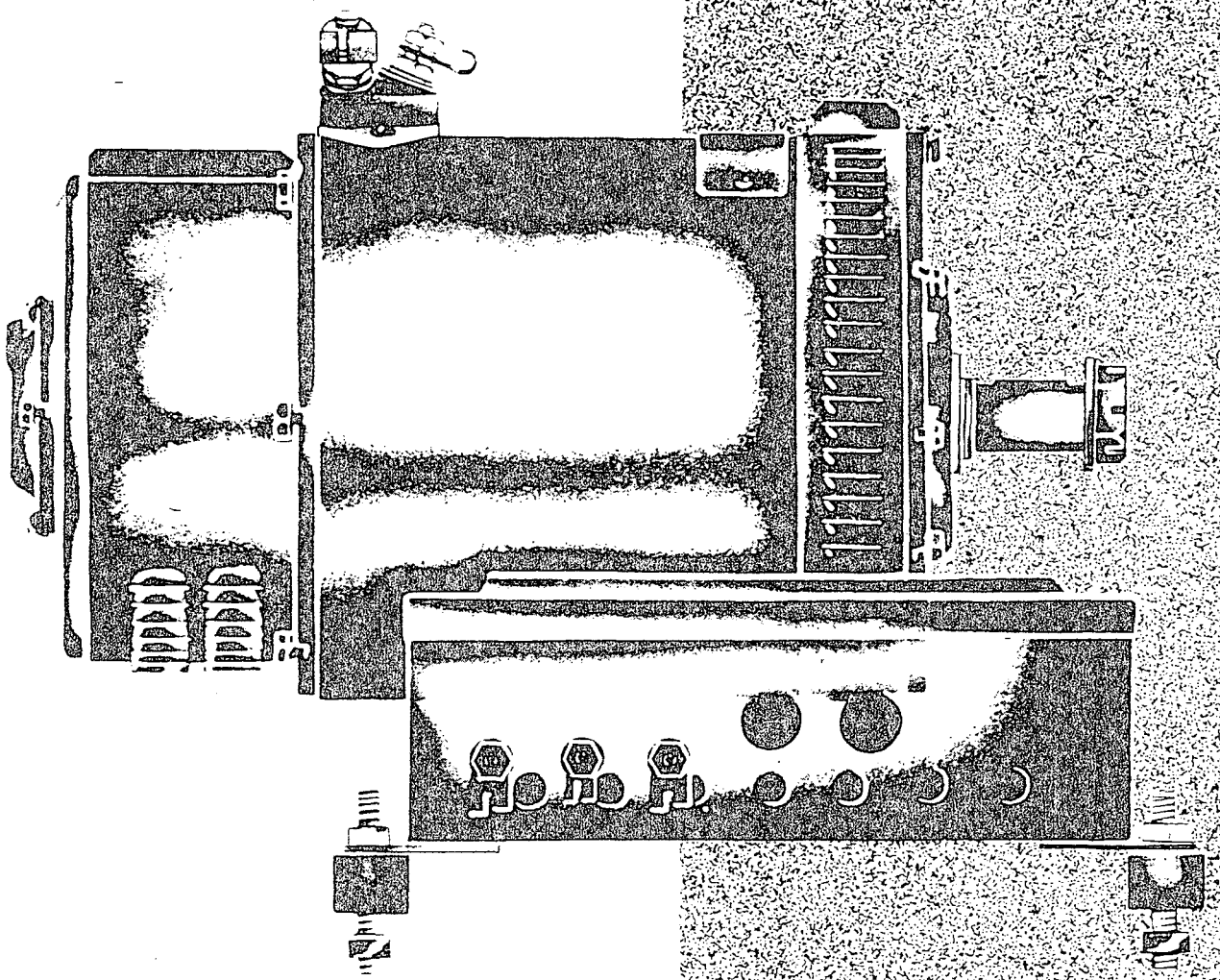
INSTRUCTIONS

2022-G
2023-G
AND
1800-R16



THE LEECE-NEVILLE CO
CLEVELAND, OHIO · U. S. A.

INDEX

LEECE-NEVILLE

CLEVELAND OHIO • U.S.A.

TYPE 2022-G or 2023-G GENERATOR

Characteristics

The generator, rated at 20 to 21 amperes, 32 to 40 volts at 900 R.P.M., is a direct-current, four-brush, shunt-wound engine-driven unit. Looking at the driven end, the units are connected internally for clockwise rotation for the type 2022-G generator, and counterclockwise for the Type 2023-G, see Fig. 1. It is connected to a type 1800-R16 Leece-Neville voltage control unit.

This generator is used for charging a 16 cell, lead acid type battery and provides current for lighting and control equipment. For internal wiring diagram for generator 2022-G or 2023-G, see Figure 1. For operation of generators in parallel see Locomotive Connection Diagram, Figure 5.

Inspection

Apparatus should be inspected often enough to prevent failure in service. This should include:

1. CLEANING

   It is essential that the apparatus be kept clean at all times. At least once a month, blow dirt or brush-dust out of the commutator-end housing 10, and brush rigging 11, Figure 1, with dry compressed air.

2. COMMUTATOR

   Inspect for roughness or eccentricity. If using No. 00 sandpaper does not correct this, or if the mica does or is about to project above the copper segment surface, the commutator must be resurfaced as described under COMMUTATOR MAINTENANCE.

3. BRUSHES AND BRUSH HOLDERS

   Check periodically for wear, proper spring pressure and that brushes are free in the brush holders. When brushes are worn down to 11/16 inch lengths, it is advisable to use the second notch of the levers. Refer to MAINTENANCE SECTION, REASSEMBLY, for spring pressures. Also check for loose, shorted or grounded connections.

4. LUBRICATION

   Lubricate generator bearings 3 and 34, Figure 1, with a light machine oil. Do not lubricate excessively as oil may enter the generator and cause failures.

Commutator Maintenance

If the commutator is rough, burned or eccentric, it must be resurfaced in a lathe. Turn off only enough copper to leave a uniformly true surface. The minimum diameter to which the commutator can be turned is 2-19/32 inches. The new diameter is 2¾ inches. Do not turn off any copper from the commutator risers 42, Figure 1. After the commutator is turned, carefully undercut the mica insulation between the copper segments to a depth of 0.030 inches. The sharp edges of the bars should be removed with a hand scraper or knife. Smooth and polish the commutator surface with fine sandpaper. Test armature for short circuits.

GENERATOR DISASSEMBLY

Refer to Figure 1.

1. Make adjacent center punch marks on housings 10, 22 and field ring 20 so that these marks can be lined up in assembly to locate the parts in their original position.
2. Remove brush opening band 40.
3. Lift up levers 13 to relieve spring pressure, taking care not to snap them which will damage the brushes.
4. Now brushes 12 may be removed from brush holders 14. Do not pull "pigtails" out of brushes.
5. Remove screws 1, bearing retainer 2, bearing retainer nut 5 and nut lockwasher 6. Do not remove flat head screws 46.
6. Remove driven-end housing screws 33.
7. With a brass rod held against exposed commutator-end of armature shaft at 4, drive the shaft out of roller bearing 3.
8. The armature 38 with driven-end housing assembly 22 will now be free.
9. Place armature 38 in a bench vise and remove screws 31, bearing retainer 26, bearing retainer nut 29, nut lockwasher 28 and spacing collar 30. Do not remove flat head screws 37.
10. Press armature 38 out of driven-end ball bearing 34.
11. Disconnect all internal connections from brush rigging 11.
12. Remove screws 39 and take away commutator-end housing 10.
13. Removal of two square head screws through two arc shaped slots in outer face of commutator-end housing 10 will release brush rigging 11.
14. Removal of flat head screws 37 and 46 will release the inner bearing retainers at the driven-end and commutator-end.
15. Do not disassemble pole pieces 17 and field coils 19 from field ring 20 unless the field coils have to be replaced.

GENERATOR REASSEMBLY

Refer to Figure 1

1. Clean all parts before reassembly.
2. Carefully inspect to determine if any repairs or replacements are necessary.
3. Test armature and field coils for ground with test lamp using alternating current. (110 volt, 60 cycle).
4. Field coils are connected in series and have a resistance of 21.5 ohms $\pm$ 0.5 ohms. At 32 volts the current will be from 1.45 to 1.5 amperes. Replace armature or field coils if necessary.
5. Discard brushes 12 when worn down to 9/16 inch length for full diameter commutator or $\frac{5}{8}$ inch length for minimum commutator diameter. New brushes are 13/16 inch long.
6. The brush spring pressure range is 3 to $3\frac{1}{4}$ lbs. up to the 4th notch of the brush lever.
7. For reassembly, reverse the procedure outlined in disassembly but note following instructions.
8. Make certain that the pilot diameters, matching diameters and facings on housings and field rings are not nicked or burred to insure proper alignment.
9. Use new felt washers 45 and saturate them in No. 6 Keystone Condensed Oil medium or equal.

GENERATOR REASSEMBLY—Continued

10. Use new tabbed and spring lockwashers under all hex and square head screws. Make certain that the spring lockwashers are next to the screw heads.

11. Pack bearings 3 and 34 with New York and New Jersey Lubricant Co. No. S-58 Non-Fluid Oil (grease) or equal.

12. Attach inner bearing retainer 8 to commutator-end housing 10 with flat head screws 46. Attach brush rigging 11 with two square head screws and their tabbed lockwashers. Do not install brushes at this time.

13. Start straight and press in roller bearing 3, then hold bearing in place with a temporary steel outer retainer made ⅛ inch thick with its outside diameter 2⅞ inches. A hole 1⅛ inches in diameter is to be punched in the center and four holes drilled with No. 15 drill (.180) spaced equidistantly from each other on the circumference of a circle whose radius is 1-7/32 inches.

14. Fasten this commutator-end housing assembly on the field ring assembly 20 with screws 39 and both spring and tabbed lockwashers.

15. Attach inner bearing retainers 23 and 24 and oil saturated felt washer 36 to driven-end housing 22 with flat head screws 37.

16. Start straight and press ball bearing 34 in place. Put fan key 35 in place and press fan 21 to stop shoulder on armature shaft. Press armature 38 into bearing in driven-end assembly using a tubular drift against the inner race to prevent damaging the bearing.

17. Slide the armature and driven-end housing assembly into the field ring and commutator-end housing assembly. Drive the armature shaft in the roller bearing with a lead hammer hitting alternately on the shaft and around the edge of the housing. Make certain the pilot diameter of driven-end housing 22 enters the field ring 20. Fasten housing 22 to field ring 20 with screws 33 and both spring and tabbed lockwasher.

18. Remove temporary steel outer retainer and proceed with the rest of the assembly.

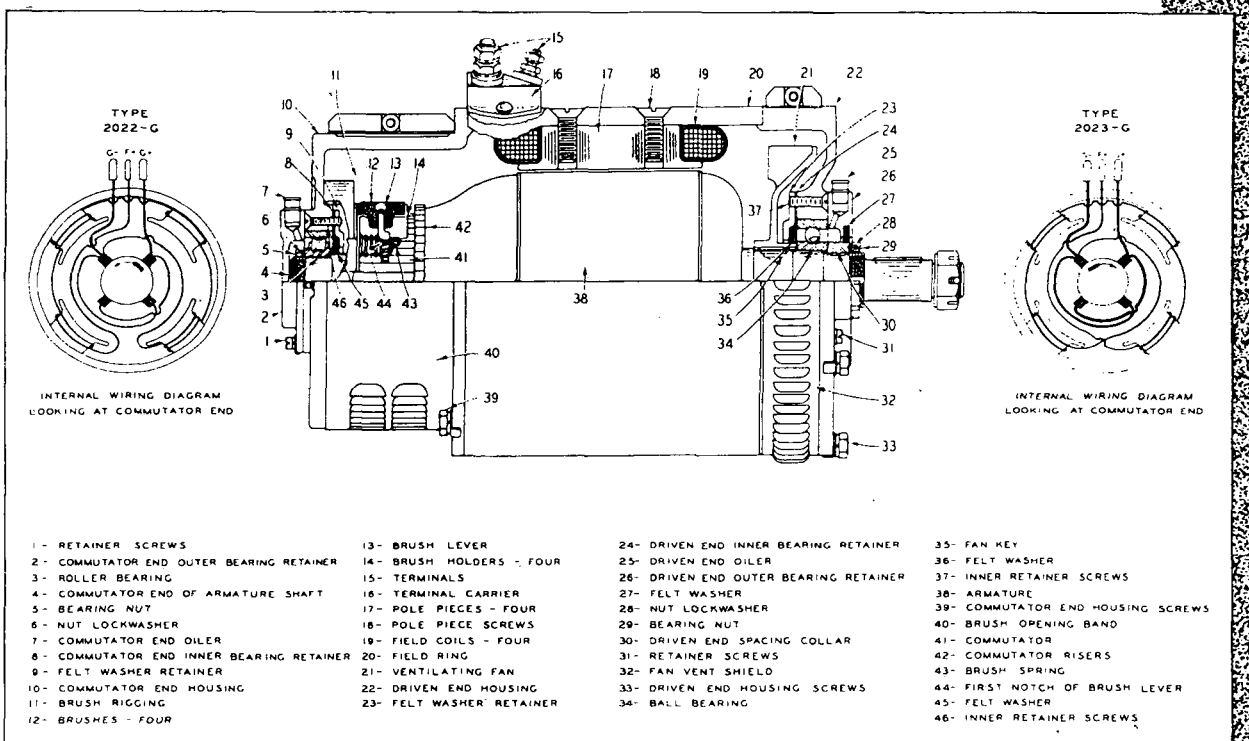


Fig. 1
SECTIONAL ILLUSTRATION AND WIRING DIAGRAMS

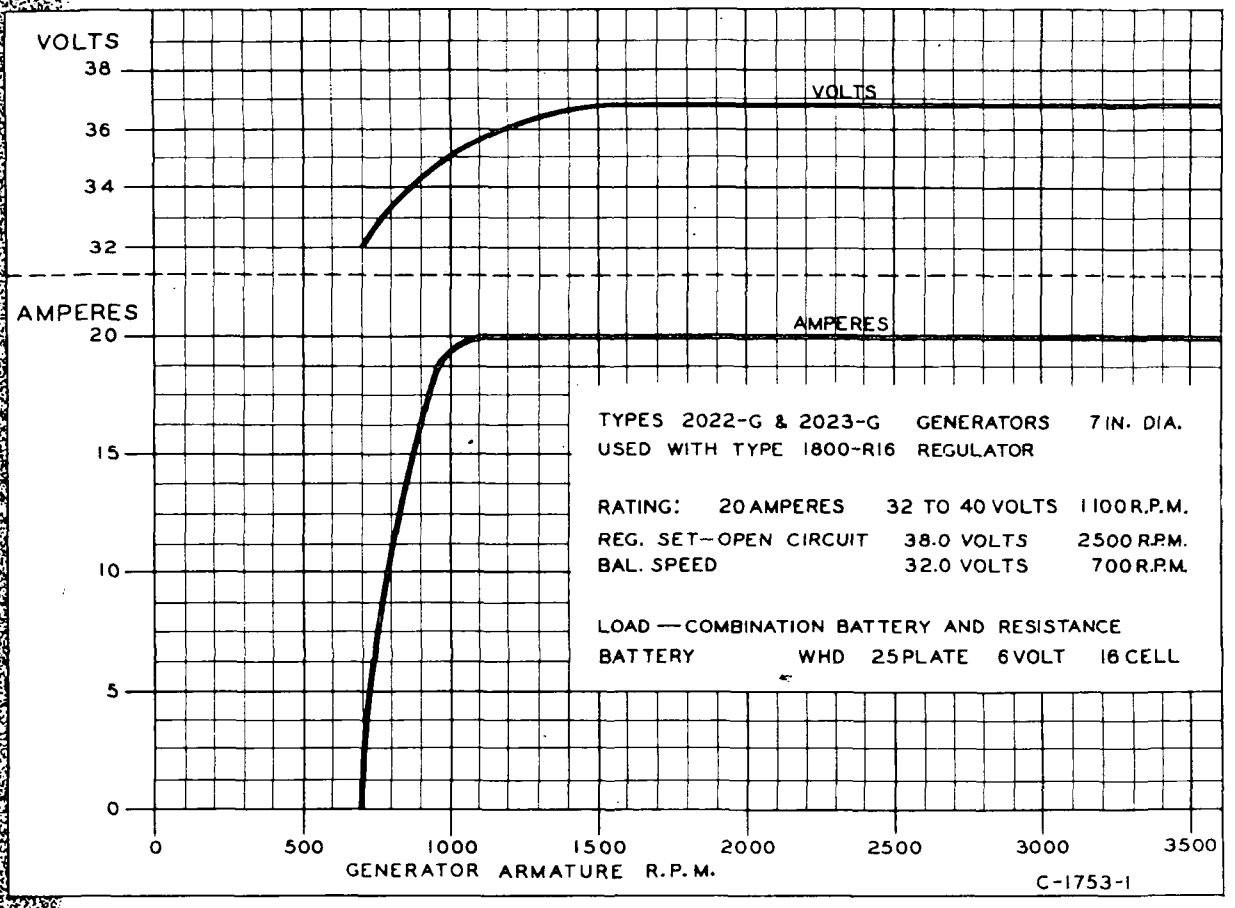


Fig. 2
PERFORMANCE CURVE

★ NOTICE! ★

ALL TYPE 2022-R REGULATORS WITH SERIAL NOS. 609 AND UNDER are to be returned to the factory for rebuilding, if performance is not satisfactory.

★ ★ ★

ALL TYPE 2022-R16 REGULATORS WITH SERIAL NOS. 610 AND UP are to be converted to Type 1800-R16. See conversion instructions Form No. 454-35C-5-43.

GENERATOR CONTROL UNIT

TYPE 1800-R16 REGULATOR

General Inspection

It is recommended that the generators and regulators be inspected every 30 days or every 500 operating hours, which ever occurs first.

First . . . . Disconnect the parallel connection, by disconnecting the wire that is connected to the P+ terminal on the regulator.

Second . . . Make certain the opposite unit of a parallel connection is at rest while testing.

Third . . . Remove the generator battery fuse.

Fourth . . . Connect the voltmeter between the regulator side of the fuse clip (B—) and a ground (B+).

Fifth . . . . For a true reading, accelerate and retard the engine several times. Take a voltage reading each time the engine is running at top speed. The voltage reading should be from 37.5 to 38.0 volts at full throttle.

Sixth . . . . Check the contacts for burned or pitted spots. If the contacts are spotted, clean with an ALOXITE block 150 or 180 grit. Place the block between the contacts and with a slight thumb pressure on the armature, move the block back and forth slowly until clean.

Seventh . . Blow out all filings.

Eighth . . . Be sure to reconnect the parallel line after checking.

FOR FURTHER INSTRUCTIONS REFER TO THE FOLLOWING CHAPTERS:

Characteristics

The Regulator or Control Unit (Figure 3) limits the output of the generator so that the charging rate within the capacity of the generator varies according to the load imposed by the electrical system and the condition of the battery. It consists of the following parts:

1. THE CUTOUT RELAY. This device functions only when the generator voltage is sufficient to charge the battery. Below this predetermined value, the contacts remain open, preventing the battery from discharging into the generator.

2. THE VOLTAGE REGULATOR automatically limits the voltage from rising beyond the level for which it is set, thereby keeping the generator from charging at a higher point than is safe for the system.

3. THE LOAD LIMITOR effectively controls the amperage or current output of the generator. As current is consumed, or if the battery is discharged, the load limitor varies the charging rate within the limits of the generator. The armature of the Load Limitor vibrates to introduce a controlling resistance which limits the charging rate of the generator to its designed capacity.

The ampere output of the generator, within the designed limits, is controlled by the load limitor and no attempt should be made to change it by adjusting the cutout or voltage regulator.

4. The resistance Units R6 and R7, Figure 3, are for control in the voltage regulator circuit. The filter unit F-1 prevents arcing between the voltage regulator contacts.

ADJUSTMENT INSTRUCTIONS

It is advisable to check adjustments frequently at first, then regular periods of inspection may be established as conditions require. See General Inspection.

Due to operating conditions on the locomotive, it is not always practical to make adjustments to the regulator while installed on the locomotive. Consequently, in some instances, it will be necessary to remove the generator and control equipment to a test stand, or provide a small variable speed engine or motor to drive the generator.

When the equipment is adjusted in the locomotive, the units should be connected according to the diagram shown in Figure 3. If adjustments are made on a test bench, connections should be made as shown in Figure 4. For parallel connections (the use of two regulators and two generators) see Figure 5.

When the equipment is adjusted on the locomotive, care must be taken that the engine idling speed is adjusted to 550 RPM for the Cummins HBI engine, and 500 RPM for the HBIS engine. Due to the fact that the engines are governed at 1800 RPM, and different generator to engine speed ratios are used on the standard and supercharged engines, care must be taken to obtain the generator speed shown in the adjustment specifications.

Make temporary adjustments at first so that no damage will result. Then operate the units for 15 minutes or more to heat them up and make the final adjustments. Do not close the cutout relay contacts at any time by hand. If Generators and Regulators are connected in parallel, adjustments are to be made on one unit at a time. The opposite set must be at rest. Detailed adjustment instructions follow. Refer to Figure 3.

CUTOUT RELAY

First . . . . Disconnect the battery wire from the terminal (B—).

Second . . . Set the contact gap (C^7) at .070" to .075" by bending the armature stop (C^5). (Set when contacts are open).

Third . . . Set the contact gap (C^8) at .040" to .045" by bending the thin carrier (C^6). ((Set when contacts are open).

Fourth . . . Loosen the two screws (C^2) and move the bracket (C^{10}) in order to set the hinge gap (C^4) at approximately .005" to .015". (Set when contacts are closed).

Fifth . . . . Set the gap (C^9) between the armature and the core at .022" to .025" by adjusting the hinge gap (C^4). (Set when contacts are closed).

Sixth . . . . The contacts at (C^7) and (C^8) should close when the voltage measured across the terminal (G— and G+) is from 28-29 volts. In addition to closing at 28 to 29 volts both contacts must seal tightly, when the generator Armature speed is between 700 and 750 R.P.M.
NOTE: Turn the adjusting nut (C^3) clockwise to increase and counter-clockwise to decrease the voltage until the proper adjustment is reached.

Seventh . . Connect one lead of the ammeter to the negative (—) battery wire and the other lead to the (B—) terminal. From a generator speed at which the contacts at (C^7) and (C^8) are closed, decrease the speed to a complete stop. The contacts should open when the discharge current in the line is from 0 to 10 amperes. If necessary, readjust the nut (C^3) to obtain this value and recheck the contact closing voltage.

VOLTAGE REGULATOR

Eighth . . . Set the voltage regulator contact gap (R^4) at .045" to .051" by holding the contact open and turning the screw (R^3). (Set when contacts are open).

Ninth . . . Set the gap (R^6) between the armature and the core at .060" to .065". File the armature stop pin (R^5) if necessary. (Set when contacts are open).

Tenth . . . Disconnect the battery from the terminal (B—).

ADJUSTMENT INSTRUCTIONS

VOLTAGE REGULATOR—Continued

Eleventh . . With the generator running in the proper direction at a speed of 2500 R.P.M. the voltage across (B—) and (B+) should be from 37.5 to 38.0 volts. If it is not, turn the adjusting nut (R^2) until this is obtained. Make a final check by increasing the generator speed from 0 to 2500 R.P.M.

LOAD LIMITOR

Twelfth . . Set the contact gap (L^2) at .025 to .030 by holding the contact open and turning the screw (L^3). (Set when contacts are open).

Thirteenth. Set the gap (L^5) between the armature and the core at .015″ to .020″ by filing the armature stop pin (L^4), if necessary. (Set when contacts are open).

Fourteenth Set the hinge gap (L^8) at approximately .005″ to .010″ by loosening the screw (L^6) and moving the bracket. (Set when contacts are open).

Fifteenth . With the battery connected, run the generator at 2000 R.P.M. using a lamp or a resistance load of 20 amperes on the generator, the ammeter in the line from the generator to the terminal (B—) should read between 20 and 21 amperes. If it is lower than 20 amperes or higher than 21 amperes, bend the bracket end (L^7) to increase or decrease the spring pressure.

Sixteenth . Recheck and readjust the voltage regulator element, if the adjustment has changed.

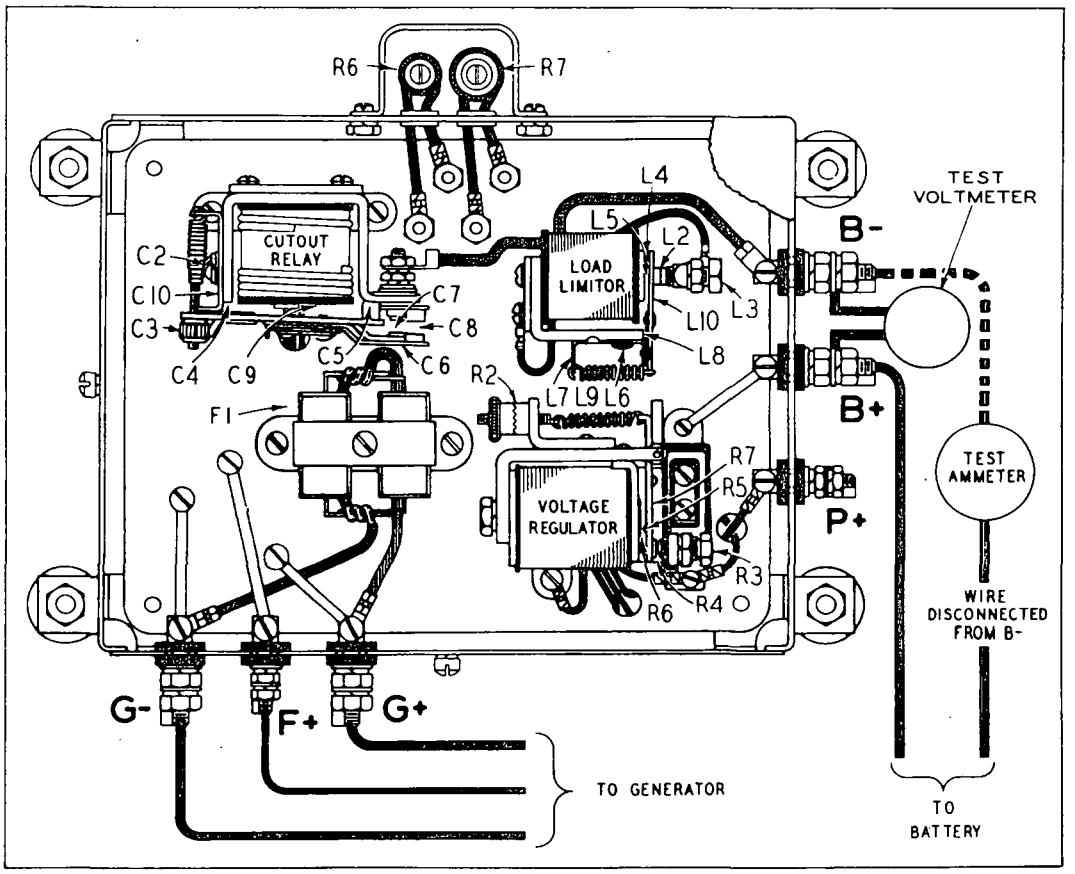


Fig. 3
TEST CONNECTION DIAGRAM

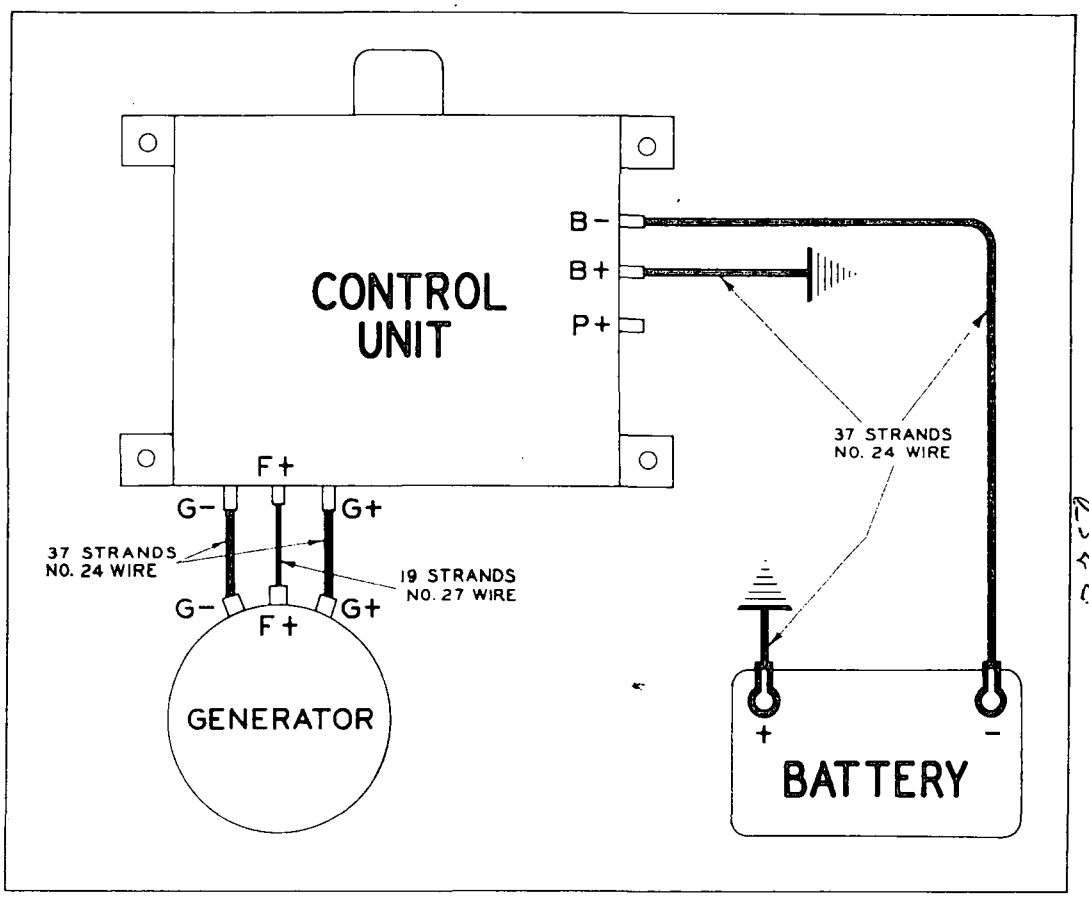


Fig. 4
BASIC CONNECTION DIAGRAM

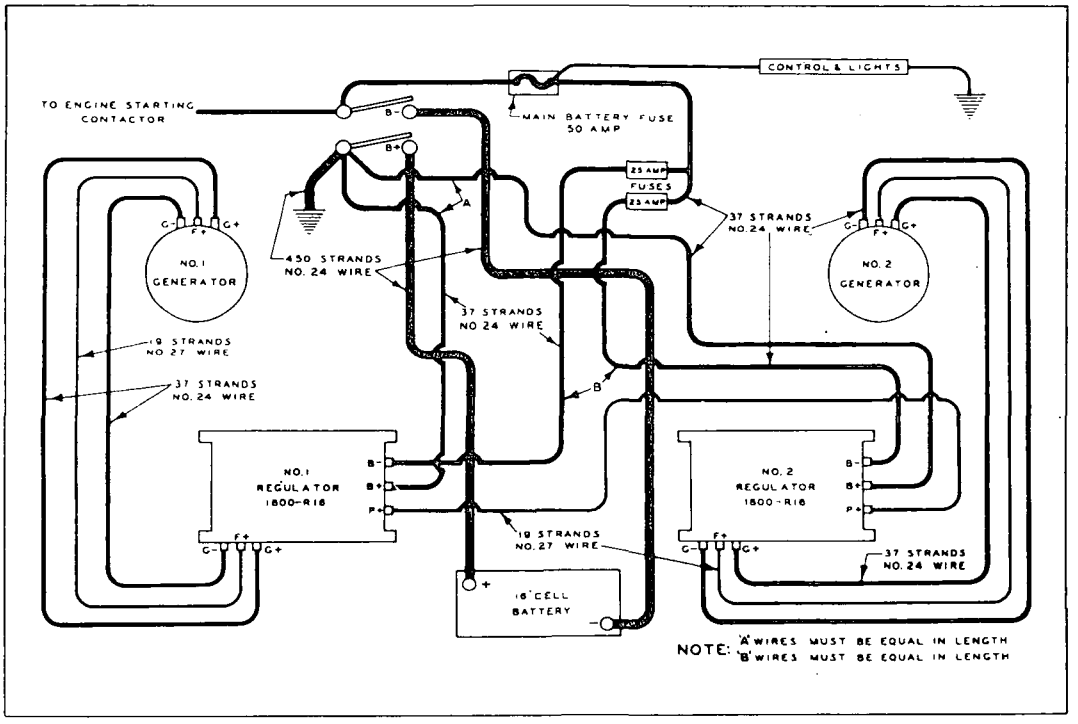


Fig. 5
LOCOMOTIVE CONNECTION DIAGRAM

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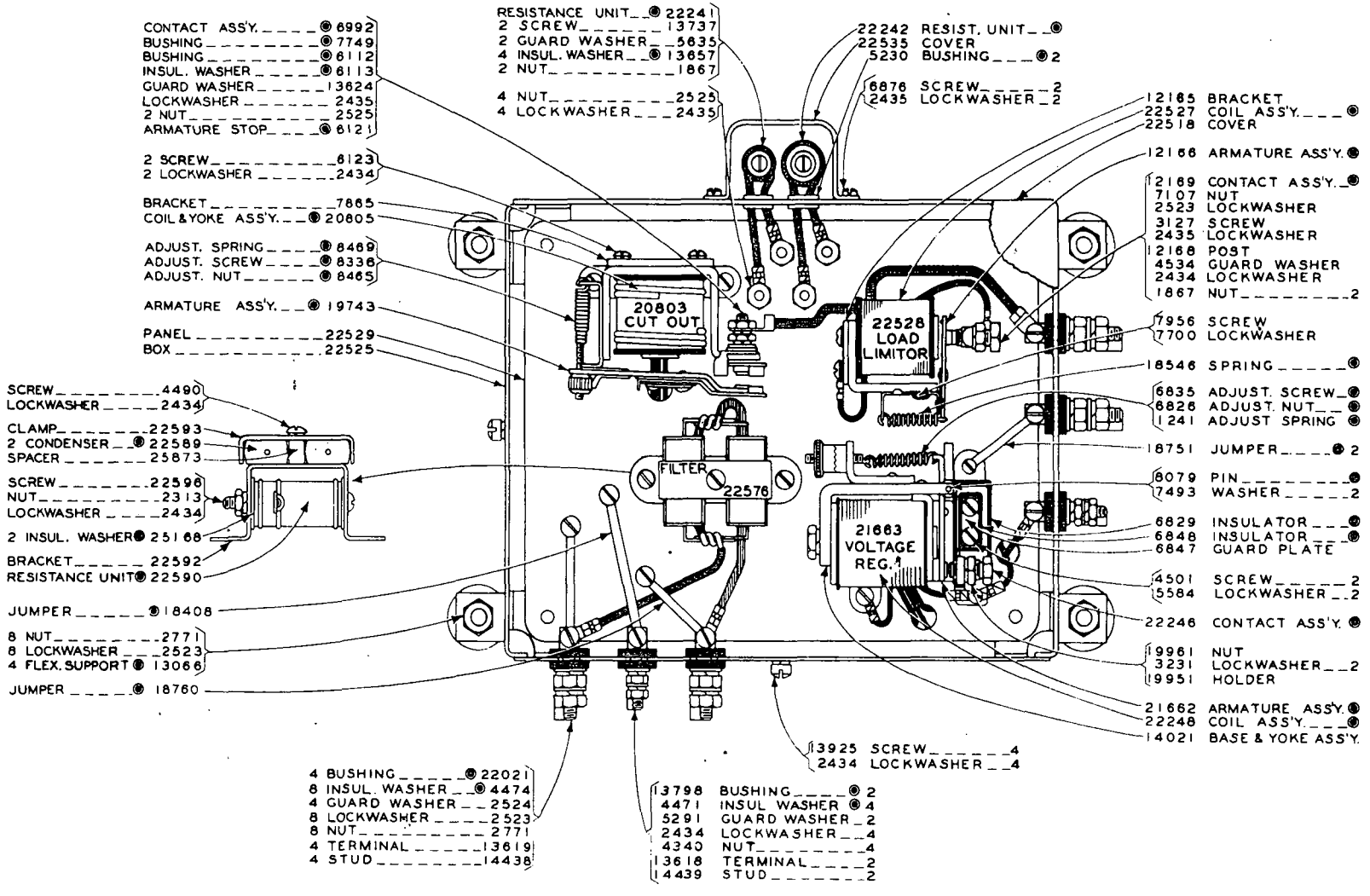

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COMPLETE PRICE LIST AVAILABLE ON REQUEST.
● SUGGESTED PARTS TO CARRY FOR SERVICING.
REGULATOR MUST BE MOUNTED FREE FROM VIBRATION AND AS SHOWN.
SEE BACK OF THIS SHEET FOR WIRING DIAGRAM

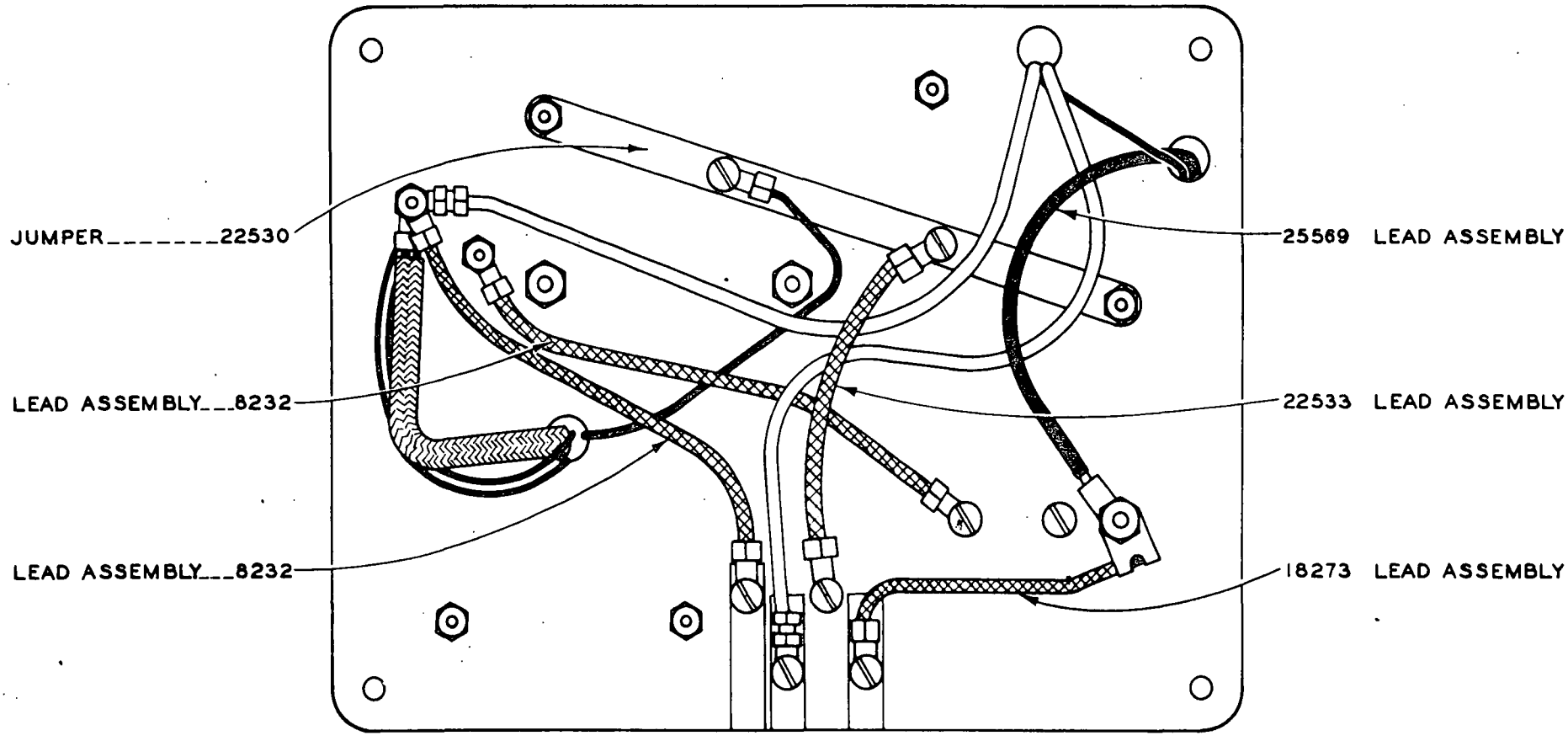
USED BY: GENERAL ELECTRIC CO.

MAY, 1943

30-37.5 Volt Voltage Regulator

TYPE 1800-R16

THIS WIRING DIAGRAM FOR REGULATORS ON FRONT OF THIS SHEET

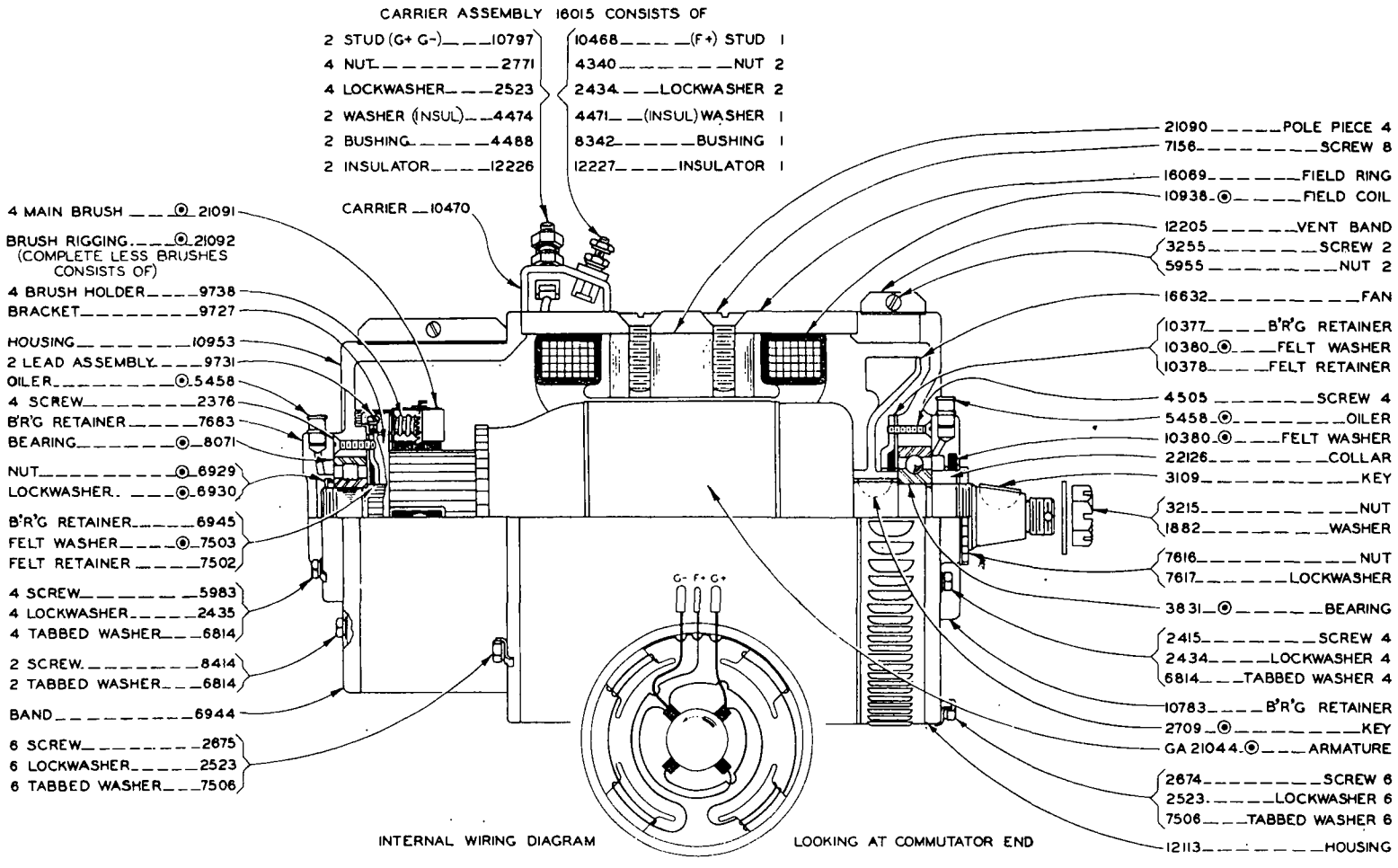


VIEW LOOKING AT BACK OF PANEL

7" Dia. Voltage Regulated Generator
Clockwise Rotation at Driven End
Bracket Mounting
Used with Type 1800-R Regulator

TYPE 2022-G

The Leece-Neville Co. . . Cleveland, Ohio



CHARACTERISTICS OF GENERATOR - HOT						
Volts	Watts	Amps at RPM	Amps at RPM	Amps at RPM	Amps at RPM	Amps at RPM
30-37.5	750	0	650	10	750	20	900	20	3500

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COMPLETE PRICE LIST AVAILABLE ON REQUEST.

USED BY:-GENERAL ELECTRIC CO.

⊙ SUGGESTED PARTS TO CARRY FOR SERVICING.

SATURATE NEW FELT WASHERS WITH OIL WHEN REPLACING.

MAY, 1943

The Leece-Neville Co. . . Cleveland, Ohio

7" Dia. Voltage Regulated Generator
Counterclock Rotation
Bracket Mounting
Used with 1800-R Regulator

TYPE 2023-G

CARRIER ASSEMBLY 16015 CONSISTS OF

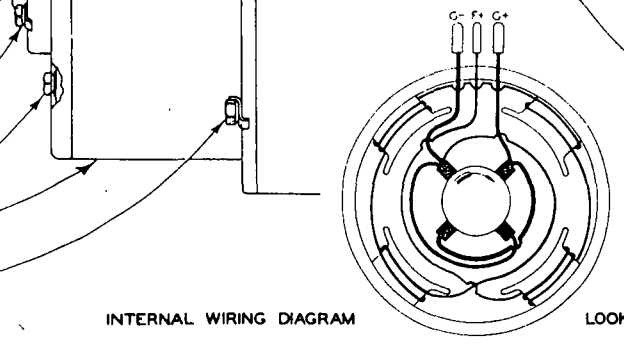
2 STUD (G+ G-) ----- 10797
4 NUT ----- 2771
4 LOCKWASHER ----- 2523
2 WASHER (INSUL) ---- 4474
2 BUSHING ----- 4488
2 INSULATOR ----- 12226

10468 ----- (F+) STUD
4340 ----- NUT 2
2434 ----- LOCKWASHER 2
4471 ----- (INSUL) WASHER
8342 ----- BUSHING
12227 ----- INSULATOR

10470 --- CARRIER

4 MAIN BRUSH --- ◉ 21091
BRUSH RIGGING --- ◉ 21092
(COMPLETE LESS BRUSHES)
CONSISTS OF
4 BRUSH HOLDER --- 9738
BRACKET ----- 9727
HOUSING ----- 10953
2 LEAD ASSEMBLY --- 9731
OILER ----- ◉ 5458
4 SCREW ----- 2376
BEARING RETAINER --- 7683
BEARING ----- ◉ 8071
NUT ----- ◉ 6929
LOCKWASHER ----- ◉ 6930
BEARING RETAINER --- 6945
FELT WASHER ----- ◉ 7503
FELT RETAINER ----- 7502
4 SCREW ----- 5983
4 LOCKWASHER ----- 2435
4 TABBED WASHER --- 6814
2 SCREW ----- 8414
2 TABBED WASHER --- 6814
BAND ----- 6944
6 SCREW ----- 2675
6 LOCKWASHER ----- 2523
6 TABBED WASHER --- 7506

21090 ----- POLE PIECE 4
7156 ----- SCREW 8
16069 ----- FIELD RING
10938 ◉ ----- FIELD COIL
12205 ----- VENT BAND
3255 ----- SCREW 2
5955 ----- NUT 2
16633 ----- FAN
10377 --- BEARING RETAINER
10380 ◉ --- FELT WASHER
10378 ----- FELT RETAINER
4505 ----- SCREW 4
5458 ◉ ----- OILER
10380 ◉ --- FELT WASHER
22126 ----- COLLAR
3109 ◉ ----- KEY
3215 ----- NUT
1882 ----- WASHER
7616 ----- NUT
7617 ----- LOCKWASHER
3831 ◉ ----- BEARING
2415 ----- SCREW 4
2434 ----- LOCKWASHER 4
6814 --- TABBED WASHER 4
10783 --- BEARING RETAINER
2709 ◉ ----- KEY
GA 21044 ◉ --- ARMATURE
2674 ----- SCREW 6
2523 ----- LOCKWASHER 6
7506 --- TABBED WASHER 6
12113 ----- HOUSING



INTERNAL WIRING DIAGRAM

LOOKING AT COMMUTATOR END

CHARACTERISTICS OF GENERATOR - HOT							
Volts	Watts	Amps at RPM	Amps at RPM	Amps at RPM	Amps at RPM	Amps at RPM	
30-37.5	750	0 650	10 750	20 900	20 3500		

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COMPLETE PRICE LIST AVAILABLE ON REQUEST.

◉ SUGGESTED PARTS TO CARRY FOR SERVICING.

SATURATE NEW FELT WASHERS WITH OIL WHEN REPLACING.

USED BY:-GENERAL ELECTRIC CO.

MAY, 1943