INSTRUCTIONS

The RC "DynAC Brake"

The RC "DynAC Brake" (pronounced "dine-ack") is a totally new means for the rapid deceleration of reversible capacitor type single phase motors as used on tap changer drive mechanisms or other applications where quick acting electrical braking is required.

The RC "DynAC Brake" operates instantly when driving power is removed to result in a smooth application of braking torgue with a minimum strain on the driving motor shaft.

DESCRIPTION

The RC "DynAC Brake" is made in two forms, one for use with the 120 cam switch and the other with the 121 cam switch of the tap changer operating mechanism.

In either case, the basic brake circuit is composed of the following material:

a. One 30 micro-farad capacitor.

b. Two 2 ohm variable resistors.

c. One SG relay.

d. One selenium half-wave rectifier.

When used with the 121 cam switch, the above equipment except for the 2 ohm resistors is mounted on its own panel and is usually located in a remote control cabinet. Figure 1 shows the arrangement of the equipment for this form of the RC "DynAC Brake".

Figure 2 shows the arrangement of the equipment when used with the 120 cam switch. Here, in addition to all of the aforementioned equipment, is mounted the motor capacitor and a 400 ohm resistor.

In either case, the apparatus is connected together electrically per the following:

The coil of the SG relay is paralleled across the capacitor. The SG relay coil and capacitor parallel combination is connected in series with the selenium half-wave rectifier. The contacts of the SG relay are connected in series with the parallel circuits formed by the two 2 ohm resistors, back contacts of the motor operating relay and the motor windings. Refer to Figure 3 for the schematic circuit as described above.

When the RC "DynAC Brake" is used with the 120 cam switch, a 400 ohm resistor, as previously mentioned, is connected in series with the selenium half-wave rectifier as well as the SG relay coil and capacitor combination. This resistor is used to introduce a time delay into the RC "DynAC Brake" circuit to permit the motor control relay to complete its operation prior to the closing of the RC "DynAC Brake" contacts. See Figure 4 for the schematic of above outlined circuit.

The time delay mentioned in the previous paragraph is a result due to the addition of the 400 ohm resistor, forming a resistance - capacitance circuit. As the selenium half-wave rectifier gives a pulsating D. C. voltage, the capacitor will require a length of time to build up to the maximum value of the impressed D. C. voltage. The resistor will increase this time value as the current, which will flow until the capacitor is completely charged, will result in an IR drop across the resistor. Figure 5 shows a comparison in time values required, in curve form, when charging a capacitor by means of a D. C. voltage with and without an additional resistor in the circuit.

For convenience, the entire circuit, outlined above will henceforth be referred to as the RC "DynAC Brake" relay. Schematically it will be shown as a relay, labled BC, with a set of contacts in the motor circuit as already explained.

SEQUENCE OF OPERATION

First, consider the RC "DynAC Brake"

shown in Figure 1. Here the RC "DynAC Brake" is connected in series with a 121 cam switch as shown in Figure 6. The complete operation of the RC "DynAC Brake" and associated equipment is as follows:

a. Close the MCR contacts. This will energize the SR relay coil.

b. The SR relay will operate, closing contacts SR1 and SR3 and opening contacts SR2 and SR5.

c. Closing of the SR3 contacts will energize the motor, causing it to operate in a raise direction.

d. Shortly after the motor has started to operate, the 120 and 121 cam switches will close. (This is a mechanical operation entirely dependent upon a mechanical moving of the tap changer and not any electrical function).

e. The 120 cam switch, upon closing, will "seal-in" the motor control relay through the SR1 contacts. This will assure continuous energization of the tap changer motor until just before the next position of the tap changer is reached.

f. The 121 cam, which operated identically with the 120 cam, will energize the Selenium half-wave rectifier, SG relay coil and capacitor combination of the RC "DynAC Brake" relay. Within two to three cycles, the voltage across the capacitor will have built up to a value large enough to energize the SG relay and thus cause the BC contacts to close. However, at this time, no action on the tap changer motor will result as the back contacts of the motor control relay, SR2, will be open. Even so the circuit for breaking has now been set up and merely requires closing of the SR2 contact to function.

As the unit approaches its next mechanical position, the 120 and 121 cam switches will open, and the braking power will be applied in the following manner:

a. The 120 and 121 cam switches operate to open approximately 25° of shaft rotation prior to position.

b. Opening of the 120 cam switch will deenergize the SR relay causing the SR2 contacts to close.

c. Closing of the SR2 contacts will apply single phase AC power to both of the motor windings simultaneously, causing the motor to be braked electrically. The application of single phase AC to both windings simultaneously is accomplished because the BC contact is closed, setting up two parallel paths - one winding through the SR2 contact and its associated resistor and the other winding through the SL1 contact and its associated resistor.

d. As the 121 cam switch opens simultaneously with the 120 cam switch, the AC supply to the RC "DynAC Brake" relay is removed as the relay is deenergized. However, as the capacitor will have to discharge through the SG relay coil, the SG relay will remain closed for approximately 20 to 25 cycles, causing the tap changer motor to come to a smooth, quick, electrical stop without using any mechanical breaking means. As the motor braking time is 8 to 10 cycles, the 20 to 25 cycle time required for the RC "DynAC Brake" relay to open its BC contact will assure positive braking before opening of the brake circuit. (The BC contact in series with the two motor windings and motor control relay back contacts parallel combination).

The operation of the control circuit when operating in the lower direction is the same as described for operation in the raise direction except as follows:

a. Close MCL instead of MCR.

b. Relay SL will be energized instead of SR.

c. Contacts SL1 will open and SL3 will close instead of SR1 and SR3 closing and SR2 and SR5 opening.

d. Tap changer motor will operate in the lower direction rather than the raise direction.

e. The SL relay will be "sealed-in" by means of the SR5 contacts.

f. Braking circuit will be completed by

closing the SL1 contacts instead of the SR2 contacts.

Now, let us consider the RC "DynAC Brake" shown in Figure 2. This RC "DynAC Brake" will be connected into the circuit as shown in Figure 7. The operation of the RC "DynAC Brake" and associated control equipment is as follows:

a. Close the MCR contacts. This will energize the SR relay coil as long as the CLR cam switch is closed.

b. The SR relay will operate, closing contacts SR1 and SR3 and opening contacts SR2 and SR5.

c. Closing of the SR3 contacts will energize the tap changer motor, causing it to operate in a raise direction.

d. At the same time as the SR3 contacts close, the SR1 contacts will also close. The closing of the SR1 contacts will energize the RC "DynAC Brake" relay, BC.

Within 4 to 6 cycles after the RC "DynAC Brake" relay has been energized, the BC contacts will close, setting up the braking circuit. However, this circuit cannot be completed until the SR relay has been de-energized, closing the SR2 contacts.

e. Shortly after the tap changer motor has started to operate in the raise direction, the 120 cam switch will be mechanically closed, acting to "seal-in" the SR relay through its SR1 contacts as well as the RC "DynAC Brake" relay.

As the tap changer approaches its next mechanical position, the 120 cam switch will open, deenergizing both the SR relay and the RC "DynAC Brake" relay. The sequence of braking will then be the same as previously described for the other form of the RC "DynAC Brake".

If we now consider the operation of the RC "DynAC Brake" of Figure 2 when operating in the lower direction, we will see a slight difference in the initial operation only. The operation of the RC "DynAC Brake" and associated control equipment is as follows:

a. First close the MCL contacts. This will energize the SL relay and the RC "DynAC Brake" relay simultaneously. The RC "DynAC Brake" relay will be energized through the SR5 contact. As the two relays, the SL and the RC "DynAC Brake", are energized simultaneously, it has been necessary to introduce an additional time delay into the RC "DynAC Brake" relay to assure that the SL motor control relay will have definetly completed its operation prior to the closing of the BC contacts of the RC "DynAC Brake" relay. This delay has been obtained by the introduction of a 400 ohm resistor in the RC "DynAC Brake" relay. This additional resistor, used only in the RC "DynAC Brake" relay of Figure 2, has been fully explained both as to its purpose and how it accomplishes same under the DESCRIPTION portion of this Instruction Leaflet.

After the RC "DynAC Brake" has been energized and the tap changer motor is operating, the rest of the operations is the same as previously described.

NOTE: When the tap changer control is set for automatic operation, the unit may not stop on every position but will depend upon the automatic control scheme employed. If the standard sequential operation is used, the unit will make as many stops as required by the Voltage Regulating Relay and then brake to a stop after the Voltage Regulating Relay has relinquished control. The sequence of operation previously described will be applicable except the Voltage Regulating Relay will initiate the tap changer operation instead of the MCL or MCR contacts.

ADJUSTMENT

As the time delay required for proper braking action is set at the factory, no adjustment of this feature is required in the field.

The XR and XL resistors serve two functions. One is to prolong the life of the motor control relay back contacts, SL1 and SR2 by limiting the motor capacitor discharge current when it is short-circuited by these same contacts. The other is to control the positioning of the cam switch rollers on

the lobes of their respective cams, 120 and/or 121. This fine adjustment, normally not required, may be desirable due to slight variations in the motors and/or mechanical drives or extremely wide variations in voltage supply. The resistance is divided between the SL1 and SR2 leads to obtain balanced braking torgue for either direction of operation.

By increasing the XL resistance, the braking torgue applied is decreased when operating in the lower direction, hence the unit will stop with the 120 and/or the 121 cam roller farther on the lobe of its associated cam. By increasing the XR resistance, the same phenomena is obtained for operating in the raise direction. Since there is an interaction between the two resistors, XL and XR, it may sometimes become necessary to readjust the one resistor after adjusting the other.

MAINTENANCE

The contacts of the RC "DynAC Brake" relay should be checked for cleanliness and future life at regular maintenance periods. It is recommended that this be done each and every time the selector contacts of the tap changer are inspected.

RENEWAL PARTS

The following renewal parts are available from the Sharon Works, Westinghouse Electric Corporation, through the nearest Westinghouse Sales Offices.

SG Relay - Complete	S#1546999
Selenium Rectifier	S#1742191
400 Ohm Resistor	S#1742055
2 Ohm Resistor	S#1590776
Capacitor	S#1743278

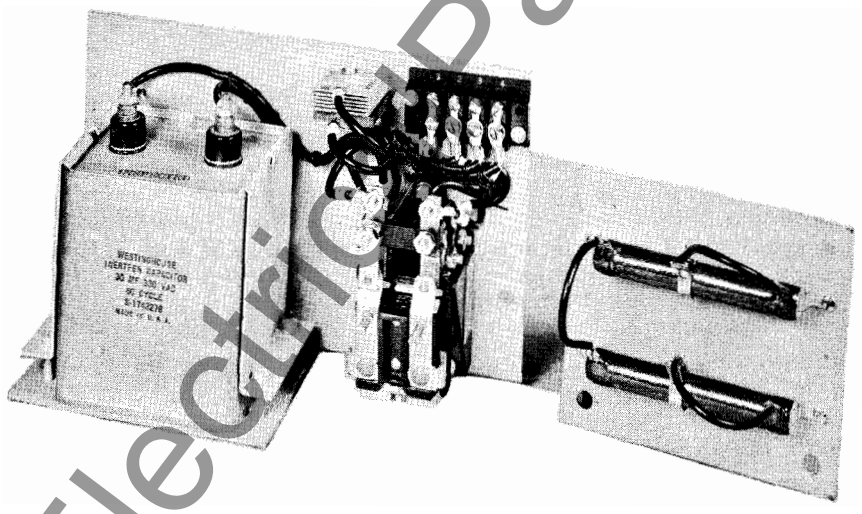


FIG. 1

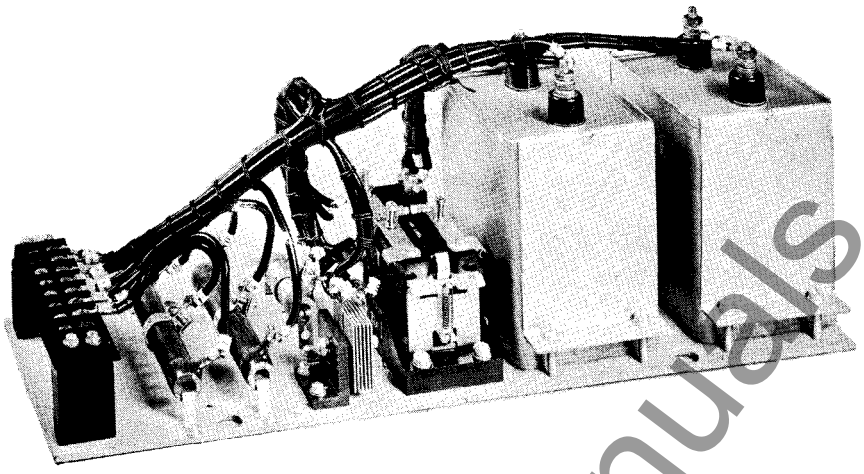
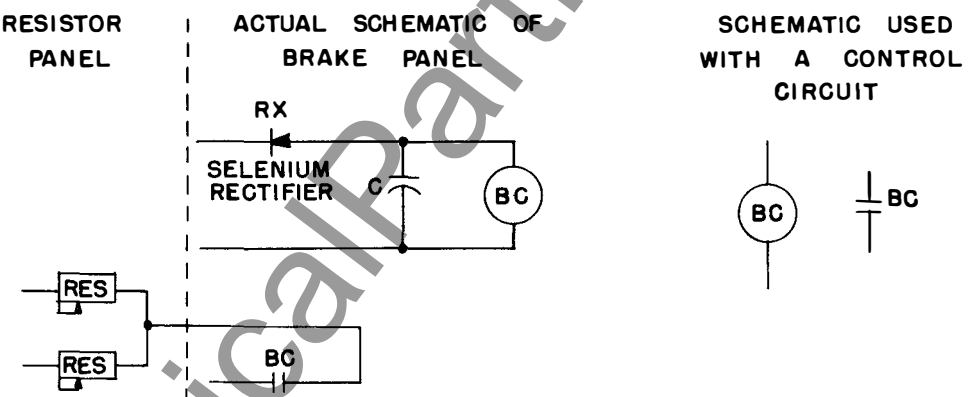


FIG. 2



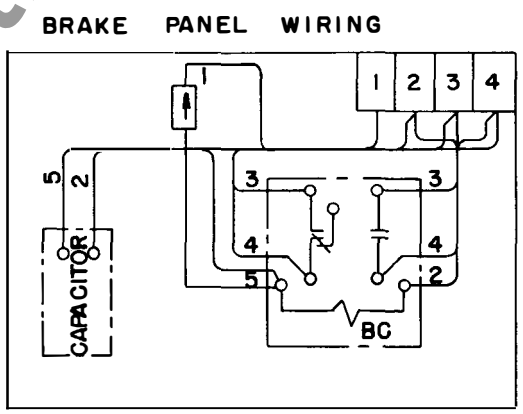


FIG. 3

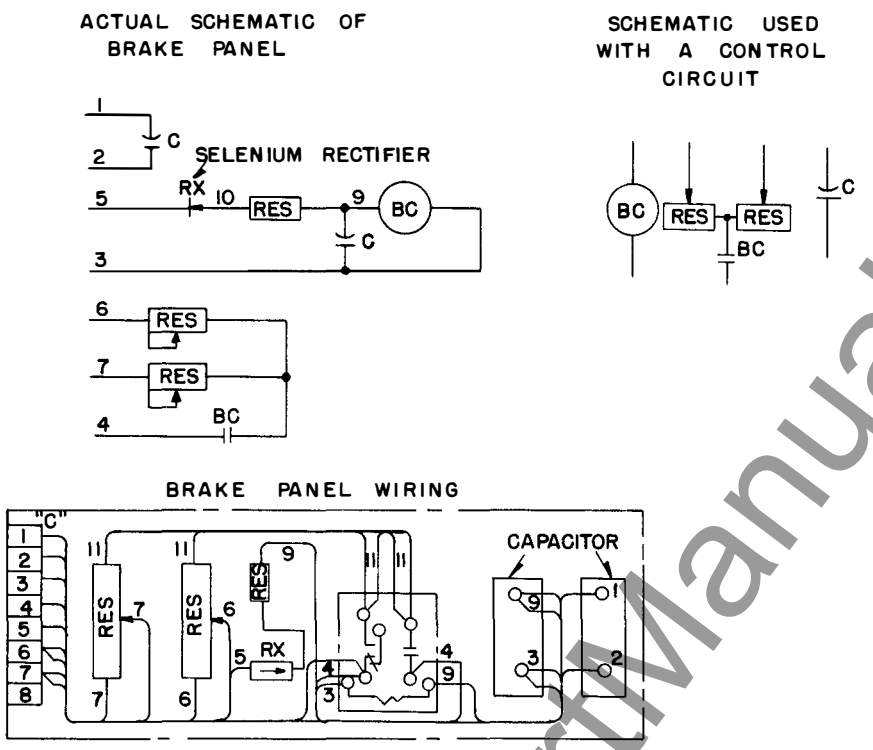


FIG. 4

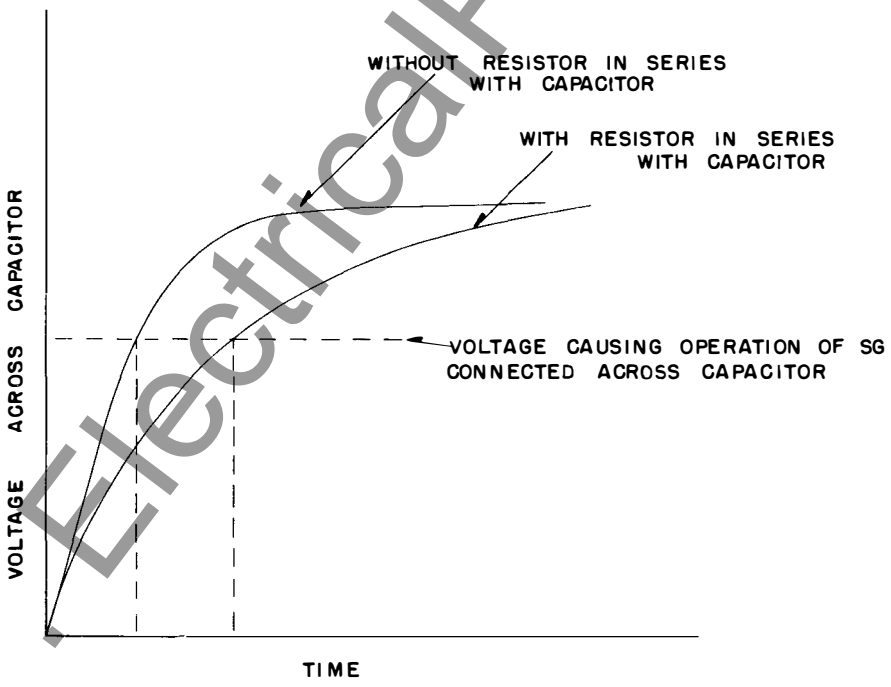


FIG. 5

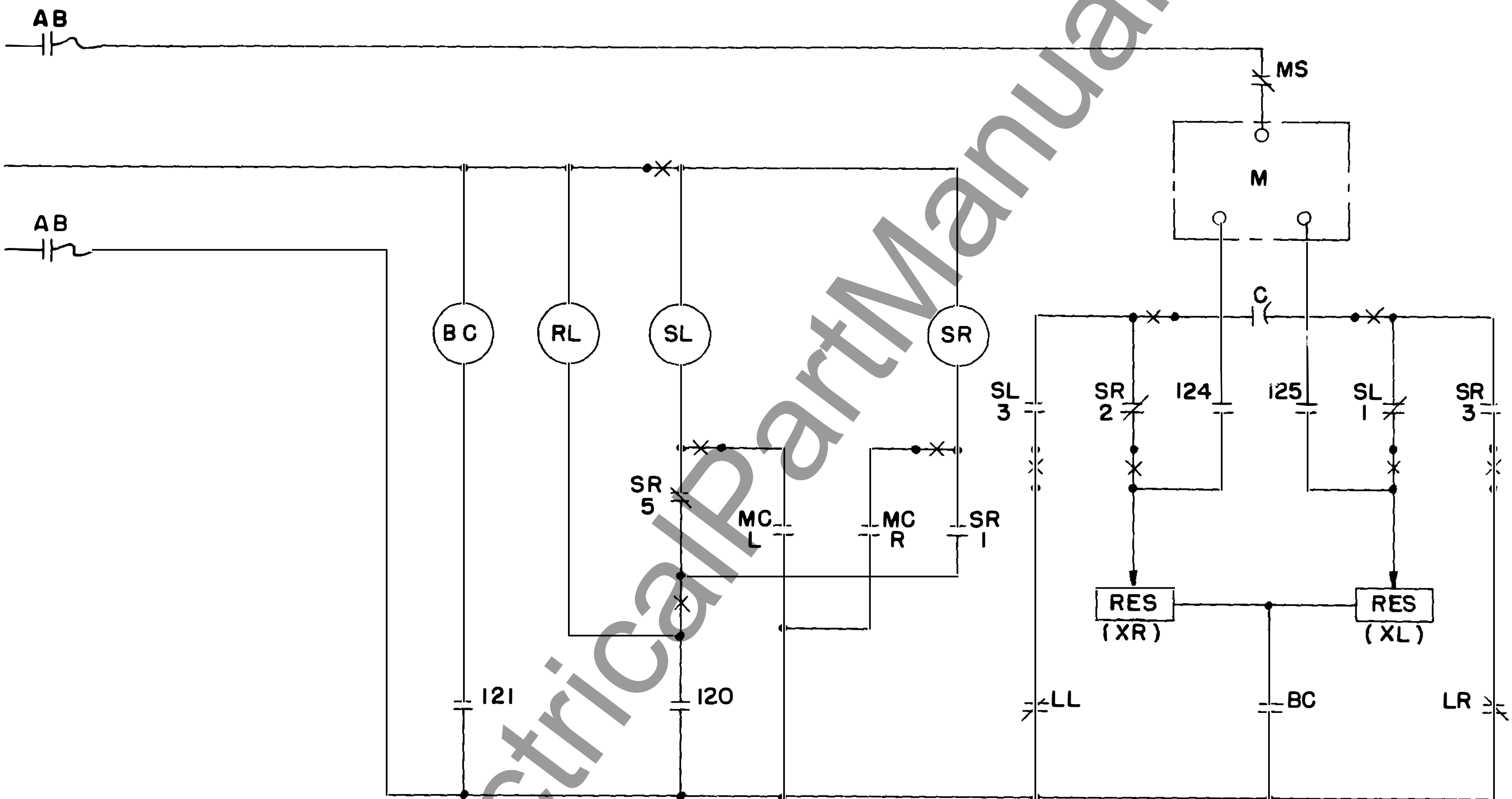


FIG. 6

TAP CHANGER ON NEUTRAL POSITION

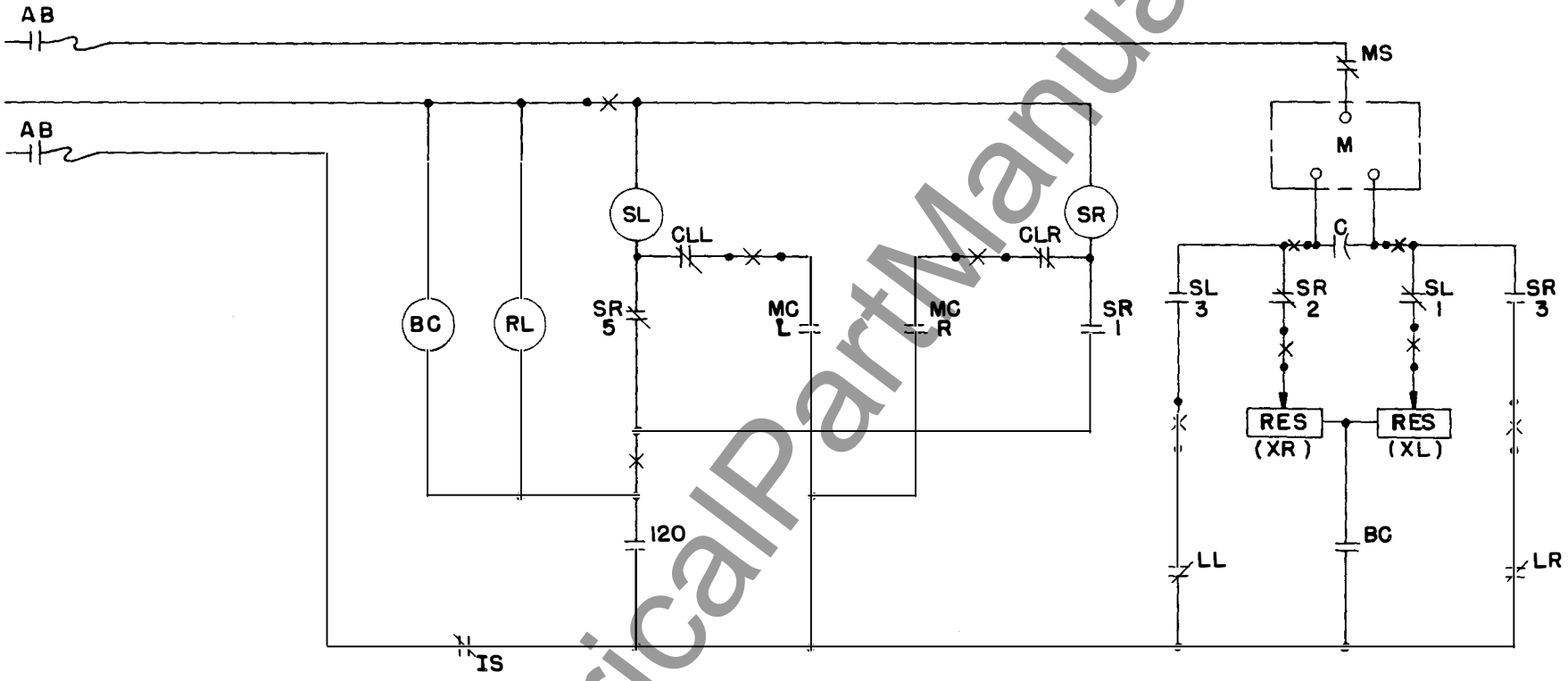


FIG. 7

TAP CHANGER ON NEUTRAL POSITION