1. Summary

Steanes Model 976B & Speaker Combo. Serial No. 2466. eBay July 2016

12AX7 microphone gain stage with volume pot to 12AX7 mixer stage, with PU input through volume pot to mixer stage. Output of mixer stage to tone control and then to 12AX7 feedback input stage to cathodyne phase splitter. 6M5 push-pull output stage with common cathode bias. Output transformer secondary with separate feedback winding, and floating 100V distribution. 6V4 full-wave rectifier with two RC droppers.

Excellent condition. Original white plastic Steanes badge on top grill, but 1958-9 manufacture date indicates Philips manufacture with Steanes badging. Green thread lock marked fixings.

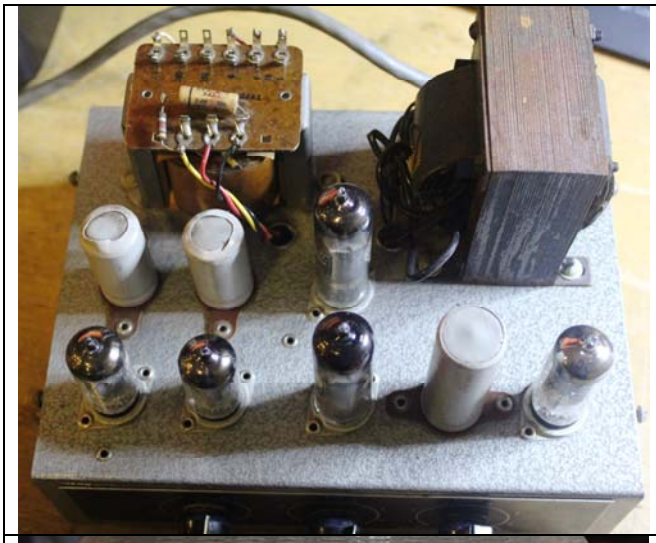
Components

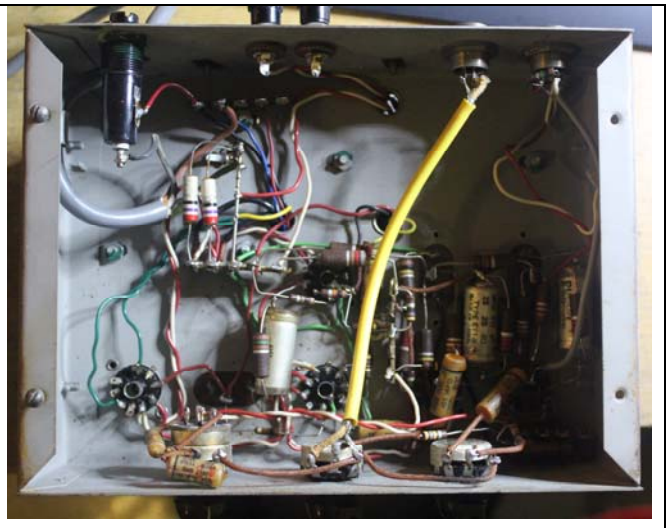
Power Transformer	'344.096', '4x9'. 250-CT-250, 6V3 ~3A, 6V3 ?A.
Output Transformer	'TYPE 903'. 0219 with VSNP stamp. 8k2Ω PP (DCR=190Ω); 0-250Ω-500Ω-1000Ω (50-70-100V); 1.5Ω F-FB.
CAPs	Ducon 24uF 300V 28 48 38
	Ducon ET1B 58 68 58
	Ducon High Seal 118
Pots	IRC 86 or 8G curve C
Tubes (all Miniwatt)	6V4 Miniwatt 8K kC 8J (kC=6X4, 8=1958 or 68)
	6M5 Miniwatt 9A M+ 8L (M+=EL80=6M5; 8=1958)
	6M5 Miniwatt 8H M+ 8G (M+=EL80=6M5; 8G=1958 ??)
	12AX7 Miniwatt 8I mC6 Δ8G (Philips Herlin 1958)
	12AX7 Miniwatt 8K mC6 Δ8I (Philips Herlin 1958)

Two open-backed speaker boxes that join back-to-back with clips, such that amplifier and cables fit inside to provide a single unit with one carry handle. Dark green vinyl with red piping on plywood. Each box with Rola M 8" speaker (7W, 2Ω coil, F57 cone) and Rola (CEL58 8M36B) isocore potted speaker transformer (date stamp 21 Mar 1956) with 2k5Ω:2Ω ratio, with parallel wiring to amplifier (1250Ω loading). Vinyl and speaker cloth in very good condition. A few minor hairline tears near rim of cones.

Issues:

No power switch. Old wax and electrolytic capacitors. Mains wiring close to circuitry. Floating speakers. Spare 6V3 winding. Not the best grounding. Speakers use line transformers. OT lowest tapping impedance is 40Ω between 50V and 70V taps (250Ω and 500Ω).





1.1 Modifications for Guitar Amplifier

- Main fuse changed to 0.5A slow blow.
- Fuse added to PT secondary CT (0.2A Fast IEC127 5x20).
- 1N4007 added in series with each rectifier plate for 6V4.
- Improved grounding scheme.
- On switch added to rear panel.
- Electrolytics and wax coupling caps replaced.
- PU Volume pot replaced with dual gang and used as post-PI volume.
- Grid stoppers added.
- 6M5 cathode 1Ω sense resistors added.
- 6M5 screen stoppers increased, and extra screen supply filtering.
- 2x 330VDC 90pF MOVs added across each OT half-winding. RC network removed from across PP.
- OT secondary grounded.
- Neoprene feet pads.
- Replace 12AX7 stages with 12AU7 to reduce gain.
- Added 1.6H choke to VS2 supply.
- Re-biased input stages for better use of 12AU7.
- Lowered cathode bypass value to 0.68uF, and output stage coupling cap from 10N to 5N, to alleviate speaker cone excess movement from low frequency signals.

To do:

- Replace rubber feet.
- Methyl cellulose based glue, and thin Kozo paper for speaker cone repair.
    - Lineco Methyl Cellulose Adhesive or Elmer's Art Paste
    - Wallpaper adhesive that is mostly 'cellulose' based.
    - Check out old speakers for suitable cone material.
- Suspect V3 valve socket – heater sometimes doesn't connect – confirm both 6M5 heaters are on!
- Check overdrive performance of stages – perhaps add high frequency filtering on cathodyne stage if it is normally driven in to clipping first (eg. 470pF cap from plate to cathode).
- Check noise floor/hiss for stages. Hiss noticeable from V1B second stage (MIC vol min) and filtered by tone pot setting.
- Feedback resonance when tone switched on and vol settings substantial – resonance frequency depends on tone pot rotation – resonance killed when tone switched off.

2. Measurements

Voltage rail regulation. Modified circuit.

Rail	240VAC mains VDC, VACrms Idle condition (12AX7, no choke)	240VAC mains VDC, VACrms Idle condition (12AU7 changes)
VS1	300, 5.1 (340V turn-on pk)	300, 5.4 (340V turn-on pk)
VS2	288, 1.6	280, 0.3
VS3	250,	250,
VS4	235,	225,
Cathode	9.8 (27+27mA) 7.5W	9.8 (27+27mA) 7.5W
Heater 1	6.6	6.6
Heater 2	?	?
Sec HT	264-0-264	264-0-264
V1A,B	132V, 132V, 1.3V	102V, 108V, 4.8V
V2A	120V, 1.03V	139V, 2.5V
V2B	60, 192 1.35V	88, 168 1.35V

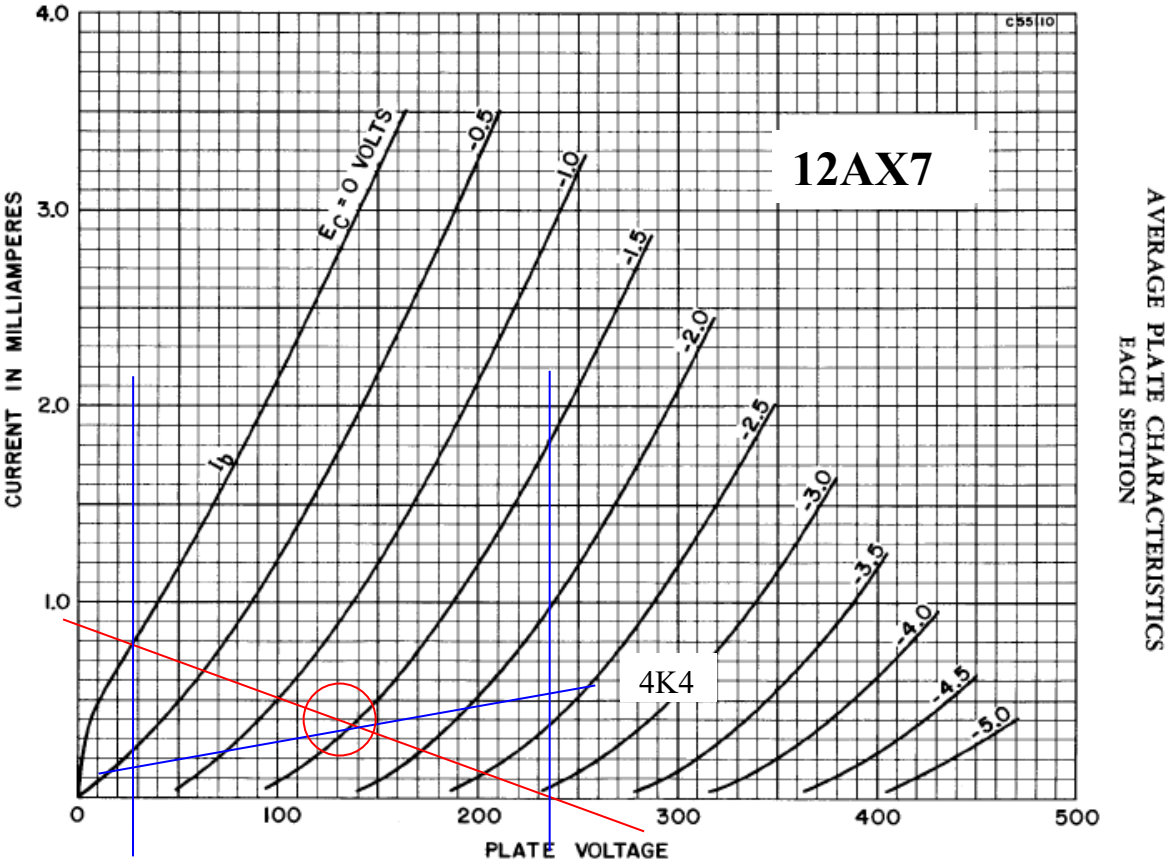
Power transformer primary DC resistance: 30Ω (BLU-BLK); 26Ω (RD-BLK).
Power transformer secondary DC resistance: 185+185Ω.
Heater current requirement is: 2x 0.71 + 2x 0.3 + 0.6 (6V4) = 2.6A indicates a 260-CT-260, 6V3 3A, 6V3 ~0.5A.

OT with 1.1kΩ resistive load:
Cranked output up to 108VAC (10.6W). Hum negligible. Hiss noticeable but minor.

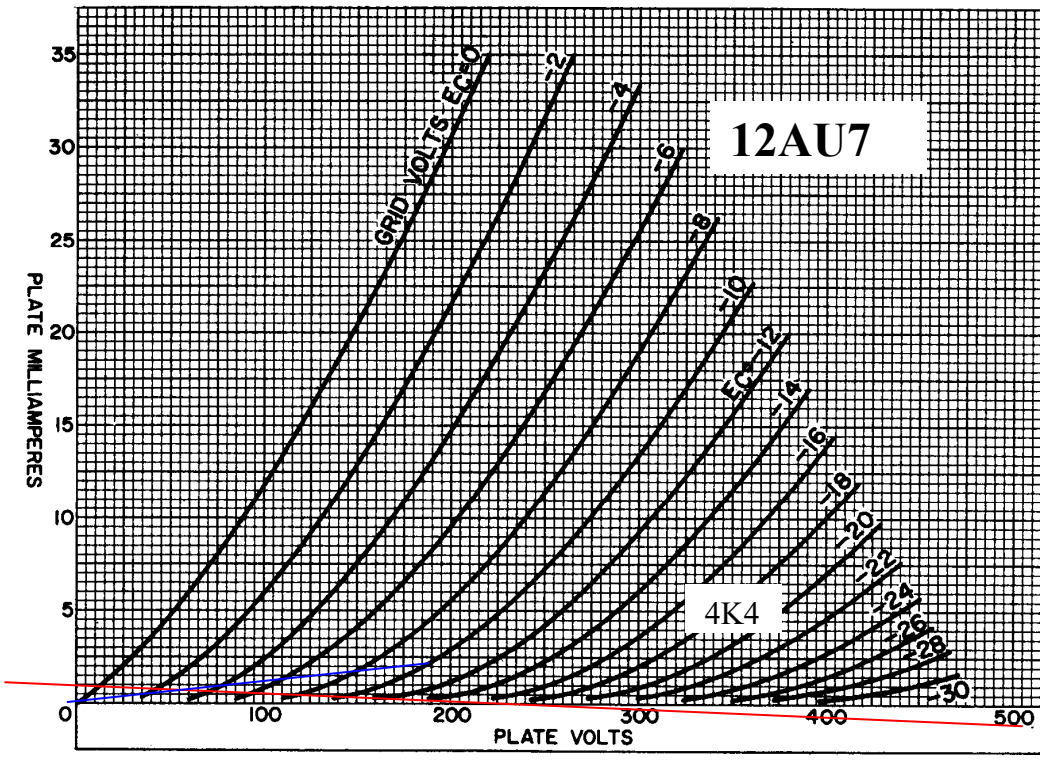
3. Design Info

3.1 Input stages 12AX7

For the first two 12AX7 stages have a common 2k2Ω cathode bias; V1A-V1B; VS4 = 235V; Va=132; Rk=4k4; Vk=1.3V; Ia=0.37mA; RLdc=270kΩ.

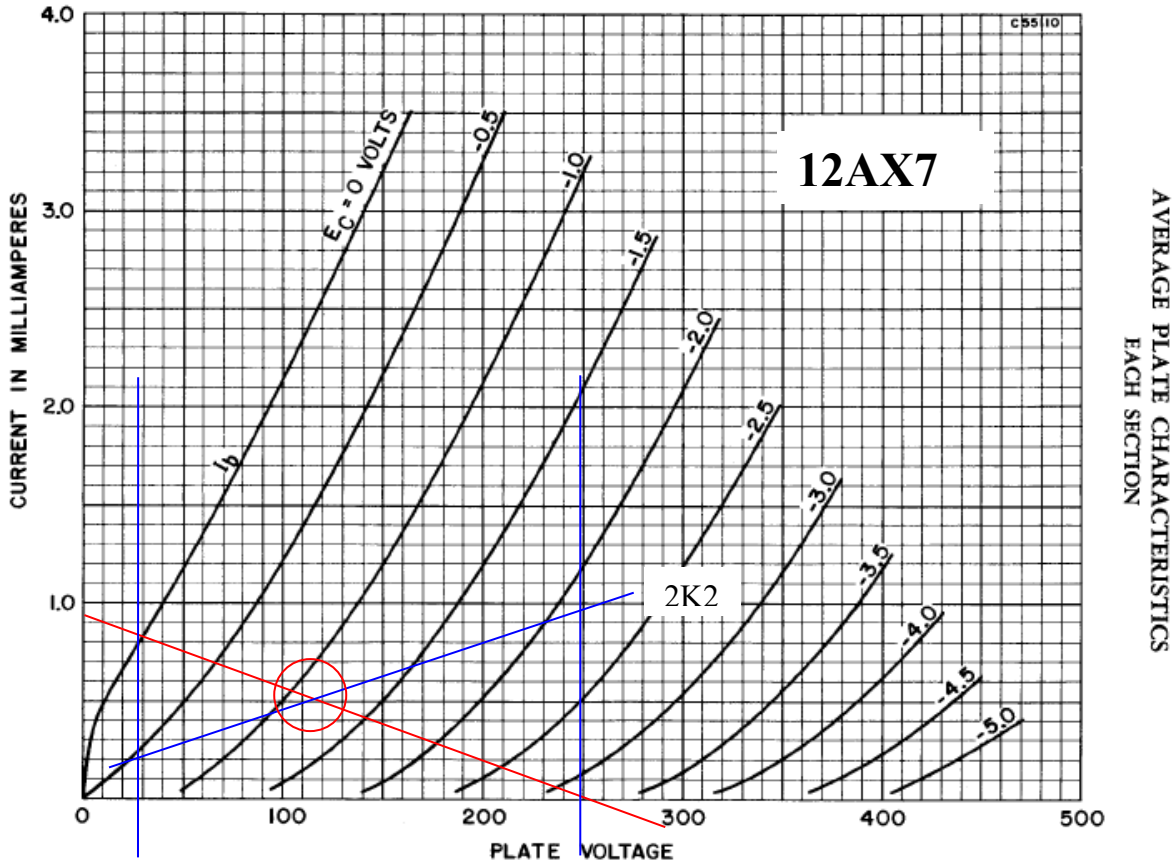


Changing to a 12AU7 will draw more current, and raise the cathode bias to ? The anode load should be reduced from 270k to about 100k, and the supply dropper reduced from 27k to 15k.

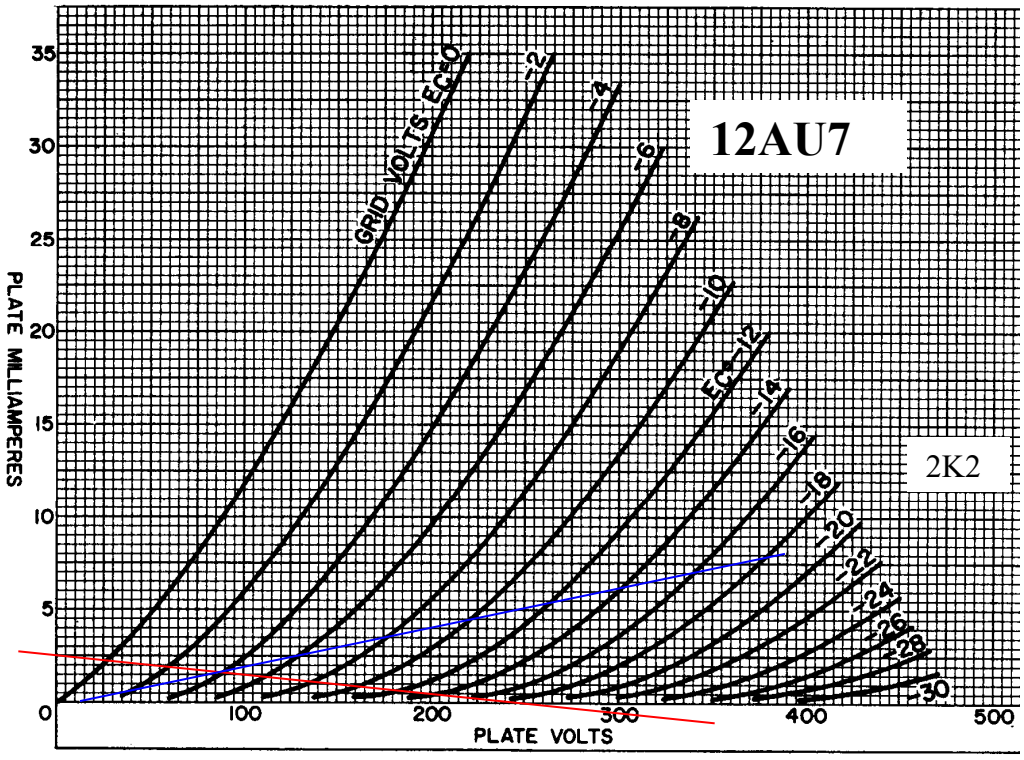


3.2 Feedback stage 12AX7

The feedback 12AX7 stage; V2A; VS3 = 250V; Va=132; Rk=2k2; Vk=1.03V; Ia=0.37mA; RLdc=270kΩ.

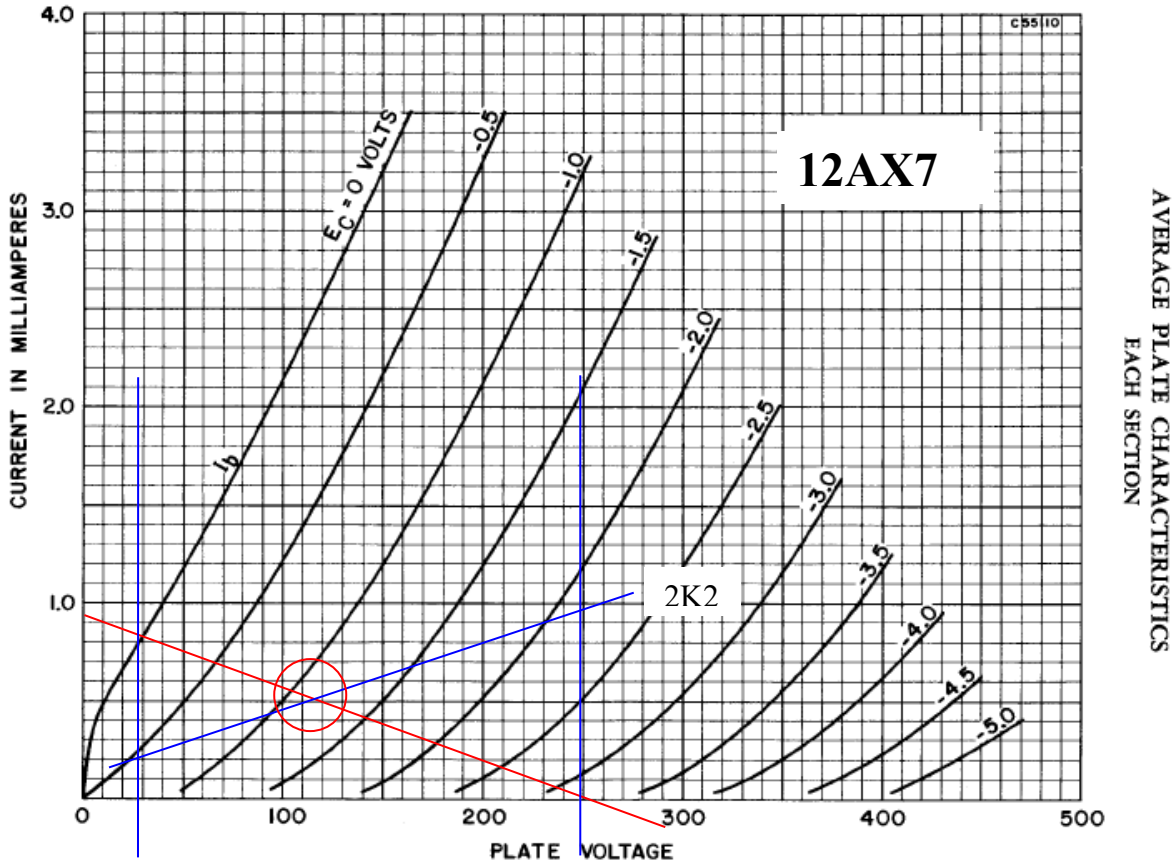


Changing to a 12AU7 will draw more current, and raise the cathode bias to ? The anode load should be reduced from 270k to about 100k, and the supply dropper reduced from 27k to 15k.

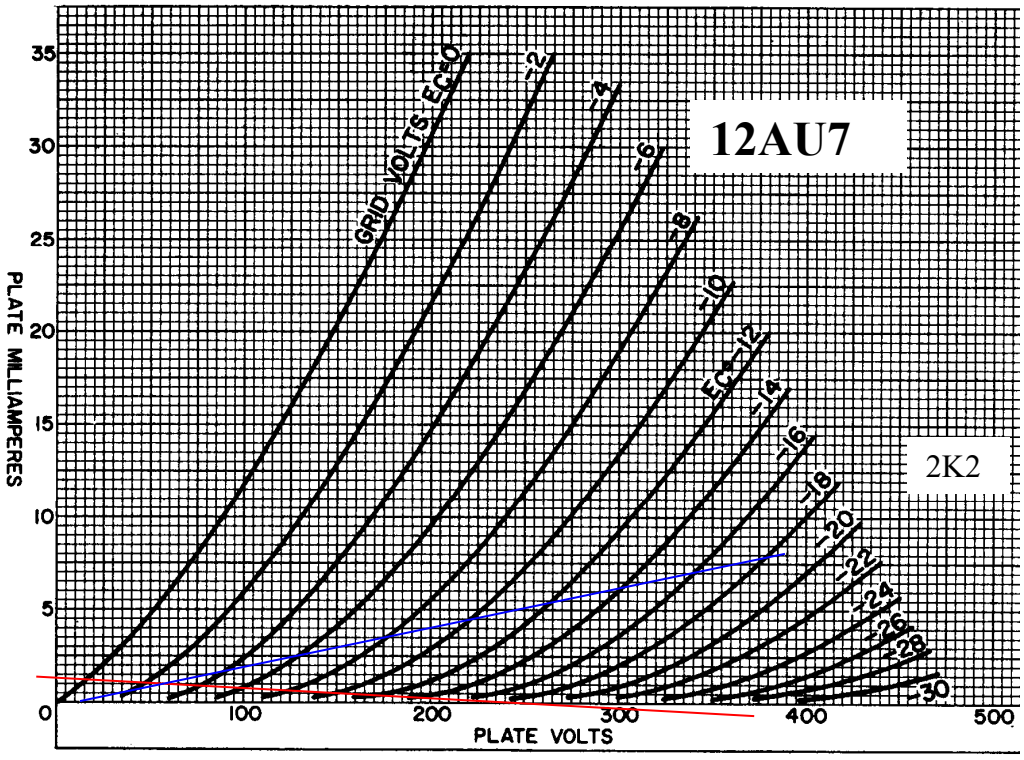


3.3 Phase Inverter stage – 12AX7 in split-load (cathodyne) config

VS3= 250V. Rk=2k2. Vgk=1.3V. Vk=61.3V. Va=192V. Vak= 130V. Anode current = (250-192)/100k=0.6mA.



Changing to a 12AU7 will draw more current, and raise the cathode bias to ? The anode/cathode loads should be reduced from 100k to about 47k, and the supply dropper reduced from 27k to 15k



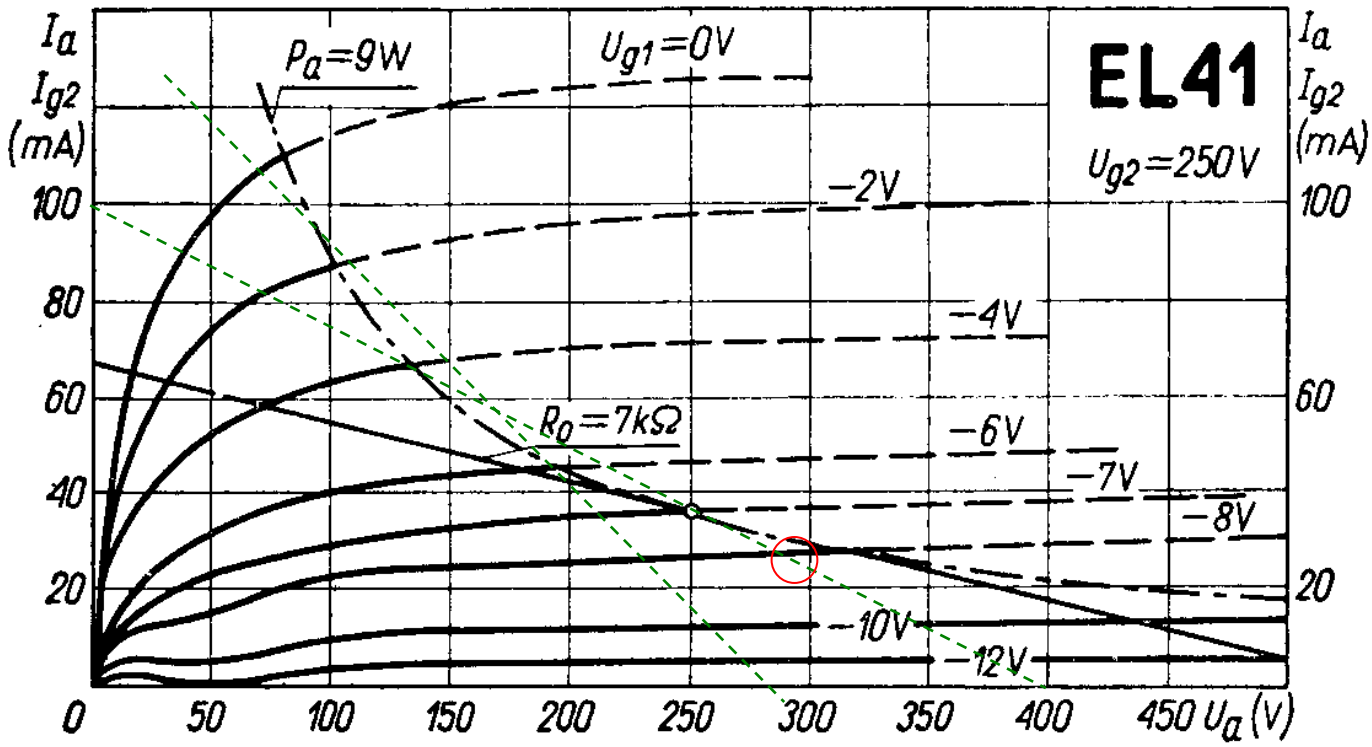
3.4 Output Stage

Class AB push-pull output stage, common cathode bias. The 8KΩ impedance plate-to-plate OPT presents signal currents into each tube with a 4KΩ impedance with both tubes conducting, to 2KΩ load impedance at higher levels. No pentode characteristic curves are available for 6M5, and similar EL41 curves are shown but at a lower 250V screen (actual screen is about 280V at idle so bias voltage is close to 10V).

As the output loading increases, the supply voltage VS1 to the output valve plates sags from about 300-10=290V towards 290V. Plate DC voltage will be lower than VS1 by an amount up to ~28V (ie. plate-cathode sags to about 260V) due to OPT half resistance of about 95Ω with a peak current of up to about 0.1A, and cathode bias drop of 18V. Screen voltage will vary from about 280 towards 265V under steady-state heavy load (ie. screen-cathode sags to about 265-18 = 245V).

The maximum output valve bias current allowed is dependant on the maximum recommended plate dissipation – assume 75% of 9W = 6.8W: Ibias(max) = Pd / Vb = 6.8W / 290V = 23mA, or about 25mA of cathode current.

For a peak plate current of 100mA, then the nominal output power of the amplifier would be: (Ipk)2 x Rpp / 8 = 0.1 x 0.1 x 8k / 8 = 10W. For this maximum signal condition, the rms OPT current draw is likely about 64mA (64% of peak), and the average VS1 power consumed is about 260V x 0.064Arms =17W, and the OPT loss is about $(0.064)^2$ x 190Ω = 0.8W, so the tube plates dissipate 17 – 9.4W – 0.8W = 7W, or just under 3.5W each, which is well below max design level.



3.5 Power Supplies

The 6V4 is rated to feed 50uF with secondary winding resistance >125Ω from 250VAC, and 90mA loading for a 265VDC output, and has a hot switch peak current rating of 900mA, and a continuous peak current rating of 270mA.

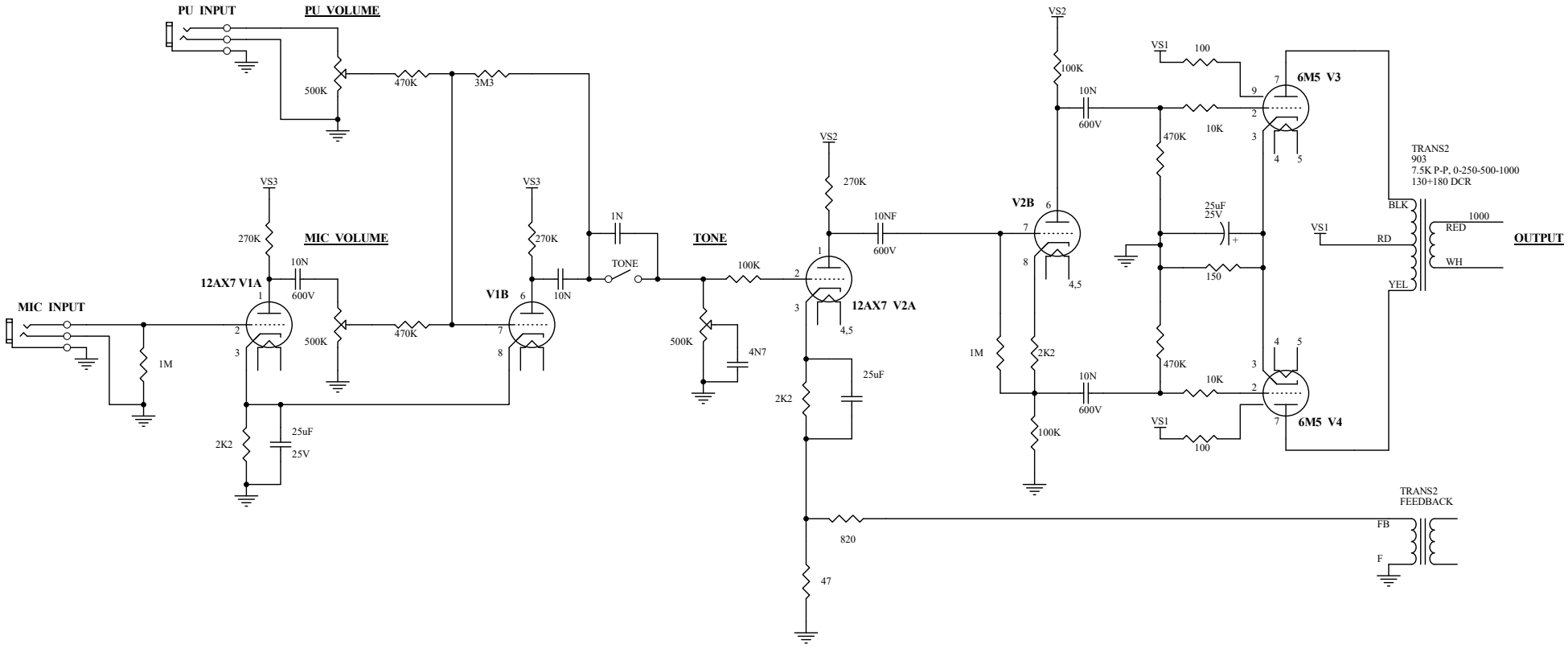
The effective series resistance is 30Ω x $(260/250)^2$ +185Ω = 220Ω, which is fine.

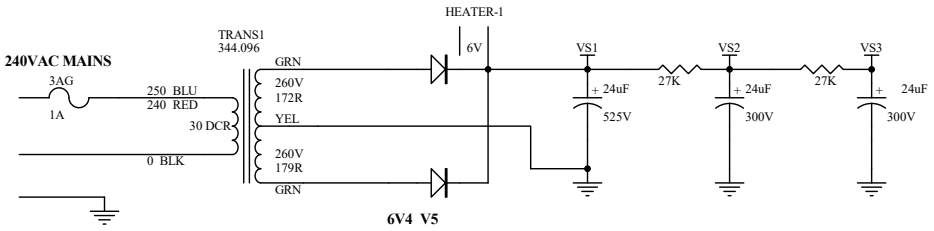
PSUD2 indicates a hot switched peak of up to 900mA, and a steady-state continuous of 240mApk at idle, which appears to be fine for cranked output. The steady-state PT secondary CT current at idle is about 110mArms, and rising to 570mArms for a 10ms period for a hot switch event, which would allow a 200mA Fast IEC127 fuse to be used (min rating of 50ms at 2.75x rating multiplier).

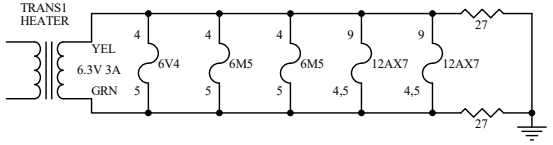
A 1.6H @ 60mAdc, DCR=430Ω (Wurlitzer 500409) choke is added in series with 1k dropper from VS1 to VS2 to reduce screen voltage ripple from 1.6Vrms to 0.3Vrms.

STEANES 976B, S.N. 2466

Original







VOLTAGE RAILS	
RAIL	**IDLE**
VS1	285V
VS2	250V
VS3	216V
HEATER-1	6.3V

VALVE	QTY
6M5	2
6V4	1
12AX7	2

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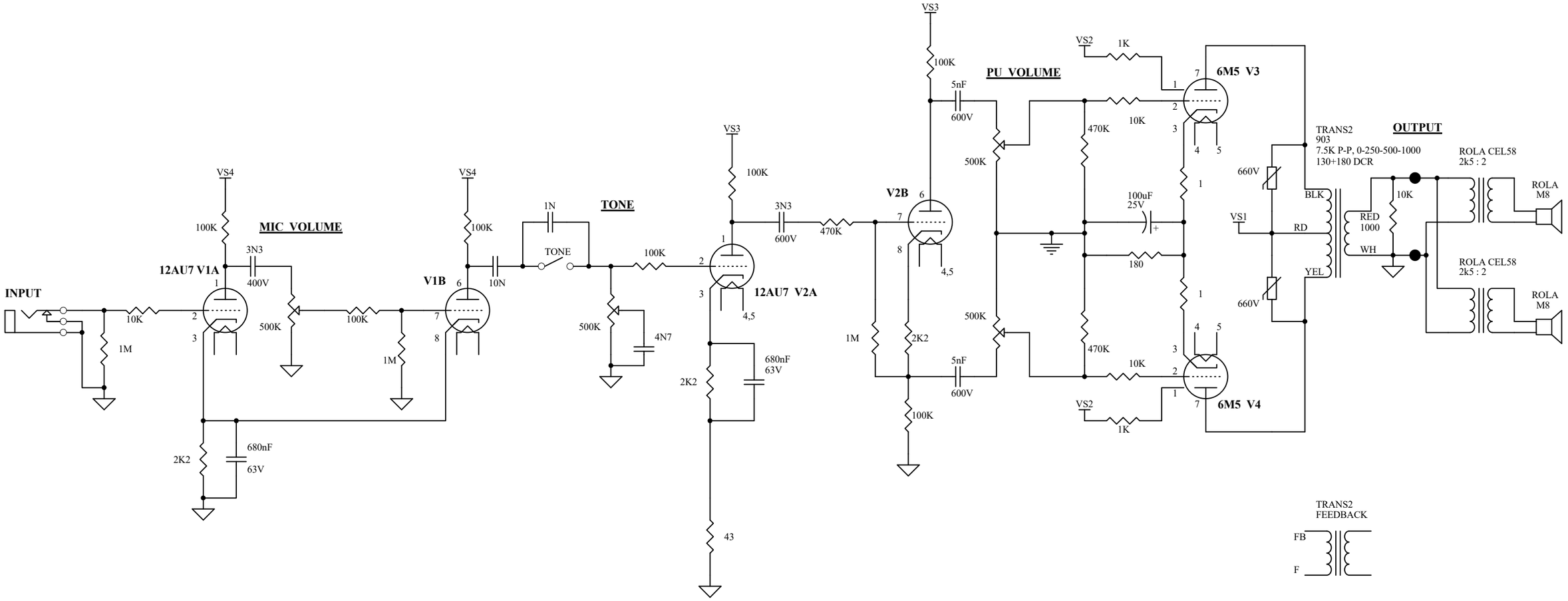
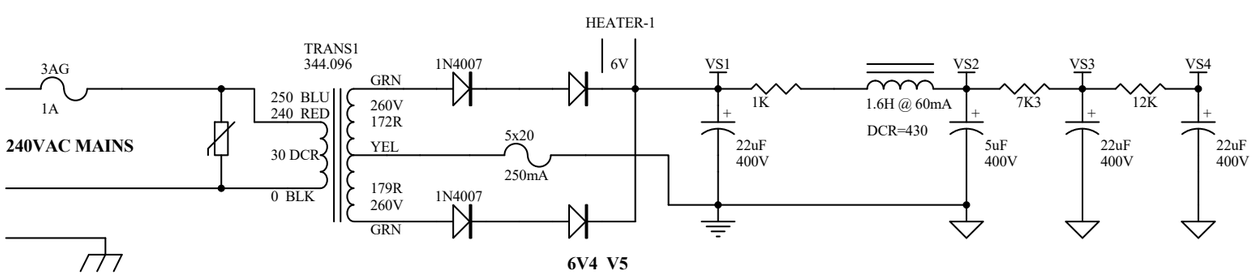
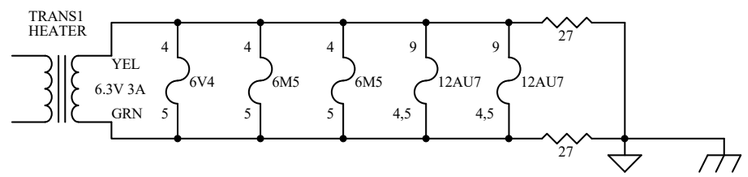
STEANES 976B , S.N. 2466

Circa 1958, Modified for guitar input







VOLTAGE RAILS

RAIL	IDLE
VS1	300V, 5.4Vrms
VS2	280V, 0.3Vrms
VS3	250V
VS4	225V
HEATER-1	6.5V

VALVE	QTY
6M5	2
6V4	1
12AU7	2

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8 WATT AMPLIFIER

SPECIFICATION

OUTPUT POWER:	8 Watts at less than 5% harmonic distortion.
FREQUENCY RESPONSE:	30 - 15000 c/s within 2 dB with tone control set for flat response.
TONE CONTROL:	Switch - potentiometer type - 18 dB at 50 c/s bass attenuation with switch - 14 dB treble attenuation at 15 Kc/s with potentiometer.
SIGNAL TO NOISE RATIO:	(With volume controls at max.) Microphone 55dB) weighted. Pickup 70dB)
POWER CONSUMPTION:	60 VA at full signal.
MAINS SUPPLY:	220 - 260 Volts 40 - 60 c/s.
INPUTS:	Microphone 1 megohm 1.4 mV. Pickup 500,000 ohm 100 mV.
OUTPUT IMPEDANCES:	1200, 600 and 300 (100, 70, 50 volts).
DAMPING FACTOR:	3.0
FUSE:	1 amp - auto.

VOLTAGE ANALYSIS

VALVE	ANODE	SCREEN	CATHODE	HEATER
V1 (A) 12 AX 7	1) 110 v D.C.	-	1.1 v D.C.	6.5 v A.C.
	2) 110 v D.C.	-	1.1 v D.C.	6.5 v A.C.
V2 (B) 12 AX 7	1) 60 v D.C.	-	.3 v D.C.	6.5 v A.C.
	2) 100 v D.C.	-	65 v D.C.	6.5 v A.C.
V3 6V4	275 v D.C.	-	278 v D.C.	6.45 v A.C.
V4&5 6M5	272 v D.C.	278 v D.C.	8.9 v D.C.	6.5 v A.C.

ALL MEASUREMENTS ARE MADE WITH A 1000 OHM PER VOLT METER TO CHASSIS

976 A MODEL ONLY

VALVE	ANODE	SCREEN	CATHODE	HEATER
V2 12AX7	1) 72 V D.C.	-	.7 v D.C.	6.5 v A.C.
	2) 150 v D.C.	-	55 v D.C.	6.5 v A.C.

OPERATING INSTRUCTIONS

for

8 WATT AMPLIFIER

GENERAL

Before using a new Amplifier, make sure that all valves are seated firmly in their sockets, and that fuses are fitting tightly in their holders.

All amplifiers leave the factory with the power cable connected to the mains transformer for 240 volt A.C. operation. In cases where the mains voltage is not 240 volt, it is necessary to remove the baseplate of the amplifier BUT ENSURE THE AMPLIFIER IS NOT CONNECTED TO THE MAINS SUPPLY, then unsolder the lead of the power cable connected to the 220-240 volt lug and attach to the 250 - 260 volt lug.

220 - 240 V leave as is
250 - 260 V Solder to lug marked 250 volts
260 volts

The power point used for Amplifiers should be of the three pin earthed type, which will then earth the amplifier through the third conductor in the power lead. If an earthed power point is unavailable, a separate earthing wire should be connected to the amplifier chassis.

INPUT CONNECTORS

Before connecting any input source to this Amplifier, ensure the voltage to the plugs does not exceed the following, otherwise severe overloading will result.

Pickup	2V
Microphones	.05V

The input connectors are two-pin plugs (metal sheathed type) which are supplied with the amplifier. The pin numbers are stamped on the inside bakelite moulding of the plug.

No. 1 being Grid Return
No. 2. being Grid

When connecting the microphone or pickup cable to the plug pins, the two inner wires must be connected to Pins No. 1 and No. 2. whilst the braid shielding is soldered directly to the outer spring on the plug.

Where a single shielded conductor is encountered, the shielding should be connected to No. 1 pin, and NOT to the spring, as this amplifier features SINGLE POINT EARTHING. If this is NOT done correctly, EXCESSIVE HUM will develop.

OUTPUT CONNECTIONS

The constant voltage output system used, eliminates mismatch distortion. This permits any number of loudspeakers to be connected provided the total impedance is not lower than 1,000 ohms when connected to the 1200 ohm tapping.

Under normal conditions speakers may be connected to the output terminals marked -

C and 1200 ohms	Total Speaker impedance	10,000 - 1,000 ohms
C and 600 ohms		1,000 - 500 ohms
C and 300 ohms		500 - 250 ohms.

Selection of wattage per speaker is calculated as under when connected between terminals C and 1200 ohms.

½ watt	20,000 ohms	4 watts	2,500 ohms
1 watt	10,000 ohms	8 watts	1,250 ohms
2 watts	5,000 ohms		

8 Watt Amplifier

VOLUME CONTROL

Separate controls are provided for each input channel and this allows individual adjustment and mixing. To increase the volume, turn the knobs clockwise.

TONE CONTROL

A combined base or treble control is provided.

Bass cut is obtained by turning the knob fully anti-clockwise until the switch operates.

Flat response is anti-clockwise until just prior to the switch operating.

Gradual Treble cut is obtained by turning the knob clockwise from the flat response position.

PRECAUTIONS

It is strongly recommended not to carry out repairs on amplifiers unless technically capable. Besides additional damage which may result from trying to tamper with an amplifier, it should always be borne in mind that if the top or bottom covers are removed, terminals carrying dangerous high voltages are exposed, sometimes even after the amplifier is disconnected from the mains supply.

It is essential that sufficient space be allowed on all sides of the amplifier to provide efficient ventilation. Under no circumstances should anything be placed on top of the perforated cover, as this will result in overheating and subsequent damage.

NOTE:

Plug numbers quoted for connections for microphone and pickup, apply to the plugs supplied with the Amplifier (Acme).

AMPLIFIER 8 WATT 230 V A.C.

TEST SHEET

1. Plug in all valves except rectifier and switch on.

2. Connect 1200 ohm load to 1200 ohm tap.

3. Plug in rectifier and watch for H.T. shorts.

4. With tone control set for flat response, and pickup volume at minimum, connect signal of 14 MV at 1000 c/s to microphone input socket.

5. Turn up microphone volume control and check output for 100 volts at less than 5% distortion.

6. With AVOMETER on 100 volt AC range, check for 70 volts and 50 volts on the 600 and 300 ohm taps respectively.

7. Turn down microphone volume control until output is 50 volts.

8. Change generator frequency to 40 c/s. Output should now be 52 volts. Turn tone control to bass cut position. Output should now be 5 volts.

9. Change generator frequency to 10,000 c/s. With tone control at flat position output should be 53 volts. Turn tone control to full treble cut position. Output should now be 14 volts.

10. Turn down microphone volume control and turn tone control to 'flat' position. Connect 100 mV at 1000 c/s from the generator to the pickup input and ensure that it is possible to obtain 100 volts across the load resistor.

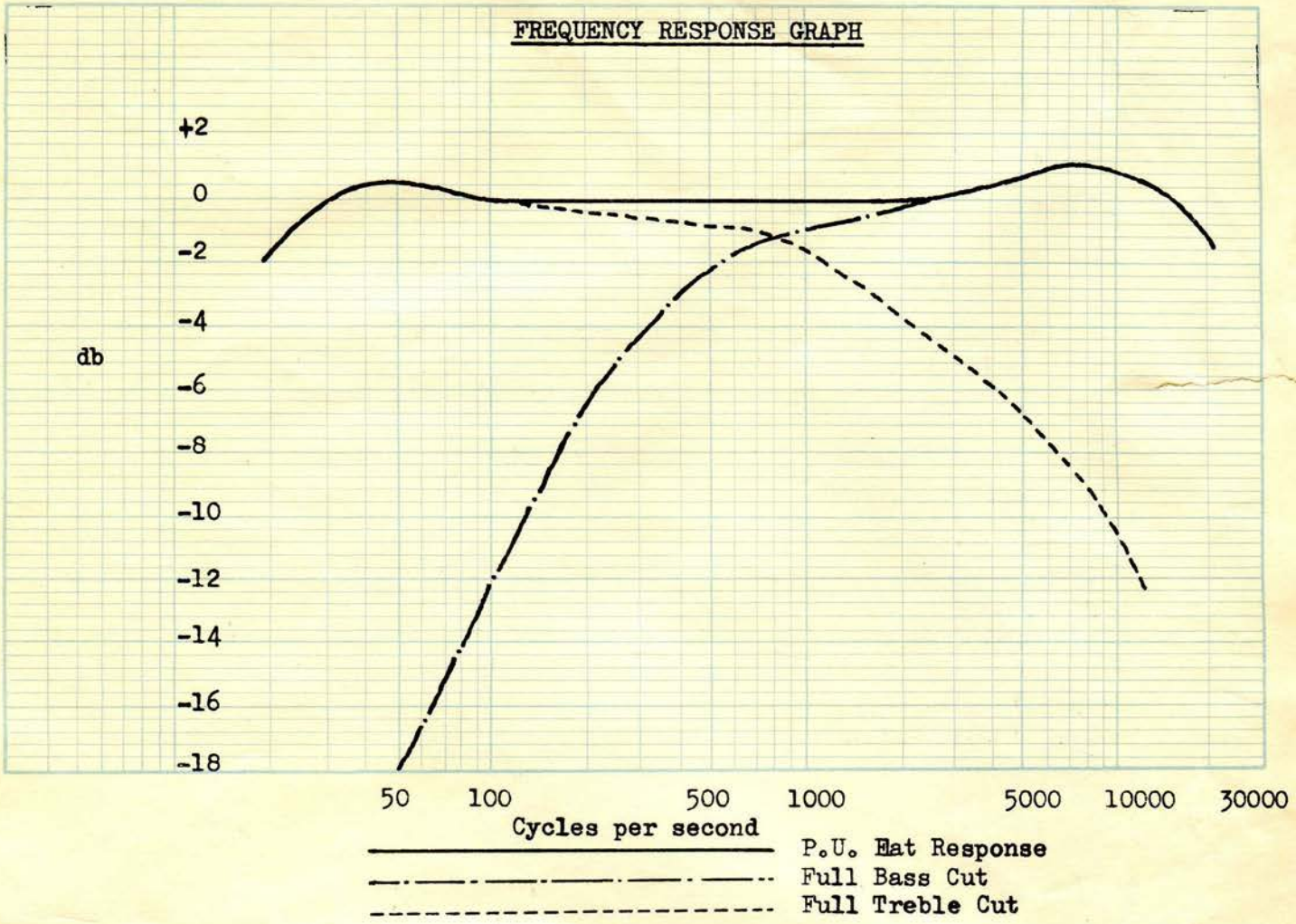
11. Disconnect generator and turn gain controls to minimum. Output should now be .2 volts.

12. Short circuit microphone input socket and turn gain controls to maximum. Output should not exceed 1 volt.

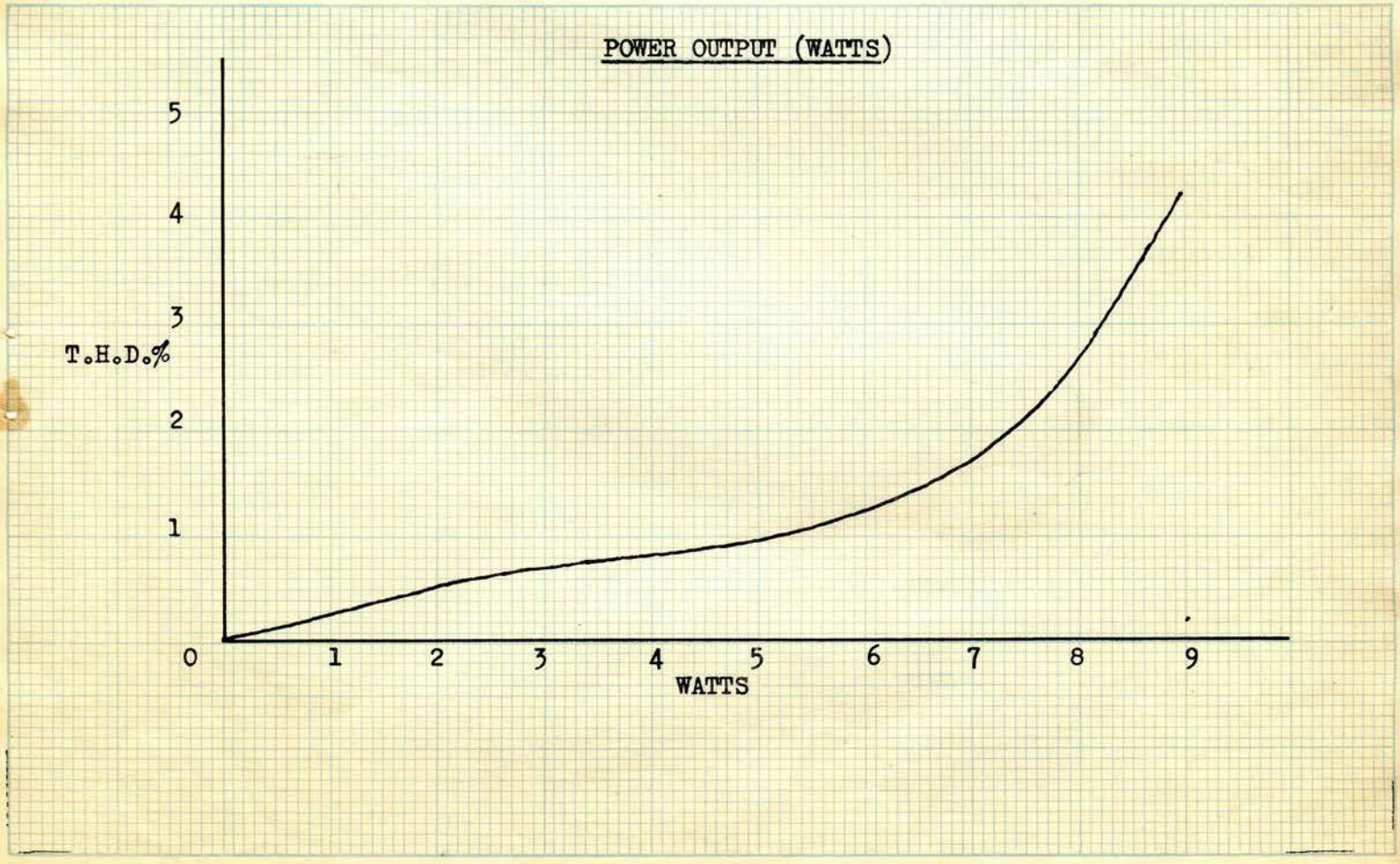
13. Tap valves and check for excessive microphony and internal short circuits.

14. With an AVOMETER the following voltages should be measured with respect to chassis; see Voltage analysis on Sheet 1.

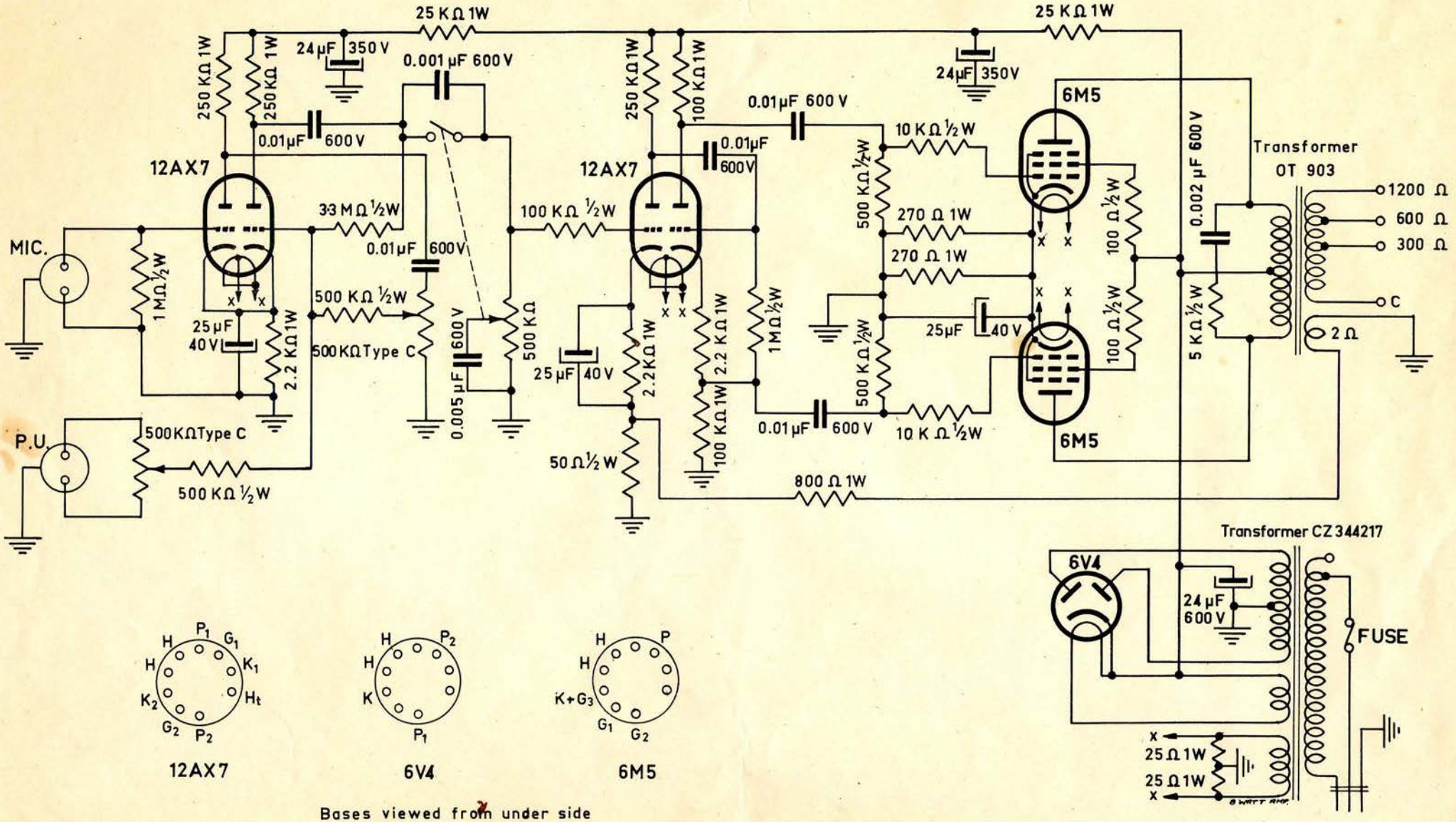
FREQUENCY RESPONSE GRAPH



POWER OUTPUT (WATTS)

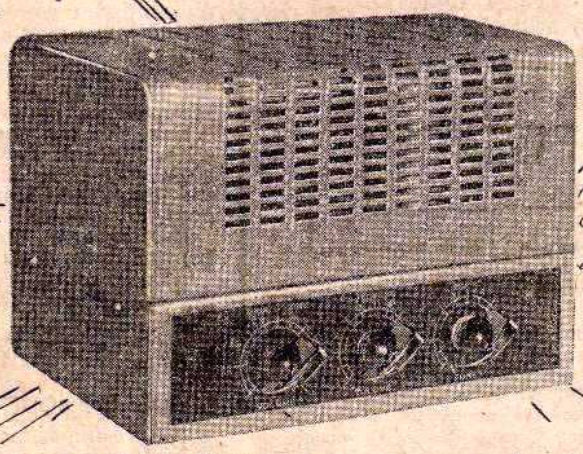


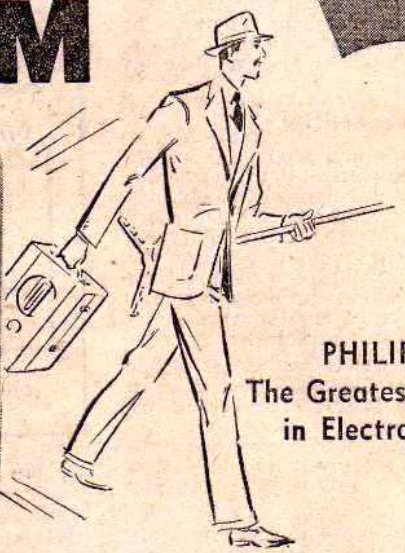
AMPLIFIER 8 WATT A.C.


25 KΩ 1W
250 KΩ 1W
250 KΩ 1W
24 μF 350 V
0.001 μF 600 V
0.01 μF 600 V
12AX7
33 MΩ ½W
0.01 μF 600 V
MIC.
1 MΩ ½W
25 μF 40 V
2.2 KΩ 1W
500 KΩ ½W
500 KΩ Type C
600 V
0.005 μF
500 KΩ
P.U.
500 KΩ Type C
500 KΩ ½W
250 KΩ 1W
100 KΩ 1W
0.01 μF 600 V
0.01 μF 600 V
12AX7
100 KΩ ½W
25 μF 40 V
2.2 KΩ 1W
2.2 KΩ 1W
1 MΩ ½W
50 Ω ½W
100 KΩ 1W
0.01 μF 600 V
25 KΩ 1W
24 μF 350 V
500 KΩ ½W
10 KΩ ½W
6M5
270 Ω 1W
270 Ω 1W
25 μF 40 V
500 KΩ ½W
10 KΩ ½W
6M5
100 Ω ½W
100 Ω ½W
800 Ω 1W
0.002 μF 600 V
5 KΩ ½W
Transformer
OT 903
1200 Ω
600 Ω
300 Ω
C
2 Ω
Transformer CZ 344217
6V4
24 μF
600 V
FUSE
25 Ω 1W
25 Ω 1W
12AX7
6V4
6M5
Bases viewed from under side

You can take it with you !

PHILIPS PORTABLE P/A SYSTEM





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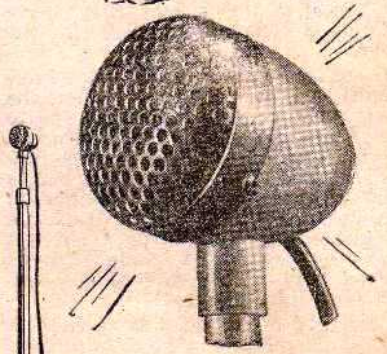
Churches, schools, clubs, dance bands, department stores, travelling demonstrators — ALL will find this latest PHILIPS contribution an invaluable asset to their cause!

8 watt Amplifier . . . Type 976

High quality type Amplifier with 8 watts of output power is sufficiently powerful for a medium-sized hall. Frequency response is within 2dB from 30-15,000 c.p.s. Microphone Input as well as Pickup Input. Push-pull arrangement for output.

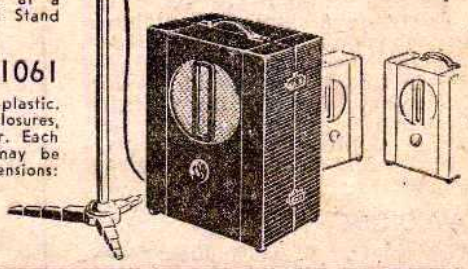
Philips Microphone . . . Type 1108

Crystal Type designed for high quality performance. The response characteristic is from 70-7000 cycles with omni-directional pick-up pattern. Other types available also at a slightly higher price. Adjustable Floor Type Microphonic Stand Included!



Portable Carrying Case . . . 1061

Beautifully made and covered with washable plastic. When opened separates into two speaker enclosures, each housing an 8in. Public Address Speaker. Each enclosure will stand without supports or may be hung on a wall or similar place. Dimensions: 13in. wide 16in. high, 10in. deep.



DANCE BANDS

TRAVELLING DEMONSTRATORS

MEETINGS

FASHION PARADES

PHILIPS

PHILIPS
ELECTRICAL INDUSTRIES
(SOUND REPRO. DEPT.)
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PERTH, 381 Murray St. BRIS, 148 Edward St.
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