

A New 6-Volt Output Pentode

IN RECENT months the automobile radio set has been given a good deal of attention by set designers and tube makers; witness the introduction of the series of 6-volt heater-type tubes. At first the "B" supply for such receivers

torted power output than the '38, with approximately two-thirds of the signal voltage required by the latter.

On page 21 are the ratings and characteristics of the ER-LA.

The family of plate curves for a screen voltage of 165 volts is shown in Fig. 1.

The curves shown in Fig. 2 bring out an interesting point about the operation of pentodes in push-pull. It is well known that the second-harmonic output of a single pentode can be made zero by proper choice of load resistance, although the third harmonic is considerably greater than with a triode of similar output rating. Offhand, then, there would seem to be little to gain by operating pentodes in push-pull from the standpoint of reduced harmonics, because the push-pull connection balances out only the even harmonics.

If two pentodes are operated with a self-biasing resistor of the proper value, however, and if the proper choice of load resistance is made, the third-

harmonic distortion can be reduced to a figure considerably below that of one tube. In general, the bias for this sort of operation will be

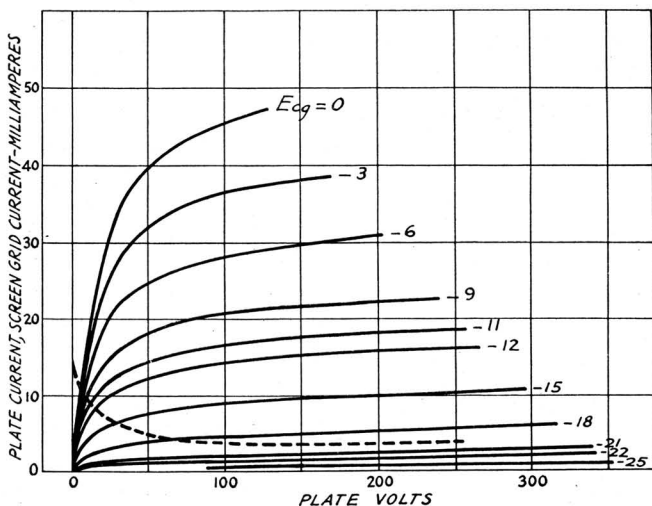


FIG. 1—AVERAGE PLATE CHARACTERISTICS OF THE TYPE LA PENTODE

Screen-grid voltage is 165 volts. The dashed line is the screen-grid current for a control-grid bias of -11 volts.

consisted solely of dry batteries; lately, however, various devices have been developed which take power from the car battery and transform it into "B" power for the set. Since the efficiency of these "B" substitutes usually is comparatively low, the car battery often is loaded up to the limit, and it is necessary therefore to get just as much audio power from the receiver as possible with the "A" and "B" power available.

For this reason a more efficient output tube is something worth having. Eveready Raytheon engineers have been working on the problem and have developed a new 6-volt pentode which will bear the type designation LA. It has a directly-heated cathode of the same rating as the heater in the Type '38, but its characteristics are more like those of the '47 than the '38. For a given plate and screen voltage the LA will give from 10% to 40% more undis-

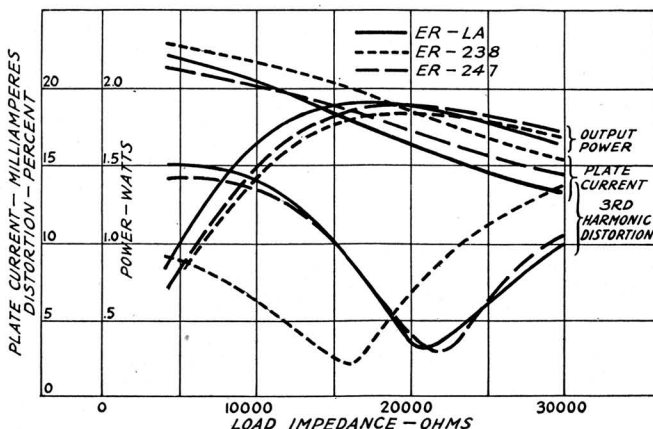
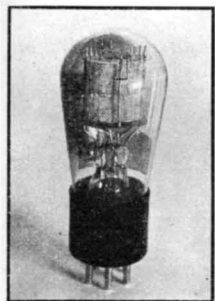


FIG. 2—PLATE CURRENT, DISTORTION AND POWER OUTPUT VS. LOAD IMPEDANCE

For two pentodes in push-pull with self-bias, operated partially Class B, as explained in the text. These curves show very clearly the reduction of the third harmonic when the proper load resistance is used. Curves for three different types of tubes are shown. The plate supply voltage is 180 volts in all three cases.

greater than the correct value for Class A amplification, so that the tubes are operating semi-



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Class B. The grids are not allowed to go positive, however. The plate current fluctuations are not great, so there is little variation in the load on the plate supply. The power output is slightly less than that obtainable using the tubes in push-pull as Class A amplifiers; but the greater operating economy and smaller distortion make this type of operation worth while. The bias resistor should be 900

ohms for two LA pentodes with 165 volts on the plates and screens.

| | | |
|-----------------------------------|------|-----------------|
| Filament voltage..... | | 6.3 volts d.c. |
| Filament current..... | | 0.30 amp. |
| Plate and screen-grid voltage.... | 135 | 165 volts max. |
| Control grid voltage..... | -9 | -11 volts |
| Plate current..... | 12 | 17 ma. |
| Screen-grid current..... | 2.5 | 3.5 ma. |
| Amplification factor..... | 100 | 100 |
| Mutual conductance..... | 1900 | 2100 microhms |
| Power output..... | 700 | 1200 milliwatts |
| Load impedance..... | 9500 | 8000 ohms |

The LA pentode should fit nicely into amateur receivers using a six-volt battery for "A" supply. It has the standard 5-prong base. The '38, it will be remembered, has its control grid connection brought out on top, requiring the use of a grid clip, but the elimination of the indirectly-heated cathode in the LA makes this extra connection unnecessary. The tube cannot be used with a.c. filament supply, however, except possibly for loud-speaker operation.

— G. G.

A Linear Electronic Voltmeter

(Continued from page 19)

of the initial adjustment; on how well the meter is set and reset to the original operating point of 10 microamps.

If the "B" battery be reduced to as low as 185 volts, the calibration will remain correct within $\frac{1}{2}$ of 1 per cent, without grid current flowing at any input in the range. At 100 volts "B" the calibration will be out by 1%. With no battery connected the calibration will be out 10%. Below 184 volts "B," grid rectification supplies the extra current necessary to operate the meter. In other words, under normal operating conditions the tube functions as a three-element plate detector; and under sub-normal conditions, as a two-element rectifier. Since the great virtue of an electronic voltmeter is its ability to measure

voltages without drawing power from the device to which it is connected, it is advisable to see to it that grid current flows at no point within the range. As long as the battery reads more than 185 volts no grid current will flow.

Tests made with 12 Type '30 tubes of the same

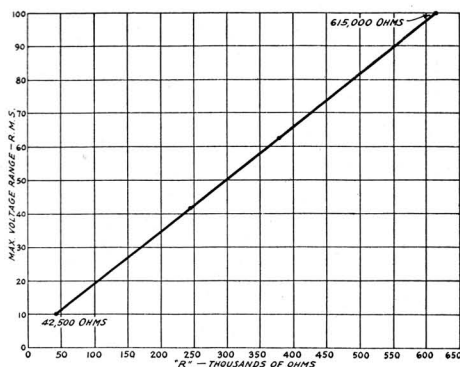


FIG. 3 — VOLTAGE RANGES USING 200-MICRO-AMPERE FULL-SCALE METER WITH VARIOUS VALUES OF RESISTOR "R"

make show a maximum deviation in calibration of 4% and an average of 1%.

In conclusion, it may be stated that the absolute accuracy at all times depends on the tube used, resistor R and the ability of the operator to set the meter to 10 microamperes.

Strays

W8ESJ is a student at the University of Michigan, where students who drive cars must have not only a state license tag but a university tag as well. Having by chance drawn the state license 733373, W8ESJ made a special request at the Dean's office for a certain university tag number and this request was granted. You're right, fellows — the number was 73.

The OW at W4ALD thinks that No. 5 of the "Amateur's Code" should be changed to read "unbalanced" and take out "never!"

In connection with the article on silvering quartz plates in the March issue, W9BOR calls our attention to the fact that solutions containing both silver and alcohol should be disposed of at once, as a fulminate of silver is formed after a few hours which is highly explosive.

In a wireless story in the *Elks Magazine* we read that the ship in distress "had not sent out the conventional three dashes, three dots, and three dashes, which would have called nearer vessels to her aid." That's what comes of trying to be "technical."