not to exceed about 5 db, due primarily to noise and crosstalk problems introduced with larger values. Along with this volume gain, improvements in quality were desirable.

Any such volume gains over present levels would of course be intolerably loud on short loops, so if limitations in the variety of sets and the attendant administrative, production, and merchandising benefits were to be retained, it meant designing a set with transmission performance suitably adjusted for short and long loops. Inasmuch as on cutovers and on P.B.X. extensions and the like, the same set would be at times on long and at others on effectively short loops, it also meant that this change in performance should automatically take place with change in connection rather than require manual reconnection or adjustment.

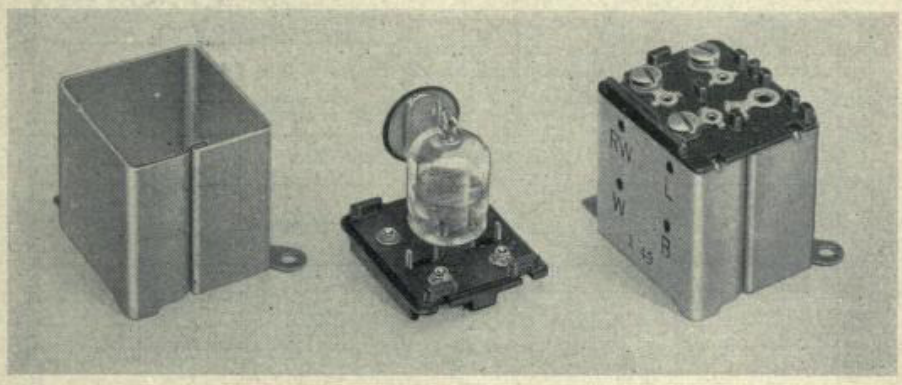

Fig. 4—View of equalizer.

This has been achieved in the present design by including an automatic transmission equalizer, Fig. 4, which is adjusted in its inserted loss characteristics by the magnitude of the d-c. line current through the set. One element of the initial design (other preferable methods may develop in the future) provides a tungsten ballast filament in series with the transmitter so proportioned that the effect on transmitting on long loops is small, but on short loops with high values of d-c., the combined battery supply and a-c. circuit loss inserted is about 5 db.

A corresponding graduated receiving loss is obtained by including a thermistor bead thermally coupled to the tungsten filament in the same structure. This bead, in series with a loss limiting resistance, is bridged across the receiver.

The filament is protected against abnormal voltages by a bridged silicon carbide varistor. The resistance current characteristics of the elements of this equalizer are shown in Fig. 5.

The required gains in transmission called for completely new transmitter