Oct. 11, 1932. D. G. GRIMLEY 1,881,515

TRANSMISSION CIRCUIT

Filed Aug. 31, 1926

Fig. 1

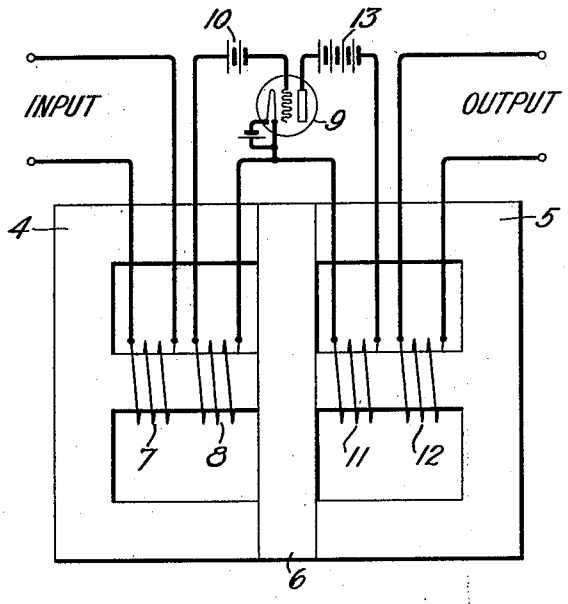
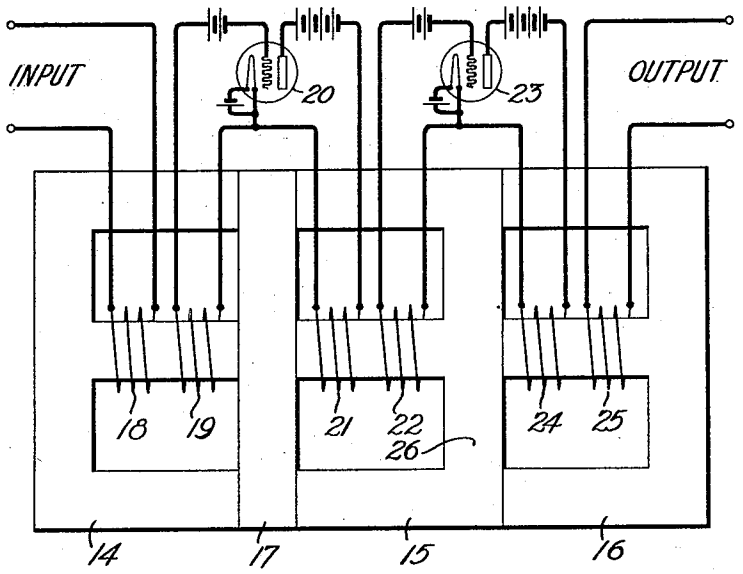


Fig. 2



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UNITED STATES PATENT OFFICE

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TRANSMISSION CIRCUIT

Application filed August 31, 1926. Serial No. 132,671.

This invention relates to electrical transmission circuits and particularly to amplifier circuits.

An object of this invention is to control the transmission characteristic of electrical circuits.

A specific object of the invention is to obtain uniform amplification over a wide range of frequencies.

In the copending application of Horace Whittle, Serial No. 132,601, filed August 30, 1926, now Patent No. 1,739,699, issued December 17, 1929, there is disclosed and claimed an arrangement which may be employed for increasing the amplification of low frequency waves to obtain uniform amplification over a wide range of frequency, this arrangement comprising a multi-branch core structure having input and output transformer windings mounted thereon in such a way as to obtain coupling therebetween, the coupling being greater for currents of certain frequencies than for others.

The present invention is a species of the generic invention of that application in which the input and output transformers, which are preferably of the shell type, have one leg of their cores in common. By regulating the reluctance of the common leg it is possible to control the coupling between the transformers and consequently the transmission characteristic of the circuit.

In one embodiment of this invention the core of an interstage transformer of a multi-stage amplifier has one leg in common with the core of the input transformer of the preceding stage and another leg in common with the core of the output transformer of a subsequent stage so that the overall amplification characteristic can be controlled through the coupling between the windings mounted on the cores.

This invention can be more readily understood by reference to the following detailed description in connection with the drawing, Fig. 1 of which shows an embodiment of this invention in a single stage amplifier and Fig. 2 of which shows an embodiment of this invention in a multi-stage amplifier.

Referring to the single stage amplifier circuit of Fig. 1 there are shown two E shaped core sections 4 and 5 which are combined with a single I shaped section 6 to form two shell type transformer cores having a common leg formed by the I section 6. Mounted on a central branch of the E section 4 are two windings 7 and 8 which function as an input transformer for the amplifier tube 9, the primary winding 7 being connected to the input terminals of the amplifier circuit, the secondary winding 8 being connected to the input electrodes of the tube 9 through the grid biasing battery 10. Mounted on the central leg of the E section 5 are two windings 11 and 12 which serve as output windings for the amplifier tube 9, the primary winding 11 being connected to the output electrodes of the tube 9 through a plate battery 13, and the secondary winding 12 being connected to the output terminals of the amplifier circuit.

If the leg 6 is of such cross section that its reluctance is low compared to the reluctance of the remainder of the magnetic circuit, there will be practically no coupling between the input and output transformer windings. However, if the reluctance of the leg 6 is increased, for example, by reducing its cross section or by the introduction of an air gap, coupling may be produced between the windings which will cause a feed-back from the output transformer to the input transformer causing an increased amplification particularly at the low frequencies.

Fig. 2 shows a similar arrangement for a multi-stage amplifier. In this case there are shown three E shaped laminations 14, 15 and 16 and one I shaped lamination 17 which are combined to form three shell type transformer cores, the central one of which has a leg in common with each of the outer ones. Mounted on a central branch of the core section 14 are transformer windings 18 and 19 which serve as an input transformer for the first stage vacuum tube 20, the primary winding 18 being connected to the input terminals of the multi-stage amplifier circuit and the secondary winding 19 being connected to the input electrodes of the tube. Mounted on the central branch of the core section 15 are two windings 21 and 22 which serve as an inter-

stage transformer, the primary winding 21 being connected to the output electrodes of the first stage tube 20 and the secondary winding 22 being connected to the input electrodes of the second stage tube 23. Output transformer windings 24 and 25 are mounted on the central branch of the core section 16, the primary winding 24 being connected to the output electrodes of the tube 23 and the secondary winding 25 being connected to the output terminals of the amplifier circuit. In this case, the reluctance of each of the common legs 17 and 26 may be regulated to control the amplification of each stage.

The feed-back arrangements described above may also be employed between a retard coil in the output circuit of an amplifying tube and the input transformer therefor, or between the coils of an inductance coupled amplifier.

What is claimed is:

1. In combination, an electron discharge amplifier, input and output transformer windings therefor, a shell type core structure for each of said windings, and means to control the transmission characteristic of said combination to give substantially uniform amplification of impressed waves over a wide range of frequencies, said means comprising a portion common to the core structures for said windings having a magnetic reluctance which is high compared to that of the other portions of said core structures.

2. In combination, an amplifier having input and output circuits, a coil in each of said circuits, a magnetic core structure for the coil in said input circuit, a second magnetic core structure for the coil in said output circuit, and means for controlling the amplification characteristic of said combination comprising a portion common to the first mentioned core structure and said second core structure and having a magnetic reluctance which is larger than that of the other portions of the core structures.

3. In combination, an amplifier, input and output transformer windings therefor, a magnetic core structure for said input transformer windings, a second magnetic core structure for said output transformer windings, and means for improving the amplification characteristic of said combination comprising a portion common to the two core structures, and having a magnetic reluctance which is large in comparison with that of the other portions of said core structures.

4. In combination, an amplifier having an input and an output coil, a magnetic core structure for said input coil, a second magnetic core structure for said output coil, and means for improving the amplification characteristic of the combination, comprising a portion common to the two magnetic core structures, and of smaller cross-sectional area than the other portions of said structures, and thereby enabling feed-back of amplified energy from said output coil to said input coil.

5. In combination, an amplifier having input and output transformer windings, a core structure for said input transformer windings, a second core structure for said output transformer windings, and means for controlling the transmission characteristic of said combination comprising a portion common to the two core structures and having an air-gap therein of such size as to make the reluctance of said common portion large in comparison with that of the other portions of said core structures.

6. In combination, a source of alternating current waves to be amplified, a vacuum tube amplifier having input transformer windings supplied with said waves, and output transformer windings, and means for controlling the transmission characteristic of said combination so as to produce uniform amplification thereby of said waves over a wide range of frequencies, said means comprising a plural-branch magnetic core structure having a central branch on which said input transformer windings are mounted, and outer branches, a second plural-branch magnetic core structure having a central branch on which said output transformer windings are mounted, and outer branches, the outer branches of the two core structures having a portion in common which has a reluctance which is large in comparison with that of the other portions of the branches of said core structures.

In witness whereof, I hereunto subscribe my name this 26th day of August, A. D., 1926.

DONALD G. GRIMLEY.