

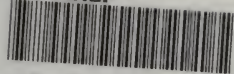
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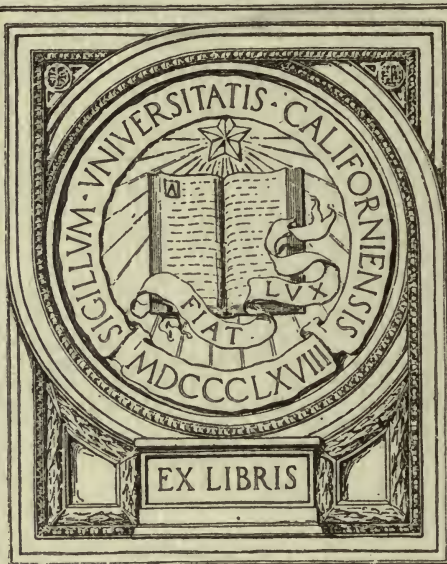
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DESCRIPTION OF
2-INCH
TELESCOPIC SIGHTS

MODEL OF 1906

(3 PLATES)



OCTOBER 11, 1907

REVISED OCTOBER 11, 1910

REVISED DECEMBER 16, 1913

REVISED MARCH 1, 1917



WASHINGTON
GOVERNMENT PRINTING OFFICE

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, March 1, 1917.

This manual is published for the information and government of the Regular Army and National Guard of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

(3)



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TWO-INCH TELESCOPIC SIGHTS.

MODEL OF 1906.

(THREE PLATES.)

(THE TELESCOPES OF THESE SIGHTS WERE DESIGNED BY THE WARNER & SWASEY Co., CLEVELAND, OHIO.)

[IMPORTANT CHANGES IN THIS PAMPHLET ARE SHOWN IN BOLD FACE TYPE.]

1. The advantages gained by the use of a telescope in laying a piece consist of a decrease in personal error and an increase in power of vision. By using a telescopic-sight a gunner is enabled to see clearly an object which is indistinct to the naked eye, and to lay a gun on it with facility and accuracy.

2. For the designation of parts, see Plates I, II, and III, and the list attached hereto giving the nomenclature which should be used when ordering spare parts. The sight was originally designed for use on the left side of 15-pounder barbette carriage, model of 1903. Plates I and II show this sight. Later, it was desired to provide an additional sight on the right side and, where necessary, certain parts were made "right and left." Still later, however, the first sights were removed from the left side, leaving only right-hand sights now in service. The 15-pounder barbette carriages, model of 1903, are the only carriages equipped with this model sight.

3. The principal parts are the telescope (Pl. III), the front and rear sight brackets (24 and 25), the cradle (15), the open sights (4 and 17), the sight shank with deflection worm box and head of sight shank (23 and 8), the range drum (29), the gear-case cover and cover for range drum (30), the elevating worm (36), the fulcrum (20), the lighting cables (26), the deflection scale (38), and the elevating worm-gear shaft (39).

4. The front and rear sight brackets (24 and 25) are bolted to the carriage at their lower ends. The cradle (15) is assembled at the forward end to the front-sight bracket (24) by means of the fulcrum (20). The fulcrum axes have bearings in the two sides of the front-sight bracket (24), permitting rotation for elevation and depression, and the fulcrum (20) has a short vertical shaft on its under-side, to which the forward end of the cradle (15) is assembled, so as to allow rotation in azimuth only. At the rear end the cradle (15) is assembled to the sight shank (23) by means of the sight-shank

head and the deflection worm (40). The latter is seated in the sight-shank head which thus forms the deflection worm box (8) and meshes into a worm segment cut in the cradle (15). The front and rear faces of the deflection worm box (8) and the head of the sight shank are arcs of circles having their common center on the axis of the vertical shaft of the fulcrum (20). The front and rear faces of the sight shank (23) and of its seat between the rear sight bracket (25) and gear-case cover (30) are arcs of circles having their common center at the middle point of the central line of the fulcrum axis. The sight shank (23) is thus assembled between the rear sight bracket (25) and the gear-case cover (30), and is held in place by the gear-case cover (30) and the elevating gearing.

5. The elevation of the sight and the rotation of the range drum (29) are accomplished by the elevating gearing, consisting of the elevating worm (36) and the elevating worm-gear shaft (39), with its worm gear and spur gear, the latter two being on one piece, called the elevating worm gear (2S4B). The elevating worm (36) engages the worm gear and the spur engages the sight-shank rack. The piece on which these two gears are cut is mounted on a squared section of the elevating worm-gear shaft (39) which is also the range-drum shaft, the range drum (29) being mounted on this shaft and held in place by the friction of a range-drum washer (56) bearing against the range drum (29), and the friction of the range drum (29) on a shoulder of the elevating worm-gear shaft (39). An elevating gear spring (2S4M), 11 feet long, is secured at one end to the elevating worm-gear shaft (39), is wound several times around the elevating worm-gear shaft (39), and has the other end secured to the gear-case cover (30). The gear-case cover (30) is bolted to the rear sight bracket (25). By rotating the elevating worm (36) the elevating worm-gear shaft (39) is moved, adding to or releasing tension on the elevating gear spring (2S4M), depressing or elevating the cradle (15) by means of the sight shank (23), and rotating the range drum (29). The elevating gear spring (2S4M) serves to equalize the force required to depress or elevate the cradle (15). The gear-case cover (30) and the rear sight bracket (25) serve to protect the elevating gearing, the elevating gear spring (2S4M), and the range drum (29). The range pointer (52) is attached to the gear-case cover (30). The range drums (29) for these sights will not be used as such and will not be graduated.

6. The elevation scale (33) is of German silver, is dovetailed into the rear face of the sight shank (23), and reads from zero to 16° , the least reading being $6'$. The range pointer (52) is a piece of German silver dovetailed into the gear-case cover (30) just opposite the lamp housing for range drum (29) and elevation scale (33).

7. Deflection is obtained by rotating the deflection worm (40), which is seated in the deflection-worm box (8) and meshes into a worm segment cut into the cradle (15) where the box is seated.

8. The deflection scale (38), of German silver, is dovetailed into the rear end of the cradle (15). The numbers on the scale are reference numbers, "3" representing the origin or central position of the deflection scale (38). The interval between whole numbers is equal to one degree of arc. The least reading of the scale is 0.10° , or 6 minutes of arc. The deflection scale pointer (19) is cut on a German-silver plate secured to a lug projecting from the rear of the sight shank (23). The lamp bracket for illuminating the deflection scale (38) and deflection scale pointer (19) is part of the rear end of the cradle (15), and is situated immediately above the deflection scale (38).

9. The open sight consists of a peep sight (4) in rear and of a front sight. An arm of the peep sight extends downward, terminating in a foot which is attached to the left side rear end of the cradle (15) by two peep sight screws (55) and two dowel pins. The front sight is attached to the front sight holder (16), mounted at the forward end, left side of cradle (15). The open sight is for use in locating an object quickly.

10. Each sight is provided with two small electric lamps (E9J) or (E9H) of 2 candlepower, which for 220-volt circuits are 74 volts and 0.147 amperes; for 110-volt circuits 106 to 116 volts and 0.094 to 0.103 amperes. One of these lamps illuminates the cross wires (47) of the telescope, giving bright lines in a dark field, and the other one illuminates the deflection scale (38). They are connected with the electric circuit by the lighting cables (26) and plug connections. The lamp that illuminates the cross wires (47) of the telescope is placed in a lamp bracket (11) that is screwed to the eye end of the telescope tube (9) on the right-hand side. Two small platinum mirrors (EA17W) deflect the rays of light through two openings cut through the telescope tube (9) 90° apart. These openings are so arranged that the light from each mirror is thrown upon the full length of the cross wire (47) opposite.

11. The principal parts of the telescope are the telescope tube (9), the objective (49), the Porro erecting prisms (48 and 48), the draw tube (50), the cross-wire holder (46), the focusing sleeve (44), the focusing ring (3), and the eyepiece (1, 2, 42, 43, and 45).

12. The telescope tube (9) is the principal piece to which the other parts are assembled. The objective (49) is double, is seated in an objective cell (EA17E) that screws into the forward end of the telescope tube (9), and gives a 2-inch clear aperture. The Porro erecting prisms (48 and 48) are two in number, secured in place by the prism holder (53). There are no cemented surfaces, thereby reducing the

chance of injury, rendering replacement easier, and facilitating cleaning.

13. The cross wires (47) are secured to the cross-wire holder (46) by four clamps, and are at right angles to each other. The cross-wire holder (46) is secured to the draw tube (9) by the cross-wire holder screws (EA18E). The draw tube (9) is assembled to the focusing sleeve (44) so as to allow longitudinal motion of the former when the focusing ring (3) is rotated, and to force rotation of the draw tube (50) when the focusing sleeve (44) is rotated. The focusing sleeve (44) is screwed into the rear end of the telescope tube (9) and is secured by a set screw (EA18H). The focusing ring (3) is seated on the focusing sleeve (44) by a threaded surface, its motion being limited by the telescope tube (9) in front and the focusing-sleeve nut (37) in rear. When turned, it transmits to the draw tube (50) and cross-wire holder (46) its longitudinal motion only.

14. The eyepiece consists of the eyepiece tube (43) the field lens (45), the eye lens (42) in its holder, the eye-lens cell (2S9B), and the rubber hood (1). The eyepiece tube (43) is screwed into the draw tube (50) and carries the field lens (45) and the eye lens (42) with the eye-lens cell (2S9B), the eyepiece cover (54) being screwed to the latter. There is an amber glass disk (2S9D) in a holder (41) that is pivoted so that it may be used or not, as desired. This shade is provided to protect the eye from a glare of light. The eyepiece serves to magnify the image at the cross wires (47) and to converge the rays of light into a pencil of a size suited to enter the pupil of the eye.

15. The front end of the telescope is provided with a movable objective shutter (13) for the protection of the objective (49).

16. The clear aperture of the telescope is 2 inches, the focal length is 12 inches, the magnifying power of the eyepiece is 8, with a field of $4\frac{1}{2}^{\circ}$. A rubber hood (1) for the eyepiece is provided for the purpose of diminishing shock to the eye or face upon discharge of the gun. The rubber hood (1) is so shaped as to keep out light from the sides and rear.

17. The image is erect, the erection being secured by the Porro prisms (48 and 48), each of which twice totally reflects the rays of light at an angle of 90° , so that the rays emerge parallel to the entering rays and in the original direction. The paths of two rays of light are shown on Plate III, which illustrates the erection process.

18. The telescope is secured in position on four accurately bored segmental projections on the cradle (15) by the front and rear telescope clamps (12 and 5) each of which is machine finished to proper bearing on the upper portion of the telescope to secure proper alignment of the optical axis and to insure verticality of the vertical wire.

19. The front and rear sight brackets (24 and 25) are bolted to seats provided on the gun cradle, so that the motion of the sight cradle (15) must conform to that of the gun, and when the sight is properly assembled to the carriage and the elevation and deflection readings are zero the optical axis of the telescope and the axis of the bore of the gun will remain parallel at all elevations. Therefore, if the sight be set at the elevation required for the range of the object to be fired at and then be laid upon it, the gun will automatically receive the same elevation. Since the deflection movement of the sight is independent of the gun, any deflection necessary may be given without affecting the elevation.

20. In assembling the front and rear sight brackets (24 and 25) great care should be taken to see that the seats on the gun cradle have been properly prepared and that burrs, paint, and rust are removed from all bearing surfaces. A small obstruction of this kind will throw the sight shank (23) out of plumb. In setting up the bolts all should be brought to a firm bearing before any are set up tight.

21. Neither the elevation nor the deflection scale pointer (19) is marked by the manufacturer of the sights, since there is no adjustment for either on the carriage. The elevation pointer should be cut at the works of the builders of the carriage to allow for any possible inaccuracy in the seats, and the deflection scale pointer (19) should be put on at the emplacement after the gun is mounted.

22. After the sight has been assembled to the carriage, and while the gun is at zero elevation, the sight should be accurately leveled and the elevation pointer cut exactly opposite the zero of the elevation scale (33).

23. The position of the deflection scale pointer (19) may be determined by adjusting the telescopic sight so that its axis intersects the axis of the gun at mid range. The index line should then be cut opposite the reference number 3 on the deflection scale (38).

ADJUSTMENT.

24. The cross wires (47) are rendered distinct by screwing the eyepiece in or out, and this adjustment has no other object. If the telescope is frequently used by one observer, the eyepiece can be reset at the correct position by using the graduations on the eyepiece cover (54). After bringing the cross wires (47) into distinct vision by adjusting the eyepiece the image may be brought into the plane of the cross wires (47) by moving the focusing ring (3) until the object appears distinctly, and there is no parallax; that is, when the object does not seem to shift relative to the cross wires (47) when the eye is moved from side to side of the eyepiece. When a sight is adjusted by the removal of parallax it is correct for all observers

for a given range. Adjustment of the eyepiece is required to accommodate variations in the eyes of different observers but is not required for variations in range.

25. The cross wires are mounted on the cross-wire holder, which is held in position by four adjusting screws which pass through elongated holes in the focusing sleeve. These screws may be reached by first removing the focusing sleeve nut and unscrewing the focusing ring until the slotted screws can be seen through the elongated openings in the focusing sleeve.

26. When adjusting the cross wires the collimating telescope furnished with the optical repair kit should be placed in the proper rings and securely clamped in the sight cradle, and when properly adjusted should be sighted on a target having plumb and horizontal lines. The telescopic sight is now placed in the cradle with its axis coinciding with the axis of the collimating telescope.

27. The cross wires should be adjusted by means of the adjusting screws to coincide with the same plumb and horizontal lines which were seen through the collimating telescope.

28. The slotted holes in the focusing sleeve permit a slight rotary motion of the cross-wire holder to secure vertical and horizontal alignment. The focusing sleeve should always be screwed into the telescope tube and locked in place with a set screw (EA18H).

29. To adjust the tension of the elevating gear spring (2S4M) run the sight shank (23) out of mesh, turn the elevating wheel (21) to the right to relieve tension or to the left to increase tension, and reengage the rack. When the cradle (15) and telescope are in place and the elevation is 8° the force required to rotate the elevating wheel (21) should be the same for both directions. The cradle (15) must be disengaged from the head of the sight shank (23) before attempting this adjustment.

CARE AND PRESERVATION.

30. Telescopic sights are necessarily delicate instruments, and must not be subjected to rough usage, jars, or strains. When not in use, the telescope should be kept in its leather case and should be stored in a dry place. It should be occasionally examined to insure its not being corroded by tannic acid from the case. All traces of dust and moisture should be removed before putting the sight in the case.

31. To obtain satisfactory vision, the glasses should be kept perfectly clean and dry. In case moisture collects on the glasses, place the telescope in a gentle warmth; this is usually sufficient to remove it. Material issued for the cleaning of lenses only should be used, care being taken that the cleaning material contains no dirt or grit. The lenses and prisms will seldom require cleaning on the inside,

but when necessary they should be removed only in a room free from dust and moisture and by a competent person who has material for resealing all exterior joints.

32. The erecting prisms (48 and 48) should not be removed except by one especially trained in the care of telescopes, and if they need repair report should be made to the proper authority. Removal is apt to disturb the adjustment, and finger marks or lint will cause difficulty.

33. The cross wires (47) are unprotected when the eyepiece is removed, and great care must be exercised not to touch them, as they are very delicate. No attempt should be made to clean them except by blowing.

34. The front and rear sight brackets (24 and 25) and cradle (15) should never be removed from the carriage unless the carriage is to be dismounted. When not in use, these parts should be kept covered by hoods provided for the purpose. All bright parts should be kept thoroughly oiled, special care being given to the deflection worm box (8), sight shank (23), and the steel bearings in the cradle for the telescope. Care should be taken not to remove the oil when putting on the hood. The oil should be wiped off before use. The hood should be removed, and the sights, brackets, cradle, etc., examined at least once in every two weeks, and the cradle (15) should be moved in elevation and deflection, so that as much as possible of the sight shank (23) and deflection worm box (8) can be inspected. No oil should be allowed on the surfaces of the lenses and prisms.

35. Special care should be taken in the use of the two small electric lamps (E9J) and (E9H), as they are fragile. Each lamp should seat in its receptacle not less than $1\frac{1}{2}$ turns.

DISMANTLING AND ASSEMBLING.

36. General instructions for disassembling and cleaning are given in pamphlet No. 1795, Instructions for the Care, Preservation, Repair, and Adjustment of Instruments for the Fire Control Systems for Coast and Field Artillery, paragraphs 24 to 28, and 35 to 38, inclusive.

37. If a sight is packed for shipment, special attention should be given to the blocking of it in its packing box to prevent all movement of the sight during transit. The telescope should be packed separately.

38. When ordering spare parts, use the following nomenclature.

NOMENCLATURE OF PARTS. (PLATES I AND II.)

No. on plates.	Piece marks.	Name of part.
	2S9J.....	Side window.
	2S9H.....	Top window.
	EA18J.....	Prism-cover screw.
	2S2A.....	Prism-holder screw.
	EA18J.....	Lamp-bracket screw.
	EA18E.....	Cross-wire holder screw.
	EA18D.....	Focusing-nut screw.
	EA18F.....	Finger-grip screw.
9	2S2J.....	Tube (for sights 1 to 45, inclusive).
9	2S2LB.....	Tube (sights 46 and following numbers only).
53	2S2L.....	Prism holder (sights 1 to 45, inclusive).
53	EA11N.....	Prism holder (sights 46 and following numbers only).
	2S2M.....	Amber-glass holder screw.
	EA11R.....	Tube plug.
	EA18C.....	Chain screw.
	EA11Q.....	Prism spring.
	2S9D.....	Amber-glass disk.
	EA18B.....	Cross-wire screw.
	2S2ZA.....	Amber-glass holder pin.
49	EA11G.....	Objective.
48	EA11J.....	Prism.
	EA11K.....	Prism.
45	EA11L.....	Field lens.
42	EA11M.....	Eye lens.
6	EA18A.....	Prism cover (sights 46 and following numbers only).
	EA18H.....	Focusing-sleeve set screw.
	EA11H.....	Objective separator.
4	2S3A.....	Peep sight.
55	2S3B.....	Peep-sight screw.
16	2S3C.....	Front-sight holder.
15	2S3D.....	Cradle.
19	2S3E.....	Deflection scale pointer.
	2S3F.....	Deflection scale pointer screw.
	2S3G.....	Cover.
	2S3FA.....	Clamping screw.
	2S3GA.....	Clamping screw.
	2S3K.....	Cover screw.
	2S3L.....	Front sight screw.
	2S3M.....	Front sight ring.
12	2S3N.....	Telescope clamp (front).

NOMENCLATURE OF PARTS. (PLATES I AND II.)—Continued.

No. on plates.	Piece marks.	Name of part.
	2S2RB.....	Objective locking ring screw.
	2S2QB.....	Objective cell locking screw.
	2S2PB.....	Eye lens cell locking screw.
	2S2HA.....	Lock washers.
	2S3P.....	Cradle liner.
	2S3Q.....	Front sight bar.
5	2S3R.....	Telescope clamp (rear).
	2S8J.....	Sight bracket and cradle number plate.
33	2S3T.....	Elevation scale.
23	2S3V.....	Sight shank.
	2S3W.....	Clamp pin.
	2S3X.....	Worm bushing.
40	2S3Y.....	Deflection worm.
	2S3Z.....	Worm nut.
7	2S3AA.....	Worm knob.
38	2S3BA.....	Deflection scale.
	2S3CA.....	Stop screw.
	2S3DA.....	Sight-shank stop.
	2S3EA.....	Cradle-liner rivet.
20	2S4A.....	Fulcrum.
	2S4B.....	Elevating worm gear.
	2S4C.....	Elevating wheel handle.
	2S4D.....	Elevating wheel-handle stem.
	2S4E.....	Elevating wheel nut.
21	2S4F.....	Elevating wheel.
29	2S4G.....	Range drum.
	2S4H.....	Range-drum scale.
	2S4J.....	Spring stud.
	2S4K.....	Elevating worm bushing (front).
	2S4L.....	Range-pointer screw.
	2S4M.....	Elevating gear spring.
52	2S4N.....	Range pointer.
56	2S4P.....	Range-drum washer.
	2S4Q.....	Elevating worm bushing (rear).
36	2S4R.....	Elevating worm.
39	2S4S.....	Elevating worm-gear shaft.
	2S4T.....	Spanner wrench.
	2S8M.....	Oil screw.
18	2S8K.....	Front-sight-bracket cap.
	2S8L.....	Front-sight-bracket cap bolts.

NOMENCLATURE OF PARTS. (PLATES I AND II.)—Continued.

No. on plates.	Piece marks.	Name of part.
	2S8H.....	Sight-shank liner.
	2S8E.....	Elevation pointer.
	2S8D.....	Front-sight bracket bolt.
24	2S8C.....	Front-sight bracket.
	2S8B.....	Rear-sight-bracket bolts.
25	2S8A.....	Rear-sight bracket.
30	2S8F.....	Gear-case cover.
	2S8G.....	Gear-case cover bolts.
13	EA17A.....	Objective shutter.
22	EA17B.....	Objective-shutter handle.
	EA17D.....	Objective-shutter spring.
	EA17C.....	Objective-shutter shaft.
	EA17G.....	Objective-shutter plunger.
	EA17E.....	Objective cell.
	EA17F.....	Objective ring.
	EA17H.....	Focusing-sleeve-nut wrench.
44	EA17J.....	Focusing sleeve.
3	EA17K.....	Focusing ring.
37	EA17L.....	Focusing-sleeve nut.
50	EA17M.....	Draw tube.
	EA17N.....	Focusing nut.
	EA12H.....	Cross-wire clip.
47	EA17P.....	Cross wires.
46	EA17Q.....	Cross-wire holder.
43	EA17R.....	Eyepiece tube.
2	2S9A.....	Eyepiece dial.
	2S9B.....	Eyelens cell.
	2S9C.....	Spring washer.
41	2S9E.....	Amber glass holder.
54	2S9F.....	Eyepiece cover.
1	2S9G.....	Rubber hood.
11	EA17S.....	Lamp bracket.
	EA17T.....	Lamp-bracket diaphragm.
	EA17U.....	Lamp-bracket bushing.
	EA17W.....	Platinum mirror.
	EA17V.....	Finger grip.
	EA17X.....	Mirror holder.
31	EA17Y.....	Lamp-bracket cap.
	EA12F.....	Chain.
	EA18G.....	Focusing-sleeve-nut set screw.

NOMENCLATURE OF PARTS. (PLATES I AND II.)—Continued.

No. on plates.	Piece marks.	Name of part.
32 & 28	E9B.....	Lamp holders.
	E9J or E9H....	Electric lamp.
14	.....	Conduit clamp.
26	.....	Lighting cables.
	2S3EA.....	Clamping wing nut.
	2S3LA.....	Clamping wing nut.
		Bowen oilers No. "2A."
		Spring cover No. 1.
8	.....	Deflection worm box and head of sight shank.
10	.....	Elevating rack.
17	.....	Front sight.
34	.....	Lamp housing for range drum and elevation scale.
51	.....	Diaphragms.

WAR DEPARTMENT,

OFFICE OF THE CHIEF OF ORDNANCE,

Washington, March 1, 1917.

October 11, 1907.

Revised October 11, 1910.

Revised December 16, 1913.

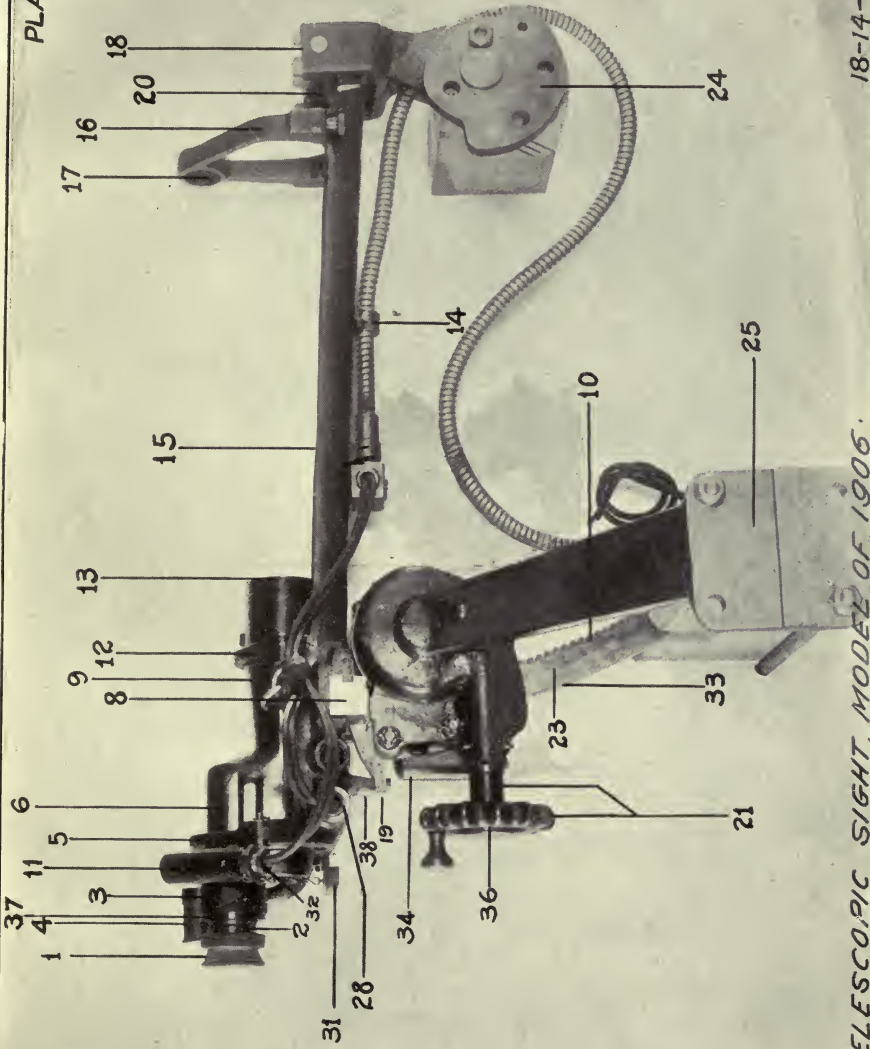
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PLATE I.



2" TELESCOPIC SIGHT, MODEL OF 1906.

18-14-25

PLATE II

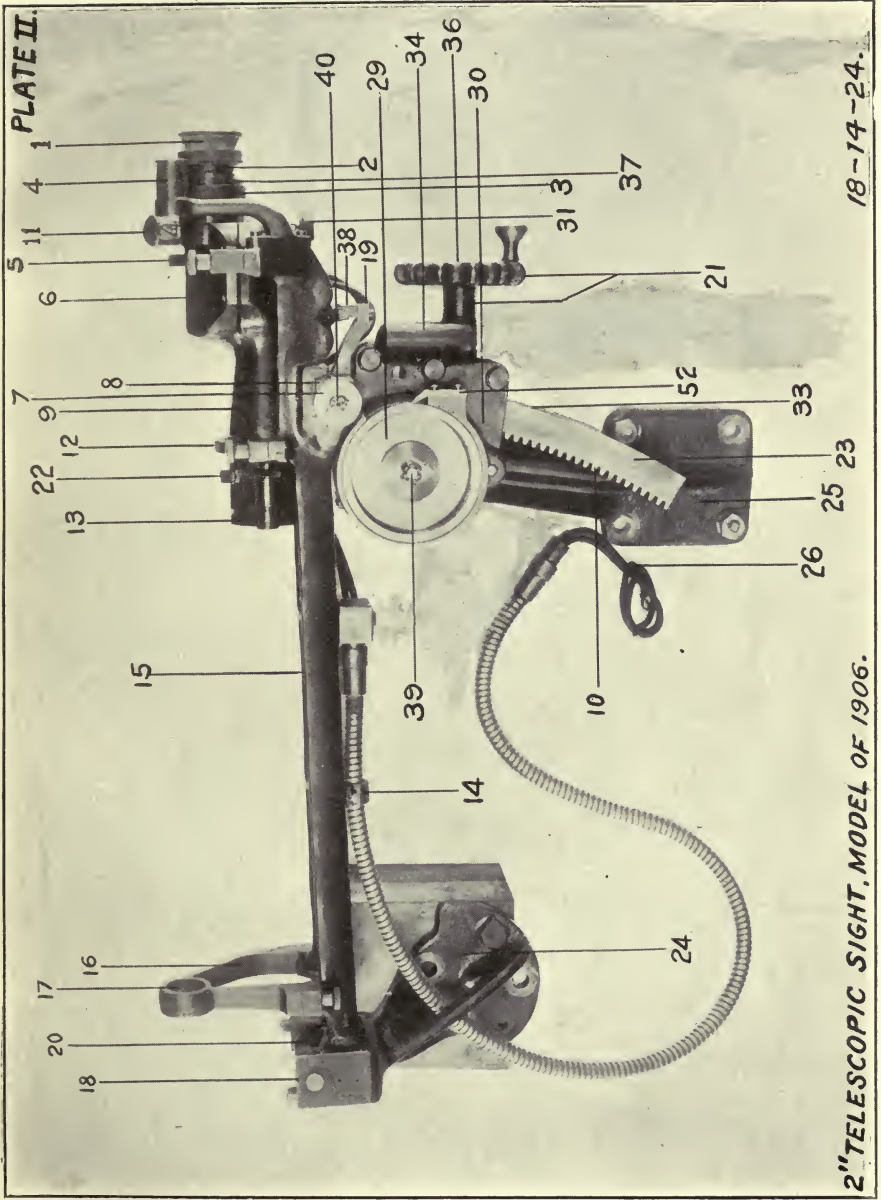


PLATE II.

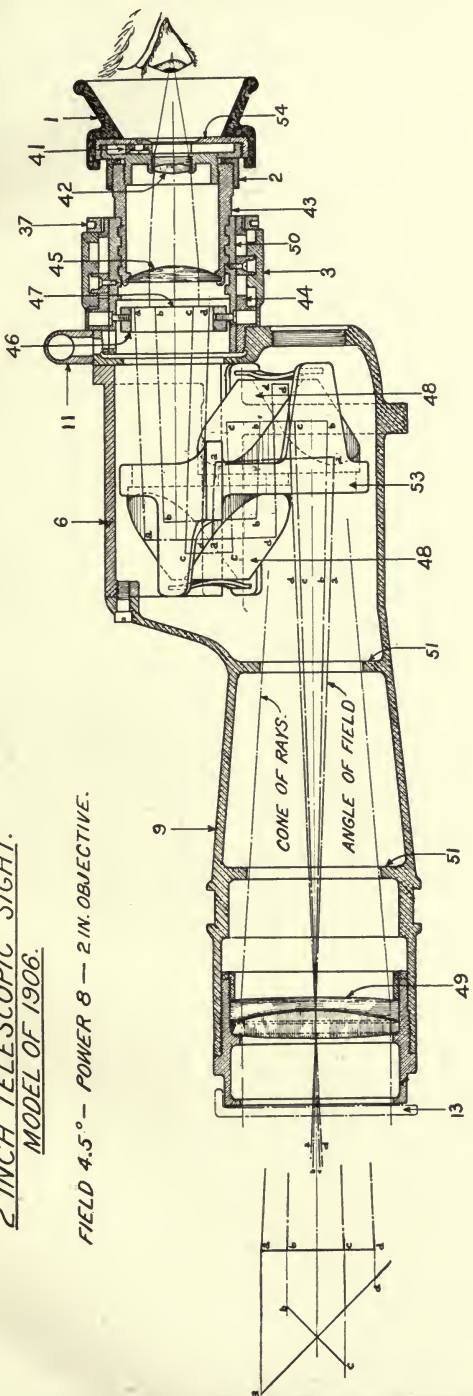
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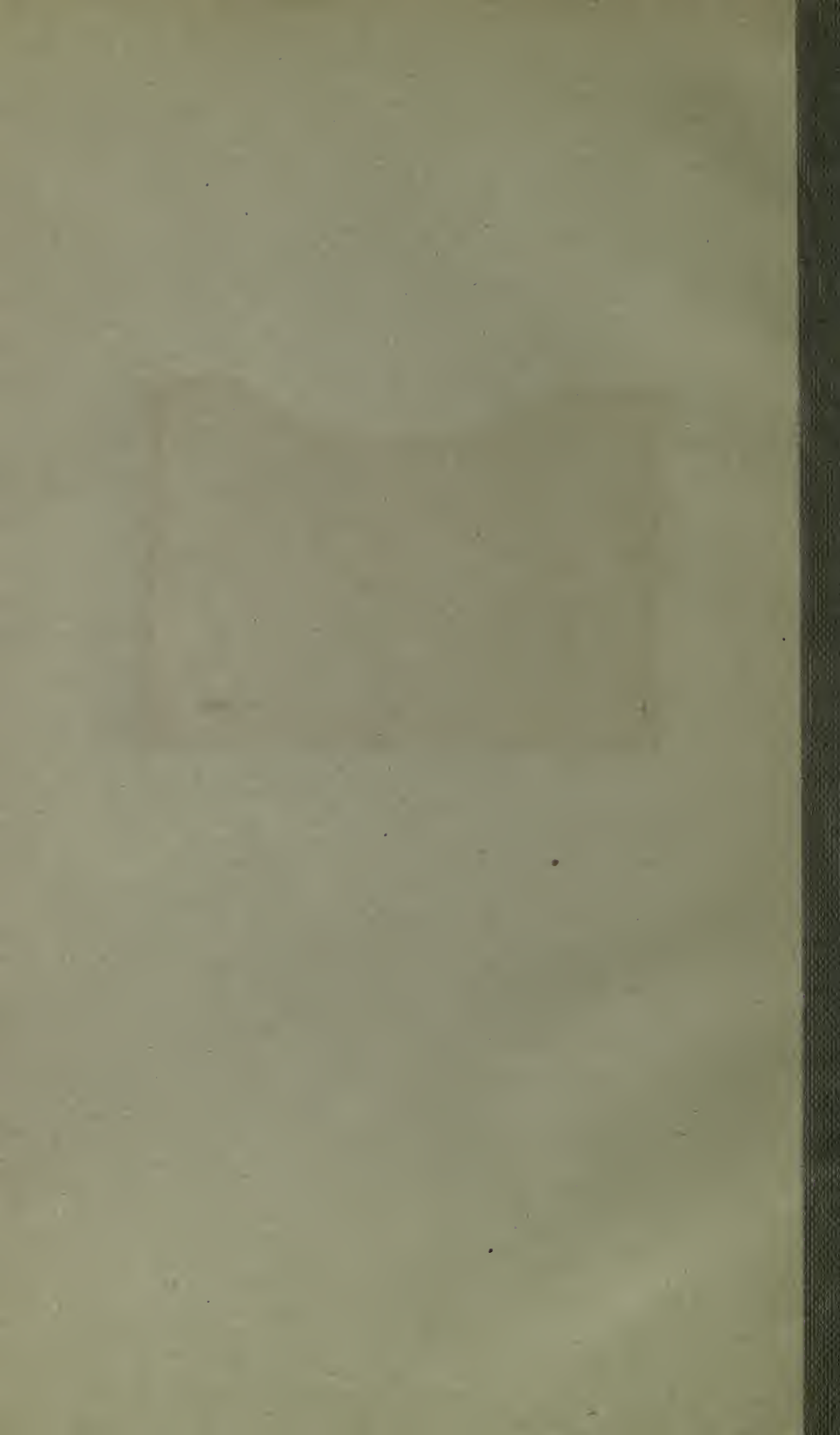
2" TELESCOPIC SIGHT, MODEL OF 1906.

2 INCH TELESCOPIC SIGHT.
MODEL OF 1906.

FIELD 4.5° — POWER 8 — 2 IN. OBJECTIVE.

PLATE III





... Bros.
Makers
Syracuse, N. Y.
PAT. JAN. 21, 1908

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