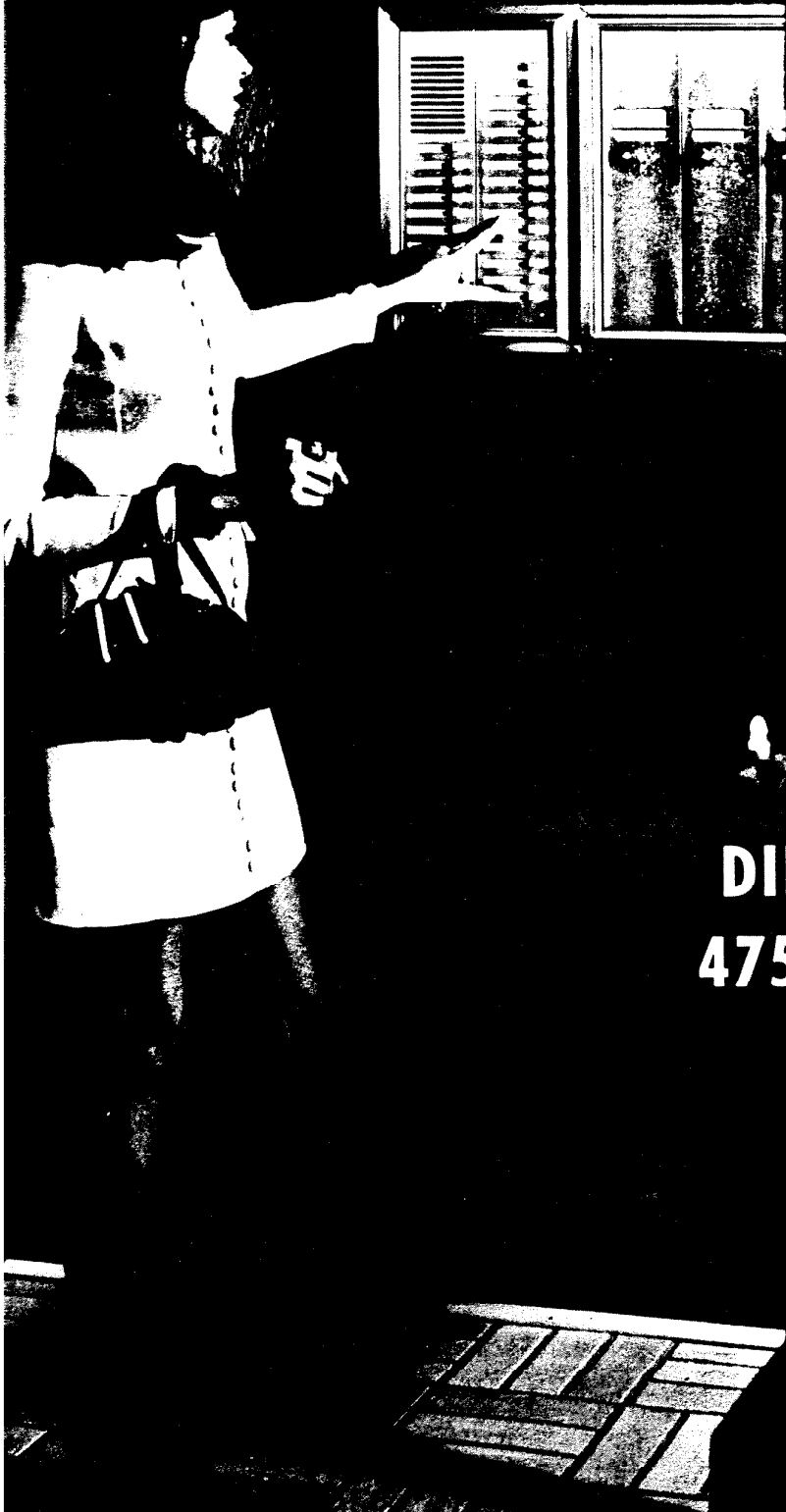


# NuTone

## SERVICE MANUAL



**DIRECT-A-COM SERIES 2  
475 CONTROL/AMPLIFIER**

**NuTone** **SCOVILL**  
DIVISION

Madison and Red Bank Rds., Cincinnati, Ohio 45227 U.S.A.

# **GENERAL DESCRIPTION DIRECT-A-COM SERIES #2 MODEL 475 CONTROL-AMPLIFIER AND MODEL 484 REMOTE SPEAKER**

The Model 475 Control-Amplifier is completely transistorized and designed for installation in the Entrance Directory or surface mounted at a remote location. Power is supplied by a NuTone Model 301N 16 VAC 30 VA which is also remotely mounted.

The Control-Amplifier uses a plug-in terminal board which allows the Control-Amplifier to be easily removed for service *without* disconnecting system wiring.

There is a built in volume control adjustment for volume of sound level throughout the entire system plus provision for selecting high or low level of tone signal.

## **SERVICING**

Removal of 475 if located in Entrance Directory, see Fig. 1.

- (1) Insert a narrow stiff card, paper clip, narrow metal ruler or similar tool between the panel and frame of Entrance Directory pushbutton panel next to speaker panel. Push down simultaneously on top and bottom latches while applying pressure to open panels. See Fig 1 & 2.
- (2) Amplifier is mounted to "A" housing as shown in Figure 3 with two sheet metal screws.
- (3) Remove the 4 sheet metal screws holding the terminal board on the Control/Amplifier. See Figure 4.
- (4) Unplug terminal board (with system wiring connected) from Control-Amplifier and set aside. Remove the two sheet metal screws holding amplifier to Directory "A" housing and remove Control- Amplifier.

## **OPERATION AND TESTING – SHOP SERVICE**

- (1) Test Terminal Board should be used for ease in wiring remote speaker, power connections and Lobby Speaker. NuTone Part #41057.
- (2) An auxiliary low voltage transformer is required to furnish power to the Control-Amplifier for testing. Connect 16 VAC from NuTone 301N Transformer or equivalent to terminal screws marked "16 VOLTS AC."
- (3) Connect test speaker to Lobby Speaker connections.
- (4) Connect twisted pair to A-1 and A-2 terminals and 1 pair to Negative and Positive terminals on Terminal Board from NuTone Model 484 Speaker. See Note.

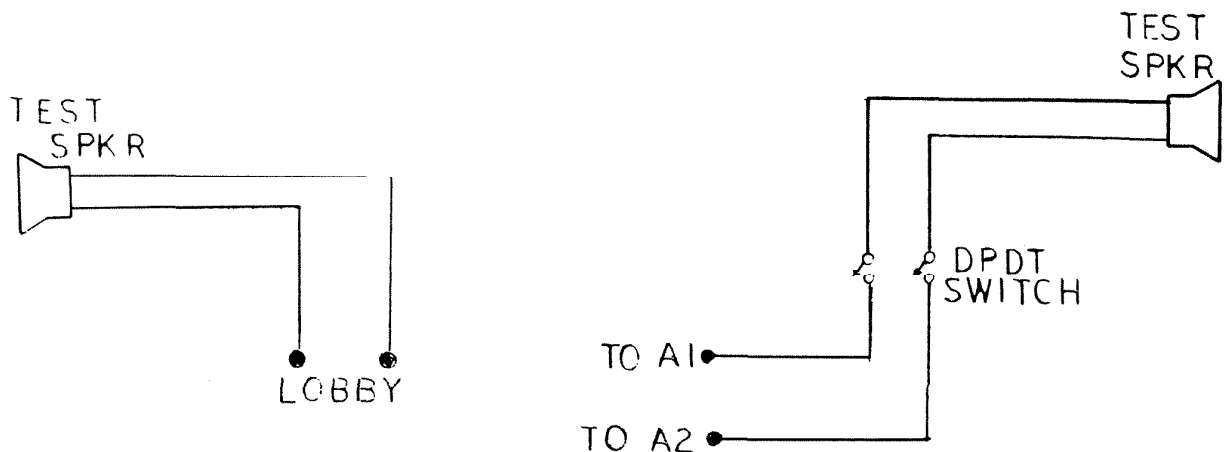
- (5) Voltage measurements and wave forms are shown on separate chart and all measurements should approximate those shown under each heading.

Should a NuTone model 484 Remote Speaker Assembly not be available, follow test procedure outlined below:

- (1) Connect test speaker across Lobby Terminals of terminal board.
- (2) Connect test speaker across A1 and A2 terminals on terminal board. A DPDT switch can be inserted as shown below to aid in controlling feedback until location of speakers as described in note can be accomplished.

NOTE: Feedback will indicate operation of system. However, in order to determine proper operation, that is, Lobby speaker to Apartment speaker and, Apartment speaker to Lobby speaker, the speakers should be separated physically as far from each other as possible in order to eliminate or reduce squeal (feedback). In actual installation these speakers are separated by wiring from Lobby to Apartments which could run 50 to 500 feet or more.

- (3) Place a 330K ohm resistor between the Positive and Negative terminals. This will simulate the Talk-Listen switch being placed in the "Listen" position. Voltages should correspond to those shown on the voltage chart under the appropriate heading.
- (4) Place a direct short across the Positive and Negative terminals on the terminal board or across the Positive and Negative buss. This will simulate Entry switch on Apartment Speaker being pushed to the "Entry #1" position. Again refer to the appropriate heading on the voltage chart.
- (5) Place a 47K ohm resistor between the Positive and Negative buss on the Control Board. This will simulate the Entry switch on the Apartment speaker being pushed to the "Entry #2" position. Refer to voltage chart under appropriate heading.



**A typical installation showing Riser Wiring – Directory Wiring – and a block diagram of Floor Riser Wiring is shown on pages 5 and 6.**

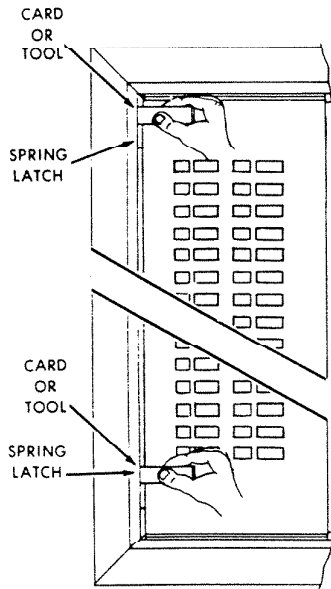


Fig. 1

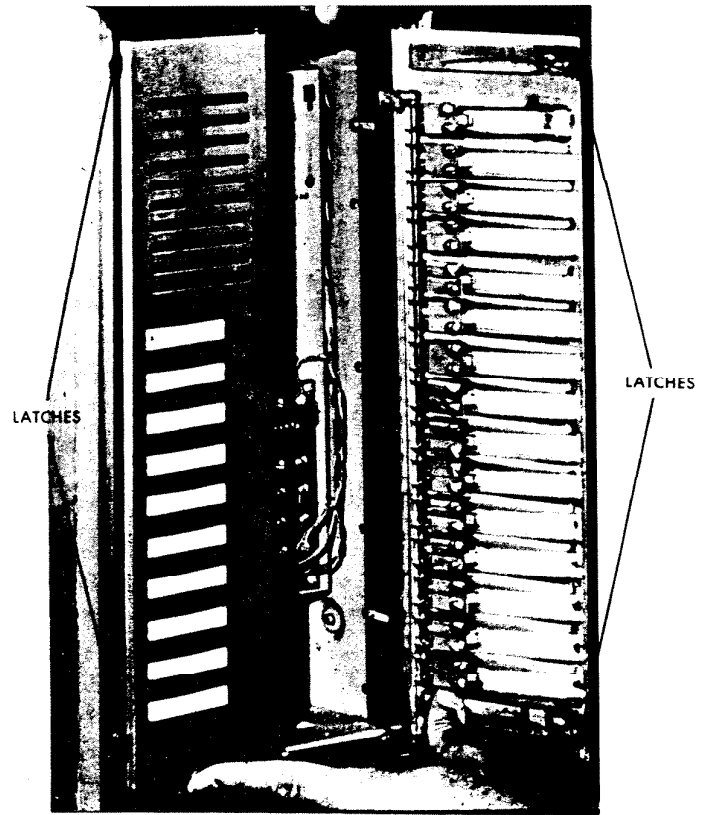


Fig. 2

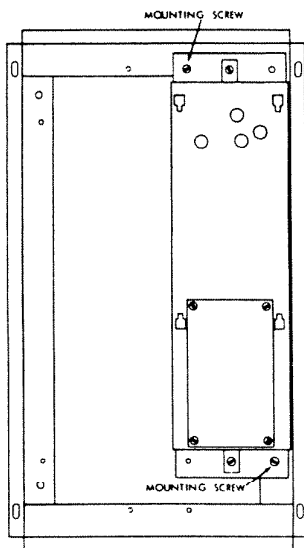


Fig. 3

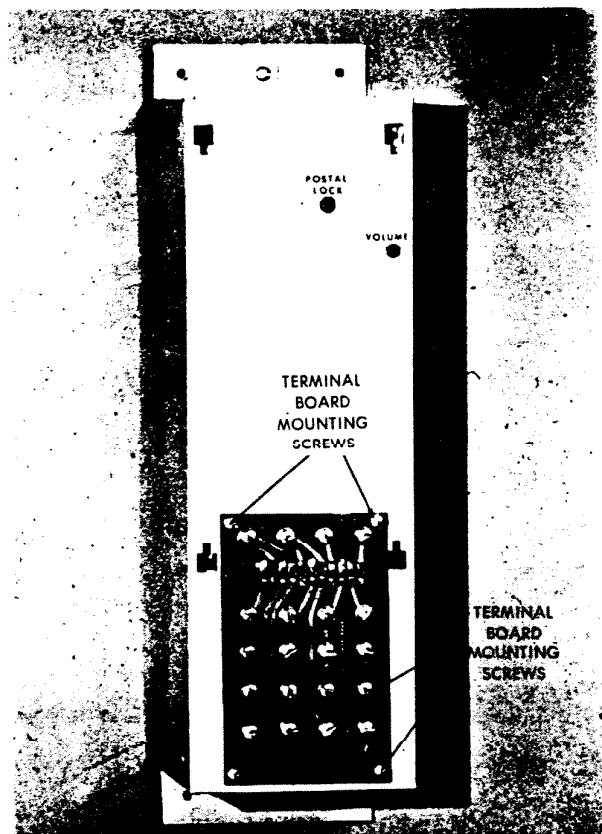


Fig. 4

## RISER WIRING DETAIL

### TYPICAL FLOOR RISER WIRING

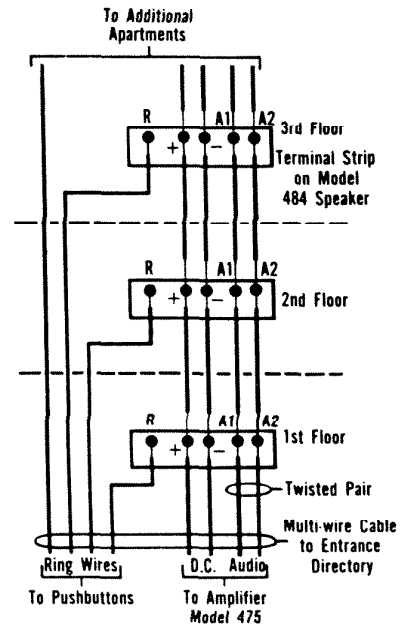
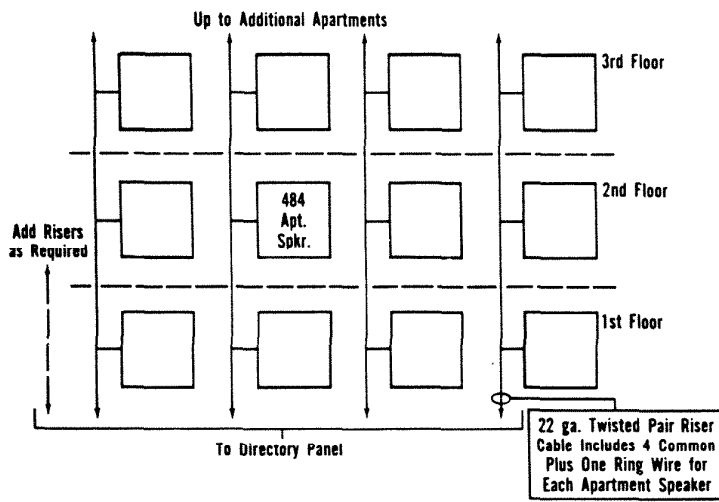


Fig. 5

### DIRECT-A-COM SERIES 2—TWO ENTRANCE DIRECTORY WIRING

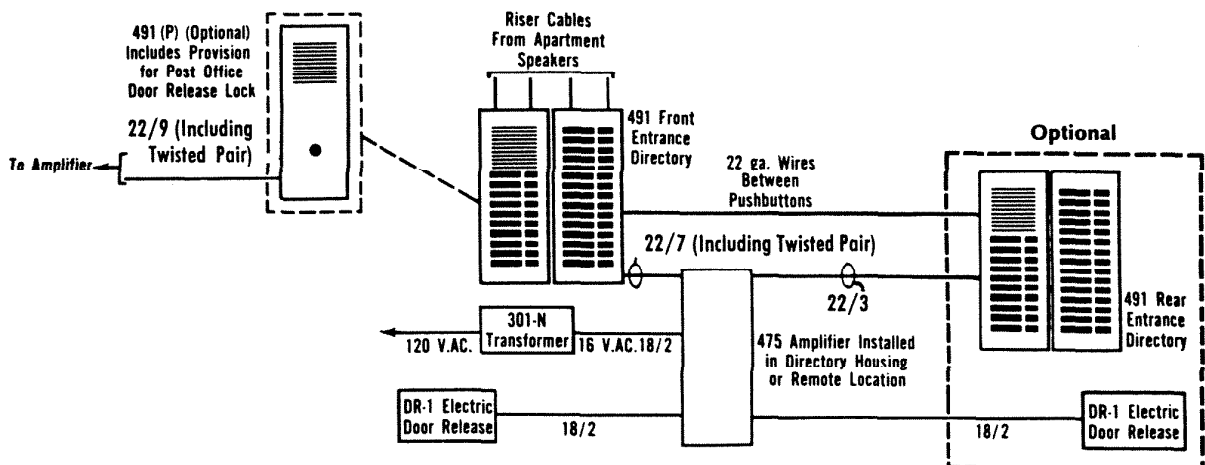


Fig. 6

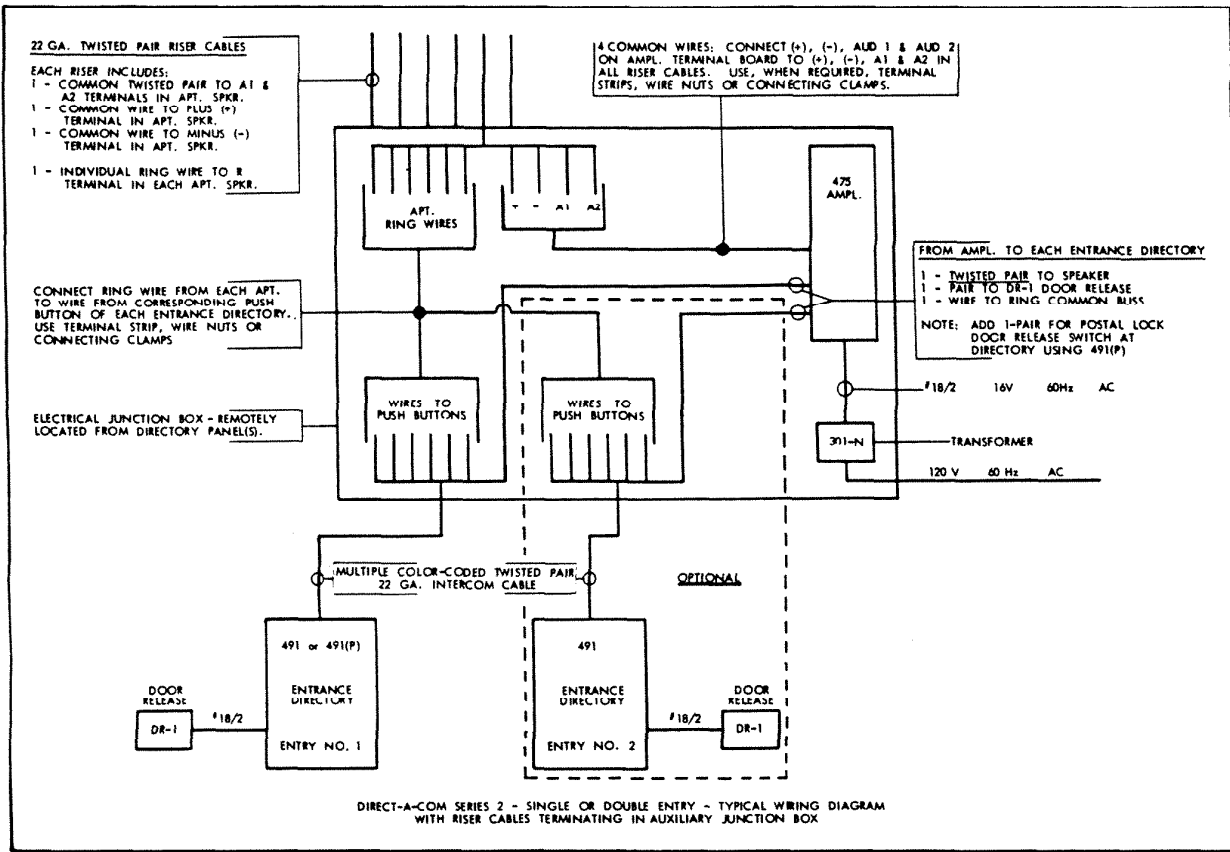


Fig. 7

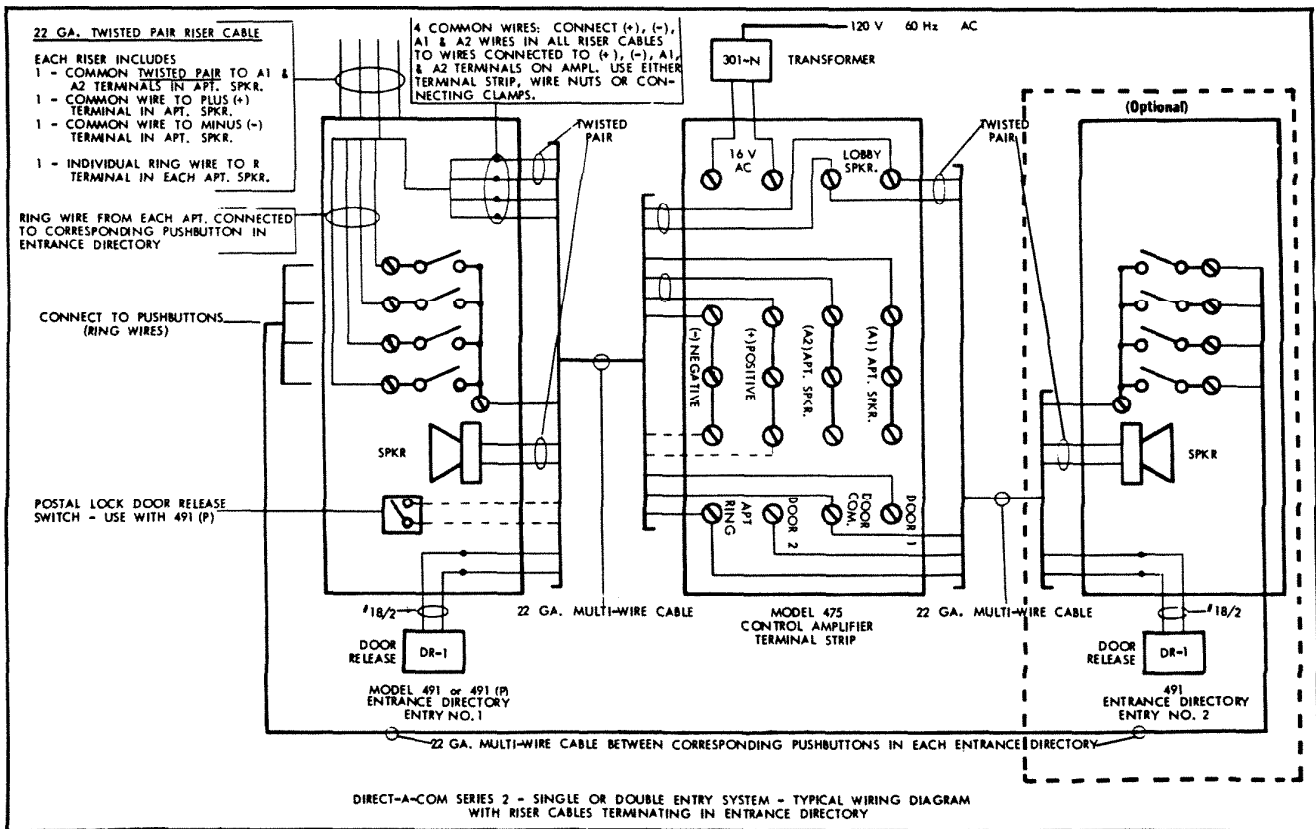


Fig. 8

## SHORT GLOSSARY OF TERMS USED IN SOLID STATE EQUIPMENT

<b>DEVICE:</b>	Transistor — SCR (Silicon Controlled Rectifier) — Diode FET (Field Effect Transistor) Zener Diode.
<b>DARLINGTON:</b>	Two Transistors in parallel.
<b>SATURATION:</b>	When the emitter and collector of a device are placed at the same potential.
<b>SCR:</b>	"Silicon Controlled Rectifier is a device to switch high current by low voltage pulses.
<b>ENERGIZE:</b>	A relay coil which has current going through it.

### SIMPLIFIED THEORY OF OPERATION

The Apartment speaker is connected to the normally open contacts of the Talk-Listen switch. The other set of contacts on the Talk-Listen switch are connected by way of the riser wiring to the A1 and A2 terminals on the Control/Amplifier terminal board which in turn connect to the input of the amplifier. The Entrance Directory speaker is connected to the Lobby Speaker terminals on the Control/Amplifier terminal board which in turn are connected to a set of contacts on the Relay, RY-1 which is located on the Control Board. These contacts are connected directly across the output of the amplifier when the relay is in a non-energized state.

The tone is generated by TR-10 and 11 which is a multivibrator circuit and this causes TR-12, which acts as a power gate, to allow oscillations to go through the apartment speaker cone. The volume of the tone is controlled by R-27. This is in a normally low mode and in order to increase the volume it is necessary to twist the resistor leads of R-27 together.

When the apartment speaker Talk-Listen switch is placed in the Talk position, the apartment speaker is then placed across the input terminals of the amplifier. When the Listen switch is depressed, R-64, which is between the Positive and Negative buss lines, generates a voltage across R-40 and R-45 which causes relay, RY-1, to energize and put the Entrance Directory speaker across the input terminals of the amplifier.

When Door Release #1 on the apartment speaker is activated, TR-14 conducts — allowing heavy current to flow through the emitter resistor, R-32. This places positive voltage on the emitter of TR-14, with respect to ground, which causes D-7 to conduct. This places positive voltage on the Gate of TR-13 (SCR-13) causing it to conduct and this energizes the door relay. Operation of Door Release #2 is identical except TR-21 and TR-18 (SCR-18) are involved.

## VOLTAGE CHART — TROUBLESHOOTING

As amplifier is transistorized, caution must be taken during servicing procedures to avoid accidental damage to transistors. Turn power to amplifier OFF before performing any soldering.

Use low voltage soldering equipment and solder or unsolder components as fast as possible.

A VTVM, with a DC scale of 0 to 1.5 volts, will be required to measure most transistor base and emitter voltages. Components should be removed from the circuit when making resistance measurements to avoid incorrect polarity battery voltage of the ohm-meter being applied to a transistor. It is also important to avoid inadvertently shorting circuit components.

### VOLTAGES UNDER "NO LOAD" CONDITION TONE GENERATOR OFF

TR-14 SEE NOTE 1			TR-15 SEE NOTE 1			TR-16 SEE NOTE 1			TR-17 SEE NOTE 2			TR-19/20 SEE NOTE 2 & 3			TR-21 SEE NOTE 1		
E	B	C	E	B	C	E	B	C	E	B	C	E	B	C	E	B	C
0	0	23.4	0	1.2	.67	0	.14	20.4	-2.9	-.33	-23.3	0	-.64	-23.4	0	0	23.4

### VOLTAGES WHEN TALK-LISTEN SWITCH IS PUSHED TO "LISTEN" POSITION

0	0	22.4	0	1.2	.69	0	.146	20	-2.82	-1.95	-22.8	0	-1.44	-.96	0	0	22.8
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### VOLTAGES WHEN DOOR RELEASE SWITCH IS PUSHED TO DOOR #1 POSITION

2.93	3.5	20	0	0	20	3.5	4.13	15.2	-6.85	-5.7	-22	0	-1.45	-.88	0	0	22
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### VOLTAGES WHEN DOOR RELEASE SWITCH IS PUSHED TO DOOR #2 POSITION

0	0	22	0	1.2	.71	0	.14	19.8	-3.1	-3.75	-3.3	0	-1.45	-.9	2.93	3.5	18.7
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Fig. 9

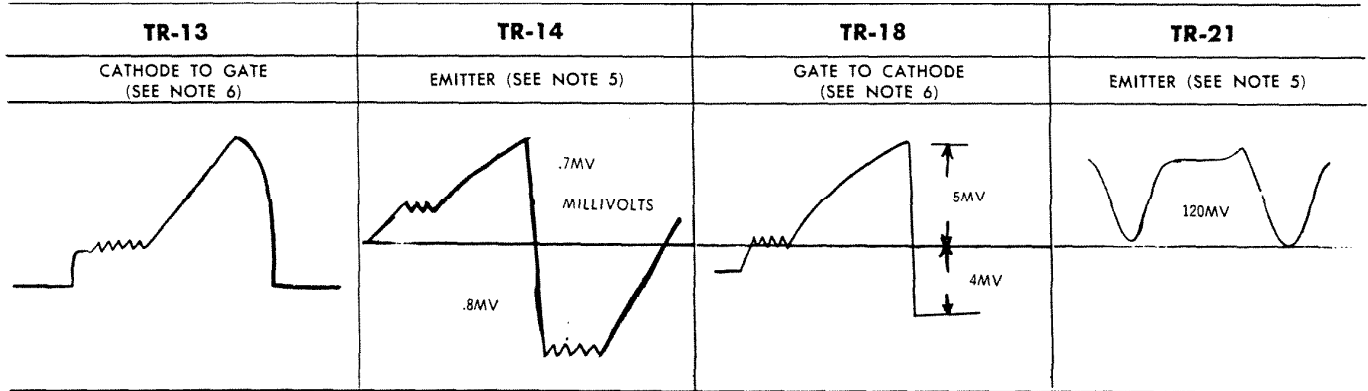
#### NOTES:

- (1) All voltages measured between B- and point under test.
- (2) All voltages measured between B+ and point under test.
- (3) Consider the two transistors as one Darlington.
- (4) Measured between B+ and point under test.
- (5) Measured across Emitter resistor, 'scope on AC, + & - halves not drawn to scale.
- (6) Measured between Cathode and Gate, 'scope on AC, minus 'scope lead on Cathode, Positive, portion of signal "up."

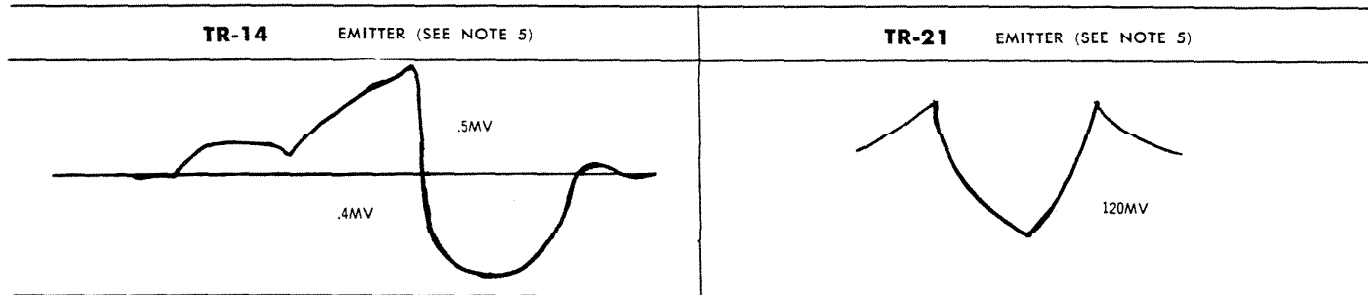


# WAVE FORMS FOR REFERENCE ONLY – NOT TO SCALE

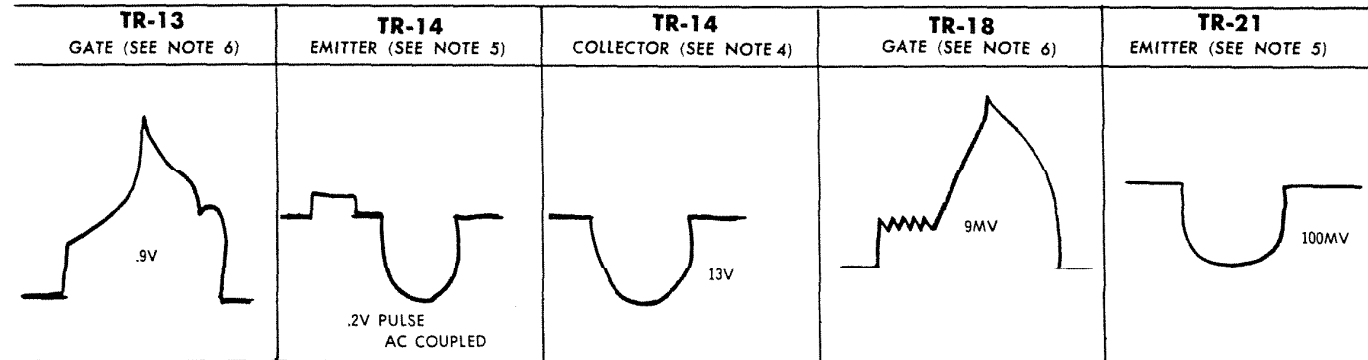
## CIRCUIT UNDER "NO LOAD" CONDITION



## TALK-LISTEN SWITCH ENERGIZED



## DOOR #1 OPEN



## DOOR #2 OPEN

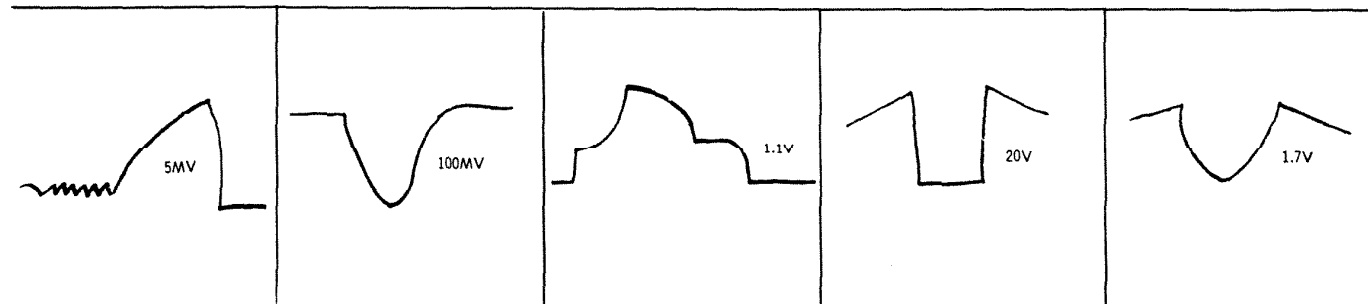


Fig. 10

# 475 CONTROL BOARD

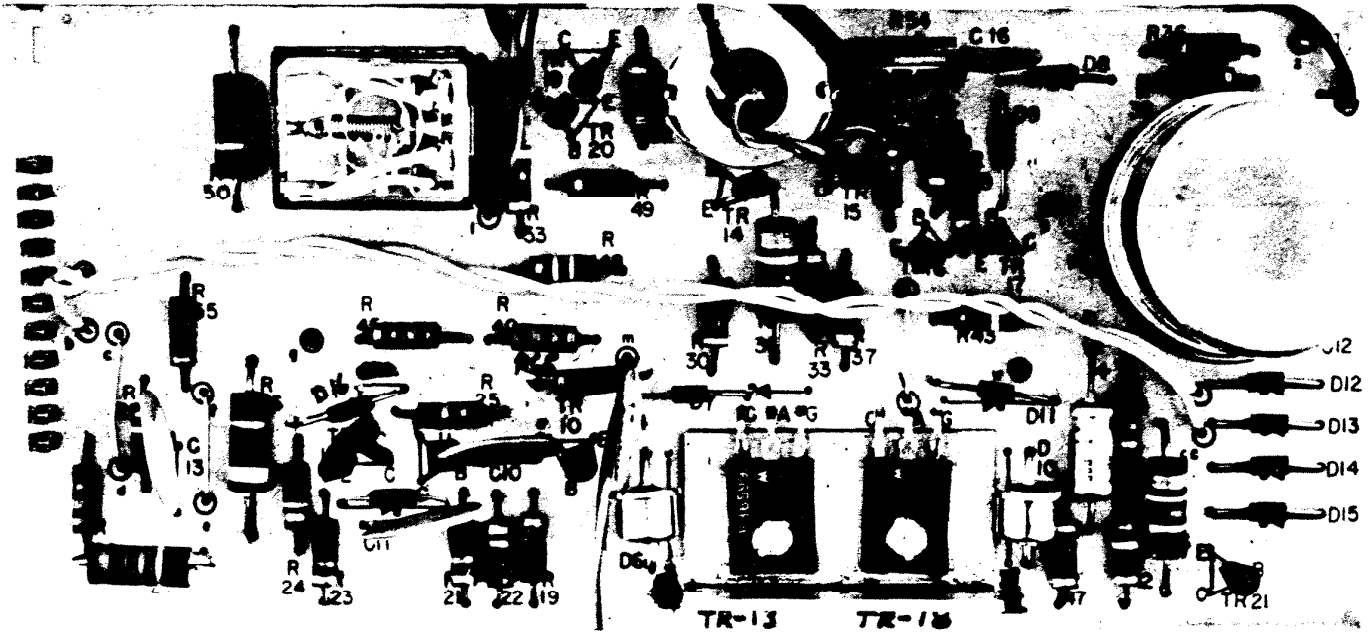


Fig. 11

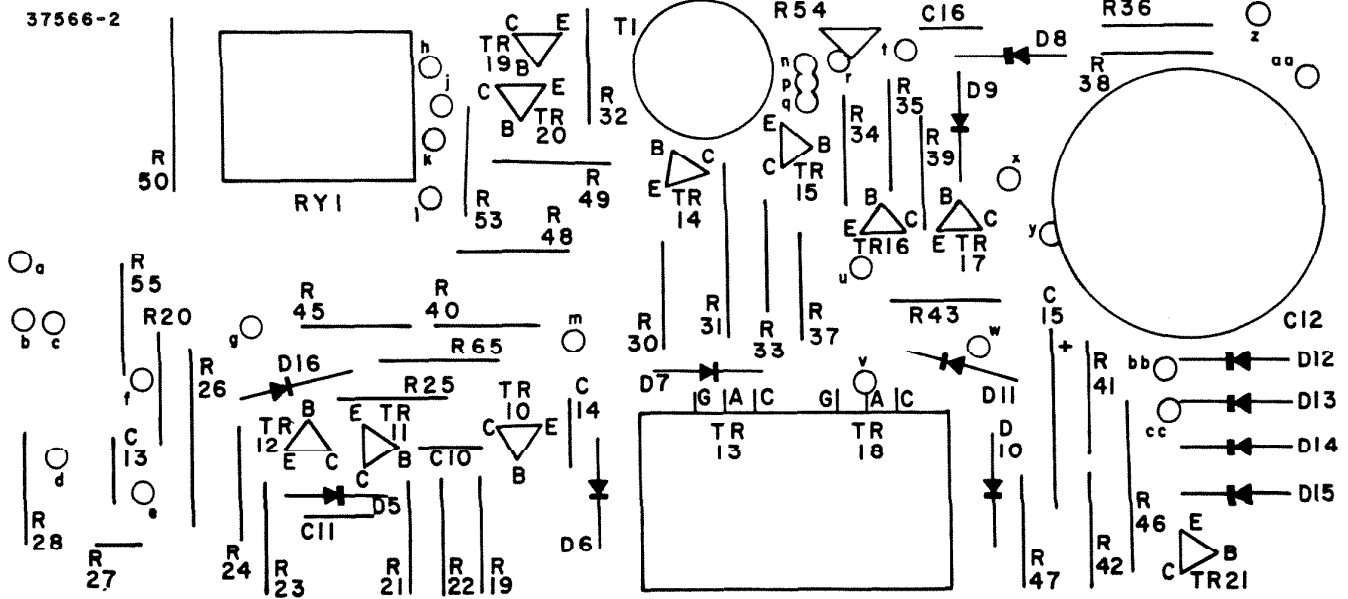


Fig. 12

# AMPLIFIER P/C BOARD

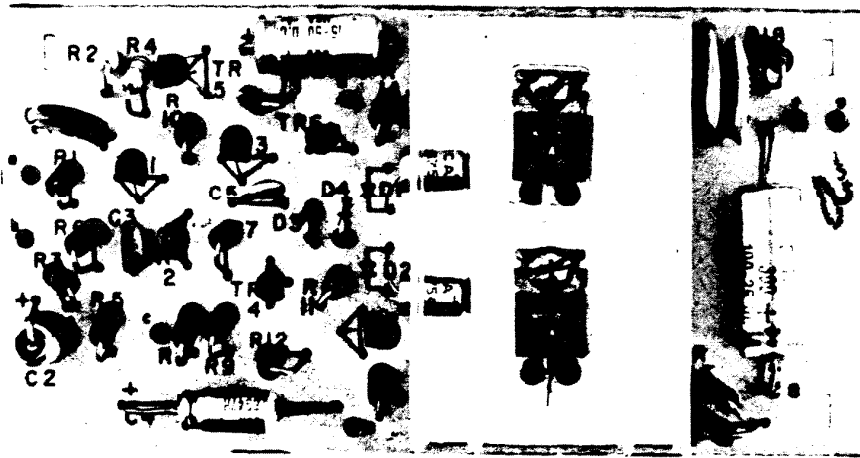


Fig. 13

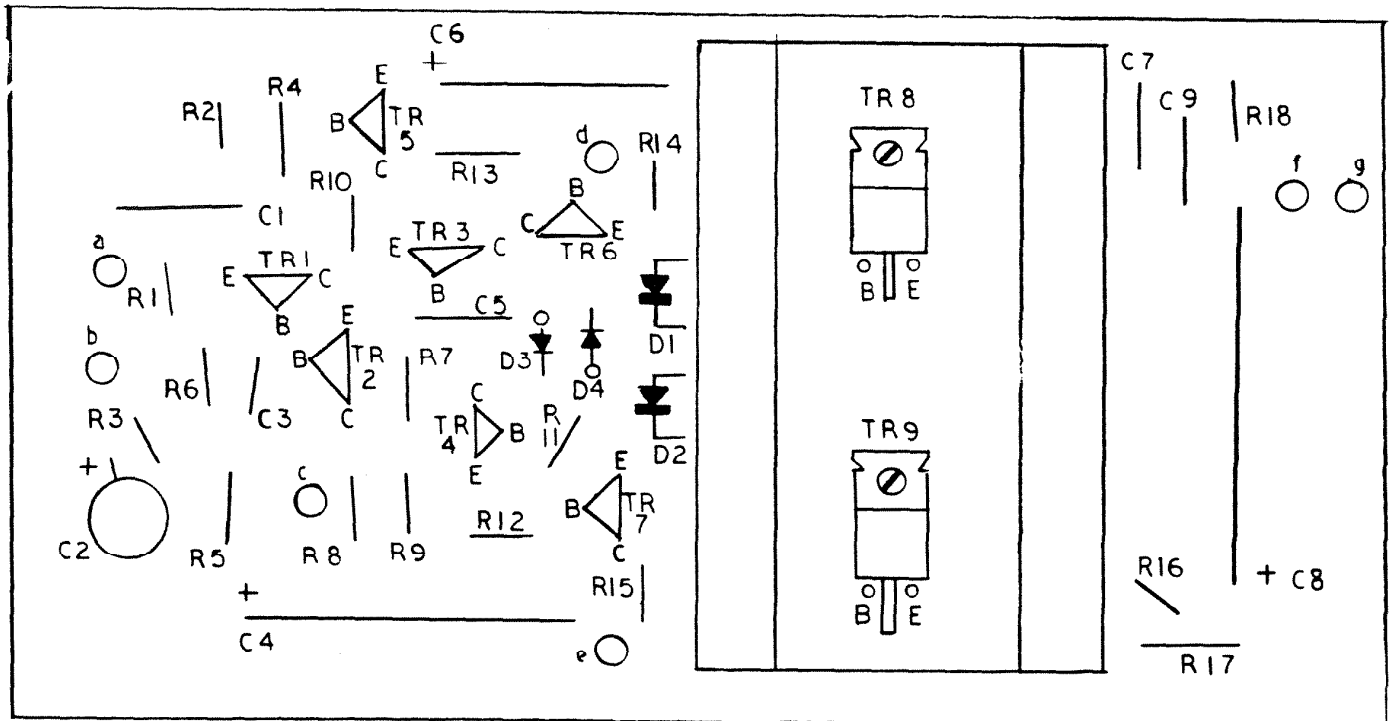
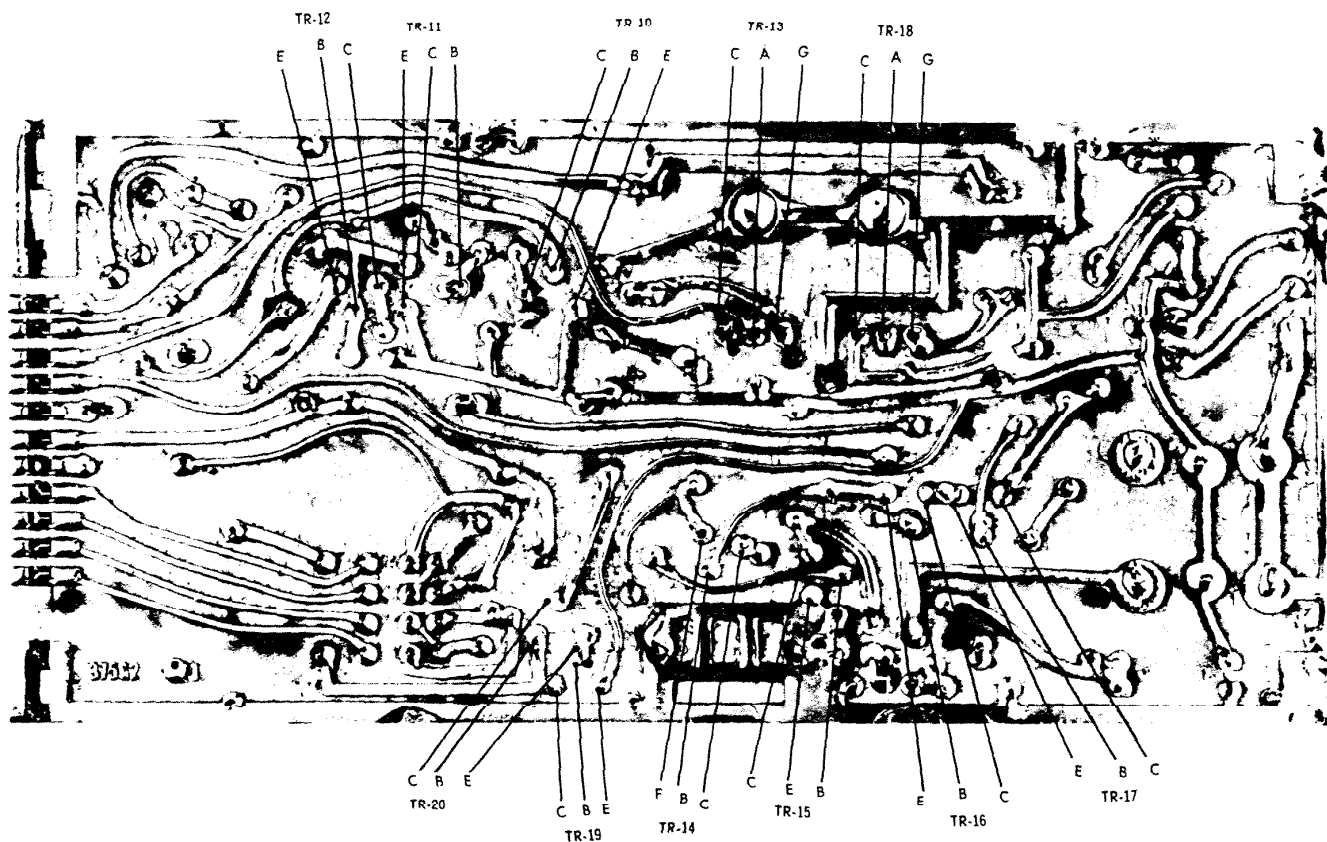
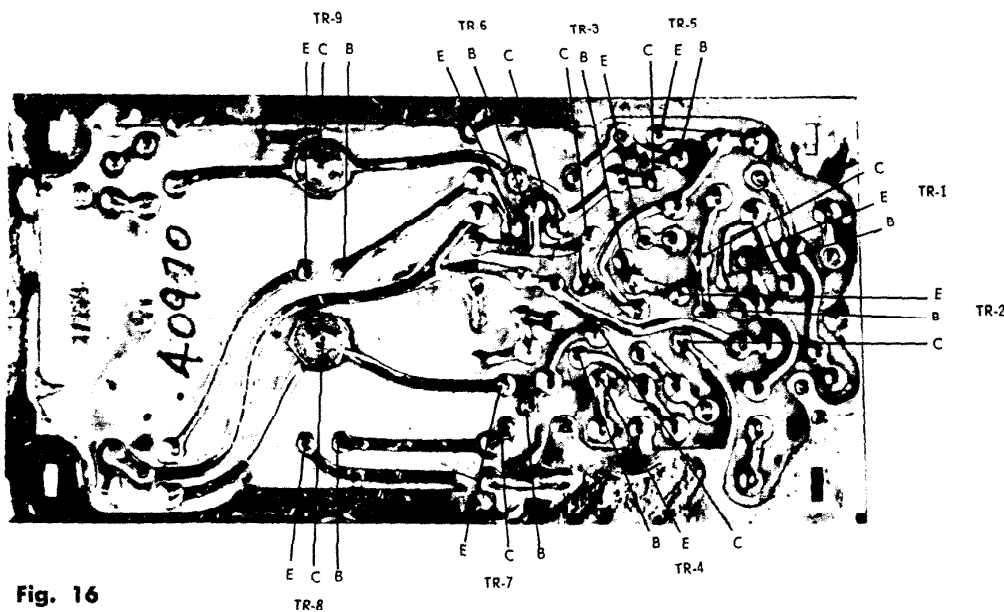


Fig. 14

**CALL OUTS FOIL SIDE 475 CONTROL BOARD**

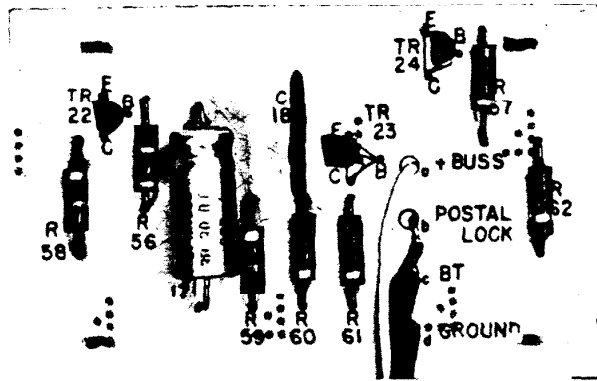


**CALL OUTS 475 AMPLIFIER**

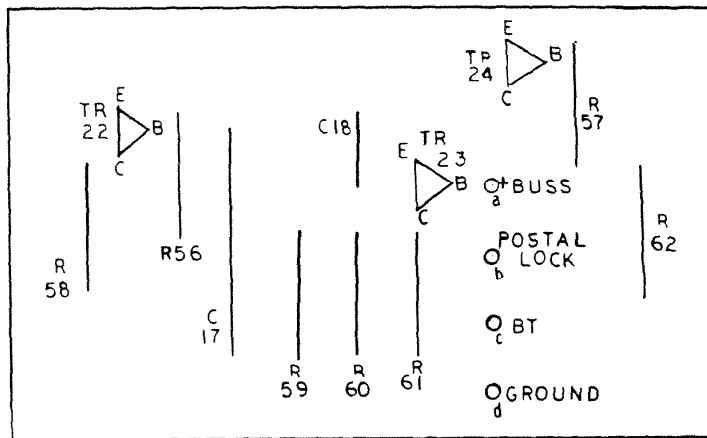


**Fig. 16**

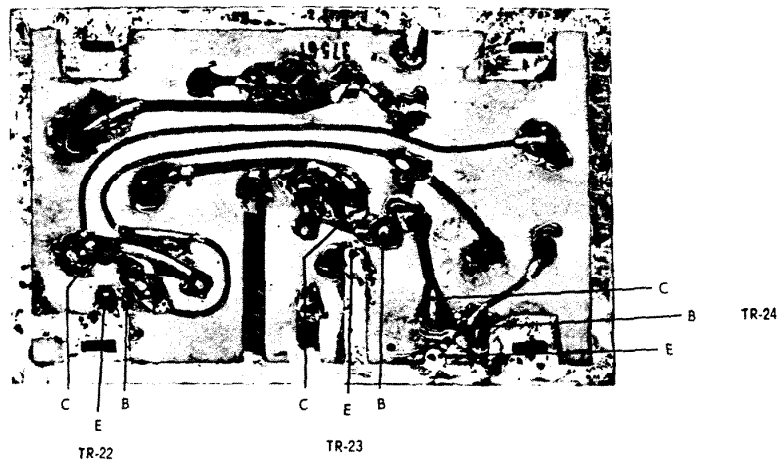
**POSTAL DOOR RELEASE ADAPTOR (OPTIONAL)**



**Fig. 17**

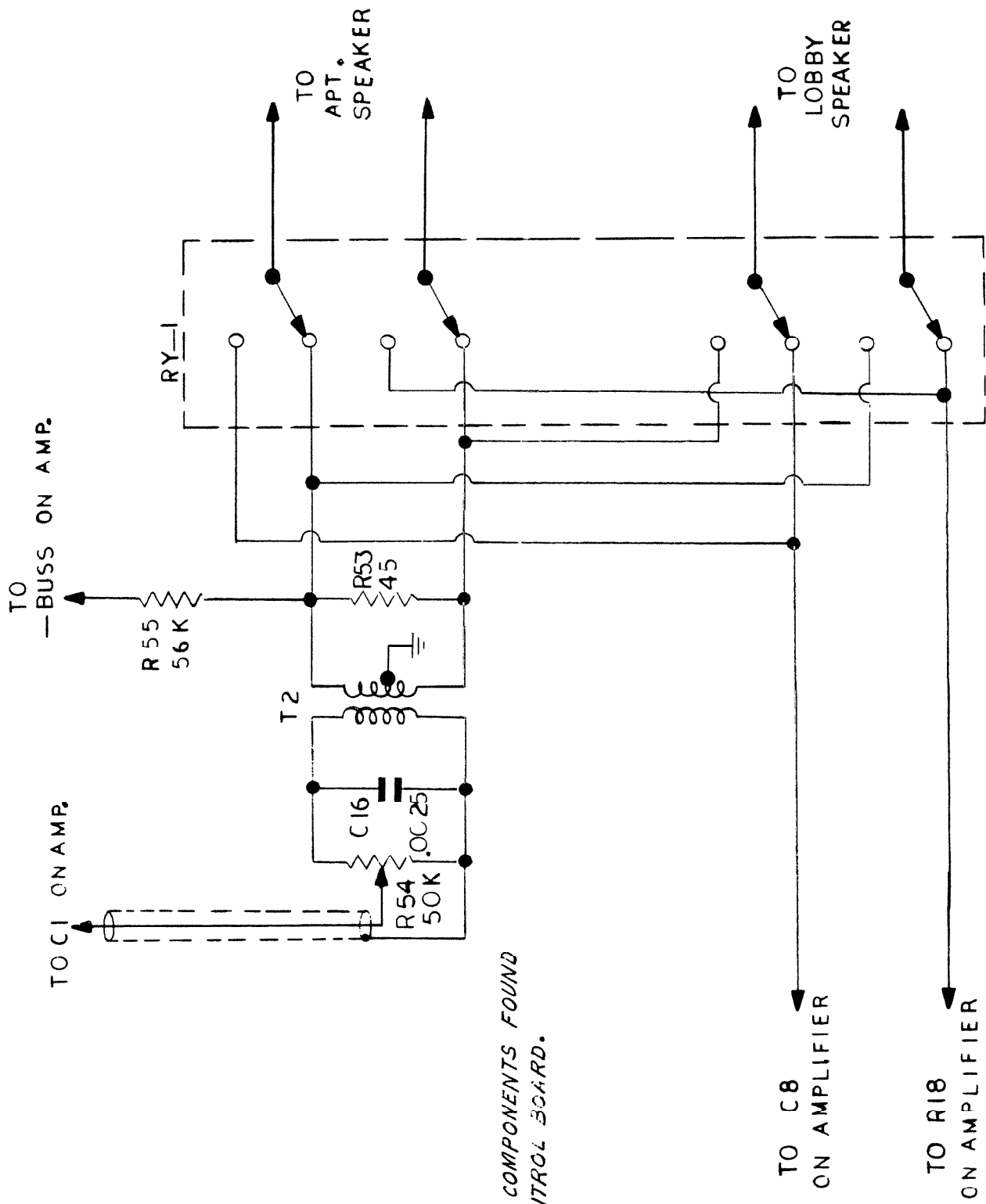


**Fig. 18**



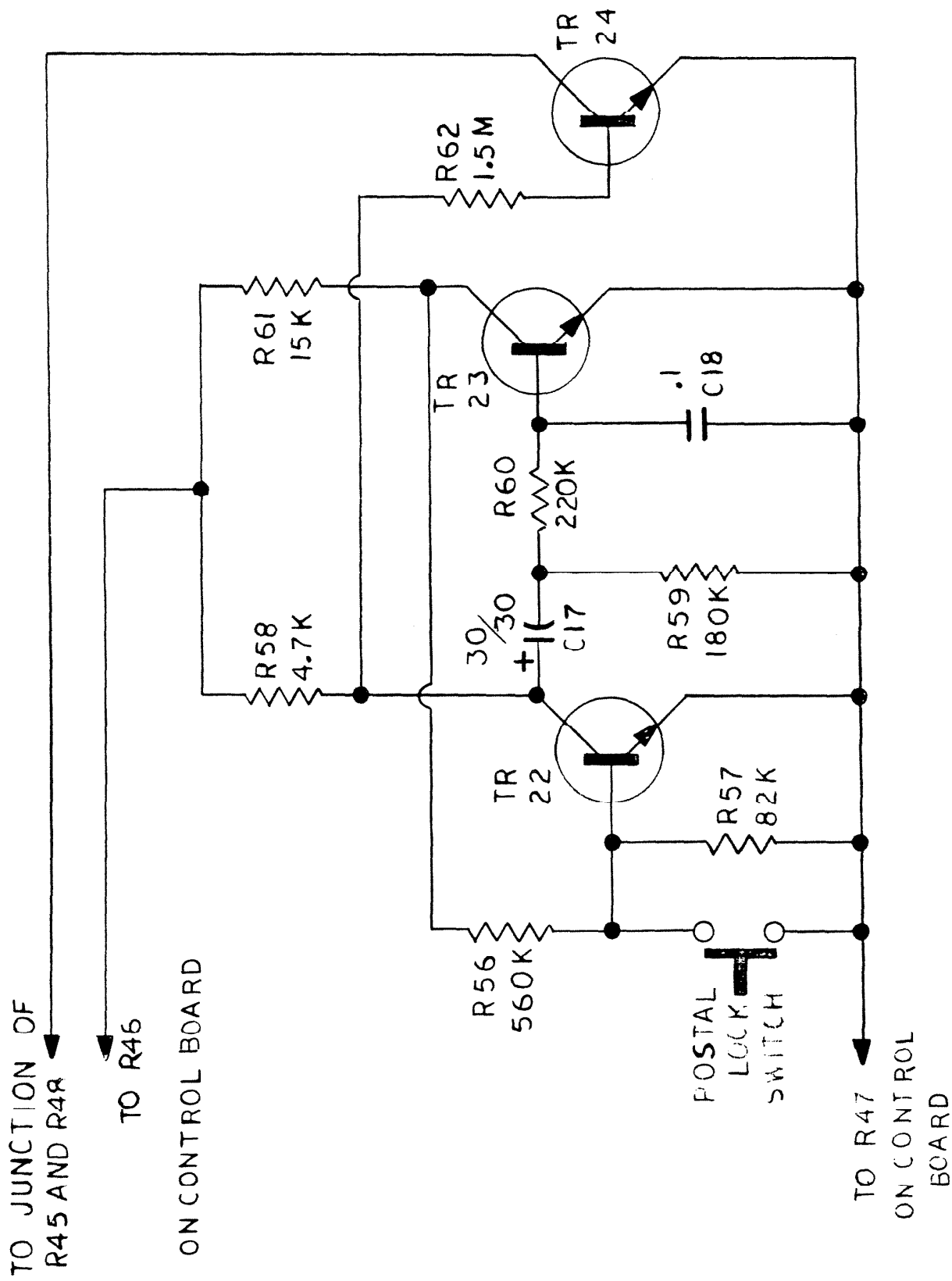
**Fig. 19**





**NOTE:**  
 THESE COMPONENTS FOUND  
 ON CONTROL BOARD.

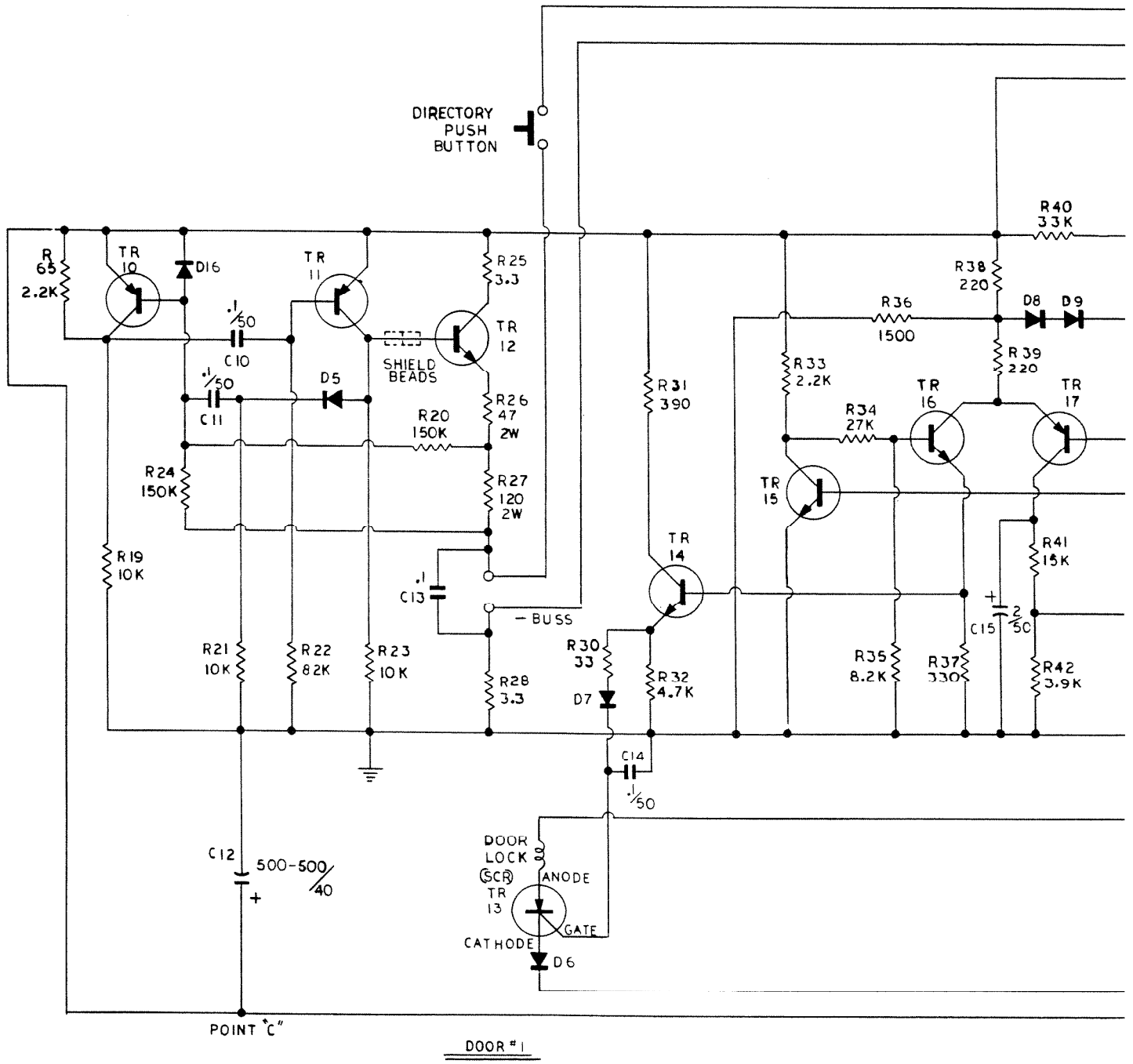
Fig. 21



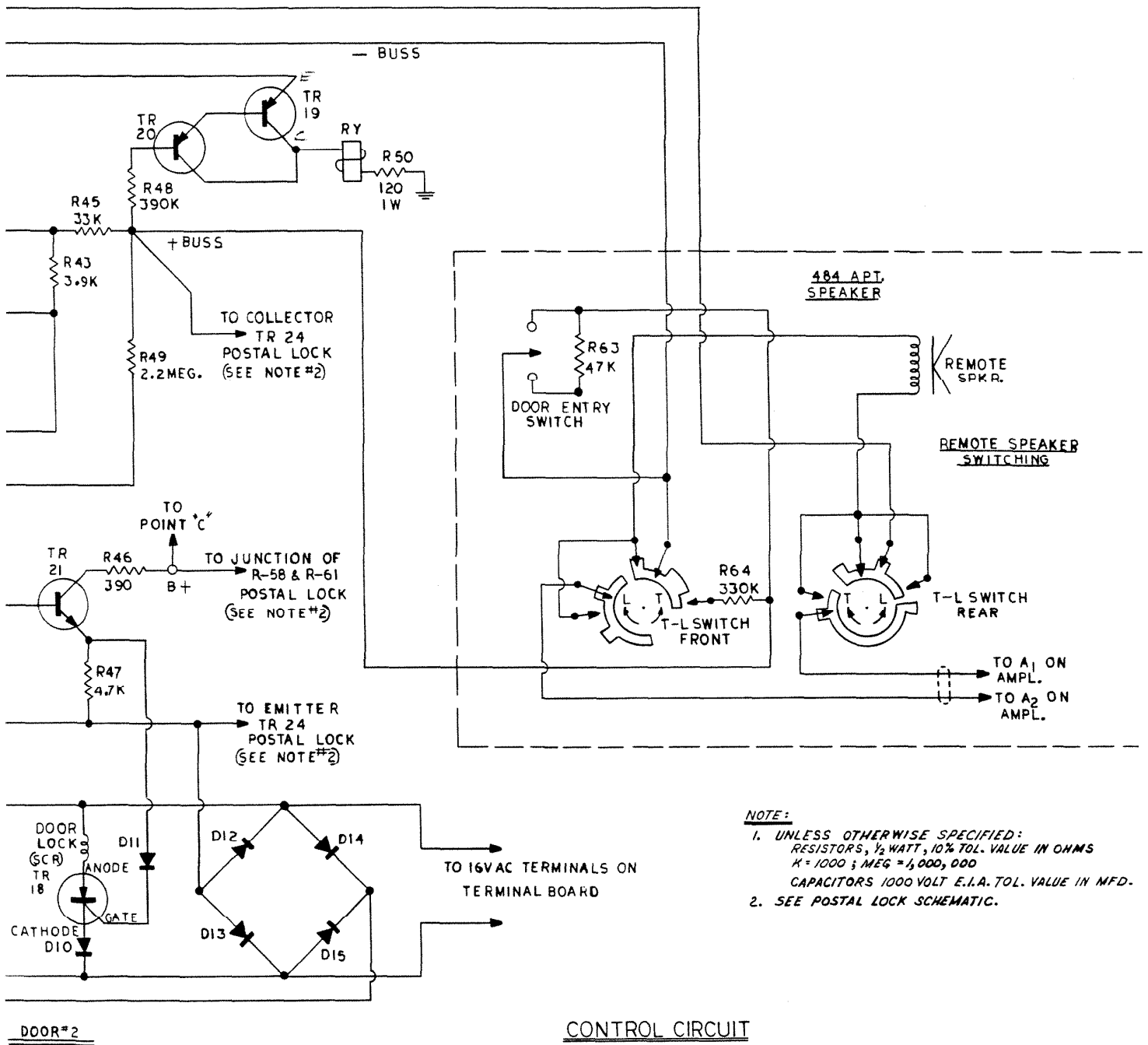
POSTAL DOOR RELEASE ADAPTOR (OPTIONAL)

Fig. 22





# 475 CONTROL



## BOARD SCHEMATIC

Fig. 23

## PARTS LIST — AMPLIFIER FOR MODEL 475 DIRECT-A-COM

REF. NO.	NUTONE PART NUMBERS	DESCRIPTION
<b>TRANSISTORS</b>		
TR-1	36580	Voltage Amplifier
TR-2	36577	Emitter Follower
TR-3	36577	Pre-Driver
TR-4	36580	Current Source
TR-5	36580	Electronic Filter
TR-6	36586 (Motorola SPS 1315)	Driver
TR-7	36587 (Motorola MPS 6517)	Driver
TR-8	36586 (RCA 40618)	Output
TR-9	36585 (RCA 40618)	Output
<b>DIODES</b>		
D-1	36589 (RCA IN 3754)	Bias Diode
D-2	36589 (RCA IN 3754)	Bias Diode
D-3	36549 (Motorola IN 4002)	Current Limiting Diode
D-4	36549 (Motorola IN 4002)	Current Limiting Diode
<b>CAPACITORS</b>		
C-1		.0027 MFD 50V
C-2		8 MFD 25V
C-3		150 PF
C-4		8 MFD 25V
C-5		10 PF
C-6		15 MFD 50V
C-7		.05 MFD 50V
C-8		100 MFD 25V
C-9		.05 MFD 50V
<b>RESISTORS</b>		
R-1		68K ohms
R-2		47K ohms
R-3		68K ohms
R-4		27K ohms
R-5		22 ohms
R-6		33K ohms
R-7		12K ohms 5%
R-8		10K ohms 10%
R-9		1.5K ohms 5%
R-10		47 ohms
R-11		68 ohms
R-12		82 ohms 5%
R-13		3.3K ohms
R-14		120 ohms
R-15		120 ohms
R-16		.33 ohms Wirewound
R-17		.27 ohms Wire
R-18		22 ohms

## PARTS LIST FOR MODEL 475 CONTROL/BOARD

REF. NO.	NUTONE PART NUMBERS	DESCRIPTION
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### TRANSISTORS

TR-10	36577	Multivibrator
TR-11	36577	Multivibrator
TR-12	36598 (Motorola MPS 6532)	Power Amp
TR-13	36599 (Motorola 2N4441)	Silicon Controlled Rectifier
TR-14	36586 (Motorola SPS 1315)	Driver for TR-13
TR-15	36590 (Motorola MPS A13)	Control for TR-13
TR-16	36580	Level Sensing
TR-17	36577	Level Sensing
TR-18	36599 (Motorola 2N4441)	Silicon Controlled Rectifier
TR-19	36587 (Motorola MPS 6517)	Relay Control
TR-20	36577	Relay Control
TR-21	36586 (Motorola SPS 1315)	Driver

### DIODES

D-5	36553	Wave Shaping Diode
D-6	36600 (Motorola IN 4719)	Ballast Diode
D-7	36549 (Motorola IN 4002)	Gate Protection Diode
D-8	36553	Base Clamping Diode
D-9	36553	Base Clamping Diode
D-10	36600 (Motorola IN 4719)	Ballast Diode
D-11	36549 (Motorola IN 4002)	Gate Protection Diode
D-12	36549 (Motorola IN 4002)	Silicon Rectifier
D-13	36549 (Motorola IN 4002)	Silicon Rectifier
D-14	36549 (Motorola IN 4002)	Silicon Rectifier
D-15	36549 (Motorola IN 4002)	Silicon Rectifier
D-16	36553	Base Clamping Diode

### CAPACITORS

C-10		.1 mfd 100V
C-11		.1 mfd 100V
C-12	35083	500/500 40V
C-13		.1 mfd 100V
C-14		.1 mfd 100V
C-15	35068-106	2 mfd 50V
C-16		.0027

### RESISTORS

R-19		10K ohms
R-20		150K ohms
R-21		10K ohms
R-22		82K ohms
R-23		10K ohms
R-24		150K ohms
R-25		3.3 ohms
R-26		47 ohms 2 watt
R-27	Hi and Low Tone-Volume Control	120 ohms 2 watt
R-28		3.3 ohms

## PARTS LIST (Cont'd.)

REF. NO.	NUTONE PART NUMBERS	DESCRIPTION
<b>RESISTORS Con't.</b>		
R-30		33 ohms
R-31		390 ohms
R-32		4.7K ohms
R-33		2.2K ohms
R-34		27K ohms
R-35		8.2K ohms
R-36		1500 ohms
R-37		330 ohms
R-38		220 ohms
R-39		220 ohms
R-40		33K ohms
R-41		15K ohms
R-42		3.9K ohms
R-43		3.9K ohms
R-45		33K ohms
R-46		390 ohms
R-47		4.7K ohms
R-48		390K ohms
R-49		2.2 Meg. ohm
R-50		120 ohms 1 watt
R-53		47 ohms
R-54	34041 Potentiometer	50K ohms
R-55		56K ohms
R-65		2200 ohms
<b>RELAY</b>		
RY-1	39038	4P DT
<b>TRANSFORMER</b>		
T-1	30544	Input

Parts may be ordered — by NuTone part number, direct from our factory — at the following address.

NuTone — Division of Scovill  
P. O. Box 27  
Cincinnati, Ohio 45227

Our minimum service parts order is \$2.00. Allow (2) weeks for filling your service parts order at the factory.