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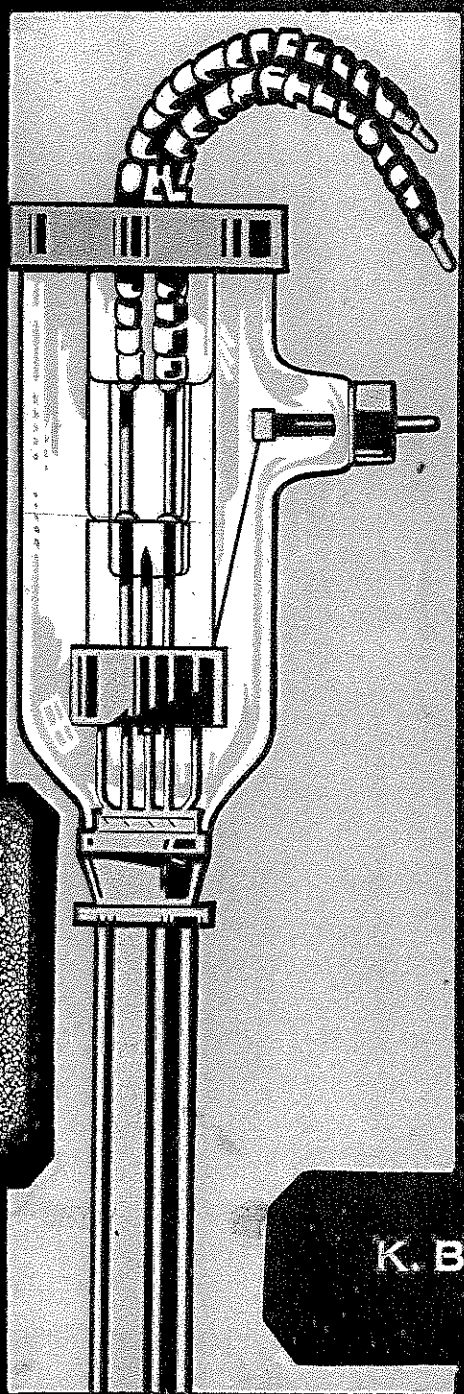

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COLLINS 12H

SPEECH INPUT ASSEMBLY

★

Instruction Book

★

MANUFACTURED BY

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA, U.S.A.

PRICE TEN DOLLARS

INSTRUCTIONS

For

COLLINS 12H

CONSOLE SPEECH INPUT ASSEMBLY

Serial No. 3409-12

Manufactured for RADIO STATIONS WHBY-WTAQ

GREENBAY, WISCONSIN.

By

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA, U. S. A.

COLLINS

COLLINS TYPE 12H SPEECH INPUT ASSEMBLY

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I INTRODUCTION

This instruction book includes description and directions for installation, operation and maintenance of the Collins type 12H Console Speech Equipment and associated apparatus listed below.

The equipment described is a complete studio speech input system for any installation where not more than four microphones, two sets of transcription equipment and six remote lines are to be used. These facilities may be extended by addition of external switching devices. Correspondence with the factory is invited with regard to special problems of this nature.

The 12H is ideally suited for the small station requiring an inexpensive arrangement for one, two or three studios, and is equally desirable for the larger station requiring complete and compact equipment for each of its several studios.

The 12H is completely powered from a 110/120 volt, 50/60 cycle line by means of the 409D Isolation Unit included.

II DESCRIPTION

EQUIPMENT INCLUDED

The apparatus included in the term "12H Console Type Speech Input Equipment", designated by the code word YARJA, is as follows:

1 - 12H Console
2 - Removable end covers for above (one right, one left)
1 - 409D Isolation Unit and Cover
1 - Interconnecting Cable
1 - 110 Volt Power Input Cable
2 - Warning Light Control Relays
1 - 6K5G Tube
2 - 6C5G Tubes
6 - 6J7G Tubes
2 - 41 Tubes
2 - 2A3 Tubes
1 - 5Z3 Tube
3 - Collins 66A-P3 Plugs
1 - Instruction Book

Microphones, cables, plugs, tubes, spare parts and other accessories are in stock at the factory. Orders for these items will receive prompt attention.

SPECIFICATIONS

Number of Mixing Positions: Six, arranged to control simultaneously four microphones, two sets of transcription equipment, and any one of six remote or chain program lines.

Gain Per Channel: The overall gain through each microphone circuit is approximately 104 db. Zero level output can be obtained at any input level greater than -70 decibels to the transcription input terminals, and -50 decibels to any one of the remote line input terminals.

Controls: The four microphone mixing controls and the remote line control are low impedance ladder type attenuators. The transcription control is a dual potentiometer type fader. The master program gain control is a high resistance step-by-step potentiometer. All controls have a uniform attenuation of 2 db per step, and a range of 45 db, with a full "off" position.

DESCRIPTION

Volume Indicator: A large copper oxide rectifier type meter is used with scale 3-3/8" long, calibrated -10/0/+6 db. The pointer action is high speed, for accurate program monitoring. Range extension from 0 to plus 20 db in 2 db steps is provided, with an additional "off" position.

Input Control Keys: A two position key associated with each mixing position serves to connect the output of that control to the program amplifier, to the audition amplifier, or to disconnect the circuit entirely. All circuits are properly terminated at all times.

Remote Line Input: Three keys are arranged to connect any one of six incoming lines to the input of the "REMOTE" mixing control on the panel.

Other Controls on Panel: The "MONITOR" input key allows the monitor/audition amplifier to be operated from the audition output of the mixing panel, or to be operated as a monitor amplifier bridged across the program circuit.

The "OUTPUT" key connects the output of the program amplifier to either of two outgoing lines.

The "PHONES" key connects the headphone monitor jack across the output of the program amplifier or across any one of the six incoming remote lines.

The "MONITOR GAIN" is a high resistance potentiometer gain control in the monitor amplifier channel.

A power switch is also mounted on the panel.

Tubes: Fourteen. 6 type 6J7G; 1 type 6K5G, 2 type 2A3, 2 type 41; 1 type 5Z3, 2 type 6C5G.

Frequency Response: Program and monitor amplifier channels are uniform within plus or minus one decibel between 40 and 10,000 cycles per second.

Hum and Noise: The total noise level will be at least 60 decibels below zero level (unweighted) at the output of the program amplifier at the normal gain control settings used with commercial types of microphones.

DESCRIPTION

Cross Talk: The cross talk between mixing channels is at least 70 decibels below program level.

Microphone Input Impedance: Each microphone channel has inputs of 30, 50, 200 and 250 ohms balanced to ground. It is also possible to connect the microphone directly to the grid of the input tube. The choice of input impedance is made by means of a plug and jack arrangement on the outside of the cabinet, and requires no extra equipment or internal wiring changes. The frequency response is essentially the same for all input impedances.

Transcription Input Impedance: The two transcription inputs will accommodate pickups of any impedance between 0 and 10,000 ohms. No matching transformers or pads are required, although the Collins type 116B Equalizer is recommended if crystal pickups are used.

Output Impedance: The output impedance of the program amplifier is 500 ohms balanced to ground. Two output lines are provided, selected by the output key.

Three separate 500 ohm outputs are available from the monitor amplifier. Each output is controlled by a separate relay. Terminals are provided for interconnection between microphone keys and speaker control relays.

Power Output and Amplitude Distortion:

Program Amplifier

Output	0 db	Distortion	0.15% r.m.s.
"	4 db	"	0.15% "
"	8 db	"	0.15% "
"	12 db	"	0.16% "
"	16 db	"	0.26% "
"	20 db	"	0.40% "
"	24 db	"	0.70% "
"	26 db	"	1.00% "

The distortion is not affected by gain control setting or input level throughout the normal operating range.

The monitor amplifier will deliver 8 watts output with a total distortion not exceeding 2% r.m.s. The power output is divided equally between the three monitor speakers.

DESCRIPTION

External Connections: The four microphone input receptacles are of a standard three conductor type as shown in the photograph.

The input line, output line, transcription and loudspeaker connections are made to terminals located conveniently on the outside of the cabinet.

Power Supply: The power supply filter is self-contained. An external Isolation Unit is furnished which may be mounted underneath the table or in any other inconspicuous position. An interconnecting cable 10 feet long is furnished for use between the Isolation Unit and the main cabinet.

The equipment is intended for operation from a source of 110 volts, 50/60 cycles a.c., and requires approximately 100 watts.

Cabinet: The cabinet is constructed of 14 gauge cold rolled steel, resistance welded. It is finished in aluminum lacquer on the inside and in gray crystalline enamel on the outside. The front panel is of aluminum, also finished in gray crystalline enamel with designations for each control engraved directly on the panel. Four heavy rubber bumpers are mounted on the bottom of the cabinet.

Attractive end covers are available for covering the input and output connections on the ends of the cabinet.

Size: The outside dimensions of the cabinet are:

Length:	28 inches
Height:	11 inches
Depth:	15$\frac{1}{2}$ inches

The end covers, when used, increase the length to 35 inches overall total.

Mechanical Assembly: Each amplifier unit is assembled on a separate chassis, mounted horizontally in the cabinet. Each chassis is floated on special live rubber mountings so designed that the mass of the amplifier components and the resilience of the rubber mountings form an effective mechanical low pass filter for practical elimination of microphonic effects.

Net Weight: 12H Console 139 pounds. 409D Isolation Unit 21 pounds.

DESCRIPTION

ELECTRICAL CIRCUIT

The circuit used is similar to that of a standard studio speech input system with improvements and changes occasioned by the compact construction used.

Each of the four microphone inputs incorporates a pre-mixing amplifier with an input transformer tapped to accommodate any type of low level self-generating microphone. The outputs of the four preamplifiers are fed into the four microphone mixing positions on the control panel.

The transcription control is a dual fader for controlling two sets of transcription equipment of any impedance. The fader feeds into an amplifier located on the mixing panel. This amplifier is used to assure ample gain for any type of pickup.

Three key switches allow any one of six incoming lines to be connected to the mixing position marked "REMOTE" on the control panel.

A key switch located immediately above each control connects the output of that control:

1. To the program amplifier on the "DOWN" position.

2. To the audition amplifier in the "UP" position.

3. Turns the channel off entirely in the center position.

The two main amplifiers have the same gain, so that the 12H provides two complete and independent program channels. It is expected that one of these channels will be used to carry the program feeding the transmitter, while the other channel can be used for monitor or audition work as required.

The output of the program amplifier can be connected to either of two outgoing lines by means of the LINE key on the control panel.

A more detailed discussion of the function of the various controls will be found under Section IV below.

DESCRIPTION

An external Isolation Unit is used to remove all detrimental a-c fields from the amplifier cabinet. Although satisfactory performance can be obtained with speech equipment incorporating a self-contained power source, the complete removal of all troublesome fields contributes to a remarkable quietness of operation.

MECHANICAL CONSTRUCTION

The cabinet is constructed of 14 gauge cold rolled sheet steel, heavily copper plated before welding. Each component unit in the 12H is assembled on a separate chassis, floated on special rubber mountings for practical elimination of microphonic troubles. The input, output and power connections of each unit are terminated on heavy double end soldering lugs mounted on bakelite. In this way the positive contact and trouble-free service afforded by soldered connections are assured, although the entire unit can be quickly disconnected and removed from the cabinet for service.

The end covers are removable without the use of tools. In addition to their attractive appearance, they provide protection and shielding for the input and output leads. These leads may enter the covers either through the rear or through the bottom. When correctly installed, the 12H presents an attractive appearance from all views, since no unsightly wires are visible.

Due to the rigid and sturdy construction and the convenient type of connectors used, the 12H is easily set up in new locations. For this reason, it is ideally suited for use in elaborate remote set-ups or in semi-permanent studios where facilities are required in excess of those provided by the Collins 12X Remote Amplifier.

ISOLATION UNIT

The type 409D Isolation Unit contains the power transformer, rectifier tube and input filter section. It is built on a small chassis designed for mounting under the control desk or in any other out-of-the-way place. The cable for interconnection between the 409D and the 12H is included.

III INSTALLATION

UNPACKING

All parts should be inspected carefully when removed from the packing boxes for evidence of damage during shipment. All claims for damage should be filed promptly with the transportation company and the Collins Radio Company should be given detailed description of the damage.

Be sure that all panel controls work properly and see that all knobs are properly positioned on the shafts. If all appear to be in good order, the equipment may be placed in operation. It is suggested that the procedure below be followed in detail.

DIRECTIONS FOR PLACING EQUIPMENT IN OPERATION

1. Place the 12H cabinet on the control desk in its intended position

2. Remove the 10 red headed screws holding the amplifier units in place during shipment. Two will be found in each unit except the preamplifier unit, where four are used. After these are removed, each unit will float freely on its rubber mountings.

3. Insert the tubes in the sockets. Refer to the photograph, Fig. 2, for location of sockets and tube types. Remove the cover of the 409D Isolation Unit and insert a 5Z3 tube in the socket. Replace the cover. Insert a 6C5 tube in transcription preamplifier located in upper right-hand corner of control panel.

4. Mount the 409D in place under table, or in other chosen position.

5. Connect 409D to 12H by means of the interconnecting cable furnished. The plugs and receptacles are arranged to prevent improper insertion. Do not cut this cable; use the entire length.

6. Connect incoming remote lines to the terminals marked REMOTE LINES on the terminal board. Any or all may be used as desired. These are numbered in pairs from 1 to 6, and the number corresponds to the number engraved on the panel by each REMOTE LINE key switch.

VII DIAGRAMS AND PHOTOGRAPHS

Fig. 1 - Front View of 12H

Fig. 2 - Inside Top View

Fig. 3 - Inside Bottom View

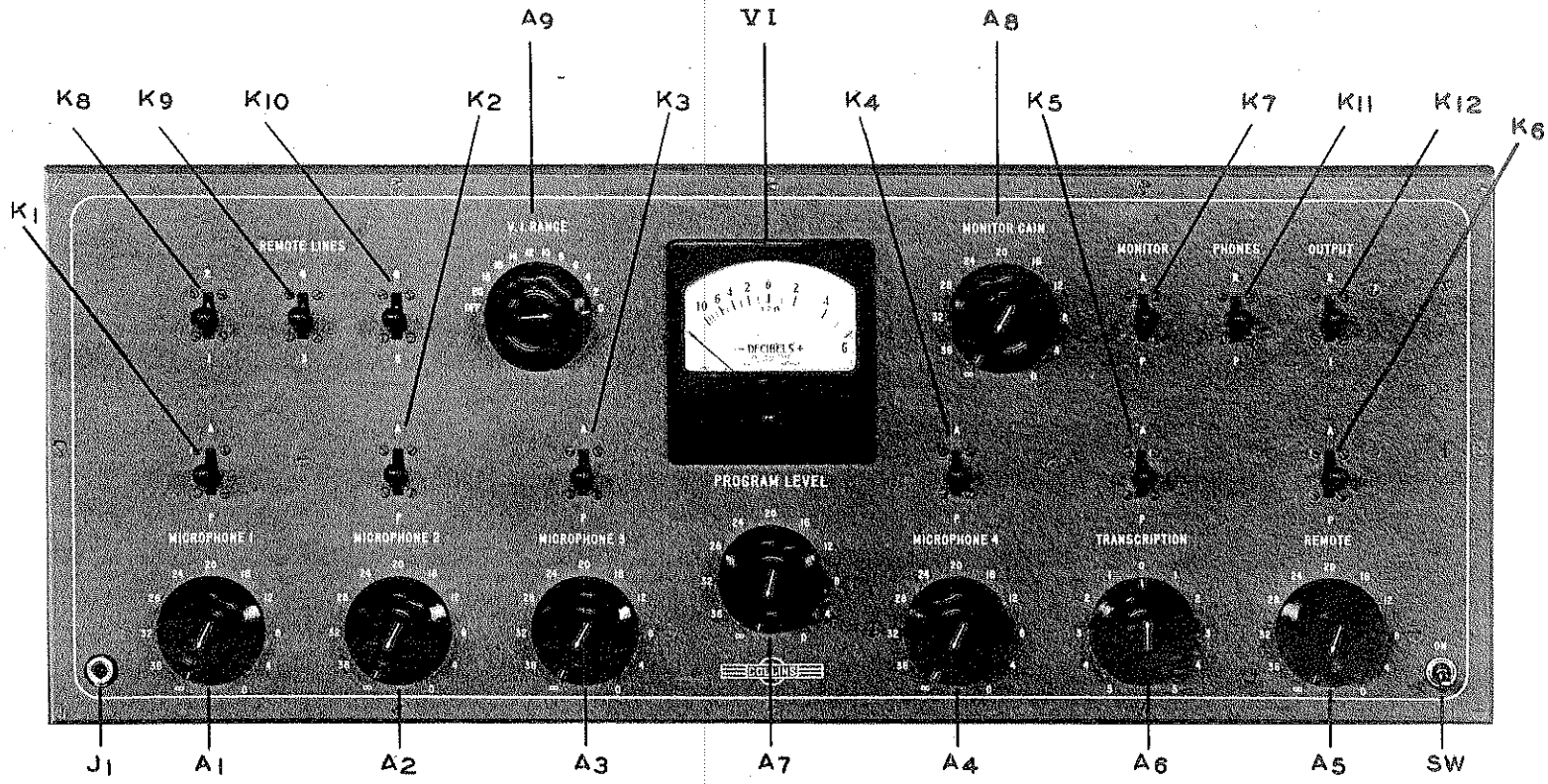
Fig. 4 - 409D Isolation Unit

Fig. 5 - Rear View of 60N Control Panel.

Fig. 6 - Block Diagram of 12H

Fig. 7 - Simplified Schematic (Inside Rear Cover)

Fig. 8 - Wiring Diagram



FRONT VIEW

60N CONTROL PANEL

FIG. 1

7. Connect output of transcription equipment to the terminals marked TRANSCR. These are also numbered in pairs. Two pairs are provided. The grounded side, if any, of the transcription equipment should be connected to the lower terminal of each pair. The input impedance of each transcription terminal is of the bridging type, or approximately 10,000 ohms. If the transcription equipment is designed to work into a resistance lower than 10,000 ohms, it will be necessary to connect a terminating resistance, R, across each pickup. The value of R may be found as follows:

$$R = \frac{10{,}000Z}{10{,}000-Z}$$

Where Z = output impedance of transcription equipment as specified by manufacturer.

This resistance, R, may be connected across the line at the pickup unit or at the terminal strip of the 12H. Small composition or wire-wound resistors of 1/2 watt rating are satisfactory. If Z is small with respect to 10,000 ohms (below 1000 ohms) the shunting effect of the transcription fader in the 12H may be neglected and a terminating resistance equal to the impedance of the pickup should be connected across output of the pickup.

8. Connect the outgoing lines to the terminal marked OUTPUT. If only one line to the transmitter is available, connect this to the pair of terminals marked "1". If, in addition, a spare line is available connect it to the pair marked "2".

9. Connect studio and control room monitor speakers to the terminals marked SPEAKERS. Each pair of the three pairs of terminals marked "A", "B" and "C" provide audio power for feeding a 500 ohm monitor speaker. If these speakers are of the permanent magnet field type, a considerable simplification in wiring will be effected, since no field power wiring is required.

10. Connect microphones to input plugs. The input plugs are Collins 66A-P3, fitting into type 66A-S3 receptacles mounted on the end of the cabinet. It is possible to connect the microphone cable directly to the plugs but a more satisfactory arrangement is to use wall receptacles in each studio, carrying the wiring from these receptacles to a junction box located in the control room. Four cables from this box can then be carried to the input plugs on the 12H. All microphone wiring must be carefully shielded, particularly if crystal microphones are to be used.

INSTALLATION

The shield of the microphone cable (or cable from junction box) should be connected to prong #1 of the plug, and the two conductors in the cable should be connected to prongs #2 and #3. In case of single conductor coaxial cable as used on crystal microphones, connect the shield to prong #1 and the center conductor to prong #2, disregarding prong #3.

It is necessary to provide the correct input impedance connections for the microphone used. See the following paragraph for a discussion of the Collins Universal Input system.

11. Connect a source of 110V. 60 cycles to the flush connector base on the 409D. The service cord provided may be used for this purpose, or other wiring may be used as desired. There are no fuses in the 409D, since this unit will often be mounted in a position which would make replacement difficult. A two or three ampere cartridge or plug fuse, mounted in a wall box or other convenient location, should be connected in the supply line to the 409D for protective purposes.

12. Turn V.I. RANGE, PROGRAM LEVEL and MONITOR GAIN controls to OFF, then turn power switch on panel to ON position. If the filaments of the tubes burn, the 12H should be ready for operation.

DIRECTIONS FOR CHANGING INPUT IMPEDANCE

The exclusive Collins Universal Input feature incorporated on the 12H allows any type of low level, self-generating microphone to be used, with optimum conditions of impedance match. The changes in input impedance are made by means of a plug and jack system located on the outside of the cabinet. The connections are available by removing the left end cover and no tools or internal wiring changes are necessary.

The two flexible leads from each microphone receptacle are terminated in plugs which fit into jacks located just above the microphone receptacles. These jacks, connecting to the various input transformer taps, provide balanced inputs of the impedance marked. In order to provide an input impedance of 200 ohms, for example, it is only necessary to put the two plugs into the two jacks marked "200".

INSTALLATION

When either of the four low impedance inputs is in use, it is necessary to provide a jumper between the two jacks marked "G" and "T" in order to connect the secondary of the transformer to the grid of the tube.

If a crystal microphone or other type of high impedance microphone is to be used, the jumper described above should be removed from the "G" and "T" jacks and placed in any two of the unused jacks. The plug on the red lead should be plugged into the jack marked "G". The black lead is not used, and may be plugged into any of the other jacks. This will provide the correct input connections provided the microphone is connected as described above.

The input connections of the four microphone circuits are entirely independent and each channel may be connected for any desired impedance without affecting the operation of the other three microphone input circuits.

CONNECTION OF SPEAKER CONTROL RELAYS

The 12H includes three relays arranged to control the output of the monitor/audition amplifier. It is expected that one loudspeaker will be used in the control room and one speaker in each studio. A Collins type 7R bridging amplifier is recommended if additional speakers are required.

The connection from one side of the operating coil of each relay is brought out to the terminal strip and marked as control circuit terminals A, B, and C. These markings correspond to the speaker terminal pairs A, B, and C, near the rear end of the terminal strip.

The contacts from the four microphone channel control keys on the panel are also brought to the terminal strip and are marked 1, 2, 3 and 4 to correspond to the first four mixing positions on the front panel.

It is only necessary to interconnect these control circuit terminals as required so that when a microphone is turned on in one studio, the speaker in the same studio is turned off. For example, suppose microphone 1, microphone 2 and speaker A are in Studio A; microphone 3 and speaker B are in Studio B, and micro-

phone 4 and speaker C are in the control room. The following control circuit connections should be made:

Join 1 to 2 to A
Join 3 to B
Join 4 to C

CONNECTION OF WARNING LIGHT RELAYS

The two warning light control relays included with each 12H assembly are intended to be used to control two studio "on the air" signs. They are identical to the relays in the 12H and obtain power from the same source.

Each relay should be mounted near the sign it controls in order to minimize the a-c wiring required. The relay contacts should be connected to the sign so that the light will burn when the relay is in the operated position. Two wires of #20 B&S or larger copper wire may be run from the operating coil of each relay to the 12H. One of these wires should be grounded to the 12H cabinet, and the other lead should be connected to the speaker control relay terminal which controls the speaker in the same studio. Referring to the example in the preceding section, if a warning light is to be installed in Studio B, one relay lead should be connected to chassis and the other to control circuit terminal B. The warning light control relay will operate at the same time the speaker control relay operates. Thus, when a microphone is turned on in Studio B, the speaker will be silenced and the warning light will burn.

MISCELLANEOUS INFORMATION

Although the transformers used in the low level stages are of the balanced type, and are provided with annealed cast alloy cases, it is possible to induce hum into the system if the 12H is placed in a strong non-uniform a-c field. It is recommended that the 12H be placed at least three feet from the 409D and other small a-c operated devices, and at least six feet from large power transformers or similar equipment. Most microphones are similarly and much more seriously affected by the presence of an a-c field, and the same care must be used in their placement.

Unusually serious difficulty with hum and microphonism can usually be traced to the input tubes. Due to the large variation

found in stock tubes of the same type and make, it is necessary to use selected tubes in order to insure uniformly satisfactory operation. The Collins Radio Company maintains a testing department for the purpose of selecting tubes suitable for use in high gain amplifiers, and it is recommended that only such selected tubes be used.

The cabinet of the 12H should be connected to a good ground. This is particularly important if the equipment is to be used adjacent to a radio transmitter.

The volume level in the monitoring headphones is approximately correct when the output of the program amplifier is near zero level. If the output is higher it may be necessary to increase the size of resistor R_{44} (Fig. 5) in order to maintain a comfortable volume level in the headphones.

The amplification through the REMOTE LINE channel of the 12H as shipped from the factory is ample to give full output with any usable line level. If the lines are short so that the equalization required is small, it may be desirable to insert some attenuation in this circuit in order to give greater range of control on attenuator A_5 (Fig. 1). This attenuation may be added in the external circuits, or it may be added in the 12H by increasing the size of resistor R_{53} (Fig. 5).

IV OPERATION

The control panel of the 12H is arranged for simple and convenient operation. In general, the functions are similar to that of other speech input systems, and any one familiar with equipment of this type should need no further instructions. A detailed description of the functions of each control will be given, however, for the benefit of any users who may not be familiar with the operation of speech equipment.

MIXING CONTROLS

Each of the microphone preamplifier outputs is carried to one of the microphone mixing positions, designated MICROPHONE 1, MICROPHONE 2, etc. The microphone receptacles on the end of the cabinet are arranged in the same order, with #1 near the front, and #4 near the rear of the cabinet.

These controls operate in the conventional manner with minimum attenuation (maximum output) being obtained in the extreme clockwise position, marked "0". Complete cut-off is obtained in the position marked "∞"

The transcription control is of the dual fader type with the OFF position located in the center of the scale. Counter-clockwise rotation from the neutral position will increase volume on transcription #1, while a clockwise rotation from the OFF position will increase volume on transcription #2. The number of steps of attenuation on each side of center is necessarily limited by the physical size of the attenuator, so that the range of control is not sufficient to take care of large variations in output of various types of pickup units. In order to allow for the use of high level pickups and to assure adequate gain for low level units, a preamplifier stage has been included in the transcription circuit. This preamplifier, mounted on the upper right-hand corner of the mixing panel (viewed from front) has a small gain control which may be set at the time of installation to give the correct gain for the pickup heads in use. No further adjustment should be required unless a change in transcription equipment is made.

The remote lines connected to terminal pairs 1 to 6 are carried to the REMOTE LINES key switches. These three keys allow

any one of the six incoming lines to be connected to the input of the mixing control marked REMOTE. Only one of the REMOTE LINES keys should be operated at one time.

CHANNEL CONTROL KEY SWITCHES

A three position key switch is located directly above each mixing control. The purpose of the key is to allow the output of the associated mixing control to be fed into the program channel, (down position) or to be fed into the monitor/audition channel (up position). In the center position, the output of the mixing control is short-circuited for absolute prevention of feed through and cross-talk effects.

The mixing and switching circuit is so designed that correct impedance relations are maintained at all times, and the volume levels in the various circuits are independent of mixing or switching operations in any other circuit.

MASTER CONTROLS

Two master gain controls are provided, one for each of the main amplifier channels. The master control for the program circuit, designated PROGRAM LEVEL, is located directly below the volume indicator meter. This control is of the high resistance potentiometer type, but its direction of rotation and attenuation per step are the same as the mixing controls described above.

The MONITOR GAIN control located to the right of the volume indicator is a high resistance potentiometer of the step-by-step type. It is identical to the program gain control described above.

OTHER PANEL CONTROLS

The volume indicator reads the level directly across the outgoing lines. The meter itself is of the high speed type, and represents a distinct improvement over the general purpose meters formerly available in the large case. The meter is calibrated to read zero decibels (reference, 0.006 Watts) across a 500 ohm line, corresponding to 1.73 volts, r.m.s. The range may be extended by means of the V.I. RANGE switch located at the left of the meter.

This switch provides extension of the range to plus 20 decibels in steps of 2 db each with an additional "OFF" position. The output level at any point is given by the sum of the range switch setting and the reading of the meter, added algebracially. For example, if the range switch is set at 4, and the meter swings up to -2 on peaks, the output level is, then 4 + (-2) = 2db.

The second main amplifier channel in the 12H may be used either for monitor or for audition work. A key switch, designated MONITOR gives the operator full control of the input circuit to this amplifier. When the MONITOR key is pushed to the "down" or "P" position, the amplifier is connected through a bridging pad to the program output, thus serving as a monitor amplifier. When this key is in the "up" or "A" position, the amplifier is connected to the audition or "A" output of the mixing system and channel control keys, and any of the input circuits whose channel control keys are in the "A" position will be fed into the amplifier and reproduced in the loudspeakers. The center position of the MONITOR key is off, and may be used to silence the monitor amplifier for answering telephone, etc.

Headphone monitoring is provided by means of a telephone jack located in the lower left-hand corner of the panel. The key switch marked PHONES allows the monitoring phones to be connected across the program amplifier output (position "P") or across the incoming remote line circuit (position "R"). The phone jack is disconnected completely in the center position of the key.

The key marked OUTPUT switches the output of the program amplifier to either of two outgoing lines. The designations "1" and "2" correspond to the similar markings on the terminal strip. In the center position of the key the program amplifier is terminated in a 500 ohm resistor but is not connected to either of the output lines.

The power switch, located on the lower right-hand corner of the panel, operates in the primary of the power transformer, and serves to apply and remove all voltages on the complete assembly. Its "On" and "Off" positions are clearly designated.

USE OF REMOTE CUE CIRCUIT

The remote cue circuit incorporated in the 12H is useful in cases where order wires are not wanted for financial reasons,

and where the remote line program circuits do not include one way repeaters.

The circuit is arranged in such a way that a signal from the monitor amplifier is fed to the remote line when the channel control key above the REMOTE mixer is in the center position. Operation of this key to the "A" or "P" position removes this cue signal before the line is connected to the amplifier input, preventing any possibility of singing and requiring no special attention on the part of the operator.

It is possible for the control operator to carry on a two way conversation with the remote operator up until the instant the remote program goes on the air. This is done by the following method:

1. Plug monitor phones into phone jack.
2. Place PHONES key in "R" position.
3. Place control room microphone key in "A" position.
4. Place key over remote line mixer in center position.
5. Select remote line by means of REMOTE LINES key.
6. Place MONITOR key in "A" position.

Under these conditions, whatever is spoken into the control room microphone, will be carried "backwards" over the remote line to the remote operator who listens with a pair of phones across the line. Similarly, words spoken into the microphone at the remote end of the line will be heard by the control room operator in his headphones.

The amplitude of the cue signal is controlled by the size of resistor R29. This resistor may be increased to cut down on the cue signal, it may be decreased to raise the level of the cue signal, or it may be removed from the circuit entirely in order to eliminate the cue signal.

TALK-BACK CIRCUITS

The Collins system of talk-back is more flexible than other systems in that the operator can talk into one studio without interrupting a program in progress in another studio.

OPERATION

Talk-back is effected by releasing the key associated with the studio microphone, then placing the control room microphone key in the "A" position. These operations (1) disconnect the studio microphone, (2) turn on the studio speaker, (3) silence the control room speaker, (4) turn on the control room microphone and the control room operator is enabled to talk into the studio.

RESERVE GAIN

The settings of the various controls during operation will depend upon several conditions. The microphone output level varies widely from one type of microphone to another. Similarly, the output level required from the 12H may be plus 20 db in some cases, and as low as zero level in other cases. The gain of the program channel is 104 decibels, which is ample to allow operation with any microphone, and at any program output level within the capabilities of the equipment as listed in the specifications. For example, with a microphone level of minus 70 decibels (referred to 6 m.w.) and a program output of plus 10 db., the total gain required will be 80 decibels, leaving a reserve gain of 24 decibels available. This reserve gain will appear on the control panel as the sum of the microphone mixing control setting and the program level control setting. Because of the extremely low noise level of the 12H, the full gain may be used if needed, without introducing objectionable noises.

RECOMMENDED OUTPUT LEVEL

In many installations the 12H will be used to feed a program line leading to the transmitter location, although sufficient output is available to drive any Collins broadcast transmitter directly without the use of additional amplifiers. The following table gives the approximate level required for the service indicated:

12H Feeding Into-		Output Level From 12H
Collins 300E	100 Watt	± 6 db
Collins 300F	250 Watt	+ 9 db
Collins 20E	500 Watt	+18 db
Collins 20C-2	1000 Watt	+20 db

OPERATION

12H Feeding Into-		Output Level From 12H
Collins 21C	1000 Watt	+14 db
	5000 Watt	+18 db
Telephone Line		-6 to +4 db

The levels listed above are based on continuous sine wave input. When using voice or music input it is necessary to reduce the average levels in order to prevent the volume peaks from exceeding the values shown. In general, the peak swings on the meter should be kept 2 to 6 decibels below the values shown in the table. The exact value for the particular installation should be determined by means of a cathode ray oscilloscope.

V MAINTENANCE

The following table gives the voltages measured at various points in the circuit during normal operation. All d-c voltages are measured between ground and the point indicated using the highest readable range on a 1000 ohm-per-volt meter. The negative terminal of the meter is connected to ground. Line Voltage = 110 Volts A.C.

UNIT	TUBE	CATHODE VOLTAGE	DECOUPLING RESISTOR VOLTAGE	PLATE VOLTAGE
6C	6J7G #1 (Front)	2.3	70	67
	6J7G #2	2.3	70	67
	6J7G #3	2.3	70	67
	6J7G #4 (Rear)	2.3	70	67
7JA	6X5G #1 (Front)	2.9	270 280	148 120
	6C5G #2	11.0		290
	41	29.2		300
	41 (Rear)	29.2		300
7HA	6J7G (Front)	1.5	165	80
	6J7G	5.1	15	160
	2A3	55		315
	2A3 (Rear)	55		315

Filament voltages measured at the tube socket are normally within 10% of the rated voltage for the tube. Voltages below this value constitute an abnormal condition and should be investigated.

The electrical design and mechanical layout of the 12H result in great simplification in location and repair of trouble which may develop. The following paragraphs of this section are intended to aid those persons who may not be familiar with audio equipment.

MAINTENANCE

NO VOLTAGE ON TUBES

If the tubes do not burn after installation is completed according to Section III above, check first to be sure the 409D is actually connected to a "live" source of 110 volts 60 cycle a.c. If so, check to see if the filament of the 5Z3 tube in the 409D is burning. If not, the trouble is due to an open connection in the primary circuit of the power transformer. This may be due to a broken connection in the interconnecting cable, poorly soldered connection to receptacles on 409D and 12H, or defective On-Off switch on control panel.

NO PLATE VOLTAGE IN 12H

If no plate voltage is found on any tubes in the 12H measure between prong #3 and prong #4 on the Howard Jones plug. If no voltage is found here, check for voltage across the same prongs on the receptacle in the 409D chassis. Voltage here indicates an open connection in the interconnecting cable. Lack of voltage at this point indicates a defective 5Z3 tube, open circuited filter choke, shorted filter condenser, defective high voltage winding on the power transformer, or a poorly soldered connection. Check the wiring carefully with the circuit diagram.

NO PLATE VOLTAGE ON ONE TUBE ONLY

Lack of plate voltage on one tube only will be caused by an open circuited resistor or transformer, by an oper circuited decoupling condenser, or by a short circuited plate decoupling condenser.

Lack of plate voltage at only one of a pair of push-pull tubes indicates that one-half of the output transformer primary is open, or that there is a poor connection to the tube socket or in associated wiring. A continuity test can be used to locate the fault.

IMPROPER VOLTAGE READINGS

Check first to be sure the line voltage is actually 110 volts, 60 cycles a.c. If the line voltage is of some other value proportionate corrections must be made in the table of Section V.

Input To	Level
Any microphone channel	-70 db balanced to ground
Either transcription input	-30 to -70 db, one terminal grounded
Any remote line input	0 to -20 db, balanced or grounded

It is very important to use an oscillator with a balanced output when making frequency runs on microphone channels. If this precaution is not observed, half of the input transformer primary will be shorted out, resulting in excessive hum and improper indication of the normal frequency response.

If a poor response is obtained under all conditions in the above paragraph, the output of the oscillator should be fed into the input of the program amplifier (terminal lugs No. 5 and 6 on the 7JA terminal strip), and the frequency response measured. If the response is still poor, connect the oscillator to the grid of the input tube and re-run the curve. If the results are still discouraging, the oscillator may be fed into the grid of the second stage. A poor response at this point indicates that the fault lies in one of the last two stages.

If it is found that there is distortion occurring in the monitor amplifier and none in the program amplifier, the same procedure may be followed step-by-step to locate the fault.

Once the fault has been localized, it will be necessary to find the exact point of defect by a careful check of circuit components and wiring. Since practically all parts in the system have some bearing on the performance, it is not practicable to attempt to give a detailed cause and effect table. Service work of this nature should only be undertaken by a competent engineer.

Excessive amplitude distortion can be caused by a defective tube or by improper operating voltages. If all voltages have been found to be correct as listed above, and the tubes are known to be in good condition, then the amplitude distortion should be of the same order as that shown in the engineering report (See Section VI) included herewith. The distortion will in no case exceed the values listed in the specifications, Section II.

MAINTENANCE

NOISE

Noise in the 12H can be divided into four classes:

1. Microphonics.
2. Hum.
3. Hiss.
4. Intermittent noises other than the three listed above.

Of these, the first three are present in some degree in any amplifying system. Their magnitude depends on circuit design. In the Collins 12H these undesirable effects have been reduced to a negligible value, even at full gain.

(1) Microphonics can be caused by tubes or transformers operating in low level circuits. Due to the unique mechanical design of the 12H, any vibrations of the control panel or desk will be "washed out" before reaching the preamplifier chassis. The same result cannot be obtained by any method where the tubes alone are mounted on rubber. No trouble should be had with microphonics in the 12H unless the tubes used are so microphonic as to pick up acoustic vibrations in the air. In this case, it is advisable to replace the troublesome tubes.

The other chasses in the 12H are also mounted on rubber, although the microphonic problem is not as severe as in the case of the preamplifier unit. The 500C Filter unit is also rubber mounted in order to prevent the relays from vibrating the tubes in the amplifier units.

(2) Hum can be caused by induction, by defective tubes, by improper grounding, by incomplete shielding of the input leads, or by a defective power supply.

Induction can occur into the microphone itself as well as into the transformer windings in the 12H. The amplifier and any microphones which are used must be located several feet away from any source of alternating magnetic field.

MAINTENANCE

Defective tubes can be located by substitution of other tubes known to be in good condition. It is suggested that one or more spare tubes of each type be kept available.

No difficulty should be had with hum due to improper grounding provided the 12H is connected to a good ground. In certain cases the 12H will operate properly with no ground at all, although the use of a ground is strongly recommended.

Hum can be caused by incomplete shielding of the microphone cables or plugs, or by lack of continuous ground connection between the microphone case and stand and the 12H cabinet.

A defective power supply can cause hum due to insufficient filtering of the high voltage supply, or due to improper grounding or unbalance of the center tap of the heater windings on the transformer.

(3) Excessive hiss in the 12H output can be caused by a defective tube or by an open grid circuit in a low level stage. In either case, it is not likely that a signal will pass through the defective stage, and this point should be checked first. The gain of the 12H is so high that a slight hiss will be heard in the output with no signal input and with the gain controls fully advanced. This is the noise of thermal agitation in the input circuits and represents the ultimate limit of application of any amplifying system. The output level of all commercial microphones is high enough to override noise from this source.

(4) Intermittent noises do not occur in the normal operation of the equipment, and are often difficult to locate if they do appear. They are usually caused by faulty connections either in circuit wiring or in any circuit component. A good procedure to follow in locating such trouble is to listen to the noise in headphones while removing first the microphone plug, then the grid clip of the input tube, then each tube in turn until the noise stops. It is probable that the apparatus or wiring associated with the tube or connector last removed is the seat of the trouble. After the location of the noise is found in this way, further inspection with substitution of circuit elements known to be in good order will usually locate the exact cause.

If any serious problems arise which cannot be handled in the field, the factory should be notified. Although the 12H, like other Collins products, is fully guaranteed against defects in workmanship

VI PARTS LIST

6C PRE-AMPLIFIER

Part	Description	Value	Part Number
R_1	Grid Resistor	5 meg. $\frac{1}{2}$ W.	170.5megBT$\frac{1}{2}$
R_2	" "	" "	"
R_3	" "	" "	"
R_4	" "	" "	"
R_5	Cathode Bias	2000 ohm 1 W.	170.2000BT1
R_6	" "	" "	"
R_7	" "	" "	"
R_8	" "	" "	"
R_9	Plate Dropping	150,000 ohm 1 W.	170.150000BT1
R_{10}	" "	" "	"
R_{11}	" "	" "	"
R_{12}	" "	" "	"
C_1	Cathode Bypass	20 mfd. 100 V.	183.5
C_2	" "	" "	"
C_3	" "	" "	"
C_4	" "	" "	"
C_5	Plate Filter	2 mfd. 450 V.	180.21
C_6	" "	" "	"
C_7	" "	" "	"
C_8	" "	" "	"
C_{36}	" "	6 mfd. 450 V.	180.47
T_1	Input Transformer	320D	160.320D
T_2	" "	"	"
T_3	" "	"	"
T_4	" "	"	"
T_5	Mixing Transformer	519E	160.519E
T_6	" "	"	"
T_7	" "	"	"
T_8	" "	"	"

PARTS LIST

7JA PROGRAM AMPLIFIER

Part	Description	Value	Part Number
R_{13}	Cathode Bias Resistor	2000 ohms 1 W.	170.2000BT1
R_{15}	Plate Resistor	150,000 ohms 1 W.	170.150000BT1
R_{16}	Plate Dropping Resistor	50,000 ohms 1 W.	170.50000BT1
R_{17}	Cathode Bias Resistor	2,000 ohms 1 W.	170.2000BT1
R_{18}	Equalizing Resistor	150,000 ohms 1 W.	170.150000BT1
R_{19}	Cathode Bias Resistor	750 ohms 10 W.	172.750BD
C_9	Cathode Bypass Condenser	20 mfd. 100 V.	183.5
C_{11}	Plate Filter Condenser	6 mfd. 450 V.	180.47
C_{12}	Coupling Condenser	0.1 mfd. 450 V.(AY)	180.26
C_{13}	Cathode Bypass Condenser	20 mfd. 100 V. "	183.5
C_{14}	Coupling Condenser	0.25 mfd. 400 V. "	180.13
C_{15}	Equalizing Condenser	0.01 mfd.	910.01BE
C_{16}	Cathode Bypass Condenser	20mfd. 100 V.	183.5
T_9	Input Transformer	519D	160.519D
T_{10}	Interstage Transformer	308E	160.308E
T_{11}	Output Transformer	215E	160.215E
L_1	Plate Choke (Included in 308E Transformer case)		

PARTS LIST

7HA MONITOR AMPLIFIER

Part	Description	Value	Part Number
R_{20}	Cathode Bias Resistor	2000 ohms 1 W.	170.2000BT1
R_{21}	Screen Dropping Resistor	1 meg. 1 W.	170.1megBT1
R_{22}	Plate Resistor	150,000 ohms 1 W.	170.150000BT1
R_{23}	Plate Dropping Resistor	50,000 ohms 1 W.	170.50000BT1
R_{24}	Cathode Bias Resistor	2,000 ohms 1 W.	170.2000BT1
C_{17}	Cathode Bypass Condenser	20 mfd. 100 V.	183.5
C_{18}	Screen Bypass Condenser	0.25 mfd. 400 V.(AY)	180.13
C_{19}	Plate Filter Condenser	6 mfd. 450 V.	180.47
C_{20}	Coupling Condenser	0.1 mfd. 400 V.(AY)	180.26
C_{21}	Cathode Bypass Condenser	20 mfd. 100 V.	183.5
C_{22}	Coupling Condenser	0.25 mfd. 400 V.(AY)	180.13
T_{12}	Input Transformer	519D	160.519D
T_{13}	Interstage Transformer	308E	160.308E
T_{14}	Output Transformer	357E	160.CD357E
L_2	Plate Choke (Included in 308E Transformer case)		

PARTS LIST

60N CONTROL PANEL

Part	Description	Value	Part Number
R_{36}	Mixer Terminating Resistor	500 ohms ½ W.	170.500BT½
R_{37}	" " "	" " " "	"
R_{38}	" " "	" " " "	"
R_{39}	" " "	" " " "	"
R_{40}	" " "	" " " "	"
R_{41}	" " "	" " " "	"
R_{42}	" " "	" " " "	"
R_{43}	" " "	" " " "	"
R_{44}	Phones Series Resistor	500 ohms ½ W	170.500BT½
R_{45}	Monitor Input Pad	100,000 ohms ½ W.	170.100MBT½
R_{46}	" " "	" " " "	"
R_{47}	Monitor Input Pad	500 ohms ½ W.	170.500BT½
R_{48}	Output Terminating Resistor	500 ohms ½ W.	170.500BT½
R_{53}	Remote Line Pad	5000 ohm ½ W.	170.5000BT½
A_1	Microphone 1 Attenuator	500 ohm ladder	173.52
A_2	Microphone 2 Attenuator	500 ohm ladder	173.52
A_3	Microphone 3 Attenuator	500 ohm ladder	173.52
A_4	Microphone 4 Attenuator	500 ohm ladder	173.52
A_5	Remote Line Attenuator	500 ohm ladder	173.52
A_6	Transcription Fader	10,000 ohms each side	173.54
A_7	Program Master Gain	200,000 ohms	173.53
A_8	Monitor Gain Control	200,000 ohms	173.53
A_9	VI Range Switch		173.53
VI	Volume Indicator		253.3173R-4
K_1	Microphone #1 Key		222.2LAD
K_2	Microphone #2 Key		222.2LAD
K_3	Microphone #3 Key		222.2LAD
K_4	Microphone #4 Key		222.2LAD
K_5	Transcription Key		222.2LC
K_6	Remote Line Key		222.2L2C
K_7	Monitor Input Key		222.2LAD
K_8	Remote Line Selector Key		222.2L2A
K_9	" " " "		"
K_{10}	" " " "		"
K_{11}	Phones Key		222.2L2A
K_{12}	Output Key		222.2LAD
J_1	Phone Jack		263.J1
SW	ON-OFF Switch	SPST	260.52

PARTS LIST

6D TRANSCRIPTION PRE-AMPLIFIER

Part	Description	Value	Part Number
R_{49}	Cathode Bias Resistor	2000 ohms $\frac{1}{2}$ W.	170.2000BT$\frac{1}{2}$
R_{50}	Plate Resistor	50,000 ohms $\frac{1}{2}$ W.	170.50000BT$\frac{1}{2}$
R_{51}	Gain Control	10,000 ohms Variable	173.60
R_{52}	Output Series Resistor	2,500 ohms $\frac{1}{2}$ W.	170.2500BT$\frac{1}{2}$
C_{33}	Cathode Bypass	20 mfd. 100 V.	183.5
C_{34}	Plate Coupling	0.1 mfd. 400 V.	180.50
T_{15}	Output Transformer	CD-335	160.CD335

409D ISOLATION UNIT

R_{54}	Bleeder Resistor	50,000 ohms 25 W.	172.0224
C_{35}	Filter Condenser	4.5 mfd. 600 V.	180.48
T_{17}	Power Transformer	CD-362	161.CD362
L_4	Choke	841C	162.841C

MISCELLANEOUS

--	Input Receptacles	--	66A-S3
--	Warning Light Control Relays	--	970-40
--	Interconnecting Cable	--	--
--	Power Cable	--	--
--	Phone Tip Jacks	--	263.J3

VII DIAGRAMS AND PHOTOGRAPHS

Fig. 1 - Front View of 12H

Fig. 2 - Inside Top View

Fig. 3 - Inside Bottom View

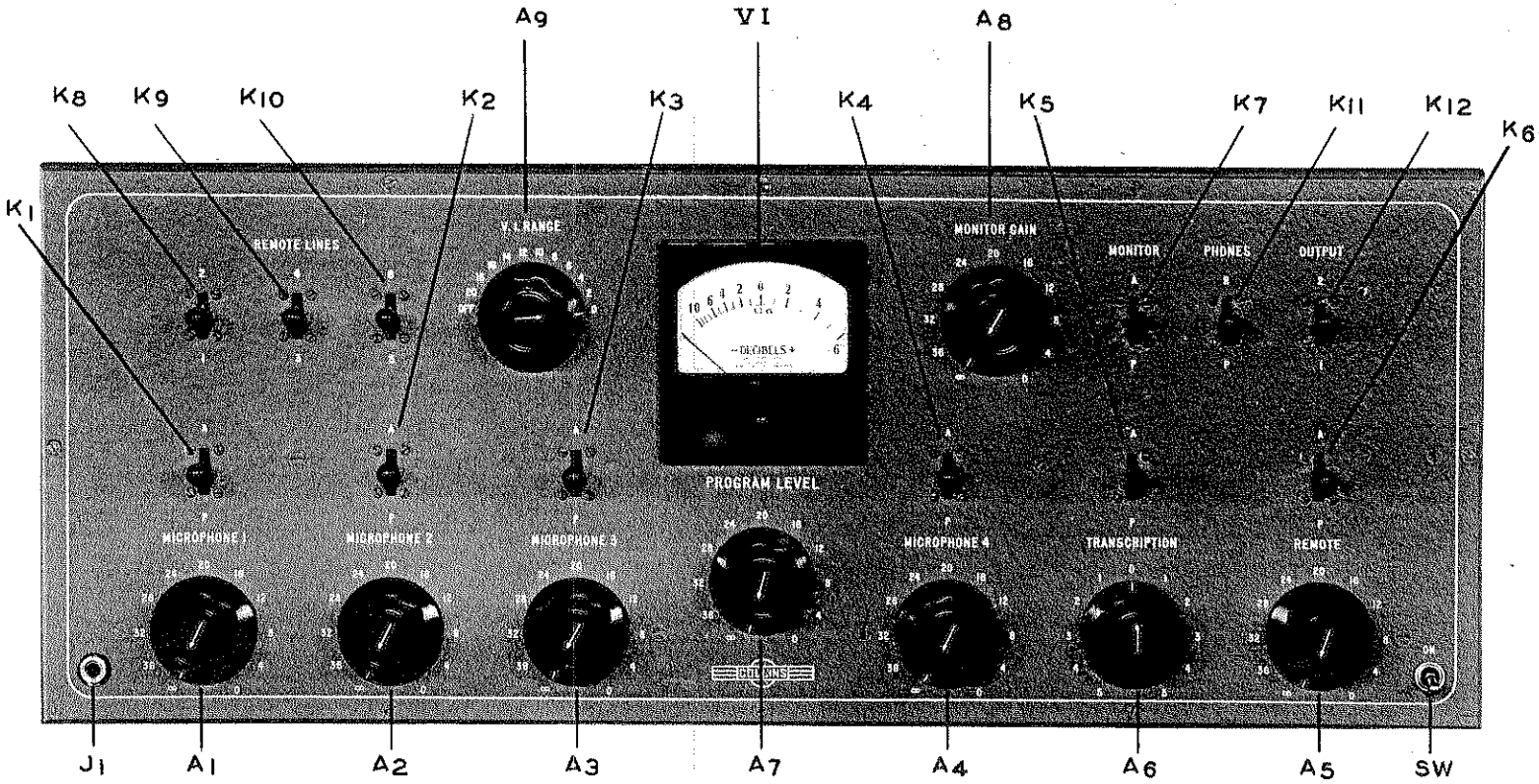
Fig. 4 - 409D Isolation Unit

Fig. 5 - Rear View of 60N Control Panel.

Fig. 6 - Block Diagram of 12H

Fig. 7 - Simplified Schematic (Inside Rear Cover)

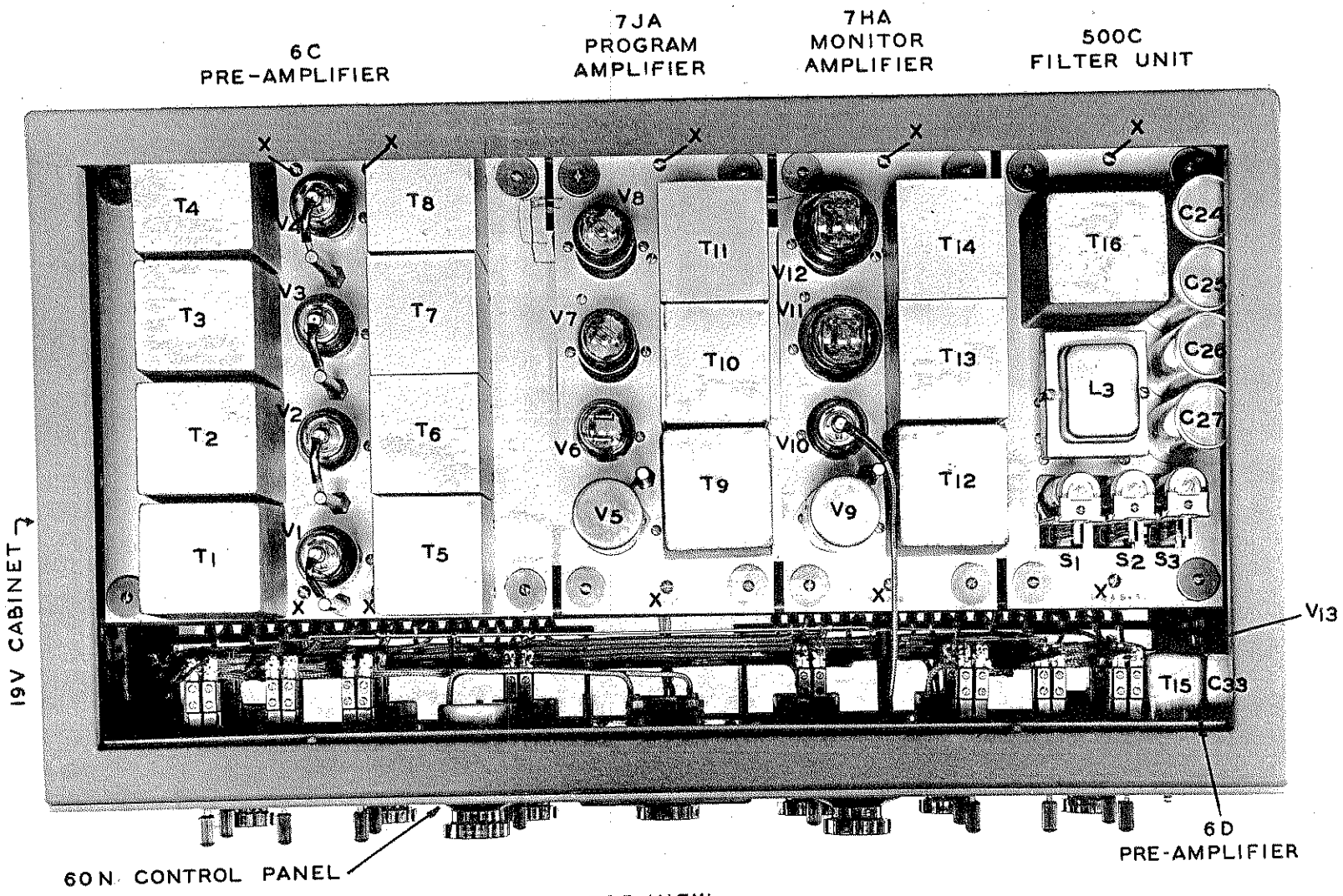
Fig. 8 - Wiring Diagram



FRONT VIEW

60N CONTROL PANEL

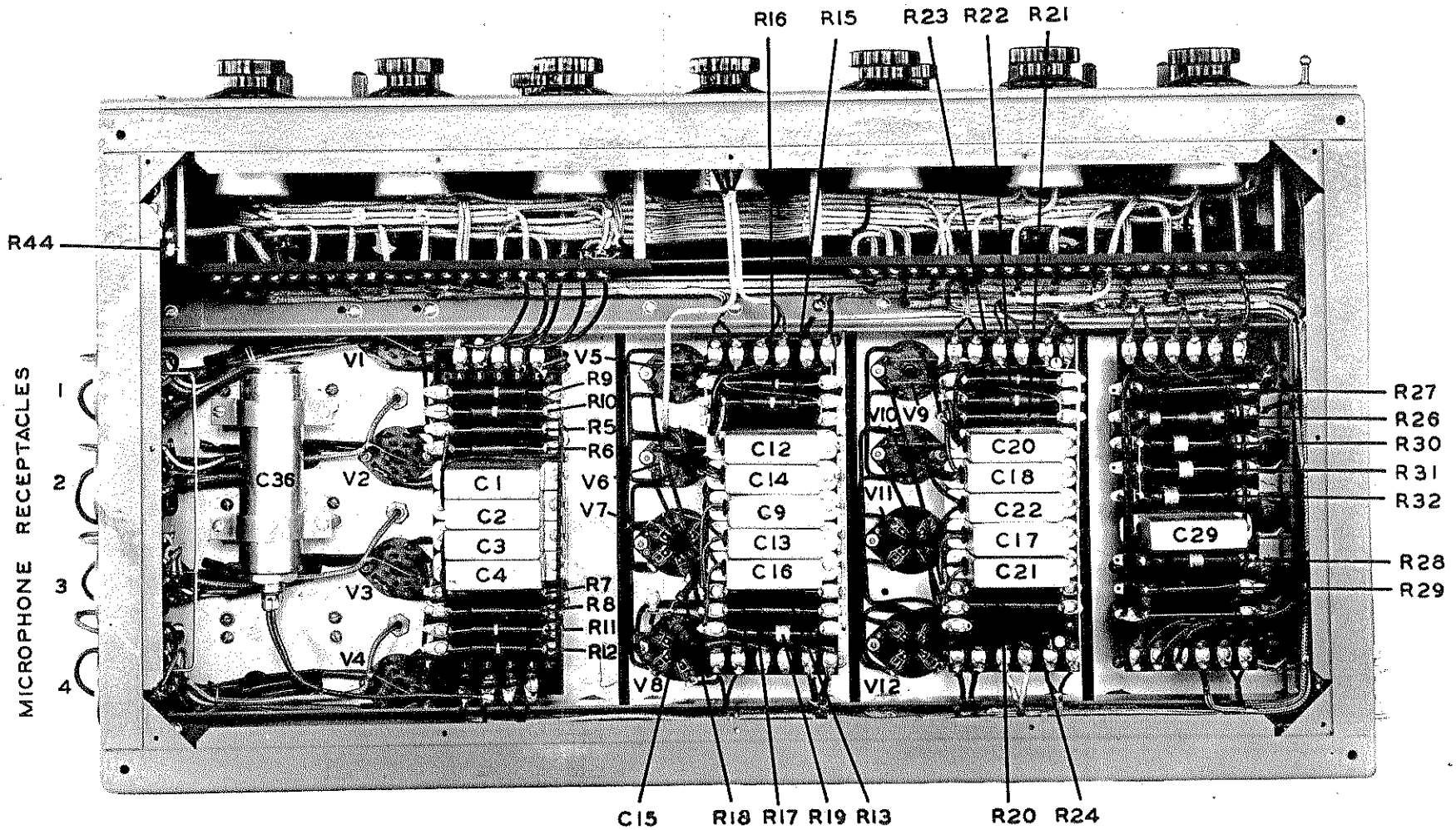
FIG. 1



TOP VIEW

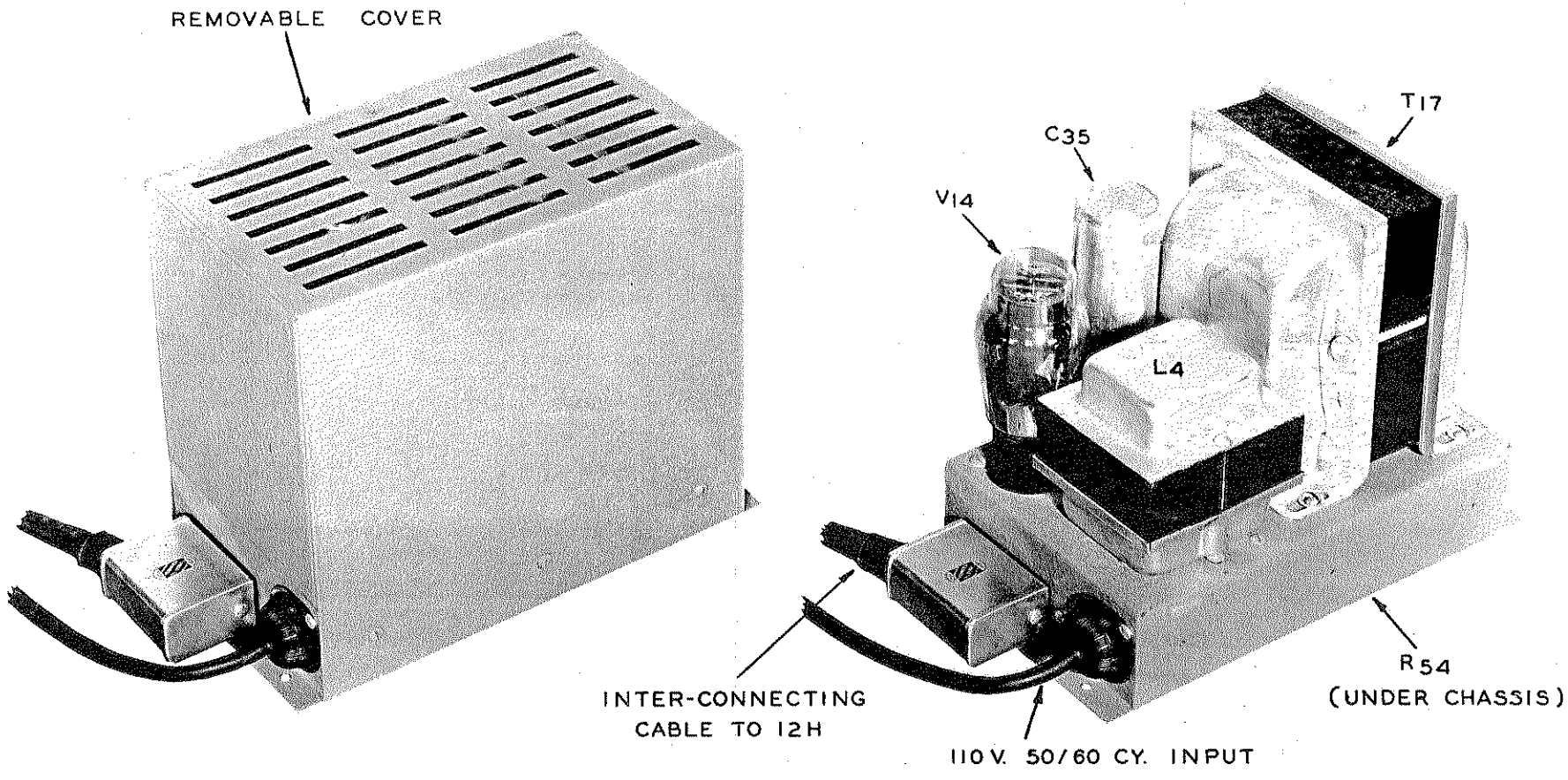
REMOVE 10 SHIPPING BOLTS MARKED X BEFORE ATTEMPTING TO OPERATE EQUIPMENT.

FIG. 2



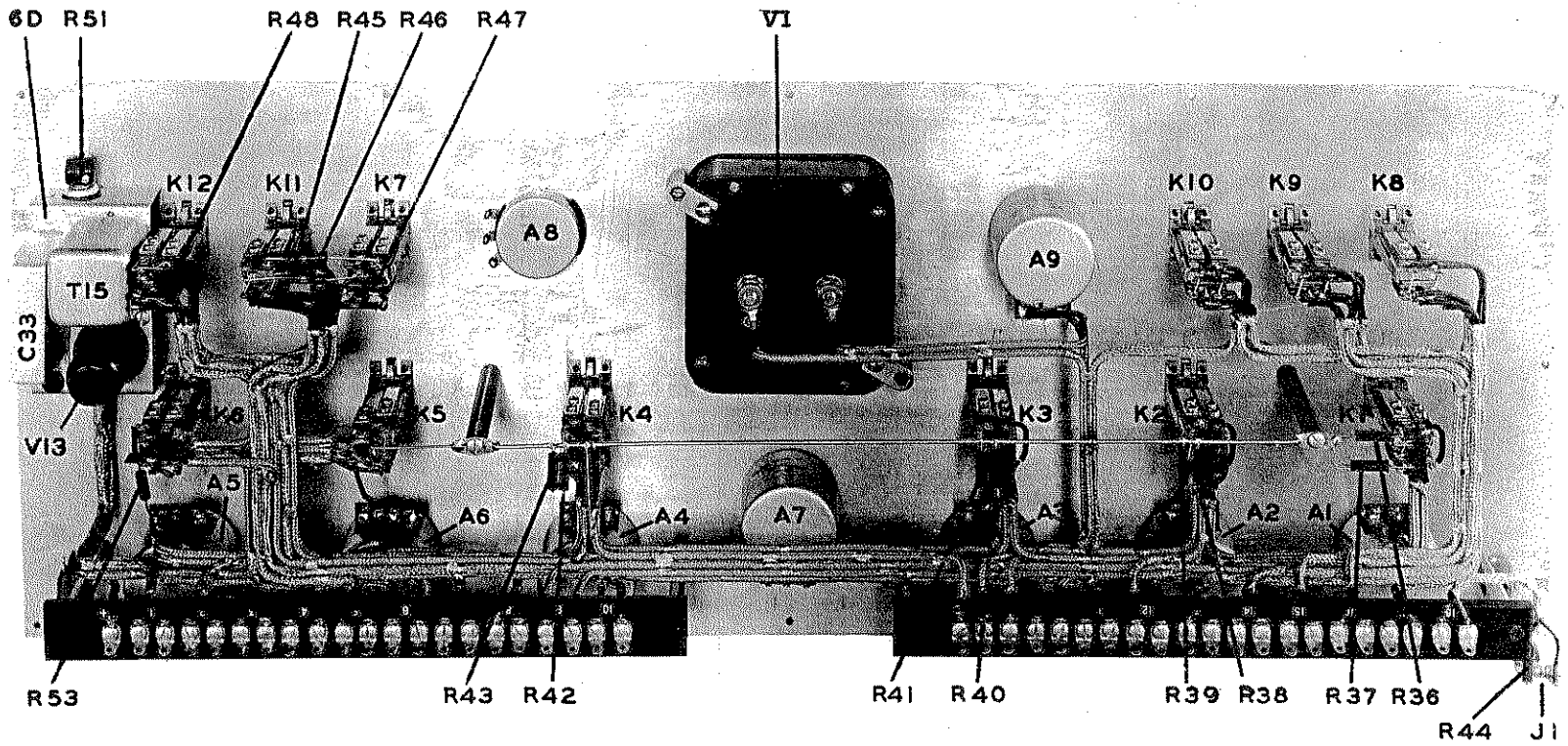
BOTTOM VIEW

FIG 3



409D ISOLATION UNIT

FIG. 4

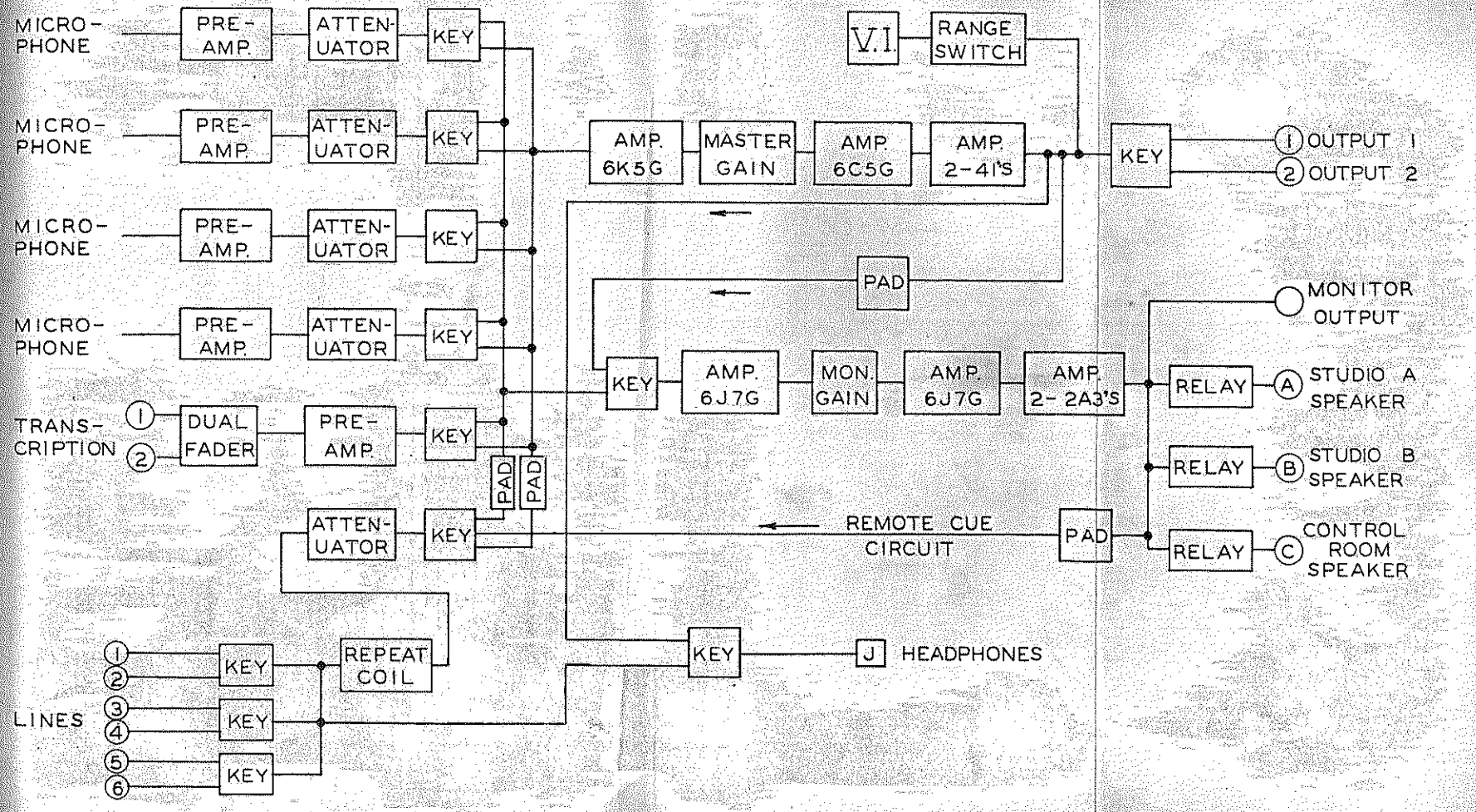


REAR VIEW

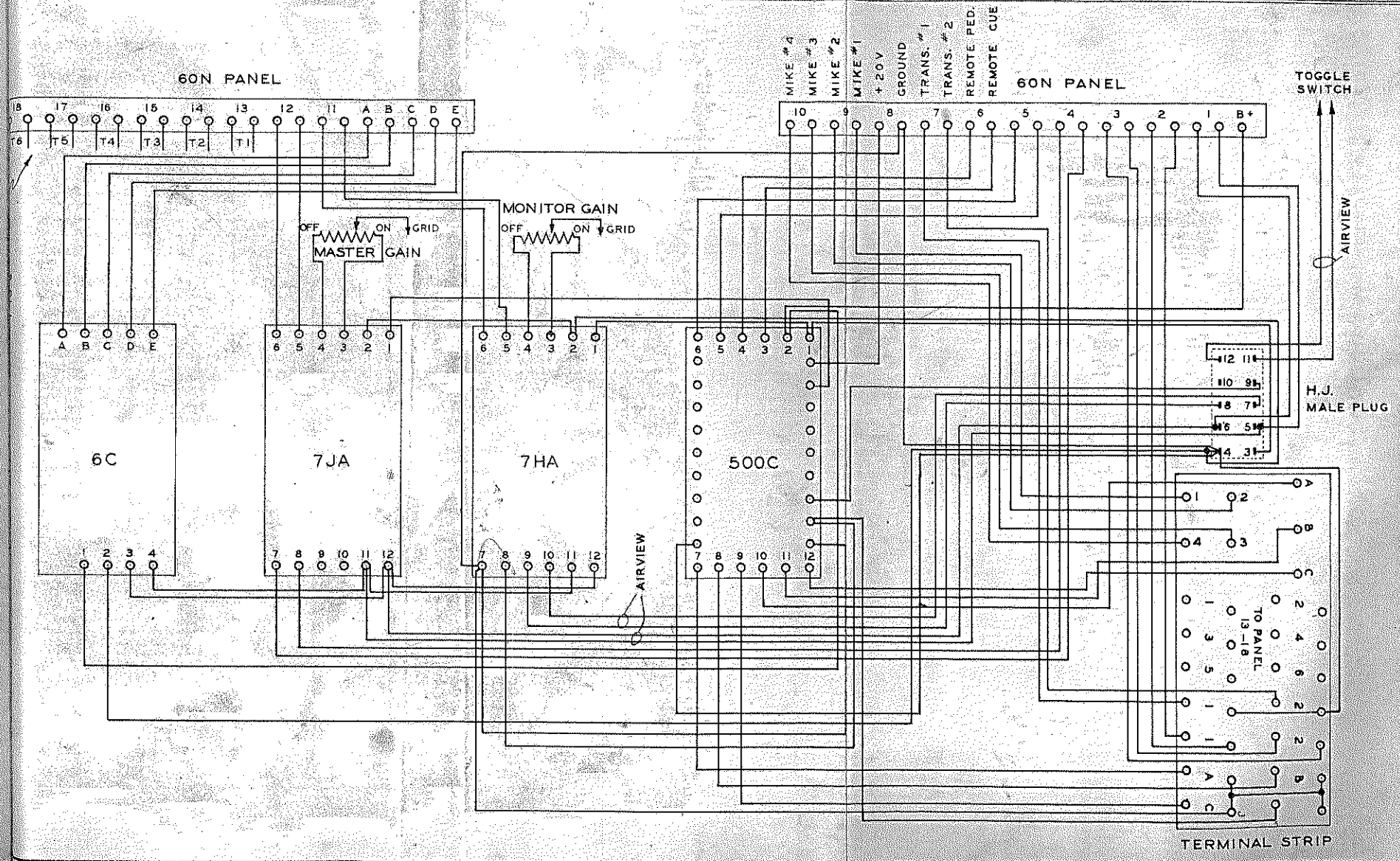
60N CONTROL PANEL

FIG. 5

MAT.:	GRADE:	TRACED BY: R.G.A.	DRAWN BY: F.M.D.	COLLINS RADIO COMPANY
FINISH:		DATE: 1-14-1937	DATE: 1-14-1937	CEDAR RAPIDS, IOWA
UNIT: BLOCK DIAGRAM: 12H SPEECH INPUT EQUIPMENT				DRAWING NO. 3721X-3



MAT.:	GRADE:	TRACED BY: R.G.A.	DRAWN BY: F.M.D.	COLLINS RADIO COMPANY
FINISH:		DATE: 4-6-1937	CHECKED BY: DATE: 4-6-1937	CEDAR RAPIDS, IOWA
UNIT: WIRING DIAGRAM 12H INPUT ASSEMBLY			SCALE	DRAWING NO. 3719X-3



(Form 13)

TYPE 12H SERIAL 3409-12 FOR RADIO STATIONS WHBY-WTAQ

POWER SUPPLY: 332 Volts d.c. 2.6 AND 6.2 Volts a.c.

MAXIMUM OUTPUT: Program Amplifier 24 db. 500 ohm load.

Monitor Amplifier 29 volts across 125 ohms. 6.7 watts.

Tabular data given in decibels. 6 mw reference level. Noise level given in db below zero level at output of amplifier at full gain.

Input to	Mic. 1	Mic 2	Mic 3	Mic 4	Remote	Trans-
Output from	Prog. Line	—	—	—	—	—
Maximum gain	105.5	105.6	105.5	105.5	53	69
Noise level	-28	-27	-27	-30	—	—
Input level	-73.5	-73.5	-73.5	-73.5	-20	-35
Output level	0	0	0	0	0	0
30 c.p.s.	-2.5	-2.5	-2.7	-2.8	-2.0	0.5
60 "	-0.5	-0.8	-0.5	-1.0	-0.4	1.3
120 "	-0.4	-0.6	-0.2	-0.2	-0.1	0.2
200 "	-0.2	-0.3	0	0	0	0
300 "	0	-0.1	0	0	0	0
500 "	0	0	0	0	0	0
1000 "	0	0	0	0	0	0
2000 "	0	0	0.1	0	0.1	0.2
3000 "	0.2	0.7	0.3	0.3	0.2	0.3
5000 "	0.7	0.7	0.9	0.8	0.8	1.0
6000 "	0.7	0.7	1.0	1.0	0.8	1.2
8000 "	0.6	0.5	1.0	0.9	0.8	1.2
10000 "	-0.6	-0.2	-0.2	-0.2	0.1	0.2
12000 "	-3.8	-2.8	-2.8	-2.5	-2.3	-2.0
15000 "	-15.0	-10.0	-10.0	-10.0	-7.0	-7.0

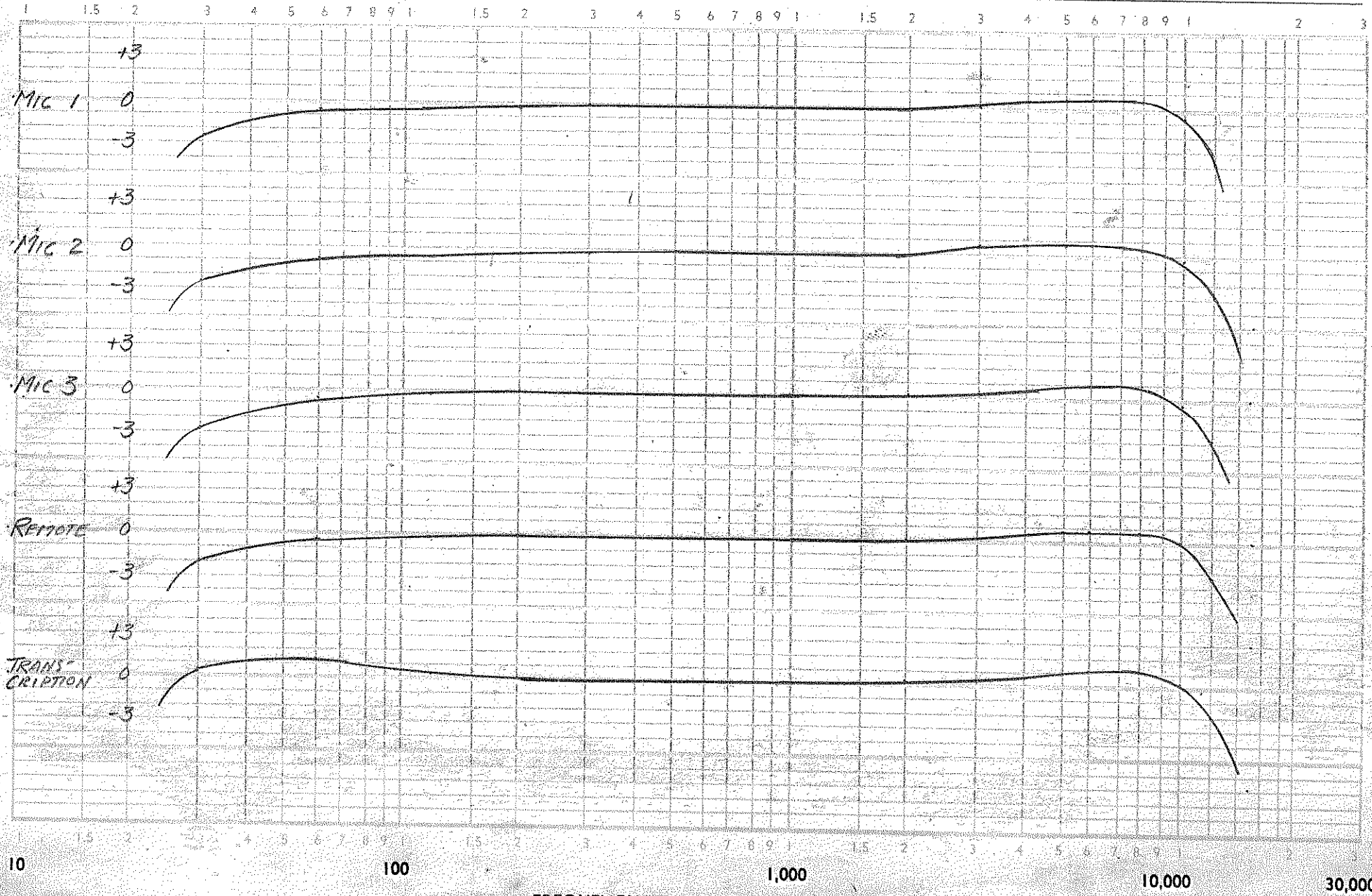
✓ Defective

Date 6-14-37 Test Engineer M. R. Smith

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA

TYPE 12H SERIAL 3409-12 DATE 6-14-37 TESTED BY M R SMITH



IX GUARANTEE

Any parts which prove, after factory inspection, to be of defective manufacture within a year from date of purchase will be replaced without charge upon return to the factory all transportation charges to be borne by the customer. Before returning any item believed to be defective, a report must be submitted giving detailed technical information as to the exact nature of the defect. Upon receipt of such a report a returned equipment tag will be sent which must accompany the shipment.

NO ACTION WILL BE TAKEN ON EQUIPMENT RETURNED WITHOUT OUR RETURN TAG!

3-19-37