TM 9-1527

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORDNANCE MAINTENANCE:

GUNNER'S QUADRANTS M1 and M1918 AND MACHINE GUN CLINOMETER M1917

DEPARTMENT OF THE ARMY • *NOVEMBER 1951*

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This manual supersedes TM 9–1527, 16 August 1943

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This manual supersedes TM 9–1527, 16 August 1943

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the information and guidance of personnel responsible for field and depot maintenance of the gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917. These instructions contain information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations. This manual does not contain information which is intended primarily for the using organization, since such information is available to ordnance maintenance personnel in TM 9–575.

b. This manual contains a description of the procedures for inspection, disassembly, repair and rebuild, and assembly of the gunner's quadrant M1 (fig. 1), gunner's quadrant M1918 (fig. 2), and machine gun clinometer M1917 (fig. 3).

c. The appendix contains a list of current references, including supply catalogs, technical manuals, and other available publications applicable to this matériel.

d. Operation, lubrication, and all maintenance operations allocated to using organizations in performing maintenance work within their scope for the gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917 are contained in TM 9–575.

e. This manual differs from TM 9–1527, dated 16 August 1943, as follows:

(1) Adds information on machine gun clinometer M1917.
(2) Revises information on maintenance procedures for gunner's quadrant M1 and gunner's quadrant M1918.

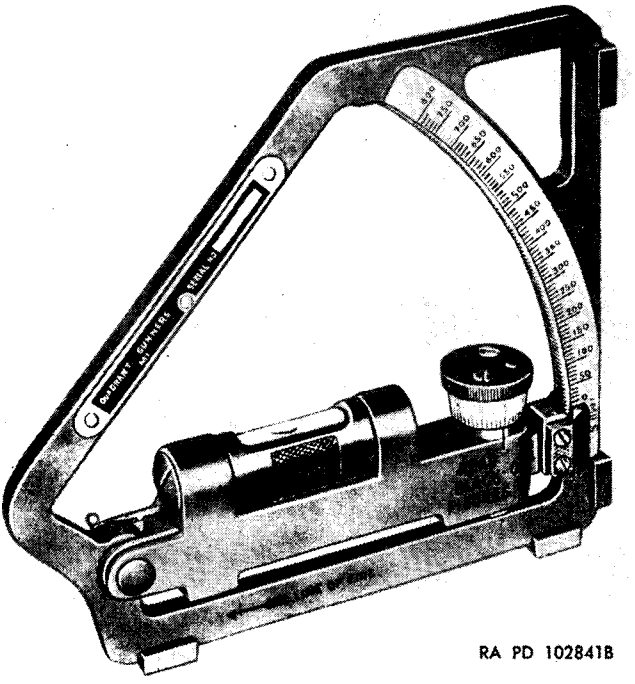

Figure 1. Gunner's quadrant M1.

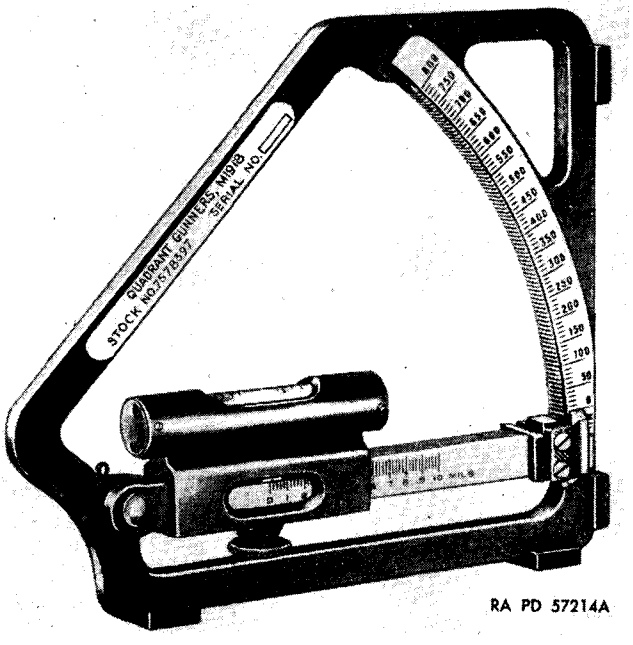

Figure 2. Gunner's quadrant M1918.

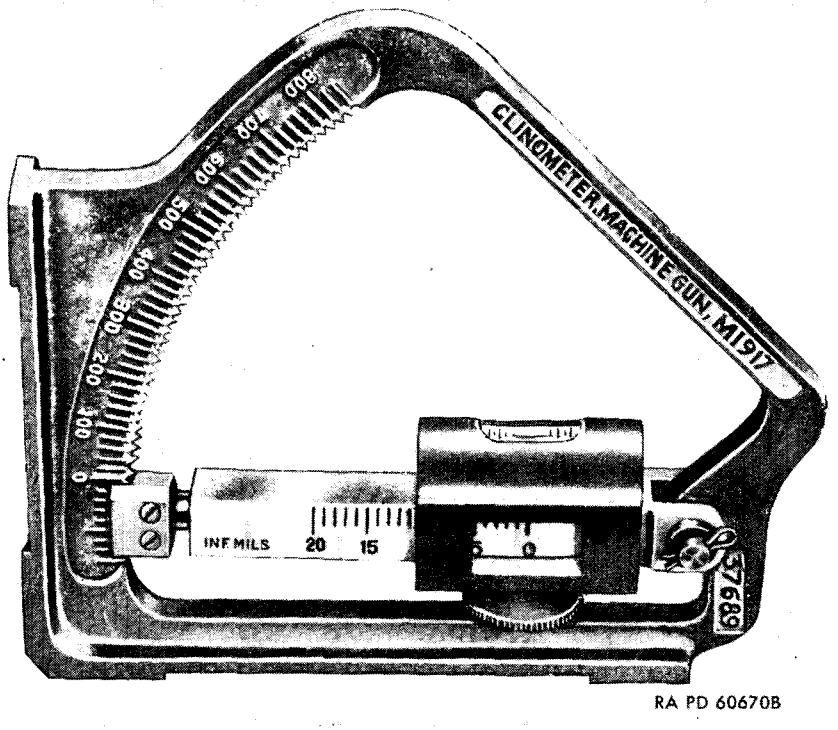

Figure 3. Machine gun clinometer M1917.

2. Field and Depot Maintenance Allocation

The publication of instructions for complete disassembly and rebuild is not to be construed as authority for the performance by field maintenance units of those functions which are restricted to depots and arsenals. In general, the prescribed maintenance responsibilities will apply as reflected in the allocation of maintenance parts and tools listed in the appropriate columns of Department of the Army Supply Catalogs ORD 8 SNL F–140, ORD 8 SNL F–13, ORD 8 SNL F–15, and ORD 6 SNL F–272. Instructions for depot maintenance are to be used by maintenance companies in the field only when the tactical situation makes the repair functions imperative. Provisions of parts listed in the depot stock guide column of ORD 8 SNL F–140, ORD 8 SNL F–13, and ORD 8 SNL F–15 will be made to field maintenance only when the emergency nature of the maintenance to be performed has been certified by a responsible officer of the requisitioning organization.

3. Forms, Records, and Reports

a. GENERAL. Forms, records, and reports are designed to serve necessary and useful purposes. Responsibility for the proper execution of these forms rests upon commanding officers of all units maintaining the gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917. It is emphasized, however, that forms, records, and reports are merely aids. They are not a substitute for thorough practical work, physical inspection, and active supervision.

b. AUTHORIZED FORMS. The forms generally applicable to units maintaining the gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917 are listed in the appendix. No forms other than those approved for the Department of the Army will be used. Pending availability of all forms listed, old forms may be used. For a current and complete listing of all forms, see current SR 310–20–6. For instructions on the use of these forms see FM 9–10. Additional forms applicable to the using personnel are listed in the operator's manual.

c. FIELD REPORTS OF ACCIDENTS. The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in the SR 385–10–40 series of special regulations. These reports are required whenever accidents involving injury to personnel or damage to matériel occur.

d. REPORT OF UNSATISFACTORY EQUIPMENT OR MATERIALS. Suggested improvements in design and maintenance or safety and efficiency of operation prompted by chronic failure or malfunction of the gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917, spare parts, or equipment; or as to defects in the application or effect of prescribed lubricants, and/or preserving materials, should be reported through technical channels as prescribed in SR 700–45–5, to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, using DA AGO Form 468, Unsatisfactory Equipment Report. Include all available pertinent information necessary to initiate corrective action. Such suggestions are encouraged so that other organizations may benefit.

Note. Do not report all failures that occur. Report only REPEATED and RECURRENT failures or malfunctions which indicate unsatisfactory design or material. See also SR 700–45–5 and the printed instructions on DA AGO Form 468.

e. REPORT OF NEGLIGENCE. Report to the responsible officer any persistent carelessness, or negligence in the observance of preventive maintenance procedures and safety precautions. This report should be accompanied by recommendations for correcting the unsatisfactory conditions.

f. INSPECTION OF RECORD FORMS. At each inspection the inspector will examine the organization's record forms to make sure that these records have been kept up-to-date and that all entries have been properly made. (Previous repairs, work performed in connection with technical bulletins, and modification work orders are some records which are usually required.) (See ch. 3.)

Section II. DESCRIPTION AND DATA

4. Description

a. GENERAL. The gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917 are portable precision instruments used for measuring the elevation or depression angles of weapons. The quadrants are used with artillery weapons and the clinometer with machine guns. They are also used for checking the adjustments of elevating mechanisms on sighting and fire control equipment.

b. GUNNER'S QUADRANT M1 (fig. 4).

(1) This quadrant consists of a sector-shaped frame to which is pivoted a radial arm and a level holder. Accurately machined teeth on the inside arc of the frame, engaging

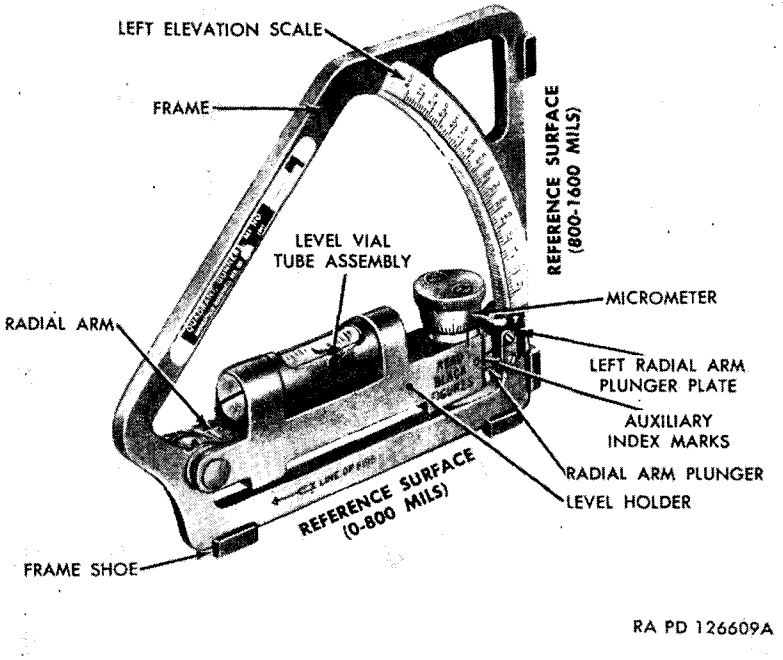

Figure 4. Location of components of gunner's quadrant M1.

with a spring-loaded plunger in the radial arm, permit rapid setting of the arm in 10-mil steps to the desired angle as indicated on the coarse elevation scale. Calibrated coarse elevation scales are provided on each side of the frame. The left scale is used for elevations from 0 to 800 mils, and the right scale is used for elevations from 800 to 1,600 mils. Four steel frame shoes, arranged in pairs, provide two reference surfaces at right angles to each other for seating the instrument when taking readings. A name plate on the left side of the frame, furnishes the serial number, model number, manufacturer's name, and date of manufacture. An arrow, along with the instructions "LINE OF FIRE," is scribed on each side of the frame to indicate the direction the instrument is to be faced when taking readings.

(2) The level holder carries an adjustable level vial tube assembly and a micrometer mounted on the plunger end of the holder. The micrometer has red and black figures scribed on it; the black figures are used when taking readings on the 0- to 800-mil scale, while the red figures are used when taking readings on the 800- to 1,600-mil scale. The micrometer is graduated in 0.2-mil steps and supplements the readings of the coarse scales.

c. GUNNER'S QUADRANT M1918 (fig. 5). The gunner's quadrant M1918 is similar to the gunner's quadrant M1, except for the method of registering the micrometer or fine readings and a few minor details. The M1918 employs a sliding level assembly mounted on a slightly curved radial arm to obtain fine readings. Each side of the radial arm is graduated in 0.2-mil intervals. The level assembly may be clamped in the desired position.

d. MACHINE GUN CLINOMETER M1917 (fig. 6). The machine gun clinometer M1917 is similar to the gunner's quadrant M1918, but is smaller. The teeth of the arc portion of the frame are spaced at 20-mil intervals for a distance of 160 mils below the 0 (normal) position to 840 mils above 0. Elevation scales are cast into each side of the frame. They are numbered from 0 to 800 mils in multiples of 100 mils. Fine readings are obtained by a sliding level assembly mounted on a slightly curved radial arm. Both sides of the radial arm are graduated into 20 equal spaces and numbered every 5 spaces from 0 to 20. Each space represents an angle of 1 mil, when used in conjunction with the coarse elevation scales of the frame.

Note. Only those clinometers having a serial number between 33,459 and 61,050 will be used; all others will be disposed of as excess.

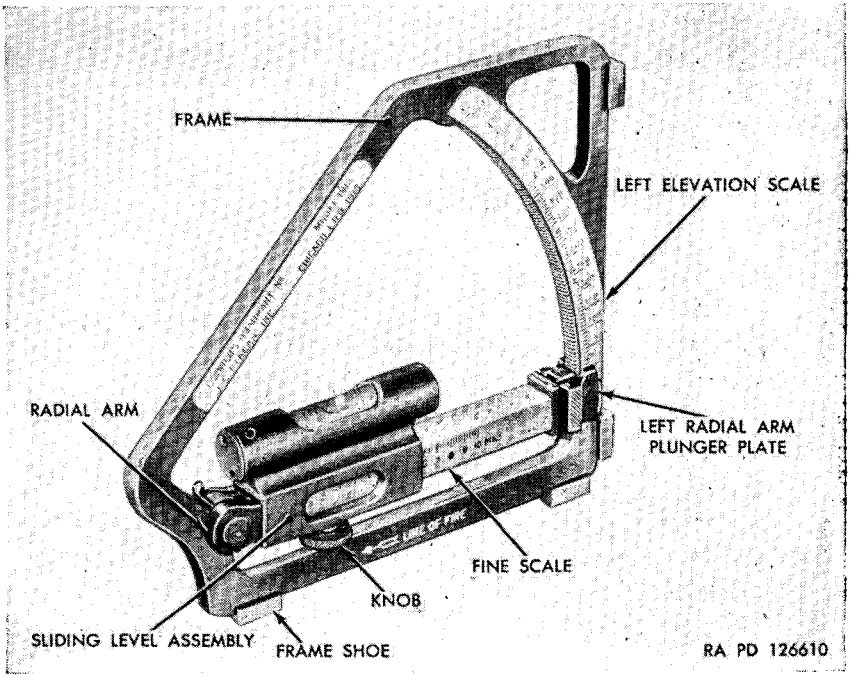

Figure 5. Location of components of gunner's quadrant M1918.

5. Differences Between and in Models

a. The principal difference in these instruments is in the design and operation of their movable radial arms. The gunner's quadrant M1 employs a level holder with a micrometer to obtain fine readings. The gunner's quadrant M1918 and the machine gun clinometer M1917 employ a sliding level assembly mounted on a slightly curved radial arm.

b. Reference surfaces on the machine gun clinometer M1917 are an integral part of the frame, while on the gunner's quadrants M1 and M1918 corresponding surfaces are provided in the form of removable frame shoes.

c. Early manufactured models of the M1 are provided with level vial tube assembly-B271185, while later manufactured models are provided with level tube assembly-7635521. The tube assemblies are interchangeable.

d. Gunner's quadrants M1 and M1918 read directly to 0.2 mil. The machine gun clinometer M1917 reads directly to 1.0 mil.

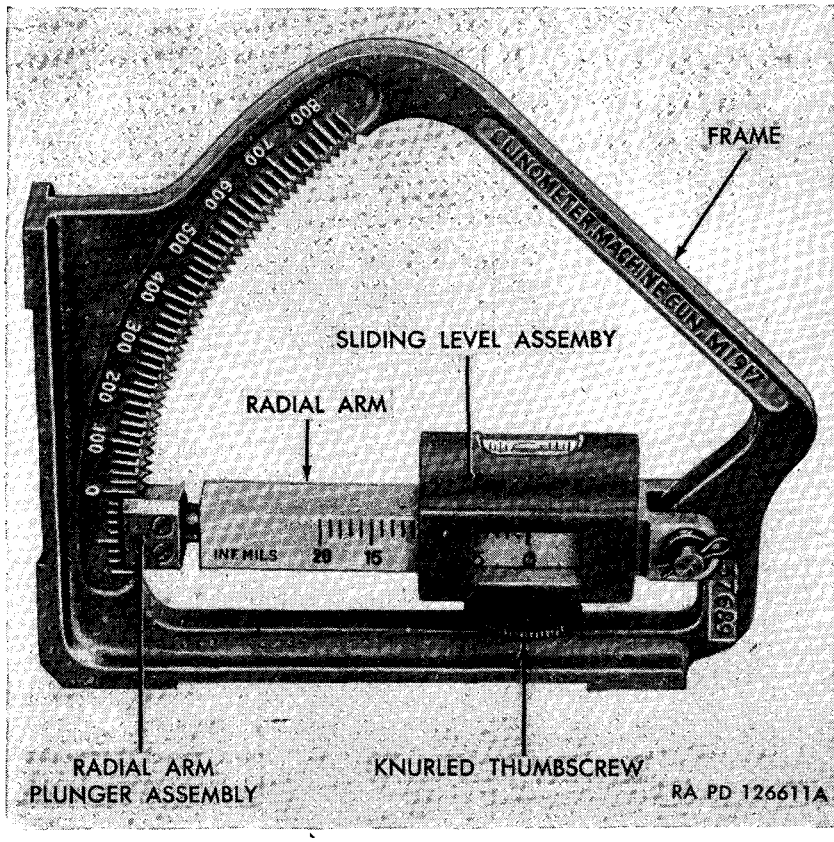

Figure 6. Location of components of machine gun clinometer M1917.

6. Tabulated Data

	Gunner's Quadrant M1	Gunner's Quadrant M1918	Machine Gun Clinometer M1917
Overall Dimensions	$5\frac{27}{32}$ x $6\frac{45}{64}$ in	$5\frac{27}{32}$ x $6\frac{45}{64}$ in	$4\frac{5}{16}$ x $4\frac{13}{16}$ in
Weight	1 lb 15 oz	1 lb 10 oz	7 oz
Limits of Operation	0 to 800— 800 to 1600 mils	0 to 800— 800 to 1600 mils	—160 to +840— —160 to +840 mils

CHAPTER 2

PARTS, SPECIAL TOOLS, AND EQUIPMENT FOR FIELD AND DEPOT MAINTENANCE

7. General

Tools and equipment and maintenance parts over and above those available to the using organization are supplied to ordnance field maintenance units and depots for maintaining, repairing, and rebuilding the matériel.

8. Parts

Maintenance parts are listed in the following Department of the Army Supply Catalogs which are the authority for requisitioning replacements. Parts not listed in an ORD 8 catalog, but required by depot shops in rebuild operations, may be requisitioned from the listing in the corresponding ORD 9 catalog and will be supplied if available. Refer also to paragraph 2.

ORD 8 SNL F–140 (for Gunner's Quadrant M1)
ORD 8 SNL F–13 (for Gunner's Quadrant M1918)
ORD 8 SNL F–15 (for Machine Gun Clinometer M1917)

9. Common Tools and Equipment

Standard and commonly used tools and equipment having general application are authorized for issue by T/A and T/O&E. They are not specifically identified in this manual.

10. Special Tools and Equipment

The special tools in table I are listed in Department of the Army Supply Catalog ORD 6 SNL F–272. This table contains only those special tools necessary to perform the operations described in this manual, is included for information only, and is not to be used as a basis for requisitions.

Note. Special tool sets in ORD 6 SNL F–272, in addition to special tools, also contain standard and commonly used tools and equipment specifically applicable to this matériel.

Table I. Special Tools and Equipment for Field and Depot Maintenance.

Item	Federal Stock No.	References		Use
		Fig.	Par.	
LEVEL, machs, bench, adj, iron, ground and grad vial, with cross level size 8 in.	41–L–1176–75	7	18	To level surface plate 41–P–1566.
PLATE, surface, C1, w/ handle and cover, size 12 x 18 in (holes drilled in top).	41–P–1566	7	18	For checking level vials and frame bearing surfaces (used with universal 90 degree angle plate).

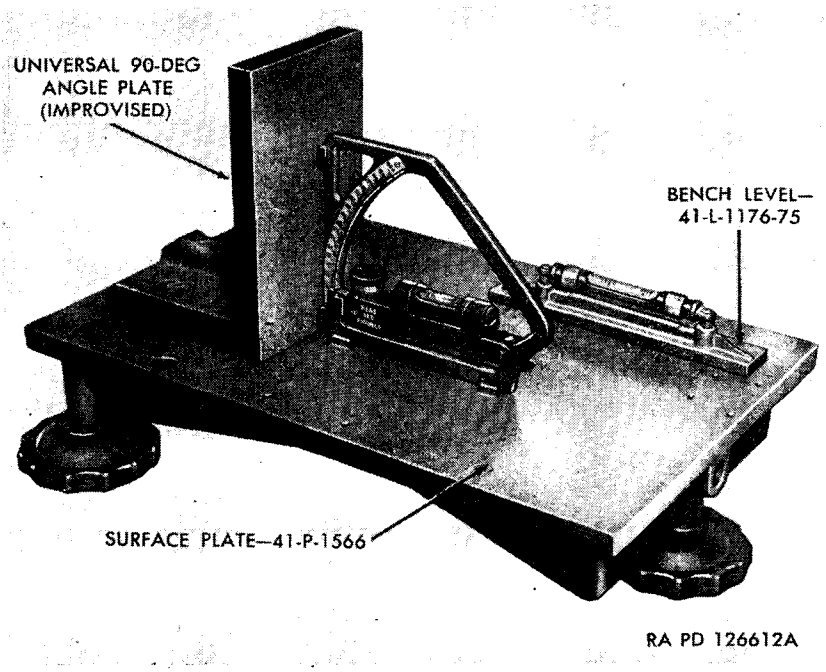

Figure 7. Checking shoes of gunner's quadrant M1 for 90° angle.

11. Improvised Tools

The improvised tool listed in table II applies only to field and depot shops in order to enable these maintenance organizations to fabricate this tool locally in accordance with the detailed drawing (fig. 8), if desired. This tool is of chief value to maintenance organizations engaged in rebuilding a large number of identical

components. This tool is not essential for rebuild and is not available for issue; the following data are furnished for information only.

Table II. Improvised Tools for Field and Depot Maintenance

Item	References		Use
	Fig.	Par.	
PLATE, universal 90 degree angle.	8	18	For checking level vials and frame bearing surfaces (used with surface plate 41–P–1566).

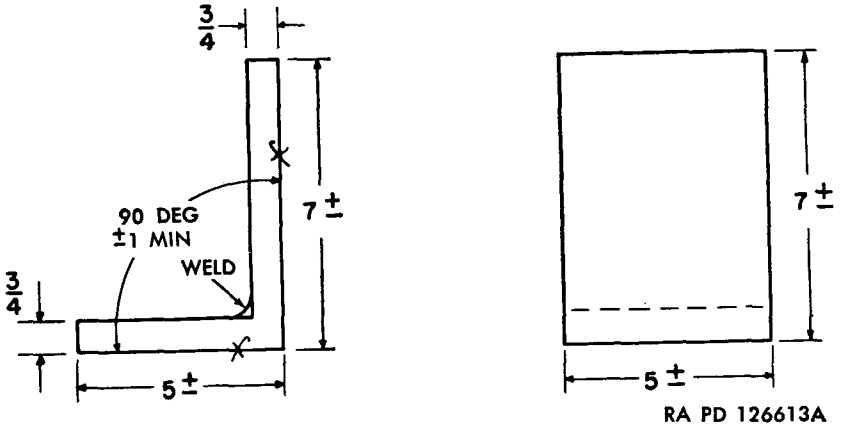

Figure 8. Dimensional detail drawing of universal 90° angle plate.

CHAPTER 3
INSPECTION

Section I. GENERAL

12. Scope

This chapter provides specific instructions for the technical inspection by ordnance maintenance personnel of gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917 either in the hands of troops or for oversea shipment and when received for repair in ordnance shops. This chapter also defines the in-process inspection of matériel during repair and rebuild and the final inspection after repair and rebuild has been completed.

13. Purpose of Inspection

Inspection is primarily for the purpose of (1) determining the condition of an item, i.e., serviceable or unserviceable, (2) determining the presence of incipient failure, (3) assuring proper application of maintenance policies at prescribed levels, and (4) determining the ability of a unit to accomplish its maintenance and supply missions.

14. Categories of Technical Inspection

In general, there are five categories of inspection performed by ordnance maintenance personnel; namely, technical inspection, pre-embarkation inspection, in-process inspection, final inspection, and spot check inspection.

a. TECHNICAL INSPECTION. This is an overall inspection performed periodically on all matériel in the hands of troops. It is also performed on matériel received for repair in field or depot maintenance shops. Upon completion of an inspection for serviceability, matériel will be declared either serviceable or unserviceable. Technical inspection may be limited in scope, such as an inspection of matériel in the hands of troops or detailed in scope, such as an ordnance shop inspection. Detailed procedures are presented in section II of this chapter.

b. PRE–EMBARKATION INSPECTION. This inspection is performed on matériel in the hands of troops alerted for oversea duty

to insure that such matériel will not become unserviceable or worn out in a relatively short time. It prescribes a higher percentage or remaining usable life in serviceable matériel to meet a specific need beyond minimum serviceability.

c. IN-PROCESS INSPECTION. This inspection is performed by the repair technician and/or floor inspector in the process of repairing or rebuilding the matériel. It insures that all parts conform to prescribed standards, that the workmanship is in accordance with approved methods and procedures, and that deficiencies not disclosed by the technical inspection are found and corrected. Detailed instructions for in-process inspection are contained in chapter 4.

d. FINAL INSPECTION. This is an acceptance inspection performed by a final inspector, after repair or rebuild has been completed and prior to reissue or storage, to insure that the matériel is acceptable according to established standards. Detailed instructions for final inspection are contained in chapter 5.

e. SPOT CHECK INSPECTION. This is a periodic overall inspection performed on only a percentage of the matériel in each unit to determine the adequacy and effectiveness of organizational and field maintenance.

15. Classification of Matériel

All ordnance matériel after inspection is classified as follows:

a. SERVICEABLE. Serviceable property consists of all new or used supplies which are in condition for issue for the purpose intended and all supplies which can be placed in such condition through pre-issue tests or inspections, in storage deprocessing, installation of accessories, correction of minor deficiencies which have developed since the item was last classified as serviceable, application of modification work orders for which parts are available, or assembly of available components.

b. UNSERVICEABLE. Unserviceable property consists of all supplies which are not serviceable (*a* above). The definition of unserviceable property is further broken down into the following subclassifications: property which is unserviceable but economically repairable and property which is unserviceable and not economically repairable.

Section II. TECHNICAL INSPECTION

16. General

This section provides specific instructions for the technical inspection by ordnance maintenance personnel of the gunner's

quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917 in the hands of troops, inspection prior to disassembly when received in field or depot maintenance shops for repair, or when in the hands of troops alerted for oversea duty. Also this section amplifies the general instructions contained in TM 9–1100 insofar as the instructions pertain to inspection of the instruments.

17. Inspection of Matériel in the Hands of Troops

The inspection procedures and standards for the instruments are listed below. In general, if the instruments are complete and perform their intended function properly, if all modification work orders classified as urgent have been completed, and if all defects as disclosed by the inspection have been corrected, they may be considered serviceable.

a. GENERAL.

(1) Check major items and major item combinations for inclusion of required components and equipment in accordance with the pertinent ORD 7 Supply Catalog.

(2) Check for any modifications that may be required. A list of current modification work orders is contained in SR 310–20–4.

(3) Record the serial number of each unit and other pertinent information as prescribed by inspection forms in TM 9–1100.

(4) See that the matériel has been cleaned of all corrosion-preventive compound, grease, excessive oil, dirt, or foreign matter, which might interfere with proper functioning or obscure the true condition of parts.

(5) Check for completeness and general appearance. The painted surfaces must not have bare spots, scratches deep enough to expose bare metal, or chipped or loose paint. There must be no signs of corrosion.

(6) The graduations, numbers, letters, and index marks must be clear and distinct.

(7) The level vials must not be cracked, broken, or loose in the holder.

(8) All moving parts must function smoothly without undue irregularities, looseness, or friction.

(9) The compression spring of the plungers must have sufficient tension to insure the plunger teeth retaining good contact with the teeth of the frame.

b. GUNNER'S QUADRANT M1.

(1) The frame shoes and segment teeth must be free from nicks or burs.

(2) The level vial cover must turn freely and snap into the detent in the open and closed position.

(3) The carrying case M18 must be free from mold, breaks, tears, loose stitching, rust, and defective or corroded catches or buckles.

(4) The carrying case M56 and packing chest must be in serviceable condition. Inspect for warped wood, defective hinges or catches, and defective exterior finish. Inspect the carrying strap on the M56 for loose stitches, mold, or tears and check the buckles for corrosion.

c. GUNNER'S QUADRANT M1918.

(1) The frame shoes and segment teeth as well as the curved top surface of the radial arm must be free from nicks or burs.

(2) There must be no shake in the radial arm pivot or the plunger.

(3) For inspection of carrying case M18 or M56 and packing chest, refer to *b* (3) and (4) above.

d. MACHINE GUN CLINOMETER M1917.

(1) The two seating surfaces of the frame must be flat and free of nicks and burs.

(2) There must be no nicks, burs, or dents on the toothed portion of the frame, curved top surface of the radial arm, or the graduated surfaces of the frame.

(3) There must be no shake in the radial arm pivot or the plunger.

(4) The leather carrying case D29063 must be in serviceable condition. There must be no loose or rotted stitching. The catch buttons must be securely fastened to the case. There must be no signs of mold inside or outside of case.

18. Accuracy Test

a. GUNNER'S QUADRANT M1.

(1) Set the plunger plate against the zero graduation on the elevation scale. Reading the black figures on the micrometer, turn the knob until the micrometer black zero graduation line is against its index, and the auxiliary index marks of the radial arm and the level holder are matched. Place the instrument on a leveled surface plate (fig. 7) so that it rests on the two frame shoes forming

the 0- to 800-mils reference surface. The bubble in the level vial must indicate a level reading within ± 0.4-mil movement (graduations) of the micrometer.

(2) Set the plunger plate against the 1,600 graduation on the elevation scale. Reading the red figures on the micrometer, turn the knob until the micrometer red zero graduation line is against its index, and the red auxiliary index marks of the radial arm and the level holder are matched. Hold the instrument with the two frame shoes that support it on the 800- to 1,600-mils reference surface against a vertical surface of a universal 90° angle plate (fig. 8). The bubble in the level vial must indicate a level position within ± 0.4-mil movement (graduations) of the micrometer.

(3) In any 6 random settings on the 0- to 1,600-mils range, the error must not exceed 0.4 mil (1 minute, 21 seconds).

b. GUNNER'S QUADRANT M1918.

(1) Set the plunger plate against zero on the elevation scale. Slide the level sliding assembly to zero on the 0- to 800-mils scale side of the arm. Place the instrument on a leveled surface plate (fig. 7) so that it rests on the two shoes forming the 0- to 800-mils reference surface. The bubble in the level vial must be centered within ± 0.4-mil movement (graduations) of the level sliding assembly.

(2) Set the plunger plate against the 1,600 graduation on the elevation scale. Slide the level sliding assembly to zero on the 800- to 1,600-mils scale side of the arm. Hold the instrument, with the two shoes that support it on the 800- to 1,600-mils reference surface against a vertical surface of a universal 90° angle plate (fig. 8). The bubble in the level vial must be centered within ± 0.4-mil movement (graduations) of the sliding assembly.

(3) In any 6 random settings on the 0- to 1,600-mils range, the error must not exceed 0.4 mil (1 minute, 21 seconds).

c. MACHINE GUN CLINOMETER M1917.

(1) Set the plunger to 0 mil on the frame scale and set the index on the sliding level assembly to 0 mil on the radial arm scale. Place the instrument on a leveled surface plate (fig. 7) so that it rests on the two reference surfaces. The bubble in the level vial must be centered within ± 1.0-mil movement (graduation) of the sliding level assembly.

(2) Without disturbing the clinometer settings, turn the

instrument 180° and again place it on the surface plate as before. In this new position also, the bubble in the level vial must be centered within ± 1.0-mil movement of the sliding level assembly.

(3) Without disturbing the settings, read the opposite side of the clinometer scale. Be sure the plunger is set at 0 mil on the frame scale and that the index on the sliding level assembly is at 0 mil on the radial arm scale. Hold the instrument against a vertical surface of a universal 90° angle plate (fig. 8). The bubble in the level vial must be centered within ± 1.0-mil movement (graduation) of the sliding level assembly.

(4) In any 8 random settings on the — 160- to + 800-mils range in combination with 4 different settings of the level holder between 0 and 20 mils, the error must not exceed ± 1.0 mil.

19. Ordnance Shop Inspection

a. GENERAL. Technical inspection performed by the ordnance repair shop upon receipt of matériel turned in for repair, determines the extent of repairs required and provides the basis for requisitioning the parts, assemblies, or supplies necessary to accomplish the repairs. Often this inspection in the shop may be the same as that performed by inspectors in the field. It may disclose additional necessary repairs not indicated by the using organization. If the units fail to meet the requirements of this inspection, service them in accordance with the applicable rebuild sections of chapter 4.

b. GUNNER'S QUADRANT M1.

(1) Make all the checks in paragraph 17*a*.

(2) Make all the checks in paragraph 17*b*.

(3) Painting and other finishes must present the appearance of a new instrument.

(4) Each shoe must show at least 75-percent contact over its bearing surface when tested on a leveled surface plate (fig. 7), using a thin film of Prussian blue (par. 24*d* (2)). The screws holding the four shoes in position must be tight and there must be no shims under the shoes.

(5) The bearing surfaces of the two sets of shoes must be perpendicular to each other within 1 minute of arc (0.0015 inch). If the instrument itself leans to either side of the vertical one-sixty-fourths of an inch or more, corrections must be made (par. 24*d* (2)).

(6) Place the instrument on a leveled surface plate (fig. 7), and see that it meets all the requirements of paragraph 18*a*.

(7) The micrometer stops must allow one complete turn of the micrometer from "0" setting, plus a maximum of three-quarters of a mil overrun past the zero graduation, in each direction.

(8) In any setting of the instrument the error must not exceed 0.4 mil (1 minute, 21 seconds).

c. GUNNER'S QUADRANT M1918.

(1) Make all checks in paragraph 17*a*.

(2) Make all checks in paragraph 17*c*.

(3) Painting and other finishes must present the appearance of a new instrument.

(4) Follow instructions in *b*(4) and (5) above.

(5) Place the instrument on a leveled surface plate (fig. 7), and see that it meets all the requirements of paragraph 18*b*.

(6) In any setting of the instrument the error must not exceed 0.4 mil (1 minute, 21 seconds).

d. MACHINE GUN CLINOMETER M1917.

(1) Make all checks in paragraph 17*a*.

(2) Make all checks in paragraph 17*d*.

(3) The instrument must be finished to present the appearance of a new instrument.

(4) Each of the clinometer frame bearing surfaces must show at least 75 percent contact when tested on a leveled surface plate (fig. 7), using a thin film of Prussian blue, and must be perpendicular to each other within a tolerance of 0.2 mil. Check perpendicularity by placing one pair of bearing surfaces on a leveled surface plate and the vertical pair of bearing surfaces against a vertical side of a universal 90° angle plate (fig. 8).

(5) With the clinometer placed on a leveled surface and with the radial arm and level holder set to zero, the level bubble must indicate true level.

20. Pre-Embarkation Inspection

a. For explanation of purpose of pre-embarkation inspection, refer to paragraph 14*b*. The outward appearance of the gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917 is of importance as well as mechanical condition.

b. Where any doubt exists as to the utility of an assembly or of the instruments as such, that assembly or the instruments must be replaced by a truly serviceable item. Equipment, when inspected, must approach new equipment standards of operation and appearance, and the workmanship and quality of the end product must reflect the highest standards obtainable. In this connection, make certain that paint covers all specified surfaces efficiently.

c. The specifications, standards, and operations intended as a guide to insure satisfactory performance and acceptability of the instruments in question are given in paragraphs 17, 18, and 19.

CHAPTER 4
REPAIR AND REBUILD

Section I. GENERAL MAINTENANCE

21. General

a. Information and instructions contained herein are supplementary to instructions for the using organization contained in TM 9–575.

b. This chapter contains general and specific maintenance instructions for the repair and rebuild of the gunner's quadrant M1, gunner's quadrant M1918, and machine gun clinometer M1917. In the following sections, specific adjustments, repairs, and rebuild procedures are described. Each part is restored to a serviceable condition by disassembling, inspecting, repairing, or replacing, followed by assembly and final inspection.

c. Only experienced ordnance personnel are permitted to disassemble the instruments. The disassembly is to be made only when necessary to replace faulty parts or make adjustments. The instruments should be disassembled only so far as is absolutely necessary to replace the faulty parts.

22. General Methods

a. RESPONSIBILITY. The shop foreman is responsible for the methods and procedures employed in the rebuild of the instruments. In particular, he should exercise constant care to see that the in-process inspection during repair and rebuild is properly performed, since final acceptance of the assembled matériel depends largely on the care exercised in process.

b. REBUILD STANDARDS. The instruments are not considered acceptable unless standards set forth herein are met. Compliance with these standards is mandatory for all installations performing rebuild of these instruments. The rebuilt item may differ from a similar new item only in dimensional tolerances of its component parts. Any differences in tolerance must not be such as to prevent the rebuilt item from meeting operating requirements of new items.

c. USE OF PROPER TOOLS. Use of proper tools is essential to avoid damage to parts and injury to hands. Use only tools that fit the part being contacted.

d. HANDLING OF DISASSEMBLED PARTS. A parts tray or suitable receptacle should be provided so that parts, as removed, can be kept together and protected against loss or damage.

e. REMOVAL OF BURS.

(1) Movable components of the instruments must operate smoothly and precisely; therefore sector and plunger teeth and bearing surfaces must be free from burs. Small burs can be removed with a knife-edge oil stone. A jeweler's file can be used if the bur is large enough to warrant its use. Reduce the bur until it is practicable to finish the operation by honing. After the process has been satisfactorily completed, clean the part thoroughly, taking care to remove all particles of metal and abrasive, lubricate, and install the component in the assembly.

(2) Remove burs from the seating surfaces with a fine mill file and polish with crocus cloth.

f. CLEANING. Thoroughly clean all parts of the instruments with a dry, clean, lintless cloth. Before proceeding with assembly after rebuild, thoroughly wash all parts with volatile mineral spirits or dry-cleaning solvent. Immerse the part to be cleaned in the solvent and clean with a stiff-bristled brush of suitable size. Remove the part from the solvent, dry thoroughly with a lintless cloth, and install as soon as practicable. Parts that have been cleaned should not be left unprotected and exposed to oxidation or accumulation of dust and dirt.

Caution: The mineral spirits and solvent are flammable and must not be used near an open flame. Continual contact with these materials without the protection of gloves will dry the skin and may cause irritation. These materials are highly destructive to natural rubber hose, tires, electrical insulation, etc., and should, therefore, be prevented from falling on such rubber parts in the vicinity of the working area (the quadrants and clinometer do not have any rubber parts).

g. FINISHING. All painted or treated surfaces must be refinished to match the appearance of new parts. Since the instruments are not subject to hard usage and wear, the painting operation will consist mostly of touching up small scratches due to handling and unavoidable blemishes caused by repair adjustment operations. Rust-inhibiting olive drab enamel should be used in painting. Care should be taken to prevent the paint from splashing on scales, vial, bearing surfaces, shoes, teeth on either frame

or plunger, or anywhere else causing hindrance to the proper operation of the instruments. All external screws and pins should be painted over to prevent the using arms from moving them, thus causing instruments to get out of adjustment. Surfaces not to be painted will be lubricated as described in *i* below.

h. GRADUATIONS. All graduations, lettering, and indexes must be clear and distinct. The engraving must be filled with graduation filler to match the original color as specified in paragraph 24*d*(1).

i. LUBRICATION. Before handling, all bare metal surfaces must be immediately coated with a thin film of aircraft and instruments lubricating grease; knobs and pivots, not readily lubricated with grease, should be oiled with aircraft instrument lubricating oil, in order to avoid rusting. Wipe off all excess lubricant with a dry, clean, wiping cloth to prevent accumulation of dust and grit. Refer to TB 9–2835–1. Keep the leather of the carrying case in good condition and pliable by an application of saddle soap 51–S–1775 and neat's-foot oil in accordance with the instructions in TM 9–850.

Section II. REPAIR AND REBUILD OF GUNNER'S QUADRANT M1

23. Disassembly of Gunner's Quadrant M1

a. REMOVE LEVEL HOLDER AND RADIAL ARM (fig. 9).

(1) Remove the split cotter pin from the pivot and remove the plain brass washer.

(2) Drive the pivot from the radial arm, level holder, and frame.

(3) Set the plunger plate at zero. Disengage the plunger from the notches on the frame; then raise the pivot hole end of level holder and arm out of position, and remove the level holder and arm as a unit.

Note. As the plunger is loose in the end of the arm, care must be taken to prevent it from accidentally falling out.

b. REMOVE NAME PLATE (fig. 9). Only if necessary for replacement, take out the three rivets and remove the name plate from the frame assembly.

c. REMOVE PLUNGER FROM RADIAL ARM (fig. 10). Slide out plunger and compression spring from radial arm.

d. REMOVE RADIAL ARM FROM LEVEL HOLDER (fig. 10).

(1) Push arm through level holder from micrometer end and lift out.

(2) Lift out the radial arm compression spring.

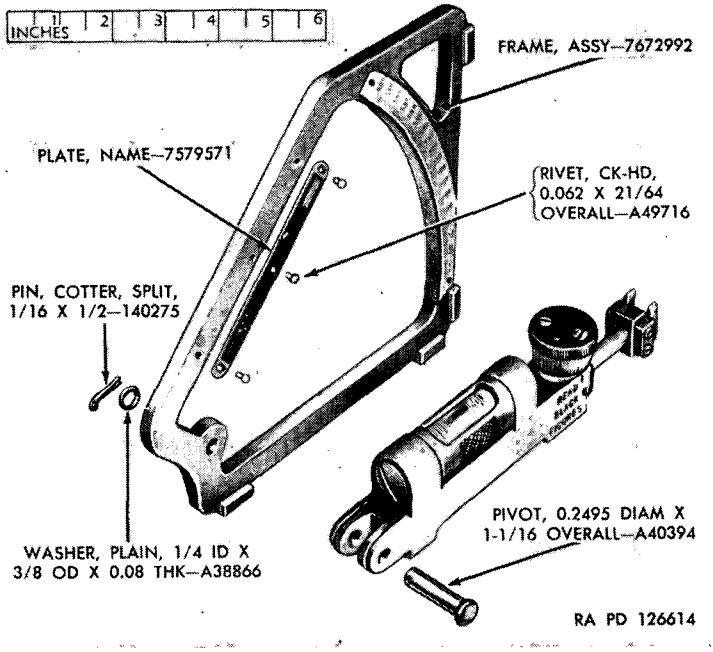

Figure 9. Level holder, radial arm, and name plate removed from frame assembly, gunner's quadrant M1.

(3) Remove anvil from arm.

Note. The anvil is staked and should be removed only if necessary for replacement.

e. REMOVE LEVEL VIAL (fig. 11).

(1) Locate and drive out the pin that secures the slotted plug in the level holder.

Note. Pin at opposite end of level holder must not be disturbed, unless it is loose and then it must be replaced.

(2) Unscrew the slotted plug from level holder.

(3) Remove the four headless cone-point adjusting screws from the end of the level vial tube (refer also to fig. 20), and pry out level vial tube through level vial cover.

(4) Lift off the cover.

(5) Do not remove level vial from the tube unless it is damaged or insecurely held in position in its holder. Clean away all broken glass and plaster of paris or gypsum.

Note. Extreme care must be exercised in removing an undamaged vial. The plaster of paris must be dug out very slowly and carefully. Avoid breaking the level vial tip off. Never cross the center of the gypsum; always dig around the edge nearest the tube. Use shim stock to dig out the remaining gypsum between the level vial

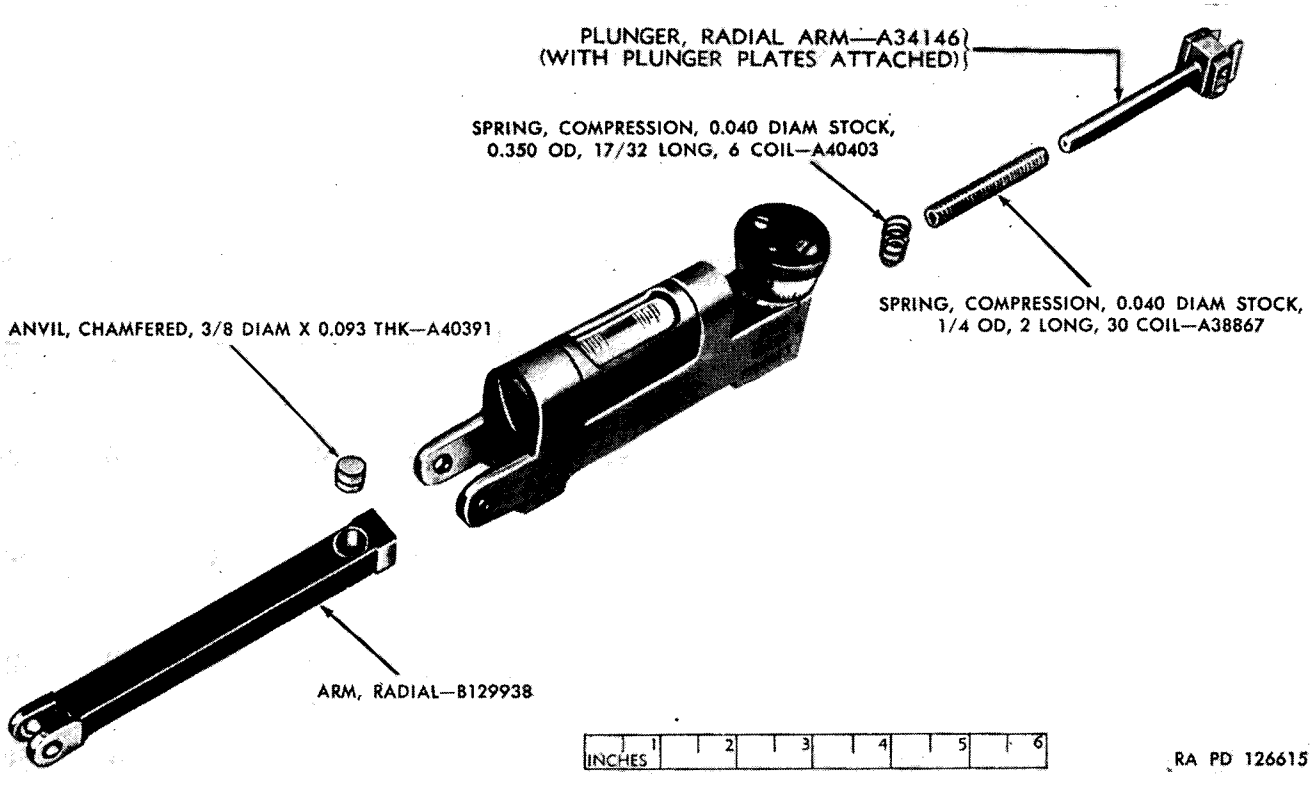

Figure 10. Radial arm and plunger removed from level holder.

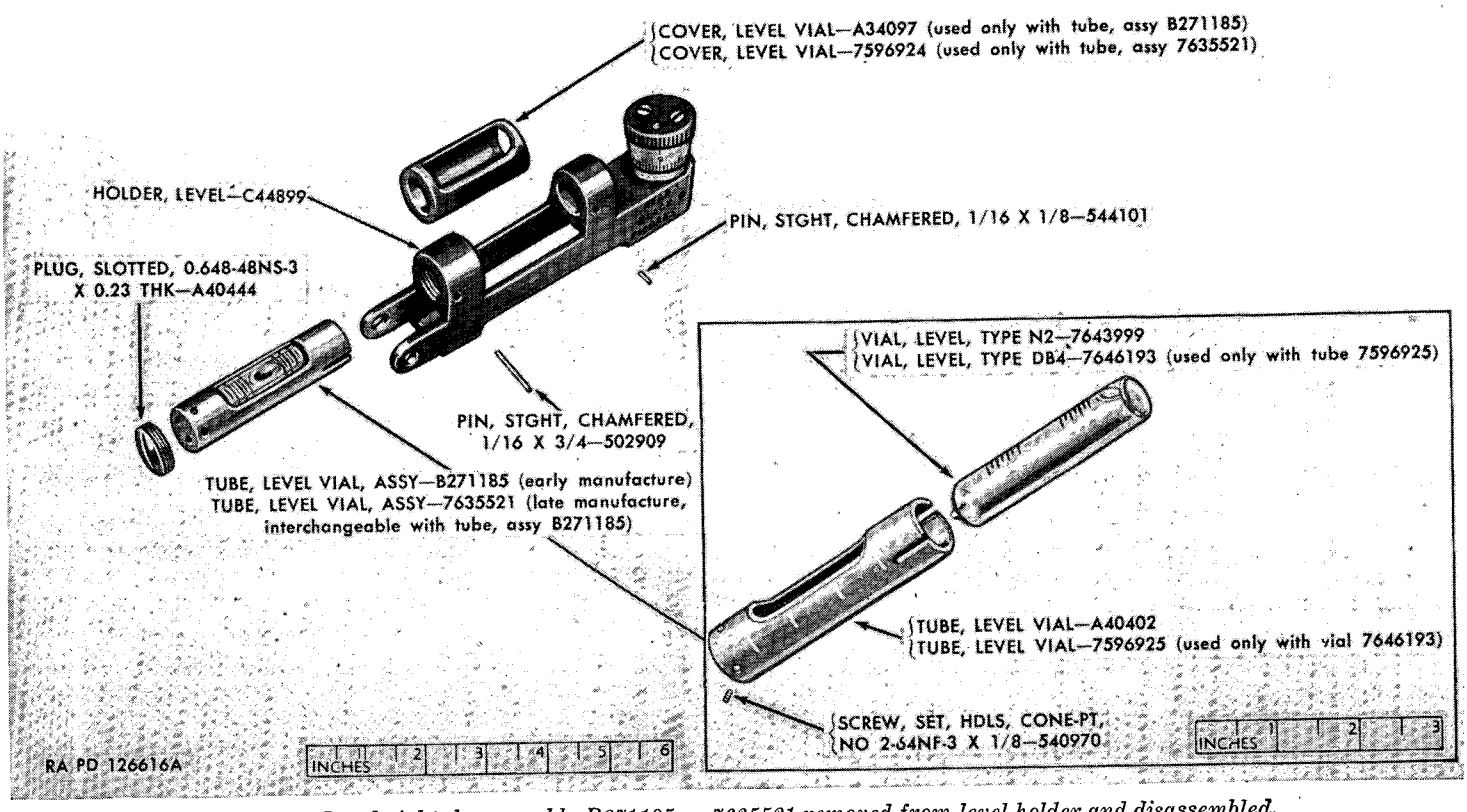

Figure 11. Level vial tube assembly B271185 or 7635521 removed from level holder and disassembled.

and the tube. After all of the gypsum has been removed, push the level vial out of the tube.

f. REMOVE MICROMETER (fig. 12).

(1) Unscrew the two oval-head screws from the micrometer knob, and lift off knob assembly and the micrometer.

Note. Only if necessary for replacement, remove the locating pin from the micrometer knob.

(2) Unscrew the micrometer screw.

(3) Gently pry off the split retaining ring from the top of the micrometer screw nut (fig. 13), and lift off micrometer stop ring.

(4) Drive out the straight pin from the micrometer screw nut and level holder.

(5) Unscrew micrometer screw nut from level holder.

g. REMOVE RADIAL ARM PLUNGER PLATES (fig. 14). Remove the four fillister-head screws holding the two radial arm plunger plates to the plunger, and remove the plates.

h. DISASSEMBLE FRAME ASSEMBLY (fig. 15).

(1) Remove the fillister-head screws securing the frame shoes to the frame, and tap off shoes with a brass hammer. Place identification marks on shoes to insure their installation in original positions.

(2) Only if necessary for replacement, drive out four straight pins and remove the two scales.

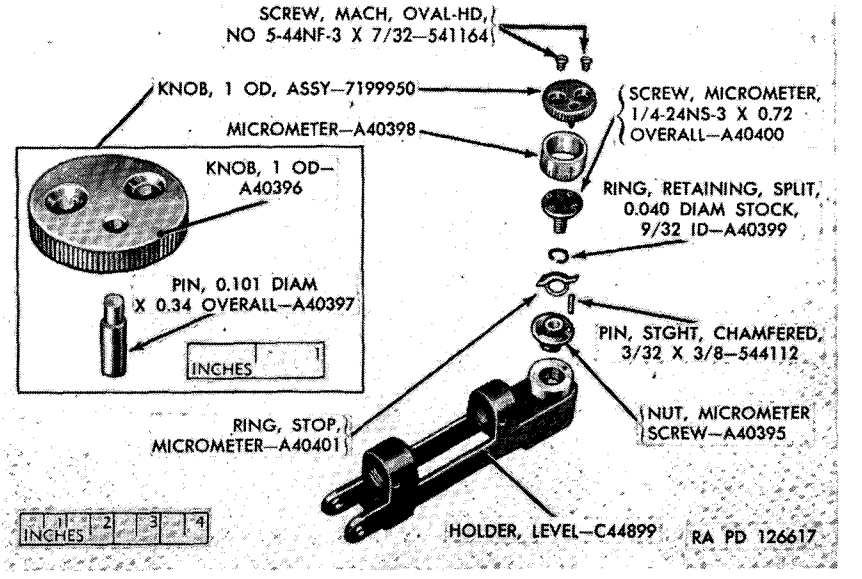

Figure 12. Micrometer removed from level holder.

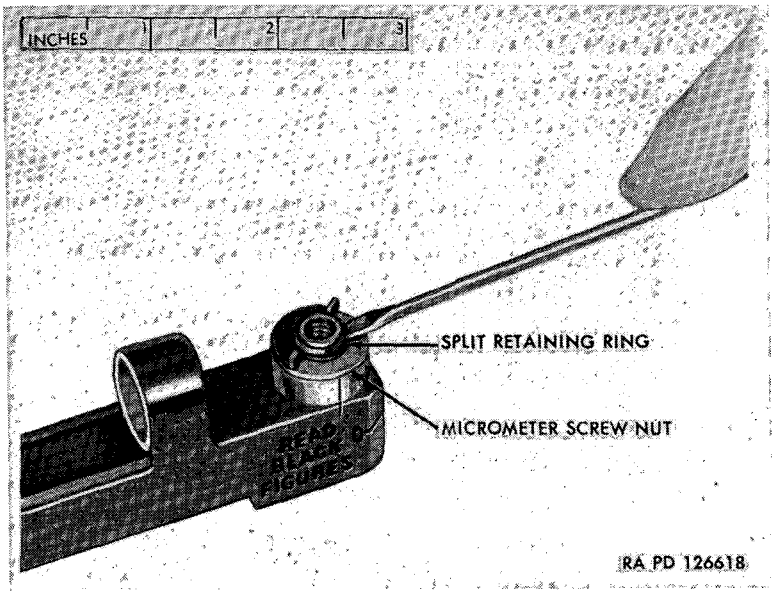

Figure 13. Prying off split retaining ring from top of micrometer screw nut.

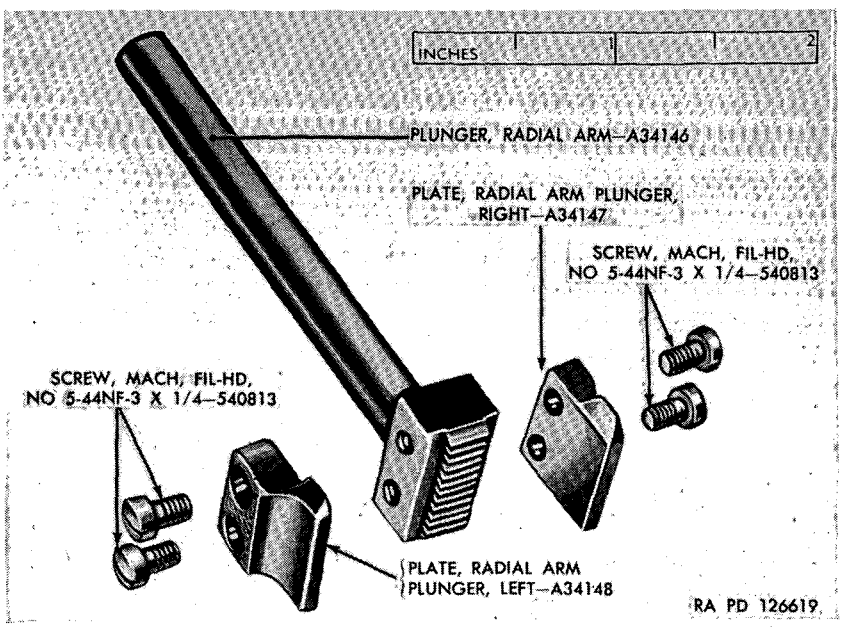

Figure 14. Radial arm plunger plates removed from plunger.

i. DISASSEMBLE CARRYING CASE M18 (fig. 16). Only if necessary for replacement, remove the catch by bending the small retaining prongs; remove rivets in the shoulder strap; also remove buckle from strap by cutting the stitching.

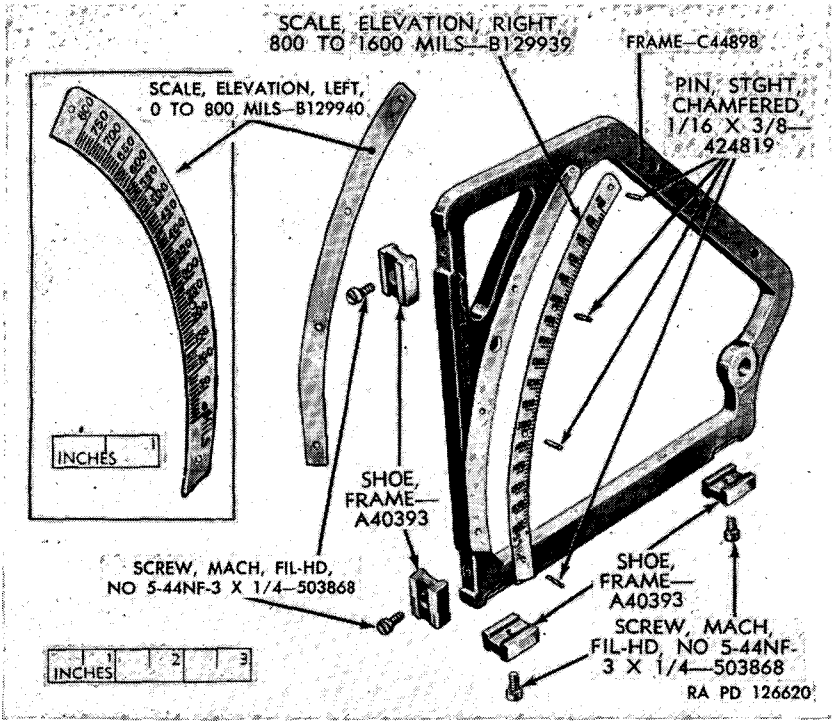

Figure 15. Frame assembly 7672992—exploded view.

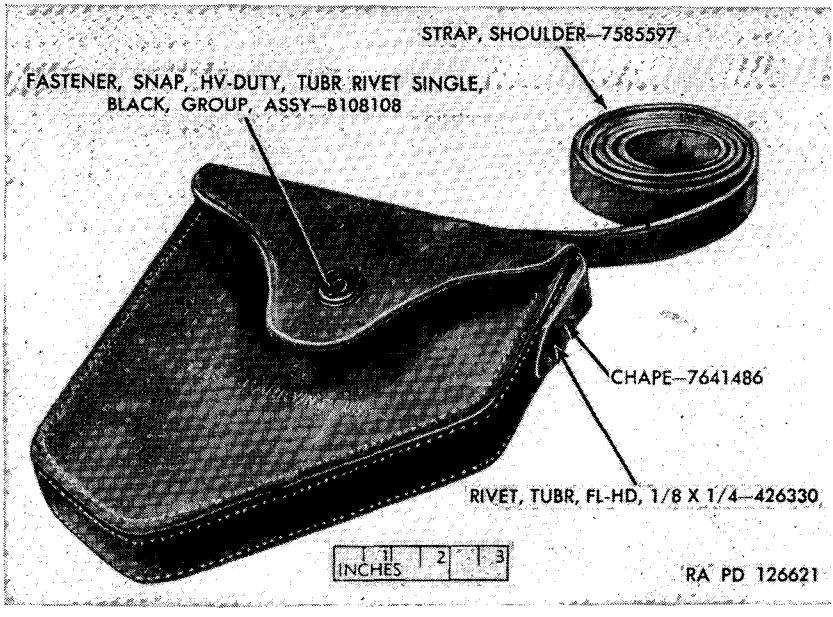

Figure 16. Carrying case M18.

j. DISASSEMBLE PACKING CHEST (fig. 17). Disassemble this chest only if the following conditions exist and only to the extent necessary to make repairs: chest does not close completely; the wood is warped; the hooks are bent and do not fit snugly in the eyes; the hinges do not allow the chest to open and close freely and are not screwed securely to it; or the internal blocks are not properly glued and nailed in place. The chest is easily disassembled with a screwdriver, pliers, and hammer.

k. DISASSEMBLE CARRYING CASE M56 (fig. 18). Disassemble this case only if the following conditions occur and only to the extent

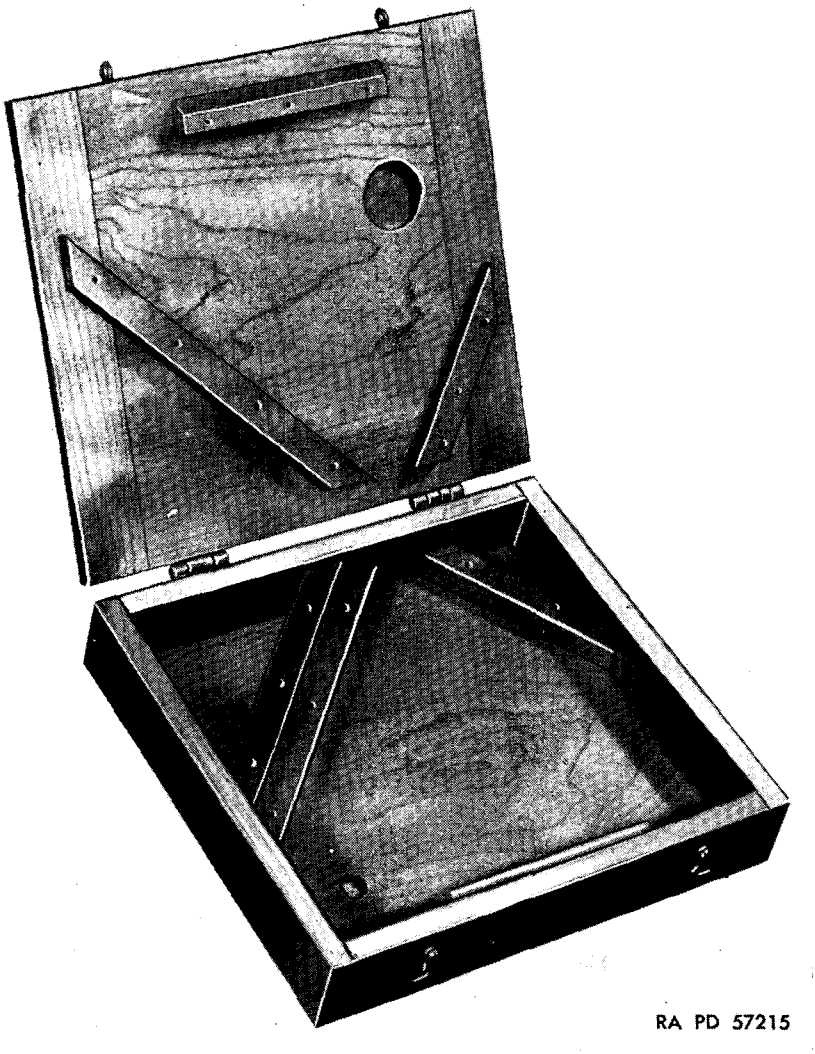

Figure 17. Gunner's quadrant packing chest 76-7-379.

necessary to make repairs: case does not close completely; the wood is warped; the catches and hinges do not work freely and are not secured firmly to the case; the gasket shows signs of deterioration; the attachments holding the carrying straps are not screwed firmly to the case; or the carrying strap and buckle are not in serviceable condition. The case is easily disassembled with a screwdriver, pliers, and hammer.

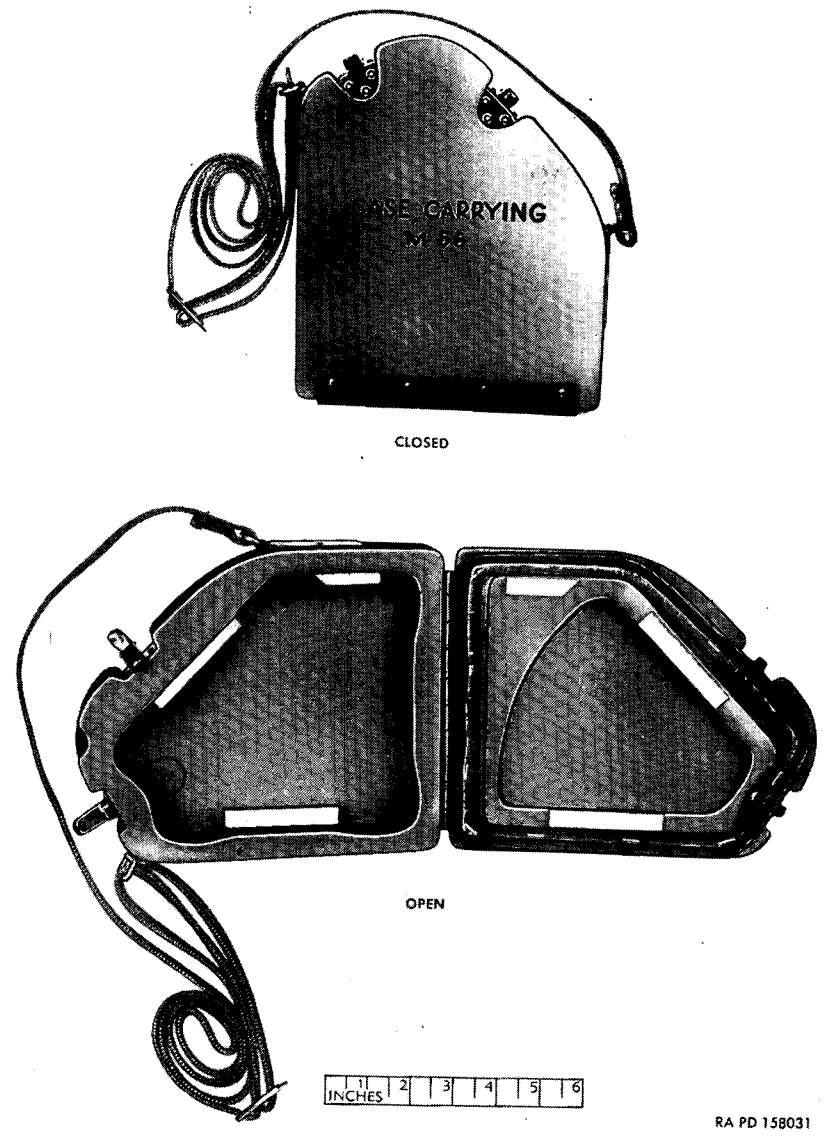

Figure 18. Carrying case M56.

24. Assembly of Gunner's Quadrant M1

a. ASSEMBLE CARRYING CASE M56 (fig. 18). To assemble the case, glue, nails, and screws will be required. Use a screwdriver, pliers, and a hammer. This case, which is wooden, must not be warped and must close completely. The catches and hinges must work freely and must be secured firmly to the case. The gasket must not show signs of deterioration. The attachments holding the carrying straps must be screwed firmly to the case. The carrying strap and buckle must be in a serviceable condition. When rebuilt, the case must have the appearance of a new item.

b. ASSEMBLE PACKING CHEST (fig. 17). To assemble the chest, glue, nails, and screws will be required. Use a screwdriver, pliers, and a hammer. This chest must close completely and the wood must not be warped. The hooks must not be bent and must fit snugly in the eyes. The hinges must allow the chest to open and close freely and must be screwed securely to it. The internal blocks must be glued and nailed firmly in place. When rebuilt, the chest must have the appearance of a new item.

c. ASSEMBLE CARRYING CASE M18 (fig. 16). The case is assembled by sewing and riveting as required. This case, which is of leather, must not have loose or missing stitches; the catch must hold the cover securely closed; the rivets in the carrying strap must be secure, and the strap and buckle must be in serviceable condition. All traces of mold must be removed and the leather cleaned and treated as outlined in TM 9–850. Leather cases that are used in or are to be shipped to tropical climates must be mildew-proofed as outlined in TM 9–850.

d. ASSEMBLE FRAME ASSEMBLY (fig. 15).

(1) *Install scales to frame.* Before installing the two scales, engravings on the 0- to 800-mils scale and the lettering and indexes on the same side must be filled with *black* graduation filler 52–F–100–10. The engravings on the 800- to 1,600-mil scale and the lettering and indexes on that side must be filled with *vermilion* graduation filler 52–F–100–220. Rub or brush the filler into the graduations. Remove surplus; wash with castile soap and rinse in clean water. Allow to dry. After they are thoroughly dry, place the two scales in position on the frame and secure by pressing in the four pins.

(2) *Install frame shoes to frame.*

(*a*) Apply a film of aircraft and instruments lubricating grease to the shoes and then wipe them dry with a lintless cloth. Place shoes in position on frame in ac-

cordance with the identification marks and secure with the No. 5 x ¼ fillister-head machine screws. The four shoes must be mounted tightly on the quadrant frame. Shims are not permitted under the shoes.

(*b*) Replace all misshaped shoes. The frame must not rock or lean to either side of a vertical plane when placed with its shoes on a level surface plate (fig. 7). If rocking or insufficient point of contact exists, interchange shoes until this condition is reduced to a minimum. To facilitate finding high spots on shoes, wipe a thin coat of Prussian blue on the surface plate. Place the instrument on the surface plate and, with slight pressure, move the instrument longitudinally (not sidewise) approximately 1 inch. On inspection, each shoe must show not less than 75 percent contact over the bearing surface. If there is insufficient bearing, the shoes must be lapped or reground to restore the bearing surface. Use the same method on both pairs of shoes.

(*c*) The bearing surfaces of the two pairs of shoes must be perpendicular to each other. In order to check the 90° angle, use the following procedure: Place a 90° angle plate (fig. 8) on a leveled surface plate (fig. 7). Place the instrument on the surface plate with the vertical shoes against the angle plate. Check with a feeler gage to ascertain that both shoes are against the angle plate within 0.0015 inch. If a 0.002-inch feeler can be inserted between either of the two shoes and the angle plate, the angle is incorrect and the frame must be set up on a surface grinder and the shoes reground to the 90° angle. Apply a film of aircraft and instruments lubricating grease to the seating surfaces of the shoes.

e. INSTALL RADIAL ARM IN LEVEL HOLDER (fig. 10).

(1) If the anvil was removed from the radial arm, securely stake or burnish a new anvil in the arm.

(2) Insert the six-coil radial arm compression spring into the detent below the micrometer hole in the level holder.

(3) Push arm, with anvil facing up, through level holder at pivot end until pivot holes in arm aline with pivot holes in level holder.

(4) Keep the pivot holes in arm and holder temporarily alined by inserting the pivot into the holes.

f. INSTALL MICROMETER (fig. 12).

(1) Press a new 0.10 diameter x 0.34 pin into the micrometer

knob, if the old one had been removed. Rivet the pin over and finish it flush.

(2) Thread micrometer screw nut into position on level holder until the nut is tight and the pin holes are alined.

(3) Drive the 3/32 x 3/8 straight pin into the alined holes. It must be tight and the end must protrude 0.060 inch above the face of the nut (fig. 19).

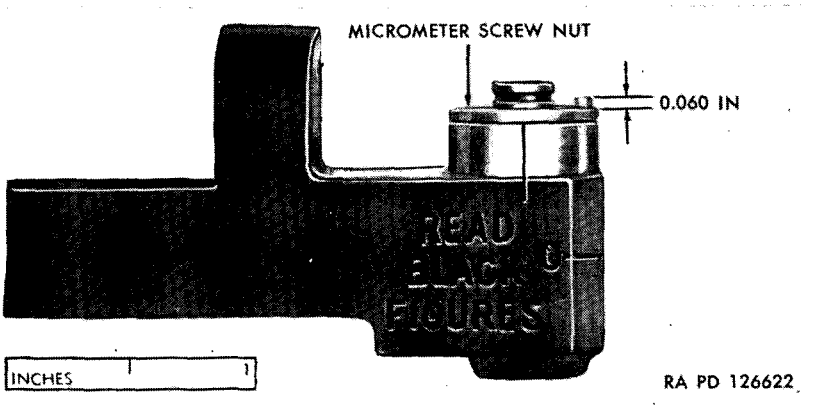

Figure 19. Micrometer screw nut positioned on level holder by pin.

(4) Place the micrometer stop ring, with lips upward, on the micrometer nut. Lock in position with the split retaining ring.

(5) Apply a film of aircraft and instruments lubricating grease to the micrometer screw. Thread the screw through the micrometer screw nut until the black auxiliary index marks on the arm and holder are in line.

Note. The screw must turn smoothly and be a close fit in the nut.

(6) Facing the black lettered side of the holder, turn the micrometer stop ring counterclockwise until its lip hits the protuding pin.

(7) Select the tapped hole on the micrometer screw nearest the black micrometer index, and turn the micrometer screw (not more than one-eighth turn) until this hole and the hole directly opposite it are in a straight line with the black and the red micrometer indexes.

(8) Place micrometer and knob in position over micrometer screw so that the pin in the knob enters the hole nearest the level vial.

(9) Secure the knob in position with the two No. 5 x 7/32 oval-head machine screws. If all parts have been posi-

tioned correctly, the micrometer will be able to make one complete turn.

Note. Final adjustment of micrometer will be made after the quadrant is completely assembled.

g. INSTALL LEVEL VIAL (fig. 11). If a level vial is being replaced, proceed as follows:

(1) Place level vial tube on leveled surface plate.

(2) Push level vial into position in level vial tube so that the graduations on the vial are centered in the top opening of the holder. Shim with paper of desired thickness to secure level vial in leveled position during the application and setting of the gypsum. Use fine calcined gypsum, mixed with water to the consistency of cream, to secure the vial in the tube.

Note. The level vial must be firmly imbedded in the gypsum.

(3) Position the level vial cover in the level holder with the small projection in the inside of the cover toward the micrometer.

(4) Push the level tube assembly, slotted end first, into the level holder and through the vial cover. Aline slot in level tube with pin in level holder and continue to push level tube in until it is seated.

Note. The tube must be firmly seated in the level holder. The level vial cover must turn freely and snap into the detent in either the closed or open position.

(5) Insert the four No. 2 x 1/8 cone-point headless set screws (fig. 11).

Note. These screws are used in making the final adjustments of the level vial and should not be tightened at this time. The slotted plug at the end of the level holder is to be installed after the final adjustment has been made.

h. INSTALL RADIAL ARM PLUNGER PLATES (fig. 14). Position the two radial arm plunger plates on the plunger and secure them with the four No. 5 x 1/4 fillister-head machine screws.

i. INSTALL PLUNGER IN RADIAL ARM (fig. 10).

(1) Drop the 30-coil plunger compression spring into radial arm.

(2) Coat the stem portion of the plunger with a thin film of aircraft and instruments lubricating grease, and place the plunger into the arm.

Note. The plunger must fit in the arm without noticeable looseness.

j. INSTALL RADIAL ARM AND LEVEL HOLDER IN FRAME (fig. 9).

(1) Remove pivot from the arm and holder.

(2) Turn plunger in arm so that beveled edges of the plunger plates face upward.

(3) With plunger, compress the spring and arm and position plunger plates near zero on the elevation scale. Push level holder and arm into position over frame. Do not release plunger until all pivot holes are alined.

(4) Apply a film of aircraft and instruments lubricating grease to the teeth of the frame and to the pivot and drive pivot through holes from front of quadrant.

Note. The pivot must fit in the frame, arm, and holder without noticeable looseness.

(5) Place plain brass washer over pivot and secure pivot with split cotter pin.

k. INSTALL NAME PLATE (fig. 9). Position name plate to frame and secure with three 0.062 x 21/64 overall countersunk-head rivets.

l. INSTALL SLOTTED PLUG (fig. 11).

Note. Install this plug only after level vial has been adjusted as follows (fig. 20):

(1) Set the radial arm plunger plate at "0" on the elevation scale. Turn micrometer knob counterclockwise to the limit of travel, bringing the auxiliary index marks on the radial arm and level holder into coincidence. Loosen the two micrometer knob retaining screws and slip micrometer around to bring the zero on the black scale of

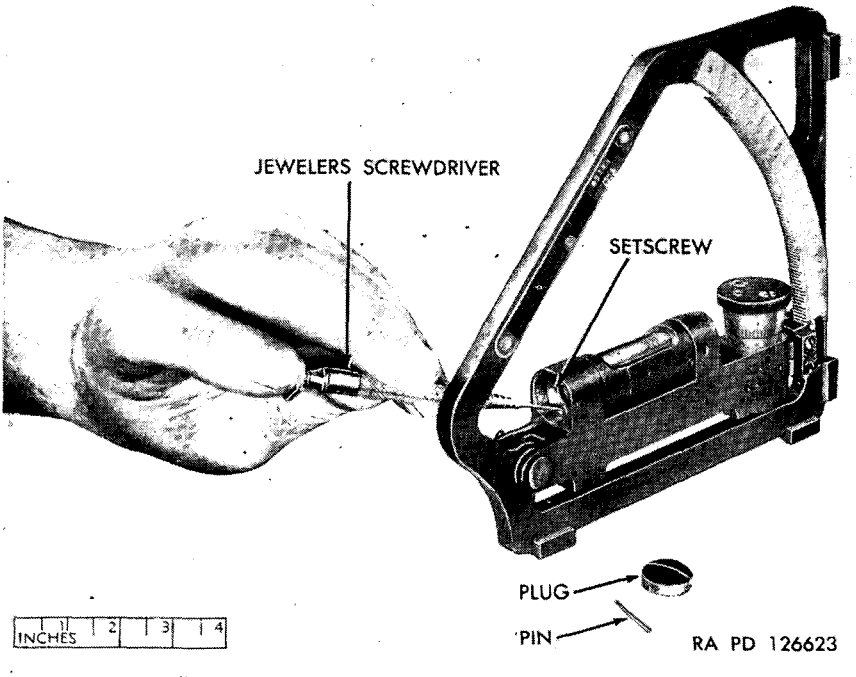

Figure 20. Adjusting level vial, gunner's quadrant M1.

the micrometer into coincidence with its index. Tighten the two screws and check to see that the three indexes are all at zero with the micrometer at its limit of travel in the counterclockwise direction. After this has been done, place the instrument on a leveled surface place (fig. 7) so that it rests on the two shoes forming the 0- to 800-mils reference surface. The bubble in the level vial should be centered.

(2) If the bubble is not centered, turn opposite headless cone-point adjusting screws to shift the end of the vial tube. After making adjustments, be sure the screws are all seated snugly.

Note. The level vial bubble must be centered with respect to the vial graduations, within a tolerance of +0.4 mil.

(3) Screw the slotted plug in until pin hole in plug is in line with the holes in the level holder (fig. 11). Drive the 1/16 x 3/4 straight pin through holder and plug.

Note. For final overall adjustments and tests, refer to chapter 5.

Section III. REPAIR AND REBUILD OF GUNNER'S QUADRANT M1918

25. Disassembly of Gunner's Quadrant M1918

a. REMOVE RADIAL ARM (fig. 21).

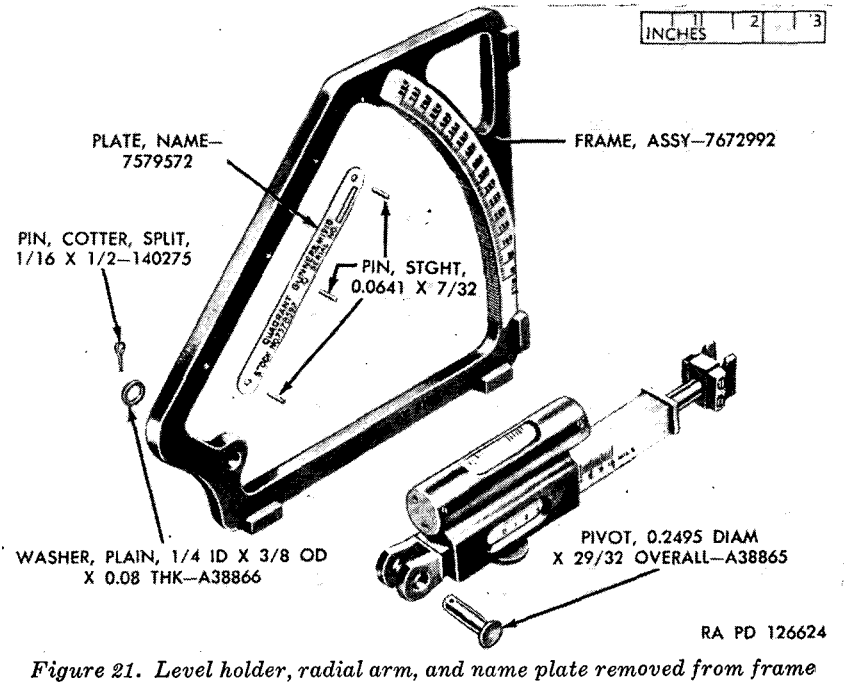

Figure 21. Level holder, radial arm, and name plate removed from frame assembly, gunner's quadrant M1918.

(1) Remove the split cotter pin from the pivot on the rear side of the instrument and remove plain brass washer.
(2) Drive the pivot from the radial arm and frame.
(3) Set the arm at zero reading on the elevation scale, raise the pivot hole end of arm out of position, and lift out arm and plunger as a unit.

Note. The plunger is loose in the end of the arm. Care must be taken to prevent it from accidentally falling out.

b. REMOVE NAME PLATE (fig. 21). Only if necessary for replacement, take out three rivets and remove name plate from frame.

c. REMOVE RADIAL ARM PLUNGER (fig. 22). Lift the radial arm plunger out of arm and allow the compression spring to drop out.

d. REMOVE SLIDING LEVEL GROUP ASSEMBLY (fig. 22).

(1) Remove two screws securing the level stop to the radial arm and lift off stop.
(2) Turn the knob to loosen the level clamping screw and free the sliding level group assembly. Remove the group assembly from the arm.
(3) Lift the flat spring out of the level vial holder. Only if necessary for replacement, remove the flat-head rivet from the spring.

e. REMOVE RADIAL ARM PLUNGER PLATES (fig. 22). Remove the four fillister-head screws holding the two radial arm plunger plates to the plunger and remove plates.

f. REMOVE TYPE N–1 LEVEL VIAL (fig. 23). If a level vial is undamaged and is securely held in position do not remove it. Remove loose vials in the following manner:

(1) Remove the headless set screw securing the plug at each end of the level vial holder.
(2) Unscrew and remove the plugs.
(3) Clean the gypsum from the level vial holder and remove the level vial. Refer to paragraph 23*e*(5).

g. REMOVE LEVEL CLAMPING SCREW AND KNOB (fig. 23).

(1) File away the portion of the level clamping screw riveted to the knob, in order to free the knob.
(2) Drive the knob from the screw, and remove screw through the inside of the level vial holder.

h. DISASSEMBLE FRAME ASSEMBLY. Refer to paragraph 23*h* and figure 15.

i. DISASSEMBLE CARRYING CASE M18. Refer to paragraph 23*i* and figure 16.

j. DISASSEMBLE PACKING CHEST. Refer to paragraph 23*j* and figure 17.

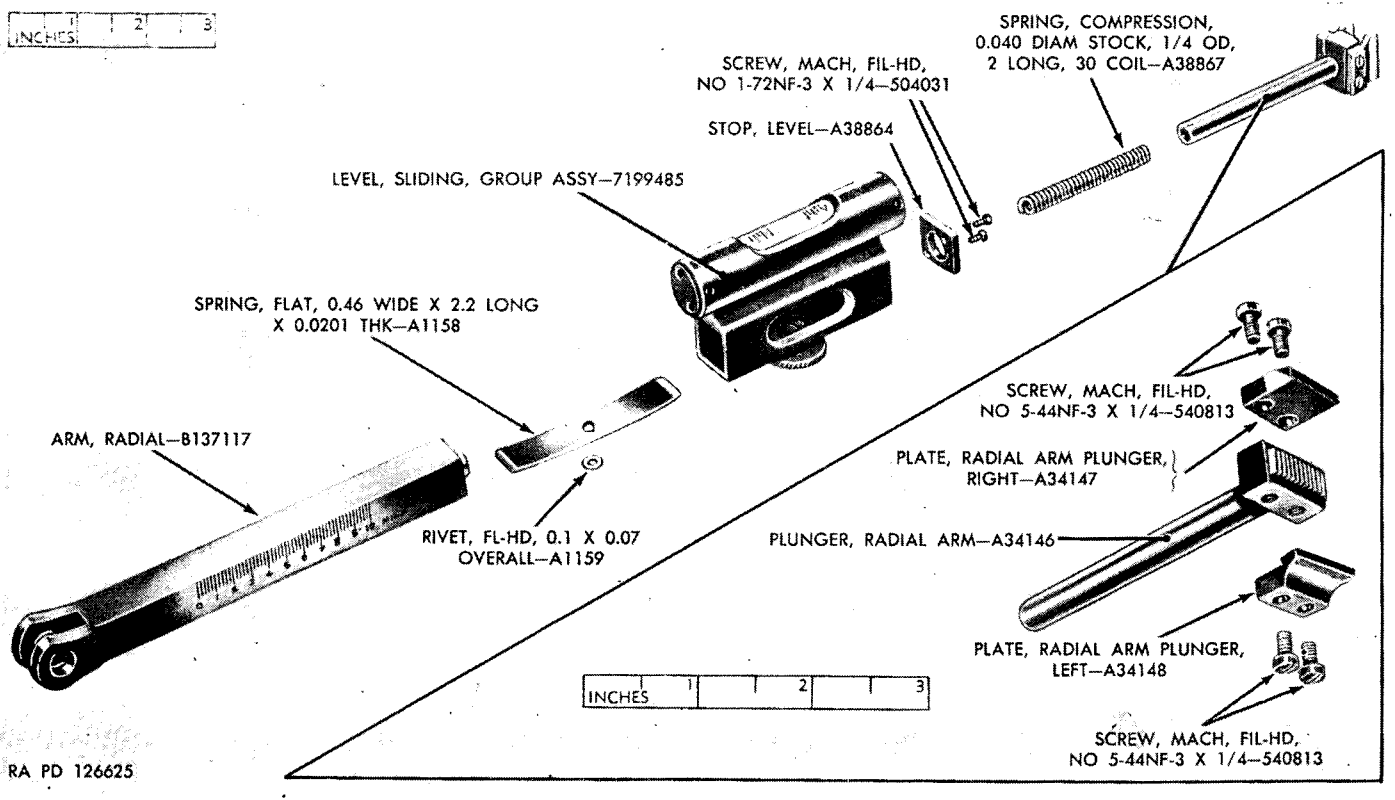

Figure 22. Radial arm and plunger removed from sliding level group assembly 7199485.

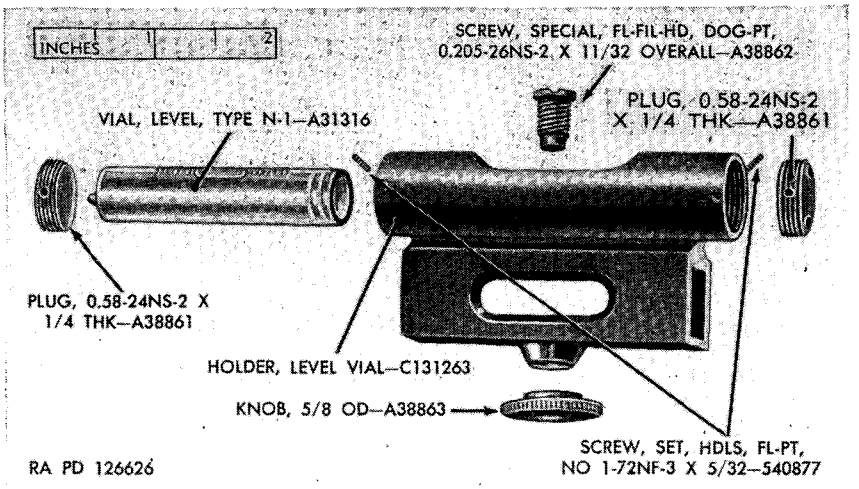

Figure 23. Level vial removed from holder.

k. DISASSEMBLE CARRYING CASE M56. Refer to paragraph 23*k* and figure 18.

26. Assembly of Gunner's Quadrant M1918

a. ASSEMBLE CARRYING CASE M56. Refer to paragraph 24*a*.

b. ASSEMBLE PACKING CHEST. Refer to paragraph 24*b* and figure 17.

c. ASSEMBLE CARRYING CASE M18. Refer to paragraph 24*c* and figure 16.

d. ASSEMBLE FRAME ASSEMBLY. Refer to paragraph 24*d* and figure 15.

e. INSTALL LEVEL CLAMPING SCREW AND KNOB (fig. 23).

(1) From inside of level vial holder, insert the level clamping screw.

(2) Place the knob over end of clamping screw so that screw end extends through hole and out of the flat surface of the knob.

(3) Place the assembly on a solid support and rivet clamping screw to knob.

f. INSTALL RADIAL ARM PLUNGER PLATES (fig. 22). Position the two radial arm plunger plates on the plunger and secure in place with the four No. 5 x ¼ fillister-head machine screws.

g. INSTALL FLAT SPRING (fig. 22). Insert the 0.1 x 0.07 overall flat-head rivet into hole of flat spring and rivet securely together.

h. INSTALL SLIDING LEVEL GROUP ASSEMBLY (fig. 22).

(1) Turn knob until level clamping screw is backed down.

(2) Insert the flat spring, with rivet head down, over the head of the clamping screw.
(3) Holding flat spring in position, push radial arm through level vial holder.
(4) Place the level stop on end of arm and secure with the two No. 1 x ¼ fillister-head machine screws.

i. INSTALL RADIAL ARM PLUNGER (fig. 22).
(1) Drop the compression spring into the arm.
(2) Coat the stem portion of the plunger with a film of aircraft and instrument lubricating grease and place plunger into arm.

j. INSTALL RADIAL ARM (fig. 21).
(1) Turn plunger in arm so that the beveled edges of the plunger plates face upward.
(2) With plunger, compress the spring and position plunger near zero on elevation scale. Push arm into position over frame. Do not release plunger until pivot holes in arm line up with pivot hole in frame.
(3) Apply a film of aircraft and instrument lubricating grease to the teeth of the frame and to the pivot, and drive pivot through holes from the back of the instrument.
(4) Place brass washer over pivot and secure with split cotter pin.

k. INSTALL LEVEL VIAL (fig. 23). If level vial is being replaced, proceed as follows:
(1) Push a type N–1 level vial into the level vial holder so that the graduations on the vial are centered in the top opening of the holder. Secure the vial in position, with small wedges inserted at each end between the vial and the holder. Use only enough wedges (3 or 4) at each end to prevent any movement of the vial in the holder while being cemented in place.
(2) Set the radial arm plunger plate at zero on the elevation scale.
(3) Set the sliding level group assembly so that the index on the holder reads zero on the 0- to 800-mils scale of the radial arm. Tighten the knob.
(4) Place the gunner's quadrant on a leveled surface plate (fig. 7), and adjust the level vial by means of the small wedges until the bubble is centered with respect to the graduations; be sure the wedges are tight.
(5) Pour or work fine calcined gypsum, mixed with water to the consistency of cream, around the level vial. Allow the

gypsum to set for at least two hours and then carefully clean away all excess gypsum from the threaded portion of the holder.

(6) Screw the two plugs into the holder until the screw holes are alined. Install the No. 1 x 5/32 flat-point headless set screw in each plug.

Note. For final overall adjustments and tests, refer to chapter 5.

Section IV. REPAIR AND REBUILD OF MACHINE GUN CLINOMETER M1917

27. Disassembly of Machine Gun Clinometer M1917

a. REMOVE RADIAL ARM (fig. 24).

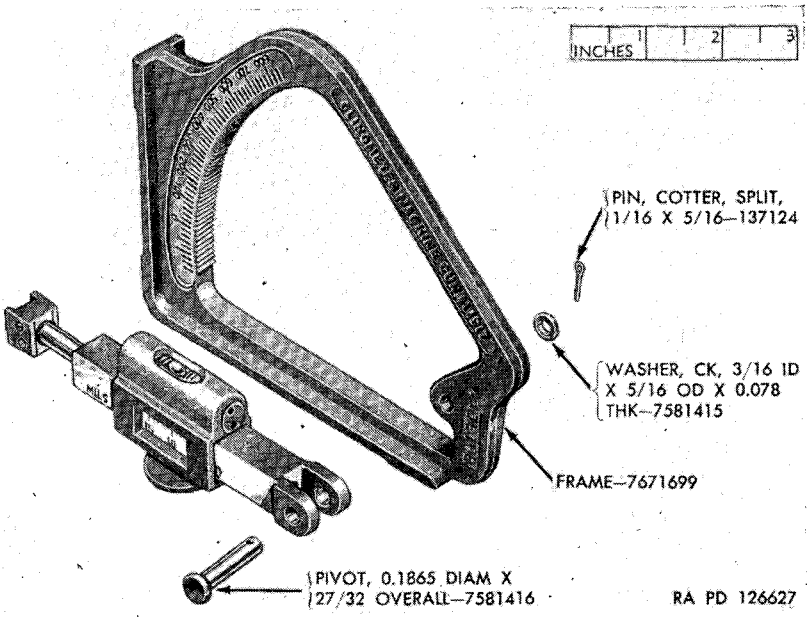

Figure 24. Sliding level assembly B271873 and radial arm group assembly 7199509 removed from frame.

(1) Remove the split cotter pin from the pivot, and remove the brass washer.

(2) Drive the pivot from the arm and frame.

(3) Set the arm at zero on the elevation scale, raise the pivot hole end of arm out of position, and lift out arm and plunger as a unit.

Note. The plunger is loose in the end of the arm. Care must be taken to prevent it from accidentally falling out.

b. REMOVE RADIAL ARM PLUNGER ASSEMBLY (fig. 25). Lift the radial arm plunger assembly out of the radial arm and allow the compression spring to drop out.

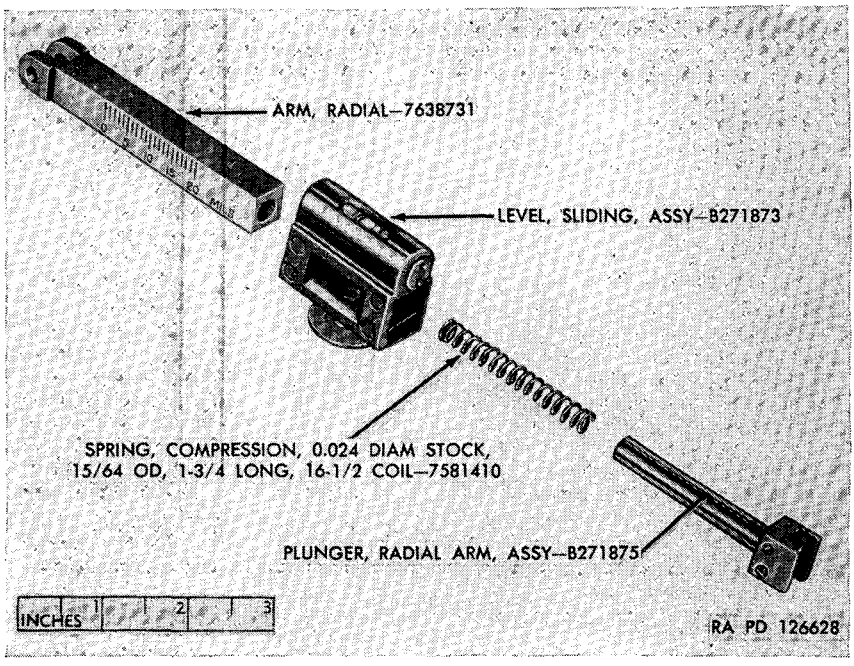

Figure 25. Sliding level assembly B271873 and radial arm plunger assembly B271875 removed from radial arm.

c. REMOVE SLIDING LEVEL ASSEMBLY (fig. 25). Loosen the knurled thumb screw, and remove the sliding level assembly from the radial arm.

d. DISASSEMBLE RADIAL ARM PLUNGER ASSEMBLY (fig. 26). Remove the four fillister-head screws holding the two radial arm plunger plates to the radial arm plunger, and remove the plates.

e. DISASSEMBLE SLIDING LEVEL ASSEMBLY (fig. 27).

(1) Unscrew and remove the plug at each end of the level vial holder.

(2) Clean the gypsum from the level vial tube and remove the level vial (par. 23*e*(5)). Do not remove a level vial that is undamaged and securely held in place in its holder.

(3) Only if necessary for replacement, place a screwdriver between the knurled thumb screw and flat spring inside the holder and force the spring away from the thumb screw. This is necessary, since the end of the thumb screw is peened to the spring. Remove the flat spring assembly from holder and screw out the thumb screw.

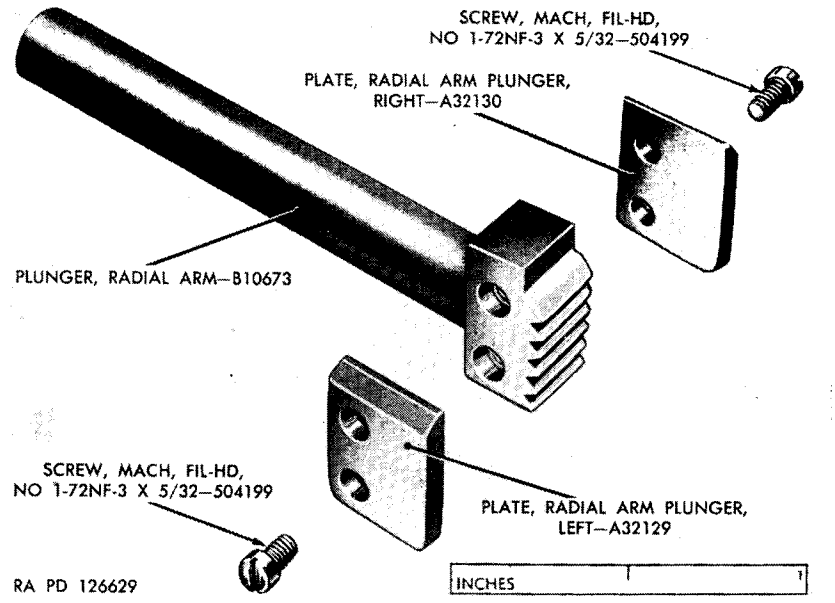

Figure 26. Radial arm plunger assembly B271875—exploded view.

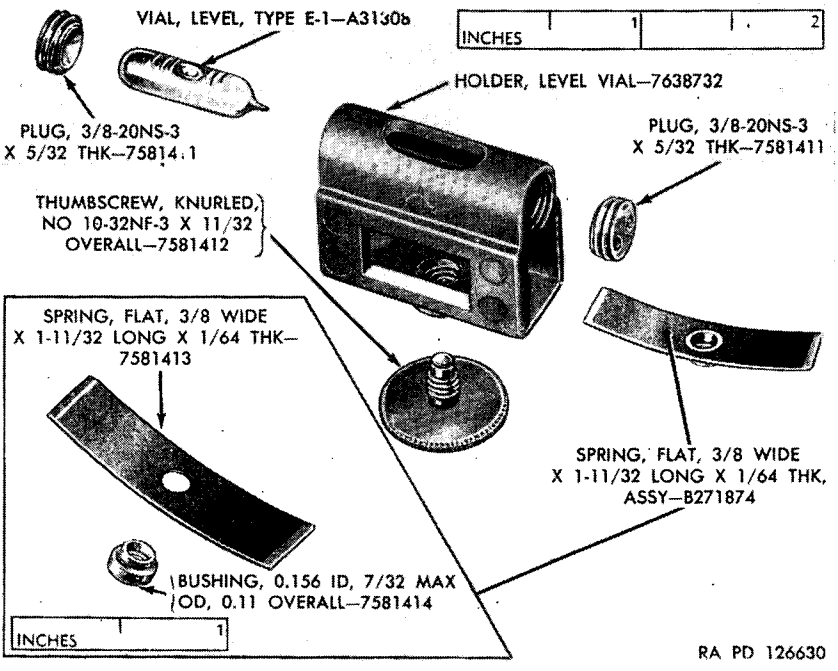

Figure 27. Sliding level assembly B271873—exploded view.

(4) If necessary for replacement, remove bushing from spring by filing peened end of bushing from spring. If bushing is removed, it must be replaced by a new one at assembly.

f. DISASSEMBLY OF CARRYING CASE (fig. 28). It is considered impractical to disassemble the carrying case—D29063 for repair or rebuild purposes. Should the seams become loose due to broken threads, resew and carry the stitching well beyond the point of breakage. The case should be regularly cleaned and treated against moisture and mold as prescribed in TM 9–575 to offset the necessity for repair.

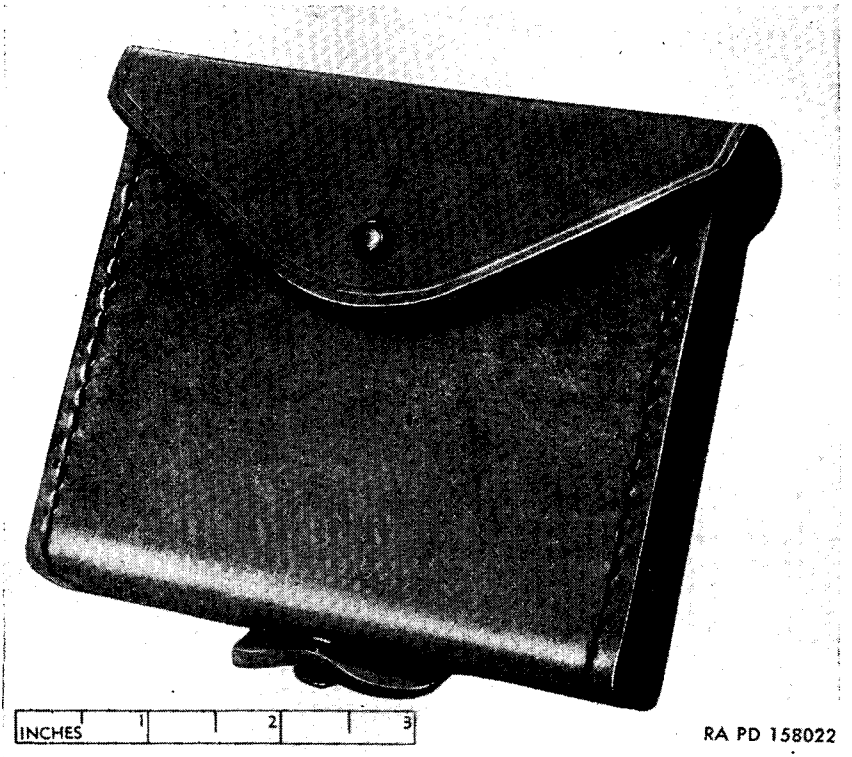

Figure 28. Machine gun clinometer carrying case—D29063.

28. Assembly of Machine Gun Clinometer M1917

a. ASSEMBLE SLIDING LEVEL ASSEMBLY (fig. 27).

(1) Place a new bushing into hole in spring. Place the assembly on a solid support and peen over the bushing.

(2) Screw a new knurled thumb screw completely into hole at bottom of level vial holder. Place the flat spring assembly, bushing end down, over projection at end of

thumb screw. Place the holder with the thumb screw resting on a solid support and press the bushing of the spring assembly onto the projection at end of the thumb screw. Enter punch through upper openings of level vial holder to engage top of thumb screw. Lightly peen over thumb screw projection. Be sure the thumb screw turns in the bushing after the peening.

Note. Do not assemble level vial into holder at this time.

b. ASSEMBLE RADIAL ARM PLUNGER ASSEMBLY (fig. 26). Secure the two plunger plates on the plunger with the four No. 1 x 5/32 fillister-head machine screws.

c. INSTALL SLIDING LEVEL ASSEMBLY (fig. 25). Turn back on thumb screw and slide level assembly onto radial arm.

d. INSTALL RADIAL ARM PLUNGER (fig. 25).

(1) Drop compression spring into arm.

(2) Coat stem portion of plunger with thin film of aircraft and instruments lubricating grease and place plunger into arm.

e. INSTALL RADIAL ARM (fig. 24).

(1) Turn plunger in arm so that beveled edges of plunger plates face upward.

(2) With plunger, compress the spring and position plunger near zero on elevation scale. Push arm into position over frame. Do not release plunger until pivot holes in arm aline with hole in frame.

(3) Apply a film of aircraft and instrument lubricating grease to the teeth of the frame and to the pivot, and drive pivot through holes from the back of the instrument.

(4) Place the brass washer over pivot and secure the pivot with the split cotter pin.

f. INSTALL LEVEL VIAL (fig. 27). Refer to paragraph 26*k*.

Note. For final overall adjustments and tests, refer to chapter 5.

CHAPTER 5
FINAL INSPECTION

29. General

Final inspection is performed after repair and rebuild has been completed to insure that the matèriel is serviceable according to established serviceability standards.

30. Visual and Manual Checks

a. Check the instruments for completeness. All movable parts must function properly without irregularities, undue friction, or looseness. The instruments must be finished so that they have the appearance of new instruments. Paint and other finishes should be as indicated in paragraph 22.

b. The plunger springs must have sufficient tension to insure the teeth of the plungers retaining good contact with the teeth on the frames.

c. There must be no shake in the radial arm pivot pin bearings.

d. The bubbles must be central in the level vials with reference to zero elevation when the instruments are placed on a leveled surface plate.

e. In gunner's quadrants M1 and M1918, the screws holding the four shoes in position must be tight and there must not be any shims under the shoes.

f. In gunner's quadrant M1, the level vial cover must turn freely and snap into the detent in either the open or closed position.

g. In gunner's quadrant M1918 and machine gun clinometer M1917, the sliding level assembly must slide smoothly on the arm.

h. Each set of shoes of gunner's quadrants M1 and M1918 and frame bearing surfaces of machine gun clinometer M1917 must show at least 75 percent contact over their bearing surfaces when tested on a leveled surface plate, using a thin film of Prussian blue.

i. The instruments must not lean from a vertical position when placed on a surface plate. Check each set of shoes of gunner's quadrants M1 and M1918 and frame bearing surfaces of machine gun clinometer M1917 with a square. If the instruments lean from

the vertical one-sixty-fourths of an inch or more, correction must be made.

j. The bearing surfaces of the two sets of shoes of gunner's quadrants M1 and M1918 and frame bearing surfaces of machine gun clinometer M1917 must be perpendicular to each other within 1 minute of arc (0.0015). Check perpendicularity as outlined in paragraph 23*d*(2).

k. For leather carrying cases, the stitching must not be broken, the catch or button must hold cover closed securely, rivets and buttons must be securely assembled to case and/or strap, and the strap and buckle must be in serviceable condition. For wooden carrying case and packing chest, the wood must not be warped, catches and hinges must work freely and be securely fastened to case and chest, and the strap and buckle must be in serviceable condition.

31. Accuracy and Performance

Note. Follow instructions in paragraph 18.

APPENDIX
REFERENCES

1. Publication Indexes

The following publication indexes and lists of current issue should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to material covered in this manual:

Index of Administrative Publications	SR 310–20–5
Index of Army Motion Pictures and Film Strips.	SR 110–1–1
Index of Training Publications	SR 310–20–3
Index of Blank Forms and Army Personnel Classification Tests.	SR 310–20–6
Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.	SR 310–20–4
Introduction and Index (supply catalogs)	ORD 1
Military Training Aids	FM 21–8
Ordnance Major Items and Major Combinations and Pertinent Publications.	SB 9–1

2. Supply Catalogs

a. FIRE CONTROL EQUIPMENT.

Clinometer, Machine Gun, M1917	ORD	(*)	SNL F–15
Major Items and Major Combinations of Group F.	ORD	3	SNL F–1
Quadrant, Gunner's, M1918 (mils)	ORD	(*)	SNL F–13
Quadrant, Gunner's, M1 (mils)	ORD	(*)	SNL F–140

(*) See ORD 1, Introduction and Index for published catalogs of the Ordnance Section of the Department of the Army Supply Catalog.

b. REPAIR AND REBUILD.

Cleaners, Preservatives, Lubricants, Recoil Fluids, Special Oils, and Related Maintenance Materials.	ORD 3 SNL K–1
Common Tools and Equipment (except machine tools).	ORD 3 SNL J–17
Miscellaneous Hardware	ORD 5 SNL H–2
Standard Hardware	ORD 5 SNL H–1
Tool Sets for Maintenance of Sighting and Fire Control Equipment.	ORD 6 SNL F–272

3. Forms

DA AGO Form 9–71, Locator and Inventory Control Card.
DA AGO Form 9–72, Ordnance Stock Record Card.
DA AGO Form 9–76, Request for Work Order.
DA AGO Form 9–77, Job Order Register.
DA AGO Form 9–78, Job Order.
DA AGO Form 9–79, Parts Requistion.
DA AGO Form 9–80, Job Order File.
DA AGO Form 9–81, Exchange Part or Unit Identification Tag.
DA AGO Form 468, Unsatisfactory Equipment Report.
DA AGO Form 811, Work Request and Job Order.
DA AGO Form 811–1, Work Request and Hand Receipt.
DA AGO Form 865, Work Order.
DA AGO Form 866, Consolidation of Parts.
DA AGO Form 867, Status of Modification Work Order.
DD Form 6, Report of Damaged or Improper Shipment.

4. Other Publications

a. DECONTAMINATION.

Decontamination	TM 3–220
Defense Against Chemical Attack	FM 21–40

b. GENERAL.

Auxiliary Sighting and Fire Control Equipment.	TM 9–575
Inspection of Ordnance Matériel in the Hands of Troops.	TM 9–1100
Ordnance Field Maintenance	FM 9–10
Reports of Accident Experiences	SR 385–10–40

Supplies and Equipment: Unsatisfactory Equipment Report.	SR 700–45–5

c. REPAIR AND REBUILD.

Cleaning, Preserving, Sealing, and Related Materials Issued for Ordnance Matériel.	TM 9–850
Distribution and Issue of Ordnance General Supplies.	SB 9–3
Fire Control Matériel: Lubrication	TB 9–2835–1
Instruction Guide: Instrument Repairman	TM 9–2602
Maintenance and Care of Hand Tools	TM 9–867
Maintenance of Supplies and Equipment: Maintenance Responsibilities and Shop Operations.	AR 750–5
Painting Instructions for Field Use	TM 9–2851

d. SHIPMENT AND LIMITED STAND-BY OR LONG-TERM STORAGE.

Army Shipping Document	TM 38–705
Instruction Guide, Ordnance Packaging and Shipping (Posts, Camps, and Stations).	TM 9–2854
Marking and Packing of Supplies and Equipment: Marking of Oversea Supply.	SR 746–30–5
Ordnance Storage and Shipment Chart—Group F.	SB 9–OSSC–F
Shipment of Supplies and Equipment: Report of Damaged or Improper Shipment.	SR 745–45–5
Standards for Oversea Shipment and Domestic Issue of Ordnance Matériel Other Than Ammunition and Army Aircraft.	TB ORD 385

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