COMMON SYSTEMS
TYPE N CARRIER TELEPHONE
VF ALARM AND
ORDER WIRE SIGNALING CKT

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Added designation (OR SG2) to lead from Fig. 3, terminal 10, with option to connect to order-wire and alarm circuit.

D.2 Connecting circuit 4.8 was added.

4. CONNECTING CIRCUITS

4.8 1000-cycle Cutoff Relay Ckt - SD-55393-01

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2161-RR-LP

COMMON SYSTEMS
TYPE N CARRIER TELEPHONE
VF ALARM AND
ORDER WIRE SIGNALING CKT.

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Add code number 108 14/1F for L3 Lamp.

D.2 In the option table for Dwg. Issue 6D - "CC" is moved from std column to M.D. column to correct an error.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2161-GWA-LP

COMMON SYSTEMS
TYPE N CARRIER TELEPHONE
VF ALARM AND
ORDER WIRE SIGNALING CKT.

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 In Fig. 3, K^4 Relay, contacts 1 and 2 bottom were shown closed in error.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2161-GWA-LP

COMMON SYSTEMS TYPE N CARRIER TELEPHONE VF ALARM AND ORDER WIRE SIGNALING CKT.

CHANGES

B. CHANGES IN APPARATUS

B.1 Added (Optional)

Fig. 4

1 - Lamp (L3)10W 120V Mazda

"KK" option

1 - Res. (R8) 3830, KS-8512, L2D.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Fig. 4 and "KK" option were added to cover B.1 above.

D.2 Fig. 2 was revised to show 130V or 152V battery connected to the previously unused portion of the (ALM CO) key (S1).

D.3 Fig. 52 was revised.

D.4 "F" or "DL" lead in figure 3 was previously designated "F" only.

D.5 Notes 119 and 120 were added.

D.6 Note 118 previously read: Strap if necessary to meet the 700 cycle frequency requirement.

All other headings under Changes, No change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is designed for use on one side of an order wire and alarm quad for the transmission of voice frequency alarm signals at the same time that the quad is being used for transmission of d-c power to a repeater switching set. Also the transmitting and receiving components are arranged for use as ringing supply and receiver units for use in order wire signaling by means of 1900 cycle transmission.

2. WORKING LIMITS

2.1 None.

3. FUNCTIONS

3.1 At Transmitting Station.

3.11 Provides an oscillator for applying tone to the alarm or order wire pair.

3.12 Provides a means of disconnecting the alarm tone when any fuse in the office blows or when the power supply fails.

3.13 Provides a means of adjusting the power of the alarm or order tone at the transmitting station.

3.2 At Receiving Station

3.21 Provides a means of receiving, amplifying, and rectifying each alarm tone individually at the receiving station.

3.22 Provides a means of receiving, amplifying and rectifying the 1900 cycle order wire signaling tone at the receiving station.

3.23 Provides a delay circuit at the receiving station which prevents the associated audible alarm or order wire signal from responding to short-duration pulses.

3.24 Provides a visual alarm and connection to an audible alarm to indicate a blown fuse or power failure at a remote unattended station.

3.25 Provides a visual indication of the reception of ringing tone in addition to providing activating connections to a standard order wire audible signal.

3.26 Provides a visual means of discrimination to determine which transmitting station has originated an alarm.

3.27 Provides a means of disabling the audible alarm.

3.28 Provides visual indication of disabled alarm circuit.

3.29 Provides for connection to an audible alarm to indicate when normal transmitting station conditions have been restored.

3.3 General

3.31 Provides a means of transmitting alarm from several stations simultaneously and means at the receiving station for identifying which stations are sending these alarms.

3.32 Provides a general purpose alarm circuit activated by any detector arranged to supply a ground connection to the transmitting oscillator circuit.

3.33 Provides a means of adjusting the delay interval from about 1 second to about 5 seconds.

4. CONNECTING CIRCUITS

When this circuit is listed on a keysheet the connecting information thereon is to be followed.

4.1 Order Wire and Alarm Circuit - SD-95142-01.

4.2 Telephone Order Wire Ckt. - SD-55574-01.

4.3 "N1" Carrier Terminal Application Schematic - SD-95121-01.

4.4 "N1" Carrier Repeater Application Schematic - SD-95124-01.

4.5 "V3" Repeater Battery Supply - SD-95113-01.

4.6 "V3" Repeater Application Schematic - SD-95144-01.

4.7 Various Alarm Circuits such as

4.71 Annunciator - SD-90202-01.

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

4.73 Audible and Visual Alarm Circuit - SD-95063-01.

4.74 Audible and Visual Alarm Circuit - SD-96188-01.

DESCRIPTION OF OPERATION

5. GENERAL

5.1 This circuit is designed to provide an alarm indication at a common receiving point for several remote power supply stations by means of a group of voice frequency signals transmitted over the alarm side of the order wire and alarm quad at the same time that this quad is being used for supplying power to the pole mounted cabinets for connection to a repeater switching set. Fig. 1 is the transmitting oscillator circuit with associated controls and is for use in each power supply station where it is desired to alarm power failures and blown fuses. Each transmitting station in the alarm line section is assigned a different frequency for transmission of its indication. An allocation of four frequencies is provided for normal use and four additional frequencies can be made available for use on a special engineering basis. The normal circuit condition is steady transmission of tone toward the alarm receiving station and an interruption of this transmission, resulting from power failure or blown fuses in individual circuits, is interpreted by the distant receiving station as an alarm condition. Also, the oscillator circuit may be used as a source of ringing current for providing 1900 cycle signaling over the order wire side of the quad.

5.2 One receiving circuit, shown in Fig. 2, must be provided at the alarm receiving station for each power supply station transmitting its individual tone. Each receiving circuit of a group for a given alarm section of line must have a different band pass filter at its input, designed to pass the particular frequency of its associated sending station. The output of the band pass filter is fed to the grid of an amplifier tube under control of a sensitivity potentiometer. The output of the amplifier is rectified for use in holding a polar relay operated when tone is being received. The polar relay connects to a delay circuit (Fig. 3) which, in turn, actuates the audible alarm or order wire calling-in signal.

The delay circuit (Fig. 3) is a cold cathode tube arrangement to prevent false alarms resulting from temporary interruptions or surges along the alarm line. The (ALM) or (OW) lamp (L2) of Fig. 3 has no delay, hence, it provides some discrimination between surge conditions and an actual alarm or calling-in signal. The individual neon indicator (PILOT) lamp (L1) for each receiving circuit provides a guide for determining which sending station is activating the audible alarm. Also, the receiving circuit may be used as a 1900 cycle detector for use in receiving order wire signals over the order wire side of the alarm and order wire quad.

6. OSCILLATOR AND ASSOCIATED TRANSMITTING END EQUIPMENT - (FIG. 1)

6.1 The oscillator of Fig. 1 is designed around a miniature twin triode tube (V1) whose heater may be operated at either 20 or 40 volts depending on whether parallel or series connection of the two heater units is used.

6.2 The triode section connected to tube pins 6, 7 and 8 is used for the RC oscillator circuit whose frequency is determined by a selection of various resistance values for (R11) and (R12) as covered by note 102 on the drawing. Capacitors (C3), (C4) and (C5) provide the capacitance portion of the circuit, the major portion of which is supplied by (C3) and (C4) with (C5) acting as a trimmer for making a vernier frequency adjustment for circuit element variations. Resistors (R15) and (R16) prevent oscillations in the TV range.

6.3 Positive voltage feedback is supplied to the oscillator grid through (R11) and (C3) to sustain oscillations. When necessary, resistance (R17) shall be connected across resistance (R11) to meet the 700 cycle frequency requirement. Negative

feedback is supplied to the oscillator cathode through thermistor (TH1) and the (LEVEL) potentiometer (R13). The control of the negative feedback by thermistor (TH1) stabilizes the oscillator output against voltage variations of the power supply. Potentiometer (LEVEL) provides sufficient adjustment of oscillator output power to take care of circuit element variations and has enough margin to provide high output for use when the oscillator is applied to lines with no repeaters. However, second harmonic modulation increases and output stability decreases as the output power is increased by means of the (LEVEL) potentiometer. Hence, the high output setting of the potentiometer should not be used except for application to non-repeatered lines. Blocking condenser (C2) is by-passed by resistance (R8) to provide a d-c voltage across thermistor (TH1) sufficient to start oscillations. The output of the oscillator section of (V1) is fed to the triode amplifier section through coupling capacitor (C1). The output of the amplifier section of (V1) is coupled by means of the (OUT) output transformer (T1) to output control (OUT) potentiometer (R14) whose range is about 24 db. This potentiometer in conjunction with the other circuit elements on the transmission pair permits the proper amount of oscillator output to be applied to the line.

Relay (K1) is wired through the panel terminal block so that it may be either included or excluded from the circuit depending on the application. For alarm use this relay provides control of the release of tone from the alarm line. For order wire use the relay is not used since 1900 cycle tone is applied to the order wire line facilities by means of a cut-off relay shown on the order wire and alarm circuit.

When Fig. 1 is used for an alarm oscillator, relay (K1) connects the tone to the line when in the operated position. In the non-operated position the 600 ohm termination (R3) is connected across the line and the oscillator output is shorted. The operation of relay (K1) is under control of the ground connection on lead "PF" which is supplied by the connecting alarm circuit. The operation of the oscillator in the alarm application is self alarming because failure of any circuit element results in a cessation of tone applied to the line.

7. RECEIVING CIRCUIT (FIG. 2)

7.1 This circuit provides means for receiving, amplifying, and detecting the voice frequency tone which is used for alarm indications and order wire signals. A selection of four different 200 type filters is provided for normal alarm use. Up to four additional filter allocations may be used when needed and when special engineering indicates their feasibility. The filters which are recommended for general alarm use are centered at 700, 1100, 1500 and 1900 cycles per second. The additional filters for specially engineered applications are centered at 900, 1300, 1700 and 2100 cycles per second. For order wire signaling 1900 cycles is always used. The (F) filter is an unbalanced configuration and matches the nominal 600 ohm line to the high impedance grid circuit. The (R1) resistance and the (SENS) potentiometer (R7), connected in parallel, terminate the output of the filter. The (SENS) potentiometer (R7) provides a means of applying any part of the voltage across (R1) to the grid of tube (V1).

7.2 The output of tube (V1) is normally stabilized by about 12 db of negative feedback provided by the cathode resistors (R3) and (R4) operating in series. When greater sensitivity is required, resistor (R4) may be strapped out of the circuit resulting in less feedback voltage, less stabilization, and about 4.5 db higher gain. The output voltage of tube (V1) is stepped down by the (OUT) transformer (T3) to a satisfactory value for presentation to varistor (VR1). Varistor (VR1) rectifies the a-c output and condenser (C2) suppresses the ripple to a satisfactory value. The d-c output of varistor (VR1) is used to operate the (K2) relay when tone in the normal input range is presented to the (F) filter input. Relay (K2) is a polar relay with biasing voltage applied to it from +130V battery through resistance (R5). Jack (RC) is provided for measuring relay operate and release currents when required. Screen voltage is supplied from +130V battery through resistance (R2), and condenser (C1) is the associated a-c by-pass to ground.

The use of the polar relay provides for a high ratio of release current to operate current and thus provides maximum margin against being held operated by any interference when the normal tone is removed to instigate an alarm. The (K2) relay is normally operated when the receiving circuit is used for alarm purposes and normally released when used for signaling purposes. The operation of the relay circuit as an alarm device will be discussed first.

The armature of relay (K2) supplies +130V through its armature spring "5" to the (NORM) contacts of key (S1) and hence, to the delay circuit, Fig. 3. Key (S1) provides a means of silencing the alarm bell by breaking the connection between the receiving circuit and the delay circuit and of lighting the guard lamp (L3) in Fig 4; this is accomplished by operating the key (S1) from the (NORM) position to the (ALM CO) position. The key then preconditions the delay circuit to again set off the alarm when the trouble at the distant office has been cleared. Restoring (S1) to its (NORM) position again silences the bell, extinguishes the guard lamp, and prepares the

delay circuit for response to subsequent power or fuse failures at the alarm sending office. Indicator (PILOT) lamp (L1) glows dimly whenever the distant office is sending tones and when the circuit between offices is operating properly. The series resistance (R6) in the (PILOT) lamp circuit reduces the current through the lamp and provides for lamp life of many years. The absence of illumination in the (PILOT) lamp when no tone is being received provides for prompt identification of the remote station in trouble. Should any (PILOT) lamp become inoperative, the identification can also be made by operating the (S1) keys from the (ALM CO) position to the (NORM) position one at a time and noting which key operation results in an audible alarm. When the identification is made by means of the (S1) key sufficient time must be allowed after each key operation for the delay circuit to operate. An interval of about 7 or 8 seconds should be allowed. The nominal delay provided by the delay circuit covered in Section 8 in the order of 5 seconds. Any temporary condition resulting in intermittent release of the (K2) relay will cause short flashes on the associated (PILOT) lamp.

For the order wire signaling application the (S1) key is not used and connection to the delay circuit is directly from make contact 4 on the (K2) relay. In this case the (PILOT) neon lamp only serves as a trouble shooting indicator that tone is passing through the receiving circuit. Upon receipt of a ringing signal, relay (K2) supplies +130 volt battery directly to the delay circuit of Fig. 3 which is strapped for a delay of about 1 second as covered in paragraph 8.

8. DELAY CIRCUIT - FIG. 3

The delay circuit is designed to function for both order wire signaling and alarm purposes.

In the order wire application about 1 second delay is provided between receipt of tone and operation of the audible signal in order to provide discrimination between talking on the order wire and steady tone. This time discrimination in combination with the band discrimination at the receiving circuit filter provides a means of signaling with a single steady frequency of 1 second duration or longer. Syllabic volume changes in voice transmission, except for steady tones in the 1900 cycle range, will not operate the (K4) relay and hence will not actuate the audible calling-in signal.

In the alarm application, about 5 seconds delay is provided between the release of tone and operation of the audible alarm in order to avoid false alarm indications resulting from temporary line interruptions, from static surges, or from careless maintenance operations. Except for the time intervals involved, circuit operation is the same for either application and is as follows.

When +130 volt battery is applied to the "A" or "S" lead of Fig. 3 by the armature of the (K2) relay, the (K3) relay operates. Relay (K3) operated, removes the 3600 ohm shunt from the (C4) condenser, applies a positive 130V potential to main anode 2 of tube (V1) and applies positive 130 volt charging potential through resistors (R3), or resistors (R3) and (R4), to capacitor (C4). The values of (R3), (R4) and (C4) determine the time interval required to raise control anode 1 to its firing potential. With both (R3) and (R4) in the circuit this interval is about 5 seconds; when (R4) is strapped out the interval is about 1 second. When enough time has elapsed to charge (C4) to the firing potential of the control gap of (V1) "1-4", this gap fires, which, in turn, fires the main gap "2-4". The main gap then provides a conducting path for 130 volt battery, through (R6) through relay (K4) to ground. (K4) then operates and either supplies ground to audible and visual alarm circuits or supplies battery for operating the order wire calling-in signal. When relay (K4) is released, a path is provided through the "2-3" top contacts for operating the cut-off relay which provides a ring out over the order wire. When 130V is removed, even momentarily, from the "A" or "S" lead the (K3) relay releases and discharges (C4) through (R2). Consequently, when (K3) is again operated, a new timing interval is started for operating (K4).

Resistance (R5) prevents the possibility of excessive current surges flowing from the main anode to the starter anode under conditions which result in a large potential difference between them. Condensers (C2) and (C3) provide a by-pass for high frequency surges of office noise which might falsely fire (V1) prematurely before condenser (C4) is charged to its normal firing value.

Capacitor (C1) and resistor (R1) provide spark protection for the contacts of (K2) in Fig. 2 from energy stored in relay (K3). For alarm applications, lamp (ALM) provides a visual indication which comes on as soon as the (K2) relay of Fig. 2 operates. Also short interruptions of the alarm line will show as flashes on the lamp and provide an indication of the

nature of the disturbance. For order wire signaling applications the (OW) lamp only serves as a trouble shooting aid to indicate the passage of tone through the receiving circuit.

9. PLATE FILAMENT AND SIGNAL BATTERY SUPPLY CIRCUITS

9.1 Battery supply for the circuits of this drawing are furnished by the "V3" Telephone Repeater application schematic.

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DEPT. 2161-GJN-LP-AZ