U. S. NAVY

Bureau of Construction & Repair

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Submarine Periscope

Design Designation 89KA40/1.414

Registry Numbers 817 to 836 Inclusive
" " 845 " 852 "

Manufactured by

KOLLMORGEN OPTICAL CORPORATION

767 Wythe Avenue Brooklyn, N. Y.

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CONFIDENTIAL

This booklet is considered confidential within the meaning of U. S. Code, Title 50, Section 31, and all persons having access hereto are warned against unauthorized disclosure of the contents hereof.

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General Description

Submarine Periscopes for this Design Designation are alti-periscopes of 40 foot nominal length and 7½ inch outer diameter. They are designed for high-power and low power observations, and are equipped with tilting prisms for elevation or depression of the line of sight. Other features comprise a built-in stadimeter for estimating the range and course angle of the target, a stabilized line for estimating the speed of the target, and interchangeable ray filters for special conditions of observation.

Characteristics of Periscope

Overall Length	41′ 8¾″
Optical Length	41′ 0″ = 12,192 m/m.
Magnification, Low Power	1.5x
Magnification, High Power	6.0x
Field, Low Power	32°
Field, High Power	8°
Exit Pupil (Both Powers)	4 m/m.
Maximum Elevation of Line of Sight (Above Horizontal)	45°
Maximum Depression of Line of Sight (Below Horizontal)	10°
Ray Filters: Clear, Red, Green, Yellow, Polarizing, Dark Neutral (In order named, rotating disk clockwise)	
Outer Diameter of Main Body Tube	7½″
Outer Diameter of Head Section	1.414″
Maximum Diameter of Hoisting Yoke	14¾″
Maximum Diameter of other External Projections (but see under "Installation")	12½″
Material of Main Body Tube	Corrosion Resisting Steel
Material of Reduced Section	Corrosion Resisting Steel

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PART ONE

INSTRUCTIONS

for the

INSTALLATION, REMOVAL,
DRYING, SHIPMENT & USE

NOTE: Attention is invited to the Manual of the Bureau of Construction and Repair, regarding the necessity for and procedure to be followed in the case of all repair work which involves breaking the hermetical seal of the periscope.

Installation

See Plate I.

Before installing periscope it is necessary to remove all parts projecting beyond the $7\frac{1}{2}$" diameter. Reference should be made to Plate I, and all screws indicated thereon *by number* should be removed, and the parts held thereby detached. Cover plates for tape adjustment should not be removed during installation, as their removal will break the seal of the periscope. A complete list of parts to be removed follows:

Training Handles—Remove by taking out screws P-1161-7.

Azimuth Line Control Panel—Remove by taking out screws P-1179-37.

Focussing Knob—Remove by taking out screws P-1179-61.

Ray Filter—Remove by opening fully and sliding out of hinges. A spring-and-ball detent is provided to prevent accidental displacement of the filter when opened.

Stadimeter Housing — The stadimeter housing contains gearing which is connected to the internal mechanism by means of a keyed shaft projecting upward from the stadimeter housing, and a recessed coupling in the bottom of the eyepiece box. A section of this assembly is shown on Plate II. Care must be taken in removing the stadimeter housing to avoid hammering or excessive tilting which might damage the shaft or the electrical contact pins which also project from the housing. The screws P-1172-13 are first removed, and the housing removed, in order to prevent improper resassembly. A further check locks the stadimeter handwheel against rotation when the housing is removed, in order to prevent improper reassemblyn. A further check on the correct reassembly of the stadimeter is afforded by noting that with the periscope in observing position (see "Operation of Stadimeter) the figure 60 on the central or stationary dial appears about opposite the value 2.2 on the intermediate dial.

Hoisting Yoke—Unscrew cover ring P-1182-4. Slide hoisting yoke assembly over eyepiece box, tapping lightly if necessary. Remove split ring P-1182-3 from groove in tube.

The parts should be removed in the order named. No parts other than those mentioned should be removed.

After insertion of the periscope, the parts should be replaced in the inverse order. The precautions noted in connection with the removal of the stadimeter housing should again be taken, with special care that the projecting stadimeter shaft enters the coupling. The electrical contact pins must not be bent, as this may break the hermetical seal of the instrument. No gasket is required between the eyepiece box and the stadimeter housing.

At the time of removal of the training handles, focussing knob, and azimuth line control panel, the markings on the various square shafts or couplings should be noted. Upon reassembly all shafts should be inserted in their original positions as marked.

The maximum diameter of external projections on the periscope (other than the hoisting yoke) does not exceed $12\frac{1}{2}$", with the exception of the folding crank provided on the stadimeter knob to facilitate its operation. This crank, when extended, projects to a maximum diameter of 15". If obstructions in the housing well or elsewhere will not clear this crank, it should be removed entirely.

Extension tubes, screwed into the female thread in the bottom of the stadimeter housing, may be required for the operation of limit switches. Such tubes should have a 3.750" O. D. 14 pitch U. S. Standard thread not more than $\frac{3}{4}$" long. A shoulder of about $4\frac{1}{4}$" diameter should be provided to seat on the stadimeter housing. Extension tubes should be as light as possible, and should not be of excessive length, in order to avoid possible damage to the periscope. Where required, a threaded plug may be used in place of an extension tube to provide a flat surface of contact with the limit switch.

Removal and Shipment

The procedure described under "Installation" should be followed in the case of removal of the periscope. All parts should be correctly mounted before shipment. The brass clamps provided should be fastened on the periscope tube to prevent axial movement during shipment.

Electrical Connections

The periscope is equipped with a self-synchronous motor for the operation of the stabilized line. A wiring diagram of the internal connections, plug and flexible cord is shown on Plate II. This motor is intended to be connected to the 36:1 speed master motor of the gyrocompass repeater system. It is designed for 90-110 v. A.C. secondary. Reversal of the periscope motor, if necessary, is effected by interchanging the green and white conductors in the connection box to which the flexible cord is attached. Care must be used in connecting to the compass circuit to avoid possibility of damage to the system.

Care of Periscope

The periscope should be hoisted and inspected daily, even while in port, by a qualified officer, to make sure that it works smoothly in its bearings and that all parts are in perfect working order. The head window, eyepiece window and ray filters should be cleaned as often as necessary, all such surfaces being readily accessible. The glass may be cleaned with alcohol and wiped with Selvyt cloth, lens paper, or a clean dry cloth. Unnecessary cleaning should be avoided, owing to the danger of scratching the glass.

It is important, in the care of the periscope, that the packing glands on shafts entering the eyepiece box be periodically tightened. The packing glands are located as follows:

1 Under Right Training Handle Bracket
1 Under Left Training Handle Bracket
2 Under Azimuth Line Control Panel
1 Under Focussing Knob Bracket
1 Under Ray Filter Assembly Mounting Plate
1 Under Stadimeter Housing.

The training handles, azimuth line control panel and focussing knob should be removed as described under "Installation". The stadimeter housing should be similarly removed, except that before removal the stadimeter knob should be rotated clockwise to the positive end stop; this is for the purpose of preventing rotation of the stadimeter shaft when the packing gland is tightened.

The six packing glands thus exposed should be tightened by first loosening the locking screws on each, and then rotating the gland clockwise, using the special wrench supplied in the tool box. The square socket on the wrench is useful for testing and working in each gland. The gland on the stadimeter shaft should be worked in only by replacing the housing and using the stadimeter knob; any other procedure may result in a derangement of the stadimeter mechanism.

The remaining packing gland, under the ray filter mounting plate, is reached through two holes in the plate. The screws under these holes should be tightened equally, one-quarter turn at a time. This gland is worked in by moving the focussing knob.

The packing glands should be tightened upon installation of the periscope, and about every two months thereafter. The gas pressure should be checked at the same intervals. This is done by removing the plug P-1120-13 marked "Air Out" and replacing it with the hose connection supplied with each periscope. A pressure gauge should be connected by means of a short length of hose, and the outlet valve P-1120-15 opened. A normal pressure is 5 to 7 pounds per square inch at 70° F.

Should the image become fogged as a result of moisture inside the periscope the instrument should be dried out. Proceed as follows: (See Plate II.) Remove plug P-1120-13 marked "Air In" and insert the air hose connection supplied with the instrument. Connect to supply of nitrogen or dry nitrogen-air mixture. Remove corresponding plug marked "Air Out" and open inlet and outlet valves P-1120-15 so as to permit a gentle circulation. Continue circulation for ten minutes, then close outlet valve and fill periscope to a pressure of 7 pounds per square inch. Then close the inlet valve and replace the plugs. Should any moisture be detected in the periscope it should be dried out at the first opportunity to avoid corrosion of internal parts.

When the periscope is cold, a temporary fogging of the outside of the eyepiece window may occur as a result of moisture in the observer's breath. The condensation may easily be wiped off by opening the ray filter plate, and the phenomenon will cease when the instrument becomes warmer.

Underneath both stadimeter scales will be found grease fittings of the Zerk type. A soft water-pump grease should be forced into these fittings occasionally to lubricate and prevent corrosion of the stadimeter scales. The surplus grease will emerge between the scales and should be wiped off. No polish or other abrasive should be used on the stadimeter scales.

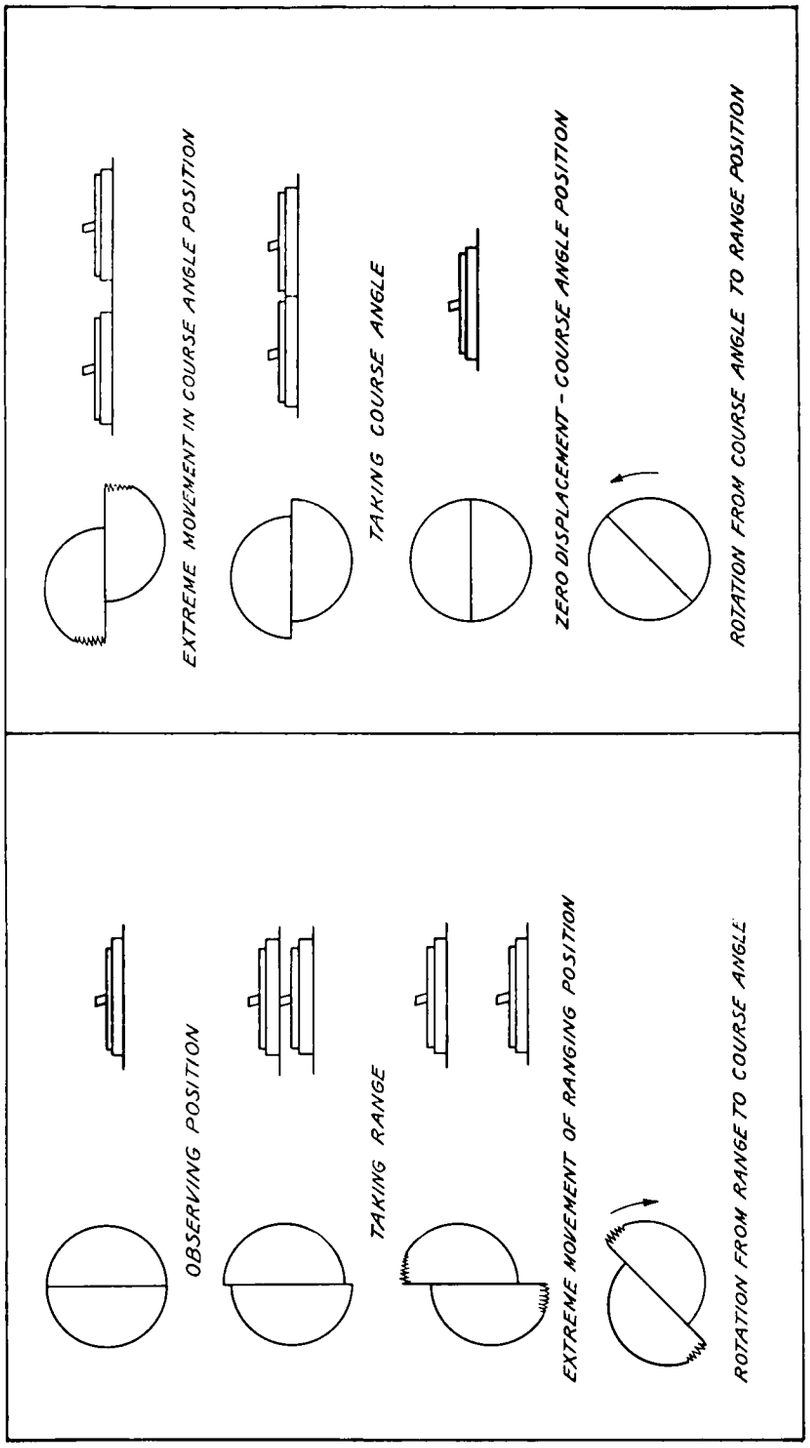
Observing with Periscope

The observer should determine the best focus for his eye, and make the proper setting on the diopter scale before starting observation. The diopter scale is located on the hub of the focussing knob. The stadimeter should of course be in the observing position.

The power shift is operated by the grip on the right training handle, which should be rotated to the limit of its travel in each position. The prism tilt is operated by the grip on the left training handle.

Each large division on the telemeter scale corresponds to an angle of 1° at high power, and 4° at low power. Each sub-division corresponds to an angle of 15′ at high power, and 1° at low power.

The use of the ray filter is recommended under conditions of visibility impaired by fog, haze or other conditions. The polarizing filter is intended to cut off the glare of sunlight reflected from the sea or other shiny surface. It may also be used in place of the light neutral filter formerly supplied.



Principles of Stadimeter

The principle of the stadimeter is that of duplicate images, the distance between which can be varied so that, for instance, the waterline of a vessel in one image can be brought into apparent contact with the masthead as seen in the other image. The amount of displacement necessary to effect this is translated on the stadimeter dials to the range of the vessel as read against the known distance between masthead and waterline. In this case the images are displaced vertically. However, a similar displacement can be produced horizontally, and the bow and stern of a vessel may be brought into apparent contact on the two images. The length of the vessel being known, and its range having just been found, the course angle can now be read on the proper scale of the stadimeter dials.

The duplicate images are produced by two movable lens halves, which travel in a plane normal to their axis and in a direction parallel to their dividing line. When so placed that they form one complete circle they form only one image, and in this condition are said to be in the observing position (see illustration). The displacement of the lens halves is actuated by the stadimeter knob through transmission gears, to which are connected also the stadimeter dials. After the lens halves have reached their maximum displacement, further rotation of the stadimeter knob causes them to rotate about each other, changing their line of division from vertical to horizontal with respect to the image, and thus changing the stadimeter from range position to course angle position.

It is desirable that the user familiarize himself with the operation of the stadimeter. This may be done by putting it through its cycle of movements, meanwhile examining the exit pupil of the periscope, either by holding the eye about ten inches away from the eyepiece, or by using a hand magnifier. Since the exit pupil is an image of the objective lens halves, (not of the object), its appearance serves to show the relative position of the halves at all times.

The accompanying illustration shows the appearance of the exit pupil and of the target at each stage of the cycle. When the stadimeter knob is turned counter-clockwise to the limit of its travel, the periscope is in its observing position. A clockwise rotation of the knob produces first a partial, then a complete, displacement of the lens halves (at complete displacement the outer ends of the lens halves are not visible, since they are outside the field). At this position further clockwise rotation of the knob lifts a detent and allows the lens halves to rotate ninety degrees. If the stadimeter knob is now rotated in a counter-clockwise direction the lens halves will approach each other through the course angle position until they again form one circle. Here a detent again lifts and further counter-clockwise rotation of the knob revolves the half lenses back to their original or observing position.

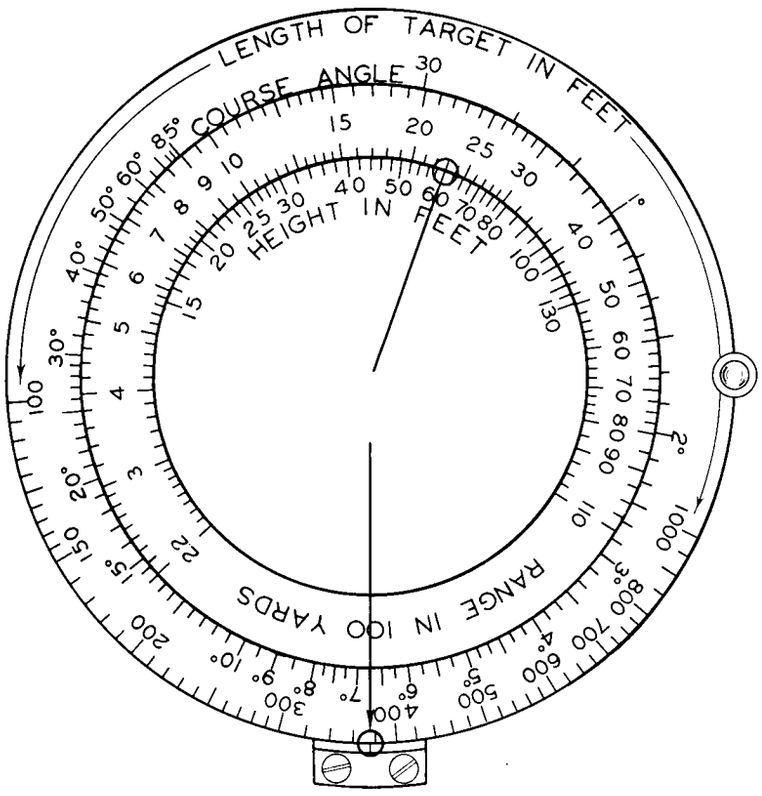


Figure A

It is well to note that in order to make a course angle observation the range position must first be traversed, and that to return from course angle position to range position it is necessary to bring the lenses into coincidence and then rotate them to the observing position. At the conclusion of the observation the stadimeter should always be returned to observing position, with the stadimeter knob turned counter-clockwise as far as it will go. The resistance of the detent encountered at coincidence of the lenses in the course angle position should not be mistaken for the limit of travel of the knob.

The indications on the two stadimeter dials, while nominally identical, may vary slightly as a result of unavoidable backlash in the gears. Similarly, the readings on one dial may show slight variations, depending upon the direction in which the observer moves the knob while setting the images in proper contact. These errors are negligible, being far smaller than the observation errors of the instrument.

The stadimeter dial at the back of the eyepiece box is provided so that the observer may keep his eye to the eyepiece while an assistant records the range and course angle of the target. The observer may do this himself, using the front dial, but in this case the observation will take more time.

Operation of Stadimeter

The illustrations Figure A and Figure B pertain to the following problem: Given a target vessel whose height from waterline to masthead

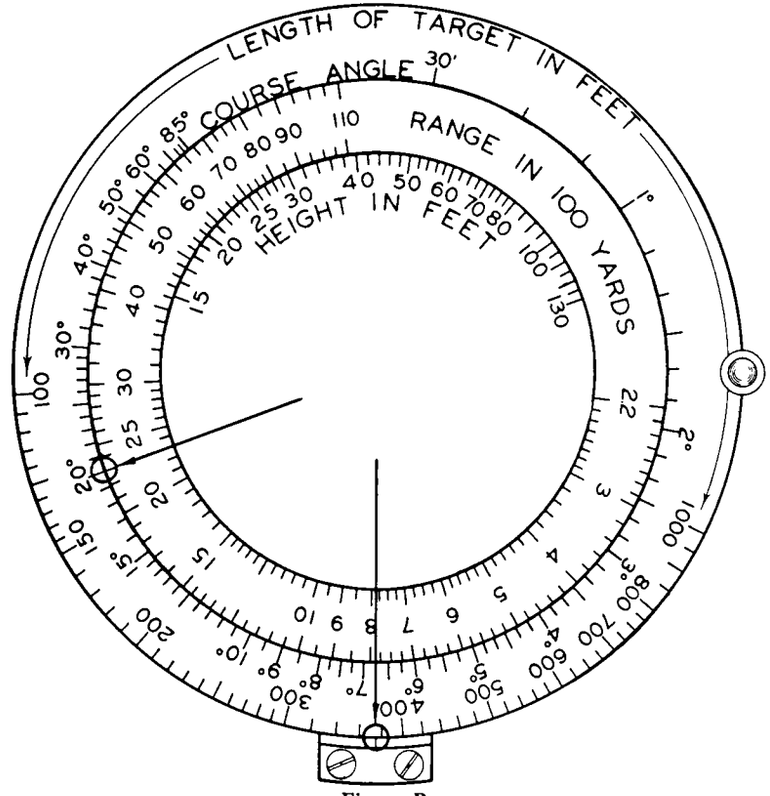


Figure B

is known to be 60 feet, and whose length from bow to stern is known to be 375 feet; to find the range and course angle.

The *length* of the target is first set on the outer scale against the index mark, and the outer scale is clamped by locking screw. Then, starting with the stadimeter at observing position, the target is first brought approximately into the center of the field of view, and the observer rotates the knob clockwise until the masthead of the object in one image coincides with the waterline in the other image. At this point the scales are as shown in Figure A, and the range (2300 yards) is read on the inner scale of the intermediate dial, opposite the height (60 feet) on the central scale.

The observer then resumes turning the knob clockwise to the limit of its travel, then reverses the direction, stopping when the bow of the target in one image coincides with the stern in the other image. The position of the scales at this stage is shown in figure B. The course angle (20 degrees) is read on the inner scale of the outer dial, against the range (2300 yards) on the intermediate dial. The angle thus found is measured from the *line of sight* of the periscope. It should be noted that the course angle is measured irrespective of the direction of movement of the target, and may be considered as the angle observed, or its supplement, in this case 160°.

By continuing the counter-clockwise rotation of the knob to the limit of its travel the periscope is restored to the observing position, ready for the next observation.

The following procedure is suggested for use when it is necessary to take observations with the minimum possible time for exposure:

Periscope Partially Housed

1. Observer's assistant sets known length of target vessel against index mark on rear stadimeter dial and clamps scale.
2. Assistant marks known height of target on central scale with red pencil, in order to find it quickly.
3. Observer makes sure that stadimeter is in observing position and that periscope is in high power, sets focus of periscope on the diopter scale for his eye, and exposes periscope.

Periscope Exposed

4. Observer locates target and centers it approximately in field of view. No accuracy is required.
5. Observer adjusts stadimeter and, upon coincidence, calls "Range". Assistant reads and marks range on intermediate scale.
6. Observer brings stadimeter to course angle position, makes adjustment, and upon coincidence, lowers periscope without taking reading.

Periscope Partially Housed

7. Assistant records course angle and range, and stadimeter is reset to observing position.

The entire observation should, with practice, be made in considerably less than a minute. If only the range is required, steps 1, 2 and 6 may be omitted, and the periscope lowered with the stadimeter in coincidence position for range, after which the range is read and the stadimeter restored to observing position.

The following hints may be of value:

(a) Difficulty may at first be encountered in centering the eye so as to see the duplicate stadimeter images with approximately equal intensity. Practice will overcome this difficulty to a great extent. On bright days one of the ray filters should be used to cut down the light and permit the eye pupil to expand so as to intercept a greater portion of the divided exit pupil.

(b) The dimensions selected for these observations should be preferably as great as possible, and the reference points should be definite and easy to see. Thus, while a masthead offers the greatest possible dimension above the water line, it may be invisible in haze. Sloping bows and sterns may introduce errors in course angle observations. In vertical measurements the use of the waterline as a reference point may result in errors due to atmospheric refraction. Even for reference points not on the waterline the atmospheric refraction, particularly at long ranges, foreshortens vertical objects and makes the range appear greater than it actually is.

(c) The stadimeter is graduated up to 11,000 yards. Longer ranges may be obtained by remembering that the angle subtended by 80 feet, for instance, at 20,000 yards is the same as that subtended by 40 feet at 10,000 yards. Thus an object 80 feet high may be set up at the 40 foot line and the range obtained multiplied by 2.

(d) Remember that practice is essential to the successful operation of the stadimeter.

Description of Stabilized Azimuth Line

The stabilized azimuth line provides in effect a "line in space" in the field of view. Irrespective of the range or course angle of the target, its apparent time of passage across this line and its known length serve as factors on which to calculate the speed of the target.

The azimuth line is actuated by a self synchronous motor, which in turn is governed by the gyro compass of the submarine. The position of the line is thus independent of changes in the course of the submarine, but if the periscope is rotated in its bearings the azimuth line will of course move against the field. Like the stadimeter, this device is intended only for use in the high power magnification. The controls of the azimuth line consist of a setting knob with which the line is placed where desired in the field of view, and a clutch by which the line is disconnected from the setting knob and connected to the motor.

Operation of Stabilized Azimuth Line

The recommended procedure is as follows:

1. Make sure that the clutch is in "out" position.
2. Connect motor by inserting plug attached to flexible cord. Note that this plug can be inserted in only one position.
3. With periscope in high power, turn setting knob until line appears in field of view and is slightly ahead of target.
4. Turn clutch to "in" position and time passage of target over line, using only one side of line for reference. A stopwatch is preferable for this observation.
5. Turn clutch to "out" position, and remove line to edge of field of view by rotating setting knob.
6. Disconnect plug.

Care should be used that the plug is not inserted while the clutch is in "in" position, otherwise damage to the motor or to other repeaters on the compass circuit might result. The plug is designed to release automatically should the periscope be suddenly housed, but this should not be relied upon for routine observation; the plug should be removed by hand. Prolonged use of the motor should be avoided, as its heating may produce detrimental air currents within the sealed portion of the periscope. The clutch lever must be turned to the limit of its travel in the "in" position, otherwise faulty operation of the line will result.

Spare Parts and Tools for Vessel

The following parts are contained in the spare part and tool box supplied to the vessel with each periscope:

Quantity	Name	Part No.
2	Rubber Eye Buffers	P-1134-9
1	Blinder	P-1134-1
1	Set of Screws	P-1172-13
1	Set of Screws	P-1161-7
1	Set of Screws	P-1179-37
1	Set of Screws	P-1179-61
1	Air Valve Connection	P-1120-16
1	Air Valve Complete	P-1120-17
1	Adjustable Pin Wrench.	
1	Packing Gland Wrench.	
1	Screw Driver.	
1	Copy of Instruction Pamphlet.	

PART TWO

INSTRUCTIONS

for the

DISASSEMBLY, RENEWAL OF PARTS, CLEANING, ASSEMBLY & ADJUSTMENT

NOTE: Attention is invited to the Manual of the Bureau of Construction and Repair, regarding the necessity for and procedure to be followed in the case of all repair work which involves breaking the hermetical seal of the periscope.

Disassembly

Refer to Plates II. and III.

Before starting disassembly it is essential that the head prism be turned to its horizontal position and that the power shift be placed in low power. The periscope should then be stripped of all external parts as described under "Installation", and disassembly should proceed as follows:

The internal gas pressure should be released and the cover plates P-1353-5 removed, exposing the adjustment of the power shift and prism tilt tapes. The tension on the tapes is relieved by loosening the adjusting nuts P-1133-12.

The joint at the head of the periscope should next be broken. This is done by removing the set screw P-1310-18 and unscrewing the right-and-left coupling P-1306-6, which has a right hand thread on the reduced section of the outer tube. Using care to avoid damage to the gasket, the outer head may now be withdrawn, with the head window still in place.

The tape clamps P-1315-3 should next be removed, together with the screws P-1310-17 holding the inner head assembly to the reduced section. The inner head assembly is then withdrawn. Before proceeding further, it is necessary to hold the tapes in place. This can be done by using a short piece of wooden dowel 1" in diameter, to which the tapes are held by small tacks passing through the holes in the tapes. The tapes are then tightened sufficiently to pull the dowel into contact with the inner tube. A larger dowel will not pass through the outer reduced section; a smaller one may rest upon the top lens in the inner tube and damage it.

The set screws P-1177-10 on the main coupling at the eyepiece box are loosened and the coupling P-1163-8 unscrewed. This coupling has a right hand thread on the body tube and a left hand thread on the eyepiece box. If it is desired to withdraw the entire inner tube this may now be done, using care to avoid bending any of the sections. If it is desired to reach merely the eyepiece box mechanism, the inner tube should be withdrawn only a few inches.

Before the eyepiece box can be detached it is necessary to remove all connections with the inner assembly. The ray filter base plate P-1358-1, which is held in place by a gib attached with screws, should be removed. All packing glands should be removed as units with the short shafts passing through them, except in the case of the stadimeter shaft gland, P-1316-8, in which a through shaft is used. The electric receptacle P-1179-48 should be removed, and the internal conductors detached from it. The eyepiece window frame P-1173-1 and eye lens mount P-1173-6 should be removed. The screws P-1179-59 which hold the eyepiece box to the inner tube are next taken out with the use of an offset screwdriver. The eyepiece box is now free, and should be passed carefully over the inner assembly.

The inner tube may be disassembled by removing the tapes, disconnecting the air duct, and separating the couplings of the inner tube sections wherever desired. That portion of the stadimeter mechanism which actuates the lower objective lens halves should not be disturbed, nor should the lens halves be unmounted, as this will destroy adjustments which can be made only where special equipment is available.

Cleaning and Renewal of Parts

Optical surfaces may be cleaned with alcohol and wiped with lens paper or Selvyt cloth. Care must be used to avoid scratching the scale or the upper surface of the eyepiece prism, as such scratches will be visible in the field of view. Alcohol must not be used on silvered surfaces, as it may soften the lacquer and expose the silver to damage.

When optical parts are renewed or reassembled, they must be seated firmly in their mounts, but without strain.

Reassembly and Adjustment

When reassembling, proceed in inverse order to that given under "Disassembly". The head prism must be in the horizontal position and the periscope in low power, before the outer head is attached. The shifting wires should be connected at their upper ends, and adjustments made in the spindles at the lower end. When shafts and gears are replaced, care should be taken to match the original markings of mating parts.

Adjustment of the stadimeter should not be undertaken unless a series of objects of known height at different ranges is available, or a collimator especially graduated for this purpose.

Use of Special Tools

The following special tools are supplied:

1 Spanner Wrench with extension handle, for main coupling.
1 Adjustable Pin Wrench, for hoisting yoke and air valves.
1 Adjustable Clamp Ring Wrench, for all clamp rings.
2 Wrenches, for tape adjusting nuts.
1 Pin Wrench, for packing glands.

Spare Parts and Tools for Repair Shop

The following parts are contained in the spare part and tool box supplied to the repair shop:

2	Sets of Screws	P-1182-10
2	Sets of Screws	P-1161-7
2	Sets of Screws	P-1179-61
2	Sets of Screws	P-1179-54
2	Sets of Screws	P-1179-43
2	Sets of Screws	P-1179-66
2	Sets of Screws	P-1172-13
2	Sets of Screws	P-1179-47
2	Sets of Screws	P-1081-16
2	Sets of Screws	P-1179-59
2	Sets of Screws	P-1177-10
2	Sets of Screws	P-1179-37
2	Sets of Screws	P-1179-45
2	Sets of Screws	P-1179-48
2	Sets of Screws	P-1310-9 -A
2	Sets of Screws	P-1179-34
2	Sets of Screws	P-1179-23
2	Sets of Screws	P-1179-35
2	Sets of Screws	P-1310-7
2	Sets of Screws	P-1310-17-18
2	Sets of Screws	P-1310-19-21-23
2	Sets of Screws	P-1310-24-25-28
2	Sets of Screws	P-1310-29-33
2	Sets of Screws	P-1310- 3- 5- 8
2	Sets of Screws	P-1179-30
2	Sets of Screws	P-1179-74
2	Dry Air Plugs, complete	P-1120-17
2	Air Valve Connections	P-1120-16
2	Gaskets	P-1314- 5
2	Gaskets	P-1072A-2
2	Gaskets	P-1179-103
2	Gaskets	P-1179-102
2	Gaskets	P-1163-9
2	Gaskets	P-1171-14
2	Gaskets	P-1170-5
2	Gaskets	P-1179-100
2	Gaskets	P-1179-101
2	Gaskets	P-1177-11
12	Gaskets	P-1160-8
2	Gaskets	P-1314-1
2	Gaskets	P-1314-2
2	Gaskets	P-1171-12
2	Washers	P-1179-120
4	Spare Self-Synchronous Motors	P-1163-1
1	Set of Metal Tags	P-1314-3
2	Top Staunching Plates	P-1313-1
2	Objective Prisms	P-1313-2
2	Eyepiece Prisms	P-1313-13
2	Eyepiece Windows	P-1313-15
1	Spanner Wrench with Extension Handle.	
1	Packing Gland Wrench.	
1	Adjustable Pin Wrench.	
1	Adjustable Clamp Ring Wrench.	
2	Wrenches	
1	Roll of Palmetto Packing.	
1	Instruction Pamphlet.	
1	Set of Blue Prints.	

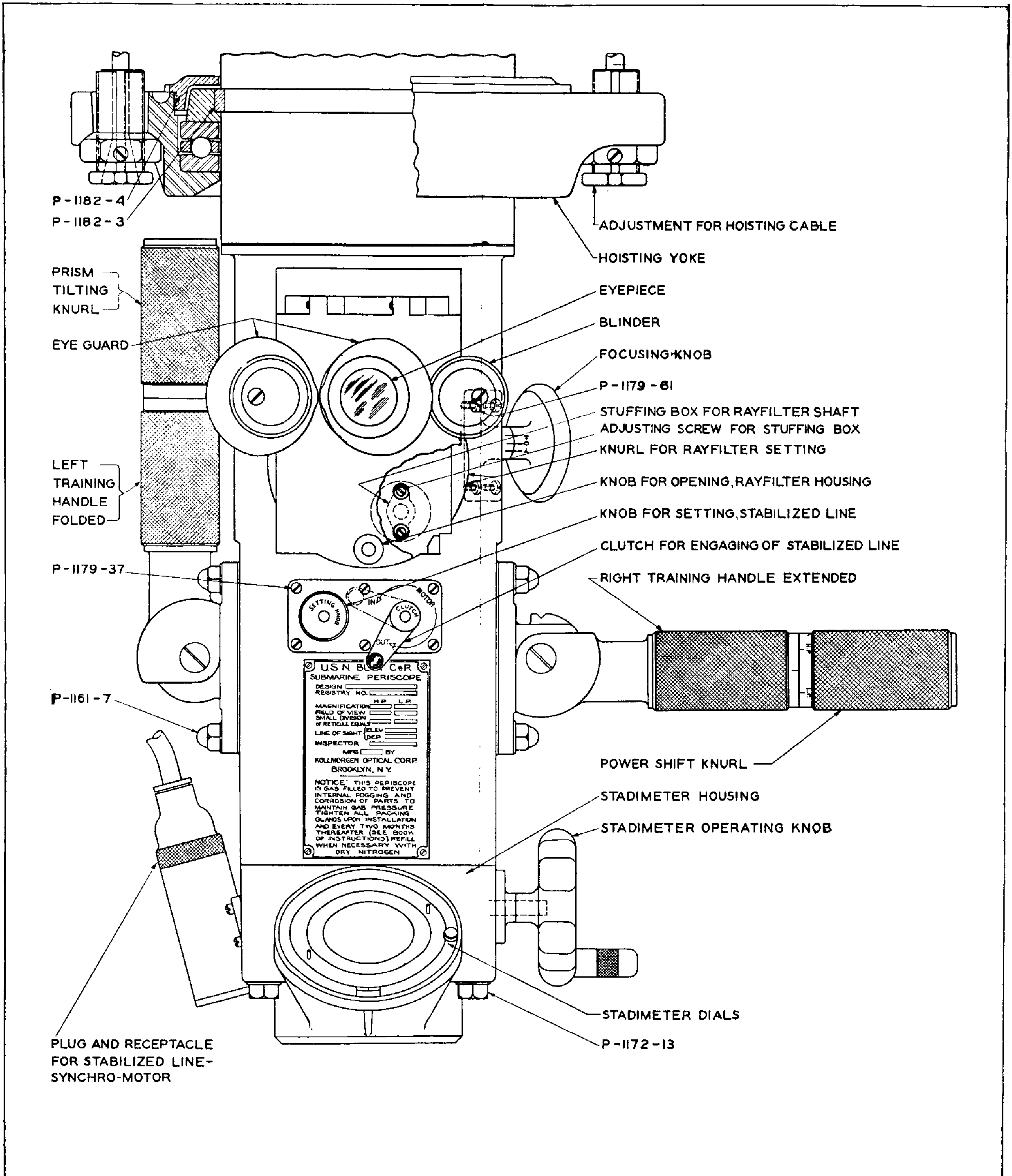

P-1182-4
P-1182-3
ADJUSTMENT FOR HOISTING CABLE
HOISTING YOKE
PRISM TILTING KNURL
EYEPIECE
BLINDER
EYE GUARD
FOCUSING KNOB
P-1179-61
STUFFING BOX FOR RAYFILTER SHAFT
ADJUSTING SCREW FOR STUFFING BOX
KNURL FOR RAYFILTER SETTING
LEFT TRAINING HANDLE FOLDED
KNOB FOR OPENING, RAYFILTER HOUSING
KNOB FOR SETTING, STABILIZED LINE
CLUTCH FOR ENGAGING OF STABILIZED LINE
P-1179-37
RIGHT TRAINING HANDLE EXTENDED
SETTING KNOB
IN
MOTOR
CLUTCH
OUT
U.S.N. BU. C&R
SUBMARINE PERISCOPE
DESIGN
REGISTRY NO.
H.P. L.P.
MAGNIFICATION
FIELD OF VIEW
SMALL DIVISION OF RETICULE EQUALS
LINE OF SIGHT ELEV DEP
INSPECTOR
MFG BY
KOLLMORGEN OPTICAL CORP.
BROOKLYN, N.Y.
NOTICE: THIS PERISCOPE IS GAS FILLED TO PREVENT INTERNAL FOGGING AND CORROSION OF PARTS. TO MAINTAIN GAS PRESSURE TIGHTEN ALL PACKING GLANDS UPON INSTALLATION AND EVERY TWO MONTHS THEREAFTER (SEE BOOK OF INSTRUCTIONS). REFILL WHEN NECESSARY WITH DRY NITROGEN
P-1161-7
POWER SHIFT KNURL
STADIMETER HOUSING
STADIMETER OPERATING KNOB
STADIMETER DIALS
P-1172-13
PLUG AND RECEPTACLE FOR STABILIZED LINE-SYNCHRO-MOTOR

Plate I.

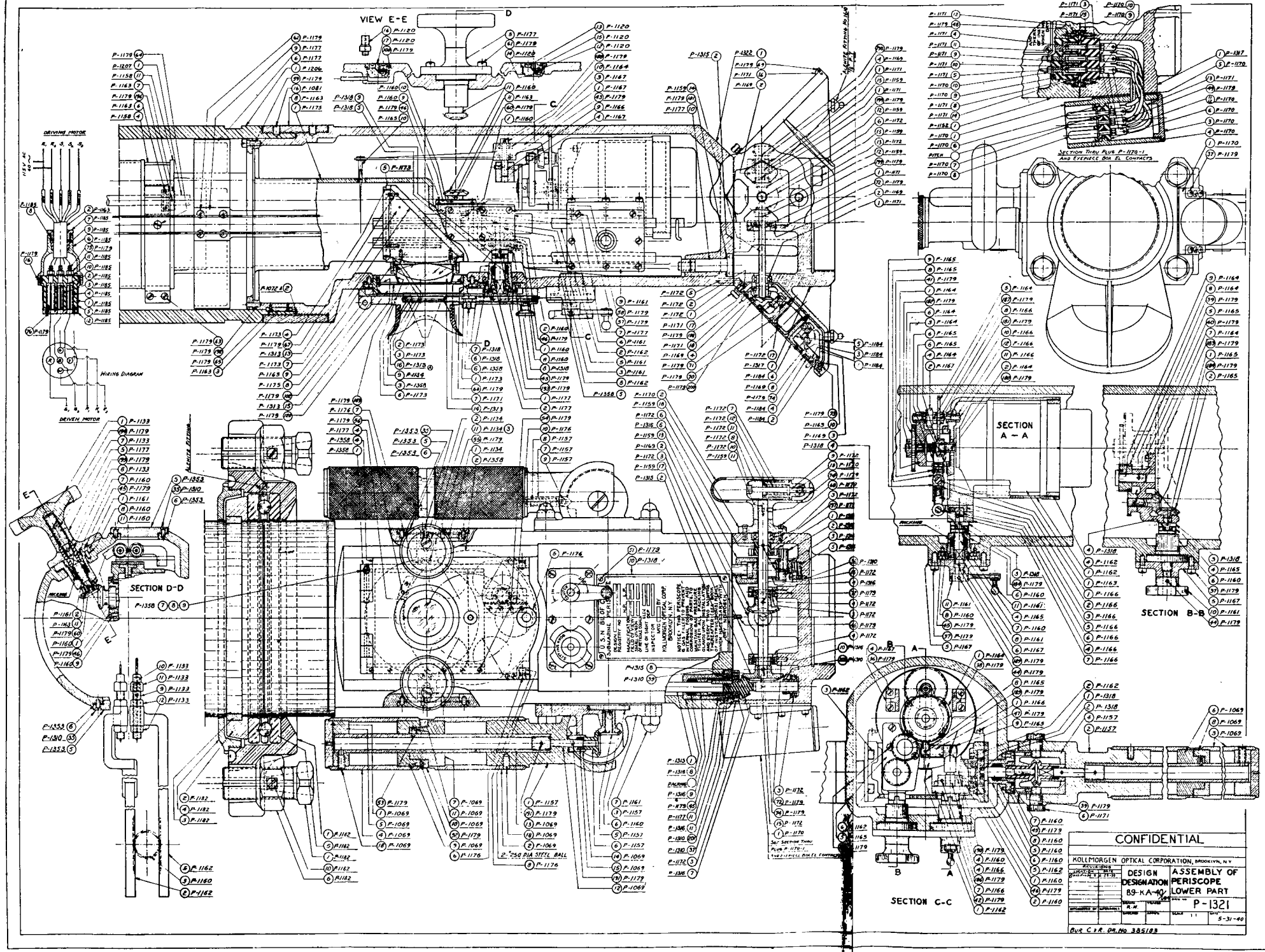
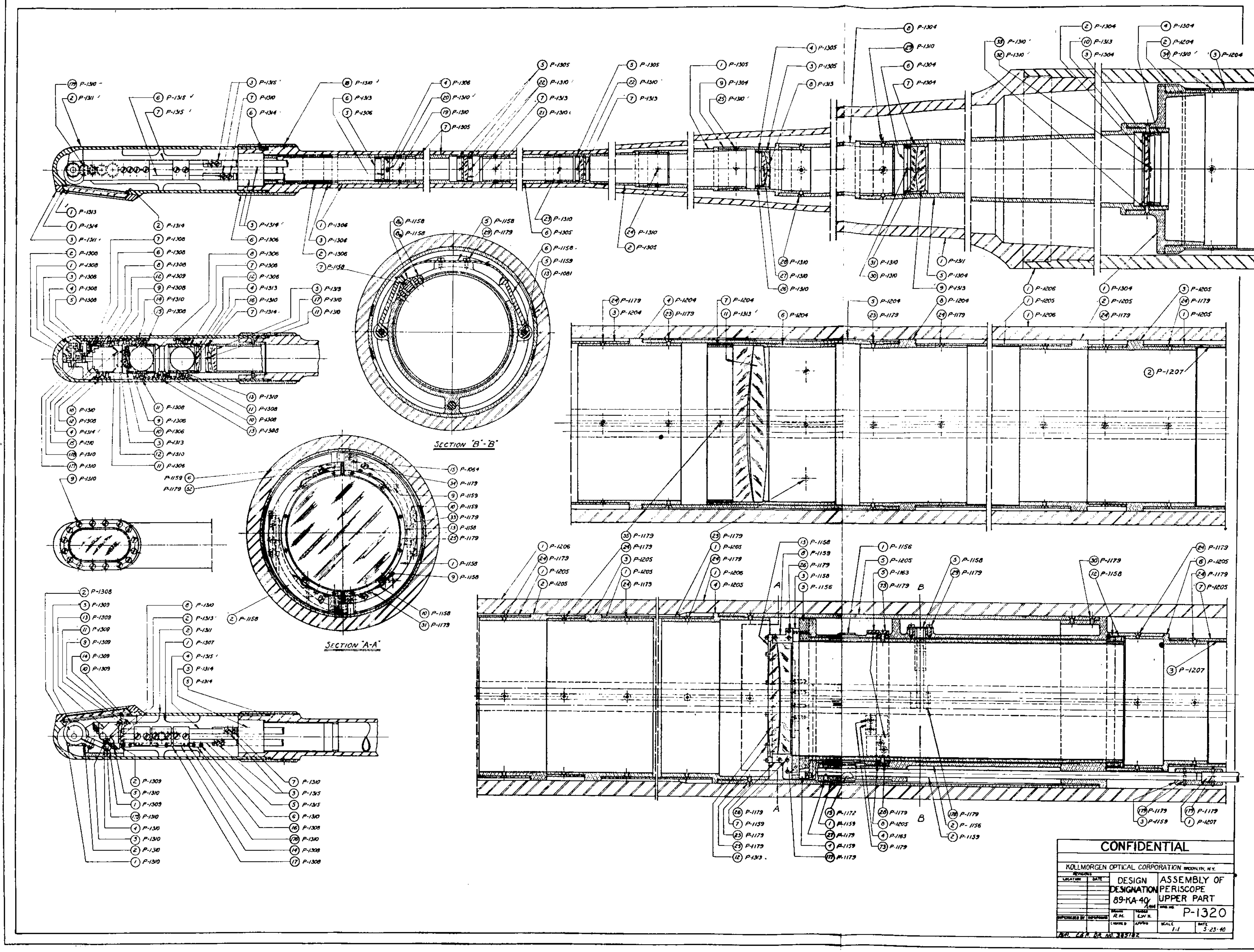

VIEW E-E
SECTION A – A
SECTION B-B
SECTION C-C
SECTION D-D
Section Thru Plug P-1170-1 And Eyepiece Box El. Contacts
DRIVING MOTOR
DRIVEN MOTOR
WIRING DIAGRAM
CONFIDENTIAL
KOLLMORGEN OPTICAL CORPORATION, BROOKLYN, N.Y.
DESIGN DESIGNATION 89-KA-40/
ASSEMBLY OF PERISCOPE LOWER PART
P-1321
5-31-40
Bur C.I.R. Dg. No 385183

Plate II.



SECTION "B"-"B"
SECTION "A-A"
CONFIDENTIAL
KOLLMORGEN OPTICAL CORPORATION BROOKLYN, N.Y.
DESIGN DESIGNATION 89-KA-40
ASSEMBLY OF PERISCOPE UPPER PART
P-1320
SCALE 1:1
DATE 5-23-40

Plate III.