POWER SYSTEMS
100 TYPE PLANTS
CHARGE AND DISCHARGE CIRCUIT
10, 20, & 30 AMPERES - 48 VOLTS
105D PLANTS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Note 216 added to limit the number of switchboard positions to 10 on a single fuse.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 5232-CPK-JMD-GC

POWER SYSTEMS
100-TYPE PLANTS
CHARGE AND DISCHARGE CIRCUIT
10, 20 AND 30 AMPERES - 48 VOLTS
105 D PLANT

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 To add control lead to inverter start circuit from (48V G1) rectifier which serves to turn on inverter which is used in dc power service areas, during no-call periods to maintain battery voltage above low alarm limit.

A.2 To add connection between (CONT 1) fuse and terminal 12 of (TS1) terminal strip for control equipment in supplementary bay.

A.3 To change Figure 22 to provide single (TRP) lead and to add (AUX) lead for 20 code ringing.

D. DESCRIPTION OF CIRCUIT CHANGES

D.01 In Note 102, reference to "J" option added.

D.02 Note 117 added.

D.03 In Note 207, reference to "G" lead added.

D.04 "Q" option added in Note 105.

D.05 In Figure 2, connection from (CONT 1) fuse to terminal 12 of (TS1) terminal strip added.

D.06 In Figure 2, (MS) control lead added to inverter start circuit from (48V G1) rectifier.

D.07 In Figure 22, reference to 356A dial offices removed.

D.08 In Figure 22, "TRP2" lead changed to "AUX" lead.

D.09 In Figure 22, "TRP" lead to ringing circuit was "TRP1".

D.10 In Table A, fuse designations "TRP" and "AUX" for Figure 22 were previously shown as "TRP1" and "TRP2".

D.11 In Figure 2 office ground formerly not shown was fixed as No. 8.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 5740-MTA-JMD-LY

POWER SYSTEMS
100 TYPE PLANTS
CHARGE & DISCHARGE CIRCUIT
10, 20 & 30 AMPERES - 48 VOLTS
105D PLANT

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 To add Fig. 22 to cover a 355A dial office for use with 806F ringing plant and also cover the 355A or 356A dial office with 806E ringing plant.

A.2 To change leads to battery cut-off circuit in Fig. 15 from No. 6 to No. 14 gauge to agree with leads formerly furnished with 105C plants.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Figure 22 and Note 215 added.

D.2 In Table A, Fig. 22 was added.

D.3 In Fig. 12, reference to J86212T Ring Equipment was added.

D.4 Reference to Fig. 22 added in Notes 107 and 115.

D.5 In Fig. 15, leads to battery cut-off circuit were No. 6 gauge.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 5740-SDV-JMD-P1

POWER SYSTEMS
100 TYPE PLANTS
CHARGE & DISCHARGE CIRCUIT
10, 20 & 30 AMPERES - 48 VOLTS
105D PLANT

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 To add rectifier cutoff feature for rectifiers (48VG1), (48VG2) and (48VG3).

A.2 To provide separate fusing ("G" option) for battery cutoff in fig. 14.

A.3 To specify 30 ampere discharge fuses for figs. 12 to 17.

A.4 To remove "B" and "G" leads associated with battery cutoff circuit not a part of this plant.

B. CHANGES IN APPARATUS

B.1 Apparatus per figs. 1A and 1B rated "Mfr. Disc."

B.2 Apparatus per figs. 1E and 1F added.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 In table A, "K" and "L" options and 30 amp. fuse added at fuse no. 2 for figs. 12 to 17, "H" option added for fuse no. 3 for fig. 14.

D.2 Note 116 added.

D.3 At figs. 1A and 1B, "Mfr. Disc." rating added.

D.4 At figs. 1C and 1D, "A" and "B" options added.

D.5 Figs. 1E and 1F added.

D.6 In figs. 18 and 20, "A" and "B" options added at junction box.

D.7 In fig. 14, "G" and "H" options added.

D.8 In figs. 14, 15 and 16, "B" and "G" leads associated with battery cutoff which are not a part of this plant were removed.

D.9 In fig. 14, "B" and "G" leads ("X" option) are specified to battery cutoff circuit for 701A PBX with 605 manual section only.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 To provide charge and discharge circuit for 10, 20 and 30 ampere 48 volt power plant to supply battery to No. 12 switchboards, 605A Manual PBXs, 701A, 711A and 740 dial PBXs, 355A and 356A community dial offices.

2. WORKING LIMITS

2.1 The working limits of the circuit are:

44-52 for 355A and 356A Community Dial Offices.
44-52 for 701A, 711A and 740 Dial PBXs.
42-52 for 605A PBX.
42-56 for No. 12 Switchboard.
44-52 for Bl Alm. and Control System.

3. FUNCTIONS

3.1 To maintain the battery voltage within the above limits.

4. CONNECTING CIRCUITS

4.1 Rectifier circuits
Alarm circuits
Ringing circuits

5. DESCRIPTION OF OPERATION

5.1 Figs. 1A, 1B, 1C and 1D cover a-c service connections to rectifier (48VG1) and different arrangements of ringing and calculagraph equipment as required. (RECT CUTOFF) switches in figs. 1A to 1D and figs 18 and 20 provided for manually disconnecting rectifiers (48VG1), (48VG2) and (48VG3) for maintenance purposes. Fig. 2 shows the external connections to rectifier (48VG1) for connection to the battery, loads and supplemental charging units which are covered by other figures on this circuit. Rectifier (48VG1) described in detail by CD-81138-01 is a regulated electron tube type rectifier rated 10 amperes intermittent and 8 amperes continuous. It charges and floats battery (48VA) in Fig. 3 over charge leads A and B as well as supplemental batteries per Fig. 4 when furnished for additional battery reserve. It also includes discharge fuses supplied for battery in Fig. 3 over separate discharge lead C. These fuses

distribute battery to various load applications per Figs. 10-17 which together with their associated notes are for the most part self-explanatory. In Figs. 10, 11,14,15,16 and 17 lead G to ringing equipment is connected to charging side of battery ground instead of office ground for noise reasons. Table A shows detail fusing, designations and connecting information for Figs. 10-17 inclusive. Rectifier (48VG1) also provides control for cutting a counter EMF cell (48V CEMF A) shown in Fig. 3 into the discharge circuit to reduce the load voltage or to permit raising the battery voltage for overcharging. As described in CD-81138-01 this is accomplished in two ways.

(1) By use of switch (TST) in the rectifier which changes the rectifier's regulated point from the load side to the battery side of the CEMF cell and inserts the CEMF cell in the discharge circuit to reduce the load voltage by about two volts below that of the battery for low voltage check of switchboard relay adjustments.

(2) By use of overcharge control which holds the load regulated at normal voltage but raises the battery voltage by inserting the CEMF cell in the discharge circuit so that the battery voltage will be about 2 volts above the regulated load voltage.

5.2 When supplemental rectifiers are furnished for additional plant capacity, Fig. 18 covers rectifier (48VG2) and Fig. 20 covers (48VG3). Fig. 5 covers a supplementary battery string for use with (48VG2) and this battery string is paralleled with the initial battery but is connected directly to (48VG2) for charging over separate leads AD and AE. A supplementary CEMF cell (48V CEMF B) is shown in Fig. 6 for paralleling with (48V CEMF A) when the increased load makes this desirable. Additional load fusing, shown in Fig. 18 supplied over lead F from Fig. 3, provides overflow fusing where fuses in Fig. 2 are insufficient. These fuses are furnished as required for their particular applications. Failure of these fuses is alarmed over lead FA tying in with the discharge fuse alarm covered on the rectifier circuit and connecting to the office alarm circuit through the various load figures. Rectifier (48VG2) is brought in on an automatic basis in two ways.

(1) Full load on rectifier (48VG1). This causes relay (ST1) in Fig. 18 to operate from potential across ballast lamp in rectifier (48VG1). Rheostat (ST1 ADJ) in series with (ST1) relay winding leads (ST1) and (ST2) to the ballast lamp, will be adjusted to cause relay (ST1) to operate when rectifier output is approximately 8 amperes. Relay (ST1) operated, connects ground to relay (ST2) operating (ST2) which in turn causes relay (ST3) to operate and bring in rectifier (48VG2). Relay (ST2) operated, opens relay (ST1) winding circuit, releasing (ST1) but relay (ST2) remains operated, locked to ground on its 1T and 2T contacts. Relay (ST2 operated also inserts resistance (R1) in the regulating circuit of rectifier (48VG1) causing that unit to operate at maximum output. This means that (48VG1) will operate at full output current until the battery is raised above 52.5 volts and relay (ST2) is released. Rectifier (48VG2) after its warm up delay assists rectifier (48VG1) in charging the battery and returns the battery to normal float voltage of 51.6 volts if the load and charging requirement is within its capabilities. If the load is excessive, then the battery will help supply the excess over and above the sum of the two rectifier outputs and the voltage will drop accordingly. When the load decreases the battery will again be charged. When the load decreases to the point where rectifier (48VG1) raises the battery voltage to 52.5 volts with rectifier (48VG2) at zero output, then rectifier (48VG2) is cutoff and (48VG1) is returned to float regulation at 51.6 volts. This is accomplished by the voltage relay (VR) in rectifier (48VG1) making its high contact at 52.5 volts and connecting low voltage battery over lead (HV) from Fig. 2 to operate relay (H) in Fig. 18. Relay (H) operated, removes battery from relay (ST2) releasing it and thereby cutting resistance (R1) out of (48VG1) regulating circuit returning it to normal over lead REG 1, 1B and 3B of (ST2), cutting off (48VG2) by releasing relay (ST3) and opening rectifier a-c input. Upon return of float voltage, the voltage relay in (48VG1) releases, in turn releasing relay (H) returning the circuit to normal with (48VG1) carrying the load again.

(2) Low battery voltage whether due to rectifier (48VG1) failure or other reasons also cuts in rectifier (48VG2) by connecting ground from relay (L) in rectifier (48VG1), which operates when the voltage relay therein makes its low contact, over lead ST3 to operate relay (ST2). Relay ST2 operated, brings (48VG2) in as described above and high voltage cuts it off again in the same manner.

5.3 Rectifier (48VG3) when furnished is cut in by overload on (48VG2) or by low battery voltage in much the same way as (48VG2) was cut in as already described. Low battery voltage operates the low contact of the voltage relay and relay (L) in rectifier (48VG1) and connects ground over leads (ST3) and (ST4) to operate relay (ST5) in Fig. 20 and relay (ST2) in Fig. 18 and

cuts in both supplemental rectifiers (48VG2) and (48VG3). Relay (ST5) operated, converts rectifier (48VG2) to full output in the same way that relay (ST2) converts rectifier (48VG1) to full output as already described. Rectifier (48VG3) regulates the battery as long as the load requirement is within its output range. When the outputs of (48VG1) and (48VG2) exceed the load with (48VG3) at zero output, the battery voltage is raised to 52.5 volts and relay (H) in Fig. 18 is operated. Operated relay (H) removes battery from over lead (ST5) to release relay (ST5). Relay (H) also removes its battery from relay (ST2) but relay (HO) in Fig. 20 which is a slow release relay holds battery on relay (ST2) to keep it operated while rectifier (48VG3) is being cutoff and rectifier (49VG2) is being returned to normal float voltage through removal of resistance (R2) from its regulating circuit. Relay (HO) should hold until the battery voltage drops sufficiently to release relay (H) which again places its battery on relay (ST2) to keep it and rectifier (48VG2) operating. Relay (HO) then releases and returns Fig. 18 to the condition shown. Relay (ST5) in operating, releases relay (ST4) and it will be noted that relay (ST4) cannot again be operated until relay (HO) is released. This provision assures time for rectifier (48VG2) to return to float after release of relay (ST5) permitting ballast lamp drop in (48VG2) to be reduced so that when relay (HO) does release and close the winding circuit of relay (ST4) should not operate. Without this feature, rectifier (48VG3) might hunt in and out. Rectifier (48VG2) will now carry the float until the load is decreased to the point where it too is cutoff. Rectifiers (48VG2) and (48VG3) are both regulated electron tube type rectifiers similar in operating characteristics to (48VG1) but covered by SD-80606-02 and described by CD-80606-02.

5.4 Rectifiers (48VG2) and (48VG3) are normally cut in and out automatically but either may be held in continuous operation by manually operating switch (48VG2 MAN - NOR - 48VG3 MAN)
AUTO
to the position desired. The chief purpose of this manual switch is for adjusting rectifier outputs as described below under part 6.

5.5 Alarms are given for fuse failure and high-low battery voltage. In most applications, these alarms are combined and battery through a 500 ohm resistance is sent over leads FA to the office alarm circuits as shown in the load figures 11 to 17. Separate fuse and voltage alarms may be used and in this case fuse alarms are sent as battery through 500 ohms over alarm leads FA and voltage alarms over leads HLV1 where no delay is desired or HLV2 where delay is desired. Rectifier (48VG1) covers these alarm connections when no supplemental rectifiers are furnished. When Fig. 18 is furnished option "Y" sends battery, with relay (H) operated, through 500 ohms over lead HLV1 to Fig. 2 where it straps to lead FA and to the office alarm circuit for a combined fuse and voltage alarm. With relay (H) operated battery is also sent over lead E to light lamp (ALM) in rectifier (48VG1). A blown fuse will also light this lamp through back contacts of relay (L) in rectifier (48VG1) in series with lead J and back contacts of relay (H) when relay (H) is released over lead E to said lamp in (48VG1). When separate fuse and voltage alarms are required, option "T" in Fig. 18 sends ground over lead HLV1 to office alarm circuits when relay (H) operates and no delay is furnished for this alarm or option "Y" sends battery through 500 ohms when the alarm circuit requires a battery signal over lead "HLV1" for this alarm. When a delay is furnished "T" option also sends ground over lead HLV1 to the delay circuit in (48VG1) which in turn sends alarm out over lead HLV2. With separate voltage and fuse alarms, series circuit arrangement of battery over leads E and J to Fig. 18 permits common use of lamp (ALM) in (48VG1) for both voltage and fuse indication without interconnecting the failure signal. That is, operation of either relay (L) in the rectifier or (H) in Fig. 18 cuts off the fuse alarm circuit from lamp (ALM) but lights this lamp to indicate voltage alarms and failure of a fuse lights this lamp with both of these relays released. A blown fuse in Fig. 18, will in addition to lighting the (ALM) lamp in (48VG1) rectifier, also light the (FA) lamp in Fig. 18.

6. ADJUSTMENTS

6.1 Rectifier (48VG1) when used without supplemental rectifiers is adjusted in accordance with CD-81138-01.

6.2 When supplemental (48VG2) rectifier is furnished.

(1) Adjust (48VG1) to regulate at normal float of 51.6 volts by means of its (ADJ VOLTS) rheostat. Adjustment should be made with rectifier output between 4 and 7 amperes depending on the line voltage as covered in CD-81138-01. If load at time of adjustment requires greater current, use supplemental rectifier (48VG2) to help carry the load by operating switch (NOR AUTO) to (48VG2 MAN) position and then blocking relay (ST2) non-operated. Raise output of (48VG1) with (ADJ VOLTS) rheostat to 8 amperes and hold at this value while adjusting rheostat (ST1 ADJ) so that

relay (ST1) just operates on the 8 ampere drop on the ballast lamp in (48VG1). If load requires (48VG2) during this adjustment, it can be used to hold (48VG1) at 8 amperes output by adjusting rheostat (R) in (48VG2) to keep 8 amperes output on (48VG1). If load is too light to use (48VG2), reduce output of (48VG1) by means of (ADJ VOLTS) rheostat until a charge of 8 amperes is required to bring the battery back to float. By successive cut and try effort, relay (ST1) can be made to operate at the 8 ampere output. After adjustment is made, return (48VG1) to regulated float voltage, remove block from relay (ST2) and cutoff (48VG2) if manually held operated by returning (NOR AUTO) switch to (NOR AUTO) position.

(2) Adjust (48VG2) to regulate the battery at 51.6 volts with its output in the range of 4 to 7 amperes as covered in CD-81138-01. If load is too small, with (48VG1) operating, to need (48VG2) for floating, block relay (ST2) non-operated and close (NOR AUTO) switch in (48VG2 MAN)position. With two rectifiers regulating in parallel, adjust (R) rheostat in (48VG2) to same output as (48VG1) with the battery at normal float voltage and rectifier outputs between 4 and 7 amperes as covered in CD-81138-01. Reduce output of (48VG1) if necessary to balance charge load and hold voltage at float value. After adjustment, return circuit to normal.

6.3 When rectifier (48VG3) is furnished.

(1) Adjust (48VG1) and (48VG2) rectifiers as covered under 6.2 above.

(2) Block relay (ST5) non-operated. Adjust output of (48VG2) by means of (R) rheostat to 8 amperes and adjust rheostat (ST4 ADJ) in Fig. 20 to just operate relay (ST4) at (8) amperes drop on ballast lamp (U3) in (48VG2). If load is too small to obtain 8 amperes without raising battery voltage to the upper voltage limit, reduce output of (48VG2) with (R) rheostat to allow battery to discharge enough to require 8 amperes output when battery voltage is again brought up to float or remove (48VG1) charge fuse and use rheostat (R) to obtain 8 ampere output and relay (ST4) adjustment. After making adjustment, return (48VG2) to float adjustment and then return circuit to normal removing block from (ST5) relay.

(3) Adjust (48VG3) rectifier to float the battery at 51.6 volts. If in operation, this adjustment should be made by means of rheostat (R) in (48VG3) when its output is between 4 and 7 amperes as covered in CD-81138-01. If not operating, it may be cut in manually by throwing (NOR AUTO) switch to (48VG3) MAN) position. In this case, rectifier (48VG3) will be regulating in parallel with the rectifier previously doing the regulating. Adjust rheostat (R) of (48VG3) to split the load equally with the paralleling rectifier with the outputs of both rectifiers between 4 and 7 amperes at time of final adjustment. Return switch (NOR AUTO) to (NOR AUTO) position.

6.4 In the above adjustments, suggested means of setting the rectifier regulated values under low power service voltage or heavy office load conditions, may result in too high a float voltage at high power service voltage and light office load conditions. It is expected field experience will permit maintenance forces to make allowance for these factors so that the average float for a particular office will be close to 51.6 volts with lower float values under heavy load and higher float (not over 52 volts) under light load periods.

BELL TELEPHONE LABORATORIES, INC.

DEPT.5740-SDV-JMD-P1