COLLINS

SPEECH INPUT EQUIPMENT

★

Instruction Book

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MANUFACTURED BY

COLLINS RADIO COMPANY

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COLLINS TYPE 26C AMPLIFIER

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COLLINS TYPE 26C AMPLIFIER

I GENERAL DESCRIPTION

The Collins 26C is a general purpose program amplifier including means for preventing the peak output signal amplitude from exceeding a certain pre-determined level. The amplifier includes a rectifier and filter system, operating from an external isolation transformer, supplied.

EQUIPMENT INCLUDED

The following apparatus is included with each standard shipment:

1 - 26C Limiting Amplifier

1 - 409G Isolation Transformer

4 - 6J7G Tubes

2 - 6R7G Tubes

2 - 6C8G Tubes

4 - 6K6G Tubes

2 - 6X5G Tubes

1 - Instruction Book

USES

The 26C can be used for any purpose where a high quality program amplifier of moderate output is required. Because of the output limiting feature the 26C will find its greatest application as a program amplifier feeding a radio transmitter, recording device or other equipment where the output level must be carefully regulated.

MECHANICAL CONSTRUCTION

The 26C is constructed on a 14" x 19" x 3/16" dural panel, notched to mount in any standard relay rack or cabinet

such as the Collins 19G-2 or 19G-3. The equipment is assembled on a vertical chassis in such a manner that practically all wiring and circuit components are accessible by removing a dust cover on the rear of the chassis. A hinged door in the front panel provides access to the tubes. The chassis is open at top and bottom, assuring adequate ventilation of tubes and transformers.

POWER SOURCE

The 26C contains a rectifier and filter system for complete a-c operation using the isolation transformer supplied. Unless ordered otherwise, the transformer supplied is for operation from 105-115 volts, 50/60 cycle a.c.

ISOLATION TRANSFORMER

When the 26C is purchased separately for installation by customer, the 409G Isolation Transformer is supplied. This transformer is mounted in a sheet metal case having flanges for mounting on a panel or baseboard. The top cover can be removed to expose the terminals. Fuses and line switch are to be furnished by customer.

The 409F Isolation Unit can be supplied at additional cost. It consists of a filament transformer and a plate transformer with rheostats for controlling these voltages separately. The unit includes fuses, a line switch, and a pilot light, and is mounted on a 7" x 19" panel with mechanical construction similar to that of the 26C.

II CIRCUIT DESCRIPTION

The signal channel of the 26C is composed of (a) voltage amplifier, (b) limiting circuit, (c) a second voltage amplifier, (d) push-pull Class A output amplifier stage.

AMPLIFIER STAGES

Both voltage amplifier stages employ 6J7G tubes, connected as triodes, transformer coupled to the preceding and following stages. Grid bias is obtained by means of the voltage drop across a resistance in the cathode circuit. The plates of the tubes are shunt fed to keep direct current out of the transformer windings.

The output stage uses two 6K6G tubes connected as triodes in push-pull Class A operation. The input is transformer coupled from the preceding stage, and the output is coupled through a transformer to the output load terminals.

LIMITING CIRCUIT

The output of tube V1 is connected to V2 through transformers T2 and T3. The grid of V3 is connected to the secondary of T3 and amplifies the output of this transformer. The output of the triode section of V3 is connected through transformer T6 to the full wave rectifier in V3. Rectified current flowing in this circuit produces a d-c voltage drop across resistor R24. This voltage, applied to the grids of tube V6, causes this tube to function as a variable resistance, controlling the balance of the bridge circuit formed by transformers T2 and T3, thereby varying the transmission through the circuit.

The triode plate current of V3, flowing through resistors R22, R23 and R8, forms a voltage drop or delay bias which the signal voltage applied to the diodes in V3 must exceed before rectified current can flow in the rectifier circuit. Thus the amplifier functions normally (linear input-output relation) until a certain pre-determined input level is reached, above which level the gain is reduced to maintain a fairly constant output.

A switch SW_1, accessible through the tube access door, is provided to remove the limiter from the circuit.

CIRCUIT DESCRIPTION

TIME OF OPERATION AND RELEASE

The time required for the gain reduction to become effective upon application of a large input signal is determined by the charging time of condenser C9. This has been chosen so that the operate time is very short, or of the order of 2 milliseconds.

The time required for the gain to return to normal after the input signal level has been reduced is determined by the discharge time of C9 through resistor R24. With the circuit constants shown this is approximately 3 seconds.

These operate and return times will be found most suitable for general purpose use where voice and music of all kinds are to be transmitted. It is possible to change the characteristics by changing the size of C9 and R24. For example, if voice only is to be handled as in communications work, it may be desirable to reduce the return time in order to maintain the greatest usable gain at all times. In this case R24 could be reduced in size. In no event should the time constant of C9 and R24 be less than 0.1 second.

If music only is to be handled it may be desirable to increase the time constant by increasing the size of R24, C9 or both. This will make the automatic changes in gain less noticeable and will tend to preserve musical expression which is normally lost in the limiting circuit at high signal amplitudes.

The Collins Radio Company can assume no liability for the performance of the 26C when circuit constants other than those originally specified are used. Correspondence with the factory is invited regarding specific applications where other than standard characteristics are required.

LEVEL AT WHICH LIMITING BEGINS

The signal level in T2 and T3 at which limiting begins is fixed at a pre-determined point by the amount of delay bias in the cathode circuit of V3. It is necessary, therefore, to regulate the gain of the system at two points in order to accommodate different input levels and to provide various output levels, while maintaining the level in T2 fixed.

The INPUT LEVEL control, R30, controls the gain preceding the limiting circuit and allows various input levels to be

used while maintaining the proper level to T2.

The OUTPUT LEVEL control, R31, controls the gain following the limiting circuit and allows the output to be adjusted to the correct level to feed the load.

The adjustment of these two controls is described later under the section "OPERATION".

METERING CIRCUITS

The 260 includes two panel instruments, permitting a complete check on the operation of the amplifier and limiting circuits.

A three range volt-milliammeter can be connected by means of push buttons to read plate current in each of the five amplifier tubes separately, and plate supply voltage from the rectifier-filter system. The circuit is wired so that failure in meter, push buttons or associated wiring will not disturb operation of the amplifier. The push buttons are provided with multipled contacts for increased reliability. A terminal, marked M, provides connection for use of the meter externally.

A rectifier type volume indicator meter is used for three purposes as selected by the switch, V.I. SELECTOR, located on the amplifier panel.

With the switch in the position marked FILAMENT, the meter is connected through a multiplier resistor across the heater supply voltage to the amplifier. The resistor is chosen so that the correct voltage is indicated at "0" on the scale. Allowable tolerances are given in the section in this book headed "OPERATION".

With the switch in the position marked OUTPUT, the meter is connected across the 500 ohm output terminals of the amplifier and reads power level in decibels above 6 mw. The output level of the amplifier is given by the setting of the V.I. RANGE switch added algebraically to the reading on the scale of the output meter. For example, if the V.I. RANGE switch is set on 10 and the meter swings up to +3 on its scale, the output level is plus 7 db. With the V.I. RANGE switch set at zero the absolute level at zero on the scale of the meter is zero db, referred to 6mw.

CIRCUIT DESCRIPTION

If the V.I. SELECTOR switch is set in the position marked COMPRESSION the meter is connected to read the d-c voltage drop across resistors R25 and R32 in parallel. As the plate resistance of V6 increases (due to increased negative bias on the grids) the plate current through the tube decreases. Hence, the voltage across R25 and R32 is a measure of the reduction in gain due to the limiting action. A scale on M_1 is calibrated directly in decibels reduction in gain. Resistor R32 is provided to permit the pointer of the meter to be set to zero for different tubes and different values of plate supply voltage.

INPUT

Terminals are provided giving a choice of three input impedances: (a) to match 200 ohms, (b) to match 500 ohms, or (c) to bridge any low impedance circuit. With the latter input connection the amplifier input is 10,000 ohms, resistive, and the gain is reduced 23 db.

The lowest input level which will drive the amplifier to the verge of limiting is approximately -35 db. The maximum input signal which can be accommodated at verge of limiting, with input gain control retarded and with bridging input connection, is plus 15 db into a 500 ohm circuit.

OUTPUT

Terminals are provided so that the 26C can be used to feed a 200 ohm or a 500 ohm load.

Power output is rated at plus 20 db at 1.5% r.m.s. distortion. This power can be increased by use of larger output tubes as described under OPERATION.

FREQUENCY RESPONSE

The frequency response is uniform with not more than 2 db variation between 30 and 10,000 c.p.s.

CIRCUIT DESCRIPTION

NOISE LEVEL

The noise level in the 26C Amplifier is 50 to 80 db below signal level, depending on gain control settings, output level, and degree of automatic control used.

III INSTALLATION

UNPACKING

All parts should be inspected closely when removed from the boxes for evidence of damage during shipment. Be sure that all panel controls work properly. 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.

If all is in good order the equipment may be placed in operation. It is suggested that the procedure outlined below be followed in detail when setting up the amplifier for the first time.

INSTALLATION

1. Mount the 26C Amplifier in position in a Collins Cabinet or similar standard relay rack. Hexagon or round head screws, used with flat washers, are preferable to the oval head screws and cupped washers often used. Do not mount the amplifier too near a source of strong alternating magnetic field as this may introduce objectionable hum.

2. Open the tube access door in the front panel by turning the slotted button counterclockwise until the slot is in a horizontal position. Insert the tubes in their proper sockets. All sockets are properly designated on the socket mounting plate.

The 6R7G, 6C8G, and the two 6J7G tubes each have a grid connection to the top of the tube. The grid lead wires are cut so that the position of the leads is obvious. The correct arrangement is shown in the photograph of the interior of the amplifier.

3. Remove the rear dust cover. The four cover fasteners can be disengaged by turning the slots to a horizontal position.

4. Connect the incoming line to the two terminals on the terminal strip marked INPUT. This line should be completely shielded, with the shield grounded, to prevent hum pickup.

5. Connect the outgoing line to the two terminals on the terminal strip marked OUTPUT. The center tap of the output

TRANSFORMER IS AVAILABLE AT THE TERMINAL MARKED C.T. and may be used if desired.

6. If the 26C Amplifier is to be used to furnish power to one or more Collins 6F, Pre-amplifiers, the terminals marked PREAMPLIFIER -, +, M should be connected to similarly labeled terminals on the pre-amplifiers. The filament supply terminals, D and E on the 26C, should also be connected to the filament terminals on the 6F as described in the 6F instruction book.

7. The connections to the isolation transformer are made by connecting terminals marked ISOLATION TRANSFORMER, A, B, C, D, E, with similarly labeled terminals on the 409C or 409F. These leads may be paralleled with like terminals on another 26C or 7S Amplifier if a common isolation unit is used.

The wires to terminals A and C should be at least equivalent to #20 B. & S., and should be approved for use at 300 volts a.c., r.m.s.

The wires to terminals D and E should be large enough to prevent undue drop in filament voltage. If the distance between isolation transformer and amplifier is not over five feet, #14 B. & S. wire will be satisfactory. If the distance is over five feet, #12 or #10 wire may be required. If the distance is very great, it may be necessary to raise the filament voltage at the transformer as described later. In any case, the installation may be considered satisfactory if the filament voltage measured at the amplifier falls within the limits given in the section in this book headed "OPERATION".

The wire to terminal B is the ground return for both high voltage and heater transformer center taps. It should be as large as is convenient, but not smaller than #14 B. & S.

8. The square bakelite plate located at the right-hand side of the chassis (viewed from rear) carries ten screw terminals which may be interconnected to provide three different input impedances. The following table shows the available input impedances and the connections which must be made to give each impedance.

INPUT IMPEDANCE	JOIN
200 ohms	A to 200; A to 200
500 ohms	A to 500; A to 500
10,000 ohms (Bridging Input)	B to 500; B to 500

On the same terminal plate, the center tap of the input transformer is brought out to the terminal marked C.T. The terminal marked G is connected to the chassis of the amplifier. If the input line is balanced to ground, it may be desirable to join these two terminals.

9. The square bakelite plate at the left-hand side of the chassis (viewed from rear) carries six screw terminals, permitting choice of two output impedances. These should be connected as shown in the following table to give the output impedance desired:

OUTPUT IMPEDANCE	JOIN
200 ohms	Output 1 to 200 Output 2 to 200
500 ohms	Output 1 to 500 Output 2 to 500

10. The line terminal of the 409G (or 409F) Isolation transformer should now be connected to a source of a.c. of the correct voltage and frequency.

INSTALLATION

If the 409G is used, it will be necessary to connect fuses and a line switch, if desired, in the supply line. The 409F includes these items.

The 26C Amplifier should now be ready for operation.

IV OPERATION

GAIN CONTROLS

Because two gain controls are provided, and since the input-output relation is not linear over part of the operating range, the method of adjusting the controls differs from that of conventional program amplifiers. The following is a convenient method which may be used if desired.

1. Turn INPUT LEVEL to the "off" (extreme counterclockwise) position.

2. Turn OUTPUT LEVEL to the "off" (extreme counterclockwise) position.

3. Apply power to amplifier.

4. Turn V.I. SELECTOR to COMPRESSION. Adjust R32, marked ZERO ADJ (accessible through tube door) until the meter reads "0" on the red scale.

5. With audio signal applied to input terminals of amplifier, advance INPUT LEVEL control until the V.I. meter (with V.I. SELECTOR at COMPRESSION) starts to kick down scale from the zero position. The amount of down-swing depends on the amount of gain reduction in effect. This can be controlled with the INPUT LEVEL control.

6. Advance OUTPUT LEVEL until the desired output is obtained, as indicated by volume indicator meter, modulator meter, etc.

AMOUNT OF CONTROL

The maximum amount of automatic control which the 26C can provide is equivalent to about 13 db reduction in gain. This limit is determined not by the characteristics of the limiter circuit, but by the overload point of the input tube, V_1.

Although the 26C is capable of this high degree of control, it is not often desirable to use all of it.

OPERATION

In voice or communications service, it may be found desirable to use a high degree of control with the release time constant shortened as described previously.

In high quality broadcast service, however, any degree of automatic gain control results in a loss faithful reproduction of the original signal. It is necessary to compromise between the advantages of higher average modulation and protection against peaks, and the disadvantage of loss of fidelity which are characteristic of all limiting amplifiers. It has been found that a desirable point of operation is with about 3 db automatic gain reduction on signal peaks, and it is recommended that the 26C be used at this point of operation for broadcast service. In other words, the gain controls should be so adjusted that the meter, set on the COMPRESSION scale, does not kick downward past the 3 db mark on the red scale.

It should be clearly understood that the 26C Limiting Amplifier can in no way replace the control operator in broadcast service. The 26C does supplement his efforts, and makes for a better regulated program by reducing the bad effects of sudden high signal amplitudes which the operator can not control.

METERING

The meter circuits provided permit a check on the operation of all amplifier tubes, and measurement of filament voltage and plate voltage.

The operating currents and voltages are read on the triple-scale meter, M2, located at the upper left-hand corner of the panel. Readings are made by depressing the button corresponding to the circuit to be checked. The following table gives typical readings obtained under normal operation. If the plate supply voltage is different from that shown (due to adjustment of taps in 409G or adjustment of rheostats in 409F) corresponding correction must be made in other readings.

Button Number	Circuit	Meter Scale	Meter Reading
1	V_1 6J7G	0-5 ma.	2 ma.
2	V_2 6J7G	0-5 ma.	1.6 ma.
3	V_3 6R7G	0-5 ma.	1.5 ma.
4	V_4 6K6G	0-50 ma.	18 ma.
5	V_5 6K6G	0-50 ma.	18 ma.
V	Plate Voltage	0-500 V.	255 V.

No provision is made for reading plate current of V6 on this meter as the COMPRESSION scale on the V.I. meter, M1, is essentially a plate current reading for this tube.

The filament voltage is read on the rectifier type meter, M1. There is no calibrated filament voltage scale on the meter, but a series multiplier is provided so that the meter reads 6.3 Volts at "0" on its scale. The following table shows filament voltage in terms of the db scale reading on the meter:

Db	-2	-1	-0.5	0	+0.5	+1	+2
Volts	5.0	5.6	5.9	6.3	6.7	7.05	7.9

The amplifier tubes will operate satisfactorily over a filament voltage range of 5.5 to 8.0 volts. Therefore, the V.I. meter with V.I. SELECTOR in position marked FILAMENT should read between -1 db and +2 db on its scale.

During normal operation the V.I. SELECTOR switch should be left either in the position marked COMPRESSION or in the position marked OUTPUT.

The panel of the 26C is fitted with clamps of special design arranged so that the instruments can be removed for in-

spection or repair without disturbing the amplifier or wiring. The clamping screws (one for each meter) are located on the rear of the panel just inside the tube door and can be seen at the upper corners of the opening when the door is open. If these screws are loosened with a small screw driver, the meter can be removed far enough from the panel to permit the leads to be disconnected from the meter terminal posts. When replacing the meter, care should be taken to tighten the clamping screw firmly enough to hold the meter securely, but not tight enough to crack the meter case.

409G ISOLATION TRANSFORMER

When the 26C is purchased for installation by customer the 409G isolation transformer is supplied. The wiring diagram of this unit as shipped is shown in drawing 5107-1 included in this book. In most cases the standard connections will be satisfactory, but in some instances it may be necessary to change the voltages somewhat. Taps are provided on the primary and on each secondary winding which permit a total variation of about 30% to be obtained. The following table shows the various connections which may be made inside the 409G transformer case (connections accessible by removing the bakelite terminal board) and the voltages which will be obtained:

Transformer Connections to 110V. Terminals	Transformer Connections to Terminals A & C	Voltage A-B or B-C	Transformer Connections to D-E	Filament Voltage D-E
Black and Black-Yellow	Red and Red	290	Green and Green	7.8
Black and Black-Red	Red and Red	261	Green and Green	7.0
Black and Black-Yellow	Blue and Blue	240	Black and Black	6.6
Black and Black-Red	Blue and Blue	216	Black and Black	6.0

*Standard connection as supplied from factory.

The connections to terminal B inside the 409G need not be disturbed.

409F ISOLATION UNIT

When the 26C is furnished as part of a rack mounted speech input assembly, the 409F Isolation Unit is more suitable and is usually supplied in place of the 409G. Its greater cost is partially offset by the fact that it is capable of operating two 26C Amplifiers, or one 26C Amplifier, one 7S Amplifier and two or three 6F Preamplifiers.

The 409F includes a line switch, line pilot light, fuses, and individual voltage controls for filament and plate circuits. The unit is wired at the factory as shown in drawing 5107, and this connection will normally operate satisfactorily. Should it be necessary to increase the voltage above that provided by the variable controls, the primary connection may be made to the Black-Yellow taps on the plate transformer in place of the Black-Red tap. This will increase the plate voltage about 10%.

REPLACEMENT TUBES

The performance of the 26C Amplifier depends to a large extent on the characteristics of the tubes used. Each amplifier is shipped (unless ordered otherwise) with two sets of tubes which have been tested and found to operate satisfactorily in the amplifier. Replacement tubes can be obtained at any time from the Collins Radio Company or can be obtained from any tube dealer. In the latter case it is advisable to try several tubes, retaining the one having lowest noise level in each position.

The 26C is designed for use with octal base "G" type glass tubes. Metal tubes can be used but in general their performance has been found inferior to that of the glass tubes.

The output stage is designed for use with type 6K6G tubes, triode connected. In some cases the power output which these tubes will furnish (about plus 20 db referred to 6 mw) is inadequate and larger tubes are required. In such cases, type 6F6G tubes may be used in the output stage with the plate voltage increased to 300 volts, giving output as high as 2 or 3 watts. Drawing 6985 shows the relation between power output and distortion at various plate voltages and with different output tubes, as measured on a typical amplifier.

V MAINTENANCE

In case of failure or improper operation of the amplifier, an attempt should be made to localize the fault. In many cases the defect will result in abnormal plate current or voltage measurements, and these readings may give a clue to the source of trouble. By means of systematic checking the trouble can be narrowed down to a single stage, after which inspection and localized checking with test instruments can be used to isolate the fault.

AMPLITUDE DISTORTION

Excessive amplitude distortion can be caused by a defective tube or by improper operating voltages. All tubes accompanying the amplifier are checked for proper operation before leaving the factory. Over a period of time the characteristics may change; it is therefore advisable to check the condition of the tubes occasionally as described previously to insure correct operation.

Practically every trouble which results in amplitude distortion will cause a change in meter reading on one or more tubes, and hence can be located by the metering system in the amplifier.

NOISE

Noise in the 26C can be divided into four classes:

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

The first three are usually present to some degree in any amplifying system. Their magnitude depends on circuit design and unit construction. In the Collins 26C these undesirable effects have been reduced to a negligible value, even at full gain.

(1) Microphonics are usually caused by vibration of the circuit components, especially the tubes. Vibrations in the tubes have been satisfactorily eliminated as a source of noise by mounting the tube socket panel on live rubber. Should microphonics become excessive in the 26C, the trouble will usually be found in the tubes and can be eliminated by replacing the troublesome tube or tubes.

(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 will occur whenever any part of the unit is near a strong alternating magnetic field. For this reason, the amplifier should be located several feet away from any such fields.

Defective tubes can best 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 providing the 26C unit is itself grounded.

A defective power supply can cause hum due to insufficient filtering of the high voltage supply. The filter condensers should be checked to determine whether they are open circuited if hum from this source is suspected.

(3) Hiss can be caused by defective tubes as well as by an open 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 defective stage can be located most easily by progressively checking the output of each stage.

(4) Intermittent noises 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 input connections, then the grid connector of the first tube, then each tube in turn until the noise stops. It is quite likely that the noise is associated with the apparatus or wiring con-

nected with the tube or connector last removed. The associated apparatus and wiring should be checked closely and if necessary parts thought to be defective should be replaced by others known to be in good working order.

Should the 26C amplifier develop difficulties which cannot be handled in the field, the factory should be notified. However, it is difficult to suggest possible solutions unless complete information is given as to the symptoms and behavior of the equipment.

REPLACEMENT PARTS

The following parts list is given as a guide in obtaining correct parts for replacement or for use as spares. All parts listed can be obtained from the Collins Radio Company. When ordering, it is necessary to give the item number, description, value and stock number of the part, and the type number of the unit in which it is used.

VI PARTS LIST

Item	Description	Value	Part No.
R1, R2	Input pad resistors	5000 ohm 1/2 W	170.5mBT½
R3	Input pad resistor	500 ohm 1/2 W	172.500BW½
R4	Bias resistor for V1	2000 ohm 1 W	170.2mBT1
R5	Bias resistor for V2	2000 ohm 1 W	170.2mBT1
R6	Meter Shunt for V1	25 ohm 1% 1 W	172.18
R7	Meter shunt for V2	25 ohm 1% 1 W	172.18
R8	Meter shunt for V3	25 ohm 1% 1 W	172.18
R9, R10, R11, R12	Limiter plate feed resistors	150,000 ohm 1 W	170.150mBT1
R13, R14	Signal voltage divider	50,000 ohm 1/2 W	170.50mBT½
R15	Plate resistor for V2	50,000 ohm 1 W	170.50mBT1
R16	Bias resistor for V4	1250 ohm 10 W	172.1250BD
R17	Bias resistor for V5	1250 ohm 10 W	170.1250BD
R18	Meter shunt for V4	2.04 ohm 1% 1 W	172.14
R19	Meter shunt for V5	2.04 ohm 1% 1 W	172.14
R20	Plate resistor for V3	50,000 ohm 1 W	170.50mBT1
R21	Grid resistor for V3	500,000 ohm 1 W	170.500mBT1
R22, R23	Cathode resistor for V3	10,000 ohm 1 W	170.10mBT1
R24	Limiter time constant resistor	10 meg. 1 W	170.10megBT1
R25	Cathode resistor for V6	500 ohm 1/2 W	172.500BW½
R26	Filament voltage mult. resistor	16,300 ohm 1% 1 W	172.69
R27	V.f. series resistor	3419 ohm 1% 1 W	172.16
R28	Meter multiplier resistor	100,000 ohm 1%	172.57
R29	Meter shunt for H.V.	25 ohm 1% 1 W	172.18
R30	Input level control	100,000 ohm 30 steps	173.92
R31	Output level control	100,000 ohm 30 steps	173.92
R32	Meter zero adjustment	400 ohm	173.94
R33	V.f. range switch		173.56
R34	Decoupling resistor for V1	20,000 ohm 1 W	170.20mBT1
R35	Plate resistor for V1	50,000 ohm 1 W	170.50mBT1
C1	Cathode by-pass for V1	20 mfd. 100 V	183.5
C2	" " " V2	.05 mfd 600 V	931N5
C3	" " " V4	20 mfd 100 V	183.5
C4	" " " V5	20 mfd 100 V	183.5
C5	" " " V3	20 mfd 100 V	183.5
C6	Plate coupling for V1	0.25 mfd 600 V	931N10
C7	" " " V2	" " " "	931N10
C8	Grid coupling for V3	0.05 " " "	931N51
C9	Limiter time constant cond.	0.25 mfd. 400 V	931N55
C10, C11 C12, C13, C14	Filter condensers	6mfd. 450 V	931N28
C15	Decoupling cond. for V1	6mfd. 450 V	931N28
T1	Input transformer		6673210D
T2, T3	Limiter transformer		6673223E
T4	Push-pull input transformer		6673223F
T5	Output transformer		6673241A
T6	Rectifier input transformer		6673223E

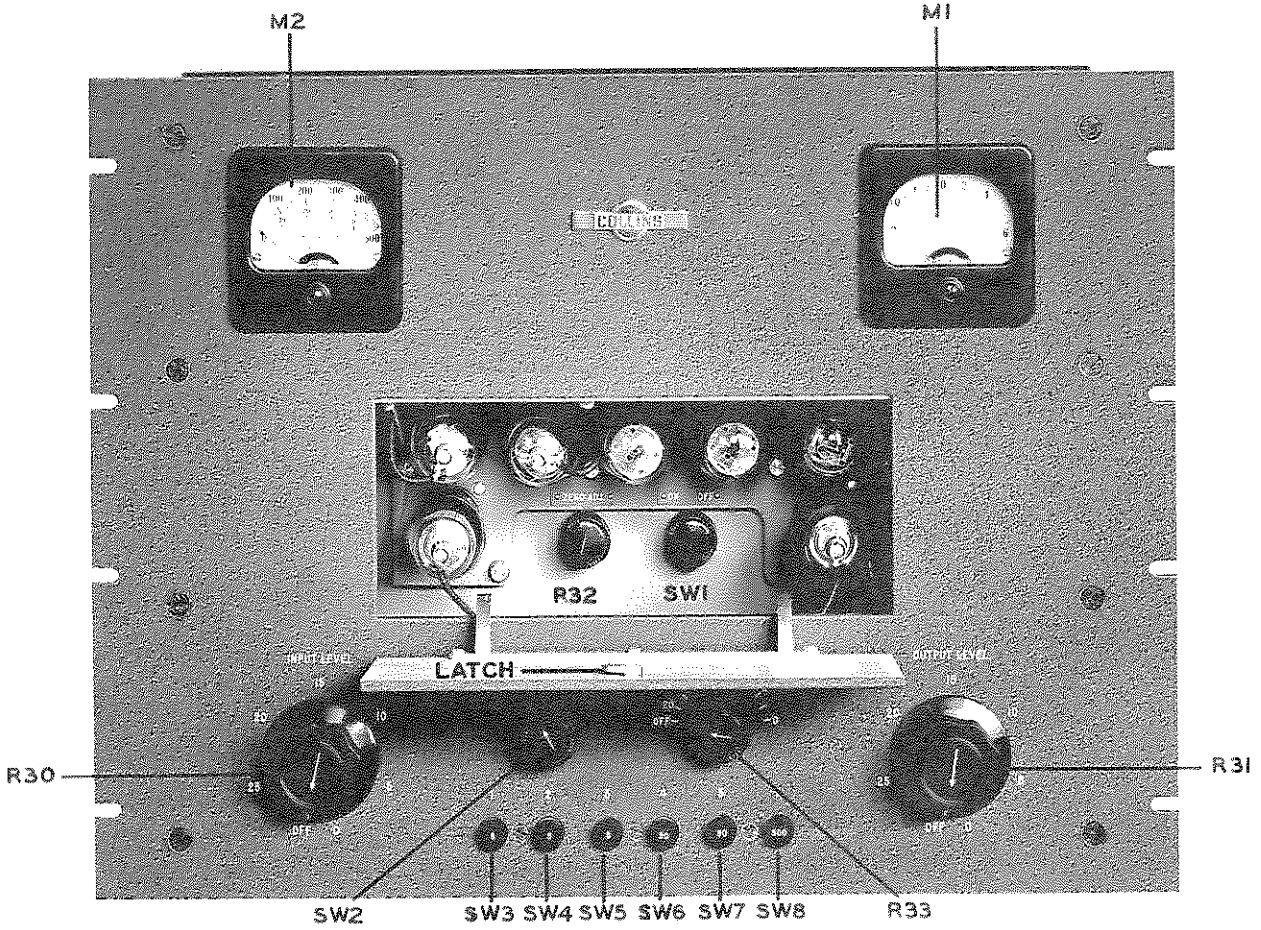
PARTS LIST

Item	Description	Value	Part No.
L1	Input filter choke		6603470
L2, L3	Dual choke in same case		6603469A
SW1	Limiter on-off switch	2 pos. 2 ckt.	259N83
SW2	V.I. selector switch	3 pos. 2 ckt.	259N69
SW3	Meter push key for V1		222.42
SW4	Meter push key for V2		222.42
SW5	Meter push key for V3		222.42
SW6	Meter push key for V4		222.42
SW7	Meter push key for V5		222.42
SW8	Meter push key for voltage		222.43
M1	V.I. meter	-10/0/+6	455.3
M2	Volt-milliammeter	0-5-50-500	457.30

VII LIST OF PHOTOGRAPHS AND DIAGRAMS

Front Panel View of 26C
Front View with panel removed
Rear View with dust cover removed

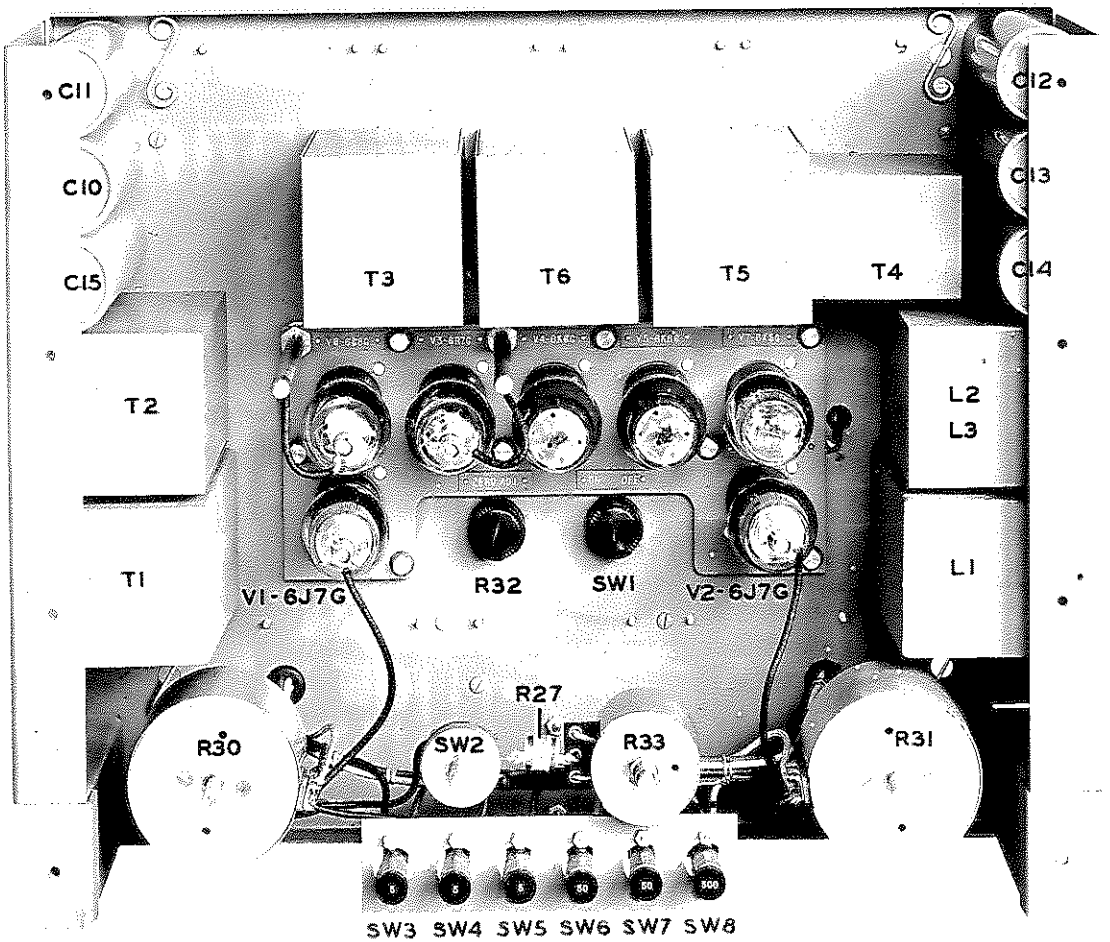
Limiting Characteristics 6984-1
Schematic 409G-409F 5107-2
Schematic 26C 6924X-1



26C LIMITING AMPLIFIER

FRONT VIEW

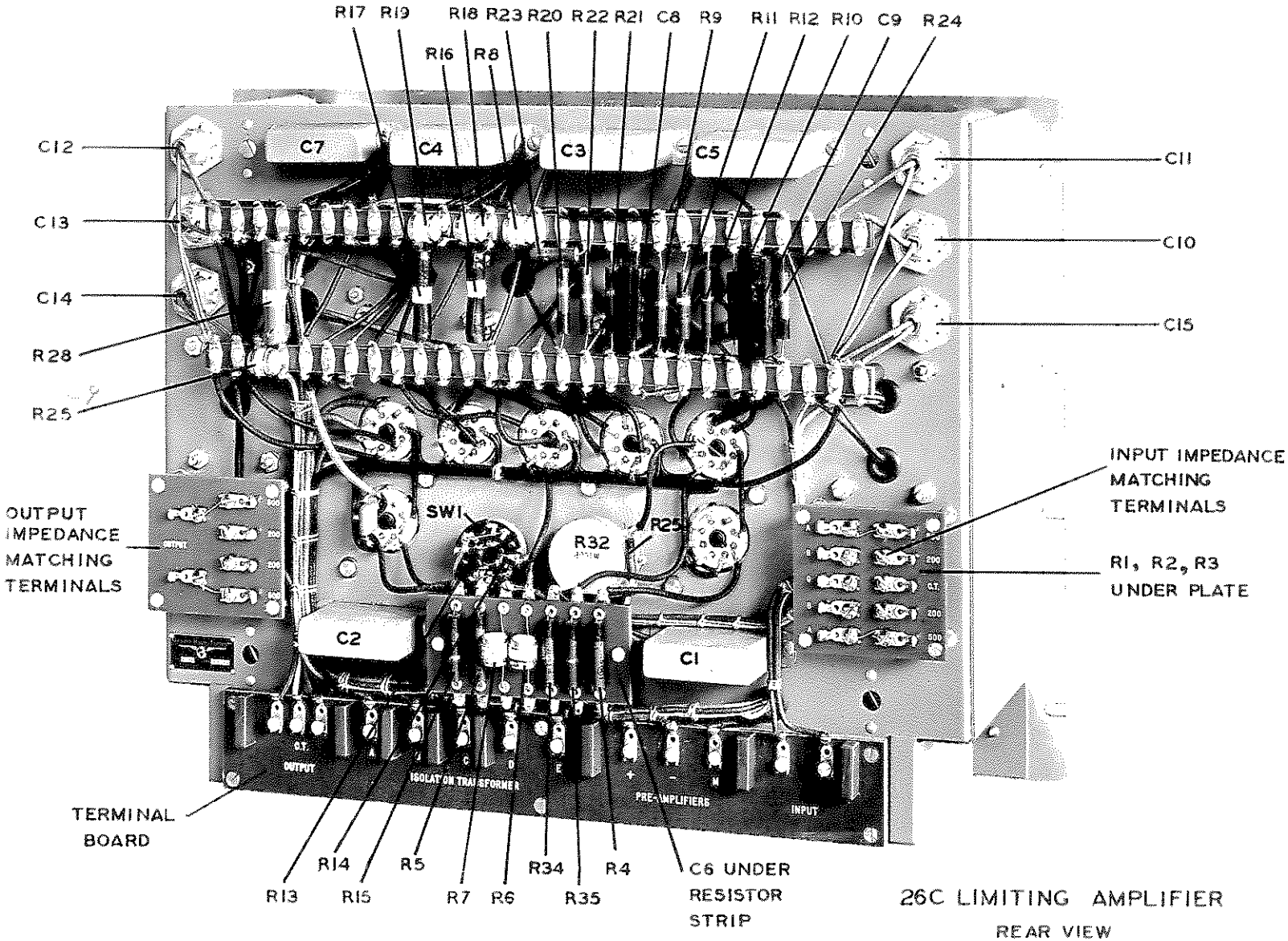
TUBE ACCESS DOOR OPEN



26C LIMITING AMPLIFIER

FRONT VIEW

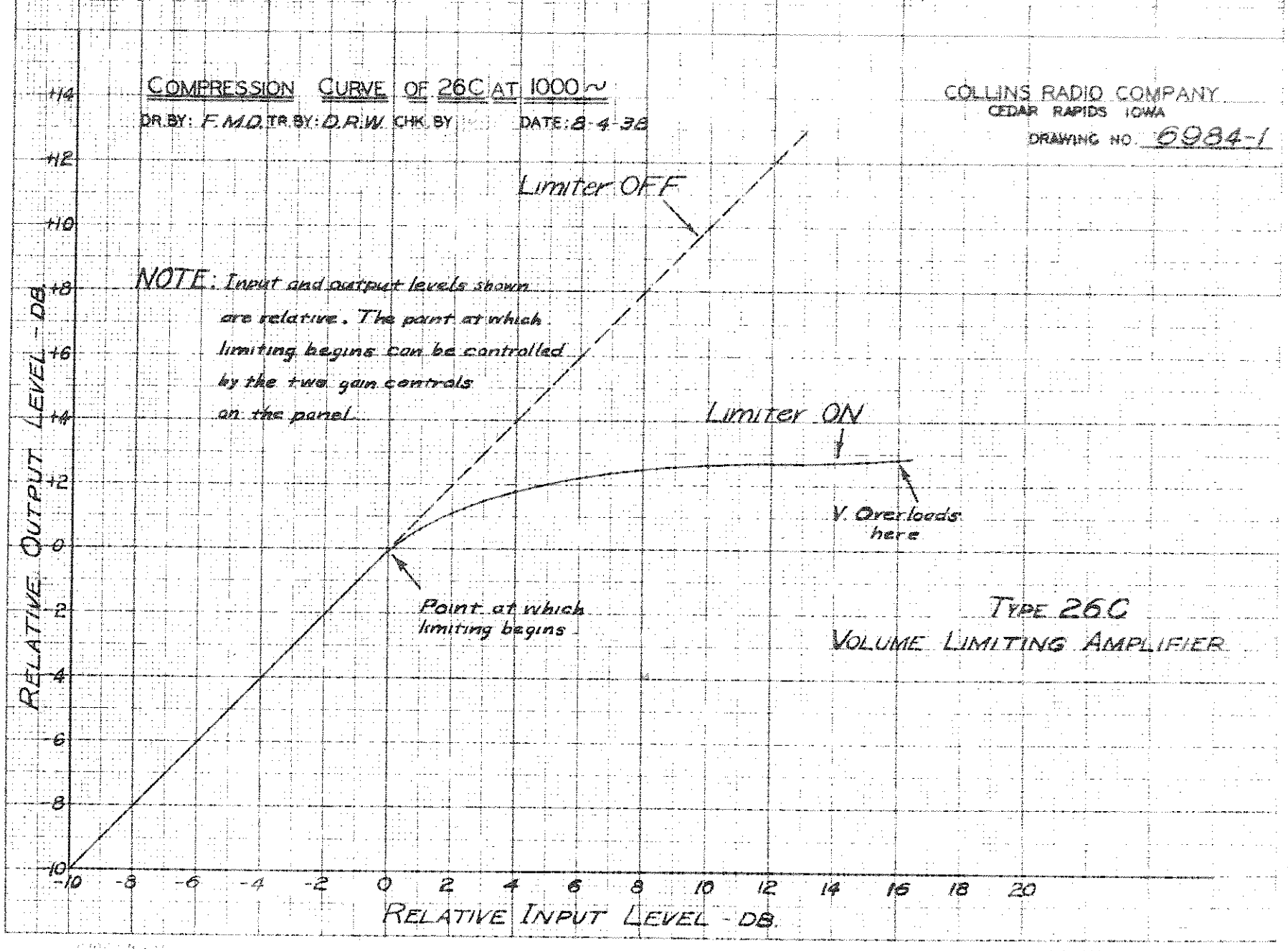
PANEL REMOVED



26C LIMITING AMPLIFIER

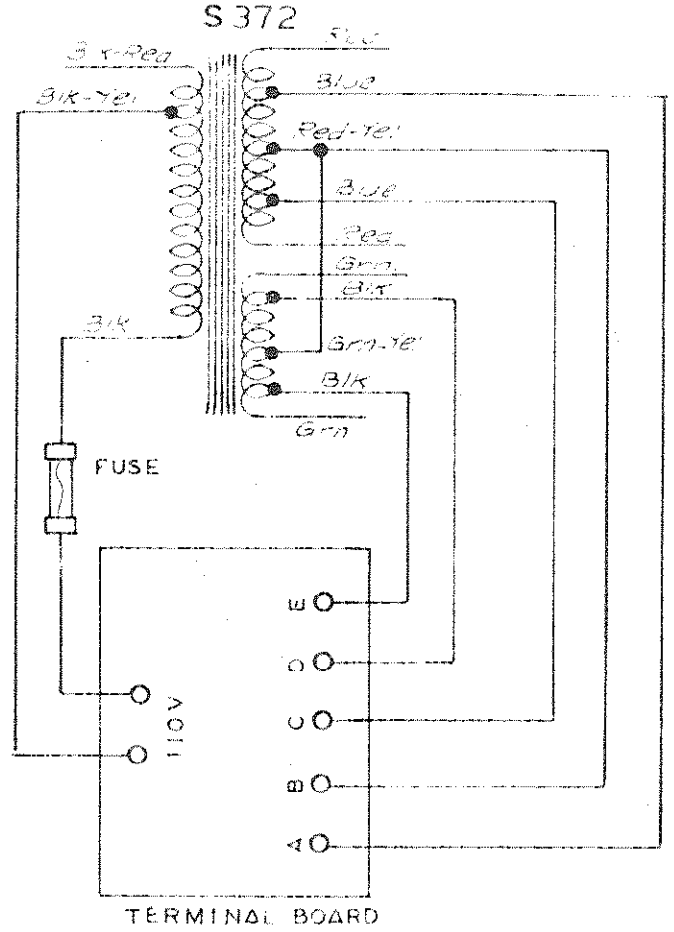
REAR VIEW

DUST COVER REMOVED

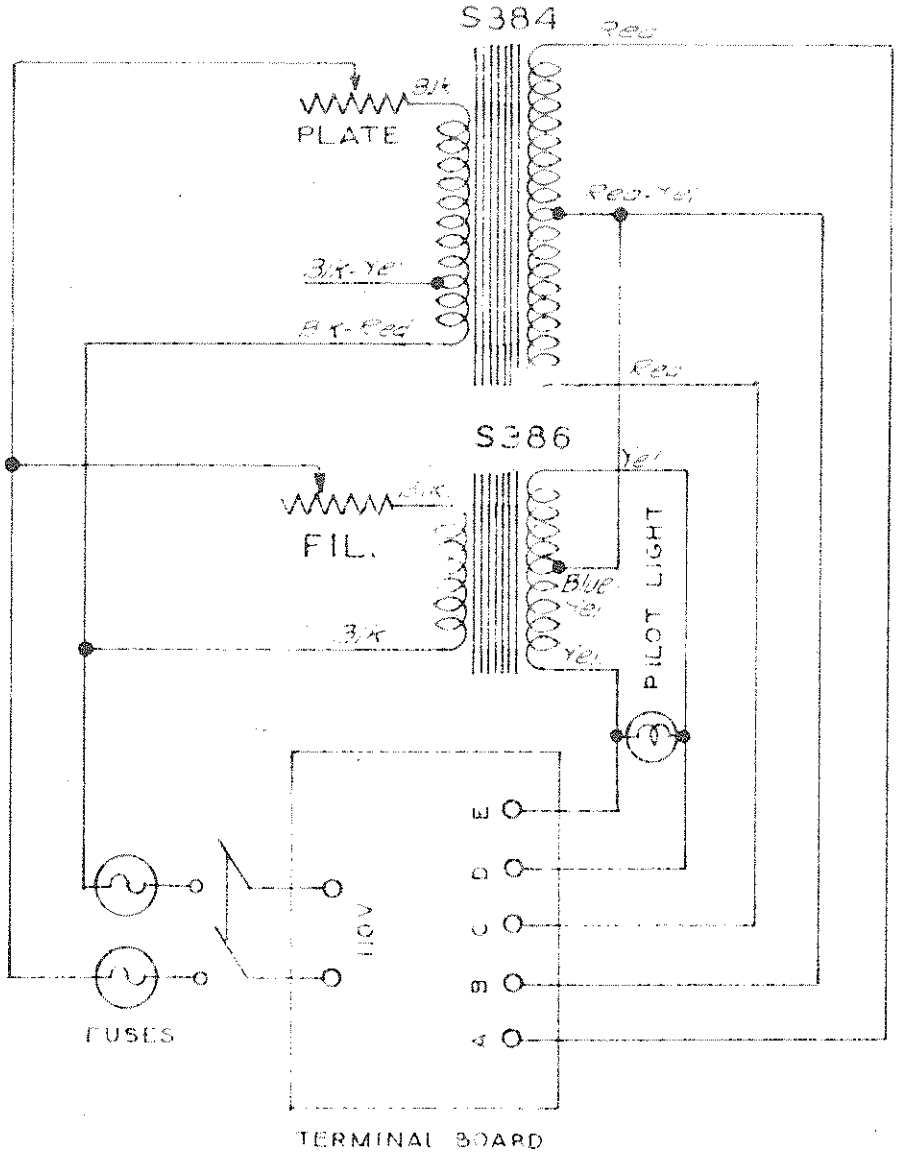

COMPRESSION CURVE OF 26C AT 1000~
DR. BY: F.M.D. TR. BY: D.R.W. CHK. BY: DATE: 8-4-38
COLLINS RADIO COMPANY
CEDAR RAPIDS IOWA
DRAWING NO. 6984-1
Limiter OFF
NOTE: Input and output levels shown are relative. The point at which limiting begins can be controlled by the two gain controls on the panel.
Limiter ON
V. Ores loads here
Point at which limiting begins
TYPE 26C
VOLUME LIMITING AMPLIFIER
RELATIVE OUTPUT LEVEL - DB
+14
+12
+10
+8
+6
+4
+2
0
-2
-4
-6
-8
-10
-10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20
RELATIVE INPUT LEVEL - DB.

MAT | GRADE | TRACED BY R.G.A. | DRAWN BY L.J.G. | COLLINS RADIO COMPANY
FINISH | DATE 7-16-1937 | DATE 7-15-1937 | CEDAR RAPIDS IOWA

UNIT 409G AND 409F SCHEMATIC | DRAWING NO. 5107-2

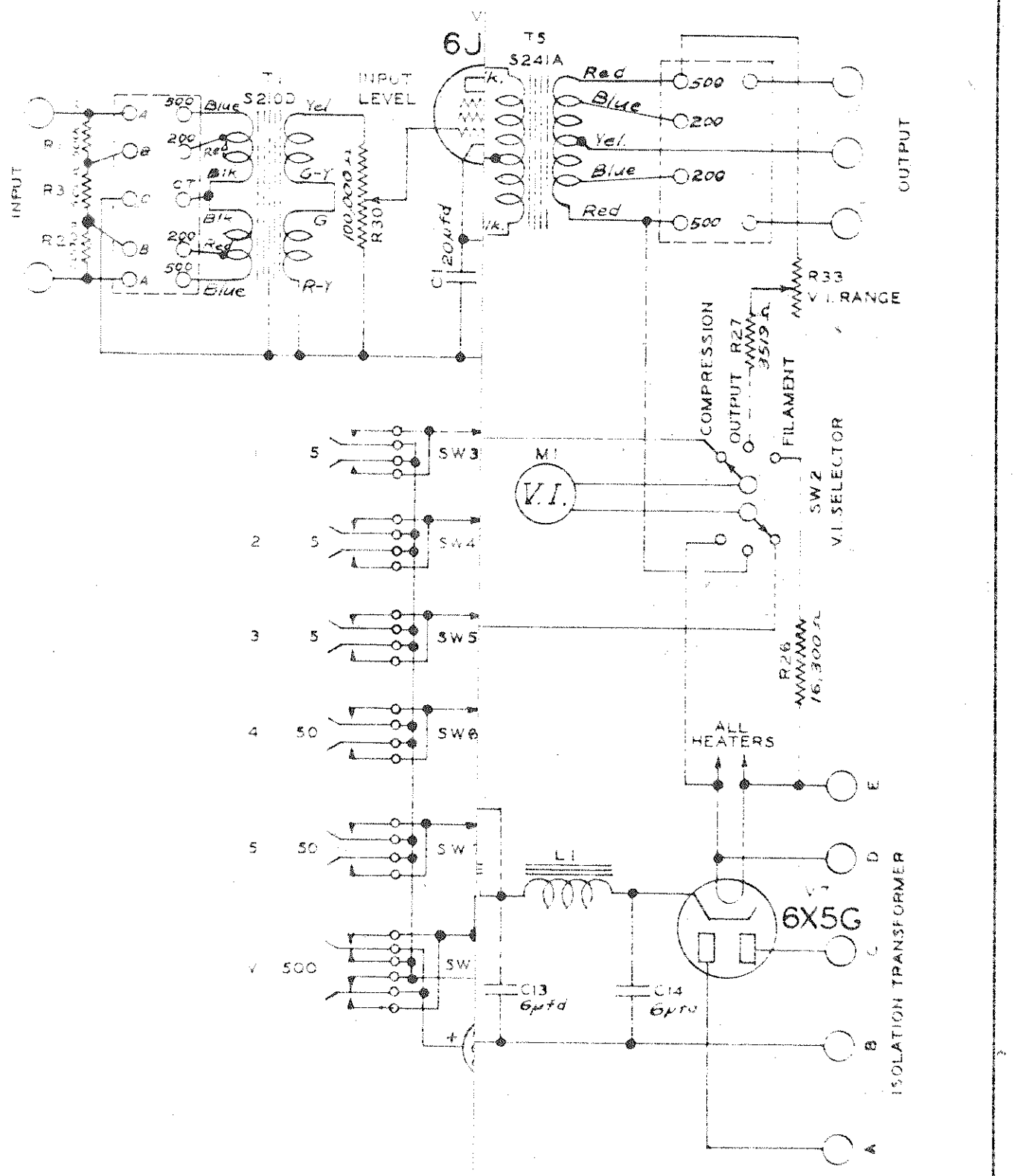


409G



409F

10-10-38	COLLINS RADIO COMPANY CEDAR RAPIDS, IOWA
SCALE	DRAWING NO. 6924X-1



Type 260 LIMITING AMPLIFIER Model _____ Serial _____
(Line voltage held at 110 V. during test) Panel finish _____

	Ext.	Int.		Ext.	Int.
V_1 cathode voltage	_____ V.		V_4 cathode voltage	_____ V.	
plate voltage	_____ V.		plate voltage	_____ V.	
decoupling V.	_____ V.		plate current	_____ ma.	_____ ma.
plate current	_____ ma.	_____ ma.	V_5 cathode voltage	_____ V.	
V_2 cathode voltage	_____ V.		plate voltage	_____ V.	
plate voltage	_____ V.		plate current	_____ ma.	_____ ma.
plate current	_____ ma.	_____ ma.	V_6 plate current	_____ ma.	
V_3 cathode voltage	_____ V.		Plate supply volts	_____ V.	_____ V.
plate voltage	_____ V.		Heater volts	_____ V.	_____ db
plate current	_____ ma.	_____ ma.	Voltage A to C	_____ V.	

At verge of compression: Min. input level _____ db; Max. output level _____ db.
Gain at 1000 c.p.s.: _____ db with 500 ohm input; _____ db with bridging input.
_____ db from grid of V_1; _____ db from grid of V_2.
Compression scale: 1 db at _____; 2 db at _____; 3 db at _____; 5 db at _____.

Distortion: -20 db input. No compression. 6 db compression.

Output	50	400	1000	5000	7500	50	400	1000	5000	7500
0 db	%	%	%	%	%	%	%	%	%	%
+5 db	%	%	%	%	%	%	%	%	%	%
+10 db	%	%	%	%	%	%	%	%	%	%
+15 db	%	%	%	%	%	%	%	%	%	%
+20 db	%	%	%	%	%	%	%	%	%	%
+22 db	%	%	%	%	%	%	%	%	%	%

Noise in db below zero level at amplifier output. Input terminated.

	Output Control at 0	Output Control at 15	Output Control Off
Input control at 0	- db	- db	
Input control off	- db	- db	- db

Limiter operate time _____ Sec.; release time _____ sec. (With signal 10 db above verge of compression applied and removed.)
Compression curve checked per 6984-1 within ± 1/2 db: _____
Frequency response: Input -20 db to 500 ohms. Output +10 db from 500 ohms.

	From V_2 Grid	From V_1 Grid	Limiter Off	Below Compr.	3 db Compr.
20 cps	db	db	db	db	db
30 "	db	db	db	db	db
60 "	db	db	db	db	db
100 "	db	db	db	db	db
200 "	db	db	db	db	db
300 "	db	db	db	db	db
500 "	db	db	db	db	db
1000 "	db	db	db	db	db
2000 "	db	db	db	db	db
3000 "	db	db	db	db	db
5000 "	db	db	db	db	db
6000 "	db	db	db	db	db
8000 "	db	db	db	db	db
10000 "	db	db	db	db	db
12000 "	db	db	db	db	db

Freq. response within ±1/2 db of above: 200 ohm in ___; bridging in ___; 200 ohm out ___.
Output V.I. calibration within ±1/2 db at all frequencies: _____
Date Tested _____ Tested By _____

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!