

KS-16161 TELETRAINER

1.00 INTRODUCTION

This section covers the description, operation, and maintenance of the KS-16161 teletrainer.

2.00 GENERAL

The KS-16161 teletrainer is a compact portable unit used for classroom training of students in the proper use of dial system telephones.

- Equipment is furnished by the Commercial Department.
- Repairs will be handled through the Plant Department.

3.00 DESCRIPTION

3.01 Components for the KS-16161 teletrainer are as follows:

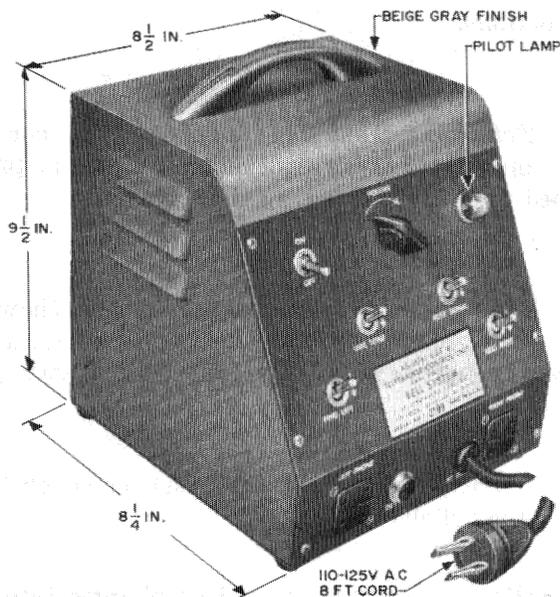
List 2 Control Unit, earlier-type (outward appearance similar to list 4)

List 3 Carrying Case

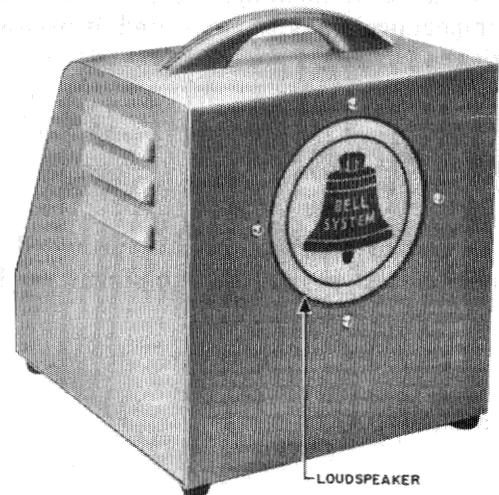
List 4 Control Unit (see Fig. 1)

List 5 combination of lists 3 and 4

500-type Telephone Set DR-61 equipped with D3BG-61 25-foot mounting cord terminated in 283B plug (2 required). Order sets separately.



Front View



Rear View

Fig. 1 — List 4 Control Unit

CONTROL UNIT LOCATED IN FRONT OF TELEPHONE SETS
TO PREVENT FEEDBACK FROM LOUDSPEAKER

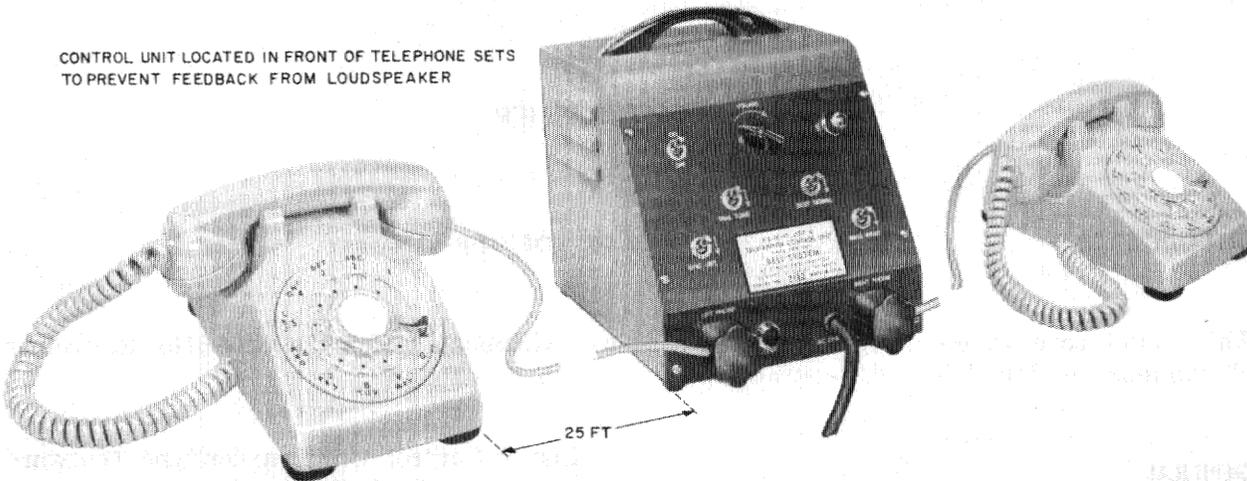


Fig. 2 — Ready for Operation

3.02 The equipment is used to demonstrate the following:

- Talking between stations.
- Ringing either telephone.
- Identifying dial tone.
- Identifying busy tone.

3.03 The loudspeaker is used for classroom work. A public address system or recorder (high impedance) may be connected, if necessary, through the OUTPUT jack.

4. OPERATION

Operating instructions are provided with each unit. Fig. 2 shows the equipment ready to use.

5.00 MAINTENANCE



In order to prevent an electric shock, disconnect power before changing tubes.

5.01 List 2 units may be shop modified to provide improved circuit features incorporated in list 4.

5.02 List 2 units modified are identified by a red stamp (CONV L4) on bottom of cabinet and top of chassis near transformer.

5.03 Troubles that develop are to be cleared locally unless the defect is such that it would be advisable to have the repairs made by the Western Electric Company. Be guided by local instructions.

5.04 *Telephone Sets:* The telephone sets, cords, plugs, and jacks shall be maintained as prescribed in sections covering those items.

5.05 *Howling:* If objectionable feedback (howling) occurs, check that telephone sets are away from speaker. Lower volume control setting.

5.06 *Power:* If power trouble is suspected, check the following:

- Power cord plug should be plugged into a 115-volt 60-cycle ac receptacle. If power is not present at the receptacle, request the customer to have it restored.
- Power switch should be ON.

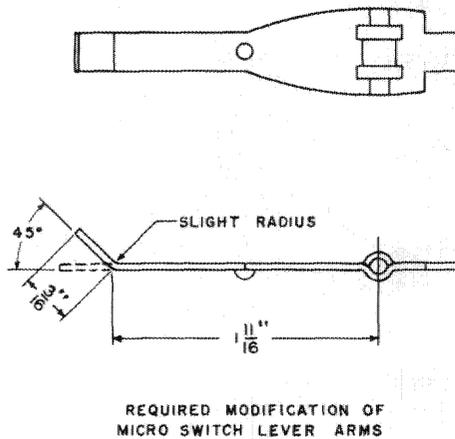


Fig. 3 — Micro Switch BZRW84

- Pilot lamp should be lighted.
- Fuse mounted under chassis.

5.07 Dial Tone and Busy Tone:

If trouble develops in these tones, check for loose connections, dirty contacts, or defective tubes.

5.08 Ringing: If ringing trouble occurs, determine whether or not the fault is within the teletrainer by testing at either or both of the 404B-9 jacks while the associated ringing switch is held operated.

5.09 A variation in the construction of relay S1 in KS-16161, List 2 teletrainer necessitates the use of either of two values, 1600 or 3300 ohms, for resistor R2 to ensure proper ringing frequency. Therefore, when relay S1 is replaced in the field, it may be necessary to change resistor R2 to either of the above values if telephone fails to ring. Resistor R2 may consist of one 1600-ohm resistor, two 3300-ohm resistors in parallel, or one 3300-ohm resistor.

5.10 A change was made in the ringing circuit of KS-16161, List 2 teletrainers, beginning with Serial No. 1621. This change consists of connecting 100,000-ohm resistors R14 and R15 across terminals R and Y of the telephone set jacks J1

and J2. The resistors *should* be installed on all sets with serial numbers under 1621.

5.11 When ordering replacement Micro Switch, lever arm must be modified as shown in Fig. 3 to operate properly with cam assembly.

**6.00 CIRCUIT DESCRIPTION — KS-16161,
LIST 2 TELETRAINER**

Power

6.01 Fig. 4, 5, and 6 are provided as an aid in clearing troubles in the list 2 unit.

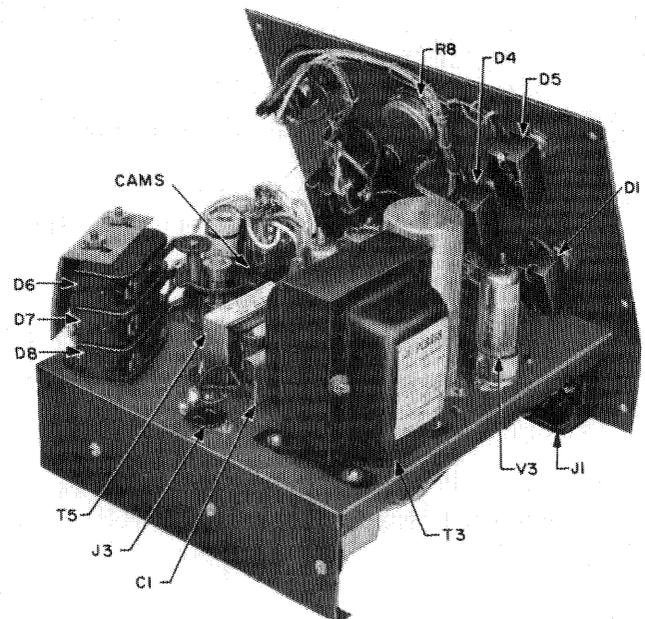


Fig. 4 — List 4 Top Assembly (List 2 is Similar)

6.02 Switch D5 operated to the ON position, 110 volts 60 cycles ac, is supplied from the line cord through fuse F1 to neon pilot lamp E1 and to the primary of power transformer T3.

6.03 Transformer T3 is equipped with two secondary windings: a low-voltage winding for heating the filaments of electron tubes V1, V2, and V3 and for energizing full-wave selenium rectifier CR1, and a high voltage winding for energizing full-wave electron tube rectifier V3.

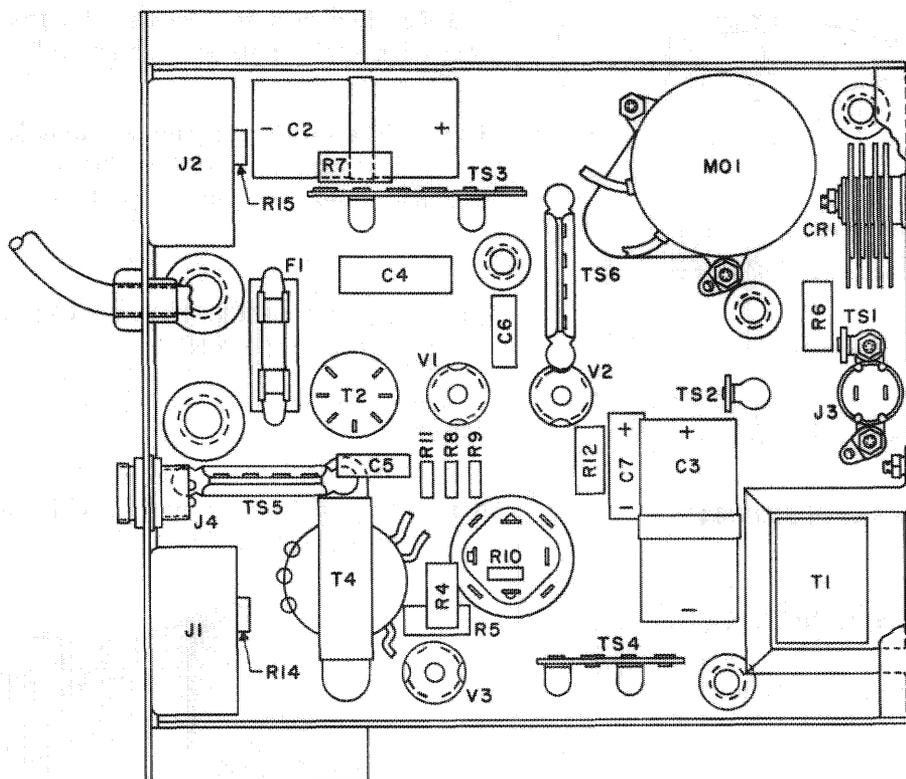


Fig. 5 — List 2 Parts Location, Underside Chassis

6.04 Rectifier CR1 furnishes a source of pulses for generating tones and a source of direct current for talking battery.

6.05 Rectifier V3 furnishes a source of direct current to supply the plates of V1 and V2.

Ringling

6.06 When RING LEFT switch D1 or RING RIGHT switch D2 is operated, a circuit is closed from the switch side of the line cord through a break contact on normal Micro Switch D6 through motor MO1 to the fused side of the line cord.

6.07 Motor MO1 rotates, driving the normal, ring, and busy cams. Rotation of the normal cam closes the contacts on Micro Switch D6 which connects the motor MO1 directly to the unfused side of the line cord.

6.08 Switch D1 or D2 also bridges signal relay S2 across the power line causing it to operate.

6.09 Relay S2 prepares a path for operating capacitor-timed relay S1 from its dc power source at the cathode of electron tube V3. This path extends through cathode V3, filter resistor R5, make contact of relay S2, dropping resistor R4, up-timing resistor R2, break contact of relay S1, the winding of relay S1, and the make contact of ring Micro Switch D7 to ground.

6.10 Relay S1 does not operate until the potential across bridged-timing capacitor C1 reaches a sufficient value to allow operating current to flow in the winding of relay S1.

6.11 When relay S1 operates, one of its transfer contacts opens the operating path from resistor R2 and closes a release path through down-timing shunt resistor R1.

6.12 Charged timing capacitor *C1* discharges through the winding of relay *S1* and shunted resistor *R1*. When the discharge current of *C1* through relay *S1* drops below hold current value, relay *S1* releases.

6.13 The cycle is then repeated, causing relay *S1* to operate and release approximately 20 times per second. Resistor *R3* and capacitor *C8A* form a network to keep constant the dc voltage supplied to relay *S1*.

6.14 Direct current from the cathode of *V3* and ground from Micro Switch *D7* are also supplied to the pole-changing transfer contacts on relay *S1*.

6.15 Alternating polarity current at approximately 20 cycles per second is supplied to the Y terminal on jack *J1* through switch *D1*, or to Y terminal on jack *J2* through switch *D2*, and to the R terminals on both jacks *J1* and *J2* through a make contact on relay *S2*.

6.16 As ring cam *D7* is rotated by motor *MO1*, 20-cycle ringing current is maintained for 2 seconds and cut off for 4 seconds.

6.17 Upon release of switch *D1* or *D2* relay *S2* releases, opening the path for relay *S1* and terminating ringing current. Motor *MO1* runs to normal position under control of Micro Switch *D6*.

Dial Tone

6.18 When switch *D5* was operated to the ON position, 6.3-volt 60-cycle current was supplied from transformer *T3* to full-wave rectifier *CR1*. This rectifier produces 120 impulses per second dc, the ac component of which flows through capacitor *C3* and the primary of tone transformer *T1* producing a current approximating dial tone.

6.19 The tone current is fed from the secondary of transformer *T1* to a closed series circuit consisting of one-half of input transformer *T2*, capacitor *C4*, break contact of relay *S2*, terminals

GN to R of jack *J1* or terminals GN to R of jack *J2* (either or both receivers off hook), break contact of relay *S2*, and capacitor *C2*.

6.20 The dial tone is normally disabled by the break contacts on the dial tone switch *D4* in series with break contacts on Micro Switch *D8* shunting the secondary of *T1*.

6.21 When dial tone switch *D4* is operated, steady 120-cycle dial tone is impressed on the talking circuit of the telephone sets and the loudspeaker amplifier.

Busy Signal

6.22 The 120-cycle tone source described in 6.18 is also used for busy signal.

6.23 Upon operating busy tone switch *D3*, make contacts close a circuit for energizing motor *MO1* from the power line.

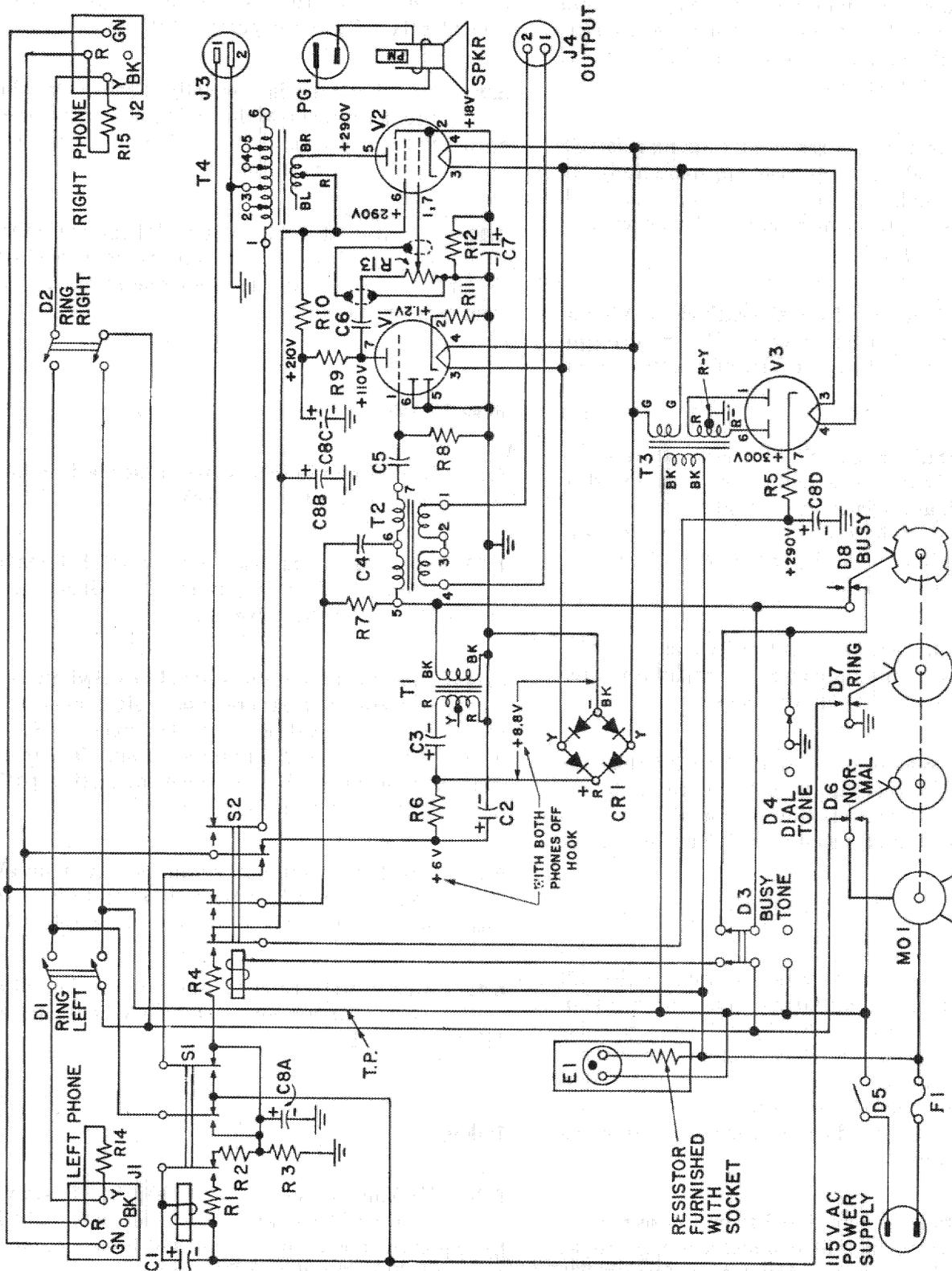
6.24 Break contacts on busy Micro Switch *D8*, actuated by a cam on motor *MO1*, open and close the tone-disabling path described in 6.19. The 120-cycle tone, interrupted to simulate busy tone, is supplied to the telephone set talking path and amplifier input of transformer *T2*.

6.25 Break contacts on switch *D3* shunt break contacts on Micro Switch *D8* to terminate busy tone instantly when switch *D3* is released.

6.26 Motor *MO1* runs to normal position (*D8* closed) under control of make contacts on Micro Switch *D6*.

Talking

6.27 Talking battery is furnished by full-wave rectifier *CR1* and filter network *R6-C2* through resistor *R7* and two sets of break contacts on relay *S2* to the R and GN terminals of *J1* and *J2*.



Note 1: R2 may also consist of two 3300-ohm, 2W, 5 per cent resistors in parallel or one 1600-ohm, 2W, 5 per cent resistor.

Fig. 6 — List 2 Wiring Diagram

TABLE A
PARTS LIST FOR THE LIST 2 TELETRAINER

Part	Type	Part	Type
C1 C2, 3 C4 C5, 6 C7 C8A, B, C, D CR1	8-uf, 450V capacitor 1000-uf, 12V capacitor 1-uf, 150V capacitor 0.01-uf, 300V capacitor 25-uf, 25V capacitor 20, 20, 20, 20-uf, 450V capacitor B-185581 selenium rectifier	R1 R2*, 4 R3 R5 R6 R7 R8	5600-ohm, 2W 5% resistor 3300-ohm, 2W 5% resistor 10K-ohm, 10W 10% resistor 390-ohm, 2W, 10% resistor 100-ohm, 2W, 10% resistor 150-ohm, 2W, 10% resistor 2-meg, 1/2W, 10% resistor
D1, D2 D3 D4 D5 D6, 7, 8	Switch DPST 216-M-ANO-73 Switch DPDT 316-73 Switch SPDT 112-M-A-73 Switch SPST T1116-73 Micro Switch No. BZRW84	R9 R10, 14, 15 R11 R12 R13 S1 S2	220K-ohm, 1/2W, 5% resistor 100K-ohm, 1/2W, 10% resistor 2700-ohm, 1/2W, 5% resistor 680-ohm, 2W, 5% resistor 1/2-meg, 1/2W potentiometer Advance 419Y-SPL-MG-3C-115VVD relay Advance 4195Y-SPL-TD-4C-115VA relay
E1 F1 J1, 2 J3 J4 MO1 PG1	NE51 neon pilot lamp Fuse, 2-amp, 250V WECO No. 404B-9 jack Jones S302AB socket Amphenol connector No. 80PC2F Cramer type 112 syn motor, 10-rpm, cw rotation, 115V 60~ with No. 1000 shaft Jones P302 CCT plug	SPKR T1 T2 T3 T4 V1 V2 V3	Speaker, Jensen P5-TX PM4-ohm VC Stancor P6134 transformer UTC H-8 transformer Stancor PC8418 transformer Stancor A3856 transformer 6AV6 electron tube 6AQ5 electron tube 6X4 electron tube

*R2 may also consist of two 3300-ohm, 2W, 5 per cent resistors in parallel or a 16-ohm, 2W, 5 per cent resistor.

6.28 The secondary of transformer T1 is short-circuited during the talking interval by break contacts on Micro Switch D8.

Loudspeaker

6.29 The amplifier V1-V2 is a conventional resistance-coupled, 2-stage circuit feeding a permanent magnet loudspeaker. Output level is controlled by potentiometer R13.

6.30 The loudspeaker voice coil, the plate battery supply, and the input circuit are opened by operation of relay S2 during the ringing interval.

6.31 Input signals to the amplifier are developed across resistor R7, shunted by capacitor C4, and one-half of the primary winding of transformer T2.

6.32 The entire primary of transformer T2 performs as a step-up autotransformer, feeding the grid circuit of electron tube V1.

External Recorder or Public Address System

6.33 Signals appearing across the primary of transformer T2 are coupled by the secondary winding to output jack J4. An external recorder or public address system may be connected to this jack.

7.00 CIRCUIT DESCRIPTION — KS-16161, LIST 4 TELETRAINER

7.01 Fig. 7, 8, and 9 are provided as an aid in clearing troubles in the list 4 unit.

- Power is the same as for list 2 (see 5.06).

Ringing

7.02 When RING LEFT switch D1 or RING RIGHT switch D2 is operated, a circuit is closed from the switch side of the line cord through a break contact on normal Micro Switch D6 through motor MO1 to the fused side of the line cord.

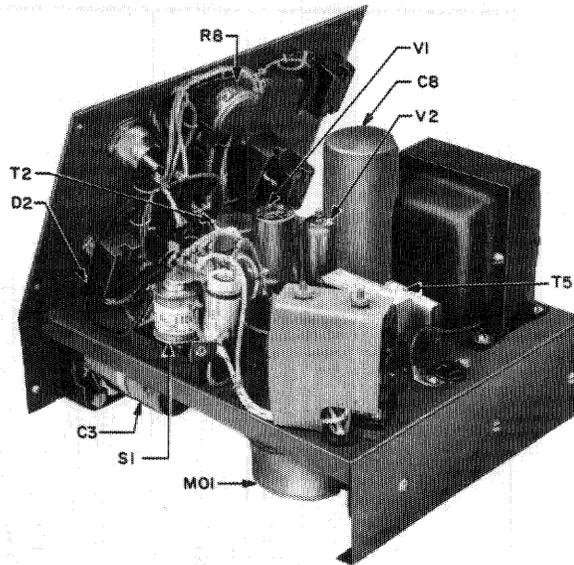


Fig. 7 — List 4 Top Assembly

7.03 Motor MO1 rotates, driving normal, ring, and busy cams. Rotation of the normal cam closes the contacts on the Micro Switch D6 which connects the motor MO1 directly to the unfused side of the line cord.

7.04 Switch D1 or D2 also bridges relay S1 across the power line through the normally made contacts of busy tone switch D3, causing S1 to operate.

7.05 The first set of break-make contacts of relay S1 removes the plate of electron tube V2 from the output of transformer T4 and connects it to Y of jack J1 through switch D1 or to jack J2 through switch D2.

7.06 High voltage from rectifier tube V3 is permanently connected to this normally open contact of S1 through resistor R2.

7.07 The second set of break-make contacts of relay S1 transfers ground from the cathode bypass capacitor C9 for tube V2 to R of jacks J1 and J2.

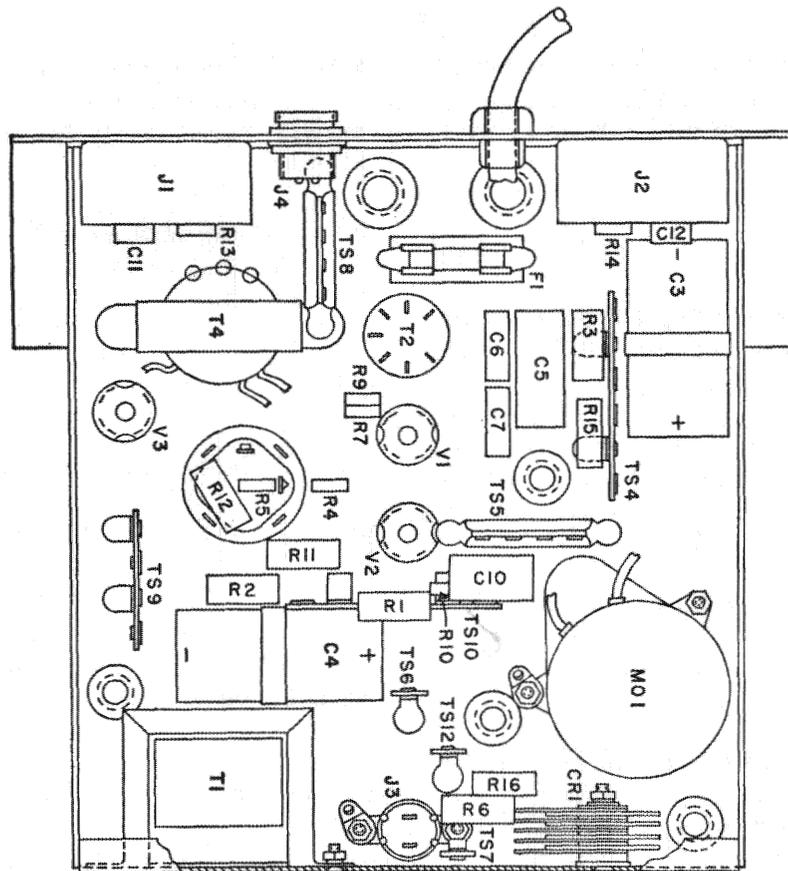


Fig. 8 - List 4 Parts Location, Underside Chassis

7.08 The third set of break-make contacts transfers the grid input of tube V2 from the volume control R8 to G of transformer T5.

7.09 The fourth set of break-make contacts grounds the cathode of tube V2 through make contacts of Micro Switch D7 when motor MO1 has advanced cam far enough to release arm of Micro Switch.

7.10 The primary winding of T5 forms a 20-cycle resonant circuit with capacitor C1.

7.11 The screen grid voltage of tube V2 is obtained from the cathode of rectifier tube V3 through resistor R1 and secondary of transformer T5.

7.12 Transformer T5, capacitor C1, the grid, and the screen grid of tube V2 form a 20-cycle oscillator.

7.13 This causes the voltage at the plate of tube V2 to vary at a 20-cycle rate.

7.14 This 20-cycle voltage is connected to Y of jack J1 or J2 through switch RING LEFT or RING RIGHT and causes the bells in the tele-trainer stations to ring. Capacitor C11 or C12 couples a portion of the ringing voltage to the telephone receiver to furnish audible ring-back signal.

7.15 As ring cam D7 is rotated by motor MO1, 20-cycle ringing current is maintained for 2 seconds and cut off for 4 seconds.

7.16 Upon release of switch D1 or D2 relay S1 releases, terminating ringing current. Motor MO1 runs to normal position under control of Micro Switch D6.

Dial Tone

7.17 When switch D5 was operated to the ON position, 6.3-volt 60-cycle current was supplied from transformer T3 to full-wave rectifier CR1 through resistor R16. This rectifier produces

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120 impulses per second, the ac component of which flows through capacitor *C4*, and the primary of tone transformer T1 produces a current approximating dial tone.

7.18 The circuit path for dial tone is as follows:

- From secondary winding of T1, through half of secondary winding of T2, then through capacitor *C5*.
- From capacitor *C5* to station jacks, terminal G; through telephone sets to station jacks, terminal R; to capacitor *C3*; then to secondary winding of T1.
- Another parallel path exists from capacitor *C5* through R15, to capacitor *C3*, then to secondary winding of T1.

7.19 The dial tone circuit is normally disabled by the break contact on the dial tone switch D4 in series with break contact on Micro Switch D8 shunting the secondary of T1.

7.20 When DIAL TONE switch D4 is operated, steady 120-cycle dial tone is impressed on the talking circuit of the telephone sets and the loudspeaker amplifier.

Busy Signal

7.21 The 120-cycle tone source described in 7.17 is also used for the busy signal.

7.22 Upon operating BUSY SIGNAL switch D3, make contacts close a circuit for energizing motor M01 from the power line.

7.23 Break contacts on busy Micro Switch D8, actuated by a cam on motor M01, open and close the tone disabling path described in 7.19. The 120-cycle tone, interrupted to simulate busy tone, is supplied to the telephone set talking path and amplifier input of transformer T2.

7.24 Break contacts on switch D3 shunt the break contacts on Micro Switch D8 to terminate busy tone instantly when switch D3 is released.

7.25 Motor M01 runs to normal position (D8 closed) under control of make contacts on Micro Switch D6.

Talking

7.26 Talking battery is furnished by full-wave rectifier CR1 and filter network R6-C3 through resistor *R3* to the R and GN terminals of jacks *J1* and *J2*.

7.27 The secondary of transformer T1 is short-circuited during the talking interval by break contacts on Micro Switch D8.

Loudspeaker

7.28 Amplifier V1-V2 is a conventional resistance-coupled, 2-stage circuit feeding a permanent magnet loudspeaker. Output level is controlled by potentiometer R8.

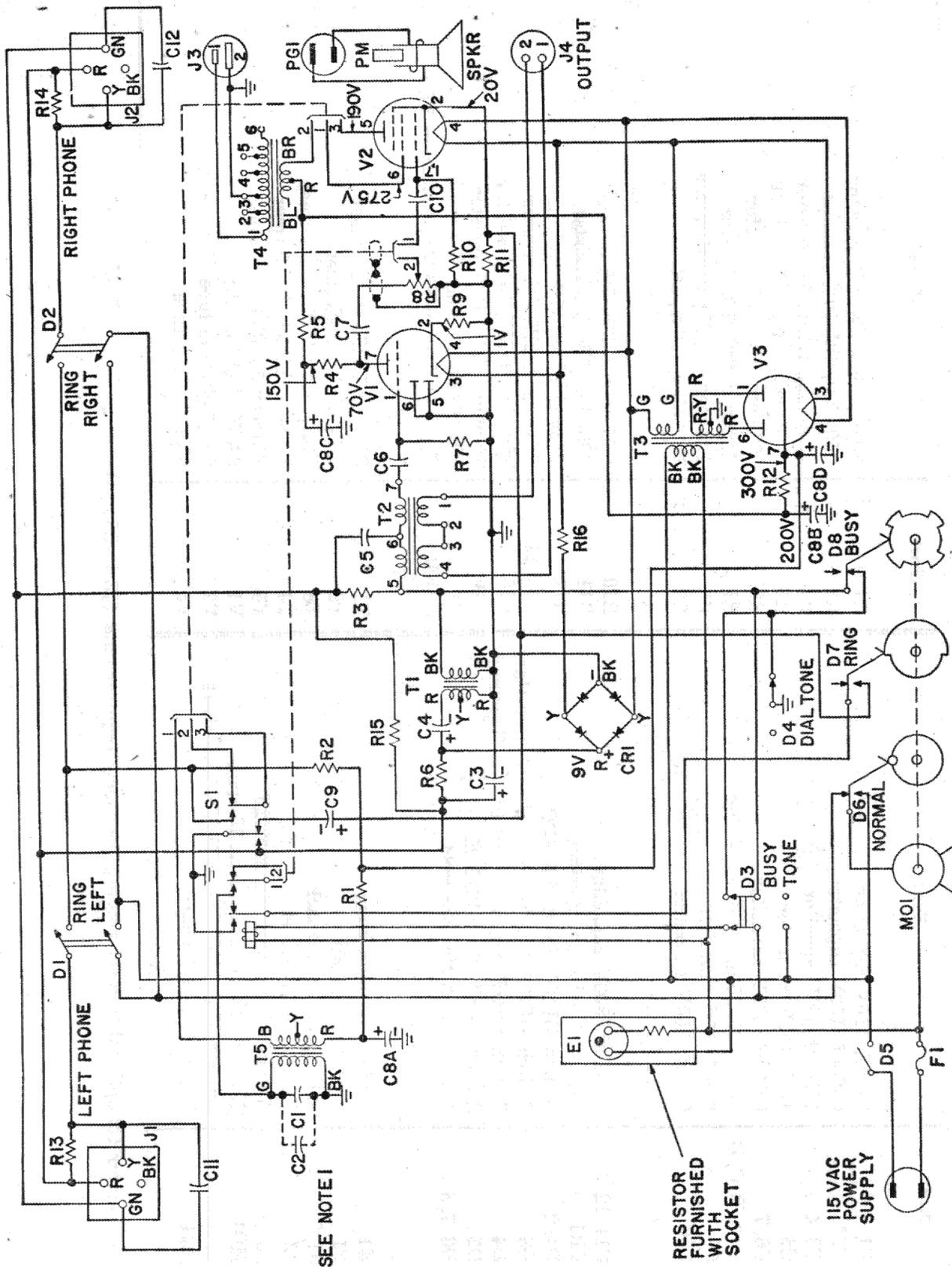
7.29 The T4 output transformer connection to the plate of V2 is opened by the operation of relay *S1* during ringing interval. This effectively disconnects the loudspeaker.

7.30 Input signals to the amplifier are developed across resistor *R3*, shunted by capacitor *C4*, and one-half of the primary winding of T2.

7.31 The entire primary of transformer T2 performs as a step-up autotransformer, feeding the grid circuit of electron tube V1.

External Recorder or Public Address System

7.32 Signals appearing across the primary of transformer T2 are coupled by the secondary winding to output jack *J4*. An external recorder or public address system may be connected to this jack.



SEE NOTE 1

RESISTOR FURNISHED WITH SOCKET

115 VAC POWER SUPPLY

Note 1: Capacitor C2 optional to meet ringing frequency requirements (18 to 25 cps).

Fig. 9 - List 4 Wiring Diagram

TABLE B
PARTS LIST FOR THE LIST 4 TELETRAINER

Part	Type	Part	Type
C1	0.5-uf, 150V capacitor	R1, 2	10,000-ohm, 2W, 5% resistor
C2*	0.25-uf, 150V capacitor	R3	150-ohm, 2W, 10% resistor
C3, 4	1000-uf, 12V capacitor	R4	0.22-meg, 1/2W, 5% resistor
C5	1-uf, 150V capacitor	R5	0.1-meg, 1/2W, 10% resistor
C6, 7	0.01-uf, 300V capacitor	R6	100-ohm, 2W, 10% resistor
C8A, B, C, D	20, 20, 20, 20-uf, 450V capacitor	R7	2-meg, 1/2W, 5% resistor
C9	50-uf, 25V capacitor	R8	1/2-meg, 1/2W potentiometer
C10	0.1-uf, 150V capacitor	R9	2700-ohm, 1/2W, 5% resistor
C11, 12	0.033-uf, 300V capacitor	R10	0.51-meg, 1/2W, 5% resistor
CR1	B-185581 selenium rectifier	R11	680-ohm, 2W, 5% resistor
D1, 2	Switch DPST No. 81055 SPC	R12	2430-ohm, 5W, 5% resistor
D3	Switch DPDT No. 81058 SPC	R13, 14	0.1-meg, 1/2W, 5% resistor
D4	Switch SPDT No. 81051 HSPC	R15	820-ohm, 1/2W, 10% resistor
D5	Switch SPST No. 81015 K	R16	15-ohm, 1/2W, 10% resistor
D6, 7, 8	Micro Switch No. BZRW84	S1	KS-16343, L1 relay
E1	NE51 neon pilot lamp	SPKR	Speaker, Jensen P5-TX, PM4-ohm VC
F1	Fuse, 2-amp, 250V	T1	Stancor P6134 transformer
J1, 2	WECo No. 404B-9 jack	T2	UTC H-8 transformer
J3	Jones S302AB socket	T3	Stancor PC8418 transformer
J4	Amphenol connector No. 80PC2F	T4	Stancor A3856 transformer
MO1	Cramer type 112 syn motor, 10-rpm, cw rotation, 115V 60~ with No. 1000 shaft	T5	Stancor A4705 transformer
PG1	Jones S302 CCT plug	V1	6AV6 electron tube
		V2	6AQ5 electron tube
		V3	6X4 electron tube

* Capacitor C2 optional to meet ringing frequency requirements (18 to 25 cps).