

Section VI. THEORY OF DYNAMOTOR-POWER SUPPLY DY-105/GRC-9X

155. General

Dynamotor-Power Supply DY-105/GRC-9X is designed to convert a 24-volt dc input from a vehicular storage battery into the necessary operating voltages for the receiver-transmitter. The dynamotor power supply consists of a dynamotor, a synchronous (self-rectifying) vibrator, and various regulatory and control elements. To control the operation of Dynamotor-Power Supply DY-105/GRC-9X from Receiver-Transmitter RT-77(*)/GRC-9, the TRANS RECEIVE-OFF switch on the dynamotor power supply first must be turned to TRANS RECEIVE. The dynamotor (D1) operates when either the receiver and the transmitter is in operation, and when the OFF-SEND-STANDBY switch control Ⓢ, on the receiver-transmitter is turned to SEND. When control Ⓢ is turned to STANDBY, the dynamotor does not operate and the receiver is supplied from the lv vibrator circuits in the dynamotor power supply. Thus, the battery is not drained excessively during prolonged periods of listening.

156. Block Diagram of Dynamotor-Power Supply DY-105/GRC-9X (fig. 105)

a. *Receiver Start Circuit.* With control Ⓢ at either SEND or STANDBY and switch S1 in the TRANS RECEIVE position, receiver start relay K1 is energized and the receiver filaments obtain their voltage from the dynamotor power supply. Ballast resistor RT3 drops the battery voltage to the proper filament operating voltage. When relay K1 is energized, contacts 3 and 2 close to provide power to the vibrator circuits, which step up the low battery voltage to a higher dc voltage (par. 158). The output of transformer T1 is fed through a filter network to the plate and screen circuits of the receiver-transmitter (except V103).

b. *Transmitter Start Circuit.* Dynamotor start relay K2 is energized when control Ⓢ, is turned to the SEND position. When K2 is energized, contacts 4 and 5 close, applying the battery voltage to the lv winding in the dynamotor. In effect, the dynamotor operates as a dc transformer, which steps up the low battery voltage

to the high voltage necessary for operation of the transmitter. The hv output from the dynamotor is fed (through a filter) to the plates and screens of the transmitter tubes V102 and V103. During send periods, the transmitter filaments and keying relay K101 receive their operating voltages from the dynamotor power supply (par. 161). The battery voltage (24 volts) is fed through voltage-dropping resistor R9 to the keying relay circuits and is also fed through two ballast resistors in parallel to the transmitter filaments.

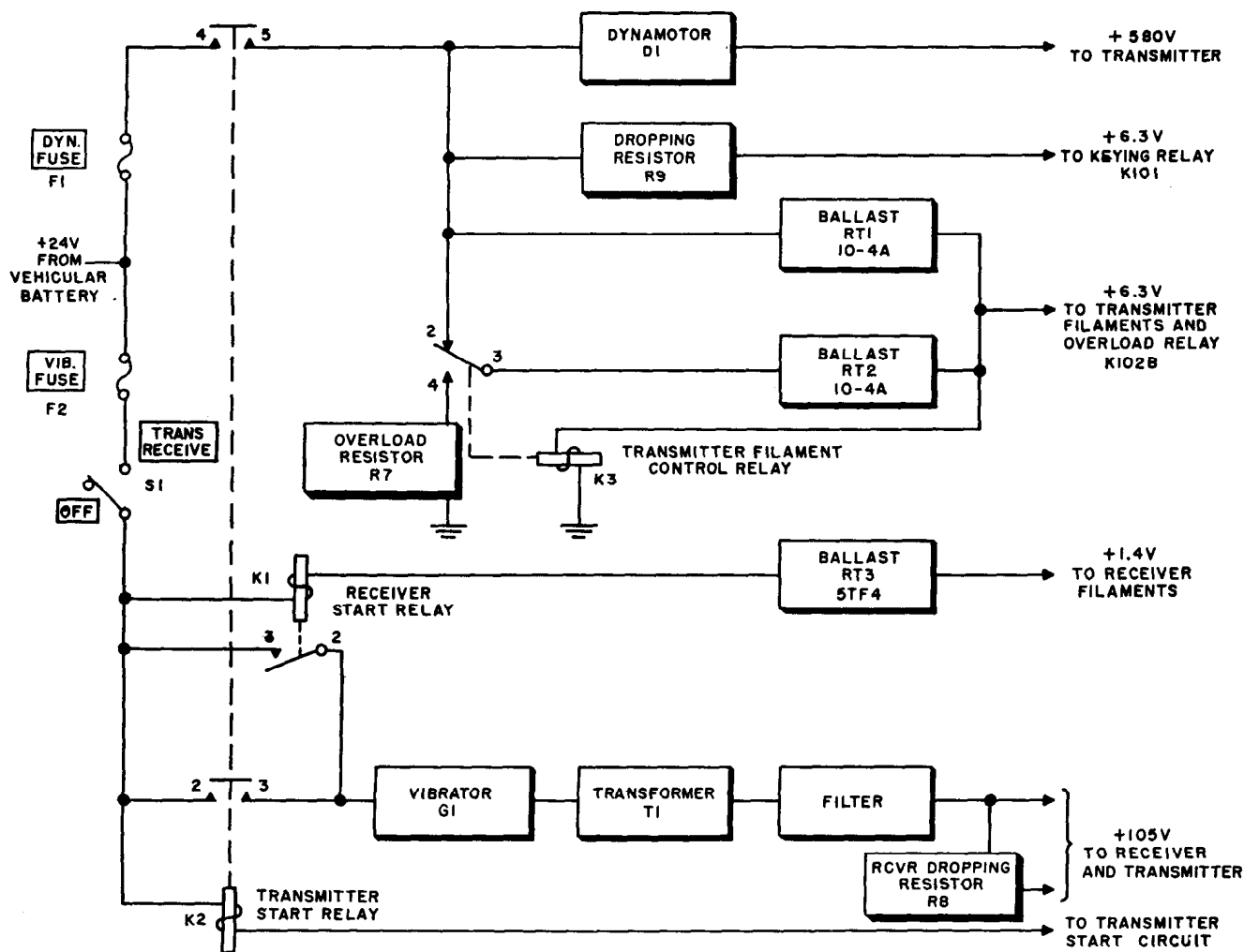
c. *Overvoltage Protect Circuit.* The 6.3-volt transmitter filament circuit includes a voltage limiting circuit which prevents the output voltage from rising to an abnormally high value when the transmitter filaments are not drawing current. When the output voltage rises to a higher than normal value (6.3 volts), filament control relay K3 is energized and its contacts connect the two ballast tubes and resistor R7 in series to form a voltage divider. The output voltage then is taken from a tap on the divider, thus protecting the transmitter from excessive filament voltage (par. 161).

157. Receiver Filament Supply of Dynamotor-Power Supply DY-105/GRC-9X (fig. 106)

a. When control Ⓢ is set in the SEND or STANDBY position, 1.4-volts dc is supplied to the filaments of the receiver tubes. Capacitor C1 acts as an rf bypass which prevents any rf hash generated in the power supply from entering other equipment through the power input cable.

b. The battery voltage is fed through VIB. FUSE F2, switch S1 in the TRANS RECEIVE position, dropping resistors R1 and R2, and fed to receiver start relay K1. The circuit is completed through the coil of relay K1, ballast RT3, receptacles J1 and J2 of the receiver-transmitter, switch S103C (fig. 94), and the receiver filaments to ground. The current that flows in this circuit energizes K1. Capacitors C14 and C17 act to eliminate any ripple voltage.

c. Ballast tube RT3 is a thermal resistor in series with the receiver filament supply. It acts as a voltage regulator, maintaining a constant



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Figure 105. Dynamotor-Power Supply DY-105/GRC-9X, block diagram.

voltage output for the receiver filaments under conditions of varying input voltage.

d. Referring to figure 94, when control ⑤ is in the STANDBY position, the receiver filaments obtain their power through terminals 22 or 23 of J2. When control ⑤ is in the SEND position, the receiver filaments also obtain their power through terminal 22 and 23 of J2.

158. Receiver Plate and Screen Supply of Dynamotor-Power Supply DY-105/GRC-9X (fig. 106)

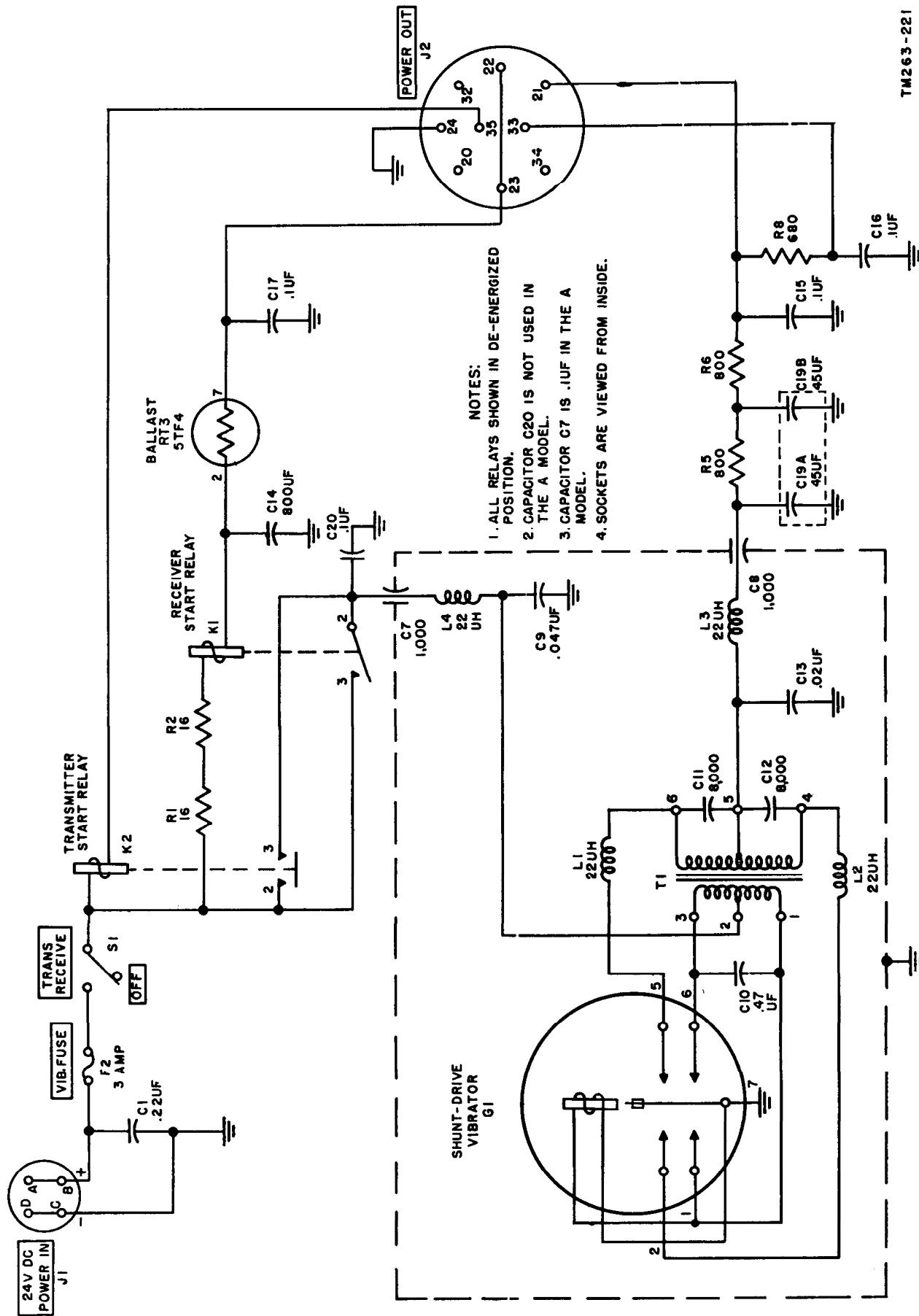
a. Synchronous vibrator G1 and transformer T1 are used to supply 105 volts dc at 17 ma to the receiver plate and screen circuits during standby periods, and 105 volts dc at 45 ma to the plate and screen circuits of V5 and V6 in the receiver (fig. 67) and to the transmitter

oscillator, doubler, and modulator plates and screens during send periods (fig. 91).

b. Receiver start relay K1 is energized when control ⑤ is at the SEND or STANDBY position (par. 157). Battery current passes through closed contacts 3 and 2 of K1, or 2 and 3 of K2, or both, to the center tap (terminal 2) of transformer T1 and to the vibrator coil.

c. Vibrator G1 is a shunt-drive type vibrator. The principles of operation are identical to that given in paragraph 150c(3). The circuit differences are as follows:

- (1) Transformer T1 is referred to in place of T201.
- (2) Primary terminals 1, 2, and 3 on T1 correspond to terminals 5, 9, and 4 on T201, respectively.
- (3) Coils L2 and L4 are referred to coils L202 and L206, respectively.



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Figure 106. Dynamotor-Power Supply DY-105/GRC-9X, vibrator, transmitter start, and receiver filament circuit.

- (4) The voltage select switch is not required on the 24-volt dynamotor power supply; coil L4 connects directly to relay K1.
- (5) Receiver start relay K1 is referred to K203 and transmitter start relay K2 is referred to K202.
- (6) Contacts 2 and 3 on K1 correspond to contacts 7 and 3 of K203 and contacts 3 and 2 on K2 correspond to contacts 6 and 5 on K202.

d. The rectifier circuit is also identical to that of the 6-, 12-, 12-volt dynamotor as described in paragraph 150c(2) except for the terminal numbers on the transformers. Terminals 4, 5, and 6 on T1 correspond to terminals 3, 2, and 1 on T201.

e. The rectified output from T1 is filtered by resistors R5 and R6 and capacitors C19A and C19B. During standby operation, the output is fed through voltage-dropping resistor R8. The 105 volts dc at 17 ma is then fed through terminal 33 on POWER OUTPUT receptacle J2, through Cord CD-1086 to terminal 57 on receiver-transmitter POWER receptacle J102 (fig. 94). With control Ⓢ set at SEND, the filtered output is fed through terminal 21 on J2 to terminal 58 on J102 (figs. 67 and 91). Dropping resistor R8 is not used during send operation as more current is drawn from the 105-volt supply than in standby operation. Thus, the required output voltage is maintained.

f. In the explanation of the receiver plate and screen supply circuits, several circuit elements were omitted. This was done to clarify essential points of operation. The functions of these elements are explained below.

- (1) Filter chokes L1 through L4 and rf filter capacitors C7, C20, and C8 are used for elimination of hash interference caused by the vibrator contacts.
- (2) Capacitor C10 is the primary buffer. Its function is to minimize arcing of the vibrator contacts and also to produce the correct wave form for efficient operation of T1.
- (3) Capacitors C11 and C12 function as arc suppressors and also as the secondary buffers.

- (4) Capacitors C15 and C16 are used to filter out rf hash in the 105-volt dc output.

159. Transmitter Start Circuit of Dynamotor-Power Supply DY-105/GRC-9X (fig. 107)

a. When control Ⓢ is turned to SEND and S1 is set at TRANS RECEIVE, transmitter start relay K2 is energized and contacts 4 and 5 close. Battery power is applied to the dynamotor D1 through DYN. FUSE F1 and the closed contacts of transmitter start relay K2.

b. The transmitter start circuit is completed to ground from K2, terminal 35 on J2, through Cord CD-1086, terminal 55 on J102, and by S103B (fig. 94).

160. Transmitter Plate and Screen Supply of Dynamotor-Power Supply DY-105/GRC-9X

a. Closed contacts 2 and 3 of K2 apply battery power to the vibrator section of the dynamotor power supply (fig. 106). The 105-volt output is applied to the transmitter through terminal 21 of J2, terminal 57 on J102 (fig. 94), and closed contacts of keying relay K101.

b. During send periods, relay K101 is energized, which causes contacts 18 and 19 to open and contacts 17 and 18 to close. This action transfers the 105 volts at 45 ma from the receiver section to the oscillator, doubler, and modulator stages in the transmitter section (par. 117).

c. Ordinarily, contacts 2 and 3 of K2 are shorted by closed contacts 3 and 2 of receiver start relay K1 so that the 105-volt supply is operating continuously. Contacts 2 and 3 of K2 insure that 105 volts are available for the transmitter even though K1 is not energized, as would be the case if the receiver were inoperative.

d. The hv output from the dynamotor power supply is fed through terminal 32 of J2 (fig. 107) to terminal 47 of J102 and is applied to the pa plate when control Ⓢ is turned to the SEND position (fig. 94). No pa plate current flows until keying relay K101 and screen cutout relay K102A are energized to close contacts 4 and 5 (on K102A) and 9 and 10 (on K101) to

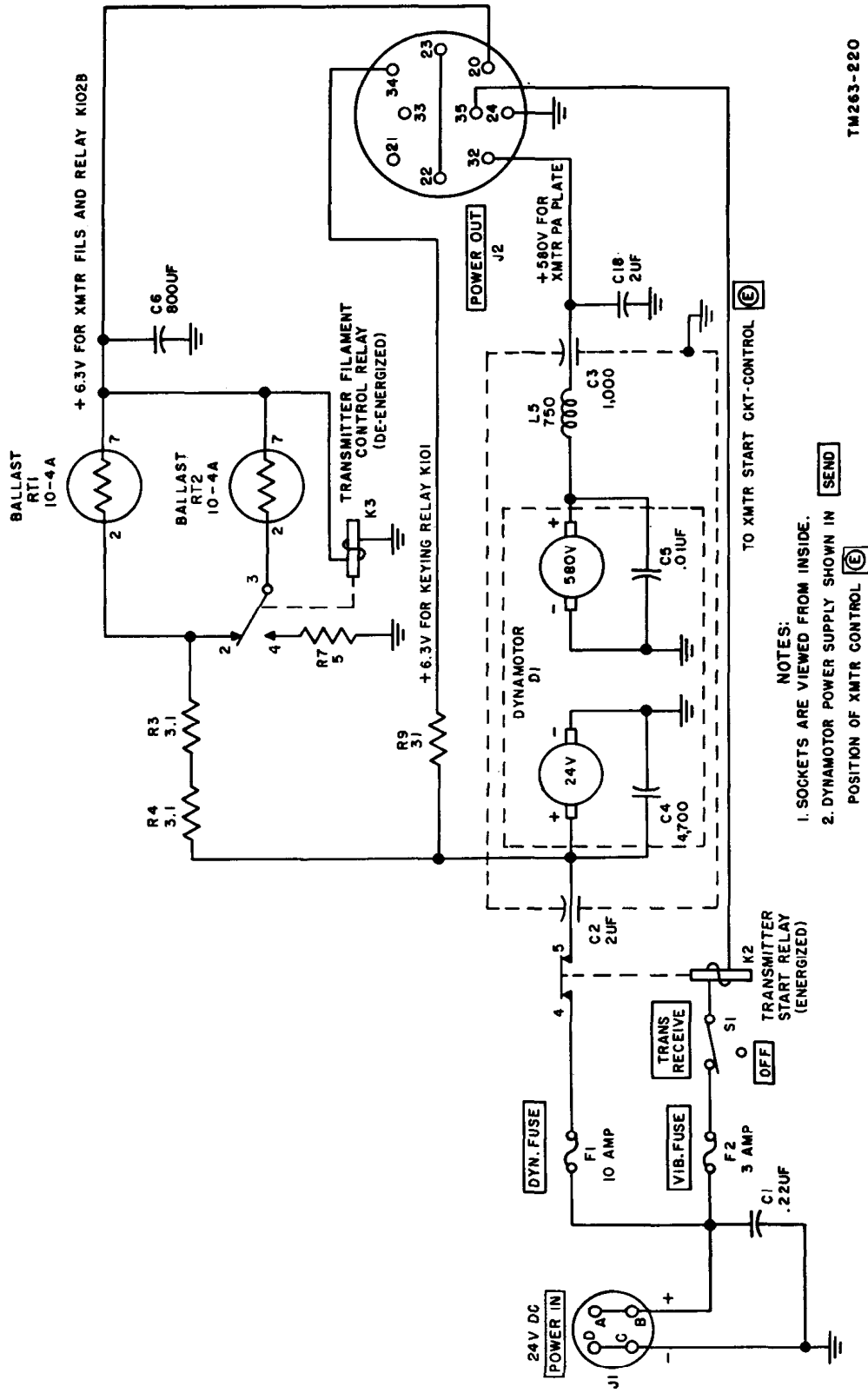


Figure 107. Dynamotor-Power Supply DY-105/GRC-9X, dynamotor circuit.

apply voltage to the screen grid of pa tube V103 (fig. 91).

e. Capacitors C4 and C5 are used to eliminate rf noise (fig. 107). Capacitor C2 reduces rf hash from the dynamotor, which might enter the battery cable and cause interference with other radio equipment. Capacitors C3 and C18 and rf choke coil L5 prevent radiation of rf energy and reduce commutator ripple in the output voltage.

161. Transmitter Filament Supply and Keying Relay Supplies of Dynamotor-Power SUPPLY DY-105/GRC-9X (fig. 107)

a. *Transmitter Filament Supply.* A regulated 6.3-volt dc output is fed to the transmitter filaments and overload relay K102B through terminal 20 of output receptacle J2, Cord CD-1086, terminal 54 on J102, and S103A (fig. 94). The 24-volt battery potential is fed through dropping resistors R4 and R3 and to the ballast tubes. Ballasts RT1 and RT2 are thermal resistors used to regulate the filament voltage at 6.3 volts, and are normally connected in parallel through normally closed contacts 2 and 3 of relay K3. Transmitter filament control relay K3 is used as an additional precaution to prevent the application of excessive voltage to the transmitter filaments. When control ⓔ is set in the SEND position and control Ⓛ is set at PHONE, no transmitter filament current is drawn until the push-to-talk button on the microphone or the key is pressed. Under these conditions, insufficient current is drawn through ballasts RT2 and RT1 to drop the voltage down to 6.3 volts as required by the transmitter filaments. If the voltage becomes excessive, K3 is energized and contacts 2 and 3 open. At the same time, contacts 3 and 4 close to connect RT1, RT2, and surge limiting resistor R7 in series to form a voltage divider. Reduced voltage for the transmitter filaments then is taken from the junction of RT1 and RT2. When push-to-talk button or key is pressed and the

transmitter filaments are energized, the voltage across the coil of relay K3 drops so that K3 is de-energized. Contacts 3 and 4 open and contacts 2 and 3 close again to connect the two ballasts in parallel.

b. *Keying Relay Supply of Dynamotor-Power Supply DY-105/GRC-9X.* The keying relay is supplied from terminal 34 of J2, through Cord CD-1086, and pin 45 on J102 (fig. 94). The 24-volt battery potential is fed to voltage-dropping resistor R9. Resistor R9 provides the necessary voltage drop so that 6.3 volts are supplied to keying relay K101 when it is energized.

162. Dynamotor D1 (fig. 107)

a. Dynamotor D1 furnishes high-voltage dc power to the plate and screen circuits of the transmitter.

b. The dynamotor consists of a motor and generator, operating from a common magnetic field. The armature contains two windings and two commutators, mounted on a common shaft. The shaft is mounted on ball bearings to provide free rotation. The low voltage windings form the motor section of the dynamotor armature. The high-voltage winding furnishes 580 volts for the transmitter plate and screen circuits.

c. When dc voltage is applied to the dynamotor, current flows through the field coils and lv armature windings. This current sets up magnetic fields in both the field and armature windings that are opposite in polarity, causing the armature to rotate. Since the hv winding is wound on the same armature it cuts the lines of the common magnetic field and generates an ac voltage, which is converted by the commutator to 580 volts dc. This voltage then is picked up from the commutator by a set of brushes and is passed through a filter circuit composed of capacitors C5 and C3 and choke L5. The brushes and commutator on the lv winding are used to transfer the dc voltage from the battery to the winding.