

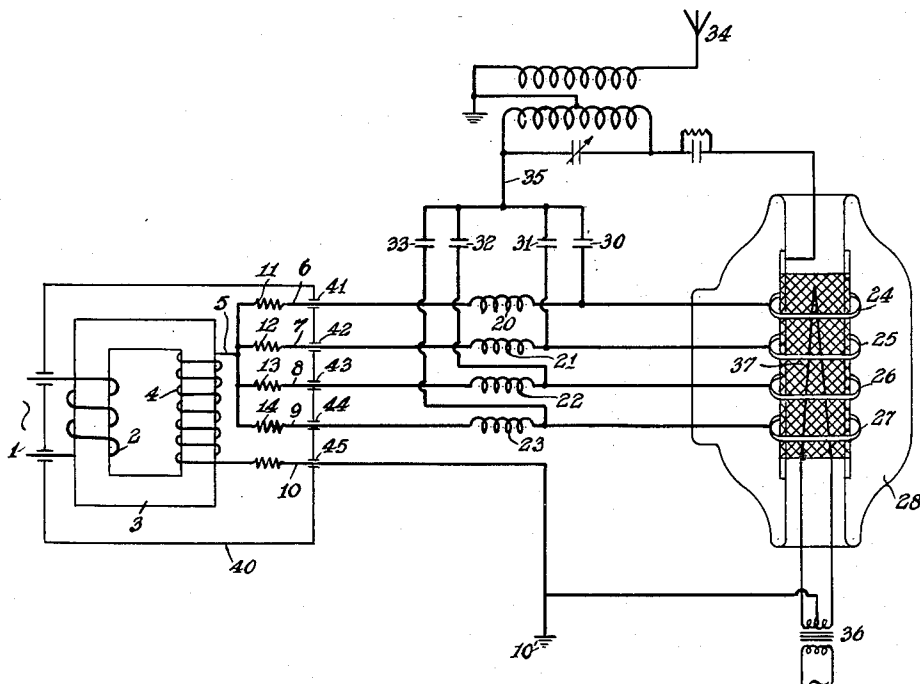
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TRANSFORMER MEANS PERMITTING SAFE HANDLING OF DANGEROUS CIRCUITS

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TRANSFORMER MEANS PERMITTING SAFE
HANDLING OF DANGEROUS CIRCUITS

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4 Claims. (Cl. 250—27)

The invention relates to means for use in electrical circuits more especially adapted for the operation of thermionic apparatus utilizing a dangerously high current and high voltage. It is particularly applicable to circuits of vacuum tube transmitters and like apparatus which ordinarily carry a comparatively heavy current.

The present invention is a division of an application filed by me May 29, 1940, Serial No. 337,806.

The invention contemplates dividing both the current and the voltage in a dangerous voltage circuit, more especially the current and voltage derived from a transformer.

It has for an object to provide in a circuit of the aforesaid nature a plurality of parallel paths from the secondary of the transformer, the total current delivered by the said secondary or the sum of the currents in all of the paths being dangerous, but the current in any single path being of a relatively safe value.

A further object of the invention is to provide a novel construction of transformer capable of supplying a dangerous voltage but safe to handle.

In carrying out the invention, the circuit is so designed that the current paths, for example, for a thermionic transmitter tube, are maintained separate by dividing the plate of the tube into separated sections, each section being fed by a separate conductor and the output paths being united. Individual leads emanating from one branch of the secondary of the transformer are connected to the respective plates of the said tube, there being included in each connection and within a casing enclosing the transformer suitable resistances whose resistivities are of an order of magnitude sufficient to reduce the current flow in a connection to a safe value in case of bodily contact therewith.

The nature of the invention, however, will best be understood when described in connection with the accompanying drawing, which is schematic diagram of an oscillator circuit with safety transformer for dividing its output circuit into parallel paths and safeguarding the respective paths by means of resistances in the different paths, together with a casing housing the transformer.

Referring to the drawing, 1 designates a source of alternating current voltage, which may, for convenience, have a frequency of 60 cycles, and is connected to the primary winding 2 of transformer having the core 3.

The secondary 4 of this transformer, however, is modified in accordance with the invention, in a manner such that one of the branches 5 is di-

vided into a plurality of output leads 6, 7, 8, and 9, the other branch 10 being indicated as grounded at 10'.

In each of the output leads 6, 7, 8, and 9, there is included a resistance of sufficient magnitude to render the current flow through the corresponding lead of a value insufficient to be dangerous in case of bodily contact with any portion of the lead or circuit beyond such resistance.

As an example of safe values, the lowest resistance which should be allowed, in a circuit with 10,000 volts applied thereto as the secondary voltage, would be 1,000,000 ohms which would pass 10 milliamperes—a safe current. For such high voltage, the human body may be considered practically a short-circuit. The maximum low-frequency current to be obtained from the transformer secondary through the divided supply lead is determined by the lowest resistance which might be interposed between the points of contact of the body; and it is important, therefore, that the lowest resistance possible to place between body and ground be such as to allow only a safe current to pass at the maximum voltage.

As indicated in the drawing, such resistances 11, 12, 13, and 14 are included in the respective output leads 6, 7, 8, and 9. The said output leads 6, 7, 8, and 9 connect through the inductances 20, 21, 22, and 23 adequate power of a suitable voltage to the plate sections 24, 25, 26, and 27 constituting the anode of an oscillator tube 28. The output of this tube is connected through the respective blocking condensers 30, 31, 32, and 33 from the leads 6, 7, 8, and 9 to, for example, the transmitting antenna 34, the outputs being combined thereby and connected therewith through the lead 35. A low-voltage transformer 36 delivers low voltage to the filament 37 of the tube.

It will be understood from the foregoing that any portion of the secondary circuit beyond the respective resistances 11, 12, 13, and 14 may be contacted with impunity or, at worst, a disagreeable shock; and to avoid any possible contact with portions of the secondary circuit in advance of these resistances, the entire transformer, or at least the secondary portion thereof, is housed, for example, in a suitable casing 40. This is provided with a plurality of outlets 41, 42, 43, 44, and 45 through which the respective leads 6, 7, 8, and 9 and the branch 10 of the secondary pass to the oscillator device 28 and ground.

By this expedient, it would not be possible to contact any dangerous portion of the transformer which, through the sub-divisions of the one branch of the secondary may provide a total cur-

rent of dangerous value, but so distributed that contact with any one of the output leads will not result disastrously, the current therein being maintained at a value not in excess of 10 milliamperes. However, when the currents of the individual leads are recombined in the oscillator device, a current value of appreciable magnitude is provided for operation of the same. Of course, contact with two or more branches or leads would provide a dangerous current but such contact would be a most unusual occurrence and the general arrangement of circuits of this nature is such that this could not occur, as a rule, accidentally.

I claim:

1. A transformer having an input winding, a high-voltage, dangerously-high-current, output secondary winding for connection to a work circuit, said winding including two output branches, one of said branches embodying a plurality of leads connected in parallel and each normally providing a dangerous current at the optimum voltage, electronic means for recombining at the work circuit the individual currents of the said leads, together with a housing for the recombining means to prevent bodily contact therewith, and current limiting means included in series in the respective leads in close proximity to the said one branch of an order of magnitude sufficient to hold the current flow in each lead, at the optimum voltage, to a safe value.

2. A transformer having an input winding, a high-voltage, dangerously-high-current, output secondary winding for connection to a work circuit, said winding including two output branches, one of said branches embodying a plurality of leads connected in parallel and each normally providing a dangerous current at the optimum voltage, electronic means for recombining at the work circuit the individual currents of the said leads, together with a housing for the recombining means to prevent bodily contact therewith, and resistances included in series in the respec-

tive leads in close proximity to the said one branch of an order of magnitude sufficient to hold the current flow in each lead, at the optimum voltage, to a safe value.

3. A transformer having an input winding, a high-voltage, dangerously-high-current, output secondary winding for connection to a work circuit, said winding including two output branches, one of said branches embodying a plurality of leads connected in parallel and each normally providing a dangerous current at the optimum voltage, means for recombining at the work circuit the individual currents of the said leads, together with a housing for the recombining means to prevent bodily contact therewith, resistances included in series in the respective leads in close proximity to the said one branch of an order of magnitude sufficient to hold the current flow in each lead, at the optimum voltage, to a safe value, and an enclosing casing for the secondary winding and current limiting means to prevent bodily contact with this portion of the secondary circuit, said casing having outlets for passing the respective lead portions from the resistances to the work circuit.

4. The combination with a transformer having an input winding, a high-voltage, dangerously-high-current, output secondary winding including two output branches, one of said branches embodying a plurality of leads connected in parallel and each normally providing a dangerous current at the optimum voltage; of unilateral means including a plurality of anodes operating at a combined dangerous voltage and current, said leads being connected with the respective anodes, together with a housing for the unilateral means to prevent bodily contact therewith, and current limiting means included in series in the respective leads in close proximity to the said one branch of an order of magnitude sufficient to hold the current flow in each lead, at the optimum voltage, to a safe value.

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