



INSTALLATION • OPERATION • MAINTENANCE INSTRUCTIONS

SYNCHROTIIE INDICATING AND RECORDING INSTRUMENTS

GENERAL

The Westinghouse Synchrotie measuring equipment operates upon the Duplicate Position Telemeter principle.

PRINCIPLE OF OPERATION

The transmitter and receiver motors are similar in general size and construction to small synchronous motors. The stators are wound for two-pole, single-phase, and the rotors are wound as for three-phase. The three rotor terminals on each unit are connected to corresponding rotor terminals on the receivers or transmitters. The single-phase stators are both connected to a-c circuits from the same source, or synchronous and in phase as shown in the diagram. Fig. 1.

The synchronizing action is due to voltages induced in the three windings of the rotor by the single-phase stator field. When all rotors are in the same position, the voltages induced in corresponding rotor windings of the transmitter and receivers are equal so that no current flows between rotors. Should the position of the transmitter rotor change, the induced voltage in its rotor windings will change, causing a voltage difference to be set up between the rotor windings of the transmitter and receivers. This will cause a current to flow between the rotors, and if the transmitter rotor position is fixed, the rotor current will cause the receiver rotors to turn by motor action until the rotors occupy the same relative positions and induced voltages are equalized. This action causes the receivers to take up the same position as the transmitter and follow any motions it may make.

A number of receivers may be operated from a

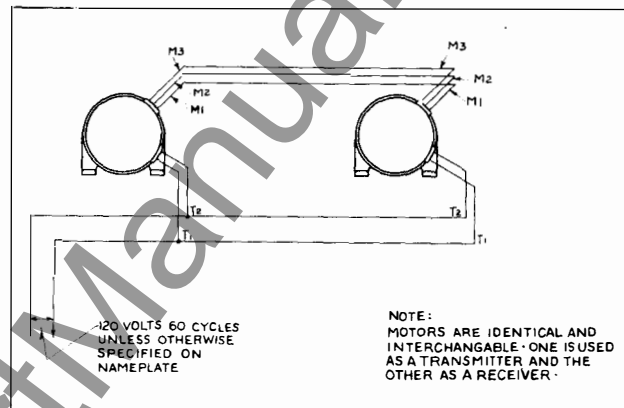


Fig. 1—Diagram of Connections Synchrotie Transmission.

single transmitter with reduced receiver torque. In the formula:

$$TR = \frac{2}{N + 1}$$

TR is the torque of each receiver when N receivers are operated from a single transmitter. Thus, with two receivers, each receiver has two-thirds normal torque; with three receivers, each receiver has one-half normal torque, etc.

The number of receivers permissible for one transmitter is thus dependent upon line resistance, voltage variation, and allowable lag-error.

The energy consumption per motor at rated voltage and frequency is 15 watts, 60 volt-amperes.

Telemetering Line Conditions

Connection between the transmitter and the receiver consists of three conductors as shown in Fig. 1. The transmitter and the receiver are also both connected at their respective

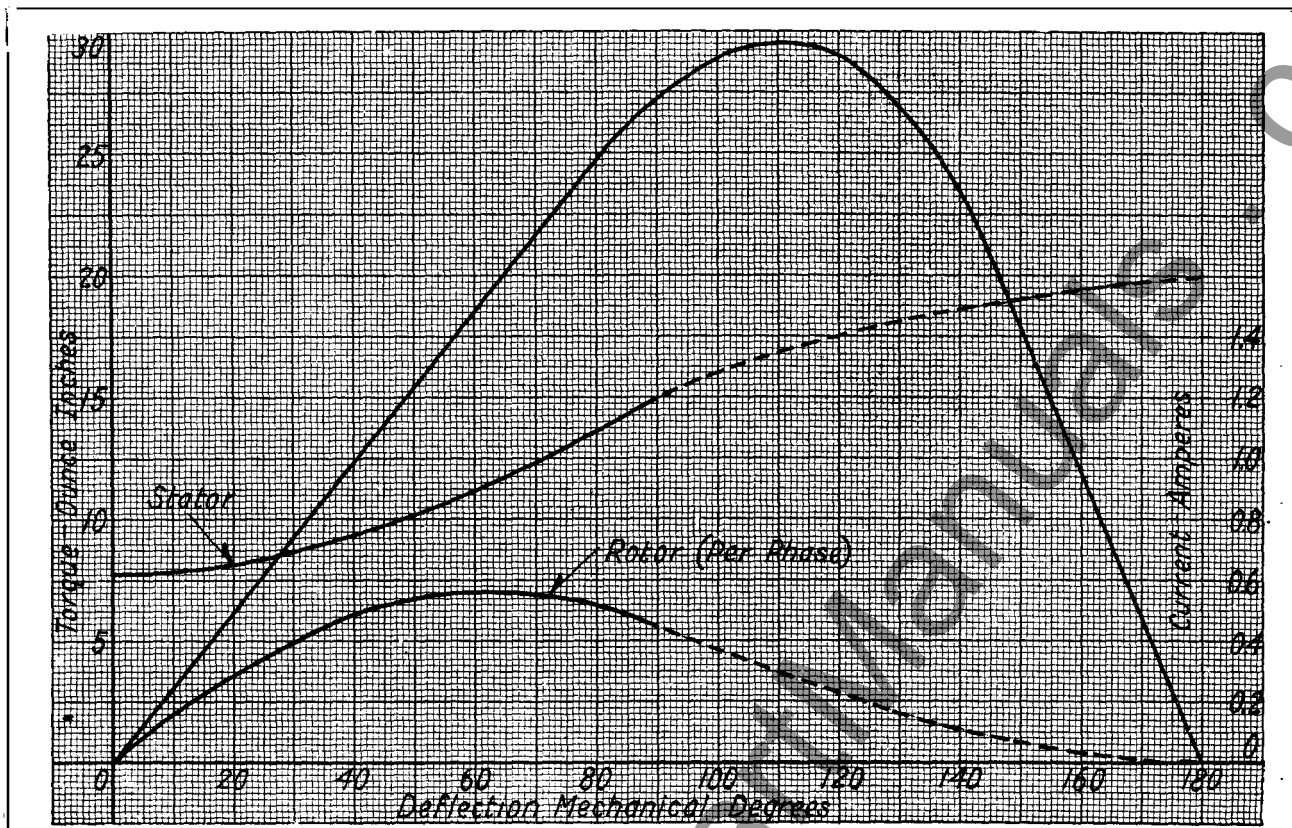


Fig. 2—Type ADS Position Indicator Meter Torque Displacement Characteristics.

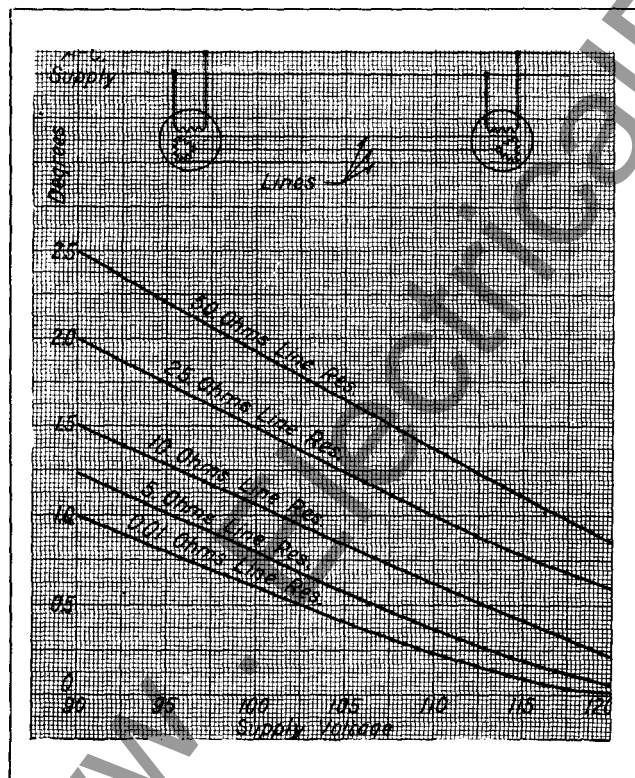


Fig. 3—Receiver Lag in Degrees With Supply Voltage Variation For Various Line Resistance.

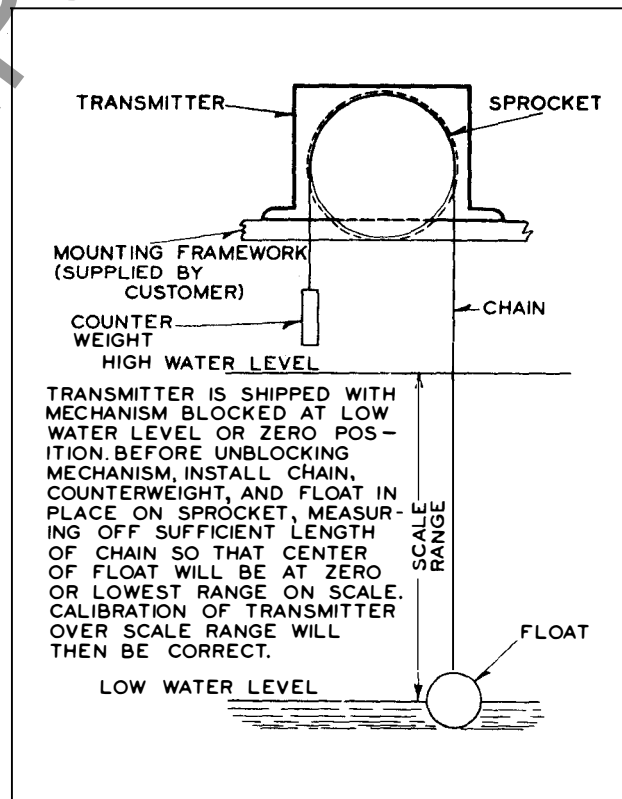


Fig. 4—Water Level Transmitter Installation.

locations to the same a-c single-phase, power-supply circuit or one derived from the same. If a circuit is not available from the same source at both transmitting and receiving stations, an additional pair of wires is necessary to energize the stator of one or the other unit from the power supply when available only at one end. The telemeter wires should have suitable insulation for the service.

The size of wire or cable required for the telemeter line will depend upon the distance. Line resistance reduces the restoring torque of the receiving instruments, and, thus, if the line resistance is too high, friction will cause a lag angle error in the indicators or recorders. This is illustrated in the curve, Fig. 3.

TRANSMITTERS

Water-Level Transmitters

The transmitter consists of a Synchrotie unit mounted in a cast moisture-proof case. The motor is connected through a gear train to a sprocket which is connected by means of a chain to a float and counterweight. The position of the float governs the position of the transmitter rotor, and in operation the receivers follow all movements of the transmitter and indicate the float position.

The outline and mounting dimensions are shown on Fig. 5. Although the case is moisture-proof and weather-proof, it is recommended that a protective housing be built over the apparatus to protect it from foreign objects and assure long life.

Sufficient chain is provided to mount the transmitter five feet above high water level. Should the transmitter be mounted higher than five feet above high water, the necessary length of wire should be added to the ends of the chain. The transmitter is shipped with the mechanism blocked in the zero position. The chain, counterweight, and float should be mounted in position accordingly, so that the float is at the lower position of the scale range by measuring the chain length to include

the distance from the base of the transmitter to the center of the float. This should include the length of chain to cover the scale range, as well as the distance from high water level to the base of the transmitter.

Other Position Transmitters

The "TS" transmitter, as described above for water-level indication, is also adaptable for mechanical connection to any mechanism, the position of which it is desired to indicate or record at a distance. Thus, instead of a sprocket wheel operated by a float, suitable gearing or links can be arranged to drive the transmitter.

Transmitter Attachment For Recording Instrument

The Synchrotie unit may be directly geared to the recording mechanism of any Westinghouse type "R" recording instrument, single circuit or totalizing, to transmit the readings of the recorder to another location.

Hand-Operated Transmitters

By means of a hand-operated Synchrotie transmitter, Fig. 7, fitted with a knob and a pointer arm, signals or readings corresponding to any markings desired on the face plate, may be transmitted to a remote position to operate a receiving instrument.

RECEIVING INSTRUMENTS

Description

Receiving instruments for the duplicate position system may be either of the indicating type or of the recording type, as desired. Indicating position type instruments are operated by the Synchrotie motor units like those in the transmitters.

Type HB boiler-room indicators are large size square instruments suitable for being read from a distance in large rooms. Types US-25 and KS-25 are of the rectangular switch-board type, to match the types H and 25 lines of instruments.

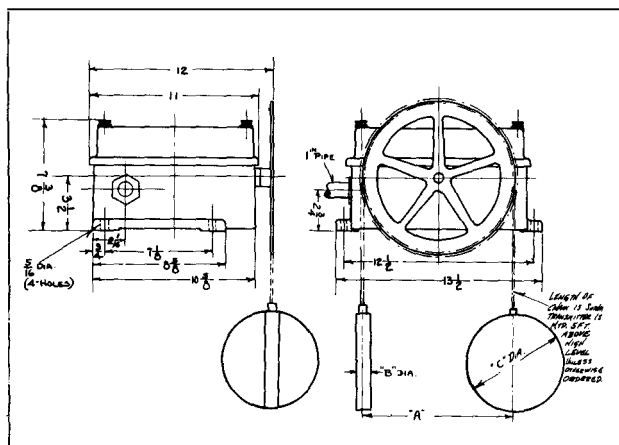


Fig. 5—Outline of Type TS Water Level Transmitter.

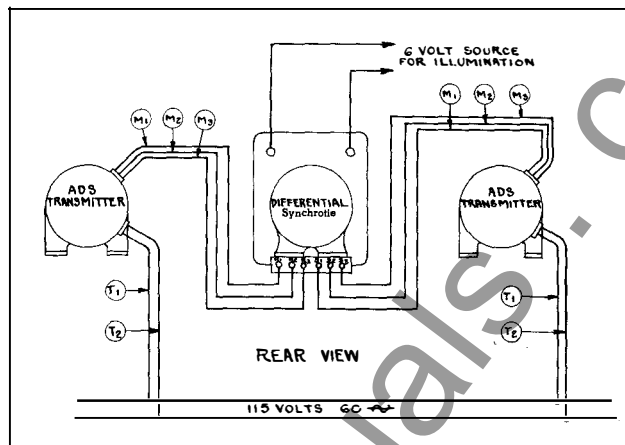


Fig. 6—Diagram of Connections, Differential Position Indicator .

INSTALLATION

Boiler-room indicators of the suspension type should be attached to overhead structures, with due regard to their weight. The connections may be brought into the cases by means of one-inch pipe conduits, either from the bottom of the case or from one side. Boiler-room indicators are often provided with an additional "Anticipatory" hand. This is operated from a separate receiving Synchrotie motor within the case, which is operated by means of a hand-operated transmitter.

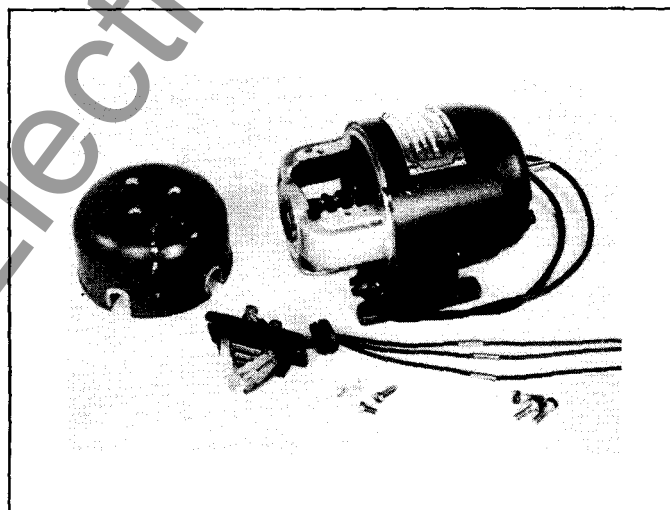
Flush-type boiler-room indicators and the types US-25 and KS-25 position indicators are designed for panel mounting. Connections for all receiving instruments are to be made per Fig. 1.

A half-revolution error in the indications of any receiving instrument is caused by a reversal of the leads to the single-phase supply line. Reversed direction of operation is caused by incorrect sequence of the three-wire system of rotor connections, M_1 , M_2 , M_3 .

Differential Receiving Instruments

The differential type of position indicator is used in conjunction with two transmitters. When connected as shown in the wiring diagram, the indicator will read the difference between the relative rotor positions of the two transmitters.

The differential type of position indicator motor differs from the standard Synchrotie position indicator in that both rotor and stator



Synchrotie Motor Unit—Opened for Service Inspection.

windings are wound as for three-phase.

When properly connected and the rotor of one transmitter blocked, the position indicator will follow the rotor of the other transmitter in both direction and angle displacement. If the indicator turns in a direction opposite to that of the transmitter, it will be found that two of the leads between that transmitter and the indicator are interchanged.

If the rotors of the two transmitters are turned in the same direction by the same amount, the position indicator will remain stationary.

Position Recorders

The type "GS-40" strip chart-type position recorder consists of a Synchrotie motor unit, geared to directly operate a recording pen. The case, clock, and other recording mechanism correspond to the construction of the other

type "G-40" recorders. For complete operating instructions, see separate I.L. 43-400.

MAINTENANCE

The end-bells of the frames are removable, giving access to the brushes and slip rings for any necessary cleaning and inspection. Such servicing may be required at intervals of a year or more.

REPAIRS AND RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

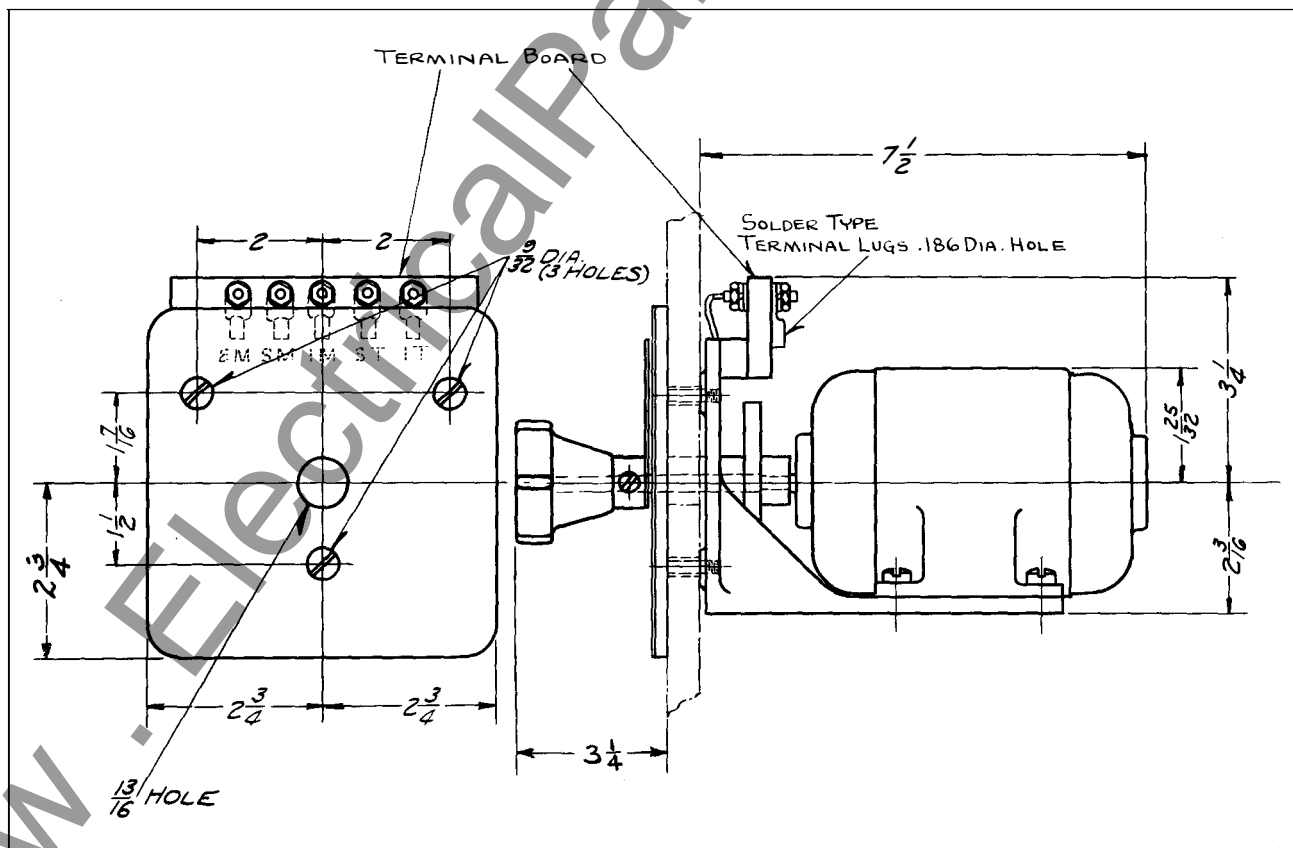


Fig. 7 — Hand-operated Synchrotie Position Transmitter.

SYNCHROTIE INDICATING AND RECORDING INSTRUMENTS

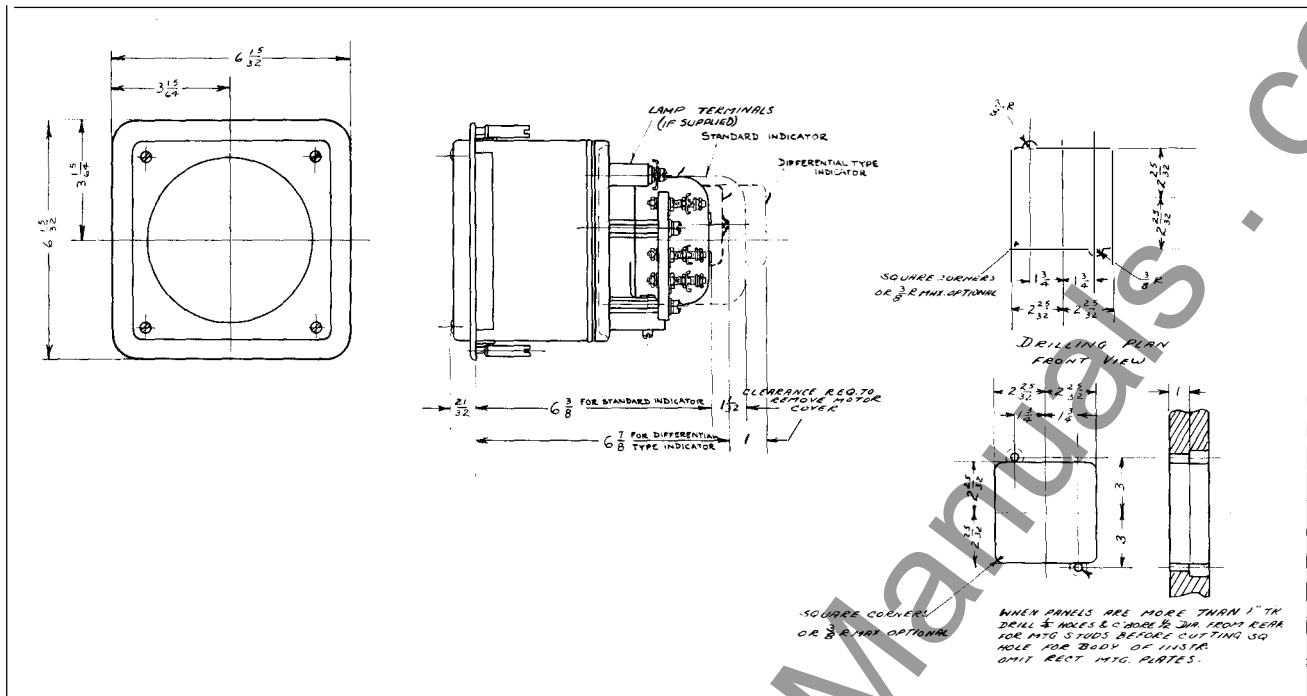


Fig. 8 — Type KS-25 Receiving Instrument Flush Type.

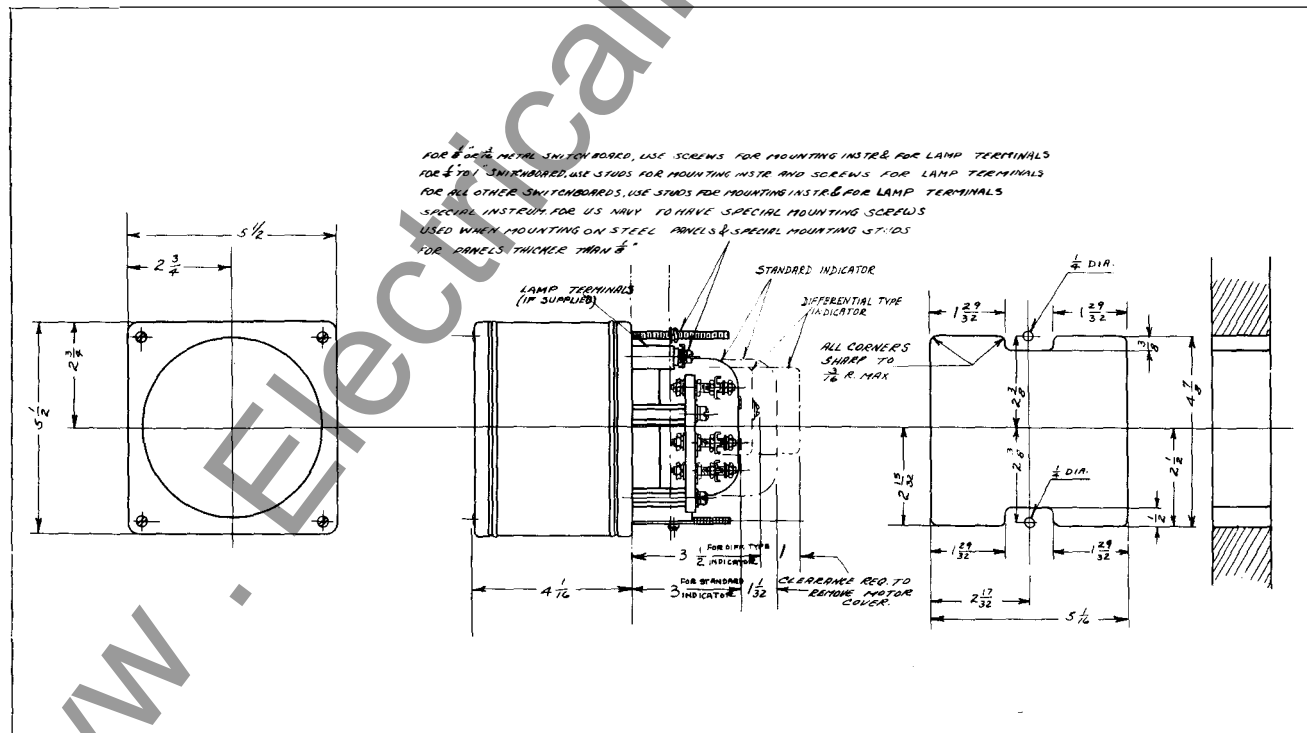


Fig. 9—Type US-25 Receiving Instrument Projecting Type.

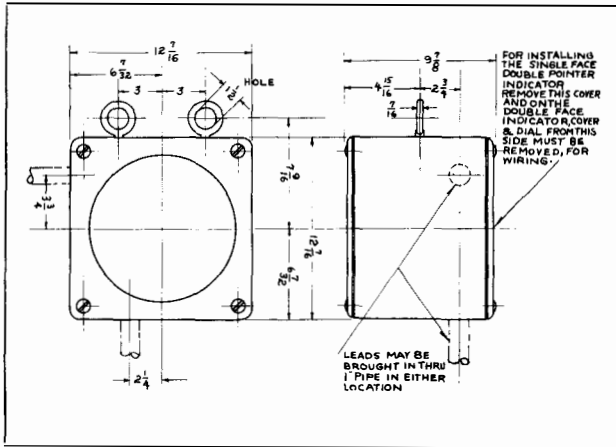


Fig. 10—Type HB Boiler Room Indicator 10" Dial.

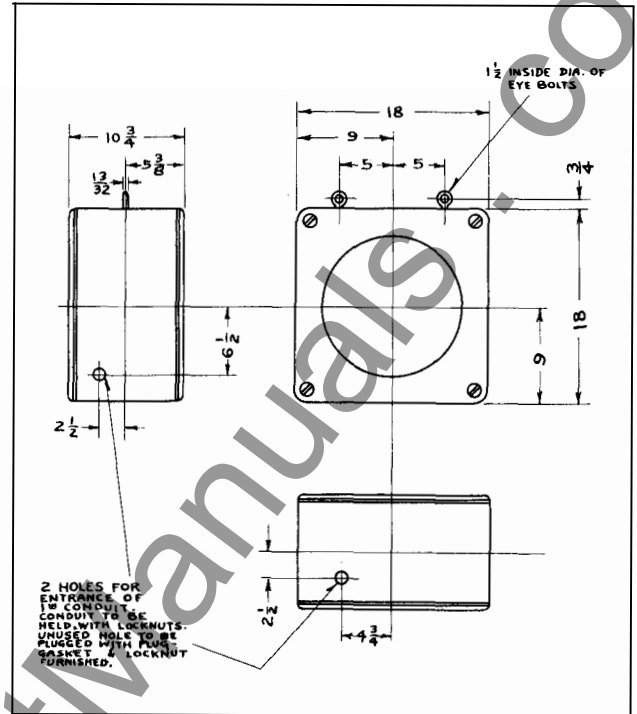


Fig. 11—Type HB Boiler Room Indicator, 15" Dial.

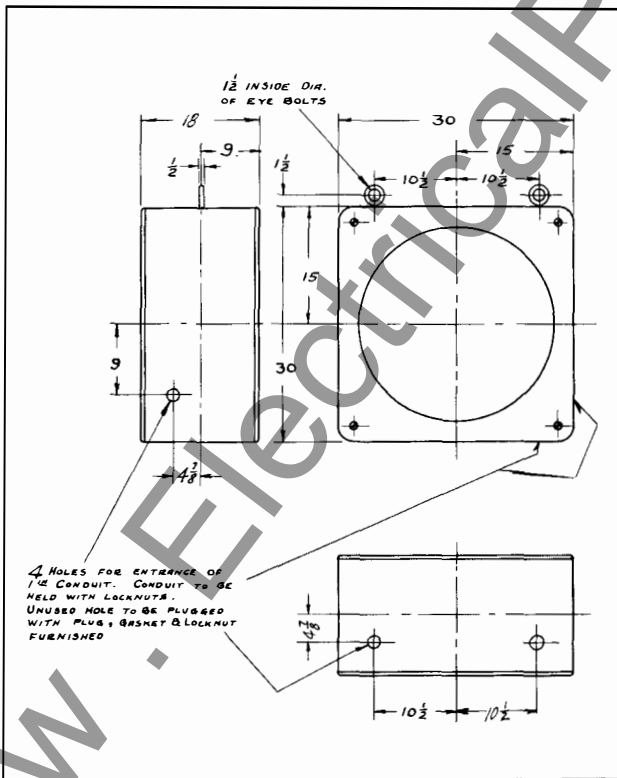


Fig. 12—Outline of Type HB Boiler Room Indicator With 25 inch Dial.

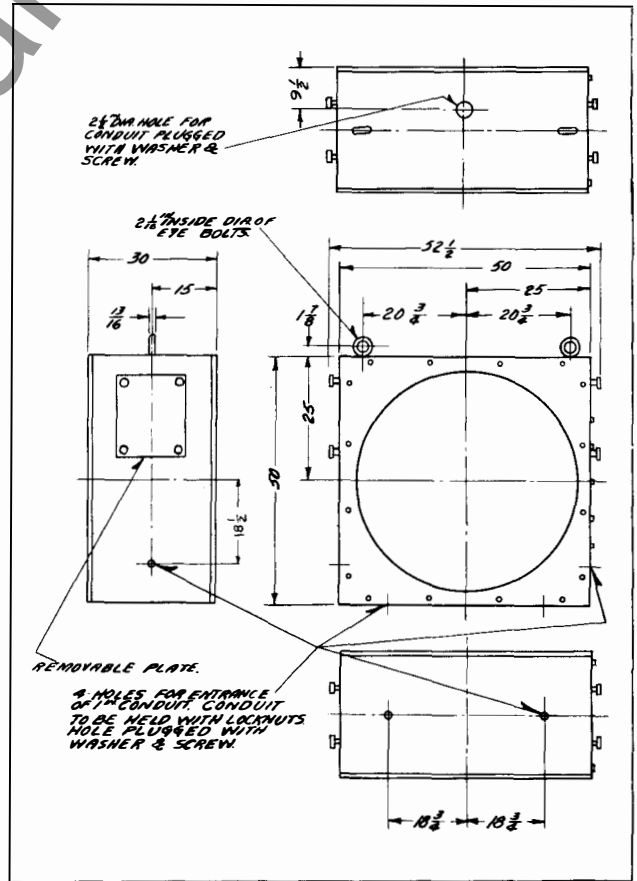


Fig. 13—Outline of Type HB Boiler Room Indicator With 40 inch Dial.

SYNCHROTIE INDICATING AND RECORDING INSTRUMENTS.

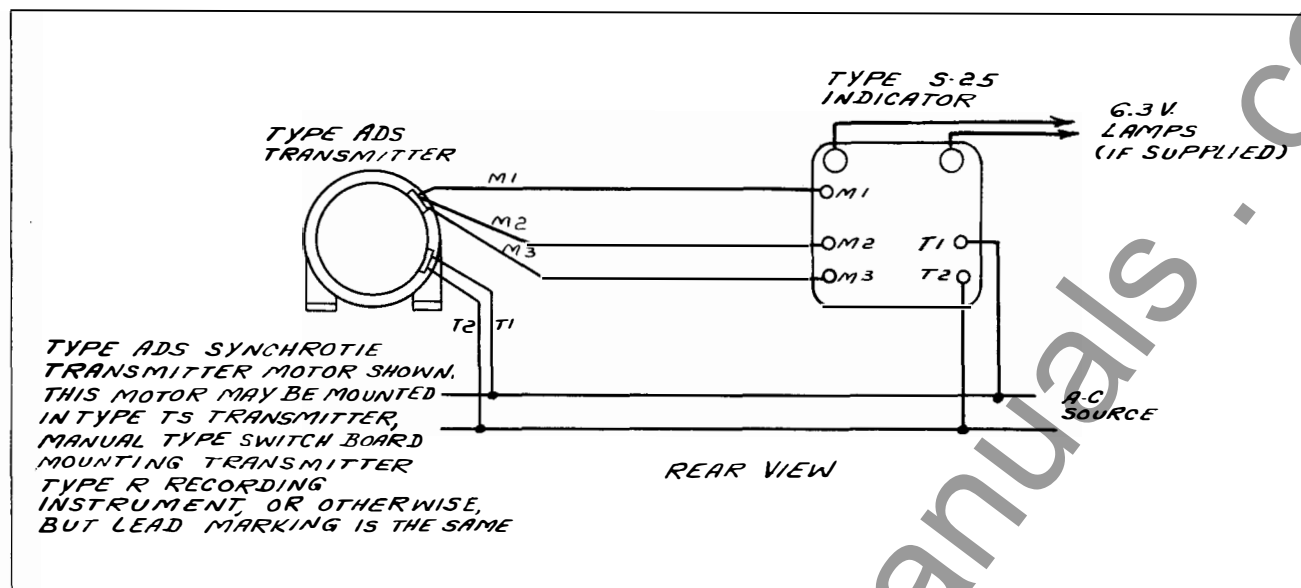


Diagram of Connections, Synchrotie Position Indicator.

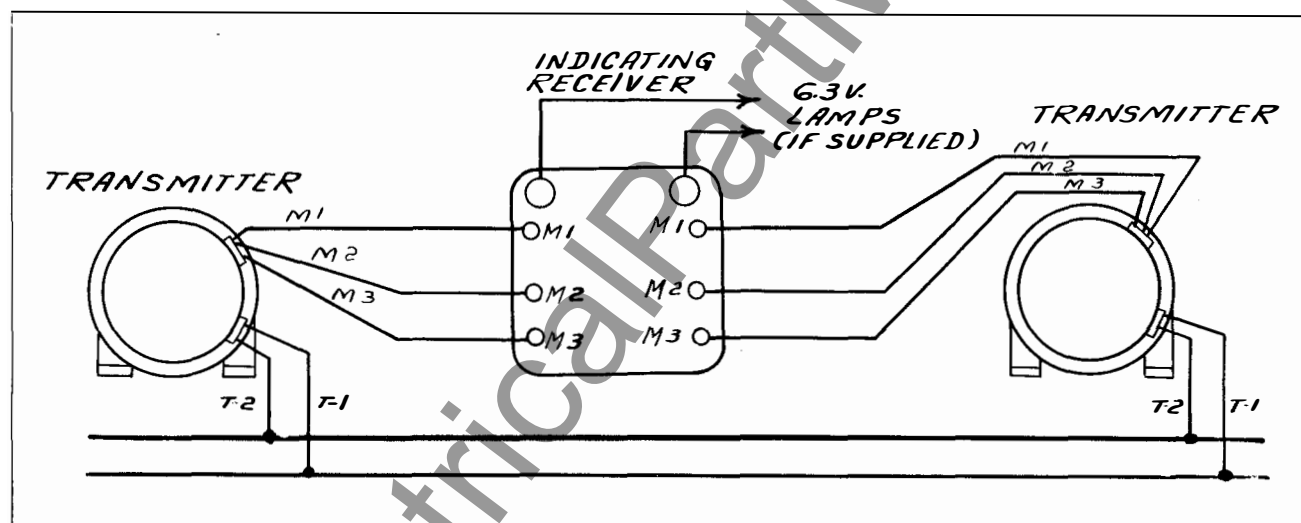


Diagram of Connections, Differential Position Indicator.