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WAR DEPARTMENT

TECHNICAL MANUAL



ORDNANCE MAINTENANCE

FIELD GLASS, TYPE EE

April 7, 1942

ORDNANCE MAINTENANCE

FIELD GLASS, TYPE EE

SECTION I. General.	Paragraph
Scope -----	1
II. Description and operation.	
General -----	2
Components -----	3
Salient characteristics -----	4
Optical characteristics -----	5
Specific characteristics -----	6
Operation -----	7
III. Inspection and correction.	
Purpose -----	8
Inspection report -----	9
Preliminary inspection -----	10
Double vision -----	11
Parallax -----	12
Diopter scale -----	13
Interpupillary distance scale -----	14
Position of reticle -----	15
Appearance of scales and exterior finish -----	16
IV. Maintenance and repair.	
General -----	17
Facilities necessary for making corrections -----	18
Double vision -----	19
Parallax -----	20
Diopter scale -----	21
Interpupillary distance scale -----	22
Position of reticle -----	23
Appearance of scales and exterior finish -----	24
V. Disassembly and assembly.	
Precautions -----	25
Disassembly of objective (right or left) -----	26
Disassembly of eyepiece from body -----	27
Disassembly of right eyepiece -----	28
Disassembly of left eyepiece -----	29

*This manual supersedes TM 9-1611, September 12, 1941.

SECTION V. Disassembly and assembly—Continued.		Paragraph
Disassembly of body (right or left)-----		30
Disassembly of right body from left body-----		31
Removal of stop-----		32
Precaution for assembly-----		33
Assembly of objectives (right or left)-----		34
Assembly of right eyepiece-----		35
Assembly of left eyepiece-----		36
Assembly of body-----		37
VI. Care and preservation.		
Care in handling-----		38
Lubrication-----		39
Care of optical parts-----		40
APPENDIX. List of references-----		Page
		24

SECTION I

GENERAL

1. **Scope.**—This manual is published for the information and guidance of ordnance maintenance personnel. It contains detailed instructions for inspection, disassembly, assembly, maintenance and repair of the glass, field, type EE, supplementary to those in the Field Manuals and Technical Manuals prepared for the using arm. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the matériel.

SECTION II

DESCRIPTION AND OPERATION

	Paragraph
General-----	2
Components-----	3
Salient characteristics-----	4
Optical characteristics-----	5
Specific characteristics-----	6
Operation-----	7

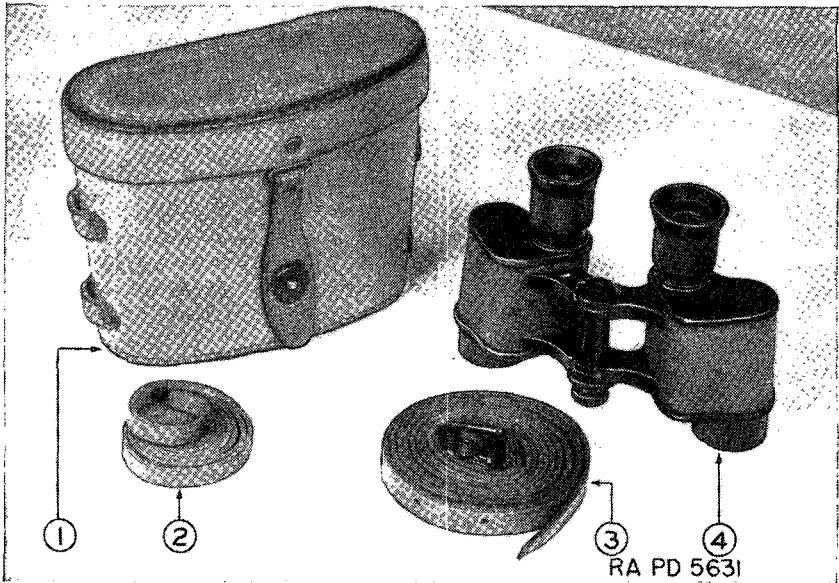
2. **General.**—*a.* The field glass is an optical instrument used for observation and approximate measurement of small horizontal and vertical angles. A field glass is essentially two terrestrial telescopes mounted together for binocular vision. It is constructed in two halves, each carrying a compact prismatic telescope. They are

pivoted about a common hinge to provide adjustment for changing interpupillary distances to suit the eyes of the user.

b. Glass, field, type EE, is the limited standard glass for issue to the using arms. Field glass, type EE, of U. S. naval gun factory manufacture is also limited standard.

- 3. Components.**—*a.* The instrument complete consists of—
 Glass, field, type EE.
 Case, carrying.
 Strap, neck.
 Strap, carrying case.

b. These four components are illustrated in figure 1.

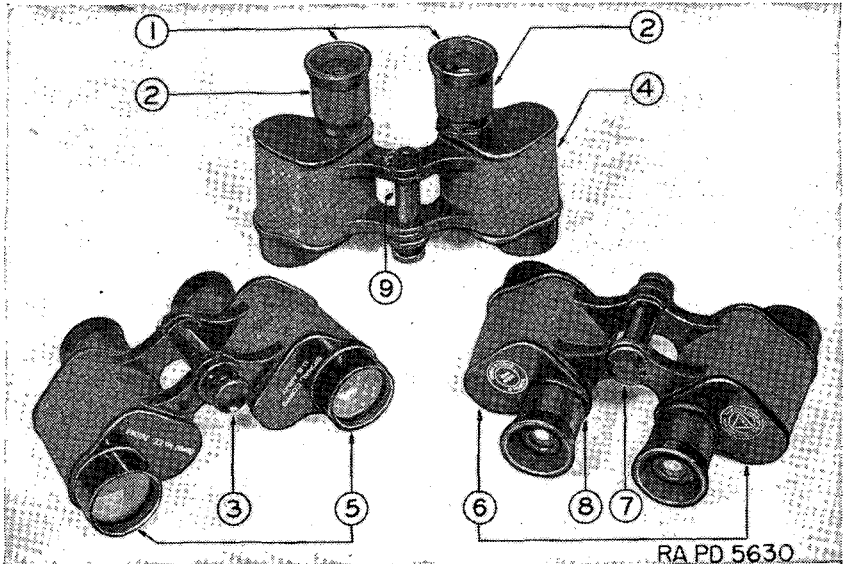


1. Carrying case.
 2. Neck strap.
 3. Carrying case strap.
 4. Field glass.

FIGURE 1.—Glass, field, type EE (complete).

4. Salient characteristics.

Magnification.....	6×
Field of view.....	8°
Apparent field of view.....	48°
Diameter of objective lens.....	30 mm.
Diameter of exit pupil.....	0.197 in.
Effective focal length of objective.....	4.890 in.
Effective focal length of eyepiece.....	0.811 in.



- | | | |
|---------------------|---------------------|-----------------------------------|
| 1. Eye guards. | 4. Body. | 7. Interpupillary distance scale. |
| 2. Focusing nuts. | 5. Objective cell. | 8. Diopter scale. |
| 3. Hinge pin screw. | 6. Rear body cover. | 9. Hinge pin. |

FIGURE 2.—Glass, field, type EE.

5. **Optical characteristics.**—*a.* (1) Each half of the type EE field glass is a terrestrial telescope employing Porro prisms as the erecting mechanism. An examination of figure 3 will show how this is accomplished. The baton and arrow represent an image in the field of view which has been inverted and reversed by the objective lens. It will be noted that the baton is again reversed by the horizontal prism while the arrow is reinverted by the vertical prism.

(2) Porro prisms not only erect the image but also greatly reduce the length of the telescope and provide a means of adjustment. Furthermore, they are so arranged as to separate the objectives of the two telescopes considerably more than the eyepiece, thus increasing the stereoscopic effect.

b. All modern military field glasses are constructed for separate focusing; that is, each eyepiece is focused independently of the other by screwing it in or out. Strictly speaking, a change of focus is necessary whenever the distance of the object viewed changes. However, with modern field glasses, when the instrument is focused for an object at average range, objects at all but very short distances can be seen at substantially their maximum distinctness.

FIELD GLASS, TYPE EE

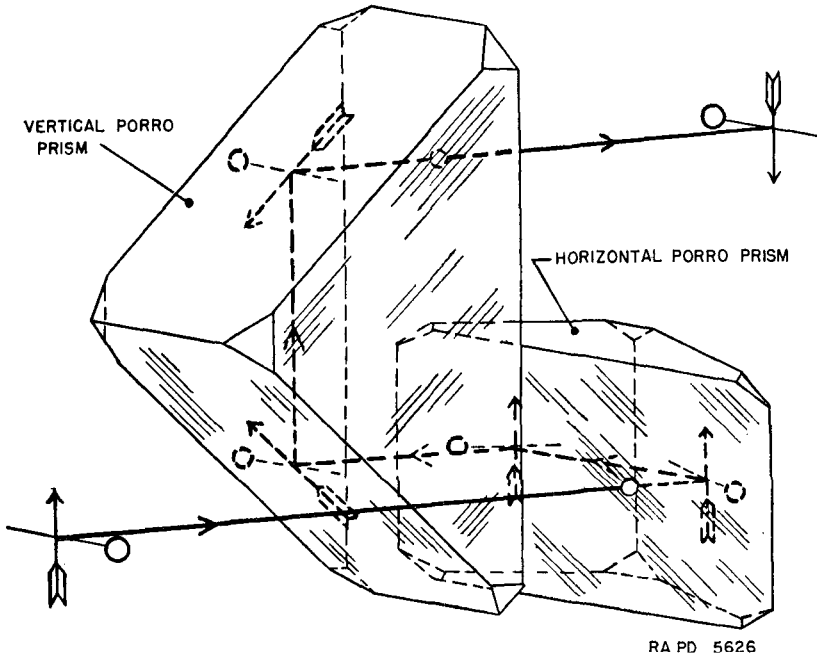


FIGURE 3.—Porro prism erecting system.

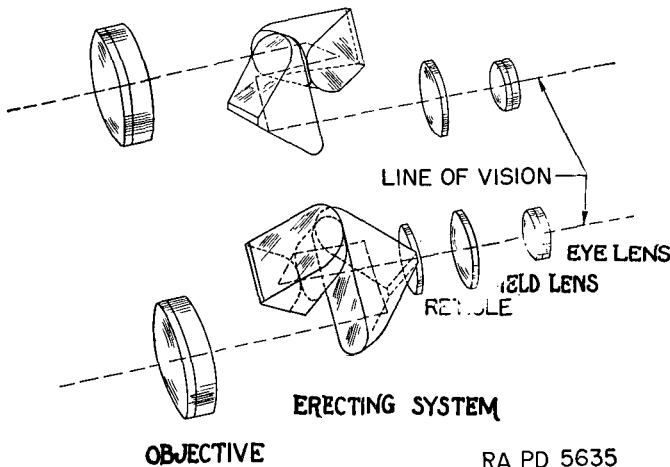
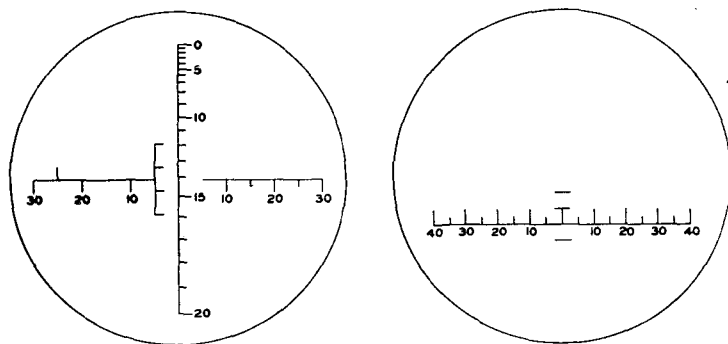


FIGURE 4.—Optical system of type EE field glass.

6. Specific characteristics.—*a.* Each eyepiece assembly (C44146 and C44147, figs. 2 and 8) can be focused independently. This is accomplished by turning the knurled focusing nuts (B16442) until a sharp image is obtained. Each is provided with a scale (B16443) graduated in diopters, a unit expressing the refractive power of a

lens. This permits the individual to determine one eyepiece setting for each eye, thus eliminating the need for focusing the field glass every time it is used.

b. The left eyepiece assembly (C44146) contains a glass reticle (B16444, figs. 5 and 8) upon which is etched a horizontal mil scale which appears in the lower portion of the field. The field is graduated in 5-mil intervals, 40 mils each side of center (fig. 5). Above and below the center of the scale are short, horizontal lines which indicate 5-mil vertical intervals. The reticle used in glasses of older manufacture contains a vertical stadia scale with graduations corresponding to the inverted sight leaf of the service rifle. This scale is used to locate auxiliary aiming points in indirect fire.



RA PD 5629

① Old style.

② New style.

FIGURE 5.—Field glass reticles.

c. The spacing between eyepiece centers, measured in millimeters, is shown on an interpupillary scale (B16451) which is graduated every 2 millimeters from 56 to 74. The desired setting is obtained by pivoting the telescopes about the body hinge pin (A36203).

d. The body hinge pin carries an adjustable hinge stop ring (A36210) which engages the hinge stop (A36202) at a predetermined setting of the interpupillary scale. This permits the user to return the instrument to that setting without reference to the scale. The hinge stop may be disengaged to allow full hinge motion without disturbance of the stop ring adjustment.

7. Operation.—*a. General.*—When using a field glass hold it in both hands and lightly press it to the eyes. This keeps the relation to the eyes constant, but does not transmit tremors of the body. When possible, it is best to use a rest for the glass or elbows.

b. Interpupillary distance.—To set the glass so that the eyepieces are adjusted accurately for interpupillary distance, that is, so that

the eyepieces are the same distance apart as the observer's eyes, look through the glasses at some fairly distant object. Open or close the glasses on the hinge until the fields of view appear as one perfect, sharply defined circle, and coincide exactly. If the telescopes are too far apart, the fields of view appear oval.

c. Focus.—In focusing an eyepiece, hold the field glass in the normal position for binocular vision, with both eyes open. Place the hand over the objective of the side other than that being focused. Turn the eyepiece until maximum distinctness is obtained and note the resulting eyepiece settings. Repeat the operation several times. On half of the trials turn the eyepiece in one direction, and half in the other. The mean of the several eyepiece settings obtained is accepted. Repeat the procedure for obtaining the setting for the other eyepiece.

SECTION III

INSPECTION AND CORRECTION

	Paragraph
Purpose.....	8
Inspection report.....	9
Preliminary inspection.....	10
Double vision.....	11
Parallax.....	12
Diopter scale.....	13
Interpupillary distance scale.....	14
Position of reticle.....	15
Appearance of scales and exterior finish.....	16

8. Purpose.—Inspection is made for the purpose of determining the condition of the instrument, whether repairs or adjustments are required, and the remedies necessary to insure serviceability and proper functioning.

9. Inspection report.—The following inspection report illustrates a satisfactory procedure in logical order. Reports will be made on these forms which can be reproduced locally if any quantity is required.

INSPECTION REPORT

FIELD GLASSES		Date _____
Serial number _____		
<i>A. General:</i>	<i>Condition</i>	<i>Remarks</i>
Completeness.....
Appearance.....
Painting.....
Sealing.....

INSPECTION REPORT—Continued.

FIELD GLASSES—Continued.

<i>B. Optical check:</i>	<i>Condition</i>	<i>Remarks</i>
Objective		
Prism		
Field lens.....		
Eyelens.....		
Reticle		
Double vision.....		
Definition:		
Right telescope.....		
Left telescope.....		
Parallax.....		

<i>C. Mechanical check:</i>	<i>Condition</i>	<i>Remarks</i>
Hinge joint.....		
Focusing nut.....		
Diopter movement:		
Right telescope.....		
Left telescope.....		
Body cover.....		
Screws.....		
Interpupillary scale.....		

<i>D. Accessories:</i>	<i>Condition</i>	<i>Remarks</i>
Carrying case.....		
Carrying strap.....		
Neck strap.....		
Modifications		

<i>E. Disposition:</i>
Arsenal.....
Shop
Field.....
Repaired at time of inspection.....

Remarks:

.....

.....

10. Preliminary inspection.—a. Inspect the exterior of the instrument to determine the condition of the visible elements, paint,

sealing, and general appearance. Make sure all accessories listed in paragraph 2 are with the field glass.

b. Look for checks or frost patterns appearing in the field of view. Such defects are evidence of loosening of the balsam used in cementing lenses, and their correction requires replacement of defective parts.

c. Check the hinge pin and focusing nut for stiffness of movement. They should be tight enough to prevent slippage but not so tight as to cause undue effort on the part of the user.

11. Double vision.—a. Double vision occurs when the optical axes of the two telescopes are not parallel.

b. To observe for double vision the inspector should hold the instrument up in front of his eyes. Hold it as steady as possible. Close either eye for a minute or so. Then open the eye quickly. If any amount of double vision exists it can be detected. Whatever is being observed will appear to blur apart, and then together again, quickly, as the eye accommodates for the defect. To use this method, observation should be confined to sharply outlined targets such as a telephone pole or smokestack.

c. Another check for double vision is as follows: Place the glasses on a flat object to steady them, or in an appropriate fixture. Glance through each telescope of the field glass individually, in order to determine the targets outlined in the edges of each individual field of view. Pick out an object, in the extreme edge of the field of view of either telescope, that can be seen clearly. On looking through the other telescope *it should appear in the same relative position in the field of view*. In other words, one field of view should show exactly the same portion of the landscape being observed as the other. If any discrepancy exists, double vision exists. To correct double vision see paragraph 19.

12. Parallax.—a. Parallax in the left telescope is due to the fact that the etched side of the reticle is not lying in the focal plane of the objective.

b. When the diopter scale reads zero and is opposite the index on the sleeve:

- (1) The field of view must be sharp and clear.
- (2) The reticle must be sharp and clear.
- (3) The tolerance between the difference in sharp definition of the field of view and the reticle must not exceed 1/2 diopter.

(4) When the three conditions in (1), (2), and (3) above have been satisfied, the diopter scale and the focusing nut must have an allowable movement of plus and minus five diopters from zero.

(5) When the diopter scale reads zero on each eyepiece, the difference in length of the two eyepieces must not exceed two diopters (approximately $\frac{3}{4}$ of an inch).

(6) The difference in length of the two objective cells and adapters must not exceed $\frac{1}{32}$ of an inch.

c. When checking for parallax, hold the glass steady, or place it on a firm support, and look through the left telescope. Without moving the glass, move the eye from side to side and up and down. If there is any apparent movement or flickering between the reticle and the field of view, parallax is present. Extreme conditions of parallax are easily perceptible. When parallax is present to a marked degree and when the instrument's field of view is in sharp definition, the reticle will not even be visible—or the reverse may be true.

d. Another method of detecting parallax is to look through the left telescope, observing a distant object until it is sharply defined in the field of view. Ignore the reticle for the moment. Note the diopter reading. Then point the instrument at the sky and focus until the reticle is sharp and clear. Pay no attention to the field of view. Note the diopter reading again. The diopter reading should be the same as the reading obtained for sharp definition of the field of view. If any difference exists in the two readings, in excess of $\frac{1}{2}$ diopter, parallax is present to the degree proportionately indicated by the difference in the two readings.

e. If no difference exists in the two readings, there is no parallax present. However, at the zero diopter reading indicated for clear and sharpest definition of the reticle and the field of view, there must be an allowable movement of plus or minus five diopters in either direction from the index; and the scale should read 0 with the index when definition is at its sharpest and clearest. To correct parallax see paragraph 20.

13. Diopter scale.—*a.* Occasionally a situation may be encountered where no parallax exists; definition is sharp and clear; on the diopter scale there is the proper plus and minus five diopters movement; but—at this point the diopter scale will not read zero.

b. When inspection indicates this condition does exist, the scale must be adjusted to satisfy the above requirement. (See par. 21.)

14. **Interpupillary distance scale.**—*a.* When the interpupillary distance scale reads 64 millimeters in relation to the index, the center points of the two eyepieces must be exactly 64 millimeters (2.51 inches) apart.

b. When inspection indicates that this condition does not exist, or when occasion demands the replacement of the interpupillary distance scale or any part which might affect this requirement, the scale must be adjusted to satisfy the above requirements. (See par. 22.)

15. **Position of reticle.**—The horizontal cross line on the reticle should be horizontal within 1/2 mil when the interpupillary scale is set at 64 millimeters. For adjustment see paragraph 23.

16. **Appearance of scales and exterior finish.**—*a.* Make sure both diopter scales as well as the interpupillary distance scale are clear and easy to read.

b. Look for small scratches on the finish and spots where the finish is worn. To improve appearance of scales and exterior finish see paragraph 24.

SECTION IV

MAINTENANCE AND REPAIR

	Paragraph
General.....	17
Facilities necessary for making corrections.....	18
Double vision.....	19
Parallax.....	20
Diopter scale.....	21
Interpupillary distance scale.....	22
Position of reticle.....	23
Appearance of scales and exterior finish.....	24

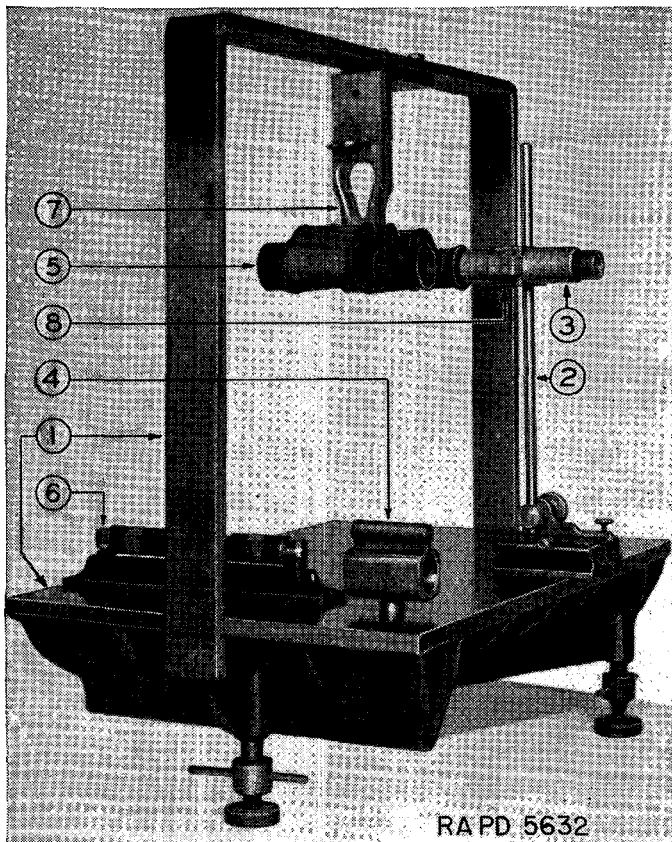
17. **General.**—The maintenance and repair of field glasses are primarily a replacement of worn and broken parts and a correction of optical malfunctions.

18. **Facilities necessary for making corrections.**—*a. Optical repair kit for field artillery.*—An optical repair kit containing the necessary tools, fixtures, cements, oils, etc., for use with these instruments is furnished to ordnance personnel. A complete list of the items comprising the kit is contained in SNL F-21, and also in a blue print fastened in the cover of the chest. Every item in the kit is designated by a number equivalent to the compartment number. Most of the items, such as screw drivers, etc., require no description,

as their uses are self-explanatory. The collimating telescope No. 90 which is furnished with the kit is of the nonerecting type.

b. In addition to the optical repair kit, the following special equipment, as shown on drawing C49109, is required. The first three items are illustrated in figure 6.

- (1) Surface plate and special testing fixture (C49454).
- (2) Surface gage and special fixture (C49455).
- (3) Telescope adapter (B121110).
- (4) Plumb line (for erecting testing target).
- (5) Testing target (fig. 7).



- | | |
|---------------------------------------|------------------------|
| 1. Surface plate and testing fixture. | 5. Field glass. |
| 2. Surface gage and special fixture. | 6. Level. |
| 3. Collimating telescope. | 7. Field glass holder. |
| 4. Telescope adapter. | 8. Telescope holder. |

FIGURE 6.—Adjusting fixtures.

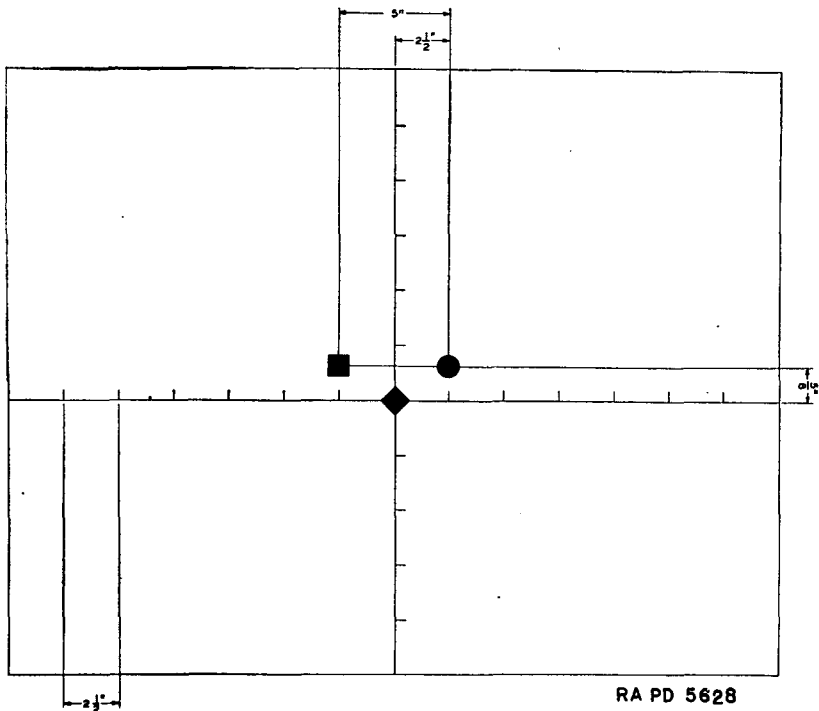


FIGURE 7. Testing target for field glasses.

19. Double vision.—*a.* To correct double vision the two optical axes must be made parallel to each other and to the mechanical axis of the instrument. When the interpupillary distance is set at 64 millimeters, the optical axes of both telescopes must be parallel within $\frac{1}{2}$ mil, both vertically and horizontally, to one another and to the mechanical axis of the hinge joint.

b. Locate the special target at a distance of 139 yards and approximately level with the testing fixture. This distance must be exact because the dimension ($2\frac{1}{2}$ inches) indicated in figure 7 is equivalent to $\frac{1}{2}$ mil at 139 yards. A 100-foot measuring tape is provided on instrument repair truck M1. The target may be leveled, and the vertical line on the testing target rendered accurately perpendicular by use of the plumb line. Mount the collimating telescope in the telescope adapter and the telescope adapter in the clamping device on the testing fixture. Adjust the adjusting fixture by means of the leveling screws so as to bring the intersection of the cross lines of the collimating telescope reticle into coincidence with the point on the testing target indicated by the diamond (fig. 7). Remove the collimating telescope from the adjusting fixture and mount it in the

telescope holder on the surface gage, as shown in figure 6. With the surface gage pins against the edge of the adjusting fixture and the right hand pin against the stop pin indicated by the 1.2-inch dimension in drawing C49109, adjust the collimating telescope until the cross lines of the reticle coincide with the cross lines on the testing target.

c. Set the field glasses to an interpupillary distance of 64 millimeters by means of the interpupillary scale. Clamp the field glasses in a level position relative to the leveled surfaces plate. Place the surface gage against the stop pin for the right eyepiece of the field glasses and, sighting through the collimating telescope into the eyepiece, focus the eyepiece until the image appears sharp and clear. Adjust the Porro prism by means of the special headless, cone-point adjusting screws until the circle on the testing target is in coincidence with the cross lines of the collimating telescope reticle. Repeat this operation with the left telescope until a similar condition is obtained on the corresponding left section of the target, the square.

d. Any apparent tilt in the field of view can be similarly corrected by adjusting the headless cone-point tilting screws until the tilt is eliminated.

e. (1) To adjust the Porro prisms nearest the objective ends, use the four headless cone-point screws (A36195) arranged in a plane around the body. The prisms may be shifted or rotated slightly in position by proper movement of the screws.

(2) To adjust the Porro prisms nearest the eyepieces use the two remaining headless cone-point screws. These move the Porro prisms diagonally up toward the center of the instrument or down and away from the center.

(3) When adjusting the Porro prisms, always be sure to loosen the opposing screws before tightening up the screws shifting the prism in the desired direction. This avoids the danger of chipping or straining the prisms. In most cases the total adjustment required will be very small.

20. Parallax.—*a.* Parallax may be eliminated in one of several ways:

(1) The reticle may be moved to coincide with the focal plane of the objective.

(2) The focal plane of the objective may be so shifted as to coincide with the reticle.

(3) A combination of (1) and (2) may be used.

b. Preliminary.—(1) To make these adjustments it is first necessary to determine how much and in what direction the correction is to be applied. To determine this, place the instrument in the fixture (fig. 6) in a horizontal position, with both of the eyepieces level in relation to each other. Put the collimating telescope in the surface gage holder and place it in front of the left eyepiece. Then obtain clear and sharp definition of an object at least 100 to 200 yards away by use of the collimating telescope.

(2) Note the reading of the diopter scale when this has been done. Assume that it is minus five. Next focus the eyepiece until the *reticle* is sharp and clear as seen through the collimating *telescope*. Note the reading of the diopter scale when this has been done. Assume that the reading obtained is minus three. This difference in the two readings would indicate a difference of sharp definition of the *reticle* in relation to sharp definition of the field of view of two diopters. It follows that this is the amount of parallax present. The tolerance permitted for the difference in readings is $1/2$ diopter. There is present (in this hypothetical instance) undesirable parallax in the amount of two diopters which must be eliminated.

(3) To eliminate it, the focal plane of the objective must be shifted two diopters to coincide with the *reticle*, or the *reticle* must be shifted two diopters to coincide with the focal plane of the objective.

c. Methods of moving focal plane of objective by interchange of parts to coincide with reticle.—(1) Interchange the objective lens cells from right to left (or vice versa) if they show an obvious difference in length.

(2) Try a new objective cell with a difference of length in the desired direction.

(3) Try a different adapter.

d. Methods of shifting reticle by interchange of parts to coincide with focal plane of objective.—(1) Change the *reticle* cell for one of different size.

(2) Change the eyepiece sleeve.

(3) Change the eyepiece washer.

(4) The eyelens cell may be screwed in or out *slightly* to give a longitudinal displacement of image.

(5) Interchange eyepiece assemblies.

e. Methods of interchanging or replacing optical elements to obtain either of results outlined in c and d above.—Optical components would not ordinarily be changed unless replacement was the only

alternative due to breakage, or for other reasons affecting the final condition of the field glasses.

(1) *Effect of replacing the objective lens.*—(a) The use of a new objective lens with a focal length longer than the original will move the focal plane in a plus direction and increase the diopter reading on the minus side.

(b) The use of a new objective lens with a focal length shorter than the original will move the focal plane in a minus direction and increase the diopter reading on the plus side.

(c) In changing objective lenses *only* the focal plane of the objective is moved in relation to the reticle. Changing the objective lenses will *not* affect a change of the diopter scale reading on the reticle.

(2) *Effect of changing Porro prisms.*—(a) If a prism is replaced by one that is larger than the original, the focal plane of the objective will be moved in a minus direction.

(b) If a prism is replaced by one smaller than the original, the focal plane of the objective will be moved in a plus direction.

f. Methods of moving image in relation to eyepiece by machine work on metal components.—(1) After *all* the forementioned procedures have been tried and exhausted, the machining of metal parts may be considered. Machine work should always be done on the cheapest part insofar as practicable, *if* satisfactory results can be obtained by so doing.

(2) The objective cell may be shortened in length to move the focal plane of the objective lens in a plus direction.

(3) The shoulder on the inside of the objective cell may be machined to move the focal plane of the objective lens in a minus direction.

(4) The objective cell adapter may be machined to move the focal plane of the objective in a plus direction. Machining should be done on the inside shoulder.

(5) Use of a thicker objective cell adapter will move the focal plane of the objective in a minus direction.

(6) The shoulder on the reticle cell may be reduced when it is desirable to move the *reticle* in a plus direction to coincide with the focal plane of the objective without changing the diopter reading of the field of view.

(7) The shoulder on the eyepiece sleeve may be machined to move the reticle in a plus direction without changing the diopter reading of the field of view.

21. Diopter scale.—*a.* If the diopter movement is correct and only the reading of the scale is in error, it can be adjusted by loosening the diopter scale lock screw and moving the scale around *independently* of the focusing nut until the zero registers opposite the index. This will in no way change or interfere with the diopter movement or affect the optical characteristics of the instrument. The only thing that has been done is the shifting of the scale relative to the index.

b. The above method of correction, however, should only be employed for small changes. When a change of three or more diopters is required, the focusing nut should be shifted by using the sextuple thread.

22. Interpupillary distance scale.—*a.* Remove the eye guards from both eyepieces. No further disassembly of the instrument will be required.

b. Measure from the outside of one eyepiece to the inside of the other. This is preferable and much more accurate than attempting an approximate measure from the center of the eyepiece, and the same result is achieved.

c. Adjust the two telescopes on the mechanical axis until they are exactly 64 millimeters apart. The interpupillary scale is then set so that the 64 millimeter line corresponds with the index line and can be locked in place with the lock screw, for which a new hole must be tapped.

23. Position of reticle.—*a.* Place the field glass in the fixture in a horizontal position with both eyepieces level in relation to each other. Set the interpupillary scale at 64 millimeters. Sight through the left eyepiece at the testing target. The reticle should be horizontal with the horizontal line on the testing target within $\frac{1}{2}$ mil.

b. If correction is necessary, remove the left eyepiece assembly and unscrew the reticle cell. Loosen the retainer slightly and turn the reticle in its cell in the desired direction. Before reassembling, wash the reticle carefully in alcohol, ethyl.

24. Appearance of scales and exterior finish.—*a.* White scale filler is used on the diopter scale and interpupillary distance scale. When the scales are not legible, clean the graduation marks and apply a thin coat of white filler. Wash off surplus filler with soap, castile, and water, rinse in clean water and dry.

b. Small scratches or worn spots, as well as unavoidable blemishes caused by assembly or adjusting operations, may be touched up with an air drying enamel of a practical color match of the original finish.

SECTION V

DISASSEMBLY AND ASSEMBLY

	Paragraph
Precautions	25
Disassembly of objective (right or left)	26
Disassembly of eyepiece from body	27
Disassembly of right eyepiece	28
Disassembly of left eyepiece	29
Disassembly of body (right or left)	30
Disassembly of right body from left body	31
Removal of stop	32
Precaution for assembly	33
Assembly of objectives (right or left)	34
Assembly of right eyepiece	35
Assembly of left eyepiece	36
Assembly of body	37

25. Precautions.—*a.* The operations in paragraphs 26 to 37, inclusive, may be performed only by qualified ordnance personnel. The using arm is prohibited from attempting them.

b. To preserve the parts of the instrument, it is necessary to exercise care and close attention during disassembly, cleaning, and adjustment. Copies of the publications listed in the appendix should be on hand for the guidance of personnel concerned.

c. All optical elements and metal components should be carefully marked or tagged as they are disassembled to insure correct positioning in the instrument on reassembly. If parts are not so marked or tagged, considerable difficulty will be encountered in the final adjustment of the glasses. Reference marks should be scribed when deemed advisable. An indelible pencil or diamond may be used for marking on *unpolished* surfaces of optical elements. Metal components may be scribed, marked, or tagged.

d. All optical elements will be cleaned with alcohol, ethyl. Care must be exercised to prevent excess alcohol from coming in contact with the edges of compound lenses, in order to prevent damage to the lens cement which is soluble in alcohol. If pencil marks have been placed on the unpolished surfaces of lens or prisms, avoid removing them to prevent difficulty when assembling. Polish the optical element with paper, lens, tissue. Remove dust and dirt with an air bulb and a small clean, camel's hair brush.

e. All metal components will be cleaned in solvent, dry-cleaning, and quickly dried in air.

Caution: Do not clean metal components in dry-cleaning solvent when the optical elements have not been removed.

f. Defective parts should be replaced from stock. Replacement of defective optical elements must be carefully checked, inasmuch as

FIELD GLASS, TYPE EE

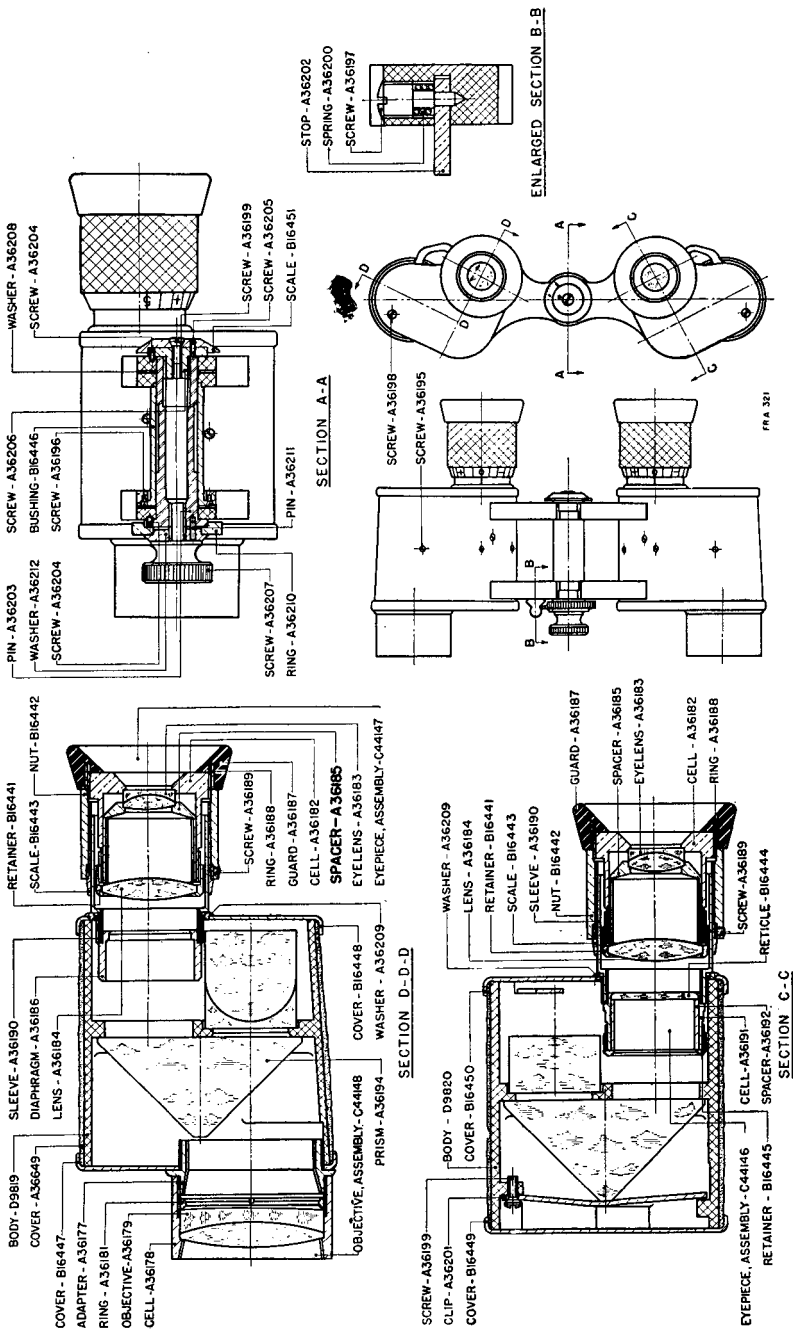


FIGURE 8.—Field glass, type EF.—assembled and sectional view.

replacement of even one optical element may change the optical characteristics of the telescope and render readjustment necessary. Replacement of metal components is easily accomplished since the components are all standardized and available as replacements. Keep in mind, however, that the replacement of such components as the objective cells, objective adapters, reticle cells, etc., may cause parallax and affect the final adjustment of the instrument. The greatest of care and considerable thought must therefore be given to the replacement of *any* part.

26. Disassembly of objective (right or left).—Before removing the objective assembly, mark the location of the cell with respect to the adapter, and of the adapter with respect to the cover. Unscrew objective cell (A36178, fig. 8) using a strap wrench if necessary. The objective cell is held to the body by the objective adapter (A36177). The objective adapter may or may not unscrew with the objective cell. If it unscrews with the objective cell, unscrew it from the cell. Unscrew the retaining ring (A36181). Remove the objective lens from the cell.

27. Disassembly of eyepiece from body.—Scribe a reference line on the body cover (B16448 or B16450) to coincide with the engraved line on the eyepiece sleeve. Unscrew the eyepiece from the body. Remove the eyepiece washer (A36209) from the body cover.

28. Disassembly of right eyepiece.—Unscrew the eye guard (A36187) from the eyepiece. Unscrew the eyelens cell (A36182) from the focusing nut (B16442). Unscrew the diaphragm (A36186) from the eyepiece sleeve (A36190). Unscrew the eyepiece sleeve (A36190) from the focusing nut (B16442). Release the special headless screw (A36189) and unscrew the diopter scale (B16443) from the focusing nut. Unscrew the retainer (B16441) from the eyelens cell, thus releasing the field lens (A36184), lens spacer (A36185), and eyelens (A36183) from the eyelens cell. Note the position (for future reference) of the eyelens and the field lens in the eyelens cell and with respect to each other.

29. Disassembly of left eyepiece.—Unscrew the eye guard (A36187) from the eyepiece. Unscrew the eyelens cell (A36182) from the focusing nut (B16442). Release the special headless screw (A36189) and unscrew the diopter scale (B16443) from the focusing nut. Scribe a reference line on the threads of the eyepiece sleeve (A36190) and the outside diameter of the reticle cell (A36191). This will serve to locate the reticle cell during assembly. Unscrew the reticle cell from the eyepiece sleeve. Unscrew the eyepiece sleeve from the focusing nut. Unscrew the retainer (B16441) from the eyelens cell, thus releasing the field lens (A36184), the lens spacer

(A36185), and the eyelens (A36183). Note the position of the eyelens and the field lens (for future reference) in the eyelens cell with respect to each other. Scribe a reference line on the edge of the reticle cell in prolongation of the graduated line on the reticle (B16444). This line will serve to locate the reticle in the reticle cell on reassembly. Unscrew the retainer (B16445) from the reticle cell, thus releasing the spacer and the reticle.

30. Disassembly of body (right or left).—*a.* Remove the special fillister head screws (A36198), one from each of the four body covers, and remove the body cover.

b. Inspect each of the Porro prisms for seating and for the location of the headless cone-point adjusting screws (A36195) which serve to hold the Porro prisms in their adjusted positions. The locations of the screw holes in the body can be ascertained from figure 8. The Porro prism toward the objective end of each telescope is held in position by four screws. The Porro prism toward the eyepiece end of each telescope is held by two screws. Porro prisms may be removed in many instances by backing off but one screw. Proper and careful inspection will indicate which screw can be backed off to remove a prism. Remove the plugging cement from the indicated holes on the exterior of the body to render the screwheads available. *Loosen* the indicated screw or screws, but do not remove unless absolutely necessary.

c. Remove the special flathead screw (A36199) (one from each of the four prism clips) and remove the prism clip. Remove prism.

d. After a Porro prism has been released from the body and removed, mark it so that it may be replaced on assembly in the *same* position and exactly as it was when removed. Repeat the procedure for the other three prisms. Reversing a Porro prism in its seat in the body or assembling a Porro prism in the wrong way may make the final adjustment very difficult because the optical elements cannot be interchanged safely, without affecting the adjustment of the glasses.

31. Disassembly of right body from left body.—Remove the clamp screw (A36207), washer (A36212), hinge stop ring (A36210), and the special headless screw (A36204). Remove the screws (A36199 and A36205), the interpupillary scale (B16451), and the screws (A36204 and A36206). Push or pull the hinge pin (A36203) out (using the screw (A36207), if necessary for gripping) and separate the bodies. Do not lose the washer (A36208). To remove bushing (B16446), withdraw the locking screws (A36196), and unscrew the bushing.

32. Removal of stop.—To remove the stop (A36202), withdraw the screw (A36197) (fig. 8, Sec. B-B), and the spring (A36200).

33. Precaution for assembly.—In assembly, parts must be replaced in their original positions. This applies to both mechanical and optical components. Extreme care must be exercised to achieve this objective if final adjustment is not to be unduly complicated.

34. Assembly of objectives (right or left).—Apply a thin layer of black navy sealing compound to the seat for the objective lens in the objective cell. Be sure not to apply this sealing compound in excess. Assemble the objective lens with curved face of lens down, away from body, against the shoulder of the cell. Secure the objective in place with the retaining ring.

35. Assembly of right eyepiece.—Apply a thin layer of black navy sealing compound to the seat for eyelens in eyelens cell. Assemble the eyelens with the curved surface away from the eye. Insert lens spacer. Assemble field lens to eyelens cell and secure in place with retainer. Assemble diopter scale to focusing nut and secure in place with special headless screw. Apply a thin layer of grease, special, low temperature to the eyepiece sleeve.

36. Assembly of left eyepiece.—Assembly of the left eyepiece is identical with the procedure that is followed for assembly of the right eyepiece, except for the last step. Instead of assembling the diaphragm to the eyepiece sleeve, assemble the reticle subassembly. In assembling the reticle subassembly, the etched side of the reticle is down and against the shoulder. *The reticle must be exceptionally clean.*

37. Assembly of body.—Tap the outer surface of the body with a wooden stick to break loose all foreign particles. Clean the interior of the bodies with compressed air. Clean the exteriors with a small amount of solvent, dry-cleaning, and wipe immediately with a dry cloth. Clean the Porro prisms individually immediately prior to replacing them in their seats. Take up the headless cone-point adjusting screws the same amount that they were backed off, in disassembly. Place a thin film of black navy sealing compound around the inside edge of the flanges on the body covers and replace the body covers on the body. Secure with screws. Apply a thin coating of grease, special, low temperature, to the threads of the objective adapters and screw them into their seats on the body covers.

SECTION VI

CARE AND PRESERVATION

	Paragraph
Care in handling.....	38
Lubrication.....	39
Care of optical parts.....	40

38. Care in handling.—Careless handling and hard knocks seriously affect the field glass. If thrown or dropped on a hard surface, even when cased, the parallelism of the lines of sight may be destroyed by even a slight bending of the frame; rough usage may also scratch or break the lenses, or fracture the dustproof sealing, thus permitting gradual internal fouling and mistiness of vision. Care begins with the case and straps, which should receive the attention due good leather. If a compass is built into the case, clamp it when not in use. The user should determine and memorize not only the interpupillary setting for his eyes, but that setting at which the glass will slip easily into and out of the case. When placing the field glass in its case, roll the strap on the glass proper neatly about the frame. Make an occasional examination to insure that the shoulder-strap keepers on the case are stitched securely.

39. Lubrication.—The field glass may be greased sparingly at long intervals with grease, special, low temperature, furnished by the Ordnance Department for fire-control instruments. The only parts requiring lubricants are the eyepiece threads and the hinge.

40. Care of optical parts.—*a.* To obtain satisfactory vision, it is necessary to keep the exposed surfaces of the lenses and other parts clean and dry. Corrosion and etching of the glass surface can thus be prevented or retarded.

b. Do not wipe lenses with the fingers. When the field glass is in use, wipe the lenses frequently with clean lens tissue paper. No substitute should ever be used for this purpose.

c. Moisture due to condensation may collect on the optical parts when the temperature of the instrument is below that of the surrounding air. This may be removed by placing the instrument in a warm place. Heat from strongly concentrated sources should never be applied directly as it may cause unequal expansion of parts with resulting inaccuracies in observation.

d. For dusting optical parts, use only a clean camel's-hair brush. To remove dust, brush the glass lightly and rap the brush against a hard body to knock out dust particles.

e. To remove oil or grease from optical surfaces, apply ethyl alcohol, sparingly, with a clean camel's-hair brush and rub gently with clean lens paper. If alcohol is not available, breathe on the glass and wipe clean. Repeat this operation several times until clean.

f. Use of polishing liquids or pastes for polishing lens is forbidden.

g. When optical assemblies are removed, wash the exposed surfaces in ethyl alcohol, then wrap the assemblies in clean lens tissue pending reassembly.

APPENDIX
LIST OF REFERENCES

1. **Standard Nomenclature Lists.**

- a. Cleaning, preserving, and lubricating materials... SNL K-1
- b. Fire control instruments.
 - Binocular, M-3..... SNL F-210
 - Glasses, field, type EE, 6 power..... SNL F-34
 - Glass, field, type EE, 6 power.....
 - Glass, field, type EE, 6 power (U. S. naval gun
factory), and..... } SNL F-146
 - Glass, field, Huet type, 8 power.....
 - Sighting and fire control equipment..... SNL F-1
- c. Kit, repair, optical, for field artillery..... SNL F-21
- d. Current Standard Nomenclature Lists are as tab-
ulated here. An up-to-date list of SNL's is
maintained as the "Ordnance Publications for
Supply Index"..... OPSI

2. **Explanatory publications.**

- a. Cleaning, preserving, and lubricating materials.. TM 9-850
- b. Fire control instruments.
 - Field artillery fire control instruments..... TM 6-220
 - Instruction guide, the instrument repairman... TM 9-2602
- c. Inspection and repair.
 - Inspection of leather and leather equipment.... TM 10-226
 - Material inspection and repair..... TM 9-1100
- d. Maintenance.
 - Lubrication instructions, general, fire control
instruments..... OFSB 6-F-1
 - Maintenance of material in hands of using troops.. OFSB 4-1
 - Special instructions, group F material..... OFSB 4-8

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BY ORDER OF THE SECRETARY OF WAR :

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The Adjutant General.

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(For explanation of symbols see FM 21-6.)