# Westinghouse

# TYPE RC AUTOMATIC RECLOSER

## INSTRUCTION BOOK

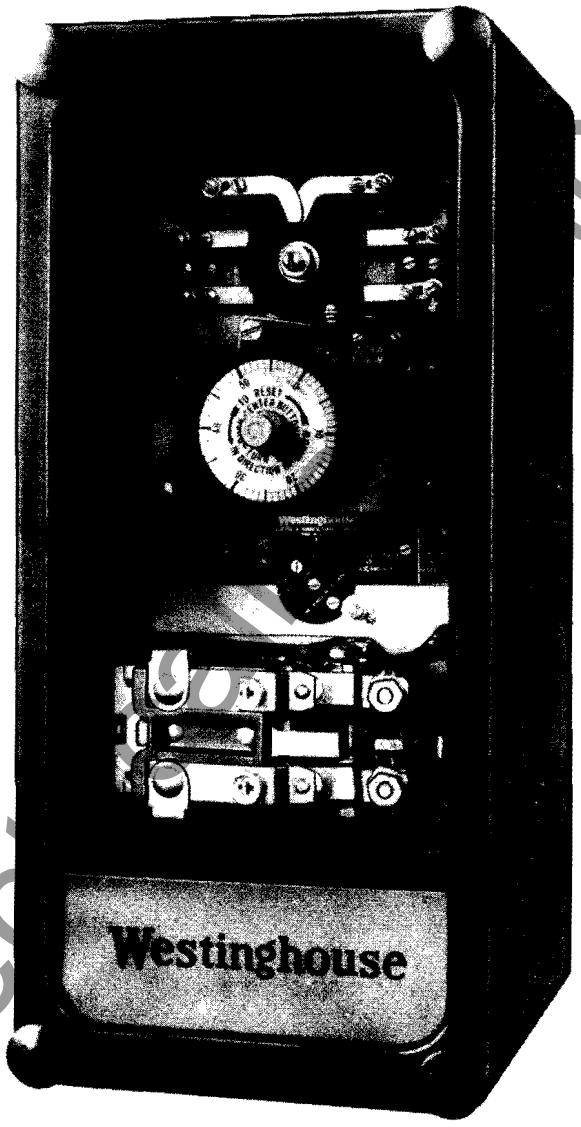


Fig. 1 - Type RC Automatic Recloser
115-230 Volts. 60 Cycles

**Westinghouse Electric & Manufacturing Company**

**East Pittsburgh Works** **East Pittsburgh, Pa.**

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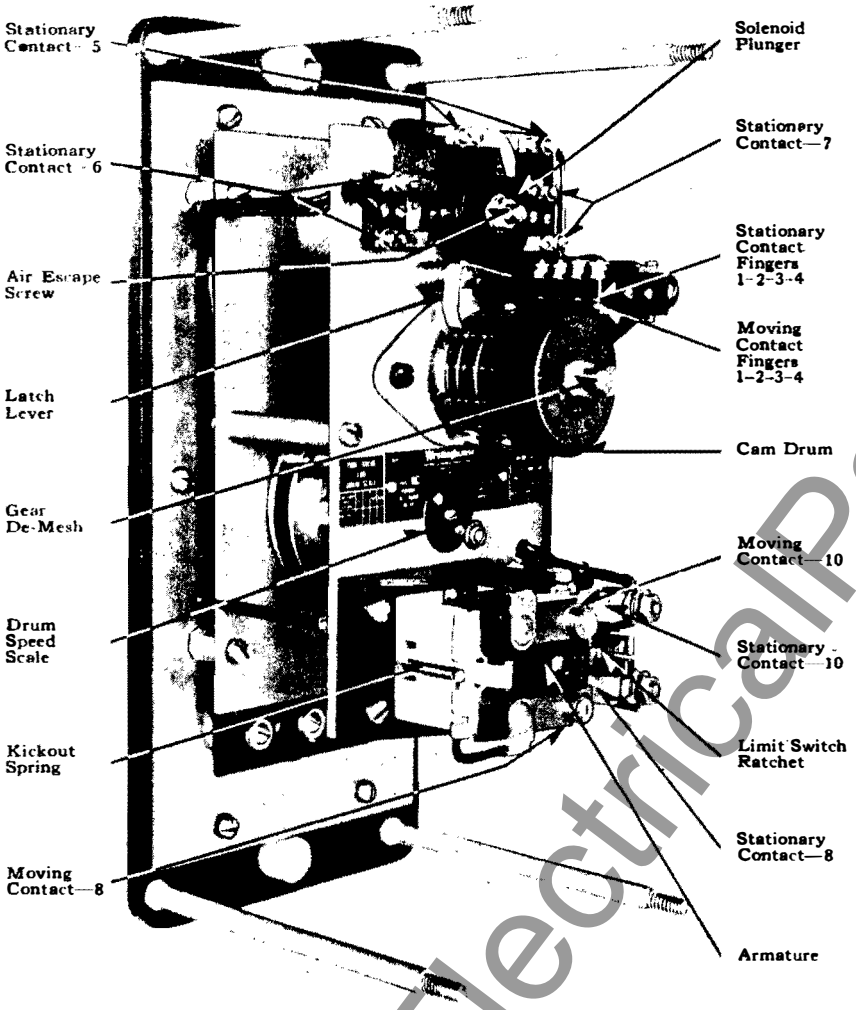



Fig. 2 - Type RC Recloser with Cover Removed
Three-Quarter Front View

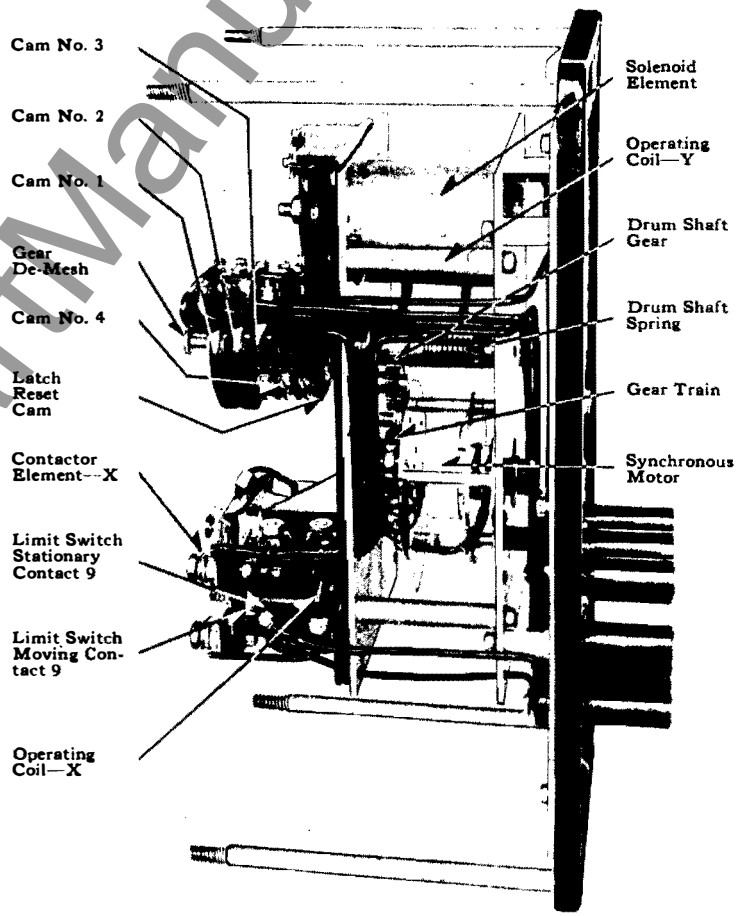



Fig. 3 - Type RC Recloser with Cover Removed
Right Hand Side View

# Westinghouse
# TYPE RC AUTOMATIC RECLOSER

GENERAL:

(1) The Type RC Automatic Recloser is the latest design of a motor-operated timing device for automatically reclosing a-c. or d-c. electrically-operated breakers on alternating-current systems. It incorporates those features found desirable through years of experience in the field of automatic reclosing, including initial immediate reclosure, anti-pumping and an integrating lockout or cumulative limit switch.

(2) The Type RC Recloser is a simple and rugged device of small physical dimensions approximately 5-1/2" x 12" x 6-3/4". It consists essentially of a synchronous motor-driven set of cams and two self-contained auxiliary elements, which provide initial immediate or delayed reclosure and several subsequent timed reclosures. The Recloser is normally arranged for a total of three reclosures with automatic reset if the breaker stays in, and lockout if the breaker trips out after the third reclosure. Since the majority of breakers when automatically reclosed, stay in after the first or second reclosure, the breaker may be subjected to an indefinite number of reclosures due to a series of faults spread over a time longer than the resetting time of the Recloser. The normal lockout feature of the reclosing device provides no protection from excessive breaker duty due to this cause. A cumulative or integrating lockout device, however, provides this very desirable feature, and can be set for any number of total reclosures up to a maximum of sixteen. The setting for any specific application depends on the type of breaker and the short-circuit duty, and the service application. After this integrating lockout has operated, the breaker is definitely locked out of service for inspection and whatever maintenance may be desirable. The cover must be removed from the Recloser to reset this integrating lockout device.

DESCRIPTION OF OPERATION WITH RECLOSER ADJUSTED FOR INITIAL IMMEDIATE RECLOSURE

(3) Referring to the schematic diagrams, Fig. 4 (D-C. Breaker Control) and Fig. 5 (A-C. Breaker Control) -- contacts 1 and 2, control the operation of the Recloser motor, causing it to start after an automatic opening of the breaker and then to stop at the reset or lockout positions, depending on whether the breaker remains closed or trips out after the final reclosure. Once started, the motor drives the cam continuously forward until contact 1, 2 or the integrating lockout opens. Contact 3, actuated by adjustable cam screws, controls the time at which reclosures are to occur. Contact 4 is an "alarm" contact which may be used to energize an alarm circuit if the recloser "locks out". The function of the other contacts can best be described by following in detail the sequence of operation of the RC Recloser following an automatic opening of a breaker.

(4) Starting with the RC Recloser in its reset position and adjusted for one immediate initial and two subsequent timed reclosures, assume that the breaker trips due to a fault. Circuit-breaker "b" auxiliary switches 152-1 and 152-3 close, thus energizing the motor 179M through contact 179-1, starting the cam drum, and energizing the coil of the contactor element, 179X, through cam contact 179-3, contact 179Y-5, and integrating lockout contact 179-9. The contactor element, device 179X, when energized, seals itself in through its own contact while its other contact energizes the coil of 179Y and 179Y-7. Upon the closure of contact 179Y-6, the circuit-breaker control relay is energized and causes the circuit-breaker to close. Circuit-breaker "b" auxiliary switches 152-1 and 152-3 then open and "a" auxiliary switch 152-2 is closed. The opening of 152-3 de-energizes the auxiliary elements, 179X and 179Y. The solenoid, 179Y, however, resets only part way to open contact 179Y-6, and is latched in this position to prevent closure of contact 179Y-5 and keep contact 179Y-7 closed until some time later. Contact 179Y-7 maintains the continuity of the motor circuit, should the breaker remain closed after the first reclosure, until cam contact #2 has time to close, thus permitting the cam drum to continue to the reset position. Contact 179Y-5 stays open, thus preventing "pumping" should the breaker trip immediately. This condition is maintained until after rotation of the cam drum has caused the #3 contact to open. This constitutes an immediate first or initial reclosure. It should be noted that this immediate reclosure is obtained because the first #3 cam screw is adjusted to close the 179-3 contact in the initial or reset position. If an immediate first reclosure is not desired, it is only necessary to change the position of the first set of #3 and #5 cam screws.

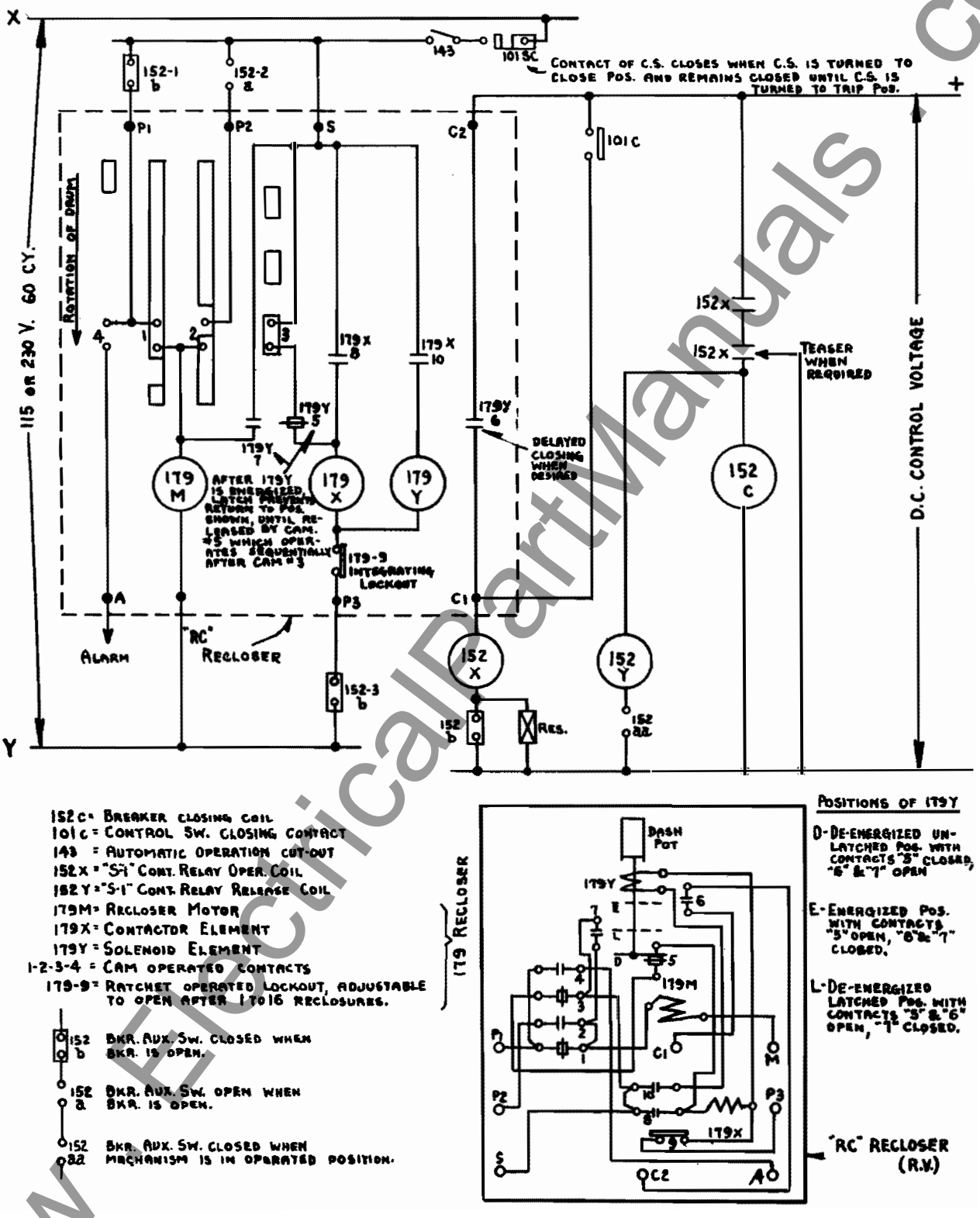
(5) If the breaker does not stay closed after the first reclosure, the sequence continues as follows:- The motor continues to run through contacts 179-1 and 179Y-7 in parallel and rotation of the cams causes contact 179-2 to close, and contact 179-3 to open. Cam screw #5 resets the solenoid element latch causing contact 179Y-7 to open and 179Y-5 to close. The set-up is now ready for another reclosure. This will occur as soon as contact 179-3 is again closed by a second #3 cam screw. As soon as this happens, the breaker is again closed by the same contact action as in the first reclosure. Subsequent reclosures are effected in a similar manner, the reclosures per revolution of the drum being determined by the number of #3 and #5 cam screws used.

(6) If the breaker still trips out after the last reclosure the motor runs until contact 179Y-7 is opened, after which contact 179-1 opens and the motor stops at the "lockout position". The attendant or inspector must now reclose the breaker manually. In so doing the Recloser automatically goes to the Reset position. If the breaker stays in after any reclosure, the motor continues to run until contact 179-2 opens, causing the cam to stop at the reset position.

(7) After a pre-determined total number of reclosures the ratchet-operated integrating lockout contact, device 179-9 will open, thus locking out the entire recloser. If this limit switch feature is not desired, its function can be eliminated by connecting a short jumper wire across its terminals, shorting out contact 179-9.

(8) A switch 143, should be provided as part of circuit-breaker control for the purpose of disconnecting the a-c. supply to the Recloser thus preventing automatic reclosure of the breaker. It should always be opened when the Recloser is being inspected or adjusted.

(9) Whenever the Recloser is located at a remote point from the breaker and it is desired to eliminate the breaker auxiliary contacts 152-1 and 152-2 and associated control wires, a small relay with a "make" and a "break" contact (such as Westinghouse type SG) can be provided and operated from the circuit-breaker 152-3 "b" auxiliary switch.




152 C = Breaker closing coil
101 C = Control Sw. closing contact
143 = Automatic operation cut-out
152 X = "S-1" Cont. Relay Oper. Coil
152 Y = "S-1" Cont. Relay Release Coil
179M = Recloser Motor
179X = Contactor Element
179Y = Solenoid Element
1-2-3-4 = Cam operated contacts
179-9 = Ratchet operated lockout, adjustable to open after 1 to 16 reclosures.

152 b — Bkr. Aux. Sw. closed when Bkr. is open.

152 a — Bkr. Aux. Sw. open when Bkr. is open.

152 aa — Bkr. Aux. Sw. closed when mechanism is in operated position.



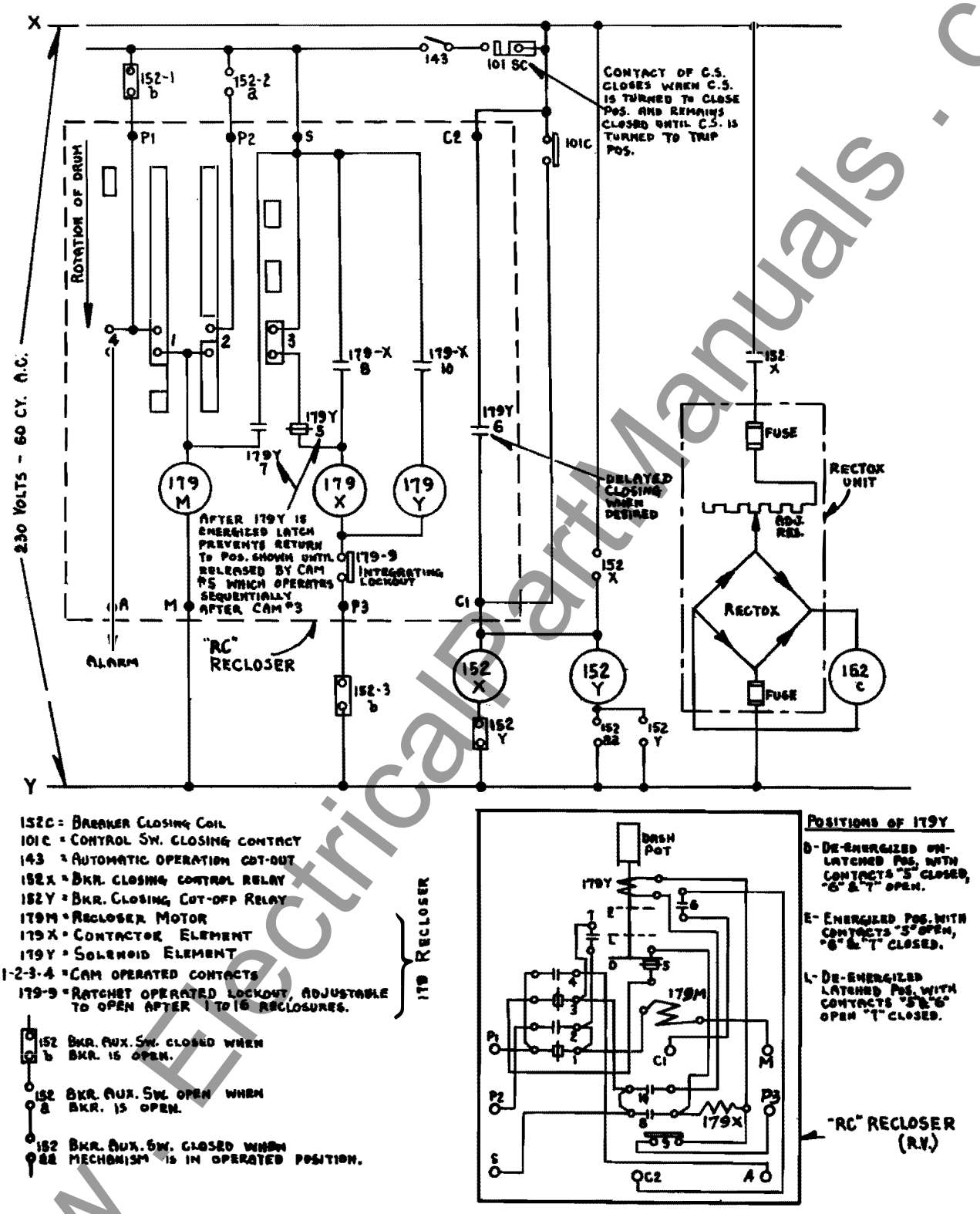

Positions of 179Y

D - De-energized unlatched pos. with contacts "5" closed, "6" & "7" open

E - Energized pos. with contacts "5" open, "6" & "7" closed.

L - De-energized latched pos. with contacts "5" & "6" open, "7" closed.

Fig. 4 - Schematic Diagram for Circuit-Breaker Automatic Reclosing Using Type RC Recloser, Set for Immediate Reclosure (Shown in Reset Position) D-C. Control Circuit with S-1 Control Relay




152C = Breaker Closing Coil
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152X = Bkr. Closing Control Relay
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179 Recloser

152 b — Bkr. Aux. Sw. closed when Bkr. is open.

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**Positions of 179Y**

D - De-energized un-latched pos. with contacts "5" closed, "6" & "7" open.

E - Energized pos. with contacts "5" open, "6" & "7" closed.

L - De-energized latched pos. with contacts "5" & "6" open "7" closed.

Fig. 5 - Schematic Diagram for Circuit-Breaker Automatic Reclosing Using Type RC Recloser, Set for Immediate Reclosure (Shown in Reset Position) A-C. Control Circuit with Rectox-Operated Solenoid

## CONSTRUCTION AND MECHANICAL DETAILS

(10) The Type RC Recloser is inclosed by a metal cover with glass window, 5-1/2" wide by 12" long and with rear-connected terminals. The Recloser is suitable for mounting on any of the usual panel materials. The outline and drilling plan for the RC Recloser is shown in Fig. 6. All electrical contacts are silver to silver and of ample carrying capacity for the service required of them.

## SOLENOID ELEMENT (179Y)

(11) This auxiliary device is located in the upper part of the Recloser and is a solenoid with a magnetic stainless steel plunger riding in a bronze tube which is closed at one end. When its coil is energized the movement of the plunger is slightly retarded, as normally the only escape for the imprisoned air is a small clearance between the plunger and the bronze tube. This time delay feature is used with mechanically full-automatic breaker mechanisms and obviates the necessity of a latch checking device in the mechanism. When non-automatic breaker mechanisms are used, the time delay feature is not required and instantaneous action of this plunger can be obtained by removal of the "air escape screw" which allows the air to escape through the hole in the plunger.

## SYNCHRONOUS MOTOR-DRIVEN CAM (179M)

(12) The synchronous motor drives a gear train which in turn rotates the cam drum. The time for one revolution of this cam drum can be easily adjusted to give one revolution in 60, 90, 180 or 360 seconds. The face of the cam drum is marked in 60 divisions, so that with the 60-second gear setting, each of the divisions represents one second. For any of the other gear settings the simple multipliers shown on the name plate give the value in time of each division on the cam drum. This scale marking greatly facilitates the adjustment of cam screws for "setting up" the desired reclosing cycle.

(13) A pushbutton (gear de-mesh) at the front of the drum disengages the gears from the cam. It should be used whenever the drum is moved by hand either to change the gear speed, to check the cam operation, or to set the cam screws. The drum should always be rotated in the direction of the arrow, counter clockwise - Never clockwise.

(14) On the right hand side of the name plate there are instructions as to the method of changing the gear setting. When the gear setting is being changed the drum speed scale located in the center of the recloser rotates with the gear and motor assembly. The correct setting is obtained when the figures indicating the time for one revolution of the drum register with the index in the center of the name plate. To change from one gear setting to another, the locking screw should be loosened and then, by using the cross-bars which support the gear and motor assembly, this assembly can be rotated until the drum speed scale indicates the desired speed. The setting is held in this position by tightening the locking screw.

(15) Cams #1 and #2 which control the lockout and reset functions of the Recloser are not adjustable. Cams #3, #4 and #5 are formed by inserting screws into nuts provided in the respective cam slots. While seven nuts are provided in both the #3 and #5 slots only 3 screws for each cam are assembled at the factory. Additional screws are supplied separately in a small container and shipped with the Recloser so that more than three reclosures per drum revolution can be obtained when desired. For cam #4, the alarm contact, one screw and nut is provided.

## CONTACTOR ELEMENT AND INTEGRATING LOCKOUT SWITCH (179X and 179-9)

(16) At the bottom of the Recloser is a small two-pole contactor relay with a mechanical linkage to operate the ratchet type integrating lockout switch. This switch consists of a ratchet and a cam which so operates that the 179-9 contact remains closed until any desired number of operations of the auxiliary contact up to sixteen have been made. Each operation of this contactor causes the ratchet to advance one division. The figures on the face of the ratchet gear indicate the number of reclosures which can be made before this device locks out the recloser.

## ELECTRICAL CHARACTERISTICS OF THE RC RECLOSER

(17) The RC Recloser is so wired that it can be used for either D.C. or A.C. closing of breakers. Contact No. 6 energizes the circuit-breaker control relay, and is brought out to studs $C_1$ and $C_2$ (the top and bottom middle studs of the Recloser as shown in Figs. 4 and 5). The driving synchronous motor and auxiliary relays must always be energized from either a 115 V. or 230 V. 60 cycle supply. This supply in case of D.C. operated circuit-breakers may be the lighting or auxiliary 60 cycle power supply in the station. When the circuit-breakers are closed by 60 cycle A.C. power, the operating transformer for the breaker may be used for the motor circuit of the RC Recloser. Only two standard style number relays are necessary to cover practically any application:

S#839100 covers 115 V. 60 cycle Syn. timing Motor and Auxiliary Relays.
S#930400 covers 230 V. 60 cycle Syn. timing Motor and Auxiliary Relays.

The burdens for the various parts of the Recloser will not exceed the following:

Contactor Element, Device 179X -
Open Position = 60 V.A.
Closed Position = 40 V.A.

Solenoid Element, Device 179Y -
Open Position = 90 V.A.
Closed Position = 40 V.A.

Motor 8 V.A.

These burdens occur only during operation of the recloser since the motor and coils are de-energized both in the lockout and the reset positions. The parts of the Recloser are designed for intermittent duty or for 15 minutes continuously. This provides ample power for operation under the most severe temperature conditions, and at the same time gives a larger factor of safety than is usually provided for devices which are used only intermittently.

## ADJUSTMENTS

(18) The question of time intervals between reclosures has received considerable attention in the application of automatic reclosing oil circuit-breakers and it is evident that special conditions and types of service may require different time settings. The greater percentage of feeder troubles are temporary, and thus the breaker usually remains closed upon the first reclosure following an automatic opening. For this reason it is usually advantageous, from service continuity standpoint, to make the first reclosure immediately. Succeeding reclosures will generally be spaced at increasing intervals of time. On this basis the duty cycle of O-15-60 second intervals has received considerable favor among operators. The time intervals however, can readily be adjusted as desired by changing the location of the #3 and #5 screws on the drum of the recloser.

(19) Practically any desired duty cycle can be obtained since the #3 cam screws which determine the time of reclosure can be set anywhere around the drum and since there is such a wide range of drum speeds available.

(20) In adjusting the #3 and #5 screws for any desired time reclosure the center line of the #3 screw should be set 1 division clockwise as measured on the front scale from the point at which the reclosure is to take place. Normally the #3 contact is closed for the time necessary for the drum to travel 4 small divisions. Therefore, to be sure that the #3 contact is open before the #5 contact is closed, the #5 screw will normally be set to unlatch the plunger after the drum has rotated about 5 divisions. Since the point at which the #5 screw unlatches the plunger is located physically 10 divisions counter clockwise from the point at which the #3 screw makes contact, this means that the #5 screw should always be located 5 divisions counter clockwise from its associated #3 screw. The time for the drum to travel five more divisions should then be allowed before another reclosure is initiated. This is necessary in order that the latch lever will be free to latch the plunger to prevent pumping on the second reclosure. This means that normally 10 divisions on the drum should be allowed between settings of adjacent #3 screws.

(21) A stop is provided in the slot for the #3 cam screws so as to prevent the setting of the last #3 screw too close to the lockout position. This is necessary in order that the relay may make a complete cycle of operation before reaching the lockout position.

(22) Ordinarily the #4 alarm contact should be set so that the alarm operates in the lockout position. This means that the center line of this #4 screw will be set on the drum in line with the 56th division on the face of the drum.

(23) In Table I, a schedule of a few typical operating cycles is given to show the manner in which the #3 and #5 cam screws are set and which settings to use to give these cycles.

(24) Any reclosing cycle as set up for one revolution of the drum can be repeated by shorting out the #1 cam contacts. The total number of reclosures is then determined by the setting of the integrating lockout.

(25) This integrating lockout is set to the desired total number of reclosures by operating the 179X contacts manually. The automatic operation cutout switch #143 should, of course, be open when this setting is being made.

(26) The integrating lockout feature has two important functions. The first of these is, as described above, to limit the total number of reclosures when the normal lockout #1 cam contacts are shorted out. In addition to this function, its use provides a check to prevent excessive wear and deterioration on the breaker due to lack of maintenance as explained previously.

## GENERAL NOTES ON APPLICATION OF RECLOSING EQUIPMENT

(27) For any reclosing breaker application it is necessary to supply in addition to the Recloser itself, suitable protective relay equipment, auxiliary switches, control relay and control switch and a source of control energy.

(28) Although no complete discussion of breaker closing mechanism is provided here, in applying Reclosers it is necessary to investigate various mechanical details and interlocks in order to be sure that the automatic features will work satisfactorily. Westinghouse Reclosers are so designed that if the proper precautions are taken the automatic reclosing equipment can be applied to all types of electrically-operated breakers.

(29) For mechanically non-trip-free mechanisms the control relay cut-off must have enough time delay so that the breaker is completely latched before the energy is removed from the closing coil.

(30) For mechanically trip free breakers, particularly under the condition of immediate reclosing, in addition to the above, it is necessary to insure that the closing mechanism is securely latched to the breaker operating rod before energy is applied to the closing coil. Otherwise, it is possible for the Recloser to energize the closing mechanism without closing the breaker. The RC Recloser takes care of the above condition by means of the time delay in the solenoid element. Mechanical latch checking devices are not required with the RC Recloser.

(31) In applying automatic reclosing equipment it is also necessary to check the protective relays to be sure that their contacts will open within 10 cycles or less after the breaker is tripped in order to insure the trip circuit being de-energized before the reclosure takes place.

(32) When using initial immediate reclosure, minimum service interruptions in consumer plants will occur if proper application is made on the customer's apparatus of such undervoltage time delay, field removal, and synchronous motor unloading devices as are necessary.

(33) For some motor-operated closing mechanisms a brake should be provided to assure the latching of the closing mechanism between successive reclosures.

(34) For any automatic reclosing application, care should be taken to check the N.E.M.A. de-rating factors when choosing any particular reclosing cycle.

TABLE I - OPERATING CYCLE

| Auto. | Int. Sec. | Auto. | Int. Sec. | Auto. | Int. Sec. | Auto. | Locate adjustable cam screws in line with numbered div. on face of cam drum | | Req'd Gear Setting |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | #3 cam | #5 cam | |
| *Open | 15 | C & O | - | - | - | - | 16 | 11 | 60 Sec. |
| *Open | 15 | C & O | 15 | C & O | 15 | Closing | 16-31-46 | 11-26-41 | 60 Sec. |
| Open | 0 | C & O | 15 | C & O | 60 | Closing | 1-11-41 | 56-6-36 | 90 Sec. |
| Open | 0 | C & O | 30 | C & O | 75 | Closing | 1-11-36 | 56-6-31 | 180 Sec. |

*No immediate initial reclosure.

C & O represents automatic closing and opening. After final closing the breaker may stay in, in which case the Recloser will reset, or the breaker may trip out, in which case the Recloser will lockout.

## RENEWAL PARTS DATA
Recommended Stock of Renewal Parts

TYPE RC AUTOMATIC RECLOSER
Style No. 839100 - 115 Volts - 60 Cycles
Style No. 930400 - 230 Volts - 60 Cycles
(For illustration of Parts, see Figures 2 and 3.)

| Reclosers in use up to and including | 1 | 5 |
|---|---|---|
| Name of Part | No. Per Recloser | Recommended for Stock |
| Recloser Complete | 1 | 0 | 0 |
| Synchronous Motor | 1 | 0 | 0 |
| Gear Train Complete | 1 | 0 | 0 |
| Cam Drum Complete | 1 | 0 | 0 |
| Drum Shaft Gear | 1 | 0 | 0 |
| Drum Shaft Spring | 1 | 0 | 1 |
| Moving Contact Finger (1-2-3-4) | 4 | 4 | 8 |
| Stationary Contact (1-2-3-4) | 4 | 4 | 8 |
| Solenoid Element (Y) | 1 | 0 | 0 |
| Solenoid Plunger | 1 | 0 | 0 |
| Stationary Contact (5) | 2 | 2 | 4 |
| Stationary Contact (6) | 2 | 2 | 4 |
| Stationary Contact (7) | 2 | 2 | 4 |
| Operating Coil (Y) | 1 | 0 | 1 |

| Reclosers in use up to and including | 1 | 5 |
|---|---|---|
| Name of Part | No. Per Recloser | Recommended for Stock |
| Contactor Element (X) | 1 | 0 | 0 |
| Armature | 1 | 0 | 0 |
| Moving Contact - L.H. (10) | 1 | 1 | 2 |
| Moving Contact - R.H. (8) | 1 | 1 | 2 |
| Stationary Contact (8-10) | 2 | 2 | 4 |
| Limit Switch Moving Contact (9) | 1 | 1 | 2 |
| Limit Switch Stationary Contact (9) | 1 | 1 | 2 |
| Kickout Spring | 1 | 0 | 1 |
| Operating Coil (X) | 1 | 0 | 1 |
| *Cover Complete | 1 | 0 | 0 |
| * Cover Glass Plate | 1 | 0 | 1 |
| * Cover Thumb Nut | 4 | 0 | 0 |

*Not illustrated.
Parts indented are included in the part under which they are indented.

ORDERING INSTRUCTIONS

When ordering Renewal Parts, always specify the name of the part wanted as shown on the illustrations in this Instruction Book, giving Shop Order Number, and the type of Recloser as shown on the nameplate. For example: 1-Contactor Element (X), for Type RC Automatic Recloser, shown in I.B. 5732, Figure 3, and quote nameplate data.

To avoid delays and misunderstandings, note carefully the following points:

1. Send all correspondence and orders to the nearest Sales Office of the Company.

2. State whether shipment is to be made by freight, express or parcel post. In the absence of instructions, goods will be shipped at our discretion. Parcel post shipments will be insured only on request. All shipments are at purchaser's risk.

3. Small orders should be combined so as to amount to a value of at least $1.00 net. Where the total of the sale is less than this, the material will be invoiced at $1.00.

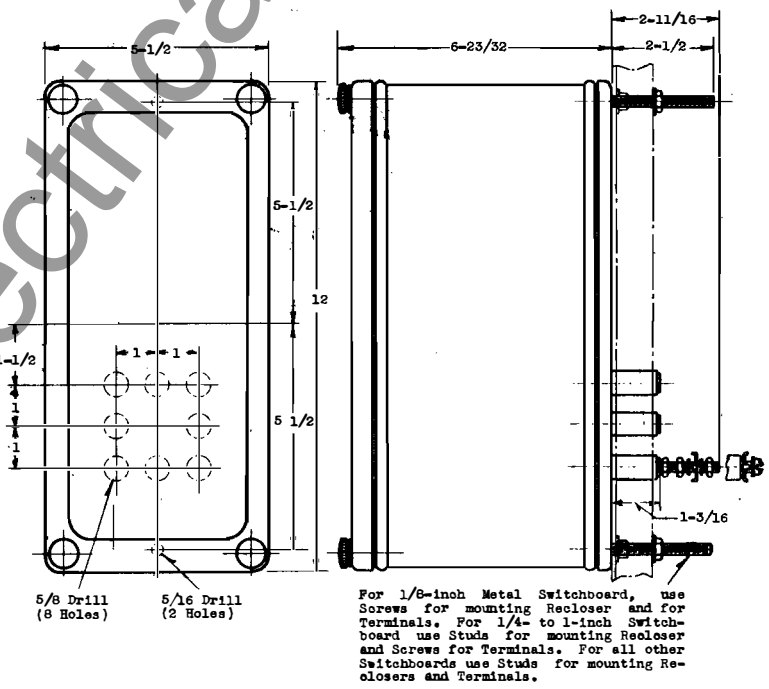


Fig. 6 - Outline Drawing for Type RC Recloser