POWER SYSTEMS
800 TYPE PLANTS
RINGING CIRCUIT
AC-DC OR SUPERIMPOSED RINGING
SXS SYSTEM NO. 355A
806F RINGING POWER PLANT

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 Low tone lead "LT1" paired with a ground return lead "LT1R", added to provide a source of tone tube used in the switching circuits to provide 30 IPM tone and flash for intertoll through selectors.

A.2 Relay (S2) in Fig. 8 changed from a 2500 ohm to a 700 ohm winding in order that audible ringing may be returned on a dial transfer from Ring G1 to Ring G2.

B. CHANGES IN APPARATUS

B.1 U407 relay (S2) in Fig. 8 replaced by a U112 relay.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Options "F" and "G" added in Fig. 8 and CR table for relay (S2).

D.2 Option "E" for "LT1" and "LT1R" leads added in Figs. 1 and 51.

D.3 In CD under section 10 - DIAL TRANSFER OF RING AND LOW TONE GENERATORS AND INTERRUPTER - add the following paragraph:

10.4 Signals for Dial Transfer of Ring and Low Tone Generators and Interrupter.

When the attendant dials the number associated with the generators or interrupter that are not operating at the time as referred to in paragraphs 10.2, 10.3 and 10.4 the audible ringing tone heard indicates that the connector has seized the proper terminal. To check whether the actual transfer has taken place, the same number should be redialed and a busy tone will indicate that the transfer has been made.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 5232-WSR-JMD-MP

POWER SYSTEMS
800 TYPE PLANTS
RINGING CIRCUIT
AC-DC OR SUPERIMPOSED RINGING
SXS SYSTEM NO. 355A
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CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 Change made to prevent shutdown of interrupter No. 2 after automatic transfer from interrupter No. 1 followed by dial transfer of generators No. 2 and subsequent dial transfer back to generators No. 1. Removal of (F) thermistor in Fig. 8 clears trouble.

A.2 Alarm fuse in parallel with (RING) fuse specified as 35J or 70K to prevent blowing when starting inverter.

B. CHANGES IN APPARATUS

B.1 (F) thermistor -1D- removed in Fig. 8.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 "J" and "K" options added at (F) thermistor in Fig. 8.

D.2 "H" option, leads "to Ring. Ckt. for absorbing surges on Mach. Ring. Brushes" added in Fig. 2.

D.3 Fuse "AUX" added in Note 101 (For Record Only).

D.4 Fuse capacities removed in Fig. 10 and reference to Note 101 added as capacities are shown in Note 101 (For Record Only).

D.5 In Note 101 (RING) fuse was formerly specified as "6-1/4 FN 8-1/2 ALM".

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 To provide code and machine ringing tones and signals required by No. 355A dial offices.

2. WORKING LIMITS

2.1 84-88 Volts A-C (AC-DC & Sup) normal, 75-90 during A-C service failure.

94-101 Volts A-C (For Long Line Ckts.) normal, 85-103 during A-C service failure.

90-120 Volts A-C (105±)

44-52 Volts D-C

3. FUNCTIONS

3.01 To furnish ringing current at the voltage required by the 355A dial equipment.

3.02 To provide interrupted ringing current and ground at the proper intervals for furnishing 5 code 10 party (Type "D" codes) or 8 party semi-selective ringing.

3.03 To provide interrupted ground for signaling.

3.04 To provide the tones required by the 355A equipment.

3.05 To transfer automatically from commercial power supply to a battery driven inverter in case of AC power failure, with automatic transfer back when the commercial power supply is again available.

3.06 To transfer automatically to a spare interrupter in case of failure of the regular interrupter. Manual transfer may also be accomplished by means of a key.

3.07 To transfer automatically to spare ringing and low tone generators in case of failure of the regular ringing or low tone generator. Manual transfer may also be accomplished by means of a key.

3.08 To provide a means of transferring to the spare interrupter and to the spare ringing and low tone generator or restoring to normal by dialing assigned numbers.

3.09 To provide a means of transferring to the spare ringing and low tone generators after an automatic transfer of interrupters or vice versa.

3.10 To provide alarms indicating failure of the ringing, low tone, or 60 cycle service or interrupter and transfer to the spare units.

4. CONNECTING CIRCUITS

This circuit was orignally designed to connect to the following circuits.

4.1 SD-81131-01, Power Ringing Circuit

4.2 SD-81132-01, Superimposing and Tripping Battery Circuit.

4.3 SD-81139-01, Auxiliary 20 Code Interrupter Circuit.

4.4 SD-32192-01, Alarm Circuit.

4.5 SD-31868-01, Interrupter Relay Ckt.

4.6 SD-81202-01, Aux. Ring & Bat. Dist. Ckt., Car System.

4.7 Power Discharge Circuits.

4.8 Switch Frame Circuits.

DESCRIPTION OF OPERATION

5. GENERAL

20 cycle audible ringing current is furnished from static ringing generators shown in Fig. 3. These generators have two output windings. In AC-DC offices winding A is connected to -48 volt battery for supplying the ringing codes and winding B is grounded to provide 105V ± for P.B.X. ringing leads or long line circuits. In superimposed offices winding A is connected to -48 volt battery and winding B to +48 volt battery thus providing both superimposed - and superimposed + ringing. The 97 volt taps in this case may be used for long line circuits requiring 94-101 volts A-C with 48 volts D-C. In superimposed offices, 105V± is obtained from the transformer shown in Fig. 6.

Low tones are obtained from 101A frequency generators shown in Fig. 3. Duplicate ringing and low tone generators are provided with automatic transfer to the spare generators in case of failure of either the regular ringing or low tone generator. The (G-) capacitor is provided to modify the low tones except in offices with selector repeaters where "V" option is disconnected. The (LT) coil in Fig. 4 is provided to step down the low tone level for certain connecting circuits. High tone, when required, is obtained from a 102A frequency generator shown in Fig. 7.

In Fig. 2, two A-C motor driven interrupters are furnished with automatic transfer to the spare in case of failure of the regular interrupter. The interrupters and codes furnished for 5 code 10 party or 8 party semi-selective ringing are shown on connecting circuit SD-81131-01. These interrupters are arranged to provide 60 IPM line busy tone and 120 IPM paths busy tone.

The ringing generator, tone generator and interrupters are normally operated on a start-stop basis - "Z" option. When 105V± is furnished for P.B.X. ringing supply the ringing and low tone generators are operated continuously (except during power failure) - "W" option and the high tone generator and interrupters on a start-stop basis. If continuous operation of ringing and tone generators and interrupters is required, including continuous operation during power service failure, "S" option may be used. This may be necessary for supply to manual switchboards but is not otherwise recommended due to increased current drain and wear on the interrupters.

In case of A-C service failure an inverter furnishes 60 cycles A-C to operate the ringing and tone generators and interrupter. The inverter is operated on a start-stop basis with "W" or "Z" option to reduce battery drain. If the ringing generator has been connected for continuous operation ("W" option) in order to supply 105V± to P.B.X.'s it will run continuously as long as the A-C service is normal but will be on a start-stop basis when the inverter is running. During power failure, provision will be made in the P.B.X.'s to use hand generators when the ringing generator is not operating.

While the inverter is supplying 60 cycles A-C to the 101A and 102A frequency generators, the quality of the dial busy and high tones will be degraded due to the presence of a 20 cycle modulation on the inverter 60 cycle output. This 20 cycle modulation is caused by the inherent input current characteristics of the (RING G-) KS-15529 ringing generator. A 4 microfarad capacitor (INV) is provided across the inverter output to improve the power factor of the 60 cycle load. This capacitor also tends to improve the quality of the tones by reducing the disturbing effect of the ringing generator input current on the tone generator.

6. NORMAL OPERATION

In normal operation with "Z" option when no calls are in process relay (ST) is held operated, and the ringing and tone generators and interrupter are not operating. When ringing current, tones, or interruptions are required by the switching circuits ground is connected to the MS lead operating the (MS) relay. Relay (MS) operated releases relay (ST) which connects the ringing and tone generators and interrupter to the A-C service. It also removes ground from the MFG lead to Fig. 5 and grounds the RF lead. These functions are described under INTERRUPTER TRANSFER and ALARMS. When ringing current is no longer required, ground is removed from the MS lead releasing the (MS) relay which in turn reoperates the (ST) relay to disconnect the A-C service from the ringing and tone generators and interrupter.

With "W" option the operation is the same except that the ringing generator is connected to the A-C service side of the

contacts of the (ST) relay. With "S" option solid ground is applied to the winding of the (MS) relay holding it operated and (ST) released.

7. AUTOMATIC TRANSFER TO INVERTER AC POWER SERVICE FAILURE

7.1 In Fig. 1, transformer (G), tube (B), relay (LV) and resistances and potentiometers (B) (C) (D) (E) (F) and (M) form a circuit which will cause relay (LV) to release when the primary voltage on (T) is approximately 85% of normal. Transformer (T) has primary taps for 100, 110 and 120 volts brought out to terminal strip (T). The tap nearest to normal line voltage should be selected. Resistance (G) is provided to prevent release of relay (LV) during the open period of the contacts on the (ADJ) key when it is being operated. Under normal power service voltage conditions the voltage put on the control gap of the tube (V) by potentiometer (C) and resistance (D) is sufficient to cause this gap to fire on each positive half cycle. This causes the main gap to fire and furnish current for the operation of relay (LV). Relay (LV) operated holds relay (LV1) operated. When the power service voltage falls below 85% of normal the control gap will not have sufficient voltage across it and will cease to fire, as will the main gap causing relay (LV) and then relay (LV1) to release. Relay (LV1) released opens a short circuit across resistance (F) in the control gap potentiometer so that tube (V) will fire again at a voltage about 5% above the release voltage. Relay (LV1) released also operates relay (TR) which locks up to ground through the contacts of relay (DL). (TR) operated removes ground from relay (TR1) which remains operated under control of a back contact on (MS). (TR) operated also prepares a path from the (MS) relay contacts to the (IS) relay so that whenever the (MS) relay is operated the (IS) relay will start the inverter. The (MS) relay operated also releases (TR1) in turn operating (TR2) which transfers the A-C load from the line to the inverter. (TR1) being slow release delays the transfer until the inverter has attained full speed. (TR) operated also removes ground from the winding of the (DL) relay and when the (DL) capacitor has discharged the (DL) relay will release. This capacitor discharge delays the release of relay (DL) for about 15 seconds, and so when once operated, the (TR) relay will not release for this period of time even though the (LV) and (LV1) relays have reoperated during this period. The purpose of the delay is to prevent unnecessary transfers back to the line during momentary restorals in service voltage after a service failure.

7.2 Adjustments

Relay (LV) should be in adjustment and relay (LV1) blocked operated before adjusting the tube circuit. The tube is adjusted as follows: Turn both rheostats (C) and (M) clockwise as far as they will go. Hold (ADJ) key depressed and turn rheostat (C) counterclockwise until relay (LV) releases, then clockwise until it just operates. Now still holding (ADJ) key depressed turn rheostat (M) counterclockwise until relay (LV) releases, then clockwise until it operates. Turn rheostat a further 10 or 15° clockwise to give the main gap some margin over the minimum requirements. The tube is now adjusted. Remove block from (LV1) relay.

7.3 Manual Start of Inverter

The inverter may be started manually by operating the (INV ST) key. This operates the (IS) relay to start the inverter but does not connect the load to it. It also lights the (GD) lamp as a warning.

While it is also possible to start the inverter with the load connected by removing the supply fuse at the A-C service cabinet while MS ground is present, this procedure is not recommended as the normal float voltage of the battery, being greater than the discharge voltage, will cause the inverter to run fast resulting in abnormally high ringing voltage.

7.4 Adjustment of Inverter Speed

The inverter speed is affected by battery voltage, causing the output frequency to vary which in turn changes the output voltage of the ringing generator. The inverter is provided with an adjustable field resistance (on the machine frame) which is ordinarily set at the factory for proper operation in this circuit. However, should the inverter speed require readjustment the following procedure is recommended: (1) for 24-cell power plants such as the 105-D insert the CEMF cell in the battery discharge circuit if provided, otherwise disconnect the charging rectifiers (by removing their A-C input fuses to place the battery on discharge. Check that the d-c input to the inverter is approximately 49.5 volts. (2) opens the a-c supply to the ringing plant by removing the fuse at the a-c service cabinet. (3) start the ringing plant by blocking relay (MS) operated. (4) using a suitable voltmeter, measure the 20 cycle a-c output voltage across terminals 0 and 86 on the A output winding of (RING G1) or (RING G2). With no-load (or light loads) on the ringing supply this voltage should read approximately 90. If not, adjust the field resistance on the inverter so that the 20 cycle output voltage becomes 90. Adding resistance tends to raise the speed and thus raises the 20 cycle output voltage. (5) restore plant to normal.

8. RINGING OR LOW TONE GENERATOR TRANSFER (FIG. 4)

8.1 Automatic Transfer

When there is no ground on the (MS) lead Fig. 1, the (GF) relay cannot operate since the ground through the (E) thermistor is opened at the 5-6% contacts of relay (MS). When motor start ground is applied to the circuit the operation of relay (MS) connects ground to the (E) thermistor but the operation of relay (GF) is delayed by the thermistor until the (AF) and (BF) relays in Fig. 4 and the (TF) relay in Fig. 5 have operated by the starting of the ringing and tone generators. The contacts of these three relays are connected in series from ground on the (GEN TRNS) key to the (GF) resistance thus shunting down relay (GF) and keeping it released.

Relays (AF) and (BF) are connected across the two output windings of (RING G1) and relay (TF) across the alarm relay winding of the low tone generator that is in circuit.

If (RING G1) fails, either the (AF) or (BF) relays will release. If (LT G1) fails the (TF) relay releases. If the (TRP1) fuse blows, (AF) will release. The release of any of these three relays removes shunting ground from the (GF) resistance, and relay (GF) operates. Relay (GF) operated locks up to ground on the (GT) relay through its 1-2B contacts and 1-3B contact on (GT), and also operates relay (GT). Relay (GT) operated transfers the locking ground for relay (GF) to the (GEN TRNS) key and operates relays (T7) - (T9) which transfer the A-C input and load from (RING G1) and (LT G1) to (RING G2) and (LT G2).

Relay (GT) operated also lights the (GF) lamp and connects battery to the MT lead to bring in a minor alarm.

The contacts of relays (AF) and (BF) are now open but the operation of relay (GT) connects ground through the contacts of relays (TF) and (NV) in Fig. 5 to the winding of the (RF) relay in Fig. 5, keeping it shunted down. If (RING G2) or (LT G2) fails after the transfer, relay (NV) or (TF) will release, removing the shunting ground from relay (RF) which operates. Relay (RF) operated lights the (RF) lamp and connects ground to the PG lead to bring in a major alarm.

To transfer back to (RING G1) and (LT G1), after the trouble has been cleared, operate the (GEN RST) key. This shunts down the (GF) relay which in turn releases relay (GT). The release of relay (GT) transfers the A-C input and load back to (RING G1) and (LT G1) and as the (AF) and (BF) relays re-operate from (RING G1) the (GF) relay will remain shunted down when the (GEN RST) key is released.

8.2 Manual Transfer

Operation of the (GEN TRNS) key to the (MAN) position, removes shunting ground from the (GF) relay which operates, in turn operating (GT) and transferring the A-C input and load to (RING G2) and (LT G2) as described before. In this case, however, the (GT) relay locks up to the (GEN TRNS) key and the (GF) relay releases as soon as the (GT) relay operates and removes holding ground.

To transfer back to (RING G1) and (LT G1) the (GEN TRNS) key is turned to the (AUTO) position. This releases relay (GT) which transfers the A-C input and load to (RING G1) and (LT G1). Relay (GF) remains released due to being shunted down.

9. INTERRUPTER TRANSFER

9.1 Automatic Transfer (Fig. 2)

When there is no ground on the MS lead in Fig. 1 the interrupter is not operating and ground from the MS relay is connected over lead MFG to the (MF) relay in Fig. 5 holding it operated. When the (MS) relay is operated the holding ground for the (MF) relay is removed but if the interrupter is running the (MA) capacitor and series resistance are connected alternately to ground and to the winding of the (MF) relay over leads A and B by a spring pileup on the interrupter which is operating at 120 I.P.M. The periodic connection of the capacitor to the relay winding keeps the relay operated while the capacitor is charging and its slow release characteristics when in parallel with the (MF) capacitor prevent it from releasing during the period that the (MA) capacitor is being discharged. If the A-C motor driving the interrupter fails or if the interrupter shaft ceases to turn due to other causes such as gear train failure, the 120 I.P.M. alarm spring pileup may stop in either one of two positions. If it stops when the (MA) capacitor is connected to the winding of the (MF) relay the relay will remain operated until the charging current falls below the relay holding current. If the interrupter stops with the lead A to the (MF) relay winding open the relay will release after a short delay due to the parallel (MF) capacitor. Relay (MF) released connects ground through contacts 1-2B on relay (DS) in Fig. 8 to operate relay (MT) in Fig. 2, connects ground to lead MF and lights the (RF) lamp. Relay (MT) - Fig. 2 - operated locks up to the (INT RST) key through a back contact on the (MNT) relay and a front contact on the normally operated (DT) relay in Fig. 8 and operates relays (T1) - (T6) to start the second interrupter and transfer the load to it. It also lights the (MT) lamp and

connects battery through 1200 ohms on the MTB lead through contacts on the (MNT) relay to the MT lead to the alarm circuit to bring in a minor alarm. Ground on the MF lead is connected through thermistor (C) to the PG lead to the alarm circuit but the delay introduced by the thermistor is sufficiently long so that relay (MF) - Fig. 5 - reoperates from the second interruper, extinguishing the (RF) lamp and removing ground from the (MF) lead before the alarm is brought in. In case of failure of the spare interrupter the (MF) relay will again release and remain released and ground over the MF lead will be connected to the PG alarm lead to bring in an major alarm. When the interrupter that has failed has been made ready for service again it should be turned by hand to the position indicated in circuit note 103 on connecting circuit SD-81131-01 before being placed back in service. This precaution is to prevent splitting ringing codes during a manual transfer. To restore Interrupter No. 1 to service the (INT RST) key should be held operated until the (MT) relay releases and extinguishes the (MT) lamp. When the (INT RST) key is operated it removes locking ground from the (MT) relay but a parallel ground is provided from the (MOTOR HOLD) contacts of Interrupter No. 2 through a front contact on the (DS) relay (normally operated) until interrupter No. 2 reaches the end of its code cycle. At that time the interrupter contacts open, releasing the (MT) relay and starting and transferring the load to Interrupter No. 1 by the release of the (T1) - (T6) relays, and stopping Interrupter No. 2.

9.2 Manual Transfer (Fig. 2)

To manually transfer the load from Interrupter No. 1 to Interrupter No. 2 operate the (INT TRNS) key (Fig. 2). This operates the (MNT) relay which locks up to the (INT RST) key. Relay (MNT) operated lights the (GD) lamp over lead GD to Fig. 1, and connects ground from its 5T contact to a spring on the (MOTOR TRNS) pileup on the No. 1 interrupter. When the interrupter reaches the end of the code cycle the (MOTOR TRNS) contacts close, connecting ground to the (MT) relay which locks up to ground on the (MNT) relay and starts and transfers the load to Interrupter No. 2 and lights the (MT) lamp. With the (MNT) relay operated no alarms are brought in as the MT lead is opened by contacts on the (MNT) relay. Transfer is made at the end of the code cycle in order to prevent garbling the codes. To transfer back to Interrupter No. 1 the (INT RST) key is operated and held until the (MNTO and (MT) relays release and the (MT) relays release and the (MT) lamp is extinguished. Holding ground is connected from Interrupter No. 2 to the (MNT) relay through the (MOTOR HOLD) springs as described under "Automatic Transfer" until the end of the code cycle. At that time the (MNT) relay releases, releasing the (MT) relay which starts and transfers the load to Interrupter No. 1 and stops Interrupter No. 2.

10. DIAL TRANSFER OF RING AND LOW TONE GENERATORS AND INTERRUPTER - FIG. 8, "T" OPTION

10.1 General

When the dial transfer feature is furnished it should not be used to transfer the load from one set of generators and interrupters on a periodic schedule as has been done in the case of battery driven ringing machines to equalize wear on commutators, etc. It is intended only for emergency use in case of failure due to an open lead or similar circumstance which the automatic transfer features will not detect. If the generators and interrupters have been dial transferred to Ring and Low Tone G2 and interrupter No. 2 there is no automatic transfer back to the No. 1 generators and interrupter in case of subsequent failure of the No. 2 generators or interrupter.

10.2 Dial Transfer with no Preceding Automatic Transfer of Generators or Interrupters

This assumes that the plant is running normally on (RING G1), (LT G1) and (INT.1) and that some trouble has occurred that requires transfer in order to keep the office operating until the trouble can be located and cleared.

The number that has been assigned to (RING G2) is dialed from any subset connected to the office. This connects ground to the S2 lead and through contacts 1-2T on relay (DT) (normally operated) contacts 8-9T on relay (DS) (normally operated) to the winding of relay (S2), operating it. Relay (S2) operated, locks up to its own 1-2B contacts through contacts on the (DS) relay, operates relay (GT) in Fig. 4 to transfer the Ring and LT generators and operates relay (MT) in Fig. 2 to transfer the interrupter. It also lights the (DT) lamp. Relays (GT) and (MT) operated remove holding ground from the (DT) relay which releases, connects ground to the (S2) lead to give a busy signal if the number is re-dialed and closes the path from the S1 lead to the (S1) relay.

When the trouble has been cleared the number assigned to (RING G1) is dialed, connecting ground to the S1 lead and operating relay (S1). (S1) operated releases (DS). (DS) released opens the locking ground for (S2) which releases. Relay (S2) released, releases relay (GT) in Fig. 4 which transfers the load to (RING G1) and (LT G1); and removes locking ground from relay (MT) in Fig. 2. Relay (MT), however, has a parallel ground through its 4-5T contacts, contacts 2-3B on relay (MNT) in Fig. 2, and the (MOTOR HOLD) interrupter on (INT.2), to

contacts 3-4B on relay (MF) in Fig. 5. This ground is maintained until the end of the code cycle on (INT.2) and is then opened, releasing relay (MT) in Fig. 2 and transferring to (INT.1). When ground is removed from the S1 lead relay (S1) releases and operates relay (DS). Relay (DS) operated, operates relay (DT) which grounds the S1 lead to give a busy signal and connects the S2 lead through to the (S2) relay. If ground has been removed from the S1 lead before the (MT) relay released, the (S1) relay is held operated from ground through contacts 8-9T on (MT) and 2-3T on (DS) and will not be released until the (MT) relay is released by the (MOTOR HOLD) interrupter on (INT.2).

10.3 Dial Transfer of Interrupters After Automatic Transfer of (RING G1) and (LT G1)

Assume that the ring and tone generators had an automatic transfer and it is desired to dial transfer the interrupter.

Dial the number assigned to (RING G2) to connect ground to the S2 lead and operate the (S2) relay. The circuit functions as described under Par. 10.2 except that in this case the (GF) and (GT) relays are already locked up due to the automatic transfer. The interrupter may be transferred back to (INT.1) by dialing the number assigned to (RING G1) as described in Par. 10.2 except that in this case the load remains on (RING G2) and (LT G2) which can be restored to G1 only by operating the (GEN RST) key as described in Par. 8.1.

10.4 Dial Transfer of (RING G1) and (LT G1) after Automatic Transfer of (INT. 1)

The automatic transfer of (INT.1) as described in Par. 9.1 left the (MT) relay locked up to the (INT RST) key through contacts 2-3B on relay (MNT), and 4-5T on normally operated relay (DT).

When ground is connected to the (S2) lead by dialing the number assigned to (RING G2) it operates relay (S2) which in turn operates (GT) in Fig. 4 to transfer the generators.

Relay (S2) operated also connects ground to hold (MT) operated after (DT) releases.

The generators may be restored to (RING G1) and (LT G1) by dialing the number assigned to (RING G1) which connects ground to the S1 lead to operate relay (S1). (S1) operated releases (DS) and (S2) which in turn releases (GT) to transfer the generators. Release of (S2) however does not release relay (MT) in Fig. 2. The release of relay (S2) removed a locking ground from (MT) but also if the interrupter was not at the end of the code cycle the G2 MOTOR HOLD interrupter furnished a locking ground to hold relay (MT) operated. If relay (S2) released at the end of the code cycle when the MOTOR HOLD interrupter was open, relay (MT) would release. The release of the (MT) relay will transfer the interrupter to (INT1) but as this interrupter has failed, relay (MF) in Fig. 5 will release and re-operate relay (MT), transferring back to (INT2) and the ringing load will remain on (INT2).

11. EFFECT OF DIAL TRANSFER AFTER VARIOUS MANUAL OR OTHER TRANSFERS

11.1 The effect of dial transfer after various manual or other transfers is outlined briefly as they are not likely to occur unless the dial transfer number has been accidently dialed.

11.2 After a Manual Transfer of Ring and Low Tone Generators

If the S2 lead is grounded the interrupters will be transferred to INT.2. Grounding the S1 lead will restore to INT.1.

11.3 After a Manual Transfer of Ring and Low Tone Generators Followed by an Interrupter Failure

If this situation occurs the (MT) relay will release at the end of each code cycle. This may be stopped by operating the (INT TRNS) key which effects a manual transfer to INT.2 and stops the relay pumping. If either the S1 or S2 loads are grounded subsequently there is no effect on the circuit.

11.4 After a Manual Transfer of Interrupters

If lead S2 is grounded the Ring and Low Tone generators will transfer to G2. If lead S1 is then grounded they restore to G1. Further grounding of S1 or S2 leads has no effect on the circuit.

11.5 After a manual transfer of generators and interrupters in this case the dial transfer is ineffective.

11.6 After an Automatic Transfer of Both Generators and Interrupter

If the S2 lead is grounded nothing happens. If the S1 lead is grounded momentarily, the interrupter transfer is temporarily released.

If the ground is held on the S1 lead INT.2 will stop and the relays will pump and a major alarm will be brought in. This condition clears up as soon as ground is removed from the S1 lead.

12. REMOVAL OF RING OR LOW TONE GENERATORS OR INTERRUPTERS FOR MAINTENANCE

12.1 Removal of INT.1

If interrupter 1 is to be removed for maintenance, operate the (INT TRNS) key to effect a manual transfer before removing the interrupter. This prevents the MT alarm from operating. If interrupter 2 now fails a major alarm will be brought in.

Manual transfer of generators is not affected. If lead S2 is grounded the generators will be transferred to G2 and restored to G1 if lead S1 is subsequently grounded. After one transfer to G2 and back to G1, further grounding of S1 or S2 leads has no effect.

If G1 fails an automatic transfer to G2 takes place. Dial transfer then has no effect.

12.2 Removal of INT.2

If the S2 lead is then grounded, both generators and interrupters will transfer to G2, but as INT.2 has been removed a major alarm will be brought in as no interrupter is running. The circuit may be restored to GEN.1 and INT.1 by dialing the number to ground the S1 lead.

If Ring or LT G1 now fails an automatic transfer to G2 takes place. If lead S2 is then grounded a major alarm will be brought in as before as INT.2 is not in the circuit. Grounding lead S1 restores the circuit to normal and if RING or LT G1 are still in trouble they will automatically transfer to G2.

If RING or LT G2 has also been removed for maintenance, grounding the S2 lead will result in a complete failure and a major alarm. The circuit may be restored by dialing to ground lead S1.

12.3 Removal of RING G1 or Low Tone G1

If RING G1 or Low Tone G1 is to be removed for maintenance, operate the (GEN TRNS) key to the (MAN position)to effect a manual transfer before removing the generator.

Automatic or dial transfer of interrupters is not affected.

12.4 Removal of RING G2 or Low Tone G2

If lead S2 is grounded by dialing the interrupters will transfer to INT.2 but a major alarm will be brought in as there is no RING 2 or Low Tone G2 available. The circuit may be restored to normal by dialing to ground lead S1.

If INT.1 fails there will be an automatic transfer to INT.2. Dialing to ground the S1 or S2 leads will now be ineffective.

13. ALARMS

Relay (NV) - Fig. 5 is connected to the 86 volt output tap of output A on the ringing generator that is operating and relay (TF) - Fig. 5 is connected to the alarm relay output of the LT tone generator that is operating. Ground is connected through the contacts on relays (GT) - Fig. 4 and (NV) to relay (RF) which keeps it shunted down while the plant is operating. If the output of the ringing generator fails the (NV) relay will release, removing the shunting ground and allowing (RF) to operate through the (A) thermistor after a delay of approximately 2 seconds, to allow for an automatic transfer to (RING G2) and (LT G2). If automatic or manual transfer of the generators has previously taken place, the contacts on relay (TF) are added in the series path to the winding of (RF). Subsequent failure of (RING G2) or (LT G2) will release the (NV) or (TF) relays and operate relay (RF). The (RF) relay operated lights the (RF) lamp and brings in a major alarm over the PG lead to the alarm circuit. When superimposed ringing is furnished leads A and B to relay contacts in the superimposing and tripping battery circuit are connected in series with the contacts of the (NV) and (TF) relays so that the alarm will also be brought in if a (SUP) fuse in that circuit is blown. When the ringing supply is not operating and the (NV) and (TF) relays are released the (RF) relay will not operate as the (MS) relay - Fig. 1 - will be released, removing operating ground from the RF lead to the winding of the (RF) relay. However if (RF) has previously been operated as described above it will remain operated over its front contact to ground, thus locking in the alarm regardless of the presence or absence of MS ground, until the trouble has been corrected and MS ground subsequently reapplied.

In case of power failure the (DL) relay - Fig. 1 - will release after a delay as described under paragraph 7, removing ground from relay (PF) - Fig. 5 and releasing it. Relay (PF) released lights the (PF) lamp and brings in a minor alarm over lead MT to the alarm circuit. Should the power be restored before (DL) has released, (DL) will release momentarily at the end of its delay, releasing (TR) and in turn reoperating (DL). Relay (PF) being slow release will hold up during this interval to prevent a momentary alarm.

Alarms are also provided to indicate interrupter transfer or failure of both interrupters as described in Par. 9.1.

14. FILTER CIRCUIT

"R" option in Fig. 1 provides a filter consisting of coil (F) and capacitor (F) to prevent noise being impressed on the central office battery due to the operation of the (INV) inverter. Under normal operation the inverter is not running and when running the noise without the filter should not seriously affect the office circuits, hence the filter is not normally required. If circuits requiring type A transmission battery are installed and no discharge filter is furnished on the 48V power plant, "R" option should be added.

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