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Issued down to include
N. C. O.'s of Field Artillery.

FIRING TABLES

75M/M GUN, MODEL 1897.

TRANSLATED FROM THE FRENCH
EDITION OF AUGUST 25th, 1917
AT
HEADQUARTERS AMERICAN EXPEDITIONARY FORCES FRANCE.

PARIS.
IMPRIMERIE NATIONALE.

DECEMBER 1917.

HEADQUARTERS AMERICAN EXPEDITIONARY FORCES.

OFFICE OF THE CHIEF OF STAFF.

December 1, 1917.

The following translation of the French «Tables de tir du canon de 75, modèle 1897, approuvées le 25 août 1917», is published for the information and guidance of all concerned.

By Command of General Pershing:

JAMES G. HARBORD.
Brigadier General,
Chief of Staff.

Official:

BENJ. ALVORD,
Adjutant General.

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FIRING TABLES

75 M/M GUN, MODEL OF 1897.

CONTENTS OF TABLES.

The tables include :

1. An introduction containing :

A) General information in regard to materiel, ammunition, and sights.

B) Explanations in regard to the use of the tables.

2. Three charts as follows :

For finding the barometric pressure at the battery from the data furnished by the meteorological station.

Showing the variations, in milligrams, in the weight of a liter of air with respect to the normal weight of 1 gr. 208, as a function of the temperature and barometer.

Showing, for a given wind direction expressed in grades, the longitudinal and cross components with respect to the plane of fire.

These charts follow the introduction.

3. Tables, printed on white paper, giving data common to all projectiles.

These are :

A) **Table I.** — Sites, in minutes and hundredths of minute, for various ranges and a difference in altitude of 1 meter.

B) **Tables IIa and IIb.** — Complementary site corrections, in degrees and minutes, for various sites and elevations. Table IIa is applicable to a target which is higher than the guns, and Table IIb to one which is lower than the guns.

C) **Tables IIIa and IIIb.** — Slope coefficients for various slopes of terrain and angles of fall.

D) **Table IVa.** — Settings for 22/31 combination fuses, Model 1897, 24/31 time detonating fuses, Model 1915, or 24/31 combination detonating fuses, Model 1916, to give the same time of burning at different altitudes (or for the corresponding barometers).

E) **Table IVb.** — Increase of corrector, or site if necessary, to allow for altitude (or barometer).

4, Tables of fire for the various kinds of projectiles.

These are :

A) **Tables V.** — Elements of fire for ranges differing by 100 meters (elevation, range setting, drift correction).

B) **Tables VI.** — Additional elements of fire for ranges differing by 500 meters.

C) **Tables VII.** — Corrections in range or direction for variations in muzzle velocity, wind, density of atmosphere, weight of projectile, and for inclination of trunnions.

These tables are divided by letter designations into :

A) **Shrapnel.** — On red paper.

B) **High explosive shell,** normal charge, with short fuse (24/31 percussion detonating fuse, Model 1899, Model 1899-1908, instantaneous fuse, Model 1914, 24-31 time detonating fuse, Model 1915, or 24/31 combination detonating fuse, Model 1916). On yellow paper.

B_1) **High explosive shell,** normal charge, with long fuse (24/31 percussion detonating fuse IA, model 1915, or IAL, model 1916). On yellow paper.

B_2) **High explosive shell,** normal charge, with plate L and short fuse. On yellow paper.

B_3) **High explosive shell,** normal charge, with plate P and short fuse. On yellow paper.

C) **High explosive shell,** reduced charge, with BG powder and short fuse. On gray paper.

D) **High explosive shell,** reduced charge, with BG_0 powder and short fuse. On blue paper.

E) **High explosive shell,** AL type, semi steel. On green paper.

A. — GENERAL INFORMATION IN REGARD TO MATERIEL, AMMUNITION, AND SIGHTS.

Diameter of the bore.	Lands		75 mm.
	Grooves		76 mm.
Total length of gun			2 m. 721.
Distance between front face of breech block and base of projectile.	Shrapnel		307 mm.
	H. E. shell, AL type		
	H. E. shell.	Model 1900 N	304 mm. 5.
		Model 1915, FN or GN types	308 mm.
Capacity of cartridge case with projectile in place.	Shrapnel		1 dm³.390.
	H. E. shell, AL type		1 dm³.396.
	H. E. shell.	Model 1900 N	1 dm³.380.
		Model 1915, FN or GN types	1 dm³.394.
Length of rifled portion			2 dm³. 2294.
Travel of projectile.	Shrapnel		2 m. 2860.
	H. E. shell, AL type		
	H. E. shell.	Model 1900 N	2 m. 2850.
		Model 1915, FN or GN types	
Number of grooves			24.
Inclination of rifling, constant			7°.
Weight of recoiling mass			461 kg.
Mean gauge pressure on breech during firing.	Normal charge, average lot of BSP powder.	Shrapnel	2400 kg.
		H. E. shell	1900 kg.
	H. E. shell, reduced velocity.	BC charge	700 kg.
		BG_0 charge	750 kg.
	H. E. shell, AL type		2300 kg.

PROJECTILES.

	SHRAPNEL.		H. E. SHELL.		
	MODEL 1897 A.	BASE charge.	MODEL 1900 N.	MODEL 1915 FN or GN type.	A L TYPE, semi steel.
Maximum diameter of bourrelet	74 mm. 7	74 mm. 7	74 mm. 7	74 mm. 7	74 mm. 8
Diameter of band	76 mm. 4	76 mm. 4	76 mm. 4	76 mm. 4	76 mm. 4
Length of projectile: without fuse	278 mm.	278 mm.	"	"	"
Length of projectile: without gaine	"	"	267 mm. 5	264 mm.	304 mm. 4
Number of bullets	263 to 269	261	"	"	"
Bursting charge: Powder	0 kg. 380	0 kg. 110	"	"	"
Bursting charge: High explosive	"	"	Variable according to kind of H. E		
Weight of projectile loaded and fused	7 kg. 240		Variable according to kind of H.E. and fuse		7 kg. 445
Jump	+ 7'	+ 7'	+ 1'	+ 1'	+ 7'

CHARGES.

1. **Shrapnel and of H. E. shell, normal velocity.** — Cases for normal velocity are filled with either BSP or US_3 powder.

Lots of BSP powder are classed, by proof firing, as quick, medium, or slow.

The charges are as follows :

Quick : 680 gr. for shrapnel, 585 gr. for H. E. shell.
Medium : 690 — 600 —
Slow : 700 — 615 —

These charges are established to give velocities as follows :

535 m. for 7 kg. 240 shrapnel.
550 — 5 kg. 315 H.E. shell.

Charges of US_3 powder are established to give the same mean velocities as the foregoing.

Properties of powders are such that the velocities of projectiles fired with

BSP powder or US_3 powder vary with the season, being greater than the mean in summer and less in winter. The influence of the season is not necessarily the same for US_3 and BSP powder (1).

Consequently, in firing, mixing powder lots should be avoided. For different lots of the same powder, owing to the method of establishing the charge, results will be generally more consistent for US_3 than for BSP.

As a matter of information, it may be stated that lots of BSP powder, even if weighed the same day and at the same powder works, may give variations of velocity in service as great as 5 meters with shrapnel and 8 meters with H. E. shell, due to the method of establishing the charge. These variations are greater for lots standardized at different times and particularly when they come from different establishments.

Moreover the variations referred to are for mean velocities found by firing a certain number of rounds (as a rule 5, in firing to establish the charge) of each lot. Dispersion of velocities of individual shots about the mean velocity for the lot must therefore also be taken into account.

2. **H. E. shell, reduced velocity.** — Reduced charges for the 75 gun are fixed as a rule at 250 grams BC and 160 grams BG_0. These weights may however be modified so as to give the desired tabular velocities, 344 meters for BC powder, 290 meters for BG_0 powder.

3. **H. E. shell, AL type, semi steel.** — Charges are made up exclusively with US_3 powder and established for each lot so as to give a mean velocity of 525 meters.

SIGHTS.

Maximum range graduation			5500 m.
Maximum elevation (2)			+ 18°
Maximum depression			− 11°
Limiting sites for direct laying.	Above horizontal	for a 5500 m. range.	+ 6°
		for ranges less than 3300 m	+ 12°15
	Below horizontal		− 11°
Limiting sites for indirect laying with quadrant, model 1901			+ 100 mils or + 5°44

(1) Variations due to the season are slow and progressive. There are other irregular variations due, to a great extent at least, to temperature.

The following formula has been proposed for temperature correction :

$$dV_0 = kV_0\,dt$$

dt being the variation in temperature, and k a coefficient depending on loading conditions (inside dimensions of gun, weight of projectile, weight and kind of powder). For lack of more accurate information, k is generally taken as 0.0011 or simply 0.001, whatever firing conditions may be. As a matter of fact recent experiments carried out by the Commission on War Powders, have shown k equal to 0.0006 for the 75 H.E. shell and 0.0015 for the 105 H.E. shell, under normal conditions of employment.

(2) Materiel on level ground, spade imbedded, elevating gear connected.

The plane of sight is parallel to the bore when set at plateau o drum 100 of the first quadrant.

When the sight setting is **increased**, the shot is moved **to the left.**

The jump plus the elevation equals the angle of departure.

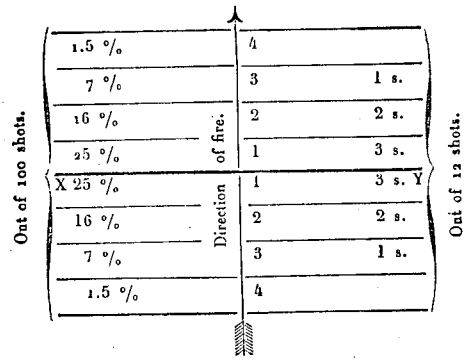
Dispersion. — The range of burst probable error for time shrapnel fire and the range probable error were determined at Bourges in December 1915 and january 1916.

The probable error is the error which, in the long run, will be as frequently exceeded as not (1).

If the line *xy* be drawn through the range center perpendicular to the direction of fire, there will be in the long run as many shots short of it as there are over. Draw lines parallel to *xy* separated from each other by one probable error, forming a double series of parallel and equal spaces, 1, 2, 3, and 4.

Of an indefinitely large number of shots fired with the same data, the various spaces would receive the following percentages of shots :

1	25 o/o.
2	16 o/o.
3	7 o/o.
4	1.5 o/o.



These proportions will be only approximately obtained when firing a limited number of shots. In order to obtain then accurately, it would be necessary to know accurately the probable error for certain conditions and fire a very large number of shots under these conditions.

For practical purposes, it may be taken that the spaces 1, 2, and 3 contain all of the shots, and that, out of 12 shots, there will be 3, 2, and 1 shots in each of the spaces 1, 2, and 3 respectively

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(1) The error of a shot in range is the difference between its range and that of the range senter.

For a very large number of shots, the probable error is equal to he mean error multiplied by 0.8453.

The total dispersion or distance between the extreme shots is usually from 6 to 8 probable errors for groups of more than 20 shots. This may be increased due to variations in atmospheric conditions, mixing lots of ammunition, and, in firing more than one piece, differences in calibration of the pieces (1).

B. — EXPLANATIONS IN REGARD TO THE USE OF THE TABLES.

Table I.

1st. To find the site of a target in minutes, when the difference in altitude between it and the battery is N, multiply by N the value found in the table opposite the range.

The site is + if the target is higher than the battery, and — if the target is lower than the battery.

2nd. To find the site in mils, divide the difference in altitude in meters between the target and battery by the range in kilometers.

Example:

Range, 3,000 meters. Difference in altitude, — 100 meters (target lower than battery).

Table I gives the value 1'15 for 3000 meters.

The site is then $-1'15 \times 100 = -115' = -1°55'$,

In mils, the site is: $-\frac{100}{3} = -33$ mils. (See par. 1208, et seq., U.S.F.A. Drill Reg.)

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(1). For projectiles of uniform shape and weight, range errors are due two principal causes:
a) Variations in angle of departure;
b) Variations in muzzle velocity.

The effect of the former diminishes as the range increases, as may be seen from the number of minutes corresponding to a range change of 100 meters, for various ranges.

The effect of variations in muzzle velocity may be ascertained from tables VI. These variations are limited by the requirements of the acceptance tests. For BSP powder, the probable error in velocity must not exceed 2 m. during the proof firing, which is very similar to shrapnel firing.

For a velocity probable error of 2 m., muzzle velocities obtained in firing with the same lot of powder and in the same gun may show differences as great as 12 to 15 meters. In fact the extreme velocity dispersion actually found by experimental firing is usually not greater than 10 meters.

If a series of firing be conducted with the same kind of projectiles, but with two lots of powder of about the same regularity, the velocity dispersion for the series may be approximately obtained by adding the dispersion of a single lot to the difference in mean velocity of the two lots. This shows that the velocity dispersion, and consequently that of range, when firing a single piece, may be considerably increased if two different lots of powder are used.

The same condition will obtain in battery firing, if the pieces are not in the same state as regards wear. The effect of wear is mainly in diminishing the muzzle velocity, other conditions being equal.

Tables IIa and IIb.

These tables give directly the complementary site correction corresponding to a given elevation and site.

The site is obtained by adding algebraically the site and its complementary correction.

Usually the complementary site correction need only be used for long range firing using the model 1888 quadrant.

In this case, the corrected site and the elevation are added algebraically.

Example;

H. E. shell, normal charge; long fuse. Range, 5000 meters. The target is 150 meters above the piece.

The site (table I] is: $+150 \times 0',69 = +(69' + 34') =$	$+1°\,43'$
Elevation (Table Vb_1)	$13°\ 2'$
Complementary site correction (table IIa)	$+6'$
Elevation to set on quadrant	$14°\,51$

Tables IIIa and IIIb.

These tables give factors for determining the range probable error when the target is on sloping ground. The range probable errors given in tables VI are applicable only when the target is on level ground. When the target is on the forward slope (rising from the battery), they are less; when the target is on the reverse slope, they are greater.

To find the range probable error for sloping ground, those for horizontal ground should be multiplied by the slope coefficient λ:

$$\lambda = \frac{\text{Sin } \omega}{\text{Sin } (\omega + n)}$$

if the target is on a forward slope

and

$$\lambda = \frac{\text{Sin } \omega}{\text{Sin } (\omega - n)}$$

if the target is on a reverse slope.

ω is the angle of fall and n is the slope of the ground, expressed in per cent or in degrees.

The slope coefficient is given opposite the angle of fall and under the slope of the ground. Table IIIa is for a forward slope and Table IIIb for a reverse slope.

Table III*a* has a column for a slope of 90°, which enables the height probable error to be determined.

The height probable error is equal to the range probable error multiplied by λ, where $\lambda = \text{Tan } \omega$.

Example :

The target is on a reverse slope, between contours 130 and 140. The horizontal distance between the contours is 50 meters.

The angle of fall is 25°.

The slope *n* in per cent is :

$$n = 100 \times \frac{140 - 130}{50} = 20.$$

Opposite 25°, and under 20 o/o, in Table III*b*, is the value of $\lambda = 1787$. The range probable error given in tables VI multiplied by this factor will give the range probable error on the slope considered.

Table IV*a*.

This table enables the fuse setting to be corrected for a difference in altitude or barometric pressure, when the fuse is set by a punch or improvised means.

Example :

Table VI*a*, for shrapnel, gives the fuse setting for a 0 burst at 6000 meters as 19.9. For an altitude of 2500 meters, or a barometer of 565 m/m, the setting should be 16.3 for a 0 burst.

Table IV*b*.

This table shows, for every 100 meters of range when firing shrapnel, the number of mils the corrector should be increased, and if necessary the site, to correct for altitude or barometer. It is applicable, when the fuse setter is used. When the increase of corrector is less than 5 mils, it should be applied entirely to the corrector scale. When it exceeds 5 mils, deduct the greatest multiple of 5 mils and increase the site by this amount. Apply the remainder as an increase of corrector.

Examples :

Range, 2500 meters. Altitude, 1000 meters, or barometer 675 mm.

The corrector should be increased 4 points.

Range, 3500 meters.

Altitude, 2500 meters, or barometer 565 mm. The corrector should be increased by 2 and the site by 15 mils.

NOTE. — The shrapnel table may be used as a first approximation in time firing with H. E. shell.

Table V.

These tables show, for a given range, the elevation in degrees and minutes and in mils, the range scale setting, and the drift in mils.

Example :

H. E. shell, normal charge, short fuse, range 4300 meters.

The elevation will be 9°24′ or 167 mils, range setting 4725, and drift 6 mils.

Tables VI.

These tables show, for every 500 meters of range :

The angle of fall in degrees and minutes, and its tangent

The time of flight.

The maximum ordinate of the trajectory.

The tangential remaining velocity.

The displacement of the point of fall :

In range, due to changing the site 1 mil.

In range, due to changing the site 5′.

In height, due to changing the site 5′.

In direction, due to changing the deflection 1 mil.

The fuse setting for a 0 burst in time fire.

The displacement of the point of burst in time fire due to a change of 0s. 1 in the setting.

The range and deflection probable errors.

The size of the bracket in degrees and minutes and in meters.

The angle of opening of shrapnel.

Tables VII.

The firing tables have been computed for the normal weights of projectiles and muzzle velocities given in the front of Tables V. The wind is taken as 0 ; the weight of a liter of air as 1 gr. 208, which corresponds approximately to a temperature of 15°, a barometer of 750 mm, and a relative humidity of 0.5.

These theoretical conditions never exist practically, and in firing the following disturbing elements are encountered :

1° **Variations.** — dV_0, in muzzle velocity, due to the powder used differing more or less from the average of its class (quick, medium, or slow),

to the variations in powder on account of season and temperature, and to the wear of the guns.

dp, in weight of projectile, which is approximately stated for each class of H. E. shell.

$d\varpi$, in the weight of a liter of air, found from the chart, knowing the barometer aud temperature, and assuming the relative humidity as 0.5.

2° **Wind.** — The wind is resolved into components parallel and perpendicular to the plane of fire, referred to respectively as Wx and Wy.

Tables VII give corrections for these disturbing elements.

The values for dV_0, muzzle velocity, may be used to translate into velocity the range discrepancies between two pieces (resulting notably from wear), to correct for changing powder lots in the same piece, or to correct for variations in powder temperature from one series of firing to another.

The value of dV_0 for a temperature variation is given approximately by the formula :

$$dV_0 = 0.0006\ V_0\ dt.$$

Wind corrections are based on a uniform direction and velocity. This condition does not in general obtain. It is therefore necessary to know the velocity and direction of an imaginary wind, which, when taken as constant, will have the same total effect on the projectile as the actual wind. This imaginary wind is called the **ballistic wind.** It varies with the maximum ordinate.

The ballistic wind is determined at meteorological stations for maximum ordinates of 500, 1000, 2000, 3000, 4000, and 5000 meters. For intermediate maximum ordinates, the ballistic wind may be computed by interpolation between the nearest including values furnished.

Use of the tables. — From the manner in which Tables VII are constructed, the corrections for existing conditions should be applied to a particular tabular range to determine the actual range which this range will probably give. The tabular values in range are in round numbers. For intermediate ranges, recourse must be had to interpolation.

The following method may be used in making this interpolation : Calculate the total range variation for two successive tabular ranges which bracket the range corresponding to the given elevation. The range to be expected from the given elevation may then be obtained by interpolation from the two corrected ranges obtained. This can generally be done by inspection if the determination is confined to the nearest 25 meters.

But in practice, the problem is generally the inverse one, to find the range setting or elevation which will correspond to a given corrected range.

The method is the same as that already described, except that the **sign** of the variations given by Tables VII must be changed. The algebraic sum of the variations with signs changed (or what is the same thing, the

algebraic sum of the original variations, with the sign of the sum changed) gives the correction to be applied to the given range in order to obtain the fictitious range to be used in laying. From this fictitious range the range setting or elevation may be obtained.

Example I :

Calculation of a range variation. — Shrapnel. — On Feb. 7, 1912, the Bourges Experiment Commission conducted some shrapnel ballistic firing. Weight of projectile, normal, 7 kilog. 240. Elevation (corrected for site), 16° 8'. The measured muzzle velocities for each shot averaged 530 m. 4. Temperature, 13° 5'. Barometer, 737 mm. Wind velocity, 5 m., measured only on the ground. Wind direction, coming from the front, at an angle of 40° (44 grades) whith the plane of fire.

The variations in the elements of fire which affected range are then :

$dV_0 = 530$ m. $4 - 535$ m. $= -4$ m. 6.
$d\varpi = -15$ (from the chart).
$Wx = -3$ m. 8 (from the chart).

The given elevation is between the tabular values corresponding to 6000 and 7000 meters. For these two ranges, Table VII *a* gives the folloving variations in range :

	6000	7000
$dV_0 = -4$ m. $6 = -(4 + 0.6)$.....	-44	-45
$d\varpi = -15 = \frac{30}{2}$	$+28$	$+34$
$Wx = -3$ m. $8 = -(3 + 0.8)$.....	-63	-84
Total variation.....	-79	-95

The tabular range, obtained by interpolation from the elevation used, was 6456 meters. — 86 is therefore taken by proportion for the total variation. $6456 - 86 = 6370$ meters is then the range to be expected under the conditions.

The experiments actually gave a mean range of 6382 meters, or an error of — 12 meters in the prediction. In view of the fact that the tabular range is 74 meters greater than the experimental range, the result is very satisfactory.

Example II :

Calculation of a range variation. — H. E. shell. — On September 12, 1916, the Calais Experiment Commission fired for velocity as follows : Temperature, 18° 5. Charge, 605 gr, of BSP powder of a certain lot. Projectile, sand-filled shell of 5 kg. 315. Fuse, I. Muzzle velocity obtained, 551 m.

On October 1, 1916, there was ballistic firing, with the same powder as follows : Temperature, 13°. Barometer, 767 mm. Elevation, 17° 30'. Projectiles, H. E. hell. Fuses, I and IA. Wind, O on the ground.

The loss of velocity between the two series, due to the lowering of the temperature, may be calculated :

$$dt = -5°5,$$
$$dV_0 = V_0 \times 0{,}0066 \times dt = 2 \text{ m. about.}$$

Then, for the second series, $V_0 = 551 - 2 = 549 = 550 - 1$, for the I fuse $dV_0 = -1$, will be assumed for both I and IA fuses.

The chart shows that $d\varpi = +37$.

Since the projectiles were not weighed, dp will be taken as 0.

$Wx = 0$, on the ground.

The elevation of 17° 30′ corresponds to a range between 6000 and 7000 for the short fuse, and between 5000 and 6000 for the long fuse.

Tables VII, for H.E. shell, normal charge, short fuses and long fuses, give the following :

	SHORT FUSES.		LONG FUSES.	
	6000.	7000.	5000.	6000.
$dV_0 = -1$	− 7	− 8	− 7	− 7
$d\varpi = 37 = 30 + 7$	− 75	− 92	− 59	− 78
Total variation	− 82	− 100	− 66	− 85

Since the tabular ranges for the elevation 17° 30, are respectively 6092 and 5735, the corrections will be taken as − 84 and − 80, from which the ranges to be expected are :

$$6092 - 84 = 6008 \quad \text{and} \quad 5735 - 80 = 6555.$$

The experimental ranges were 6155 and 5868 giving errors of :

$$6155 - 6008 = 147 \quad \text{and} \quad 5768 - 5655 = 113.$$

Contrary to what might be expected, the application of the tables has increased the difference between the tabular ranges and those actually observed. The differences are of the same order of magnitude for both types of fuses, and cannot therefore be attributed to inaccuracy of the tables. They are the result of disturbing causes which have not been taken into account. These might well be an excess in the weight of the projectiles with respect to the normal weight (5 kg. 315), and a rear wind of appreciable strength in certain atmospheric strata.

This example shows the necessity of taking into consideration all of the

disturbing causes and evaluating them with as much precision as is practicable.

Example III :

Preparation of fire. — Projectile. H. E. shell, type AL. Fuse, I. Map range, 9325 meters. Charge established for normal velocity. Mean weight of projectiles, 7 kg. 500. Barometer at the battery position, 758 mm. Temperature, + 6°.

For a maximum ordinate of 1420 m., which is applicable to this case the direction of the ballistic wind makes an angle of 30° with the angle of fire, and has a velocity of 12 m.

The ammunition is in a dugout whose temperature is + 8°.

For the variation of velocity due to the powder temperature, we have :

$$dt = 15° - 8° = -7°$$
$$dV_0 = -0{,}0006 \times 525 \times 7 = -0.0042 \times 525 = -2 \text{ m.}$$

For the variation of the weight of the projectile :

$$dp = +65 \text{ gr.}$$

For the variation of the weight of a liter of air, from the chart :

$$d\varpi = +55 \text{ milligrams,}$$

For the longitudinal component of the wind, from the chart :

$$W = 12 \text{ m.} = 2 \times 6 \text{ m.}$$
$$Wx = -2 \times 5 \text{ m. } 3 = -10 \text{ m. } 6, \text{ or } -11 \text{ m. about.}$$

The variations in range for the two tabular ranges including the range sought are, from Table VII *e* :

	9000	10000
$dV_0 = -2$ m.	— 28	— 31
$dp = +65$ gr.	+ 1	+ 2
$d\varpi = +55 = (50+5)$ mm.	— 139	— 156
$Wx = -11$ m. $= -(10+1)$ m.	— 275	— 321
	— 441	— 506

Range desired : 9325 m.

Corresponding variation in range : 462 m.

Correction to make in the range desired to obtain the corresponding fictitious range : + 462 m.

Fictitious range to use in laying : 9787 m.

Corresponding elevation : 26° 53′.

Example IV.

Modification of firing data. — Another practical problem is the determination of the corrections necessary in adjusted firing data to make them applicable to slightly different conditions.

Fire has been adjusted under the following conditions : H. E. shell,

normal charge. Short fuse. Atmospheric temperature, + 22°. Barometer, 747 mm. Temperature of powder, + 17°. Longitudinal component of the ballistic wind, + 7 m. Adjusted range, 4900 m.

To continue this fire whith the same ammunition. Atmospheric temperature, + 10°. Barometer, 754 mm. Temperature of powder, + 12°. Longitudinal component of the ballistic wind, — 2 m.

The lowering of the temperature of the powder by 5° varies the initial velocity by :

$$dV_0 = -0{,}0006 \times 550 \times 5 = -0{,}003 \times 550 = -1 \text{ m. } 65,$$
or about — 2 m.

The weight of a liter of air, from the chart, is changed from 1 gr. 208 — 0 gr. 035 to 1 gr. 208 — 0 gr. 028, or $d\varpi = +63$ milligrams.

The longitudinal component of the wind varies by — 9 m.

The variations in range for the tabular ranges of 4000 and 5000 meters are, from Table VII *b*,

	4000	5000
$dV_0 = -2$ m.	— 13	— 14
$d\varpi = +63 = +(60+3)$	— 77	— 100
$dw_x = -9$ m.	— 91	— 134
Total	— 181	— 248

Previous adjusted range : 4900 m.
Corresponding range variation : — 240 m.
Correction for the new firing conditions : + 240 m
New range to be used : 5140 m.

CONCLUSIONS.

The foregoing examples show how Tables VII should be used. It is necessary to take into consideration **all** of the disturbing elements in order to arrive at the range to be expected with a fair degree of precision (such as was obtained in example 1).

Too much must not be expected however of calculations of this kind ; their accuracy is limited. In general, the firing tables should be used more to obtain differences or adjustment coefficients, and not absolute values.

Of the range corrections which can be made on the field of battle, the most reliable are those for weight of projectile and for the weight of a liter of air (dp and $d\varpi$),

The correction for wind will often be rather uncertain because of the variations of w_x with the altitude. As to the range variation due to the muzzle velocity not being tabular, since this involves the gun, the powder, and the season (or temperature), it is almost impossible to evaluate it in

advance. Some idea of the values to assume for dV_0 may be obtained by a systematic study of the record of the piece and the powder, to whatever extent circumstances permit.

This might be done as follows :

The ajusted range is **stripped** of the conditions of the moment, as far as known, that is, corrected to tabular conditions. The difference, stripped range less map range, is attributed to a variation of velocity, $V - V_0 - dV_0$, called the velocity correction. This velocity can be used, together with new conditions of the moment, to correct the map range for subsequent firing.

It is also possible to use an adjustment coefficient, K_0, the ratio $\frac{\text{stripped range}}{\text{map range}}$, multiplying by this coefficient the map range for subsequent objectives and correcting for new conditions of the moment.

But, in all cases, the firing data determined in this manner can only be considered as a first approximation. **No precision firing can be done, as far as these elements are concerned, without their being checked, and generally corrected, by firing for adjustment.**

Charts.

N°. 1_ Barometer.

N°. 2_ Weight of a cubic meter of air. (Relative humidity, 3/4).

N°. 3_ Wind components.

Barometric chart N°1

Difference in altitude ΔN

Battery higher than meteorological station

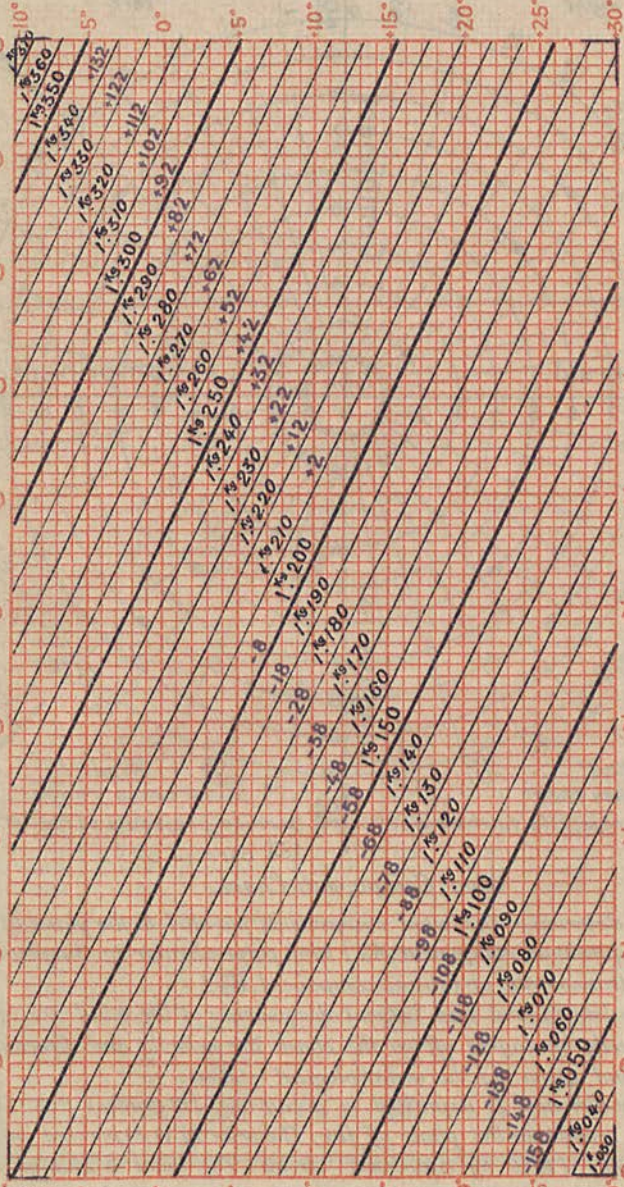
Battery lower than meteorological station

Barometric pressure H

Weight of cubic meter of air

Hygrometric status ¾

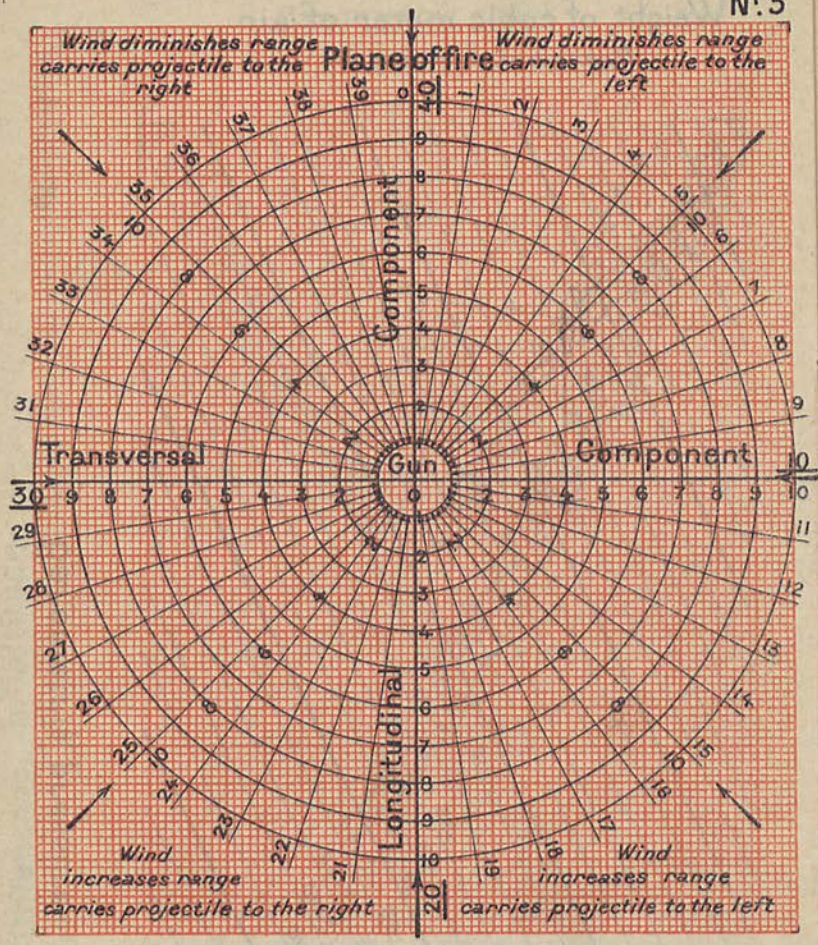
N°2



Barometric pressure

Temperatures

Variations in weight of litre of air in milligrams



Wind Component Chart.

To determine the wind components parallel to the plane of fire (longitudinal component, Wx) and perpendicular to the plane of fire (transversal or lateral component, Wy).

The longitudinal and lateral components of the wind can be read directly by laying off on the chart the velocity and direction of the wind given by the meteorological station.

The direction is expressed in decagrades (10 grades) from 1 to 40 with respect to the plane of fire. The velocity is expressed in meters from 1 to 10 by concentric circles. The wind is always considered as blowing from the circumference toward the center.

The direction of wind furnished by the meteorological station is referred to the true north and must be transposed for the direction of fire before the chart is used.

TABLE I.

VALUE OF SITE FOR A DIFFERENCE IN ALTITUDE OF 1 METER.

Site is taken as + when target is higher than piece.
Site is taken as − when target is lower than piece.

RANGE in METERS.	SITE in MINUTES and hundredths of minute.	RANGE in METERS.	SITE in MINUTES and hundredths of minute.	RANGE in METERS.	SITE in MINUTES and hundredths of minute.	RANGE in METERS.	SITE in MINUTES and hundredths of minute.
		3000	1′ 15	6000	0′ 57	9000	0′ 38
		3100	1 11	6100	0 56	9100	0 38
200	17′ 20	3200	1 07	6200	0 55	9200	0 37
300	11 40	3300	1 04	6300	0 54	9300	0 37
400	8 60	3400	1 01	6400	0 54	9400	0 37
500	6 90	3500	0 98	6500	0 53	9500	0 37
600	5 70	3600	0 95	6600	0 52	9600	0 36
700	4 90	3700	0 93	6700	0 52	9700	0 36
800	4 30	3800	0 90	6800	0 51	9800	0 35
900	3 80	3900	0 88	6900	0 50	9900	0 35
1000	3′ 44	4000	0′ 86	7000	0′ 49	10000	3′ 34
1100	3 12	4100	0 84	7100	0 49	10100	3 34
1200	2 86	4200	0 82	7200	0 48	10200	3 34
1300	2 64	4300	0 80	7300	0 47	10300	3 33
1400	2 46	4400	0 78	7400	0 46	10400	3 33
1500	2 29	4500	0 76	7500	0 45	10500	3 33
1600	2 15	4600	0 75	7600	0 45	10600	3 32
1700	2 02	4700	0 73	7700	0 45	10700	3 32
1800	1 91	4800	0 72	7800	0 44	10800	3 32
1900	1 81	4900	0 70	7900	0 44	10900	3 31
2000	1′ 72	5000	0′ 69	8000	0′ 43	11000	0′ 31
2100	1 64	5100	0 67	8100	0 43	11100	0 31
2200	1 56	5200	0 66	8200	0 42	11200	0 30
2300	1 49	5300	0 65	8300	0 42	11300	0 30
2400	1 43	5400	0 64	8400	0 41	11400	0 30
2500	1 37	5500	0 63	8500	0 41	11500	0 30
2600	1 32	5600	0 61	8600	0 40		
2700	1 27	5700	0 60	8700	0 40		
2800	1 23	5800	0 59	8800	0 39		
2900	1 19	5900	0 58	8900	0 39		

TABLE

COMPLEMENTARY SITE CORRECTION (*SIGN*

(TARGET HIGHER

SITE IN DEGREES.	ELEVATION IN DEGREES.							
	10°	11°	12°	13°	14°	15°	16°	17°
+ 0°30′	+ 1′	+ 1′	+ 2′	+ 2′	+ 2′	+ 3	+ 3′	+ 3′
1	2	2	3	3	4	5	5	6
1 30	3	4	5	5	6	7	8	9
2	4	5	6	7	8	9	11	13
2 30	5	6	7	8	10	11	13	16
3	6	7	8	10	12	14	16	19
3 30	7	8	10	12	14	16	19	22
4	8	10	12	14	16	19	22	26
4 30	9	11	13	16	18	22	25	29
5	10	12	15	18	21	25	29	33
5 30	11	13	16	20	23	27	32	37
6	12	15	18	22	26	30	35	41
6 30	13	16	19	23	28	32	38	44
7	14	17	21	25	30	35	41	48
7 30	15	18	22	27	32	38	44	52
8	16	20	24	29	35	41	48	56
8 30	17	21	26	31	37	44	51	1°
9	18	23	28	33	40	47	55	1 4
9 30	19	24	30	35	42	50	58	1 8
10	21	26	32	38	45	53	1° 2	1 13

SITE IN DEGREES.	ELEVATION IN DEGREES.							
	18°	19°	20°	21°	22°	23°	24°	25°
+ 0°30′	+ 4	+ 4′	+ 5′	+ 5′	+ 6′	+ 7′	+ 8′	+ 9′
1	7	8	9	10	11	13	15	17
1 30	11	12	14	16	18	20	23	26
2	15	17	19	21	24	27	31	35
2 30	18	21	24	27	30	34	39	45
3	22	26	29	33	37	42	48	55
3 30	26	30	34	39	44	50	57	1° 5
4	30	35	40	45	51	58	1° 6	1 15
4 30	34	39	45	51	58	1° 5	1 15	1 26
5	38	44	50	57	1° 5	1 13	1 25	1 37
5 30	42	49	55	1° 3	1 12	1 22	1 35	1 49
6	47	54	1° 1	1 10	1 20	1 32	1 45	2 1
6 30	51	59	1 7	1 17	1 28	1 41	1 56	2 14
7	55	1° 4	1 13	1 24	1 37	1 51	2 8	2 27
7 30	59	1 9	1 20	1 31	1 46	2 1	2 20	2 41
8	1° 4	1 15	1 26	1 39	1 54	2 11	2 32	
8 30	1 9	1 20	1 32	1 46	2 3	2 21		
9	1 14	1 26	1 39	1 54	2 12			
9 30	1 19	1 32	1 46	2 2				
10	1 24	1 38	1 53	2 10				

II$_a$.

SAME AS THAT OF SITE.)

THAN PIECE.)

SITE IN DEGREES.	ELEVATION IN DEGREES.							
	26°	27°	28°	29°	30°	31°	32°	33°
+ 0 30	+ 10′	+ 11′	+ 12′	+ 13′	+ 15′	+ 17′	+ 19′	+ 22′
1	19	21	24	27	31	35	41	47
1 30	29	33	37	42	46	55	1° 3	1° 14
2	40	45	51	58	1° 6	1° 16	1 28	1 42
2 30	51	57	1° 5	1° 15	1 25	1 38	1 54	2 14
3	1° 2	1° 10	1 20	1 32	1 45	2 2	2 23	2 51
3 30	1 14	1 24	1 36	1 50	2 7	2 28	2 56	3 30
4	1 25	1 38	1 52	2 9	2 30	2 57	3 30	4 25
4 30	1 38	1 52	2 9	2 30	2 57	3 30		
5	1 52	2 8	2 28	2 52	3 23			
5 30	2 5	2 24	2 48	3 16	3 34			
6	2 20	2 41	3 8					
6 30	2 35	3						
7	2 51							

SITE IN DEGREES.	ELEVATION IN DEGREES.						
	33′	35°	36°	37°	38°	39°	40°
+ 0°30′	+ 26′	+ 30′	+ 35′	+ 42′	+ 52′	+ 1° 6′	+ 1° 6′
1	54	1° 4	1° 16	1° 33	1° 55		
1 30	1° 26	1 42	2 5	2 39			
2	2 1	2 27					
2 30	2 42	3 22					
3	3 30	4 36					
3 30	4 32						

TABLE

COMPLEMENTARY SITE CORRECTION (*SIGN*
(TARGET LOWER

SITE IN DEGREES.	ELEVATION IN DEGREES.							
	10°	11°	12°	13°	14°	15°	16°	17°
— 0°30′	— 1′	— 1′	— 1′	— 2′	— 2′	— 3′	— 3′	— 4′
1	2	2	3	3	4	4	5	6
1 30	3	4	5	5	6	6	7	9
2	4	5	6	7	8	9	10	12
2 30	5	6	7	8	10	11	13	15
3	6	7	8	10	12	14	16	18
3 30	6	8	9	11	13	16	18	20
4	7	9	11	13	15	18	20	23
4 30	8	10	12	14	17	20	22	26
5	9	11	13	16	19	22	25	29
5 30	10	12	14	17	20	24	27	32
6	11	13	16	19	22	26	30	35
6 30	12	14	17	20	24	28	32	37
7	.....	16	19	22	26	30	35	40
7 30	.....	.....	20	23	28	32	37	42
8	.....	.....	.....	25	29	34	40	45
8 30	.....	.....	.....	.....	31	36	42	47
9	.....	.....	.....	.....	33	38	44	50
9 30	.....	.....	.....	.....	.....	40	46	52
10	.....	.....	.....	.....	.....	42	48	55

SITE IN DEGREES.	ELEVATION IN DEGREES.							
	18°	19°	20°	21°	22°	23°	24°	25°
— 0°30′	— 4′	— 5′	— 5′	— 6′	— 6′	— 7′	— 7′	— 8′
1	7	8	9	10	11	13	14	16
1 30	10	12	13	14	16	19	21	24
2	14	16	18	19	22	25	28	32
2 30	17	20	22	24	27	31	34	39
3	20	23	26	29	33	37	41	46
3 30	23	26	30	34	38	43	47	53
4	26	30	34	39	44	49	54	1°
4 30	29	33	38	43	49	54	1°	1 7
5	33	37	42	48	54	1°	1 6	1 11
5 30	36	40	45	52	58	1 5	1 10	1 21
6	39	44	49	56	1° 3	1 10	1 19	1 28
6 30	42	47	52	1°	1 7	1 15	1 24	1 34
7	45	51	56	1 5	1 12	1 21	1 30	1 40
7 30	48	54	1°	1 9	1 16	1 26	1 35	1 46
8	51	58	1 4	1 13	1 21	1 31	1 41	1 52
8 30	54	1° 1	1 8	1 17	1 25	1 35	1 46	1 57
9	57	1 4	1 12	1 21	1 30	1 40	1 51	
9 30	1°	1 8	1 16	1 25	1 34			
10	1 3	1 12	1 20	1 29	1 39			

II_b.

SAME AS THAT OF SITE.)

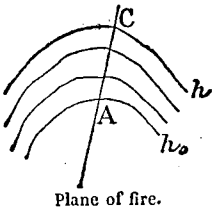
THAN PIECE.)

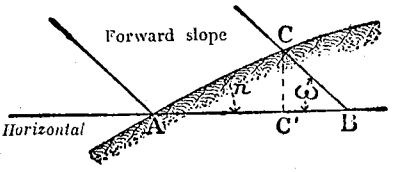
SITE IN DEGREES.	ELEVATION IN DEGREES. 26°	27°	28°	29°	30°	31°	32°	33°
— 0°30′	— 9′	— 10′	— 12′	— 14′	— 15′.	— 17′	— 19′	— 21′
1	18	20	23	26	29	32	30	41
1 30	27	30	35	37	42	47	53	1°
2	36	40	44	49	55	1° 2	1° 9	1 18
2 30	44	49	54	1° 1	1° 7	1 16	1 25	1 35
3	52	58	1° 4	1 12	1 19	1 29	1 39	1 51
3 30	59	1° 6	1 14	1 22	1 30	1 42	1 52	2 6
4	1° 7	1 15	1 23	1 32	1 40	1 55	2 7	2 20
4 30	1 14	1 23	1 32	1 42	1 53	2 6	2 20	2 35
5	1 22	1 31	1 41	1 52	2 4	2 17	2 31	2 45
5 30	1 29	1 39	1 49	2 1	2 14	2 29	2 45	3 2
6	1 37	1 47	1 58	2 10	2 24	2 40	2 56	3 15
6 30	1 43	1 54	2 6	2 19	2 34	2 50		
7	1 50	2 1	2 15	2 29	2 44			
7 30	1 56	2 7	2 24					
8	2 2							

SITE IN DEGREES.	ELEVATION IN DEGREES. 34°	35°	36°	37°	38°	39°	40°
— 0°30′	— 24′	— 27′	— 31′	— 36′	— 43′	— 51′	— 1° 2′
1	46	53	1° 1	1°10	1°21	1°35	1 51
1 30	1° 8	1°16	1 28	1 40	1 55	2 14	2 33
2	1 27	1 39	1 52	2 8	2 25	2 40	3 10
2 30	1 46	1 59	2 14	2 31	2 51	3 15	3 42
3	2 4	2 19	2 35	2 55	3 17	3 42	4 12
3 30	2 20	2 37	2 55	3 16	3 40	4 7	4 38
4	2 36	2 54	3 15	3 37	4 2	4 31	5 4
4 30	2 52	3 10	3 52	3 56	4 23	4 52	5 27
5	3 6	3 27	3 49	4 15	4 45		
5 30	3 21	3 42	4 6				

TABLE IIIa.

Value of slope coefficient λ as a fuction of the slope of the ground n and angle of fall ω.





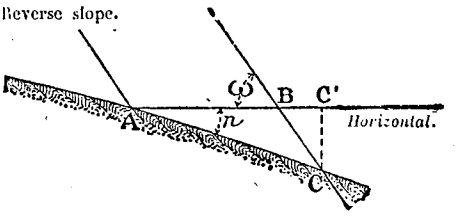
$$\lambda = \frac{AC}{AB} = \frac{\sin \omega}{\sin (\omega + n)}$$

Slope of ground in o/o : $n = 100 \frac{CC'}{AC'} = 100 \frac{h - h_0}{AC'}$.

ANGLE OF FALL ω	SLOPE IN 0/0 OR IN DEGREES.										∞
	1 o/o	2 o/o	3 o/o	4 o/o	5 o/o	10 o/o	20 o/o	30 o/o	40 o/o	50 o/o	
	35'	1° 1/4	1° 3/4	2° 1/4	2° 3/4	5° 3/4	11°1/2	16°3/4	21°3/4	26°1/2	90°
degrees.											
5°	0.899	0.814	0.745	0.688	0.637	0.469	0.310	0.236	0.193	0.167	0.087
10	0.947	0.898	0.855	0.816	0.780	0.641	0.478	0.387	0.330	0.293	0.176
15	0.965	0.931	0.900	0.871	0.844	0.732	0.584	0.493	0.432	0.390	0.268
20	0.974	0.948	0.924	0.902	0.880	0.788	0.658	0.572	0.513	0.471	0.364
25	0.979	0.959	0.940	0.922	0.904	0.827	0.714	0.635	0.580	0.540	0.466
30	0.983	0.967	0.951	0.936	0.921	0.857	0.757	0.687	0.636	0.600	0.577
35	0.986	0.972	0.959	0.947	0.934	0.879	0.793	0.731	0.686	0.652	0.700
40	0.988	0.977	0.966	0.955	0.945	0.898	0.823	0.769	0.729	0.701	0.839
45	0.990	0.981	0.971	0.962	0.954	0.914	0.850	0.803	0.769	0.745	1.000
50	0.992	0.984	0.976	0.968	0.961	0.927	0.873	0.834	0.806	0.788	1.192

Table IIIb.

Value of slope coefficient λ as a function of the slope of the grount n and angle of fall ω.



$$\lambda = \frac{AC}{AB} = \frac{\sin \omega}{\sin (\omega - n)}$$

Slope of ground in o/o : $n = 100 \frac{CC'}{AC'} = 100 \frac{h_0 = h}{AC'}$

ANGLE OF FALL ω	SLOPE IN 0/0 OR IN DEGREES.									
	1 o/o	2 o/o	3 o/o	4 o/o	5 o/o	10 o/o	20 o/o	30 o/o	40 o/o	50 o/o
	35′	1° 1/4	1° 3/4	2° 1/4	2° 3/4	5° 3/4	11°1/2	16°3/4	21°3/4	26°1/2
degrees.										
5°	1.128	1.301	1.522	1.839	2.341					
10	1.059	1.129	1.205	1.293	1.398	2.325				
15	1.038	1.081	1.126	1.176	1.231	1.604	3.170			
20	1.028	1.059	1.090	1.124	1.161	1.386	2.265	5.942		
25	1.022	1.045	1.069	1.094	1.122	1.280	1.787	2.928	7.571	
30	1.017	1.036	1.055	1.075	1.096	1.216	1.561	2.173	3.500	8.349
35	1.014	1.030	1.045	1.061	1.078	1.173	1.428	1.827	2.512	3.911
40	1.012	1.025	1.038	1.051	1.065	1.141	1.339	1.625	2.058	2.767
45	1.010	1.021	1.031	1.042	1.054	1.117	1.275	1.492	1.795	2.236
50	1.008	1.017	1.026	1.035	1.045	1.097	1.226	1.395	1.621	1.926

TABLE IVa.

SETTINGS for 22/31 combination fuses, Model 1897, 24/31 time detonating fuses, Model 1915, or 24/31 combination detonating fuses, Model 1916, to give the same time of burning at different altitudes (or for the corresponding barometers).

Altitude in meters.....	150 (A)	500	1000	1500	2000	2500	3000
Barometer in millimeters.	750	715	675	635	600	565	530
Time Setting.....	1	1.0	1.0	0.9	0.9	0.9	0.9
	2	2.0	1.9	1.8	1.8	1.7	1.7
	3	2.9	2.8	2.7	2.6	2.5	2.4
	4	3.9	3.8	3.6	3.5	3.4	3.2
	5	4.9	4.7	4.5	4.3	4.2	4.0
	6	5.8	5.6	5.4	5.2	5.0	4.8
	7	6.8	6.5	6.3	6.1	5.8	5.6
	8	7.8	7.5	7.2	6.9	6.6	6.4
	9	8.7	8.4	8.1	7.8	7.5	7.2
	10	9.7	9.3	9.0	8.6	8.3	8.0
	11	10.7	10.3	9.9	9.5	9.1	8.7
	12	11.6	11.2	10.8	10.3	9.9	9.5
	13	12.6	12.2	11.7	11.2	10.8	10.3
	14	13.6	13.1	12.6	12.0	11.6	11.1
	15	14.6	14.0	13.4	12.9	12.4	11.9
	16	15.6	14.9	14.3	13.7	13.2	12.7
	17	16.5	15.8	15.2	14.6	14.0	13.5
	18	17.5	16.7	16.1	15.4	14.8	14.2
	19	18.5	17.7	16.9	16.2	15.6	14.9
	20	19.4	18.6	17.8	17.1	16.4	15.7
	21	20.4	19.5	18.6	17.9	17.2	16.4
	22	21.3	20.4	19.7	18.8	18.0	17.2
	23	22.3	21.4	20.5	19.6	18.8	18.0
	24	23.2	22.3	21.3	20.4	19.5	18.7

(A) 150 meters is the altitude for wich tables of fire are computed.

TABLE IVb.

INCREASE of corrector, or site if necessary, to allow for altitude (or barometer).

RANGE in METERS.	INCREASE IN MILS FOR AN ALTITUDE (OR BAROMETER) OF						
	150 meters.	500 meters.	1000 meters.	1500 meters.	2000 meters.	2500 meters.	3000 meters.
	750mm	715mm	675mm	635mm	600mm	565mm	530mm
100	0	0.1	0.2	0.2	0.3	0.3	0.4
200	0	0.1	0.2	0.4	0.5	0.6	0.8
300	0	0.2	0.3	0.6	0.8	1.0	1.2
400	0	0.2	0.5	0.8	1.1	1.3	1.6
500	0	0.3	0.6	1.0	1.4	1.7	2.0
600	0	0.3	0.7	1.3	1.7	2.1	2.5
700	0	0.4	0.9	1.5	2.0	2.5	2.9
800	0	0.4	1.0	1.7	2.3	2.9	3.4
900	0	0.5	1.3	2.0	2.6	3.3	3.9
1000	0	0.5	1.3	2.2	3.0	3.7	4.4
1100	0	0.6	1.5	2.4	3.3	4.1	4.9
1200	0	0.7	1.6	2.7	3.7	4.6	5.4
1300	0	0.7	1.8	3.0	4.0	5.0	6.0
1400	0	0.8	2.0	3.2	4.4	5.5	6.5
1500	0	0.9	2.2	3.5	4.8	6.0	7.1
1600	0	1.0	2.3	3.8	5.1	6.4	7.7
1700	0	1.1	2.5	4.0	5.5	6.9	8.3
1800	0	1.2	2.7	4.3	5.9	7.5	8.9
1900	0	1.2	2.9	4.6	6.3	8.0	9.6
2000	0	1.3	3.1	4.9	6.7	8.5	10.2
2100	0	1.4	3.3	5.2	7.1	9.0	10.8
2200	0	1.5	3.5	5.6	7.6	9.6	11.5
2300	0	1.6	3.7	5.9	8.0	10.1	12.1
2400	0	1.7	3.9	6.2	8.5	10.7	12.8
2500	0	1.8	4.1	6.5	8.9	11.2	13.4

RANGE in METERS.	INCREASE IN MILS FOR AN ALTITUDE (OR BAROMETER) OF						
	150 meters.	500 meters.	1000 meters.	1500 meters.	2000 meters.	2500 meters.	3000 meters.
	750mm	715mm	675mm	635mm	600mm	565mm	530mm
2600	0	1.8	4.3	6.9	9.3	11.8	14.1
2700	0	1.9	4.5	7.2	9.8	12.3	14.7
2800	0	2.0	4.8	7.5	10.2	12.9	15.4
2900	0	2.1	5.0	7.9	10.7	13.4	16.0
3000	0	2.2	5.2	8.2	11.1	14.0	16.7
3100	0	2.3	5.4	8.5	11.6	14.6	17.4
3200	0	2.4	5.6	8.9	12.0	15.1	18.1
3300	0	2.5	5.9	9.2	12.5	15.7	18.8
3400		2.6	6.1	9.6	12.9	16.3	19.5
3500		2.7	6.3	9.9	13.4	16.8	20.1
3600		2.8	6.5	10.2	13.8	17.4	20.8
3700	0	2.9	6.7	10.6	14.3	18.0	21.5
3800	0	3.1	7.2	10.9	14.8	18.6	22.2
3900	0	3.1	7.2	11.3	15.2	19.1	22.9
4000	0	3.2	7.4	11.6	15.7	19.7	23.6
4100	0	3.3	7.6	11.9	16.2	20.3	24.3
4200	0	3.4	7.9	12.3	16.6	20.8	25.0
4300	0	3.5	8.1	12.7	17.1	21.4	25.7
4400	0	3.6	8.4	13.0	17.6	22.0	26.5
4500	0	3.7	8.6	13.4	18.1	22.7	27.2
4600	0	3.8	8.8	13.8	18.6	23.3	28.0
4700	0	3.9	9.1	14.1	19.1	24.0	28.8
4800	0	4.0	9.3	14.5	19.6	24.6	29.6
4900	0	4.1	9.6	14.9	20.2	25.3	30.4
5000	0	4.2	9.8	15.3	20.7	26.0	31.2
5100	0	4.3	10.0	15.7	21.3	26.7	32.0
5200	0	4.4	10.3	16.1	21.8	27.4	32.9
5300	0	4.5	10.5	16.5	22.4	28.2	33.7
5400	0	4.6	10.8	16.9	23.0	28.9	34.6
5500	0	4.8	11.0	17.3	23.6	29.7	35.5
5600	0	4.9	11·3	17.8	24.2	30.5	36.4
5700	0	5.0	11.5	18.2	24.8	31.2	37.3
5800	0	5.1	11.8	18.6	25.5	32.0	38.3
5900	0	5.2	12.0	19.1	26.1	32.9	39.2
6000	0	5.3	12.3	19.5	26.8	33.7	40.2

SHRAPNEL MODEL 1897-A.

SHRAPNEL WITH BASE CHARGE.

TABLES V_a, VI_a, VII_a.

Normal weight of shrapnel : 7 kg. 240.

Actual weight may vary by ± 0 kg. 075

between 7 kg. 165 and 7 kg. 315.

APPROXIMATE VALUE OF BALISTIC COEFFICIENT.

VELOCITY.	JUMP.	LOG. C.
535m	7'	$\bar{4}.75$

TABLE V_a.

75 shrapnel.

(Model 1897-M and shrapnel with base charge).

$V_0 = 535^m$.

RANGE in METERS.	ELEVATION. DEGREES and minutes.	ELEVATION. MILS.	RANGE SETTING.	DRIFT in MILS.	RANGE in METERS	ELEVATION. DEGREES and minutes.	ELEVATION. MILS.	RANGE SETTING.	DRIFT in MILS.
			m.					m.	
					2000	2° 35′	46	1925	1
					2100	2 46	49	2025	1
					2200	2 57	52	2125	1
300	12′	4	300	0	2300	3 9	56	2225	2
400	18	5	400	0	2400	3 22	60	2350	2
500	25′	7	500	0	2500	3° 35′	64	2450	2
600	32	9	600	0	2600	3 48	68	2550	2
700	39	12	675	0	2700	4 1	71	2650	2
800	47	14	775	0	2800	4 14	75	2750	3
900	54	16	875	0	2900	4 28	79	2875	3
1000	1° 2′	18	950	0	3000	4° 42′	84	2975	3
1100	1 10	21	1050	0	3100	4 56	88	3075	3
1200	1 18	23	1150	1	3200	5 11	92	3175	3
1300	1 26	25	1225	1	3300	5 26	97	3300	3
1400	1 35	28	1325	1	3400	5 41	101	3400	3
1500	1°44′	31	1425	1	3500	5° 57′	106	3500	4
1600	1 54	34	1525	1	3600	6 13	111	3600	4
1700	2 4	37	1625	1	3700	6 29	115	3700	4
1800	2 14	40	1725	1	3800	6 45	120	3800	4
1900	2 24	43	1825	1	3900	7 2	125	3900	4

TABLE V_a. (Suite.)

$V_0 = 535^m$.

RANGE in METERS.	ELEVATION DEGREES and minutes.	ELEVATION MILS.	RANGE SETTING.	DRIFT in MILS.	RANGE in METERS.	ELEVATION DEGREES and minutes.	ELEVATION MILS.	RANGE SETTING.	DRIFT in MILS.
			m.					m.	
4000	7°19'	130	4025	5	6500	16° 8'	287		14
4100	7 36	135	4125	5	6600	16 34	295		14
4200	7 53	140	4225	5	6700	17 1	303		15
4300	8 11	145	4325	5	6800	17 28	311		16
4400	8 29	151	4425	6	6900	17 56	319		16
4500	8°48'	156	4525	6	7000	18°24'	327		17
4600	9 07	162	4625	6	7100	18 53	336		18
4700	9 26	168	4725	6	7200	19 23	345		18
4800	9 45	173	4825	7	7300	19 53	354		19
4900	10 5	179	4925	7	7400	20 24	363		20
5000	10°26'	185	5025	7	7500	20°56	372		21
5100	10 47	192	5125	8	7600	21 28	382		22
5200	11 8	198	5225	8	7700	22 2	392		23
5300	11 29	204	5325	8	7800	22 37	402		24
5400	11 50	210	5425	9	7900	23 13	413		26
5500	12°12'	217		9	8000	23°50'	424		27
5600	12 34	223		9	8100	24 28	435		29
5700	12 57	230		10	8200	25 8	447		31
5800	13 20	237		10	8300	25 49	459		33
5900	13 43	244		11	8400	26 31	471		35
6000	14° 6'	251	Laying by quadrant.	11	85 00	27°14'	484	Laying by quadrant.	37
6100	14 29	258		12					
6200	14 53	265		12					
6300	15 18	272		13					
6400	15 43	279		13					

TABLE

ADDITIONAL elements

RANGE IN METERS.	BRACKET.	ANGLE OF FALL.	TANGENT OF ANGLE OF FALL.	DISPLACEMENT OF POINT OF FALL				TIME OF FLIGHT.	MAXIMUM ORDINATE.
				in range, for 1 mil of site.	in range, for 5' of elevation.	in height, for 5' of elevation.	in direction, for 1 mil of deflection.		
	°	° '		m.	m.	m.	m.	sec.	m.
500	3	33	0.01	48.2	71.4	0.7	0.5	1	0.1
1000	3	1 19	0.02	42.2	62.5	1.4	1.0	2.1	5
1500	5	2 18	0.04	35.8	53.0	2.1	1.5	3.3	14
2000	6	3 32	0.06	31.0	45.9	2.8	2.0	4.7	29
2500	8	5 3	0.08	27.2	40.2	3.5	2.5	6.2	49
3000	9	6 45	0.11	24.1	35.7	4.2	3.0	7.8	77
3500	12	8 37	0.15	21.5	31.9	4.9	3.4	9.5	115
4000	15	10 55	0.19	19.6	29.0	5.6	3.9	11.3	163
4500	19	13 18	0.24	17.9	26.5	6.3	4.4	13.2	225
5000	24	15 56	0.29	16.5	24.4	7.0	4.9	15.2	300
5500	28	18 46	0.34	15.2	22.5	7.7	5.4	17.3	393
6000	35	21 52	0.40	14.0	20.8	8.3	5.9	19.6	502
6500	41	25 19	0.47	12.8	19.0	8.9	6.4	22.1	638
7000	53	28 58	0.55	11.7	17.3	9.5	6.9	24.7	802
7500	1 7	32 42	0.64	10.6	15.7	10.1	7.4	28.1	990
8000	1 30	37 46	0.77	9.4	14.0	10.7	7.8	31.0	1266
8500	2 0	42 46	0 92	8.3	12.3	11.3	8.3	34.7	1500

VI$_a$.

of fire for shrapnel.

V_0=535^m.

REMAINING VELOCITY.			SETTING OF 22/31 FUSE FOR 0 HEIGHT OF BURST.	0·1 DISPLACES POINT OF BURST			PROBABLE ERROR		ANGLE OF OPENING.	RANGE IN METERS.
				in height						
Horizontal.	Vertical.	Tangential.		meters.	mils.	in range. meters.	in range.	in direction.		
m.	m.	m.					m.	m.	° ′	
480	5	480	1.0	0.5	1	48	6	0.1	13 55	500
430	10	430	2.2	1	1	43	7	0.3	15 15	1000
387	13	387	3.4	1.5	1	38	8	0.4	16 40	1500
351	22	352	4.8	2.2	1.1	35	9	0.6	17 15	2000
325	29	326	6.3	2.9	1.2	32	10	0.8	19 0	2500
306	36	308	8.0	3.6	1.2	30	11	1.1	20 0	3000
290	44	293	9.7	4.4	1.3	29	13	1.3	20 55	3500
276	53	281	11.5	5.3	1.4	27	15	1.6	21 40	4000
264	62	271	13.4	6.2	1.4	26	17	1.9	22 25	4500
252	72	262	15.5	7.2	1.4	25	19	2.3	23 10	5000
241	82	255	17.6	8.2	1.5	24	21	2.7	23 55	5500
231	93	249	19.9	9.3	1.5	23	24	3.1	24 20	6000
220	104	244	22.5	10.4	1.6	22	27	3.6	24 45	6500
210	115	240	25.1	11.5	1 6	21	31	4.1		7000
201	129	238	28.5	12.9	1.7	20	35	4.7		7500
188	145	237	31.5	14.5	1.8	18	40	5.4		8000
176	162	236	35.2	16.2	1.9	17	46	6.2		8500

TABLE

SHRAPNEL

A. — *VARIATIONS in meters of range due to :*
a variation dV_o of muzzle velocity,
a variation dp of weight of projectile,
a variation $d\varpi$ of weight of liter of air,
a longitudinal wind component Wx.

RANGE IN METERS.		1000	2000	3000	4000	5000	6000	7000	8000	8500
dV_o in meters. (Range variation has same sign as dV_o.)	1	4	6	7	8	9	9	10	10	10
	2	7	12	14	16	18	19	20	20	20
	3	10	18	22	24	27	28	29	30	31
	4	14	24	29	33	36	38	39	40	41
	5	18	29	36	41	44	47	49	50	51
	6	22	35	43	49	53	57	59	61	61
	7	25	41	50	57	62	66	69	71	71
	8	29	47	57	65	71	75	79	81	82
	9	32	53	65	74	80	85	88	91	92
	10	36	59	72	82	89	94	98	101	102
dp in grams. (Range variation is in some cases of the same [+] sign as dp, and in others the opposite [−].)	25	− 2	− 3	− 2	− 1	0	+ 2	+ 3	+ 5	+ 5
	50	− 3	− 5	− 3	− 1	+ 1	+ 3	+ 6	+ 9	+ 11
	75	− 5	− 7	− 5	− 2	+ 1	+ 5	+ 9	+ 13	+ 16
	100	− 7	− 10	− 7	− 3	+ 1	+ 6	+ 11	+ 18	+ 21
$d\varpi$ in milligrams. (Range variation is of opposite sign to $d\varpi$.)	10	− 1	− 3	− 7	− 11	− 15	− 18	− 22	− 26	− 29
	20	− 2	− 7	− 15	− 22	− 29	− 37	− 44	− 53	− 57
	30	− 3	− 10	− 22	− 33	− 44	− 55	− 67	− 79	− 86
	40	− 4	− 14	− 29	− 44	− 58	− 73	− 89	−106	−114
	50	− 5	− 17	− 36	− 55	− 73	− 91	−111	−132	−143
	60	− 5	− 21	− 44	− 66	− 88	−110	−133	−158	−172
	70	− 6	− 24	− 51	− 77	−102	−128	−155	−185	−200
	80	− 7	− 27	− 58	− 88	−117	−146	−178	−211	−229
	90	− 8	− 31	− 66	− 99	−131	−165	−200	−238	−257
	100	− 9	− 34	− 73	−110	−146	−183	−222	−264	−286
Wx in meters per second. (Range variation has the same sign as Wx.)	1	0	2	5	8	12	17	22	28	31
	2	1	4	9	16	24	34	44	56	63
	3	1	5	14	24	37	50	66	85	94
	4	2	7	18	32	49	67	88	113	126
	5	2	9	22	40	61	84	110	141	157
	6	2	11	27	48	73	101	133	169	189
	7	3	13	32	56	85	118	155	197	220
	8	3	15	36	64	98	134	177	226	252
	9	4	16	41	72	110	151	199	254	283
	10	4	18	45	80	122	168	221	282	315

VII$_a$.

($V_c = 535$ METERS).

B. — *Lateral deviation in mils due to a cross wind component*, Wy.

RANGE IN METERS.		1000	2000	3000	4000	5000	6000	7000	8000	8500
Wy in meters per second.	1	0	1	1	1	1	1	1	2	2
	2	0	1	1	2	2	3	3	4	4
	3	1	2	2	3	3	4	5	5	6
	4	1	2	3	4	5	5	6	7	8
	5	1	3	3	5	6	7	8	9	10
	6	1	3	4	6	7	8	9	11	12
	7	1	4	5	6	8	9	11	13	14
	8	2	4	6	7	9	11	12	14	16
	9	2	5	6	8	10	12	14	16	18
	10	2	5	7	9	11	13	15	18	20

C. — *Lateral deviation in mils due to an inclination of the trunnions of 1°.*

	1000	2000	3000	4000	5000	6000	7000	8000	8500
$\theta = 1°$.....	0	1	1	2	3	4	6	8	9

HIGH EXPLOSIVE SHELL

NORMAL CHARGE OF BSP OR US3 POWDER.

TABLES V_b, b_1, b_2, b_3; VI_b, b_1, b_2, b_3; VII_b, b_1, b_2, b_3.

NORMAL WEIGHT OF SHELL			
WITH SHORT FUSE.	WITH LONG FUSE.	WITH L PLATE.	WITH P PLATE.
5 kg. 315	5 kg. 550	5 kg. 349	5 kg. 362

TO FACILITATE CORRECTIONS, THE FIRING TABLES ARE BASED ON THE MEAN WEIGHT OF SHELLS MARKED + +.

MARKING OF SHELL.	WEIGHT		MEAN *dp*.
	WITH SHORT FUSE.	WITH LONG FUSE.	
L	5 kg. 000 to 5 kg. 150	5 kg. 235 to 5 kg. 385	− 300 g.
+	5 kg. 151 to 5 kg. 300	5 kg. 386 to 5 kg. 535	− 150 g.
+ +	5 kg. 301 to 5 kg. 450	5 kg. 536 to 5 kg. 685	0
+ + +	5 kg. 451 to 5 kg. 600	5 kg. 686 to 5 kg. 835	+ 150 g
+ + + +	5 kg. 601 to 5 kg. 750	5 kg. 836 to 5 kg. 985	+ 300 g.

APPROXIMATE VALUE OF BALLISTIC COEFFICIENT OF H.E. SHELL, SHORT FUSE.

MUZZLE VELOCITY.	JUMP.	LOG. C.
550m		4.88

TABLES V_b, VI_b, VII_b

H. E. SHELL, SHORT FUSE.

Short fuse. ($V_o = 550$ m.)

- 24/31 percussion fuse, Model 1899.
- 24/31 percussion fuse, Model 1899-08.
- I fuse, Model 1914.
- 24/31 time fuse, Model 1915.
- 24/31 combination fuse, Model 1916.
- 24/31 Ry fuse, Model 1917.

TABLES V_{b1}, VI_{b1}, VII_{b1}

H. E. SHELL, LONG FUSE.

Long fuse. ($V_o = 542$ m.)

- 1A 24/31 percussion fuse, Model 1915.
- 1AL percussion fuse, Model 1916, with or without plate (1).

TABLES V_{b2}, VI_{b2}, VII_{b2}

H. E. SHELL, PLATE L.

Plate L, of 58 mm. ($V_o = 549$ m.)

- I fuse, Model 1914 (weight of plate, 34 gr.).

TABLES V_{b3}, VI_{b3}, VII_{b5}

H. E. SHELL, PLATE P.

Plate P, of 68 mm. ($V_o = 548$ m.)

- I fuse, Model 1914 (weight of plate, 47 gr.).

(1) Plates do not modify to any extent the trajectory of shells fitted with the long fuse.

NOTE. — With 24/31 time fuse, Model 1915, and 24/31 combination fuse Model 1916 the corrector for a 0 burst is 16, the fuse setter range being the same as the gun range setting.

TABLE Vb.

SHORT FUSE.
$V_o = 550^m$.

RANGE in meters.	ELEVATION. Degrees and minutes.	ELEVATION. Mils.	RANGE setting.	DRIFT in mils.
300	16′	5	350	
400	23	7	450	
500	30′	9	550	
600	37	11	650	
700	44	13	725	
800	52	15	825	
900	1° 0	18	925	
1000	1° 8′	20	1025	
1100	1 17	23	1125	
1200	1 26	25	1225	1
1300	1 35	28	1325	1
1400	1 45	31	1450	1
1500	1°55′	34	1550	1
1600	2 5	37	1650	1
1700	2 16	40	1750	1
1800	2 27	44	1850	1
1900	2 39	47	1975	1
2000	2°51′	51	2075	1
2100	3 4	54	2200	1
2200	3 17	58	2300	2
2300	3 30	62	2400	2
2400	3 44	66	2525	2
2500	3°58′	70	2625	2
2600	4 13	75	2750	2
2700	4 28	79	2875	2
2800	4 43	84	3000	3
2900	4 59	89	3100	3
3000	5°15′	93	3200	3
3100	5 32	98	3325	3
3200	5 49	103	3450	3
3300	6 6	108	3550	4
3400	6 23	113	3675	4
3500	6°41′	119	3775	4
3600	6 59	124	3900	4
3700	7 18	130	4000	5
3800	7 38	136	4125	5
3900	7 59	142	4250	5
4000	8°20′	148	4375	5

TABLE Vb1.

LONG FUSE.
$V_o = 542^m$.

RANGE in meters.	ELEVATION. Degrees and minutes.	ELEVATION. Mils.	RANGE setting.	DRIFT in mils.
300				
400				
500				
600				
700				
800				
900				
1000				
1100				
1200				
1300				
1400				
1500				
1600				
1700				
1800				
1900				
2000	2°58′	53	2125	1
2100	3 11	57	2250	2
2200	3 24	61	2350	2
2300	3 38	65	2475	2
2400	3 52	69	2600	2
2500	4° 7′	73	2700	2
2600	4 22	78	2825	2
2700	4 37	82	2925	2
2800	4 53	87	3050	3
2900	5 9	92	3175	3
3000	5°26′	97	3300	3
3100	5 43	102	3400	3
3200	6 0	107	3525	3
3300	6 18	112	3650	4
3400	6 37	118	3750	4
3500	6°57′	124	3875	4
3600	7 17	130	4000	5
3700	7 37	136	4125	5
3800	7 57	142	4250	5
3900	8 18	148	4350	5
4000	8°39′	154	4475	6

Table Vb_3.

Plate L.
$V_o = 549^m$.

Range in meters.	Elevation. Degrees and minutes.	Elevation. Mils.	Range setting.	Drift in mils.
300	16′	5	350	
400	21	7	475	
500	32′	9	600	
600	40	12	700	
700	48	14	800	
800	57	17	900	
900	1° 6	20	1000	1
1000	1°16′	23	1125	1
1100	1 27	26	1250	1
1200	1 38	29	1375	1
1300	1 49	32	1475	1
1400	2 1	36	1600	1
1500	2°13′	40	1725	1
1600	2 27	44	1850	2
1700	2 41	48	1975	2
1800	2 55	52	2100	2
1900	3 10	56	2250	2
2000	3°25′	61	2375	2
2100	3 40	65	2500	2
2200	3 56	70	2625	3
2300	4 14	75	2750	3
2400	4 33	81	2900	3
2500	4°52′	86	3050	3
2600	5 11	92	3175	3
2700	5 31	98	3325	4
2800	5 51	104	3450	4
2900	6 11	110	3600	4
3000	6°32′	116	3725	4
3100	6 54	123	3850	4
3200	7 17	129	4000	5
3300	7 40	136	4150	5
3400	8 04	143	4275	6
3500	8°28′	150	4425	6
3600	8 53	158	4550	6
3700	9 19	166	4700	6
3800	9 46	174	4825	7
3900	10 13	182	4975	7
4000	10°41′	190	5100	8

Table Vb_3.

Plate P.
$V_o = 548^m$.

Range in meters.	Elevation. Degrees and minutes.	Elevation. Mils.	Range setting.	Drift in mils.
300	17′	5	375	
400	25	7	475	
500	33′	10	600	
600	41	12	700	
700	50	15	800	
800	1° 0	18	925	
900	1 11	21	1050	1
1000	1°24′	25	1200	1
1100	1 38	29	1375	1
1200	1 52	33	1500	1
1300	2 7	38	1650	1
1400	2 22	42	1800	1
1500	2°37′	46	1950	1
1600	2 53	51	2100	1
1700	3 10	56	2250	1
1800	3 30	62	2400	2
1900	3 50	68	2575	2
2000	4°11′	74	2750	2
2100	4 34	81	2925	2
2200	4 59	88	3100	3
2300	5 24	96	3275	3
2400	5 50	104	3450	3
2500	6°18′	112	3625	3
2600	6 46	121	3800	3
2700	7 15	129	4000	3
2800	7 45	138	4175	4
2900	8 17	147	4350	4
3000	8°49′	157	4525	4
3100	9 23	167	4725	5
3200	9 58	177	4900	5
3300	10 35	188	5075	5
3400	11 14	200	5275	5
3500	11°55′	212	5450	6
3600	12 36	224		6
3700	13 18	236		6
3800	14 0	249	Laying by quadrant.	6
3900	14 43	262		7
4000	15°26′	274		7

Table V_b, continued.

Short fuse.
$V_o = 550^m$.

Range in meters.	Elevation. Degrees and minutes.	Elevation. Mils.	Range setting.	Drift in mils.
4000	8°20′	148	4375	5
4100	8 41	154	4500	6
4200	9 2	161	4600	6
4300	9 24	167	4725	6
4400	9 46	174	4825	7
4500	10° 8′	180	4950	7
4600	10 31	187	5050	8
4700	10 54	194	5175	8
4800	11 18	201	5275	8
4900	11 43	208	5400	9
5000	12° 8′	216	5500	9
5100	12 34	223		10
5200	13 1	231		10
5300	13 29	240		11
5400	13 57	248		11
5500	14°26′	257		12
5600	14 56	266		12
5700	15 27	275		13
5800	15 58	284		13
5900	16 29	293		14
6000	17° 1′	302		15
6100	17 34	312		16
6200	18 8	322		16
6300	18 43	333		17
6400	19 19	343		17
6500	19°55′	354		18
6600	20 32	365		19
6700	21 9	376		20
6800	21 47	387		21
6900	22 26	399		22
7000	23° 8′	411		23
7100	23 53	425		24
7200	24 42	439		25
7300	25 34	455		27
7400	26 32	472		28
7500	27°34′	490		30
7600	28 42	510		32
7700	29 54	532		34
7800	31 9	554		36
7900	32 29	577		39
8000	33°50′	602		41

Laying by quadrant.

Table V_{b_1}, continued.

Long fuse.
$V_o = 542^m$.

Range in meters.	Elevation. Degrees and minutes.	Elevation. Mils.	Range setting.	Drift in mils.
4000	8°39′	154	4475	6
4100	9 0	160	4600	6
4200	9 23	167	4725	6
4300	9 47	174	4850	7
4400	10 13	182	4975	7
4500	10°40′	190	5100	8
4600	11 07	198	5225	8
4700	11 35	206	5375	9
4800	12 3	214	5500	9
4900	12 32	223		10
5000	13° 2′	232		10
5100	13 34	241		11
5200	14 8	251		11
5300	14 43	262		12
5400	15 19	273		12
5500	15°57′	284		13
5600	16 36	295		13
5700	17 16	307		14
5800	17 56	319		14
6900	18 38	331		15
6000	19°21′	344		16
6100	20 5	357		17
6200	20 52	371		17
6300	21 42	386		18
6400	22 35	402		19
6500	23°33′	419		20
6600	24 34	437		21
6700	25 39	456		22
6800	26 48	476		23
6900	28 1	498		24
7000	29°18′	521		25
7100	30 39	545		27
7200	32 4	570		28
7300	33 33	596		29
7400	35 7	624		30
7500	36°43′	653		32
7600				
7700				
7800				
7900				
8000				

Laying by quadrant.

Tables VI_b, VI_{b1}, VI_{b2}, VI_{b3}.

ADDITIONAL ELEMENTS OF FIRE

FOR

H. E. SHELL

NORMAL CHARGE.

TABLE VI$_b$.

H. E. SHELL.

SHORT FUSE. V_o=550^m.

RANGE in METERS.	BRACKET.	ANGLE OF FALL.	TANGENT OF ANGLE OF FALL.	TIME OF FLIGHT.	MAXIMUM ORDINATE.	TANGENTIAL REMAINING VELOCITY.	DISPLACEMENT of POINT OF FALL in range, for 1 mil of site.	DISPLACEMENT of POINT OF FALL in range, for 5' of elevation.	DISPLACEMENT of POINT OF FALL in height, for 5' of elevation.	DISPLACEMENT of POINT OF FALL in direction, for 1 mil of deflection.	PROBABLE ERROR in range.	PROBABLE ERROR in direction.	SETTING OF 21/31 FUSE FOR 0 BURST.	0^s.1 IN FUSE setting displaces burst by height in meters.	0^s.1 IN FUSE setting displaces burst by height in mils.	0^s.1 IN FUSE setting displaces burst by range in meters.
	° '	° '		sec.	m.	m.	m.	m.	m.	m.	m.	m.				
500	4	33	0.009	1.0	1	475	48.2	71.4	0.6	0.5	8.4	0.2	1.0	0.5	1	55
1000	5	1 23	0.024	2.1	6	410	39.8	59.0	1.4	1.0	8.9	0.3	2.1	1	1	41
1500	6	2 32	0.045	3.4	15	359	33.2	49.1	2.2	1.5	9.6	0.4	3.4	1.6	1	36
2000	8	4 2	0.071	4.9	30	323	27.3	40.5	2.9	2.0	10.3	0.6	4.9	2.3	1.1	32
2500	10	5 51	0.102	6.5	55	300	32.5	34.8	3.6	2.5	11.2	0.9	6.6	3	1.2	29
3000	12	7 58	0.140	8.3	83	282	20.7	30.7	4.3	3.0	12.2	1.2	8.4	3.9	1.3	27
3500	14	10 22	0.183	10.2	134	267	18.4	27.3	5.0	3.4	13.4	1.5	10.4	4.8	1.3	25
4000	18	13 4	0.232	12.2	194	255	16.3	24.2	5.6	3.9	14.7	1.8	12.7	5.8	1.4	23
4500	22	16 4	0.288	14.3	264	245	14.5	21.5	6.2	4.4	16.2	2.3	14.9	6.8	1.5	22
5000	27	19 26	0.352	16.7	375	236	12.8	19.0	6.7	4.9	17.9	2.7	17.3	7.8	1.6	20
5500	35	23 7	0.427	19.1	482	229	11.9	16.8	7.2	5.4	19.8	3.2	20.1	9.0	1.6	19
6000	43	27 17	0.516	21.8	628	223	9.3	14.6	7.6	5.9	22.0	3.8	23	10.2	1.7	18
6500	55	31 53	0.622	24.8	811	220	8.4	12.5	7.8	6.4	24.6	4.4		11.8	1.7	17
7000	1 13	37 3	0.755	28.2	1041	218	7.1	10.5	7.9	6.9	28.0	5.1		13 5	1.9	16
7500	2 7	42 57	0.931	32.2	1383	220	5.7	8.5	7.9	7.4	32.5	6.0		15.3	2.0	15
8000	3 11	50 25	1.216	37.7	1872	227	4.4	6.5	7 9	7.9	38.6	7.2		18	2.2	13

TABLE VI$_{bis}$.

H. E. SHELL.

LONG FUSE. V_o=542^m.

RANGE in METERS.	BRACKET.	ANGLE OF FALL.	TANGENT OF ANGLE OF FALL.	TIME OF FLIGHT.	MAXIMUM ORDINATE.	TANGENTIAL REMAINING VELOCITY.	DISPLACEMENT of POINT OF FALL				PROBABLE ERROR	
							in range, for 1 mil of site	in range, for 5' of elevation.	in height, for 5' of elevation.	in direction, for 1 mil of deflection	in range.	in direction.
	° ′	° ′		sec.	m.	m.	m.	m.	m.	m.	m.	m.
500	"	"	"	"	"	"	"	"	"	"	"	"
1000	"	"	"	"	"	"	"	"	"	"	"	"
1500	"	"	"	"	"	"	"	"	"	"	"	"
2000	0	4 11	0.073	4.9	32	318	26.0	38.5	2.8	2	11.0	0.6
2500	12	6 4	0.106	6.7	57	295	22.4	33.2	3.5	2.5	12.8	0.9
3000	15	8 14	0.145	8.3	92	278	19.4	28.8	4,2	3	14.9	1.2
3500	21	10 46	0.190	10.3	139	264	16.8	24.9	4.7	3.4	17.5	1.5
4000	26	13 28	0.239	12.5	201	242	14.5	21.5	5.2	3.9	20.5	1.8
4500	39	16 52	0.303	14.7	283	239	12.5	18.5	5.6	4.4	24.3	2.3
5000	53	20 47	0.380	17.2	391	229	10.6	15.7	6.0	4.9	28.7	2.7
5500	1 18	24 37	0.479	20.2	538	219	8.9	13.2	6.3	5.4	33.6	3.2
6000	1 42	31 22	0.610	23.5	725	211	7.4	10.9	6.6	5.9	39.0	3.8
6500	2 42	37 52	0.777	27.4	986	207	6.0	8.9	6.9	6.4	45.0	4.4
7000	4 4	45 55	1.032	32.5	1360	209	4.7	7.0	7.2	6.9	51.5	5.1
7500	5 39	56 3	1.486	40.0	2096	220	3.4	5.1	7.6	7.4	58.2	6.0
8000	"	"	"	"	"	"	"	"	"	"	"	"

TABLE VI$_{bis}$.

H. E. SHELL.

PLATE I.

V_0=549^m.

RANGE in METERS.	BRACKET.	ANGLE OF FALL.	TANGENT OF ANGLE OF FALL.	TIME OF FLIGHT.	MAXIMUM ORDINATE.	TANGENTIAL REMAINING VELOCITY.	DISPLACEMENT of POINT OF FALL				PROBABLE ERROR	
							in range, for 1 mil of site.	in range for 5' of elevation.	in height, for 6' of elevation.	in direction, for 1 mil of deflection	in range.	in direction.
	° ′	° ′		sec.	m.	m.	m.	m.	m.	m.	m.	m.
500	4	37	0.011	1.0	1	444	42.2	62.5	0.7	0.5	8.7	0.2
1000	6	1 40	0.029	2.3	6	363	32.3	47.9	1.4	1	9.6	0.4
1500	8	3 0	0.054	3.8	19	314	26.1	38.6	2.1	1.5	10.8	0.8
2000	11	5 11	0.091	5.5	38	284	21.5	31.8	2.8	2	12.5	1.3
2500	17	7 35	0.133	2.3	70	263	17.9	26.5	3.5	2.5	14.9	1.9
3000	23	10 24	0.183	9.3	115	245	15.2	22.5	4.1	3	18.2	2.6
3500	33	13 42	0.244	11.6	176	230	13.1	19.4	4.7	3.5	22.3	3.5
4000	47	17 30	0.315	14.0	257	223	11.2	16.6	5.2	3.9	27.4	4.5
4500	"	"	"	"	"	"	"	"	"	"	"	"
5000	"	"	"	"	"	"	"	"	"	"	"	"
5500	"	"	"	"	"	"	"	"	"	"	"	"
6000	"	"	"	"	"	"	"	"	"	"	"	"
6500	"	"	"	"	"	"	"	"	"	"	"	"
7000	"	"	"	"	"	"	"	"	"	"	"	"
7500	"	"	"	"	"	"	"	"	"	"	"	"
8000	"	"	"	"	"	"	"	"	"	"	"	"

TABLE VI_{b3}.

H. E. SHELL.
PLATE P.

V_o=548m.

RANGE in METERS.	BRACKET.	ANGLE OF FALL.	TANGENT OF ANGLE OF FALL.	TIME OF FLIGHT.	MAXIMUM ORDINATE.	TANGENTIAL REMAINING VELOCITY.	DISPLACEMENT of POINT OF FALL in range, for 1 mil of site.	DISPLACEMENT of POINT OF FALL in range for 5', of elevation.	DISPLACEMENT of POINT OF FALL in height, for 5' of elevation.	DISPLACEMENT of POINT OF FALL in direction, for 1 mil of deflection	PROBABLE ERROR in range.	PROBABLE ERROR in direction.
	° '	° '		sec.	m.	m.	m.	m.	m.	m.	m.	m.
500	4	41	0.012	1.0	1	417	47.2	62.5	0.7	0.5	9.0	0.4
1000	8	1 58	0.034	2.4	7	328	28.2	41.8	1.4	1.0	10.2	1.1
1500	11	3 59	0.070	4.1	22	280	20.1	29.8	2.1	1.5	11.9	1.9
2000	19	6 45	0.118	6.1	49	248	15.3	22.7	2.7	2.0	14.2	2.0
2500	31	10 40	0.188	8.7	99	221	12.3	18.2	3.4	2.5	17.6	4.2
3000	40	15 3	0.269	11.1	161	199	10.2	15.1	4.1	3.0	20.3	5.6
3500	1.09	21 7	0.386	14.1	269	181	8.7	12.9	5.0	3.5	28.2	7.5
4000	1.34	30 8	0.580	17.9	384	167	7.7	11.4	6.6	3.9	35.7	10.0
4500	"	"	"	"	"	"	"	"	"	"	"	"
5000	"	"	"	"	"	"	"	"	"	"	"	"
5500	"	"	"	"	"	"	"	"	"	"	"	"
6000	"	"	"	"	"	"	"	"	"	"	"	"
6500	"	"	"	"	"	"	"	"	"	"	"	"
7000	"	"	"	"	"	"	"	"	"	"	"	"
7500	"	"	"	"	"	"	"	"	"	"	"	"
8000	"	"	"	"	"	"	"	"	"	"	"	"

TABLE

H. E. SHELL, NORMAL

A. — *VARIATIONS in meters of range due to :*
a variation dV_o of muzzle velocity,
a variation dp of weight of shell,
a variation $d\varpi$ of weight of liter of air,
a longitudinal wind component, $W\varpi$.

RANGE IN METERS.		1000	2000	3000	4000	5000	6000	7000	8000
dV_o in meters (Range variation has same sign as dV_o.)	1	3	5	6	6	7	7	8	9
	2	6	10	12	13	13	15	16	17
	3	10	14	17	19	21	22	23	26
	4	13	19	23	25	28	29	31	34
	5	16	24	29	32	35	37	39	43
	6	19	29	35	38	41	44	47	52
	7	22	34	41	45	48	51	55	60
	8	26	38	47	51	55	58	62	69
	9	29	43	53	57	62	66	70	77
	10	32	48	58	64	69	73	78	86
Mean dp in grams. (Range variation is in some cases of the same [+] sign as dp, and in others the opposite [−].)	L	+ 22	+ 18	+ 4	− 16	− 34	− 58	− 84	− 112
	+	+ 11	+ 9	+ 2	− 8	− 17	− 29	− 42	− 56
	++	0	0	0	0	0	0	0	0
	+++	− 11	− 9	− 2	+ 8	+ 17	+ 29	+ 42	+ 56
	++++	− 22	− 18	− 4	+ 16	+ 34	+ 58	+ 84	+ 112
$d\varpi$ in milligrams. (Range variation is of opposite sign to $d\varpi$.)	10	− 1	− 5	− 8	− 12	− 16	− 20	− 25	− 30
	20	− 3	− 10	− 17	− 24	− 32	− 41	− 50	− 59
	30	− 4	− 14	− 25	− 37	− 48	− 61	− 74	− 89
	40	− 6	− 19	− 34	− 49	− 64	− 81	− 99	− 119
	50	− 7	− 24	− 42	− 61	− 81	− 102	− 124	− 148
	60	− 8	− 29	− 50	− 73	− 97	− 122	− 148	− 178
	70	− 10	− 33	− 59	− 85	− 113	− 142	− 174	− 207
	80	− 11	− 38	− 67	− 98	− 129	− 162	− 198	− 237
	90	− 12	− 43	− 76	− 110	− 145	− 183	− 223	− 267
	100	− 14	− 48	− 84	− 122	− 161	− 203	− 248	− 297
$W\varpi$ in meters per second. (Range variation has the same sign as $W\varpi$.)	1	1	3	6	10	15	20	27	35
	2	1	5	12	20	30	41	53	70
	3	2	8	18	30	45	61	80	105
	4	3	10	24	40	60	81	106	140
	5	4	12	30	50	74	101	133	174
	6	4	15	36	61	89	122	160	209
	7	5	18	42	71	104	142	186	244
	8	6	20	48	81	119	162	213	279
	9	6	23	54	91	134	183	239	314
	10	7	25	60	101	149	203	266	349

VII$_b$.

CHARGE, SHORT FUSE,

$V_o = 550^m$.

B. — *Lateral deviation in mils due to a cross wind component*, Wy.

RANGE IN METERS.		1000	2000	3000	4000	5000	6000	7000	8000
Wy in meters per second.	1	0	0	1	1	1	2	2	2
	2	1	1	2	2	3	3	4	5
	3	1	1	3	4	4	5	6	8
	4	1	2	4	5	6	7	8	10
	5	1	2	5	6	7	9	10	13
	6	2	3	6	7	9	10	12	15
	7	2	4	6	8	10	12	14	18
	8	2	4	7	10	12	14	16	20
	9	3	5	8	11	13	16	18	23
	10	3	6	9	12	15	17	20	25

C. — *Lateral deviation in mils due to an inclination of the trunnions of 1°.*

	1000	2000	3000	4000	5000	6000	7000	8000
$\theta = 1°$.....	0	1	2	3	4	5	7	10

TABLE

H. E. SHELL, NORMAL

A. — *VARIATIONS in meters of range due to:*
a variation dV_0 of muzzle velocity,
a variation dp of weight of shell,
a variation $d\varpi$ of weight of liter of air,
a longitudinal wind component, Wx.

RANGE IN METERS.		2000	3000	4000	5000	6000	7000	7500
dV_0 in meters. (Range variation has same sign as dV_0.)	1	4	5	6	6	7	7	7
	2	8	10	12	12	13	14	15
	3	12	15	17	19	20	21	22
	4	16	20	23	25	26	28	29
	5	20	25	29	31	33	35	37
	6	24	30	35	37	39	42	44
	7	28	35	41	43	46	49	51
	8	32	40	46	50	52	56	58
	9	36	45	52	56	59	63	66
	10	40	50	58	62	65	70	73
Mean dp in grams. (Range variation is in some cases of the same [+] sign as dp, and in others the opposite [−].)	L	+ 12	0	− 20	− 42	− 70	− 102	− 114
	+	+ 6	0	− 10	− 21	− 35	− 51	− 57
	++	0	0	0	0	0	0	0
	+++	− 6	0	+ 10	+ 21	+ 35	+ 51	+ 57
	++++	− 12	0	+ 20	+ 42	+ 70	+ 102	+ 114
$d\varpi$ in milligrams. (Range variation is of opposite sign to $d\varpi$.)	10	− 5	− 9	− 12	− 16	− 21	− 27	− 31
	20	− 10	− 17	− 24	− 32	− 42	− 53	− 62
	30	− 14	− 25	− 37	− 48	− 63	− 80	− 93
	40	− 19	− 34	− 49	− 64	− 83	− 107	− 124
	50	− 22	− 42	− 61	− 80	− 104	− 134	− 155
	60	− 29	− 50	− 73	− 97	− 125	− 160	− 185
	70	− 34	− 59	− 85	− 113	− 146	− 187	− 216
	80	− 38	− 67	− 98	− 129	− 166	− 214	− 247
	90	− 43	− 75	− 110	− 145	− 187	− 240	− 278
	100	− 48	− 84	− 122	− 161	− 208	− 267	− 309
Wx in meters per second. (Range variation has the same sign as Wx.)	1	3	6	11	16	22	31	35
	2	5	12	21	32	45	61	69
	3	8	18	31	48	67	92	104
	4	10	24	42	65	90	122	139
	5	13	30	53	79	112	153	173
	6	15	36	63	95	135	184	209
	7	18	42	73	110	158	214	242
	8	20	48	84	127	180	245	278
	9	22	54	94	142	202	275	312
	10	25	60	105	158	225	306	347

VII$_{bl}$.

CHARGE, LONG FUSE.

$V_o = 542^m$.

B. — *Lateral deviation in mils due to a cross wind component, Wy.*

RANGE IN METERS.		2000	3000	4000	5000	6000	7000	7500
Wy in meters per second.	1	1	1	1	1	2	2	3
	2	1	2	2	3	4	5	6
	3	2	3	4	4	6	7	9
	4	2	4	5	6	8	10	12
	5	3	4	6	7	10	12	15
	6	4	5	7	9	12	15	18
	7	4	6	8	10	14	17	21
	8	5	7	10	12	16	20	24
	9	5	8	11	13	18	22	27
	10	6	9	12	15	20	25	30

C. — *Lateral deviation in mils due to an inclination of the trunnions of 1°.*

	2000	3000	4000	5000	6000	7000	7500
$\theta = 1^\circ$.....	1	2	3	4	6	9	13

TABLE

H. E. SHELL, NORMAL

A. — *Variations in meters of range due to :*
a variation dV_0 of muzzle velocity,
a variation dp of weight of shell,
a variation $d\varpi$ of weight of liter of air,
a longitudinal wind component, Wx.

RANGE IN METERS.		1000	2000	3000	4000
dV_0 in meters. (Range variation has same sign as dV_0.)	1	3	4	5	5
	2	6	8	9	10
	3	8	12	14	15
	4	11	16	19	20
	5	14	20	23	26
	6	17	25	28	31
	7	20	29	33	36
	8	22	33	38	41
	9	25	37	42	46
	10	28	41	47	51
Mean dp in grams. (Range variation is in some cases of the same [+] sign as dp, and in others the opposite [−].)	L	+ 18	+ 10	− 10	− 36
	+	+ 9	+ 5	− 5	− 18
	++	0	0	0	0
	+++	− 9	− 5	+ 5	+ 18
	++++	− 18	− 10	+ 10	+ 36
$d\varpi$ in milligrams. (Range variation is of opposite sign to $d\varpi$.)	10	− 2	− 5	− 9	− 13
	20	− 4	− 10	− 18	− 27
	30	− 6	− 16	− 27	− 40
	40	− 8	− 21	− 36	− 53
	50	− 10	− 26	− 45	− 66
	60	− 11	− 31	− 53	− 80
	70	− 13	− 36	− 62	− 93
	80	− 15	− 42	− 71	− 106
	90	− 17	− 57	− 80	− 120
	100	− 19	− 42	− 89	− 133
Wx in meters per second. (Range variation has the same sign as Wx.)	1	1	4	8	13
	2	2	8	16	26
	3	3	11	24	39
	4	4	15	32	52
	5	4	19	40	66
	6	5	23	48	79
	7	6	27	56	92
	8	7	30	64	105
	9	8	34	72	118
	10	9	38	80	131

VII_{b2}.

CHARGE, PLATE L.

$V_o = 549^m$.

B. — *Lateral deviation in mils due to a cross wind component, Wy.*

RANGE IN METERS.		1000	2000	3000	4000
Wy in meters per second.	1	0	1	1	2
	2	1	2	3	3
	3	1	3	4	5
	4	2	4	5	6
	5	2	4	6	8
	6	2	5	8	10
	7	3	6	9	11
	8	3	7	10	13
	9	4	8	12	14
	10	4	9	13	16

C. — *Lateral deviation in mils due to an inclination of the trunnions of 1°.*

	1000	2000	3000	4000
$\theta = 1°$.....	0	1	2	3

TABLE

II. E. SHELL, NORMAL

A. — *VARIATIONS in meters of range due to :*
a variation dV_o of muzzle velocity,
a variation dp of weight of shell,
a variation $d\varpi$ of weight of liter of air
a longitudinal wind component, Wx.

RANGE IN METERS.		1000	2000	3000	4000
dV_o in meters. (Range variation has same sign as dV_o.)	1	3	3	3	3
	2	5	6	6	6
	3	8	10	10	10
	4	10	13	13	13
	5	13	16	16	16
	6	15	19	19	19
	7	18	22	22	22
	8	20	26	26	26
	9	23	29	29	29
	10	25	32	32	32
Mean dp in grams. (Range variation is in some cases of the same [+] sign as dp, and in others the opposite [–].)	L	+ 12	– 6	– 36	– 78
	+	+ 6	– 3	– 18	– 39
	++	0	0	0	0
	+++	– 6	+ 3	+ 18	+ 39
	++++	– 12	+ 6	+ 36	+ 78
$d\varpi$ in milligrams. (Range variation is of opposite sign to $d\varpi$.)	10	– 2	– 6	– 10	– 17
	20	– 5	– 12	– 21	– 35
	30	– 7	– 18	– 31	– 52
	40	– 9	– 24	– 42	– 69
	50	– 11	– 30	– 52	– 86
	60	– 14	– 36	– 62	– 104
	70	– 16	– 42	– 73	– 121
	80	– 18	– 48	– 83	– 138
	90	– 21	– 54	– 94	– 156
	100	– 23	– 60	– 104	– 173
Wx in meters per second. (Range variation has the same sign as Wx.)	1	1	5	11	18
	2	2	10	22	36
	3	4	16	32	54
	4	5	21	43	72
	5	6	26	54	89
	6	7	31	65	107
	7	8	36	76	125
	8	10	42	86	143
	9	11	47	97	161
	10	12	52	108	179

VII_{b3}.

CHARGE, PLATE P.

$V_o = 548^m$.

B. — *Lateral deviation in mils due to a cross wind component, Wy.*

RANGE IN METERS.		1000	2000	3000	4000
Wy in meters per second.	1	1	1	2	3
	2	1	2	4	5
	3	2	4	5	8
	3	2	5	7	10
	5	2	6	9	13
	6	4	7	11	16
	7	4	8	13	18
	8	5	10	14	21
	9	5	11	16	23
	10	6	12	18	26

C. — *Lateral deviation in mils due to an inclination of the trunnions of 1°.*

	1000	2000	3000	4000
$\theta = 1°$.....	0	1	3	5

HIGH EXPLOSIVE SHELL

REDUCED CHARGE.

(BC POWDER.)

TABLES V_c, VI_c, VII_c.

Normal weight of shell, with short fuse, 5 kg. 315.

MARKING OF SHELL.	WEIGHT WITH SHORT FUSE.	MEAN *dp*.
L	5 kg. 000 to 5 kg. 150.	— 300 g.
+	5 kg. 151 to 5 kg. 300.	— 150 g.
+ +	5 kg. 301 to 5 kg. 450.	0
+ + +	5 kg. 451 to 5 kg. 600.	+ 150 g.
+ + + +	5 kg. 601 to 5 kg. 750.	+ 300 g.

TABLE V_c.

REDUCED CHARGE, BC POWDER, 75 H. E. SHELL.

Short fuse ($V_o = 344$ m.)

- 24/31 percussion fuse, Model 1899.
- 24/31 percussion fuse, Model 1899-08.
- I fuse, model 1914.
- 24/31 time fuse, Model 1915.
- 24/31 combination fuse, Model 1916.
- 24/31 *Ry* fuse, model 1917.

NOTE 1. Shells fired with reduced charges must never be fitted with long fuses, as abnormal shots will probably result.

2. With 24/31 time detonating fuses, Model 1915, and 24/31 combination detonating fuses, Model 1916, the corrector for 0 burst is 18. The fuse setter range is given in the table below.

RANGE in METERS.	ELEVATION. DEGREES and minutes.	ELEVATION. MILS.	RANGE SETTING.	DRIFT IN MILS.	FUSE SETTER RANGE.	RANGE in METERS.	ELEVATION. DEGREES and minutes.	ELEVATION. MILS.	RANGE SETTING.	DRIFT IN MILS.	FUSE SETTER RANGE.
	Short fuse.	Short fuse.	Short fuse.	Short fuse.	Short fuse.		Short fuse.	Short fuse.	Short fuse.	Short fuse.	Short fuse.
			m.		m.				m.		m.
1000	2°42′	48	2000	1	1550	2500	7°44′	138	4175	3	3425
1100	3 1	54	2150	1	1675	2600	8 8	145	4300	3	3550
1200	3 20	59	2325	1	1800	2700	8 32	152	4450	3	3675
1300	3 39	65	2475	1	1925	2800	8 57	159	4575	4	3800
1400	3 58	70	2625	2	2050	2900	9 23	167	4725	4	3925
1500	4°17′	76	2775	2	2175	3000	9°49′	174	4850	4	4050
1600	4 36	82	2925	2	2300	3100	10 15	182	4975	5	4175
1700	4 55	87	3075	2	2425	3200	10 42	190	5125	5	4300
1800	5 14	93	3200	2	2550	3300	11 09	198	5250	5	4425
1900	5 33	99	3325	2	2675	3400	11 38	207	5375	6	4550
2000	5°53′	105	3475	2	2800	3500	12° 7′	215	laying by quadrant.	6	4675
2100	6 14	111	3625	2	2925	3600	12 36	224		6	4800
2200	6 36	117	3750	3	3050	3700	13 5	233		7	4925
2300	6 58	124	3875	3	3175	3800	13 36	242		7	5075
2400	7 21	132	4025	3	3300	3900	14 8	251		7	5200

TABLE V_c, continued.

H. E. SHELL. REDUCED CHARGE, BC POWDER. $V_o = 344^m$. SHORT FUSE.

RANGE in METERS.	ELEVATION. DEGREES and minutes. Short fuse.	ELEVATION. MILS. Short fuse.	RANGE SETTING. Short fuse.	DRIFT IN MILS. Short fuse.	FUSE SETTER RANGE. Short fuse.	RANGE in METERS.	ELEVATION. DEGREES and minutes. Short fuse.	ELEVATION. MILS. Short fuse.	RANGE SETTING. Short fuse.	DRIFT IN MILS. Short fuse.	FUSE SETTER RANGE. Short fuse.
					m.						
4000	14°40′	261	↑	8	5300	5500	25° 9′	447	↑	19	
4100	15 12	270	|	8	5425	5600	26 10	465	|	21	
4200	15 45	280	|	8	5550	5700	27 12	484	|	22	
4300	16 18	290	|	9	5675	5800	28 20	504	|	24	
4400	16 53	300	|	9	5775	5900	29 30	524	|	25	
4500	17°30′	311	Laying by quadrant.	10	5875	6000	30°45′	547	— Laying by quadrant.	26	
4600	18 8	322	|	10	6000	6100	32 15	573	|	28	
4700	18 47	334	|	11	6100	6200	34 5	606	|	29	
4800	19 29	346	|	11	6200	6300	36 15	644	|	30	
4900	20 11	359	|	12		6400	39 10	696	↓	33	
5000	20°56′	372	|	13							
5100	21 41	386	|	14							
5200	22 29	400	|	15							
5300	23 21	415	|	16							
5400	24 14	431	↓	17							

NOTE. — The H. E. shell, with the 24/31 time detonating fuse, Model 1915, or the 24/31 combination detonating fuse, Model 1916, at ranges around 5000 meters, falls about 150 meters *short* of the same shell with a short fuse, both shells being fired at the same elevation.

TABLE

ADDITIONAL ELEMENTS of fire, reduced

RANGE METERS.	BRACKET.	ANGLE of FALL. — Short fuse.	TANGENT of ANGLE of fall. — Short fuse.	TIME of FLIGHT. — Short fuse.	MAXIMUM ORDINATE. — Short fuse.	TANGENTIAL REMAINING velocity. — Short fuse.
				s.	m.	m.
1000	7	3° 5'	0.054	3.5	20	305
1500	8	4 55	0.086	5.5	35	275
2000	10	7 10	0.126	7.6	60	260
2500	14	9 50	0.173	9.8	100	245
3000	17	13 20	0.237	12.2	160	235
3500	22	17 10	0.309	14.8	225	225
4000	27	21 30	0.394	17.4	325	215
4500	36	25 0	0.488	20.2	450	210
5000	44	31 35	0.615	23.0	615	205
5500	1°12	37 50	0.776	26.5	810	200
6000	1 49	45 40	1.023	31.2	1100	205

VI$_c$.

charge, BC powder, H. E. shell, short fuse.

$V_o = 344^m$.
SHORT FUSE.

RANGE in METERS.	DISPLACEMENT OF POINT OF FALL. Short fuse.				SETTING OF 24/31 FUSE FOR 0 BURST.	0^s 1 DISPLACES POINT OF BURST			PROBABLE ERROR Short fuse.	
	In range, for 1 mil of site.	In range, for 5' of elevation.	In height, for 5' for elevation.	In direction, for 1 mil of deflection.		In height.		In range.	In range.	In direction.
	m.	m.	m.	m.		m.	mils.	m.	m.	m.
1000	18.9	28.0	1.5	1.0	3.3	1.6	1.6	30	6.5	0.2
1500	17.4	25.8	2.2	1.5	5.1	2.4	1.6	28	7.4	0.3
2000	15.9	23.6	3.0	2.0	7.0	3.2	1.6	26	8.5	0.4
2500	14.4	21.4	3.7	2.5	9.0	4.2	1.7	24	9.6	0.5
3000	13.0	19.2	4.5	3.0	11.3	5.4	1.8	22	10.9	0.7
3500	11.5	17.1	5.3	3.4	13.7	6.6	1.9	21	12.4	0.9
4000	10.1	15.0	5.9	3.9	16.2	7.7	1.9	20	14.0	1.2
4500	8.7	12.9	6.3	4.4	18.9	8.9	2	19	15.9	1.5
5000	7.3	10.8	6.6	4.9					18.1	1.9
5500	6.0	8.9	6.9	5.4					20.6	2.3
6000	4.8	7.1	7.1	5.9					23.5	3.0

TABLE

H. E. SHELL, REDUCED CHARGE,

A. — *VARIATIONS in meters of range due to :*
a variation dV_o of muzzle velocity,
a variation dp of weight of shell,
a variation $d\varpi$ of weight of liter of air,
a longitudinal wind component, Wx.

RANGE IN METERS.		1000	2000	3000	4000	5000	6000
dV_o in meters. (Range variation has same sign as dV_o.)	1	5	7	9	11	12	13
	2	9	15	18	21	24	27
	3	14	22	27	32	36	40
	4	19	29	36	42	48	53
	5	24	37	46	53	60	67
	6	28	44	55	64	72	80
	7	33	51	64	74	84	93
	8	38	58	73	85	96	106
	9	42	66	82	95	108	120
	10	47	73	91	109	120	133
Mean dp in grams. (Range variation is in some cases of the same [+] sign as dp, and in others the opposite [−].)	L	+ 26	+ 32	+ 30	+ 22	+ 12	− 2
	+	+ 13	+ 16	+ 15	+ 11	+ 6	− 1
	++	0	0	0	0	0	0
	+++	− 13	− 16	− 15	− 11	− 6	+ 1
	++++	− 26	− 32	− 30	− 22	− 12	+ 2
$d\varpi$ in milligrams. (Range variation is of opposite sign to $d\varpi$.)	10	− 1	− 3	− 6	− 9	− 12	− 15
	20	− 3	− 7	− 12	− 18	− 24	− 31
	30	− 4	− 10	− 18	− 26	− 36	− 46
	40	− 6	− 14	− 24	− 35	− 48	− 62
	50	− 7	− 17	− 30	− 44	− 60	− 77
	60	− 8	− 20	− 35	− 53	− 72	− 92
	70	− 10	− 24	− 41	− 62	− 84	− 108
	80	− 11	− 27	− 47	− 70	− 96	− 123
	90	− 13	− 31	− 53	− 79	− 108	− 139
	100	− 14	− 34	− 59	− 88	− 120	− 154
Wx in meters per second. (Range variation has the same sign as Wx.)	1	1	3	7	12	18	26
	2	2	7	14	24	36	53
	3	3	10	21	36	54	79
	4	4	14	28	48	72	106
	5	6	17	36	60	91	132
	6	7	20	43	72	109	158
	7	8	24	50	84	127	185
	8	9	27	57	96	145	211
	9	10	31	64	108	163	238
	10	11	34	71	120	181	264

VII$_c$.

BC POWDER, SHORT FUSE.

$V_o = 344^m$.

B. — *Lateral deviation in mils due to a cross wind component, Wy.*

RANGE IN METERS.	1000	2000	3000	4000	5000	6000
Wy in meters per second. 1	0	1	1	1	1	2
2	1	1	2	2	3	3
3	1	2	2	3	4	5
4	1	2	3	4	5	6
5	1	3	4	5	7	8
6	2	3	5	6	8	10
7	2	4	5	7	9	11
8	2	4	6	8	11	15
9	2	5	7	9	13	14
10	3	5	8	10	14	16

C. — *Lateral deviation in mils due to an inclination of the trunnions of 1°.*

	1000	2000	3000	4000	5000	6000
θ — 1°	1	2	3	5	7	10

HIGH EXPLOSIVE SHELL

REDUCED CHARGE

(BG$_0$ POWDER.)

TABLES V_d, VI_d, VII_d.

Normal weight of shell, with short fuse, 5 kg. 315.

MARKING OF SHELL.	WEIGHT WITH SHORT FUSE.	MEAN dp.
L	5 kg. 000 to 5 kg. 150.	− 300 g.
+	5 kg. 151 to 5 kg. 300.	− 150 g.
++	5 kg. 301 to 5 kg. 450	0
+++	5 kg. 451 to 5 kg. 600.	+ 150 g.
++++	5 kg. 601 to 5 kg. 700.	+ 300 g.

TABLE V_d.

REDUCED CHARGE, BG_0 POWDER, 75 H. E. SHELL.

Short fuse. ($V_0 = 290$ m.)

- 24/21 percussion detonating fuse, Model 1899.
- 24/31 percussion detonating fuse, Model 1899-08.
- 24/31 time detonating fuse, Model 1915.
- 24/31 combination fuse, Model 1916,
- 24/31 Py fuse, Model 1917.

NOTE I. — Shells fired with reduced charges must never be fitted with long fuses, as abnormal shots will probably result.

RANGE IN METERS.	ELEVATION. Degrees and minutes.	ELEVATION. Mils.	RANGE SETTING.	DRIFT IN MILS.	FUSE SETTER RANGE.	RANGE IN METERS.	ELEVATION. Degrees and minutes.	ELEVATION. Mils.	RANGE SETTING.	DRIFT IN MILS.	FUSE SETTER RANGE.
						SHORT FUSE.					
1000	3 40	65	2500	1		2000	7 55	141	4225	3	
1100	4 3	72	2675	2		2100	8 23	149	4400	3	
1200	4 27	79	2875	2		2200	8 51	158	4550	4	
1300	4 52	86	3050	2		2300	9 20	166	4700	4	
1400	5 17	94	3225	2		2400	9 50	175	4850	4	
1500	5 42	101	3400	2		2500	10 20	184	5000	5	
1600	6 8	109	3575	2		2600	10 52	193	5150	5	
1700	6 34	117	3750	2		2700	11 25	203	5325	5	
1800	7 1	125	3900	3		2800	11 58	213	5475	6	
1900	7 28	133	4075	3		2900	12 32	223	laying by quadrant.	6	

TABLE V_d. (Continued.)

U. E. SHELL. REDUCED CHARGE, BG. POWDER. $V_o = 290$ m. SHORT FUSE.

RANGE IN METERS.	ELEVATION. Degrees and minutes.	ELEVATION. Mils.	RANGE SETTING.	DRIFT IN MILS.	FUSE SETTER RANGE.	RANGE IN METERS.	ELEVATION. Degrees and minutes.	ELEVATION. Mils.	RANGE SETTING.	DRIFT IN MILS.	FUSE SETTER RANGE.
				SHORT FUSE.							
3000	13 8	234		7		4500	25 55	425		18	
3100	13 45	244		7		4600	24 55	443		19	
3200	14 22	255		7		4700	26 2	463		21	
3300	15 00	267		8		4800	27 15	484		22	
3400	15 38	278		8		4900	28 30	507		24	
3500	16 16	289	Laying by quadrant.	9		5000	29 55	532	Laying by quadrant.	25	
3600	16 55	301		9		5100	31 35	561		27	
3700	17 35	313		10		5200	33 30	596		28	
3800	18 17	325		10		5300	36 0	640		30	
3900	19 00	338		11		5400	39 30	702		32	
4000	19 45	351		11							
4100	20 30	364		12							
4200	21 17	378		13							
4300	22 7	393		15							
4400	23 0	409		17							

TABLE

ADDITIONAL ELEMENTS of fire, reduced charge,

RANGE in METERS.	BRACKET.	ANGLE of FALL. — Short fuse.	TANGENT of ANGLE of fall. — Short fuse.	TIME of FLIGHT. — Short fuse.	MAXIMUM ORDINATE. — Short fuse.	TANGENTIAL REMAINING velocity. — Short fuse.
	° ′	° ′		s.	m.	m.
1000	11	4 0	0.070	3.6	25	270
1500	14	6 10	0.108	5.6	55	250
2000	18	9 0	0.158	7.8	90	234
2500	25	12 10	0.216	10.1	145	221
3000	36	15 56	0.285	12.6	220	210
3500	46	20 15	0.369	15.3	315	200
4000	1 6	25 20	0.473	18.2	430	195
4500	1 44	30 50	0.597	21.6	590	190
5000	3 28	38 50	0.805	26.1	845	188

VI_d.

BG_o powder, H. E. shell, short fuse.

V_o = 290 m.
SHORT FUSE.

RANGE in METERS.	DISPLACEMENT OF POINT OF FALL. Short fuse.				SETTING OF 24/31 FUSE for 0 burst.	0 s. 1 DISPLACES POINT OF BURST.			PROBABLE ERROR.	
	In range, for 1 mil of site.	In range, for 5' of elevation.	In height, for 5' of elevation.	In direction, for 1 mil of deflection.		In height.		In range	In range.	In direction.
	m.	m.	m.	m.		m.	mils.	m.	m.	m.
1000	15.3	22.6	1.8	1.0	"	"	"	"	8.0	0.2
1500	13.7	20.3	2.2	1.5	"	"	"	"	9.3	0.3
2000	12.2	18.0	2.8	2.0	"	"	"	"	11.1	0.4
2500	10.7	15.8	3.4	2.5	"	"	"	"	13.3	0.5
3000	9.3	13.7	3.9	3.0	"	"	"	"	16.3	0.7
3500	7.9	11.7	4.3	3.4	"	"	"	"	20.0	0.9
4000	6.7	9.9	4.7	3.9	"	"	"	"	24.6	1.1
4500	5.5	8.2	4.9	4.4	"	"	"	"	30.3	1.3
5000	4.3	6.4	5.1	4.9	"	"	"	"	37.5	1.7

TABLE

H. E. SHELL, REDUCED CHARGE.

A. *Variations in meters of range due to :*
a variation dV_o of muzzle velocity,
a variation dp of weight of shell,
a variation $d\varpi$ of weight of liter of air,
a longitudinal wind component, Wx.

RANGE IN METERS.		1000	2000	3000	4000	5000
dV_o in meters. (Range variation has same sign as dV_o.)	1	6	10	12	14	16
	2	12	19	25	29	33
	3	18	29	37	43	49
	4	24	39	49	58	66
	5	31	49	62	72	82
	6	37	58	74	86	98
	7	43	68	86	101	115
	8	49	78	98	115	131
	9	55	87	111	130	148
	10	61	97	123	144	164
Mean dp in grams. (Range variation is some cases of the same sign [+] as dp, and in others the opposite [−].)	L	+36	+46	+46	+42	+36
	+	+18	+23	+23	+21	+18
	++	0	0	0	0	0
	+++	−18	−23	−23	−21	−18
	++++	−36	−46	−46	−42	−36
$d\varpi$ in milligrams. (Range variation is of opposite sign to $d\varpi$.)	10	− 1	− 3	− 5	− 8	−11
	20	− 2	− 5	−10	−15	−21
	30	− 3	− 8	−15	−23	−32
	40	− 4	−11	−20	−30	−42
	50	− 6	−14	−25	−38	−53
	60	− 7	−16	−30	−46	−63
	70	− 8	−19	−35	−53	−74
	80	− 9	−22	−40	−61	−84
	90	−10	−24	−45	−68	−95
	100	−11	−27	−50	−76	−105
Wx in meters per second. (Range variation has the same sign as Wx.)	1	1	4	8	13	19
	2	2	7	15	25	38
	3	3	11	23	38	57
	4	4	14	30	51	76
	5	6	18	38	64	96
	6	7	22	45	76	115
	7	8	25	53	89	134
	8	9	29	60	102	153
	9	10	32	68	114	172
	10	11	36	75	127	191

VII_d.

BG_o POWDER, SHORT FUSE.

$V_o = 200$ m.

B. *Lateral deviation in mils due to a cross wind component, Wy.*

RANGE IN METERS.		1000	2000	3000	4000	5000
Wæ in meters per second.	1	0	1	1	1	1
	2	0	1	1	2	2
	3	1	2	2	3	4
	4	1	2	3	4	5
	5	1	3	4	5	6
	6	1	3	4	5	7
	7	1	4	5	6	8
	8	2	4	6	7	10
	9	2	5	6	8	11
	10	2	5	7	9	12

C. *Lateral deviation in mils due to an inclination of the trunnions of 1°.*

	1000	2000	3000	4000	5000
$\theta = 1°$.....	1	2	4	6	10

75 AL SEMI-STEEL SHELL.

TABLES V_e, VI_e, VII_e.

Weight of projectile without fuse..... 7 kg. 300.

Weight of projectile with 24/31 I fuse, Model 1914, with green head..... 7 kg. 445.

Weight of projectile with truncated AL fuse..... 7 kg. 625.

A shell fitted with truncated AL fuse has the same range as one with I fuse, up to a range of 8000 m.

Its range is less by 20 m. at a range of 9000 m.

Its range is less by 55 m. at a range of 10000 m.

Its range is less by 110 m. at a range of 11000 m.

Approximate VALUE of ballistic coefficient.

MUZZLE VELOCITY.	JUMP.	Log. C.
525 m.....	5'	$\bar{4}.60$

TABLE V_e.

75 AL semi-steel shell 24/31 1 fuse, Model 1914, green head.

$V_o = 525^m$.

RANGE IN METERS.	ELEVATION		RANGE SETTING.	DRIFT IN MILS.	RANGE IN METERS.	ELEVATION		RANGE SETTING.	DRIFT IN MILS.
	DEGREES and minutes.	MILS.				DEGREES and minutes.	MILS.		
					3000	4° 15′	76	2775	2
100	− 1′	0	100	0	3100	4 27	79	2850	2
200	+ 5	1	200	0	3200	4 39	83	2950	2
300	11	3	300	0	3300	4 52	86	3050	2
400	18	5	400	0	3400	5 5	90	3150	2
500	24′	7	475	0	3500	5° 17′	94	3225	2
600	31	9	575	0	3600	5 30	98	3325	3
700	38	11	650	0	3700	5 43	102	3400	3
800	45	13	750	0	3800	5 56	106	3500	3
900	53	16	850	0	3900	6 10	110	3600	3
1000	1° 1′	18	950	0	4000	6° 24′	114	3675	3
1100	1 9	20	1025	0	4100	6 38	118	3775	3
1200	1 17	23	1125	0	4200	6 53	122	3850	3
1300	1 25	25	1225	0	4300	7 8	127	3950	4
1400	1 33	28	1300	0	4400	7 23	131	4050	4
1500	1° 41′	30	1400	0	4500	7° 38′	136	4125	4
1600	1 50	33	1500	0	4600	7 54	140	4225	4
1700	1 59	35	1575	0	4700	8 10	145	4325	4
1800	2 9	38	1675	0	4800	8 27	150	4425	5
1900	2 19	41	1775	0	490 0	8 44	155	4500	5
2000	2° 29′	44	1875	1	5000	9° 1′	160	4600	5
2100	2 39	47	1950	1	5100	9 18	165	4700	5
2200	2 49	50	2050	1	5200	9 35	170	4775	6
2300	2 59	53	2150	1	5300	9 52	175	4875	6
2400	3 9	56	2225	1	5400	10 9	180	4950	6
2500	3° 19′	59	2325	1	5500	10° 27′	186	5050	6
2600	3 29	62	2400	1	5600	10 45	191	5125	7
2700	3 40	65	2500	1	5700	11 3	196	5225	7
2800	3 51	68	2575	1	5800	11 21	202	5300	7
2900	4 3	72	2675	1	5900	11 40	207	5400	7

TABLE V_e. (Continued.)

AL SHELL. $V_o = 525^m$.

RANGE IN METERS.	ELEVATION DEGREES and minutes.	ELEVATION MILS.	RANGE SETTINGS.	DRIFT IN MILS.	RANGE IN METERS.	ELEVATION DEGREES and minutes.	ELEVATION MILS.	RANGE SETTING.	DRIFT IN MILS.
6000	11°58′	213	5475	8	9000	23°	412	↑	16
6100	12 17	219	↑	8	9100	23 36	420		17
6200	12 36	224		8	9200	24 3	428		17
6300	12 55	230		8	9300	24 31	436		17
6400	13 14	235		9	9400	25 0	444		18
6500	13°33′	241		9	9500	25°29′	453		18
6600	13 53	247		9	9600	25 58	462		19
6700	14 13	253		10	9700	26 27	470		19
6800	14 33	259		10	9400	26 56	479		20
6900	14 54	265		10	9900	27 26	488		20
7000	15°14′	271		11	10000	27°57′	497		21
7100	15 35	277		11	10100	28 29	506		21
7200	15 56	283		11	10200	29 1	516		22
7300	16 18	290		11	10300	29 34	526		23
7400	16 40	296		12	10400	30 7	535		23
7500	17° 3′	303		12	10500	30°41′	545		24
7600	17 25	310		12	10600	31 16	556		25
7700	17 48	316		13	10700	31 51	566		26
7800	18 11	323		13	10800	32 27	577		27
7900	18 34	330		13	10900	33 4	588		29
8000	18 57	337		13	11000	33°42′	599	↓	30
8100	19 21	344		14					
8200	19 45	351		14					
8300	20 9	358		14					
4400	20 33	365		14					
8500	20°58′	373		15					
8600	21 23	380		15					
8700	21 49	388		15					
8800	22 15	396		16					
8900	22 42	404	↓	16					

Laying by quadrant.

Laying by quadrant.

TABLE

ADDITIONNAL ELEMENTS of fire AL semi-steel or 24/31

RANGE in METERS.	ANGLE OF FIRE.	BRACKET.		ANGLE OF FALL.	TANGENT OF ANGLE OF FALL.	DISPLACEMENY OF POINT OF FALL			
		Fuse I.	Troncated fuse			in range, for 1 mil of site.	in range, for 5' of elevation.	in height, for 5' of elevation.	in direction, for 1 mil of deflection.
						m.	m.	m.	m.
500	0°24'	4'	4'	1° 4'	0.019	51.4	76.0	1.4	0.5
1000	1 1	5	5	2 10	0.038	43.4	64.2	2.4	1.0
1500	1 41	5	5	3 17	0.057	39.5	58.4	3.3	1.5
2000	2 29	6	7	4 28	0.078	34.7	51.4	4.0	2.0
2500	3 19	6	7	5 44	0.100	31.6	46.8	4.7	2.5
3000	4 15	8	9	7 4	0.124	28.8	42.6	5.3	2.9
3500	5 17	9	10	8 28	0.149	26 3	38.9	5.8	3.4
4000	6 24	11	12	10 0	0.18	24.9	35.4	6.4	3.9
4500	7 38	13	15	11 36	0.21	22.0	32.6	6.9	4.4
5000	9 1	15	18	13 16	0.24	20.4	30.2	7.3	4.9
5500	10 27	17	21	15 4	0.27	19.1	28.3	7.7	5.4
6000	11 58	19	24	16 57	0.30	17.9	26.5	8.1	5.9
6500	13 33	22	28	19 0	0.34	16.8	24.9	8.5	6.4
7000	15 14	25	33	21 10	0.39	15.9	23.5	9.2	6.9
7500	17 3	31	41	23 32	0.44	15.0	22.2	9.8	7.4
8000	18 57	35	49	26 8	0.49	14.2	20.9	10.2	7.9
8500	20 58	41	58	29 0	0.55	13.3	19.6	10.8	8.3
9000	23 9	49	1°10'	32 10	0.63	12.4	18.4	11.6	8.8
9500	25 29	57	1 26	35 54	0.72	11.7	17.3	12.5	9.3
10000	27 57	1° 9'	1 46	40 0	0.84	11.0	16.3	13.7	9.8
10500	30 41	1 23	2 11	44 30	0.98	10.3	15.2	14.9	10.3
11000	33 42	1 44	2 49	50 0	1.19	9.6	14.2	16.9	10.8

VI_c.

shell 24/31 I fuse, model 1914, green head, troncated AL fuse.

$V_o = 525^m$.

TIME OF FLIGHT.	MAXIMUM ORDINATE.	REMAINING VELOCITY			PROBABLE ERROR in range.		PROBABLE ERROR in direction.		RANGE in METERS.
		horizontal.	vertical.	tangential.	I fuse.	Troncated fuse.	I fuse.	Troncaded fuse.	
sec.	m.	m.	m.	m.	m.	m.	m.	m.	
1.0	1	480	9	480	9.2	9.3	0.1	0.1	500
2.1	7	441	17	441	9.5	9.8	0.2	0.2	1000
3.3	15	406	23	407	9.8	10.3	0.3	0.3	1500
4.6	26	377	29	378	10.3	10.9	0.4	0.4	2000
6.0	46	352	35	354	10.8	11.6	0.5	0.5	2500
7.4	70	331	41	334	11.4	12.5	0.6	0.6	3000
8.9	100	314	47	317	12.1	13.4	0.8	0.8	3500
10.4	140	297	52	302	12.8	14.3	1.0	1.0	4000
12.0	192	283	58	289	13.8	15.9	1.2	1.2	4500
13.8	253	272	64	279	14.8	17.5	1.4	1.4	5000
15.5	325	262	70	271	16.1	19.5	1.6	1.6	5500
17.3	408	253	77	264	17.4	21.8	1.8	1.8	6000
19.3	505	245	84	259	18.9	24.0	2.1	2.1	6500
21.4	618	239	92	256	20.7	26.9	2.4	2.4	7000
23.7	750	233	101	254	22.7	30.4	2.7	2.8	7500
26.1	900	228	112	254	24.8	34.4	3.0	3.2	8000
28.5	1077	224	124	256	27.3	38.4	3.3	3.6	8500
31.2	1272	219	138	259	30.0	43.5	3.7	4.2	9000
33.8	1495	212	151	262	33.0	49.5	4.1	4.6	9500
36.7	1740	204	171	266	36.3	56.0	4.6	5.3	10000
39.7	2042	193	190	271	40.2	63.5	5.1	5.8	10500
43.0	2420	178	212	277	45.0	73.0	5.8	6.2	11000

TABLE

75 AL SEMI-STEEL SHELL, 24/31, I FUSE, MODEL 1914

A. — *VARIATIONS in meters of range due to :*
a variation dV_o of muzzle velocity,
a variation dp of weight of shell,
a variation $d\varpi$ of weight of liter of air,
a longitudinal wind component, Wx.

RANGE in METERS.		1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000
dV_o in meters.	1	4	6	8	9	10	11	12	13	14	16	17
	2	8	13	16	18	20	22	24	26	28	31	35
	3	12	19	24	27	30	33	36	39	43	47	52
	4	16	26	32	36	40	44	48	52	57	62	70
	5	20	32	40	45	50	55	60	65	71	78	87
	6	24	39	48	54	60	66	72	78	85	94	105
	7	28	45	56	63	70	77	84	91	99	109	122
	8	32	52	64	72	80	88	96	104	114	125	140
	9	36	58	72	81	90	99	108	117	128	140	157
	10	40	65	80	90	100	110	120	130	142	156	175
dp in grams.	25	− 2	− 2	− 2	− 2	− 1	− 1	0	0	0	+ 1	+ 1
	50	− 3	− 4	− 5	− 4	− 3	− 2	− 1	0	+ 1	+ 2	+ 3
	75	− 5	− 6	− 7	− 6	− 4	− 3	− 1	0	+ 1	+ 3	+ 4
	100	− 7	− 8	− 10	− 8	− 6	− 4	− 2	0	+ 2	+ 4	+ 6
$d\varpi$ in milli-grammes.	10	− 1	− 3	− 6	− 9	− 12	− 15	− 19	− 22	− 25	− 28	− 32
	20	− 2	− 6	− 12	− 18	− 23	− 30	− 39	− 44	− 51	− 57	− 64
	30	− 2	− 9	− 18	− 27	− 35	− 46	− 58	− 66	− 75	− 85	− 96
	40	− 3	− 12	− 24	− 36	− 47	− 61	− 77	− 88	− 101	− 114	− 128
	50	− 4	− 15	− 30	− 45	− 58	− 76	− 96	− 110	− 126	− 142	− 160
	60	− 5	− 18	− 36	− 54	− 70	− 91	− 116	− 132	− 152	− 171	− 192
	70	− 6	− 21	− 42	− 63	− 82	− 106	− 135	− 154	− 177	− 199	− 224
	80	− 6	− 24	− 48	− 72	− 94	− 122	− 154	− 176	− 202	− 228	− 256
	90	− 7	− 27	− 54	− 81	− 105	− 137	− 174	− 193	− 228	− 256	− 288
	100	− 8	− 30	− 60	− 90	− 117	− 152	− 193	− 220	− 253	− 285	− 320
Wx in meters per second.	1	0	2	4	6	9	13	17	21	25	29	34
	2	1	3	8	13	19	26	34	42	50	58	67
	3	1	5	11	19	28	39	50	63	75	88	101
	4	2	7	15	26	38	52	67	84	100	117	135
	5	2	8	19	32	47	65	84	105	125	146	168
	6	2	10	23	38	57	79	101	126	150	175	202
	7	3	12	27	45	66	92	117	147	175	204	236
	8	3	14	30	51	76	105	134	168	200	234	270
	9	4	15	34	58	85	118	151	189	225	263	303
	10	4	17	38	64	95	131	168	210	250	292	337

VII$_c$.

GREEN HEAD, OR 24/31 TRUNCATED AL FUSE.

$V^o = 525^m$.

B. — *Lateral deviation in mils due to a crosswind component*, Wy.

RANGE in METERS.	1000	2000	3000	4000	5000	6000	7000	8000	9000	10005	11000
Wy in meters per second. 1	0	0	0	1	1	1	1	1	1	1	2
2	0	0	1	1	2	2	2	3	3	3	3
3	0	1	1	2	3	3	4	4	4	4	5
4	0	1	2	3	3	4	5	5	6	6	6
5	0	1	2	4	4	5	6	6	7	7	8
6	0	1	3	4	5	6	7	8	8	9	10
7	1	2	3	5	6	8	8	9	10	10	11
8	1	2	4	6	7	9	10	10	11	12	13
9	1	2	4	7	8	10	11	12	13	13	14
10	1	2	5	7	9	11	12	13	14	15	16

C. — *Lateral deviation in mils due to an inclination of the trunnions of 1°.*

	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000
$\theta = 1^o$.....	0	1	1	2	3	4	5	6	7	9	11