

centage of the primary winding common to plate and screen-grid circuits increases. It is found that under optimum conditions about two-thirds of the power-handling capacity of the corresponding pentode stage can be used with greatly reduced distortion, while at power levels corresponding to triode operation, a similar order of distortion is obtained. At the same time, the output impedance is reduced to a level approaching that obtained when a conventional push-pull triode stage is used. Such a stage can, therefore, be used with pentodes of the 25-watt class in high-quality amplifiers designed for power outputs well in excess of 30 watts, the over-all power efficiency being much greater than with triode operation.

Table 1 is a comparison of triode, pentode, and distributed-load operation for the EL34. For tubes of the EL34 type, comparison with triode operation is of most interest. It will be seen that distributed-load operation enables the power-handling capacity to be more than double that possible with triode operation while, at the same time, distortion in the stage can be held to a very low level. Although with a common winding ratio of 0.2 to 1 the distortion level is comparable to triode conditions, it has been found that appreciable improvement is obtained at higher power outputs if the common winding ratio is further increased.

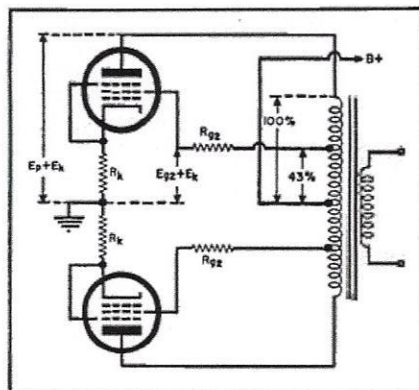


Fig. 1. Theoretical design for "Ultra-Linear" circuitry used in amplifier. The percentage figure is turns ratio.

From the figures of Table 1, little advantage would appear to be gained by further approaching triode conditions. There are, however, at least two advantages in using a tap at about 40% of primary turns, particularly with the EL34 where a high power output is still available. In the first place, almost identical performance is obtained under cathode and fixed bias conditions since with a closer approach to Class A triode operation, variations in plate and screen grid currents are reduced when the stage is driven. Secondly, as with normal triode operation, power output and distortion are less dependent on the precise value of the load impedance. With a primary tap

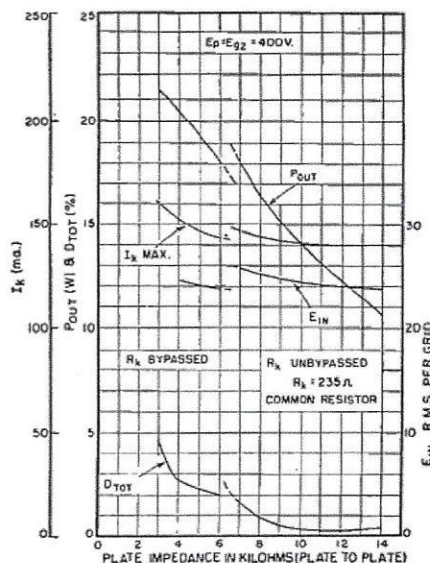


Fig. 2. Performance curves of two triode-connected EL34 tubes in push-pull. Refer to text for complete discussion.

of about 40% of the turns, little change in performance is produced by a change in the plate-to-plate load impedance of 6000 to 9000 ohms. In addition the output impedance of the stage is still further reduced by the use of the larger common winding ratio.

Circuit Arrangements

The next-to-the-last-stage of the amplifier must be capable of providing a

Fig. 3. Schematic of Mullard 520 amplifier. All parts are available at local parts jobbers. Maximum current drain for preamp is 40 ma.

