TARGET RANGE POCKET BOOK

FOR USE WITH THE

U. S. MAGAZINE RIFLE

MODEL OF 1903, CAL. .30

APRIL 23, 1908

No. 1998

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7 PLATES

U.S. Ordnance dept.

APRIL 28, 1908

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

TARGET RANGE POCKET BOOK.

I. This pamphlet has been prepared especially for use with the service rifle, model of 1903, on the target range. The tables contained herein refer to the above-mentioned rifle equipped with the model of 1905 sights, graduated for the ball cartridge, caliber .30, model of 1906. The data given in the tables have been either determined experimentally for the average rifle under standard conditions or computed, using constants obtained experimentally.

II. Blank columns have been left in the tables for the addition of such data peculiar to any particular rifle, as may be desired by the marksman. Great care is taken in the manufacture of the rifle to insure its uniformity and excellence, but so many variables enter into the shooting of a rifle that a certain amount of deviation from the average inevitably results.

III. The bore of the U. S. magazine rifle is drilled, reamed, straightened, and rifled with the utmost of mechanical and personal skill and the barrel is finally stocked and targeted in order to test its actual shooting qualities.

In targeting, each rifle is required, at a range of 200 yards, to place the center of impact of all shots well within a vertical strip 7 inches wide. Too much care can not be exercised in preserving the barrel and bore of the rifle in good condition. The main points to be observed are:

1. To keep the bore clean and well oiled so as to avoid rust.

2. To avoid the use in the bore of emery cloth or any other harsh abrasive.

3. To protect the lips of the muzzle of the barrel from deformation.

4. To protect the stock from moisture and consequent swelling.

The above points are all important factors in the good shooting of the rifle and should be carefully observed by all who desire to obtain the best results.

IV. The following method of cleaning the bores of small arms has been practiced at the Springfield Armory for a number of years with good results: As soon as practicable after firing, using the brass cleaning rod and cloth patches (preferably canton flannnel)—

First. Thoroughly clean the bore with patches soaked in a saturated solution of sal soda.

Second. Remove the soda from the bore, using dry patches.

Third. Oil the bore, using patches saturated with cosmic oil.

Fourth. About twenty-four hours after this cleaning repeat the three operations just mentioned.

This second cleaning is necessary, no matter how carefully the first cleaning is done, for the reason that the powder gases are probably occluded by the steel under the heavy chamber pressure and are not reached by the first cleaning.

After the second cleaning and oiling the rifle may be stored indefinitely in a reasonably dry place without fear of any deterioration of the bore.

V. True metallic fouling consists of a thin film of cupro nickel, which is abraded from the bullet jacket and deposited on the bore. Contrary to the usual idea,

it has been found that this film does not affect the accuracy of the rifle and is in no way detrimental. On the contrary, it is if anything, beneficial, inasmuch as it offsets the erosion to a minute degree. The thickness of this fouling after several thousand rounds is less than ″.0001. The stripping of a considerable portion of the jacket in the bore is not properly called metallic fouling, but is a metallic obstruction, which should be removed by the bullet-jacket extractor described in Form 1923, if practicable, or if not, the rifle should be turned in to an armory or ordnance depot.

VI. The table on page 57 of the Description and Rules for the Management of the U. S. Magazine Rifle, Model of 1903, .30 caliber, shows three columns or sets of deviations of the bullet. The first column shows the path of the bullet as projected on a horizontal plane when firing with the line of sight coincident with a vertical plane through the axis of the bore. In this column the deviation is to the left up to 500 yards. This is due to the lateral jump or whip of the barrel. The second column shows the amount of deviation corrected for by the inclination of the drift slot in the rear sight leaf. The third column is the difference between the first and second, shows how the rifle shoots with the model of 1905 sight, or the amount of drift which is not automatically corrected.

The following table shows how the average rifle shoots when issued to the service:

Example: Under standard conditions, with the sight set at 800 yards, zero deflection, and aiming at the center of a target 800 yards away, the bullet will strike 1.9″ to the right of the point aimed at.

TABLE I (Drift).

Range.	Deviations.		Deviations.	
	Left.	Right.	Left.	Right.
Yards.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
100	.0		.....	.....
200	.0		.....	.....
300	.0		.....	.....
400	.0		.....	.....
500	.0	.0	.....	.....
600		.0	.....	.....
700		.6	.....	.....
800		1.9	.....	.....
900		4.0	.....	.....
1,000		6.7	.....	.....

VII. Deviations due to wind are computed by the formula:

$$S = \left(t - \frac{3R}{V}\right) C\ W \sin \theta$$

in which

S = deviation at target in inches.

t = time of flight for range considered.

R = range in yards.

V = muzzle velocity in feet per second.

C = a constant = 10.44.

W = velocity of wind in feet per second.

θ = inclination of the direction of the wind to trajectory.

It may be noted that the wind effect is less for the model of 1906 ammunition than for the model of 1903 ammunition, formerly used with the U. S. magazine rifle, model of 1903. This is largely due to the shorter times of flight which obtain with the former. The deviations for the model of 1906 cartridge are tabulated in Table II below for a 1-mile-an-hour III or IX o'clock wind.

Table II (Wind).

Range.	Deviation.	Deviation.
Yards.	*Inches.*	*Inches.*
100	0.1	.....
200	.3	.....
300	.8	.....
400	1.5	.....
500	2.4	.....
600	3.6	.....
700	5.1	.....
800	6.9	.....
900	9.1	.....
1,000	11.5	.....

VIII. The rear end of the movable base of the model of 1905 sight bears graduations, the value of the smallest graduation being about 3.99 inches at 100 yards. These smallest graduations are known as "points" of deflection or windage. The following table shows the

lateral correction caused at the target by setting off one point of deflection:

Table III (Deflection).

Range.	Correction at target.	Correction at target.
Yards.	*Inches.**	*Inches.*
100	4	.....
200	8	.....
300	12	.....
400	16	.....
500	20	.....
600	24	.....
700	28	.....
800	32	.....
900	36	.....
1,000	40	.....

*An exact point of windage, as stated above, is equivalent to about 3″.99 at 100 yards, but no appreciable error is made up to 1,000 yards by considering the point equal to 4 inches, and calculation is simplified thereby.

IX. When firing at a given range, if the rear sight slide is raised by an amount corresponding to 25 yards of range, the point of impact of the bullet at the target is raised by a certain number of inches. The following table shows how much the point of impact is raised or lowered by a change of 25 yards in the sight setting.

TABLE IV (Elevation).

Range.	Correction at target.	Correction at target.
Yards.	*Inches.*	*Inches.*
100	0.7	.....
200	1.6	.....
300	2.8	.....
400	4.3	.....
500	6.2	.....
600	8.6	.....
700	11.6	.....
800	15.4	.....
900	19.9	.....
1,000	25.1	.....

X. Table II, page 7, of this pamphlet shows how much the bullet is deflected by a 1-mile-an-hour wind blowing directly across the range from III or IX o'clock. If the same wind blows from the II, IV, VIII, or X o'clock directions, the resulting deflection of the bullet is less than when the wind blows directly across the range, and to obtain these deflections the deflections in Table II are multiplied by the cosine of 30 degrees, or .866+. Similarly if the same wind blows from the I, V, VII, or XI o'clock directions the resulting deflection is still less, and to obtain these deflections the deflections in Table II are multiplied by the cosine of 60 degrees, or .5. In other words, a 1-mile-an-hour wind blowing from I, V, VII, or XI o'clock directions

has just half the deflecting power of the same wind blowing from the III or IX o'clock directions.

To counteract or compensate for wind deflection a certain number of points of deflection must be set off on the rear sight. The following table shows how many points must be used at the various ranges for a 10-mile-an-hour wind from each of the various directions.

Since the deflecting power of a wind is directly proportional to its velocity, the proper corrections for any velocity of wind may be readily computed from the following table:

TABLE V (**Wind, Lateral**).

Points of windage necessary to correct a 10-mile-an-hour wind.

Range.	III or IX.	II, IV, VIII, or X.	I, V, VII, or XI.	III or IX.	II, IV, VIII, or X.	I, V, VII, or XI.
Yards.	*Points.*	*Points.*	*Points.*	*Points.*	*Points.*	*Points.*
100	0.2	0.2	0.1	.....	.....	.....
200	.4	.4	.2	.....	.....	.....
300	.7	.6	.3	.....	.....	.....
400	.9	.8	.5	.....	.....	.....
500	1.2	1.0	.6	.....	.....	.....
600	1.5	1.3	.7	.....	.....	.....
700	1.8	1.6	.9	.....	.....	.....
800	2.2	1.9	1.1	.....	.....	.....
900	2.5	2.2	1.3	.....	.....	.....
1,000	2.8	2.4	1.4	.....	.....	.....

XI. Winds blowing from the XII and VI o'clock directions have no deflecting influence on the flight of the bullet, but these winds have the effect of shortening (in the case of XII o'clock winds) or lengthening the range (in the case of VI o'clock winds). Or, to put it in another way, a wind blowing directly down the range from the firing point toward the target, has the effect of raising the point where the bullet strikes the target. Similarly, a wind blowing directly up the range toward the firing point has the effect of lowering the point where the bullet strikes the target.

The following table, showing the effects of these winds, has been computed, using Colonel Ingall's formula:

$$\pm\Delta X = C\{S(v \pm Wp) - S(V \pm Wp)\} - (X \pm TWp)$$

and the approximate relation:

$$\pm\Delta y = \pm\Delta X \tan \omega$$

The following table shows effects of XII and VI o'clock winds blowing 10 miles per hour. For other wind velocities, the corrections may be readily computed without appreciable error by assuming that these corrections are directly proportional to the wind velocities. The longitudinal wind effects of I and II o'clock winds may be found by multiplying the figures in the table by .866 and .5, respectively.

TABLE VI (Wind, Longitudinal).

Corrections for 10-mile-an-hour wind.				
Range.	VI yards over at target.	XII yards short at target.	VI inches above at target.	XII inches below at target.
Yards.				
100	1.0	0.9	.03	.02
200	2.0	2.0	.12	.11
300	3.2	3.2	.41	.40
400	4.5	4.4	.69	.68
500	6.1	6.0	1.4	1.3
600	8.0	8.0	2.5	2.4
700	10.2	9.9	4.4	4.3
800	13.6	13.3	7.8	7.6
900	19.9	19.0	14.7	14.1
1,000	26.7	25.5	25.1	23.9

NOTE.—The correction in sight elevation in yards corresponding to inches above or below may be read from the second or third columns of this table.

XII. The following diagrams illustrate graphically the values of the point of deflection and of the elevation corrections on the several standard targets at the several ranges prescribed in Small-Arms Firing Regulations, 1906.

Plate I simply illustrates how the value of any correction on the sight increases with the range.

Plate II shows the value of the point of deflection on the "A" target at a range of 200 yards. This diagram also shows the value at the target of a change of sight setting of 50 yards.

To illustrate the method of using this and the subsequent diagrams, let it be supposed that a shot was fired at the "A" target at a range of 200 yards and that the bullet struck at the point marked "P" (Plate II), then the correction necessary to bring the next shot on the center of the bull's-eye may be read directly from the diagram, thus: 75 yards less elevation and 2 points of deflection to the left.

War Department,
Office of the Chief of Ordnance,
Washington, April 28, 1908.

Form No. 1998.
Ed. June 13-17-5,000.
26791—O—1587.

POINT OF DEFLECTION
ELEVATION CORRECTION
200 YDS.
400 YDS.
600 YDS.
800 YDS.
1000 YDS.

PLATE I

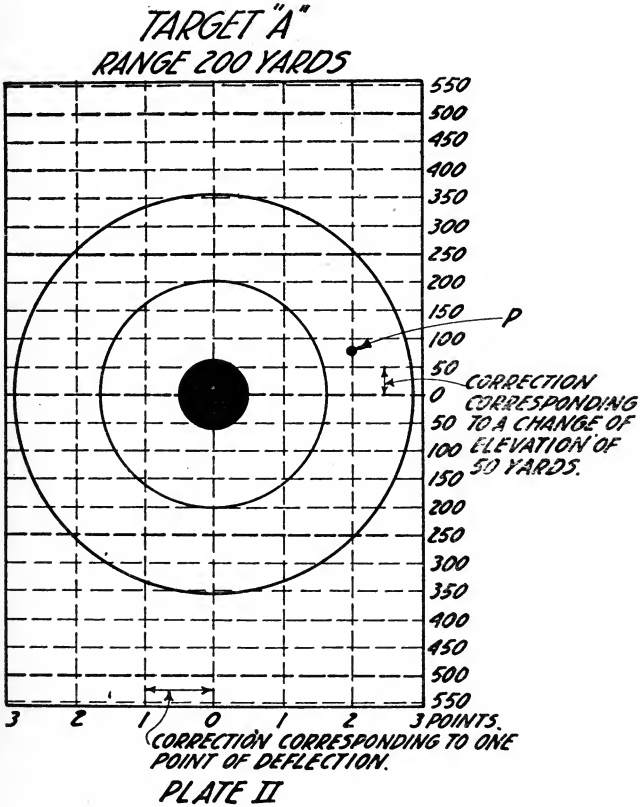
TARGET "A"
RANGE 200 YARDS
550
500
450
400
350
300
250
200
150
100
50
0
50
100
150
200
250
300
350
400
450
500
550
P
CORRECTION CORRESPONDING TO A CHANGE OF ELEVATION OF 50 YARDS.
3
2
1
0
1
2
3 POINTS.
CORRECTION CORRESPONDING TO ONE POINT OF DEFLECTION.

PLATE II

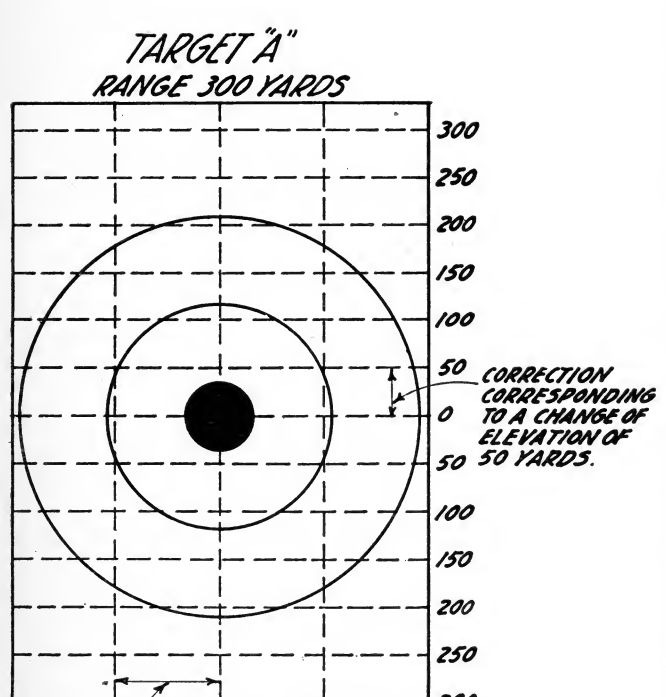
TARGET "A"
RANGE 300 YARDS
300
250
200
150
100
50
0
50
100
150
200
250
300
CORRECTION CORRESPONDING TO A CHANGE OF ELEVATION OF 50 YARDS.
2
1
0
1
2 POINTS
CORRECTION CORRESPONDING TO ONE POINT OF DEFLECTION.

PLATE III

TARGET "B"
RANGE 500 YARDS

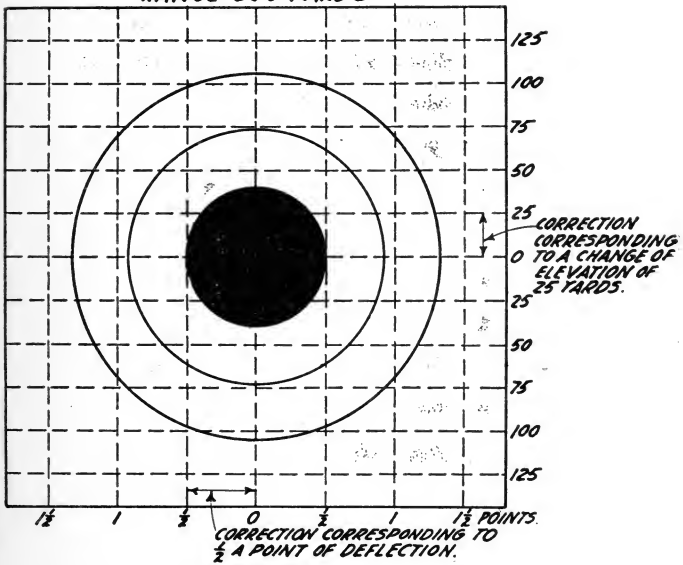

PLATE IV

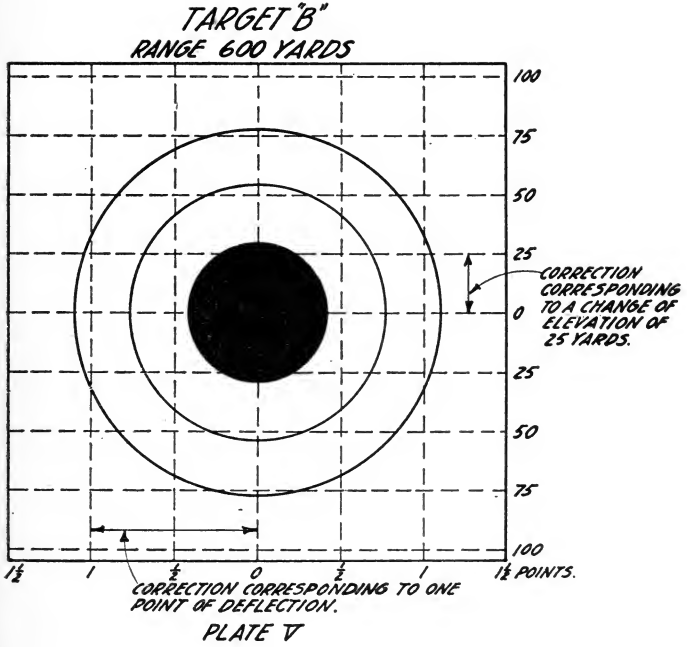
TARGET "B"
RANGE 600 YARDS
100
75
50
25
0
25
50
75
100
CORRECTION CORRESPONDING TO A CHANGE OF ELEVATION OF 25 YARDS.
1½
1
½
0
½
1
1½ POINTS.
CORRECTION CORRESPONDING TO ONE POINT OF DEFLECTION.

PLATE V

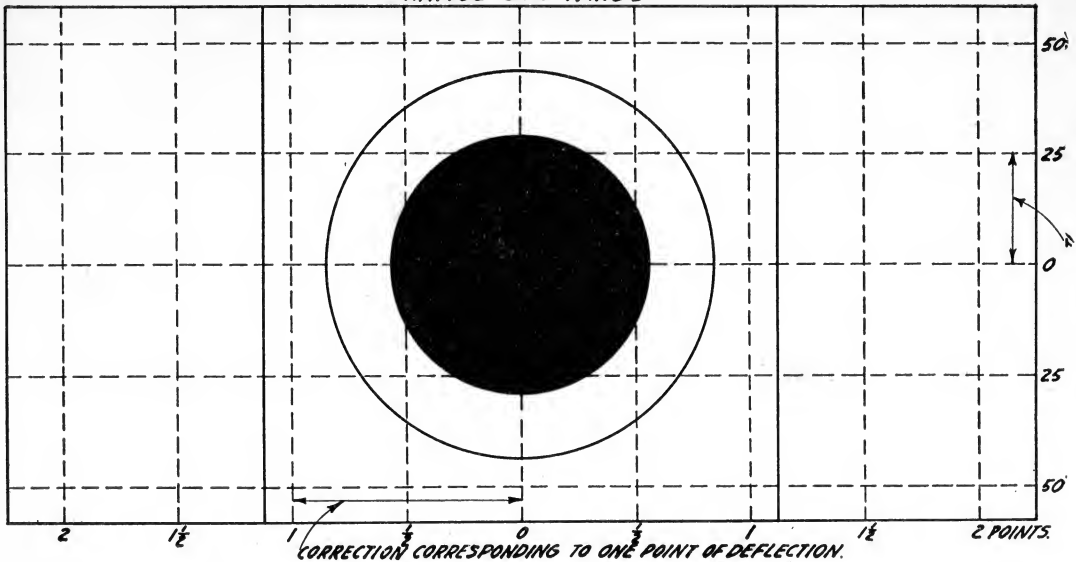

PLATE VI

Correction corresponding to a change of elevation of 25 yards.

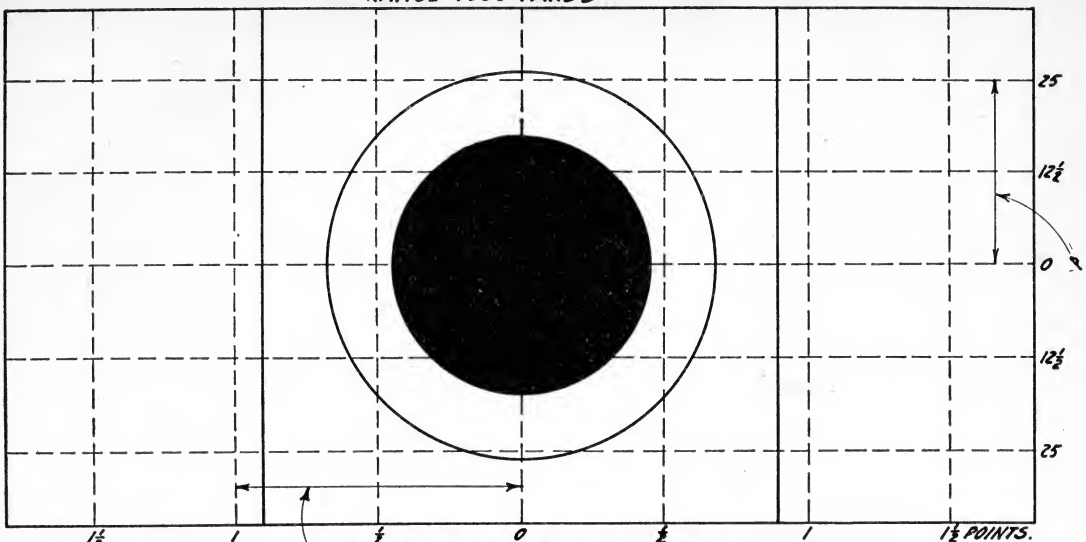

PLATE VII

Correction corresponding to a change of elevation of 25 yards.