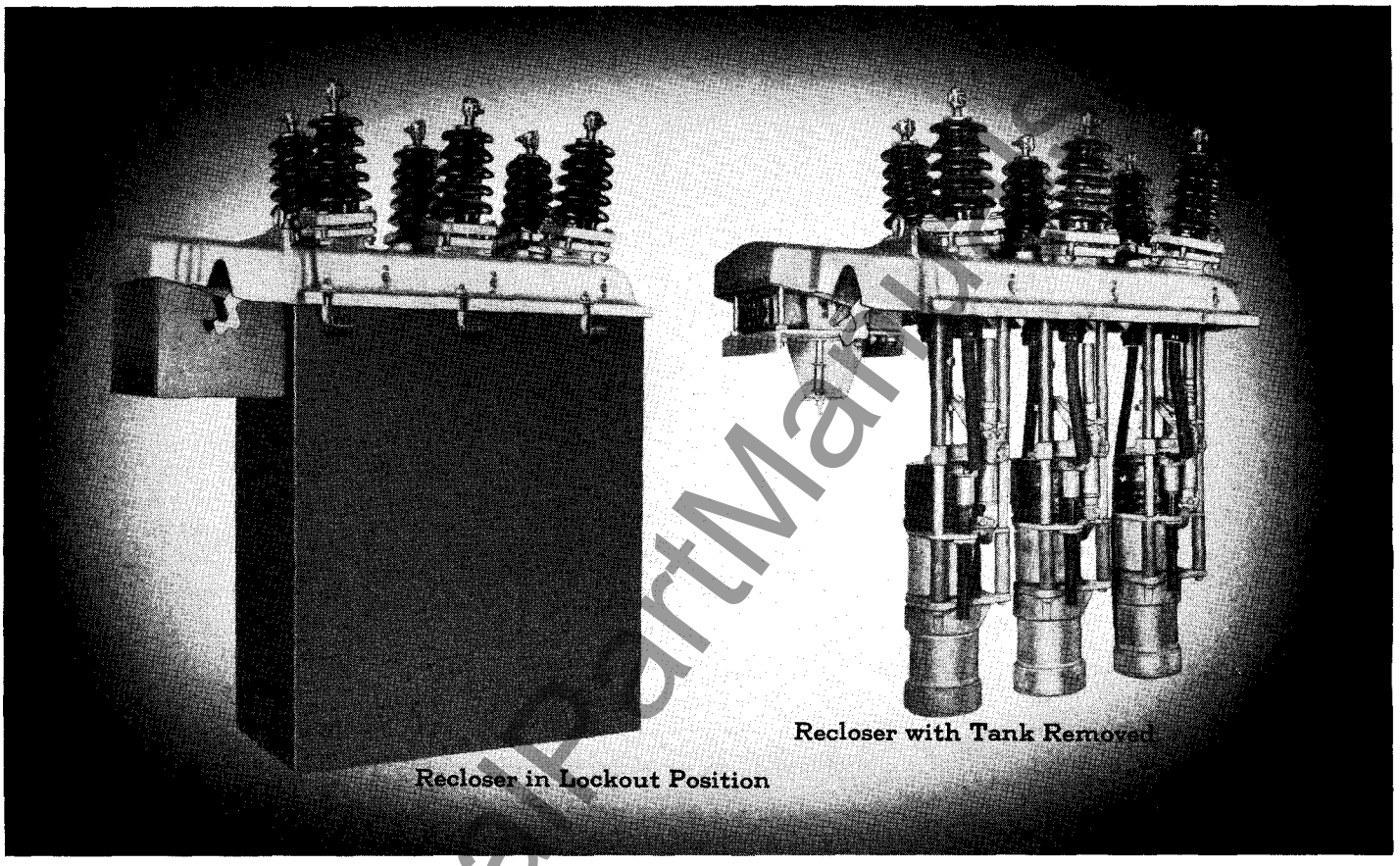
DESCRIPTIVE BULLETIN
33-753



Recloser with Tank Removed

Recloser in Lockout Position

AUTOMATIC CIRCUIT RECLOSERS—TYPE GR-3 consist of three single pole, 100-ampere frame Type GR recloser units mounted on an integral cast aluminum base and immersed in a single tank of oil. The three-pole linkages are arranged to give single-pole reclosing but three-pole lockout and reset. The GR-3 recloser can be applied at any point on a three-phase distribution system where fault currents are within its rating. Its chief application is in remote substations, on rural three-phase distribution lines, or in control of three-phase apparatus such as motors on irrigation pumps. Standard ratings include:

CONTINUOUS LOAD CURRENT—25, 35, 50, 70 and 100 amperes.

INTERRUPTING RATINGS—1000 to 2500 amperes (depending on the operating coil and system voltages).

VOLTAGE—2300 to 15,500 volts, three-phase.

WESTINGHOUSE SPECIAL FEATURES

1 **ENCLOSED SELF-DRIVEN DE-ION® INTERRUPTER** increases fault clearing capacity as short circuit current increases.

2 **MANUAL OR SOLENOID OPERATION** closes the three pole units simultaneously. When any pole unit reaches lockout position, the other two pole units will open.

3 **INTERCHANGEABLE TRIP COILS,** with current range of 25 to 100 amperes, provide simple, economical increase of capacity as system or load grows.

4 **CHOICE OF TRIPPING.**—Either one instantaneous and three time-delay or four time-delay trippings are provided to facilitate co-ordination with other reclosers, sectionalizers, or fuses.

NEW INFORMATION
E42-5M,S; D64-5C,H; C26-5b; C28-5Y; Classified File

EFFECTIVE OCTOBER, 1950

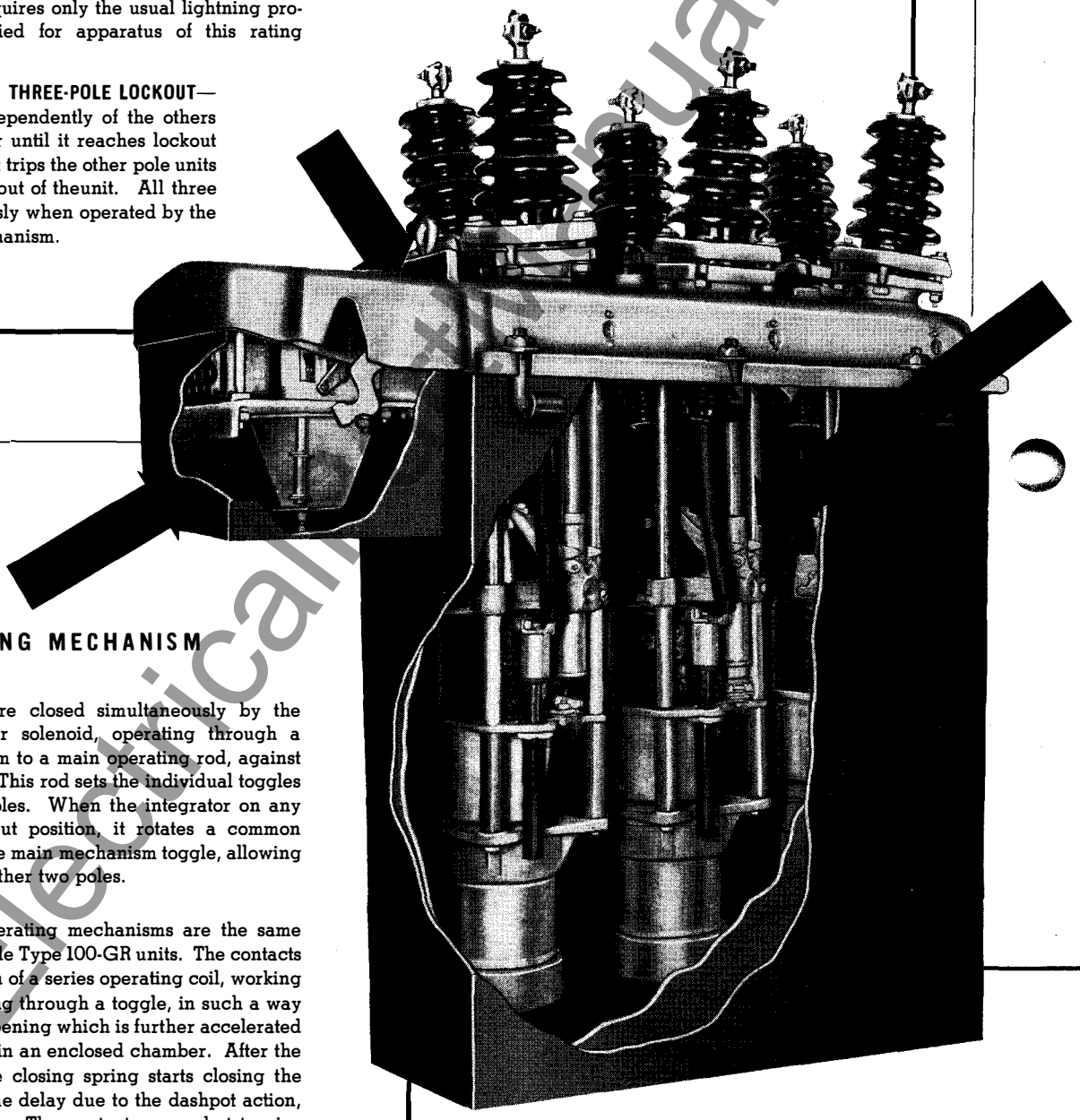
CONSTRUCTION

The Type GR-3 recloser consists of three single-pole 100-ampere frame GR recloser units, mounted on a single heavy cast aluminum base and immersed in a common tank of oil. The tank is fabricated from heavy sheet steel, is finished with standard oil circuit breaker paint, and has a Micarta® liner and inter-phase barriers.

BUSHINGS are wet process porcelain, with full 15-kv class insulation. The unit requires only the usual lightning protection normally supplied for apparatus of this rating and type.

SINGLE-POLE RECLOSING, THREE-POLE LOCKOUT—Each pole operates independently of the others as a single-pole recloser until it reaches lockout position, at which time it trips the other pole units to give three-phase lockout of theunit. All three poles close simultaneously when operated by the common operating mechanism.

PARTS INTERCHANGEABLE WITH SINGLE-POLE TYPE 100-GR include contact parts, interrupters, coils, and bushings. The number of spare parts required is therefore reduced, since these parts can be used on both three-pole and single-pole units.



OPERATING MECHANISM

The three pole-units are closed simultaneously by the hand-operating lever or solenoid, operating through a simple toggle mechanism to a main operating rod, against heavy spring pressure. This rod sets the individual toggles on each of the three poles. When the integrator on any pole reaches the lockout position, it rotates a common trip rod which breaks the main mechanism toggle, allowing the spring to open the other two poles.

The individual pole operating mechanisms are the same as those on the single-pole Type 100-GR units. The contacts are opened by the action of a series operating coil, working against the closing spring through a toggle, in such a way as to give snap-action opening which is further accelerated by the action of the arc in an enclosed chamber. After the arc is extinguished, the closing spring starts closing the contacts slowly, with time delay due to the dashpot action, until the toggle releases. The contacts snap shut to give positive closing with full contact pressure.

The reclosing time for all reclosers is two seconds.

TRIPPING MECHANISM

The tripping sequence can be adjusted to provide either one instantaneous trip followed by three time-lag trips or four time-lag trips. Tripping operations are controlled and counted by a mechanical integrator, with the fourth opening of the recloser causing lockout. Time delay of the inverse-time-limit type is provided by an oil dashpot, and controlled by a slide valve on the integrator. The integrator is mechanically restrained from resetting to give a single time-delay trip after lockout: (1) to permit picking up the load, and (2) so that if a fault is still present, there is only one trip to lock out the contacts again. Resetting or recycling time is approximately one minute per tripping operation.

Tripping curves for all ratings are available on request. Temperature compensation to provide consistent timing at very low temperatures is available as an optional item. The GR-3 recloser can be co-ordinated with most ratings of reclosers built by other manufacturers.

INTERCHANGEABLE SERIES TRIP COILS—All 100-ampere frame series coils are interchangeable and can be installed in the field with minimum dis-assembly of the breaker. The coils are protected from surges by an expulsion-type protective gap. The overload rating of these coils is 200 per cent of rating for two hours without damaging the insulation.

Sequence of Operation

Figure 1—An upward push of the operating handle 1 sets the simple toggle mechanism, and permits the contacts 2 to close. Assuming that the recloser has been set for one instantaneous and three time-delay operations, action will be as follows in case of a short circuit, or an overload exceeding twice the recloser rating.

Figure 2—Fault or overload current through the coil 3 raises armature 4, pushing oil freely through port 5 and compressing operating spring 6. Contacts are still closed.

Figure 3—Armature 4 moves thrust tube 7 which strikes armature stop 8 on lift rod, parting the contacts.

Figure 4—Contacts snap to full open position by force of operating spring and accelerated by gas pressure in the interrupter. Arc is quickly extinguished in high pressure interrupter chamber. Integrator 9 is advanced one step, closing oil port 5. Interruption of short circuit current allows contact to close with time delay because of the dash-pot acting on the armature.

Figure 5—If line has not cleared, time lag on second, third, and fourth openings is obtained by dash-pot action, since dash-pot port 5 was closed by integrator 9 on first operation, otherwise operation is the same as the previous opening.

Figure 6—On the fourth opening, integrator 9 strikes lock-out toggle lever 10, breaking the toggle and locking out the recloser. This moves the operating lever 1 to the full open indicating position.

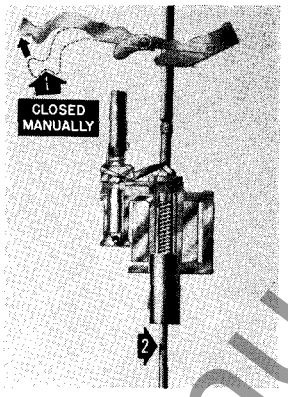


Figure 1

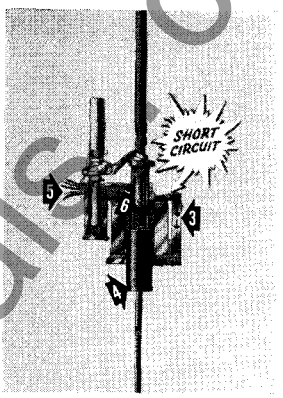


Figure 2

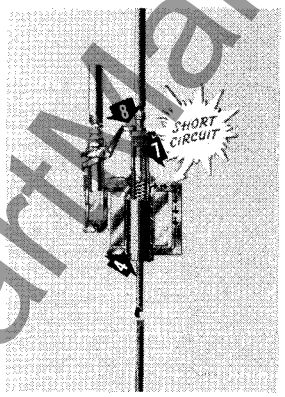


Figure 3

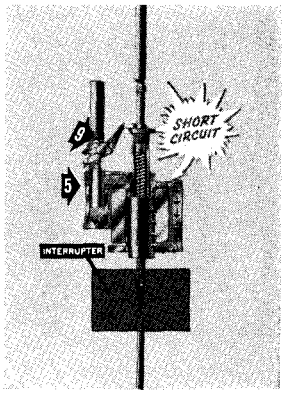


Figure 4

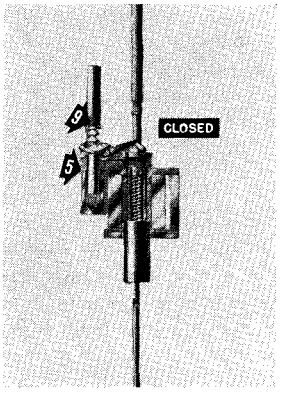


Figure 5

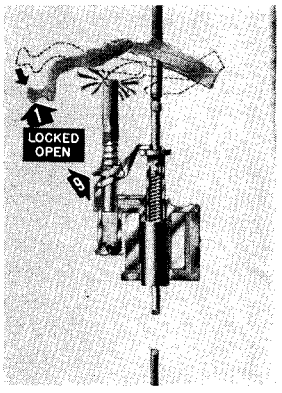


Figure 6

SPECIAL OPTIONAL DETAILS

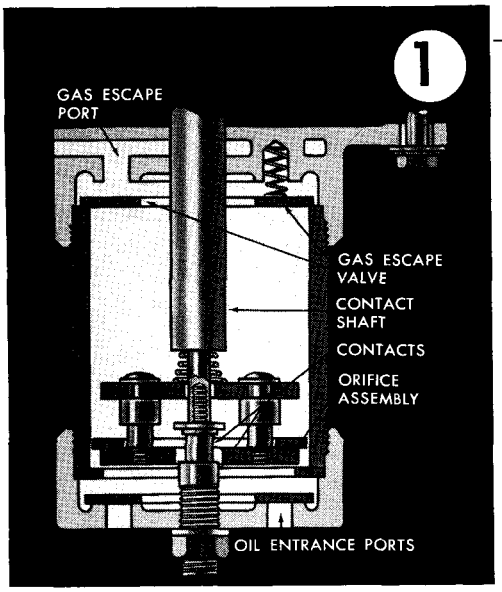
The standard Type GR-3 recloser, as described above is manually operated. The following optional features are available:

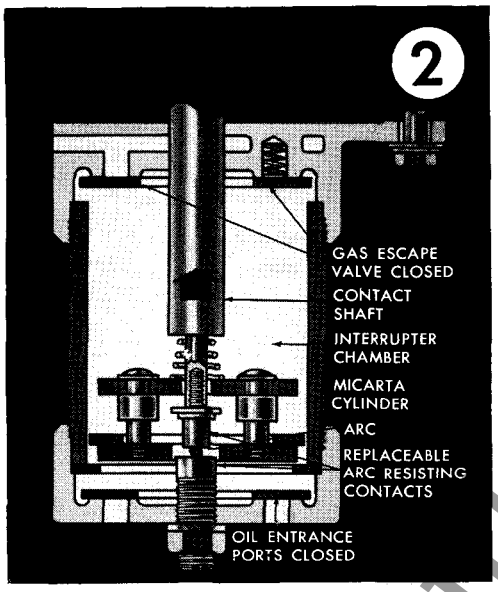
FLOOR MOUNTING FRAME of angle-iron construction, has sufficient height to give good clearance of high voltage terminals.

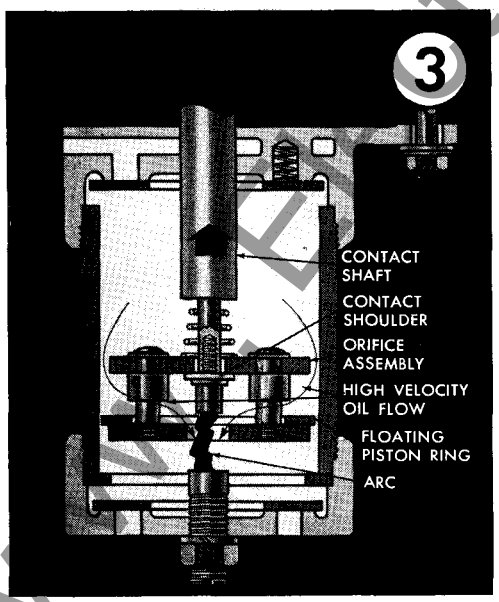
TEMPERATURE COMPENSATION can be provided for consistent timing at low temperatures.

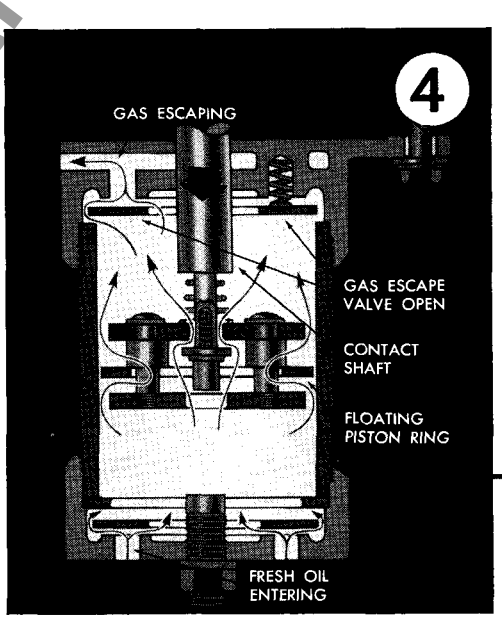
MANUALLY-OPERATED RECLOSER ACCESSORIES include a four-pole auxiliary switch and a shunt-trip coil.

SOLENOID OPERATING MECHANISM for complete remote control can be supplied, with shunt trip and control relay, to operate from a-c or d-c source.









DE-ION INTERRUPTER . . .

Enclosed, Self-Driven

The interrupting capacity of the recloser has been proved under all conditions of rated current and voltage, both in the High Power Laboratory and in service. The basic design has been proved on the single pole, 100 ampere frame reclosers. It utilizes an enclosed, self-driven oil orifice type of interrupter in which the interrupting effort is greater for heavier short circuit currents. Copper-tungsten arc resistant contacts give long life under all conditions.

① Interrupter chamber in normal operation—contacts closed.

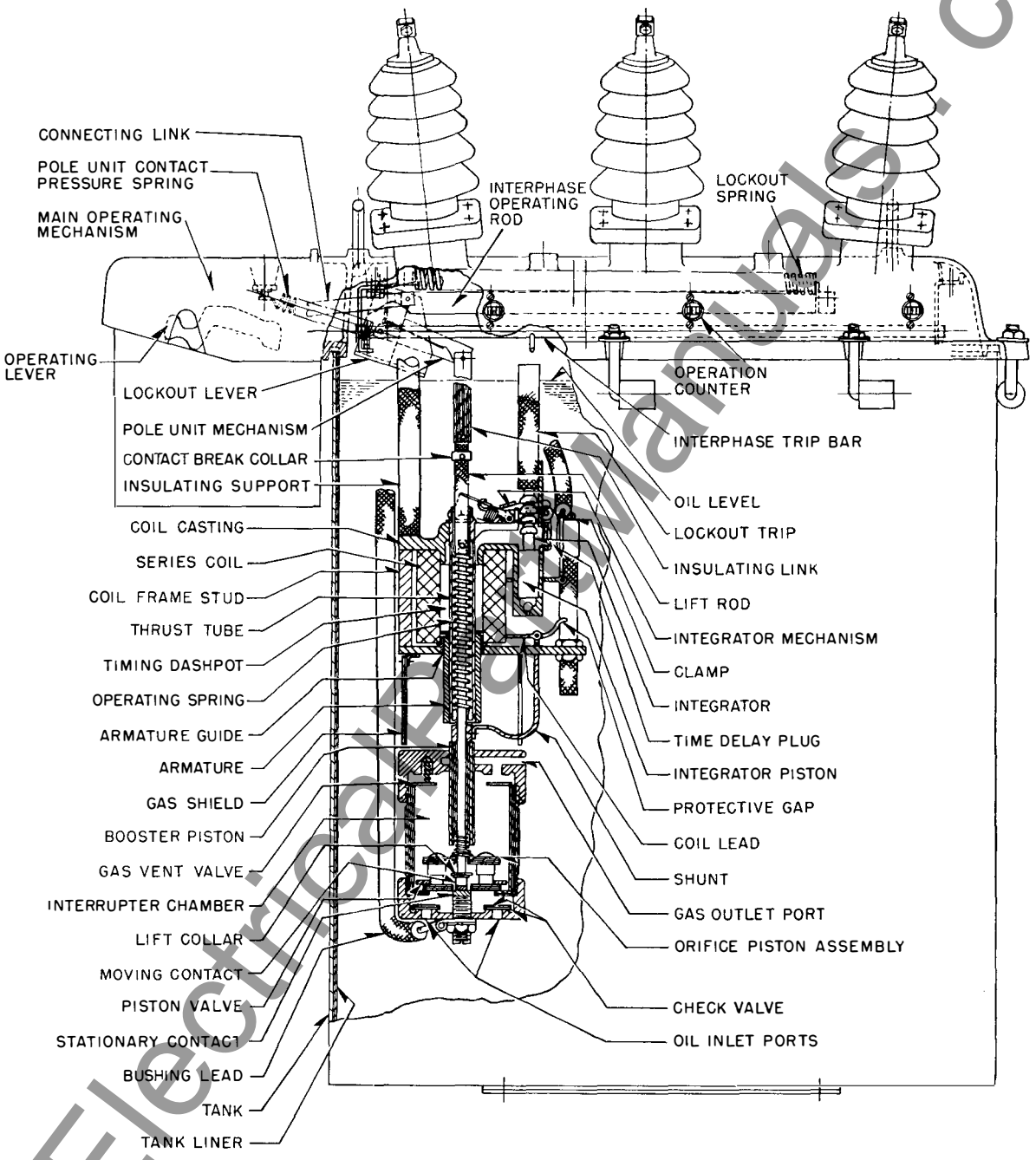
② When fault occurs, armature is drawn upward into coil by magnetic attraction. When the contacts part, the ensuing arc forms a gas bubble which creates a pressure in the interrupter. This pressure closes the normally open gas escape valve and completely seals off the interrupter chamber. The pressure also forces the contact shaft upward, lengthening the arc. The speed of contact separation is a function of the gas pressure, which in turn is controlled by the size of the arc being extinguished.

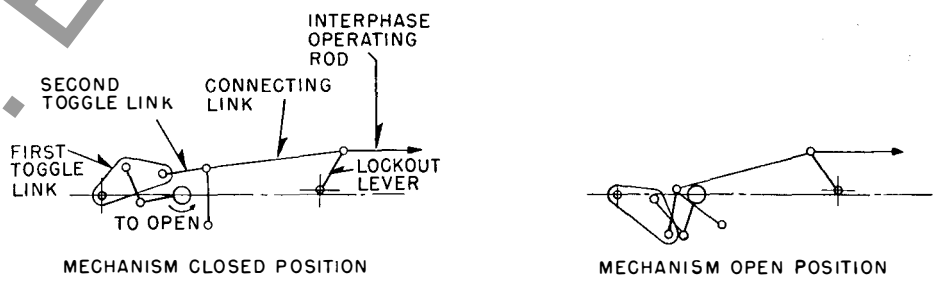
③ As the contact shaft rises, it picks up the orifice assembly and carries it along. As this orifice assembly is carried upward by the contacts, the oil in the upper part of the interrupter chamber is forced down around the top ring and through the center hole—into the arc. Since the orifice assembly moves very rapidly, the oil surrounds the arc radially at high velocity. This results in very quick arc interruption with low arc energy and little oil deterioration or contact burning.

④ After the arc is interrupted, the armature and shaft are forced down and back into position by the contact pressure spring in the top of the recloser tank. The floating piston ring allows the orifice assembly to return to the normal position. The spring-loaded gas valves open, and the gas bubble rises through the gas escape chamber. Oil pressure lifts the oil entrance ports, allowing clean oil to enter the chamber.

This interrupter is distinctive, in that, the higher the current to be interrupted, the greater is the pressure generated by the arc, the greater the speed of contact separation and the greater the velocity of oil flow into the arc, thus the greater the interrupting ability of the recloser.

SECTIONAL VIEW—TYPE GR-3 RECLOSER





MECHANISM CLOSED POSITION

MECHANISM OPEN POSITION

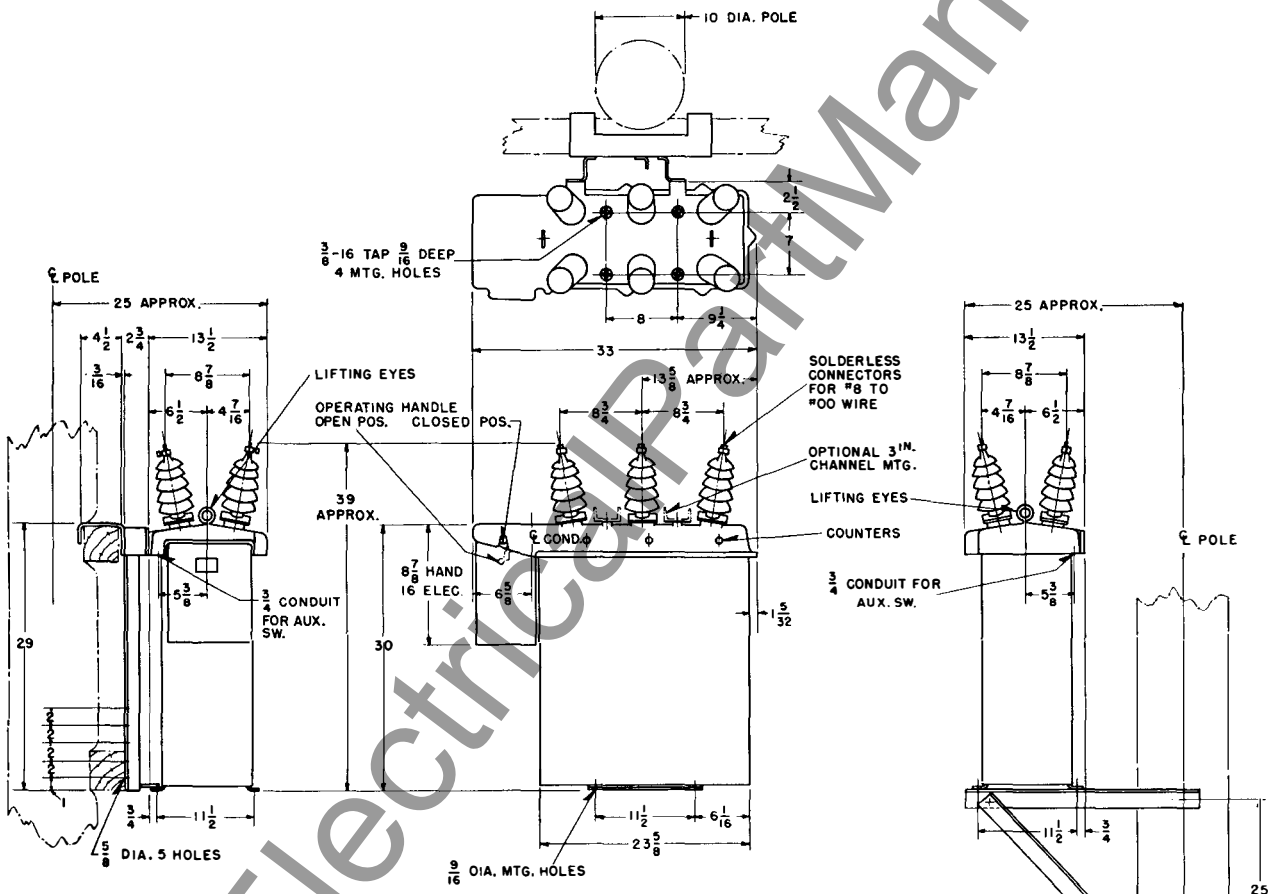
DETAIL OF MAIN OPERATING MECHANISM

RATINGS—TYPE GR-3 RECLOSERS

TYPE	VOLTAGE RATING		CURRENT RATINGS IN AMPERES		INTERRUPTING CAPACITY RATINGS SYMMETRICAL RMS AMPS ON SYSTEM VOLTAGES		INSULATION LEVEL WITHSTAND TEST		STYLE NUMBER (MANUALLY OPERATED)
	NOMINAL RATED KV	MAXIMUM DESIGN KV	COIL SIZE CONTINUOUS CURRENT RATING	MINIMUM TRIP RATING	2.4, 4.8, AND 7.2 KV △; 2.4/4.16 AND 4.8/8.32 KV Y	7.2/12.47 KV Y; 7.62/13.2 KV Y; 11 TO 15 KV △	60-CYCLE	IMPULSE	
100-GR3-25	14.4	15.5	25	50	1000	1000	50	110	**1585 107**
100-GR3-35	14.4	15.5	35	70	1500	1500	50	110	**1585 108**
100-GR3-50	14.4	15.5	50	100	2500	2000	50	110	**1585 109**
100-GR3-70	14.4	15.5	70	140	2500	2000	50	110	**1585 110**
100-GR3-100	14.4	15.5	100	200	2500	2000	50	110	**1585 111**

OUTLINE DIMENSIONS IN INCHES

Approximate Only. Do Not Use for Construction Purposes.



Side, Top, and Front View of Pole-Mounted Unit

Side View of Platform-Mounted Unit

WEIGHTS AND OIL REQUIREMENTS

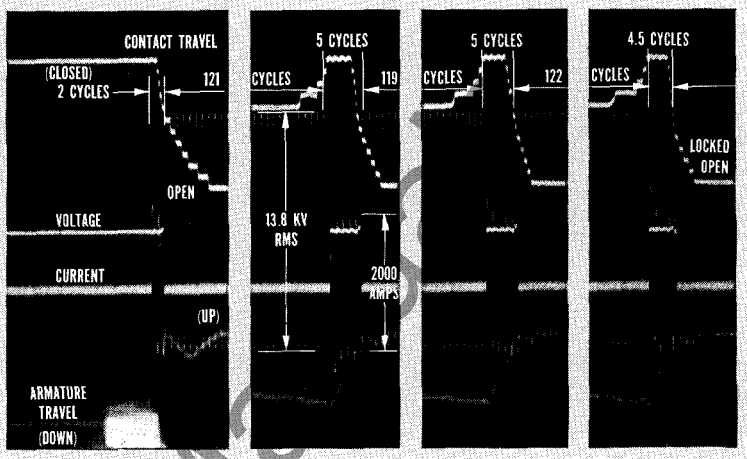
	MANUALLY OPERATED	SOLENOID OPERATED
Net Weight with oil	450 lbs.	480 lbs.
Net Weight without oil	258 lbs.	288 lbs.
Shipping weight without oil	300 lbs.	330 lbs.
Shipping weight of oil	250 lbs.	250 lbs.
Quantity of oil required	26 gallons	26 gallons

TYPICAL INTERRUPTION TESTS

Shown here is an oscillogram of a typical operation to lockout of a 100-GR recloser with a 100-ampere coil. The short circuit current interrupted was 2000 a peres at 13.8 kv, power factor of 11%. Since the current interruption illustrated here is at the maximum recloser rating and on a laboratory circuit "stiffer" than normally found in the field, it illustrates the short arcing time and interrupting ability of the specially designed "se f-driven" interrupter.

BASIS OF RATING—This recloser is rated on a symmetrical current basis. The interrupting current ratings have been determined by tests on a circuit having a very high d-c component. Therefore the reclos r as rated is capable of interrupting any circuit on which the calculated symmetrical bolted fault current is not above the interrupting ratings given in the rating table on page 6.

Note that even though this test was conducted at 13.8 kv, the recloser interrupted the arc before the contacts had co p eted even 50% of their total ava lable separation. This indicates the generous margin of safety with which the recloser is rated.



First opening, total clearing time 2 cycles, arcing time at contacts ½ cycle, reclosing time 121 cycles.

Secondopening, total clearing time 5 cycles, arcing time at contacts ½ cycle, reclosing time, 119 cycles.

Third opening, total clearing time 5 cycles, arcing time at contacts ½ cycle, reclosing time 122 cycles.

Fourthopening, total clearing time 4¼ cycles, arcing time at contacts ½ cycle, recloser locks open.

LITERATURE REFERENCE

PRICES—See Price List 33-753.

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