

TOLL SYSTEMS
DISTRIBUTION FUSE, INDIVIDUAL
AUDIBLE AND VISUAL
ALARM CIRCUIT
FOR USE WITH TD RADIO SYSTEMS

CHANGES

B. CHANGES IN APPARATUS

B.1 Superseded Superseded By
Haydon Co. (Fig. Haydon Co. (Fig.
Timer 34 Timer 34
No. 6429 No. C6448

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

- C.1 The "Block and Insulate" column for the (DA) relay formerly read: 5T (DAL).
- C.2 The "Block and Insulate" column for the (T2) relay formerly read: (T) O.
- C.3 Note 1 (Page 3) for the (L4) and the (L5) relay formerly read: Provide dry cells in series with office battery if required to obtain current of 90MA to test secondary winding on operate.
- C.4 The operate test for the secondary windings of the (L4) and (L5) relay was removed as this test requires extra battery voltage and is not necessary.
- C.5 "3T" was removed from the Block or Insulate column for the (L5) relay as this information was not necessary.

D. DESCRIPTION OF CIRCUIT CHANGES

- D.01 The Haydon Co. Timer No. 6429 (Fig. 34) is rated Mfr. Disc. and replaced by the Haydon Co. Timer No. C6448 (Fig. 34).
- D.02 Options V and T were added to Notes 102, 107 and the Options Used Table.
- D.03 Changes were made in Figures 65, 69 and 83 and Note 101 to permit fusing with one fuse all Figures 32 associated with a pair of F.M. terminal bays. Formerly a maximum of 21 Figures 32 were fused with one fuse.
- D.04 Figure 84 was added as a cross-connection figure for Wire Line Entrance Link Fuse Alarms.

- D.05 Cross-connecting information was added to Figures 51, 57, 58, 61, 66 and 67 with reference to Figure 84.
- D.06 Reference to the alarm sending bay was removed from Figures 57 and 58.
- D.07 Notes 204 and 205 were added.
- D.08 The connecting information for the "B" lead in Figure 8 formerly read: "To Fig. 7 C18 Fig. 31 F17 or to Auto. Sw. Alm. Ckt." and in Figure 31 it read: "To Fig. 7, C18 or to Auto. Sw. Alm. Ckt."
- D.09 The multiple information for the "L" lead in Fig. 7 formerly read: To other Fig. 7 on other Fl.
- D.10 The multiple information for the "B" lead in Fig. 7 formerly read: To other Fig. 7.
- D.11 The multiple information for the "LS" lead in Fig. 16 formerly read: To other Fig. 16 on Other Floor.
- D.12 Connecting information shown on cross-connection Figures 57 and 72 was changed in accordance with changes on Figures 7 and 16 respectively.
- D.13 Prior to this issue the multiple information for the "L" lead in Figure 36 was not shown.
- D.14 The connecting information for the "L" lead in Figure 41 formerly read: To Fig. 7, C18.
- D.15 The "L" lead in Fig. 80 was removed. This change and changes in Figures 36 and 41 were made to bring this drawing in agreement with Western Electric drawings.
- D.16 The title of the connecting circuit SD-56362-01 was changed, it formerly read: "Automatic Switching System Alarm Circuit".

4. CONNECTING CIRCUITS

When this circuit is listed on a key-sheet, the connecting information thereon is to be followed.

- | | | | |
|------|---|------|--|
| 4.01 | Indication Sending Circuit -
SD-56189-01. | 4.12 | Air Navigation Obstruction Lighting
Circuit - SD-81113-01. |
| 4.02 | Station Alarm Sending Circuit -
SD-56193-01. | 4.13 | Air Navigation Obstruction Lighting
Circuit - SD-81114-01. |
| 4.03 | Order Wire Circuit, Auxiliary
Station - SD-56227-01. | 4.14 | Audible Alarm and Pilot Lamp Ckt. -
SD-90614-01. |
| 4.04 | Order Wire Circuit, Main Station -
SD-56228-01. | 4.15 | Audible and Visual Alarm Ckt. -
SD-95063-01, SD-96188-01. |
| 4.05 | 130V Charge and Discharge Circuit -
SD-81084-01. | 4.16 | Tube Cooling Blower Circuit -
SD-59444-01. |
| 4.06 | 250V Charge and Discharge Circuit -
SD-81085-01. | 4.17 | TD-2 Radio - Application Schematic
for Transmitter - Receiver Bay -
SD-59403-01. |
| 4.07 | 12V Charge and Discharge Circuit -
SD-81086-01. | 4.18 | TD-2 Radio - Transmitter Control
Ckt. - SD-59400-01. |
| 4.08 | 24V Charge and Discharge Circuit -
SD-81091-01. | 4.19 | Dynamic Air Supply Circuit -
SD-59493-01. |
| 4.09 | Power Service Circuit - SD-81095-01. | 4.20 | Alarm Circuit for Automatic or
Program Switching - SD-56362-01. |
| 4.10 | Power Service Circuit - SD-81140-01. | 4.21 | Distribution Fuse, Common Aisle and
Miscellaneous Individual Alarm Ckt. -
SD-95072-01. |
| 4.11 | Alarm Circuit - AC low voltage and
engine failures alarms - SD-81100-01. | | All other headings no change. |

BELL TELEPHONE LABORATORIES, INC.

DEPT. 2325-AJC-FSE-GC

TOLL SYSTEMS
DISTRIBUTION FUSE, INDIVIDUAL
AUDIBLE AND VISUAL
ALARM CIRCUIT
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CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Cross connection Figs. 81, 82 & 83 were added.
- D.2 Cross connection information was added to Figs. 53, 54, 55, 57, 58, 65 & 69.
- D.3 In Figs. 1, 12 & 13 reference was made to cross conn. Fig. 83.
- D.4 In Figs. 18, 19 & 33 reference was made to cross conn. Fig. 82.
- D.5 In Fig. 18 reference was made to cross conn. Fig. 81.
- D.6 In Fig. 55 connecting information was shown to the "Auto Sw. Alm. Ckt." through the ACO lead.
- D.7 In Fig. 70 reference to the "Auto Sw. Alm. Ckt." as a connecting circuit to the ACO lead was removed.
- D.8 Circuit Note 105 formerly provided for 7 Figs. 18 per Fig. 19.
- D.9 In Fig. 33 the HC6, AC7 & HC8 lead formerly read, "To 6th or 14th Fig. 18", "To 7th or 15th Fig. 18" and "To 8th or 16th Fig. 18" respectively.
- D.10 In Fig. 19 the SB lead formerly read "To last 3 Assoc. Figs. 18".
- D.11 ED-63833-01 & J68342E-90 were added to "Equipment Information".
- All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3320-GD-FSE-B3

TOLL SYSTEMS
DISTRIBUTION FUSE, INDIVIDUAL
AUDIBLE AND VISUAL
ALARM CIRCUIT
FOR USE WITH TD RADIO SYSTEMS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The connecting circuit information for the following leads and figures was changed to provide for connection to the Automatic Switching System Alarm Ckt.:

Lead (ACO) of Fig. 2,
Leads (F), (DF) and (B) of Fig. 8,
Lead (A) or (D) of Fig. 17,
and Lead (B) of Fig. 31

This provides for using the Alarm Cutoff key, the audible alarm and its cutoff, the individual alarm lamp cutoff and the floor pilot lamps of this circuit in common with the Automatic Switching System Alarm Ckt.

D.2 Circuit Note 103 was changed in connection with use of lead (B) of Fig. 8 for the Automatic Switching System Alarm Ckt. Prior to Issue 10-D this note was as follows: "Not more than 21, A1 lamp shall be connected to contacts 4T, 6T or 8T of relay (LAL). When more than 63 lamps are required provide Fig. 31."

D.3 In Fig. 34 the (K) lead from Fig. 41 is connected in multiple with the (K) lead from Fig. 35 instead of the (K) lead from Fig. 2. This is to correct an error and to make this dwg. conform to the W. E. Co. (T) dwg.

D.4 Test Note No. 1 on the Circuits Requirements Table Pg. 2 for relay (FA4) was changed to omit the word "grams." Prior to Issue 10-D this note read, "Front contacts make readjust 6 gram test 4 grams."

All other headings, no change.

4. CONNECTING CIRCUITS

- 4.01 Indication Sending Circuit - SD-56189-01.
- 4.02 Station Alarm Sending Circuit - SD-56193-01.
- 4.03 Order Wire Circuit, Auxiliary Station - SD-56227-01.

- 4.04 Order Wire Circuit, Main Station - SD-56228-01.
- 4.05 130V Charge and Discharge Circuit - SD-81084-01.
- 4.06 250V Charge and Discharge Circuit - SD-81085-01.
- 4.07 12V Charge and Discharge Circuit - SD-81086-01.
- 4.08 24V Charge and Discharge Circuit - SD-81091-01.
- 4.09 Power Service Circuit - SD-81095-01.
- 4.10 Power Service Circuit - SD-81140-01.
- 4.11 Alarm Circuit - AC low voltage and engine failure alarms - SD-81100-01.
- 4.12 Air Navigation Obstruction Lighting Circuit - SD-81113-01.
- 4.13 Air Navigation Obstruction Lighting Circuit - SD-81114-01.
- 4.14 Audible Alarm and Pilot Lamp Ckt. SD-90614-01.
- 4.15 Audible and Visual Alarm Ckt. - SD-95063-01, SD-96188-01.
- 4.16 Tube Cooling Blower Circuit - SD-59444-01.
- 4.17 TD-2 Radio - Application Schematic for Transmitter - Receiver Bay - SD-59403-01.
- 4.18 TD-2 Radio - Transmitter Control Ckt. - SD-59400-01.
- 4.19 Dynamic Air Supply Circuit - SD-59493-01.
- 4.20 Automatic Switching System Alarm Circuit - SD-56362-01.
- 4.21 Distribution Fuse, Common Aisle and Miscellaneous Individual Alarm Ckt. - SD-95072-01.

TOLL SYSTEMS
DISTRIBUTION FUSE, INDIVIDUAL
AUDIBLE AND VISUAL
ALARM CIRCUIT
FOR USE WITH TD RADIO SYSTEMS

CHANGES

A. CHANGED OR ADDED FUNCTIONS

- A.1 Provides means for energizing the "other floor" pilot in the central office alarm circuit when radio station alarms are transferred to that circuit.
- A.2 Provides means for giving a major alarm when the tower lighting flasher beacon stops in the "on" position.

B. CHANGES IN APPARATUS

- B.1 Added
 - 2 U150 Relays Fig. 40.
 - 1 U650 Relay Fig. 41.

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Figure 40 added to provide for energizing "other floor" pilot in the central office alarm system.
- D.2 Fig. 41 was added to provide an alarm when flasher mechanism stops in the "on" position and beacon remains on constantly.
- D.3 Fig 8 was modified to show connections to Fig. 40.
- D.4 The title of Figure 36 has been changed to "Flasher Failure Ckt. With Lamp Off".
- D.5 Fig. 34 was modified to show connections to Fig. 41.
- D.6 Under circuit note 102 audible alarm and flasher failure alarm circuit options were added.
- D.7 In circuit note 101 Fig. 41 was added to "U" fuse.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

- 1.1 This circuit provides fuse alarms, individual alarms, local audible and visual alarms and control circuits for use in unattended or attended stations of TD radio relay systems.

- 1.2 Indications of alarm conditions in an unattended or partially attended station are transmitted to the Alarm Center by means of the C1 Alarm and Control System.

2. WORKING LIMITS

- 2.1 None.

3. FUNCTIONS

- 3.01 Provides individual visual signals which denote the types and locations of the alarm conditions.
- 3.02 Provides time delays, when required, to block the receipt of unwanted alarms.
- 3.03 Provides visual floor pilots which indicate on which floor the alarm originates.
- 3.04 Provides an audible alarm which is energized whenever an individual alarm condition arises or a fuse operates.
- 3.05 Provides means for silencing the audible alarm if the trouble in the connecting circuit cannot be corrected immediately.
- 3.06 Provides means for disabling the audible and visual alarms when the station is unattended.
- 3.07 Causes an indication of a trouble condition in an unattended station to be transmitted to the Alarm Center.
- 3.08 Provides means for releasing a locked-in channel alarm under control of the Indication Sending circuit.
- 3.09 Provides means for transferring major and minor alarms to the central office alarm circuit on another floor.
- 3.10 Provides a multiple lamp relay to allow for additional multiple appearances of individual alarm lamps when required.
- 3.11 Provides means to disable the 12-volt circuit breaker alarm

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until the trouble condition is corrected.

3.12 Provides a guard lamp to indicate when the 12-volt circuit breaker alarm is disabled.

3.13 Provides means for releasing a locked-in channel alarm by means of a momentary operation of a key.

3.14 Provides means for energizing d-c operated tube cooling equipment upon the failure of the a-c operated equipment.

3.15 Provides means for testing alarm circuits by operation of switches simulating alarm conditions.

3.16 Provides means for releasing the d-c operated blower motor by manual operation of a switch.

3.17 Provides means for energizing the "other floor" pilot in the central office alarm circuit when radio station alarms are transferred to that circuit.

3.18 Provides means for giving a major alarm when the tower fighting flasher beacon stops in the "on" position.

4. CONNECTING CIRCUITS

When this circuit is listed on a key sheet, the connecting information thereon is to be followed.

- 4.01 SD-56189-01 Indication Sending Circuit.
- 4.02 SD-56193-01 Station Alarm Sending Circuit.
- 4.03 SD-56227-01 Order Wire Circuit, Auxiliary Station.
- 4.04 SD-56228-01 Order Wire Circuit, Main Station.
- 4.05 SD-81084-01 130V Charge and Discharge Circuit.
- 4.06 SD-81085-01 250V Charge and Discharge Circuit.
- 4.07 SD-81086-01 12V Charge and Discharge Circuit.
- 4.08 SD-81091-01 24V Charge and Discharge Circuit.
- 4.09 SD-81095-01 Power Service Circuit.
- 4.10 SD-81140-01 Power Service Circuit.

4.11 SD-81100-01 Alarm Circuit - AC low voltage and engine failure alarms.

4.12 SD-91113-01) Air Navigation Obstruction Lighting
4.13 SD-81114-01) Circuit.

4.14 SD-90614-01 Audible Alarm and Pilot Lamp Circuit.

4.15 SD-95063-01, SD-96188-01 Audible and Visual Alarm Circuit.

4.16 SD-59444-01 Tube Cooling Blower Circuit.

4.17 SD-59403-01 TD-2 Radio - Application Schematic for Transmitter - Receiver Bay.

4.18 SD-59400-01 TD-2 Radio - Transmitter Control Circuit.

4.19 Dynamic Air Supply Circuit - SD-59493-01.

DESCRIPTION OF OPERATION

5. GENERAL

5.1 This circuit provides the facilities required to bring in distinctive alarms at TD radio stations and to control the alarm indications transmitted to the alarm center by the associated CI Alarm and Control system. The following general features are provided:

- (a) a major or minor audible signal (or, if desired, a common one) will be operated in the station whenever an alarm condition arises.
- (b) floor pilot lamps will be lighted to indicate the floor of the station on which the alarm is located.
- (c) individual alarm lamps will be lighted to indicate the specific source of each trouble.
- (d) leads to the Station Alarm Sending Circuit of the CI Alarm and Control System will be grounded as required to transmit the alarms to the alarm center with which the station is associated.

5.2 At times when the station is unattended, the audible signals and the individual alarm lamps may be cut off completely by operating a master switch at the door of the stations. When an attendant is present, he may silence the audible signals after each

alarm, but they will come in again whenever a new one appears. In the latter case, the floor pilots are also extinguished and reoperated, but the individual alarm lamps and the indications to the alarm center cannot be retired except by removing the cause of the alarm.

6. STATION AUDIBLE AND VISUAL SIGNALS - FIGS. 2,7,8,9,14,15,16,17,24,25,31 38 & 40

6.1 Fig. 7 covers the lamps which are used to indicate all of the individual alarm conditions except those associated with the ABS (alarm battery supply) power supplies. The ABS alarms are indicated by lamps per Fig. 16.

6.2 Fig. 8 and ALM switch per Fig. 14 provide a master control system whereby the audible signals and the individual alarm lamps (Fig. 7) may be cut off during periods while the station is unattended. The switch is located at the door of the station, where it can be readily operated by the attendant when he enters and leaves. With the switch in its "on" position, relay (LAL) is operated and battery is connected to the various alarm lamp circuits over the "B" leads. If more than 21 lamps are required on a particular lead, relay (MR) per Fig. 31 can be added to obtain more leads. The "DF" lead in Fig. 8 multiples to all of the alarm circuits which require a major alarm, and when ground appears on this lead relay (LA) operates and, in turn, operates the major alarm bells per Fig. 9. The "F" lead in Fig. 8 multiples to all of the alarm circuits which require a minor alarm, and, if option "Z" is provided, ground appearing on the "F" lead operates the buzzer per Fig. 24. In case distinctive signals are not required, option "Y" is used and ground on the "F" lead operates relay (LA) to bring in the bells per Fig. 9 in the same way as the major alarms. In addition to its other functions, relay (LAL), when operated, also connects ground to the "G" lead to the order wire circuit. This lead provides a locking path for incoming signals over the order circuits. This path is carried through relay (LAL) so that these signals can be made non-locking in the same manner as the audible alarms and the individual alarm lamps while the station is unattended. The battery for operating relays (LA) and (LAL) is obtained from Fig. 25, as explained in Par. 6.4.

6.21 The AG lamp in Fig. 14 and its associated multiple (designated ML) in Fig. 15 are provided as guard

lamps to show when the ALM switch is in its "on" position.

6.22 If the radio station happens to be located in a regular telephone building having continuous attendance on other floors, leads "AG or MN" and "DB or MJ" may be connected to the regular office alarm circuits, and the radio station alarms will then operate the audible signals on the attended floors during the periods when relay (LAL) is released.

When Figure 40 is provided, leads "AG" or "MN" and "DB" or "MJ" from figure 8 connect to relays which repeat the alarm signals to the central office alarm circuit, and which, in addition connect ground over the "MA", "MG", "MR" or "MW" lead to light the "other floor" pilot in that circuit.

6.23 In the following descriptions of the different alarm circuits, it will be assumed that relay (LAL) is operated.

6.3 Fig. 17 shows the floor pilot lamps which are provided to indicate the floor on which an alarm condition is located. Each alarm circuit relay on a particular floor connects to a particular multiplied group of these lamps, one lamp of which is located on each floor on which an indication is required. The alarm circuits on a second floor connect to a second group of lamps, etc. Thus, if an alarm condition arises on floor No. 1 the No. 1 pilot lamp on all the other floors will light; if the alarm condition is on floor No. 3, the No. 3 pilot lamps on all floors will light, etc. Battery for the floor pilots is normally obtained directly from the ABS supply through option "W", but the pilots for the floor on which the 24V power plant is located are supplied from Fig. 25 through "X" option. The purpose of this arrangement is to insure that the pilot lamps for the floor having this power plant will remain operated in case the main ABS discharge fuse should blow. (See the next paragraph). The fact that the other pilot lamps are disabled is of no consequence, as the ABS failure is of prime importance and receives first attention. As soon as that trouble is cleared, the other alarm and pilot lamp conditions will be indicated in the normal manner.

6.4 The lamps and relays of this alarm system are normally operated from the alarm battery supply (ABS), which consists of a separate group of

battery leads which do not supply any other loads. Since the failure of the main discharge fuse supplying these circuits would kill all of the alarms, Fig. 25 has been provided to change over the battery supplies for Figs. 8, 9, 24 and part of 17 from ABS battery to regular signal battery under this condition. The failure of the main ABS discharge fuse operates relay (BF) over the "ABSF" lead. The operation of this relay:

- (a) grounds lead "LS" to light the ABS lamp per Fig. 16.
- (b) grounds lead "AA" to light a lamp in the power plant control panel.
- (c) grounds lead "DF" to operate the major alarm as previously described.
- (d) grounds lead "A" to light the floor pilot lamps for the floor on which the power plant is located.
- (e) transfers the battery supply leads for Figs. 8, 9, 24 and 17 from the ABS battery taps "M" and "L" to the regular signal battery taps "B" and "C".
- (f) connects battery to operate relay (BF1) in Fig. 38. This relay provides additional transfers from ABS to signal battery for the leads which supply battery to the relays in the blower control and air pressure alarm circuits per Fig. 39, which are described in Section 14.

It is not necessary to provide a connection to the CI alarm and control system in order to indicate this type of failure to the alarm center because the failure of the ABS supply to the CI system causes the transmission of a distinctive alarm.

6.5 Non-locking alarm cutoff keys (ACO) per Fig. 2 are connected to the various alarm circuits (except the fuse or circuit breaker alarms - see Section 7) to permit the attendant to retire the station audible signals and the floor pilot lamps when the alarm conditions cannot be rectified immediately. Operation of one of these keys grounds the "K" lead and operates a relay in the alarm circuit involved, which relay locks up to the lead originating the alarm and removes ground from the "F" or "DF" lead and the "A" lead. Subsequent alarms from other causes will bring in the audible signals and pilot lamps again, but they may be retired in each case by means of an ACO key. Each individual alarm lamp and the associated

indication to the alarm center remain energized, however, until the cause of the alarm is cleared. An ACO key in the radio transmitter control circuit facilitates the retiring of the channel failure alarms from the transmitter-receiver bays. This key connects ground to the "ACO" lead, which connects to the "K" lead in Fig. 2.

7. CIRCUIT BREAKER AND DISTRIBUTION FUSE ALARMS - FIGS. 1, 10, 11, 12, 13, 21, 26, 27, 28 AND 32

7.1 The operation of a circuit breaker or the failure of a distribution fuse supplies battery over an "FA" lead to operate the associated alarm relay in Fig. 1, 10, 11, 12 or 13. The operation of any of these relays:

- (a) lights individual alarm lamps per Fig. 7 or ABS lamps per Fig. 16, to indicate the type of alarm.
- (b) connects ground to an "AT" lead, to cause the transmission of the alarm to the alarm center.
- (c) lights the floor pilot lamps.
- (d) operates the office audible signals.

7.11 The "L" leads of Figures 1, 11, 12 and 13 may be connected to light separate individual alarm lamps per Figure 7, or they may be multiplied to light only one lamp depending upon the arrangement and designation of lamps at the individual alarm lamp panel.

7.12 The "LS" leads in Figs. 10 and 12 may light individual ABS alarm lamps per Fig. 16, or they may be multiplied to a single lamp, if desired.

7.13 The "AT" leads of Figures 1, 10, 11, 12 and 13 may each connect to a separate alarm registering relay in the Station Alarm Sending Circuit, or they may be multiplied as required depending upon whether the associated alarm registering relay is to register separate alarms or several types of alarms.

7.2 Figs. 21, 26, 27 and 28 show the protective resistances which are provided in the "FA" leads to limit the current in case the leads should become grounded. One resistance is provided for every equipment group of fuse mountings. Each resistance should be located as close to the mountings as possible.

7.3 A cutoff key per Fig. 32 is required for the 12-volt circuit

breaker alarm in order to prevent the alarm from sounding continuously while the trouble is being cleared, inasmuch as the breaker cannot be reset until the cause of the trouble is removed. Operation of the BCO key releases the (FA4) relay of Fig. 1, and lights the BG guard lamp as an indication that the key has been operated.

7.4 The fuse alarms do not require a cutoff arrangement, since they can be easily retired by removing the blown fuse.

8. ROOM TEMPERATURE AND WAVE GUIDE GAS PRESSURE ALARMS - FIGS. 3, 4 AND 29

8.1 A Fig. 4 is used with Fig. 3 to provide a room temperature alarm circuit, and another Fig. 4 is used with one or more Figs. 29 to provide a wave guide pressure alarm circuit when the static pressure system is used. A Fig. 4 by itself is used with the dynamic pressure system. Ground is connected to the "A" lead when the room temperature exceeds the limits of the air switches in Fig. 3, or when the wave guide pressure drops to a low enough level to operate one of the pressure gauge switches per Fig. 29 or the pressure gauge switch in the dynamic air supply circuit. This ground operates relay (A), which:

- (a) grounds the "L" lead to light an individual alarm lamp per Fig. 7 to show which alarm is involved.
- (b) grounds the "AT" lead to cause an indication of the alarm condition to be transmitted to the alarm center.
- (c) grounds the "F" lead to operate the minor audible signal, and the "A" lead to light the floor pilot lamps.

8.2 If the alarm condition cannot be corrected immediately, the audible signals and the floor pilots may be cut off by momentarily operating one of the ACO keys. Momentary ground from the key over the "K" lead and through make contacts on relay (A) operates relay (A1), which locks up to the grounded "A" lead which originated the alarm, and releases relay (A). With relay (A) down and relay (A1) up, the audible signals are silenced and the floor pilots are extinguished, but the individual alarm lamp remains lighted and the "AT" lead remains grounded under control of relay (A1). When the trouble condition is cleared, relay (A1) releases and the circuit is back to normal.

9. OPEN DOOR ALARM - FIGS. 5 AND 6

9.1 The door alarm relay (DA) operates whenever the contacts in one of the door switches per Fig. 5 are closed by the opening of the door, and it locks up to ground over the "RE" lead from the Station Alarm Sending Circuit. The ground on the "RE" lead insures that the alarm will be transmitted even though the door is opened only momentarily. It is removed when the alarm is registered in the Station Alarm Sending Circuit, and relay (DA) is then free to release as soon as all doors are closed. This alarm circuit lights an individual alarm lamp and grounds the "AT" lead in order to send the alarm to the associated alarm center, but does not energize the audible alarms or pilot lamps.

10. OBSTRUCTION LIGHTING ALARM CIRCUIT - FIGS. 34, 35, 36 AND 41

10.1 General

10.1.1 Since the concrete buildings or steel towers used in the TD radio systems are high enough to be a hazard to air navigation they are equipped with obstruction lighting circuits. Two lamps are provided at the top in each case, and the steel towers are also equipped with side lighting. The two top lamps are operated in three different ways:

- (a) with one lamp normally "on" and the other held in reserve, to be automatically lighted when the first one fails.
- (b) with both lamps normally on continuously.
- (c) with both lamps flashed "on" and "off" intermittently.

The side lights are provided in pairs at the 1/3 level and the 2/3 level, and remain on continuously. The alarm circuit provides a warning when one or more of the various lamps fails.

10.1.2 Failure of the beacon lights may be caused by burned out bulbs, wiring failures, breakdown of the flasher mechanism, etc., or by failure of the commercial power. All but the last may be considered as "lamp failures", and to avoid giving a false "lamp failure" alarm under "power failure" conditions, no alarm is operated until after a delay of approximately 10 minutes. This allows time for the emergency engine-alternator to start and pick up the load,

thereby lighting the beacons again and removing the grounds from the alarm leads. If a ground is still present after the 10 minute interval, a lamp failure is indicated and the alarms will operate. Since none of the alarm indications would be given if the 10 minute timer should fail, two timers operating in multiple, and separately fused, are provided.

10.13 A failure of one top beacon in any of the three arrangements will bring in a minor alarm, while a failure of both will bring in a major alarm. A failure in the flasher mechanism with the lamps either on or off will also bring in a major alarm. Only a minor alarm is given by the failure of one or more of the side lighting units. Distinctive lamp indications and grounds on the "AT-" leads to the Cl alarm and control system are provided. The audible signals and the floor pilot lamps can be cut off without disturbing the individual alarm lamps or the grounds on the "AT-" leads by operating one of the ACO keys.

10.14 The 10-minute delay circuit does not function, and the office alarms and floor pilots are not energized, if a second alarm of the same type (either major or minor) comes in after the first one has been cut off by the operation of the ACO key, but the proper individual alarm lamp will light. With one exception, a different alarm will come in the same manner as an original one, and the office signals can be retired again by the operation of the ACO key. The exception is the case in which two top lamps are out, and when this occurs a subsequent failure of the side lamps will not be registered until the top lamps are repaired.

10.2 Circuit Operation

10.21 Minor Alarms - Failure of one of the top lighting beacons results in the grounding of lead "LA" or "LB" from the Obstruction Lighting Circuit. Assuming it to be lead "LA", relay (L1) operates and supplies ground through its 8B contact to start the timers (T1) and (T2). After a delay of approximately 10 minutes one of the timers closes its contacts and connects ground to relay (L3), which operates and locks up to the ground coming from relay (L1). Relay (L3) connects grounds to the translating contacts on the other relays and causes the operation of the various alarms and indications. In the present case, with relay (L1) operated and relays (L2), (L6) and (L7) released:

- (a) an individual alarm lamp is operated by ground over the "LA" lead to Fig. 7.
- (b) ground is connected to the "ATA" lead in order to send a minor alarm to the alarm center via the Cl alarm and control system.
- (c) the minor alarm in the station is operated by ground over the "F" lead.
- (d) the floor pilot lights are energized by ground over the "A" lead.

If lead "LB" from the Obstruction Lighting Circuit is grounded instead of lead "LA", the operation is the same except that relay (L2) operates in place of relay (L1), and a different individual alarm lamp is lighted over the "LB" lead to Fig. 7. Similarly, if a side lighting failure occurs, relay (L6) is operated over the "LS" lead, the timers are started by ground over lead "T1" and the minor alarms are energized when relay (L3) operates. Another individual alarm lamp is lighted for this condition over lead "L".

10.22 Major Alarms - If both top beacon lights fail, ground will be connected to both leads "LA" and "LB" from the Obstruction Lighting Circuit and relays (L1) and (L2) will both operate. The timers and relay (L3) operate as previously described and the floor pilot lamps are lighted as before over lead "A"; but in this case both individual alarm lamps light as the "LA" and "LB" leads to Fig. 7 now receive ground. In addition, leads "DF" and "ATB" are grounded in place of leads "F" and "ATA", respectively, and the major alarms are thereby actuated instead of the minor alarms. The same results are obtained when relay (L7) operates over the "LF" lead because of a failure of the flasher in its open position, except that a separate individual alarm lamp is lighted over lead "L" instead of the lamps associated with the "LA" and "LB" leads. The same results are also obtained when relay "LB" operates over the "LG" lead because of the failure of the flasher with beacon in the "on" position but instead of lead "ATB" being grounded lead "ATC" is grounded. An individual alarm is lighted over lead "L" instead of the lamps associated with "LA" and "LB" leads.

10.23 Alarm Cutoff - After an alarm has been registered, the floor

pilots and the local audible signals in the station may be cut off by the momentary operation of an ACO key. Momentary ground from the key over the "K" lead and through a make contact on any operated alarm relay (L1), (L2), (L6), (7) or (L8) energizes the primary winding of relays (L4) and (L5). If the alarm is a major one, relay (L4) locks up on its secondary winding; if the alarm is a minor one, relay (L5) locks up on its secondary winding. The operation of relays (L4) and (L5) breaks any holding path for relay (L3), so that relay releases and thereby removes the grounds which it was supplying to the various alarm and indication leads; but the grounds to the individual alarm lamps and the "ATA", "ATB" or "ATC" leads are not lost, as they are maintained through make contacts on relay (L4) or (L5). The audible signals and the floor pilot lamp at the station are thus cut off, but the individual alarm lamps and the indications to the alarm center are not. The alarm lamps cannot be extinguished, nor the indication to the alarm center be removed, until the troubles which originated the alarms have been cleared.

10.24 Double Alarms - A second major alarm originating after relay (L4) is locked up, or a second minor alarm originating after relay (L5) is locked up, has no effect except to light the proper individual alarm lamp for the new condition. A major alarm following a minor one, or vice versa, will, however, bring in the audible signals and pilot lamps again (after the regular 10 minute delay interval) - except when the original major alarm was caused by the failure of both top lamps. In this case relays (L4) and (L5) both lock up on the original alarm, so a subsequent minor alarm cannot bring in the audible signals and pilot lamps until the original trouble has been cleared.

11. OBSTRUCTION LIGHTING ALARM - FIG. 22 (MFR. DISC.)

11.1 General

11.11 This Alarm circuit may be used with any of the three types of top lighting described in Par. 10.11, but it has no provision for a side lighting alarm.

11.12 The alarm indications are similar to those described in Par. 10.13, except that there is no alarm cut off feature and the failure of the flasher mechanism lights the

same alarm lamps as the failure of both top lights, instead of giving a distinctive indication.

11.2 Circuit Operation

11.21 When either of the top beacon lamps fails, ground is connected to lead "LA" or "LB" from the Obstruction Lighting Circuit, depending upon the unit involved. Assuming the ground to be on "LA", relay (L1) operates and in turn energizes the timers, (T1) and (T2). After a delay of about 10 minutes, one of the timers closes its contacts and relay (L3) operates. Relay (L3) locks to the ground on the "LA" lead and connects ground to the contacts of relays (L1) and (L2). With relay (L1) operated and (L2) normal: an individual alarm lamp per Fig. 7 is lighted, ground is connected to lead "ATA" to send a minor alarm to the alarm center, and the station audible and visual signals are operated for a minor alarm. If the originating ground comes in on lead "L2" the operation is the same except that relay (L2) is operated instead of relay (L1), and a different individual alarm lamp is lighted.

11.22 If both beacon lamps fail, leads "LA" and "LB" are both grounded and relays (L1) and (L2) both operate. When relay (L3) operates after the 10 minute delay interval: both individual alarm lamps light, ground is connected to lead "ATB" to send a major alarm to the alarm center, and the station audible and visual alarms are operated for a major alarm. If the second lamp fails after the timer has operated because of the failure of the first lamp, the alarms change immediately from minor to major and the second individual alarm lamp lights.

11.23 If the beacon flashing mechanism fails in such a manner that both lamps are extinguished, the Obstruction Lighting Circuit grounds lead "LF" instead of leads "LA" and "LB". This operates relay (L4), which in turn operates relays (L1) and (L2) to bring in the major alarms and the same lamps as in the preceding case.

11.24 Since no alarm cutoff arrangements are provided, the alarms will operate until the troubles causing them have been corrected.

12. CRYSTAL OVEN TEMPERATURE ALARM - FIG. 23

12.1 When the temperature of the crystal oven in the microwave

generator circuit exceeds the specified limits, contacts are closed which connect ground to the "OT" lead and operate relay (OT). With relay (OT) operated:

- (a) ground is connected to lead "L" to light an individual alarm lamp per Fig. 7.
- (b) ground is connected to lead "AT" to send an alarm to the alarm center.
- (c) ground is connected to lead "A" to light the floor pilot lights.
- (d) ground is connected to lead "F" to bring in a minor alarm in the station.
- (e) the "K" lead is extended to the winding of relay (OT1) in preparation for its future operation.

12.2 The audible signals and the floor pilots can be retired by momentarily operating one of the ACO keys. This connects ground to the "K" lead and operates relay (OT1), which locks up to the "OT" lead and releases relay (OT). With relay (OT) down and relay (OT1) up, the audible signals and pilot lamp are deenergized, but the individual alarm lamp remains lighted and the "AT" lead remains grounded under the control of relay (OT1). When the trouble is cleared, this relay releases and the circuit is back to normal.

13. CHANNEL ALARMS - FIGS. 18, 19, 20, 33 AND 37

13.1 General

13.11 The transmission levels of the radio channels are subject to fading, but unless the condition persists for an appreciable interval no attention is paid to it. This circuit is arranged to time the fading intervals and to register an alarm when they exceed approximately 6 seconds.

13.12 The transmission levels are checked by means of a Sensitrol relay associated with each radio channel. When the level becomes too low, the moving contact of the relay approaches the fixed contact and locks up to it under the control of a permanent magnet which is part of the device. This arrangement given positive operation without contact chatter. To release the relay, current is applied to a reset solenoid which produces a field that overcomes the permanent magnet and drives the moving contact

away from the fixed one. After the solenoid is deenergized, the moving contact is again free to travel as determined by the current in the operating winding.

13.13 When one of the Sensitrol relays closes its contacts, the alarm circuit first waits about 250 milliseconds to allow any others to operate, in case the fading condition is general, so that they can all be timed together. The reset solenoids of the operated relays are then energized in order to release them, and the 6-second timer is started. At the end of that interval, the reset solenoids are deenergized and the moving contacts are free to take up the positions determined by the transmission levels at that time. Another timer allows 1.3 seconds for them to make their adjustment. If they remain open, the alarm circuit restores to normal; but if any of them re-close, the alarm circuit functions to bring in a major alarm, light an individual alarm lamp and ground an "AT" lead to cause the transmission of the alarm to the alarm center. The station audible and visual alarms may be retired by operating an ACO key in the alarm circuit or in the transmitter control circuit.

13.2 Detailed Operation

13.21 When one of the (SR) Sensitrol relays closes its contacts, it connects ground to the primary winding of its associated relay (S), which operates and locks up on that winding under the joint control of relays (G) and (T2). A second locking path is also set up through the secondary winding under control of relay (T2). Relay (S), when operated:

- (a) prepares a path for the future operation of relay (C) on its primary winding.
- (b) connects ground to terminal 5B of relay (C) in preparation for the future operation of relay (CA).
- (c) grounds lead "ST" to operate relay (ST).
- (d) prepares a circuit from the reset solenoid of relay (SR) to contacts on relay (G) via the "SA" or "SB" lead.

Relay (ST), in operating, releases relay (G), which takes about 250 milliseconds as it is of the slow release type. Its purpose is to allow the fading on several channels to be treated as a unit and to be timed out

treated as a unit and to be timed out together if they should occur at about the same instant.

13.22 When relay (G) releases:

(a) it removes battery from the primary windings of all the (S) relays in order to prevent the operation of any new ones while a timing cycle is in progress; but those already operated remain so because of the locking path through their secondary windings.

(b) it connects ground from relay (T1) to the "SA" and "SB" leads, and thence through front contacts on all the operated (S) relays to the reset solenoids of all Sensitrols associated with channels that are encountering fading.

(c) it opens the 470-ohm shunt across condenser (A) and connects ground to the condenser and to the winding of relay (T1). This starts the 6-second timing cycle, which is determined by the time required to charge condenser A through resistance L to the point where the control gap 1-4 of the cold cathode tube A breaks down. When this occurs, the tube conducts through the main gap 2-4, and relay (T1) operates.

13.23 When relay (T1) operates at the end of the 6-second interval:

(a) it de-energizes the reset solenoids by removing ground from the "SA" and "SB" leads, leaving the contacts free to move as determined by the transmission levels on the channels.

(b) it connects battery from relay (T2) to the "C" lead, in preparation for the operation of any (C) relay on its primary winding in case any of the Sensitrols recloses its contacts during the next 1.3-second interval.

(c) it starts the 1.3-second timer by removing the 470-ohm shunt across the D condenser and connecting ground to the condenser and to the winding of the (T2) relay. Condenser D charges through resistance N, and when the voltage on it is high enough to fire the cold cathode tube B, relay (T2) operates.

13.24 If no (C) relay operates during the 1.3-second interval, the

circuit restores to normal when relay (T2) operates, as that relay removes ground from the "T" lead and releases the operated (S) relays. With the (S) relays released, relay (ST) releases, relay (G) reoperates, relay (T1) releases, and the circuit is ready for a new cycle.

13.25 If any of the Sensitrols does close its contacts during the 1.3 sec. timing interval, the associated (C) relay operates on its primary winding, and locks up on its secondary winding. With a relay (C) operated:

(a) ground is connected to lead "L" to light an individual alarm lamp per Fig. 7.

(b) ground is connected to lead "AT" to send an alarm to the alarm center.

(c) ground from relay (S) is applied to lead "AL" momentarily for the period of time that relay (C) is operated before relay (S) releases. This pulse of ground operates relay (CA), which locks to ground over the "AL1" lead and brings in the audible and visual alarms in the station by grounding the "DF" and the "A" leads.

(d) the "SRA" and "SRB" leads are connected to the reset solenoids of the Sensitrols, and the "HC1" to "HC8" leads are connected to the contacts of the sensitrols, for purpose explained in Par. 13.27.

At the end of the 1.3 second timing interval relay (T2) operates, the (S) and (ST) relays release, relay (G) re-operates, relay (T1) releases, and the circuit is left with the (C) relays for the low channels locked operated. The audible alarms and floor pilots may be retired by momentarily operating one of the ACO keys per Fig. 2, or a corresponding key in the radio transmitter control circuit. The operation of one of these keys operates relay (CA1) by connecting ground over lead "K", and the operation of relay (CA1) release relay (CA). The individual alarm lamps remain lighted and the grounds on the "AT" leads remain in effect, however, until the channels are returned to normal and the (C) relays are released. The circuit is now ready to register a new fading alarm. When one is received, as indicated by the operation of another Sensitrol relay (or relays), the cycle will be repeated and the new (C) relay (or relays) will lock up.

If relay (CA) has been released, it will reoperate and bring in the audible and visual signals again.

13.26 At a fully attended station the operated (C) relays are released individually by operating the RESET key in the transmitter control circuit of the channels involved. Operating this key energizes the reset solenoid of the Sensitrol for the channel, and thereby opens its contacts and releases the associated (C) relay. With relay (C) released: the individual alarm lamp is extinguished, the ground on the "AT" lead for the channel is removed and the operating path for relay (S) is reestablished. If the fading condition has cleared up so the Sensitrol contacts remain open, the alarm circuit remains normal; but if the fading is still present, the Sensitrol contacts will reclose and the alarm circuit will go through its cycle and bring in a new alarm.

13.27 In the case of unattended stations which send alarms, the release of the operated (C) relays is effected by means of Fig. 33 and the C1 alarm and control system. When the attendant at the alarm center sends the order causing the station to transmit its alarm indications, the C1 system provides a pulse of ground on the "AR" lead at the start of each cycle of scanning. This pulse of ground operates one or more (AR) relays, depending upon the number of channels. Each (AR) relay applies ground to leads "HC1" to "HC8", and operates its associated relay (SR) over a local circuit. The (SR) relays connect ground to the reset solenoids of all the operated Sensitrols via the "SRA" and "SRB" leads and contacts on the operated (C) relays. The grounds on the "HC1" to "HC8" leads prevent the immediate release of the (C) relays when the contacts of the Sensitrols open. This feature is provided to make certain that the solenoids have current applied long enough to properly damp the moving elements and prevent them from rebounding and falsely reclosing the contacts. Relays (AR) and (SR) release at the end of the pulse from the Indication Sending Circuit, the (C) relays release and the alarm circuit restores to normal, but the alarm registering relay in the Station Alarm Sending Circuit (which was operated over the "AT" lead) remains locked up over another path until the end of the scanning cycle. If the fading has cleared up by the time the scan is under way, the alarm registering relay releases at the end

of the scan and the alarm center receives an indication of an alarm condition that existed but later disappeared. If the fading is still present, and persists while the channel alarm circuit goes through its cycle, one or more (C) relays will reoperate and ground will be reapplied to the "AT" lead (or leads). If this ground appears before the end of the scan, the initial alarm indication remains registered; but if it appears after the end of the scan a new alarm will be transmitted to the alarm center.

13.28 When a radio station that is unattended or partially attended is located in the same building as a fully attended office, there is no C1 alarm and control system and the station does not send alarms. To permit the release of the (C) relays from the attended office in such cases, Fig. 33 is provided, as above, but the (AR) relays are controlled manually by means of the SR keys per Fig. 37.

14. TUBE COOLING BLOWER FAILURE ALARM CIRCUIT AND D-C BLOWER CONTROL CIRCUIT - FIGS. 30 AND 39

14.1 The vacuum tubes in the radio transmitters require forced air cooling to dissipate the heat which they develop, and the air supply must not be interrupted for more than a minute or so or the tubes will be damaged. Two blowers are, therefore, provided, one operating on commercial or emergency a-c, and the other operating from the 130V d-c power plant in the station. This circuit provides a non-locking transfer to the d-c equipment during the interval between a failure of the commercial a-c supply and the switch over to the engine-alternator reserve; and it provides a locked in transfer to the d-c equipment if the a-c equipment fails and the pressure goes down. Alarms are provided for the latter condition, but not for the former.

14.2 A failure of the commercial a-c supply removes the operating voltage from the normally operated thermal relay (AC), and after a nominal delay of 8 seconds, this relay releases and closes its contacts. This completes an operating path for relay (DC), which connects 130V to the "DC" lead to start the d-c blower. The delay introduced by relay (AC) prevents needless starts of the d-c equipment on momentary interruptions of the a-c supply, but it is not long enough to allow the pressure to fall to the point where the locking and alarm arrangements described in the

next paragraph will function. When the emergency a-c supply from the engine-alternator becomes available, the a-c blower starts up again, relay (AC) reoperates, relay (DC) releases and the d-c blower shuts down. The changeover from the alternator to the commercial supply when the latter returns is made so quickly that this circuit is unaffected.

14.21 Relay (AC), being slow in operating as well as releasing provides a few seconds delay in the release of relay (DC) when the a-c power returns. This delay is desirable in order to minimize the likelihood that relay (DC) will have to break the heavy starting current of the d-c motor if the a-c should return just after the transfer occurred.

14.3 If the a-c blower fails for reasons other than the loss of the supply voltage the air pressure will drop slowly and in about 15 to 20 seconds the pressure switch will connect ground to the heaters of the thermal relays (TH) and (TH1). When either one closes its contacts, after a nominal delay of 15 seconds, an operating path is established for relays (LU), (LU1) and (LP). Relays (LU) and (LU1) lock up under control of switch RLS, but relay (LP) remains under control of the pressure switch. With relays (LU) and (LU1) operated, the starting circuit for the d-c blower is closed and the following alarms and indications are operated to show that a blower has failed:

- (a) an individual alarm lamp is lighted by ground on lead "LA".
- (b) an alarm is transmitted to the alarm center by ground on lead "ATA".
- (c) the major alarm in the station is energized by ground on lead "DF".

- (d) the floor pilots are lighted by ground on lead "A" to Fig. 17.

The (LP) relay also grounds the "DF" and the "A" leads - and, in addition, lights a different individual alarm lamp and transmits a different alarm indication to the alarm center by grounding leads "LB" and "ATB" respectively. The two latter indications will be retired by the release of relay (LP) when the d-c blower starts and restores the air pressure, but the motor failure indications will remain until relays (LU) and (LU1) are released by the manual operation of the release switch RLS. The audible signals and the floor pilot lamps may be cut off, however, by the operation of an ACO key, which operates relay (K) over the "K" lead. Relay (K) locks up under control of the (LU) and (LU1) relays and opens the "DF" and "A" leads. If the d-c blower fails to start, the air pressure failure alarms will, of course, remain operated.

14.31 The alarms will also come in if the d-c blower should fail to start when relay (AC) releases in response to a power failure, but in this case the pressure will be restored and the pressure failure alarms will be retired when the a-c blower picks up on the emergency supply or the restored commercial supply. This may or may not occur in time to save the transmitter tubes, however, depending upon the actual time that the pressure is down.

14.32 The (TH1) and (LU1) relays are provided as duplicates of the (TH) and (LU) relays as a precautionary measure to guard against failure of the alarm circuit to actuate the blower alarms. The time delay provided by relays (TH) and (TH1) is required to insure that the d-c blower does not lock in unless the transfer to it is caused by a failure of the a-c equipment and not by a power failure.

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