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ELECTRICAL TRANSFORMER

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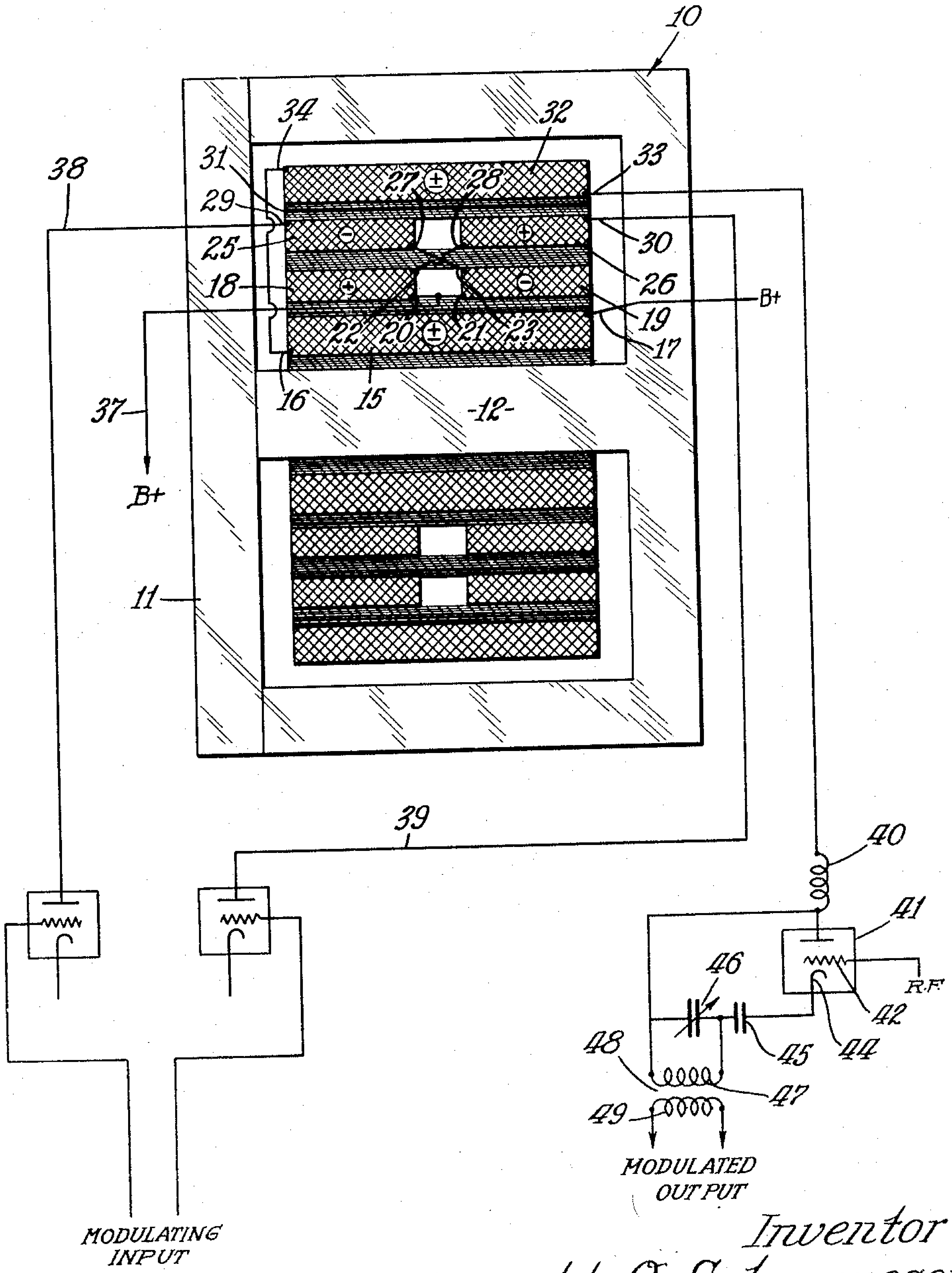

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ELECTRICAL TRANSFORMER

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2 Claims. (Cl. 175—356)

1

This invention relates to an electrical apparatus and particularly to an audio frequency transformer for use in plate circuit modulation. The transformer primary is adapted to be energized from push-pull amplifying means, while the secondary is adapted to be connected in the plate circuit of a modulating stage for the purpose of modulating a suitable radio frequency carrier.

The transformer hereinafter described is particularly adapted for handling a broad band of audio frequencies for high fidelity. As is well known, in audio-frequency transformers particularly for use over extended frequency ranges, capacitance to ground in the windings exert a substantial influence on the operation of the transformer. This is particularly true where transformers have primary and secondary windings of substantial size and have large potential differences impressed across said windings. The capacitance to ground distributed over various parts of the transformer creates parasitic resonant circuits and imparts undesirable peaks and characteristics to the transformer.

The above problems inherent in an audio-frequency transformer are particularly aggravated in the case of a transformer for use in plate circuit modulation. In such a modulating system, the transformer output potential must vary over substantial values. Thus, the secondary of a transformer used in plate circuit modulation inherently involves massive construction with capacitance to ground normally distributed over large parts of the structure.

In order to provide a transformer having an extended audio frequency characteristic curve, the invention hereinafter described may be utilized. In accordance with this invention, both the primary and secondary windings are sub-divided. These sub-divided windings are so connected and the direction of winding is so chosen that the effects of capacitance to ground throughout both the primary and secondary windings are concentrated. Thus, any parasitic resonance effects are concentrated into what might-be-termed a single parasitic circuit. The effects may be compensated in any desired manner.

The single figure in the drawing shows a transformer wound in accordance with this invention and diagrammatically indicates the various circuit connections to the transformer windings.

Transformer 10 is provided with shell core 11 in accordance with customary practice. Core 11 may be made of suitable laminations with the dimensions of the various legs of the core suitably proportioned in accordance with well-known practice. The core itself may be split at any desired number of places for permitting assembly of the core around the windings, or the core may be of the type using continuous coiled strips of metal. Since the core is no part of this invention, further details are not deemed necessary.

2

Core 11 has central leg 12 around which the various windings are disposed. Thus, immediately adjacent leg 12 is one part of secondary winding 15 having inner terminal 16 and outer terminal 17. The terms "inner" and "outer" with respect to terminals indicates respectively the position of the terminal with respect to leg 12. The inner terminal will always be the beginning of the winding, while the outer terminal will always be the end of that particular winding. The direction in which the wire is wound is indicated by plus and minus signs. Thus, a plus sign may mean that the wire is wound clockwise for example, in which case the minus sign will have the wire wound in reverse fashion. If desired, the same effects may be obtained by winding all coils in the same direction and reversing the winding.

Portion 15 of the secondary winding extends the full length of the transformer. Around winding 15 are primary winding portions 18 and 19. It will be noted that primary portions 18 and 19 are side by side. Windings 18 and 19 have inner terminals 20 and 21 and outer terminals 22 and 23 respectively. The next windings are also primary windings 25 and 26. These two windings are side by side with 25 being over 18 and 26 being over 19. Windings 25 and 26 have inner terminals 27 and 28 and outer terminals 29 and 30. Around windings 25 and 26 is electrostatic shield 31. The final winding is secondary portion 32, this extending the full extent of the transformer. Secondary 32 has inner terminal 33 and outer terminal 34. An outer electrostatic shield for the entire transformer may be provided.

Secondary windings 15 and 32 are preferably equal with regard to the number of layers of wire. However, this may be varied within wide limits. The same is true of primary windings 18 and 19, on the one hand, and primary windings 25 and 26, on the other hand. Primary windings 18 and 25 preferably have the same number of turns. Similarly, primary windings 19 and 26 also have the same number of turns, this number being the same as the number of turns for primary windings 18 and 25.

Each winding has the wire wound from the inner terminal to the outer terminal thereof in the direction, as viewed from the end where the inner terminal is, corresponding to the algebraic sign. Thus, secondary winding 15 may have the wire going clockwise (or positive) as viewed from the left-hand side of the transformer where inner terminal 16 is provided. Looking at primary winding 18 from inner terminal 20, the wire also goes in a clockwise direction around secondary 15. Looking at primary 19 from inner terminal 21, the wire goes in a counter-clockwise direction.

Considering primary 25, the wire goes counter-clockwise from inner terminal 27. Primary 26 has the wire going in a clockwise direction when viewed from inner terminal 28. Secondary 32 has the wire going clockwise as seen from inner terminal 33.

As seen from say the left side of transformer 10 in the drawing and considering the direction of the wire from the inner terminal to the outer terminal, windings 19 and 25 have what might-be-termed a positive direction, while windings 18 and 26 have a negative direction. Windings 15 and 32 have the same sign, here negative. They can both be positive if desired.

In all cases, all primary winding portions as connected are magnetically additive. The same is true for the secondary winding portions.

It is also possible to have all windings wound in the same direction during winding and have certain portions disposed in the transformer in reversed relation.

As is clearly shown in the drawing, inner terminal 16 and outer terminal 34 of the secondary windings are connected together. Outer terminals 22 and 23 of the primary windings are cross-connected to inner terminals 26 and 28 respectively of the remaining primary windings.

It is understood that suitable insulation between windings may be provided. The electrostatic shields and frame are suitably grounded.

Inner terminals 20 and 21 are connected to lead 37 going to any suitable source of B plus potential. Outer terminals 29 and 30 of the primary windings are connected by leads 38 and 39 to the output of a push-pull amplifier. This push-pull amplifier may be considered as a source of modulating audio frequency input to transformer 10.

Outer terminal 17 of the secondary is connected to a suitable source of B plus potential, while

inner terminal 33 of the secondary may be connected through a suitable radio frequency choke 40 to the anode of modulator tube or stage 41. Modulator 41 may have grid 42 supplied with suitable radio frequency carrier waves. Tube 41 has cathode 44 between which electrode and anode are condensers 45 and 46 connected in series. Across condenser 46 is primary 47 of radio frequency transformer 48 whose secondary 49 has modulated radio frequency potentials. Condenser 46 may be variable to tune winding 47 and select the proper modulated frequency output.

What is claimed is:

1. A wide-band audio frequency transformer comprising a ferromagnetic core, a first full-length secondary winding, second and third primary windings disposed side by side around said first winding, fourth and fifth primary windings disposed side by side over the second and third windings respectively, an electrostatic shield over said fourth and fifth windings, a sixth full-length secondary winding similar to the first winding over said electrostatic shield, all of said windings having inner and outer terminals respectively and connected as follows: the inner second to the inner third to provide one common primary terminal, the outer second to the inner fifth, the outer third to the inner fourth, the outer terminals of the fourth and fifth being free for connection of the primary to an external circuit, the inner first to the outer sixth leaving the outer first and inner sixth as external secondary connections, all primary windings being magnetically aiding, the secondary windings also being magnetically aiding.

2. The transformer of claim 1 wherein said core is of the shell type.

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