GENERATORS
RINGING AND COIN CONTROL
P TYPE
DESCRIPTION

1. GENERAL

1.01 P type ringing generator sets per KS-5028 and KS-5030 are used in medium and large sized central office power plants to furnish low frequency alternating current, positive and negative direct current and pulsating direct current. The alternating current is used for ringing subscribers' call bells, signaling over toll lines, operating alarm bells and other similar devices. The positive and negative direct current is used for energizing the generator field and coin control equipment while the pulsating direct current is used, when required, for audible ringing.

1.02 A transformer is used in all cases with the a-c. output of these machines, permitting the use of the same ringing generator on different systems requiring different ringing voltages. The ringing voltages available at the secondary taps of the transformer are held within narrow limits by means of a voltage regulator connected to the generator field. These machines are available in three sizes, P-½, P-1 and P-2. Current may be taken from any one or all taps providing the wattage of the machine is not exceeded. The a-c. output of the machine measured at the transformer secondary is as follows:

Transformer Taps	A-C. Volts Unregulated	A-C. Volts Regulated	A-C. Ampere Output P-½	P-1	P-2
4-8	101-110	103-108	1.00	3.0	6.0
4-7	96-105	98-103	1.00	3.0	6.0
4-6	81-90	83-88	1.25	4.0	8.0
4-5	73-82	75-80	1.25	4.0	8.0

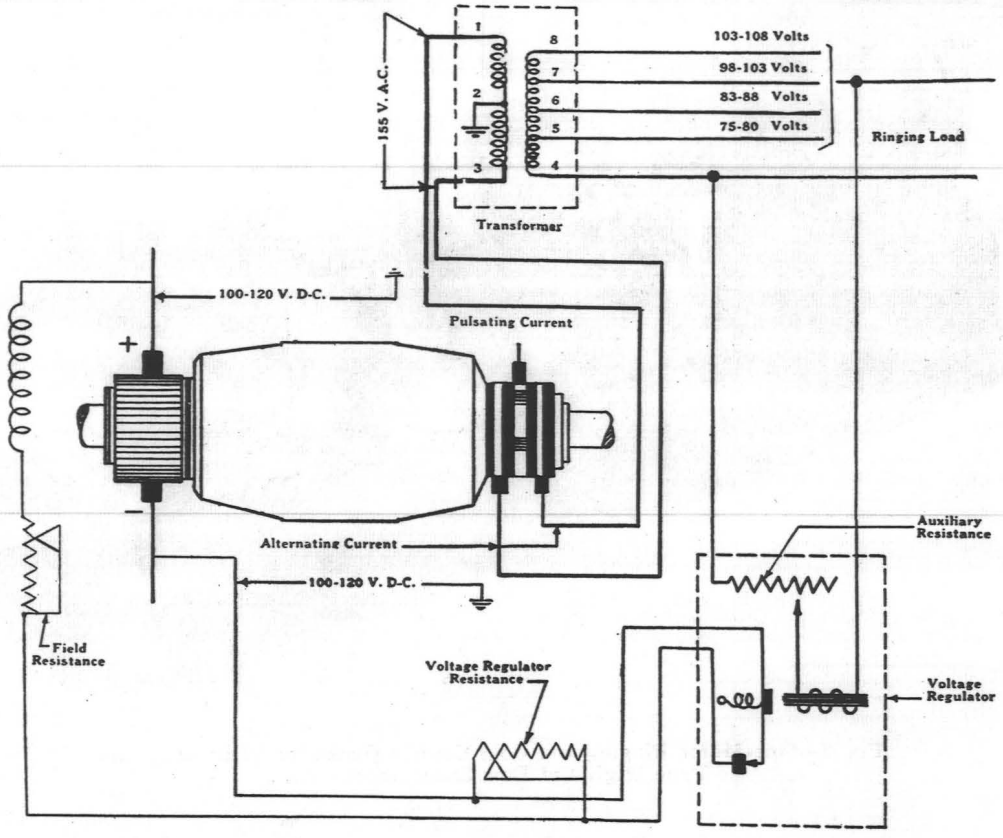

Fig. 1—Schematic Diagram of Connections for P-Type Ringing and Coin Control Generator.

1.03 The voltage of the d-c. output for all machines is the same, being between 100-120 volts from either the positive or negative brush to ground. The nominal current capacities of each polarity are .25, .38 and .50 amperes for the P-½, P-1 and P-2 machines respectively. In some instances in heavily developed coin control districts the control current may be supplied from a separate battery instead of from the ringing generators.

1.04 In the case of the majority of P-type machines now in the field the various tones, ringing intervals, etc., are obtained by the use of a high-speed interrupter mounted on the generator shaft and low-speed interrupter connected through a reduction gear box to this shaft while the pulsating current used in connection with audible ringing is furnished from slip rings on the P-type generator. Later developments use a tone alternator and mercury-type interrupter to replace both the high and low-speed interrupters and with this later arrangement the audible ringing current is furnished by the tone alternator and is not required from the P-type generator. See Figures 2 and 3.

Note: The tone alternator and mercury-type interrupters are described in separate Bell System Practices. Any further discussion herein refers to the older type high and low-speed interrupters.

1.05 In addition to the line-driven generator sets there is generally a separate battery-driven generator set to insure service in case of power failure. In the case of P-1 and P-2 machines a two-motor set is sometimes used. This assembly consists of a line and battery-driven motor mounted in line on the same subbase, driving one ringing generator. (See Fig. 3.)

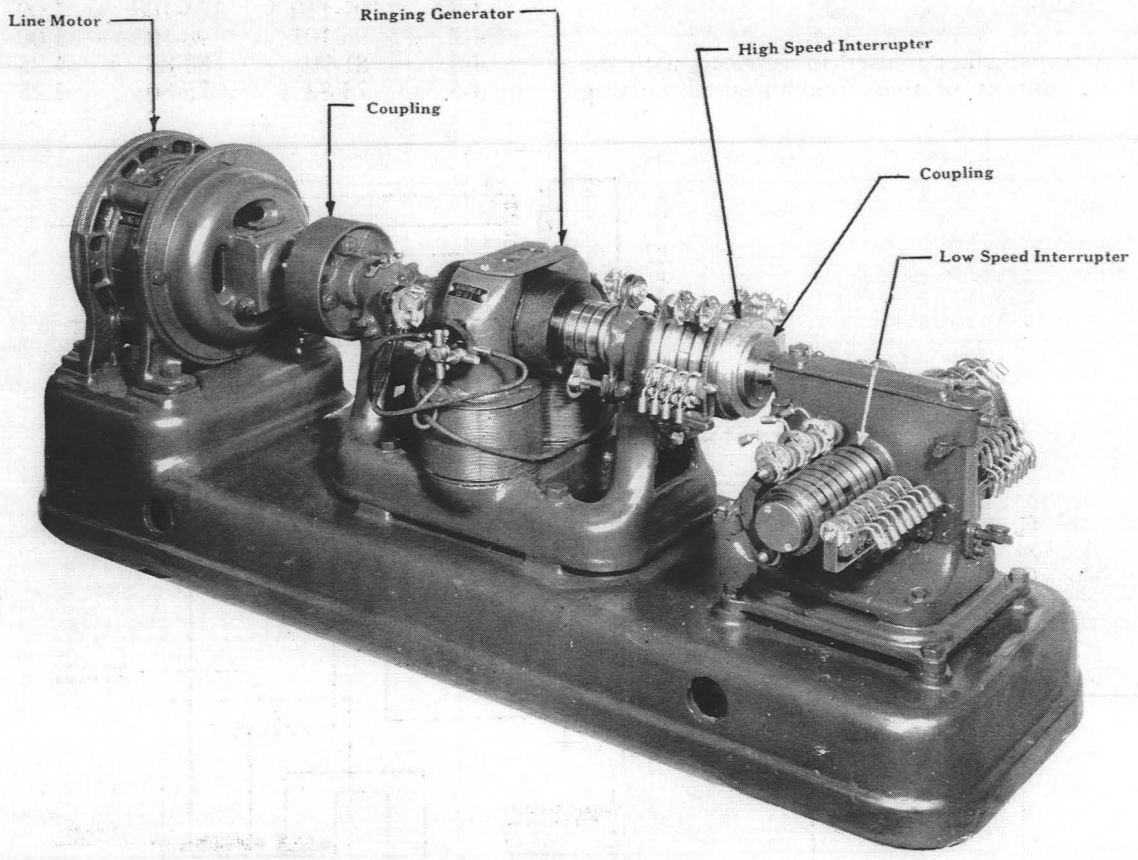

Fig. 2—One-Motor Ringing and Coin Control Generator With Split Ring Type High and Low-Speed Interrupters.

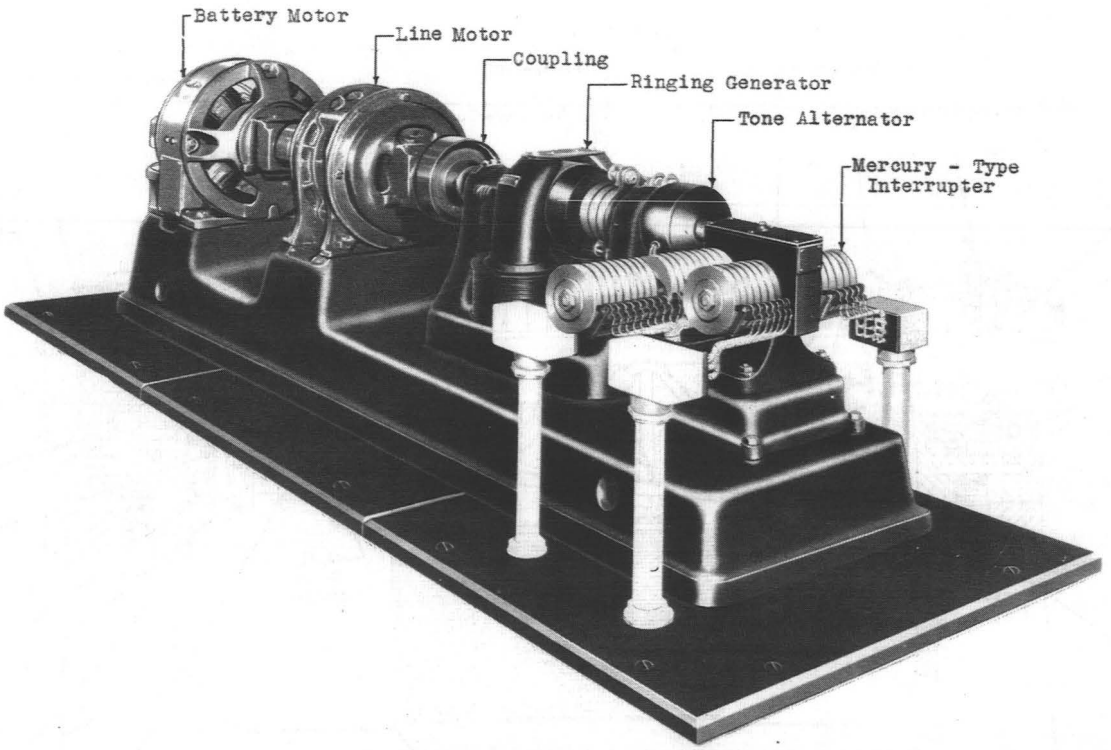

Fig. 3—Two-Motor Ringing and Coin Control Generator with Tone Alternator and Mercury-Type Interrupter.

1.06 On two-motor generator sets an automatic control circuit is furnished which closes the circuit of the battery-motor when the commercial service is interrupted, the set continuing to run without failure of the ringing or coin control supply. Upon the restoration of normal line voltage the set automatically transfers to line operation.

1.07 On the one-motor generator sets equipped with an automatic (See Fig. 12) battery-motor starter, the reserve set will automatically start in case of power failure and in addition transfer the load from one machine to the other by means of a magnetically operated multi-pole transfer switch with a very slight interruption, and upon restoration of normal line voltage the load will be transferred back and the battery-driven motor will automatically be shut down. On the one-motor generator sets of the non-automatic type, starting of the reserve set and transferring of the ringing load is done manually and therefore the length of interruption will depend upon the promptness of the attendant in restoring service in case of power failure.

2. DESCRIPTION

2.01 **Motors:** The motors supplied with the P-type ringing machine may be either a-c. or d-c., the ratings of which are .75, 1.2 and 1.8 H.P. for the P-½, P-1 and P-2 machines, respectively. The d-c. motors are shunt wound, usually with a speed regulator. The a-c. motors are either single or polyphase. The single-phase motors on one-motor generator sets are of the repulsion induction type to permit self-starting and the squirrel cage type on all two-motor generator sets as the set is started by the battery-driven motor.

Generators

2.02 **Type:** Each generator is self excited, shunt wound with a factory set resistance permanently in the field circuit and another factory set resistance cut in and out of the field circuit under the action of a voltage regulator. The terminal blocks on the P-½ and P-1 generators are mounted on the side of each pole piece while the single terminal block on the P-2 generator is mounted on the top of and secured to the pole pieces.

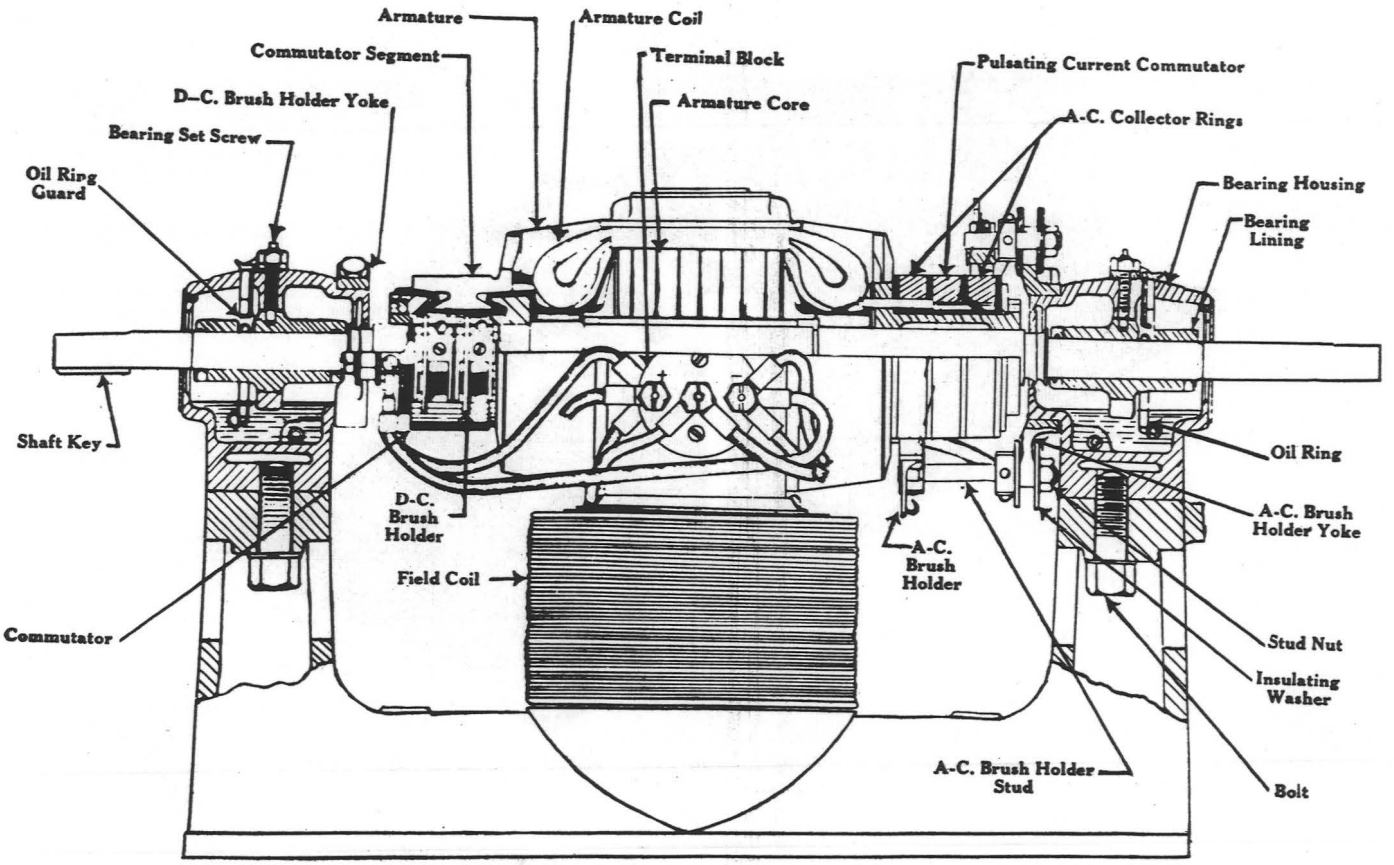

Fig. 4—Generator—Cross Section.

2.03 **Armature:** The armature is built up of steel laminations or punchings. These punchings are assembled to form slots in the periphery into which windings are placed and connected to commutator bars or segments. The commutator is made of hard-drawn copper segments insulated from each other and from the grounded frame by mica. The same armature winding is used to generate the a-c. voltage, being tapped at two diametrically opposite points which in turn are connected to slip rings. An additional slip ring divided into two segments insulated from each other, makes it possible to obtain either positive or negative pulsating current. For audible ringing signals, the brushes are arranged so that positive pulsating current is obtained, and shifting of the a-c. brush holder yoke will vary the voltage of the pulsating current to give the desired intensity of the audible ringing circuit. On later machines provided with a tone alternator, the audible ringing current is supplied by the tone alternator instead of the pulsating current of the generator, since the alternator tone is more uniform and reliable.

2.04 **Brush Rigging and Brushes:** The brushes on the P-type ringing and coin control sets are supported by Baylis reaction type brush holders. The brush holders on the d-c. and a-c. end are secured to the brush holder studs. The brush holder studs are fastened to a yoke or collar which is supported by a shoulder on the bearing housing.

2.05 The high-speed and low-speed interrupter brush assemblies are triple decked, that is, they are equipped with three separate brushes in order to give independent electrical connections to the interrupter. The brush holders are secured to the brush holder studs which in turn are clamped

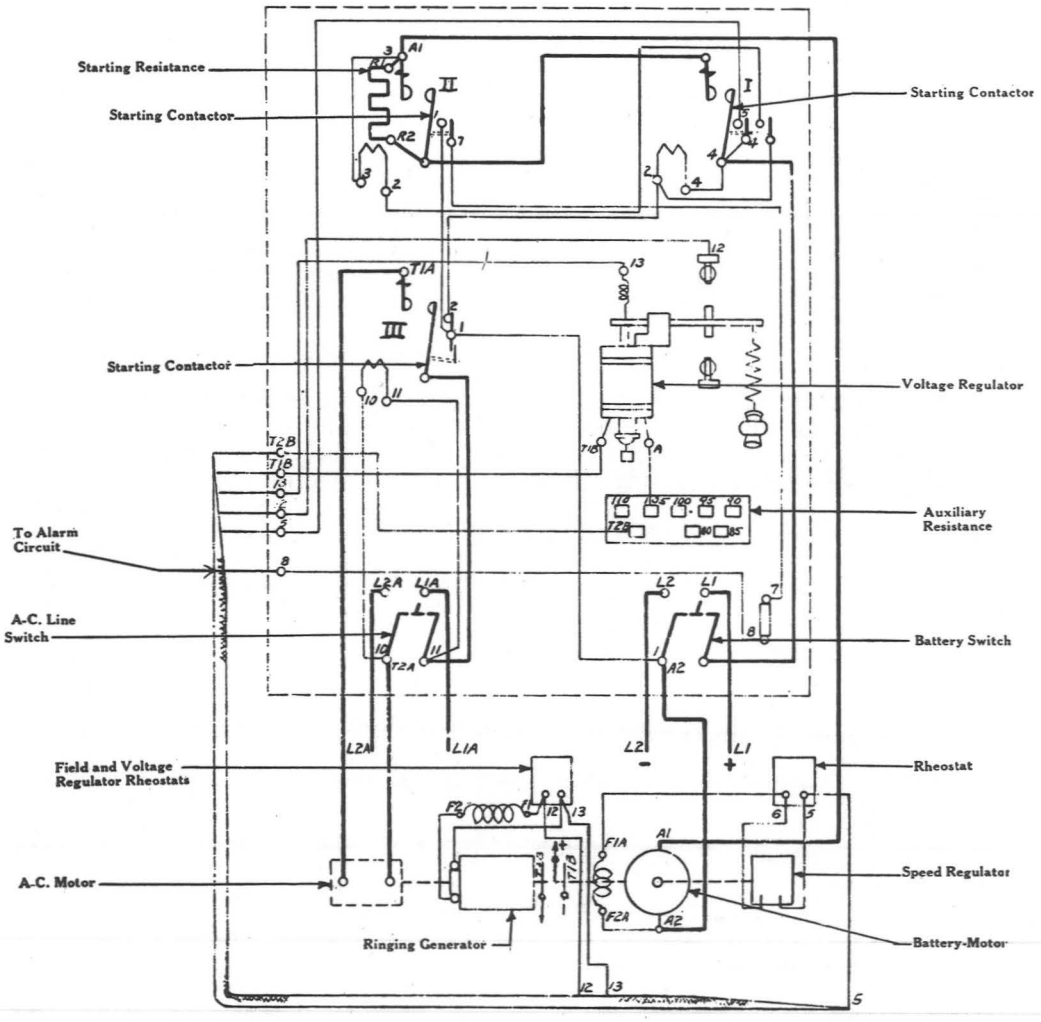

Fig. 5—Schematic Diagram of Control Equipment for A-C/Battery-Driven Ringing and Coin Control Set.

2.05 **(Continued)** to a "U"-shaped part. The bracket upon which the "U"-shaped part is fastened is bolted to the bearing housing for the high-speed interrupter and to the gear case for the low-speed interrupter.

2.06 **Bearings:** The generator bearings are of the pedestal type. The bearing lining is of the sleeve type with oil rings located in the bearing housing which is mounted on the pedestal. The bearing housing can be easily removed by loosening a bolt which holds the housing in place on the pedestal.

2.07 When a tone alternator replaces the split-ring type high-speed interrupter it is necessary to replace the bearing housing on that end of the generator. The new bearing housing is so constructed that when the tone alternator is mounted thereon and the assembly is mounted on the ringing generator, the outer face of the tone alternator rotor is approximately flush with the end of the generator shaft extension.

2.08 The high-speed gear case bearing lining is of the sleeve type with oil ring located in the gear case housing. An outboard bearing is used for the low-speed interrupter where ten or more rings are used on one side of the interrupter gear case. This type

of bearing does not require any lubrication.

2.09 **Sub-Base:** Each generator with its associated driving unit is mounted on a common sub-base which in turn is mounted on a table.

2.10 **Connections:** Fig. 1 shows a schematic diagram of connections for P-type ringing and coin control generators. The secondary taps of the associated transformer permit the use of the same generator in various types of offices having different a-c. voltage requirements. The d-c. voltage between machine terminals is approximately 200-240 volts although the voltage from either terminal to ground is only half this amount, one side being positive and the other side negative, providing potential for the coin control feature.

2.11 Fig. 5 shows a schematic diagram of control equipment for a two-motor set. This set consists of an a-c. line driven motor with a battery-driven motor as reserve, arranged for automatic transfer to the battery-driven motor in case of power failure of the line-driven motor.

2.12 Fig. 12 shows a schematic diagram of connections for an a-c. line-driven generator set with a d-c. battery-driven generator set as reserve arranged for automatic transfer of the ringing load to the reserve set in case of a failure of the line-driven motor.

Accessories

2.13 **Interrupters:** With P-type ringing generators two sets of interrupters are used for producing the various tones and signals required in different type of central offices. One set of interrupter rings, known as the high-speed interrupter, (See Figs. 6 and 7) is mounted on the shaft extension of the ringing generator. The other set of interrupter rings, known as the low-speed interrupter (See Figs. 6 and 7) is mounted at right angles to the ringing generator shaft

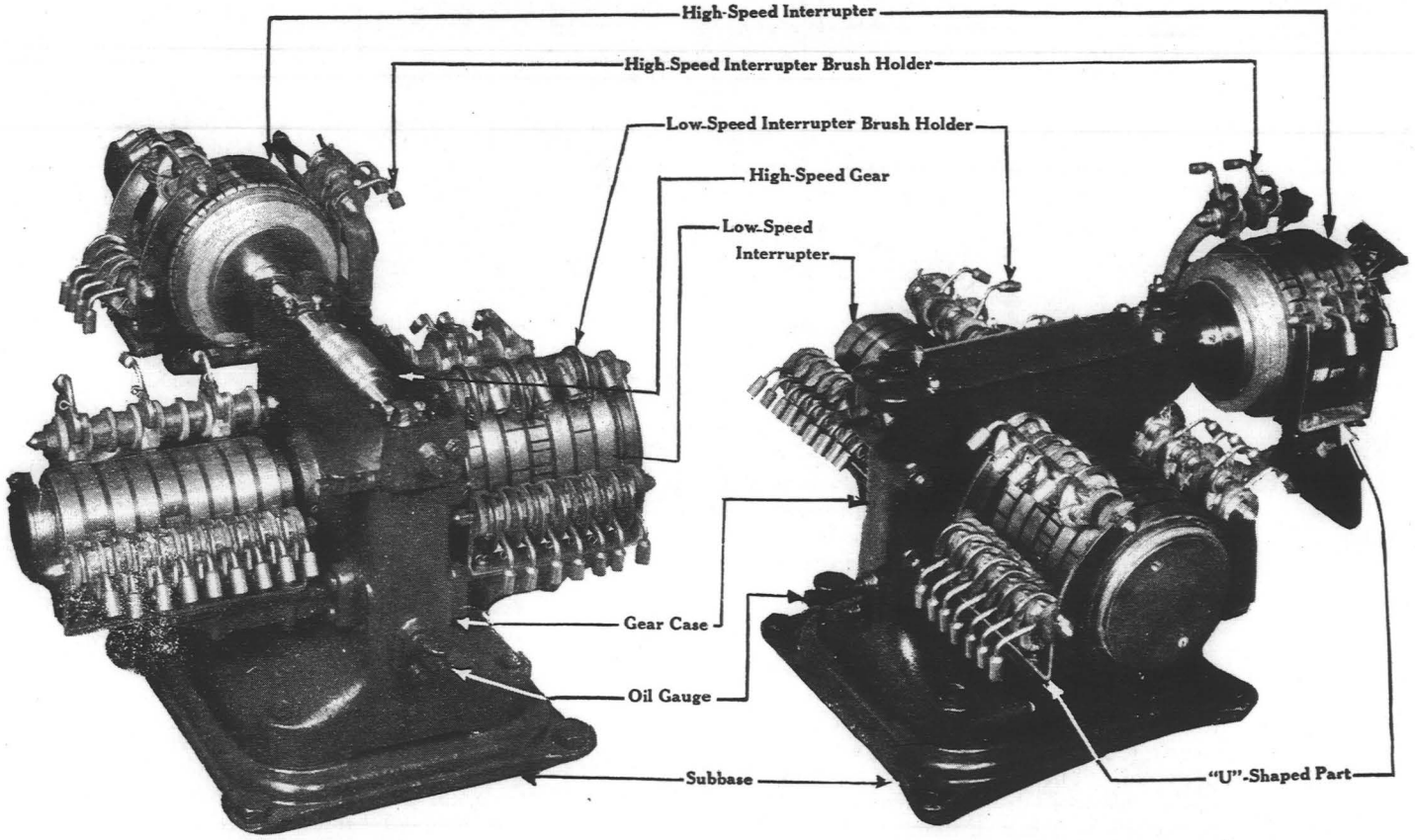

Fig. 6—High and Low-Speed Interrupter Gear Case With Cover Removed.

Fig. 7—Triple Decked Brush Holders.

and driven by it through a flexible coupling and reduction worm gear. The high-speed interrupter produces a high and low tone which in conjunction with the low-speed interrupter give numerous signals such as dial-tone, busy-back, etc. The low-speed interrupter also provides a means of obtaining machine ringing, pick-up, etc. On later machines the high and low-speed interrupters have been replaced by the tone alternator and mercury-type interrupter which are described in other sections of the Bell System Practices.

2.14 **Transformer:** Each transformer has a primary and secondary winding, the secondary winding being provided with five taps for four different voltages. The primary winding is grounded at its mid point with approximately 155 volts alternating current impressed at its terminals 1 and 3 (See Fig. 1). The line is connected to terminals 4 and 5, 6, 7 or 8 depending upon the voltage required for the particular installation. The No. 4 tap on the secondary winding is one of three fine step adjusting taps. The proper adjusting tap to give the voltage limits of paragraph 1.02 is selected on test and marked 4, and the other two adjusting taps cut off and taped. Where a transformer is shipped without being tested with the machine with which it is to be used, all three adjusting taps are left long and marked 4, 4-A and 4-B, and the proper tap selected upon installation.

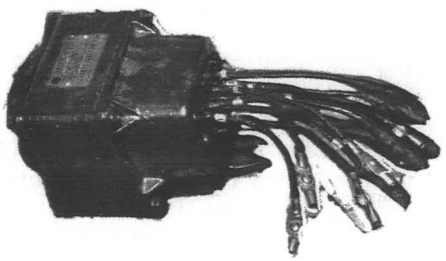

Fig. 8—Transformer.

2.15 **Resistor Unit:** A resistor unit for the control of the generator field is mounted separately. This unit consists of two single plate rheostats decked and arranged for either rear or front of board mounting. One rheostat is in parallel with the contact of the voltage regulator and in series with the second rheostat and the generator field. Each rheostat arm is adjusted, marked and locked in position after being tested with its associated generator, has the serial number of the generator painted on it and is correct for use with that generator only.

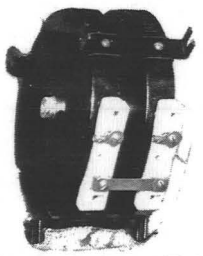

Fig. 9—Resistor Unit.

2.16 **Voltage Regulator:** An automatic voltage regulator is provided with each generator to hold the a-c. voltage within close limits by changing the strength of the generator field as required. This regulator is described in separate Bell System Practices.

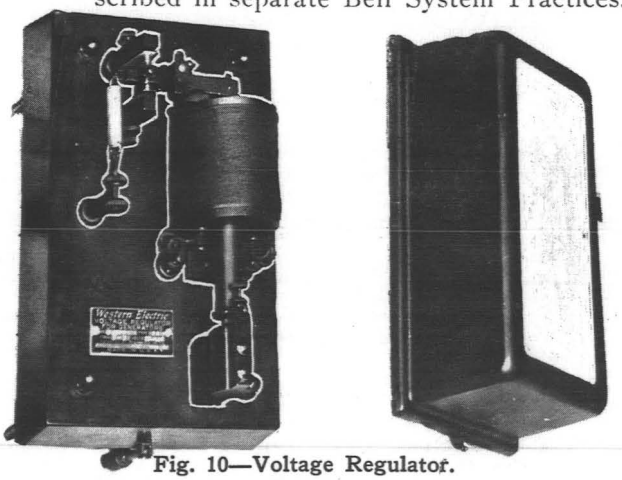

Fig. 10—Voltage Regulator.

2.17 **Auxiliary Resistance:** An auxiliary resistance is separately mounted and connected in series with the solenoid coil of the voltage regulator. This resistance has numerous taps corresponding to the different secondary voltages of the associated transformer and connections are made to the tap corresponding to the voltage of the particular installation.

Fig. 11—Auxiliary Resistance.

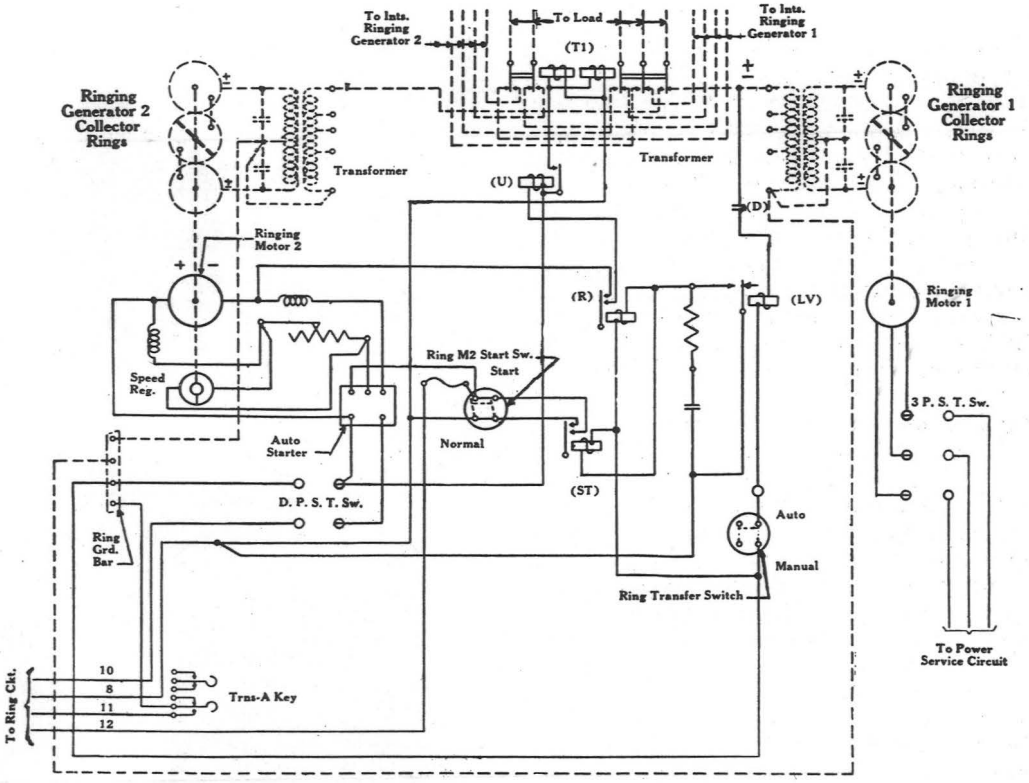

Fig. 12—Schematic Diagram for Automatically Transferring the Ringing Machine Load from the Line to the Battery-Driven Ringing and Coin Control Generators.

2.18 **Detailed Description of Fig. 12:** Assume an interruption in ringing voltage from ringing generator 1 due to a power or brush failure. The (LV) relay, which is connected to the ± lead thru the (D) condenser and to ground through the normally closed "Ring Transfer Switch," will release, putting 24 volt battery from lead 8 on the windings of the (R) and (ST) relays. Their windings being grounded these relays operate, the (R) relay connecting the winding of the (U) relay to the negative armature terminal of the ringing motor 2 and the (ST) relay causing the "Automatic Starter" to operate. (The Ring M2 Start Switch in parallel with the contact of the (ST) relay is normally open.) The operation of the "Automatic Starter" starts the motor from battery on lead 10, limiting the current during starting and excites the shunt field. When the motor comes up to speed, the (U) relay operates. It is connected across the armature through the contacts of the (R) relay referred to above, and the DPST motor switch. The (T1) relay is then operated through the contacts of the (U) relay transferring the load to the battery-driven generator set:

2.19 When power is restored the (LV) relay operates causing the (ST) and (R) relays to release. The release of the (R) relay in turn causes the (U) and (T1) relays to release restoring the load to the line-driven set. The release of the (ST) relay causes the starter to release stopping the battery-driven generator set.

2.20 When the (ST) relay or "Ring M2 Start Switch" is operated as covered above, battery is placed on lead 12 which brings in an alarm. The operation of the Trns-A (transfer alarm) key will cut off the alarm bell when desired.