TECHNICAL MANUAL

MAINTENANCE INSTRUCTIONS

FOR

SEXTANT TYPE STADIMETER

MARK 5, MOD 1

MANUFACTURER: CARBONARA LABS, INC.
CONTRACT NO. N00104-81-C-1794

PUBLISHED BY DIRECTION OF
COMMANDER, NAVAL SEA SYSTEMS COMMAND

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June 1986

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Page No.	* Change No.	Page No.	* Change No.
Title page.....	0	5-1 - 5-8.....	0
i - vii.....	0	6-1 - 6-14.....	0
1-1 - 1-4.....	0	7-1 - 7-11.....	0
2-1 - 2-6.....	0	8-1 - 8-3.....	0
3-1 - 3-22.....	0	9-1.....	0
4-1 - 4-7.....	0		

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RECORD OF REVISIONS

REV NO.	ISSUE DATE	DATE INSERTED	BY	REV NO.	ISSUE DATE	DATE INSERTED	BY	REV NO.	ISSUE DATE	DATE INSERTED	BY

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF TABLES

SECTION I

INTRODUCTION

1-1 GENERAL. This manual contains overhaul, repair and handling instructions for Sextant Type Stadimeter, Mark 5, Mod 1. The stadimeter is manufactured by Carbonara Labs, Inc., Huntington, NY. The stadimeter, (Figure 1-1) its accessories and spare parts are supplied in a fitted carrying case. Their allowances to the vessels and ships of the Navy are indicated on the ships' allowance lists.

1-2 PURPOSE AND PLAN OF REPAIR MANUALS FOR NAVIGATIONAL INSTRUMENTS. Each of these manuals on the repair of navigational instruments has several purposes:

a. To make an adequate record of know-how at the time the information was prepared.

b. To establish standard practice for the particular instrument.

c. To provide a manpower training tool for newcomers to the field, especially in cases of national emergency, when working forces must be expanded rapidly.

d. To form a foundation or base from which the quality of repair may be constantly improved, and the cost of repair reduced.

This standard repair practice manual will provide the groundwork for establishing standard allowable repair times by which performance may be judged.

1-2.1 Methods Employed. Prior to the preparation of this manual, an engineering survey of repair methods was conducted in Naval shipyards and in the plants of manufacturers. Consequently, the methods selected as standard repair practice are an integration of the best and most modern in Naval repair activities and those used by instrument manufacturers.

1-2.2 Methods Improvement. This handbook, as you see it, is by no means the final word. It is hoped that it will be subject to continuous change. The Navy wishes each one working with navigational instrument repair to become "methods-consicious." It would like you to contribute ideas for further improvements to standard practice. Your suggestions should be cleared with your foreman and he will then submit them to the Beneficial Suggestions Committee. The Committee will forward each suggestion to the navigational instruments authority of the Bureau of Ships. There, it will be properly evaluated and, if adopted, you will be given credit and the appropriate portion of this manual will be changed.

Why is this opportunity being offered? Because everyone wants to do his or her share in improving methods and reducing repair costs. After this standard practice has first been put into effect, nobody but a person using it is in the best position to recommend improvement. You are the expert, so put your ideas to work. Take advantage of this chance to better your own position and, at the same time, increase the efficiency of instrument repair.

1-3 PREPARATION FOR REPAIR. A predisassembly inspection is incorporated in the overhaul procedure to make a preliminary determination of whether the stadimeter is worth repairing and,

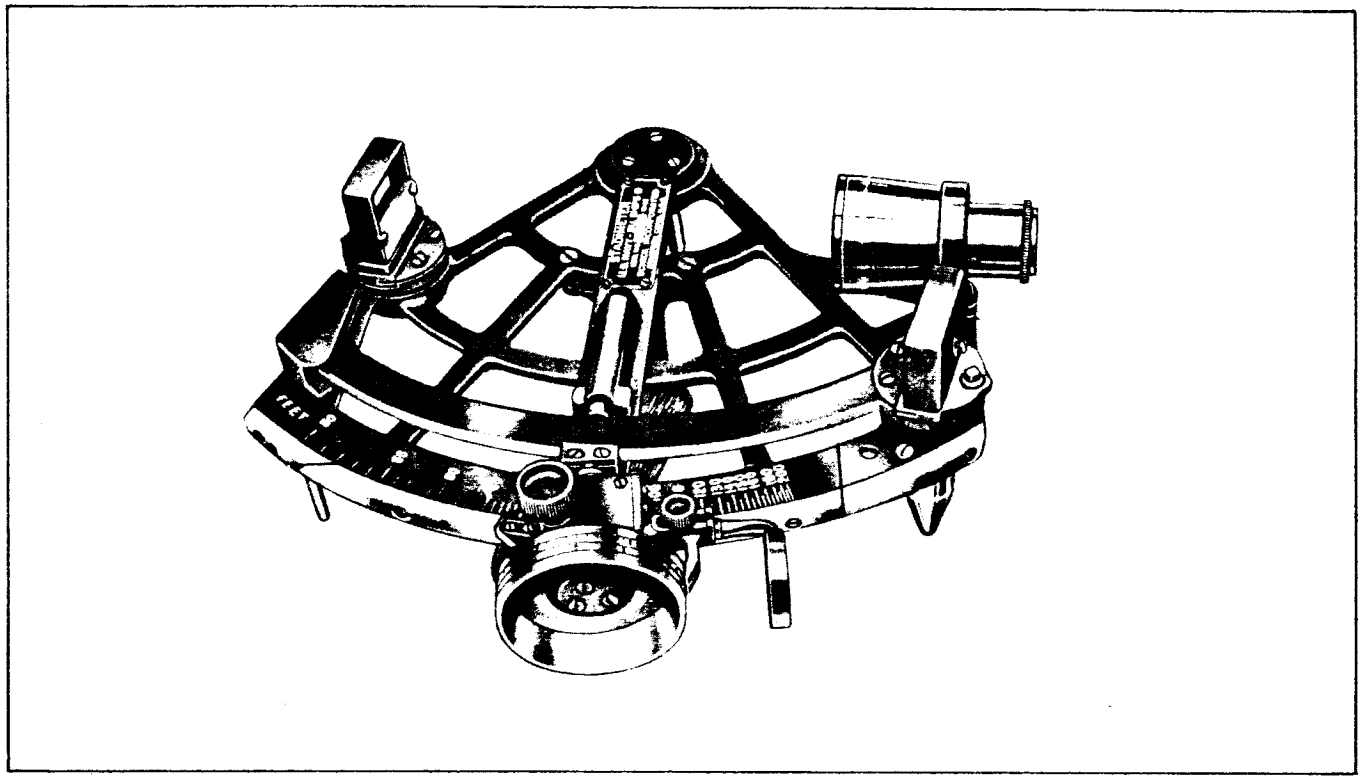


Figure 1-1. Sextant Type Stadimeter, Mark 5, Mod 1

if so, to what extent disassembly is required. The arrangement of the repair procedures provides convenient instructions for a complete overhaul, or the repair of single components, as required.

Section II of this manual covers general information on stadimeters including their performance requirements, critical points of repair and differences between the various types. All repair personnel should be thoroughly familiar with that information.

1-4 OUTLINE OF REPAIR PROCEDURE. The repair operations are divided into four main activities:

a. Disassembly (Sections III)

b. Parts Inspection, Repair and Cleaning (Section IV)

c. Reassembly (Sections V)

d. Test, Adjustment and Final Inspection (Section VI)

These repair sections are supplemented in this manual by a "Maintenance Parts Catalog", Section VII, and an index of "Special Service Tools and Test Apparatus", Section VIII.

A separate manual, the "Bureau of Ships Navigational Instrument Control Manual", covers such general standardized procedures as lubrication, cleaning and inspection techniques. In addition, there is a section on repair inspection standards and a catalog of test apparatus. For convenience, that volume will be referred to as the "Control Manual". Use its index for all material pertinent to the particular references in the repair text of this manual.

The major repair procedures have been planned so that they may be performed by one or more persons. Upon completion of the work covered in any one section of the manual, the stadimeter (or its component parts) may then be returned to the Instrument Control Center.

If the number of instruments being processed at the same time is sufficiently large, work may flow from one section to the next without returning to the Instrument Control Center. The decision to set up a flow-line basis of work is left to the discretion of the supervisor.

The Instrument Control Center, referred to in the preceding paragraphs, is the clearing house for all repair work. It serves to level off the flow of work through the repair facility. The personnel of the Center receive the instruments and sort them into lots for processing through the repair operations. All repair personnel draw their work (whole instruments or the parts of a single instrument in a parts tray) from the Center and return it to the Center upon completion of the work they perform. After final inspection, the completed instrument is returned to the Center for storage or shipment.

1-4.1 Disassembly. A pre-disassembly inspection is made to determine whether the instrument is to be overhauled, or surveyed and salvaged for parts. If it is worth overhauling, the disassembly required for the correction of the noted defects is determined. The results of this inspection decision and the required disassembly are to be recorded on a route ticket that will accompany the instrument throughout the repair procedures. All repair personnel who work on the instrument will sign the route ticket. The pre-disassembly inspector also collects performance and usage data as a by-product of his inspections. This information is useful to the Bureau of Ships as a guide for redesign and development work.

The disassemblers follow the instructions on the route ticket and perform only the indicated disassembly. The parts and components of each stadimeter are placed in an individual parts tray and returned to the Instrument Control Center.

1-4.2 Parts Inspection, Repair and Cleaning. The parts inspector is charged with the responsibility of preparing a complete set of serviceable parts, ready for reassembly. He inspects the parts and has them repaired or replaced on the basis of the "Parts Inspection Standards" set forth in the Control Manual. These standards authorize the allowable repair times for all parts.

Performance and usage data on the wear, defects and failure of parts is gathered by the parts inspector to supplement the data collected by the pre-disassembly inspector.

After the repairs and replacements have been made, the inspector gives the parts a final check and has all the mechanical parts cleaned. The full set of parts is placed in the instrument's parts tray and returned to the Instrument Control Center.

1-4.3 Reassembly. The reassembly work is done by one or more persons following the step-by-step procedure. The reassembler uses reassembly guide marks, made during disassembly, for positioning critical parts. The instrument is reassembled only to the point where it is ready for the test and adjustment operations of Section VI. The partially reassembled stadimeter together with the remaining unassembled parts is returned, in a parts tray, to the Instrument Control Center.

1-4.4 Test, Adjustment and Final Inspection. The instrument is given a visual inspection as a check on previous work before any time is invested in test and adjustment. If the stadimeter appears to be in serviceable condition, the test and adjustment operations are performed to make it meet the "Performance Requirements" as described in Section II. If the stadimeter failed the initial inspection or if it will not adjust to the requirements, it is returned for correction to the responsible individual, as determined by the route ticket.

The final assembly is completed during the test and adjustment operations. The adjusted instrument is given a final check. When the repair shop is satisfied with it, an independent navigational instrument inspector then performs a final inspection. The approved stadimeter is coded in accordance with "Coding" in the Control Manual. It is then returned to the Instrument Control Center to be processed for shipment or storage.

The intent and purpose of the repair procedure, as described in the foregoing paragraphs, is to raise all stadimeters to the highest authorized performance and serviceability levels. The procedure is designed to afford the opportunity to plan the flow of work and to utilize the best in methods and techniques so as to lower repair costs to a minimum.

SECTION II

DESCRIPTION

2-1 GENERAL. The information contained in this section is a necessary part of the preliminary training of all personnel for work on the stadimeter. Section II also provides information on how the stadimeter works, what performance requirements it must meet and what the critical points are in the repair procedure.

2-2 PRINCIPLES OF OPERATION. The stadimeter is used aboard ship to measure the range of objects of known height. For example, the officer of the deck uses a stadimeter to space his ship in convoy by sighting on another ship (of known height) for range. The height scale is calibrated in feet for objects from 50 to 200 feet in height. The range scale is calibrated in yards for readings from 200 to 10,000 yards. It is not a precision range finder.

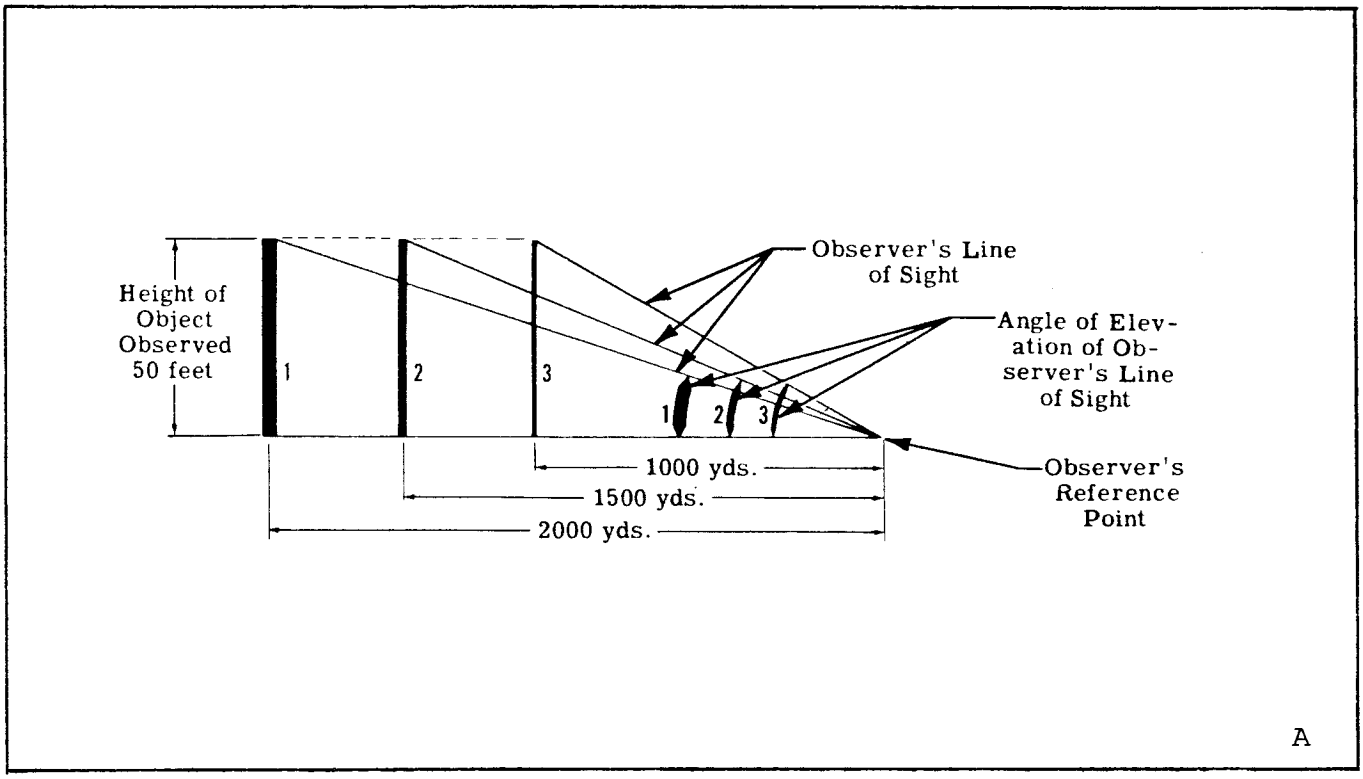
The theory behind the stadimeter is as follows: An observer's line of sight must be elevated a varying amount to view the top of an object which is moving away from, or towards him. If the object moves away from the observer, the angle of elevation of the observer's line of sight becomes smaller. If the object moves toward the observer, the angle becomes larger (see Figure 2-1). Therefore if the object is distant, the angle is small; if the object is near, the angle is large.

2-2.1 Line of Sight Measurements. Generally, the heights of objects at sea are known, such as the mast heights of various classes of ships. The stadimeter by means of its optical system, will measure the angle to which the observer's line of sight is elevated in order to view the top of the object. Then, by means of a directly calibrated range drum, this angular measurement is converted to a range reading in yards.

This calibration of the range drum would be in order if all objects to be observed were the same height, but in practice they are not. Referring to Figure 2-1, B, you will see that the object observed is at the same distances from the observer as the object in Figure 2-1, A. However, due to the increased height of the object, the angle of the observer's line of sight in each case has increased for the same distance. To compensate for this, the stadimeter has an arcuate arm. This arm gives a greater or lesser displacement of the index mirror, depending upon the height of the object observed, for the same movement of the range drum. Thus the distance of the object is measured correctly regardless of its height.

In actual fact, the sighting triangle is not a right triangle. This is because the observer is generally above the level of the water line of the vessel he is observing (see Figure 2-2). However, the distances involved are such that the triangle can be considered as a right-angled one in practice.

2-2.2 Range Determination. To determine the range of an object, the range drum (4, Figure 2-3) on the stadimeter is swung by means of the radius arm (7) over to the graduation on the index scale (5) which represents the known height of the object. With the frame



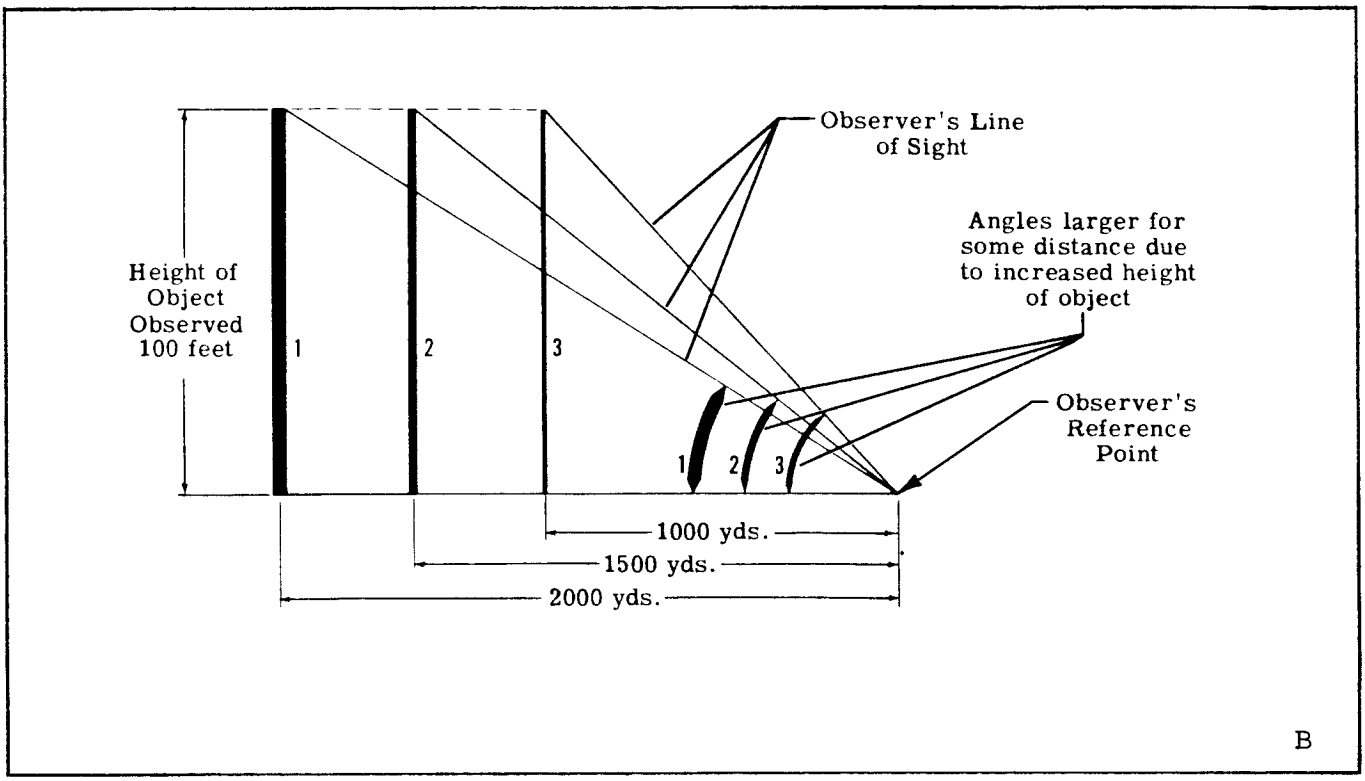


Figure 2-1. Observer's Line of Sight Measurements

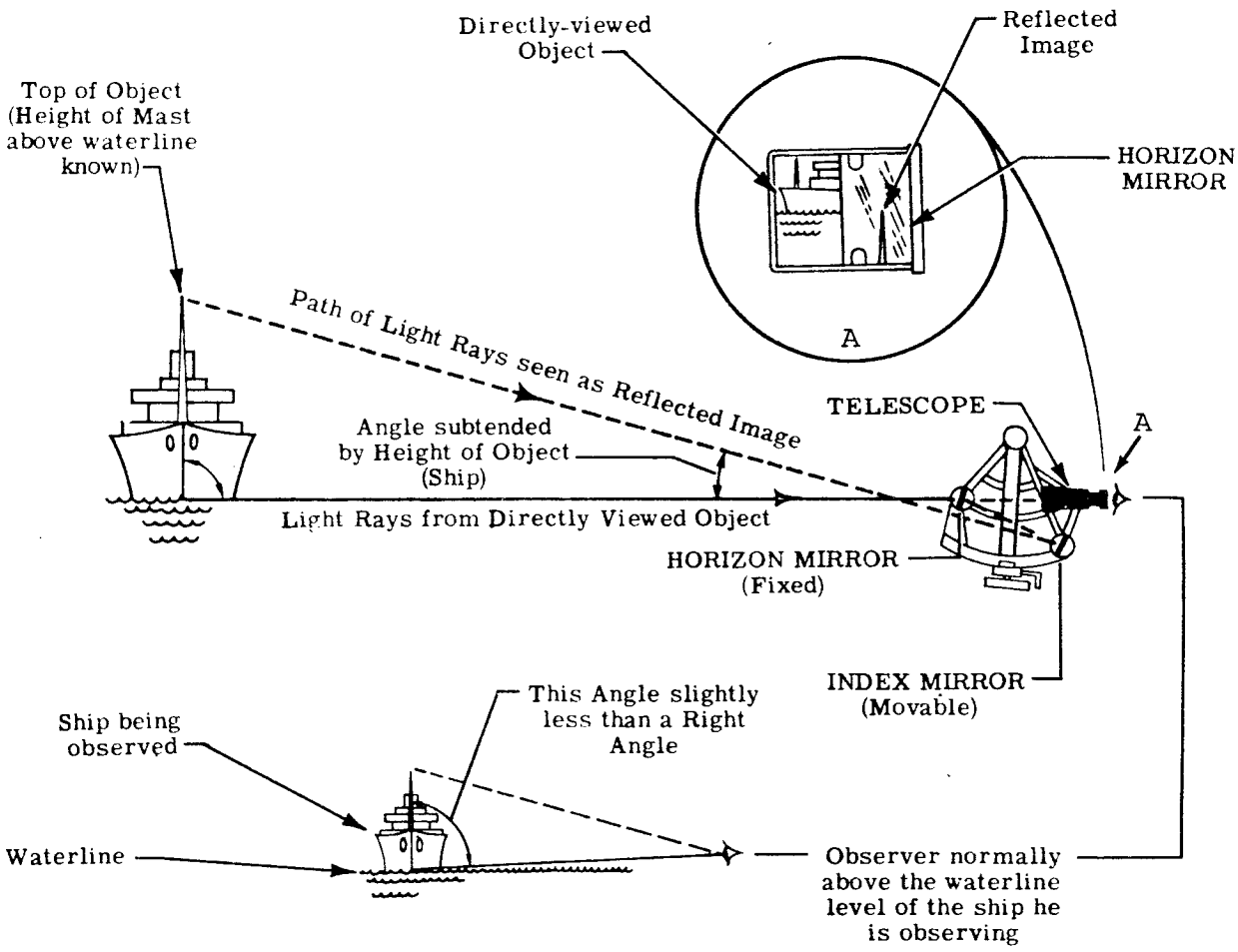
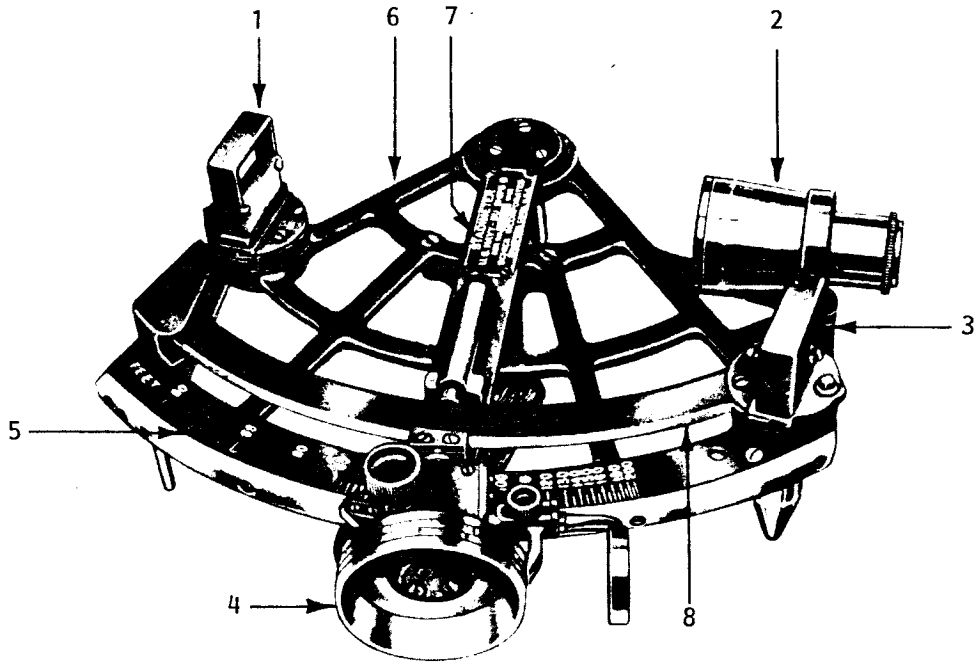


Figure 2-2. Sighting Triangle



1 - HORIZON MIRROR
2 - TELESCOPE ASSEMBLY
3 - INDEX MIRROR
4 - RANGE DRUM
5 - INDEX SCALE
6 - FRAME
7 - RADIUS ARM
8 - ARCUATE ARM

Figure 2-3. Major Components, Stadimeter

(6) of the instrument in a vertical position, the bottom of the object is viewed directly by sighting through the open half of the horizon mirror (1). At the same time, the top of the object is viewed as a reflected image, by means of the index mirror (3) and the mirror half of the horizon mirror (1). See A, Figure 2-2. The index mirror, mounted on the movable arcuate arm (8, Figure 2-3) is turned by rotating the range drum, until the reflected top of the object is made to coincide with the directly-viewed bottom of the object. At this point, the angle between the horizon mirror and the index mirror is read in terms of range in yards on the range drum. Actually, the angle (subtended by the object) being measured is twice the angle between the two mirrors (Figure 2-2). A low power telescope (2, Figure 2-3) is provided to aid in sighting.

2-3 PERFORMANCE REQUIREMENTS. There are certain performance requirements each stadimeter must meet if it is to perform properly when in use. These requirements are set forth in the following paragraphs for your information. The accuracy of all repair work has an affect on the instrument's performance and serviceable life.

2-3.1 Accuracy of Range Readings. The stadimeter is required to determine ranges with an accuracy of ± 5 percent over its limit of 200 to 10,000 yards. At the lower end of the range scale, the range drum readings are spaced much wider than at the higher end because the range readings follow the reciprocal of the tangent (cotangent) of the subtended angle. If the readings are in error due to such causes as play in the moving parts, inaccuracies of mirrors or mechanical parts, the effect will be to produce a much larger percentage of error on the greater range readings, than on the lower range readings, for any one setting on the index scale. Therefore, it will become apparent during test and adjustment that the lower range readings will be exceedingly accurate when the high range readings are within the 5 percent tolerance. This presumes the same index scale setting to eliminate variations in the accuracy of the arcuate arm.

2-3.2 Image Fidelity of Telescope. The stadimeter telescope affords a magnification of approximately twice the object image as seen with the unaided eye. The telescope is required to form a sharp, clear and bright image that is free from aberrations.

2-3.3 Quality of Mirrors. The index and horizon mirrors must be made of high quality optical glass. They are to be free from physical defects that would obscure the image. Lack of parallelism between the front and back surfaces can cause distortion of the image which would result in inaccurate range readings.

2-4 CRITICAL POINTS OF REPAIR. The instructions within the repair sections of the manuals are complete; however, there are certain critical points in the repair procedure with which you should be acquainted. Knowing them in advance will certainly save you time and trouble. Above all else, remember that there are many parts that were fitted and matched by the manufacturer to attain the necessary accuracy of the instrument. The general rule is: Keep the parts of each stadimeter together for reassembly with each other.

2-4.1 Arcuate Arm. The accuracy of the range readings is directly dependent upon the trueness of the arcuate arm of the stadimeter. Any bumps or depressions on the bearing surface of these arms is immediately reflected in the readings taken from the range drum. A variation as little as one-thousandth of an inch will cause an appreciable

error. Be especially careful in handling the arms. Protect them at all times from accidental damage.

2-4.2 Frame and Arc Shoe. Due to the frail design and construction of the arc shoe on the stadimeter, you will in all probability encounter considerable difficulty with warpage at reassembly in getting the original trueness of arc and flatness required if you remove the arc shoe from the frame. To avoid this difficulty, do not remove the arc shoe. Replacement frames are supplied with an arc shoe assembled.

2-4.3 Male and Female Centers. Because binding or end play in the centers would cause erroneous readings, the arcuate arm and radius arm must pivot freely and smoothly without any binding or play. The manufacturer went to great length to obtain a perfect fit by machining and hand lapping the male and female centers together as a unit to obtain the desired fit. You cannot interchange them with other centers; they must be kept together as originally fitted. Should it be necessary for you to replace one or the other for any reason, you must replace both the male and the female by substituting a new matched pair.

2-4.3.1 Removing Centers. The male and female centers on the arcuate arm center are fixed in respect to the frame and can be removed without requiring any realignment with the frame at reassembly. However, the female center for the radius arm of the stadimeter has been accurately positioned on the frame; so, to avoid much unnecessary work at reassembly, it should not be disturbed unless it is necessary.

2-4.4 Carriage and Drum Screw. The fit of the drum screw in its corresponding thread in the carriage is critical. The slightest play will cause errors in the range readings. Keep these fitted parts together for reassembly with each other.

2-4.5 Test, Adjustment and Final Inspection. The test and adjustment operations bring the stadimeter up to the specified performance requirements. The instrument will only be as accurate as you make it by performing the adjustment operations. All the previous work is wasted if these operations are not done carefully and accurately. The final inspection is the last opportunity to make sure that the stadimeter has been repaired properly. Perform the inspection critically.

The critical points of repair will take on added significance after you have performed the overhaul operations on a few stadimeters. Refer back to them to make sure they are firmly fixed in your mind.

SECTION III

DISASSEMBLY PROCEDURE

3-1 GENERAL. This section contains the standardized procedure for the efficient disassembly of the Stadimeter MK 5, Mod 1. Instructions for a pre-disassembly inspection are provided in paragraph 3-2. This inspection is intended to determine whether the stadimeter is worth repairing and, if so, its defects and the extent of disassembly required. The order of operations is as follows: Pre-disassembly inspection, removal of subassemblies from the frame and disassembly of the subassemblies to their component parts.

Those operations for which special tools (other than common shop tools) are needed include a reference by name and number to the proper tool. All such tools are listed in the "Special Service Tool List" in Section VIII. These tools were designed to help prevent damage to parts and to make your job easier. If you get any ideas for improving them or originating new ones, request permission from your shop supervisor to develop the idea under the Beneficial Suggestion Program.

3-2 PRE-DISASSEMBLY INSPECTION OPERATIONS. The primary purpose of this pre-disassembly inspection is to promote the overall efficiency of the repair work by determining whether or not an instrument is worth repairing; then, if it is worth repairing, by determining the defects and indicating the extent of disassembly required to permit the necessary repairs. It is obvious that unnecessary disassembly is wasted work.

The "Pre-disassembly Inspection Standards" in the Control Manual are the basis for inspection decisions. That volume also includes a description of standardized inspection techniques which are applicable to all navigational instruments; see the information referenced under "Inspection" in the index. For the performance requirements and all specific information on stadimeters, see Section II of this manual.

3-2.1 Route Ticket. A route ticket will be attached to each instrument being inspected and processed for overhaul. You will indicate your inspection decisions and the required disassembly on the route ticket. A simple code system based on common defects and referenced to the repair sections of the manual should prove to be convenient. You will also sign each route ticket upon completion of inspection.

3-2.2 Performance and Usage Data. While performing pre-disassembly inspections, you have the opportunity to observe the types and frequencies of defects which cause failures in service. This information is most valuable to the navigational instrument section of the Bureau of Ships as a factual basis for redesign and development of stadimeters. Keep statistical records of the types of failures, their frequencies and any other pertinent information on the serviceability of the instruments.. The Bureau will request this information periodically on the specific "Usage Data Check Points": as set forth in the Control Manual; however, do not hesitate to submit, through your supervisor, reports on any conditions you consider to be of importance. Your effort will be appreciated.

The parts inspector also is collecting similar data on the parts he inspects. For all reports, your supervisor will consolidate your data with his.

3-2.3 Pre-disassembly Inspection. The following inspection operations are intended to reveal all possible defects; however, each instrument will not necessarily be subjected to all tests. In general, only perform subsequent tests which are independent of defects already found. However, keep in mind that any defects overlooked will cause rejections at final inspection, resulting in loss of efficiency which this inspection is primarily intended to prevent. Record appropriate instructions on the route ticket for correction of defects that are revealed by this inspection. The standards to be upheld and the disposition of defects are defined in the Control Manual as "Pre-disassembly Inspection Standards", under the subheading "Mechanical Test Standards".

Check the stadimeter for appearance and condition of the parts. Examine the range drum and index scale markings for legibility. Check the carrying case for appearance and serviceability.

NOTE

No pre-judgment of the instruments' serviceability will be made on the results of the appearance inspection. The functional efficiency will be determined solely on the basis of the following functional tests.

Perform the operations under "Setting the Range Drum to Infinity and Checking the Arcuate Arm" as set forth in Section VI. Follow the instructions accordingly.

NOTE

For stadimeters, the arcuate arm and radius arm center caps and the arcuate arm guard must be disassembled from the frame to permit the use of the center locating and infinity setting fixture (Tool No. 8).

Set the range drum to infinity obtaining as high a degree of accuracy in these settings as the condition of the instrument will permit.

Make a graph of the deflection readings while checking the arcuate arm. These readings will indicate on this pre-disassembly inspection, the total deflection due to the following sources of error. (These sources of error have been listed as far as is practically possible in accordance with their relative order of magnitude of effect in introducing error into the instrument readings.)

a. Bent or irregular arcuate arm.

b. Backlash or play in the drum screw.

c. Slack or backlash in the radius or arcuate arm center.

Upon completion of the graph, check backlash and slack as follows in the locations mentioned in (b) and (c) above.

Lock the radius arm to the frame by tightening the lock spindle knob. Then shake the range drum.

Record all deflection readings and make note of any movement felt due to slackness or wear. If the magnitude of the back-lash or slack is near that of the total deflection readings, as shown on the graph you have drawn, then the deflection is mostly due to this cause and very little deflection is due to the arcuate arm.

Check the radius or arcuate arm center, for slack or backlash. Again record your findings.

Indicate the defects on the route ticket. Those parts to which the defects are attributable, and the magnitude of such defects, will be decided by you from an analysis of your findings during the preceding tests. Clearly indicate on the route ticket the extent of disassembly required to effectively remedy the defects.

If the stadimeter meets the requirements in the foregoing test, adjust the mirrors and perform a collimation check on the range readings at 50, 80 and 200 feet on the index scale. Follow the procedure in Section VI for these tests. Indicate defects and required disassembly on the route ticket.

NOTE

If defective mirrors are causing failure in collimation, substitute a serviceable set, recheck the instrument, and indicate mirror replacements. It is always a good policy to check mirrors before going into the collimation procedure. As you well know, the simple defects will get by you if you don't make a particular point to check for them.

Look through the stadimeter telescope assembly. The image should be bright, clear and free from distortion of shape and color. Record any defects and disposition on the route ticket.

Determine whether the stadimeter is to be overhauled, or surveyed and salvaged for parts. The basis for this decision is the "Survey and Salvage Standards" as set forth in the Control Manual. Indicate your decision on the route ticket. If the stadimeter is to be surveyed, indicate the salvaging to be performed. Serviceable subassemblies should be turned in to the Instrument Control Center for stock, under their BuShips plan and piece numbers or their inventory control numbers, as available replacements. Defective subassemblies are to be disassembled and cannibalized for serviceable parts.

Return the inspected stadimeter to the Instrument Control Center. The route ticket for each instrument should accompany it. The indicated defects and the extent of disassembly required, or directions to survey and salvage, should be completely recorded on the route ticket. The disassemblers subsequently will draw lots of similar instruments for processing together through the disassembly operations.

3-3 MAJOR-ASSEMBLY DISASSEMBLY OPERATIONS. Information that will prove to be exceedingly helpful to you will be found in the following supplementary sections of this manual: "Description", Section II; "Maintenance Parts Catalog",

Section VII; "Special Service Tools and Test Apparatus", Section VIII. Study the contents of these sections and at least learn where the information is to prepare for the time when you will need it.

3-3.1 General Precautions. To facilitate reassembly and the adjustment operations, the instructions will call for making guide marks for the matching of fitted parts and to preserve the original positioning of critical parts. Perform these operations carefully.

In general, keep all the parts of each instrument together in a parts tray for reassembly with each other. Unnecessary replacement of parts can only cause difficulties, with no profit.

Read each operation through carefully before performing it. Take care not to damage parts by forcing them. Recheck the instructions when in doubt.

3-3.2 Route Ticket. The predisassembly inspector has indicated on the route ticket what disassembly is to be done. Do only the necessary work indicated by performing the applicable disassembly operations that tell you how to do the job. If in the process of disassembly a part is damaged, make a note of it on the route ticket. All personnel who work on an instrument are required to sign the route ticket.

3-4 REMOVING THE STADIMETER TELESCOPE ASSEMBLY. The complete stadimeter assembly (less case) consists of the stadimeter telescope assembly and the stadimeter assembly itself. Refer to Figure 2-3. The disassembly operations for the stadimeter telescope assembly are placed at the end of this section (refer to disassembly operations paragraph 3-16, steps a. through f.) because those operations are to be performed by an optical instrument assembler.

CAUTION

The position of the peephole in the telescope holder is critical; do not bend or twist the telescope holder when removing the telescope. Do not touch the surfaces of the lenses in the telescope with your hands. Fingerprints have a tendency to etch optical glass which results in permanent damage.

The stadimeter telescope assembly may be in the carrying case or it may be assembled to the stadimeter. To remove it from the stadimeter assembly, proceed as follows:

a. Unscrew from the telescope holder.

b. Check the route ticket. If the pre-disassembly inspector has called for any repairs on the telescope, send it to the optical group to have the necessary disassembly done.

3-5 REMOVING THE HORIZON AND INDEX MIRRORS WITH THEIR FRAMES AND THE RANGE DRUM MAGNIFIER.

a. Remove the mirror clamping screws from the backs of the horizon mirror frame and the index mirror frame. See Figure 3-1, A and B.

b. Cover the face of the horizon mirror with lens tissue; then lift the mirror, together with its frame, from the stadimeter. Remove the index mirror and the index mirror frame in the same manner. Wrap each mirror in

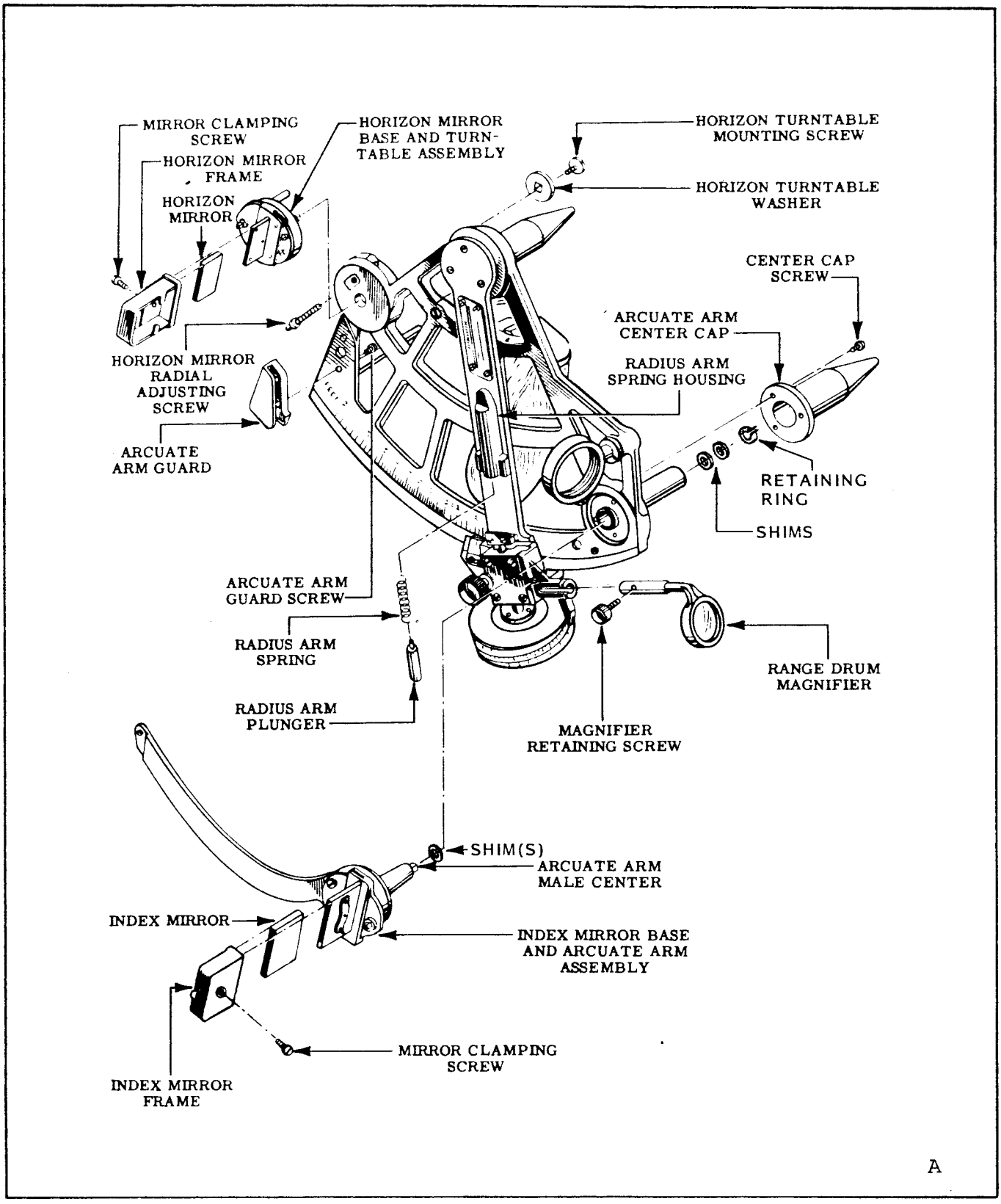


Figure 3-1. Removing Horizon and Index Mirrors with Frames and Range Drum Magnifier (Sheet 1 of 2)

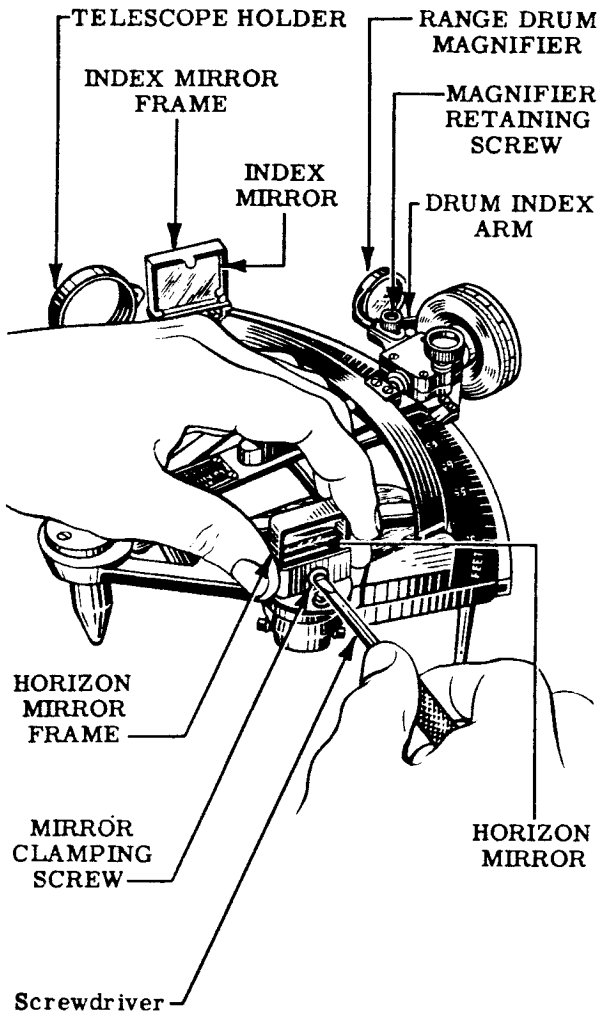


Figure 3-1. Removing Horizon and Index Mirrors with Frames and Range Drum Magnifier (Sheet 2 of 2)

lens tissue upon its removal for protective purposes. See Figure 3-1, A and B.

c. Loosen the magnifier retaining screw. See Figure 3-1, B. If it does not unscrew completely, the end has been peened over to act as a stop to prevent accidental loss. Do not force it; the enlarged end will ruin the thread in the slide bar of the magnifier.

d. Slide the range drum magnifier out of the drum index arm. See Figure 3-1, A and B.

NOTE

Do not remove the range drum magnifier lens from its frame. The range drum magnifier will be replaced as a unit if either part is defective. Also, do not disassemble the magnifier retaining screw if the end is peened to prevent it from being unscrewed completely.

3-6 REMOVING THE HORIZON MIRROR BASE AND TURNTABLE ASSEMBLY.

a. Using the adjusting screw wrench (Tool No. 1), unscrew and remove the two horizon mirror radial adjusting screws from the frame. See Figures 3-1, A and 3-2.

b. Turn the stadimeter over and use a screwdriver to remove the horizon turntable mounting screw. The horizon turntable washer and the horizon mirror base and turntable assembly now can be disassembled from the frame. See Figures 3-1, A and 3-3, A.

3-7 REMOVING THE INDEX MIRROR BASE AND ARCUATE ARM ASSEMBLY.

a. Turn over the stadimeter assembly and disassemble the arcuate arm guard from the frame by removing the two arcuate arm guard screws. See Figures 3-1, A and 3-3, A.

b. Remove the three center cap screws and remove the arcuate arm center cap. See Figures 3-1, A and 3-3, A.

c. Remove the retaining ring from the arcuate arm male center; then remove the shims, noting the order of assembly. The thick shim (.020") is assembled directly under the retaining ring.

d. Turn the stadimeter assembly right side up. Turn the range drum to the high end of its scale. Depress the radius arm plunger into the radius arm spring housing with the thumb of your left hand and lift out the index mirror base and arcuate arm assembly. See Figures 3-1, A and 3-3, B. Do Not scratch, dent or damage the arcuate arm male center. Wrap it in tissue and then set the index mirror base and arcuate arm assembly in the parts tray where it will be protected from accidental damage.

e. Remove the radius arm plunger and the radius arm spring from the radius arm spring housing on the radius arm. See Figure 3-1, A.

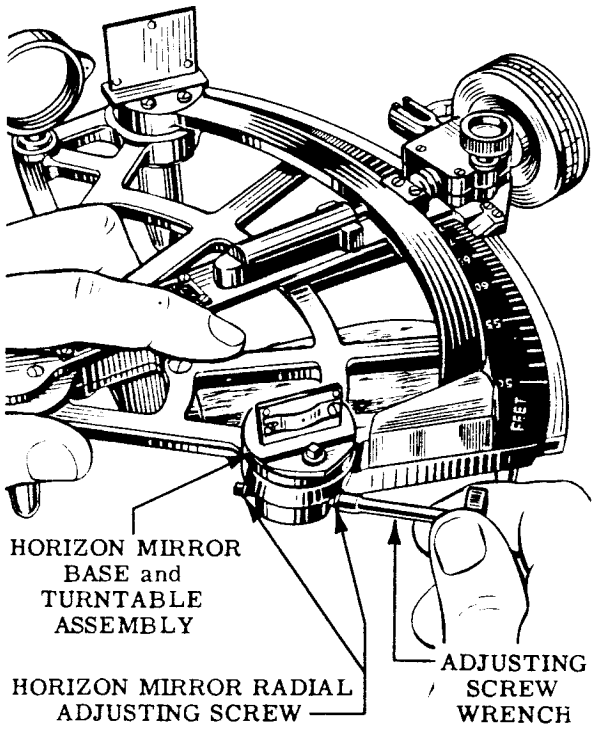
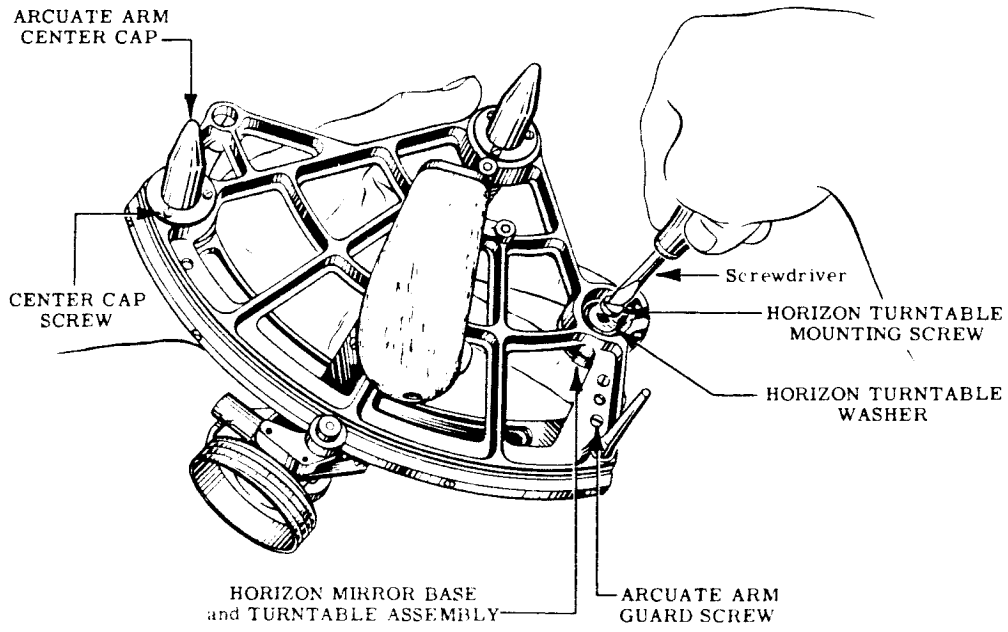


Figure 3-2. Removing the Horizon Mirror Base and Turntable Assembly



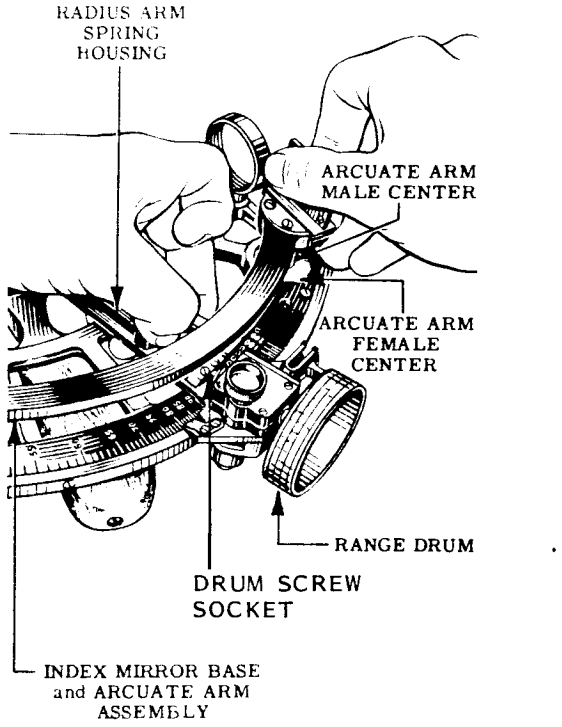


Figure 3-3. Removing the Index Mirror Base and Arcuate Arm Assembly

3-8 REMOVING THE LOCK SPINDLE, CARRIAGE AND RADIUS ARM ASSEMBLY.

a. Remove the three radius arm-to-center screws from the radius arm. See Figure 3-4, A.

b. Turn the lock spindle knob to loosen the clamping action of the lock spindle assembly on the arc of the frame. Lift the radius arm to clear the boss on the radius arm male center and slide back the lock spindle, carriage and radius arm assembly to remove it from the frame. See Figure 3-4, A and B.

3-9 REMOVING THE RADIUS ARM CENTER PARTS FROM THE FRAME.

a. Disassemble the radius arm center cap from the frame by removing the three center cap screws. See Figure 3-4, A.

b. Remove the three female center screws to disassemble the center from the frame. See Figure 3-4, A.

NOTE

The radius arm female center, male center and male center washer are matched parts. Assemble them loosely with the male center screw and wrap in tissue for protection from damage. Place in parts tray.

3-10 REMOVING THE FRAME LEG, THE ARCUATE ARM FEMALE CENTER, THE HANDLE ASSEMBLY, THE TELESCOPE HOLDER AND THE RADIUS ARM STOP SCREW.

a. Unscrew the frame leg from the frame using the frame leg pin wrench, Tool No. 2. See Figures 3-4, A and 3-5.

b. Remove the three female center screws to disassemble the arcuate arm female center from the frame. See Figures 3-4, A and 3-5.

c. The telescope holder is held to the frame by the telescope holder screw. It is dowelled to the correct position for the peephole (the small hole in the ear on the telescope holder) with the telescope holder pin. Remove the screw and pry the telescope holder off the pin. Refer to Figure 3-4, A.

NOTE

Do not disassemble the telescope holder pin. Also, keep the telescope holder with its frame for reassembly with each other.

d. Unscrew the radius arm stop screw from the top of the frame. See Figure 3-4, A.

e. Remove the three handle bracket screws to disassemble the handle assembly from the frame. See Figures 3-4, A and 3-5.

At this stage in the repair procedure, the stadimeter has been disassembled into its various subassemblies. Examine the route ticket of each particular stadimeter to see which subassemblies are to be further disassembled. Remember, these instructions tell you How; the route ticket tells you What.

3-11 SUBASSEMBLY DISASSEMBLY OPERATIONS.

3-12 DISASSEMBLING THE HANDLE ASSEMBLY. Proceed as follows:

a. Remove the handle center screw from inside the round end of the handle. Then remove the handle. See Figure 3-4, A.

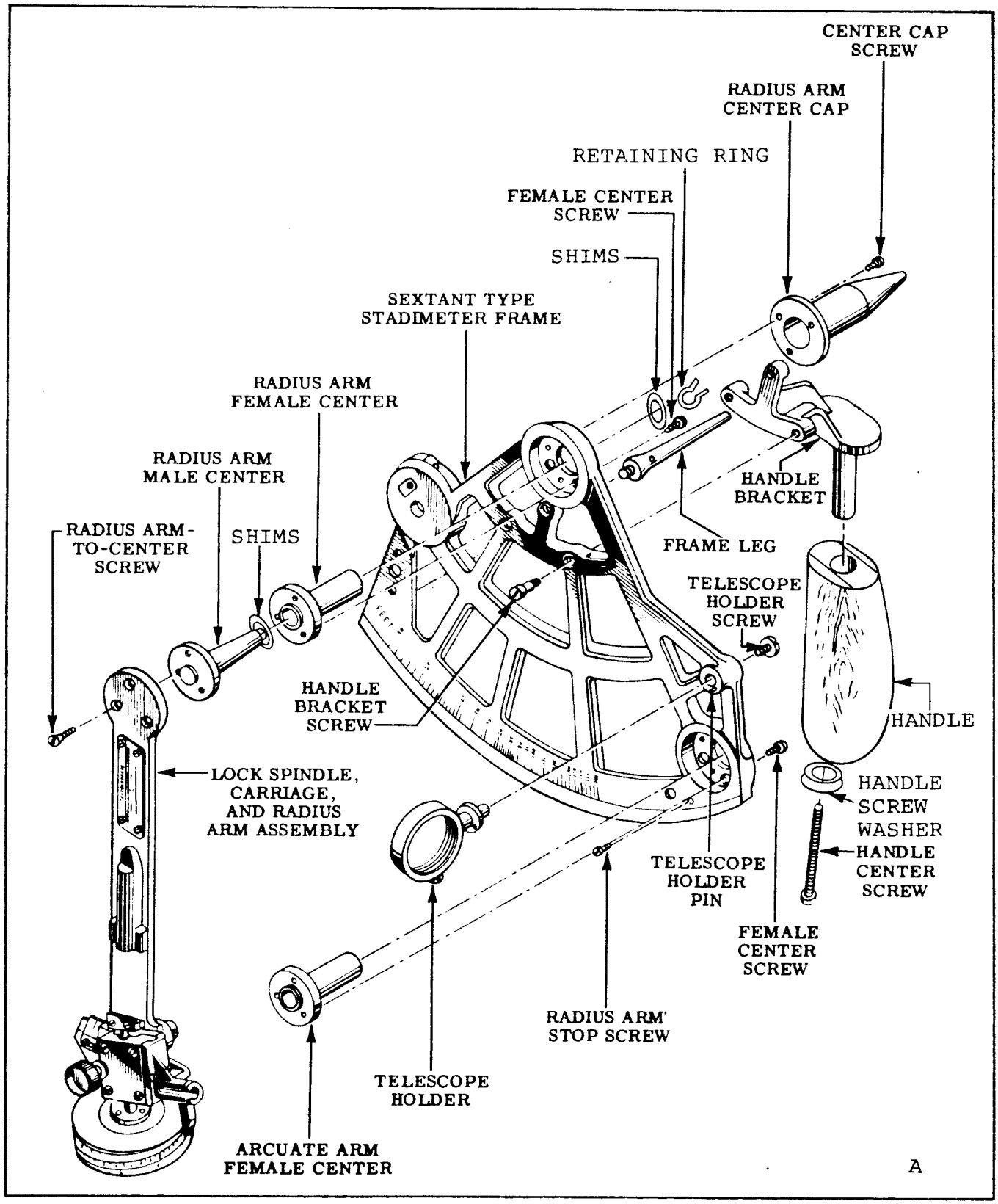
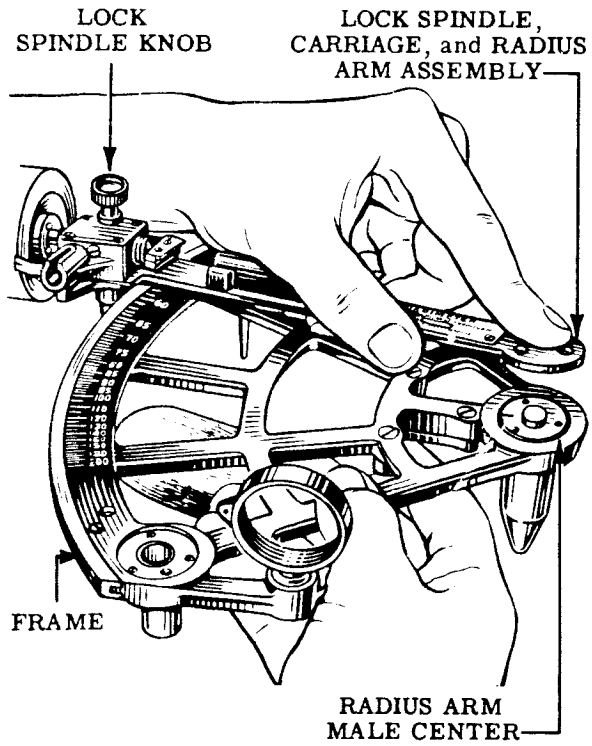


Figure 3-4. Removing the Lock Spindle, Carriage and Radius Arm Assembly (Sheet 1 of 2)



B

Figure 3-4. Removing the Lock Spindle, Carriage and Radius Arm Assembly
(Sheet 2 of 2)

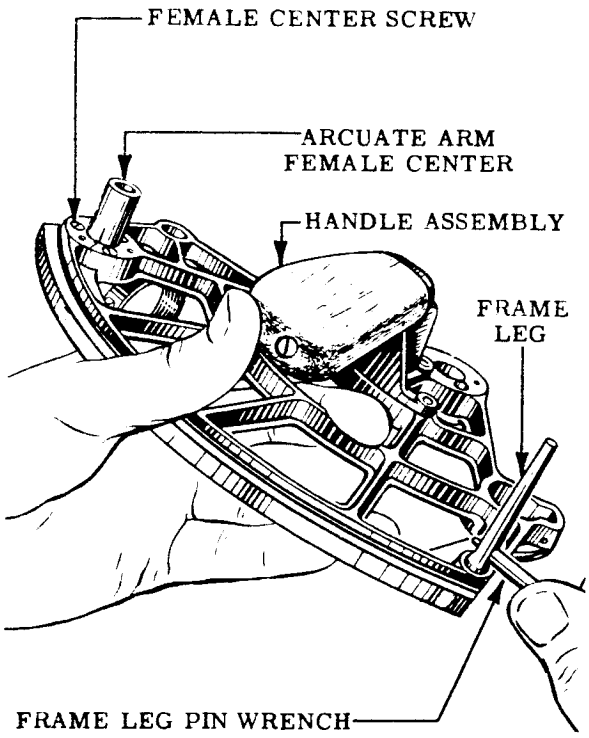


Figure 3-5. Removing the Frame Leg, the Arcuate Arm Female Center, the Handle Assembly, the Telescope Holder and the Radius Arm Stop Screw

b. Remove handle screw washer by driving it out from the flat end.

3-13 DISASSEMBLING THE LOCK SPINDLE, CARRIAGE, AND RADIUS ARM ASSEMBLY.

a. With the lock spindle collar resting on a block, use a drift pin and hammer to drive out the spindle collar stake pin. Take the lock spindle collar off the end of the lock spindle. See Figure 3-6, A.

b. Unscrew the lock spindle assembly and remove it from the carriage. The spindle lock nut, the spindle lock spring and the spindle locking plate will be disassembled at the same time. See Figure 3-6, B and C.

c. To disassemble the lock spindle assembly, drive out the spindle knob pin. Pull the lock spindle knob off the lock spindle. See Figure 3-6, B.

d. Remove the drum index arm screws and disassemble the drum index arm from the carriage. See Figure 3-6, B.

e. The lower part of the carriage is dowelled to the radius arm to maintain an angular relationship between the drum screw and the radius arm. Disassemble the carriage by removing the two radius arm-to-carriage screws. Lift the lower part of the carriage off the radius arm. The carriage-to-arm dowel pins are tight in the lower part of the carriage; do not remove them. See Figure 3-6, B.

NOTE

The two parts of the carriage are matched. The threaded hole for the drum screw was drilled and tapped in both parts at the same time. They must be kept together for reassembly to each other.

f. Remove drum socket pin by driving it out with drift pin and hammer, remove drum screw socket.

g. Screw the drum screw assembly out of the carriage. See Figure 3-6, D.

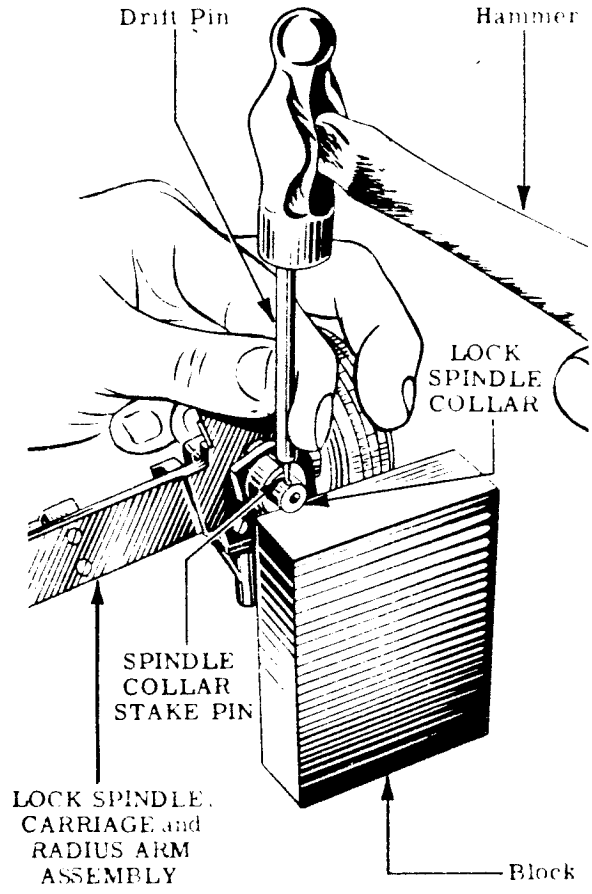
NOTE

If the drum screw assembly is frozen in the carriage, perform step h. to remove the upper part of the carriage. Then carefully lift out the drum screw assembly.

h. Remove the four (two long and two short) carriage screws that hold the two parts of the carriage together. Remove the upper part of the carriage. See Figure 3-6, B and D.

i. If the drum screw assembly is to be disassembled, scribe a reassembly guide mark on the drum screw and the range drum as shown in Figure 3-6, E. Remove the three drum clamp plate screws and disassemble the drum screw, the range drum and the drum clamp plate. See Figure 3-6, B.

j. Disassemble the radius arm spring housing from the radius arm by removing the three spring housing screws. See Figure 3-6, B.



A

Figure 3-6. Disassembling the Lock Spindle, Carriage, and Radius Arm Assembly (Sheet 1 of 3)

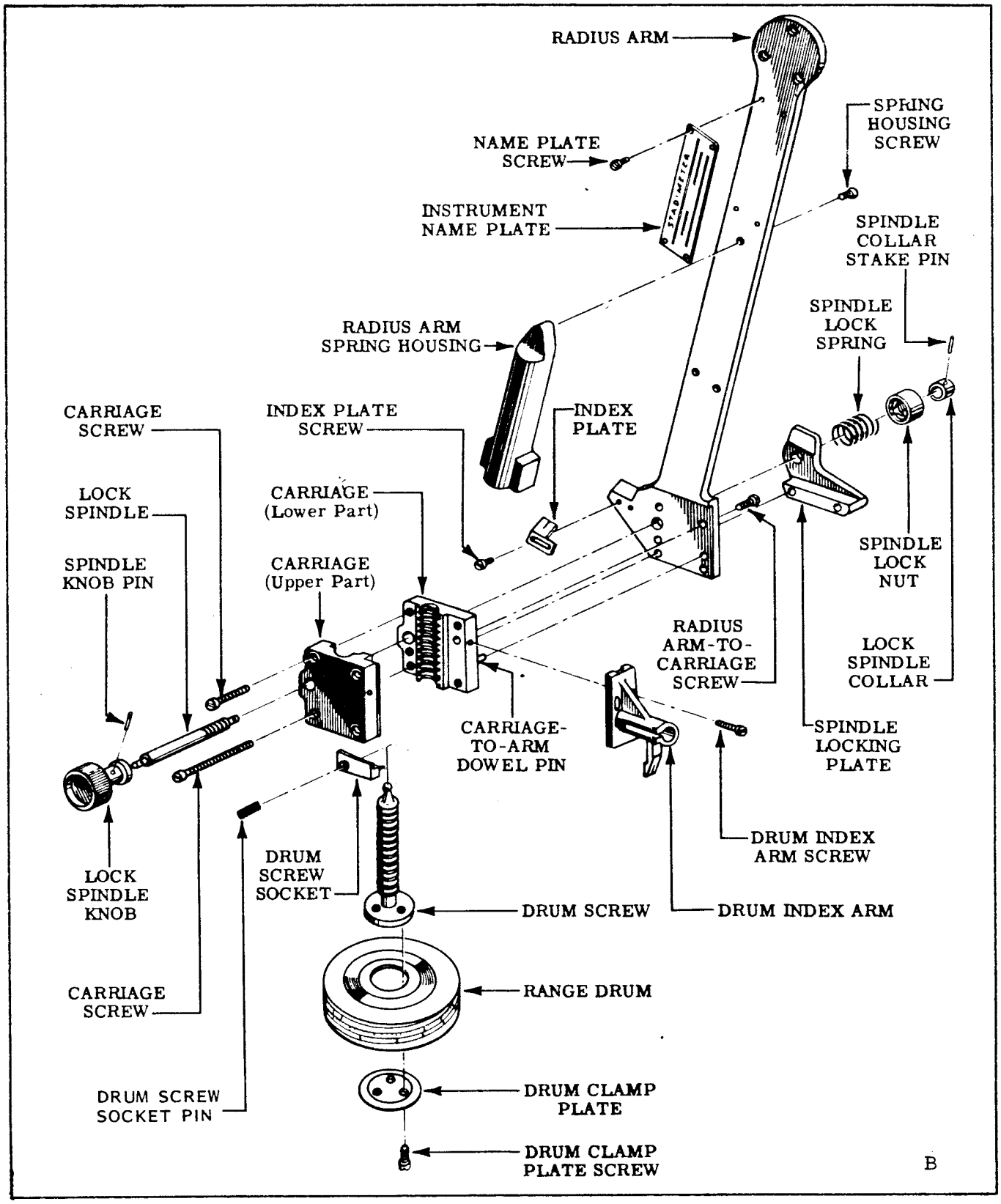


Figure 3-6. Disassembling the Lock Spindle, Carriage, and Radius Arm Assembly (Sheet 2 of 3)

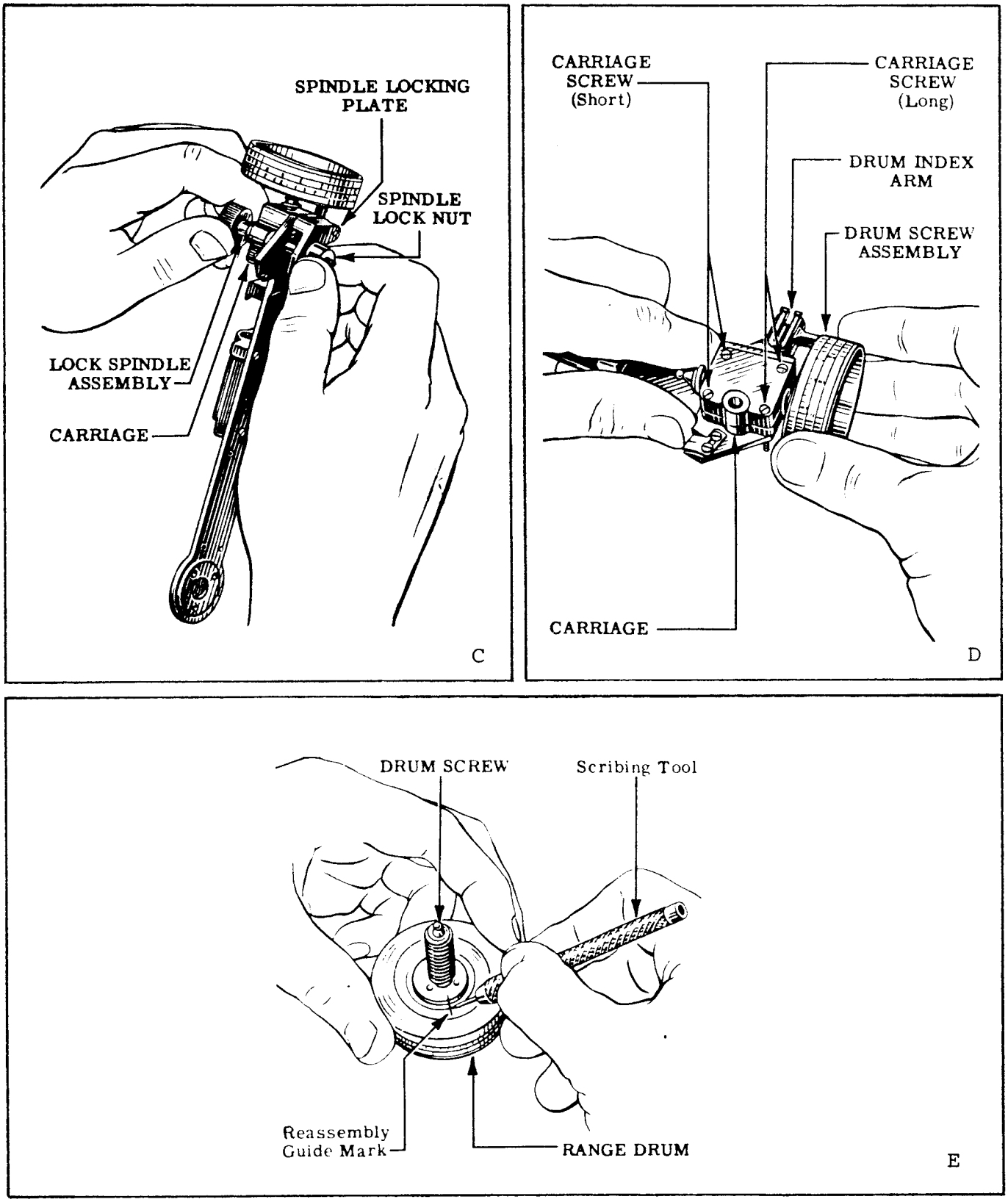


Figure 3-6. Disassembling the Lock Spindle, Carriage, and Radius Arm Assembly (Sheet 3 of 3)

k. Disassemble the index plate from the radius arm by removing the two index plate screws. See Figure 3-6, B.

l. Disassemble the instrument name plate from the radius arm by removing the four name plate screws. See Figure 3-6, B.

3-14 DISASSEMBLING THE INDEX MIRROR BASE AND ARCUATE ARM ASSEMBLY.

a. To disassemble the index mirror base and clamping spring assembly from the arcuate arm, use the adjusting screw wrench (Tool No. 1) to remove the index mirror vertical adjusting screw. See Figure 3-7, A. Then remove the two base-to-arm screws. See Figure 3-7, B.

b. The only part to be disassembled from the index mirror base and clamping spring assembly is the mirror clamping spring. Disassemble it by removing the clamping spring screw. See Figure 3-7, B.

c. If the arcuate arm male center is to be disassembled from the arcuate arm, remove the three arcuate arm-to-center screws. See Figure 3-7, B.

NOTE

The arcuate arm male center is matched to the arcuate arm female center. Keep them together at all times for reassembly as this will save you and others a considerable amount of difficulty and extra work.

3-15 DISASSEMBLING THE HORIZON MIRROR BASE AND TURNTABLE ASSEMBLY.

a. To disassemble the horizon mirror base and clamping spring assembly from the horizon mirror turntable, use the adjusting screw wrench (Tool No. 1) to unscrew the horizon mirror vertical adjusting screw. Then remove the two base-to-turntable screws. See Figure 3-8.

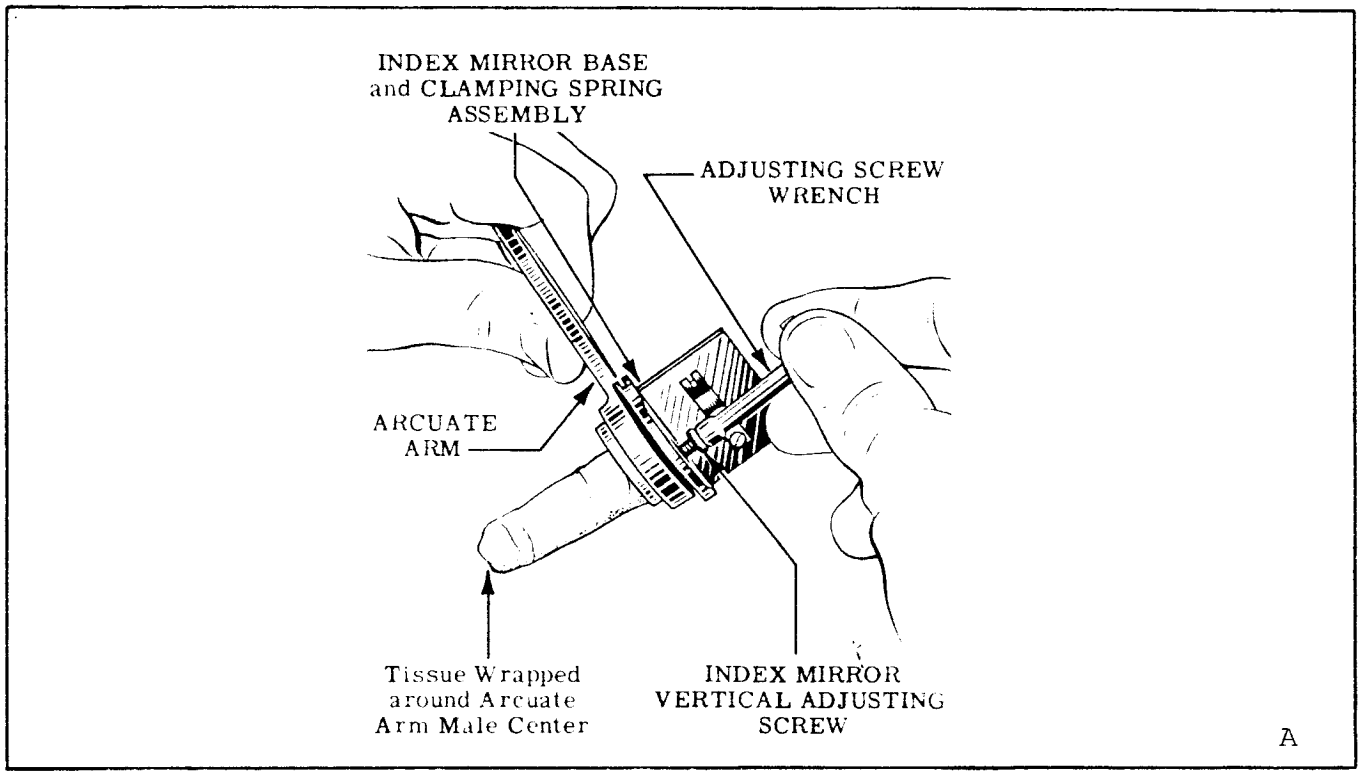
b. The only part to be disassembled from the horizon mirror base and clamping spring assembly is the mirror clamping spring. Remove the clamping spring screw to disassemble the spring. See Figure 3-8.

3-16 STADIMETER TELESCOPE ASSEMBLY DISASSEMBLY OPERATIONS.

a. Pull the eyepiece draw tube out of the telescope body by grasping the knurled shoulder of the eyepiece lens mount. Use the eyepiece clamp wrench (Tool No. 3) if it is stuck. See Figure 3-9, A.

b. Unscrew the eyepiece lens mount from the eyepiece draw tube. See Figure 3-9, B.

c. To remove the eyepiece lens from the eyepiece lens mount, use the eye lens and objective retainer ring wrench (Tool No. 4) to unscrew the eyepiece lens retainer ring. If necessary, hold the eyepiece lens mount in the eyepiece clamp wrench (Tool



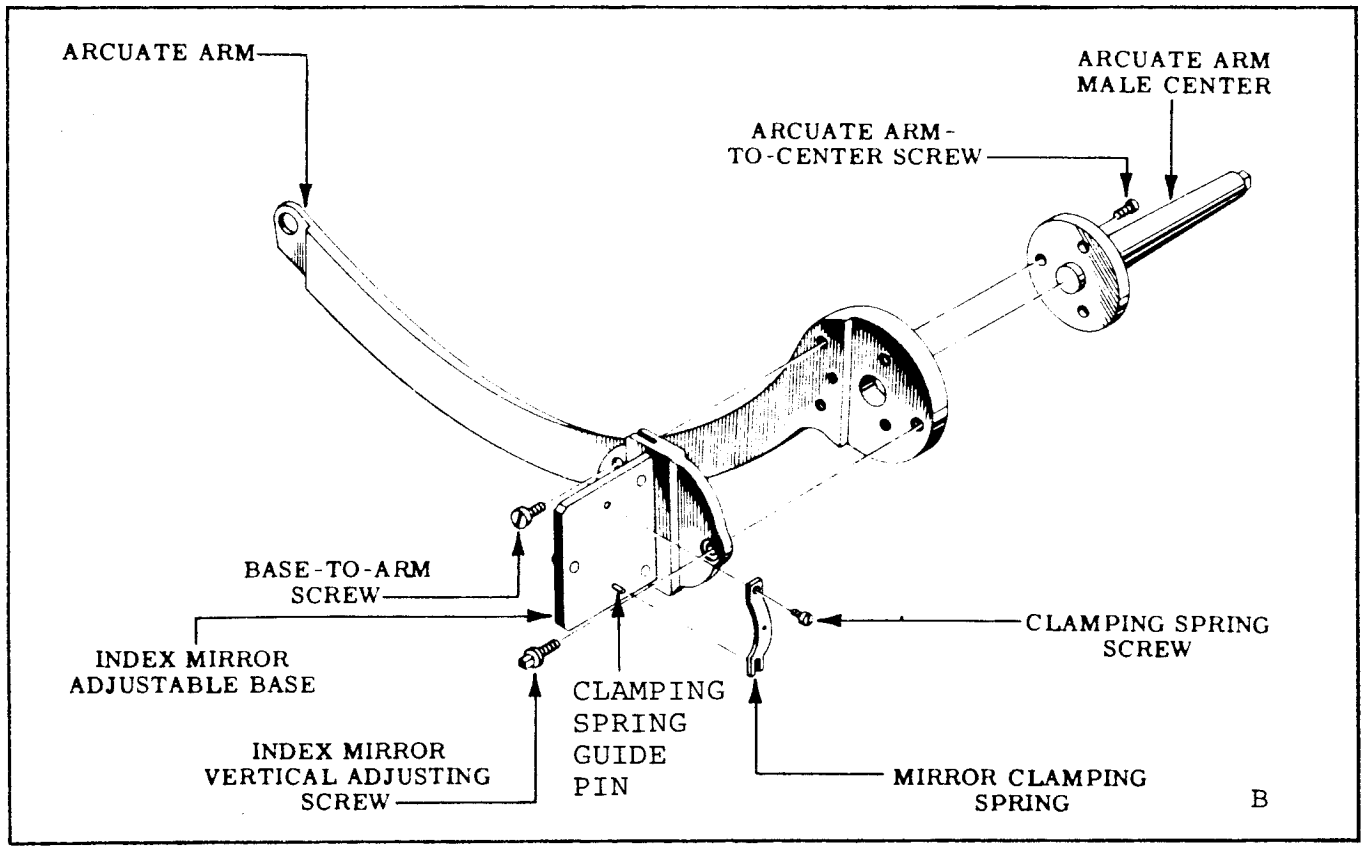
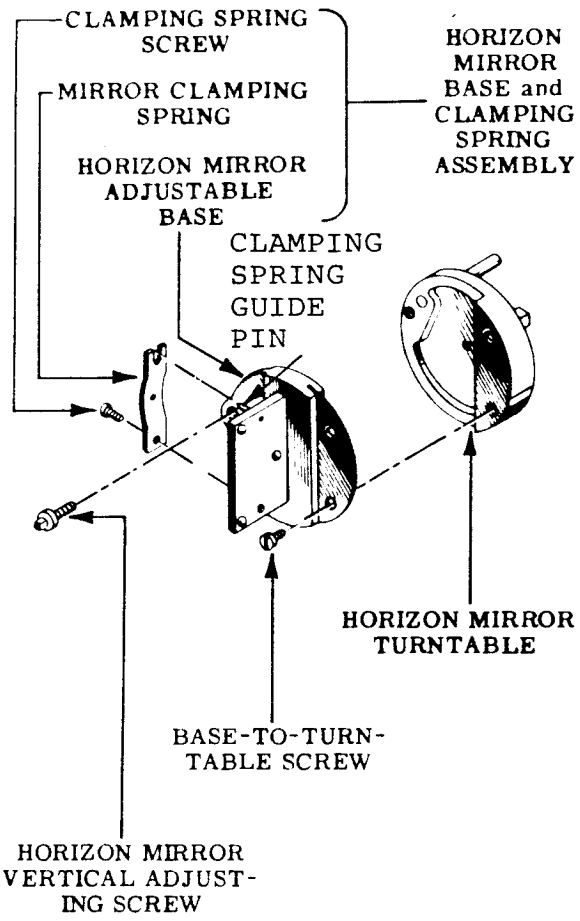
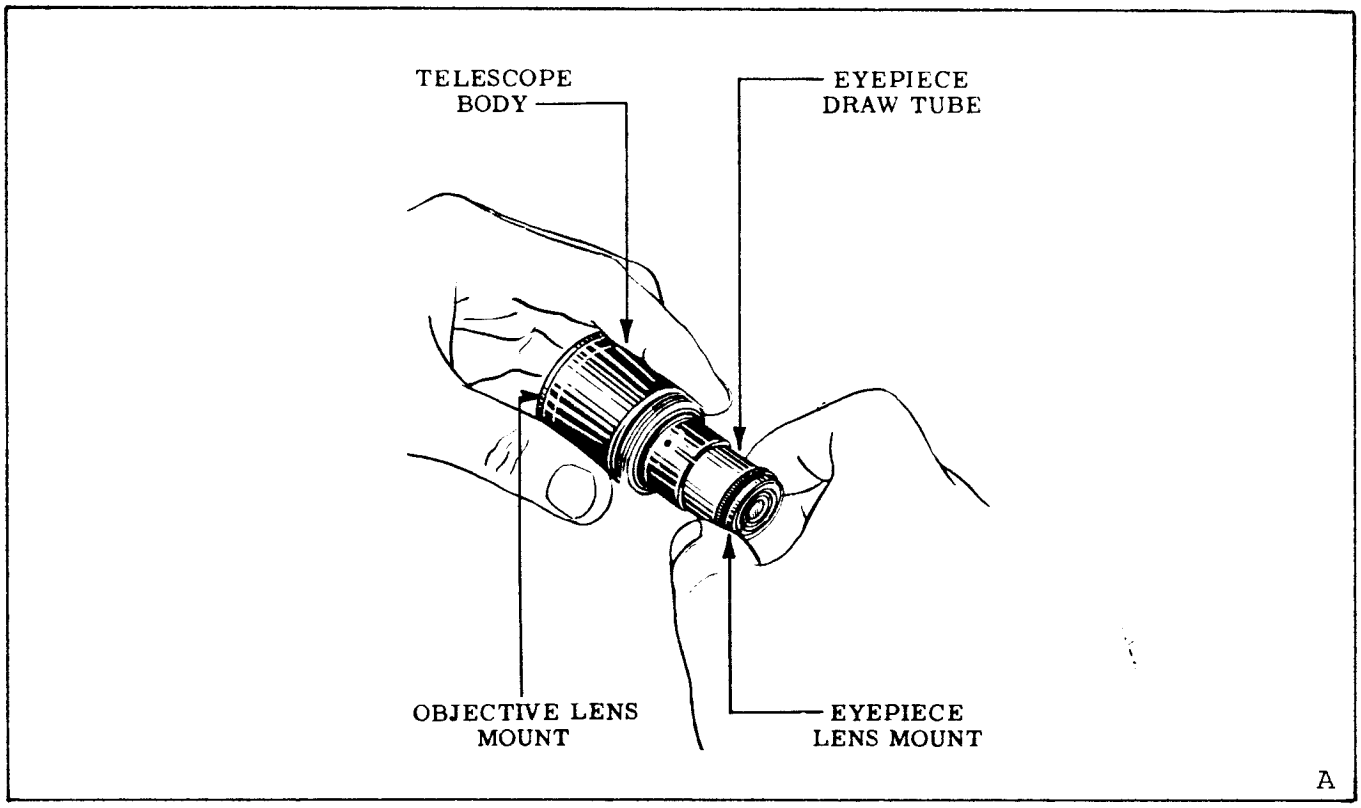


Figure 3-7. Disassembling the Index Mirror Base and Arcuate Arm Assembly



3-8. Disassembling the Horizon Mirror Base and Turntable Assembly



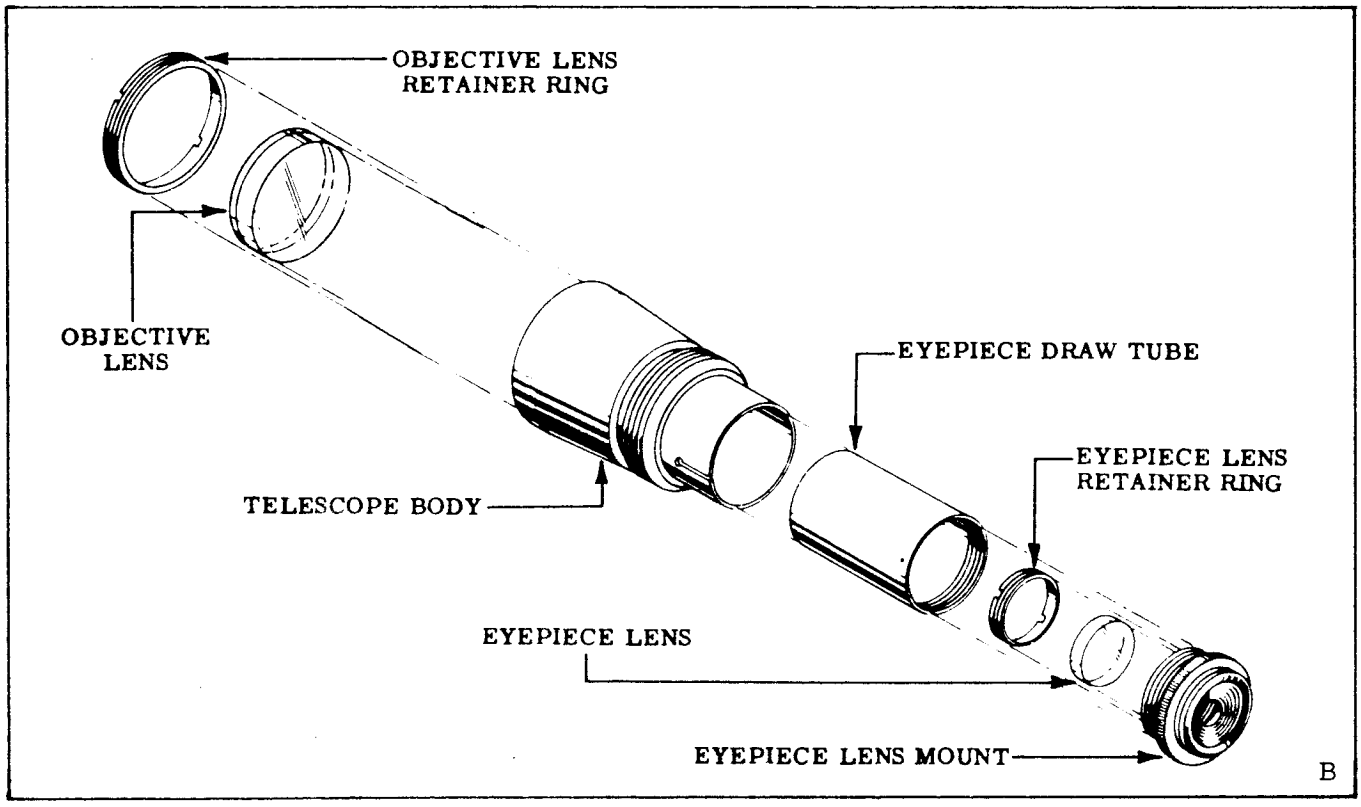


Figure 3-9. Stadimeter Telescope Assembly Disassembly Operations
(Sheet 1 of 2)

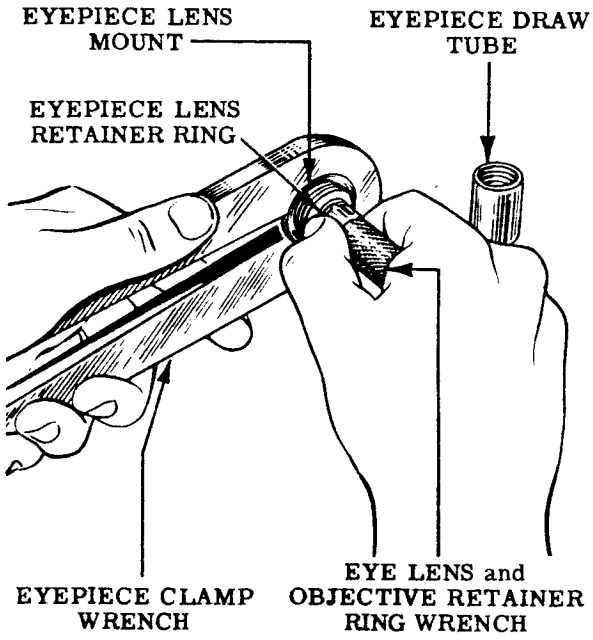


Figure 3-9. Stadimeter Telescope Assembly Disassembly Operations (Sheet 2 of 2)

No. 3) so as to obtain more leverage on the eyepiece lens retainer ring. See Figure 3-9, C.

d. The eyepiece lens is loose in the eyepiece lens mount. Catch the lens in a piece of lens tissue and wrap it in the tissue to keep it protected. See Figure 3-9, B.

e. Unscrew the objective lens retainer ring from the telescope body, using the eye lens and objective retainer ring wrench. See Figure 3-9, B.

f. Take the objective lens out of the telescope body using lens tissue to protect the lens. Wrap the lens in the tissue for safekeeping. See Figure 3-9, B.

If so specified on the route ticket, a Stadimeter MK 5, Mod 1 would have been disassembled completely at this point. In any case, when each stadimeter has been disassembled to the extent indicated on its route ticket, its parts tray is to be returned to the Instrument Control Center to await parts inspection, repair and cleaning.

SECTION IV

PARTS INSPECTION, REPAIR AND CLEANING

4-1 INTRODUCTION TO PARTS INSPECTION. The purpose of the procedure within this section is to provide a complete set of clean, serviceable parts ready for reassembly. The pre-disassembly inspection, to which each stadimeter was subjected at the outset of the overhaul procedure, was to determine and specify the instrument's defects and the disassembly required to remedy those defects. This disassembly has been performed; you receive a partially disassembled instrument. Read the route ticket to find out what defects were revealed by the pre-disassembly inspection. Then examine the disassembled parts to "trouble-shoot" the original defect by detecting the malfunctioning parts. Suitable repairs and replacements are to be made. Those parts which are not disassembled have been judged to be serviceable by the pre-disassembly inspector. The mirrors, the lenses of the telescope and their attaching parts are possible exceptions; they may have been disassembled for cleaning only. However, you will only inspect the optical parts for the condition of the cement in doublets and the mirrored surfaces. The pre-disassembly inspector will indicate, on the route ticket, when replacements are necessary for any other reason.

The applicable "Parts Inspection Standards" as referenced in the index of the Control Manual are to be observed. You also should be familiar with the standard procedures and techniques in the Control Manual under the headings "Overhaul and Repair" and "Inspection".

4-2 PERFORMANCE AND USAGE DATA. An important by-product of this inspection and the pre-disassembly inspection is the collection of data on the nature and frequency of the defects and failures of parts. You are asked to record such data in statistical form. The navigational instrument section of the Bureau of Ships will periodically request this information from you and the pre-disassembly inspector. However, if you notice any condition you consider to be of special importance, report it to your supervisor. He will consolidate your data with that being collected by the pre-disassembly inspector and submit a joint report to the Bureau of Ships.

4-3 PARTS INSPECTION OPERATIONS. The "Maintenance Parts Catalog", Section VII, is your source for identifying parts when requisitioning replacements. The parts lists also indicate those parts which must be replaced as a subassembly or in matched sets and not individually.

The parts for each stadimeter are contained in an individual parts tray. Keep the sets of parts segregated in their respective parts trays so that the reassemblers will get all the original parts except for replacements.

4-3.1 Optical Parts Inspection. The applicable inspection standards are set forth in the Control Manual under "Parts Inspection Standards - Optical Test Standards" which includes the allowable repair times (if authorized) for recementing lenses and re-silvering mirrors.

a. Inspect the objective lens of the stadimeter telescope assembly for defects in the cement between the elements. See the "Definition of Optical Defects" and the "Parts Inspection Standards" in the Control Manual.

b. Inspect the horizon and index mirrors for the condition of the silvering. See "Parts Inspection Standards" in the Control Manual.

c. If authorized, have recementing of lenses and mirror repairs performed in accordance with the standardized procedures under "Overhaul and Repair" in the Control Manual. Otherwise, replace the defective parts.

4-3.2 Mechanical Parts Inspection. The inspection standards and disposition of mechanical parts also are covered by the "Parts Inspection Standards" as set forth in the Control Manual. These standards include the authorization to repair or replace and the allowable repair time for individual parts. The mechanical parts inspections follow:

a. Inspect all mechanical parts for material defects such as dents, burrs, distortions wear and damaged threads that affect the function of the part - not its appearance. On the basis of the "Parts Inspection Standards" determine the disposition of the parts. Write on the route ticket the required repairs and the allowable repair time for the individual repairs. Have the repair work done by the repairman. See "Parts Repair Operations" in this section.

b. There should be a telescope holder pin in the top of the frame directly in back of the hole for the telescope holder. The telescope holder should have a corresponding hole in the flange at its base. Send the telescope holder, the frame and a telescope holder pin to the parts repairman to have the telescope holder positioned and dowelled to the frame. See "Parts Repair Operations" in this section.

c. Inspect the mechanical parts for appearance and condition of finishes. The allowable repair times for the correction of appearance defects also are given in the "Parts Inspection Standards" in the Control Manual. Indicate, on the route ticket, the work to be done and the allowable repair time for the individual parts. Have such work done in accordance with the applicable procedures as described in the Control Manual.

4-3.3 Matched Parts. The heart of the stadimeter is the drum screw and the carriage into which it is fitted in a thread. These parts are matched. Have the parts repairman perform an inspection and fitting procedure on these parts for all instruments. See "Parts Repair Operations" in this section.

The male and female center of each center assembly are matched parts. The "Parts Repair Operations" include instructions for adjusting the fit of centers.

4-4 PARTS REPAIR OPERATIONS. The parts inspector will send you parts that are in need of repair with information on what repairs are to be made and the allowable repair time. In the case of the drum screw and carriage, you will inspect and fit these parts for every stadimeter undergoing repair.

Familiarize yourself with the allowable repair time for the individual parts, as specified under "Parts Inspection Standards" in the Control Manual. If, in your judgment, you cannot complete a satisfactory repair in the authorized time, report to your supervisor. He will resolve the question with the parts inspector.

Common repair techniques are described in the Control Manual. The following procedures are those peculiar to stadimeters.

4-4.1 Fitting The Drum Screw to the Carriage. The drum screw fits into the two sections of the carriage in a 3/8"-9 American National Acme thread, Class 3 fit. The close fit is required to eliminate play in the drum screw; a one-thousandth of an inch side shake or back lash (end shake) will cause an appreciable error in the range readings.

The thread wears from use, causing play in the drum screw. To fit the parts, proceed as follows:

a. Clean the parts to remove the old grease. Test the fit of the drum screw in the carriage for side shake and end shake. See Figure 3-6, B. (The range drum was not disassembled from the drum screw in these cases.) Test for play in the drum screw throughout its travel in the carriage. If the screw is much looser at certain depths, it indicates uneven wear in the drum screw; replace the drum screw with a new one.

b. If a new drum screw or an original one is loose, try shifting the upper part of the carriage in the direction of the length of the drum screw. Loosen the four carriage screws before shifting the upper part. See Figure 3-6, B. Then tighten them in the new position. The step keeps the threaded portion of the upper and lower parts of the carriage aligned. These carriages are shown in Figure 3-6, B. If this eliminates play of the drum screw in the carriage, make a note of it on the route ticket for the reassembler; indicate a shift of the top part toward or away from the head of the drum screw. If it does not eliminate play, refer to the following operation.

c. Adjustment will be made by separating the two parts of its carriage and draw filing the contact faces of these two parts. Use a fine Swiss file for this work, which will have the effect of closing up the threaded hole for the drum screw. Remove only a slight amount of material because this adjustment makes the hole egg-shaped (ovate), resulting in pressure being put on the tops of crests of the threads which causes rapid wear. Reassemble the parts and try the fit of the drum screw.

   This method of adjustment may be used if sufficient adjustment cannot be obtained by the method outlined in step b.

d. For fitting new drum screws and also original screws that do not fit after the parts of the carriage block have been filed down, a set of six drum screw taps (Tool No. 5), that range from two-thousandths below to four and one-half thousandths above the nominal of three-eights of an inch, are provided for tapping the carriage. Start with the smallest tap and try the drum screw. Then try each next larger size in turn until a fit is obtained.

If the foregoing procedures will not easily produce a good fit, indicate your work on the route ticket and request replacement parts.

4-4.2 Positioning and Pinning the Telescope Holder. The telescope holder must be positioned on the frame so that a mounted telescope will "look" through the pivot center of the horizon mirror turntable, that is, the optical center of the telescope will be in line with the mirror pivotal point. The telescope holder pin is tight in the frame and a sliding fit in the telescope holder. Proceed as follows to drill the holes for the pin when the telescope holder is in correct position and to assemble the pin in the frame.

a. Mount the telescope holder on the frame with a modified telescope holder screw (the head diameter of the screw should be cut down to one-quarter inch). Assemble the telescope holder pin drill jig (part of Tool No. 7), to be used with the particular type of stadimeter on which you are working, under the head of the screw as a washer. Do not tighten the screw. See Figure 4-1.

NOTE

If a telescope holder pin is assembled in the frame and only the telescope holder is being replaced, pull out the pin and follow the procedure.

b. Screw the plug of the telescope alignment fixture, with pin drill jig (Tool No. 7) into the telescope holder. Mount the block of the alignment fixture as the horizon mirror turntable is usually mounted with a block mounting screw from underneath the frame. Then slide the rod through the holes in the plug and the block by turning them into alignment. The telescope holder should be set with its ear on the left side, looking from the holder towards the block. See Figure 4-1.

c. When the rod is free in the block and the plug, securely tighten the screw holding the telescope holder but be sure to position the telescope holder pin drill jig as shown in the underside view in Figure 4-1.

NOTE

If the frame has a hole for the pin, turn the drill jig to bring the slot over the existing hole.

d. Drill a hole through the frame and the flange on the telescope holder with a #53 (.0595 in.) drill, using the telescope holder pin drill jig locating hole to position the drill.

e. Disassemble all the parts of the telescope holder alignment fixture and the telescope holder from the frame.

f. Enlarge the drilled hole in the telescope holder for clearance so that the telescope holder pin will slide easily. Drill through with a 0.0625 inch drill to enlarge the hole.

g. Tap a telescope holder pin into the hole in the frame. Let it project 1/16 to 3/32 inch above the top of the frame.

4-4.3 Fitting a Male Center and a Female Center. The male and female center of all center assemblies are matched parts and they are not replaceable individually. When assembled there must be no excessive side shake or end play. The fit must be smooth and close.

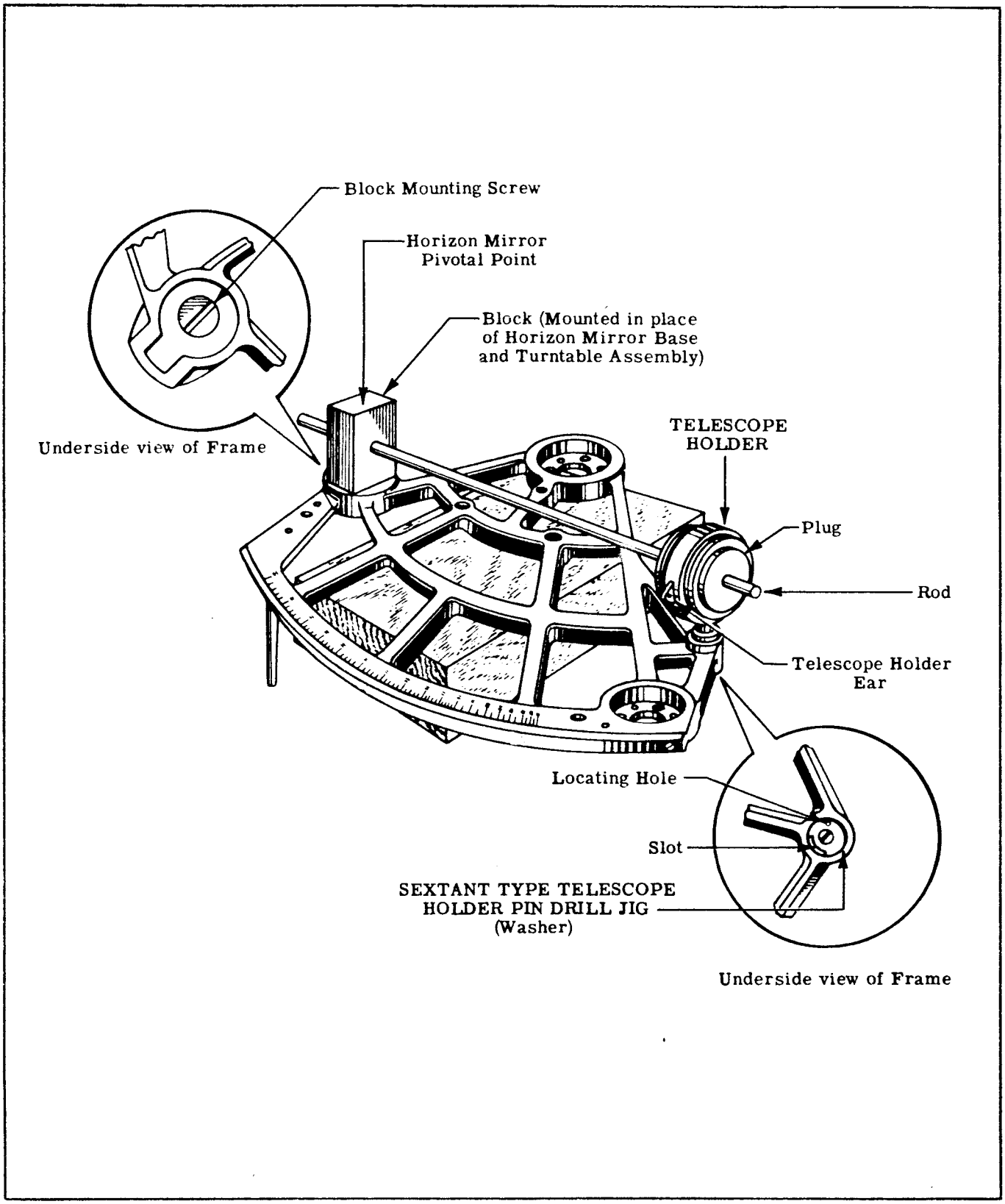


Figure 4-1. Positioning and Pinning the Telescope Holder

4-4.4 End Play Elimination. The Mark 5 Mod 1 has a re-designed center assembly. See Figure 4-2. Shims are employed to establish end play and thereby to control radial play. The male and female centers are separated by shims to provide a minimum of radial play. If the pair of centers, scrupulously clean, are placed together they will lock-up. The space between the two shoulders can be determined by using a standard thickness gauge. Shims measuring .002 more than the determined space, assembled between the two centers, should provide free motion with very little radial play. (In theory there is a 24-1 ratio between end play and radial play; the taper being 1/2 inch/foot. Therefore an end play of .0024 will result in approximately .0001 radial play.)

Shims are also employed between the female center and the external retaining ring. The retaining ring secures the assembly. The shims determine end play. One shim is a .020 thick spacer and is always used and is always just below the retaining ring. This precludes the possibility of a thin shim sliding into the retaining ring groove. Shims should be fitted to provide .001 - .003 end play.

If the shims from the original assembly are used, they will almost certainly provide the proper play, since wear on this assembly is minimal.

4-5 CLEANING OPERATIONS. Keep the parts of each stadimeter together; do not mix up the parts of different ones.

a. Clean all the disassembled mechanical parts. The standard procedure is set forth under "Cleaning--Optical and Mechanical" in the Control Manual.

b. Clean only those optical parts for which you receive special instructions.

c. Clean off any paint from surfaces where it would interfere with easy reassembly or spoil the function or appearance of the stadimeter undergoing repair.

d. Chase the threads in tapped holes and on parts where necessary to remove paint and corrosion. Use commercial thread chasers and old taps. Be sure to check the thread size and tool type with the parts inspector. The wrong size tool will ruin the thread.

4-6 GENERAL INSTRUCTIONS. As stated at the beginning of this section, it is your responsibility, as parts inspector, to prepare a complete set of serviceable parts for the reassemblers. Your work is not complete until you have inspected all repaired parts and made sure that proper and complete replacements have been made. The following additional operations will complete your inspection procedure:

a. Have all the mechanical parts cleaned. See "Cleaning Operations" in this section. The cleaning work is to include chasing all threads and the removal of undesired paint and corrosion, as necessary for easy reassembly.

b. The parts are to be returned to you after repair and cleaning. Re-inspect them as required, to fulfill your responsibility.

c. When you are satisfied with the repaired parts, obtain the necessary replacements to complete the set of parts. Then return the complete parts tray to the Instrument Control Center.

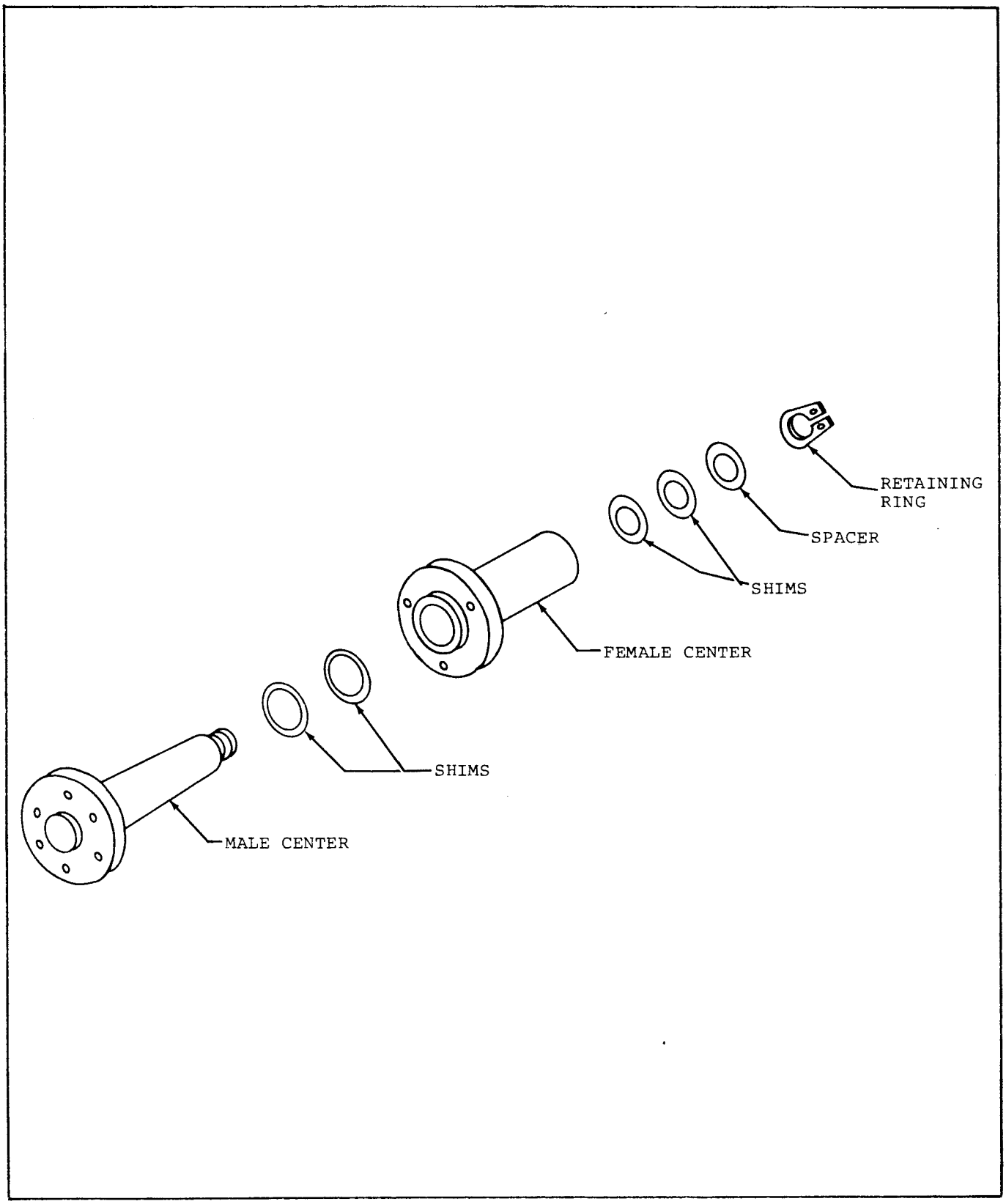


Figure 4-2. Fitting a Male Center and Female Center

SECTION V

REASSEMBLY PROCEDURE, SEXTANT TYPE, MARK 5, MOD 1

5-1 GENERAL. This section describes in detail the standardized procedure for the reassembly of Sextant Type MK 5, Mod 1 Stadimeters.

The order of the reassembly procedures is as follows: The individual parts first are reassembled to make up the subassemblies. Then the subassemblies are attached to each other to form the major assembly.

Before you begin the actual work of reassembly, it is important that you have a familiarization with the functions of the various parts of the stadimeter. You should also know the performance requirements which the instrument must meet. See "Description", Section II for this information. Also study the exploded views and corresponding parts lists in the "Maintenance Parts Catalog", Section VII. From these you can become familiar with the names, physical appearance and relationship of the various parts and subassemblies.

5-2 REASSEMBLY PROCEDURE.

5-2.1 Special Tools. As in the case of the disassembly operations, a few special tools have been provided to make your job of reassembly easier and to minimize the chances of damage to the parts. The text calls for the proper tool by name and number as indexed and illustrated in Section VIII. In most cases, the tool is illustrated in use, in connection with the required operation.

If you can suggest improvements on existing tools or devise new ones that will make your job easier, by all means do so through the Beneficial Suggestion Program at your repair facility.

5-2.2 Reassembling Fitted Parts. To facilitate the adjustment operations and to insure the proper functioning of the instrument, some parts have been marked and paired for reassembly with each other in certain positions. Perform the reassembly operations carefully, using matched parts. In general, do not mix parts of one stadimeter with those of another. See "Critical Points of Repair" in Section II for further information.

5-2.3 Lubrication. The proper functioning of movable parts is dependent upon the use of the right kind of lubricant. The Navy and manufacturers have done considerable research to find suitable lubricants. Never use ordinary greases or lubricants; use only the lubricant specified and apply it in accordance with the procedures in the Control Manual as indexed under "Lubrication".

5-2.4 General Precautions. You will receive a complete set of clean and serviceable parts from the Instrument Control Center. Protect the parts from accidental damage. Keep them covered to preserve their cleanliness if there is any delay in reassembly.

Read each operation through carefully before performing it. Check your work with the illustrations. Work carefully and accurately. When your name goes on the route ticket, indicating completion of reassembly, be sure that the job has been well done.

5-2.5 Route Ticket. Each stadimeter has a route ticket on which the pre-disassembly inspector has indicated the required disassembly. Therefore, the instruments will vary as to the extent to which they are disassembled. The

instructions within this section tell you how to reassemble and the condition of the stadimeter determines what needs to be reassembled. Each person who performs any of the reassembly operations is required to sign the route ticket of each instrument.

5-3 SUBASSEMBLY REASSEMBLY OPERATIONS.

5-3.1 Reassembling The Horizon Mirror Base and Turntable Assembly.

a. Assemble the mirror clamping spring to the back of the horizon mirror adjustable base with a clamping spring screw. See Figure 3-7, B. The slot in the end of the mirror clamping spring fits around the clamping spring guide pin. Check the horizon mirror adjustable base to see that the guide pin is assembled; if it is not, tap a guide pin into the hole in the back of the horizon mirror adjustable base. Support the base under the hole but do not rest it on the three mirror fulcrum rivets.

b. Assemble the horizon mirror base (see Figure 3-8) and clamping spring assembly to the horizon mirror turntable with two base-to-turntable screws and one horizon mirror vertical adjusting screw. Use the adjusting screw wrench (Tool No. 1) (Figure 3-7, A) on the adjusting screw.

5-3.2 Reassembling The Index Mirror Base and Arcuate Arm Assembly.

a. Assemble the mirror clamping spring to the back of the index mirror adjustable base with a clamping spring screw. See Figure 3-7, B. The slot in the end of the mirror clamping spring fits around the clamping spring guide pin. Check the index mirror adjustable base to see that the guide pin is assembled; if it is not, tap a guide pin into the hole in the back of the index mirror adjustable base. Support the base under the hole, but do not rest it on the three mirror fulcrum rivets.

b. Assemble the index mirror base and clamping spring assembly to the arcuate arm with two base-to-arm screws and one index mirror vertical adjusting screw. See Figure 3-7, B. Use the adjusting screw wrench (Tool No. 1) on the adjusting screw as shown in Figure 3-7, A.

c. Assemble three arcuate arm-to-center screws. See Figure 3-7, B. The arcuate arm male center should be wrapped in tissue to prevent accidental damage to its tapered bearing surface. See Figure 3-7, A.

NOTE

The arcuate arm male center is matched and fitted to the arcuate arm female center. Be sure to have these parts properly matched for reassembly. Such simple precautions as these serve to make the job of reassembly that much simpler. They also help insure the outcome in the final test and inspection.

5-3.3 Reassembling The Lock Spindle Carriage and Radius Arm Assembly.

a. Assemble the instrument name plate to the radius arm with four name plate screws. See Figure 3-6, B.

b. Assemble the index plate to the radius arm with two index plate screws. See Figure 3-6, B. Do not tighten the screws.

c. Assemble the radius arm spring housing to the radius arm with three spring housing screws. See Figure 3-6, B.

d. Place the upper part of the carriage on the lower part. Assemble two short carriage screws in the holes in the carriage which are towards the radius arm spring housing. Assemble two long carriage screws in the front two holes in the carriage. The long screws go through the radius arm. See Figure 3-6, B. Do not tighten the screws.

NOTE

The two parts of the carriage are matched parts. They must be reassembled together.

e. Assemble the range drum to the drum screw with the drum clamp plate and three drum clamp plate screws. See Figure 3-6, B. Look for a reassembly guide mark on the head of the drum screw and the back of the range drum. These parts comprise the drum screw assembly. See Figure 3-6, E. Align the marks and tighten the clamp plate screws.

f. If the guide mark is missing, tighten the screws for convenience in reassembly. The drum will be positioned during test and adjustment in Section VI.

g. Apply a film of drum screw grease on the threads of the drum screw. See "Lubrication" in the Control Manual for the standardized procedure.

h. Screw the drum screw assembly into the carriage. Run the screw back and forth to distribute the grease. Wipe off any excess that may be squeezed out.

i. Try the fit of the drum screw in the carriage. No play is permissible. The parts repairman indicated on the route ticket how the upper part of the carriage is to be shifted to get a close fit. Shift the upper part of the carriage and tighten the carriage screws.

j. Apply a thin film of drum screw socket oil on the ball end of the drum screw. See "Lubrication" in the Control Manual.

k. Assemble the drum screw socket to the end of the drum screw and secure with drum screw pin. See Figure 3-6, B.

l. Assemble the lower part of the carriage to the radius arm. The two carriage-to-arm dowel pins are tight in the carriage. They should be a sliding fit in the matching holes in the radius arm. Secure the parts by assembling two radius arm-to-carriage screws. See Figure 3-6, B.

m. Attach the drum index arm to the side of the carriage with two drum index arm screws. See Figure 3-6, B. Do not tighten the screws.

n. Reassemble the lock spindle assembly by inserting the lock spindle in the lock spindle knob and tapping in a spindle knob pin. See Figure 3-6, B.

o. Lubricate the lock spindle with lock spindle grease. Then insert it into the carriage. See "Lubrication" in the Control Manual. See Figure 3-6, B.

p. Assemble the spindle locking plate on the lock spindle assembly and the protruding ends of the two long carriage screws. See Figures 3-6, B and C.

q. Slip the spindle lock spring onto the end of the lock spindle. See Figure 3-6, B.

r. Start the spindle lock nut on the threads of the lock spindle. Then push the spindle lock nut up against the locking plate. The two lugs on the lock nut must be set into the slot in the locking plate. Turn the lock spindle by means of the lock spindle knob and screw it to tighten up the lock nut. See Figure 3-6, C.

s. Slide the lock spindle collar onto the end of the lock spindle. See Figure 3-6, B.

t. Support the lock spindle collar on a block and use a hammer and drift pin to drive in the spindle collar stake pin. Be sure the hole in the lock spindle is lined up with the hole in the lock spindle collar before driving the stake pin. See Figure 3-6, A.

5-3.4 Reassembling the Handle Assembly.

a. Fit the stud on the handle bracket into the hole in the flat end of the handle.

b. Assemble handle center screw washer.

c. Assemble the handle center screw through the round end of the handle. See Figure 3-4, A.

5-4 MAJOR ASSEMBLY REASSEMBLY OPERATIONS.

5-4.1 Assembling the Handle Assembly, the Frame Leg, the Telescope Holder and the Radius Arm Stop Screw to the Frame.

a. Attach the handle assembly to the underside of the frame with three handle bracket screws. See Figures 3-4, A and 3-5.

b. Screw the frame leg into the frame. Use the frame leg pin wrench (Tool No. 2) to tighten it. See Figure 3-5.

c. Insert the stud of the telescope holder into the hole in the frame and turn the telescope holder to align the hole in its base with the telescope holder pin in the frame. Assemble the telescope holder screw. See Figure 3-4, A.

d. Assemble the radius arm stop screw into the hole in the top of the frame. See Figure 3-4, A.

5-4.2 Assembling the Arcuate Arm Female Center and the Radius Arm Center Parts to the Frame.

a. Insert the arcuate arm female center into the hole for it in the frame. Assemble three female center screws. See Figure 3-4, A.

NOTE

The arcuate arm female center is a matched part with the arcuate arm male center. Be sure to assemble these mated parts to the same stadimeter, along with the same shims.

b. Assemble the radius arm female center to the frame. Assemble three female center screws. See Figure 3-4, A.

NOTE

The radius arm male and female centers are matched parts.

c. Run a stripe of pivot center oil down the bearing surface of the radius arm male center as shown in Figure 5-1. Run another stripe down the other side. See "Lubrication" in the Control Manual. Place appropriate shims on the male center, see Figure 3-4, A, then insert the male center into the female center and rotate it to distribute the oil. Wipe off any excess that may be forced out.

d. Place appropriate shims and the retaining ring on the end of the male center. See Figure 3-4, A.

NOTE

Be sure the thick .020 shim washer is just below the retaining ring.

5-4.3 Assembling the Lock Spindle Carriage and Radius Arm Assembly.

a. Pick up the lock spindle, carriage and radius arm assembly. Loosen the lock spindle by turning the lock spindle knob. Pull down the spindle locking plate and fit the arc of the frame between the bottom of the radius arm and the locking plate. See Figure 3-4, B.

b. Place the radius arm on the radius arm male center. The circular lug on the center should set into the countersunk hole in the arm. See Figure 3-4, B.

c. If the three screw holes in the radius arm and the male center are not aligned, lift the arm and rotate the center to bring them close. Replace the arm and use a piece of stiff wire to align the holes. Assemble the three radius arm-to-center screws. See Figure 3-4, A.

5-4.4 Assembling the Index Mirror Base and Arcuate Arm Assembly.

a. Run two stripes of pivot center oil down opposite sides of the arcuate arm male center. Place appropriate shims on center. See Figures 3-1, A and 5-2. See "Lubrication" in the Control Manual.

b. Turn out the drum screw. Insert the radius arm spring and the radius arm plunger (pin end first) into the radius arm spring housing. See Figure 3-1, A.

c. Hold the radius arm plunger in the radius arm spring housing with your left hand. Pick up the index mirror base and arcuate arm assembly and insert the arcuate arm male center into the arcuate arm female center. Fit the arcuate arm between the drum screw socket and the radius arm plunger. See Figures 3-1, A and 3-3, B.

d. Turn over the assembled parts and place appropriate shims and the retaining ring on the end of the male center. See Figure 3-1, A.

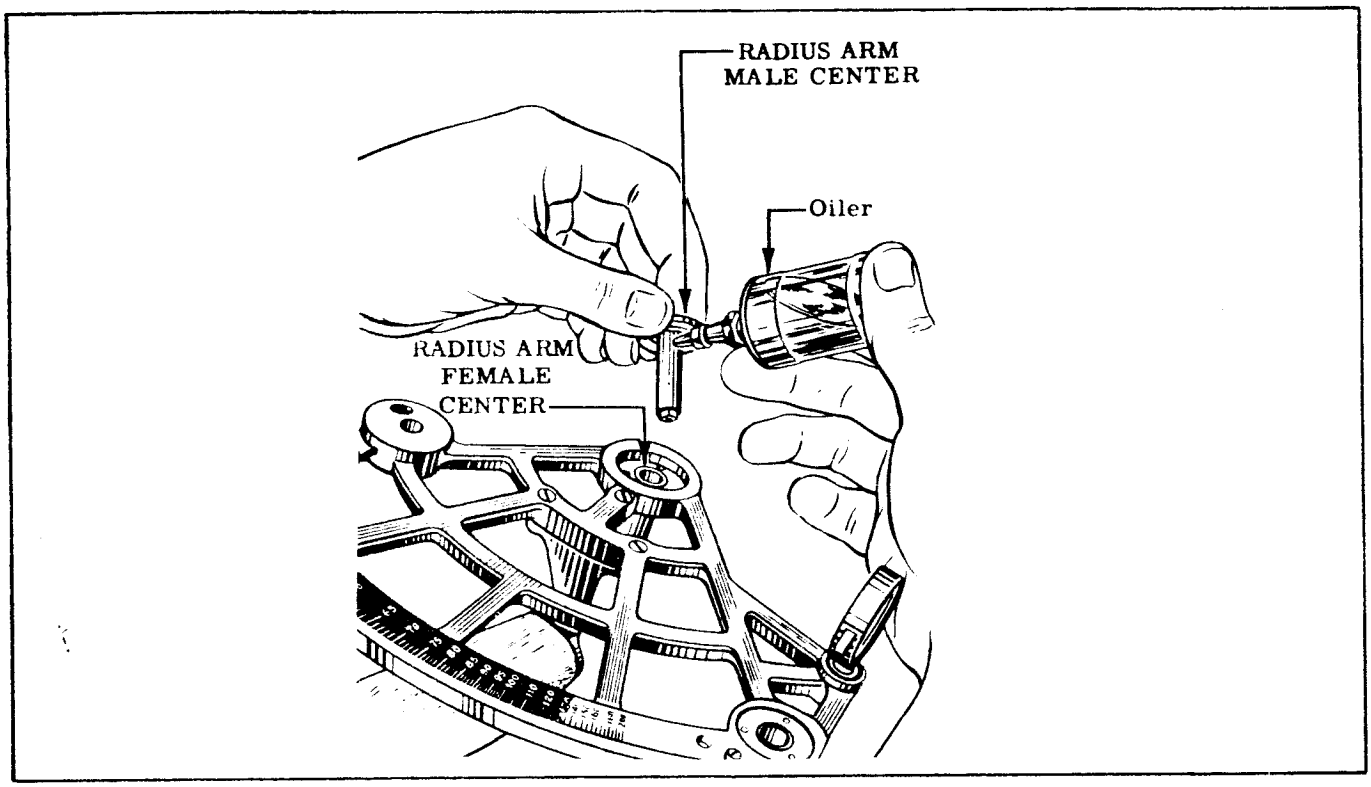


Figure 5-1. Assembling the Arcuate Arm Female Center and the Radius Arm Center

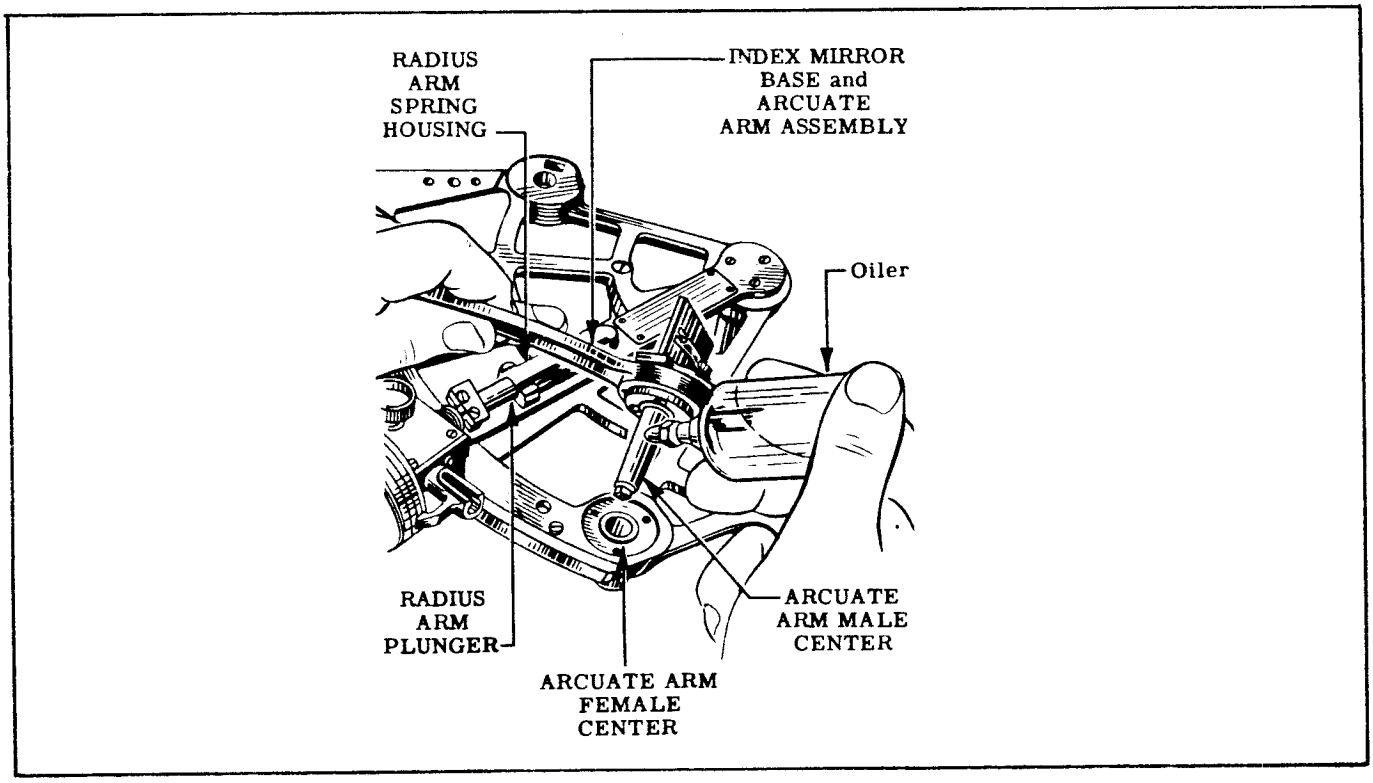


Figure 5-2. Assembling the Index Mirror Base and Arcuate Arm Assembly

NOTE

Be sure the thick .020 shim washer is just below the retaining ring.

5-4.5 Assembling the Horizon Mirror Base and Turntable Assembly to the Frame.

a. Lubricate the underside of the horizon mirror base and turntable assembly and the flat side of the horizon turntable washer with turntable grease. See Figure 3-1, A. See "Lubrication" in the Control Manual.

b. Assemble the horizon mirror base and turntable assembly to the frame with the horizon turntable washer and the horizon turntable mounting screw. See Figure 3-3, A.

c. Screw the two horizon mirror radial adjusting screws into the frame and leave them loose. Use the adjusting screw wrench, Tool No. 1. See Figures 3-1, A and 3-2.

The arcuate arm guard, the radius and arcuate arm center caps, the range drum magnifier, and the horizon and index mirrors and frames will be assembled during the test and adjustment operations.

5-4.6 Stadimeter Telescope Assembly Reassembly Operations.

CAUTION

Do not touch the polished faces of the lenses with your fingers. Always use lens tissue or tweezers for handling optical parts. Fingerprints have a tendency to etch optical glass which causes a permanent defect in an optical surface. See "Handling Glass Optics" in the Control Manual.

a. Clean the eyepiece lens in accordance with the standard techniques set forth in the Control Manual under "Cleaning - Optical Parts".

b. Pick up the clean eyepiece lens by its edge, using tweezers, and set it concave side down in the eyepiece lens mount. See Figure 3-9, B.

c. Screw the eyepiece lens retainer ring into the eyepiece lens mount, against the eyepiece lens. Use the eye lens and objective retainer ring wrench (Tool No. 5) to tighten it. See Figure 3-9, C. Make it just tight enough to prevent the eyepiece lens from shaking. Excess pressure will put strain in the lens.

d. Screw the eyepiece lens mount into the end of the eyepiece draw tube. See Figure 3-9, B.

e. Apply a thin coating of eyepiece grease on the outside surface of the eyepiece draw tube. See "Lubrication" in the Control Manual. Then slide the draw tube into the telescope body. See Figure 3-9, A. Wipe off any excess lubricant that may be squeezed out from between the tube and the body.

f. Clean the objective lens. See the standard technique and procedure in the Control Manual under "Cleaning - Optical Parts".

g. Pick up the clean objective lens by its edge, using tweezers. Set it, flat side down, into the telescope body. See Figure 3-9, B.

h. Screw the objective lens retainer ring into the telescope body against the objective lens. Use the eye lens and objective retainer ring wrench, Tool No. 5. See Figure 3-9, C. Tighten the ring just enough to hold the lens with no shake; excess pressure will put strain in the lens.

The partially reassembled stadimeter is now ready for "Test, Adjustment and Final Inspection Procedure", Section VI. The reassembly will be completed during those operations. Return the instrument, its route ticket and its loose parts to the Instrument Control Center.

SECTION VI

TEST, ADJUSTMENT AND FINAL INSPECTION PROCEDURE

6-1 INTRODUCTION. The partially reassembled stadimeter has to be adjusted and tested to meet the "Performance Requirements" as set forth in Section II of this manual. The remaining parts will be assembled during this procedure.

A final repair inspection will be made preliminary to the start of the test and adjustment operations as a check on the work already performed. Also, a final shop inspection will be made before the completed instrument is inspected by the navigational instrument inspector. The standards for these inspections which make up the final inspection are defined as "Final Inspection Standards" in the Control Manual.

If poor quality workmanship is revealed by the inspections or the test and adjustment operations, return the stadimeter to the person who is responsible. The route ticket indicates who has performed the various operations. By this means of pointing out errors, a constant training program will be in effect. This will benefit the individual and result also in a higher overall efficiency in the shop.

6-2 FINAL REPAIR INSPECTION. The following inspection is intended to catch defects in workmanship before any time is invested in test and adjustment.

a. Inspect the finishes of all parts and the legibility of all engravings. Examine the general physical appearance of the stadimeter. The "Final Inspection Standards" referenced in the Control Manual apply.

b. Check the drum screw for play in the carriage.

c. Check all moving parts for free action and smoothness of motion.

If the instrument passes inspection, proceed with the test and adjustment operations. If you note any defects, consult the route ticket for the responsible person and return the instrument to him for correction.

6-3 SETTING THE RANGE DRUM TO INFINITY AND CHECKING THE ARCUATE ARM. The range drum is calibrated at infinity because at infinite range the index and horizon mirrors remain parallel to each other regardless of the height of the object being sighted. Therefore, at the infinity setting, if the stadimeter is varied along the index scale, the index mirror (the arcuate arm) will remain stationary. This provides a convenient means for setting the range drum to infinity and it also provides a simple check on the trueness of the arcuate arm.

6-4 SETTING THE RANGE DRUM TO INFINITY. For this instrument, the proper length of the radius arm from the radius arm center to the drum screw socket must be determined for the infinity setting and the radius arm must also pivot about the proper point in relation to the arcuate arm curve. The procedure is as follows.

a. Set the stadimeter in the center locating and infinity setting fixture (Tool No. 8). Turn the frame hold-down clamp over the frame. Tighten the two center clamp knobs and the frame clamp and positioning knob. Mount the dial indicator on its bracket with the indicator arm against the front edge of the arcuate arm. See Figure 6-1, A.

b. Set the range drum to read "INF". If the original drum screw and range drum were properly reassembled, this infinity setting should be very close. The dial indicator will show little change as the radius arm is moved from the 50 foot to 200 foot position.

c. Move the radius arm to the 50 foot mark and set the indicator to zero by positioning the indicator dial. Swing the arm to the 200 foot mark and read the deflection on the indicator. Turn the range drum to bring the indicator needle back to zero. Move the arm back to the 50 foot mark and read the deflection. Add one-half the deflection to the present reading by turning the range drum. Then reset the indicator dial to zero.

NOTE

Repeat the procedure outlined in the foregoing Operation c. until the deflection at the 50 foot and 200 foot marks is ±0.0005 (one-half a thousandth) inch or less. If this condition is not obtained by repeating Operation c. four or five times, the radius arm female center has to be repositioned. In any case, proceed with Operation d.

d. Without changing the range drum setting, slowly move the radius arm throughout its travel. The deflection should not exceed 0.0005 inch at any point. Disregard deflections that exceed the limit at isolated points along the arcuate arm. These are due to irregularities in the surface of the arcuate arm. At this time, concentrate on checking for a gradually varying change in deflection.

e. Smear a film of retaining screw grease on the arm of the range drum magnifier. See "Lubrication" in the Control Manual. Assemble it with its magnifier retaining screw to the drum index arm. See Figure 6-1, B.

f. Check the setting of the range drum by repeating Operation 3. If the range drum is not reading infinity as indicated by the drum index arm, loosen the three drum clamp without moving the drum screw, and set to infinity, "INF" on its scale. Tighten one drum clamp plate screw to fix the position. Check it for zero (minimum) deflection and tighten the other two drum clamp plate screws. See Figure 6-1, B.

NOTE

The foregoing operations covering setting the range drum may prove difficult because it is hard to prevent the drum screw from moving. Be patient - you will get the knack of it after a while.

g. The end of the drum index arm should split the circular lines on the range drum. See Figure 6-1, B. Loosen the two drum index arm screws, shift the drum index arm and tighten the screws.

Go on to the procedure for "Checking the Arcuate Arm". Leave the stadimeter set up on the center locating and infinity setting fixture, Tool No. 8.

6-5 CHECKING THE ARCUATE ARM. Now that the range drum has been set to infinity, the arcuate arm has to be checked to make certain that the index mirror will not be moved at any

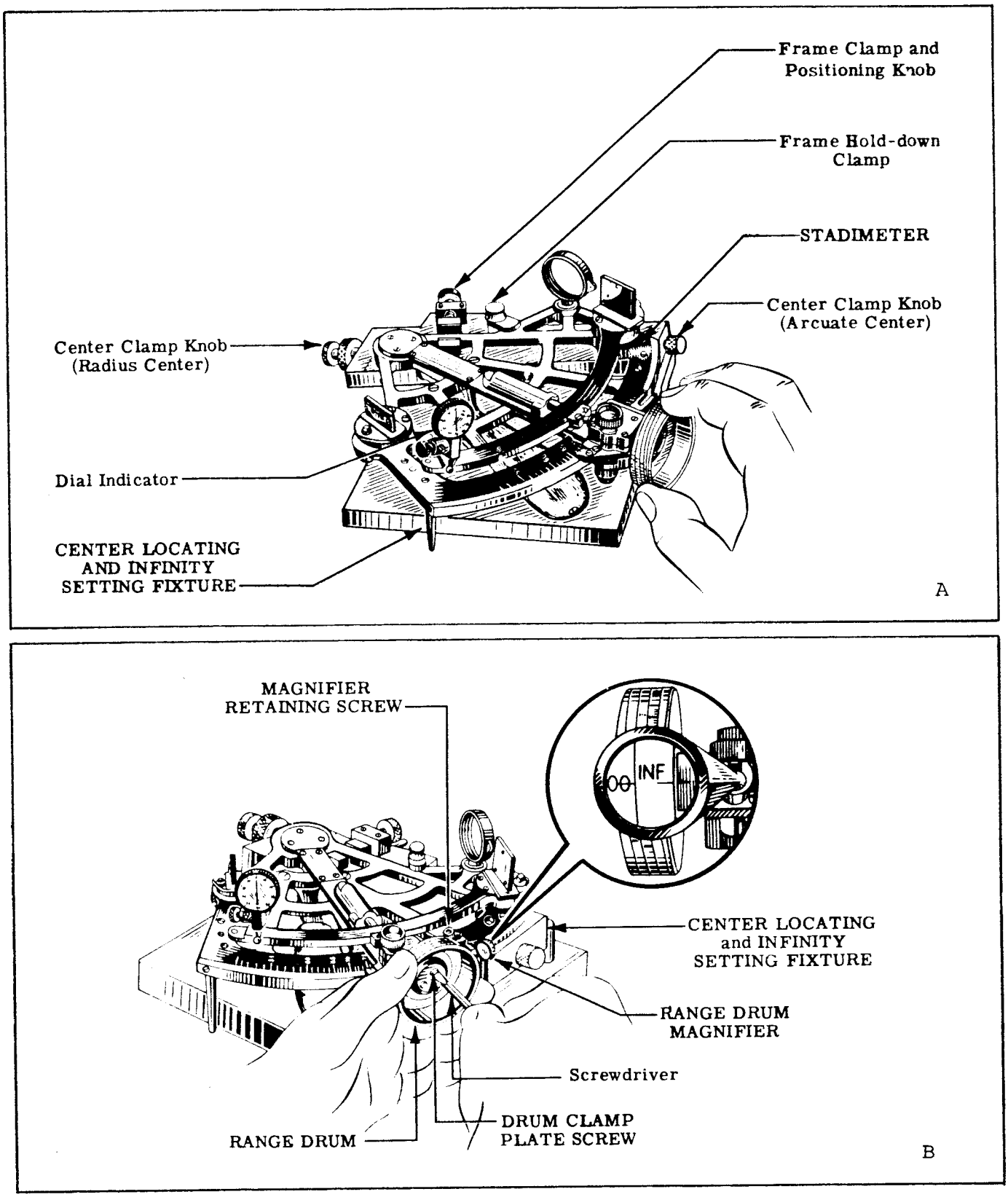


Figure 6-1. Setting the Range Drum to Infinity

intermediate point on the index scale more than the allowable deflection of ±0.0005 inch. All slack and backlash should have been removed from the functional parts of the stadimeter at this stage. Remember any slack that is present will show up in this test which you are about to perform, and a true check of the arcuate arm will not be possible.

a. Set the range drum to infinity. Position the carriage to read 50 feet on the index scale. Set the indicator to read zero.

b. Move the carriage in small steps from the 50 foot to 200 foot marks and read the indicator dial constantly. If the deflection exceeds 0.0005 inch, record the index reading and the deflection with its plus or minus sign. Minus deflections are for bumps on the arm and plus for hollow spots.

c. Rub down the high spots on the arm. Use fine emery cloth and finish with croecus cloth. Be sure to wash off all the abrasive. If it remains, the action of the drum screw socket against the arm will wear down the surface of the arm.

CAUTION

Use a sweeping motion on the arcuate arm in rubbing it. Do not put flats on the surface.

NOTE

Eliminate hollow spots by rubbing down the whole arm. Only take off what is necessary, otherwise, you may ruin the arm. It may prove economical to replace the arcuate arm if it is bent or seriously uneven.

d. When the indicator shows no more than a ±0.0005 inch deflection, at infinity setting of the range drum, all across the arm, the stadimeter is ready for collimation.

6-6 REASSEMBLY OF REMAINING PARTS.

a. Assemble center caps over the radius arm center parts and the arcuate arm center parts. Attach the caps to the frame with three center cap screws in each. Refer to Figure 3-1, A.

b. Assemble an arcuate arm guard to the frame with two arcuate arm guard screws. See Figures 3-1, A and 3-3, A.

NOTE

The arcuate arm should be clear of the guard. If it binds at any point, check the arm for flatness. File the guard if the arm is found to be true and binding occurs.

c. Clean the index and horizon mirrors. See "Cleaning - Optical Parts" in the Control Manual. Also clean the range drum magnifier at this time.

NOTE

Be careful not to scratch the mirrors. Never touch the polished surface with the hands. Always handle the mirrors by their edges.

d. Set the horizon mirror on the horizon mirror base and clamping spring assembly. While holding it by the edges with one hand, slide the horizon mirror frame down over the horizon mirror. See Figure 3-1, A.

NOTE

The point on the end of the mirror clamping screw is supposed to set into the small hole in the mirror clamping spring. Sight through the hole in the horizon mirror frame to see if the holes are lined up. If they are not, elongate the hole in the mirror clamping spring.

e. Screw the mirror clamping screw into the back of the horizon mirror frame. Tighten just enough to hold the mirror firmly. Too much pressure will cause strain and distortion in the mirror which would make the readings incorrect.

f. Reassemble the index mirror and the index mirror frame to the index mirror base and clamping spring assembly in the same way.

6-7 ADJUSTING THE MIRRORS. To save time in collimation, the horizon and index mirrors are to be adjusted by sighting natural targets. The procedure to be outlined is the same as that followed by anyone using a stadimeter. The mirrors loosen up and get out of adjustment very easily; for this reason they must be adjusted each time the stadimeter is used.

The index and horizon mirrors have to be perpendicular to the frame of the stadimeter at all times. At infinity range setting, the mirrors must also be parallel to each other.

6-8 PERPENDICULAR ADJUSTMENT OF THE HORIZON MIRROR. The top edge of the silvering on the horizon mirror and the center of the small peephole in the telescope holder are the same height above the frame of the stadimeter. Therefore, if the horizon mirror is perpendicular to the plane of the instrument, you will see the reflection of one-half of the peephole in the silvered portion of the horizon mirror.

a. Look through the peephole toward the top edge of the horizon mirror. You should see one-half of the peephole in the horizon mirror; if not, turn the horizon mirror vertical adjusting screw on the horizon mirror adjustable base with the adjusting screw wrench (Tool No. 1) one way or the other until you see one-half of the peephole, as shown in Figure 6-2.

NOTE

If the peephole and telescope holder cannot be seen in the horizon mirror, the mirror may be at the wrong angle. Use the adjusting screw wrench (Tool No. 1) to turn the horizon mirror radial adjusting screws which are in the frame below the horizon mirror. Set the horizon mirror to give a reflection as shown in Figure 6-2.

6-9 PERPENDICULAR ADJUSTMENT OF THE INDEX MIRROR. If the index mirror is not perpendicular to the frame, the directly viewed object and its reflected image will not be aligned.

a. Hold the stadimeter with its frame vertical and look through the telescope holder at some small vertical object such as a mast or flagpole. If the index mirror is correctly adjusted, the reflected image and directly-viewed object will appear to coincide as shown in Figure 6-3. If you find that the directly-viewed object and its reflected image do not coincide, then turn the index mirror

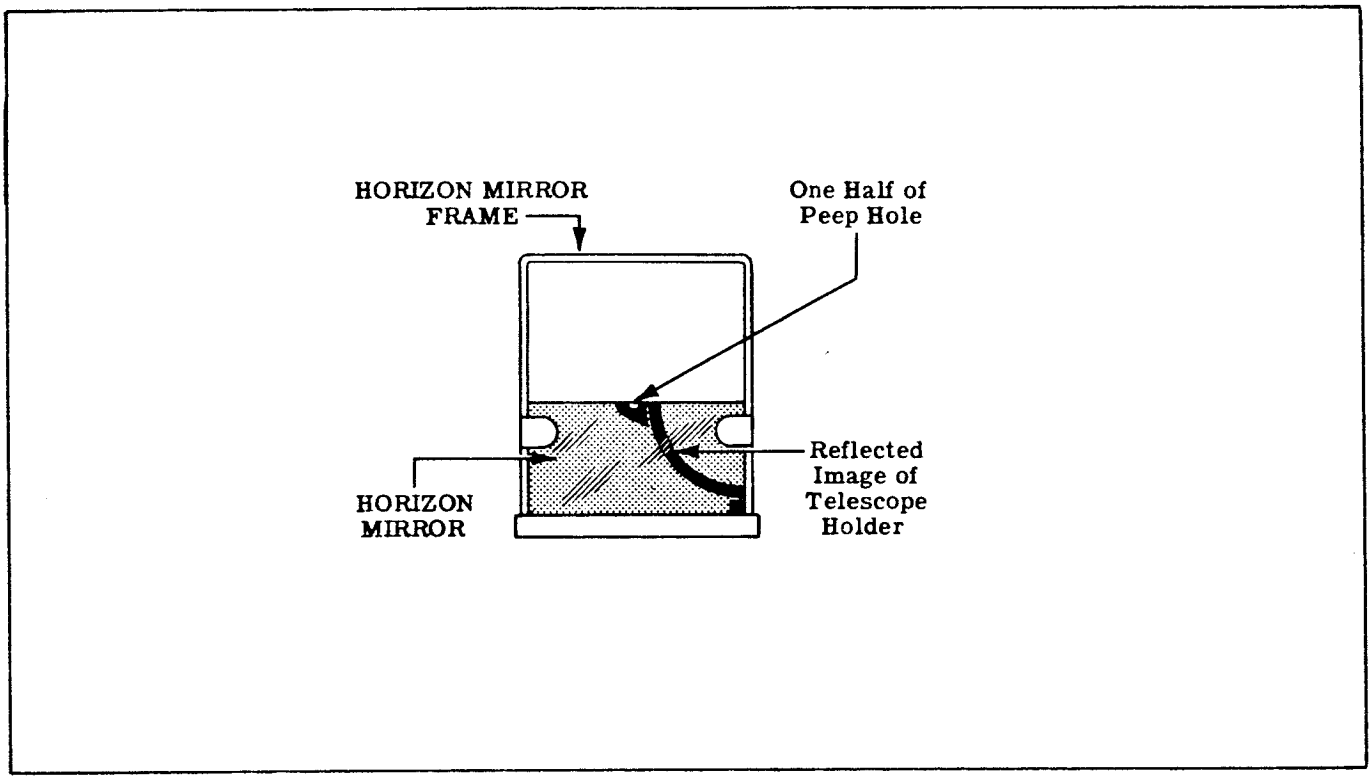


Figure 6-2. Perpendicular Adjustment of the Horizon Mirror

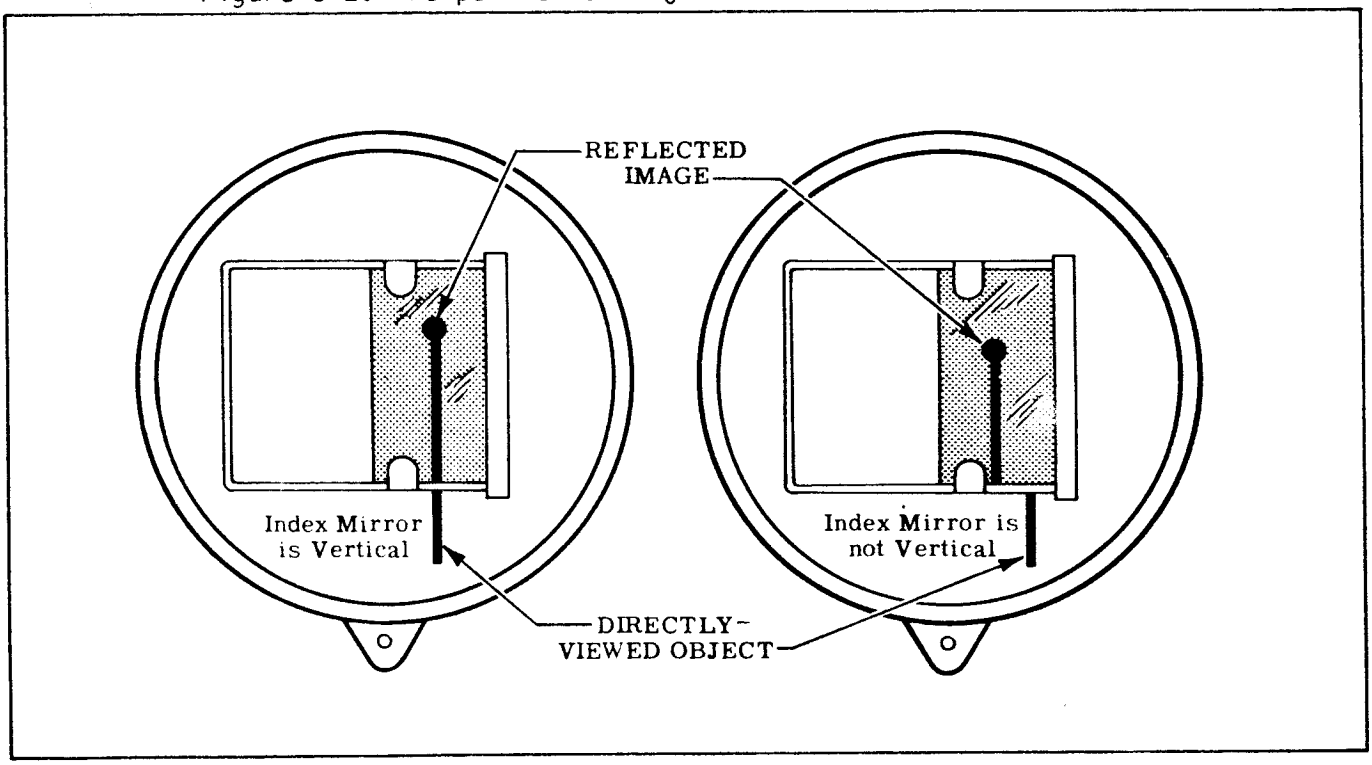


Figure 6-3. Perpendicular Adjustment of the Index Mirror

vertical adjusting screw on the index mirror adjustable base with the adjusting screw wrench (Tool No. 1) until they are in coincidence.

NOTE

An accurate check on the alignment of the directly-viewed object and its reflected image can be made by wobbling the stadimeter in its vertical plane. This will move the bottom edge of the mirror up and down the length of the vertical object being sighted. If the line formed by the directly-viewed object and reflected image "snakes" or appears to wiggle, the index mirror is not vertical. If adjusting the index mirror will not eliminate the wiggle go back to "Perpendicular Adjustment of the Horizon Mirror" and repeat the procedure.

The horizon and index mirrors have been made perpendicular to the frame. Now they are to be made parallel to each other when the range drum is set at infinity.

6-10 PARALLEL ADJUSTMENT OF MIRRORS.

a. Set the range drum to infinity. The index or height scale can be set at any position.

b. Hold the stadimeter so that the plane of instrument is vertical. Look through the telescope holder at a distant horizontal line such as the horizon. The reflected image and directly-viewed horizon which you see should be continuous as shown in Figure 6-4. If the reflected image and directly-viewed horizon are <u>not</u> continuous, loosen one of the two horizon mirror radial adjusting screws that are in the frame directly below the horizon mirror and tighten the other, until the horizontal line appears continuous.

NOTE

A distant vertical object such as a smoke stack can be sighted with the stadimeter held <u>horizontally</u>. This, in effect, serves the same purpose as the horizon.

c. Check the alignment of the object and its reflected image by wobbling the instrument along the horizon. If the horizontal line appears to "snake" or wiggle, the mirrors are not exactly parallel.

d. As an overall check on the adjustment of the mirrors, wobble the stadimeter diagonally (at 45 degrees) as you sight the horizon. Any snaking or wiggle may be caused by the mirrors not being vertical to the frame or parallel to each other. Make the necessary adjustments until there is no detectable wiggle or movement.

NOTE

If you sight the horizon with the stadimeter horizontal, any displacement is caused by the mirrors not being vertical to the frame. As you see, the same object, horizontal or vertical, can be sighted to check each mirror adjustment, depending on whether the stadimeter is held horizontally or vertically. When it is held diagonally, both adjustments are checked at the same time.

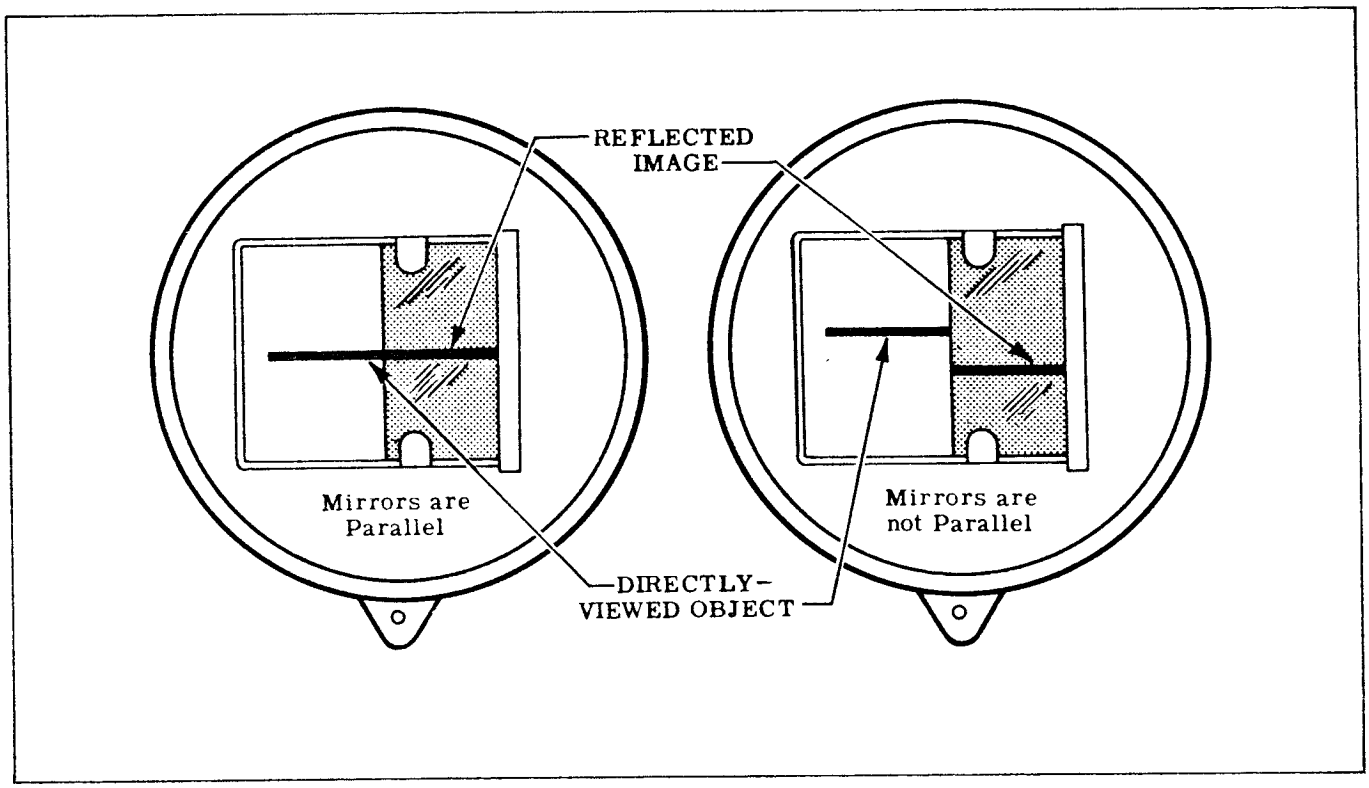


Figure 6-4. Parallel Adjustment of Mirrors

Now that the mirrors have been correctly adjusted and aligned, the stadimeter is ready for the collimation operations.

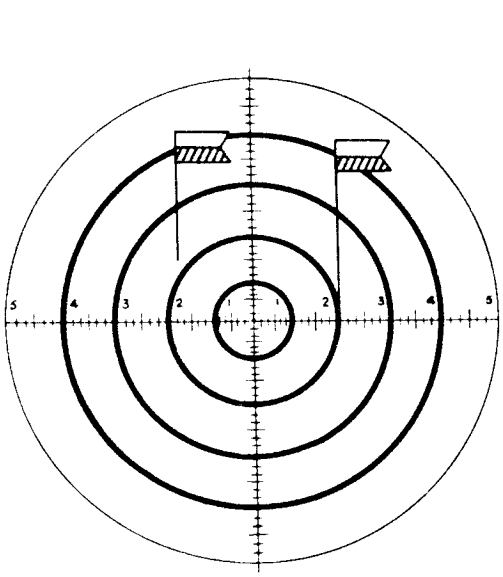
6-11 COLLIMATION. This collimation test procedure to be performed on a collimator is intended to calibrate the index scale and check the range readings. If the stadimeter has been properly adjusted for the range drum infinity setting, the check on the trueness of the arcuate or radius arm and the adjustment of the mirrors, the range readings should be correct once the index scale is set. If the readings are incorrect, even though the stadimeter passed the foregoing tests, it would indicate play or backlash in the drum screw. Also any other loose parts may cause the readings to be in error.

6-11.1 Collimator Used. The Navy has provided most of its facilities with either a Mark 4, No. 5 or a Mark 5 collimator. Either one can be used; however, the target in the Mark 4, No. 5 is more suited to collimating stadimeters exclusively because of the inclusion of two flagstaffs.

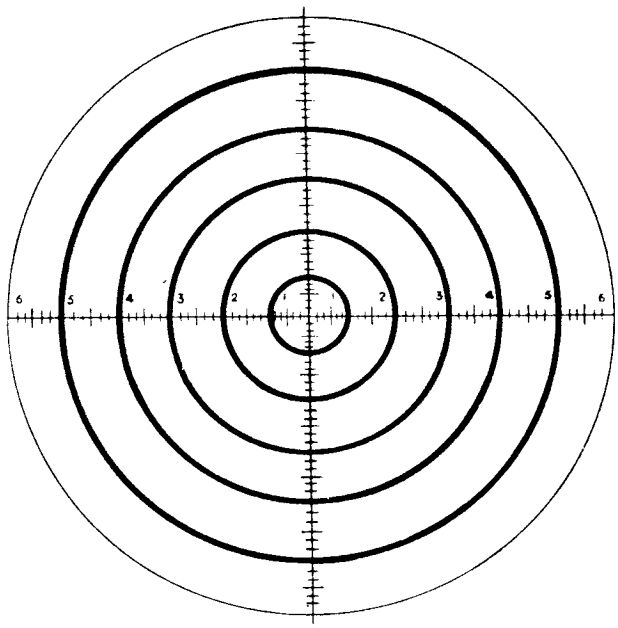
The procedure is the same whichever collimator is used. Figure 6-5, A shows both targets. The radial lines of the collimator target cross the coordinate axis at one degree intervals. Each intersection is marked with the number of degrees which it is displaced from the target center. The Mark 4, No. 5 is used here for the purposes of illustration and description.

The flagstaffs in the MK 4, No. 5 target are spaced to subtend an angle of 3°-48'-48". The reason for this will become clear by considering the following facts.

The stadimeter determines range of objects of known heights by sighting

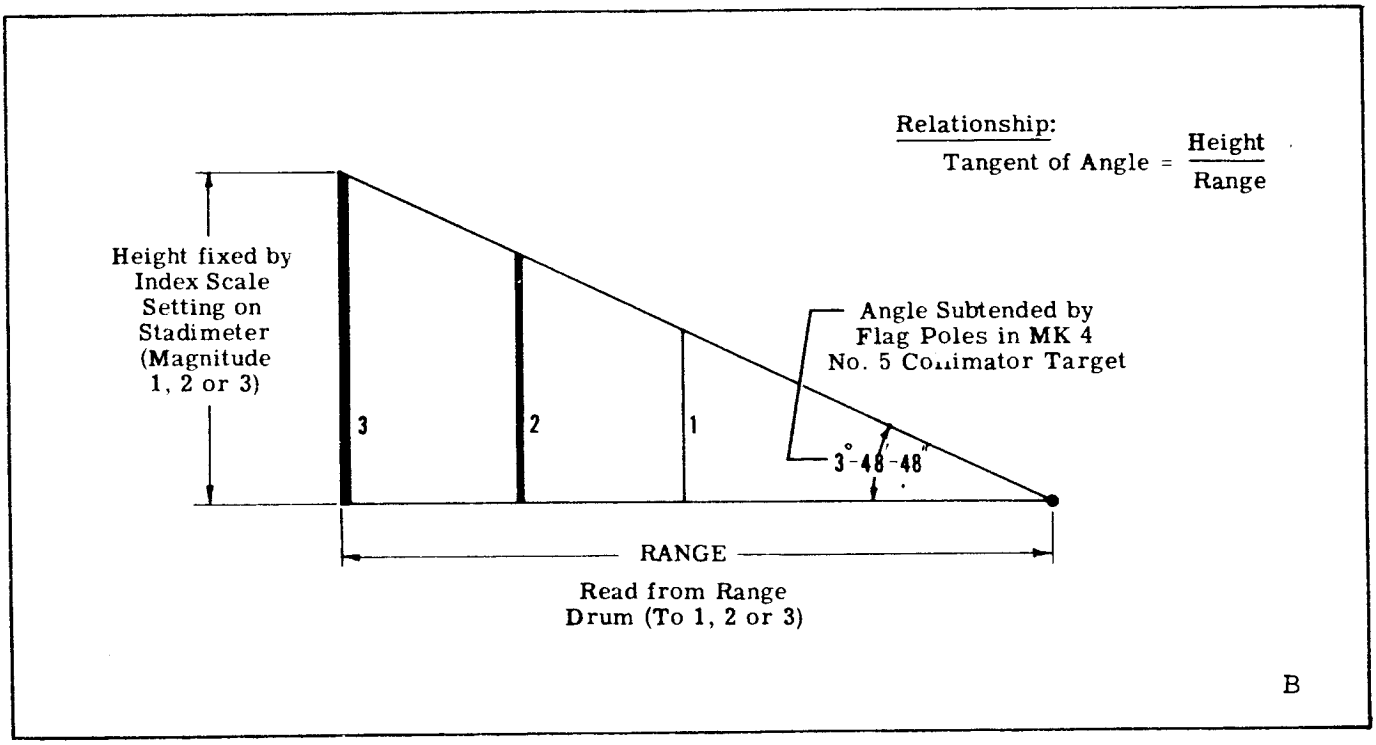


Mark 4, No. 5 Target



Mark 5, Target

A



B

Figure 6-5. Collimation Test Procedure

the angle subtended by the object. This is done by varying the index mirror to superimpose the direct and reflected images. If the angular height of the object is known, the ratio of height to range will be equal to the tangent of the angle (see Figure 6-5, B) by the formula:

$$\text{Tangent of angle} = \frac{\text{Height}}{\text{Range}}$$

$$\text{Tangent of } 3°\text{-}48'\text{-}48'' - 0.0666 = \frac{1}{15}$$

Therefore, the ratio of height to range is 1 to 15 if they are expressed in the same distance units. Since the stadimeter scales are calibrated in feet for the height (index) scale and in yards for range (on the range drum), the ratio becomes 1 to 5.

It should be clear that if the stadimeter scales are set to the 1 to 5 ratio - 50 feet and 250 yards, 100 feet and 500 yards, etc. - the flagstaffs in the collimator will be superimposed.

Any other convenient ratio can be set up and a target made to suit it. If a collimator target such as the MK 5 is used, two graduations on the target that subtend a known angle will have to be selected. It is much more desirable to include special definite targets such as the flagstaffs because they are easily identified.

6-12 COLLIMATION OPERATIONS.

6-12.1 Checking the Mirror Adjustment and the Infinity Setting.

a. Set the stadimeter on the stand of the collimator, MK 4, No. 5, Tool No. 9. See Figures 6-6, A and B. The stadimeter telescope is not required for the collimation operations.

CAUTION

Do not use the clamp on the stadimeter because the pressure on the handle will distort the frame of the stadimeter and cause errors in the readings.

NOTE

The following Operations b. through e. provide a quick check on the positioning of the horizon and index mirrors. They are easily disturbed by handling and normal shocks. Refer to the foregoing "Adjusting the Mirrors" for background information.

b. Sight through the peephole in the telescope holder to check the vertical position of the horizon mirror. One-half of the peephole should be reflected. See Figure 6-2. Use the adjusting screw wrench (Tool No. 1) on the horizon mirror vertical adjusting screw if the mirror is not vertical to the frame.

c. Set the range drum to infinity. Sight the target to check for the vertical position of the index mirror. If the mirror is not vertical to the frame, the reflected portion of the target, as seen in the horizon mirror, will be displaced up or down. See the pullout in Figure 6-6, B. Adjust the index mirror vertical adjusting screw to bring the reflected image into place. Shake your head up and down as if to signify "yes" and look at the top edge of the horizon mirror. If the image jumps, the index mirror is not exactly vertical.

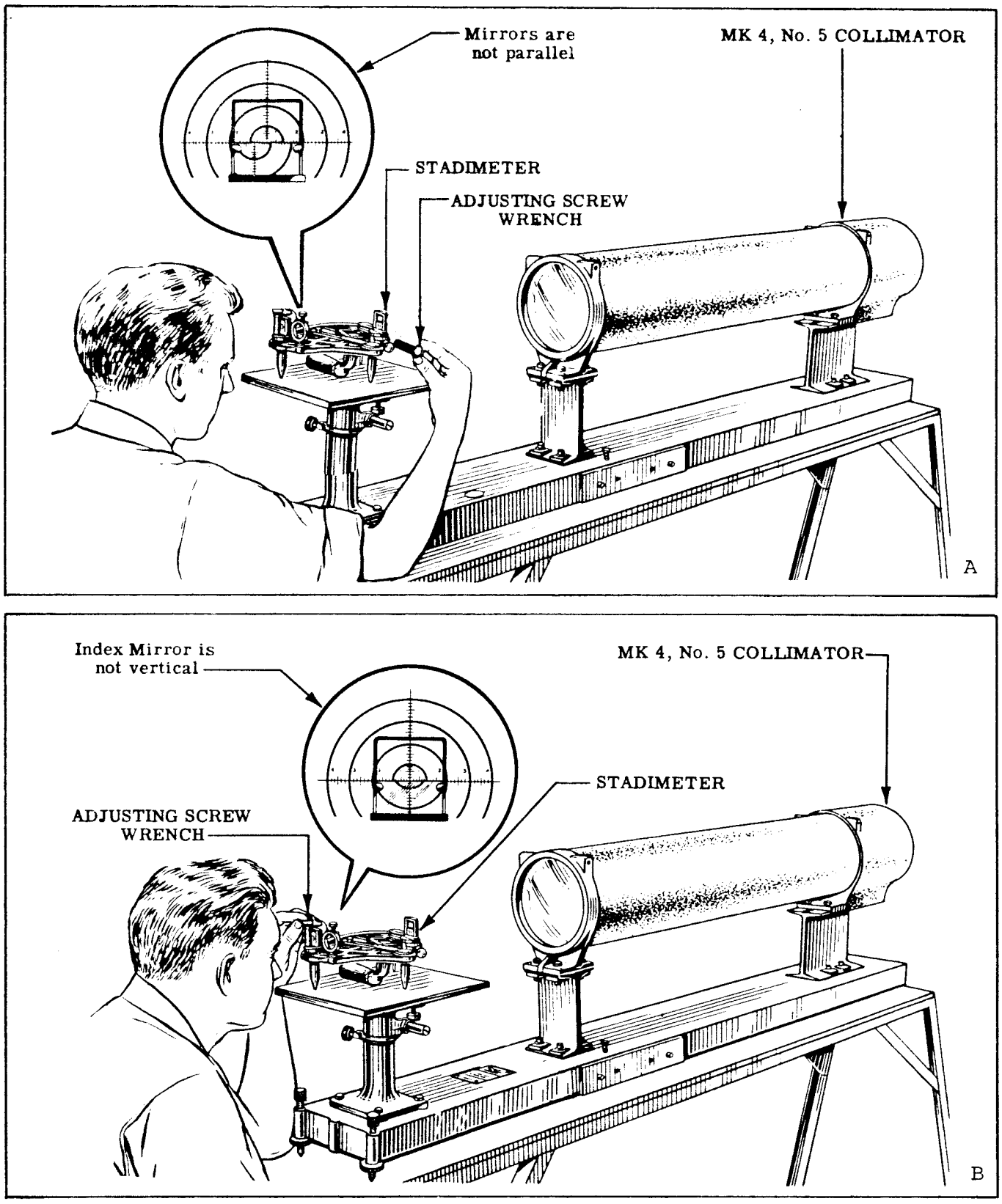


Figure 6-6. Checking the Mirror Adjustment and the Infinity Setting

NOTE

If there is any horizontal displacement of the reflected image, the infinity setting of the range drum is wrong or the horizon mirror is not parallel to the index mirror. Disregard this effect during the previous operation. Suitably adjust the range drum setting to eliminate it for the time being.

d. Set the range drum to infinity and sight the target to check the radial position of the horizon mirror; that is, the horizon mirror parallelism to the index mirror. Assume that the infinity setting is correct. If the reflected image is displaced horizontally, adjust the position of the horizon mirror with the horizon mirror radial adjusting screws. See the displaced image in the pullout in Figure 6-6, A. For an accurate check, look at the vertical line on the target between the directly-viewed portion of the line and its reflected image and shake your head up and down as if to say "yes." If the line appears to snake, the horizon mirror is not properly adjusted.

NOTE

The foregoing operation assumed that the infinity setting is correct. To check the setting, perform the following operation.

e. Set the range drum to infinity. Run the carriage to the 50 foot end of the scale and check for horizontal displacement as in Operation d. Then check again at the 200 foot mark. If displacement is noted at either or both ends, the infinity setting is not correct. Go back and repeat the operations under "Setting the Range Drum to Infinity and Checking the Arcuate Arm". Then start again at the beginning of these "Collimation Operations."

6-12.2 Setting the Index Scale. This stadimeter has a fixed index scale engraved on the frame. An index plate on the radius arm is adjustable and is to be set accurately as follows:

a. Carefully set the range drum to read 250 yards. Sight the collimator target and move the radius arm until the right flagstaff is exactly superimposed on the left flagstaff. Shake your head up and down and look for snaking or wiggle. Lock the radius arm in position with the lock spindle. Check the alignment again.

b. Loosen the two index plate screws and position the index plate to the 50 foot mark. Tighten the screws.

6-12.3 Checking the Range Readings. The stadimeter is required to determine the range of objects of known height to within 5 percent. If all previous adjustments have been properly made, the range readings should be correct. This test procedure is to be a final check on all previous work. If the stadimeter does not give accurate readings, diagnose the cause and return the instrument to the person who is responsible (see the route ticket) for the work that covers the defect.

The test of range readings will cover the scale of range from 200 to 1000 yards for objects of heights between the index scale limits of 50 to 200 feet. Perform the test as follows:

a. Set the index scale to 50 feet. Sight the collimator target. See Figure 6-5, A. Turn the range drum to make the right flagstaff move and superimpose it on the left flagstaff.

b. Shake your head up and down to look for snaking; align the flagstaffs accurately. Read the range drum. It should read 250 yards.

According to the performance requirements, an accuracy of 5 percent is required. At a range of 200 yards, a 5 percent error is 10 yards. In mechanical terms, this measures almost 5/8 inch on the range drum scale. However, 5/8 inch along the scale at the high end is almost 700 yards. Therefore, a misalignment or play in the stadimeter has its greatest effect at the long ranges.

To provide a convenient overall standard, the following calculation is made: the tolerance at 10,000 yards is 500 yards. This is equal to approximately 1/64 inch on the range drum at the 10,000 yard mark. So at any range for any height object if the reading is within ±1/64 inch, the instrument will be within tolerance for the 10,000 yard range and certainly at all lesser ranges. The range drum magnifier gives a magnification of approximately twice the length. With a little experience you will be able to judge the tolerance in the magnifier.

c. Repeat Step a, at 55, 60, 70, 80, 90, 100, 110, 120, 140, 160, 180 and 200 feet on the index scale. In each case, multiply the index scale reading by 5 to determine the range reading to be expected.

6-12.4 Diagnosing Defects. Table 6-1 sets forth the indicated trouble and the possible cause. Have the defects corrected by the person who did the work as indicated on the route ticket.

Table 6-1. Diagnosing Defects

Defect	Possible Cause
Wrong range reading for particular index settings.	1. Bumps or low spots on the arcuate arm. 2. Play in drum screw. 3. Misplaced radius arm center of stadimeter
High or low range readings over the entire scale.	1. Range drum infinity setting is incorrect. 2. Index scale setting is incorrect. 3. Defective mirrors.
Inconsistent readings.	1. Play in drum screw. 2. Loose mirror mountings. 3. Play in centers.

The stadimeter has been fully tested and adjusted at this point. It should be ready for the final inspection operations.

6-13 FINAL SHOP INSPECTION. The stadimeter has been completely reassembled tested and adjusted to serviceable con-, dition ready for use aboard ship. This final shop inspection is intended to catch any details that may have been overlooked. See the "Final Inspection Standards" in the Control Manual.

a. Check the stadimeter for completeness of component parts.

b. Check the parts for finish, tightness in assembly and legibility of engravings. Make sure that all screws are secure. Look through the stadimeter telescope assembly. The image should be bright, clear and free from distortion of shape and color.

c. Examine the index and horizon mirrors. They should be clean and free from any visible defects.

d. The carrying case should have a name plate attached and an instruction sheet pasted on the underside of the cover. Refer to Figure 7-1 in Section VII.

e. When you are satisfied with the stadimeter, place it in its carrying case. Include a spare set of horizon and index mirrors, a screwdriver (Stanley Tool No. 177 or equal) and an adjusting screw wrench. In addition, include two spare radius arm springs. See the stadimeter parts list and exploded view, Figure 7-1 (item 14) in Section VII.

f. Code the instrument in accordance with the "Coding" instructions in the Control Manual. Complete the route ticket and sign it.

g. Return the completed stadimeter, in its case, to the Instrument Control Center. The navigational instrument inspector will take it out for a complete inspection before packaging for shipment or storage. See the "Navigational Instrument Inspector's Final Inspection Standards and Procedure" in the Control Manual.

SECTION VII

MAINTENANCE PARTS CATALOG

7-1 INTRODUCTION. This maintenance parts catalog, consisting of parts lists and supplementary exploded view illustrations, provides a convenient source of identification for all components and maintenance parts of the stadimeter covered in the repair sections of this manual. Maintenance parts are under the cognizance of the Ships Parts Control Center, Mechanicsburg, PA.

The Sextant Type Stadimeter, MK 5, Mod 1 is covered by a Group Assembly Parts List. The Group Assembly Parts List contains in disassembly order all assemblies, subassemblies and component and maintenance parts. These are supplemented by individual series of exploded views which are indexed to the lists.

Following the disassembly order as in Section III, the part name column is indented to indicate the relationship of each component to its next higher assembly; however, the attaching parts for each assembly are listed directly following before that assembly is broken down into its component parts.

Each parts list includes particular footnote references.

The part names used were derived from normal nautical terms, official Navy usage, and manufacturers' names.

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY	NOTES
7-1		SEXTANT TYPE STADIMETER MK 5 MOD 1 COMPLETE WITH CARRYING CASE AND ACCESSORIES	REF	
1	12004-9240-035-1	. STADIMETER ASSEMBLY (SEE FIGURE 7-2 FOR BREAKDOWN)	1	
	12004-9240-035-83	. CARRYING CASE ASSEMBLY	REF	
2	12004-9240-035-84	. . . CARRYING CASE	1	
3	12004-9240-035-85	. . . CARRYING CASE STRAP	1	
4	12004-9240-035-86	. . . CARRYING CASE STRAP SLEEVE . .	1	
5	12004-9240-035-87	. . . CARRYING CASE STRAP LOCK SCREW	1	
6	12004-9240-035-89	. . . WASHER	1	
7	12004-9240-035-88	. . . FOOT	3	
8	12004-9240-035-90	. . . SCREWDRIVER	1	
9	12004-9240-035-91	. . . INSTRUCTION SHEET	1	
10	12004-9240-035-93	. . . NAMEPLATE, CASE	1	
11	12004-9240-035-80	. . . WRENCH ASSEMBLY	REF	
	12004-9240-035-81	. . . WRENCH HANDLE	1	A
	12004-9240-035-82	. . . WRENCH SHANK	1	A
12	12004-9240-035-32	. . INDEX MIRROR (SPARE PART) . . .	1	
13	12004-9240-035-26	. . HORIZON MIRROR (SPARE PART) . .	1	
14	12004-9240-035-47	. . RADIUS ARM SPRING (SPARE PART) .	2	

A. Not procurable as separate part. Order 12004-9240-035-80.

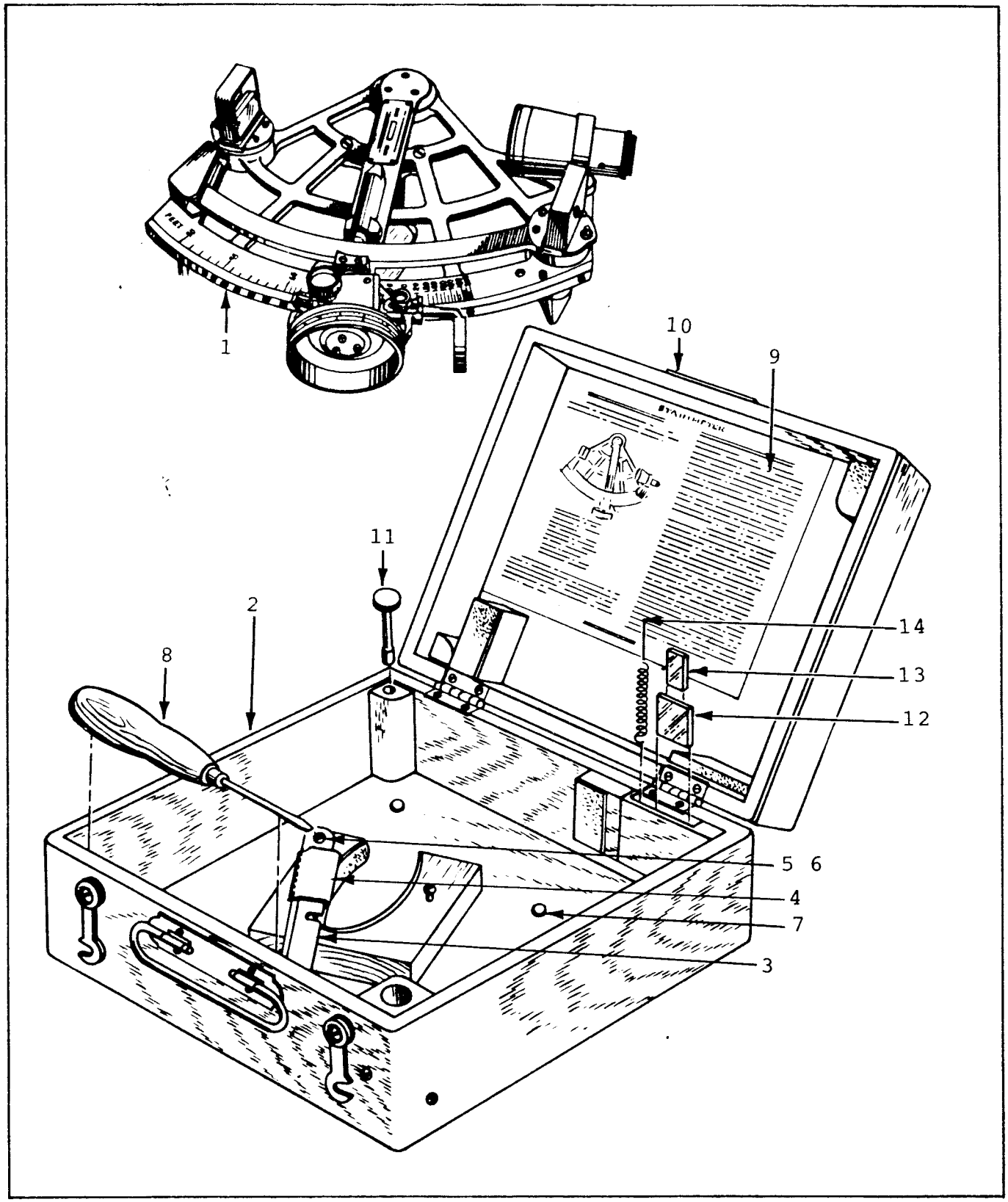


Figure 7-1. Sextant Type Stadimeter, MK 5, Mod 1, Complete with Carrying Case and Accessories

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY	NOTES
7-2	12004-9240-035-1	STADIMETER ASSEMBLY	REF	
1	12004-9240-035-2	. . FRAME, ENGRAVED	1	
2	12004-9240-035-4	. . TELESCOPE HOLDER	1	
3	12004-9240-035-106	. . DOWEL PIN	1	
4	12004-9240-035-107	. . SCREW, TRUSS HEAD	1	
5	12004-9240-035-72	. . LEG	1	
	12004-9240-035-38	. CENTER ASSEMBLY	REF	
	12004-9240-035-39	. . . CENTER SUBASSEMBLY	REF	B
6	12004-9240-035-40	. . . . INNER CENTER	2	B
7	12004-9240-035-41	. . . . OUTER CENTER	2	B
8	12004-9240-035-112/ 115	. . . SHIM	AR	B
9	12004-9240-035-117/ 120	. . . SHIM	AR	B
10	12004-9240-035-121	. . . SHIM WASHER	2	B
11	12004-9240-035-116	. . . RETAINING RING	2	B
12	12004-9240-035-122	. . SCREW, BINDING HEAD	3	
13	12004-9240-035-125	. . SCREW, BINDING HEAD	3	
14		. BASE AND ARCUATE ARM ASSEMBLY - INDEX MIRROR	REF	Fig. 7-4
15	12004-9240-035-124	. . SCREW, FIL HEAD	3	
16	12004-9240-035-73	. . CENTER CAP	2	
17	12004-9240-035-102	. . SCREW, FIL HEAD	6	
	12004-9240-035-74	. HANDLE ASSEMBLY	REF	
18	12004-9240-035-75	. . . HANDLE	1	
	12004-9240-035-76	. . . HANDLE BRACKET ASSEMBLY . . .	REF	
19	12004-9240-035-77	. . . . HANDLE BRACKET	1	
20	12004-9240-035-78	. . . . HANDLE BRACKET STUD	1	
21	12004-9240-035-79	. . . WASHER	1	
22	12004-9240-035-104	. . . SCREW, FIL HEAD	1	
23	12004-9240-035-103	. . SCREW, FIL HEAD	3	
24		. BASE AND TURNTABLE ASSEMBLY - HORIZON MIRROR	REF	Fig. 7-5
25	12004-9240-035-17	. . HORIZON TURNTABLE WASHER . . .	1	
26	12004-9240-035-18	. . TURNTABLE MOUNTING SCREW . . .	1	
27	12004-9240-035-28	. . RADIAL MIRROR ADJ SCREW	2	
28	12004-9240-035-42	. RADIUS ARM ASSEMBLY AND PARTS . .	REF	Fig. 7-3
29	12004-9240-035-46	. . RADIUS ARM PLUNGER	1	
30	12004-9240-035-47	. . RADIUS ARM SPRING	1	
31	12004-9240-035-126	. . SCREW, OVAL HEAD	3	
32	12004-9240-035-37	. . ARCUATE ARM GUARD	1	
33	12004-9240-035-105	. . SCREW, OVAL HEAD	2	
34	12004-9240-035-101	. . SCREW, FIL HEAD	1	

B. Not procurable as separate part. Order 12004-9240-035-38.

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY	NOTES
	12004-9240-035-60	. MAGNIFIER LENS ASSEMBLY	REF	
35	12004-9240-035-62	. . . MAGNIFIER LENS HOLDER	1	
36	12004-9240-035-61	. . . MAGNIFIER LENS	1	
37	12004-9240-035-63	. . . SNAP RING	1	
38	12004-9240-035-64	. . MAGNIFIER RETAINING SCREW . . .	1	
39	12004-9240-035-32	. . INDEX MIRROR	1	
40	12004-9240-035-33	. . INDEX MIRROR FRAME	1	
41	12004-9240-035-25	. . MIRROR CLAMPING SCREW	2	
42	12004-9240-035-26	. . HORIZON MIRROR	1	
43	12004-9240-035-27	. . HORIZON MIRROR FRAME	1	
44	12004-9240-035-5	. TELESCOPE ASSEMBLY	REF	Fig. 7-6

B. Not procurable as separate part. Order 12004-9240-035-38.

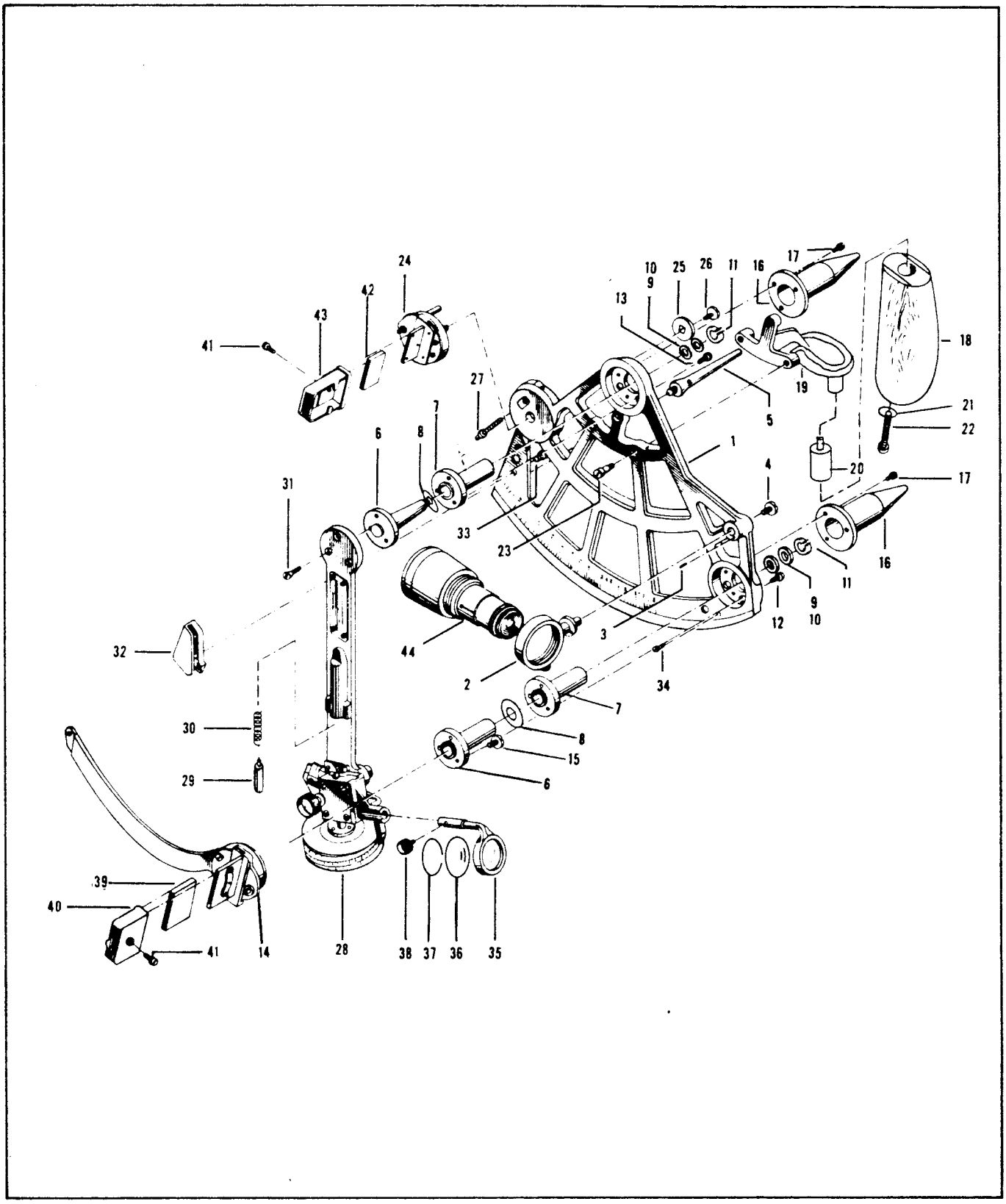


Figure 7-2. Stadimeter Assembly - Complete, less Case

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY	NOTES
7-3		RADIUS ARM ASSEMBLY AND PARTS . . .	REF	
	12004-9240-035-42	. RADIUS ARM ASSEMBLY	REF	
1	12004-9240-035-43	. . RADIUS ARM	1	
	12004-9240-035-48	. . CARRIAGE AND DRUM SCREW ASSY . .	REF	
2	12004-9240-035-49	. . . CARRIAGE ASSEMBLY	REF	C
3	12004-9240-035-50	. . . . CARRIAGE UPPER SECTION . . .	1	C
4	12004-9240-035-51	. . . . CARRIAGE LOWER SECTION . . .	1	C
5	12004-9240-035-52	. . . DRUM SCREW	1	C
6	12004-9240-035-128	. . . SCREW, FIL HEAD	2	C
7	12004-9240-035-129	. . . SCREW, FIL HEAD	2	C
8	12004-9240-035-130	. . . DOWEL PIN	2	C
9	12004-9240-035-53	. . DRUM SCREW SOCKET	1	
10	12004-9240-035-131	. . PIN, SPIROL	1	
11	12004-9240-035-54	. . DRUM SCREW STOP	1	
12	12004-9240-035-127	. . SCREW, FLAT HEAD	2	
13	12004-9240-035-66	. LOCK SPINDLE ASSEMBLY	REF	
14	12004-9240-035-67	. . . LOCK KNOB	1	
15	12004-9240-035-133	. . . PIN, SPRING	1	
16	12004-9240-035-68	. . . LOCK SPINDLE	1	
17	12004-9240-035-69	. . . LOCK SPINDLE COLLAR	1	
18	12004-9240-035-134	. . . PIN, SPRING	1	
19	12004-9240-035-71	. . LOCK NUT	1	
20	12004-9240-035-70	. . LOCK SPRING	1	
21	12004-9240-035-65	. . LOCK PLATE	1	
22	12004-9240-035-44	. RADIUS ARM SPRING HOUSING	1	
	12004-9240-035-45	. . . SCREW INSERT (3X)	REF	D
23	12004-9240-035-127	. . SCREW, FLAT HEAD	3	
24	12004-9240-035-58	. . INDEX PLATE	1	
25	12004-9240-035-136	. . SCREW, PAN HEAD	2	
26	12004-9240-035-92	. . INSTRUMENT NAMEPLATE	1	
27	12004-9240-035-109	. . SCREW, FIL HEAD	4	
28	12004-9240-035-59	. . DRUM INDEX ARM BRACKET	1	
29	12004-9240-035-123	. . SCREW, FIL HEAD	2	
30	12004-9240-035-55	. . DRUM	1	
31	12004-9240-035-57	. . DRUM CLAMP PLATE	1	
32	12004-9240-035-132	. . SCREW, FIL HEAD	3	

C. Not procurable as separate part. Order 12004-9240-035-048

D. Not procurable as separate part. Order 12004-9240-035-44

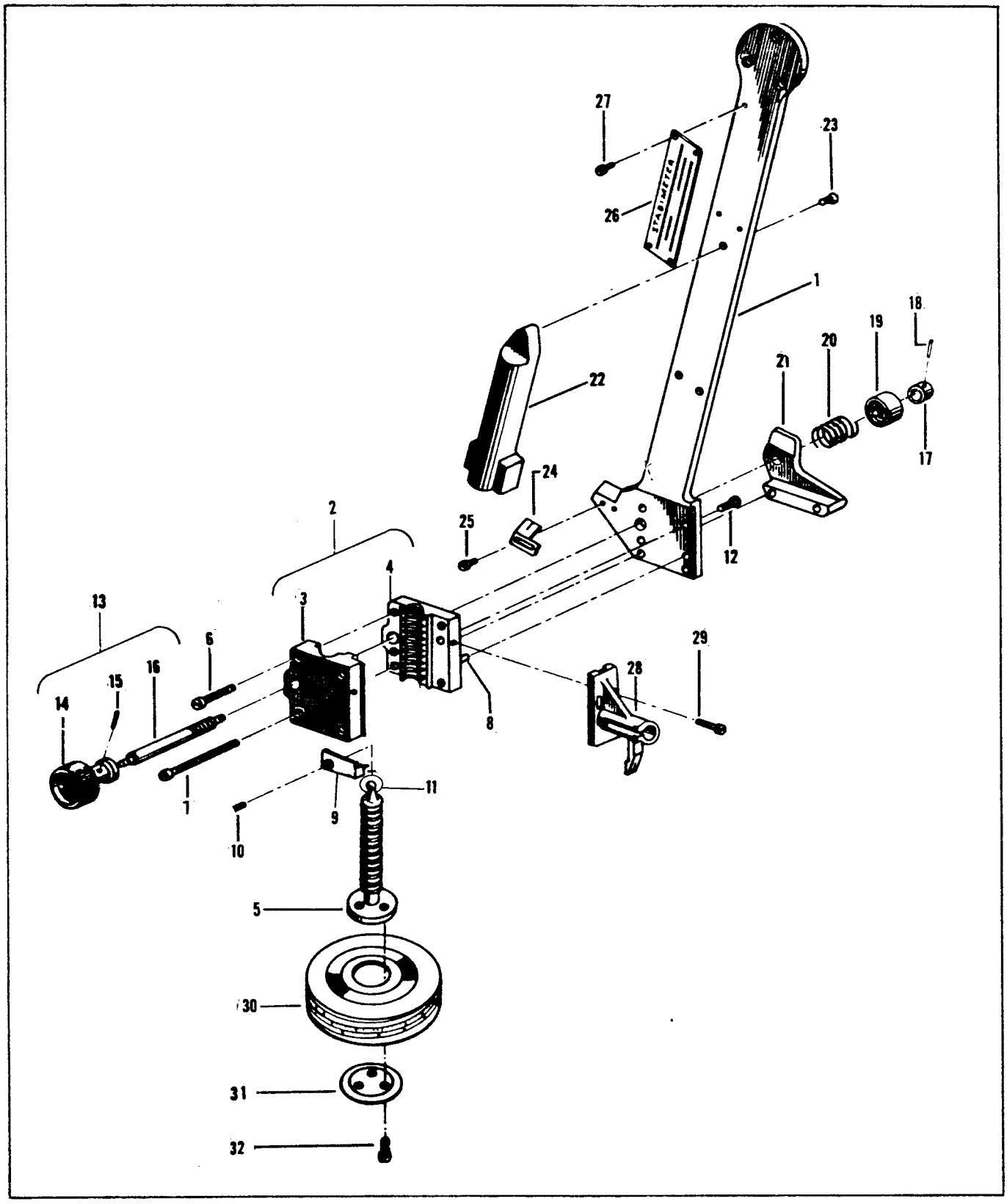


Figure 7-3. Radius Arm Assembly and Radius Arm Parts

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY	NOTES
7-4		BASE AND ARCUATE ARM ASSEMBLY - INDEX MIRROR	REF	
1	12004-9240-035-30	. INDEX MIRROR ADJ BASE ASSEMBLY . .	REF	
2	12004-9240-035-136	. . . SCREW, CLAMPING SPRING	1	
3	12004-9240-035-24	. . . MIRROR CLAMPING SPRING	1	
4	12004-9240-035-23	. . . DOWEL PIN, GUIDE	1	
5	12004-9240-035-108	. . . RIVET, ROUND HEAD	3	
6	12004-9240-035-31	. . . INDEX MIRROR ADJ BASE	1	
7	12004-9240-035-21	. . . MIRROR ADJ PLATE	1	
8	12004-9240-035-22	. . . RIVET, FLAT HEAD	2	
9	12004-9240-035-34	. ARCUATE ARM ASSEMBLY	REF	
10	12004-9240-035-35	. . . ARCUATE ARM	1	E
11	12004-9240-035-36	. . . ARCUATE ARM HUB	1	E
12	12004-9240-035-29	. . MIRROR ADJ SCREW VERTICAL . . .	1	
13	12004-9240-035-110	. . SCREW, FIL HEAD	2	

E. Not procurable as separate part. Order 12004-9240-035-34.

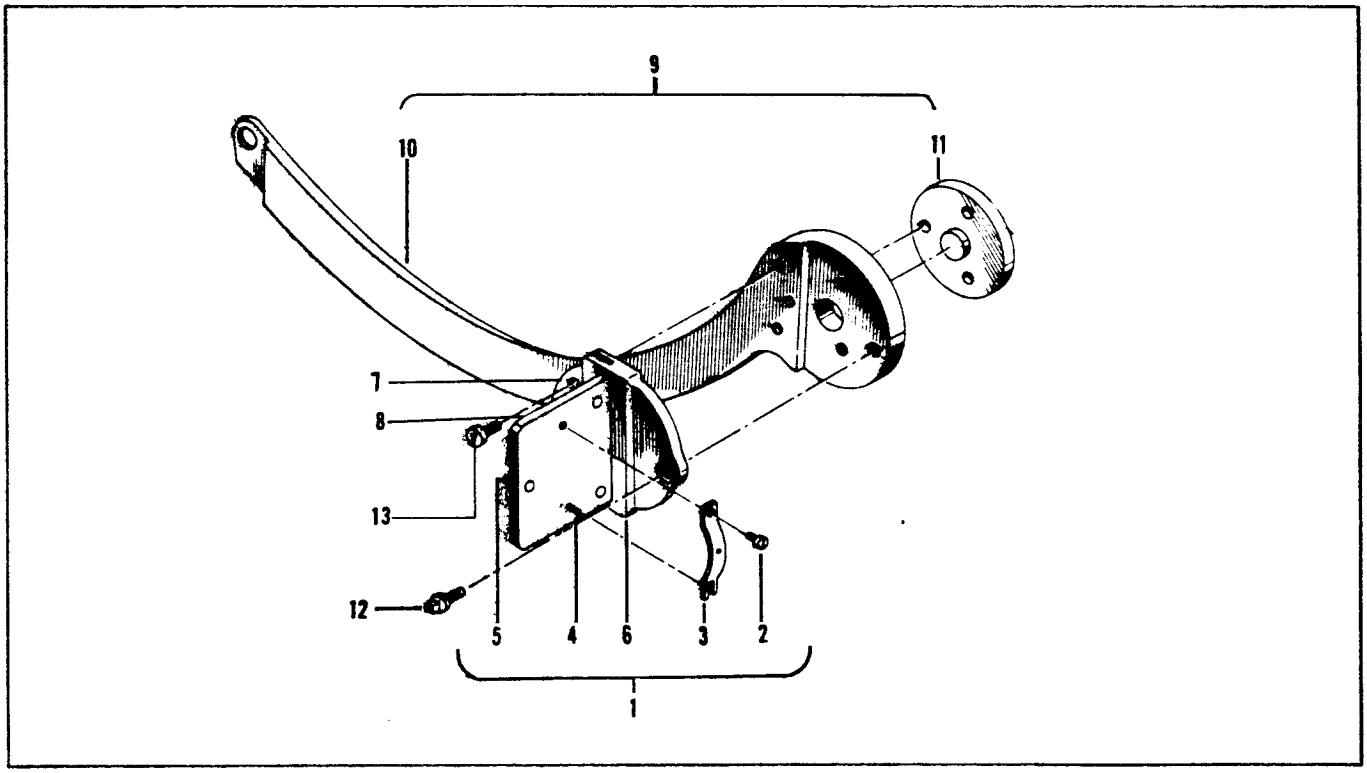


Figure 7-4. Base and Arcuate Arm Assembly

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY	NOTES
7-5		BASE AND TURNTABLE ASSEMBLY - HORIZON MIRROR	REF	
1	12004-9240-035-19	. HORIZON MIRROR ADJ BASE ASSEMBLY	REF	
2	12004-9240-035-136	. . . SCREW, CLAMPING SPRING	1	
3	12004-9240-035-24	. . . MIRROR CLAMPING SPRING	1	
4	12004-9240-035-23	. . . DOWEL PIN, GUIDE	1	
5	12004-9240-035-108	. . . RIVET, ROUND HEAD	3	
6	12004-9240-035-20	. . . HORIZON MIRROR ADJ BASE . . .	1	
7	12004-9240-035-21	. . . MIRROR ADJ PLATE	1	
8	12004-9240-035-22	. . . RIVET, FLAT HEAD	2	
9	12004-9240-035-14	. HORIZON MIRROR TURNTABLE ASSEMBLY	REF	
10	12004-9240-035-15	. . . HORIZON MIRROR TURNTABLE . . .	1	
11	12004-9240-035-16	. . . TURNTABLE ADJUSTMENT PIN . . .	1	
12	12004-9240-035-29	. . MIRROR ADJ SCREW VERTICAL . . .	1	
13	12004-9240-035-110	. . SCREW, FIL HEAD	2	

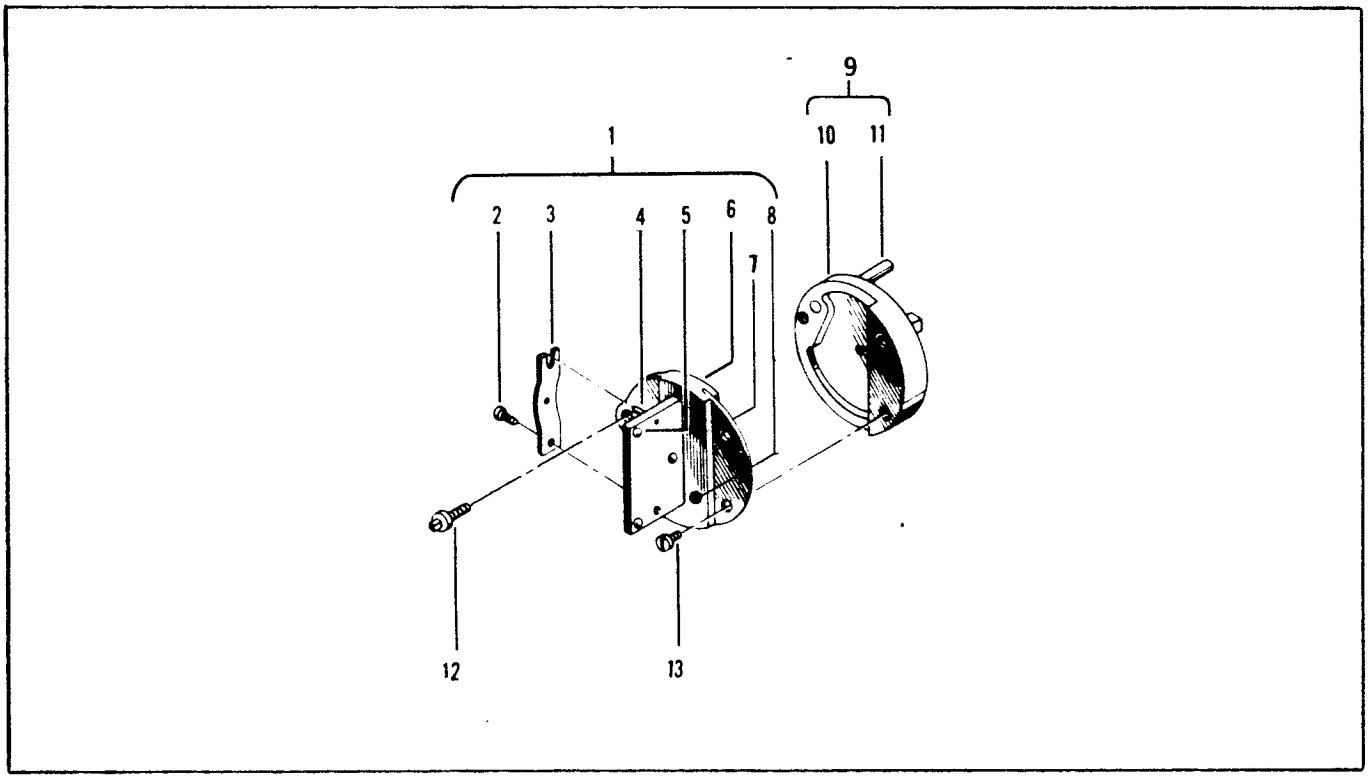


Figure 7-5. Base and Turntable Arm Assembly

FIG. & INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY	NOTES
7-6	12004-9240-035-5	TELESCOPE ASSEMBLY	REF	
1	12004-9240-035-9	. . EYEPIECE DRAW	1	
	12004-9240-035-10	. EYEPIECE LENS ASSEMBLY	REF	
2	12004-9240-035-13	. . . EYEPIECE LENS RING	1	
3	12004-9240-035-12	. . . EYEPIECE LENS	1	
4	12004-9240-035-11	. . . EYEPIECE MOUNT	1	
5	12004-9240-035-8	. . OBJECTIVE LENS RING	1	
6	12004-9240-035-7	. . OBJECTIVE LENS	1	
7	12004-9240-035-6	. . TELESCOPE BODY	1	

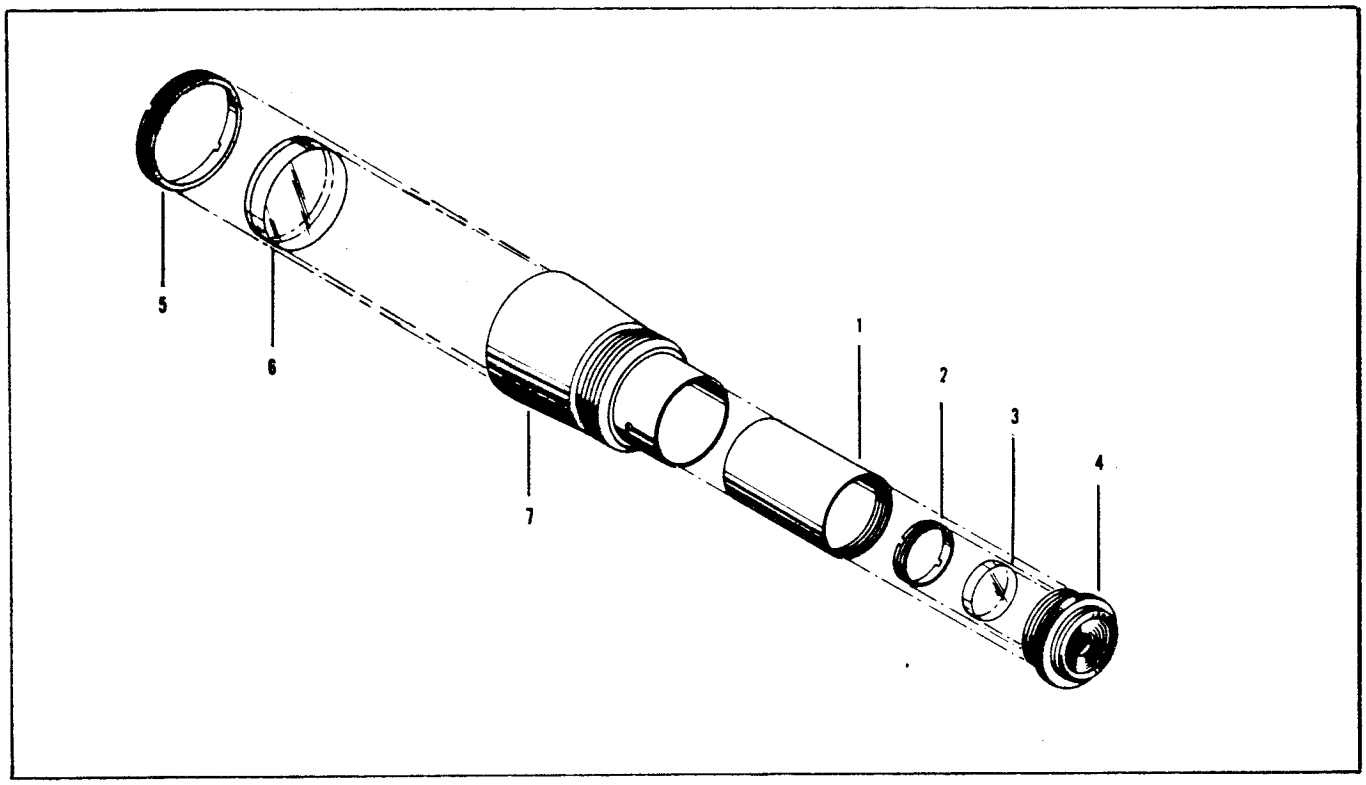


Figure 7-6. Telescope Assembly, Stadimeter

SECTION VIII

SPECIAL SERVICE TOOLS AND TEST APPARATUS

8-1 INTRODUCTION. The standard practice, as set forth in this manual for the repair of stadimeters is the result of an integration of the best and latest methods employed by both instrument manufacturers and Naval repair facilities. The special service tools, fixtures and test apparatus, used throughout the text and indexed in this section, were selected to:

a. Implement and expedite standard practice.

b. Reduce skill requirements to that of the personnel ratings indicated.

c. Prevent damage to parts during repair operations.

The tools are listed numerically by their tool numbers in Table 8-1, Special Service Tools and Test Apparatus. The names of the tools were selected to be as functional as conveniently possible to suggest their use.

Where tools and testing devices developed by a particular manufacturer or Naval facility are listed, the "Source" column in the tool list shows an acknowledgement.

The special service tools are illustrated in Figure 8-1. The tool illustrations are referenced by figure and index from the tool list. For those fixtures and test apparatus that are not illustrated in this section, references are included in the tool list to operational illustrations of them in the repair sections of the manual. The Control Manual includes a section entitled, "Navigational Instrument Test Apparatus" wherein the various types of test apparatus are described. Also, see the section "Navigational Instrument Service Tools and Fixtures" in that volume; it is an index of the special service tools for all navigational instruments.

As has been mentioned, the special service tools and fixtures are intended to save time, make your job easier and promote the efficiency of the repair work. However, these tools and fixtures are only the best to date. They can be improved and there is always a need for new and better tools.

You can contribute the benefits of your experience in actually doing the work by improving on these tools. The Beneficial Suggestion Program in shipyards was developed to encourage new ideas by offering rewards to those who make acceptable suggestions that save time and money. Enlisted personnel aboard repair ships and tenders are also invited to make their suggestions.

Become methods-conscious and constantly analyze your job and the tools you are using to see what improvements you can suggest. If you get an idea that will take time and material to develop, ask your supervisor for permission to work on it. Clear all such suggestions through your supervisor, and Beneficial Suggestion Committee, for transmittal to the navigational instrument authority in the Bureau of Ships.

Your efforts in this direction will make your job more interesting and it will profit you personally. The Navy will appreciate your interest. Future revisions of the Special Service Tool List will include any accepted suggestions and show which activity is responsible for the improvement.

FIG. & INDEX NO.	TOOL NUMBER	TOOL NAME	SOURCE
8-1	1	Wrench - Adjusting screw	BuShips Plan & Piece No. 57655-S2407 533132-N4615
8-1	2	Wrench - Frame leg pin	
8-1	3	Wrench - Eyepiece clamp	
8-1	4	Wrench - Eye lens and objective retainer ring	
8-1	5	Taps - Drum screw (set of six) 0.373 inch-9 American National Acme Thread - Class 3 0.374 inch-9 (same) 0.375 inch-9 (same) (nominal) 0.376 inch-9 (same) 0.377-1/2 inch-9 (same) 0.379-1/2 inch-9 (same)	Norfolk Naval Shipyard
8-1	6	Indicator, Dial with bracket	
4-1	7	Fixture - Telescope alignment, with pin drill jig	
6-1	8	Fixture - Center locating and infinity setting	Schick, Inc. T-1499
6-6	9	Collimator - Stadimeter MK 4, No. 5	

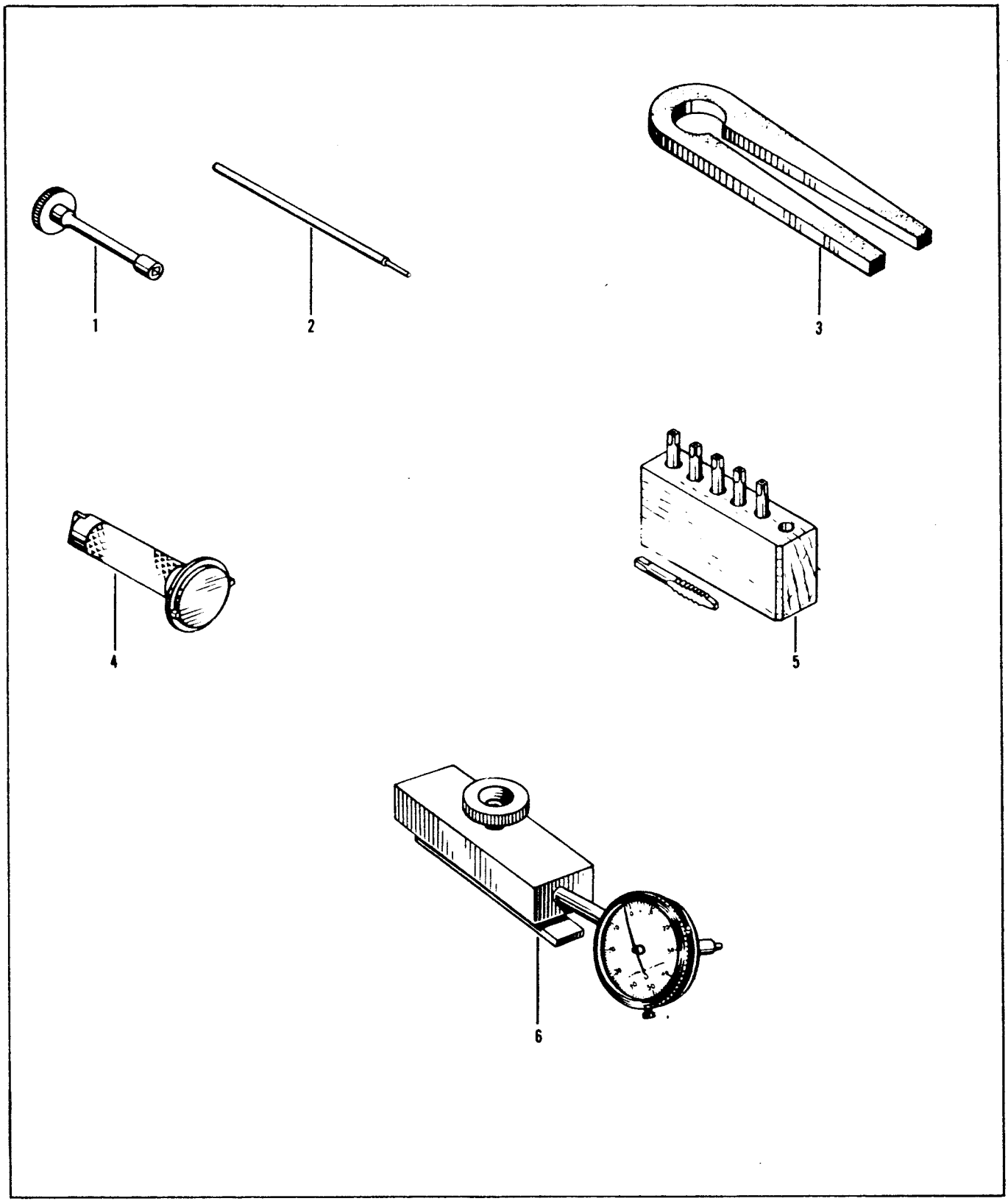


Figure 8-1. Special Service Tools

SECTION IX

STADIMETER SERVICE BULLETINS

9-1 INTRODUCTION. This section is provided for the manual as a place to incorporate the various stadimeter service bulletins as they are issued by the Bureau of Ships. It is contemplated that such bulletins will be the medium by which navigational instrument repair facilities are informed of changes and developments in stadimeter overhaul and repair procedures. Hence, it is important that all such information peculiar to stadimeter repair be placed immediately in this section of the manual. Changes affecting general navigational instrument standard repair procedures and techniques, inspection standards, etc. will be issued as supplementary service bulletins to the Bureau of Ships Navigational Instrument Control Manual.

All repair personnel should appreciate the importance of keeping up to date on all such changes. Good work can come only from well-informed personnel who are experienced in performing their duties.