INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE TH THERMAL TIMING RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type TH thermal timing relay is a simple and rugged time delay device developed expressly to meet the requirements of Westinghouse tap-changing-under-load equipment, where reliability of operation and freedom from maintenance are items of major importance. The relay also may be used in other applications where its characteristics are suitable. As adjusted at the factory, the time delay on a recycling basis can be varied from approximately 15 seconds with the control knob set on the MIN dial position, to approximately 60 seconds with the knob on the MAX position, with 120 volts applied to the relay. A 105 to 135 volt variation of applied voltage has negligible effect on the relay timing when the control knob is set on the MIN position. When set on the MAX position, the effect of voltage variation is more noticeable, but the relay timing is still within the calibration limits.

Two timing elements are required in the control of a tap-changing equipment. The type TH relay is available both with a single timing element in a projection mounted case (Fig. 1), and as a duplex timing relay containing two timing elements in an 8 terminal Flexitest case (Fig. 4).

The complete operating cycle of the relay is composed of two parts; (1) the time required for the bimetal actuating system to deflect under the influence of heat and operate a micro switch, and (2) the time required for the bimetal system to cool until the micro switch resets. The mechanical construction of the relay is rugged, simple and reliable, with a minimum number of moving parts. The entire assembly is enclosed in a dust-proof case and after installation will require only a routine inspection to keep it in operating condition.

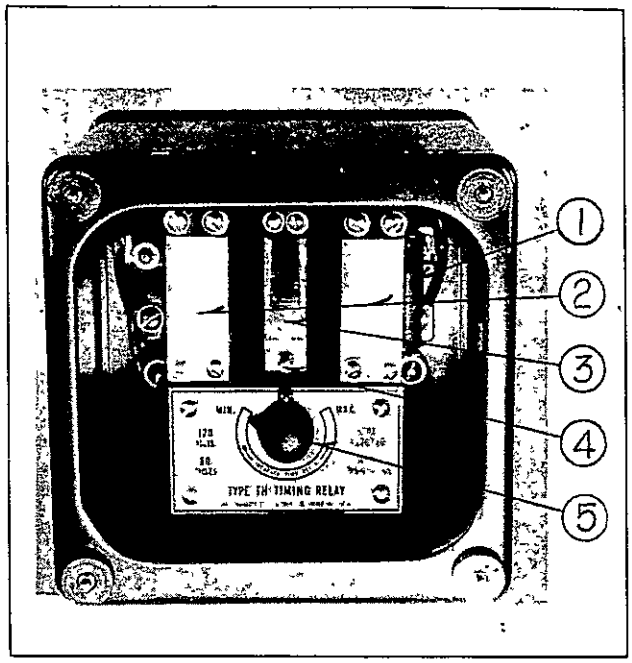

Fig. 1—Type TH Single-Element Thermal Timing Relay. 1—Resistor, 2—Side Bimetal Strips, 3—Heater Coil and Center Bimetal Strip, 4—"F" Bimetal Screw, 5—"T" Timing Screw.

CAUTION The relay is designed specifically for application on Westinghouse regulators and tap-changing-under-load equipment and when so used should give a minimum of well over a million operations. If used otherwise, the effect or possible higher current in the controlled circuit upon the life of the relay should be considered.

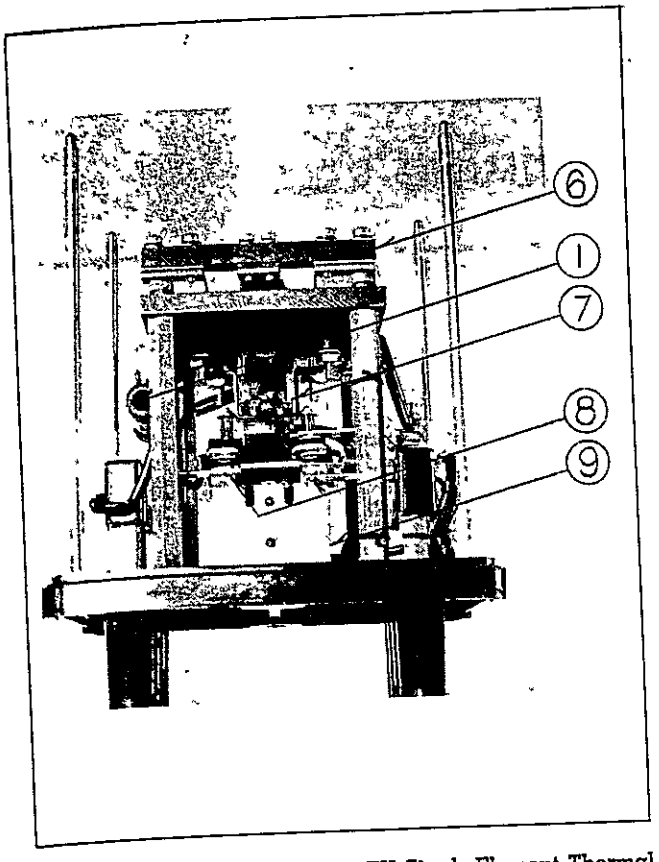

Fig. 2—Top Views of the Type TH Single-Element Thermal Timing Relay. 1—Resistor, 6—Bimetal Assembly, 7—Micro Switch, 8—Contacts, 9—Auxiliary Contactor.

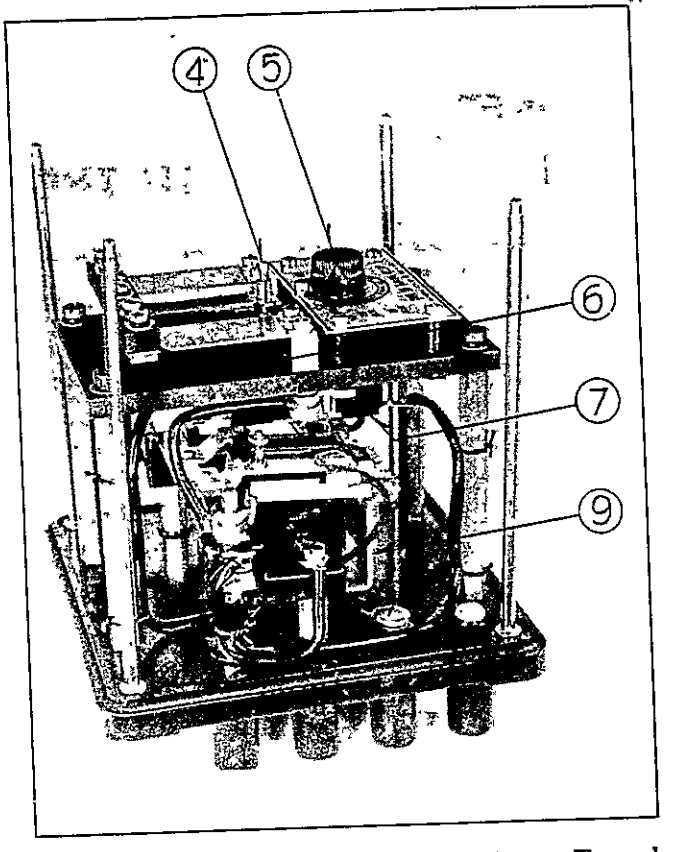

Fig. 3—Side View of the Type TH Single-Element Thermal Timing Relay. 4—"F" Bimetal Screw, 5—"T" Timing Screw, 6—Bimetal Assembly, 7—Micro Switch, 9—Auxiliary Contactor.

CONSTRUCTION

The type TH relay consists essentially of three elements: (1) a bimetal actuating system, (2) a micro switch operated by the pressure exerted by the bimetal system, and (3) an auxiliary magnetic contactor.

The Bimetal System

The bimetal system of the single-element relay consists of three elements mounted in the front part of the relay, directly behind the glass cover of the case. The center strip is equipped with a heater coil and represents the actuating element of the relay. On heating, this strip bends and exerts a pressure on the operating plunger of the micro switch. The two side bimetal strips eliminate the effect of ambient temperature on the relay operation. The moving end of the center bimetal is equipped with a self-locking adjusting screw. The position of this screw is properly adjusted before the relay is shipped from the factory and should not require any readjustment in the field. The duplex relay has a bimetal system consisting of four bimetal strips. The two inside strips are equipped with heater coils and actuate separate micro switches, while the two outside strips provide compensation for ambient temperature changes. The heater coils are never energized simultaneously by the tap changer control, and the two timing elements have a negligible effect on each other.

The Micro Switch

The micro switches are mounted on the rear of a Micarta panel and in front of the magnetic contactor. The micro switch is a snap action single-pole double-throw switch, operated by the pressure exerted by the bimetal assembly. The normally-open contact is fixed

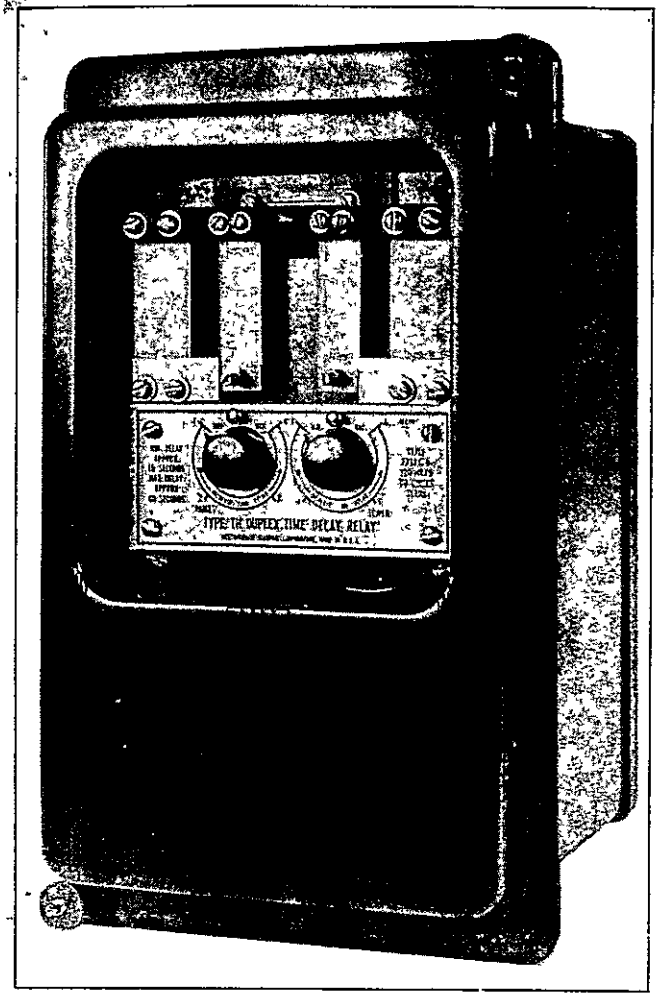

Fig. 4—The Type TH Duplex Thermal Timing Relay.

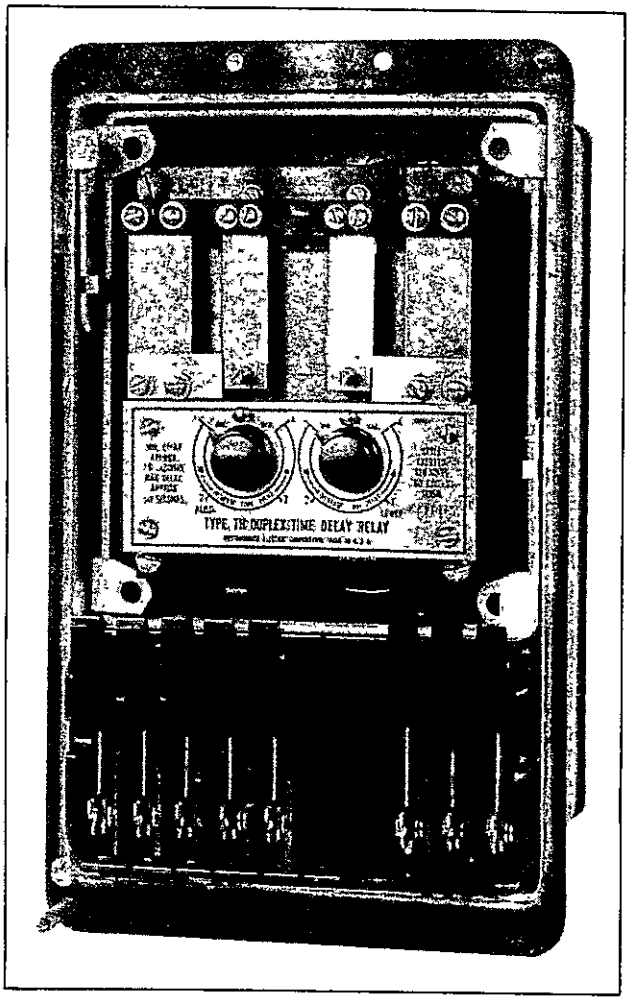

Fig. 5—The Type TH Duplex Thermal Timing Relay With Cover Removed, Showing Test Switches.

while the normally-closed contact is movable, thus providing for adjustment of the relay timing cycle. The normally-closed contact is mounted on the end of the timing screw which extends forward through a bushing in the Micarta panel and has an adjusting knob on its front end. Variation of timing is obtained by turning the knob to the required position as determined by the indication of the pointer on the dial.

The Auxiliary Contactor

The auxiliary contactor of the single-element relay is mounted on the relay base behind the micro switch. It carries the necessary contacts to enable the utilization of both the heating and cooling periods for timing. The two contactors of the duplex relay are similarly mounted on the relay sub-base.

OPERATION

The circuit controlled by the single-element relay is included between terminals 3 and 8 as shown in Fig. 7. This circuit is opened at contact A-3 when the relay is de-energized. The relay is energized by placing voltage on terminals 3 and 6, thus initiating the bimetal heating period. When the bimetal temperature rise reaches a pre-determined value, the micro switch operates, opening the circuit between terminal 3 and contact A-3 and closing the circuit through the coil of the auxiliary contactor. Operation of the latter closes contacts A-11, A-12, and A-3, and opens contact A-2, which discontinues the heating of the bimetal. When the bimetal has cooled to a predetermined temperature rise above ambient, the micro switch returns to its original position,

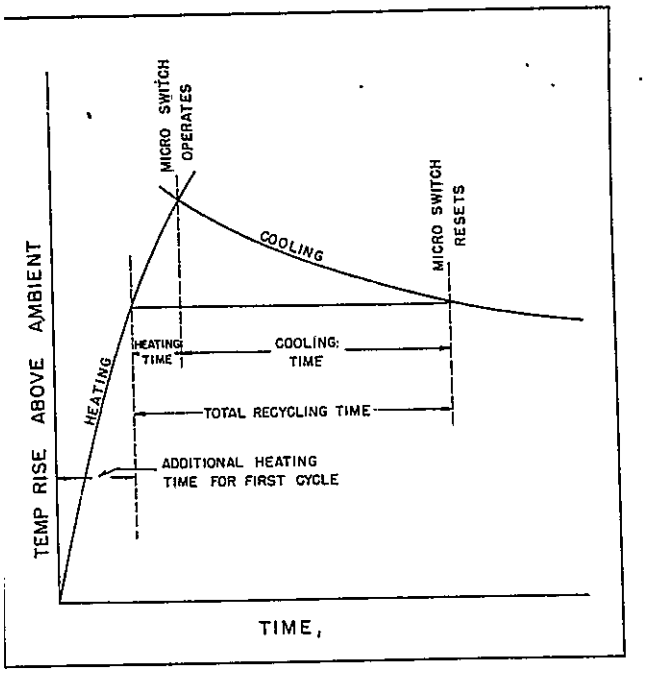

Fig. 6—The Time-Temperature Characteristic of the Type TH Relay.

thus closing the circuit between terminals 3 and 8. The relay is reset by de-energizing the coil, of the auxiliary contactor.

The controlled circuits of the duplex relay are between terminals 1 and 3, and between 2 and 4 (Fig. 8). The duplex relay does not have contacts corresponding to contact A-11 of the single-element relay.

RELAYS IN TYPE FT CASE

The type TH duplex timing relay is supplied in the S size FT case. The type FT cases are dust-proof enclosures combining relay elements and knife-blade test switches in the same case. This combination provides a compact flexible assembly easy to maintain, inspect, test and adjust. There are three main units of the type FT case; the case cover and chassis. The case is an all welded steel housing containing the hinge half of the knife-blade test switches and the terminals for external connections. The cover is a drawn steel frame with a clear window which fits over the front of the case with the switches closed. The chassis is a frame that supports the relay elements and the contact jaw half of the test switches. This slides in

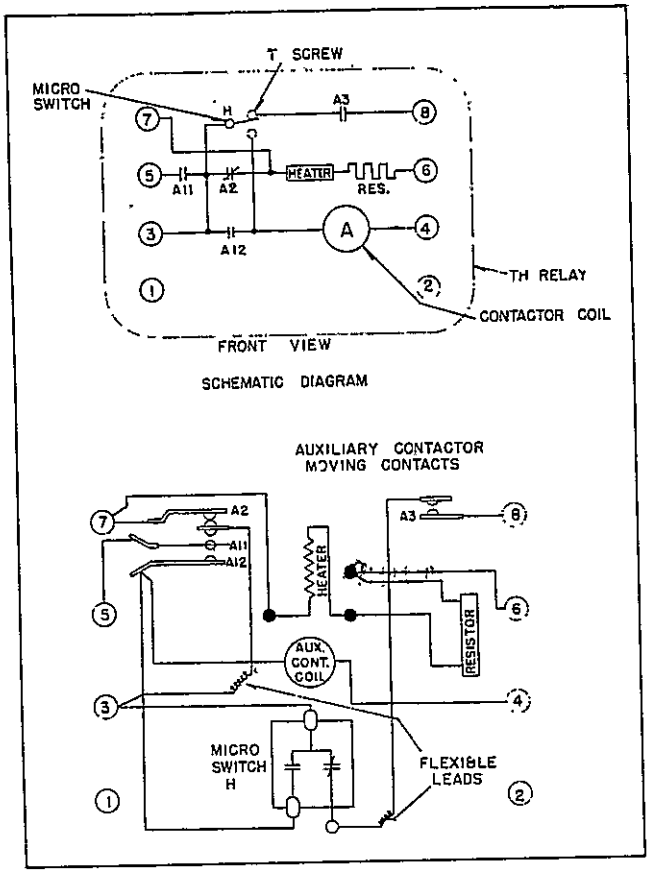

Fig. 7—Schematic and Wiring Diagrams of the Type TH Single-Element Relay.

and out of the case. The electrical connections between the base and chassis are completed through the closed knife-blades.

Removing Chassis

To remove the chassis, first remove the cover by unscrewing the captive nuts at the two corners. This exposes the relay elements and all the test switches for inspection and testing. The next step is to open the test switches. In opening the test switches they should be moved all the way back against the stops. With all the switches fully opened, grasp the two cam action latch arms and pull outward. This releases the chassis from the case. Using the latch arms as handles, pull the chassis out of the case. The chassis can be set on a test bench in a normal upright position as well as on its top, back or sides for easy inspection, maintenance and test.

After removing the chassis a duplicate

chassis may be inserted in the case or the blade portion of the switches can be closed and the cover put in place without the chassis.

When the chassis is to be put back in the case, the above procedure is to be followed in the reversed order.

Electrical Circuits

Each terminal in the base connects thru a test switch to the relay elements in the chassis as shown on the internal schematic diagrams. The relay terminal is identified by numbers marked on both the inside and outside of the base. The test switch positions are identified by letters marked on the top and bottom surface of the moulded blocks. These letters can be seen when the chassis is removed from the case.

The potential and control circuits thru the relay are disconnected from the external circuit by opening the associated test switches.

A cover operated switch can be supplied with its contacts wired in series with the trip circuit. This switch opens the trip circuit when the cover is removed. This switch can be added to the existing type FT cases at any time.

Testing

The relays can be tested in service, in the case but with the external circuits isolated, or out of the case as follows:

Testing In Service

Voltages between the potential circuits can be measured conveniently by clamping #2 clip leads on the projecting clip lead lug on the contact jaw.

Testing In Case

With all blades in the full open position, the ten circuit test plug can be inserted in the contact jaws. This connects the relay elements to a set of binding posts and completely isolates the relay circuits from the external connections by means of an insulating barrier on the plug. The external test circuits are connected to these binding posts. The plug is inserted in the bottom test jaws with the binding posts up and in the top test switch jaws with the binding posts down.

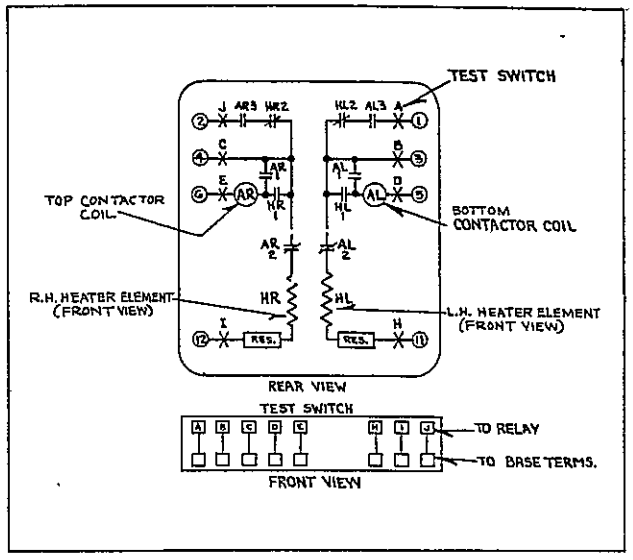

Fig. 8—Schematic Diagram of Type TH Duplex Relay.

The external test circuits may be made to the relay elements by #2 test clip leads instead of the test plug.

Testing Out of Case

With the chassis removed from the base, relay elements may be tested by using the ten circuit test plug or by #2 test clip leads as described above. The factory calibration is made with the chassis in the case and removing the chassis from the case will change the calibration values of some relays by a small percentage. It is recommended that the relay be checked in position as a final check on calibration.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of

the two mounting studs. The electrical connections may be made direct to the terminals by means of screws for steel panel mounting or to terminal studs furnished with the relay for ebony-asbestos or slate panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the studs and then turning the proper nut with a wrench.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or it it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed:

All contacts should be periodically cleaned with a fine file. S#1002110 file is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

All moving contacts of the duplex relay, and the RH moving contact of the single-element relay, should deflect 3/64" when the armature is closed. The inner end of the terminal strip for the LH make contact of the single-element relay should just touch the contact back-up spring when the armature is open. Both the moving and the stationary LH make contacts will deflect when the armature closes and the moving contact deflection should be approximately 1/32". Sufficient contact deflection is important, both to provide good electrical circuits and to avoid any possibility of having residual magnetism hold the armature closed when de-energized, after the plating has been worn from the pole faces by numerous operations. The contact gaps should be 1/8" to 5/32" (sum of both gaps on LH side of single-element relay) and the outward travel of the armature should be limited by the back stationary contact and not by the tongue of the yoke which projects through the opening in the armature between the hinge points.

If the adjustment of the timing screw or the bimetals is disturbed, the instructions below may be used as a guide in restoring the normal adjustment of the relay. If only the bimetal assembly requires replacement, no re-adjustment should be necessary in the timing dial but only in the adjusting screws at the movable end of the center bimetal. Should the timing screw assembly be replaced, the only adjustment required should be in the timing screw, none in the bimetal system. But if the micro switch is replaced, both the timing screw and the bimetal screw will have to be readjusted.

1. Equipment Required

a) A source of 120 volt, 60 cycle power.

b) A high impedance circuit tester. An ohm meter or a neon glow lamp connected as a circuit indicator is recommended.

WARNING: - If any appreciable current is passed through the micro switch contact during adjustment, the switch contacts may be damaged.

2. To Adjust Timing Screw "T"

a) Connect circuit tester in series with power source and apply to terminals 3 and 4 of the single-element relay, or terminals 3 and 5 or 4 and 6 of the duplex relay.

b) Check operation of micro switch by pressing bimetal screw "F". The micro switch should close the circuit and operate the indicator. When "F" screw is released, micro switch should open indicator circuit.

c) Remove knob from timing screw "T". Turn screw clockwise until circuit indicator shows that micro switch normally-open contacts are just barely closed. From this position turn screw counter-clockwise slightly over one-eighth (1/8) turn. This is the approximate MIN setting. Replace knob on screw shaft

with pointer at MIN position and tighten set screw.

d) Recheck micro switch operation.

3. To Adjust Bimetal Screw "F"

a) Follow instructions given in section 2-a and 2-b.

b) Turn screw "F" clockwise until circuit indicator shows that micro switch normally-open contacts just barely stay closed when "F" screw is pressed down and then released. From this position, turn screw counter-clockwise one and one-quarter (1-1/4) complete turns. The center bimetal strip must be at the same temperature as the side strips during this adjustment.

4. To Check Timing Adjustment

(Note: Contact designations and terminal numbers in the following paragraphs apply to the single-element relay. Refer to Figs. 7 and 8 and make corresponding connections when checking the duplex relay).

a) Place a short-circuiting jumper across contact A-3. Insulate contact A-12 with a piece of stiff paper. Place cover on relay.

b) Connect circuit indicator as follows: If ohm-meter is used, connect between terminals 3 and 8: if glow lamp circuit tester is used, connect between terminals 4 and 8 of relay. Place a test jumper between terminals 4 and 6 and connect 120 volt, 60 cycle power source to terminals 3 and 6.

c) Timing cycle will begin when supply voltage is turned on. The heating portion of the cycle will be complete when the indicator shows that the circuit has been reclosed.

d) Note that the first cycle will take longer time than subsequent cycles, due to the additional time required for the bimetal temperature rise and resultant deflection to reach the point at which the micro switch resets. This is shown diagramatically in Fig. 4. Adjustment should not be made on the basis of the first cycle but on the average of several subsequent cycles following immediately after the first. All times referred to in this leaflet are "re-cycling" time defined as the average time consumed by a complete cycle consecutively following the first cycle.

e) When properly adjusted the time of one complete re-cycling operation should be between 11 and 16-1/2 seconds with pointer on "T" set at MIN, and between 54 and 69 seconds with pointer set at MAX. Individual readings should not vary more than approximately 2 seconds at MIN or 3 seconds at MAX. If the re-cycling times for these two positions of the knob are both high or both low, correction may be made by changing the position of the knob on screw "T".

f) If adjustment of "F" screw has been made closer adjustment may be affected when necessary by turning screw "F" in 1/16 revolution steps. Clockwise rotation will increase re-cycling time; counter-clockwise rotation will decrease time.

IMPORTANT: Readjustment should not be made on either element unless its factory adjustment has been disturbed.

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 name-plate data.

ENERGY REQUIREMENTS

At 120 volts, 60 cycles, the contactor element burden is 11 voltamperes at approximately 50% power-factor. The heater circuit burden is 18 watts.

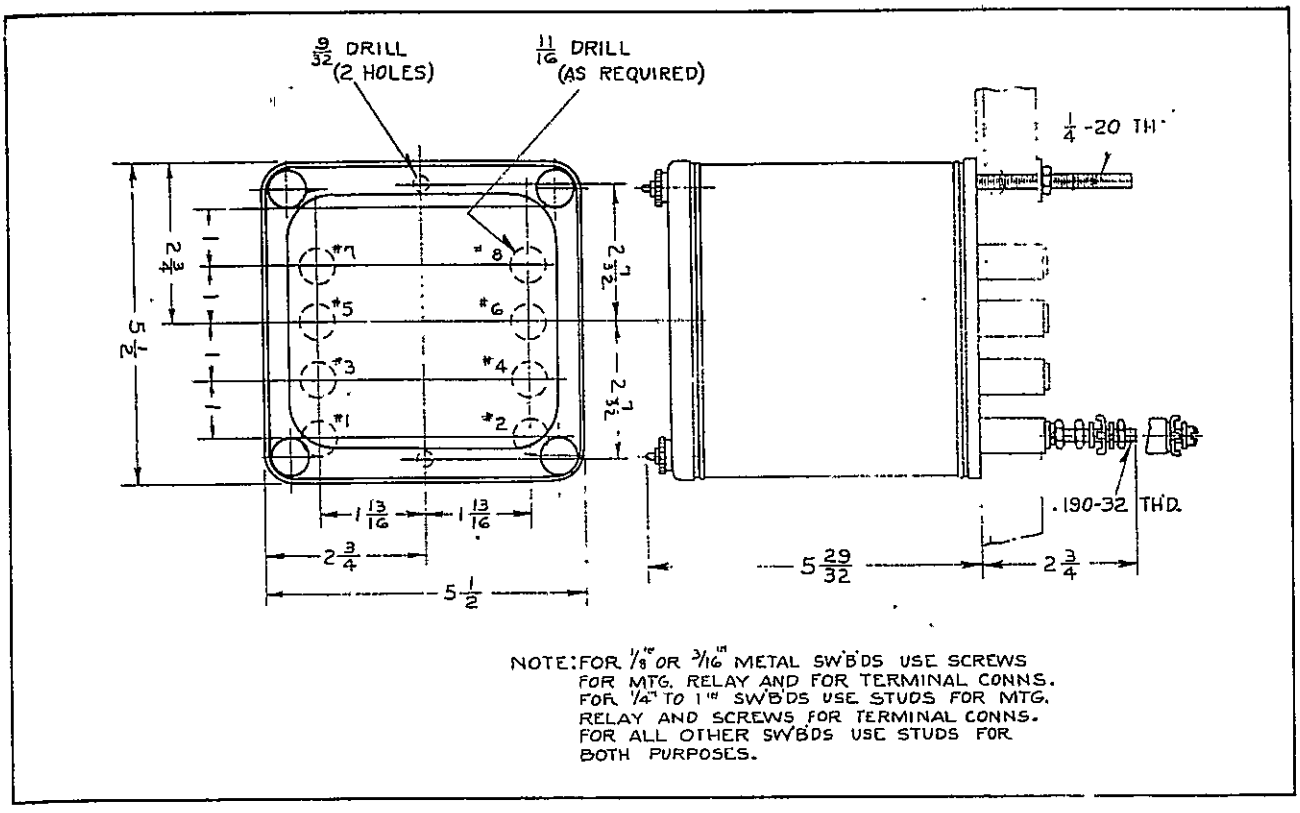

Fig. 9—Outline and Drilling Plan for the Type TH Single-Element Relay.

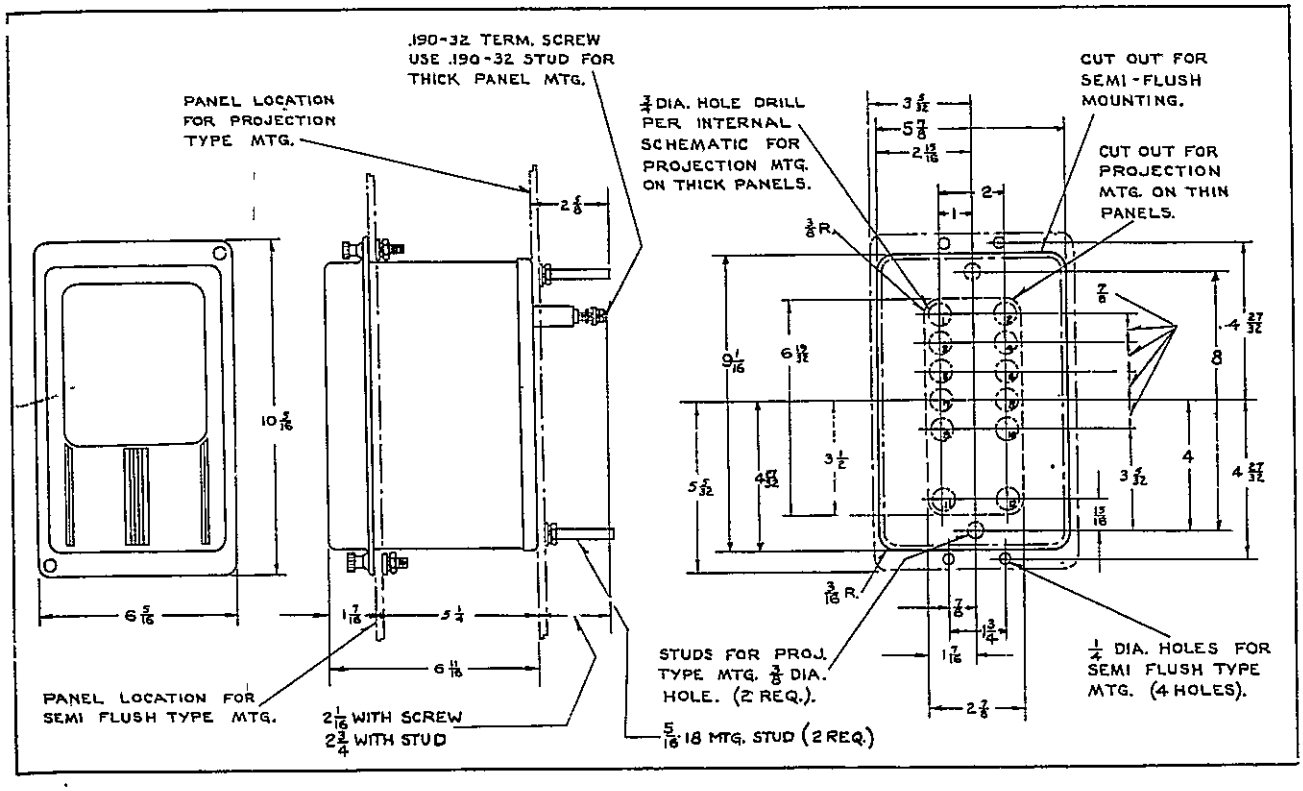

Fig. 10—Outline and Drilling Plan for the Type TH Duplex Relay. See Internal Schematic for the Terminals Supplied. For Reference Only.

WESTINGHOUSE ELECTRIC CORPORATION

METER DIVISION • **NEWARK, N.J.**

Printed in U.S.A.