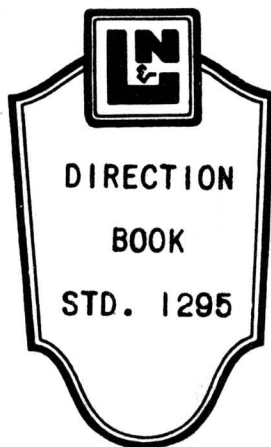


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DIRECTIONS FOR  
NO. 8621, NO. 8622 AND NO. 8623  
OPTICAL PYROMETERS



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**DIRECTIONS FOR**  
**NO. 8621, NO. 8622 AND NO. 8623**  
**OPTICAL PYROMETERS**

**1. GENERAL DATA**

These Optical Pyrometers are designed to measure the temperature of incandescent bodies under so called black body conditions and with special screens (placed in the telescope) certain of them can be used to measure the temperature of molten metal (such as molten steel).

The No. 8621 Pyrometer is a double range instrument with a low range of 1400°F. to 2250°F. and a high range of 1950°F. to 3200°F. The temperature values are read directly on two separate scales corresponding to the ranges.

The No. 8622 Pyrometer is a triple range instrument with a low range of 1400°F. to 2250°F., a high range of 1950°F. to 3200°F. and an extra high range of 2700°F. to 5200°F. The temperature values are read directly on three separate scales corresponding to these ranges.

The No. 8623 Pyrometer is a triple range instrument with a low range of 1400°F. to 2250°F., a high range of 1950°F. to 3200°F. and a range of 1950°F. to 3200°F. for molten metals (having a .4 emissivity factor). The temperature values for the low and high ranges are read directly on two separate scales corresponding to these ranges. The temperature values for the molten metal range are also read directly on the 1950°F. to 3200°F. scale but with the range change selector ring set at the .4 position.

The actual temperature ranges given above are for the standard catalog instruments as listed. However, these temperature ranges may vary considerably in special instruments but the directions will still apply to the special instrument except where otherwise noted.

These instruments are arranged primarily for portable use but can be mounted in a fixed location. The two major pieces composing the instrument are a telescope and a control box as shown in Fig. 1. The telescope "1", Fig. 1, is designed to fit the hand and has a

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\*Quotation marks indicate that reference is to a marking on a figure or illustration, when such marking is not engraved on the instrument itself. Quotation marks are omitted in references to actual instrument markings.

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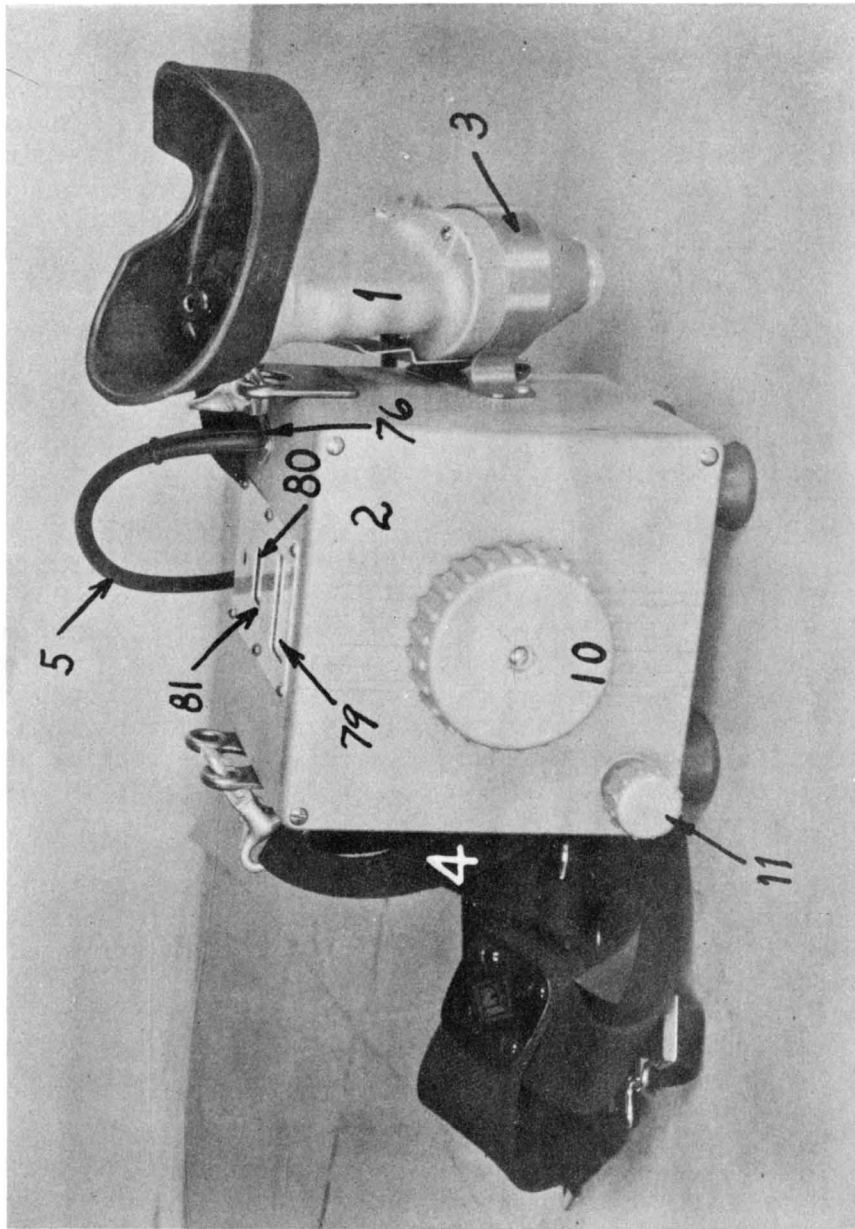


Fig. 1

eye shield for use when sighting on the body whose temperature is to be measured. The control box "2", Fig. 1, is provided with a bracket "3", Fig. 1, on one side for supporting and clamping the telescope when not in use, as in Fig. 1, and with an adjustable harness "4", Fig. 1, for use in supporting the instrument on the observer while the instrument is in use and also for carrying the instrument. The electrical connections between the control box and the telescope are made by means of wires in the flexible cable "5", Fig. 1, with the wires soldered to terminals in the control box at one end and sol-



dered to terminals in the telescope at the other end.

The control box contains a galvanometer "6", Fig. 2; a standard cell "7", Fig. 2; a breather "8", Fig. 2; two slidewires located under drum "9", Fig. 2; knobs "10" and "11", Fig. 1, for operating the slidewire contacts; and four dry cells mounted in a separate compartment in the back of the control box as shown in Fig. 3.

The telescope consists of a system of lenses and diaphragms, a lamp, a switch and means for focusing the lamp filament and the image of the hot body, all as shown in Fig. 4.

It is possible to obtain, as a separate item, a pistol grip to fasten to the telescope as in Fig. 3, where such a grip is desired for holding the telescope. The method of attaching this pistol grip to the telescope is outlined in Section 2-E.

The telescopes furnished with the standard No. 8621 and No. 8623 instruments have the objective lens "12", Fig. 4, adjusted for a distance of 8 feet from the telescope to the body upon which the telescope is sighted, and locked in this position. The Pyrometer then becomes a fixed focus instrument which is satisfactory for making typical commercial measurements without any further focusing of the hot object. However, if the highest degree of accuracy is required for each reading, it is necessary to release the locking device and adjust lens "12" for each distance. This adjustment is easily made as outlined in more detail in Section 4-E.

For some applications, where it is desirable to focus on a larger field, a substitute lens assembly may be furnished along with the No. 8623. In such cases, loosen the clamping screw in knurled ring "43", Fig. 4, and unscrew lens assembly "46" from the Pyrometer. Screw the wide angle lens into position and focus as explained in Section 4-E. It is recommended that the standard lens assembly be retained for possible use in checking the Optical Pyrometer by comparison with a standard Optical Pyrometer.

The telescope furnished with the standard No. 8622 instrument does not have the objective lens adjusted for use as a fixed focus instrument as it is necessary to adjust this lens when the readings change from either the low or high range to the extra high range or vice versa. However, if a series of readings are to be made on hot bodies involving only the low and high ranges, the focusing lens "12", Fig. 4, can be adjusted for a distance of 8 feet (from the telescope to the hot body) with the range changing ring "43", Fig. 6, in either the L (low) or H (high) range position and used as a fixed focus instrument for these two ranges. Further, if a series of readings are to be made on hot bodies involving only the extra high range the focusing lens "12", Fig. 4, can be adjusted for a distance of 8 feet (from the telescope to the hot body) with the range changing ring "43", Fig. 6, in the  $x^H$  (extra high) position and used as a

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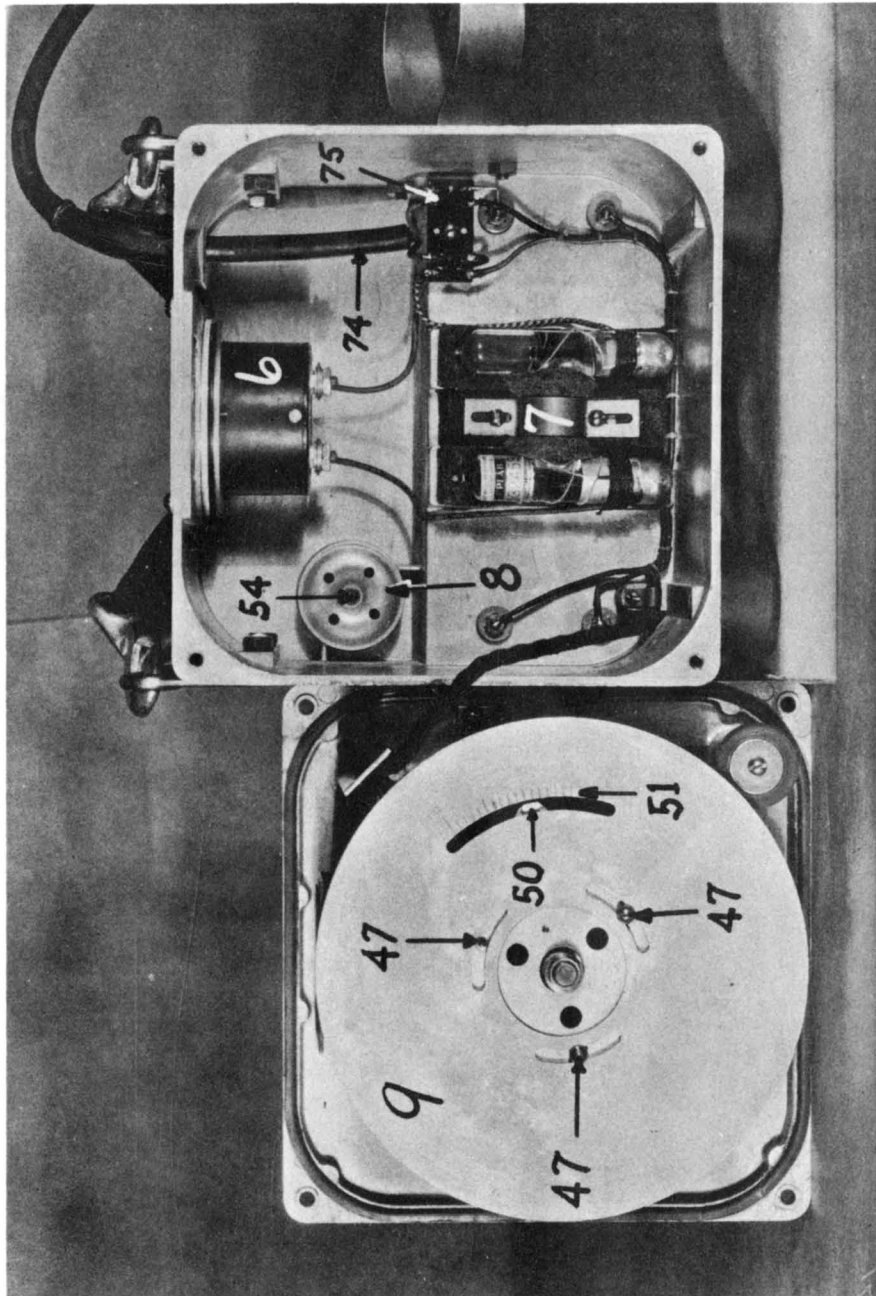


Fig. 2

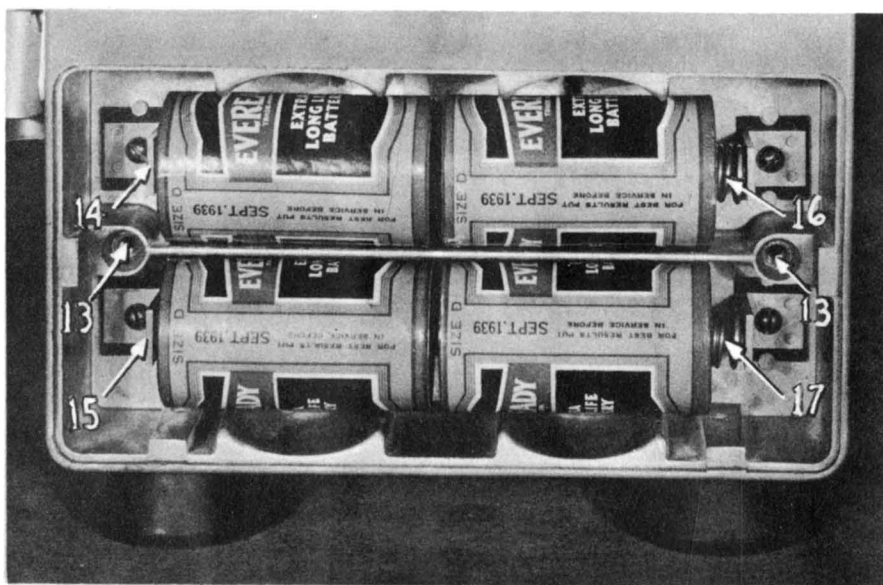


Fig. 3

fixed focus instrument for this range.

## 2. PREPARE INSTRUMENT FOR SERVICE

### A. Check Installation Of Dry Cells

The four size D dry cells are installed in a separate compartment which is accessible by removing the plate from the back of the control box as shown in Fig. 3.

The plate is held in place by two screws which fit into holes "13", Fig. 3. Loosen these two screws and lift the plate and screws (held in the holes in the plate by means of nuts) from the back of the control box.

The dry cells should be mounted in series in pairs as shown in Fig. 3, with the positive ends (top of cells) fitted against the bracket terminals at "14" and "15", Fig. 3, and the negative ends (bottom of cells) fitted against the spring contacts at "16" and "17", Fig. 3.

After the dry cells have been properly installed or checked, replace the plate on the compartment and fasten it in place with the two screws which fit into holes "13", Fig. 3.

### B. Clean Lenses Of Telescope

During shipment, the lenses at "12" and "18", Fig. 4, may have become dusty. Carefully wipe these lenses with fine tissue paper or soft cloth.

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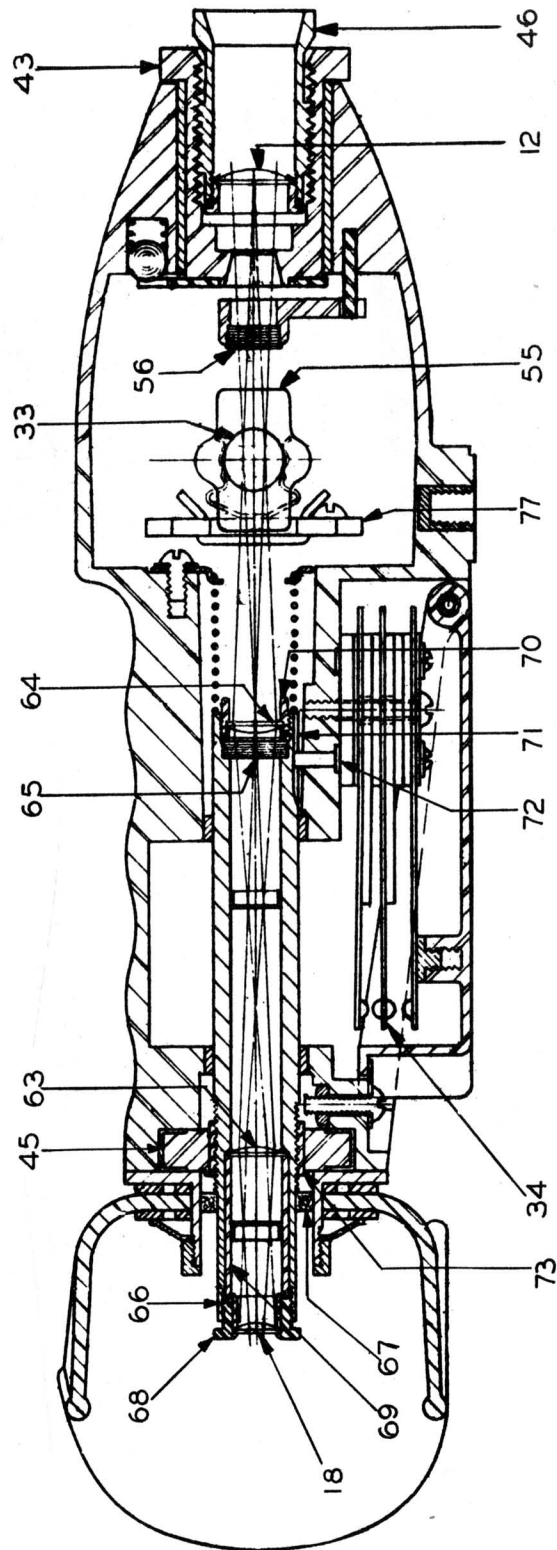


Fig. 4

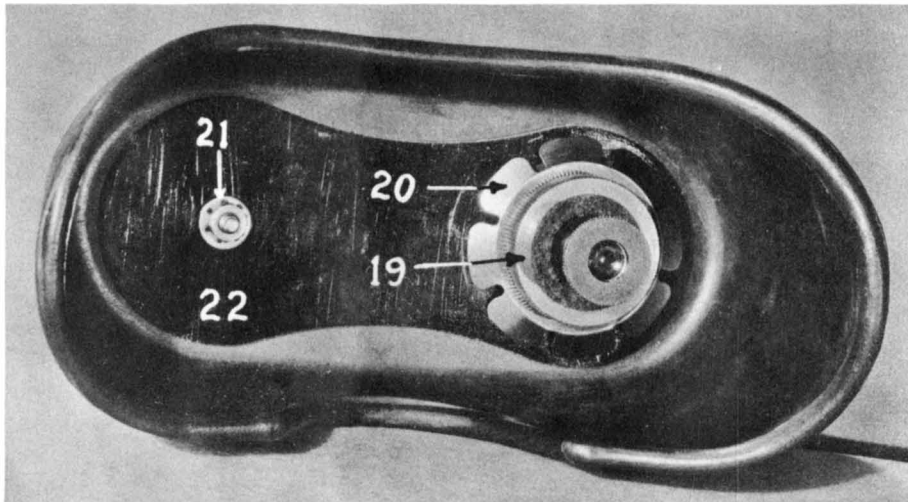


Fig. 5

#### C. Adjust Eye Shield On Telescope

The telescope, of a standard instrument, is shipped with the eye shield arranged to use the right eye in sighting through the telescope. However, it is readily possible to change the eye shield for use with the left eye if so desired. To change the eye shield so as to use the other eye with the telescope, proceed as follows:

Remove knurled collar "19", Fig. 5, and spring washer "20", Fig. 5, and lift the shield from the telescope. Then remove nut "21", Fig. 5, the washers and the screw at "21" and the washer under the head of the screw. This will allow plate "22", Fig. 5, and a similar plate on the other side of the shield, to be removed along with a metal spacer between these plates (in the unused hole in the shield).

Place the blank end of the two plates over the opposite hole in the shield with the metal spacer in the hole between the plates and see that the plates are placed so that the slots are at the top of the eye shield. Insert the screw at "21", Fig. 5, (from the front of the shield and with a washer under the head of the screw). Then replace the two washers and nut at "21", Fig. 5, and tighten the nut just enough to hold the plates in position. Fit the eye shield on the telescope so that the slot in the front plate on the shield fits over the pin in the telescope. Then replace spring washer "20", Fig. 5, and knurled collar "19", Fig. 5. Tighten knurled collar "19". This will keep the shield in a given position but still permit the shield to be easily turned by hand.

#### D. Adjust Zero Of Galvanometer

Place the control box so that the upper face "23", Fig. 6, is horizontal and be sure that switch "24", Fig. 7, is open. Then

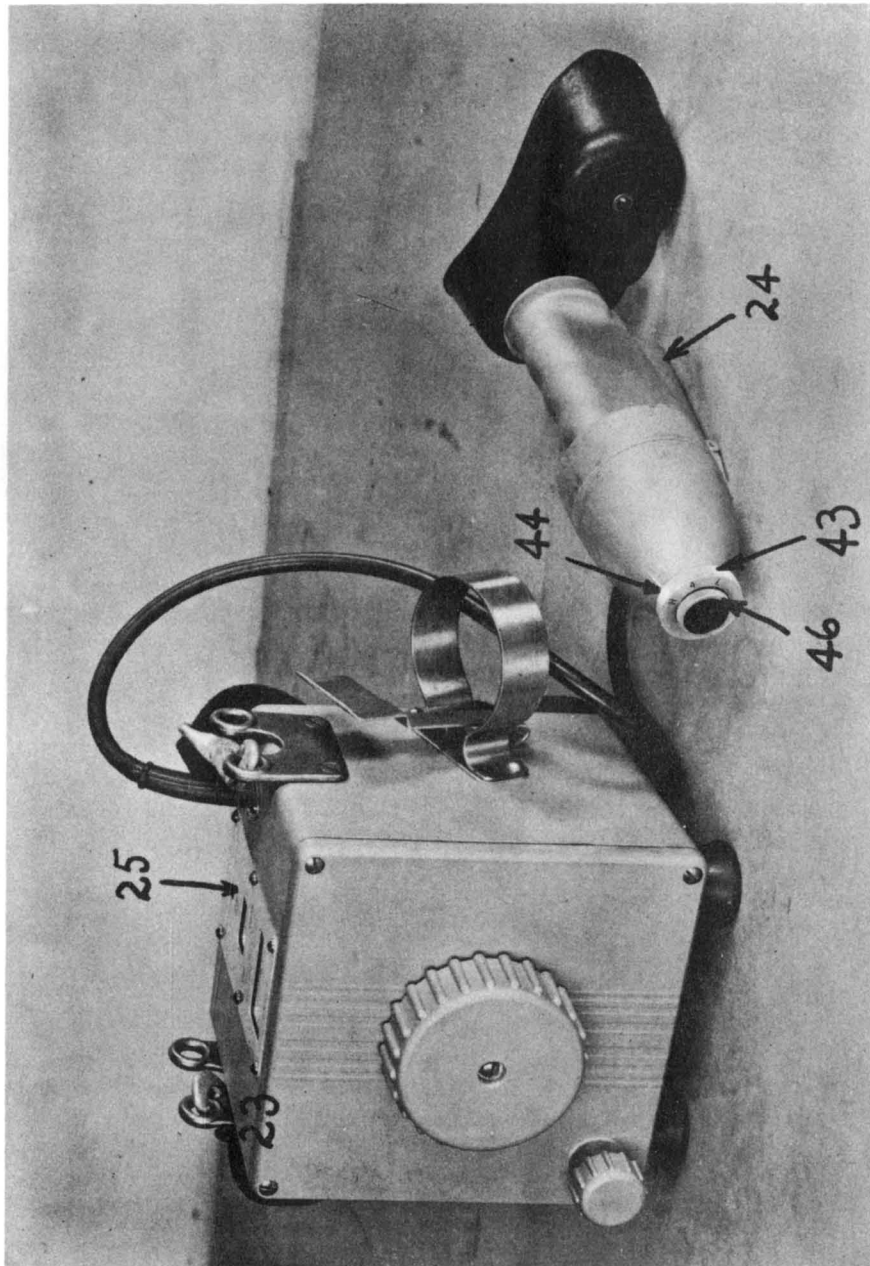


Fig. 6



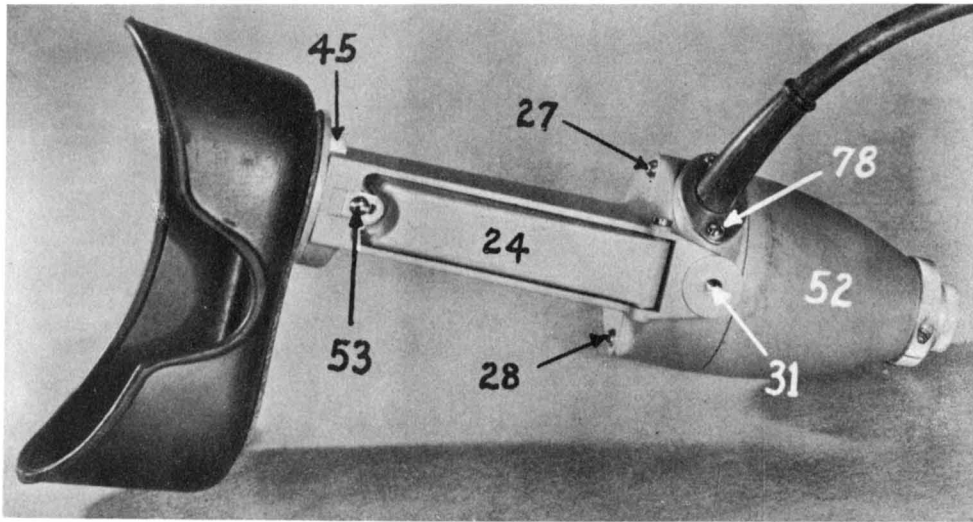


Fig. 7

insert a small screw driver in screw "25", Fig. 6, and adjust this screw until the galvanometer pointer balances at zero on its scale.

#### E. Attach Pistol Grip To Telescope

• The pistol grip "26", Fig. 8, is shown mounted on the telescope. This pistol grip is a special part and is furnished only when ordered as a separate item.

In order to mount the pistol grip, proceed as follows: Remove the two screws "27" and "28", Fig. 7. Hold the two sections of the telescope together and place the pistol grip in place as in Fig. 8, with the hole in arm "29", Fig. 8, lined up with the hole from which screw "28", Fig. 7, was removed; with the hole in the other similar arm lined up with the hole from which screw "27", Fig. 7, was removed and with the hole in arm "30", Fig. 8, lined up with hole "31", Fig. 7. Insert the two new longer screws in arm "29", Fig. 8, and the similar arm at the other side and turn these screws in until they are almost tight. Insert the short screw at "32", Fig. 8, and tighten it. Then completely tighten the screws in arm "29", Fig. 8, and in the other similar arm.

Release switch "35", Fig. 8, and allow switch "24", Fig. 8, to drop out as far as it will go. With the switches released as above, switch "24" should rest down against the small stop at "53", Fig. 8, and the roller operated by switch "35", Fig. 8, should just touch switch "24". If these conditions do not exist, remove the locking screw from the hole at "60", Fig. 8, and adjust the other screw in this hole until the above conditions are obtained. Then replace the locking screw in the hole at "60" to keep the adjusting screw in place.

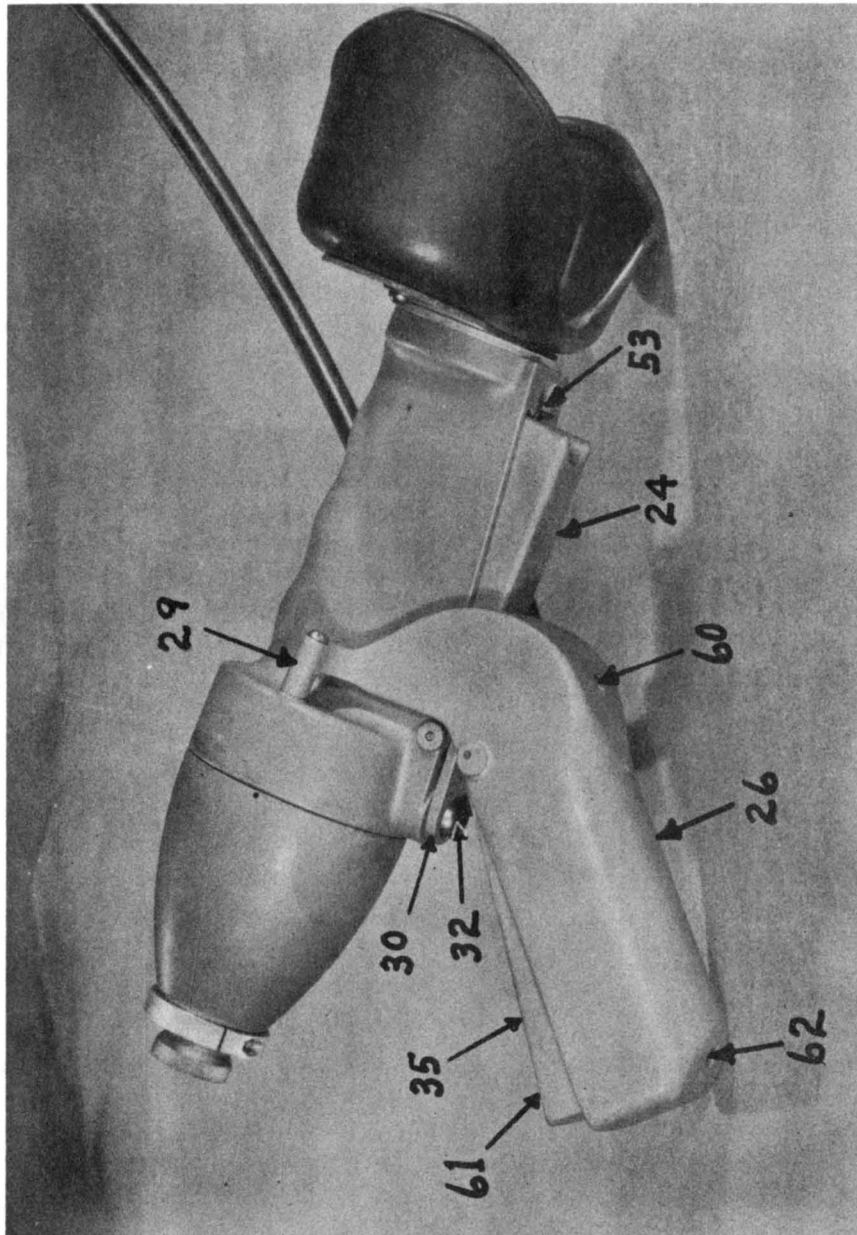


Fig. 8



When switch "35", Fig. 8, is pressed in it should reach its stop just before switch "24", Fig. 8, reaches its stop. To adjust this stop proceed as follows: Remove the locking screw from the hole at "61", Fig. 8, and back out the adjusting screw in the hole at "61" far enough to allow switch "24", Fig. 8, to close against its stop when switch "35" is pressed in. Press switch "35" in far enough to just close switch "24" against its stop. Keep switches "35" and "24" pressed in as in the preceding sentence and turn the adjusting screw, in the hole at "61", in until it just touches the stop for switch "35". Then release switch "35" and turn the adjusting screw, in the hole at "61", in 1-1/2 turns further. Replace the locking screw in the hole at "61" to keep the adjusting screw in place.

### 3. WIRING CONNECTIONS

The wiring connections are shown in Fig. 9. The lamp "33", Fig. 4, is shown at "33", Fig. 9; the contacts "34" of Fig. 4, are shown at "34", Fig. 9, which are operated by switch "24", Fig. 7 (switch "24" is in turn operated by switch "35", Fig. 8, when the pistol grip attachment is used); the four dry cells shown in Fig. 3, are shown at "36", Fig. 9; the galvanometer "6", Fig. 2 and standard cell "7", Fig. 2, are shown at "6" and "7" respectively in Fig. 9.

When knob "10", Fig. 1, is rotated both contacts "38" and "39", Fig. 9, are rotated, but when knob "11", Fig. 1, is pressed in and rotated only contact "39", Fig. 9, is rotated. In either case the scale drum "9", Fig. 2, is rotated. When knob "11", Fig. 1, is pressed in it closes contact "37", Fig. 9.

### 4. OPERATION

#### A. Cautions

Do not allow the telescope to rest in such a position as to keep switch "24", Fig. 7, closed, as this switch closes the battery circuit and the dry cells will be used unnecessarily, thus shortening the life of the dry cells.

The control box contains a standard cell which must not be exposed to temperatures below 32°F. or above 140°F.

Knob "11", Fig. 1, should not be pressed in and turned indiscriminately when not making temperature measurements, as this may unbalance the measuring circuit to such an extent that an unnecessary drain will be imposed on the standard cell in making the balance for the next temperature measurement.

#### B. Mount Telescope On Tripod

Tapped holes are provided at "31", Fig. 7, and "62", Fig. 8, to be used for mounting the telescope on a tripod or some similar de-

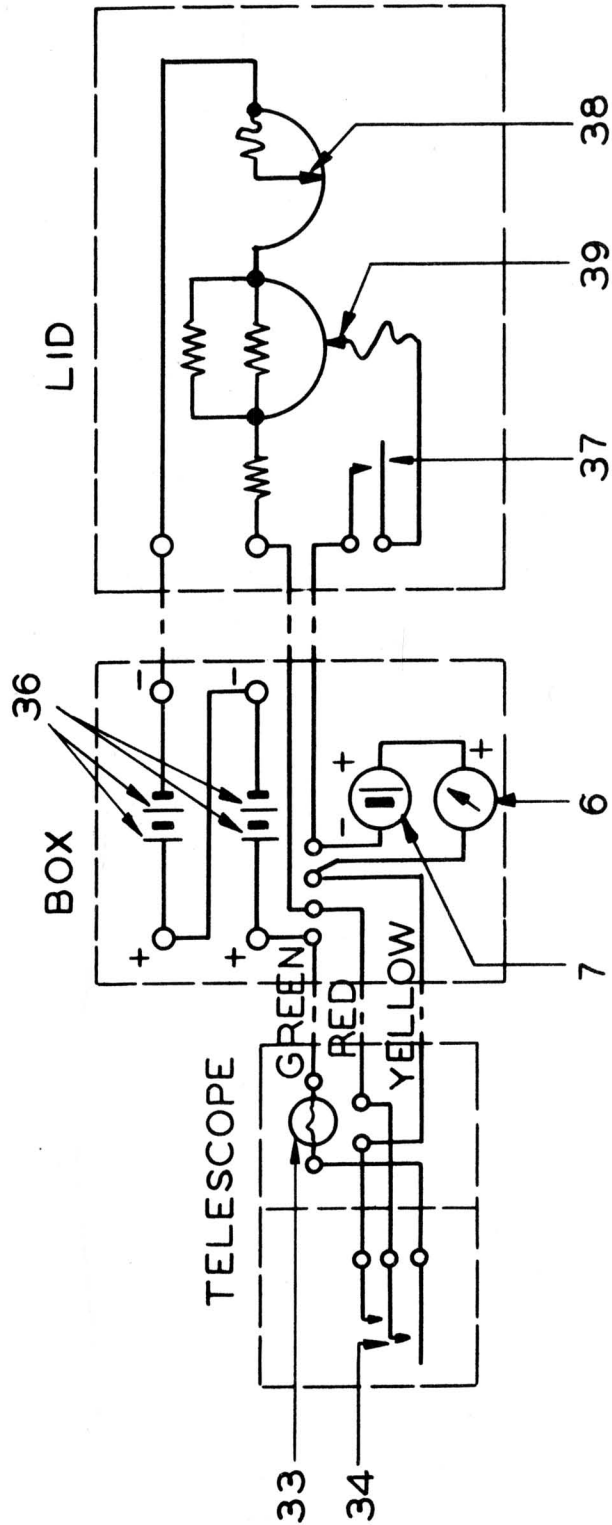


Fig. 9

vice where this is desired. These holes are tapped for a 1/4"- 20 screw (same as the mounting screw on the standard camera tripod).

### C. Adjust The Harness

The harness, with the instrument attached, is shown in place ready for operation in Figs. 10 and 11. From these figures it can be noted that the harness is worn similar to a vest and can be slipped into vest by unsnapping it from the instrument. The leather reinforcement, where the webbing crosses, should face out as at "40", Fig. 10, which will then bring the adjusting clamps in position as at "41" and "42", Fig. 11. See that these clamps are fastened at approximately the same position on each strap. Hold the control box in position as shown in Fig. 11, and snap the hasps in the carrier eyes which are nearer the body as in Fig. 11. Adjust the height of the control box to suit the convenience by means of the adjusting clamps "41" and "42", Fig. 11, (the control box must be raised high enough to permit the telescope to be raised up to and fitted over the eyes).

The hasps on the harness should be snapped into the carrier eyes which are on the centerline of the control box for ease in carrying the equipment.

### D. Focus Lamp Filament

The eye shield is arranged to swing to two limits. One limit is as shown in Fig. 6, while the other position is 90° from this position (in a counter-clockwise direction when looking into the eye shield). With the eye shield in position as in Fig. 6, the filament of the lamp in the telescope is horizontal in the field of view, while with the shield in the other position the filament of the lamp is vertical in the field of view. Rotate knurled ring "43", Fig. 6, until L on this ring is at the index mark "44", Fig. 6. Sight through the telescope at a bright back-ground with the telescope switch "24", Fig. 7, open (not pressed in) and observe the position of the lamp filament, which will appear as a straight black line across the field of view. The short black line at right angles to the filament is an index. Turn the eye shield until the lamp filament is in the desired direction (horizontal or vertical). Then sight through the telescope and adjust knurled ring "45", Fig. 7, until the lamp filament is sharply focused (with switch "24", Fig. 7, open). If the telescope is sighted against a dark back-ground, it may be necessary to close switch "24" or switch "35", Fig. 8, which will light the lamp filament to make it visible.

### E. Objective Focusing Adjustment

The object whose temperature is to be measured is brought into focus by sighting through the telescope on the object and turning knurled ring "46", Fig. 6, until the object is focused properly.



Fig. 10

As previously mentioned, the standard No. 8621 and No. 8623 instruments have this adjustment made in the factory for a distance of eight feet (from object to telescope) and knurled ring "46", Fig. 6, is then locked in this position by tightening the clamping screw in knurled ring "43", Fig. 6. With this arrangement the instrument can be used as a fixed focus instrument and thus save time when taking typical commercial readings. However, if the highest degree of accuracy is required for each reading, the objective lens should be focused for each distance. In order to do this it is necessary to loosen the clamping screw in knurled ring "43", Fig. 6, so that knurled ring "46" can be turned independently.

#### F. Take A Reading

If the low range is to be used, turn knurled ring "43", Fig. 6, until L is opposite the index mark "44", Fig. 6. If the high range is to be used, turn knurled ring "43" until H is opposite the index mark "44". If the instrument has a third range and this range is to be used, turn knurled ring "43" until  $xH$  (or other designation) is opposite the index mark "44".

See that the adjustments are made as directed in Parts D and E above in this Section.

Then sight on the object whose temperature is to be mea-



Fig. 11

sured. If the instrument is being used as a fixed focus instrument, proceed to the next paragraph. If the instrument is being used as a variable focus instrument, turn knurled ring "46", Fig. 6, until the object is focused properly and then proceed to the next paragraph.

Keep the telescope sighted on the hot object, press switch "24", Fig. 7, or "35", Fig. 8, to close the contacts. Keep these contacts closed and rotate knob "10", Fig. 1, until the filament of the lamp blends with (has the same brilliance as) the image of the hot object (until an optical balance is obtained). In making this optical balance use the section of the lamp filament which is opposite the index in the lamp.

Remove the telescope from the eyes, keep switch "24", Fig. 7, or "35", Fig. 8, closed, press knob "11", Fig. 1, in and, while holding it in, rotate it until the galvanometer pointer balances at zero on its scale. Then read the value of temperature (on the proper scale) which is under the hair line index over the scale.

## 5. MAINTENANCE

### A. Replace Dry Cells

When it is no longer possible to obtain a balance of the galvanometer as directed in Section 4-F (with the scale at the high

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temperature end), by pressing knob "11", Fig. 1, in and rotating it, the dry cells should be replaced by fresh ones.

To do this, remove the plate from the back of the control box as directed in Section 2-A, remove the old dry cells and install four fresh ones as directed in Section 2-A.

### B. Install Lamp In Telescope

Each lamp is calibrated with a separate shunt resistance (across the slidewire) and with a definite position of drum "9", Fig. 2. Therefore, each time a new lamp is installed the proper shunt resistance must be installed and the proper drum setting made. Each lamp has a serial number marked on one ferrule and the resistance value of the shunt (with the ohm sign  $\Omega$ ) and drum setting marked on the other ferrule. The shunt resistance is wound on a separate spool with the resistance value marked on one end of the spool.

To install a lamp, proceed as follows: Open the control box, as in Fig. 2, remove the three screws "47", Fig. 2, and carefully lift drum "9", Fig. 2, from the assembly. This will expose the slidewire disc as shown in Fig. 12. The small resistance coil used with the lamp is shown at "48", Fig. 12. Unsolder the two leads of this coil from points "49", Fig. 12, and remove the coil from the disc. Place the resistance coil which is to be used with the new lamp in position at "48", Fig. 12, and solder the leads to points "49", Fig. 12. Carefully replace drum "9", Fig. 2, fitting arm "50", Fig. 2, into the slot in the drum and replace and slightly tighten the three screws "47", Fig. 2. Then adjust drum "9", Fig. 2, until the value on scale "51", Fig. 2, which is opposite the index of arm "50", corresponds to the drum setting marked on the ferrule of the lamp to be used. Hold the drum in this position and tighten the three screws "47", Fig. 2, to hold the drum in position. Then replace the cover on the control box and fasten it in place. Remove screws "27" and "28", Fig. 7, and lift off the front end "52", Fig. 7, of the telescope. This will expose lamp "33", Fig. 4. Lift the lamp from the clips and insert the new lamp (on which is marked the resistance value, corresponding to the value of resistance marked on the coil mounted on the slidewire disc) in the clips in place of the one removed. In doing this, note that one ferrule of the lamp has a small hole drilled in the metal and also note that one clip of the lamp socket has a small projection extending out into the socket. The lamp should be placed in the clips so that the small projection in the clip snaps into the hole in the lamp ferrule. Replace the end "52", Fig. 7, on the telescope and fasten it in place with screws "27" and "28", Fig. 7.

NOTE: When the lamp is mounted in the instrument, the lamp window is not necessarily at right angles to the optical axis.

### C. Clean Telescope Switch

In order to clean the contacts of switch "24", Fig. 7, loosen screw "53", Fig. 7, a slight amount and push the small stop which

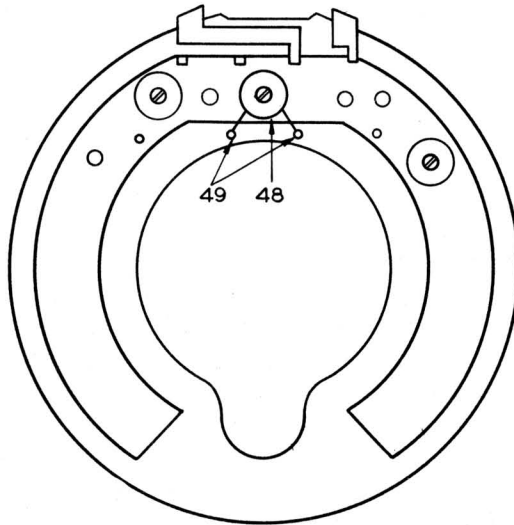


Fig. 12

is held in place by screw "53", back in the slot so as to permit switch "24" to swing open. Place a piece of clean smooth cardboard between one set of contacts, press the contacts together on the cardboard and pull the cardboard back and forth a few times. Repeat this procedure with the other set of contacts. Then swing switch "24", back into position, push the small stop under screw "53", back into position so as to keep switch "24" from swinging out and tighten screw "53" to hold this stop in place.

#### D. Clean Breather Magnet

The breather indicated at "8", Fig. 2, is provided as a means of cleaning the air which is drawn into the control box under normal operating conditions. It consists of a small magnet inserted in the hole of the control box (through which the air enters) and a thin disc of filtering material. The small magnet is provided to remove magnetic particles from the air while the filter disc is to remove other foreign substances.

In order to clean the magnet, remove screw "54", Fig. 2, lift off cover "8", Fig. 2, and remove the disc of filtering material under this cover. Then carefully pull the small magnet from the hole in the control box, remove any metallic particles or dirt from the magnet and then replace it in the hole in the control box. Replace the filter disc, cover "8", and screw "54", in order to hold the assembly in place.

#### E. Clean Slidewires

Open the control box as shown in Fig. 2, and note the setting (to the nearest .1) of index "50", Fig. 2, on the scale. The in-



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dex must be set at this same point on the scale after the slidewires are cleaned. Remove the three screws "47", Fig. 2, and carefully lift the scale drum "9", Fig. 2, from the cover. Place a small quantity of pure vaseline on a cloth and work the vaseline into the cloth so as to have no excess vaseline. Then rub the cloth over the contacting surface of the slidewires, being careful to wipe off any excess vaseline from the slidewires. It may be necessary to repeat this procedure several times to properly clean the slidewires. If the vaseline fails to clean properly it may be necessary to use a good grade of benzine, followed by a cleaning with vaseline. If the instrument is being cleaned in a place where the use of benzine is prohibited, carbon tetrachloride may be used sparingly, followed by a cleaning with vaseline. Replace drum "9", Fig. 2, fitting arm "50", Fig. 2, into the slot in the drum, and replace and slightly tighten the three screws "47", Fig. 2. Then adjust drum "9", until the value on scale "51", Fig. 2, which is opposite the index of arm "50", corresponds to the drum setting noted in the first sentence of this Part which should be the same as the value marked on the ferrule of the lamp in the telescope. Hold the drum in this position and tighten the three screws "47", Fig. 2, to hold the drum in position. Then replace the cover on the control box and fasten it in place.

#### F. Clean Lenses Of Telescope

To clean lens "12", Fig. 4, see that the clamping screw in ring "43" is loosened and then unscrew and remove tube "46", Fig. 4, containing lens "12". Lens "12" is mounted in a threaded frame and screwed into tube "46". Unscrew and remove the lens from the tube, carefully clean both faces of the lens and screw it back into the tube. Then screw tube "46" back into the end of the telescope. If tube "46" (lens "12") is to be locked in a given position, make the Objective Focusing Adjustment as directed in Section 4-E for the desired distance.

To clean lenses "18", "63" and "64", Fig. 4, and glass "65", Fig. 4, turn knurled ring "45", Figs. 4 and 7 until the locking screw in this ring is accessible. Loosen this locking screw so as to release tube "66", Fig. 4, and carefully pull tube "66" out of the telescope, bringing the lenses and glass with it. The felt packing "67", Fig. 4, no doubt will be pulled out with the tube.

After tube "66" is removed from the telescope, unscrew and remove knurled ring "68", Fig. 4, (containing lens "18") from the end of the tube. Lens "63" is fastened in the end of tube "69", Fig. 4, which in turn is slip fitted in tube "66". Hold tube "66" approximately in a vertical position, with the end containing tube "69" pointing down, and carefully remove tube "69". This may be a little difficult as a slight vacuum is formed in tube "66". Then unscrew and remove knurled ring "70", Fig. 4, containing lens "64". Glass "65", Fig. 4, will then drop out the end of tube "66".

Carefully clean both faces of the three lenses and the glass



removed from tube "66" and then reassemble these parts as follows: Replace glass "65" in the end of the tube and screw lens "64" back into place until it fits snugly against the glass when the glass is down in position. Fit tube "69" back in the other end of tube "66" and push tube "69" in until it fits against the stop shoulder. Then screw lens "18" back in place until it fits against the end of tube "69". Then insert the complete tube "66" into the telescope (from the eye shield end). This tube should be inserted with slot "71", Fig. 4, down as shown, as this slot must fit over pin "72", Fig. 4. See that the slot fits over the pin as noted above and push the tube in until the shoulder "73", Fig. 4, fits up against knurled ring "45" as shown. Then tighten the locking screw in knurled ring "45" to hold the tube in the telescope. Carefully replace the felt packing "67".

#### G. Clean Telescope Lamp And Range Screens

Remove screws "27" and "28", Fig. 7, and lift off the end section "52". Remove lamp "33", Fig. 4, from the clips and carefully wipe both faces of the lamp. Then replace the lamp as directed in Section 5-B.

In order to clean a range screen, such as the one shown at "56", Fig. 4, remove screw "57", Fig. 13, and then lift out the screen frame "58", Fig. 13. Carefully wipe both sides of the screens in this screen frame and then replace it in the telescope. In doing this, proceed as follows: Rotate knurled ring "43", Fig. 6, until H on this ring is at index "44", Fig. 6. Hold the screen frame with the side marked UP facing up and fit the frame in place with the pin in the slot, the screw hole over its boss, and the screen frame adjusted so that the heavier glass is over the aperture of the telescope section. Replace and tighten screw "57", Fig. 13.

Then replace the end section "52", Fig. 7, and replace and tighten screws "27" and "28", Fig. 7, to hold this section in place.

#### H. Replace Cable Between Telescope And Control Box

To remove one cable and install a new one, proceed as follows: Remove the four screws from cover "2", Fig. 1, and open the control box as in Fig. 2. Carefully unsolder the three leads in cord "74", Fig. 2, from terminal block "75", Fig. 2. Then remove the two screws from clamp "76", Fig. 1, and pull the cable (with clamp "76" attached) out of the control box.

Remove screws "27" and "28", Fig. 7, and remove the front section "52", Fig. 7, from the telescope so as to expose terminal block "77", Fig. 4. Remove lamp "33", Fig. 4, from the telescope. Carefully unsolder the three leads in the cable from terminal block "77", Fig. 4. Then remove the two screws from clamp "78", Fig. 7, and pull the cable (with clamp "78" attached) out of the telescope.

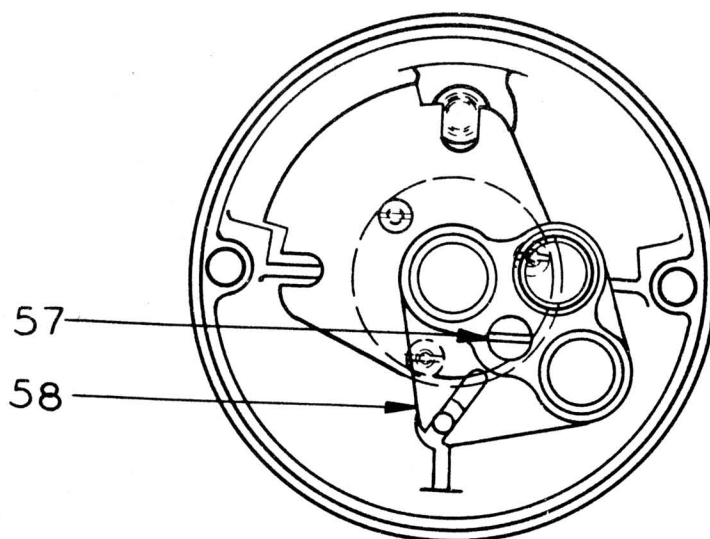


Fig. 13

The new cable has metal clamps in place for use at each end of the cable. The end of the cable to be used in the telescope has this metal clamp nearer the end of the cable. Insert this shorter end in the hole in the telescope, fit the clamp in place as at "78", Fig. 7, and replace and tighten the two screws in the clamp to hold the cable in place. The leads in the cable are color coded (red, yellow and green) and there are three similar color spots on terminal block "77", Fig. 4. Solder the green coded lead to the lamp clip opposite the green dot on the terminal block and solder the other two leads to the terminals with corresponding color markings. Replace the lamp in the clips as directed in Section 5-B. Replace the front section "52", Fig. 7, on the telescope and replace and tighten screws "27" and "28", Fig. 7, to hold it in place.

Insert the other end of the cable in the hole in the control box, fit the metal clamp into place as at "76", Fig. 1, and replace and tighten the two screws in the clamp to hold the cable in place. The terminal block "75", Fig. 2, has colored dots corresponding to the code colors of the leads in the cable. Solder these leads to the terminals opposite the colored dot which corresponds to the lead code color. Replace the cover on the control box and replace and tighten the four screws to hold the cover in place.

#### J. Replace Top Glass In Windows Of Control Box

The windows at "79" and "80", Fig. 1, are each made of two thicknesses of glass. If the top glass becomes unusable (due to pitting from hot metal, scratching, etc.) it can be replaced as follows: Remove the six screws from plate "81", Fig. 1, and remove this plate. Remove any packing which may be between cover "81" and the top piece of glass (keep this packing for use with the new glass) and remove

the old glass. Place the new glass in position (on top of the packing between the bottom glass and top glass). Then replace a sufficient amount of the packing, just removed, around the edges of the new glass to be flush with the top edge of the control box and replace cover "81", Fig. 1. Then replace and tighten the six screws in cover "81" to hold the cover in place.

ADDENDA FOR  
DIRECTION BOOK STD. 1295  
SECTION 4-F

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For precise measurements, proceed as in Section 4-F.

For approximate measurements, proceed as outlined below:

. For Approximate Measurements

When the time available for each reading in a series of readings is not sufficient to allow for the conventional potentiometer balance at the end of each reading, as for precise measurements, a quicker but approximate method of making a series of measurements may be used as outlined below.

To use this approximate method, the series of readings should be within a span of approximately 100°F or less and an accuracy of the order of 10°F must be satisfactory.

To take readings under these conditions, rotate knob "10", Fig. 1, until the middle of the expected temperature span is at the index mark for the scale. For example, if the expected temperature span is 2100°F to 2200°F, set knob "10" with 2150°F at the index mark.

Keep knob "10" set as indicated above and adjust the potentiometer by pressing knob "11", Fig. 1, and rotating it until the galvanometer pointer balances at zero on its scale. Release knob "11" and reset knob "10" with 2150 at zero on the scale. Then readjust the potentiometer with knob "11". Continue this alternate setting of knob "10" at 2150 and adjusting the potentiometer with knob "11" until the adjustment of knob "10" to 2150 does not cause the galvanometer to deflect from zero on its scale when knob "11" is pressed (no adjustment of knob "11" required). Then release knob "11" and proceed to next paragraph.

Then turn knob "10" until either limit of the temperature span (2100°F or 2200°F in the example) is at the index mark. Press (but do not turn) knob "11" and note that the galvanometer pointer deflection is approximately within the limits of the white rectangle on the galvanometer scale. Balance the potentiometer (by means of knob "11") and note that the temperature scale reading is within approximately 10°F of the previous limit setting (2100°F or 2200°F in the example). If these conditions are not met, install new dry cells and then readjust the potentiometer with knob "10" set at the middle of the expected temperature span (2150°F in the example).

Then proceed with the required series of readings within the temperature span set up (2100°F to 2200°F in the example) without adjusting the potentiometer at the end of each temperature reading.

During a series of readings as outlined above, periodically press (but do not turn) knob "11" to make certain the galvanometer deflection is still within the limits of the white triangle on the galvanometer scale. When this check indicates that the pointer is beyond the limits of the white rectangle, adjust the potentiometer and make the check as indicated above, installing new dry cells as required.