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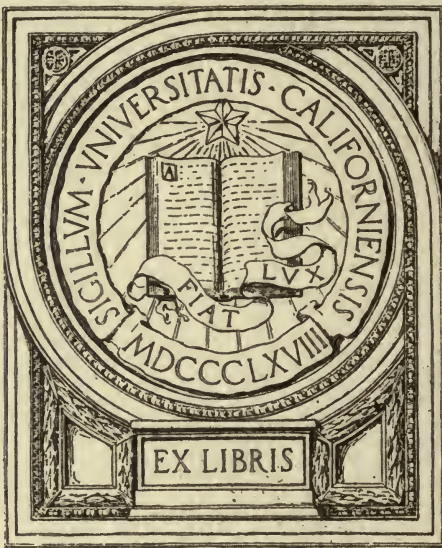
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DESCRIPTION
OF THE
PRATT RANGE BOARD
MODEL OF 1905

MECHANICAL FEATURES AND RULES GOVERNING
ITS CARE AND PRESERVATION
IN SERVICE

(SIX PLATES)

MAY 20, 1908
REVISED DECEMBER 30, 1914



WASHINGTON
GOVERNMENT PRINTING OFFICE
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U.S. Ordnance dept.

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, December 30, 1914.

This Manual is published for the information and government of the Regular Army and Organized Militia of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

(3)



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DESCRIPTION OF THE PRATT RANGE BOARD.

MODEL OF 1905.

GENERAL DESCRIPTION.

1. The Pratt Range Board is a mechanical computing device used in determining the corrected range to be transmitted to the gun emplacements. It consists of a box, chart board, canvas chart mount, correction chart, curve-indicator system, correction ruler, chain for ruler and counterweight, chain sprockets, and counterweight.

2. The chart board is secured within the box by means of the upper clips and lower clip. The canvas chart mount is stretched in position by the clamps, nut for clamps, and washer for clamp. This clamping device is secure to the pipes for canvas, which in turn retain the rods for canvas. The rods are sewed to the margin of the canvas chart mount. The canvas chart mount should be stretched in position before pasting the correction chart thereto. The correction chart is so located that its range scale is perpendicular to the bottom end of the chart board. The chart for the 1-pounder subcaliber gun is mounted on the reverse side of the canvas chart mount.

3. The correction chart is provided with four sets of correction curves, designated "atmosphere," "velocity," "tide," and "wind." It has a vertical range scale on each edge of the chart and horizontal range lines and data for accuracy tests. The curves reading from left to right are drawn to give the range correction for every 2 per cent variation in the density of atmosphere, for every 10-foot-second of velocity, for every 5 feet of tide, and for every 10-mile range component of wind. The red line of the chart is a line of no correction and is called the normal. To avoid liability of error, reference numbers are used for atmosphere, velocity, and wind, instead of two sets of numbers with the plus and minus signs. The horizontal scale of the chart is 200 yards to the inch.

4. The curve indicator system consists of the bar for curve indicators, curve indicators, clamping screw for curve indicator, support for curve-indicator bar, and chain for clamping screw for curve-indicator bar. The bar for curve indicators is the main part on which the curve indicators are used to indicate the correction curve to be used in each set. The bar for curve indicators is attached to the box near its top and is supported at the left end by the clamping screw for curve-indicator bar and the support for curve-indicator bar, and on the right end by the clamping screw for curve-indicator bar and the

bearing strip for ruler. The three tapped holes in the bearing strip for ruler allow for the three different settings of the bar for curve indicators. The clamping screw for curve-indicator bar is fastened to the chain for clamping screw for curve-indicator bar, which in turn is secured to the top of the box by a brass screw eye.

CORRECTION RULER.

5. The correction ruler consists principally of the body, stationary box, movable bar, movable scale, four movable clamping devices with pointers, a gear mechanism, reading glass holder support slide with cross wire, and reading glass, guide plate (right) and guide plate (left) with ruler clamps and ruler clamp screws, and two range pointers.

6. The body is the main part to which the other pieces are attached. The scale engraved on the body is graduated 400 yards to the inch. The stationary bar is secured to the upper edge of the body by seven 0.177 by 0.5 inch standard flister head bronze screws and acts as one of the guides for the movable clamping device with pointers. The movable bar is so designed that when the knob is turned the gear mechanism will move the bar twice the distance of the movable scale. The 0.099 by 0.187 ($\frac{3}{16}$) inch standard flister head steel screw is located on the top and at each end of the movable bar and forms a stop for the movable clamp. The movable bar also acts as the other guide for the movable clamping device with pointers and consists principally of the pointer, movable clamp, eccentric, stop screw, wing nut, clamp spring, and taper pin.

7. The movable clamping device with pointers is so designed that each is clamped, independently of the others, either to the stationary bar or the movable bar, or to both bars simultaneously. When clamped to both bars, the entire mechanism is locked. The provision for locking to both bars serves two purposes—first, to provide against shifting the pointer when passing from one clamped position to the other; and, second, to prevent the mechanism from getting out of adjustment. The pointer is secured to the upper edge of the movable clamp by two 0.112 by 0.125 inch standard roundhead bronze screws. One pointer is used by each set of correction curves. The letter "S" on the right, "L" in the center, and "M" on the left are engraved on the plan and upper view of the movable clamp. The wing nut is secured to the eccentric by a 0.093 ($\frac{3}{32}$) by 0.56 inch taper pin. The movable scale, which slides in a dovetail slot in the body, is moved by the gear mechanism when the knob is turned. The graduated scale is 400 yards to the inch.

8. The gear mechanism consists principally of the gear bracket, gear cover, knob, main gear, movable bar gear, gear and pinion, and idler gear. The gear bracket is secured to the lower edge of the body by

four 0.177 by 0.75 inch standard flister head bronze screws and retains the main gear and the idler gear. The gear cover retains the gears in position and is secured to the bottom of the body by seven 0.112 by 0.25 inch standard countersunk head bronze screws. The knob is fastened to the main gear, which meshes with the idler gear, which in turn rotates the gear and pinion and movable-bar gear. The pinion is riveted to the gear and pinion and meshes with the teeth of the rack on movable scale. The movable-bar gear moves the bar when rotated. The knob should never be turned except when adjusting, while all four movable clamping devices with pointers are clamped to the stationary bar.

9. The reading-glass holder support slide is so designed as to slide in a T-shaped slot in the body. The cross wire is secured to the left side of the reading-glass holder support slide by the cross-wire clips and cross-wire screws. The reading glass is retained in the reading-glass holder by the reading-glass retaining screw. The reading glass magnifies the graduations on the body and the movable scale. The reading-glass holder hinge screw forms a pivot for the reading-glass holder in the reading-glass holder support slide. The 0.099 by 0.16 inch headless steel screw in the slot at the right-hand end of the body prevents the reading-glass holder support slide from coming out.

10. The guide plate (right) and guide plate (left) are secured to the bottom and their respective ends of the body by four 0.216 by 0.375 inch standard flister head bronze screws. The ruler clamps enable the correction ruler to be clamped in any desired position to the bearing strips for ruler with the aid of the ruler clamp screws.

11. The range pointers are secured to the bottom of the body, one at each end, by two 0.112 by 0.25 inch countersunk head bronze screws, and are used for indicating the range of the correcting chart.

12. The correction ruler is maintained in any desired position in front of the correction chart by the chains for ruler and counterweight. It should be set parallel with the horizontal lines on the correcting chart. One end of each chain for ruler and counterweight is attached to the counterweight by means of a brass screw eye. Both chains for ruler and counterweight pass up through the middle of the top of the box, separate, and each passes over two chain sprockets, thence down through the top of the box, and each is attached at its other end to an end of the correction ruler. The chain for ruler and counterweight is attached to the right end of the correction ruler by means of the chain screw, and to the left end by means of the chain-adjusting screw and cap. The cap is secured to the chain-adjusting screw by a 0.063 by 0.31 inch bronze pin. The chain sprockets rotate on the axis for chain sprockets, which in turn are secured in the sprocket stand (right) and sprocket stand (left).

ADJUSTMENTS.

13. There are two adjustments: First, vertical adjustment.—With the chain-adjusting screw on one of the chains for ruler and counterweight at the left end of the correction ruler, set the two range pointers at the same range on the vertical scales on the correction chart.

14. Second, horizontal adjustment.—Clamp the movable clamping device with pointers to the movable bar. Turn the knob of the gear mechanism until the pointer of the movable clamping device is exactly opposite the normal of its set of correction curves. Clamp this movable clamping device with pointers to the stationary bar. In like manner set each of the other pointers of the movable clamping devices to the normal of its correction curve and clamp to the stationary bar. When all four pointers of the movable clamping devices are at their normals and clamped to the stationary bar, turn the knob until the reading-glass holder support slide with cross wire and reading glass indicates the same range on both the scale graduated on the body and the movable scale. Clamp one outside movable clamping device only to both movable bar and stationary bar, locking the system.

OPERATION.

15. Set each curve indicator at its proper correction curve. Set the cross wire with the aid of the reading glass at the range to the set-forward point on the scale graduated on the body. Set the range pointers of the correction ruler at the range of the set-forward point on both vertical range scales of the correction chart. Clamp the movable clamping device with pointer to the movable bar, and by means of the knob set the pointer at the correction curve indicated by the curve indicator. Then clamp the stationary bar. Proceed in like manner with the other movable clamping devices with pointers in succession, locking the mechanism with last outside movable clamping device with pointer. The range on the movable scale at the cross wire under the reading glass is the corrected range. The range-board operator transmits this corrected range to the gun emplacements.

NOTE.—In operating it is not necessary to return any pointer to the normal of its set of correction curves. It is necessary to set only the correction ruler and range pointers at the range for the set-forward point and move each pointer directly to its proper correction curve. The correction curve is frequently imaginary and lies between two of the plotted curves, in which case the pointer is set on the imaginary curve, as indicated by the curve indicator.

TEST OF ACCURACY.

16. There are two tests for accuracy, viz: *For mechanical accuracy*—Use each set of test points marked on the correction curves and on the same range line and determine the corrected range. The true

corrected range corresponding to each set is shown in brackets on the margin. Repeat several times for each set and record the difference of each determined range from the true range. The mean of these differences is the mechanical error. An officer should conduct this test, exercising the utmost care in operating the board.

For accuracy of the range-board operator.—Direct method: The range-board operator uses the test points with the range pointers.

Reverse method: After a series of corrected ranges have been determined by the range-board operator, the range officer sets each pointer at the normal of its set of correction curves.

The difference in ranges on the scale graduated on the body and the movable scale under the cross wire in excess of the mechanical error will be due to inaccurate work on the part of the range-board operator.

Other methods of test may be devised if found desirable.

CARE AND PRESERVATION.

17. The parts subject to friction should be oiled with clock oil when necessary. An excess of oil should not be used. All parts should be kept free from dust and the board kept covered when not in use.

No.	Nomenclature.	Drawing.
1	Box.....	22-3-2
2	Chart board.....	22-3-2
3	Correction chart.....	F. A. 3846
4	Canvas chart mount.....	F. A. 3847
5	Eyelets in canvas.....	22-3-3
6	Gear bracket.....	22-3-8
7	Gear cover.....	22-3-8
8	Chain-adjusting screw.....	22-3-8
9	Chain for ruler and counterweight.....	22-3-3
10	Chain sprocket.....	22-3-3
11	Bar for curve indicators.....	22-2-3
12	Curve indicator.....	22-3-3
13	Counterweight.....	22-3-9
14	Ruler clamp screw.....	22-3-9
15	Sprocket stand (right).....	22-3-4
16	Sprocket stand (left).....	22-3-4
17	Stationary bar.....	22-3-8
18	Movable bar.....	22-3-8
19	Movable scale.....	22-3-8
20	Body.....	22-3-7
21	Knob.....	22-3-9
22	Pointer.....	22-3-8
23	Movable clamp.....	22-3-8
24	Range pointer.....	22-3-8
25	Reading glass.....	22-3-9
26	Cap.....	22-3-8
27	Chain screw.....	22-3-8
28	Eccentric.....	22-3-8
29	Stop screw.....	22-3-8

No.	Nomenclature.	Drawing.
30	Wing nut.....	22-3-8
31	Clamp spring.....	22-3-9
32	Ruler clamp.....	22-3-9
33	Guide plate (left).....	22-3-9
34	Guide plate (right).....	22-3-9
35	Reading-glass holder support slide.....	22-3-9
36	Main gear.....	22-3-9
37	Movable-bar gear.....	22-3-9
38	Gear and pinion.....	22-3-9
39	Idler gear.....	22-3-9
40	Reading-glass retaining screw.....	22-3-9
41	Reading-glass holder hinge screw.....	22-3-9
42	Cross-wire clip.....	22-3-9
43	Cross-wire screw.....	22-3-9
44	Cross wire.....	22-3-9
45	Reading-glass holder.....	22-3-9
46	Brass screw eye for counterweight.....	22-3-9
47	Clamp.....	22-3-3
48	Nut for clamp.....	22-3-3
49	Washer for clamp.....	22-3-3
50	Bearing strip for ruler (right), countersunk holes.....	22-3-3
51	Bearing strip for ruler (left), elongated holes.....	22-3-3
52	Upper clip.....	22-3-3
53	Lower clip.....	22-3-3
54	Lower clip (straight).....	22-3-3
55	0.312 ($\frac{1}{8}$) Bennett handy oiler.....	22-3-7
56	Counterweight rollers.....	22-3-3
57	Clamping screw for curve-indicator bar.....	22-3-3
58	Axle for counterweight rollers.....	22-3-3
59	Axis for chain sprocket.....	22-3-3
60	Name plate.....	22-3-3
61	Support for curve-indicator bar.....	22-3-3
62	Guide strip for counterweight (right).....	22-3-3
63	Guide strip for counterweight (left).....	22-3-3
64	Chain for clamping screw for curve-indicator bar.....	22-3-3
65	Rod for canvas (long).....	22-3-3
66	Pipe for canvas (long).....	22-3-3
67	Rod for canvas (short).....	22-3-3
68	Pipe for canvas (short).....	22-3-3
69	0.099 by 0.16 headless steel screw.....	22-3-7
70	No. 5 by 0.625 flathead wood screw.....	22-3-3
71	No. 5 by 0.625 roundhead wood screw.....	22-3-3
72	0.177 by 0.5 standard filister head bronze screw.....	22-3-8
73	No. 6 by 0.875 flathead wood screw.....	22-3-3
74	0.216 by 0.375 standard filister head bronze screw.....	22-3-9
75	0.099 by 0.187 ($\frac{1}{8}$) standard filister head steel screw.....	22-3-8
76	0.064 by 0.31 bronze pin.....	22-3-8
77	0.112 by 0.125 standard roundhead bronze screw.....	22-3-8
78	0.093 ($\frac{1}{8}$) by 0.56 taper pin.....	22-3-8
79	0.093 ($\frac{1}{8}$) by 0.75 taper pin.....	22-3-9
80	0.112 by 0.25 standard countersunk head bronze screws.....	22-3-8
81	0.177 by 0.75 standard filister head bronze screws.....	22-3-8

LIST OF DRAWINGS.

Assembled views and canvas chart mount.....	F. A. 3847
Details, wood.....	22-3-2
Details, metal.....	22-3-3
Details, travel device.....	22-3-4
Correction ruler, assembled views and body.....	22-3-7
Correction ruler, details.....	22-3-8
Correction ruler, details.....	22-3-9

WAR DEPARTMENT,
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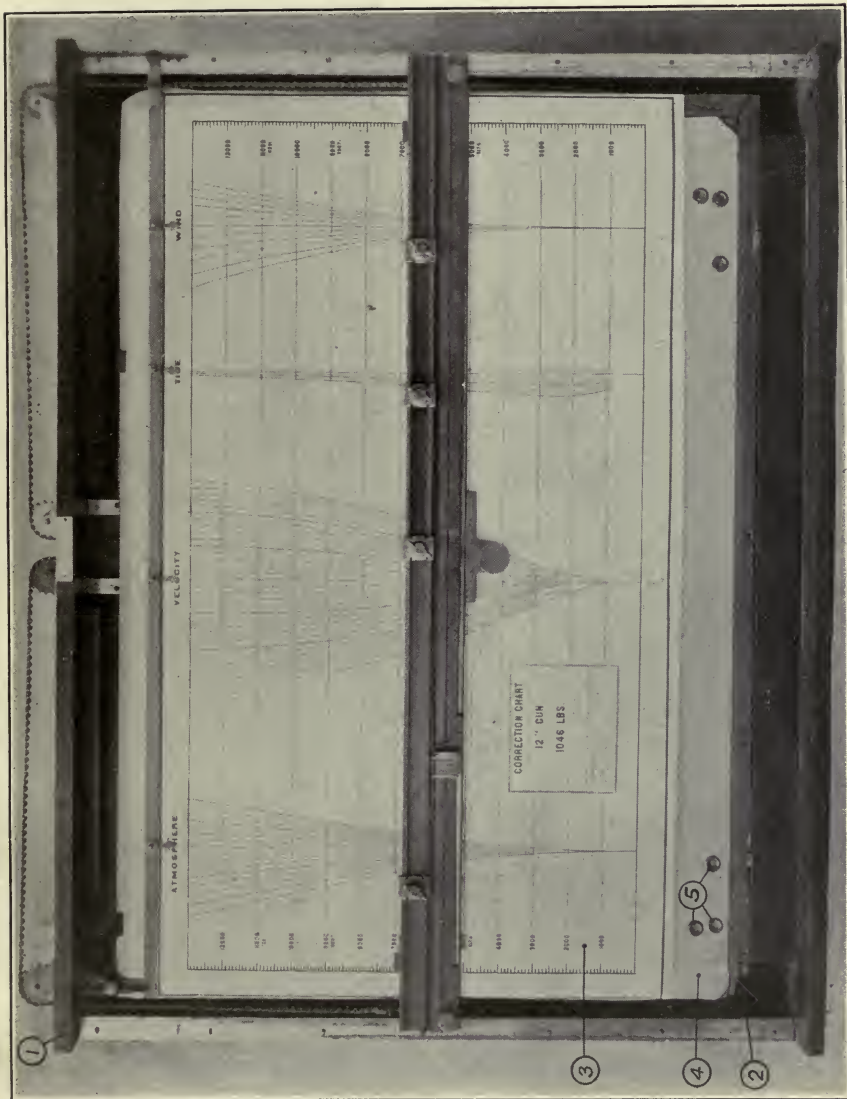


PLATE II.

PLATE II.

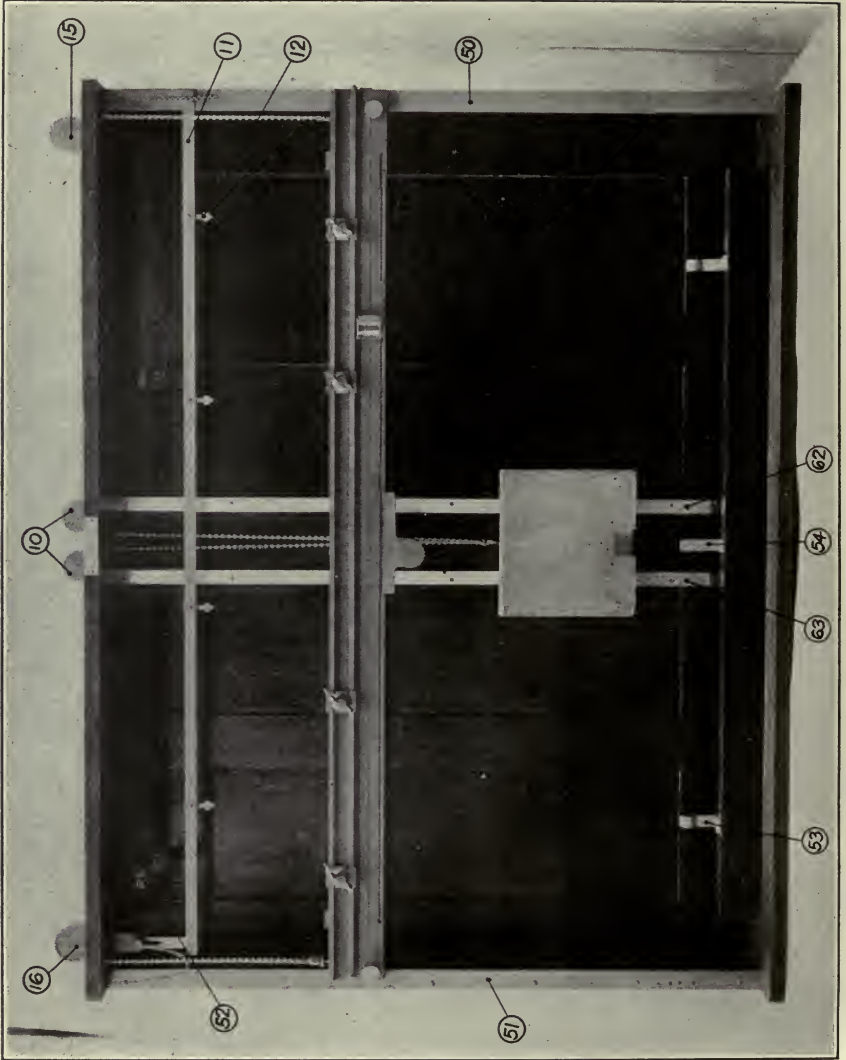


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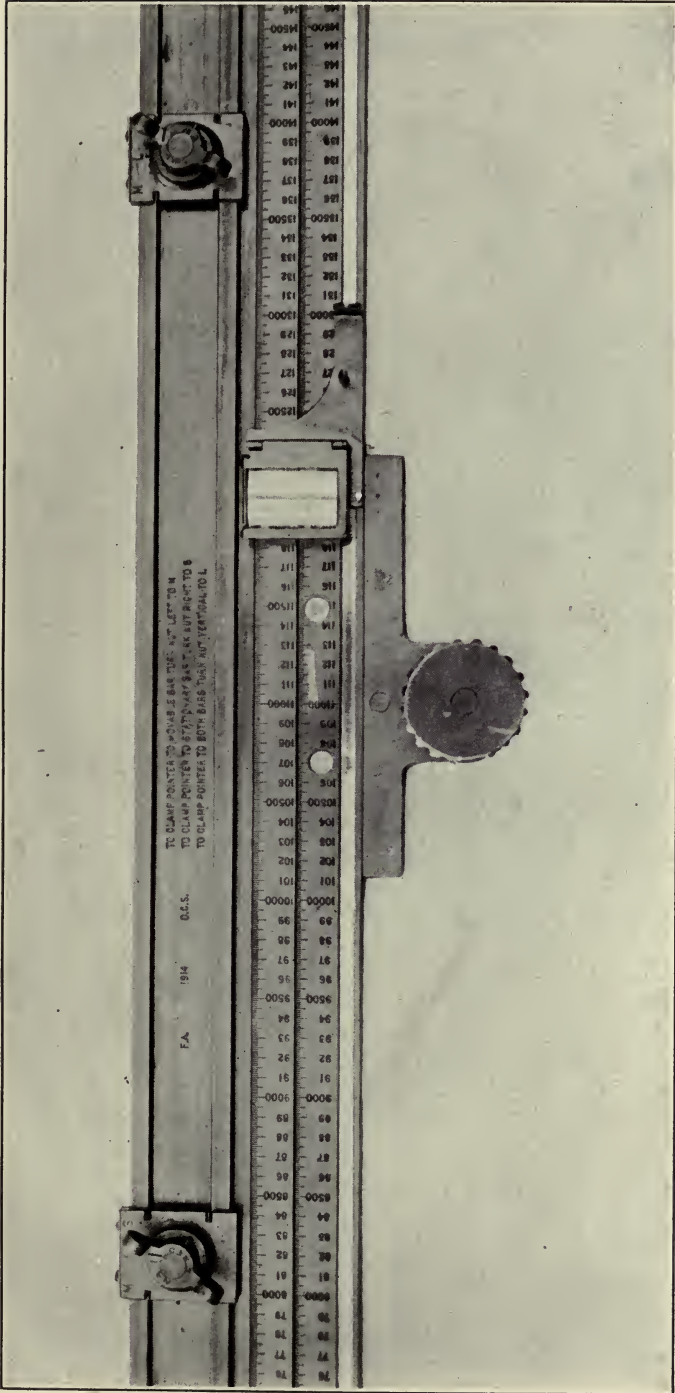


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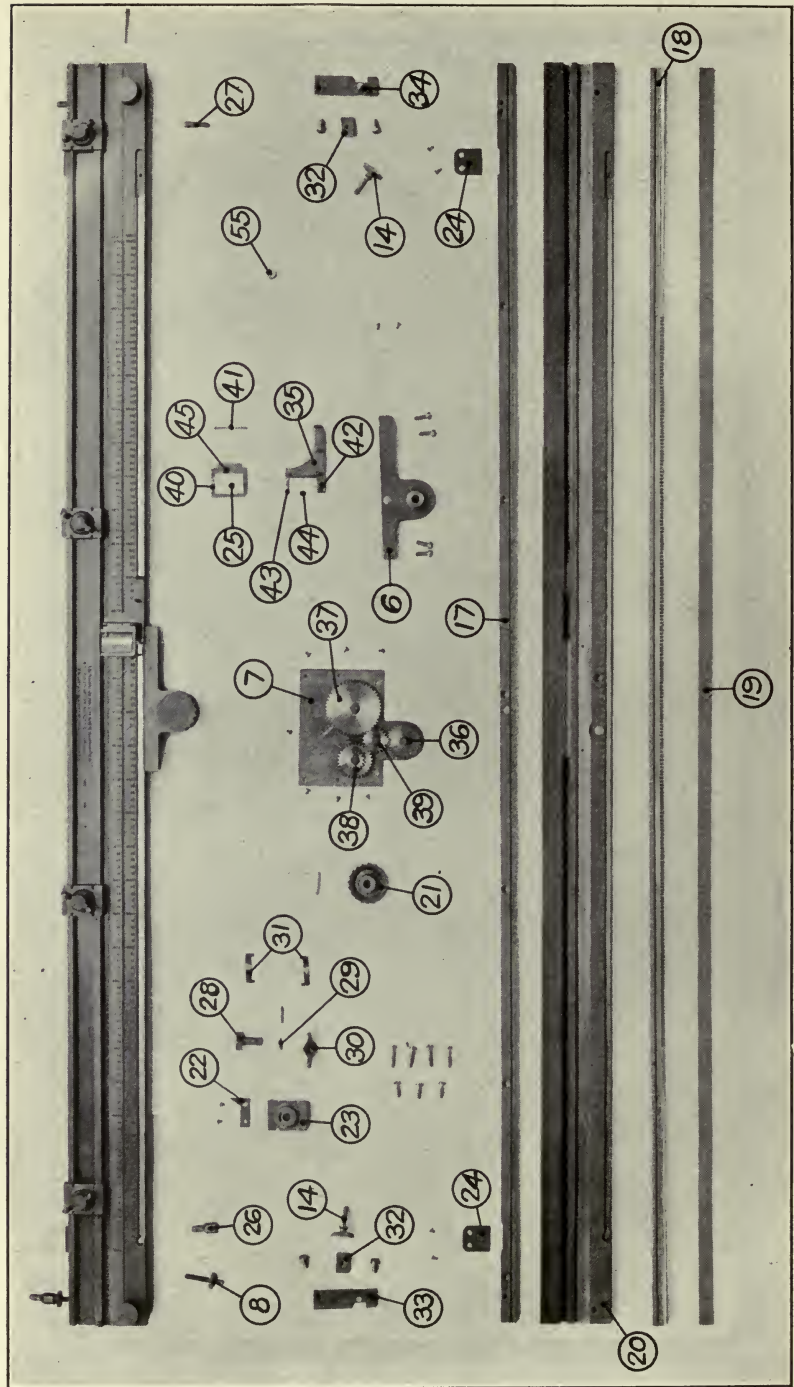
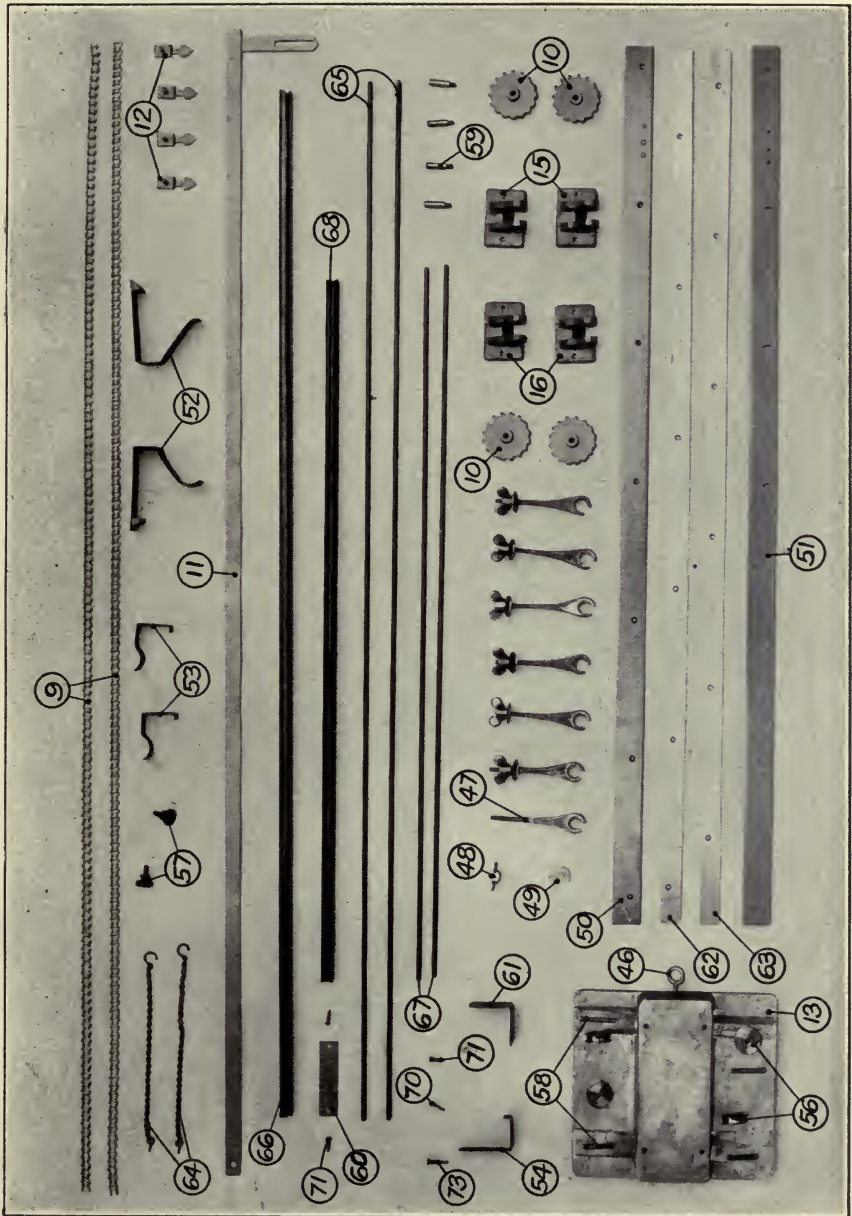
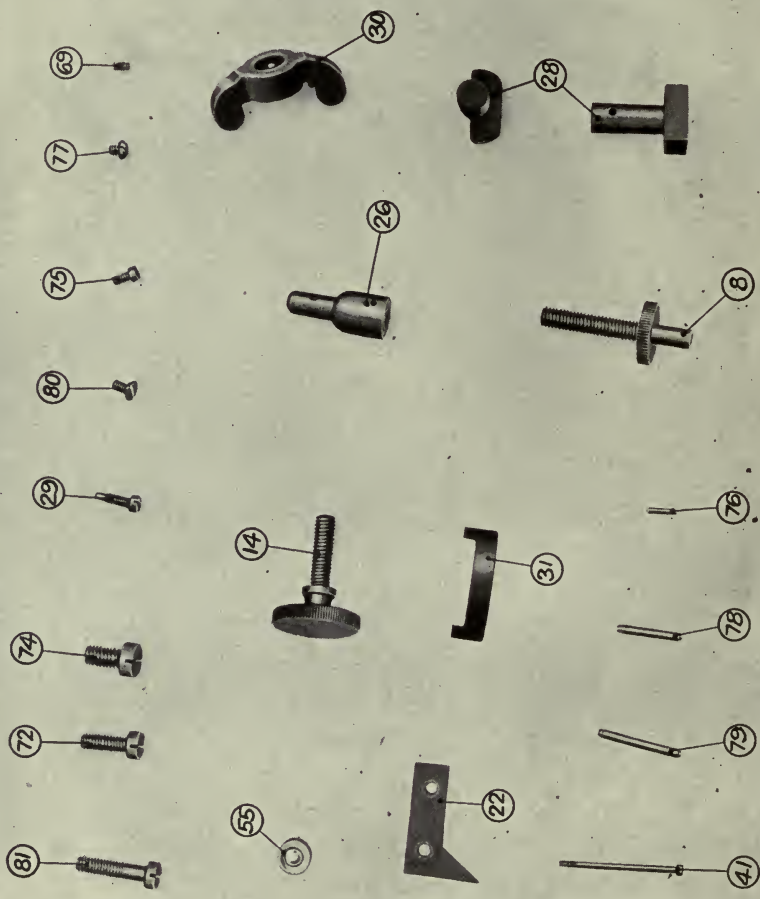


PLATE V.









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