upon certain things from the battery, should be explained to all Battery Commanders with whom it is likely shoots will be carried out. The battery with which most work is done should be told of all targets likely to be engaged, so that they may lose as little time as possible in getting ready to fire on them when the occasion arises.

The proposal to range on a N.F. target should come from the Section, it being the best judge of the possibility of success.

On days of good hearing which are quiet, a section should offer, in addition, to carry out a part of the R.A.F. Counter-Battery programme.

If visual observation is impossible, a section can also—

- (a) Register.
- (b) Calibrate on trench and hostile battery targets.

It must be realised, however, that calibration by visual methods is more simple and accurate than calibration by Sound Ranging, and should always be used if possible.

At noisy times, or times of bad hearing, requests may come from Brigades or Batteries to observe neutralizing fire on a hostile battery. Work may be clearly impossible, but, if it is at all possible to give some kind of observation, a section should try.

Some people hate to be discouraged, and one should not worry about one's reputation for accuracy if there is a possibility of helping a battery even with corrections which are rough only.

ARRANGEMENTS IN OFFICE.

Each Section Commander makes his own arrangements in the office previous to a shoot. These arrangements, however, differ only in details. The essential thing is that every step taken from the moment a shoot is proposed to the moment when the results of a round are ready to be telephoned to the battery, should be practised by all concerned till the work is done with the maximum speed and accuracy. The computers should practice making out ellipse graphs quickly, and plotting and interpreting results quickly. Similarly the photographer should concern himself with quick development.

Everything that is needed in the shoot should be to hand. I have found it very useful to prepare a series of time-intervals representing the fall of rounds near a target and to work through the series on an off-day as though a real shoot were being done. At "T" Section the duties are arranged as follows:—The officer doing the shoot reads the records and calls out the time intervals of the first round of the battery to computer A and of the second round to computer B, who plot them on their ellipse graphs. If four guns are being ranged, computer A gets the first and third rounds, computer B the second and fourth. He sees that the apparatus keeps in adjustment, makes necessary changes in the time-intervals occasioned by the change of wind when necessary, collects and checks results and talks to the officer at the battery who is superintending.

Prior to the shoot, one computer prepares the ellipse graphs, another computer the time-intervals (for targets other than N.F. ones) that would be obtained with the wind and temperature at the time if a direct hit were obtained on the target point, and deduces the correction for plotting, *i.e.*, the actual numbers to be applied to intervals obtained from a film before they may be plotted in the ordinary way. These computers later assist in the shoot, as described above. A telephonist keeps communication with the battery being ranged, turns on and turns off the apparatus at the right times, and keeps a record of the shoot.

If the shoot is a simple one, one computer alone assists. The routine work is dealt with by another officer or computer, and their locations are telephoned to the proper quarter by a second telephonist.

For plotting the fall of the bursts the ellipse method is the method we use in all work. It has proved of the utmost value, and it is very quick.

This method appears poor in two circumstances:—

1. When a round is more than 100^x right or left or more than 250^x short or over; and
2. When the gun being ranged is at the flank of the line of microphones.

The first of these occurs generally with initial rounds which may be wide not only through an error in laying the gun, but because an approximate position only of the target has been given by the Sound Ranging section. Such rounds are plotted as though they were gun locations, and the results obtained referred to gun-target line.

In the second case the rounds are plotted by the ellipse method with reference to a line joining target and some point between the central microphones, and the results so obtained referred to the gun-target line by a simple device.

RANGING—GENERAL.

(a) It is best and quickest from the point of view of Sound Ranging to range as many guns at a time as the battery will fire, but this is a counsel of perfection, and in actual practice one is influenced by the following circumstances:—

1. The importance of the target.
2. The number of rounds which the battery intends firing provided the ranging goes satisfactorily.
3. Conditions for Sound Ranging.
4. Whether target is at a flank or in a good position.
5. The amount of noise due to firing occurring at the time or likely to occur during the shoot.

Ranging with four guns should be attempted only when conditions are good, when the front is quiet, the target not too far to a flank, and the battery has a generous allotment. Otherwise it is better to range two only.

(b) When more than one gun is being ranged, the rate of fire is Battery (or Section) fire 5 seconds. Missfires not to be fired. Guns to be fired always in the same order. 106-fuse always to be used during ranging except with the 12-in. and 15-in. Howitzers. Confusion may arise if these conditions are not complied with. With 106-fuses one gets not only loud reports from the shell, but a singular freedom from blinds.

(c) When a group of rounds is fired from a gun or from a battery each gun is fired at constant line and elevation, and successive rounds are fired at a convenient interval, usually two minutes.

(d) All results sent to battery are reported as gun errors in *minutes* right or left, and *yards* short or over the gun-target line. When a group has been fired, the M.P.I's. of the rounds of each gun are determined by the Section and sent to the battery, the results of every round of all guns firing not being sent to the battery until the conclusion of the shoot. It is a good thing to classify results of individual rounds as "good" and "fair" or "wash out," depending upon the clearness of the record, the fit of the curves, etc., and so to describe them when sending individual results to the battery.

RANGING—PARTICULAR.

A. Registration on or Neutralisation of a N.F. target.

The battery should be immediately warned so that its fire may be opened as quickly as possible. For neutralisation, as many guns as possible should be used, bearing in mind the remarks made above on this point. For registration, the gun or guns desired to be registered, will of course alone be used.

Procedure:—

- (a) One round battery-fire five seconds is fired and the fall of each shell is reported.
- (b) The corresponding correction is made to each gun and one round battery-fire five seconds is fired every $1\frac{1}{2}$ or 2 minutes until each gun has fired 8 rounds. The M.P.I. of each gun is reported.
- (c) Full correction is made again and 8 rounds battery-fire are fired as in (b). The M.P.I. of each gun is reported.

From this result, the battery should know the line and elevation of each gun to the target. If the B.C. is not satisfied when registering, after the group of 8 rounds has been fired, or if the hostile battery ranged on is still firing, further groups of 8 rounds as described in (c) are fired. Sound Ranging Forward Observers should be warned to inform headquarters immediately the hostile battery ceases, and when (if it does) it opens up again.

B. Destructive Shoot on a N.F. target.

The best targets tactically to be engaged with a Sound Ranging section are new batteries located by Sound Ranging when registering, and batteries in woods, villages and in places where their position is difficult or impossible to locate by photographs, or to be ranged upon from the air.

Procedure as in A. When the B.C. is satisfied with the results from his group of 8 rounds battery fire—

- (d) He makes the final corrections and proceeds to fire for effect with the fuse that will give him the best results.
- (e) After firing 20 or 30 rounds per gun for effect, a verifying group of 5 rounds is fired with 106-fuse. The Battery Commander then corrects and continues for effect.

C. Shoot with very heavy pieces (e.g., 9·2-in. Gun, 12-in. and 15-in. Howitzers).

With these pieces 106-fuses are rarely used. The Battery Commander wishes to know where each round has fallen before firing the next. Each round is consequently corrected upon, and no groups are fired. If two 12-in. Howitzers are to be ranged, it is better to have each firing separately, and at such an interval that one is being got ready to fire whilst the fall of the round from the second gun is being worked out.

D. Doing two shoots together.

This may be attempted when

- (1) Two hostile batteries are firing together, each of which can be ranged upon, or when a good N.F. target offers itself when a shoot is in progress.
- (2) A hostile battery is known to fire according to a system, so that when it is neutralised, another one near by opens out on the same target to give the impression that neutralisation is futile (we have carried this out in the Arras Sector on batteries firing from Bianche and from Plouvain).

Two shoots are most conveniently done by ranging separately two sections of the same battery. Two sets of personnel each working on its own job should be employed.

E. Shooting on Map Points.

Shooting on a Map Point is neither of the same importance nor, in general, of the same accuracy as shoots described above, and is carried out with a battery that has to fire when visual observation is impossible and Sound Ranging conditions are good.

GERMAN SYSTEM OF SQUARING MAPS.

A recently captured German document, issued by the C.G.S. of the Field Army, Nr. II. 55,358, dated 16-5-17, is the first (of which there is any evidence) to lay down a uniform system for the use of map squares, for conventional signs and for scales, in connection with maps issued by German Armies. This system may be described as follows:—

A.—USE OF MAP SQUARES.

1. **Designation of square.**—German squared maps are divided into kilometre squares: each of these is identified by a 4-figure number, of which the two first figures denote its position in the vertical sense, and the two last in the horizontal sense.

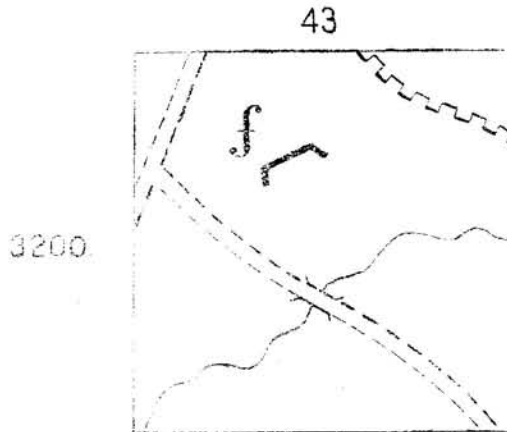


FIG. 1.

Thus, in Fig. 1, the square is called 3243: 32 is called its vertical number and 43 its horizontal number.

For wireless messages, this 4-figure number may be abbreviated to 2 figures, in which case the square is known as 23, the 2nd and 4th figures being taken.

2. **Identification of points.**—There are three authorized methods of identifying points within the square. These methods are respectively employed for the identification of:—

- (a) Enemy batteries.
- (b) "Reference points" in German or in enemy trenches.
- (c) Other points.

(a) **Enemy batteries.**—Batteries, which have been confirmed by aeroplane photographs and have been noted by the Germans as active, are allotted a letter. Within each map square, letters are used in alphabetical order, but, in order to avoid confusion, the letters a, b, c, d, e, s and u are not used. If there are more than 18 batteries in a square, f_1 , g_1 , etc., are used.

Batteries are identified by the square number, followed by the letter allotted, as stated above. Thus, in Fig. 1, the battery would be known as 3243f, or, abbreviated for wireless, as 23f.

This method gives no indication of the position of the battery within the square, but presupposes the possession of a map on which the battery letters are marked.

(b) **"Reference points" in German or in enemy trenches.**—Each "reference point" is identified by a 4-figure number, which denotes its position in the square. This number is based on a rough co-ordinate system similar to our own, but the co-ordinates are measured from the N.W. corner, *east* and *south*.

The method can be understood best by studying Fig. 2.

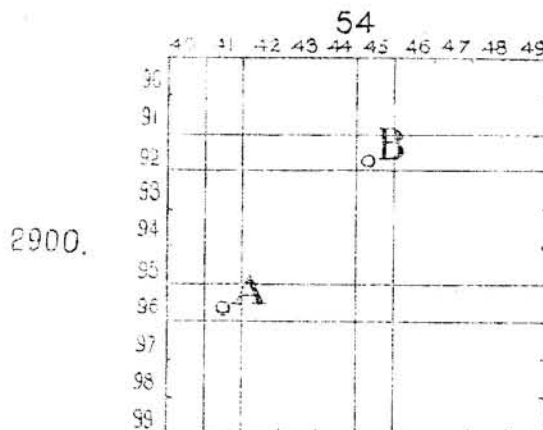


FIG. 2.

Point A is called 4196; point B 4592. The 4 in the horizontal row of numbers 40, 41, 42 . . . is the 2nd figure of the horizontal number, 54, of the square. The 9 in the vertical row of numbers is the 2nd figure of the vertical number 2900.

To find the position of a point, reconstruct the square in imagination, thus :—

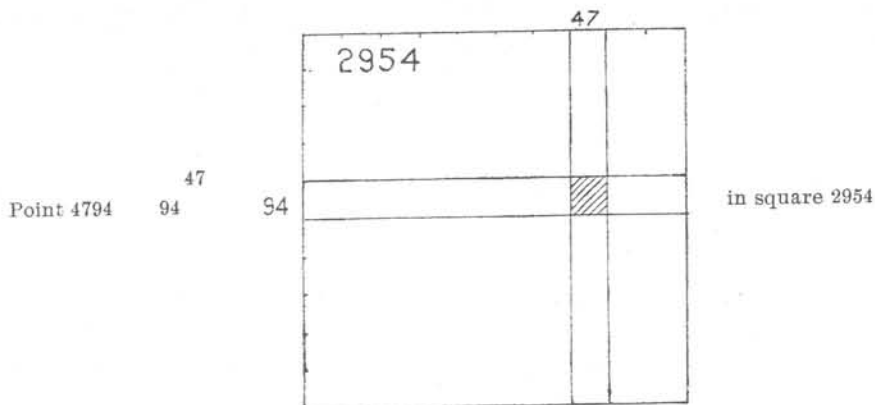


FIG. 3.

The German instructions are that the numbers allotted to "reference points" in German trenches should be printed in red and those allotted to "reference points" in enemy trenches should be printed in blue (*Blaupunkte*). "Reference points" should not be shown in such quantities as to obscure the clearness of the map. A number once given to a point should not be changed.

(c) **Other points.**—For the identification of points other than enemy batteries or the "reference points" described above, the square is divided (in imagination or by a tracing) into 25 small squares numbered 1 to 25; each of these small squares is sub-divided into four quarters, lettered a, b, c, d.

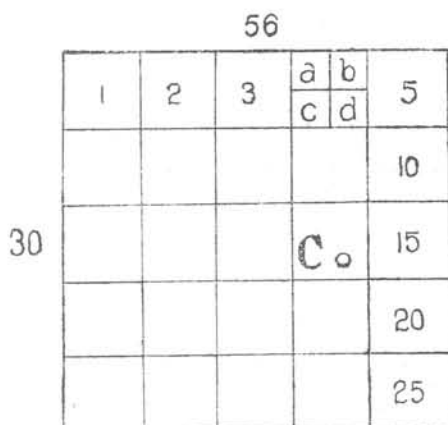


FIG. 4.

Thus, in Fig. 4, point C would be denoted within the square by 14.d. To identify it absolutely, the number of the square would have to be given too, thus, 3056.14.d.

B.—CONVENTIONAL SIGNS.

A reproduction of the universal conventional signs laid down for use on maps issued by German Armies is being issued separately as S.S.618a, "German Conventional Signs, No. 2."

The conventional signs for units and the various types of guns are given in S.S.618, "German Conventional Signs."

C.—SCALES.

It is laid down that the following scales, from 1/25,000 upwards, will be employed in German Armies in future :—

- 1/25,000 (in the 4th Army, 1/20,000).
- 1/10,000.
- 1/5,000.

In exceptional cases, scales of over 1/5,000 may be sanctioned.

GENERAL STAFF (INTELLIGENCE),
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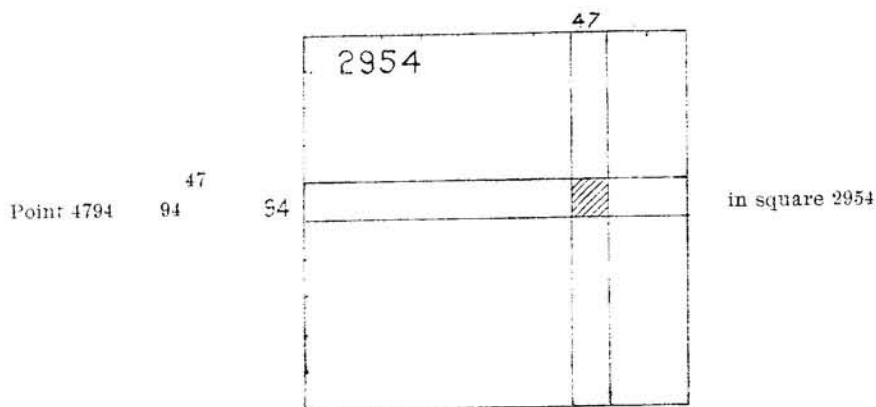


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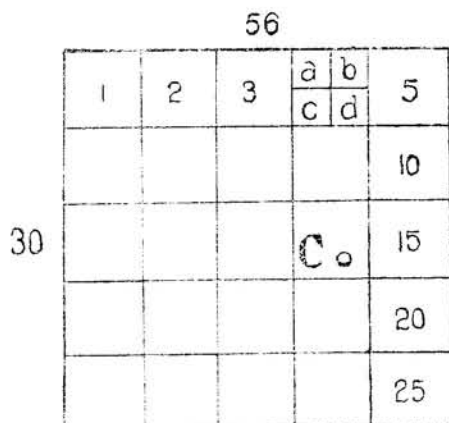


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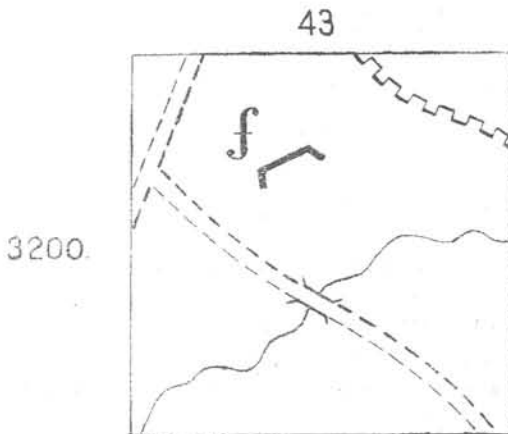


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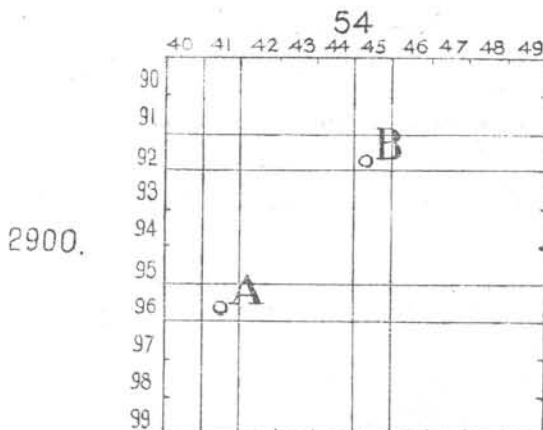


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