RCA RADIOTRON COMPANY, INC.
A RADIO CORPORATION OF AMERICA SUBSIDIARY
HARRISON
NEW JERSEY

OFFICE OF MANAGER
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EQUIPMENT SALES
ENGINEERING SERVICE DIVISION

APPLICATION NOTE No.44

November 14, 1934.

APPLICATION NOTE ON OPERATING CONDITIONS FOR THE 6A6

The 6A6 is a twin-triode amplifier tube. Except for its 6.3-volt, 0.8-ampere heater, the 6A6 has the same static and dynamic characteristics as the 53.

Application of the 6A6

The 6A6 is primarily intended for use as an audio output tube in Class B service. The two triode units in a single envelope, however, make the tube an admirable one for many other applications, such as a Class A driver with the two triode units in parallel, a resistance-coupled amplifier with the units in cascade, a combination detector and audio amplifier, or a phase-inverter stage to supply resistance-coupled push-pull output tubes. These special applications of the 53 were described in Application Note No.17; the conditions and constants specified for the 53 apply equally well to the 6A6. The requirements and considerations for using the 53 as a Class B audio output tube were given in Application Note No.14; this information also applies to the 6A6.

This Application Note gives additional operating conditions for the 6A6 in Class B service with various driver combinations and supply voltages. Results under both optimum (ideal) and practical conditions are presented.

Drivers for Use with the 6A6

The question naturally arises as to the best driver tube to use with a 6A6. Of the 6.3-volt tubes, the most suitable for this purpose are the 6A6 with the units connected in parallel, the 76 which is the 6.3-volt equivalent of the 56, and the 41 connected as a triode (screen tied to plate).

The overall operating conditions for these driver tubes in combination with the 6A6 in Class B service are shown in the accompanying tabulation. This table is divided into two parts: The first, showing "Optimum Operating Conditions" for which a perfect-regulation B-supply (battery) was used; the second, showing "Practical Operating Conditions" for the case where the power supply has an equivalent internal resistance of 1000 ohms in three cases, and of 2000 ohms in one case. The regulation of the average power supply, using a vacuum-type rectifier tube and having a high-resistance speaker field connected across the power supply, can generally be assumed to have an equivalent resistance of 500 to 1000 ohms. Hence, the power output obtainable with any of the combinations of tubes shown in the tabulation will generally be as good as that shown under "Practical Operating Conditions." The power output can be greatly improved by reducing the equivalent resistance of the power supply to about 200 ohms. The difference in the power output obtainable with high- and low-resistance power supplies is illustrated by the following cases. For the condition of #7 in the tabulation, where the power output is 5.7 watts, the regulation of the power-supply system corresponds to that of a constant-voltage source supplying power through a 2000-ohm resistance. If the speaker field in the power-supply system is replaced by a choke and the speaker field is connected across the power supply, the regulation can be reduced to the equivalent of a 1000-ohm resistance. This improvement in regulation increases the power in the voice coil to 6.4 watts. The use of a power-supply system having nearly perfect regulation, such as is obtained with a mercury-vapor rectifier tube together with a transformer and choke having very low resistance, will increase the power in the voice coil to more than 7.0 watts.

The power sensitivities of the different combinations are shown in the tabulation. A comparison of the values shows that, although the 6A6 driver provides the best power sensitivity, it will not always fulfill the power-output requirements. Use of the 41 as a driver makes possible better overall power output than the use of either the 6A6 or the 76. The input-signal requirements are such that either the 75, 85, or 6B7 will normally provide adequate signal to fully excite the grid of the driver tube.

For driver operation, the 41 should be connected as a triode with the screen grid tied to the plate. When resistance coupled to a preceding tube, the 41 should have not more than 500,000 ohms in the grid circuit. The maximum voltage recommended for the 41 driver is 275 volts; for the 76, 250 volts; and for the 6A6 or 53 as a driver or output tube, 300 volts.

In order that higher-order harmonics or sizzle may be minimized, the interstage or input transformer for a Class-B-operated 6A6 should be carefully designed. For best results, an interleaved winding should be used in which the primary is split into two windings with the secondary interposed between the windings. Satisfactory results can be obtained with the regular type of transformer winding, however, if the leakage reactance is low.

The primary inductance of the output transformer should be high enough to give good low-frequency response; yet, at the same time, it should be kept sufficiently low to obtain good high-frequency response. Close coupling and low leakage reactance are required for low-distortion levels and good power output at high frequencies.

CLASS B OPERATION OF TYPE 6A6
With The 6A6, 76, And 41 As Driver Tubes

Tube Combination			Driver Stage						Input Transformer	Output Stage (Zero Grid Bias)							Power Output		
#	Driver	Output	Input Signal RMS Volts	Plate Volts	Grid Bias Volts	Grid-Supply Resistance (R_c) Ohms	Zero-Signal Plate Current Milliamperes	Max.-Signal Plate Current Milliamperes	Primary / 1/2 Secondary	Zero-Signal Plate Volts	Plate-Supply Resistance (R_b) Ohms	Max.-Signal Plate Volts	Grid Current Microamperes	Zero-Signal Plate Current (total) Milliamperes	Max.-Signal Plate Current (total) Milliamperes	Plate-to-Plate Load Ohms	At Given Driver Input Signal-Watts	Distortion Per Cent	Power Sensitivity **
A. Optimum Operating Conditions (Ideal Case)																			
1	6A6*	6A6	4.0	294	-6.0	0	7.0	--	5.0/1	300	0	300	4.5	36	61.0	10000	10.0	8.5	0.6250
2	76	6A6	9.6	250	-13.5	0	5.0	--	5.0/1	300	0	300	4.5	35	62.0	10000	10.2	9.2	0.1110
3	41 Triode	6A6	18.5	250	-25.7	1200	21.4	22.0	3.64/1	300	0	300	18.0	36	78.0	10000	14.8	10.0	0.0433
4	41 Triode	6A6	20.7	275	-28.7	1200	23.9	24.6	3.64/1	300	0	300	18.0	36	82.5	10000	15.8	9.9	0.0369
5	41 Triode	6A6	20.3	275	-28.7	1200	23.2	24.4	5.0/1	300	0	300	10.4	36	69.5	10000	11.0	6.3	0.0267
6	41 Triode	6A6	18.5	250	-25.7	1200	21.4	22.0	3.33/1	275	0	275	18.0	33	74.0	10000	12.9	10.0	0.0377
B. Practical Operating Conditions																			
7	6A6*	6A6	3.3	300	-6.6	950	7.0	--	5.0/1	300	2000	272	3.6	35	50.0	10000	5.7	8.5	0.5230
8	41 Triode	6A6	17.18	275	-28.7	1200	23.9	21.4	3.64/1	300	1000	266	14.8	36	68.0	10000	11.0	8.3	0.0373
9	41 Triode	6A6	18.25	275	-28.7	1200	23.2	22.0	5.0/1	300	1000	274	10.0	36	60.0	10000	8.3	6.3	0.0250
10	41 Triode	6A6	16.45	250	-25.7	1200	21.4	19.7	3.33/1	275	1000	248	14.6	32	64.0	10000	9.6	8.9	0.0355

*Parallel connection.

**Power Sensitivity = $\frac{\text{Power Output in Watts}}{(\text{RMS Driver Signal})^2}$

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February 15, 1935.

ERRATA NOTICE

ON

APPLICATION NOTE No. 45

In Application Note No. 45, "The Use of the 57 or 6C6 to obtain Negative Transconductance and Negative Resistance," the following corrections should be made:

Page 4 - last line: Please change 0.010 to 10 micro-microfarads

Page 5 - third line: Please change 0.012 to 12 micro-microfarads

Page 5 - fourth line: Please change 0.006 to 6 micro-microfarads