DIRECTIONS

77-6-4-6

NO. 2430
D-C GALVANOMETER

LEEDS NORTHRUP
PHILADELPHIA 44, PA.

CONTENTS

DIRECTIONS FOR

NO. 2430

D-C GALVANOMETER

1. GENERAL DATA

The front view of this instrument is shown in Fig. 1; the rear view in Fig. 2; an internal view, looking down with the cover removed, in Fig. 3; and the wiring connections in Fig. 4.

Fig. 1

The flexible cord and plug 1, Figs. 2 and 4, are for connection to a 115 volt a-c (usually 60 cycles) supply for the feed to the 115v/6v transformer which in turn supplies the 6 volt lamp for the light source.

The two terminals 2, Figs. 2 and 4, are for the connections to the galvanometer coil.

Knob 3, Fig. 1, operates the fine zero adjuster of the galvanometer.

For safety in shipping, gummed tape is placed around pin 30, Fig. 3, and ribbon is placed around support 15 and arm 29. Furthermore, glass strip 12, Fig. 3, is shipped in a separate envelope. Before using the instrument, remove the cover (as indicated in Section 3) and remove the tape and ribbon mentioned above. Then fit glass strip 12 into the spring holder 23, Fig. 3, as shown.

CAUTION: Mirror 10 is surfaced on the front. This surface should not be touched with the bare fingers as it can be easily damaged in an attempt to remove finger marks, dust, etc. If the mirror is dusty, it is recommended that it be blown off; do not wipe it.

The instrument should be placed on a horizontal surface which is relatively free from vibrations. Vibrations of a minor or temporary nature will be effectively damped out through the built-in oil dampers arranged in the galvanometer system. Some types of momentary or sustained vibrations may require additional vibration damping action. For details see

Section 8.

2. WIRING CONNECTIONS

Connect the flexible cord 1, Fig. 2, to a 115 volt a-c supply (usually 60 cycles).

Make the connections to the galvanometer coil at terminals 2, Fig. 2. The wire used for the connections to these terminals should be of light flexible material so as to eliminate as much as possible all shock and vibration which might be transmitted through these connections to the instrument. The asterisk marking on one of the terminals at 2, Fig. 2, serves to distinguish one galvanometer terminal from the other and may be helpful in associating input polarity with direction of galvanometer deflection.

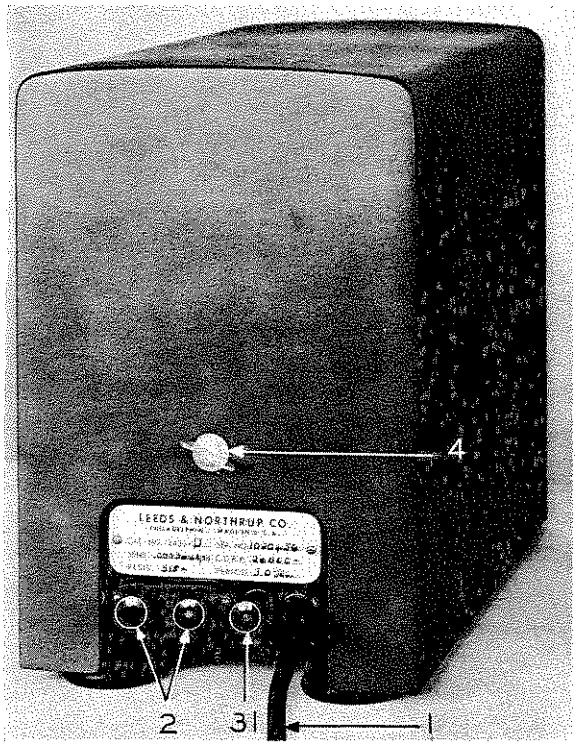

Fig. 2

Run a ground connection to terminal 31, Fig. 2, to ground the metal shield (case and cover) surrounding the galvanometer element.

3. TO REMOVE COVER

The cover is held in place by means of a bayonet type pin on the end of wing clamp 4, Fig. 2, and three lugs on the inside of the cover at the front. The pin fits into a socket, which is mounted on a plate under the cover, while the lugs fit inside a rim on the front casting.

To remove the cover, grasp wing clamp 4, Fig. 2, press in slightly and turn it approximately 90 degrees. This releases the pin from the socket and a spring pushes the pin out. However, the pin is held in place in the cover. Then carefully slide the cover back from the front casting and at the same time hold the cover so that it will not drop when the lugs are free from the front casting. With the cover removed, the parts will be exposed as in Fig. 3.

To replace the cover, fit it carefully in place with the lugs on the front fitted inside the rim on the front casting and with pin 4, Fig. 2, fitted into the socket. Press in on the pin (against the spring) and turn it until the small lugs on the pin fit into the slot in the socket. Then turn the pin approximately 90 degrees to lock it in the socket.

4. DESCRIPTION OF LIGHT SYSTEM

The 6 volt lamp, Fig. 4, is mounted in the housing 6, Fig. 3, with the base of the lamp showing at 5, Fig. 3. Tube 7, Fig. 3, has a plano-convex lens mounted in the end nearer the lamp. This lens is silvered on the plane face (which is toward the lamp) except for a narrow rectangular aperture, with the long sides of the aperture vertical. A fine hairline crosses the aperture, parallel to the long sides. Screw 19, Fig. 3, holds the adjustment of tube 7 in tube 8.

The lens in tube 7, Fig. 3, projects an image of the lamp filament and hairline onto the mirror of the galvanometer (through lens 9, Fig. 3, which acts as a window). The galvanometer mirror in turn reflects the light beam to the cylindrical mirror 10, Fig. 3. The image is amplified by mirror 10 and is reflected by this mirror to scale 11, Figs. 1 and 3. The combined effects of lens 9 and mirror 10 form an image of the rectangular aperture and the hairline of the lens (in tube 7) on scale 11. This image is called the primary image and the hairline image is the

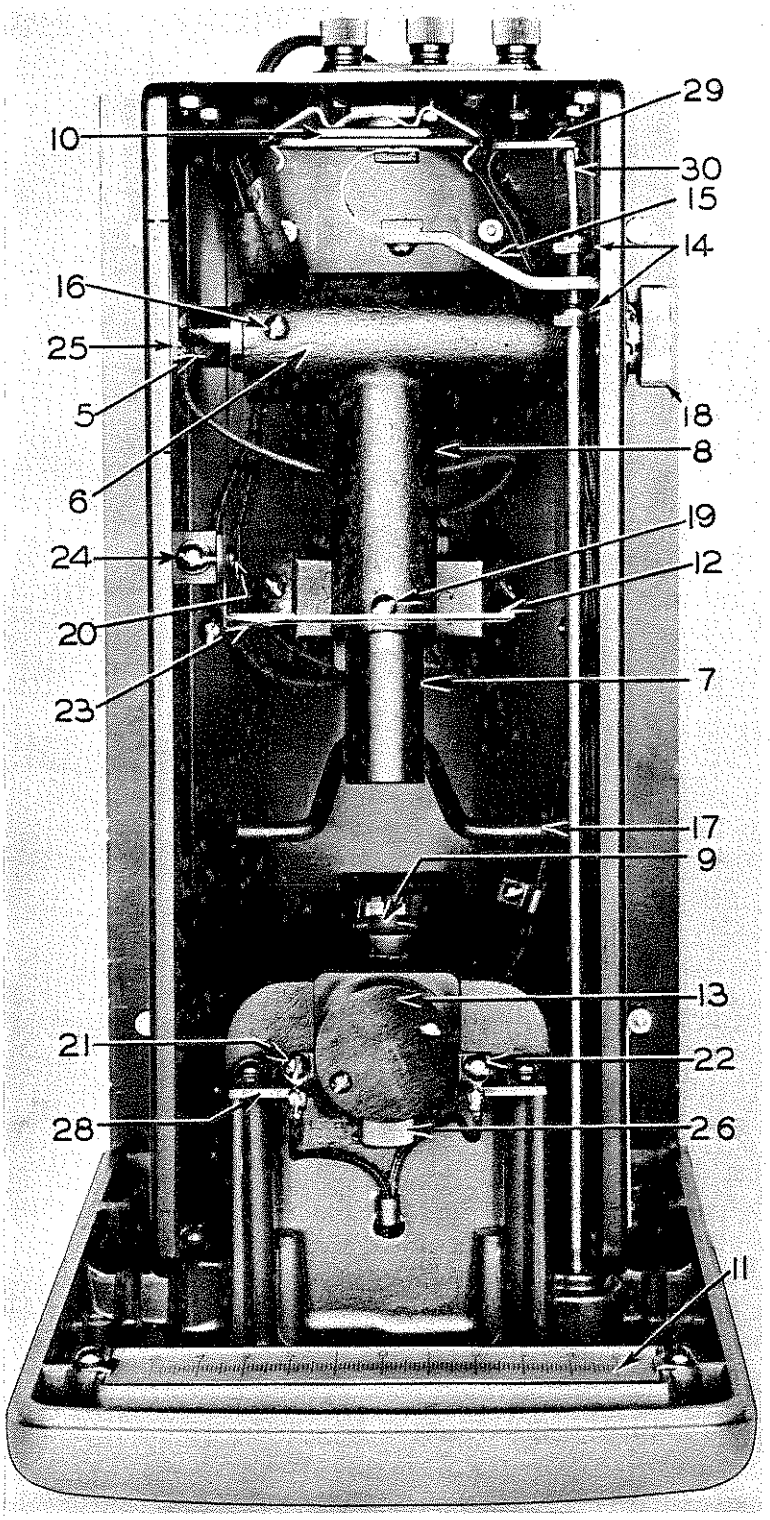

Fig. 3

index used to indicate galvanometer deflections.

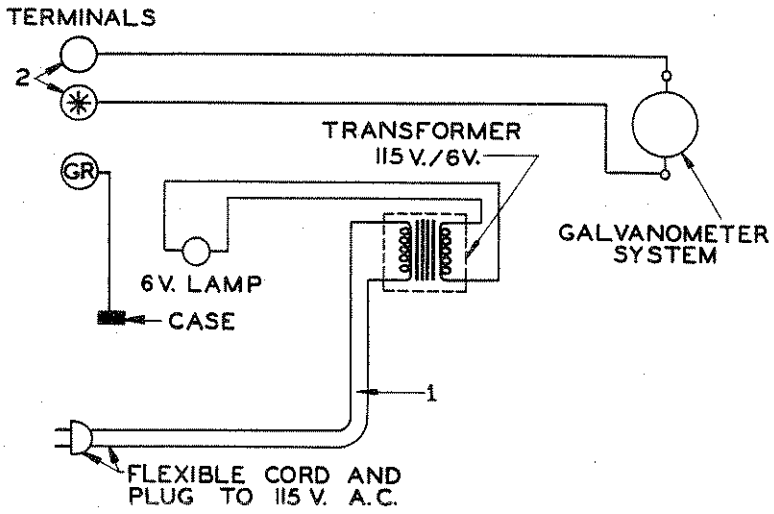

Fig. 4

As the light beam is reflected by the galvanometer mirror to the cylindrical mirror, it passes through the piece of clear glass 12, Fig. 3. Most of the light passes through this glass, but a small amount of this light is reflected from glass 12 to scale 11, where the lens at 9 causes an image of the rectangular aperture, of the mirror in tube 7, to be formed. This image is called the secondary image and shows up as a narrow bright spot. This image deflects a very small amount for a relatively large deflection of the primary image. It is used simply as a means of determining where the primary image is in case this image goes off the scale. In other words, if the primary image does not appear on the scale while the secondary image does appear, it is known that the primary image is off scale on the same side of zero as the secondary image. Thus, the operator knows which direction to turn the zero adjusting cap 13, Fig. 3, to bring the primary image back on the scale.

5. ADJUSTMENTS

A. General Items

(1) Wiring Connections

Make the wiring connections as indicated in Section 2 and see that the galvanometer coil circuit is not energized. However, in order to help the damping of the galvanometer coil, while making adjustments, it is suggested that a jumper be placed across the galvanometer coil terminals 2, Fig. 2. CAUTION: Be sure to remove this jumper after the adjustments are made.

(2) Both Images Show

If both the primary image (with the hairline) and the secondary (bright spot) show on scale 11, Fig. 1, it may be necessary to proceed with only Part B below. However, it may be found advisable to proceed also with Parts C and D below.

(3) Only Primary Image Shows

If only the primary image shows on the scale, it will be necessary to proceed as in Part D below and then with Part B and, if advisable, Part C.

(4) Only Secondary Image Shows

If only the secondary image shows on the scale, it will be necessary to proceed as in Part B and then with Parts C and D if necessary.

(5) No Image Shows

If no image shows on the scale, check the power supply to the lamp to be sure it is energized. Then check the lamp by holding a piece of paper a little in front of the end of tube 7, Fig. 3. If the lamp is lighted, an image will appear on the paper. If there is no image on the paper, replace the lamp as indicated in Section 6. Then proceed with Parts B, C, D, and E as required, depending upon the condition of the image as indicated above. If the lack of an image is due to a faulty galvanometer system replace the galvanometer system as indicated in Section 7.

B. Adjust Zero

Before starting to make a zero adjustment, see that the galvanometer coil circuit is deenergized. If desired, a jumper may then be placed between the two terminals 2, Fig. 2. See that the galvanometer lamp is lighted.

The coarse adjustment is obtained by rotating cap 13, Fig. 3, in the proper direction. The fine adjustment is obtained by rotating knob 3, Fig. 1, in the proper direction. Adjust the galvanometer so that the image of the hairline balances at zero on the scale. When this condition is obtained, the galvanometer zero is properly adjusted.

When starting to make adjustments for a new set of conditions it is advisable to turn knob 3, Fig. 1, until the two limit stops 14, Fig. 3, are spaced approximately an equal distance from support 15, Fig. 3. This will permit the zero adjusting knob 3 to be turned approximately an equal amount in either direction before reaching a limit.

If a jumper is used between terminals 2, to assist in this adjustment, be sure to remove it when the adjustment is complete.

C. Adjust Focus Of Primary Image

Before adjusting the focus of the primary image, it is suggested that the brightness of the image be checked. To do this, loosen screw 16, Fig. 3, to release the lamp. Hold the lamp by means of its socket 5, Fig. 3. Then slowly rotate the lamp, noting the change in brightness of the image

as it is rotated, and move the lamp slowly backward and forward in the housing, noting the change in brightness of the image. Adjust the lamp in this manner until the position of maximum (or satisfactory) brightness is obtained. Then tighten screw 16 to hold the lamp in position.

To make the coarse focusing adjustment, the complete lamp and lens housing consisting of housing 6, Fig. 3, its extension 8, tube 7 and arms 17 can be adjusted. To do this, reach through the hole at 25, Fig. 3, and grasp the housing assembly at this end to help prevent it from swinging down when clamping nut 18, Fig. 3, is released. Loosen clamping nut 18. This permits the complete housing assembly to be moved in the slot in the side of the mounting frame to adjust the focus of the primary image. When the housing assembly has been adjusted for the best image obtainable in this manner, tighten clamping nut 18 to hold the adjustment.

To make the fine focusing adjustment, loosen screw 19, Fig. 3, to release tube 7, and slide tube 7, forward or backward, by means of arms 17, Fig. 3, to obtain the best primary image. If the image of the hairline is not parallel with the lines on the scale, rotate tube 7, until this condition is obtained. Then tighten screw 19 to hold the adjustment.

D. Adjust Secondary Image

As mentioned in Section 4, the secondary image is light reflected from glass 12, Fig. 3. To change the relative position of this image in respect to the top and bottom of the scale, which also changes the vertical length of the image, loosen screw 20, Fig. 3, and swing the glass, about this point as a pivot, until the desired size image is obtained. Then tighten screw 20.

To adjust the focus of the secondary image, loosen screw 20, Fig. 3, and move the glass forward or backward as required. Then tighten screw 20.

It is not necessary for the secondary image to be at zero on the scale when the primary image is adjusted to zero. However, it should not be too far to one side as its value in helping to locate the primary image will decrease. To adjust the secondary image to zero with the primary image, adjust the zero (for the primary image) as indicated in Section 5-B. If the secondary image is off a small amount, it can be brought to zero by springing the mounting for the glass, at point 23, a small amount. If the secondary image is off too far for the previous type of adjustment, loosen screw 24, Fig. 3, and turn the mounting for the glass the required amount to bring the image to zero. Then tighten screw 24.

E. To Direct Light Onto Galvanometer Mirror

See that the lamp is lighted. Hold the left hand arm 17, Fig. 3, and loosen clamp nut 18, Fig. 3, just enough to permit the lamp housing assembly to be moved. Then hold a small piece of paper in front of window

9 of the galvanometer housing and adjust the lamp housing assembly until the light beam shows on the piece of paper. Remove the paper and check to see that the light is directed through the window to the galvanometer mirror. Make any slight adjustment necessary and tighten nut 18 to hold this adjustment.

6. REPLACE LAMP

To replace the lamp, loosen screw 16, Fig. 3. Grasp the lamp socket 5, Fig. 3, through hole 25, and remove the lamp from the housing. Remove the lamp from the socket and insert the new lamp in the socket. Insert the lamp in the housing and adjust the position of the lamp as indicated in Section 5-C.

7. REPLACE GALVANOMETER SYSTEM

To replace the galvanometer system, disconnect the leads from screws 21 and 22, Fig. 3, and loosen thumb screw 26, Fig. 3. Then lift the galvanometer system from the mounting.

To install the new galvanometer system, back out the thumb screw far enough to clear support 28, Fig. 3, when the system is fitted into place. Then slip the system down between the poles of the magnet, as in Fig. 3, with the threaded section of thumb screw 26, Fig. 3, fitted into the slot in support 28. Push the system down as far as it will go and tighten thumb screw 26 to hold it in place. Then fasten the leads under screws 21 and 22, Fig. 3.

8. VIBRATION DAMPING

The galvanometer system installed in this instrument is equipped with an oil damper arrangement which will effectively damp out vibrations of a minor or temporary nature. The damping is obtained through two drops of heavy oil placed in two loops of wire coiled around the suspensions and located about 1/4" above and below the moving coil. This oil under normal conditions, should not require replacement for a period of years. Additional damping oil if required, can be obtained from Leeds & Northrup Co.

In some instances, because of the nature of the vibrations, the oil dampers may not be entirely satisfactory. In such cases, additional protection against the effects of vibrations may be obtained through the substitution of shock absorbing type feet for the hard rubber feet installed on standard instruments. Shock absorbing feet make the instrument somewhat more difficult to adjust, because of the less firm footing provided and for this reason are not installed on all instruments initially. These shock absorbing feet may be obtained from Leeds & Northrup Co. by ordering Std. 3351-AR.