MOTORS—DIRECT CURRENT
ONE-QUARTER HORSE-POWER OR LARGER

1. GENERAL

1.01 The ¼ hp. or larger d-c. commercial type motors are used in Manual, Dial, PBX and Toll Power Plants. This Section describes these machines and replaces in part Specification X-72546-01, Issue 1. The motors are furnished with or without speed regulators, and have either an indirect or direct connected operation.

1.02 This Section is reissued to include motors which are covered in KS-5006 and several other Specifications of motor-driven generator sets employing d-c. motors of similar ratings.

1.03 Each motor when direct connected to its associated unit is mounted on a common sub-base either of fabricated steel or cast iron.

1.04 Carbon brushes are used on the motors. Practically sparkless commutation may be expected although occasional slight sparking may be evident without causing deterioration.

1.05 Each motor is provided with a starting box although some of the small motors may be thrown directly across the line. The starting box may be one of three types, the lever arm type, the multiple switch type or the automatic type.

2. DESCRIPTION

Types

2.01 The motors are shunt-wound machines having an associated field rheostat for controlling the speed. The larger motors (with oil ring bearings) have interpoles, connected so as to aid commutation. The smaller motors with waste-packed bearings have no interpoles. Unless specified to the contrary, the standard direction of rotation of the motors is counter-clockwise when viewed from the commutator end.

2.02 A field-regulating resistance is included in the field circuit so as to provide a means of varying the field current and to compensate for variations in the speed.

2.03 The interpoles are windings located between the main poles of the motor and aid in giving better commutation over the entire speed and load ranges without shifting the position of the brushes.

Armatures

2.04 The commutators of most motors have the mica between the bars undercut. The commutators of small motors are of the moulded

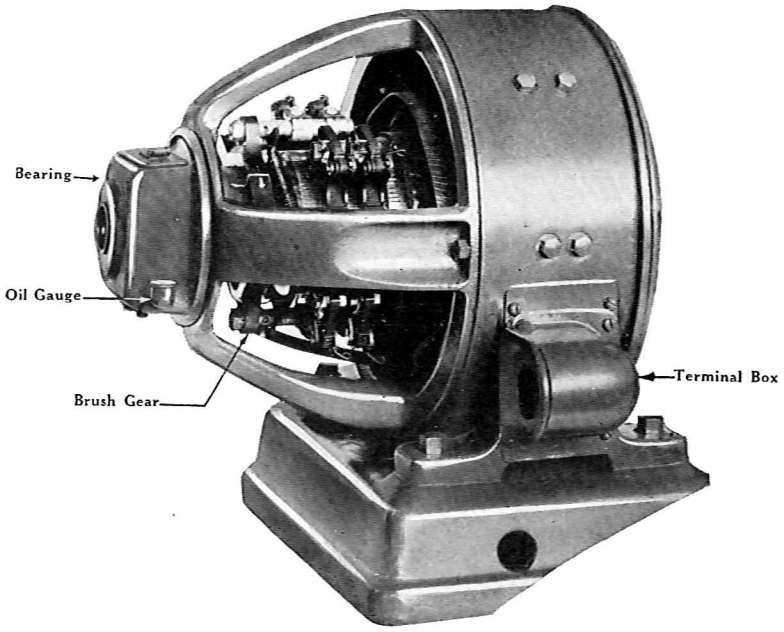


Fig. 1—Motor—Oil Ring Type

2.04 (Continued)

type of construction, while the larger motors have tightening rings. The armatures are built up of steel laminations or punchings. These punchings are assembled to form slots in the armature periphery into which the armature coils or windings are inserted. The ends of the windings are connected to the commutator bars. The windings of the motors are so arranged that ample circulation of air through the armature and frame for cooling purposes is provided.

Bearings

2.05 The bearings on motors of the oil ring type are solid, steel-backed and babbit lined and are lubricated by means of oil rings which rest on the shaft in slots cut through the bearing and lining. The rings dip into the oil in the oil chamber and, as they rotate, deposit oil on the shaft where it passes along grooves cut into the bearing lining thus lubricating the entire bearing surface. The bearings on the smaller motors are made of bronze and are lubricated by means of oil soaked waste, packed around the bearing. Provision is made for oiling waste-packed bearings through an oil hole in the upper bearing dust cap.

2.06 The waste used for retaining the oil in the waste-packed bearings consists of wool yarn which comes in hanks about 22 inches long and which is looped around the shaft several times inside the bearing housing.

Brush Gear

2.07 On motors with oil ring bearings carbon brushes are mounted in brush holders rigidly clamped to the brush holder studs. The brush holder studs are firmly fastened to a yoke or collar which is supported by a shoulder on the bearing housing. The tension of the brushes may be varied by a spring adjustment, and the brush holder yoke may be moved around the bearing housing to the desired position for good commutation.

2.08 On motors with waste-packed bearings carbon brushes are held in cartridge type brush holders mounted in, but insulated from, the end shield. These brushes have a coiled spring mounted on them which is compressed by means of a cap screw in the end of the brush holder.

Sub-base

2.09 Each motor with its associated driven unit is mounted on a common sub-base either of fabricated steel or cast iron.

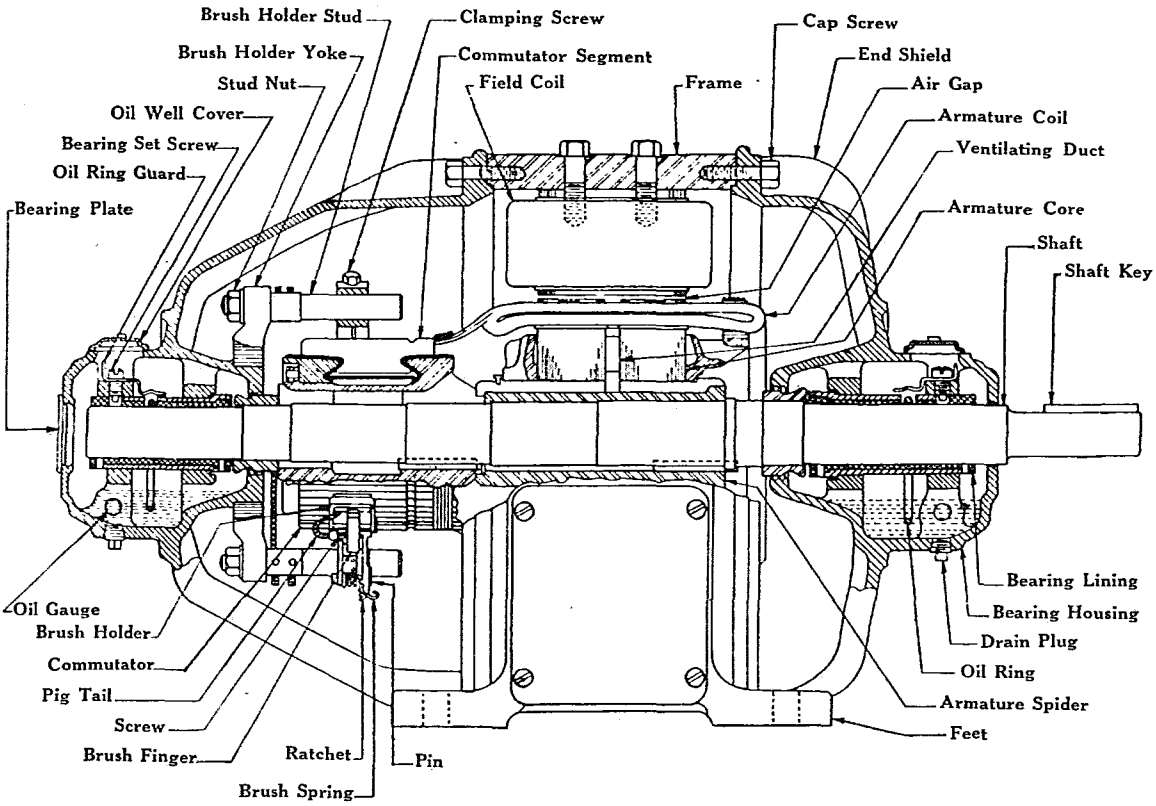


Fig. 2—Motor—Cross Section

Starting Box

2.10 The starting box will be one of three types, the lever arm type, the multiple switch type or the automatic type.

2.11 The lever arm type is operated manually and may be either for front or rear of board mounting. Rear of board mounted starters will usually be operated from the front of the board by a handwheel. The starter is held in the operated position by a no voltage release coil and returns to the OFF position automatically upon being released when the voltage is low or is cut off.

2.12 The multiple switch type is operated manually and consists of a number of fingers of the circuit breaker type, each finger being closed individually and held in the closed position by the succeeding finger. The last finger is held in the operated position by a no voltage coil. All fingers return to the off position automatically upon release of the last finger when the voltage is low or is cut off.

2.13 The automatic type is operated upon energizing the associated solenoid, the speed of closing being controlled by a dashpot. The solenoid is remotely controlled from a push button switch. All fingers automatically return to the OFF position when the voltage is low or is cut off.

2.14 Figs. 3 and 4 show the schematic diagram for starting boxes with no voltage and overload and no voltage protection respectively. The resistance in series with the motor armature is cut out step by step by moving the arm across the set of contacts mounted on the starting box base and connected to taps on the starting resistor. The "no-voltage" holding coil is in series with the motor field, while the "overload" coil, when provided, is in series with the line. Operation of the overload coil neutralizes the pull of the holding coil allowing the contact arm to be returned to the OFF position by a spring.

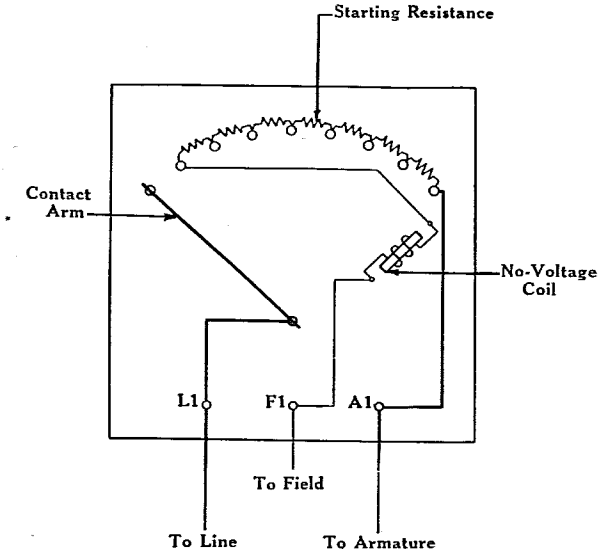


Fig. 3—Starting Box With No Voltage Protection

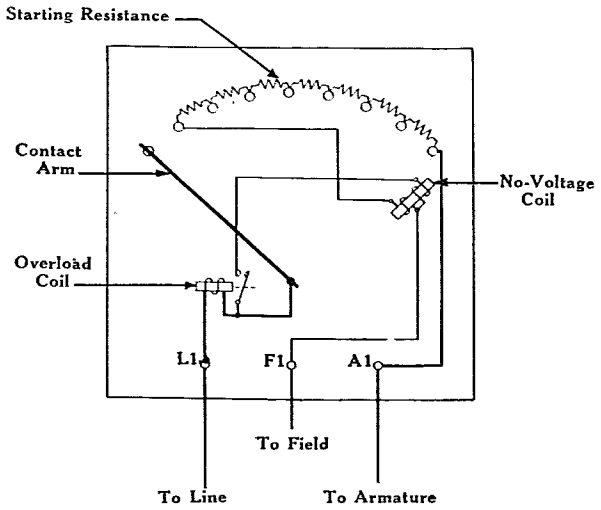


Fig. 4—Starting Box With Overload and No Voltage Protection

Automatic Speed Regulator

2.15 The Type TD, Form W, speed regulator has been developed to meet the demand for a device to hold constant speed on d-c. motors, particularly where the source of voltage supply is subject to variations.

2.16 The regulator consists of a centrifugal control device which is mounted on the end of the motor shaft. The stationary case surrounding the control device is mounted on the bearing housing on the commutator end. The brush holders are located in this stationary case. The controller contains two contacts, one stationary, the other movable, mounted on the end of a governor arm. The action of the governor arm is controlled by a spring which can be adjusted for any desired speed.

2.17 The contacts are connected through two collector rings, brushes, and brush holders, to close a shunt circuit across the motor field rheostat, or, in the case of large motors, to control relays that operate across the rheostat. This shunt circuit is rapidly opened and closed, resulting in an average field excitation of the correct value to give the required motor speed, in the same manner that the voltage regulator main-

2.17 (Continued)

tains constant d-c. voltage. In no case, however, is there danger of breaking the motor field, as the device is operated in shunt with the motor field rheostat.

Connections

2.18 Fig. 5 shows the schematic diagram of the speed regulator connected to a direct-current motor. The contacts of the control device are connected across the motor field rheostat. Upon starting, the motor field resistance is short circuited through the speed regulator. This is accomplished by a pair of auxiliary or starting contacts (see Fig. 7) connected in parallel with the main contacts (see Fig. 6). These contacts remain closed until the motor comes up to approximately two-thirds normal speed, at which time they open and cut additional resistance into the field circuit causing the motor to increase its speed. At approximately normal speed the main contacts come into action and maintain an effective excitation sufficient to keep the motor at the desired speed. As mounted in the regulator case the starting contacts are nearest the motor windings.

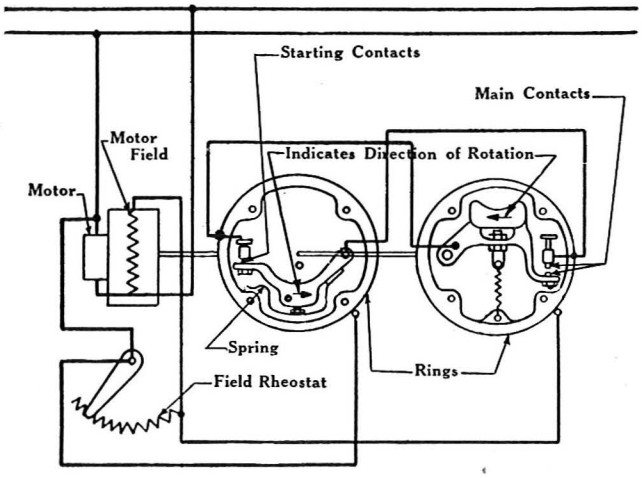
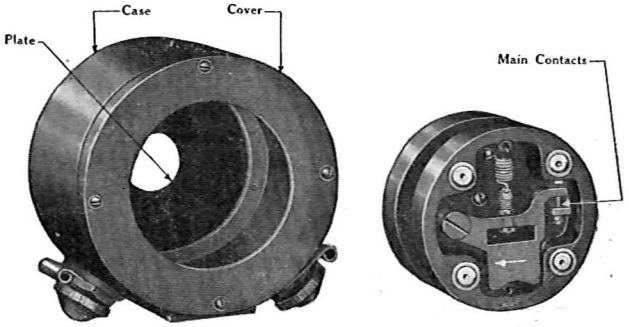


Fig. 5—Wiring Showing Type TD—Form W—Speed Regulator Connected to Direct-Current Motor

Rheostat

2.19 The field rheostat used in connection with the automatic speed regulator consists of a rheostat without hand wheel or index plate, arranged for mounting on the rear of the power board. The rheostat arm is adjusted to the proper position for operation with the regulator, locked in position and this position clearly marked. The rheostat is fireproof and capable of carrying the required current without undue heating. Each rheostat is tested with its associated motor, and the serial number of the motor is painted with white figures on the contact side of the rheostat.



Stationary Case With Brushes

Centrifugal Rotating Assembly

Fig. 6—Type TD—Form W—Speed Regulator (Front View)

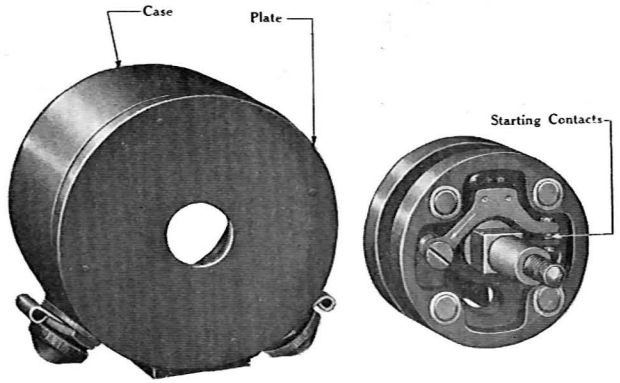


Fig. 7—Type TD—Form W—Speed Regulator (Rear View)

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