COMMON SYSTEMS
"O" AND "ON" CARRIER TELEPHONE
"O1" TERMINAL GROUP OSCILLATOR &
"ON1" AND "ON2" GROUP OSCILLATOR CKTS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Note 204 was revised to ease requirements on critical lead lengths.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2161-CIC-LP

COMMON SYSTEMS
"O" AND "ON" CARRIER TELEPHONE
"O1" TERMINAL GROUP OSCILLATOR &
"ON1" AND "ON2" GROUP OSCILLATOR CKTS

CHANGES

B. CHANGES IN APPARATUS

B.1

Superseded	Superseded by
1 - Crystal (Y2)33DA 312 kc for ON2 Group 1	1 - Crystal (Y2)33DA 296 kc for ON2 Group 2
1 - Crystal (Y2)33DA 280 kc for ON2 Group 3	1 - Crystal (Y2)33DA 264 kc for ON2 Group 4
1 - Crystal (Y2)33DA 248 kc for ON2 Group 5	1 - Crystal (Y2)33DA 232 kc for ON2 Group 6
1 - Crystal (Y1)33DA 296 kc for ON2 Group 2	1 - Crystal (Y1)33DA 312 kc for ON2 Group 1
1 - Crystal (Y1)33DA 264 kc for ON2 Group 4	1 - Crystal (Y1)33DA 280 kc for ON2 Group 3
1 - Crystal (Y1)33DA 232 kc for ON2 Group 6	1 - Crystal (Y1)33DA 248 kc for ON2 Group 5
1 - Cap. (C17) KS-13365, L1, 300 uuf for ON2 Group 1	1 - Cap. (C17) KS-13365, L1, 330 uuf for ON2 Group 2
1 - Cap. (C17) KS-13365, L1, 390 uuf for ON2 Group 5	1 - Cap. (C17) KS-13365, L1, 430 uuf for ON2 Group 6
1 - Cap. (C11) KS-13365, L1, 330 uuf for ON2 Group 2	1 - Cap. (C11) KS-13365, L1, 300 uuf for ON2 Group 1
1 - Cap. (C11) KS-13365, L1, 430 uuf for ON2 Group 6	1 - Cap. (C11) KS-13365, L1, 390 uuf for ON2 Group 5
1 - Cap. (C20) KS-14056, L4, 75 uuf for ON2 Group 1	1 - Cap. (C20) KS-14056, L4, 91 uuf for ON2 Group 2
1 - Cap. (C20) KS-14056, L11, 100 uuf for ON2 Group 3	1 - Cap. (C20) KS-14056, L11, 110 uuf for ON2 Group 4
1 - Cap. (C19) KS-14056, L4, 91 uuf for ON2 Group 2	1 - Cap. (C19) KS-14056, L4, 75 uuf for ON2 Group 1
1 - Cap. (C19) KS-14056, L11, 110 uuf for ON2 Group 4	1 - Cap. (C19) KS-14056, L11, 100 uuf for ON2 Group 3

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Circuit note 101D was revised to cover the changes in strapping necessitated by apparatus changes covered in B.1 above.

D.2 Note 103 was revised to interchange frequencies of oscillator crystals (Y1) and (Y2) and values of capacitors (C11), (C17), (C19) and (C20) for ON2 options "S," "T" and "V" as specified in B.1 above, to make the equipment arrangement of the oscillators for type ON2 consistent with type O and ON1.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit provides the carriers for the Group Transmitting and Group Receiving Circuits.

1.2 This circuit also provides tne 3700 cycle signal tone required by the signaling circuits in the four associated Channel Units.

2. WORKING LIMITS

2.1 None.

3. FUNCTIONS

3.1 Generates two carriers, "Carr-L" and "Carr-H." These carriers are required for the modulation processes in the Group Transmitting and Group Receiving Circuits. Alternate apparatus is specified so that the proper carrier frequencies can be obtained for use in either an "OA1," "OB1," "OC1," or "OD1" Carrier System or ON1 and ON2 Terminals of ON Carrier System.

3.2 Generates the 3700 cycle signal tone required by the signaling circuits in the four associated Channel Units.

3.3 Provides the operating current for an external 3700 cycle alarm circuit.

3.4 Provides means for making output voltage tests.

3.5 Provides means for strapping carrier connections for the particular kind of O or ON terminal group with which the unit is associated.

4. CONNECTING CIRCUITS

4.1 N1 and O1 Channel Ckt. - SD-95118-01.

4.2 Application Schematic for O1, ON1, and ON2 Carrier Terminal - SD-95150-01.

4.3 OB1, OC1, OD1 Group Receiving or Repeater Amplifier Ckt. and ON1 and ON2 Group Receiving Ckt. - SD-95152-01.

4.4 OB1, OC1, OD1, ON1, and ON2 Group Transmitting Ckt. - SD-95153-01.

4.5 Application Schematic for ON1 Junction Group 1 - SD-95196-01.

4.6 Application Schematic for ON1 Junction Groups 2 and 3 or Groups 4 and 15 - SD-95197-01.

DESCRIPTION OF OPERATION

5. GENERAL

5.1 The Group Oscillator Unit plugs into the "O1" and "ON" Carrier Terminal Mounting and together with the Group Receiving and Group Transmitting Circuits constitutes the group equipment.

6. "CARR-L" OSCILLATOR CIRCUIT

6.1 The "CARR-L" oscillator is a crystal oscillator. The oscillating portion of the circuit utilizes the cathode, grid and screen of tube V3 as a triode oscillator. The screen is coupled back to the control grid through variable capacitor (C16) in series with the crystal (Y2). Variable capacitor (C16) and capacitor (C18) provide voltage division determining the feedback from the screen grid to control grid. Variable capacitor (C16) permits frequency adjustment. Resistor (R22) prevents spurious high frequency oscillations. Resistor (R23) provides a dc return path for the control grid. Capacitor (C17) and resistor (R21) constitute the screen load impedance and determine the ac screen voltage and crystal drive.

6.2 The oscillator output (198, 232, 236, 264, 276, 296, or 316 kc) is taken from the electron-coupled plate circuit through transformer (T3). The primary of this transformer is tuned by capacitor (C20) to provide discrimination against harmonics of the fundamental. Resistor (R26) provides additional harmonic discrimination by increasing the "Q" of the loaded transformer.

6.3 DC power is fed to the oscillator plate circuit through the primary of transformer (T3). Capacitor (C15) is a plate circuit bypass and together with (R20) acts as a filter between the plate circuit and the 130-volt dc supply.

6.4 Screen dc power is fed through screen load resistor (R21). Capacitor (C14) is the screen bypass, and together with resistor (R19) acts as a filter between the screen circuit and the 130-volt dc supply.

6.5 The unbalanced oscillator output is connected to terminal punchings of (TB1). These terminals connect the unbalanced output either to terminal 5 for option "X" or to terminal 19 for option "Y," or to both 5 and 19 for option "W." The output voltage can be measured between test jack (CARR-L) and ground.

6.6 In ON1 and ON2 only one carrier is in use. It may be either "CARR-L" or "CARR-H" with correct strapping.

7. "CARR-H" OSCILLATOR CIRCUIT

7.1 The "CARR-H" oscillator circuit is identical to the "CARR-L" oscillator circuit except for oscillating frequency (216, 248, 256, 280, 296, 312, or 336 kc) component values and designations, and terminal and test jack designations. The unbalanced output of the "CARR-H" oscillator is connected through terminal punching (TB1) to terminal 19 for option "X" or to terminal 5 for option "Y" or to both 5 and 19 for option "Z." The output voltage can be measured between test jack (CARR-H) and panel.

8. 3700 CYCLE OSCILLATOR CIRCUIT

8.01 This circuit is a Wien bridge ocsillator. One arm of the bridge is composed of capacitors (C5) and (C6) in parallel with resistors (R11) and (R10). (R11) is connected through the insulating capacitor (C12). Capacitor (C5) is the variable tuning element. The second arm of the bridge consists of capacitor (C2) in series with resistor (R3). The frequency of oscillation is determined mainly by these two arms. The third arm of the bridge is the thermistor (RT1), and the fourth arm is resistor (R9) returned to ground by capacitor (C12) and shunted by the series combination of resistor (R12) and capacitors (C4) and (C21).

8.02 The horizontal diagonal of this bridge is connected to the grid and cathode of the first section (V2B) of double triode (V2). The cathode and plate of the second section (V2A) of the double triode are coupled back to the vertical diagonal of

he bridge, so that the bridge is included in the feedback circuit. The bridge is always operated slightly unbalanced.

8.03 Thermistor (RT1) limits the amplitude of oscillation to the linear portion of the double triode characteristics by adjusting the bridge balance as oscillations initially build up. This provides a signal with low harmonic content. The thermistor (RT1) also stabilizes the output voltage amplitude against variations in load impedance and supply voltages by automatically adjusting bridge balance to maintain constant output voltage.

8.04 The control grid of triode section (V2B) is connected to the junction of the first two bridge arms through resistor (R5) to prevent spurious oscillations. Bias voltage for triode section (V2B) is obtained by a balance between two opposing IR drops. The resistors (R11) and (R10) are in series across the -40 volt battery and hold the grid at -20 volts with respect to ground potential. Resistor (R9) passes the cathode current and produces about -17 volts between cathode and ground, thereby placing a net operating bias of about -3 volts on tube section (V2B).

8.05 The amplifier bridge output voltage appears across resistor (R8), the plate load resistance of triode section (V2B). Resistor (R8) is returned to the cathode of (V2B) through bypass capacitor (C4). The ac voltage across (R8) constitutes one component of the voltage applied between grid and cathode of triode section (V2A). The other component is the ac voltage across resistor (R9). These two components add in series through bypass capacitor (C4), and the net ac voltage is applied between grid and cathode of triode section (V2A).

8.06 The ac voltage across resistor (R9) is of opposite phase to the ac voltage across resistor (R8), so that the amplitude of the net voltage applied between grid and cathode of triode section (V2A) is the difference between the two components. The ac voltage across (R8) is slightly greater than that across (R9) so that the net voltage is of the proper phase to maintain oscillations. The effect of the bucking voltage across (R9) is to increase the percentage variation of the net voltage amplitude for a given change in bridge balance. Thus less change in bridge balance is required to correct for a given change in output voltage, and frequency stability is therefore enhanced.

8.07 Capacitor (C3) is the grid-coupling capacitor for triode section (V2A). Resistor (R4) is to prevent high frequency spurious oscillation. Resistor (R7) provides a dc return path for the grid, and cathode resistor (R6) develops bias for the output stage. Resistor (R12) in the dc plate supply path to triode section (V2B) is necessary to prevent an ac short circuit across bridge arm (R9). This circuit condition results from the grid and cathode of (V2B) and the plate and cathode of (V2A) being connected across opposite diagonals of the bridge.

8.08 The feedback of the circuit is obtained by connecting the plate of triode section (V2A) back to the bridge through resistor (R1), potentiometer (3700 Out), and blocking capacitor (C1). Resistor (R25) in conjunction with capacitor (C12) filters the 40 volt supply to the 3700 cycle oscillator while resistors (R13) and (R28) and capacitors (C8), (C21) and (C12) filter the 130 volt supply. Capacitor (C8) also acts as the plate circuit bypass for triode section (V2A). Resistor (R28) and capacitor (C21) provide isolation between the plate and grid of triode section (V2A) by preventing feedback of the ac voltage across capacitor (C8).

8.09 Oscillator output is taken from the plate circuit of (V2A) through transformer (T1). The balanced secondary of (T1) is connected to plug terminals (15) and (18) and rectifier (CR1), which supplies rectified current for operating an external 3700 cycle alarm relay. Test jack (3700) is connected to one side of the balanced secondary of (T1). Output voltage can be measured between test jack (3700) and ground.

8.10 Resistor (R27), together with the leakage reactance of transformer (T1), acts as a filter and attenuates the higher harmonics of 3700 cycles. By acting as a minimum load, this resistor also improves transient behavior and frequency stability with load variations.

9. FILAMENT CIRCUIT

9.1 The 40-volt filament supply is obtained from an office 48-volt battery through a dropping resistor external to this circuit. The heaters of tubes (V1) and (V3) in series are in parallel with the two heaters of tube (V2) in series.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2161-CIC-LP