

UNIFIED SALES--ENGINEERING SERVICE
TO
EQUIPMENT MANUFACTURERSMEADE BRUNET, Manager
HARRISON, NEW JERSEY

APPLICATION NOTE No. 33

January 31, 1934

APPLICATION NOTE
ON
THE RCA-800 IN CLASS B AUDIO AMPLIFIERS

The RCA-800 is a triode designed for use as a radio-frequency power amplifier or oscillator. It can also be used to advantage as a Class B audio-frequency amplifier where large power output is required. When two of these tubes are used in this way, 100 watts of audio power can be obtained.

In this application note, data are given for Class B operation of the RCA-800 with plate potentials of 750, 1000, and 1250 volts. The optimum plate-to-plate loads and transformer ratios for each condition of operating voltage are also shown. A pair of 2A3 or 45 tubes will supply maximum driver signal.

Typical operating conditions for two 800's in a Class B output stage are as shown:

TABLE I

Driver Tubes, Two 2A3's; Plate Volts, 250; Grid Volts, -45

Plate Volts	Grid-Bias Volts	Driver Transformer Pri. to Sec.	Trans-Ratio* $\frac{1}{2}$ Sec.	Plate-to-Plate Load Ohms	Plate Input Power (2 Tubes) Watts	Total Power Output Watts	Total Distortion Per Cent
750	-50	1.75	1.0	6400	160	90	7.3
1000	-55	2.0	1.0	12500	160	100	7.0
1250	-70	2.0	1.0	21000	160	106	7.0

TABLE II

Driver Tubes, Two 45's; Plate Volts, 275; Grid Volts, -56.

1000	-55	2.16	1.0	12500	160	100	7.9
------	-----	------	-----	-------	-----	-----	-----

*For approximately 80% peak-power efficiency.

APPLI CATION NOTES

Figures 1, 2, 3, and 4 show power output, per cent harmonics, d-c plate current, and d-c grid current versus RMS voltage on the grids of the drivers for each of the above tabulated operating conditions. Figure 5 shows the fidelity curve for the 1000-volt condition of Table I.

Figure 6 is the plate family for the 800.

Figure 7 is a circuit diagram of a typical Class B audio amplifier. Grid bias should be supplied from a source having good voltage regulation. A small-capacity storage battery is excellent for supplying this bias, since the action of this type of amplifier is usually such as to keep the battery charged. In general, a dry battery should not be used since it may polarize when grid current is drawn or it may have too high an internal resistance. If it is desired to use a rectifier arrangement, a rectifier with good voltage regulation should be used.

Transformer design specifications are given for three transformers, as follows:

- (1) #S-119 - Input transformer for operation of two 800 tubes in a Class B system driven by two 2A3 tubes.
- (2) #S-121 - Input transformer for operation of two 800 tubes in a Class B system driven by two 45 tubes.
- (3) #S-120 - Output transformer for use with two 800's operated in a Class B system.

#S-120 is a modulation transformer designed to carry direct current. The secondary windings of this transformer provide a plate-to-plate load on the 800's of 12500 ohms when they are series-connected and shunted by 20000 ohms, or when they are parallel-connected and shunted by 5000 ohms. For loud-speaker operation, a transformer should be designed in accordance with the plate-to-plate loads given in the tabulation. This transformer should have the same primary inductance and the same space distribution of windings as the #S-120 but should not have an air gap.

The high voltage required for the operation of 800's is dangerous to the user and should be carefully insulated to protect him. The tubes should be operated in well-ventilated compartments provided with interlocks which automatically shut off the power during adjustment of the apparatus.

TRANSFORMER SPECIFICATIONS

INPUT TRANSFORMER S-121*

(For two 45 tubes operating in push-pull at plate volts = 275, grid volts = -56, and driving two 800 tubes, Class B.)

Core: Material - Super Dynamo Gauge #26 Allegheny Steel Co. or
 equivalent
 Punching - EI - 11
 Window - .432" x 1-5/16"
 Tongue - 7/8"
 Stack - 1-5/16"
 Joint - Lap
 Net section - 6.5 sq. cm.
 Mean length of magnetic circuit - 15.6 cm.
 Weight - 1.5 lb.

Winding: Traverse and margin - 1/8" + 1" + 1/8"

Primary #1: Turns - 870 #35 enamelled
 Location - over core
 Turns per layer - 145
 Layers - 6
 Insulation between layers - .0015" paper
 Insulation under winding - .063" paper

Primary #2: Turns - 870 #35 enamelled
 Location - over insulated secondary
 Turns per layer - 145
 Layers - 6
 Insulation between layers - .0015" paper
 Insulation over winding - .012" paper
 Insulation under winding - .025" paper
 Mean length of turn of Primary #1 and #2 in series - 6"
 Resistance at 25° C of Primary #1 and #2 - 300 ohms

Secondary: Turns - 2080 tapped at 1040 #34 enamelled
 Location - over #1 Primary
 Turns per layer - 130
 Layers - 16
 Insulation between layers - .0015" paper
 Insulation under winding - .025" paper
 Mean length of turn - 6"
 Resistance at 25° C - 298 ohms

Efficiency at full load = 80%
Inductance of total primary = approximately 30 henries at
full signal; higher at lower
signal levels.

*Our design identification number.

TRANSFORMER SPECIFICATIONS

OUTPUT TRANSFORMER S-120* - For two 800's Class B

Core: Material - Super Dynamo #26 Allegheny Steel Co. or equivalent
Punching - LE - 5
Window - .925" x 3.0"
Tongue - 1.450"
Stack - 2.9"
Joint - 0.015" spacing per leg. (See note A)
Net section - 25.4 sq. cm.
Mean length magnetic circuit - 29.2 cm.
Weight - 11.4 lbs.

Winding: Traverse and Margin - 1/8" + 2-11/16" + 1/8"
Max. depth of windings - use approx. 55% of net winding
space for total primary tapped at 1900T

Primary: Turns - 3800 #28 enamelled
Location - next to core
Turns per layer - 180
Insulation between layers - .003" paper
Insulation under winding - .063" cardboard
Mean length of turn - 10.9"
Resistance at 25° C - 234 ohms total

Secondary #1: Turns - 2450 #31 enamelled
Location - over primary
Turns per layers - 250
Layers - 10
Insulation between layers - .003" paper
Insulation under winding - .045" built up with empire cloth
Mean length of turn - 13.34"
Resistance at 25°C - 370 ohms

Secondary #2: Turns - 2450 #31 enamelled
Location - over #1 Secondary
Turns per layer - 250
Layers - 10
Insulation between layers - .003" paper
Insulation over winding - .020" built up with empire cloth
Insulation under winding - .030" " " " " "
Mean length of turn - 14.62"
Resistance at 25°C. - 408 ohms

Efficiency - 89.1% with 20000 ohm load and 89.5% with 5000
ohm load at 60 cycles.
Inductance - Approximately 11.8 henries 1/2 primary with
100 ma. d.c. in total secondary (series con-
nected) and 10% full signal volts at 100 cycles.

Note A - Center leg of LE-5 lamination should have gap as shown in Figure
8A or 8B.

*Our design identification number.

TRANSFORMER SPECIFICATIONS

OUTPUT TRANSFORMER S-120* (continued)

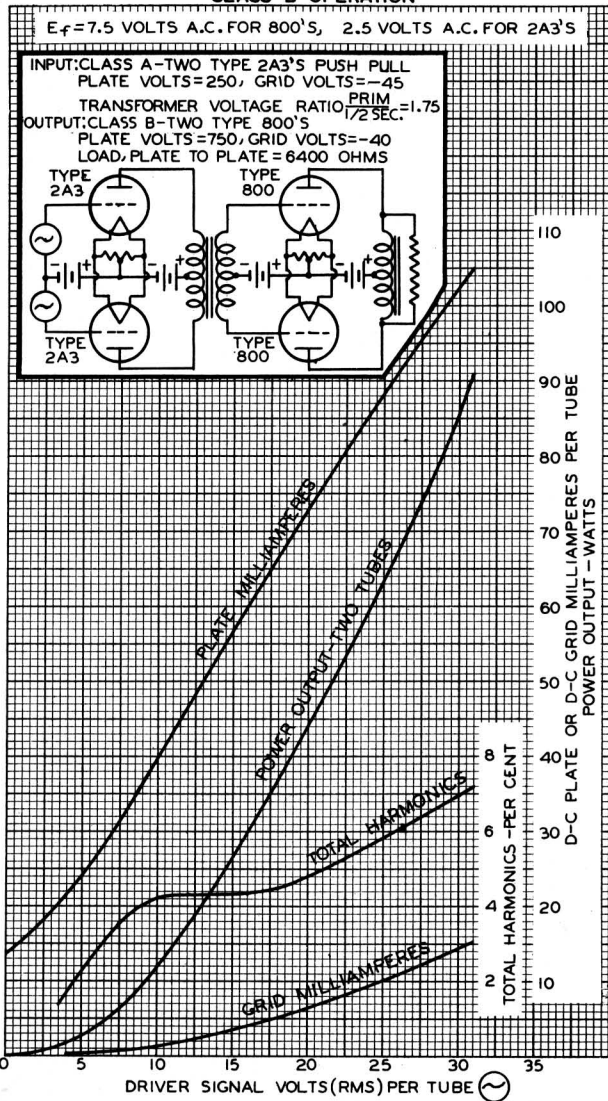
Note B: Plate-to-plate load is 12500 ohms with a 20000-ohm load on the secondary when the secondaries are connected in series, or 5000-ohm load on the secondary when the parallel connection is used. Since the transformer is designed to modulate transmitting tubes imposing one of the two stated loads on the transformer, it is provided with an air gap to carry 100 ma. d.c. for the two secondaries connected in series, or 200 ma. for the parallel connection of the secondaries. In case of a secondary load without direct current, the air gap becomes unnecessary so that a smaller size of transformer can be employed to give the same efficiency.

*Our design identification number.



800

OPERATION CHARACTERISTICS CLASS B OPERATION



JAN. 23, 1934

FIG. 1

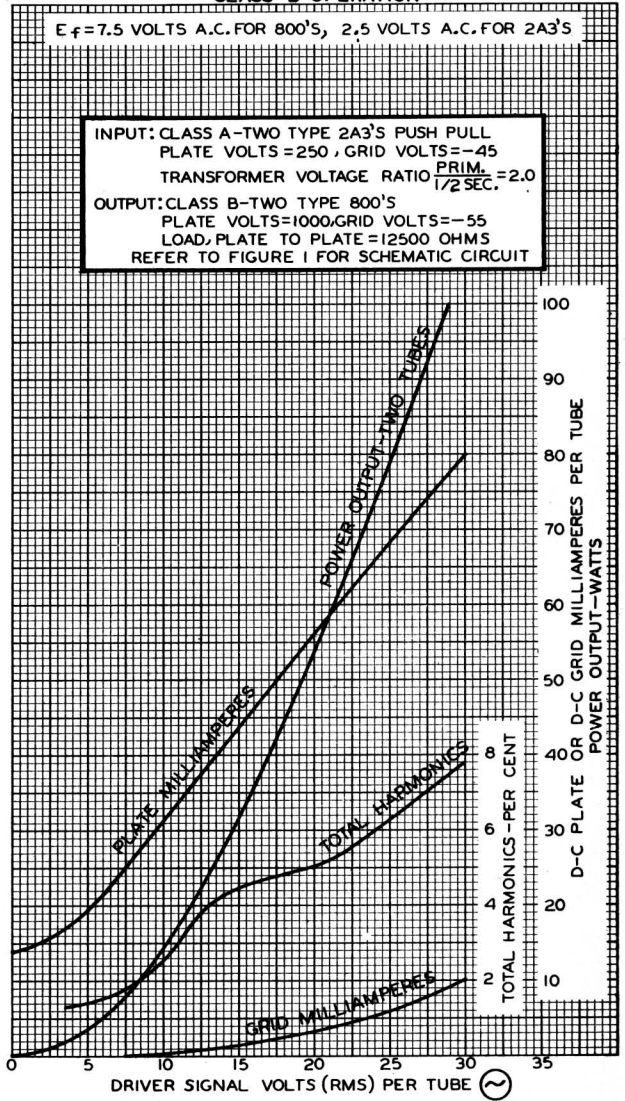
925-5444

RCA RADOTRON COMPANY, INC.



800

OPERATION CHARACTERISTICS CLASS B OPERATION



JAN. 23, 1934

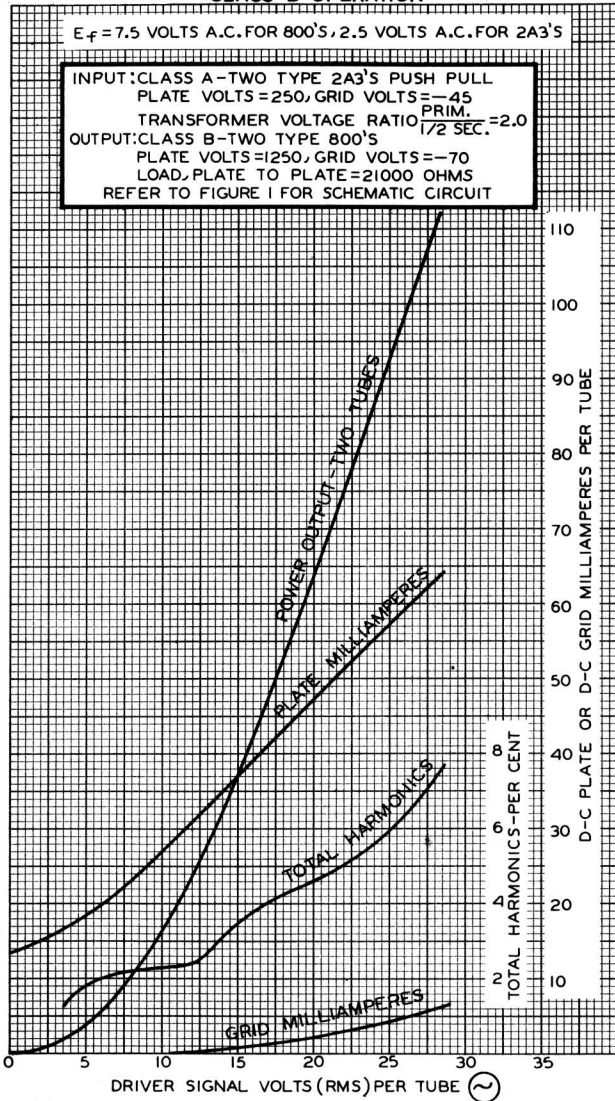
FIG. 2

925-5445

RCA RADOTRON COMPANY, INC.



OPERATION CHARACTERISTICS
CLASS B OPERATION



JAN. 24, 1934

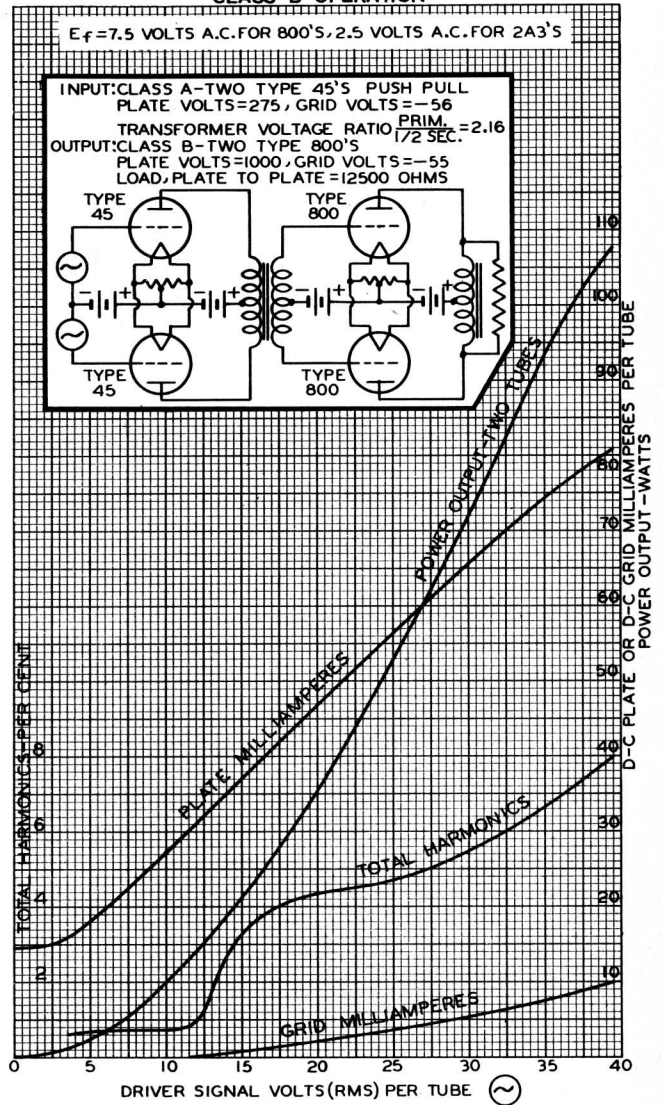
FIG. 3

925-5446

RCA RADIOTRON COMPANY, INC.



OPERATION CHARACTERISTICS
CLASS B OPERATION



JAN. 24, 1934

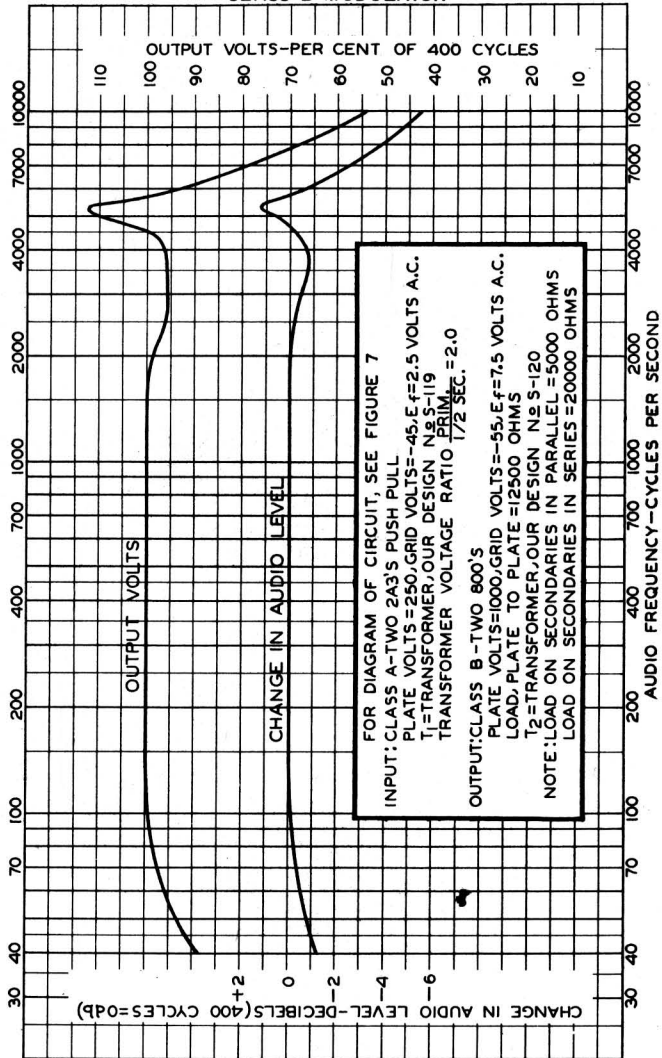
FIG. 4

925-5447

RCA RADIOTRON COMPANY, INC.



FIDELITY CHARACTERISTICS
CLASS B MODULATOR



JAN. 24, 1934

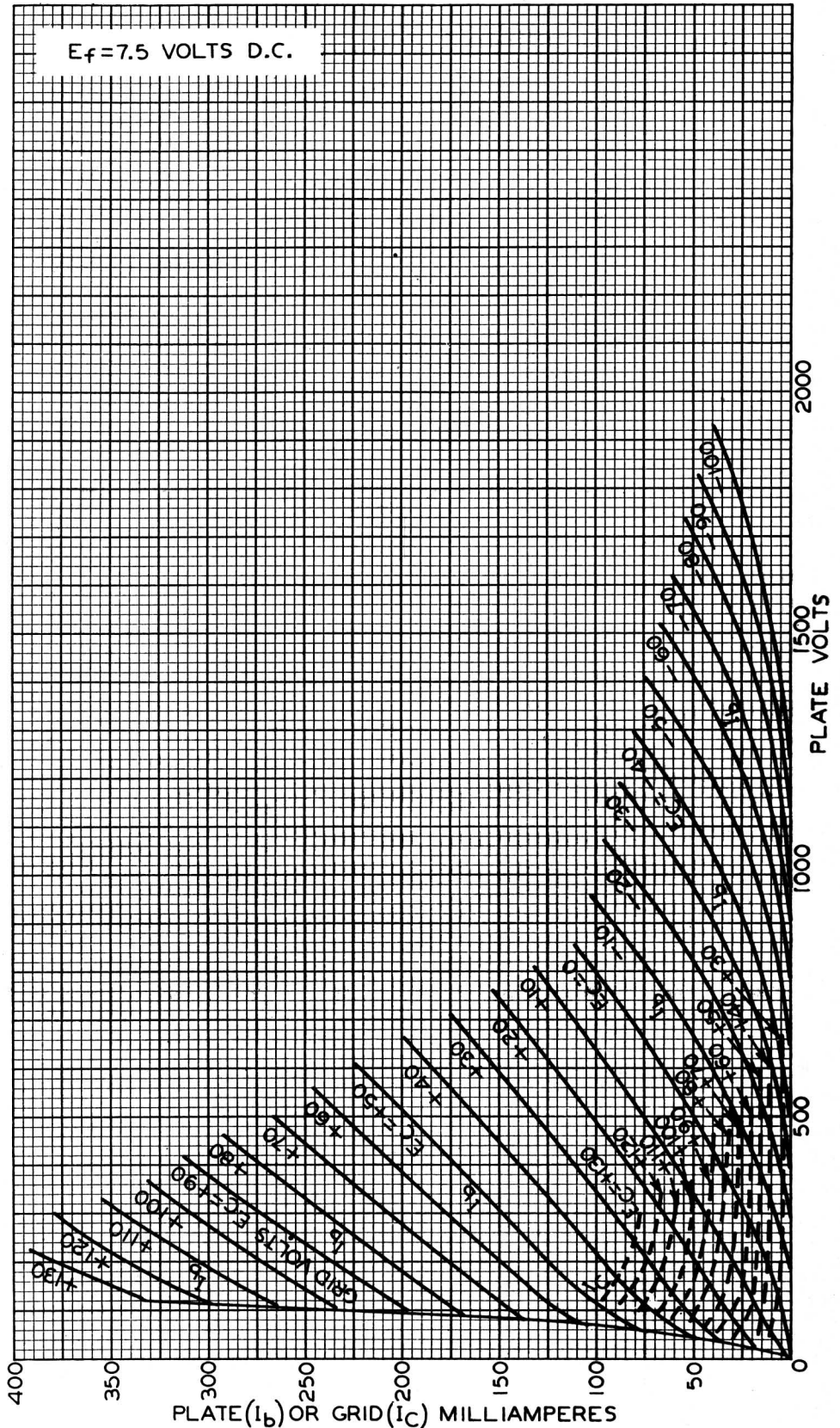
FIG. 5

925-5448



800

AVERAGE PLATE CHARACTERISTICS



SEPT. 11, 1933

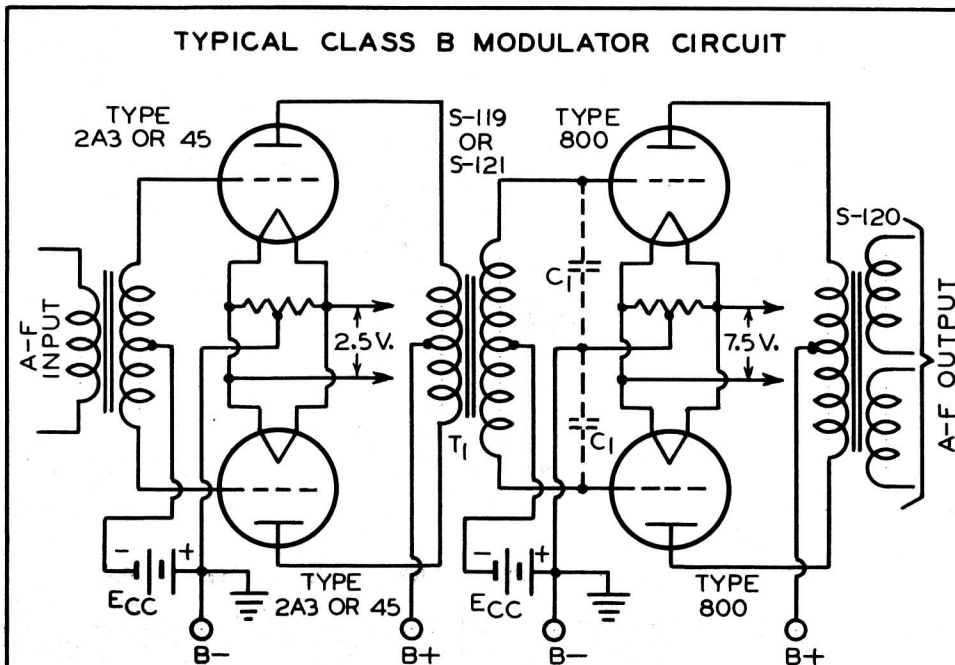
FIG. 6

925-5368



800

TYPICAL CIRCUIT FOR CLASS B MODULATOR S-120 TRANSFORMER CORE ASSEMBLY DETAILS



S-119* OR S-121* = INPUT TRANSFORMER TO CLASS B STAGE
 S-120* = OUTPUT TRANSFORMER FOR CLASS B STAGE
 $C_1 = 0.0001 \mu\text{f}$ CONDENSER. TWO OF THESE ARE SOMETIMES
 USED AS SHOWN TO PREVENT OSCILLATION.

FIG. 7

S-120* TRANSFORMER CORE ASSEMBLY DETAILS

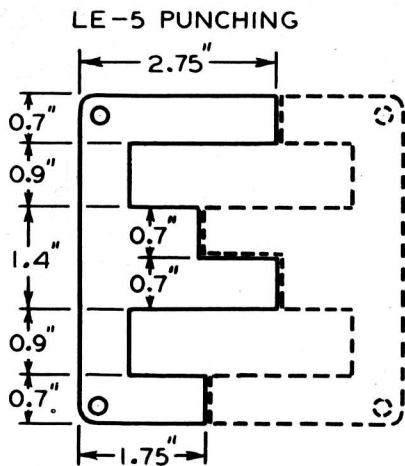
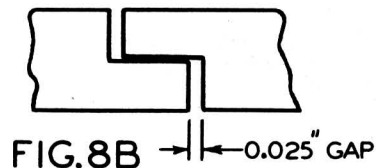
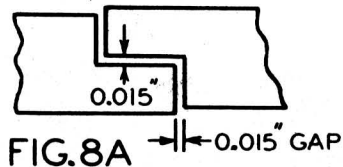


FIG. 8

ASSEMBLY VARIATIONS OF LAPPED JOINT



* OUR DESIGN IDENTIFICATION NUMBER

The license extended to the purchaser of tubes appears in the License Notice accompanying them. Information contained herein is furnished without assuming any obligations.