VOLTAGE REGULATOR TYPE 17 LH 2 K 22 (Cat No KE 13470)

This panel is illustrated in Figure 45 and contains field resistors, control resistor, voltage adjusting rheostat, stabilizing rheostat, stabilizing resistor, detuning resistor, stabilizing capacitor, fixed coil, shunt coil, series coil, current limit coil, wedge type contact bar and finger contacts.

This relay panel is used to regulate the generator voltage at a selected value, except as effected by excessive current loading as when charging an empty battery. Voltage setting is adjustable for proper charging by constant potential method for either lead or Edison batteries.

Current limit settings are automatically reduced in value by load shunt relay "C" or stand-by operation, to match the capacity of the A.C. motor.

THE FIXED COIL: is mounted on the central stationary core which excites the magnetic structure, See Figure 46. The series coil and shunt coil are on the right, or contact bar end. The current limit coil is on the left. Both coil assemblies are held in the circular air gap by supporting leaf springs. External adjustable tension springs hold the coil assemblies in outward position with all contacts closed. Current limit coil acts on contact mechanism and supporting leaf springs by rollers against U-strap.

THE SHUNT COIL: circuit is through the control rheostat and the control resistor. This shunt coil is connected in parallel with fixed coil. See Figure 47. The current in this circuit is proportional to the generator voltage.

THE SERIES COIL: is connected in series with generator shunt field and is wound on same spool with the shunt coil winding; its polarity is opposite to shunt coil and is used to compensate for the pressure of the contact fingers resting on the contact bar as the regulator operates. The force produced by this winding opposes the force of shunt coil. Its current is high at low speed and low at high speed; and force produced by this winding varies correspondingly. Thus it is able to compensate for the variable number of contact fingers that are closed.

THE CURRENT LIMIT COIL: is connected in parallel with load shunts and receives current proportional to load current. As the U-strap is further away from the current-limit rollers at high speed, it requires more line amperes to change the voltage setting, that is, the current-limit setting is higher. The speed is mainly determined by the gradient of the current-limit calibrating spring. The per-cent changes from design to design and occasionally the slope will be varied.

The current-limit cut-in and per-cent slope is essentially independent of the voltage setting. A slight drop in voltage from no load to the cut-in point will occur. This drop is about 1½ per-cent. For lower current-limit settings required when operating from stand-by power, only one section of the load shunt is connected.

THE CONTACT BAR is wedge shaped 1/8" thin at front. The ends of bar are stamped "FRONT" and "BACK". The travel to operate all contacts from closed to open is 3/16".

CONTACTS: Hinge type stationary contact fingers mounted in groups of ten on an insulated finger block are separated from each other by a shield. See Figure 45 for location on panel.

WIRING: The wire used is No 16 with Flamenol, asbestos, flame-resistant insulation.

OPERATION: As the generator voltage builds up, the fixed coil and shunt coil energize, creating a motor action or magnetic attraction to pull the shunt and series coil assembly inward against the pull of the voltage calibrating spring.

Since the contact bar is directly coupled to this coil assembly, the pull to the left opens contacts and inserts resistance in generator field. With further increase of generator speed and voltage, more contacts are opened and more resistance is added to the field in order to maintain voltage setting. If the amount of resistance required falls between a pair of contacts, the contact mechanism will vibrate between these contacts to hold average voltage setting.

To add stability, the shunt coil is coupled to the generator shunt field through stabilizing resistor and stabilizing rheostat connected in series, and a capacitor and detuning resistor are connected in series to shunt coil and No 6 contact.

The arrangement of resistance is used to compensate for the inductive current set up in the field circuit as the contact bar moves, breaking the contacts. The resistance of the stabilizing circuit controls voltage at a constant value for the normal range of generator speed.

There is also a magnetic plug in the face of the shunt and series coil assembly which serves as a trimmer to obtain constant voltage at high speed. The usual setting leaves from one to two threads visible on the plug.

When generator comes into current regulation, any increase in generated current above setting of the current limit causes this coil to move inward and acts on both the current limit spring and the voltage spring through pressure on the U-strap. This opens more contacts reducing the voltage setting in proportion to excessive current loading so that approximate constant K.W. loading is maintained.

CHECKING REGULATOR (YARD TEST): Before attempting to make adjustment of the regulator settings, all cleaning and mechanical repairs must be made and contacts set and adjusted in accordance with instructions shown on contact details. See Figure 48. Check circuits, rheostats, resistors, and coils; check contact gap, wipe, and travel. See Figure 47. Voltage setting increases approximately two volts when cover is removed; therefore, check final setting with cover in place.

In time the silver alloy contact material on the bar and fingers may transfer from the finger to the bar, or vice versa, which will upset normal sequence. A few light strokes of a clean fine file should remove projections; it is not necessary to remove small craters, *do not use sandpaper, emery cloth, etc.* With all of the contacts open and the mechanism against stop, the break on the two back contacts should be 1/32". With the mechanism in the normally closed position, the wipe on the front contacts should be 1/32". Adjust support studs on finger blocks to obtain

DO NOT SHIM THE CONTACT BAR OR BEND FINGERS. When it becomes necessary to renew contact bar, a complete new assembly of fingers and bar will be installed, old contacts to be returned to shop for matching; contact fingers are interchangeable. Be sure to note the order of assembly of the shield, finger, terminal, washer, lockwasher, and screw. Incorrect assembly will throw the finger out of line. Fingers should have free action. Operate mechanism by hand and observe that fingers on each side of the block contact the bar in sequence. Note also that each pair of fingers contact the bar at approximately the same time.

It is important to remember that contacts of various thicknesses will upset the sequence of contacts touching the bar; therefore, all finger contacts on any one regulator should be exchanged in sets of twenty.

Check performance with the equipment operating from stand-by power. Since all settings and checkings must be made at operating temperatures, allow twenty minutes warm-up period.

For routine check remove generator load by tripping overload relay, connect D.C. voltmeter to G+ and F— terminals. Note the reading of the meter and use the voltage adjusting rheostat to correct setting by turning knob, if necessary. *DO NOT TAMPER WITH VOLTAGE CALIBRATING SPRINGS.* Remove stand-by cable and note voltage reading as the generator speed decreases; voltage should not exceed the setting of the voltage adjusting rheostat or drop more than 5 volts. Adjust stabilizing rheostat to correct. If the adjusting of either of the rheostats does not have any effect on the meter readings, major repairs are required and regulator should be exchanged.

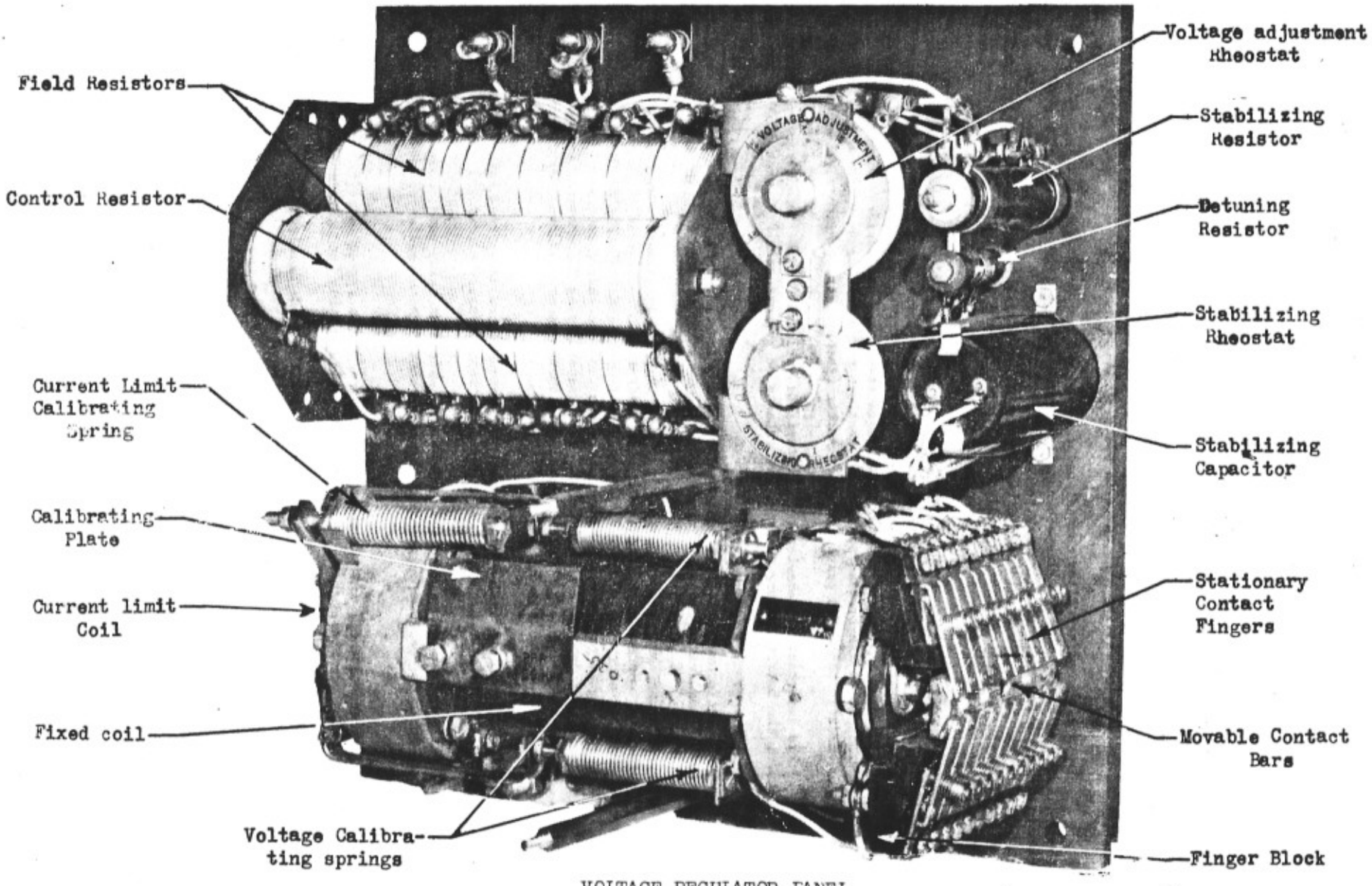
CURRENT REGULATION: Check clearance between U-strap and rollers on current coil assembly, which should be .001 to .005 with generator not operating and all contacts normally closed.

Install D.C. ammeter shunt and ammeter in G+ lead on relay panel; reset overload relay, add load. If necessary, discharge battery beforehand to bring about current regulation. See Data Chart Page 156 for values.

Adjust current coil tension springs as required; this spring is stiff and a small adjustment will make a great change, do not exceed original factory marked setting cut on calibrating plate see Fig. 45.

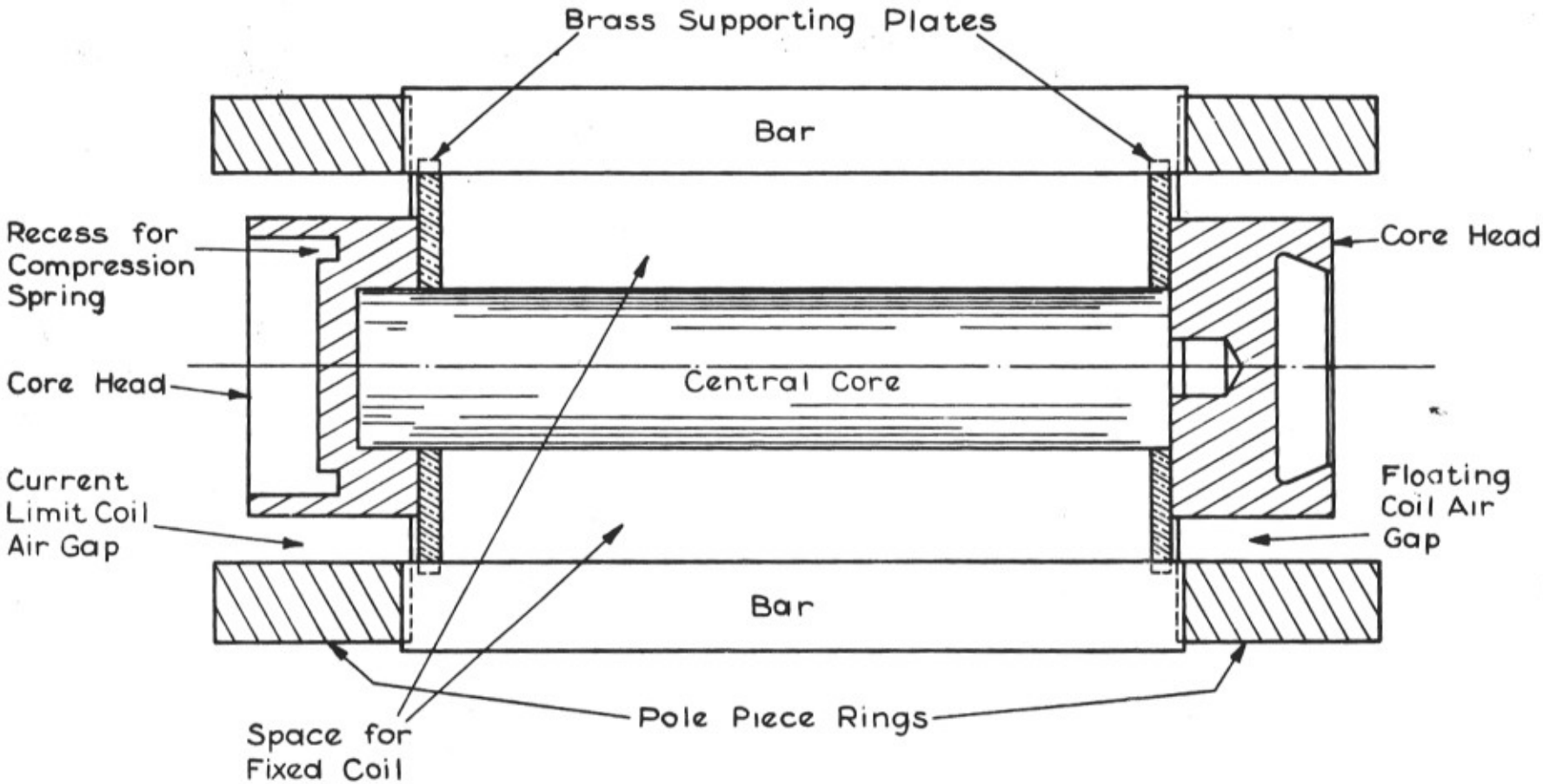
A rough check of current regulation setting can be made merely by pushing on the U-strap by hand to raise generator load. At the same time watch the action of the current limit coil assembly.

Ordinarily, if current setting is correct on stand-by operation, it will also be correct for road operation, provided the "C" relay closes through the interlock contacts of the "AR" relay.



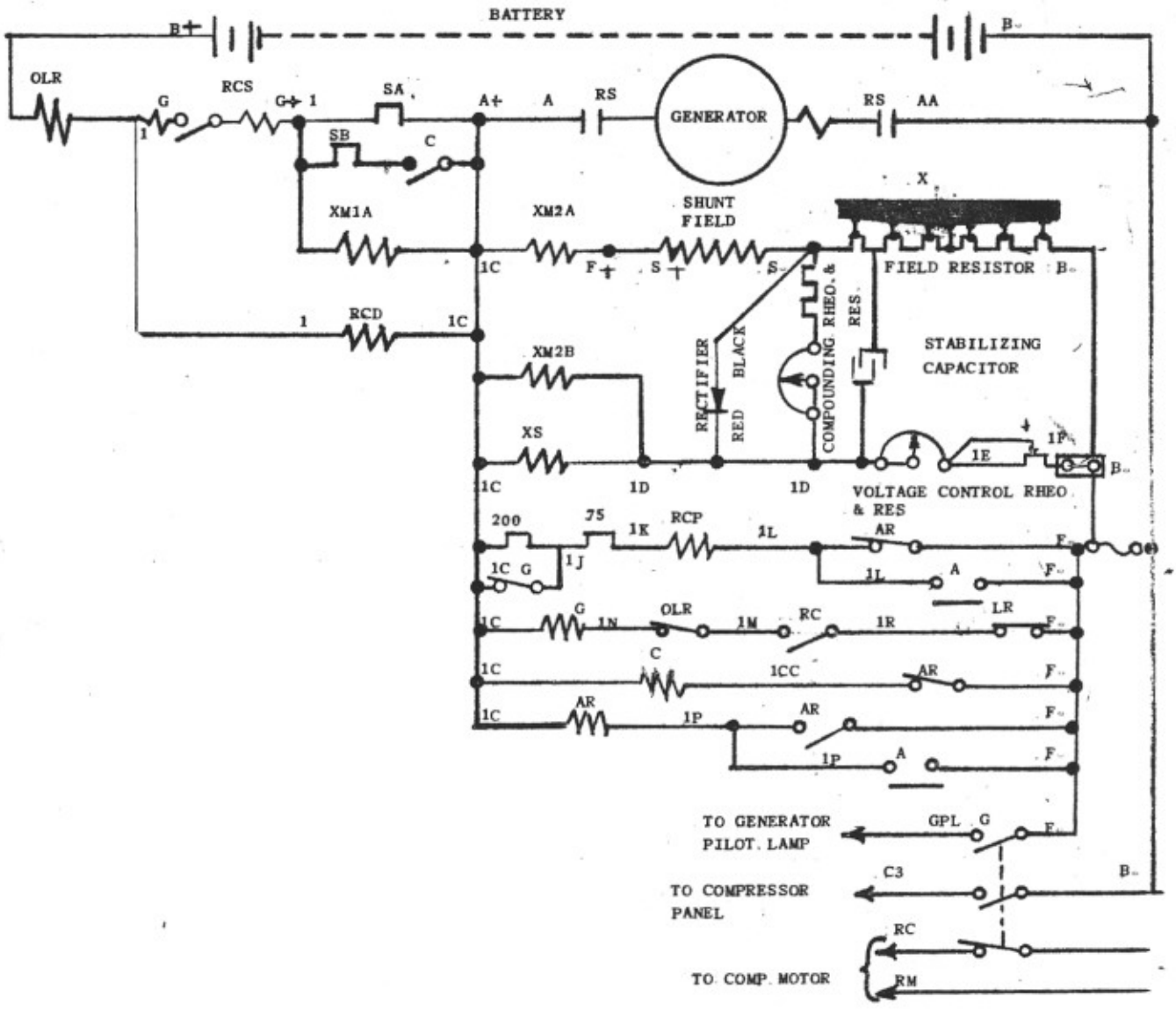
VOLTAGE REGULATOR PANEL

Figure 45



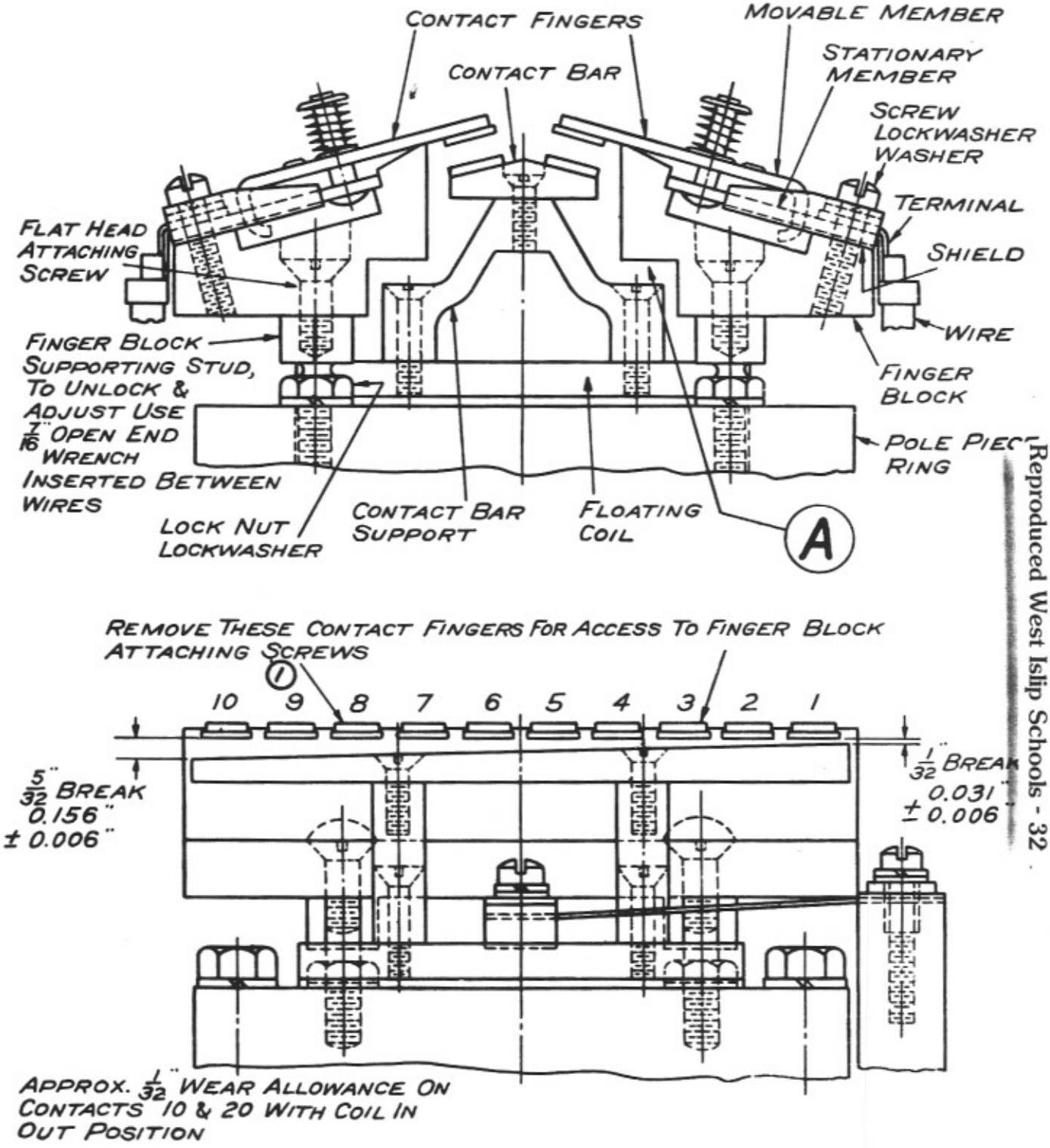
CROSS SECTION OF MAGNETIC STRUCTURE FOR VOLTAGE REGULATOR

Figure 46



SCHEMATIC WIRING DIAGRAM GENERATOR 150-A-4
CONTROLS

Figure 47



FLOATING COIL CONTACT DETAILS

Figure 48

COIL REPLACEMENT: It is advisable to remove the regulator to a bench. To remove a right hand shunt coil, remove the contact bar from its support and then remove both finger blocks complete. The finger blocks may be allowed to swing sideward on the asbestos covered wire. Remove the front supporting spring steel fingers complete. Note that two such fingers are used at this point. Use a pen knife to lift the fingers out of the slotted recess in the triangular finger base. See Figure 49.

Remove the attaching screws and hardware at the inside ends of the rear supporting fingers and lift the fingers out of the slots in the triangular finger base. Use care not to damage the fingers. Remove the U-strap from the ends of the spring rods. Remove the two cap screws which attach the front brass plate to the back of the pole piece ring. The complete floating coil together with its spring and the pole piece ring can then be removed from the relay by taking out the two cap screws which attach the ring to the rectangular bars. It may be necessary to knock the ring free with a rawhide mallet.

The floating coil springs, spring support, and the spring rods can then be removed from the coil and the pole piece ring. The coil can then be taken out of the ring. Note that the insulated connections are made through terminals and shunts which are soldered to the ends of the coil windings. These should be unsoldered and used again on the replacement coil.

To remove the fixed coil, the shunt coil should first be removed as described above. The moving coil core head should then be removed by taking out the two 10-32 fillister head screws, which attach the core head to the central core. The core head and the attached brass plate will then come out as a unit after which the fixed coil can be removed. When replacing a fixed coil, note especially the location end for end and radially. Refer to an assembled relay for the correct position. Note that a bent out tab is used for location purposes. This fits into a corresponding slot in one of the brass plates.

The current limit coil is removed in the same manner as the moving coil. It is not necessary to remove the roller arms. Note that the flexible copper shunts are soldered at both ends to insure continuity of the circuit.

After removal or replacement of any coil, the relay must be carefully and completely set and tested.

SETTING:

1. Voltage calibrating springs. Voltage end. See Figure 45. The voltage calibrating springs setting is a primary adjustment as it determines the heating level of the regulator. This setting is properly made at the factory. In the case of replacements necessitating removal of these springs this setting must be carefully re-established. Any change in this setting will require complete re-testing of the regulator.

2. Current limit cut-in point is changed by increasing or decreasing the current limit coil spring tension. In no case should this setting be increased above values.

3. Voltage Adjustment Rheostat. This rheostat is provided for the purpose of setting the voltage at a value above or below the nominal as service dictates, or for changing from lead to Edison batteries. Adjustment should be made at high speed with an accurately calibrated meter, being careful that the regulator is not in current limit. (Overload relay tripped).

4. Stabilizing Rheostat. This rheostat is provided to secure flat voltage curve of the regulator and should be adjusted to give the desired voltage at low speed. See Figure 45. For adjustment at near top speed, see the paragraph on Magnetic Adjusting Plug, under "Operation".

T E S T I N G: With a completely assembled voltage control relay, the following test should be made.

1. Check circuits, resistors and coils per connection diagram. Check soldered connections.

2. Set contact gap, wipe, and travel, per Figure 48. All contacts must be checked for proper sequence. It is absolutely essential that each pair of contacts open before either contact of the next pair opens.

3. Make the following mechanical checks

   a. Contact finger friction and binding. Check for freedom of motion of each finger.

   b. Buckling in moving coil support springs.

   c. All wiring should be clear of moving parts, adequately supported, and must be tied at frequent intervals.

   d. Check the cover fit for clearance from electrically live parts.

   e. Check for absence of friction of contact bar shunt with both mechanism and cover.

   f. Be sure coils are centered in end rings (approximately 1/16 gap all around between ring and steel moving coil end disc).

4. Adjust current limit U-strap to clear the current limit coil rollers between .001 and .005 inch with all moving elements in the de-energized position.

5. Mount the relay in same position as on car. The panel must be plumb and level. Connect up a circuit in accordance with Figure 50. Use a G.M.G.-150 type generator for which the relay was designed, with line ammeter, line voltmeter, field ammeter, and ammeter in float shunt winding. Adjust field circuit resistance to equal generator hot field ohms.

6. Set voltage adjustment rheostat to high end of the range.

7. Operate at near top speed (next to last pair of contracts operating) and adjust voltage calibrating springs to regulate at voltage as given in item 5 on Data sheet. To obtain correct voltage setting, with amperes as given in item 6 on Data sheet, flowing in floating shunt coil, it is important that this current not be exceeded. If current in floating shunt coil is too high when adjusting regulator voltage calibrating springs, adjust slider (tap) on control resistor in series with floating shunt coil. When adjusting voltage calibrating springs, maintain equal spring length. After making this spring setting at top speed, do not change. Make all subsequent voltage adjustments, if necessary with voltage adjusting rheostat.

8. Re-adjust adjusting rheostat to give proper charging voltage while still operating at high speed. Run for heating up period of 15 to 20 minutes at this voltage.

9. Re-check setting made in Paragraph 7 and be sure moving shunt winding current is within ±10 per cent of correct value.

10. Operate over entire speed range, rising and falling speed, and check that voltage is within ± 3 per cent of nominal. Further adjustment may be made with the magnetic adjusting plug if required at high speed.

11. Operate at nominal volts and high speed. Set current limit cut in by adjusting current limit spring. This check may best be made with the individual panel but may be made by merely passing the appropriate current through the current limit coil.

12. Make final check with cover in place and all adjustments locked. Voltage may be one to two volts lower with cover in place. Any final adjustment of voltage should be made by means of the voltage adjusting rheostat. *DO NOT TAMPER WITH CALIBRATING SPRINGS,* when they have once been adjusted for proper shunt coil current as increase will cause relay to overheat. Be sure all voltage adjustments are made while relay is not in current limit.
13. Make test from cover to ground using megger.
14. When applied to car regulator must be re-adjusted as outlined in " Checking Regulator (Yard Test)".

CHECKING REGULATOR (ROAD TEST):

1. Axle driven - Voltage Check.
After warm-up period, check nominal voltage setting held under no load conditions with line contactor *G* open with rising and falling generator speed. Adjust compounding by means of stabilizing rheostat, turning counter-clockwise to raise voltage at low speed. Adjust high speed voltage by means of voltage adjusting rheostat, turning counter-clockwise to increase voltage.

2. Axle driven - Current Limit Check.

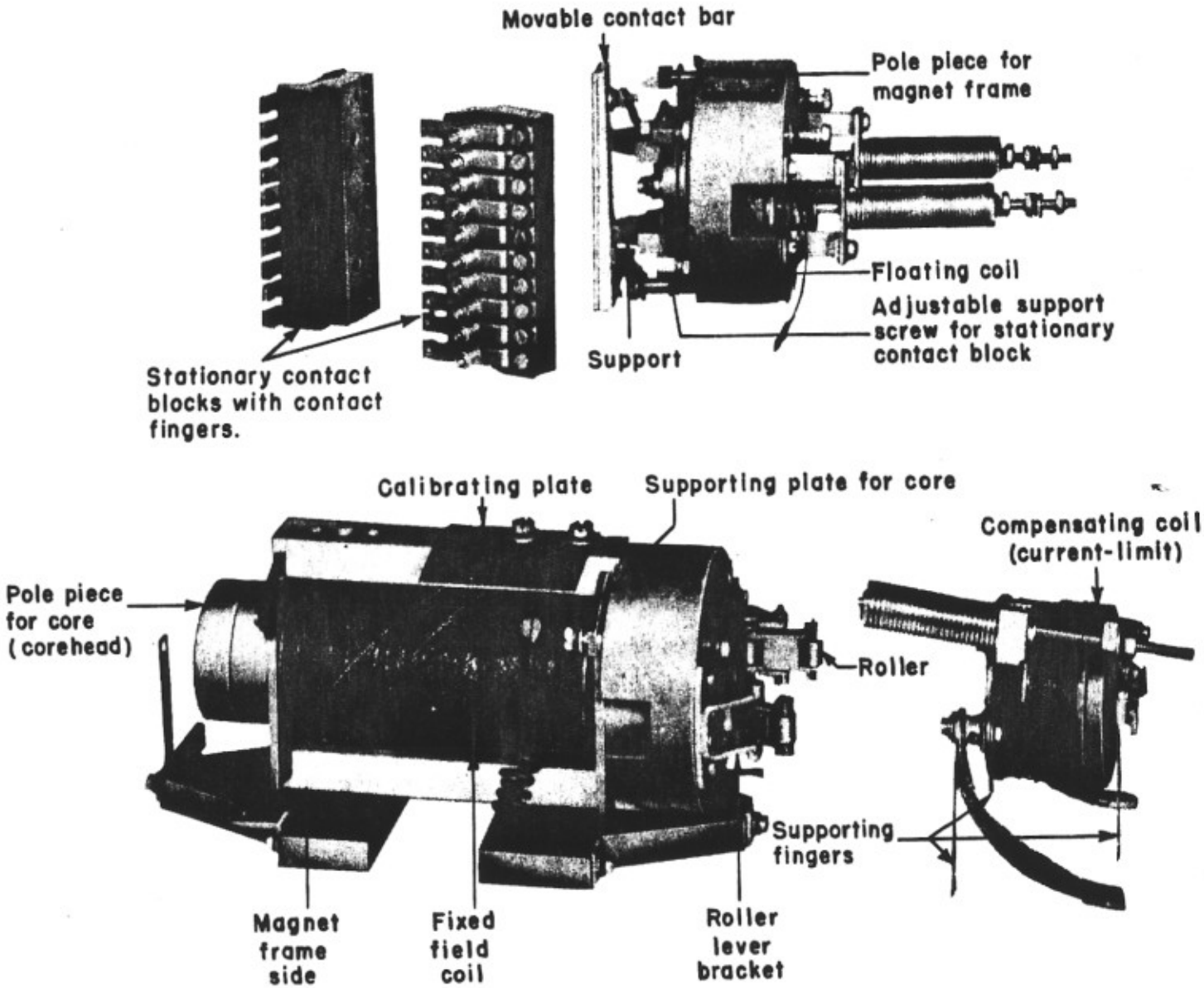
To obtain current limit action, allow line contactor *G* to close and obtain load. Note that load shunt relay *C* is closed for road operation. The current at which current limit is obtained will vary considerably with generator speed. Refer to characteristic curve for road operation. Figure 51. Since the current limit cut-in point varies, it is advisable to make checks at as high a generator speed as possible. Make necessary adjustment by means of current limit spring. This spring is quite stiff and a small adjustment will make a large change.

DATA SHEET

Voltage-control Relay Type 17LH2K22
with
Railway Motor-generator Set Type GMG 150 A4.

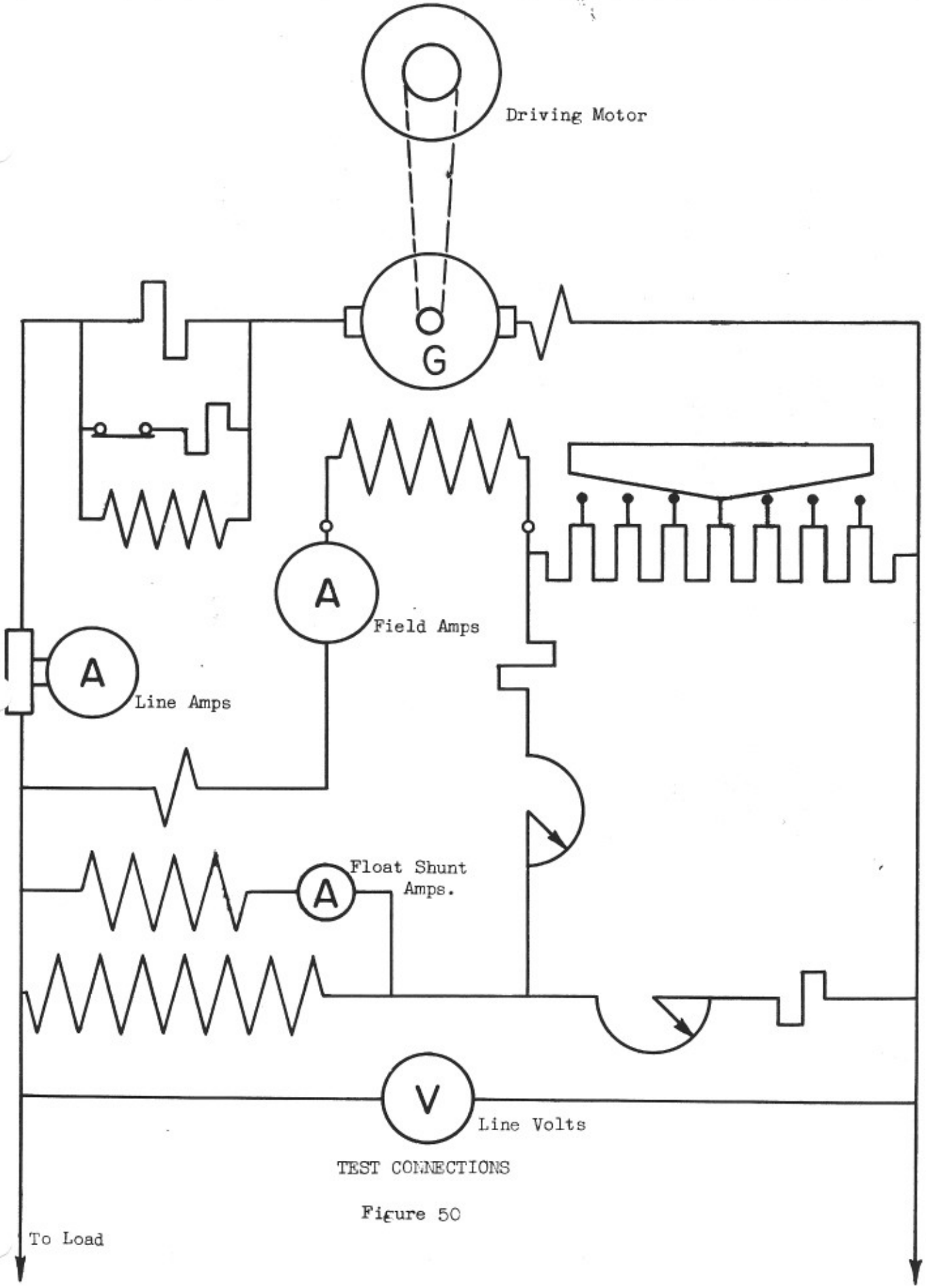
Item	Test	Value
1.	Shunt-field resistance hot	9.87 ohms
2.	Shunt-field resistance cold (25 C)	8.29 ohms
3.	Regulator field-current range	7.3-0.452 amps.
4.	Nominal voltage setting of regulator	75 ±3 per cent
5.	Maximum voltage setting of regulator	88 ±3 per cent
6.	Float shunt coil amperes (at a speed corresponding to 0.8 field amperes) High speed	1.0 ±10 per cent
7.	Voltage range adjustment with control rheostat	78-74 volts.
8.	Current-limit field amperes	0.8 amps.
	BENCH TEST - NO PANEL	
9.	Current-limit, cut-in coil amperes with field amperes in item 8	46 amperes ±5 per cent
10.	Voltage reduction under current limit at 55.2 amperes with coil amperes	63.7 V ±2 per cent
11.	Current-limit circuit resistance	0.00658 ohms
	BENCH TEST AXLE DRIVEN - WITH PANEL	
12.	Current-limit cut-in load amperes at 3780 rpm	330 amps. ±5 per cent
13.	Voltage reduction under current limit at 465 amperes with load amperes at 3780 rpm	63.7V ±2 per cent
14.	Current-limit cut-in load amperes at 690 rpm	286 amps. ±5 −10 per cent
15.	Voltage reduction under current limit at 372 amps. with load amperes at 690 rpm	±5 per cent; 63.7 V ±2 per cent
	STAND-BY A C DRIVE - WITH PANEL	
16.	Current-limit cut-in, 1750 rpm motor driven	198 amps ±7 per cent
17.	Voltage reduction under current limit at 253 amps.	±7 per cent
18.	No load operating voltage for battery charging	76 volts.

NOTE: This regulator also has a rectifier 6 RS 5 C 63 connected between the field and coils for additional stability.



VOLTAGE CONTROL RELAY

Figure 49



TEST CONNECTIONS

Figure 50

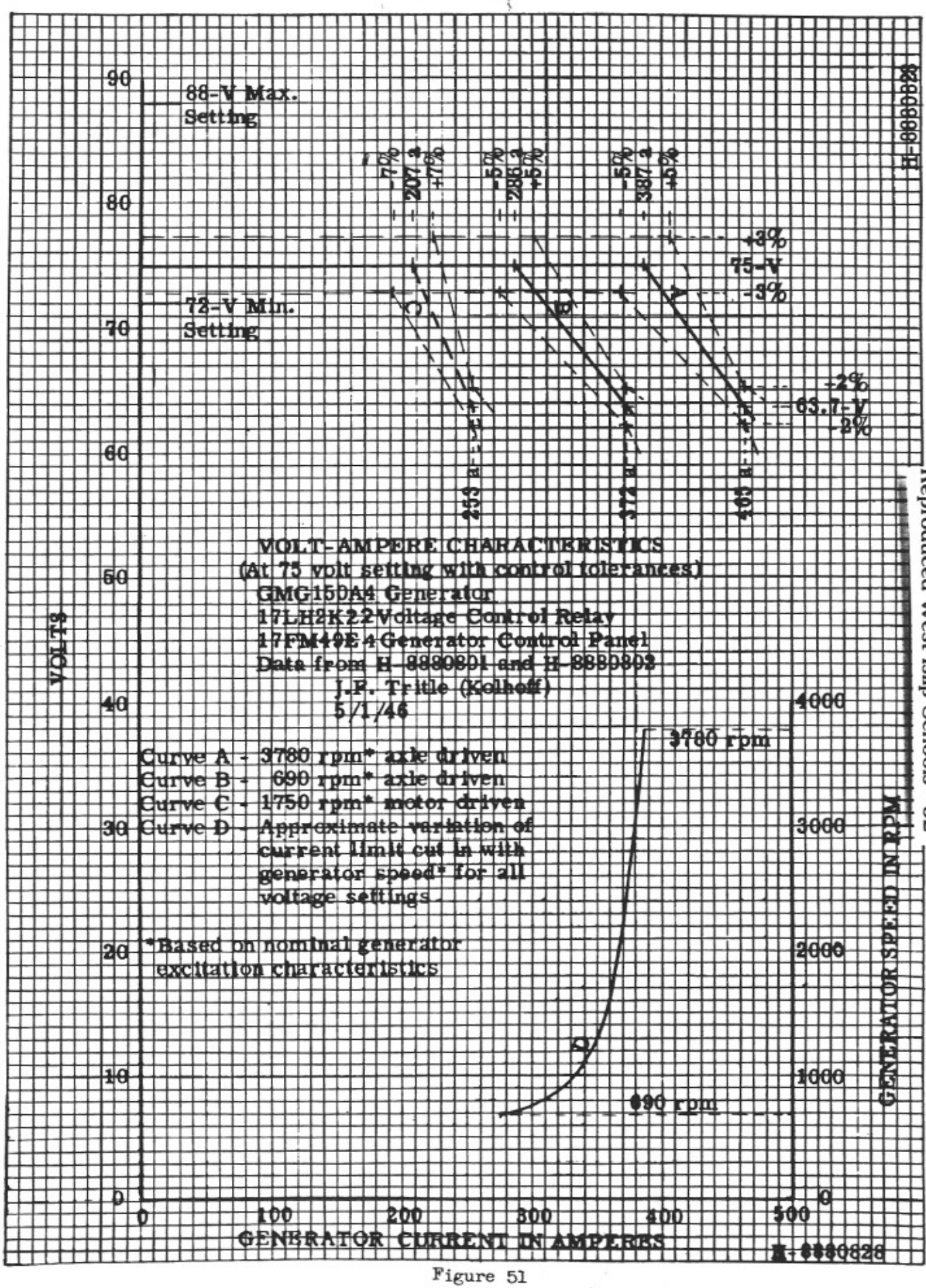


Figure 51

GENERATOR CONTROL PANEL

This panel is illustrated in Figure 52 and contains reverse current relay *RC*, line contactor *G*, overload relay *OLR*, auxiliary relay *AR*, two section load shunt *SA* and *SB* load shunt relay *C* and field fuse.

The controls are arranged for dual operation - from the car axle automatic clutch drive while the car is in motion, and from the built-in motor when connected to 220 volt, 60 cycle, 3 phase stand-by power.

The armature reversing switch *RS* makes correct armature connections for the forward or reverse direction during initial generator rotation following automatic clutch engagement. The generator builds up its terminal voltage as a self excited machine.

When the generated voltage slightly exceeds that of the battery, the reverse current relay *RC* operates and closes line contactor *G*. This connects the generator to the battery and load circuits.

With further increase in speed the generator takes over whatever load was connected to the system and begins to return power to the battery. From this point on, generator control is assumed by voltage control relay 17 LH 2 K 22. Constant voltage is held throughout the normal generator speed range, except as follows:

Should the generator load tend to exceed the "CURRENT LIMIT" valve, the relay voltage setting is automatically reduced in proportion to the excess current loading so that approximately constant *K W* loading is maintained. The "CURRENT LIMIT" rises as the car speed increases, taking advantage of the increase in generator rating at the higher generator speeds. As a further illustration of the current limit characteristic, see curve, Figure 51.

Load shunt relay *C* is picked up during axle driven operation, placing the two sections of the load shunt (*SA* and *SB*) in parallel, giving the axle driven current limit range.

When the generator speed decreases below the voltage control relay range, the resulting decrease in generated voltage causes reverse current to flow between the battery and generator. *RC* relay drops out, opening line contactor *G*.

STAND-BY POWER - A.C. MOTOR DRIVE: With 220 volt, 60 cycle, 3 phase A.C. power plugged in, A.C. line contact *A* closes, starting motor and bringing the set up to normal speed within a few seconds.

As in road service the reversing switch *RS* operates to make the correct armature connection for direction of rotation.

An interlock on auxiliary relay *AR* prevents operation of relay *C*, leaving only load shunt selection *SA* in circuit, which gives a reduced "CURRENT LIMIT" for motor driven operation, as shown by Curve, Figure 51.

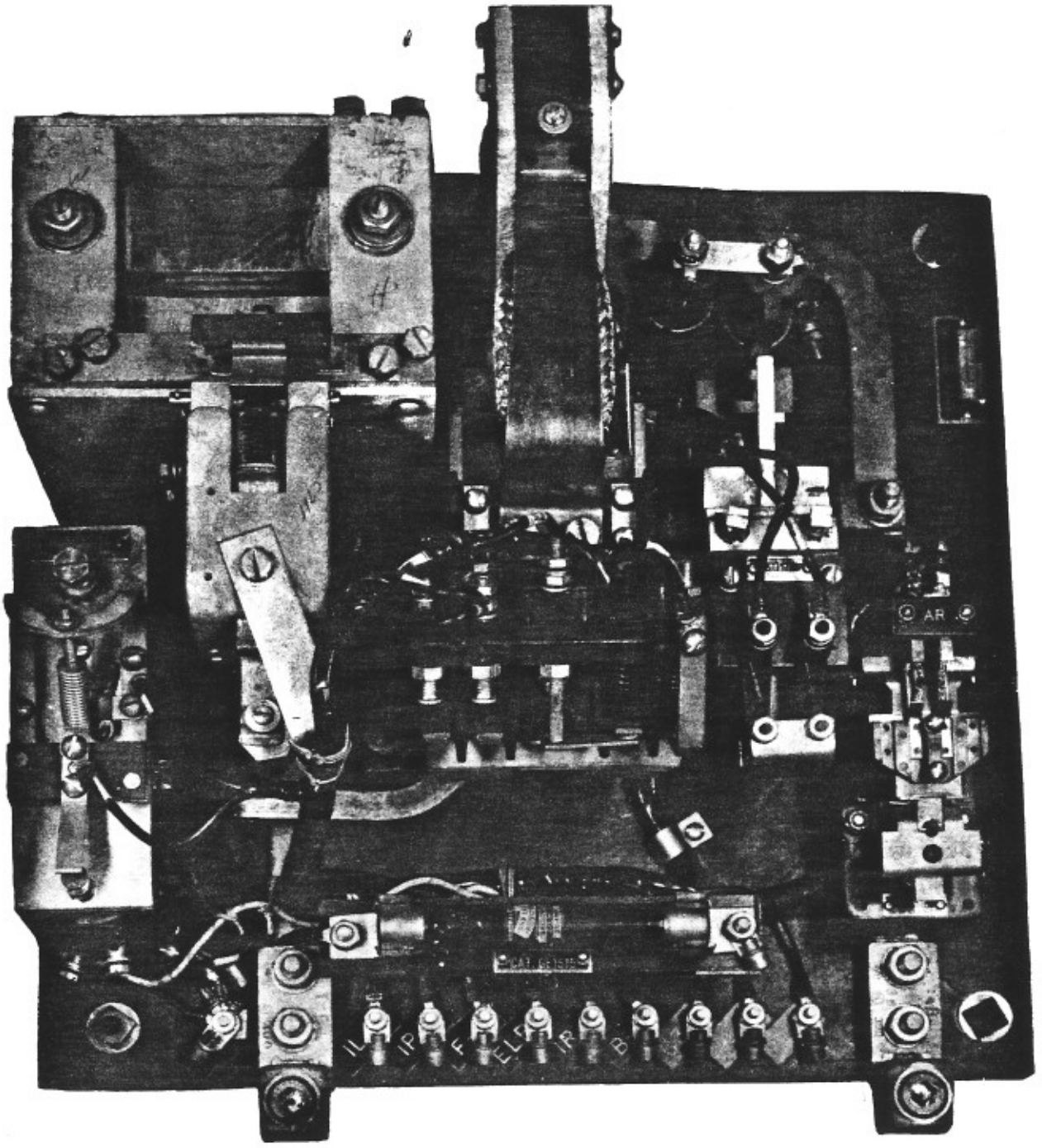
When the generated voltage slightly exceeds battery voltage, relay *RC* closes, but line contactor *G* is prevented from closing until line relay *LR* operates. The time interval is approximately three seconds, allowing the motor generator to come up to its normal operating speed without load. Operation of *LR* then closes contactor *G* and operation continues as in road service, except that relay 17 LH 2 K 22 limits the generator loading to the capacity of the A.C. motor.

There are limitations which prevent the reverse current relay from being made sensitive enough to buck out on the motoring light current of the motor generator set. Since this condition prevails when the set is unplugged from stand-by power auxiliary relay *A R* is provided to hold contactor *G* open until the generator voltage has been reduced to such a low value that motoring cannot occur. On axle drive *AR* is not energized, thus allowing the circuits to function normally, and the reverse current relay bucks out at its proper setting because the automatic clutch does not disengage until the set is below motoring speed.

REVERSE CURRENT RELAY RC: controls operation of line contactor *G*. This relay is an E-shaped magnetic structure having three cores on common base. Top core carries shunt or potential coil *R C P*, and bottom carries differencial coil *R C D*.

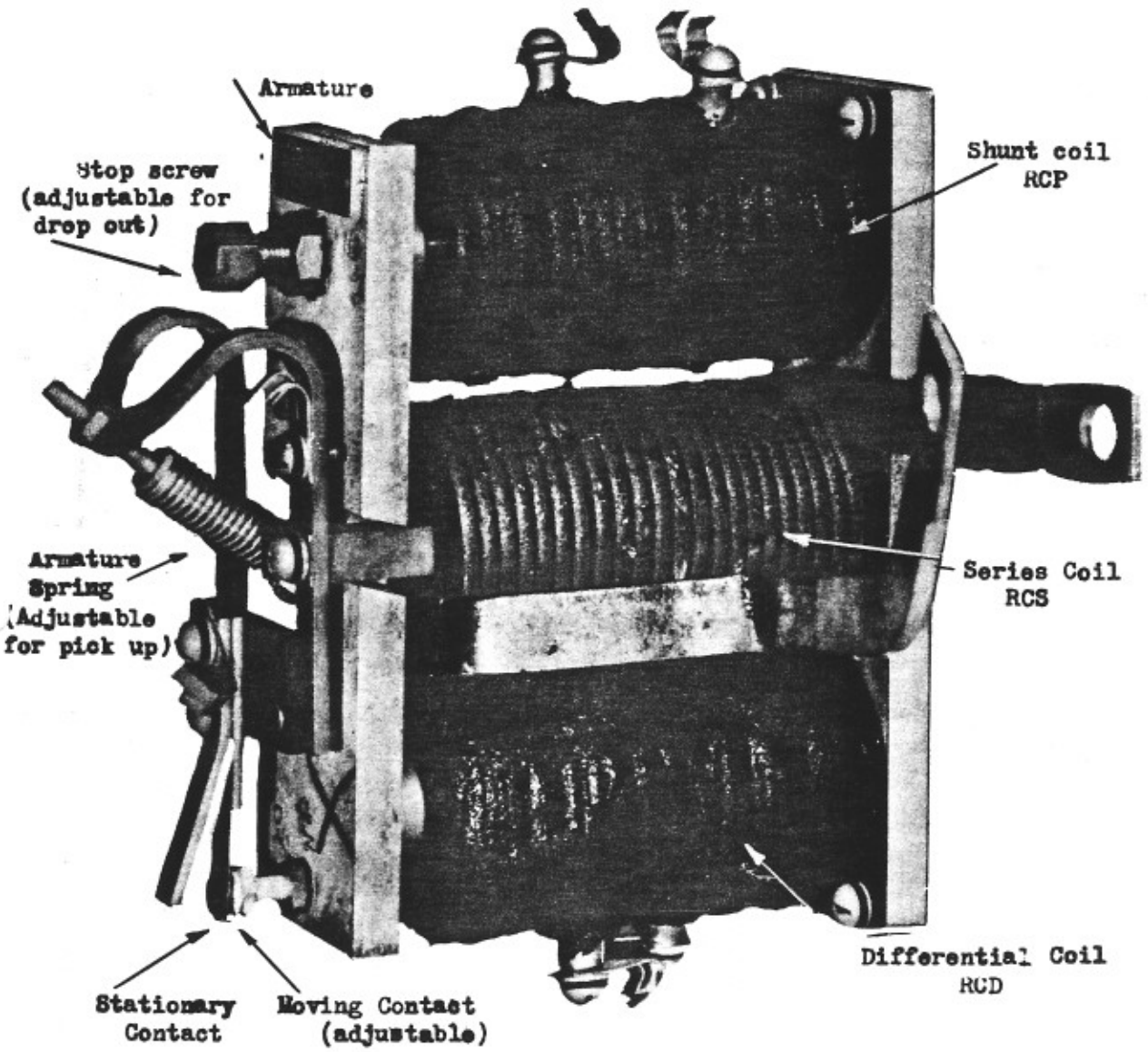
The function of the reverse current relay is to prevent the generator from being connected to the battery unless the generated voltage is above battery. Figure 53 shows the details.

N.H.



TYPE 17 FM 49 PANEL

Figure 52



REVERSE CURRENT RELAY RC, TYPE 17LC19A

Figure 53

For generator voltages less than battery voltages, magnetic flux in the armature from coils *R C D* and *R C P* is additive, holding armature in open contact position.

When generator voltage equals battery voltage, flux from coil *R C D* becomes zero and reverses with further increase. At a voltage above battery voltage, flux in armature shifts, pulling armature into closed contact position. The differential is a maximum at minimum battery voltage. With *G* closed, generator load current in coil *R C S* creates a flux which holds the armature in closed position.

For reverse current from battery to generator, flux from *R C S* is differential to flux from *R C P* dropping out the armature.

For flux directions in coil see Figure 54.

CHECKING REVERSE CURRENT RELAY (YARD): With the generator operating from stand-by power, reduce generator voltage to minimum by manual operation of the voltage regulator. Gradually release pressure to bring up voltage slowly.

PICK UP'S - See Figure 53. The relay should be set by changing the adjustment of the armature adjusting spring to close when generator voltage exceeds battery voltage by the number of volts as shown on Data Sheet. With higher battery potential this differential will be less, but should never be less than 1 volt above battery.

DROP OUT - See Figure 53. The adjustment on the stop screw should then be checked to be sure that it is flush with the back face of the armature. It is not necessary to check the reverse current as this adjustment will automatically set it.

CHECKING RELAYS (SHOP): After relays have been repaired, the following major tests should be made in order to save time on the final adjustments on car with motor generator, regulator and relay with which it must operate:

1. Apply current to *R C D* coil in negative direction. (See Data Sheet). Connect positive to right hand terminal No. 1 marked Generator.

2. Apply current to *R C P* coil in positive direction. (See Data Sheet). Connect positive to right-hand terminal No. 1 K marked " T ".

3. Decrease *R C D* current to zero and reverse. Armature should close as *R C D* current is increased to that shown on Data Sheet in positive direction. Adjust armature adjustment spring to obtain.

4. Set the screw flush with the backface of armature.

NOTE: Coils *R C P* and *R C D* are dismounted from the front after removal of armature. Coil *R C S* is demounted by removal of relay from panel for access to middle core attaching bolt.

A final adjustment must be made on car; repeat (yard test) after installation.

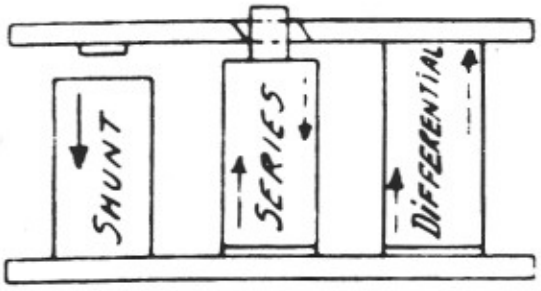
LINE CONTACTOR G: connects motor generator to battery. It also carries two normally closed and two normally open interlocks. (See Figure 55).

The function of the line contactor is under control of the reverse current relay. Contactor should pick up with 0.262 amperes, or approximately 40 volts at 77° F. Adjust armature spring tension by turning the adjusting screw to obtain.

The contact pressure is not adjustable; it is maintained by the wipe tension spring at 10 to 13 pounds.

To check pressure, place a thin piece of paper between contacts, form a wire loop and attach to the end of the shunt next to movable contact tip, or under the head of the screw; in which case allow 20% less pressure than specified. Attach spring scale and pull perpendicularly until paper can be removed easily. If less than ten pounds pull is required, exchange wiping spring. (See Figure 56). When making this check, be sure contacts are fully closed and overload relay has been tripped.

The gap between the contact tips when new should be 13/32" - 16/32". These contacts should be renewed when burned one half through or when clearance between contacts exceed 3/4". The gap with old tips may be greater than shown by the amount of wear on the tips; this is caused by worn tip lever or bent armature stop.

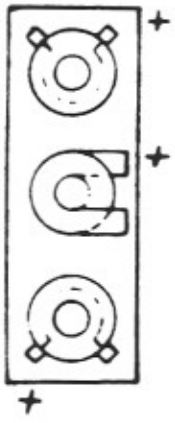


Before Pick Up
Generator < Battery

SHUNT FLUX

DIFFERENTIAL FLUX

SERIES FLUX

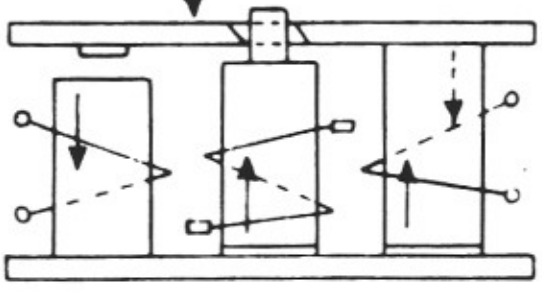


Shunt

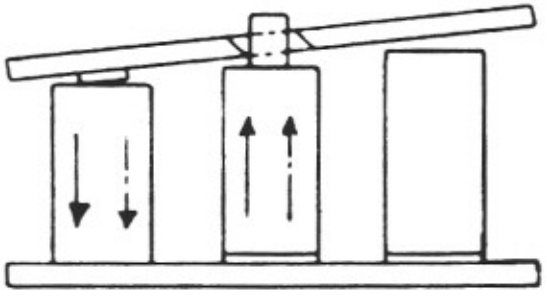
Series

Differential

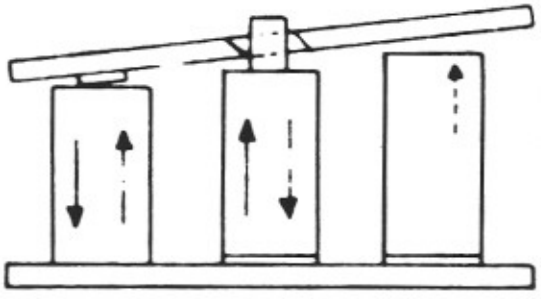
Polarity just before pick up Generator Battery.



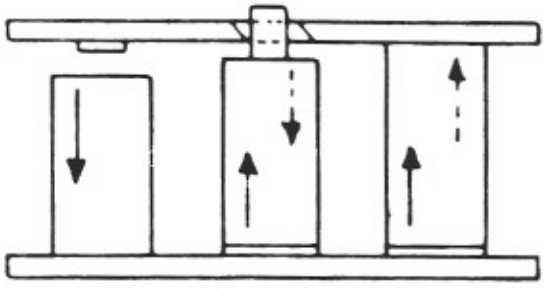
Just Before Pick Up
Generator > Battery



After Pick Up
Generator > Battery



Just Before Drop Out
Generator < Battery



After Drop Out
Generator < Battery

FLUX DIRECTIONS IN RELAY

Figure 54

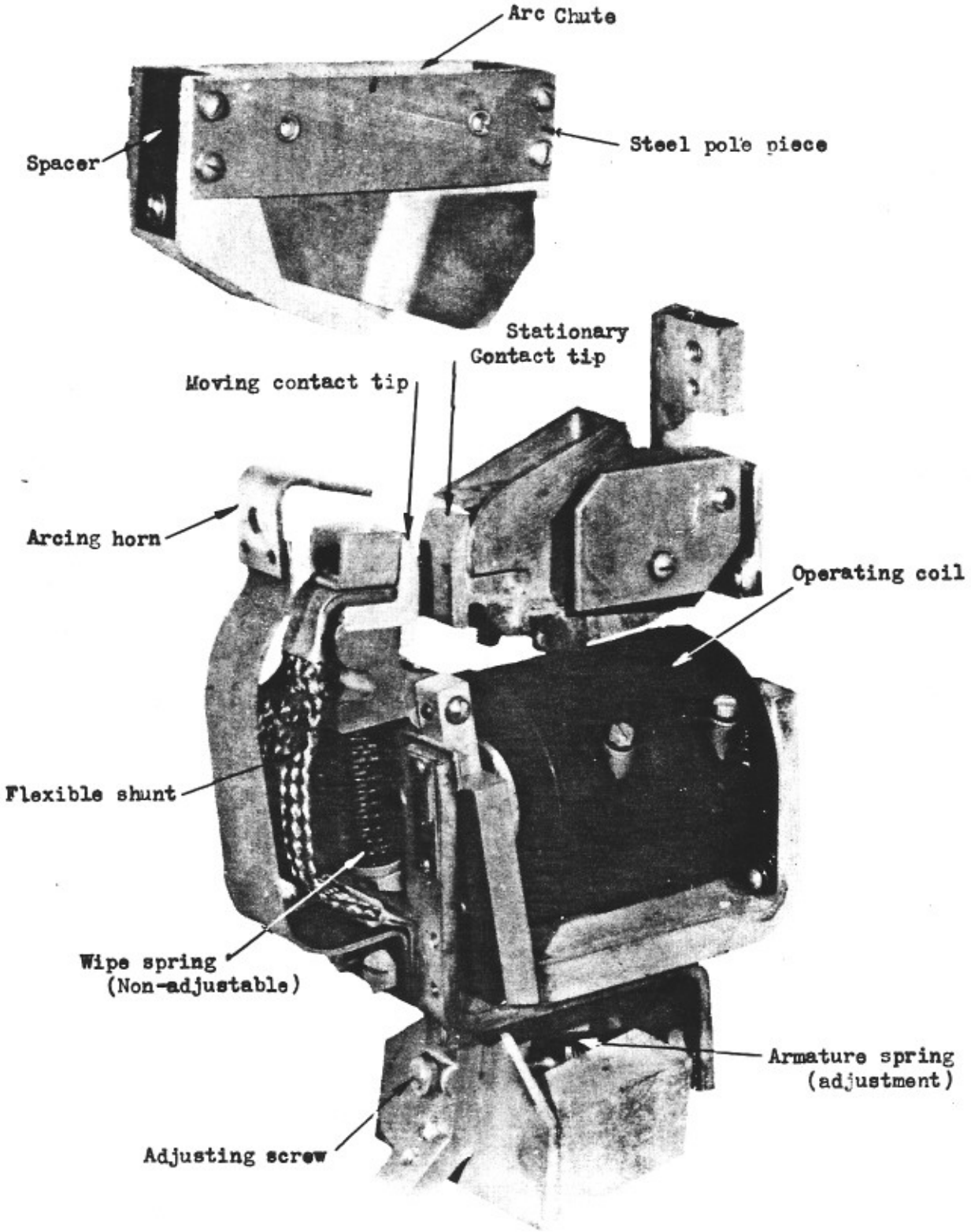
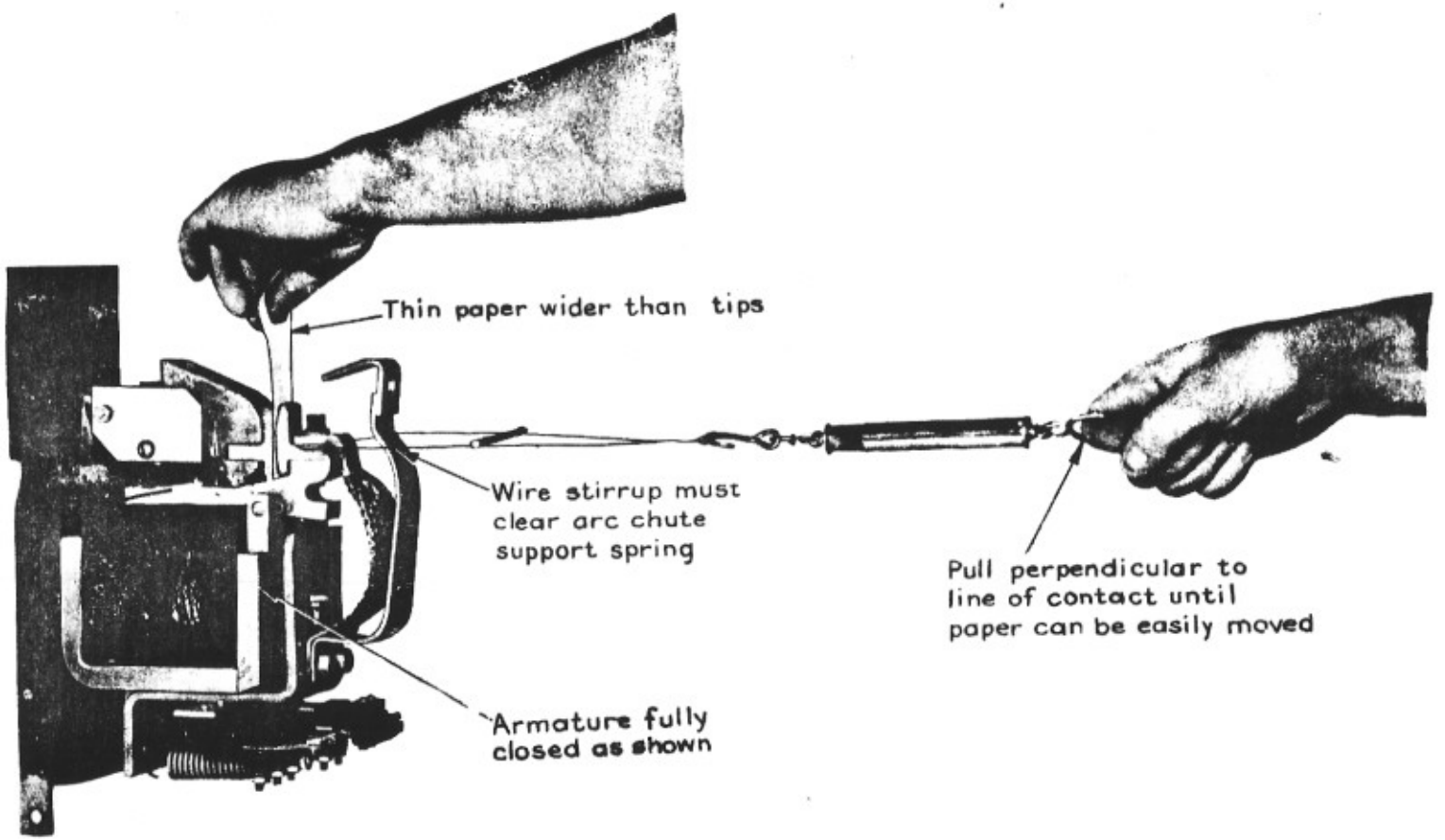


Figure 55 LINE CONTACTOR G.



G-E TRANSPORTATION MAGNETIC CONTACTOR. TYPE 17CM. SHOWING METHOD OF MEASURING FINAL CONTACT TIP PRESSURE.

Figure 56

Renew asbestos side plates on arc chute when burned one half through, using old spacers and new tubular rivets.

The function of the two circuit interlocks are

The left-hand outside interlock, normally open, controls low voltage relay on compressor motor panel.

The left-hand inside interlock, normally open, controls generator pilot light.

The right-hand outside interlock, normally closed, bridges out larger portion of the resistance in the shunt coil of the reverse current relay until line contactor closes.

The right-hand inside contacts, normally closed, operate in the compressor motor field circuit as heretofore.

Interlocks are adjusted by threaded studs on the stationary contacts and by use of washers under the right-hand U-shaped stationary bracket. Break 7/16". - 1/2" wear allowance 3/32" - 1/64". See Figure 57.

LINE RELAY LR: connected in series with the M-3 lead from the A.C. starter switch and the A.C. motor. The initial flow of current to the motor is heavy. Since this relay is in series with one of the motor leads, the flow through the coil is also heavy, creating a strong magnetic field which lifts the relay contact plunger, opening its contacts. As the motor comes up to speed, the current flow through the coil decreases and the relay drops out, completing circuit to coil of *G* contactor.

OVERLOAD RELAY OLR: contact opens circuit to line *G* contactor coil in the event the motor generator becomes overloaded. (See Figure 58). The coil of *OLR* is connected in series with generator. A manual reset mechanical latch holds contact open once it has been tripped and must be reset by lifting the latch. This relay is factory set at 650 amperes and this setting should be maintained ± 5 %.

AUXILIARY RELAY AR: The circuit to the coil of the auxiliary relay is through interlock on A.C. starter switch and operates only when 220 volt A.C. starter switch is closed. Its normally closed contacts open circuits to *C* relay coil. It is kept energized by its own contacts after the A.C. starter switch has dropped out to maintain a circuit until after the reverse current relay has operated.

LOAD SHUNT SA AND SB: Connected in positive generator line. They create voltage drop proportional to load current to operate current limit of the generator regulator panel. The two section load shunt is for dual setting of generator loading. The small section at the bottom permanently in circuit, limits generator output when operating on stand-by. The large section at top is connected in parallel by closure of *C* relay when operating on car axle drive.

LOAD SHUNT RELAY C: Operates from generated voltage and connects both portions of load shunt in parallel for road operation. It is held out by interlocks on auxiliary relay when operating on stand-by to prevent overloading of the alternating current motor. Relay should pick up with 0.112 spring tension to obtain 40 volts.

The contact pressure should be two to three pounds. Renew wiping spring to maintain pressure. Contact break approximately 3/8". contact wear allowance 1/8". Load shunt and *C* relay is shown in Figure 59.

FIELD FUSE: See fuse chart Page 166 is used in negative field circuit; it also protects coils of regulator, *G* relay, *RCP* relay, *AR* and *C* relay. Do not flash this fuse as a reversed field may result.

ALTERNATING CURRENT STARTER SWITCH: is a clapper open type, 25 H.P. 220 volt, 3 phase 60 cycle switch with an A.C. operating coil and connects alternating current stand-by power to the motor. Normally closed right-hand interlocks open to prevent energizing *C* relay. Normally closed left-hand interlocks open to prevent line contactor *G* from closing until alternating current motor has come up to full speed. There is a normally open interlock which holds starter switch closed after being energized by the start-stop button. Thermal overload trips starter switch when alternating current is excessive. These heaters are rated 97 amperes at 104° Fahrenheit. Check to see that overloads can trip after installing heaters.

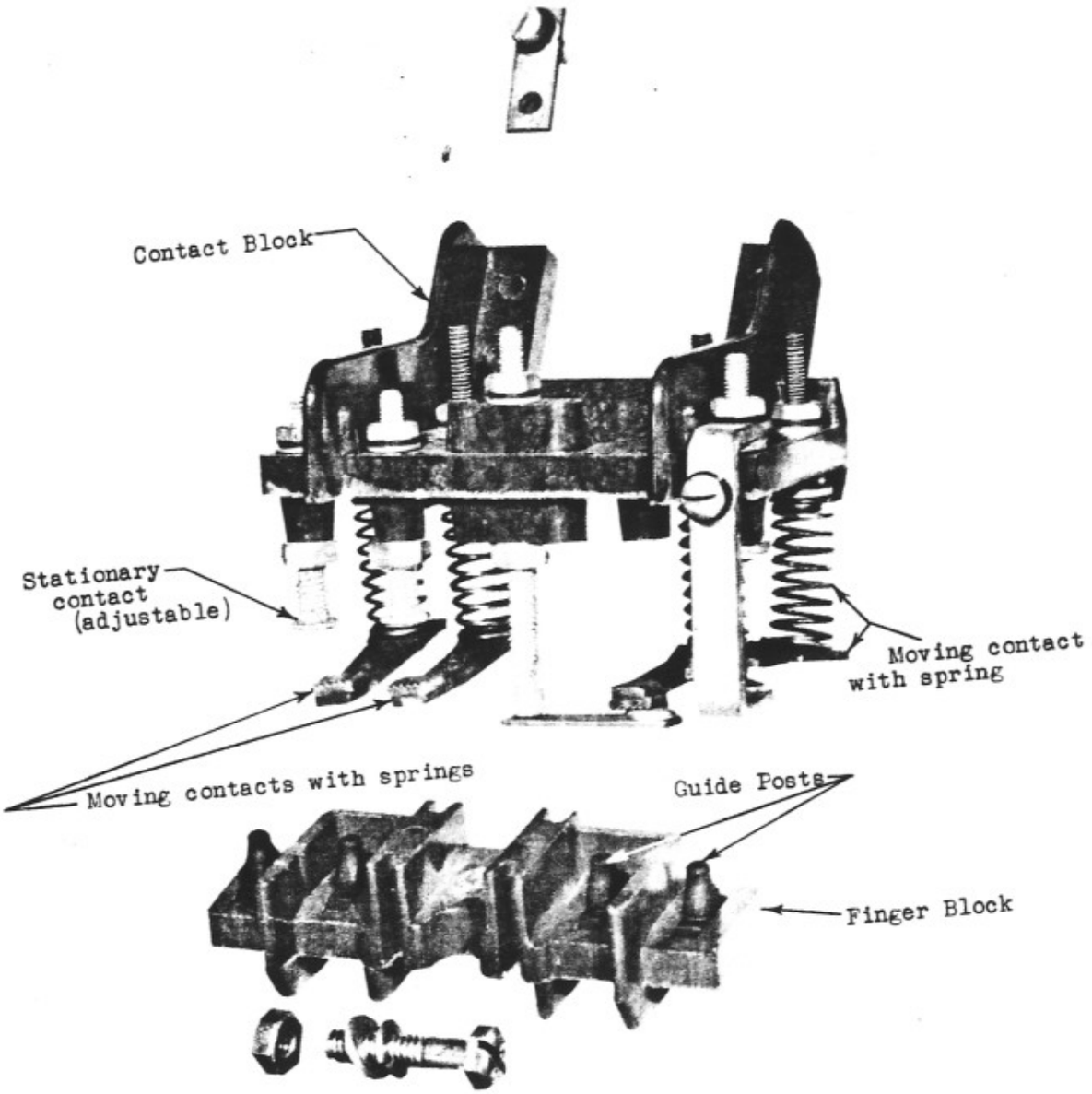
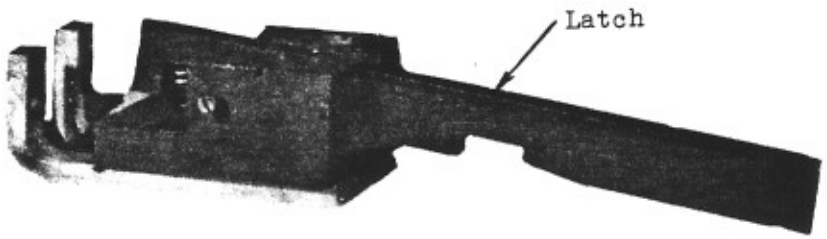
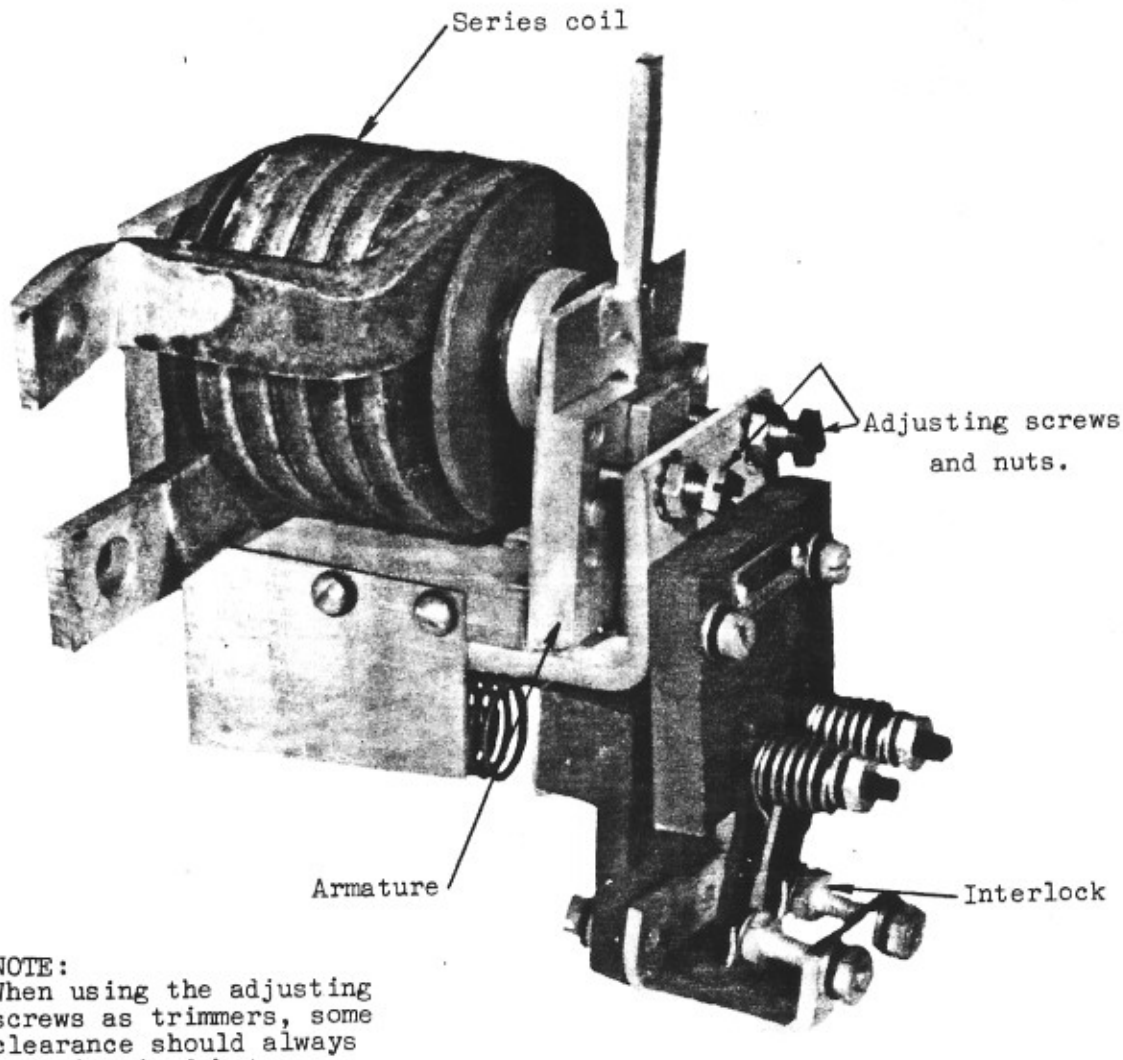


Figure 57

INTERLOCK TYPE 17 AF
MOUNTS ON LINE CONTACTOR G

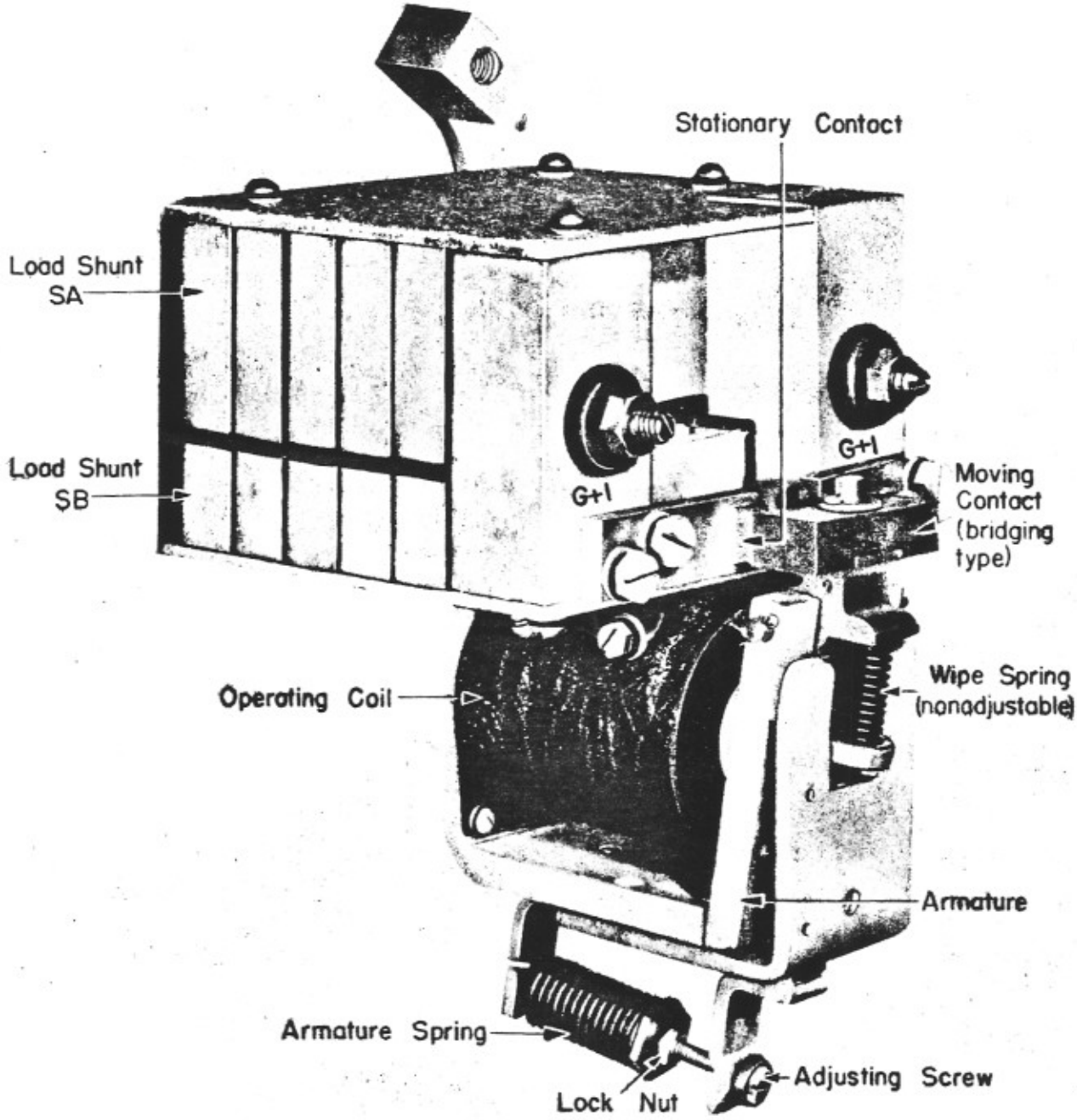




NOTE:
When using the adjusting screws as trimmers, some clearance should always be maintained between armature and frame.

G.E. OVERLOAD RELAY

Figure 58



Load Shunt and Load Shunt Relay O

Figure 59

The mechanical adjustments should be made loose so that the switch will drop to open position when de-energized.

The contact faces should be dressed with a fine file if beads form on the surface. To determine the condition of the contacts, block the contactor closed, applying force to the magnet laminations and not to the supporting bracket, and measure the gap between the movable tip and tip support. When this gap is 1/16" or less, the tips should be renewed.

RENEW STATIONARY TIPS: Remove the arc chutes by sliding them upward off the projection of the stationary tip arcing horn. Remove the screws and the movable tip arc horns. Next loosen armature stop screw sufficiently to allow the armature to open beyond the armature stop. The slotted stationary tips may now be removed by loosening screws and drawing them forward. It is not necessary to remove screws completely.

RENEW MOVABLE TIPS: Insert a screw driver in the top of the spring and slide the spring upward out of its holder. The screw holding the tip to the shunt is then exposed for removal. To replace the spring, slide the movable tip forward and place the end of the spring over the screw. Then slide both spring and tip backward into place. After re-assembling the arcing horns, the gap between the end of the horn and the stationary tip should be 1/2" plus or minus 1/32".

RENEW INTERLOCK TIPS: The entire interlock should be removed from the contactor base for replacement of the interlock tips. Removing interlock screws permits complete dis-assembly of the interlock unit.

RE-ASSEMBLE NORMALLY OPEN INTERLOCK: Assemble the parts on the operating rod. Place the entire assembly on the moulded base with the longer portion of the operating rod toward the contactor, and replace interlock screws. Check to see that the operating rod moves without binding.

RE-ASSEMBLE NORMALLY CLOSED INTERLOCK: Assemble the parts on the operating rod. Complete re-assembly in the manner described for the normally open interlock.

NOISE: To reduce noise of the starter switch, smooth and clean contacting surfaces of laminated armature and core.

TESTING OVERLOAD RELAY

1. Remove the generator plus lead from the control panel and insert a shunt for use with a millivolt meter, the ratings of which will depend upon the overload relay setting. See Fig. 59 A for connection diagram.

2. Remove the field fuse for safety purposes.

3. Remove the positive field wire from the S plus terminal on the relay.

4. Complete the generator armature circuit by removing B+ and B- cables from the battery and connecting together to short circuit generator armature.

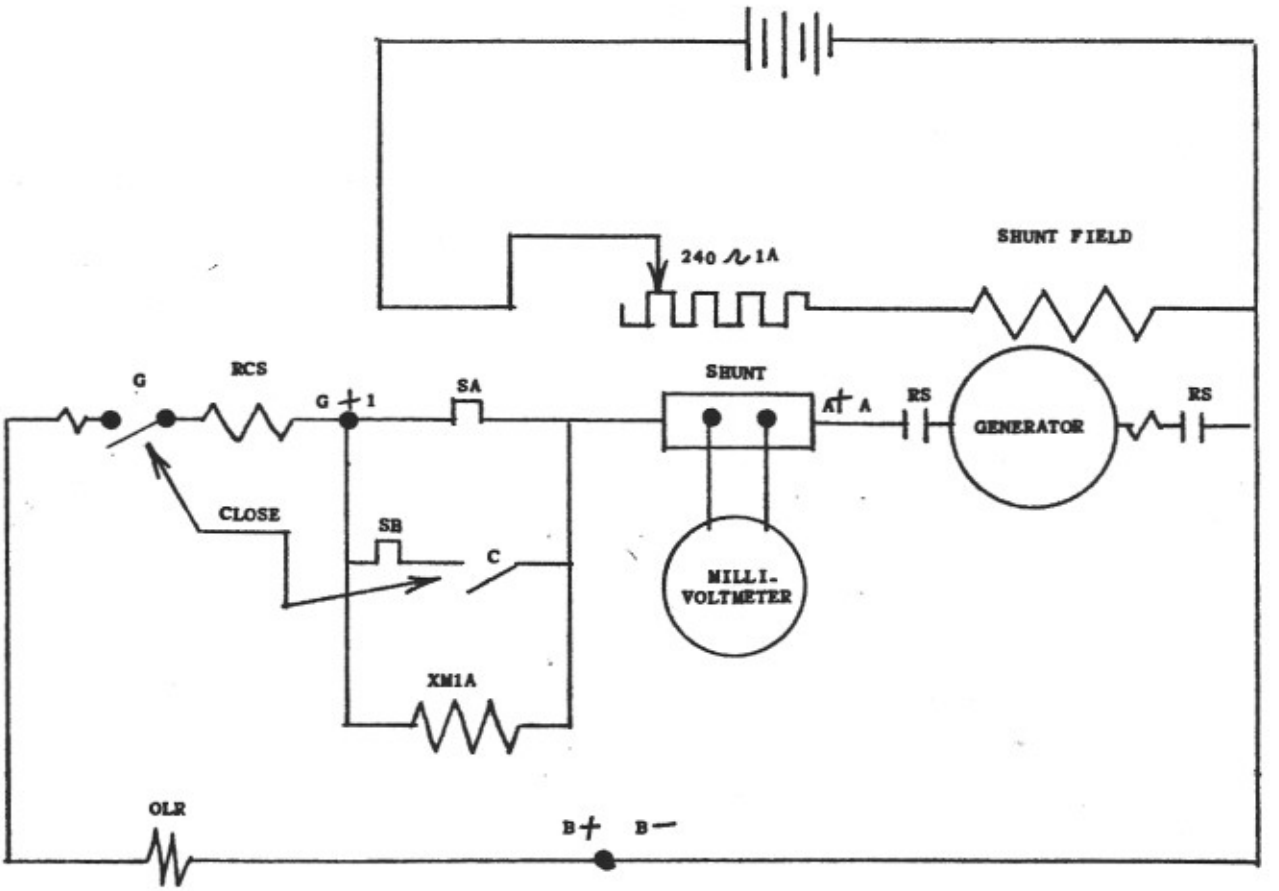
5. Separately excite the field by means of voltage (3-8V) obtained from flashlight batteries, cell from car battery, etc. connected to the shunt field through an adjustable series resistor (240 ohms/a). The excitation required will be very low and will be dependent upon the type of equipment to which method is applied. The polarity connection of the field excitation voltage will depend on the generator residual. Since this residual may be sufficient to cause the generator to build up past relay trip current, it would have to be bucked down by changing either the field voltage connection to oppose residual or direction of rotation of generator. The residual may be checked by starting motor generator set with generator field open and noting millivoltmeter reading (G closed).

6. Connect to stand-by power and start A.C. motor.

7. After motor-generator set is running close the generator contact (G) by pushing in the armature with a strong stick.

8. By means of the variable resistance (all in at starting) in the shunt field circuit, slowly increase (by taking resistance out of field) the generator armature current until the overload relay trips. Record reading at time of tripping.

9. Increase relay setting by increasing the calibrating spring tension and repeat 8 until the relay trips at the desired current.



SCHEMATIC DIAGRAM FOR SETTING OVERLOAD RELAY

Figure 59-A