CIRCUIT DEVELOPMENT
POWER DEVELOPMENT DEPARTMENT

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Appendix 6-D
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POWER SYSTEMS
CHARGE CIRCUIT
130 VOLTS 1-25 AMPERE
410A PLANTS

CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS OTHER THAN THOSE APPLYING TO ADDED OR REMOVED APPARATUS

C.1 Note 6 Added.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 An additional (F5) lead was added to the (L2) relay in Fig. 5.

D.2 Lead (B8) was put on punching 38 in Fig. 63. This change separates the (B8) req. lead so that it may be separately fused when this circuit is used as a negative 130V supply (Pos. grounded).

D.3 Option ZA, ZB, ZC and ZD added. Note 119 added.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 5152-KK-CSK-VEP

POWER SYSTEMS
CHARGE CIRCUIT
130 VOLTS 1 - 25 AMPERE
410A PLANTS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Note 104 changed to rate the use of Fig. 2 as a supplementary rectifier Mfr. Disc.

D.2 Note 108 change to rate Fig. 2 Standard.

D.3 Fig. 2 shown as Standard.

D.4 The word "Float" removed from Note 115.

D.5 Punching 84 of Fig. 60 shown solid.

D.6 L5 shown in Fig. 12 instead of L2.

D.7 Note 118 added.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 5152-PWC-JMD-MJ

POWER SYSTEMS
CHARGE CIRCUIT
130-VOLTS 1-25 AMPERE
410A PLANTS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 In Fig. 5, "F" and "G" optionsare added to add "D" leads to Fig. 12. Corresponding change is shown in Fig. 53.

D.2 Fig. 12.1s added.

D.3 Notes 116 and 117 added.

D.4 "A" & "B" options are added in Fig. 1

D.5 Fig. 2 was not rated Mfr. Disc.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT: 5152-WJM-HMS-GM

POWER SYSTEMS
CHARGE CIRCUIT
130 VOLTS 1-15 AMPERE
410A PLANTS

CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS OTHER THAN THOSE APPLYING TO ADDED OR REMOVED APPARATUS

C.1 For (H2) relay, U532, "J" and "S" options, the primary test operate value was erroneously shown as 12.9 ma.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 5232-WJM-HNS-BO

POWER SYSTEMS
CHARGE CIRCUIT
130 VOLTS 1-25-AMPERE
410A PLANTS

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 The (H2) relay of "J" option and the associated capacitor give the required operated time of the (H2) relay by means of the capacitor charging current in the auxiliary winding of the relay. This assures shutdown of the last operating rectifier.

B. CHANGES IN APPARATUS

B.1 The U216 (H2) relay of Figure 5 and its associated (H) resistor have been replaced by a U532 relay, a KS-13492, L1 100-ohm resistor and a KS-14504 50 MF capacitor.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 "J" option is added in Figure 5 replacing "K" option which was formerly part of Figure 5.

D.2 "H" option in Figures 2 and 4 is added.

D.3 "Mfr. Disc." rating is removed from Figure 2 in accordance with manufacturing information.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 5740-WJM-HHS-AK

POWER SYSTEMS
CHARGE CIRCUIT
130 VOLTS 1-25 AMPERE
410A PLANTS

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 This circuit was revised to add "M" option at (VR2) relay in Fig. 5B to provide for 66 cell control when two CEMF cell or resistor groups are required.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 In Fig. 5B, "M" option added.

D.2 Note 115 added.

D.3 For plants using two CEMF cell or resistor groups, "M" option across the high section allows the (VR2) to operate over its low range (139-146V). In this case the setting of the overcharge rheostats in the rectifiers should be slightly lower than 146 volts.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 5740-SDV-JMD-BW

POWER SYSTEMS
CHARGE CIRCUIT
130 VOLTS 1-25 AMPERE
410-A PLANTS

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 This circuit was revised to function with a maximum of 8 rectifiers and to operate with either 66 or 70 cell batteries.

B. CHANGES IN APPARATUS

B.1 Added

Figs. 5C, 5D, 5E.

B.2 Changed

J86207C rectifiers per Fig. 2 replaced by J86240A rectifiers per Fig. 11.

D. DESCRIPTION OF CIRCUIT CHANGES.

D.1 Fig. 5B for 66 cell battery operation was part of Fig. 5.

D.2 Fig. 5C added for 70 cell battery operation.

D.3 Figs. 5D & 5E added to provide control of additional rectifiers.

D.4 Fig. 2 Rated "MFR DISC". Replaced by Fig. 11.

D.5 Leads C6, C6, & C7 added from (H3) Relay, Fig. 5.

D.6 Leads J6, B6, J7, B7 added from (OC) Relay Fig. 5.

D.7 Lead A added from Fig. 5 to Fig. 5E.

D.8 Cross-connection Figs. 61, 62, 63 added for 6th, 7th, & 8th Rects.

D.9 "H" Lead added to Fig. 60 for operation with addl. rects.

All other headings under changes, no change.

1. PURPOSE OF CIRCUIT

1.1 To provide a charging circuit for a positive or negative 130 volt battery for loads up to 25 amperes. Provision is made to increase the capacity of the positive plant to 40 amperes.

2. WORKING LIMITS

2.1 The limits for this circuit are governed by those of the discharge circuit. Normal discharge limits are 125-135 volts and emergency charge limits 125-153 volts for 66 cell batteries and 125-157 volts for 70 cell batteries or maximum charge voltage on the battery.

3. FUNCTIONS

3.1 To maintain the battery within closely regulated floating limits normally and automatically charge it as required.

4. CONNECTING CIRCUITS

4.1 Discharge circuit SD-80942-01.

4.2 Alarm circuit.

4.3 Auxiliary charge circuit SD-81016-01

DETAILED DESCRIPTION

5. OPERATION

5.1 This circuit uses automatically controlled regulated tube rectifiers per Fig. 11 to charge a 130 volt battery shown on a separate discharge circuit. The 66 cell battery is floated at 2.15 volts per cell, 142 volts, and after an emergency discharge the circuit is arranged to return the battery to a charge voltage of 146 volts before returning it to the normal float value. The 70 cell battery is floated at about 2.16 volts per cell, 151 volts, and charges to 156 volts after emergency discharge. Where only one rectifier is used, this is accomplished by holding the rectifier at current regulation under control of relay (TR) in the rectifier, which is locked up to a back contact of relay (H3) of this circuit. When the 66 cell battery is charged to 146 volts, or the 70 cell battery to 156 volts the (VR2) relay operates the (H2) and (H3) relays releasing the relay in the rectifier and returning the rectifier to normal voltage regulation. Under this condition, no alarm is given as a time delay in relays (D1) and (D2) shown on the discharge circuit prevents an alarm for the short time (VR2) is on its high contact.

5.2 Operation with two rectifiers.

Where two rectifiers are furnished, the first will carry the charging load up to 9 amperes at which point its (OL) relay will operate and cause it to automatically transfer to a regulated current output of 8 amperes and furnish ground over lead D in Fig. 4 to operate relay (A) in Fig. 7. Relay (A) operated cuts in the second rectifier (130VG2) by connecting ground over lead S to a relay in the rectifier. Operated the (A) relay locks up to ground on the (H3) relay in Fig. 5. If the output of (130VG2) goes high enough to operate its transfer relay, its output becomes constant and will remain that way until the (H3) relay is operated by high voltage from the (VR2) relay in Fig. 5B or 5C. Operation of the transfer relay in this rectifier causes the (M) relay in Fig. 7 to operate. This relay which has a very slow release holds ground on the transfer relay in the first rectifier and on the (A) relay so they will not release on operation of the (H3) relay. Thus when the battery charges due to both rectifiers being at constant current to high enough voltage to operate the high contact of the (VR2) relay, the (H3) relay operates and removes lock up from the transfer relays in the rectifiers and from the (A) relay. The relay in rectifier (130VG2) releases and returns this rectifier to regulation which results in lowered battery voltage. This releases (VR2), (H2) and (H3) relays which again puts holding ground on the transfer relay in rectifier (130VG1) and the (A) relay. The (M) relay then releases. If the load is such that 8 amperes charging current from rectifier (130VG1) again raises battery voltage to the high point of the (VR2) relay, the (H3) relay will return rectifier (130VG1) to regulation and release relay (A) cutting rectifier (130VG2) off. As in the case with only one rectifier, no alarm will be given when the (VR2) relay makes its high contact due to the time delay provided.

Where the load or charging current required is such that more than two rectifiers are furnished, the first rectifier will carry the charging load up to 9 amperes at which point it will transfer to current control at 8 amperes and will cause relay (A) to cut in rectifier (130VG2) as described above. If (130VG2) output goes high enough to operate its transfer (TR) relay, its output becomes constant at 8 amperes and relay (A) in 2nd Fig. 7 for the next rectifier is operated to cut in rectifier (130VG3). Relay (A) locks up to ground on relay (H3). If (130VG2) goes to current control, its output remains constant at 8 amperes until (H3) relay operates from high voltage and removes lock up from (TR) relay in rectifier. The (TR) relay operated causes relay (M) to operate, and being slow release this relay holds ground on the (A) relay as well as on the (TR) relay in rectifier (130VG2) while the (TR) relay in (130VG3) is releasing to return (130VG3) to regulation. The (A) relay then releases but rectifiers (130VG1) and (130VG2) remain at constant current under control of (M) and (A) relays in 1st Fig. 7. If under this condition, the load is such that 16 amperes raise the voltage to the high point again, the (H3) relay will release relay (A) cutting off (130VG3) and relay (TR) in (130VG2) returning (130VG2) to voltage regulation. If the load is such that 8 amperes from (130VG1) is sufficient to raise the battery again to the high point, the (H3) relay will remove ground from (TR) relay in (130VG1) and (A) relay, returning (130VG1) to voltage regulation and cutting off (130VG2).

In like manner where more than 3 rectifiers are furnished, each rectifier will be cut in whenever the preceding rectifier overloads and goes to constant current. When six or more rectifiers are furnished, relay (H4), Fig. 5B operates in parallel with relay (H3) to provide additional contacts. Upon charging the battery to the high point, the last rectifier will be cut off, then the preceding and so on until only those needed to float the load are left.

In the event of failure of a rectifier, an alarm will be given either as a rectifier alarm or low voltage alarm. If the rectifier which is operating under voltage regulation should fail, a low voltage alarm will be given when the battery discharges to the point where (VR2) operates its low contact. If only one rectifier is furnished, the low voltage alarm will be the only one given. If more than one rectifier is furnished, ground over leads F from the (L2) relay will be supplied to the (A) relays of all figures 7 to cut in all rectifiers to replace the rectifier that failed and give a rectifier alarm indicating the failure. When six or more rectifiers are furnished, lead "F5", instead of being connected to Fig. 7 of the fifth rectifier, is used to operate relay (L3) of Fig. 5D to provide F leads for rectifiers 5, 6, 7 and 8. When the rectifier which failed is again placed in service it may be necessary to force it to current regulation by turning off higher numbered rectifiers and restoring them to service in sequence to insure that only the last one required is on voltage regulation. Failure of the last rectifier furnished will be indicated only by a low voltage alarm. Both rectifier and low voltage alarms are shown on the discharge circuit.

A menas is provided for giving the 66 cell battery a continuous overcharge by operating the (CHG-NOR) key to hold relay (OC) operated. This changes the range of relay (VR2) to the higher value, and opens shorts on overcharge regulating rheostats in the first seven rectifiers by opening connections between leads J and +RC to rectifiers. On opening these connections and attempting to instantly raise voltage to charge value, the first seven rectifiers will be successively cut in at constant current and will charge under current control until the (VR2) relay makes contact at 152.2 volts to return to voltage control at the over charge value. This value will be determined by the setting of the overcharge rheostats in the first seven rectifiers. This setting should be well below the low tolerance of the 152.2 volt contact of the (VR2) volt contact of the (VR2) relay, say 150 volts. When it is desired to stop the charge, the (CHG-NOR) key should be returned to NOR which automatically returns the rectifiers to their normal regulated values and (VR2) to its normal range. Transfer from the float to the overcharge range or from overcharge to float may cause a momentary voltage alarm.

The 70 cell battery may be overcharged in the same manner except that its overcharge voltage is set by the overcharge rheostats in the rectifiers should not exceed 154 volts. The (VR2) relay used with the 70 cell battery, is connected as a single range unit and the over charge value must be within its normal range.

5.3 Operation With Auxiliary Charging Circuit per SD-81016-01

Operation of the 410A plant with motor generator auxiliary charging is limited to those plants with less than 5 rectifiers provided.

The operation of this circuit with the auxiliary charging circuit is covered in CD-81016-01.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 5740-WJM-JMD-ZI