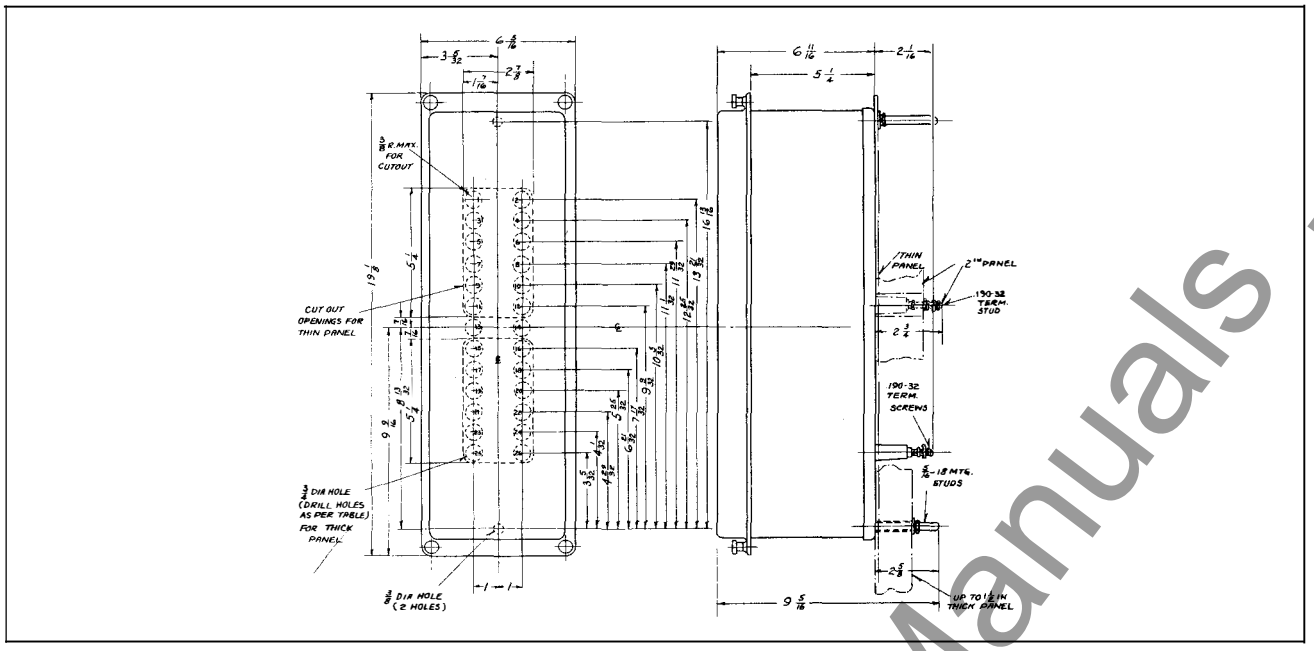

Fig. 8—Outline and Drilling Plan For the M20 Projection Type FT Flexitest Case. See the Internal Schematic For Terminals Supplied. For Reference Only.

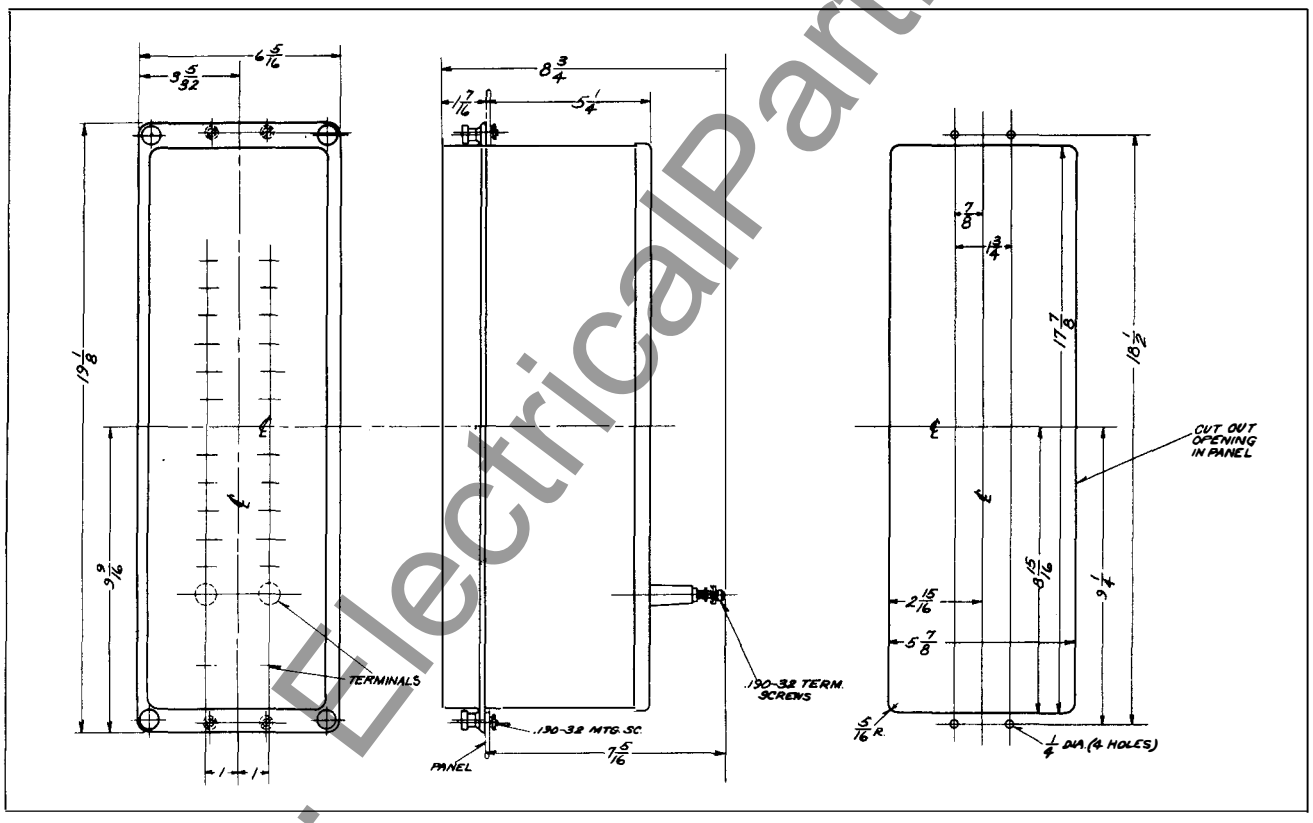

Fig. 9—Outline and Drilling Plan For the M20 Semi-Flush Type FT Flexitest Case. For Reference Only.

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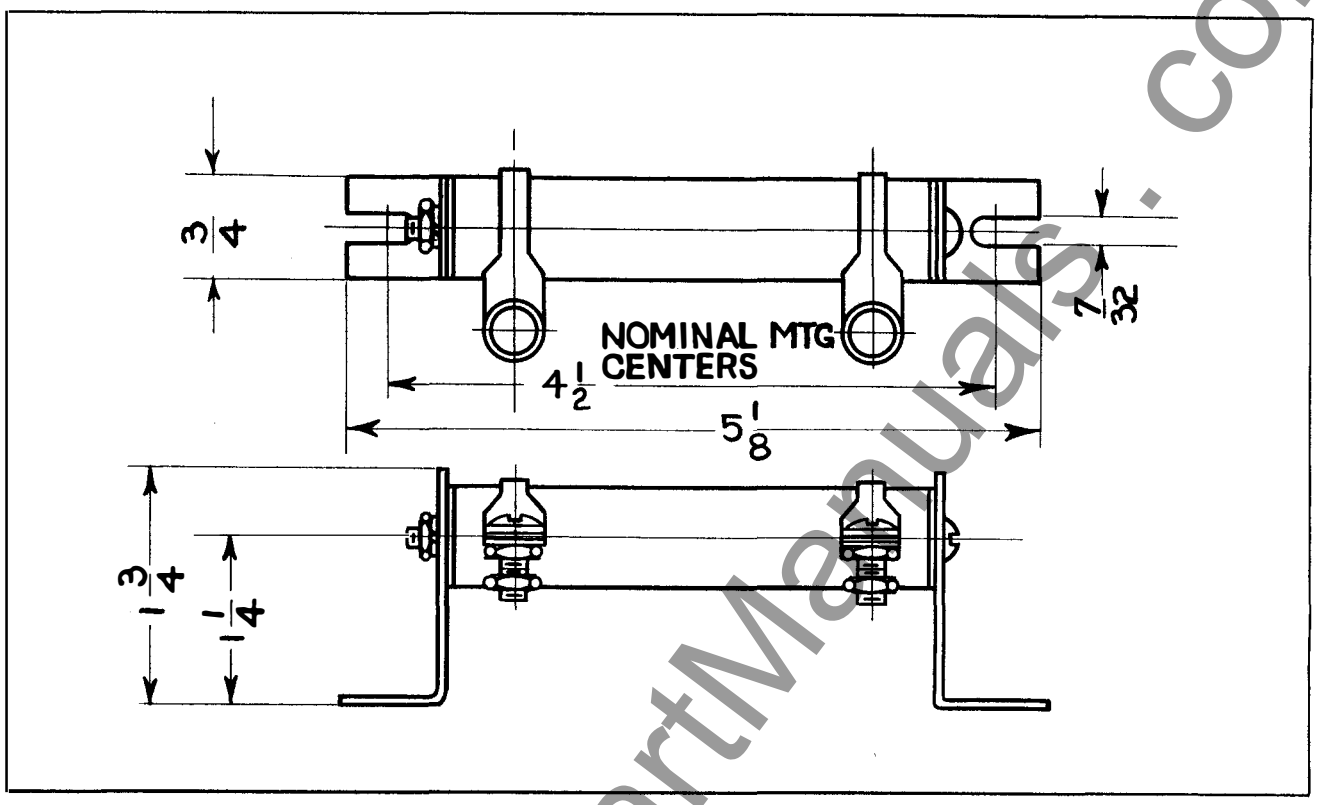

Fig. 6—Outline of the External Resistor. For Reference Only.

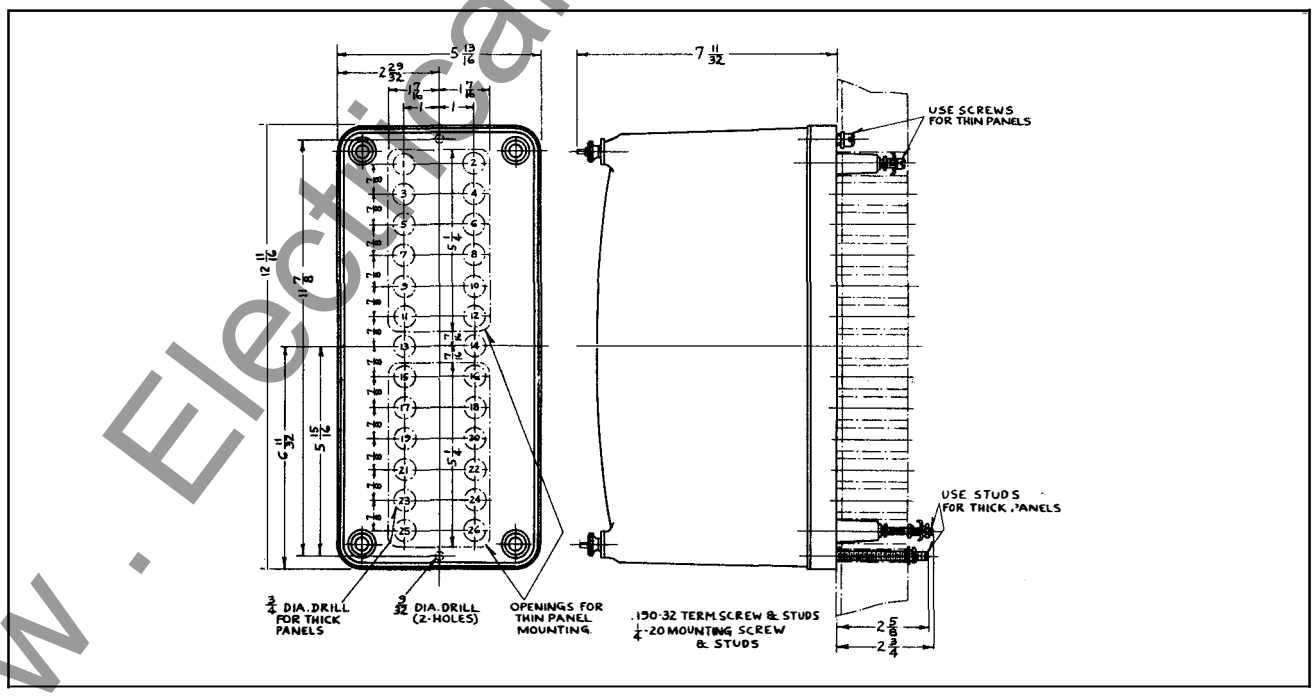

Fig. 7—Outline and Drilling Plan For the Projection Type Standard Case. See the Internal Schematic For Terminals Supplied. For Reference Only.

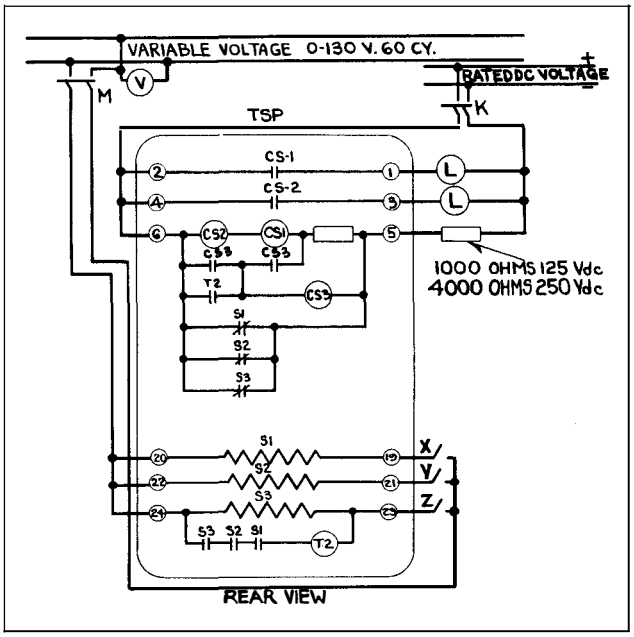

Fig. 4—Diagram of Test Connections For the Type TSP Tripping Suppressor in the Standard Case.

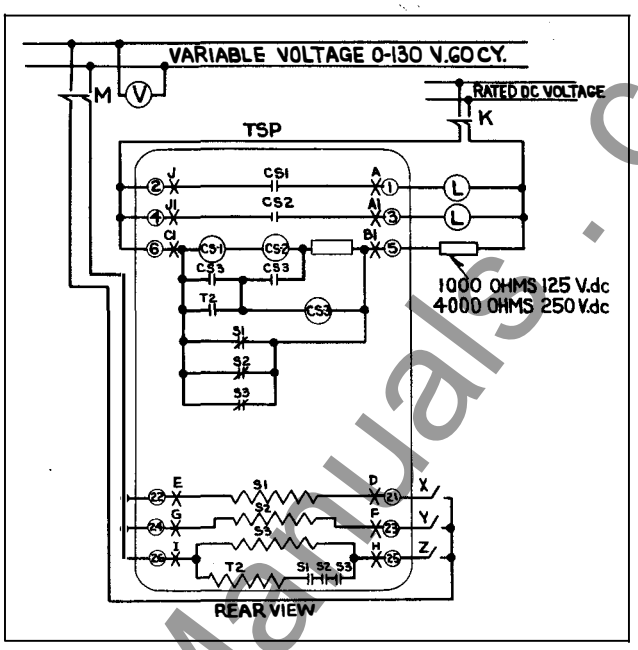

Fig. 5—Diagram of Test Connections For the Type TSP Tripping Suppressor in the Type FT Case.

where the moving core just separates from the stationary core screw. Back off the stationary core screw 1/2 turn beyond this point and lock in place with the locknut provided. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism. Adjust the contact clearance for 1/16 inch by means of the two small nuts on either side of the Micarta Disc. The switch in the 125 volt relays should pick up on not less than 75 volts d-c. Test for sticking when 125 volts d-c is removed. For the 250 volt relays. double the voltage values above.

Overall Test

Connect the relay per Fig. 4 or 5 with all switches closed. All three SV elements should pick up and the timer motor should run at all voltages from 100 to 130 volts. with the SV elements set for 100 volts pick-up.

Close switches X, Y, Z and K. Now close switch M, with the voltage adjusted for 115 volts. The lamps should light until the timer times out, at which time the lamps should go out.

ENERGY REQUIREMENTS

The burdens of the type TSP Tripping Suppressor are as follows:

Element	Watts at 125 V. or 250V d-c.	Voltamperes at 115 volts, 60 cycles	P.F. Angle Degrees Lag
Auxiliary Switches	8.8	------	------
Synchronous Timer T2	----	2.50	56.6
Type SV Relay, S1, S2, S3 (each)	----	7.30	62.2

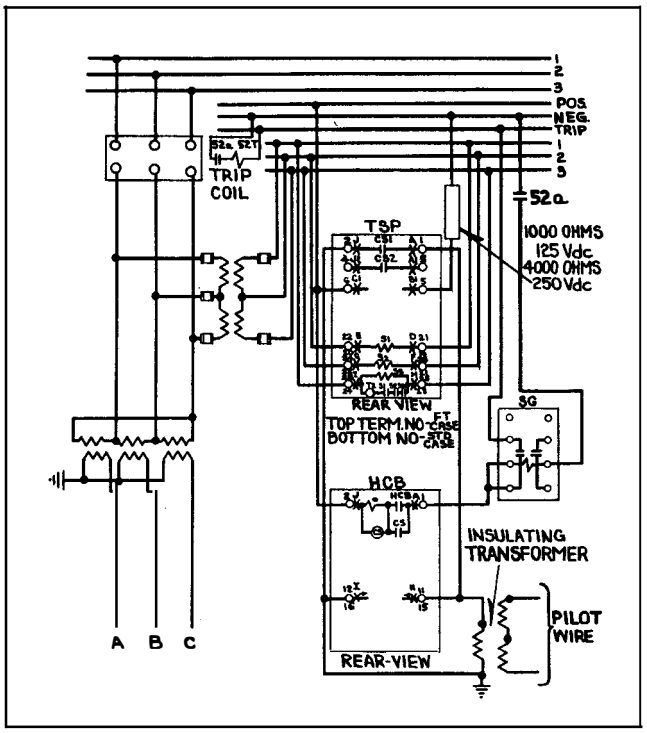

Fig. 3—External Connections of the Type TSP Tripping Suppressor Used With the Type HCB Relay.

energized and sealed in.

SETTINGS

The settings to be made are the pickup values on the voltage elements, and the time setting on the synchronous timer. The drop-out voltage of the SV voltage elements should always be higher than the drop out of the synchronous timer.

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 if 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.

Type SV Voltage Elements

Adjust the make contact for 9/64 inch contact separation with the break contact out of the way. In other words, when the plunger rises from the de-energized position it should travel 9/64 inch before the make contacts touch.

The clearance between the bob on the back-up-spring and the silver stationary contact should be .008 to .015 inch.

Adjust the magnetic shunt on each element so that the elements pick-up at 100 volts, 60 cycles. When moving the shunt be sure that the locking lever is pushed out to free the shunt. Energize all three elements at once, and make sure that all three make contacts maintain a steady circuit to the motor with 100 to 130 volts on the type SV elements. This is indicated by uniform operation of the motor without flutter.

The drop out of the elements should be 90 volts or more when the pick-up setting is 100 volts, 60 cycles.

Synchronous Timer

The moving contacts should have approximately 1/16 inch follow after the motor stalls. Make sure that the spiral spring returns the contact arm to the full open position quickly when the motor is de-energized. The motor should pick-up and run in synchronism at 100 volts, 60 cycles, and drop out at below 90 volts.

Auxiliary Contactor Switches

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core when the switch is picked up. This can be most conveniently done by turning the relay up-side down. Screw up the core screw until the moving core starts rotating. Now, back off the core screw until the moving core stops rotating. This indicates the point

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 jaw with the binding posts down.

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 by a small percentage. It is recommended that the relay be checked in position as a final check on the 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 for the standard cases and the type FT projection case or by means of the four mounting holes on the flange for the semi-flush type FT case. Either of the studs or the mounting screws may be utilized for grounding the relay. 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 the two nuts on the studs and then turning the proper nut with a wrench.

The potential transformers used to energize the type TSP tripping suppressor should be located within the differential zone so that they are energized at the same time that the power transformer is energized. An alternate method is to use bus potential transformers, in which case auxiliary switches on the breakers must be used so that the voltage elements of the tripping suppressor are de-energized when the power transformer is de-energized. In this case, it is preferable that the breaker auxiliary switch contacts close before the main contacts close. This alternate scheme will not be effective, however, if the bank is energized by closing the breaker at the far end of the line.

The multi-contact auxiliary tripping relays should have suitable contacts to open the trip circuit after the breaker trip circuits are

CHARACTERISTICS

The type TSP tripping suppressor is rated 115 volts, 60 cycles and separate models are available for 125 or 250 volt d-c trip circuits. The type SV voltage elements pick-up at approximately 100 volts and drop out at approximately 90 volts or more. The pick-up setting is adjustable, however, and the drop out is from 90-98 per cent of the pick-up. The synchronous timer scale is marked in 30 cycle divisions and is adjustable up to 5 seconds.

RELAYS IN TYPE 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 houses the relay elements and supports the contact jaw half of the test switches. This slides in 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 corners. There are two cover nuts on the S size case and four on the L and M size cases. This exposes the relay elements and all the test switches for inspection and testing. The next step is to open the test switches. Always open the elongated red handle switches first before any of the black handle switches or the cam action latches. This opens the trip circuit to prevent accidental trip out. Then open all the remaining switches. The order of opening the remaining switches is not important. In opening the test switches they should

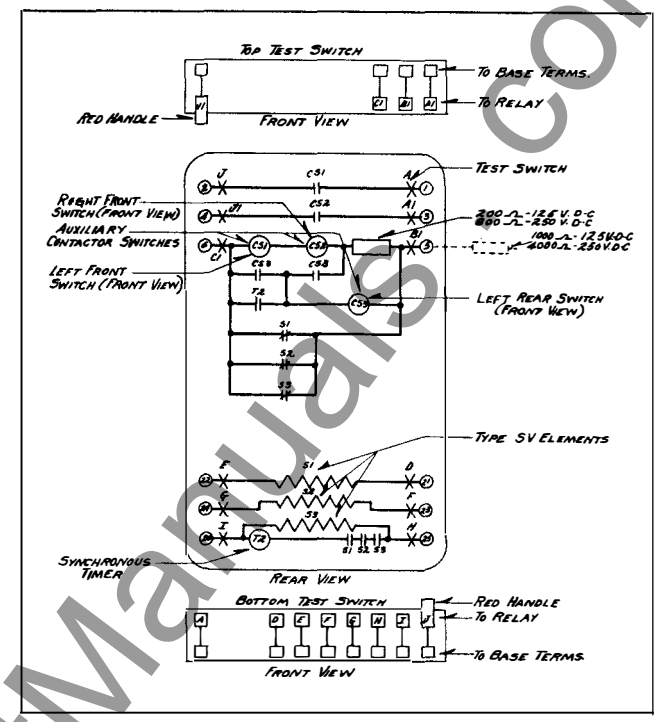

Fig. 2—Internal Schematic of the Type TSP Tripping Suppressor in the Type FT Case.

be moved all the way back against the stops. With all 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 & 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. The elongated red handle switch should not be closed until after the chassis has been latched in place and all of the black handle switches closed.

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

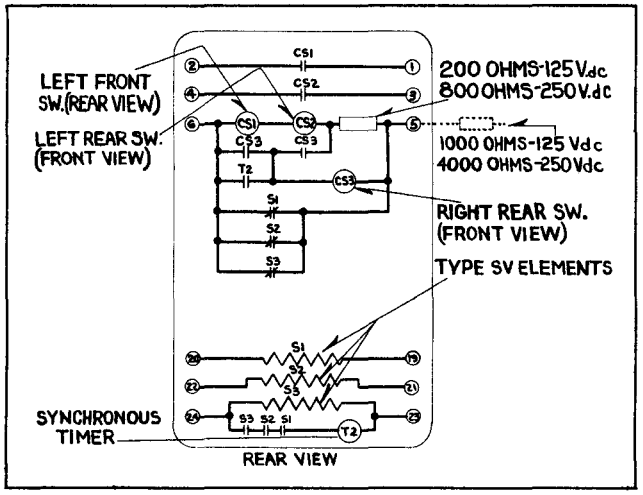

Fig. 1—Internal Schematic of the Type TSP Tripping Suppressor in the Standard Case.

three silver stationary contacts, only two of which are used in this relay. A small threaded stud projects below the plunger which supports the silver disc and carries the adjusting nuts. A weight is used on the plunger assembly to improve the drop-out characteristics of the switch.

OPERATION

The operation of the tripping suppressor in conjunction with the type HCB relay is as follows with reference to the schematic diagram of Figs. 1, 2 or 4, 5.

The voltage switches S1, S2, and S3 are energized by potential transformers. These transformers should be energized at the same time the power transformer is energized. (An alternate method, using bus potential transformers, is described under "Installation"). When all three switches are energized at normal voltage, their front contacts close a series circuit to energize the synchronous timer T2 connected in parallel with S3 coil.

Assume that a circuit breaker is closed to energize the transformer bank and line included in the type HCB differential zone, and that the circuit is defaulted. The voltage elements operate, so that the break contacts, S1, S2, S3, open to remove a short circuit around CS1, CS2 and the internal resistor. This causes CS1 and CS2 to operate, one of which is used to short circuit the output terminals of the type HCB relay on the relay side of the insulating transformer, as shown in Figure 3. If the type HCB relay contacts have already closed due to the inrush, they will immediately reset when this short circuit is established before tripping can be accomplished. It is the purpose of the type SG relay inserted in the trip circuit to provide a slight time delay in tripping to guarantee that CS1 or CS2 will be able to operate in time to block tripping. At the expiration of the time interval corresponding to the setting of the timer, the timer contacts, T2, will close and energize auxiliary switch coil, CS3. Contacts CS3 short circuit the coils of CS1 and CS2, which open their contacts and remove the short circuit from the type HCB relay output terminals. The timer motor stalls, maintaining considerable deflection, or follow, on T2 contacts. However, CS3 contacts also provide a seal in circuit, and CS3 remains in the operated position. If a short circuit now occurs in the transformer bank, or on the line, operation of the type HCB relays will trip the breakers. If a short circuit occurs during the inrush period, the voltage will be reduced causing one or more break contacts S1, S2 or S3 to close, which will cause CS1 and CS2 to drop out, thus removing the short circuit from the type HCB relay output terminals, and permitting a tripping operation. If a fault already exists when the breaker is closed, the low voltage encountered will fail to open one or more break contacts, S1, S2 or S3, and operation of the type HCB relay will not be blocked.

In the event of a severe external fault, which reduces the system voltage to such an extent that the power bank will suffer another magnetizing inrush, or recovery surge, when the fault is cleared, then the suppressor will act in the same way as for an initial inrush. This is because the low voltage during the short-circuit will cause one or more of the SV relays to drop out, thus opening the circuits to the synchronous timer coil so that it will have to time out again when the external short-circuit is cleared and the voltage goes back to normal.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE TSP MAGNETIZING INRUSH TRIPPING SUPPRESSOR

FOR USE WITH TYPE HCB PILOT WIRE RELAYS

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 TSP suppressor provides a time delay to prevent unnecessary tripping of transformer bank breakers upon the occurrence of a magnetizing inrush or recovery surge, but does not interfere with the prompt operation of the differential relay when a fault exists in the transformer bank or on the transmission line either during normal operation or when it is initially energized.

The suppressor described in this leaflet is intended for use with type HCB Relays and not with the types CA, CA4 and CA6 relays. The type TSI tripping suppressor is for use with the induction type relays mentioned above and is covered in I.L. 41-212.

CONSTRUCTION

The type TSI relay consists of three type SV voltage elements, synchronous timer, and three auxiliary contactor switches. The construction of the elements is described below.

Type SV Voltage Elements

These elements, designated S1, S2, S3 are solenoid types with a U-shaped iron frame that supports the coil and serves as the external magnetic path for the coil. The coil surrounds a core and an adjustable flux shunt by which calibration is obtained. The plunger moves in the core and is guided by two bearings, one at the top of the assembly, and one at the bottom of a bronze guide tube for the flux shunt.

Make and break contacts are required. The moving contacts are assembled on Micarta insulation plate attached to the upper end of the moving plunger. The electrical connections are made by means of coiled flexible wire. The stationary contacts are attached to the end of a slotted bracket. The bracket is held in place by screws to which the electrical connections are made.

Synchronous Timer

The timer designated T2, is a small synchronous motor operating on voltage and driving a moving contact arm thru a gear train. The contact arm terminates in a short flat spring with contacts on the opposite outer ends. When the arm travel time elapses, the moving contacts strike two rigid stationary contacts to stall the motor. Contact follow is obtained by the deflection of the moving contact spring.

The synchronous motor has a floating rotor which is in mesh with the gear train only when energized. The rotor falls out instantly when the motor is de-energized and permits a spiral spring to reset the moving arm quickly.

Auxiliary Contactor Switches

These switches designated as CS1, CS2, CS3 are small solenoid type switches. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward, the disc bridge