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No. 1955

**DESCRIPTION OF
3-INCH
TELESCOPIC SIGHTS
MODEL OF 1904**

(THREE PLATES)

**JUNE 15, 1905
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By order of the Secretary of War:

WILLIAM CROZIER,
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(3)

3-INCH TELESCOPIC SIGHTS,

MODEL OF 1904.

(Three plates.)

(The important changes in this pamphlet are shown in boldface type.)

(The telescopes for these sights were designed by the Warner & Swasey Company, Cleveland, Ohio.)

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. A telescopic sight enables a gunner 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. Plate I shows a telescopic sight and cradle with a bracket for a barbette carriage. Plate II shows same with arm for a disappearing carriage. Plate III shows a sectional view of the telescope.

SIGHTS FOR BARBETTE CARRIAGES.

3. The principal parts are the telescope (1, 2, 3, 6, 9, 13, Pl. III), the sight bracket (25), the cradle (15), the open sights (**4, 16**), the **sight shank (24)**, the range drum (30), the gear case cover (31), the elevating worm (43), the fulcrum (21), the yoke (40), the cables and electric lamps, the deflection scales (45), the elevation scale (34), the deflection worm (47), and the elevating gear shaft (46).

4. The sight bracket is bolted to the carriage by means of the feet. The cradle is assembled at the forward end to the sight bracket by means of the yoke and fulcrum. The yoke shaft seats in the sight bracket and is keyed in place; the fulcrum axes have bearings in the two sides of the yoke permitting rotation for elevation and depression, and the fulcrum has a short vertical shaft on its underside to

which the forward end of the cradle is assembled so as to allow rotation in azimuth only. At the rear end the sight shank is assembled between the sight bracket and the gear case cover, being held in place by the gear case cover and the elevating gearing. The cradle is assembled to the sight shank by means of its head (which is also the deflection worm box) and the deflection worm, the latter being seated in the box and meshing into a worm segment cut in the cradle. The front and rear faces of the deflection box 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, and the front and rear faces of the sight shank and its seat are arcs of circles having their center on the central line of the fulcrum axes. **The sight shank stop (73) attached to the lower end of the sight shank limits the movement of the sight shank in elevation.**

5. The elevation of the sight and the rotation of the range drum are accomplished by the elevating gearing, consisting of the elevating worm and the elevating gear shaft with its worm gear and spur gear, the latter two being on one piece. The elevating worm engages the worm gear and the spur gear engages the sight shank rack. The piece on which these two gears are cut is mounted on a squared section of the elevating gear shaft, which is also the range drum shaft. The range drum is also mounted on this shaft and is held in place by the friction of a nut on a washer bearing against the drum and the friction of the drum on a shoulder of the shaft. A ribbon spring 11 feet long and of German silver is secured at one end to the elevating gear shaft, is wound several times around the shaft, and has the other end secured to the gear case cover. The cover is bolted to the sight bracket. By rotating the elevating worm, the elevating gear shaft is turned, adding to or releasing tension on the spring, depressing or elevating the cradle by means of the sight shank and rotating the range drum. The spring serves to equalize the force required to depress and elevate the cradle. The gear case cover and the bracket serve to protect the elevating gearing, the spring, and the range drum. The range scale pointer is attached to the cover.

6. An elevation scale of German silver is dovetailed into the rear face of the sight shank, and reads to 6 minutes from zero to 16 degrees. The pointer is on a piece of German silver dovetailed into the sight bracket.

7. Deflection is obtained by rotating the deflection worm which is seated in the deflection worm box and meshes into a worm segment cut into the cradle where the box is seated.

8. The deflection scale, of German silver, is secured to the rear end of the cradle and reads to 0.05 of a degree, which equals 3 minutes, over an arc of 4 degrees, beginning with 1 degree on the right hand. The 3-degree mark gives no deflection. The pointer plate is

secured to a bracket which is screwed to the under side of the sight shank head. This bracket has, at the rear end, the deflection lamp bracket and a lug that works in a groove in the end of the cradle.

9. The open sight consists of a peep sight in rear and a cross sight in front, the former mounted on the eye-end telescope clamp and the latter on the cross-sight holder. It is for use in picking up an object quickly.

10. Each sight is provided with two small electric lamps of about 2 candlepower, and of the following voltages: 110-volt when used on disappearing carriages mounted in emplacements with 110 or 220 volt mains; 74-volt when used on other than disappearing carriages with 220-volt mains; and 36-volt when used with 5-inch and 6-inch barbette carriages with 110-volt mains. One of these lamps illuminates the cross wires, giving bright lines in a dark field, and the other illuminates the deflection pointer. They are connected with the electric circuit by the cables and plug connections. The lamp that illuminates the cross wires is placed in a holder that is secured to the eye end of the telescope tube on the right-hand side. Two small mirrors deflect the rays of light through two elongated openings cut through the focusing sleeve and telescope tube about 90 degrees apart. These openings are so arranged that the light from each mirror is thrown upon the full length of the wire opposite. The intensity of illumination of the cross wires may be varied by turning the lamp bracket diaphragm which has two V-shaped openings which pass over slots in the lamp bracket, thereby varying the area of the light openings.

11. The principal parts of the telescope are the telescope tube (9), the objective (56), the Porro erecting prisms (55), the draw tube (57), the cross-wire holder (53), the focusing sleeve (51), the focusing ring (3), and the eyepiece (1, 2, 48, 49, 50, 52).

12. The telescope tube is the principal piece to which the other parts are assembled. The objective is a triplet seated in a cell that screws into the forward end of the telescope tube, and gives a 3-inch clear aperture. The Porro erecting prisms are two in number, which are retained in the prism holder by flat springs. Brashear-Hastings prisms having cemented surfaces are used in sights Nos. 1 to 26. In sights Nos. 27 to 297, inclusive, the prism holder and cover are made in one piece. In sights after No. 297 the cover is separate from the prism holder.

13. The cross wires are secured to a ring by four clamps, and are at right angles to each other. The cross-wire holder (53) is secured to the draw tube by screws. The draw tube is assembled to the focusing sleeve so as to allow longitudinal motion of the former when the focusing ring is rotated, and to force rotation of the tube when the focusing sleeve is rotated. The sleeve is screwed into the rear end of the telescope tube by a thread of tight fit, and will be locked in place by a set screw (80). The focusing ring is seated on the focus-

ing sleeve by a threaded surface, its motion being limited by the telescope tube in front and the focusing-sleeve nut in rear. When turned, it transmits longitudinal motion to the draw tube and reticule.

14. Two eyepieces are furnished. Each consists of the eyepiece tube (50), the field lens (52), the eye lens (49) in its holder, and the eyepiece cover (1). The eyepiece tube is screwed into the draw tube and carries the field lens and the eye lens with its cell, the cover being screwed to the latter. There is an amber glass shade in a holder (48), that is pivoted so that it may be used or not, as desired. It is provided to protect the eye from a glare of light. The eyepiece of power 12 should be used under conditions of poor illumination.

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

16. The clear aperture of the telescope is 3 inches, the focal length of objective is 17.25 inches, the magnifying powers of the two eyepieces are 12 and 20 diameters, and the fields are 3.6 degrees for the 12-power eyepiece and 2.6 degrees for the 20-power.

17. The image is erect, the erection being secured by the Porro prisms, each of which twice totally reflects the pencil of light at an angle of 90 degrees, so that it emerges parallel to the entering pencil and in the original direction. The path of an axial pencil of light is shown on Plate III, giving an illustration of the erecting process, in which, however, the 90-degree angles are not all projected as 90 degrees, because of the relative position of the prisms.

18. The telescope is secured in position by clamps and is located by six accurately bored segmental projections, four on the cradle and one on each clamp. A locating lug on the front clamp fits into a recess in the telescope, thus bringing the vertical wire plumb.

19. For those carriages in which the gun is carried in a cradle, the sight bracket is bolted by means of the feet to seats which form parts of the gun cradle. Thus the motion of the bracket conforms to that of the gun, and when the sight is properly assembled to the carriage and the elevation reading is zero, the optical axis of the telescope and the axis of the bore of the gun will remain in parallel planes at all elevations. Therefore, if the sight be set at the elevation required for the range of the target, and then 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 to it without affecting the elevation. The elevation scale on the sight shank is normally not used.

20. The sight brackets for barbette carriages are lefts and rights. Plate I shows a right-hand sight. It is expected that eventually all left-hand sights will be removed from 5-inch and 6-inch barbette carriages.

SIGHTS FOR DISAPPEARING CARRIAGES.

21. The sights for disappearing carriages differ from those for barbette carriages in that a sight arm is substituted for the sight bracket, and a different method of attachment is used. See Plate II.

22. The sight arm differs from the sight bracket in shape, has an elevation guide, and the feet of the sight bracket are replaced by seats for two pins.

23. All disappearing carriages are constructed for the mounting of the 3-inch telescopic sight on the left side of the carriage, except the 6-inch disappearing carriage, model of 1905. The top of the sight standard ends in a horizontal flange surmounted by a cylindrical axis, upon which is centered a sight-arm bracket with a flange resting on the flange of the sight standard. The sight-arm bracket is forked and provides seats for the pins by which the sight arm is attached. The sight-arm bracket has a small motion in azimuth and can be set in its proper position by lugs and adjusting screws, then clamped by screw bolts passing through its flange and into that of the sight standard. The method of attachment of the sight to the carriage is more fully described in the pamphlets descriptive of the various models of carriages.

SIGHTS OF NEARLY THE SAME DESIGN AS THE MODEL OF 1904.

24. There are in service 26 sights, numbered from 1 to 26, both inclusive, which are nearly the same as those described above. The differences are due to substituting in the latter Porro double reflecting prisms for the Brashear-Hastings erecting prisms used in the former.

25. The telescopes of these sights are differently shaped from the model of 1904, being practically symmetrical about the axis; they are longer by about $3\frac{1}{2}$ inches, the peep sight is directly over the eyepiece, the rear clamp is differently shaped, the sides upon which the shutter and clamps are hinged have been reversed, the adjusting arrangements for the cross-wire holder are different, and the diameters of bearings on the telescopes and cradles for seating the telescope are $\frac{3}{8}$ inch smaller than on the model of 1904.

METHOD OF ASSEMBLING THE SIGHTS AND LOCATING THE POINTERS.

FOR BARBETTE CARRIAGES.

26. In assembling the brackets for the barbette carriages, great care should be taken to see that the seats are level in both directions, and that burrs, paint, and rust are removed from them and the feet of the brackets. A small obstruction of this kind will throw the sight shank out of plumb. In setting up the bolts, all should be brought to a firm bearing before any are set up tight.

27. The elevation pointer is marked by the manufacturer of the sights, since there is no adjustment for it on the carriage. The elevation pointer should be cut at the works of the builder of the carriage to allow for any possible inaccuracy in the seats and the deflection pointer should be put on at the emplacement after the gun is mounted.

28. After the sight is assembled to the carriage and while the gun is at zero elevation the sight should be accurately leveled and the pointer cut exactly opposite the zero of the elevation scale.

29. The position of the deflection pointer may be determined by adjusting the telescopic sight so that its axis intersects the axis of the gun at mid range. The pointer should then be set exactly opposite to the 3-degree mark on the deflection scale.

FOR DISAPPEARING CARRIAGES.

30. The deflection pointer is cut by the manufacturer of the sight, but the axis of the telescopic sight and the axis of the bore of the gun should be adjusted at the emplacement, so that they intersect at mid range. When the sight is in the correct position the bracket should be clamped and a light line cut so as to extend over both the flange on the bracket and that on the sight standard.

31. The range drums for these sights will not be used as such, nor will they be graduated. The sight shank elevation scales are also not used. The movement of the sight in elevation allows for variations in the angle of site of the target.

ADJUSTMENTS.

32. The cross wires are rendered distinct by screwing the eyepiece in or out, and this adjustment has no other object. If the telescope is frequently used by the same observer, the eyepiece can be reset at the correct position by using the graduations on the outer rim in connection with the pointer on the focusing sleeve nut. After bringing the cross wires into distinct vision by adjusting the eyepiece, the wires may be brought into the focal plane by turning the focusing ring until the object appears distinctly and does not seem to shift when the eye is moved from side to side of the eyepiece. This adjustment is impossible if the object is too close to the telescope.

33. 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.

34. 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.

35. 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.

36. 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 (60).

37. The adjustment of the cross wires of the sights numbered from 1 to 26 is made by unscrewing the focusing sleeve nut and the focusing ring until access is given to the capstan head adjusting screws that secure the cross-wire ring. These screws should be loosened, the adjustment made, and the screws again set up.

38. To adjust the tension of the range drum spring, run the sight shank rack out of mesh, turn the balanced handwheel to the right to relieve tension or to the left to increase tension and reengage the rack. When the cradle and telescope are in place and the elevation is 8 degrees, the force required to rotate the handwheel should be the same for both directions. *The cradle must first be disengaged from the head of the sight shank before this adjustment is made.*

CARE AND PRESERVATION.

39. 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, and all traces of dust or moisture should be removed before putting it away.

40. To obtain satisfactory vision, the glasses should be kept perfectly clear 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 cleaning of lenses only should be used*, care being taken that the cleaning material does not contain any dirt or grit. The glasses will seldom require cleaning on the inside; but, when necessary, they should be unscrewed, and by a competent person only. The object glass must always be kept screwed home, except when removed for cleaning.

41. The erecting prisms should not be removed *from the prism holder except by a person with special training in the care of telescopes*, and if they need repair, report should be made to proper authority. Removal is apt to disturb the adjustment, and finger marks or lint will cause difficulty.

42. The cross wires 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.

43. The sight bracket (or arm) and cradle should never be removed from the carriage unless the carriage is to be dismounted. When not in use, these parts should be kept protected by the covers provided for the purpose. All bearing surfaces should be kept thoroughly oiled, especial care being given to the worm box, sight shank, and bearings for the telescope, which are of steel. Care should be taken not to remove the oil in putting on the cover. The oil should be wiped off before use. The cover should be removed and the sight brackets (or arms), etc., examined at least once in every two weeks, and the cradle should be moved in elevation and deflection, so that as much as possible of the sight shank and worm box can be inspected.

No oil should be allowed on the surfaces of the lenses and prisms.

44. Special care should be taken in the use of the small electric lamps, as they are fragile. Each lamp should seat in its receptacle not less than one and one-half turns.

DISMANTLING AND ASSEMBLING.

45. 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.

46. 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.

47. When ordering spare parts, use the nomenclature given below.

NOMENCLATURE OF SIGHTS.

(Plates I, II, and III.)

1. Eye piece cover.
2. Eye piece dial.
3. Focusing ring.
4. Peep sight.
5. Eye end telescope clamp.
6. Prism holder.
7. Deflection worm knob.
8. Clamp pin.
9. Telescope tube.
10. Split pin for clamp pin.
11. Telescope lamp bracket.
12. Cell end telescope clamp.

13. Objective shutter.
14. Twisted hook.
15. Cradle.
16. Cross sight holder with sight (complete).
17. Clamping screw.
18. Yoke cap.
19. Cross sight screw.
20. Deflection pointer bracket.
21. Fulcrum.
22. Elevating wheel.
23. Objective shutter handle.
24. Sight shank.
25. Sight bracket.
26. Deflection pointer bracket screw.
27. Lamp cord.
28. Plug connection for lamps.
29. Lamp holder for deflection scale.
30. Range drum with range drum scale.
31. Gear case cover.
32. Lamp cap.
33. Telescope lamp holder.
34. Sight shank elevation scale.
35. Yoke cap bolt.
36. Split pin for yoke.
37. Sight arm.
38. Deflection scale screw.
39. Lamp bracket screw.
40. Yoke.
41. Focusing nut.
42. Focusing nut screw.
43. Elevating worm.
44. Focusing sleeve nut.
45. Deflection scale.
46. Elevating gear shaft.
47. Deflection worm and nut.
48. Amber glass holder with disc (complete).
49. Eye lens.
50. Eyepiece tube.
51. Focusing sleeve.
52. Field lens.
53. Cross-wire holder.
54. Cross wires.
55. Erecting prisms (Porro).
56. Objective.
57. Draw tube.

58. Cross-wire holder screw.
59. Cross-wire clip.
60. Focusing sleeve locking screw.
61. Eyepiece (complete) 12 power.
62. Eyepiece (complete) 20 power.
63. Gear case cover bolt and nut.
64. Prism spring.
65. Prism holder screw.
66. Range pointer (right hand).
67. Range pointer (left hand).
68. Range pointer screw.
69. Spring cover.
70. Spring cover screw.
71. Rubber hood for 12 power.
72. Rubber hood for 20 power.
73. Sight shank stop.

WAR DEPARTMENT,

OFFICE OF THE CHIEF OF ORDNANCE,

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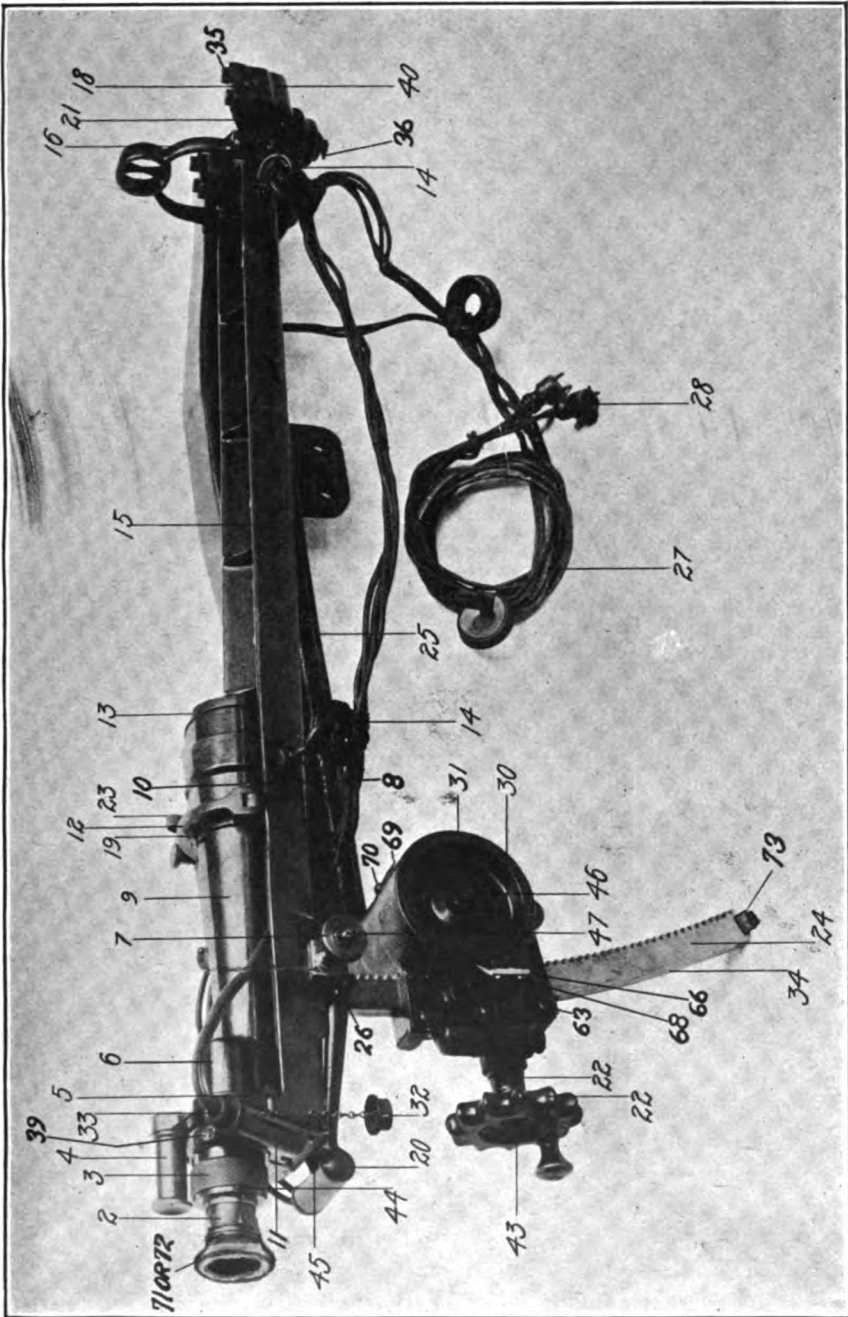
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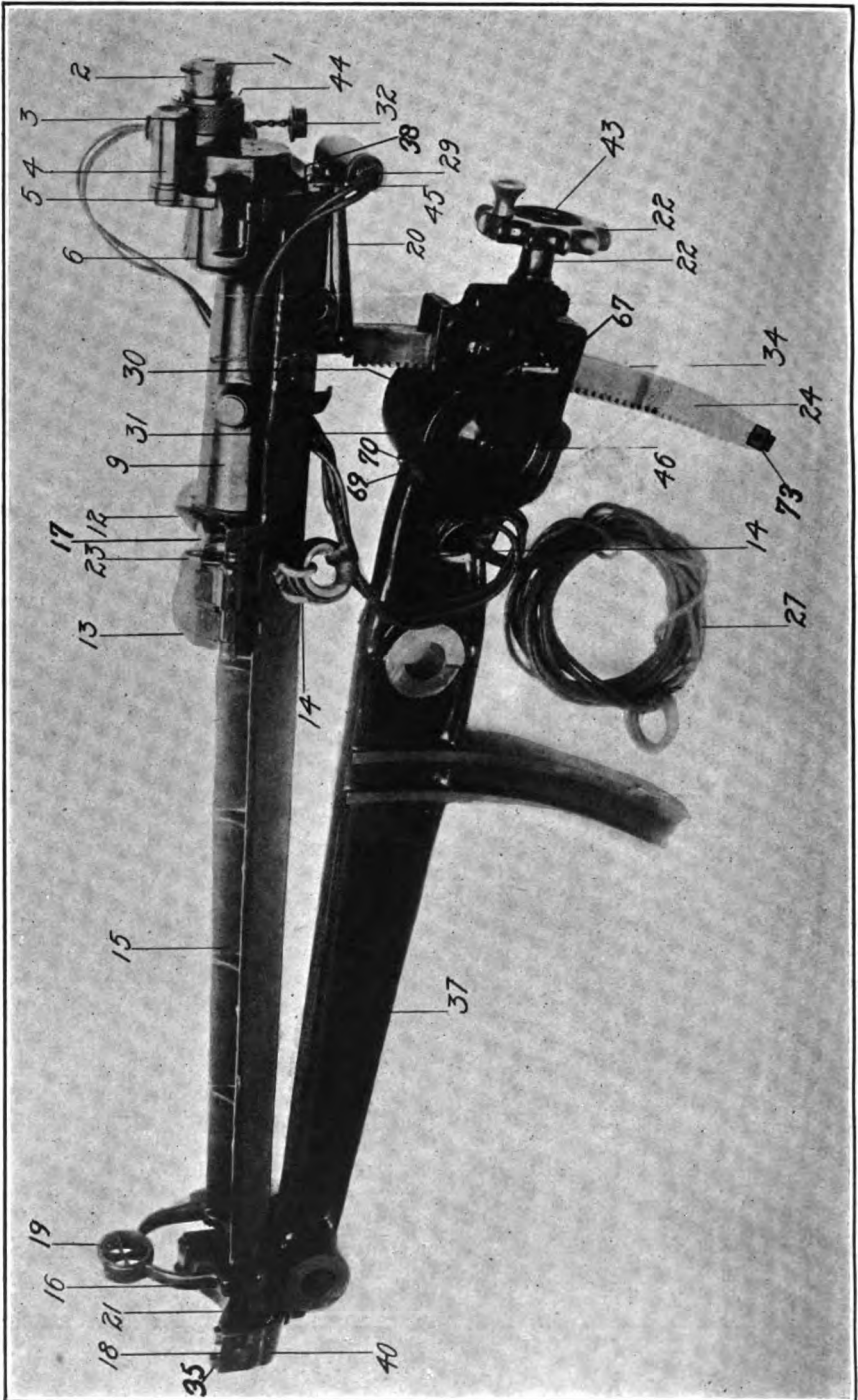
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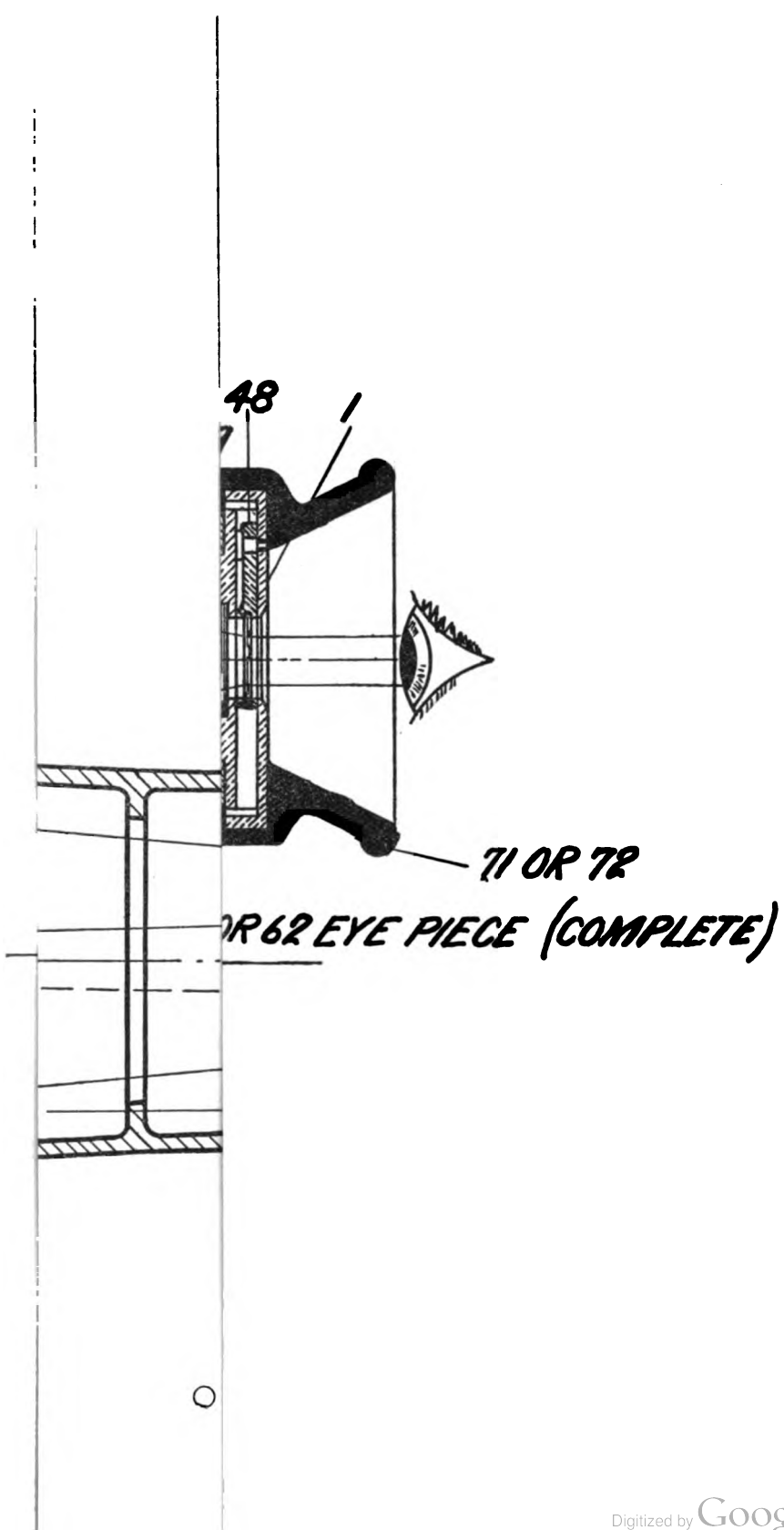
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