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Instruction Book

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OPERATING MECHANISM

TYPE AH-10

Westinghouse Electric Corporation
Power Circuit Breaker Division, Trafford, Pa.

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LIST OF ILLUSTRATIONS

PART 1 - RECEIVING, HANDLING, and STORAGE

Each mechanism and its associated equipment is tested at the factory and should be in good condition when received. Inspection should be made immediately to see that no damage has occurred in shipment. If injury is evident, or indication of rough handling is visible, a claim for damage should be filed at once with the carrier (Transportation Company), and the nearest Westinghouse Sales Office notified promptly.

Unpacking should be done carefully to prevent damage, and all parts should be checked with the shipping list to insure against leaving any parts in the packing material. The mechanism should be accompanied by the proper identification tag and this instruction book.

If the mechanism is not placed in service immediately, it should be kept in a clean dry place, protected from corrosion and moisture. This may be accomplished by closing the mechanism housing and energizing the space heaters provided in it. This procedure is recommended even if it requires the use of a temporary wire circuit to the heaters. In case this is impracticable, all machined parts, especially on the latching surfaces of the latch and rollers should be coated with grease or some rust inhibiting material. Additional protection may be obtained by the use of silica gel, activated alumina or similar dehydrating agents. Two or three small bags of the material should be hung in the mechanism housing near the parts requiring protection. It should be remembered that complete protection may not be provided in spite of all of the above precautions and periodic inspections should be made to determine the condition of the apparatus.

PART 2 - DESCRIPTION

GENERAL

The following equipment will be designated as a complete operating mechanism.

1. An air compressor, air storage reservoir and the necessary attachments and accessories for controlling the air supply. (covered elsewhere)

2. A pneumatic cylinder which supplies energy for closing a circuit breaker or pole unit, a control valve, a lever system for modifying the force exerted by the piston to exceed, at all parts of a closing stroke, the loading imposed on the operating rods by the breaker, and a latch to hold the breaker in the closed position without sustained air pressure in the cylinder.

3. A trip-free linkage between the operating cylinder and the operating rods and a high speed trip which can release the trip-free linkage.

4. A control panel to provide necessary relays and interlocks for remote electrical control.

5. A number of accessories essential to the proper functioning of the unit such as retrieving spring assembly, auxiliary switches, a latch-check switch, space heaters, thermostat, fused knife switches for the establishing and protection of the electrical circuits, and terminal blocks for terminating all wiring where it will be readily accessible for connections on installation.

CLOSING PISTON-CYLINDER ASSEMBLY

The main closing piston W (Fig. 1) which is cast from a non-ferrous alloy is screwed on and locked to the piston rod. An adjustable packing gland around the piston rod, plus gaskets at the top and bottom of the cylinder combined with two piston rings on the main closing piston, minimize the air losses during closing operations. The cylinder is held between the top and bottom plate by four bolts passing through the plates. The whole assembly is then held to the main frame with four other bolts.

CLOSING PISTON DASHPOT

The closing piston has a dashpot which acts to reduce the speed of the piston before it strikes the bottom plate. As the mechanism approaches the closed position, a collar on the underside of the piston almost closes the opening in the bottom plate. This traps a small volume of air between the underside of the piston and the end of the cylinder providing pneumatic dashpot action.

CHECK VALVE FOR AIR CYLINDER

A check valve in the bottom plate of the air cylinder breaks the vacuum created in the dashpot when the mechanism starts to retrieve and thus facilitates faster retrieving operation.

RETRIEVING SPRING ASSEMBLY

The retrieving spring assembly (Fig. 1, N) consists of two springs, one next to the other which are compressed during the closing operation by the action of link P and

which supply the energy necessary to retrieve the piston and reset the trip-free linkage after the tripping operation has taken place.

TRIP MECHANISM ASSEMBLY

The trip mechanism assembly (Fig. 2) is a holding magnet and a system of levers which function to hold the roller lever U in position during closing and to release it during tripping. The force necessary to hold the roller lever in the closed position is supplied by a permanent magnet assembly F which holds the armature E in place. Tripping is accomplished by energizing trip coils G which tend to shift the magnetic flux produced by the permanent magnet from the armature to an alternate magnetic circuit to free the armature and thus release the roller lever.

A lever for tripping the breaker manually operates the trigger to release the roller lever.

CONTROL VALVE

The control valve combines both the inlet and exhaust functions in a single compact unit and is controlled by a single electro-pneumatic pilot valve as illustrated in Fig. 3.

The pilot magnet valve is double acting, i.e.: when the inlet seat is closed, the exhaust ports are open; see pilot magnet valve assembly. The pilot valve inlet has a lapped-in metal to metal seat and is spring biased closed. The inlet valve is opened either by energizing the pilot valve coil or by manually operating the pushbutton on top of the coil which in both cases moves the pilot valve plunger down. The inlet valve remains open only while the coil is kept energized or the button held down. As soon as the coil is de-energized or the button is released, the spring bias and air pressure close the inlet valve and open the exhaust valve.

The main inlet valve has a metal reinforced neoprene rubber disc seat to insure positive seating and dependable service. The valve is held tightly closed by a spring bias and the air pressure acting on the underside of the seat. The valve is opened by a separate piston which is located directly above and opens the valve by forcing down the valve stem. The inlet valve piston has a piston ring to keep the leakage to a minimum and insure obtaining full control air pressure above the piston for positive action. The valve is closed by the biasing spring assisted by air pressure under the inlet valve piston. This pressure is produced and regulated after the valve opens by two small bleeder holes, one through the bottom of the cylinder to admit air under pressure and one to atmosphere through the side wall of the valve body near the bottom of the inlet valve cylinder.

Because of the range of functions which the mechanism may be called upon to perform, there are two exhaust schemes offered in the control valve assembly Fig. 3 as follows:

1. Where only one reclosure is required, a slow acting "poppet" type of exhaust, which allows the pressure to leak down to a low value before exhausting rapidly.

2. For all breakers where immediate multiple reclosures are required, a fast acting exhaust valve is incorporated.

The slow exhaust valve consists of a poppet type valve, with a metal to metal seat. It is closed by a piston acted upon by control air and is spring biased to the open position. Because of leakage around the piston, the valve stays closed for a few seconds after the pilot valve is closed.

The fast exhaust valve consists of a freely floating piston which is maintained in the closed position by gravity when there is no air pressure through the control valve. The valve seat is undercut to provide access for the air pressure in the main closing cylinder to act on the underside of the exhaust valve piston seat. The piston on top of the valve has a larger area than the exposed area of the valve seat. Thus when the control air is admitted above the exhaust valve piston, there is a preponderance of force to maintain the valve closed. Whenever the control air is exhausted from above the piston, the closing air, acting on the exposed surface of the valve seat, creates a preponderance of force upwards to open the valve. Since the exhaust valve only has to retain the air during the short interval while the mechanism is closing, a metal to metal seat is satisfactory. The four holes through the step on the piston serve the dual purpose of:

1. Preventing a build-up of pressure in this space due to leakage of control air past the piston and

2. Preventing air being trapped in the space above the step on the piston when the valve opens.

The main components of the valve are made of a non-ferrous alloy. All moving parts such as valve stems and pistons are chromium plated to minimize galling and insure trouble free performance.

CONTROL SCHEME

To provide for remote and semi-automatic control of the admission of air to the mechanism, and the cutting off of the air at the end of a closing operation, a control panel is included as part of the standard equipment. The equipment on the standard panel mounted in the gas house includes a closing relay, a cut-off relay, and control knife switches. Referring to Fig. 6, the closing relay designated as "X" and the cut-off relay designated as "Y" are pictured in the de-energized position. The arrangement of the two relays as shown provides an electrically trip-free, non-pumping device and is commonly designated as an X-Y control scheme.

The electrically trip-free feature is provided by inserting an auxiliary switch contact designated as "aa" in the cut-off relay coil circuit, and a circuit opening contact of the cut-off relay in the closing relay circuit. The auxiliary switch known as the cut-off switch is mounted on the pneumatic mechanism and connected by a switch operating lever to a projection on lever P, (Fig. 1). Thus the position of its contacts are determined by the position of the mechanism closing piston. On a closing operation, as the mechanism approaches the closed position, the "aa" switch makes up its contact energizing the cut-off relay coil, and this in turn opens the cut-off relay contact in the closing relay coil circuit, which returns the closing relay to the de-energized position. Simultaneously the normally closed cut-off relay contacts in the pilot valve coil circuit open. To provide the non-pumping feature, a normally open cut-off relay contact is connected in parallel with the cut-off switch "aa" contact, and another normally open cut-off relay contact is connected in parallel with the low pressure cut-off and latch check switches. If the mechanism and its connected load fail to remain closed due to some mal-functioning part such as a broken latch, as soon as the mechanism has dropped open far enough to re-open the cut-off switch "aa" contacts, the cut-off relay contact in parallel with the "aa" contact remains closed maintaining the closing circuit "locked out". The closing circuit will continue to be "locked out" until the operator releases the control switch de-energizing the control circuit.

For those special applications where multiple immediate reclosures are required, the 2 pole cut-off switch is replaced with a 5 pole switch which permits two "bb" switch contacts to be inserted in the pilot valve coil circuit in series with the cut-off relay contacts. The "bb" contacts open the pilot valve coil circuit, resulting in faster cutting off of the closing air by eliminating the pickup time of the cut-off relay. This speeds up the retrieving action of the mechanism levers and triggers and makes possible faster successive reclosing times. Leaving the cut-off relay contacts in the circuit retains the anti-pumping feature.

AUXILIARY SWITCHES

In addition to the 2 pole cut-off switch, two independently adjustable 11 pole auxiliary switches are provided for use in interlocking, indicating, alarm and trip circuits. The 11 pole switches are operated by the mechanism bell crank lever (Fig. 1) and hence indicate the position of the pole unit or breaker.

LOW PRESSURE CUT-OUT SWITCH

To insure against the mechanism attempting to close when there is insufficient air pressure in the reservoir to complete the operation, a low pressure cut-out switch mounted in each pole unit and located in the air supply system between the inlet valve and the reservoir and on the mechanism side of the shut-off valve, has their contacts connected in series in the closing circuit. The low pressure cut-out switch contacts are normally closed, but open before the critical operating pressure is reached.

To further insure against a possible faulty operation due to the low pressure cut-out switch opening its contacts during a closing operation, a "make" contact of the closing relay is provided in parallel with the low pressure cut-out switch. As soon as the closing relay is energized, the "make" contact "seals itself in" and insures the admission of air to the mechanism to complete the closing operation. This "seal-in" contact also insures the completion of any closing operation once started, even though the operator might release the control switch before the mechanism has had time to complete the operation.

If the breaker is closed on a fault, and the operating pressure is near the lower limit, the low pressure cut-out switch contacts may open momentarily just after the breaker reaches the closed position. Should this occur while the operator is still maintaining the control switch closed, and after the cut-off relay has caused the "X" seal-in to drop out, the breaker would reclose. Employing a normally open cut-off relay contact in parallel with the low pressure cut-off switch insures against this faulty operation.

Additional contacts of the closing relay are situated in the intake pilot valve coil circuit to provide additional adjustment in the closing or reclosing time. Three contacts of the cut-off relay are also placed in this same circuit in order to speed up the de-energizing of the intake valve at the conclusion of the closing stroke as much as possible, and thus minimize the consumption of the stored compressed air per operation.

One of the fused knife switches on the control panel is provided to take the power off from the control circuit locally during maintenance periods and also provide overload protection. Other fused knife switches are provided for the same reason for the air and gas compressor motor circuits. A fused knife switch is provided in the heater circuit.

RECLOSING ADJUSTMENT SWITCH

Reference diagram 501F742. For reclosing duty, besides the addition of a reclosing relay such as the Type SGR-12 shown, an auxiliary switch indicated as "bb" on the diagram and located in the circuit from the recloser to the control relays is required. This switch which is normally open when the mechanism is closed, is capable of adjustment so that the point in the opening stroke at which it makes up its contact can be varied. The setting of this switch controls the amount of opening of the breaker before reclosing and consequently determines the reclosing time. The "bb" contact is located on the 2 pole or 5 pole auxiliary switch and has adjustable finger contacts for varying the switch setting. A time delay relay is superimposed in the recloser circuit to vary the reclosing time.

LATCH CHECK SWITCH

Reference diagram 501F742. To insure that the mechanism is completely retrieved and the trigger is fully engaged before any closing or reclosing operation (2nd or 3rd reclosure on multiple reclosing) is attempted electrically, an auxiliary switch indicated as LCH (latch check) on the diagram and located in the circuit between the closing circuit at the mechanism and the lead coming from the point of remote control is provided. This switch is operated mechanically by lever H. (Fig. 2) Lever H is linked to trigger B in such a way that the latch check switch makes up and allows the closing circuit to be completed only when the trigger B is in position to hold roller A.

For applications where the Type AA-10 mechanism is used for multiple reclosing duty, the switch determines the reclosing time by requiring that the energizing of the closing circuit be delayed until the mechanism is fully retrieved and the trigger reset following the tripping out of the breaker.

ACCESSORIES

Operation Counter

An operation counter is mounted on the two pole switch, and is operated by the switch operating arm. The counter records on the opening stroke.

Heaters

Two heaters are provided in the mechanism housing. One of these heaters is to be energized continuously winter and summer to maintain a temperature differential between the inside and outside to prevent undesirable moisture condensation within the housing. The other heater, thermostatically controlled, is suitably located to provide more heat and better heat distribution in colder weather.

Mechanical Interlocks

Mechanical interlocks are supplied, when required, to lock the breaker in the open position. On breakers furnished with mechanical interlocks, pulling the hand trip lever to the trip position opens the breaker at normal speed to the full open position. The mechanism can then be locked open by the key interlock while the hand trip lever is held in the tripped position.

Hand Closing Device

A removable hydraulic hand closing device is provided for maintenance operation only. It is inserted as shown in Fig. 1, and is used for closing the mechanism and its connected load during adjustment of the breaker. This device is not to be used for emergency manual closing of the breaker on a hot line.

Locking Bar

A locking bar is provided which, when inserted through two holes in the side plates on the frame, prevent the breaker from being opened. The bar blocks the roller lever and prevents opening of the mechanism and breaker even though the mechanism receives an electric or mechanical tripping impulse.

PART 3 - OPERATION

TRIP MECHANISM OPERATION

When the breaker is in the closed position, the forces biasing the breaker toward the open position are held in check through a lever system in the mechanism and a holding force exerted on an armature E by a permanent magnet F. Energizing of the trip coil shifts the holding flux away from the armature and releases the armature and lever D. Levers B, C and D rotate on C" axis initially as a unit. After the trigger B has moved up approximately 1/32 inch the force exerted by roller A acts on the other side of pin C' and the trigger B can move out of the way of roller A. The arm U is then free and the biasing springs open the breaker. The armature can return to the holding position as soon as the roller is released.

TRIP OPERATION

Figure 1 shows the circuit breaker operating mechanism Type AH-10 in the closed position. From this position a trip may be performed upon the release of roller A by the trip mechanism as described in the above section.

In the closed position horizontal pull rods Y are in tension and are attached by pins X' to lever X. These forces are applied by the torque bars in the interrupter heads and the accelerating springs at the outside ends of the horizontal pull rods. The forces on the horizontal rods are transferred through links R, S, T, and roller lever U to roller A. Force transferred to the roller lever (made less than the force in the horizontal rods by the mechanical ratios introduced in the mechanism) is resisted by the trigger which rests against roller A.

When the trip operation takes place the trigger B is moved out of the way and roller lever U pivots about pin U' allowing links T, S and R to move toward the open position. The mechanism moves about 50% to its open position when the projection on link K being rotated by the motions of links R, S and T pushes the nose of the closing latch M off the pin K' thus allowing the piston and associated straight line mechanism to move to its open position under the action of the retrieving springs N (Fig. 1). This operation pulls roller lever U back through the retrieve and to the closed position as shown in Figure 1. It should be noted that the breaker remains open during reset and that after the resetting operation is complete the breaker is again ready to be closed.

CLOSING OPERATION

During the closing operation the closing cylinder is subjected to high pressure air in such a way that the piston goes from its up position to its down position. This motion causes lever P to rotate downward and push the latch back and out of the way until the pin K' slips under the latch and is caught in that position. At this point the mechanism is latched closed. The other links S, K and R in the meantime have rotated to the closed position and forced the horizontal pull rods to the closed position which closes the breaker. Note that pivot point T' does not move during this operation and that the associated linkage T, U and the trip mechanism does not move.

PART 4 - INSPECTION, MAINTENANCE, ADJUSTMENT

Since operating conditions vary so greatly from one area to another and even between installations in the same locality, it is difficult to recommend any time interval for inspection and maintenance. The important consideration is that a regular schedule is established and maintained in order that the condition of the equipment is known, and any deficiencies be found and corrected before they can develop into a serious condition. The circuit breaker is highly dependent upon the proper functioning of the mechanism which, therefore, should always be kept in good condition.

MAINTENANCE

Caution

When working around the mechanism or breaker and when the pneumatic system is not being tested or used, CLOSE the hand valve between the reservoir and mechanism or drain the mechanism air reservoir and open the control circuit at the control panel so that accidental operation of the intake valve or closing contactor will not cause the breaker to close unexpectedly. As a further safety precaution, it is recommended that the pushbutton on top of the pilot valve be depressed momentarily to exhaust the high pressure air between the hand shut off valve and the control valve.

When working around the mechanism or breaker, accidental tripping either electric or manual can be prevented by inserting the locking bar.

Personnel should be cautioned to keep all tools and especially their hands outside of the side plates of the frame whenever the mechanism is in the closed and latched position. This is especially true of the space immediately in front of the roller lever, as this lever travels at a very fast speed and could result in serious injury if this precaution is not observed.

In order to be sure of the mechanisms good condition and to check its readiness for satisfactory operation, especially in applications where the mechanism is not called on to operate for extended periods of time, several operations should be made at each inspection period.

Before returning the breaker to service be sure the locking bar has been removed.

LATCHES AND TRIGGERS

The latch is made of hardened steel machined to shape with the latching surfaces ground smooth after hardening. The trigger is cast from a tough high strength non-ferrous alloy with a corrosion resistant stellite insert at the latching surface. The engaging surfaces of the latch and trigger may be polished with fine emery cloth if they become dirty. DO NOT ATTEMPT TO GRIND THE SURFACES NOR CHANGE THEIR ANGLE. Apply a thin film of rust inhibitor S#1802 395 (M9921-r) to the engaging surfaces of the latch and rollers. This inhibitor should be carefully selected to be free-flowing at all anticipated temperatures, non-hardening, and self-healing (does not completely wipe off in one operation). The latching surfaces should be examined at every inspection to make sure that they are not gummed up.

The roller bearings in the mechanism are packed with Westinghouse Grease S#1802 395 and should not require repacking more often than every 18 months.

AIR LEAKAGES

Overall

A good overall check for air leaks in the air supply system is to determine the rate of pressure loss. If the reservoir has just been filled from atmospheric pressure, allow the system to cool for about 2 hours before starting the readings, otherwise a pressure drop of a few pounds caused by contraction of the air on cooling will be included. When the mechanisms leave the factory, the air system will not lose more than two or three pounds per square inch per hour, but there is no need for alarm if the leakage exceeds this figure somewhat, unless it becomes progressively worse.

As a protective measure before the mechanism assembly leaves the factory, the air cleaner is removed and the compressor run for several minutes while atomized oil is drawn in through the air intake. Therefore when the breaker is first put into service, this oil may show up either in the air exhausted from the control valve or in the air discharge from the reservoir whenever the condensate is blown out. Evidence of oil at these points is normal and expected and should not be cause for alarm.

Inlet Valve

The first place to check for leaks is the pilot valve. Cover one of the two exhaust ports, that come out of either side of the housing directly under the coil, with a finger and apply a soap solution over the other port. Leakage here is generally due to dirt particles on the valve seat. "Cracking" the valve several times by pressing on the pushbutton momentarily will generally dislodge the dirt and make the valve seal properly. However if this proves unsuccessful, refer to instructions on pilot magnet valve.

Checking for leaks of the main inlet valve can be accomplished easily for the valve assembly employing the "fast exhaust". Apply a soap solution over the bleeder hole through the right hand side of the valve body. If a leak is detected here, it indicates that the main inlet valve is not sealing properly. For valve assemblies using the "slow exhaust", it is necessary to first remove the exhaust assembly from the valve body and either close off the exhaust by tightening up the nut on the lower end of the valve stem and then reassembling the exhaust assembly in the valve body or otherwise sealing of the exhaust opening before checking for a leak through the bleeder hole. The quickest method of stopping a leak and one that generally is successful is to "crack" the valve several times by depressing momentarily the pushbutton on the pilot valve. The valve can be removed for inspection of the rubber disc seat by removing the cover on the underside of the valve body.

If the leak is not connected with the control valve, all air connections including the safety valve should be checked with soap solution.

PILOT MAGNET VALVE

General Description

Referring to Pilot Valve Assembly, when the pilot valve coil is energized, the armature depresses the upper stem which in turn pushes the lower stem to admit air from the storage reservoir through a small port (lower valve seat). At the same time, the lower end of the upper stem seats on the upper valve seat to prevent air from escaping through the exhaust port. When the pilot valve is de-energized, a spring closes the lower valve, while the upper valve opens to exhaust air from the main control valve to atmosphere.

Repair

It is generally recommended that a complete valve with coil be carried as a renewal part for important power station installations rather than attempting to repair this small pilot valve. However, for those operators that do wish to attempt maintenance of this valve, the following paragraphs may be helpful. In any case, we seriously recommend carrying at least one complete spare valve with coil for emergency use, so that a faulty valve may be removed and repaired when convenient.

Inlet Valve Leakage

Occasionally a pilot valve may "blow" (that is, give out a hissing sound) due to leakage of air; if this occurs when the magnet coil is de-energized and the air blows out the exhaust port, it is an indication that the lower (inlet) valve is not seating properly. This trouble is caused generally by the presence of a little dirt on the valve seat and in most cases can be relieved by popping the valve quickly with the manual button several times. If the blowing persists, shut off the hand valve in the supply line from the storage reservoir and unscrew the plug at the bottom of the magnet valve. Carefully lower the plug straight down, so that the spring and lower valve stem drop down with it. Wipe the valve stem perfectly clean and also clean the valve seat with a small stick and piece of cloth. It is also helpful to smooth the valve seat by spinning the lower stem on its seat with a screw driver several times. The upper stem should be in place to act as a guide. Use machine oil on the seat to prevent scoring.

When replacing the lower valve stem, spring and plug, first remove the cover by taking out the screw in order to prevent bending the lower stem. With the cover and armature removed, it will be obvious if the lower stem does not enter the upper stem properly, as the latter would be raised.

Exhaust Valve Leakage

If the valve "blows" through the exhaust port when the pilot coil is energized, it is an indication that the exhaust valve is not seating properly. This may be due to any one of the following causes:

a) Dirt on valve seat.
b) Dirt under magnet valve armature.
c) Low voltage applied to magnet coil.
d) Upper valve stem worn down so that armature strikes the core before valve seats.

To remove upper stem it is not necessary to shut off the air. First remove cover and armature. Next place fingers over exhaust ports and press down valve stem and release quickly so that air pressure will raise stem far enough to grasp for removal. Wipe valve stem clean and examine for seating imperfections. If grinding appears to be necessary, follow instructions below.

Another possible but not too likely cause of a blowing exhaust valve is a stem worn down so short that the armature strikes the magnet core before the valve seats. Shut off the air and carefully measure how far the stem protrudes above the magnet core when depressed and seated (Figure 4). This dimension corresponds to the closed armature air gap which is .052" normal as shown. Replace the valve stem only if this dimension is less than .032". If it is necessary to install a new stem, the end must be filed down to get .052 - .054" dimension, since new stems always come long.

Grinding Valves

If it becomes necessary to grind the valves to cure leakage, use a fine grade of regular valve grinding compound or make a thin paste of finely ground pumice and machine oil. Apply a little grinding compound on the valve seat, and spin valve stems back and forth on their seats with a screw driver. When grinding the lower valve, the upper stem should be in place to act as a guide.

After grinding the stems, the valve seats should be thoroughly cleaned with gasoline and blown out with air.

Replacing Coil (Pilot Valve)

To replace a coil, first remove cover, armature, and set screw. Next remove magnet core, using special spanner wrench S#757 466. Finally remove box, and coil may be removed readily.

Replacement of Trip Coil

In the same manner as a pull-off test would be performed (See Fig. 5: Adjustment, Step 5) insert the pull-off tool on the hex shaft C" (See Figures 2 and 5). Pull the armature E, of the magnet and insert a piece of cardboard between the surfaces of the magnet and the armature.

Remove the pull-off tool and loosen bolt D' which clamps the arm D to the hex shaft. Loosen the four bolts K and remove them so that the magnet, armature and arm may be slipped off the shaft and removed from the trip assembly. Remove the coils and replace with new coils. Be sure the polarity markings on the coil casings where the terminals enter the epoxy are located in the assembly as shown in Figure 4. Replace the magnet assembly and the four bolts holding the magnet assembly to the trip mechanism but do not tighten them. Replace the armature arm assembly on the hex shaft making sure that the cardboard is placed such that the sliding surfaces on the armature and the magnet are not allowed to touch during the time that the sliding takes place. Tighten the bolt D' making sure that the armature is centrally located with respect to the pole faces of the magnet. The scribe lines on the armature should line up directly with the inside edges of the pole faces. After the alignment has been accomplished tighten the four bolts holding the magnet assembly to the main trip assembly. With the pull-off tool and a torque wrench pull the armature off, remove the cardboard separating the armature and the magnet pole faces, let the armature reset and again check the alignment of the armature and magnet. If alignment is not correct replace the cardboard and reset the magnet.

Replacement of Magnet Assembly

Should it be necessary to replace the magnet assembly in the field, the trip mechanism must be adjusted using shims L (Figure 2). This operation should be accomplished with the trip mechanism removed from the breaker.

Remove levers I and H by removing pin I'. Reinsert pin I'. Measure the dimension Z with a micrometer. Dimension Z is measured from the top of pin I' to the bottom most point on trigger B (maximum measurable distance). By adjusting the shims (L) the dimension Z should be 1.475 to 1.485 in. A 2:1 ratio exists between the trigger dimension change and the shim change.

ADJUSTMENTS

Pressure Gauge

It is advisable to check the pressure gauge with a master gauge to verify the accuracy of the indication before checking the pressure switch adjustments.

Pressure Switches

At each regular inspection period the settings of the pressure switches should be checked against the values stamped on the mechanism nameplate.

Governor Switch

Pressures higher than normal will cause the breaker to slam hard on closing, while pressures lower than normal reduce the amount of energy stored in the reservoir. If the pressure at the time the compressor has just completed recharging the reservoir indicates that the switch is not cutting off at the proper pressure, and if the differential has been previously adjusted correctly at the factory, the cut-off pressure may be corrected by adjusting the slotted knurled stud on top of the switch. With the differential set, adjustment of the slotted knurled stud on top of the switch will change the cut-in and cut-out pressure by a like amount. If the settings are off excessively, as would be the case when installing a complete new pressure switch, the procedure to follow is as follows: Set the cut-in pressure to the value stamped on the mechanism nameplate by adjusting the slotted knurled stud on top of the switch and set the cut-out pressure by adjusting the differential adjusting screw located on the right hand side of switch box under the cover.

Low Pressure Cut-Off Switch

Too low a setting of the low pressure cut-off switch, nullifies the purpose of the switch: i.e., to prevent the mechanism from attempting to close when there is insufficient air pressure to complete the operation. Too high a setting would result in the switch opening prematurely and thereby reduce the number of operations that are possible unnecessarily from a fully charged reservoir.

The governor switch is normally set to start the compressor at a pressure well above the operating pressure of the cut-out switch, thus the cut-out switch is not normally called on to operate except in the event the compressor is out of operation. Since this switch may remain idle over long periods, its readiness to operate in an emergency should be checked at each inspection period.

Low Pressure Alarm Switch

The low pressure alarm switch is intended to give a warning to the operator in the event that the compressor fails to recharge the reservoir. Therefore, in order to forestall erroneous indication of the alarm, the setting of the alarm switch should be checked.

Safety Valve

To insure against overloading the pneumatic system or damage to the mechanism and breaker from operating at excessive pressures in the event of failure of the governor switch to cut off the compressor, the safety valve is set to open at 110 to 115 percent of normal pressure.

Mechanical Adjustment

The dimensions and instructions given in Figure 5 are essential to the correct functioning of the AH-10 mechanism. An adjusting "trip gauge" is provided to check the 0.405 -0.420 and 0.450 -0.455 dimension.

Overtravel Check

Jack the breaker closed so that the closing latch has made up and the breaker is in the fully closed position. Release the pressure on the jack and measure from the bottom of the lower base plate of the piston cylinder assembly to the bottom of the piston skirt.

Jack the breaker into overtravel position being sure to cease jacking when the piston stops moving. Again, measure the difference between the bottom of the lower base plate to the bottom of the piston skirt. The difference between the measurement in the closed position and the overtravel position should be 1/8" -0 +1/32".

If the overtravel is less than specified place a shim in position W' in order to obtain the correct overtravel. The shim used should be the same thickness as necessary to make up the difference between the measured overtravel and the specified overtravel.

PART 5 - MANUAL OPERATION OF THE BREAKER

Manual closing operation of the breaker is provided for maintenance purposes only. The breaker must not be closed manually when connected to an energized circuit.

Closing the Breaker

A hydraulic jack is supplied with the breaker for the manual closing operation and should be used in the following manner:

Place the jack V in position as shown in Figure 1 (Open) making sure that its ramrod is in the fully depressed position. Place the rod V' on top of the jack ramrod and slide the pin V" through the holes in right far end of the lever P. The breaker is now ready to be closed. Close the breaker by pumping until the latch M has been pushed back and snaps over the top of the pin K' to the latch position. When this happens a distinct click will be heard. At this point release the pressure on the jack - the breaker is in the fully closed position.

Opening the Breaker Without Tripping

While opening the mechanism from the closed position with the jack great care should be exercised at all times. The breaker should be jacked into overtravel, that is, the pin K' should not be resting against the latching surface. When the breaker is in overtravel the latch will be free. Using a stick of wood, approximately 2 to 3 feet long and about two inches square, apply pressure at the top of latch M in such a way that the latch frees pin K'. When the closing latch M has been fully depressed, the oil in the hydraulic jack may be released gradually and the mechanism and breaker will open slowly. Remove the stick of wood as soon as the latch M begins ride on pin K'. As soon as the pin K' has come up to a point where the latch M can no longer restrain it, the pressure on the latch may be removed. It should be noted that the trip mechanism remains inoperative during this time and also the pin T' remains in a fixed position.

PART 6 - TROUBLE SHOOTING SUGGESTIONS

A. If the Mechanism Fails to Close the Breaker.

1. Check to see that the correct control voltage is available.

2. Check the closing relay to see that it closes its contacts.

3. Check the inlet valve coil circuit.

4. Check the pressure of the air in the reservoir to see that it agrees with normal pressure given on the nameplate.

5. Check the position of the hand shut-off valve between the reservoir and the mechanism if the breaker is so equipped.

6. Check the admission of air to the main closing cylinder by observing whether the mechanism starts to close when the button on the pilot valve is bumped and and also that there is a momentary discharge from the exhaust, when the button on the pilot valve is released.

7. Check to be sure the three screws holding the valve assembly to the piston cylinder assembly are secure.

8. Check to see that the trip mechanism and roller lever arm are in reset positions.

9. Check to see that magnet pole faces and the armature surfaces are clean and undamaged.

B. If the Mechanism Closes the Breaker but Fails to Keep it Closed.

1. Check the two pole switch contacts to see if they are closing too soon, so as to cut off the air to the cylinder before the mechanism is fully closed and latched.

2. Check to see that the overtravel of the piston cylinder assembly is correct.

3. Check to be sure that the main closing stops of the horizontal rods are adjusted correctly.

4. Check the adjustments of the trip mechanism with respect to the breaker as described under trip mechanism adjustment.

5. Check to be sure that the air pressure in the reservoir agrees with the normal pressure given on the nameplate.

6. Check for excessive leakage between the cylinder and piston.

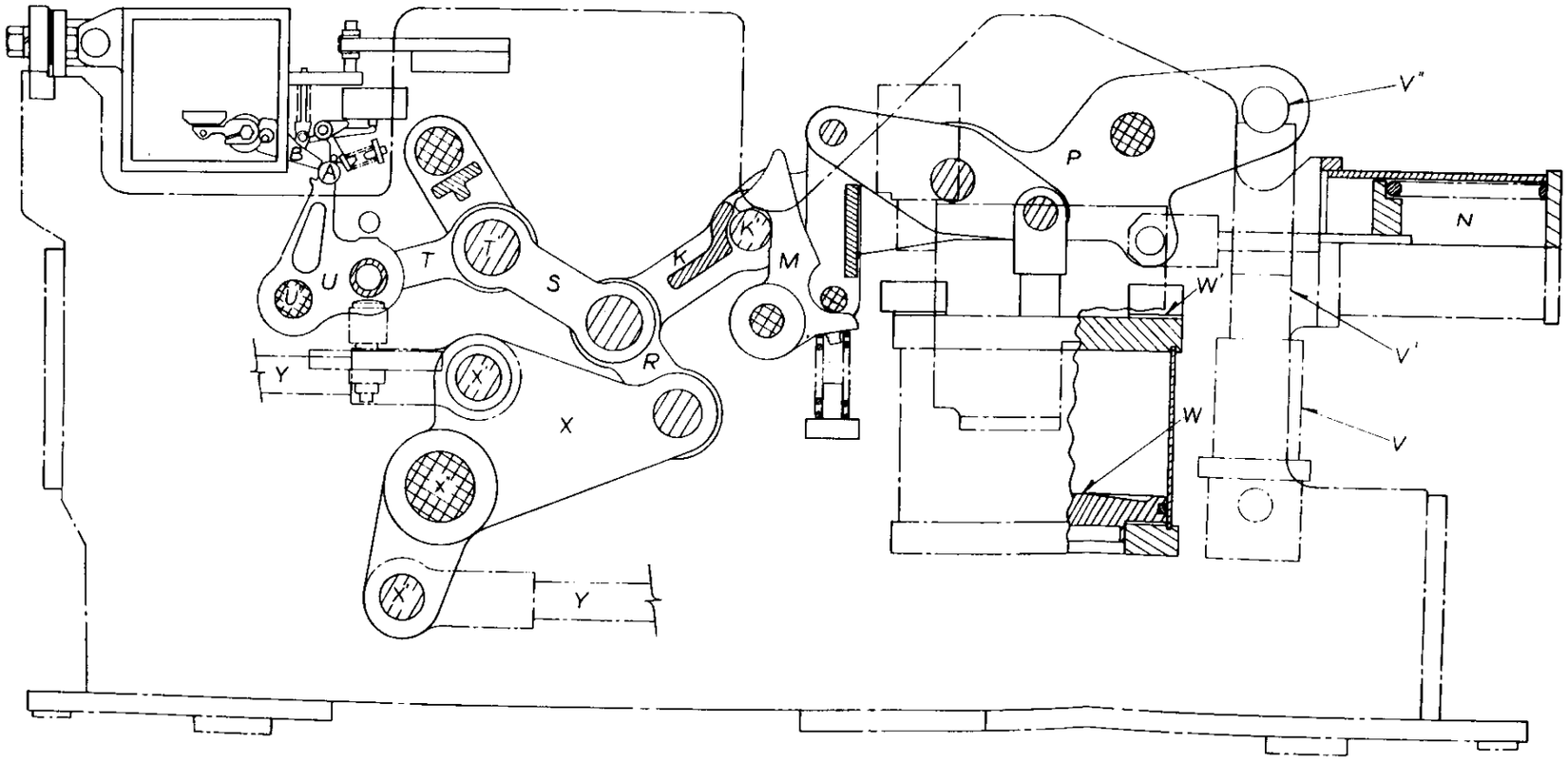
C. If the Mechanism Fails to Trip.

1. Check the voltage across the trip coil circuit.

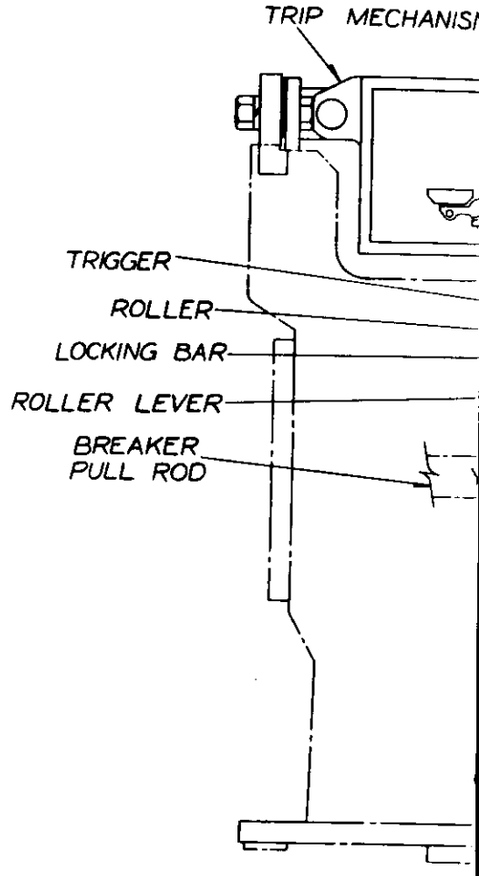
2. Check the terminals on the eleven pole auxiliary switch to be sure that they are making good contact.

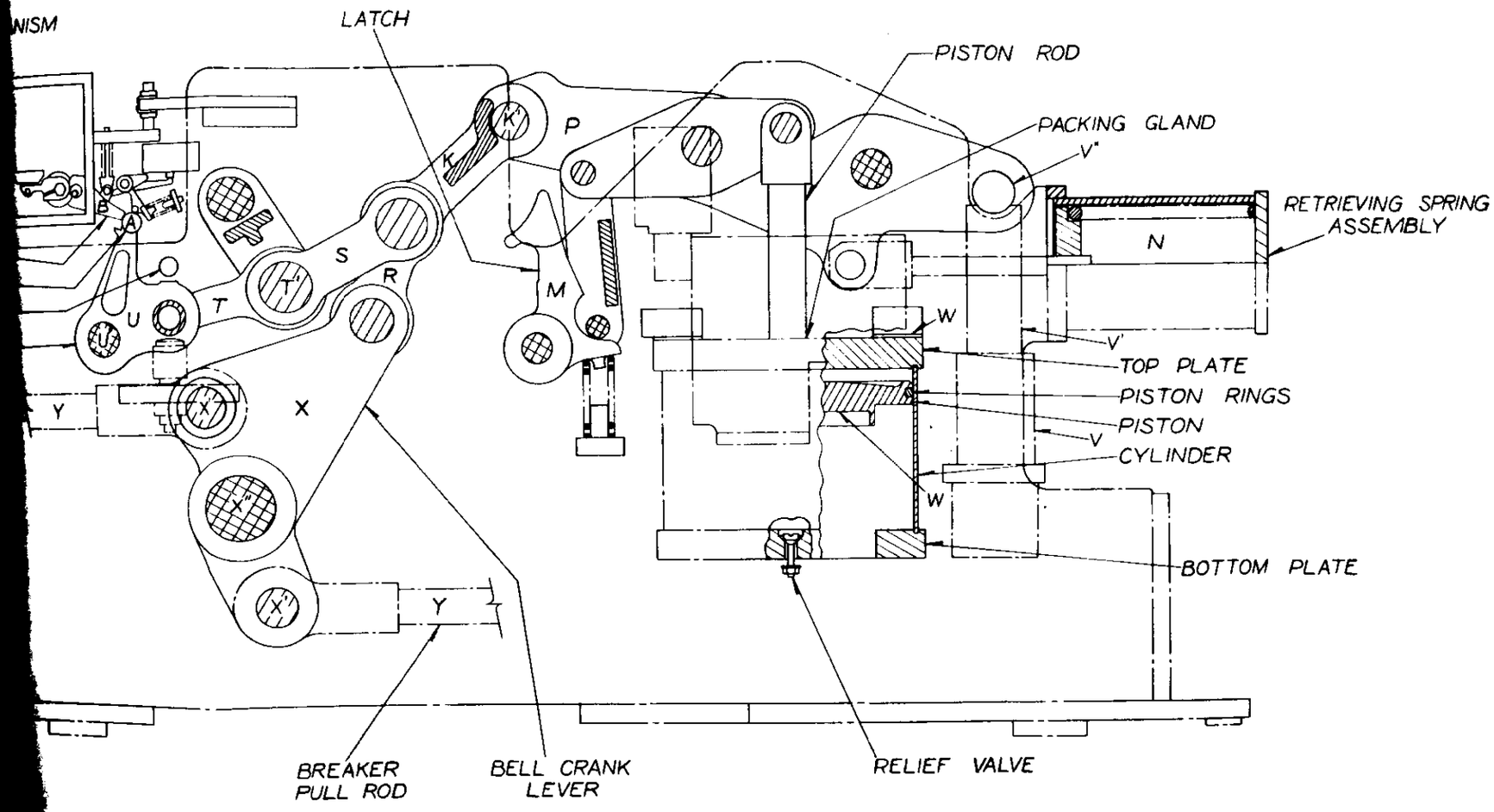
3. Observe whether the trip armature releases from the magnet when the trip circuit is energized.

4. Check that the locking bar has not been left in position to block tripping.

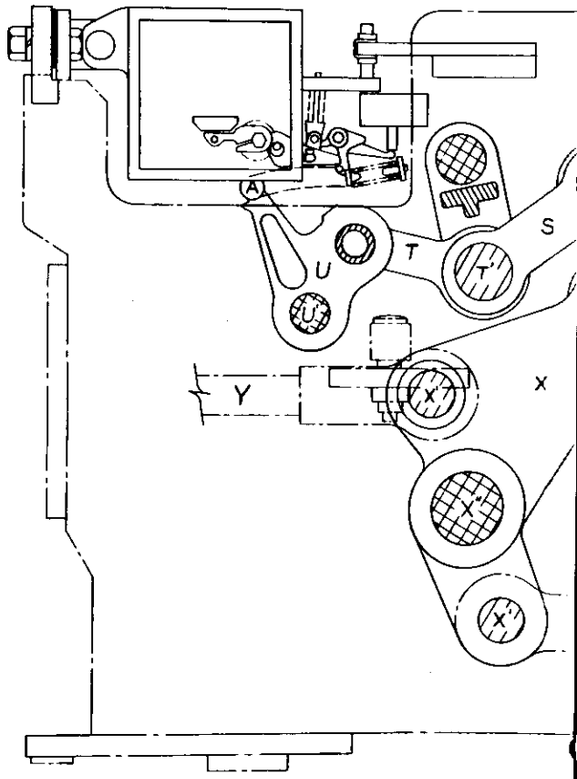


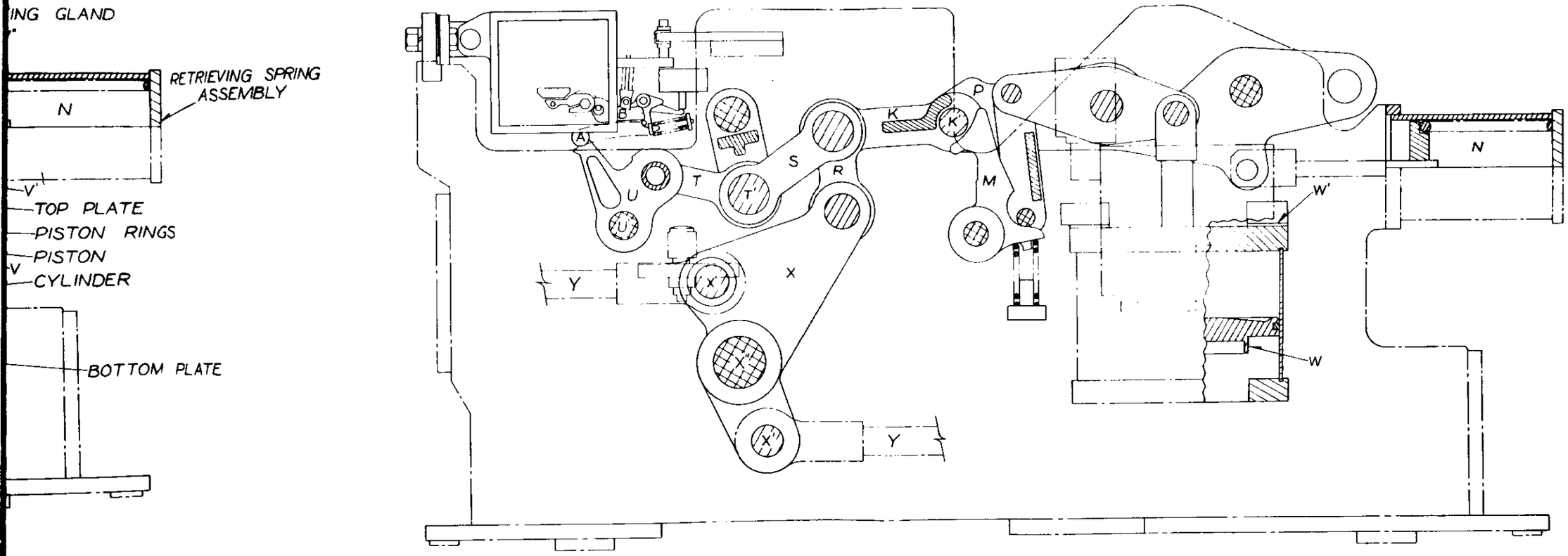
CLOSED POSITION





OPEN POSITION




ING GLAND
RETRIEVING SPRING ASSEMBLY
N
V'
TOP PLATE
PISTON RINGS
PISTON
V
CYLINDER
BOTTOM PLATE
A
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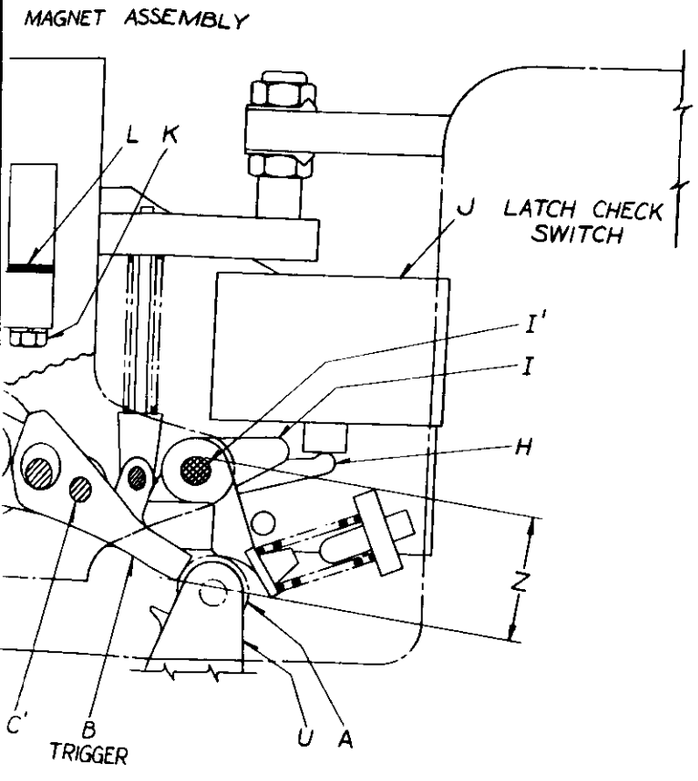
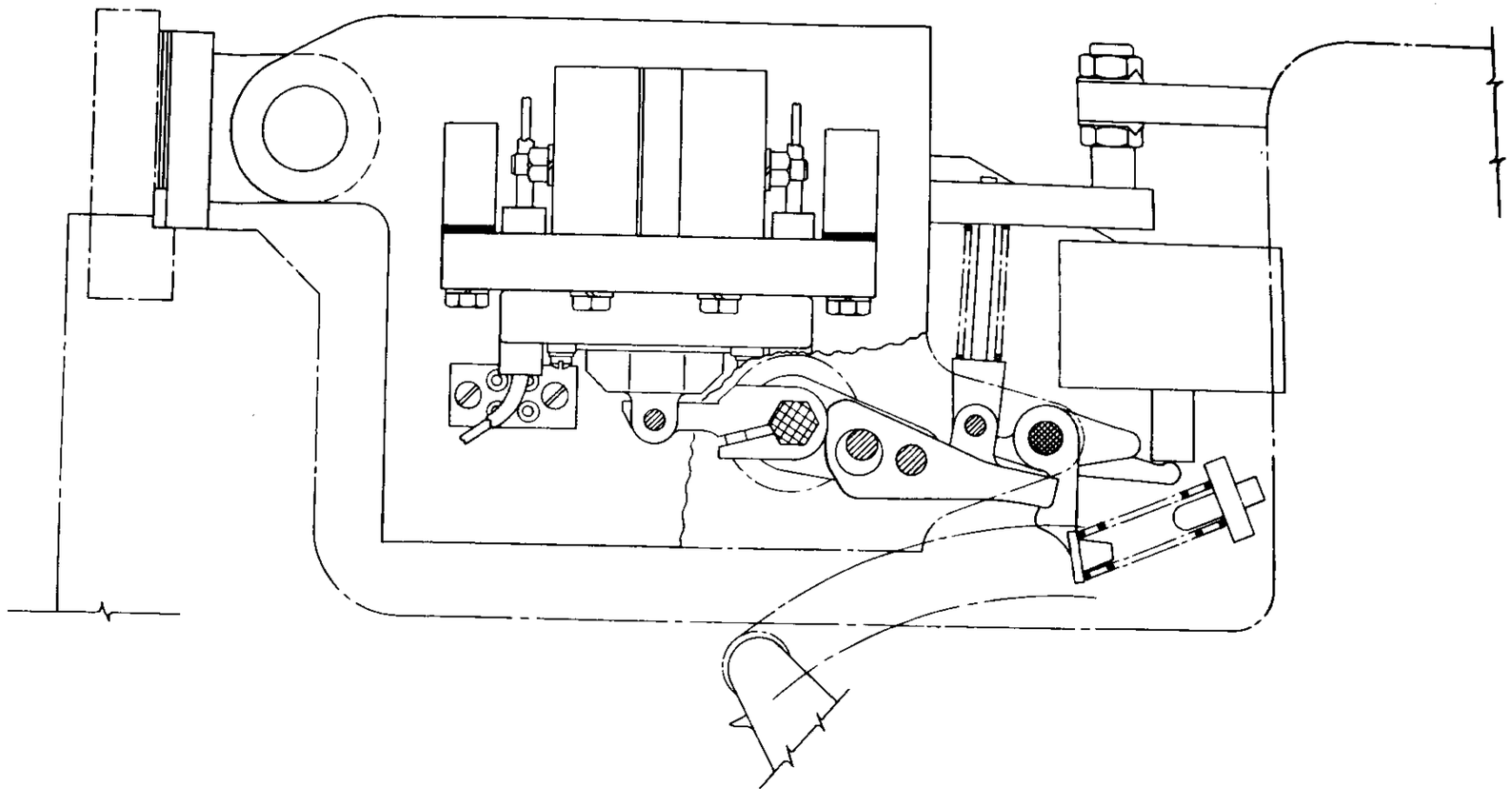
RETRIEVE

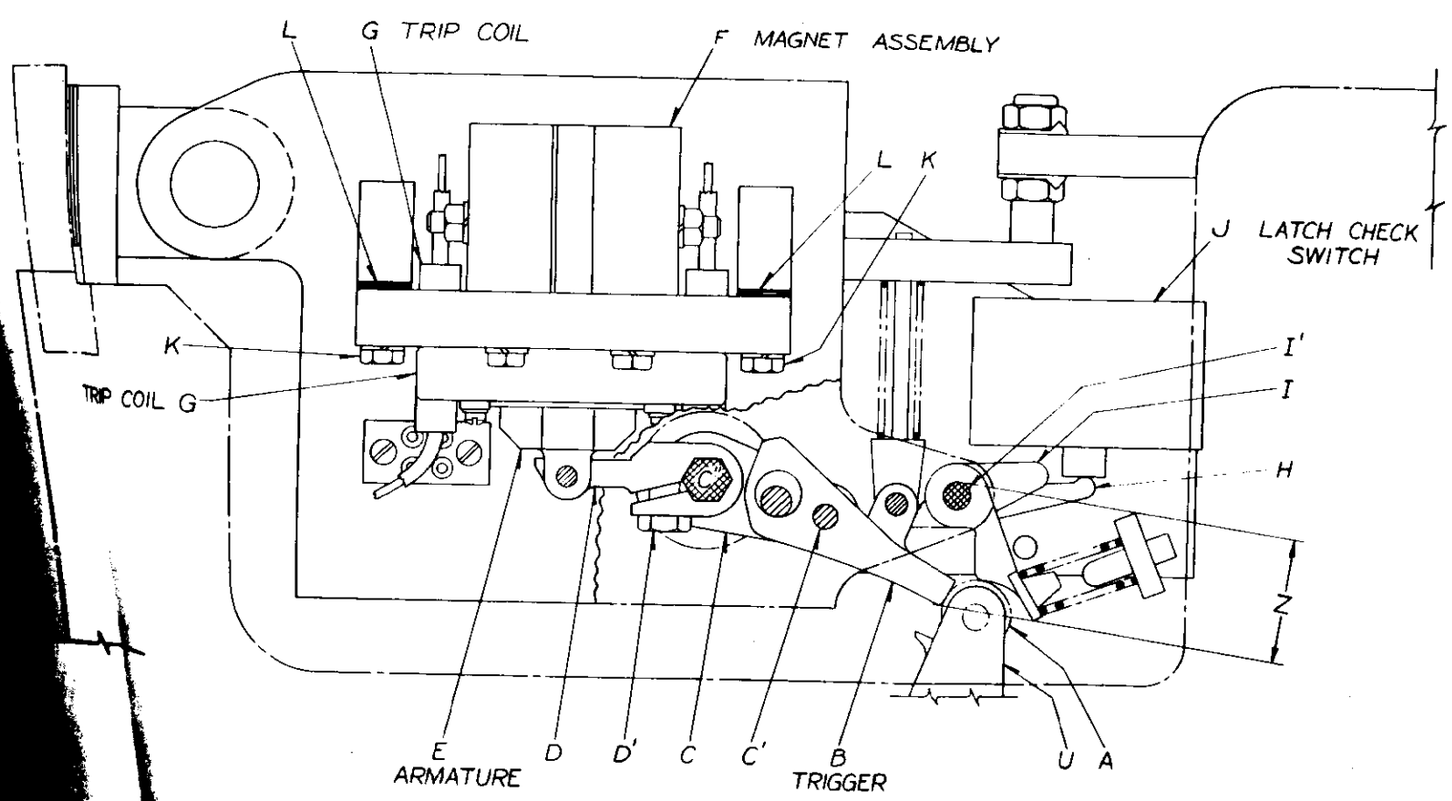


& OPEN POSITION

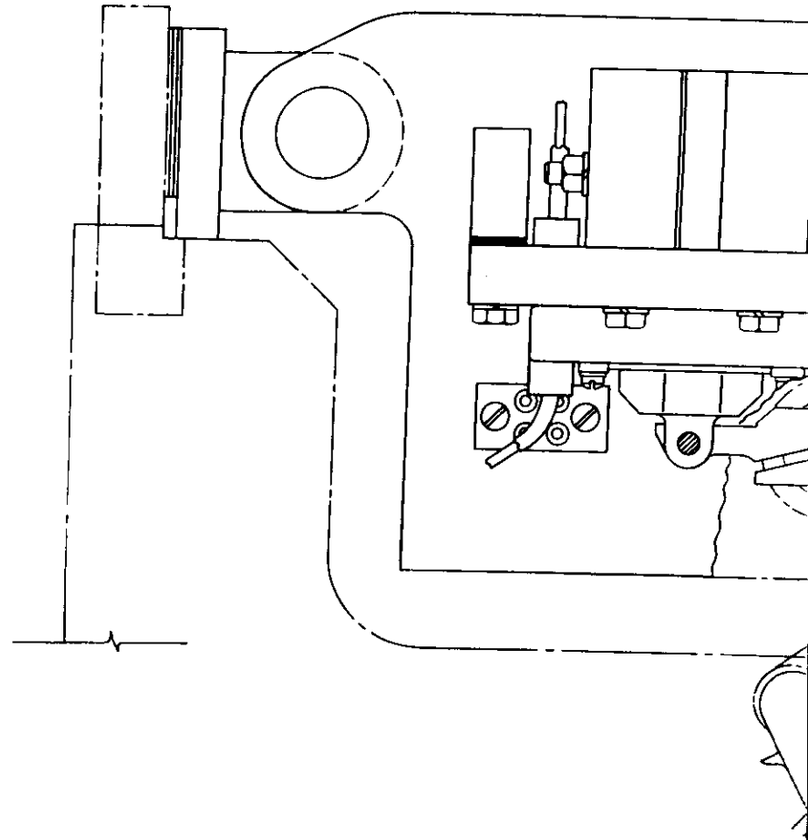


TRIP MECHANISM RETRIEVING POSITION

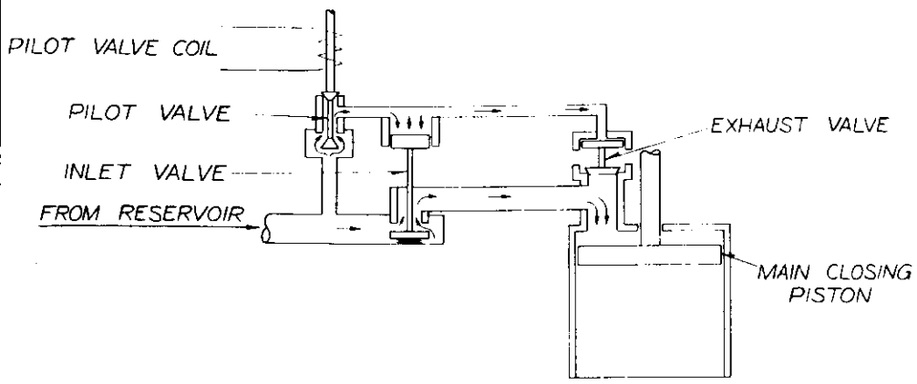
FIG. 2 Trip Mechanism



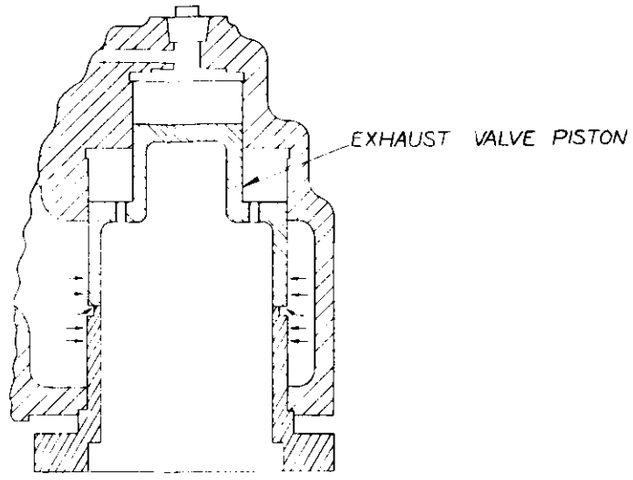
TRIP MECHANISM CLOSED & OPEN POSITION



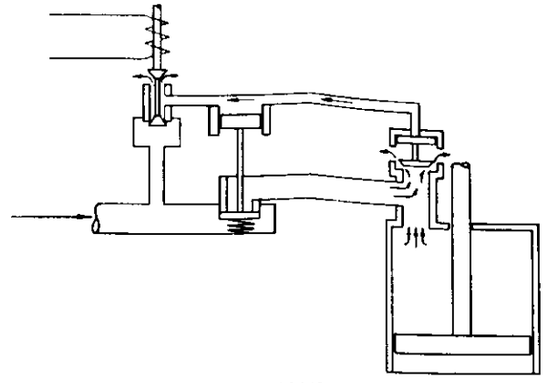
TRIP MECHANISM RET



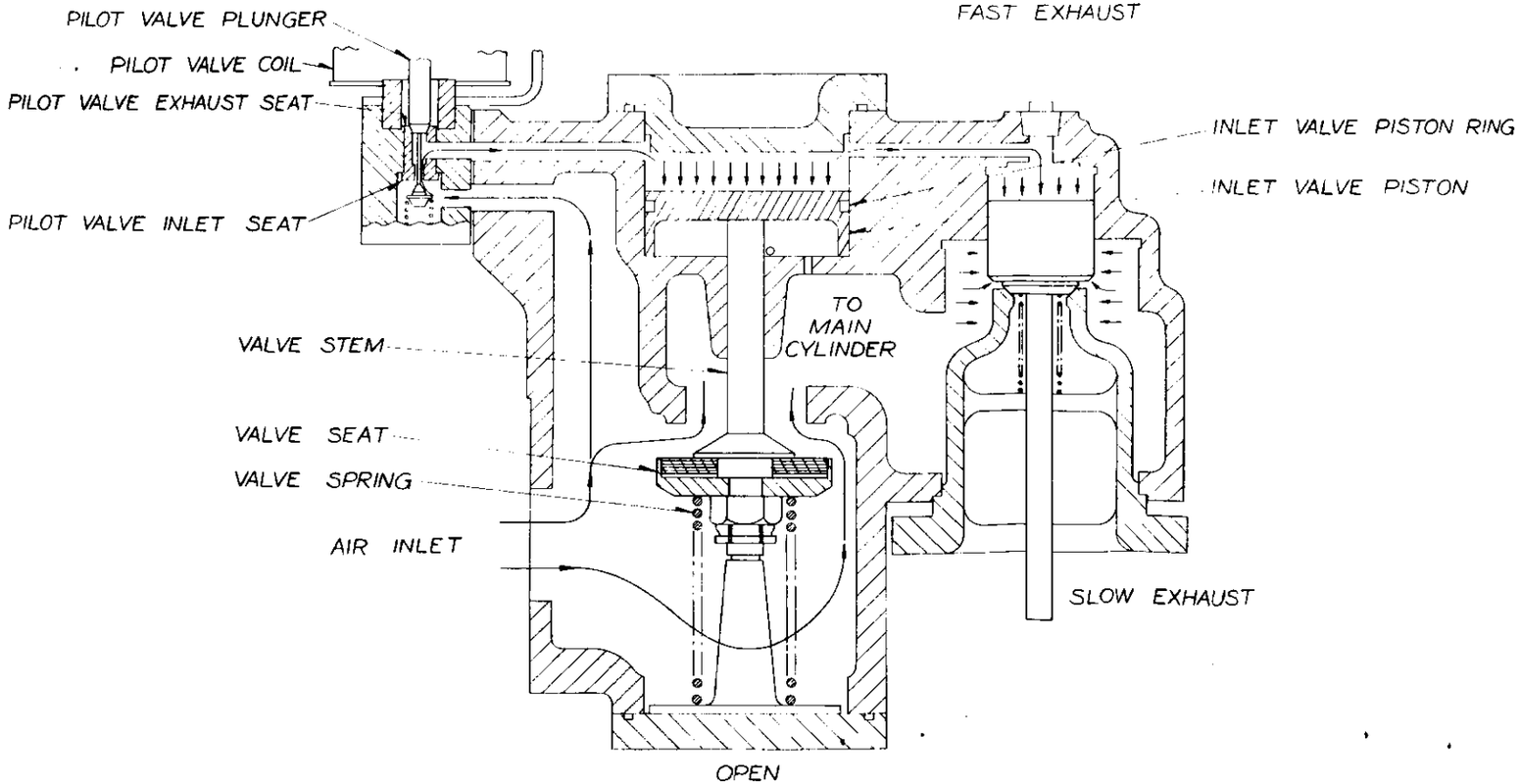
OPEN
SCHEMATIC OF CONTROL VALVE



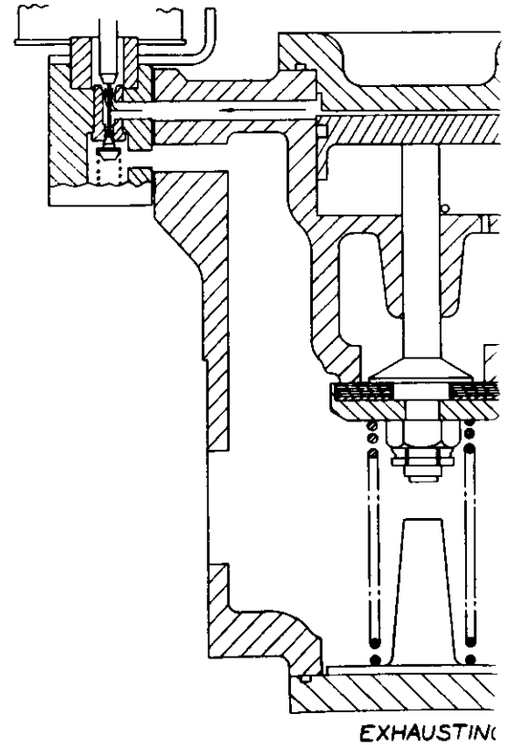
FAST EXHAUST



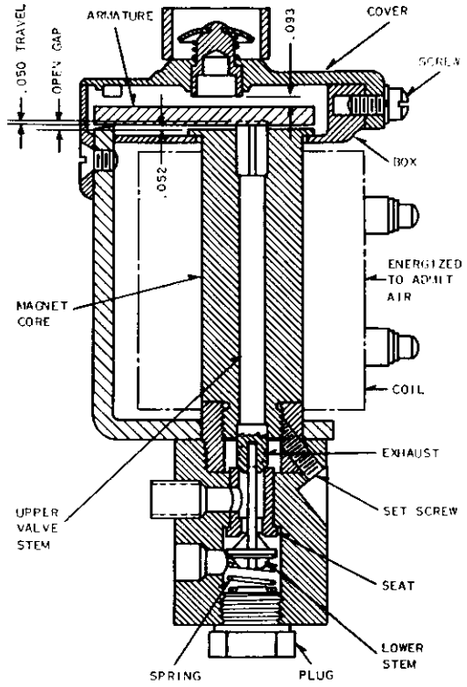
EXHAUSTING
SCHEMATIC OF CONTROL VALVE



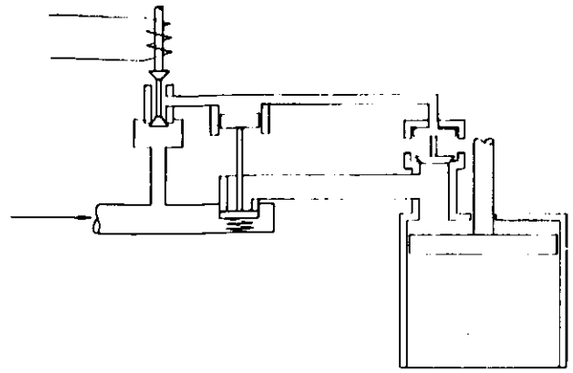
OPEN



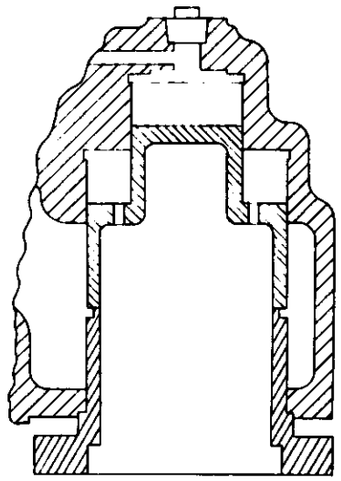
EXHAUSTIN



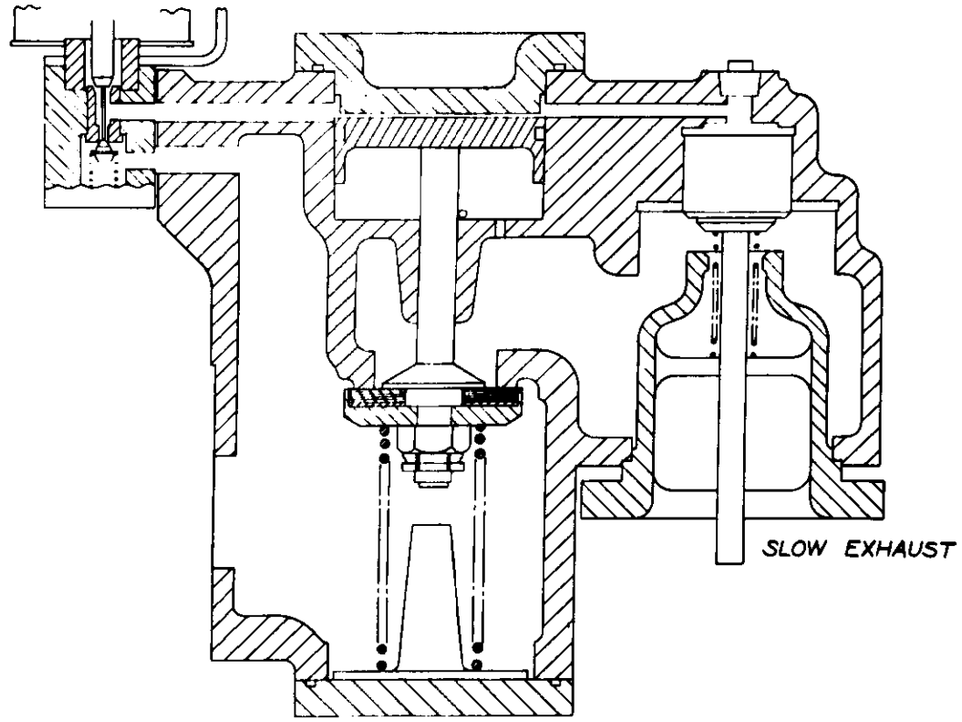
PILOT MAGNET VALVE ASSEMBLY



CLOSED
SCHEMATIC OF CONTROL VALVE

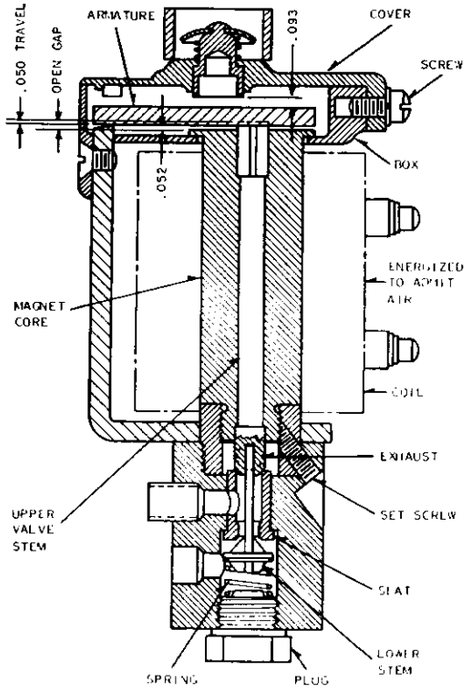


FAST EXHAUST

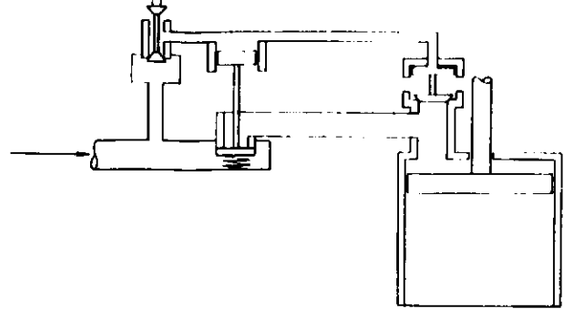


SLOW EXHAUST

CLOSED



PILOT MAGNET VALVE ASSEMBLY



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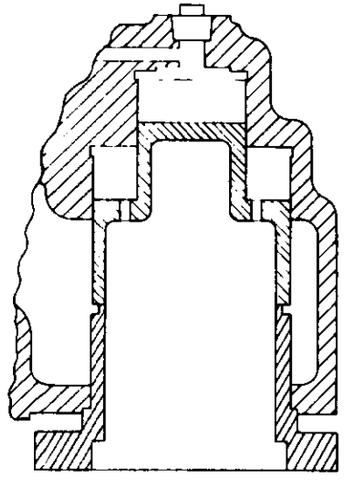
SCHEMATIC OF CONTROL VALVE



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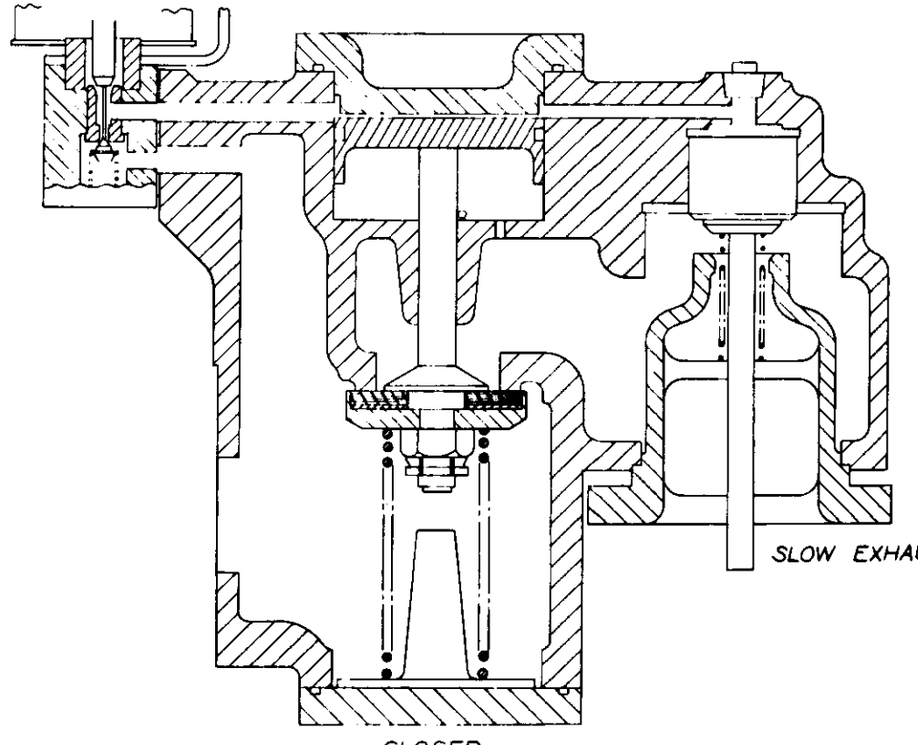
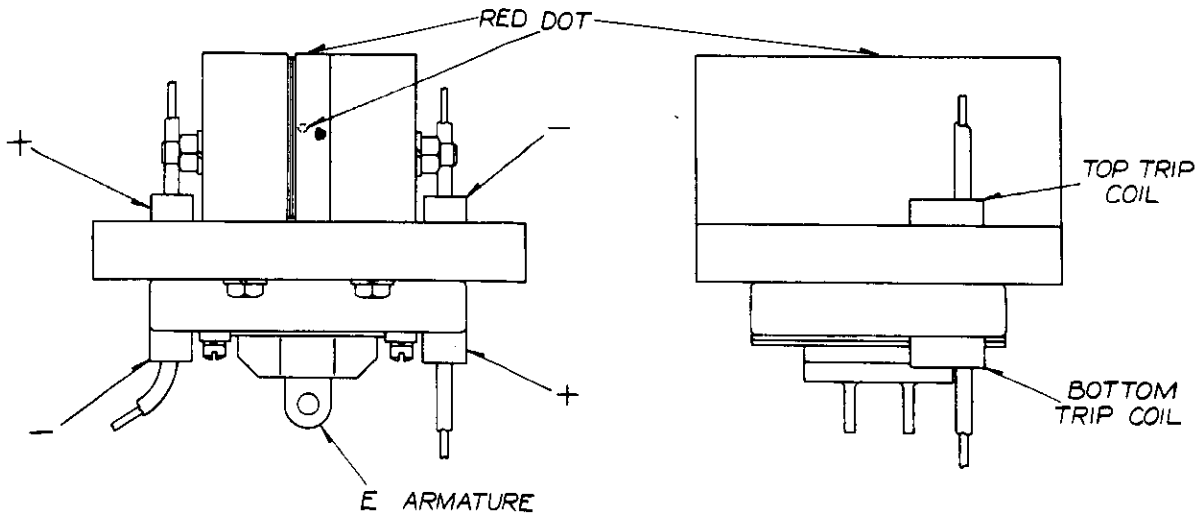
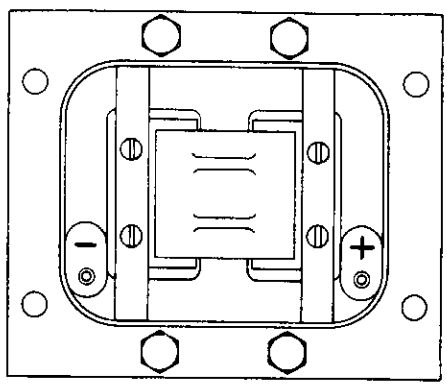


SLOW EXHAUST

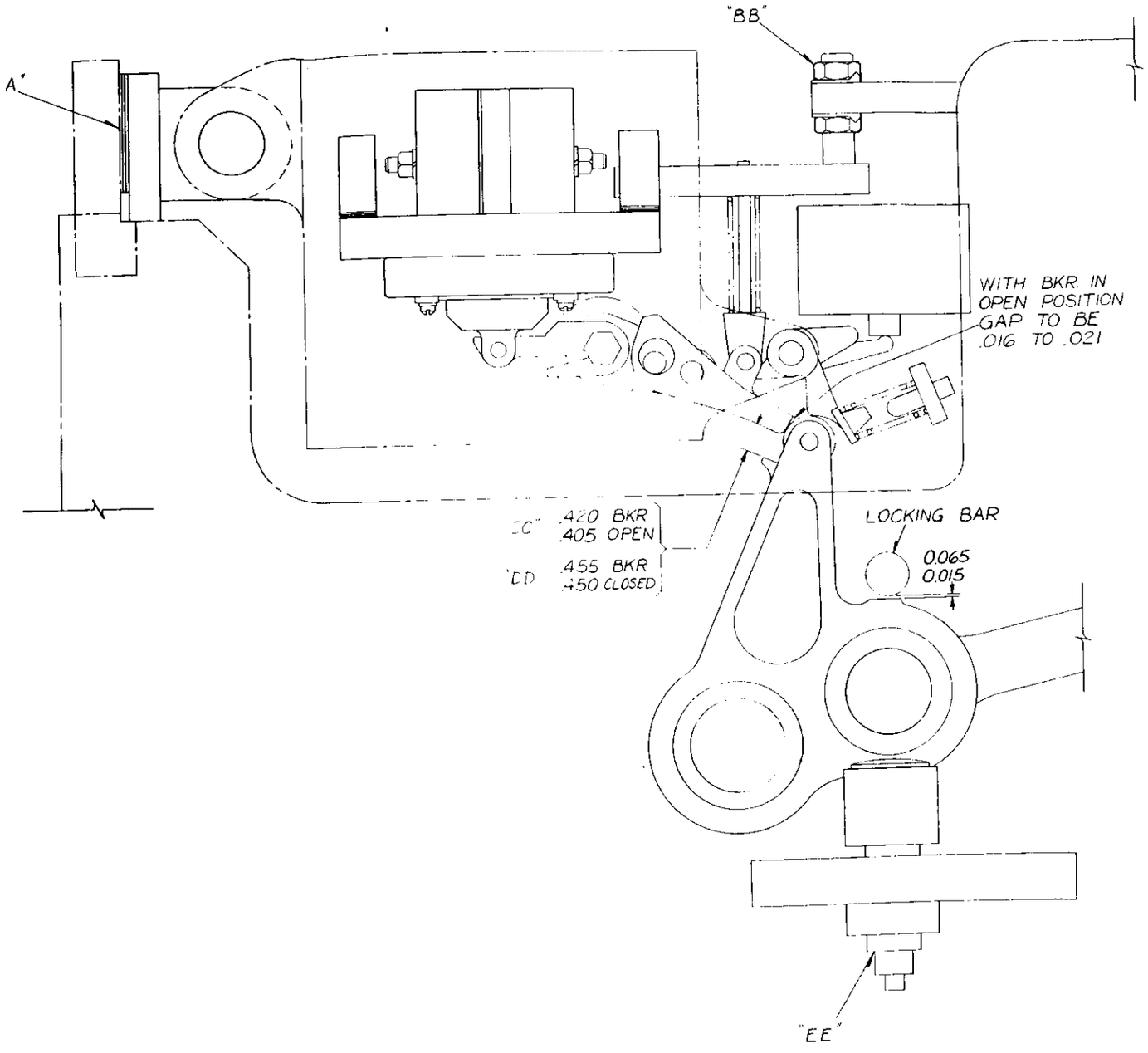
CLOSED





RED DOT INDICATES NORTH POLE OF MAGNET. POLARITY OF TRIP COILS AND MAGNET MUST BE AS SHOWN.

FIG. 4 Magnet Assembly



ADJUSTMENT

1 WITH BREAKER OPEN INSERT LOCKING BAR, ADJUST BUMPERS(EE) TO OBTAIN 0.015-0.065 CLEARANCE AS SHOWN.

2 ADJUST TRIP ASSEMBLY BY INSERTING SHIM WASHERS (AA) TO OBTAIN .016-.021 CLEARANCE AS SPECIFIED AT LEVER ROLLER.

3 ADJUST NUTS (BB) TO OBTAIN .405-.420 DIMENSION (CC) (PRELIMINARY SETTING ONLY)

4 WITH LOCKING BAR REMAINING IN PLACE, CLOSE BREAKER WITH HAND CLOSING JACK, DIMENSION (DD) TO BE .450-.455 READJUST NUTS (BB) IF NECESSARY (FINAL ADJUSTMENT,

5 WITH LOCKING BAR REMOVED DETERMINE PULL-OFF TORQUE USING PULL-OFF TOOL ON HEX SHAFT. A TORQUE OF 14 TO 18 FT LBS SHOULD TRIP THE BREAKER.

WHEN BREAKER IS IN OPEN POSITION PULL OFF TORQUE AT HEX. SHAFT TO BE 27 MINIMUM FT LBS.

CAUTION:
CARE SHOULD BE TAKEN NOT TO MOVE THE TRIGGER WHEN CHECKING DIMENSIONS.

FIG. 5 Trip Mechanism Adjustment Detail

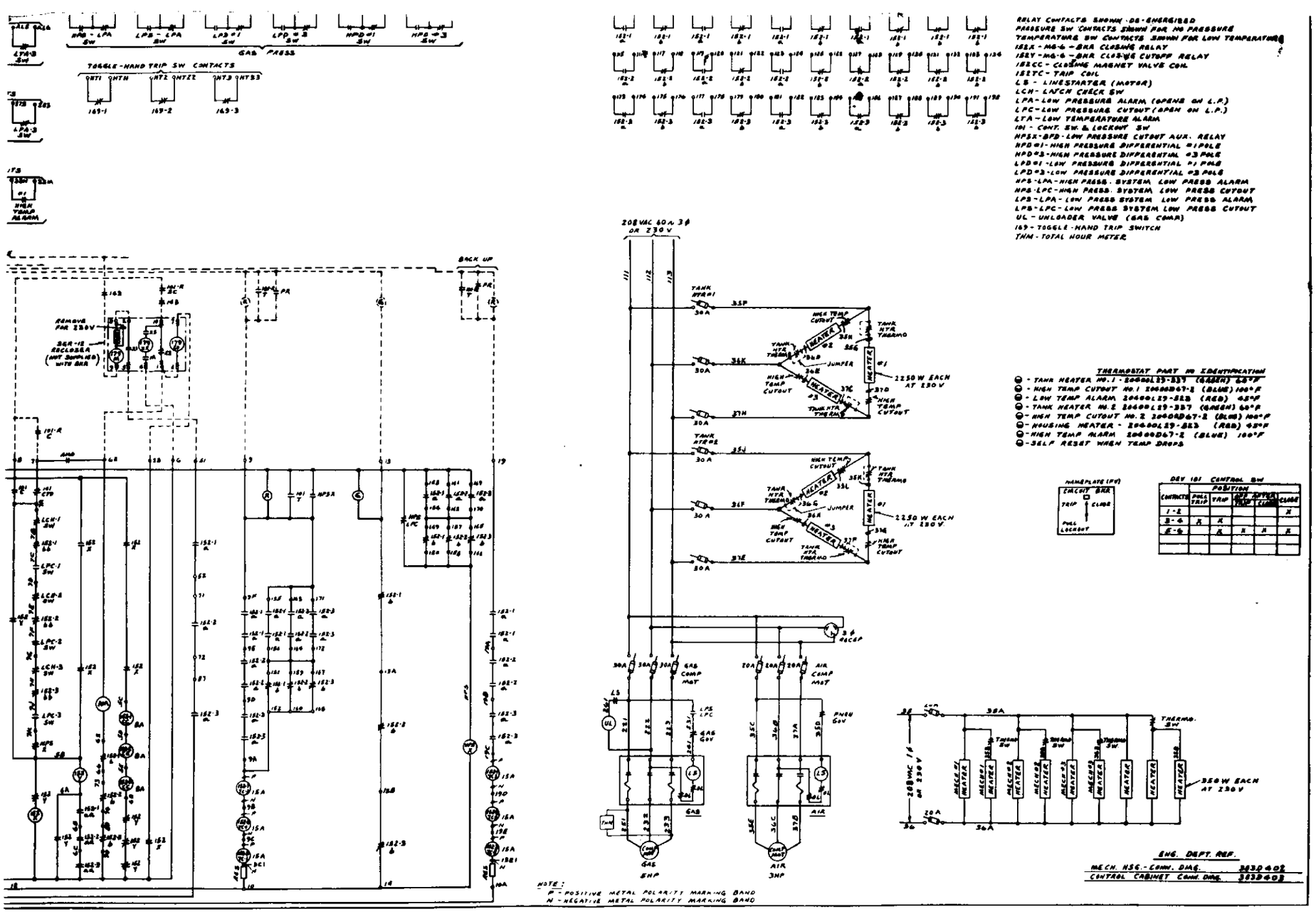


FIG. 6 Control Diagram