AUTOTRANSFORMER-TYPE MANUAL AC STARTERS
GENERAL ELECTRIC COMPANY
DESCRIPTION

1. GENERAL

1.1 The General Electric Company's hand starting compensators described hereinafter are used for controlling two and three phase induction motors in manual, dial, and toll power plants. The Requirements and Adjusting Procedures for these compensators are outlined in Section 026-380-701.

1.2 Section 2 describes the principal parts which go to make up the compensator and will be called ***"Description."***

1.3 Section 3 describes the method of operating the compensator and will be called ***"Operation."***

1.4 Section 4 describes various conditions which may interfere with the proper operation of the compensator and will be called ***"General Troubles."***

1.5 The following drawings are attached to and form a part of this section:

Fig. 1 – Hand Starting Compensators for Polyphase Motors — Schematic Power Circuit — 2 Phase — 3 and 4 Wire.

Fig. 2 – Hand Starting Compensators for Polyphase Motors — Schematic Power Circuit — 3 Phase — 3 Wire.

Fig. 3 – Hand Starting Compensators for Polyphase Motors — Temperature Overload Relay.

Fig. 4 – Hand Starting Compensators for Polyphase Motors — Solenoid Type, Undervoltage Protective Device.

Fig. 5 – Hand Starting Compensators for Polyphase Motors — Contactor Type Undervoltage Protective Device.

Fig. 6 – Hand Starting Compensators for Polyphase Motors — Oil-Immersed, Double-Throw Switch — Parallel Motion.

Fig. 7 – Hand Starting Compensators for Polyphase Motors — Oil-Immersed Double-Throw Switch — Rotary Motion.

Fig. 8 – Hand Starting Compensators for Polyphase Motors — Outline.

2. DESCRIPTION

2.01 Compensators are used to keep the starting current from the line as low as the torque requirements will permit and to prevent unnecessary mechanical shocks to the driven machinery.

Each hand starting compensator consists of a polyphase auto-transformer, a switching device, and an undervoltage protective device, all self-contained within a sheet metal case. In addition compensators for motors associated with commercial type sets are provided with hand-reset temperature overload relays.

The compensators described are of the tapped, hand starting, auto-transformer type wired as shown in Fig. 1 and Fig. 2. With the switch handle in the "Off" position, the motor is entirely disconnected from line potential. The switch handle is first pushed to the "Start" position where low voltage is applied to and starts the motor. When the motor has reached constant speed, the switch handle is pulled over to the "Run" position and the motor connected directly across the line. The motor is stopped manually by operating the "Stop" button on the front of the compensator cover, thereby opening the undervoltage protective device circuit.

Any interruption of the power service also opens the undervoltage protective device circuit, releases the latching device and returns the

switch handle to the "Off" position automatically. A thermal overload relay (where provided) opens the circuit of the undervoltage coil in case the motor becomes overloaded. The relay is reset by pushing the "Stop" button on the front of the compensator.

2.1 ***Auto-Transformers*** (See Fig. 1 and Fig. 2)

Each compensator is provided with a polyphase auto-transformer suitable for frequent and heavy duty starting. The auto-transformer is mounted above the switching device and carefully insulated from the enclosing case and other associated apparatus.

Each auto-transformer coil is provided with four reduced voltage taps for starting the motor. The leads or taps of the auto-transformers are not marked but are determined from their position. The lowest voltage tap is brought out from a point nearest the core and the highest from a point nearest the surface of the coil.

2.2 ***Undervoltage Protective Device*** (See Fig. 4 and Fig. 5)

Figure 4 shows the solenoid type undervoltage protective device (mounted outside of the compensator case) made up of a solenoid with laminated core and an associated latching device. The solenoid is energized by full line potential and holds the switch in the "Run" position until there is a failure of voltage, or the "Stop" button is operated, (deenergizing the magnet coil circuit). This releases the laminated core (which is held by the magnetizing force of the solenoid) and trips the latching device, allowing the switch to be returned to the "Off" position. Figure 5 shows the contactor type undervoltage protective device (mounted inside of the compensator case) made up of a magnet coil mounted upon a laminated core, a movable laminated armature, connecting link and a latching device. The magnet coil is energized by full line potential and holds the switch in the "Run" position until there is a failure of voltage, or the "Stop" button is operated. Deenergizing the magnet coil circuit releases the pivoted armature, which in turn releases the pivoted latching device and allows the switch to return automatically to the "Off" position.

2.3 ***Temperature Overload Relay*** (See Fig. 3)

In addition to undervoltage protection, overload protection is furnished with some compensators. The overload feature (a temperature overload relay) consists of two heating elements and associated thermostatic strips, contacts and calibrating arms.

The heating elements carry the motor current and on overload are heated above their normal temperature. This heat is transmitted to the thermostatic strips which are deflected outward sufficiently to release the contact arms which hold the contacts closed. The contacts are connected in the undervoltage control circuit and upon opening deenergize the holding magnet and allow the switch to return to the "Off" position. After tripping on overload, the thermostatic strips must cool from 15 to 90 seconds (depending upon the severity of the overload) before they can be reset. The relay is mechanically reset by pushing the "Stop" button on the front of the compensator.

One heating element is connected in each of two phases of a polyphase circuit. The calibrating arms govern the load at which the relay trips and may be set for the relay to operate between 80% and 120% of its rating. The scale on the relay is marked "Percent of Rated Current of Relay."

2.4 ***Switching Device***

Refer to Figure 8. The switching device is a double-throw, oil-immersed switch wired as shown in Fig. 1 and Fig. 2. The switch has three positions, "Off," "Start" and "Run." When the switch handle is in the "Off" position, the line, motor and auto-transformer windings are entirely disconnected from one another. When in the "Start" position, each auto-transformer is connected directly across the line with one side and the low voltage tap connected to the motor. When in the "Run" position, the auto-transformer is completely disconnected and the motor is connected directly to the line.

As shown in Figure 4, the positions "Off," "Start" and "Run" are determined by notches in the latching device. When the switch is in the "Off" position the latching device engages with a tripping lever (Fig. 6 and Fig. 7) attached to the main switch shaft (Fig. 6 and Fig. 7) and prevents it from being thrown directly to the

"Run" position. This latch also prevents moving the switch handle slowly from the "Start" to the "Run" position.

The switch contacts are of two types, one having a rotary motion, and the other a parallel motion. In the rotary motion switch (see Fig. 7) the center contacts, which are suspended from the switch shaft make contact with the front finger contacts or the back finger contacts, depending upon whether the compensator switch handle is in the "Start" or the "Run" position. In the parallel motion switch (see Fig. 6) the center contacts are divided into two groups, the front contacts and the back contacts which are raised vertically by the lifting arms attached to the operating levers. The front contacts make contact with the front finger contacts (the back contacts remaining in their unoperated position) when the switch handle is in the "Start" position, and the back contacts make contact with the back finger contacts (the front contacts remaining in their unoperated position) when the switch handle is in the "Run" position. Upon the release of the tripping lever the spring pulls the operating levers together, returning the contacts and switch handle to the "Off" position.

All contacts on both types of switches are readily accessible when the switch oil box is lowered and may be renewed when necessary without difficulty.

2.5 ***"Stop" Button Switch*** (See Fig. 1, Fig. 2 and Fig. 8)

Compensators provided with the contactor type undervoltage protective device have a push button switch mounted inside and operated through a hole in the front cover while the compensators provided with the solenoid type of undervoltage protective device have the push button switch mounted directly on the power panel. The functions of this switch are indicated schematically in Figs. 1 and 2 and are as follows:

2.51 ***Stop Feature***

The contacts of the push button switch are connected in series with the contacts of the overload relay (if provided) and also in series with the undervoltage coil across one phase of the power service. When the button is pressed, it opens the undervoltage release circuit, tripping the switch if it is in the "Run" position. In addition the switch mechanism provided with the contactor type undervoltage protective device is arranged to open this control circuit in case the front cover is removed, thereby insuring the switch being in the open position whenever the cover is off.

2.52 ***Reset Feature***

On starters where overload protection is provided, the push button switch is so designed, that when pressed from the outside through the opening in the cover, the overload relay will be reset. Should the compensator be tripped on account of an overload, it is necessary to push the "Stop" button (closing the relay contacts by a system of levers) before the motor can again be started.

3. OPERATION

3.1 ***Starting***

3.11 Push "Stop" button to reset temperature overload relay.

3.12 Push the operating switch handle quickly to the "Start" position. Hold in this position long enough to see if the motor is going to start.

Caution: If the motor does not start, release the switch handle and allow it to return to the "Off" position.

3.13 Hold the switch handle in the "Start" position until the motor reaches constant speed.

3.14 Pull the switch handle quickly with a single unhesitating movement to the "Run" position.

3.2 ***Stopping***

To stop the motor, push the "Stop" button.

4. GENERAL TROUBLES

4.1 ***Motor Does Not Start***

CAUSE	ACTION
Fuses open	Replace fuses
No voltage on one or more phases of the power service	Take steps to have service restored

CAUSE	ACTION
Low transformer tap voltage	Check power service and change to the next higher tap on auto-transformer if necessary
Contacts do not make	Adjust or replace

4.2 *Motor Stops*

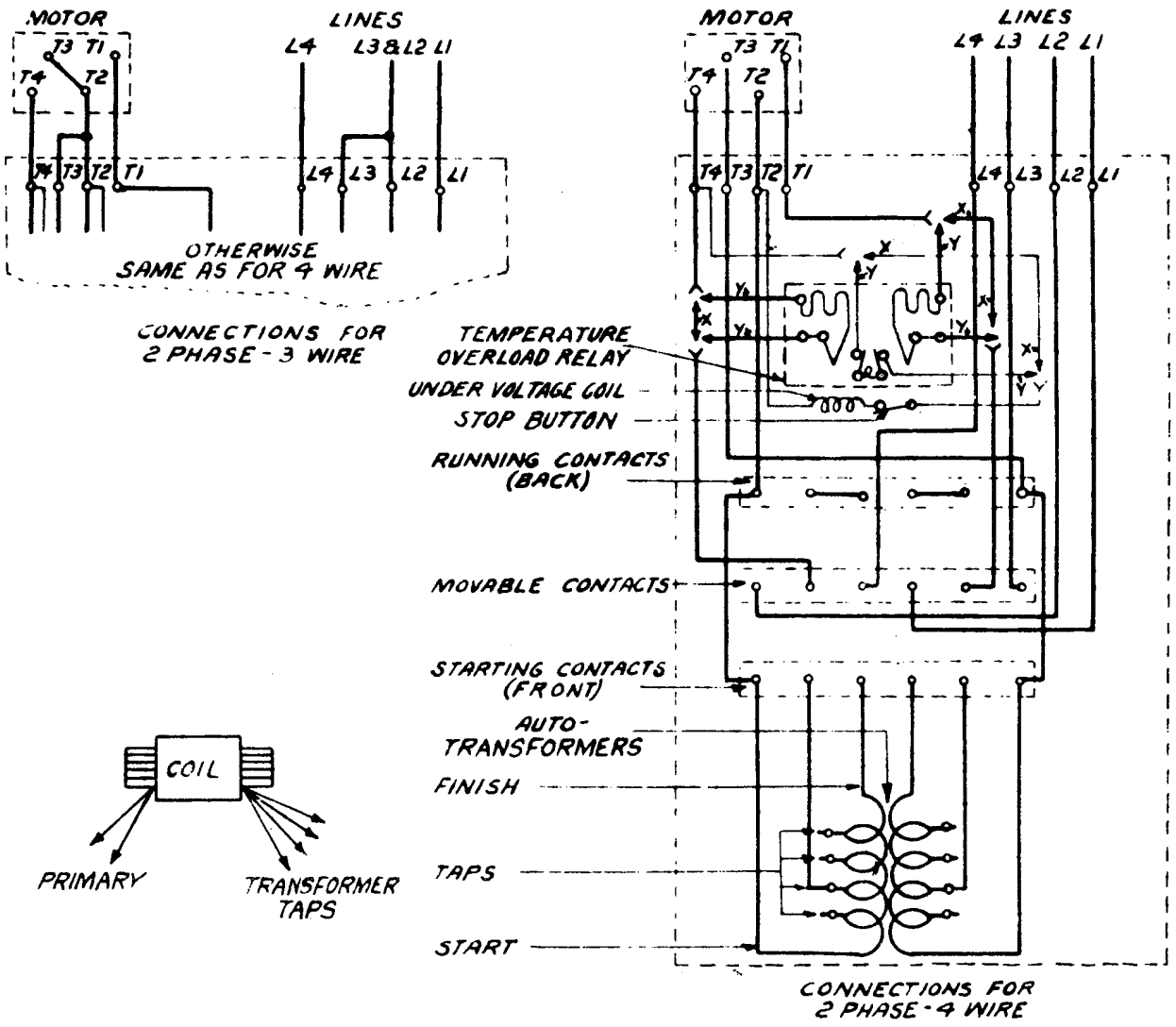
CAUSE	ACTION
Overload relay on compensator operated	Reset and start again, avoiding overload
No voltage on one or more phases	Check fuses. If fuses are all right, notify supervisor
Overload relay defective	Replace
No voltage release operated	Start motor again
Fuses blown by overload or excessive starting current	Try to locate cause and replace fuses. Change to next lower tap on auto-transformer if necessary

4.3 *Motor Fails to Stop*

CAUSE	ACTION
Undervoltage protective device binding	Remedy trouble
Overload relay defective	Replace
"Stop" button defective	Repair or replace

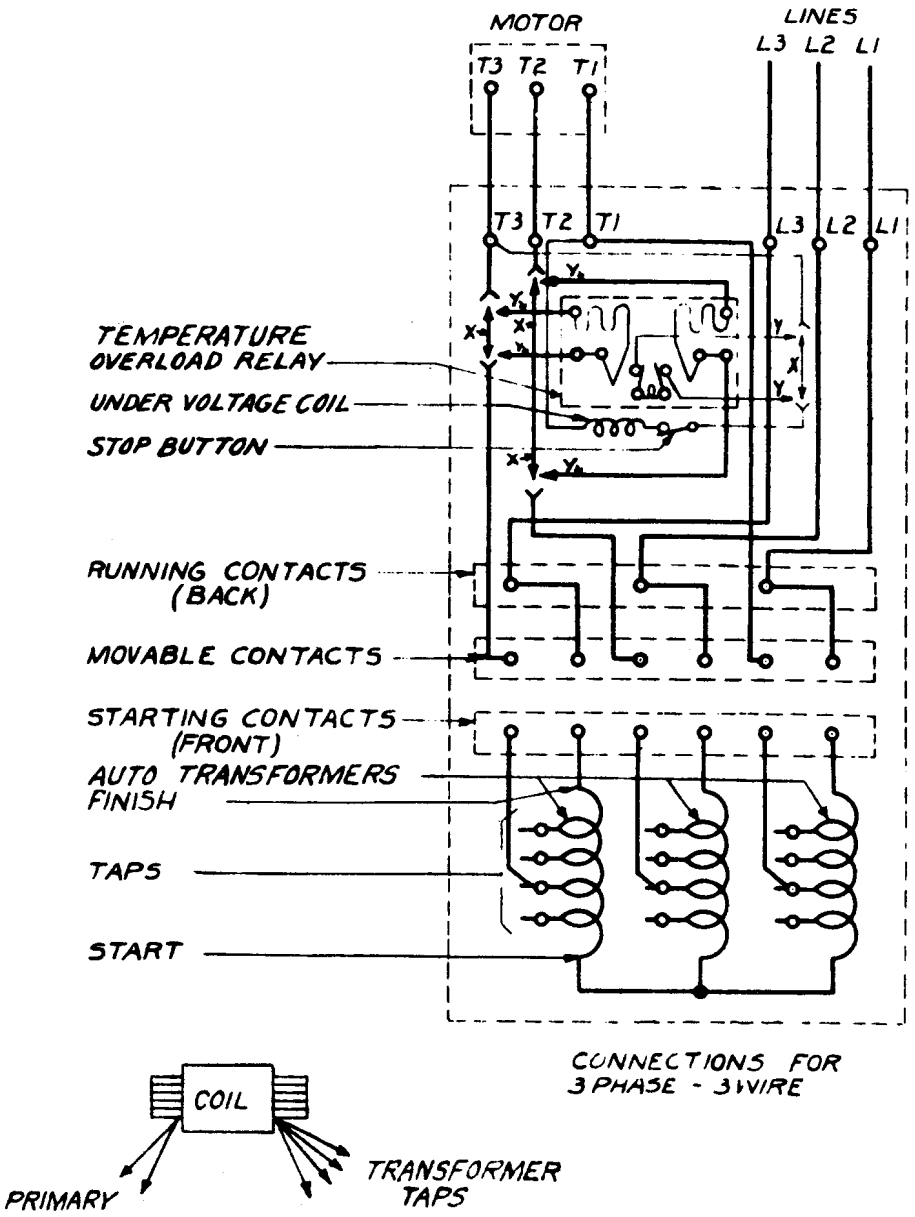
4.5 *Motor Heats Excessively*

CAUSE	ACTION
"Running" contacts do not make	Adjust or replace



NOTES:
1. WHEN TEMPERATURE OVERLOAD RELAY IS FURNISHED USE "Y" WIRING.
WHEN TEMPERATURE OVERLOAD RELAY IS NOT FURNISHED USE "X" WIRING.

Fig. 1 – Hand Starting Compensators For Polyphase Motors–Schematic Power Circuit — Two Phase — Three and Four Wire



NOTES:
1. WHEN TEMPERATURE OVERLOAD RELAY IS FURNISHED USE Y WIRING. WHEN TEMPERATURE OVERLOAD RELAY IS NOT FURNISHED USE "X" WIRING.

Fig. 2 – Hand Starting Compensators For Polyphase Motors–Schematic Power Circuit — Three Phase — Three Wire

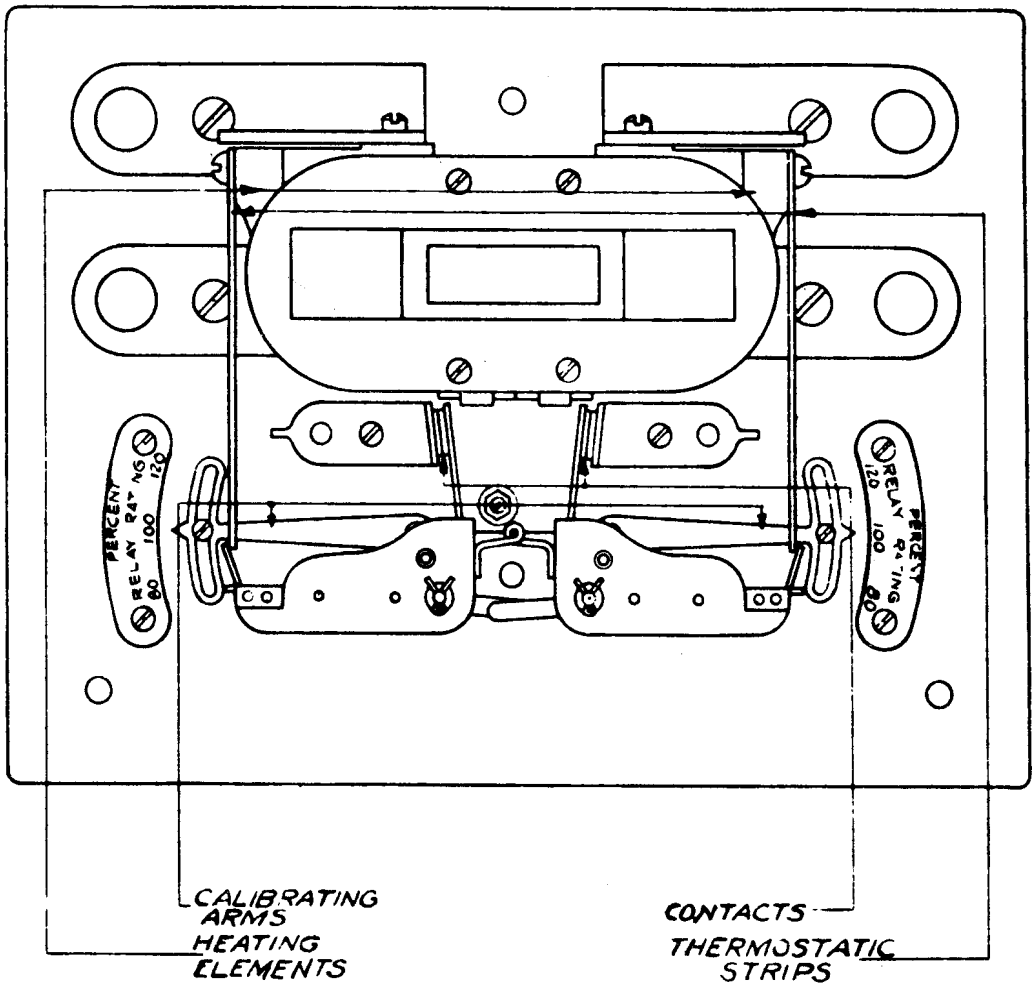


Fig. 3 – Hand Starting Compensators For Polyphase Motors–Temperature Overload Relay

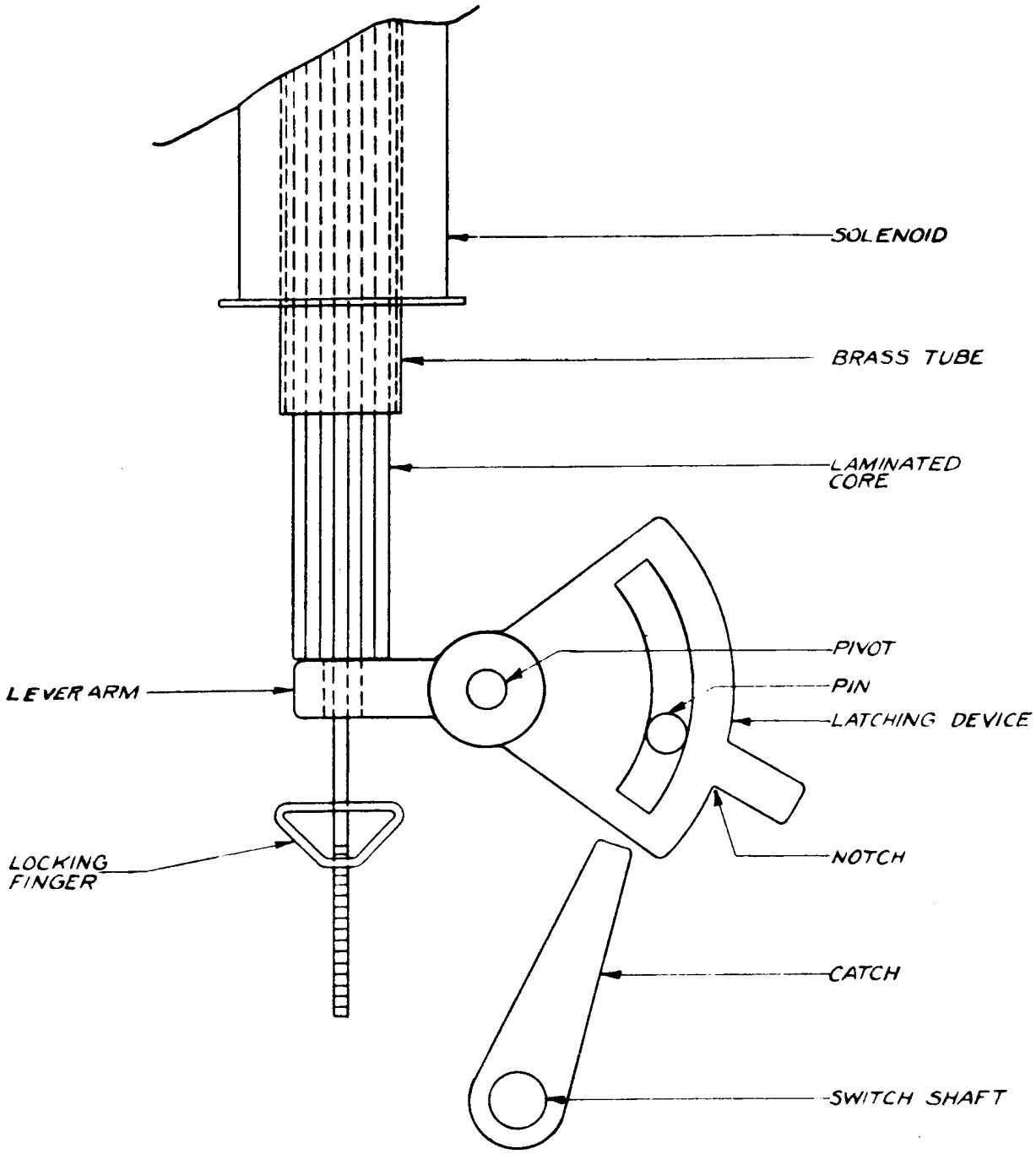


Fig. 4 – Hand Starting Compensators For Polyphase Motors-Solenoid Type — Undervoltage Protective Device

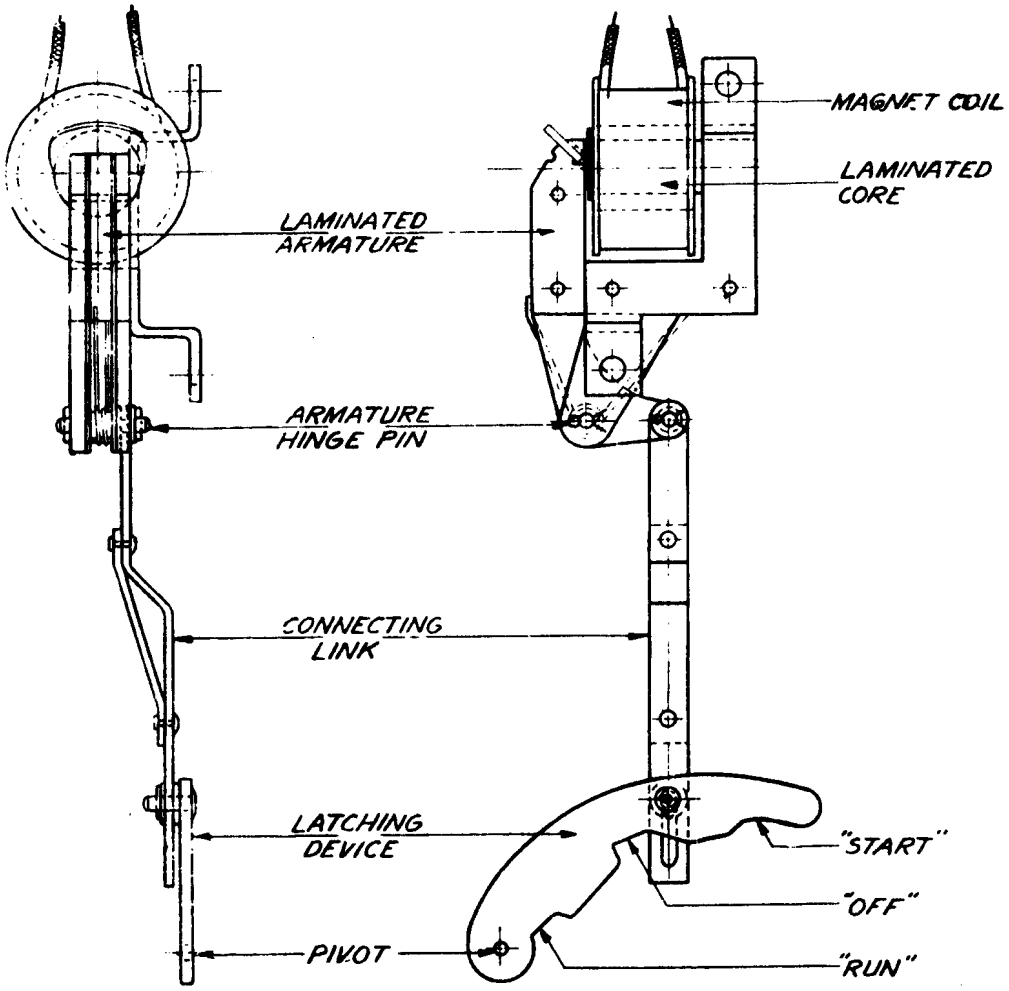


Fig. 5 – Hand Starting Compensators For Polyphase Motors-Contactor Type — Undervoltage Protective Device

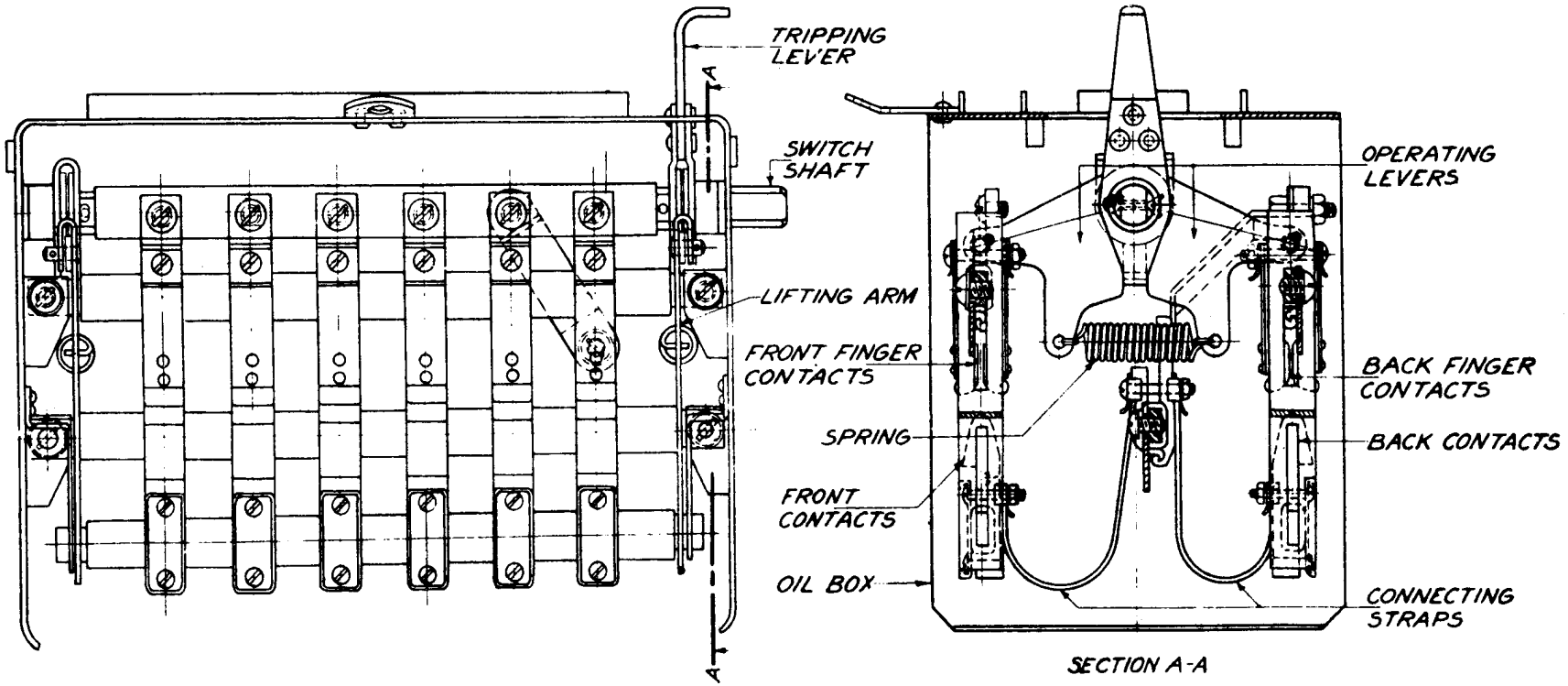


Fig. 6 – Hand Starting Compensators For Polyphase Motors-Oil-Immersed Double-Throw Switch-Parallel Motion

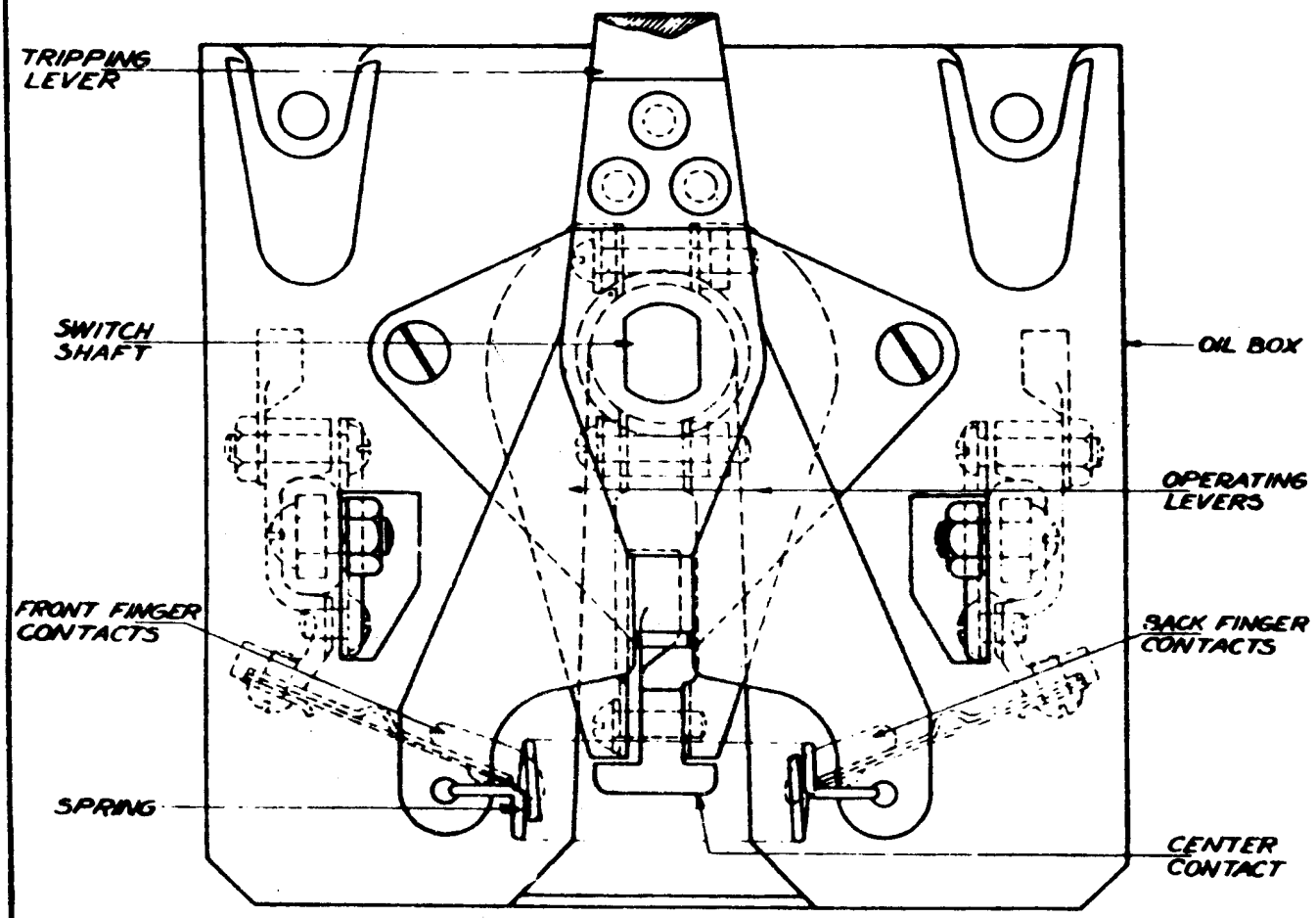


Fig. 7 – Hand Starting Compensators For Polyphase Motors-Oil-Immersed Double-Throw Switch-Rotary Motion

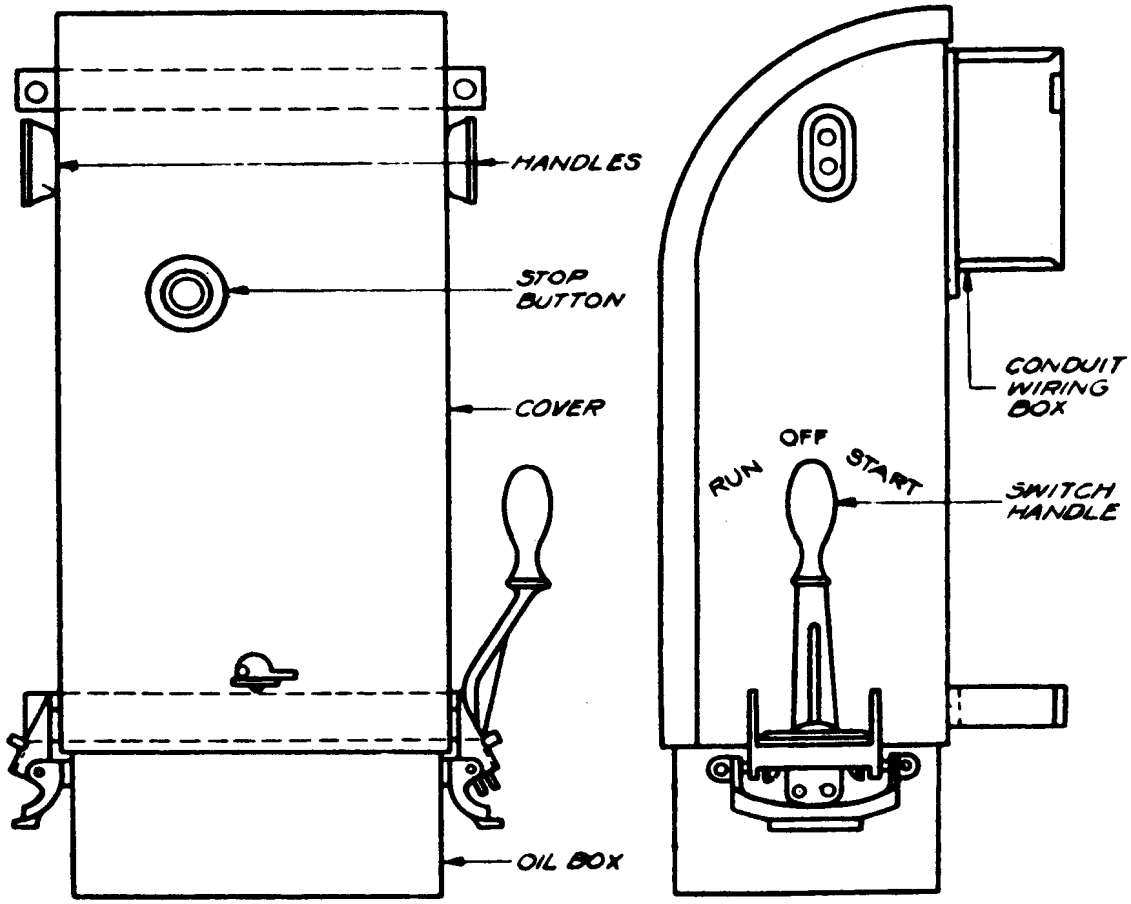


Fig. 8 – Hand Starting Compensators For Polyphase Motors-Outline