

28 MOTOR UNITS

DESCRIPTION AND PRINCIPLES OF OPERATION

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1. GENERAL

1.01 The motor units that provide electro-mechanical rotating motion for operating various 28 teletypewriter apparatus are of two basic types: synchronous and series (governed). Both types are self-contained motor units, with characteristics adaptable for use with standard power sources.

1.02 The synchronous type motor units (Fig. 1) are available in 1/20 and 1/12 horsepower ratings. These motor units must be operated from a standard, single-phase, regulated power source with specifications as listed in Table 1.

1.03 The series (governed) type motor units (Fig. 2) are available in 1/20 and 1/15 horsepower ratings. These motor units may be operated from regulated or unregulated,

standard, single-phase power sources, or dc (direct current). The series type motor unit is also available for operation with 48 volts dc only. Specifications are listed in Table 1.

2. DESCRIPTION

SYNCHRONOUS MOTOR UNITS (Fig. 1)

2.01 In general, the synchronous motor units consist of a motor and mounting arrangement, and the required starting and protective devices. Variations of this type are described below.

A. 1/20 Horsepower Motor Units

2.02 The 1/20 hp synchronous motor consists of a two-pole wound stator and two end shields that support a ball bearing rotor. A combination hand wheel and fan is mounted on the motor shaft, and two fans are mounted at each end of the rotor within the end shields. The opposite end of the shaft contains a tapped hole for mounting the driving gear. A motor starting relay, starting capacitor, and thermostatic cutout switch are mounted in a compartment of the motor mounting bracket. The thermostatic cutout switch, which is reset manually, protects the motor windings from excessive current drawn by the motor. The motor is supported by resilient mounts which are part of the end shields and which are held in place by straps attached to the mounting bracket. The resilient mounts tend to reduce the transmission of vibration from the motor to the driven associated apparatus.

2.03 A variation of the motor unit described in 2.01 has the control parts mounted in a housing located at the rear of the fan (instead of under the motor), to permit its use in applications such as the Multiple KSR and RO Set.

B. 1/12 Horsepower Motor Units

2.04 Except for the increase in motor horsepower rating and the use of heavy-duty control parts, the 1/12 hp synchronous motor units are essentially the same as the units described in 2.02.

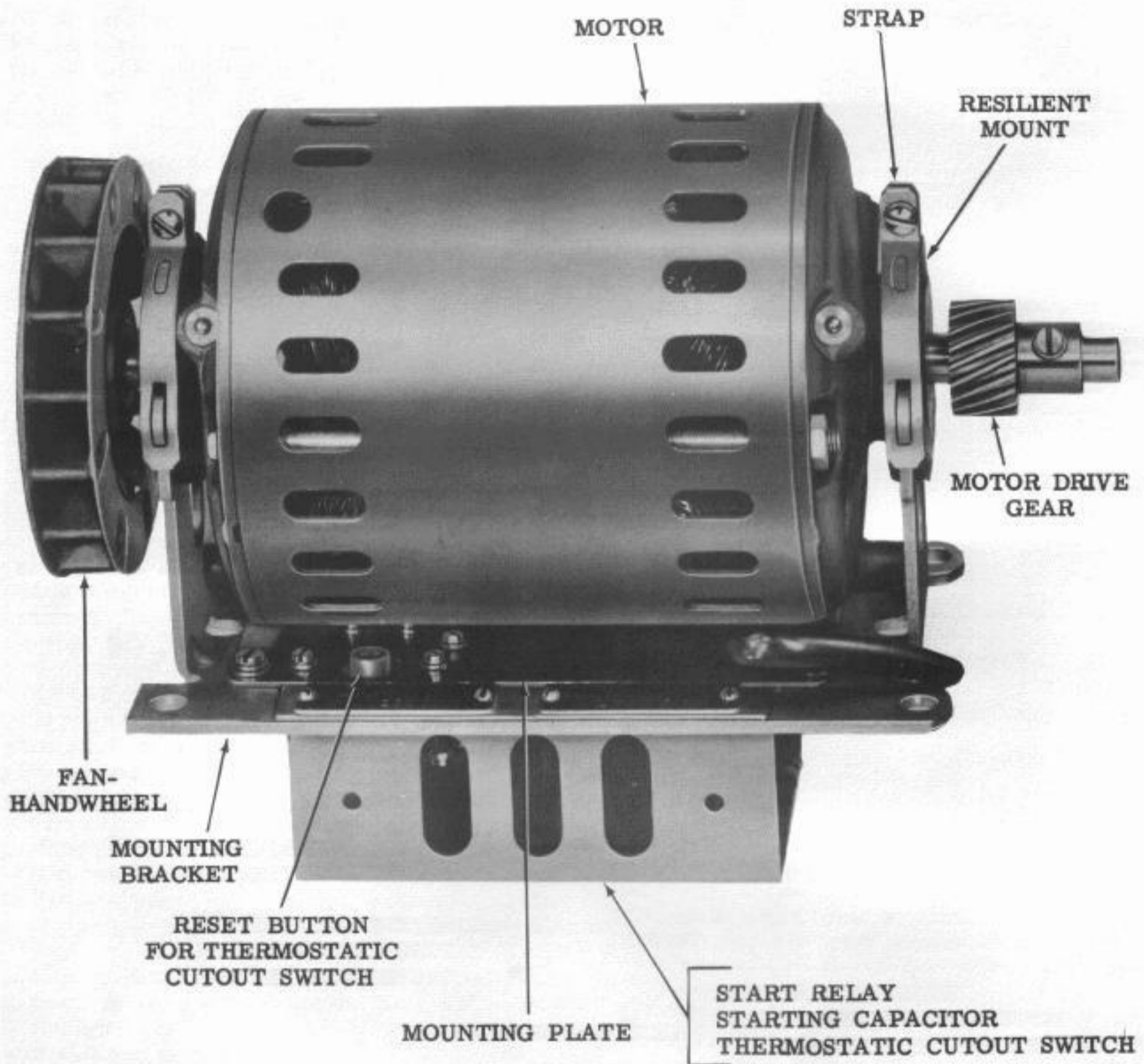


Figure 1 - 28 Synchronous Motor Unit

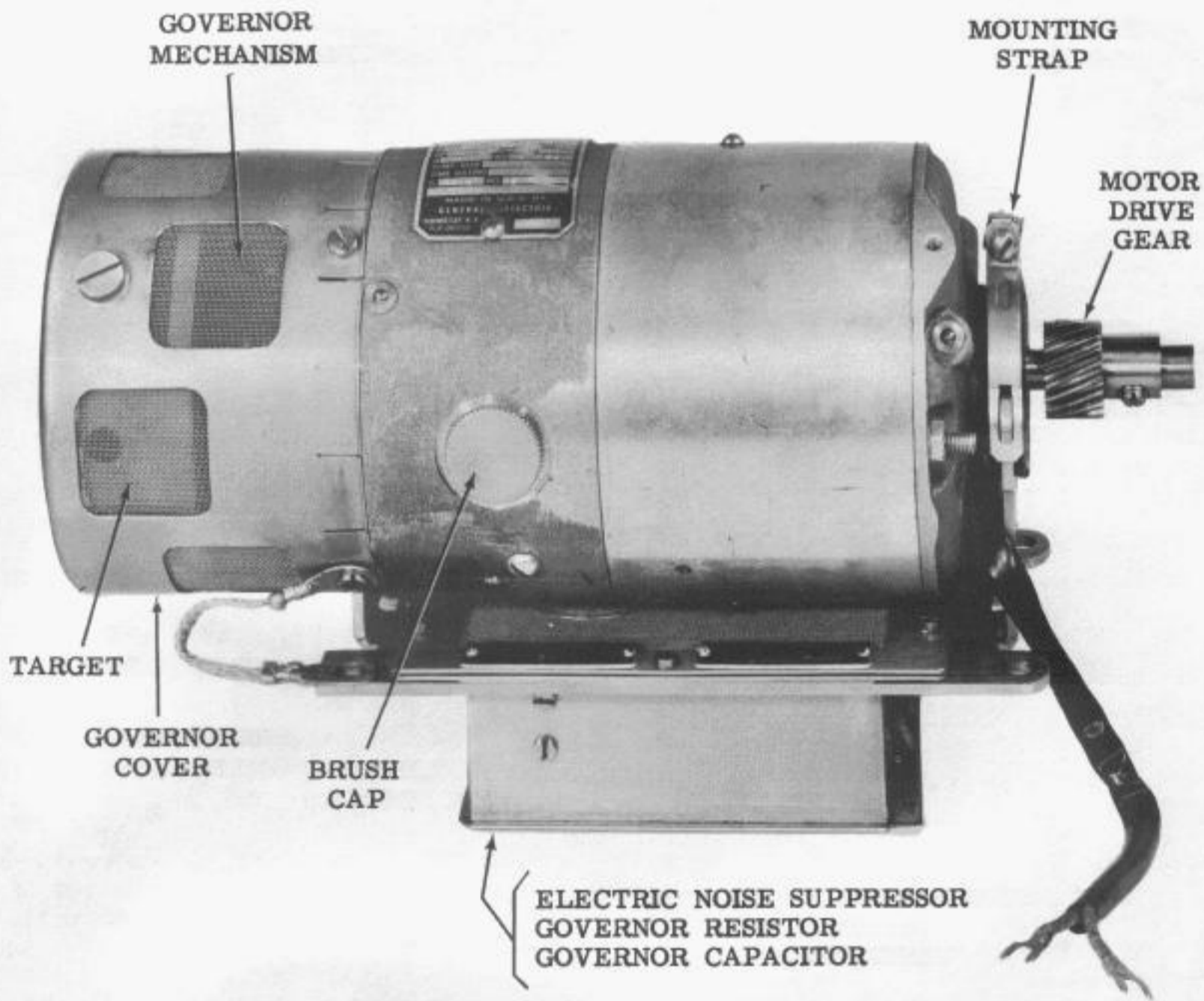


Figure 2 - 28 Series (Governed) Motor Unit

TABLE 1. TECHNICAL CHARACTERISTICS

Characteristics	Synchronous Motor Unit		Series (Governed) Motor Unit									
	1/20 HP	1/12 HP	1/20 HP (AC/DC)*				1/15 HP (AC/DC)*	1/15 HP (DC)				
Input Voltage	115V AC, ±10%	115V AC, ±10%	115±10%, AC/DC				115±10%, AC/DC	48V DC, +10%				
Phase	Single	Single	Single				Single	-				
Frequency	60 cycles, ±0.75%	60 cycles, ±0.75%	25, 50 or 60 cycles, or DC				25, 50 or 60 cycles, or DC	-				
Input Current (Amperes)			Cycles				Cycles					
			25	50	60	DC	25	50	60	DC		
Starting	9	12.25	2.4	2.7	1.9	1.8	4.5	5	4	3.4	13	
Running	1.85	2.58	1.18	1.4	1.2	0.9	2.1	2.8	2.9	1.7	2.5	
Power Factor Full Load	30%	45%	90%	74%	71%	-	96.8%	81%	79%	-	-	
Watts Input Full Load	65	133	123	114	92	107	130	200	190	195	120	
Start Capacitor Rating	43-48 UF	170 UF	-	-	-	-	-	-	-	-	-	
Target	-	-	4, 6 and 35 Spot				4, 6 and 35 Spot				4, 6 and 35 Spot	
Speed	3600 RPM	3600 RPM	3600 RPM				3600 RPM				3600 RPM	
Rotation	CCW viewed from fan end	CCW viewed from fan end	CCW viewed from commutator end				CCW viewed from gov. end				CCW viewed from gov. end	

\* External resistance required for 25-cycle and dc operation.

#### SERIES (GOVERNED) MOTOR UNITS (Fig. 2)

2.05 The series (governed) motor units typically consist of a motor, speed regulator (governor), protective and control devices, and a mounting. Variations of this type are described below.

##### A. 1/20 Horsepower Motor Units (AC/DC)

2.06 The 1/20 hp series (governed) motor unit consists of a series type motor, speed governor, motor mounting bracket, and a housing for the governor resistors and spark suppression capacitor. The governor is mounted on an extension of the armature shaft and includes a fan that circulates air through the

motor. The opposite end of the shaft contains a tapped hole for mounting the driving gear. Targets for speed checking purposes are provided on the governor cover. The motor is mounted by means of resilient mounts at each end shield that are fastened to the mounting bracket by straps.

2.07 A variation of the motor unit described in 2.06 is available with electrostatic shielding and radio frequency noise suppression.

##### B. 1/15 Horsepower Motor Units (AC/DC)

2.08 These motor units are similar to the units described in 2.06, but are equipped with electrostatic shielding and radio frequency

noise suppression. The higher horsepower rating accommodates, for example, the requirements of the Automatic Send-Receive Set.

### C. 1/15 Horsepower Motor Units (DC)

2.09 These motor units are designed to operate with 48 volts dc only and are equipped with electrostatic shielding and radio frequency noise suppression.

## 3. PRINCIPLES OF OPERATION

### SYNCHRONOUS MOTOR UNITS (Figs. 1 and 3)

3.01 The following description of operation is applicable to all synchronous motor units.

3.02 The stator of the synchronous motor has two windings: a starting winding and an operating (or run) winding. The starting winding, starting capacitor and the normally-open contacts of the starting relay are connected in series. The coil of the current-operated start-

ing relay is connected in series with the operating winding. When power is applied, the initial current through the operating winding (and also the starting relay coil) energizes the relay, and its contacts close the circuit to the starting winding. As the speed of the rotor increases, the current in the operating winding decreases and, when the current has decreased to a predetermined magnitude, the starting relay de-energizes. Its contacts open and remove the starting winding from the operating circuit. The rotor continues to accelerate until it reaches the synchronous operating speed (3600 rpm). Rotation is in the counterclockwise direction, as viewed from the fan or short-shaft end of the motor.

3.03 The thermostatic cutout switch is connected in series with both stator windings. This temperature operated device opens the circuit to these windings whenever excessive current is drawn, such as may occur if the motor is stalled, thereby preventing overheating and damage to the motor and control parts. The switch may be reset after the unit has cooled by depressing a pushbutton.

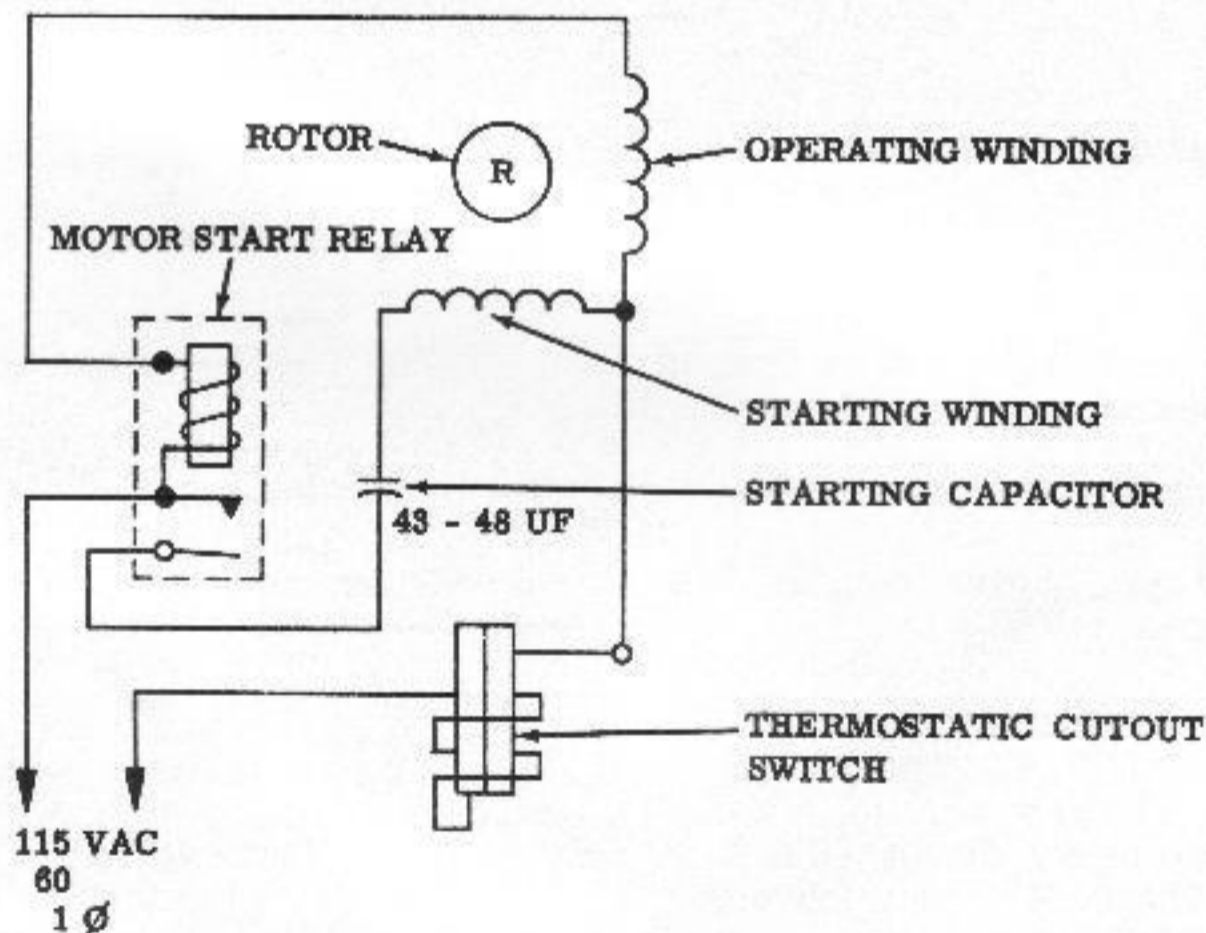


Figure 3 - Typical Synchronous Motor Unit Schematic Diagram

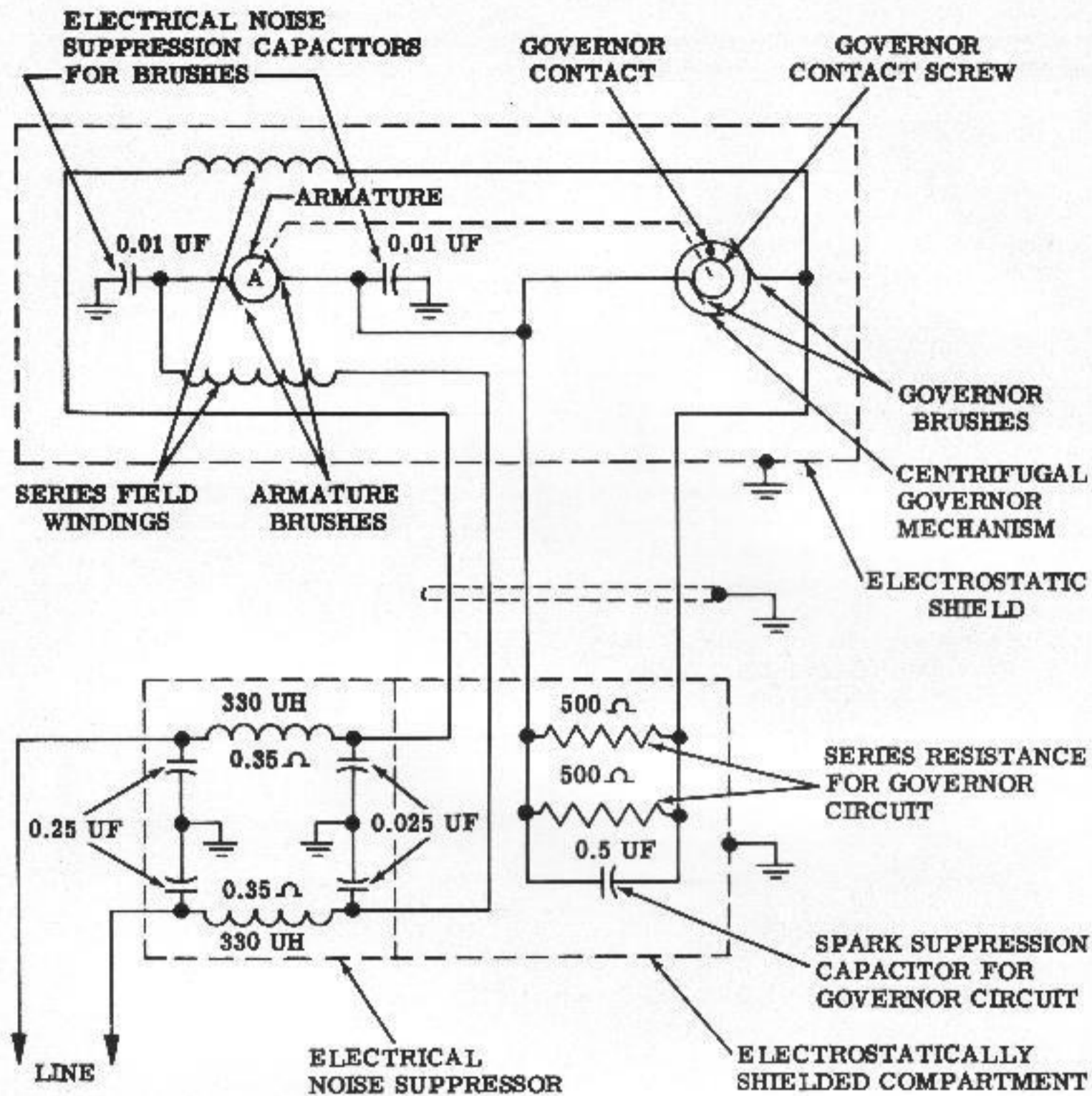


Figure 4 - Typical Series (Governed) Motor Unit Schematic Diagram

**SERIES (GOVERNED) MOTOR UNITS (Figs. 2 and 4)**

3.04 The following description of operation is applicable to all series (governed) motor units.

3.05 The series wound motor utilizes an electro-mechanical governor for speed regulation. The governor regulates the speed at 3600 rpm,  $\pm 1$  percent, by alternately increasing and decreasing the current in the series connected field windings and armature, which are also in series with a governor contact. Two

parallel-connected, high-wattage resistors are connected in parallel with the governor contact. The contact is held closed under the tension of a spring which is adjusted to maintain this condition during speeds up to a predetermined rate. With the contact closed, the resistors are shorted out. When the speed of the motor exceeds the predetermined rate, the centrifugal force acting upon the contact momentarily overcomes the spring tension and the contact is opened. This removes the short from the resistors and they then appear in series with the field windings and armature, reducing their current, and consequently reducing the speed of the motor.

3.06 The tension on the contact spring is adjustable to maintain the motor speed at 3600 rpm. To make this adjustment, a target is provided to compare the motor speed with a standard. The outside surface of the governor cover is finished in white with three rows of black spots equally spaced about its periphery. The outer, center, and inner rows contain four, six, and thirty-five spots, respectively. The

four spot row is a target which should remain essentially stable at 3600 rpm, when viewed through the moving shutter of a 120 vibrations per-second tuning fork. The six spot and thirty-five spot rows serve as targets when using an 87.6 vibration-per-second tuning fork. The six spot row is used to approach an on-speed setting and the thirty-five spot row is used to arrive at an accurate setting of 3600 rpm.