United States Patent

[11] 3,573,694

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[21] Appl. No. **870,039**
[22] Filed **Oct. 28, 1969**
[45] Patented **Apr. 6, 1971**
[73] Assignee **General Electric Company**
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[54] **HIGH VOLTAGE TRANSFORMER FOR TELEVISION RECEIVERS**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **336/198,** 336/231
[51] **Int. Cl.** **H01f 27/30**
[50] **Field of Search** 336/198, 208, 231, 225

[56] **References Cited**

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ABSTRACT: An improved high voltage transformer for television receivers and the like. The transformer coils are wound around novel slotted coil form means comprising hollow, electrically insulative means, the interior of which surrounds a portion of the transformer core means and the exterior of which is provided with a plurality of axially spaced circumferential slots. The slots for the high voltage windings are located at progressively increasing radial distances from the core means portion so as to provide a sufficiently great insulative barrier between the coil and the core means to prevent electrical arcing therebetween.

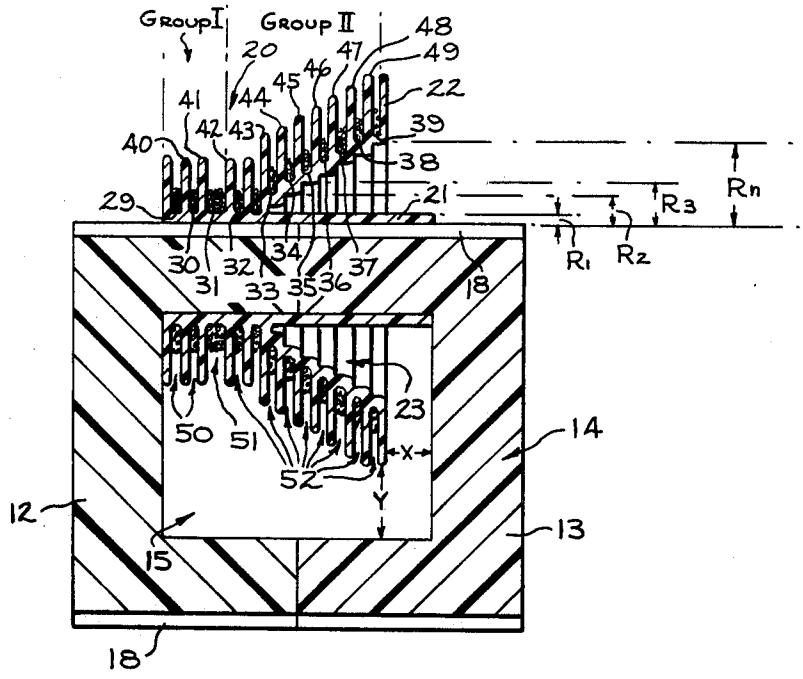
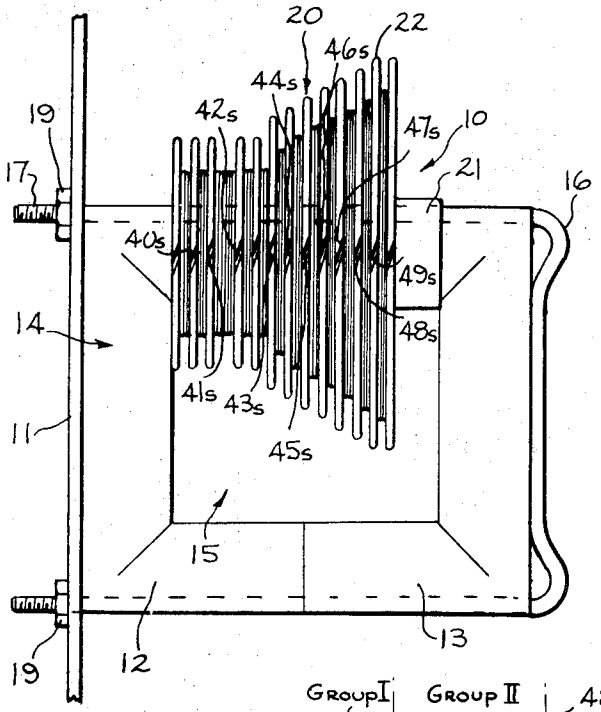


FIG.1



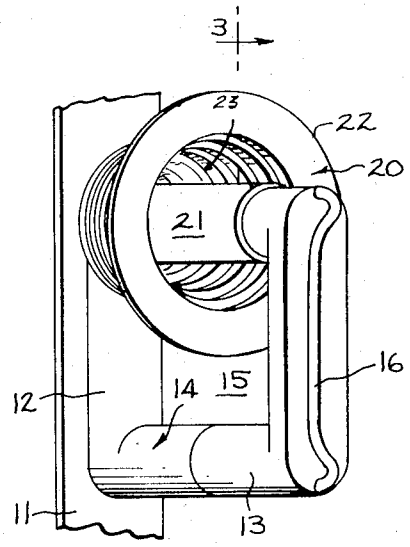


FIG.2

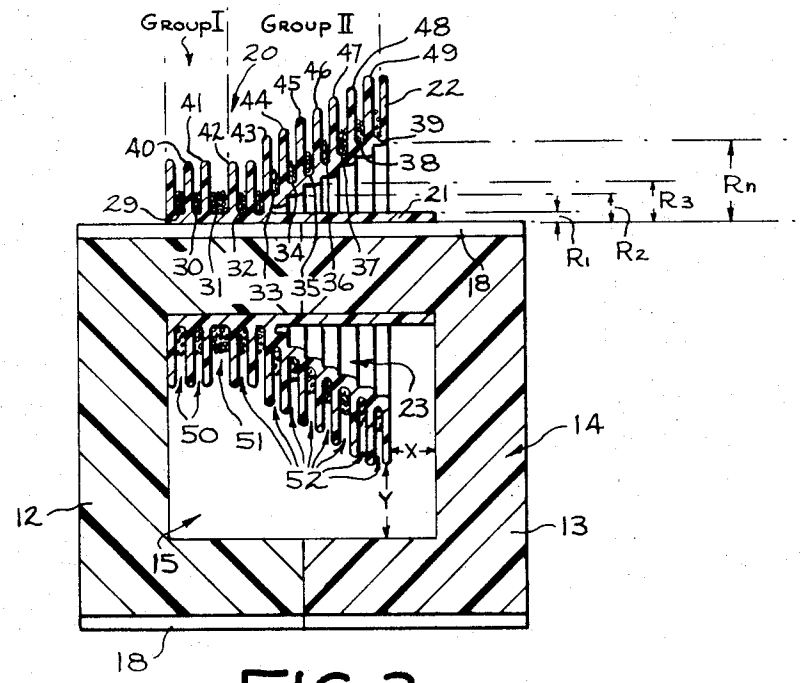


FIG.3

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HIGH VOLTAGE TRANSFORMER FOR TELEVISION RECEIVERS

BACKGROUND OF THE INVENTION

This invention relates to high frequency pulse transformers and, more particularly, to an improved transformer of the aforedescribed type which can be used as a horizontal output and high voltage transformer for television receivers and the like.

Heretofore, layer-wound transformers have been employed in this service. U. S. Pat. Nos. 2,500,766 and 2,612,545 describe typical versions of such conventional transformers. With these prior-art transformers, the tapes and insulating sheets which have been used between the layers of wire forming the coils and the overlapping of the coil layers over one another have retarded the transfer of heat away from the coil to the surrounding atmosphere. Furthermore, it has been difficult to obtain consistency in operating characteristics with these conventional layer-wound transformers and their production has required a slow and tedious manufacturing process.

SUMMARY OF THE INVENTION

To overcome the aforenoted shortcomings of these conventional layer-wound transformers, the present invention has been developed which provides a novel slot-wound transformer that can be used in small and large screen color and monochrome television receivers. Basically, the novel improved transformer of the present invention performs the same operation as the conventional layer-wound transformer which it replaces, differing mostly therefrom in that it employs novel slotted coil form means around which the transformer coils are wound. The novel coil form means comprises hollow electrically insulative means, the interior of which surrounds a portion of the transformer core means and the exterior of which is provided with a plurality of axially spaced circumferential slots. The slots for the high voltage coil windings are located at progressively increasing radial distances from the core means portion so as to provide a sufficiently great insulative barrier between the coil and the core means to prevent electric arcing therebetween. The transformer of the present invention presents improvements over the conventional layer-wound transformer, which it replaces, in relation to such factors as more efficient transfer of heat away from the coil windings to the surrounding atmosphere, greater ease and lower costs of manufacture, and increased reproducibility and reliability.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated in the accompanying drawing, wherein:

FIG. 1 is a side elevational view of an assembled transformer incorporating the present invention;

FIG. 2 is a right end elevational perspective view of the transformer illustrated in FIG. 1; and

FIG. 3 is an enlarged, somewhat schematic sectional view taken along line 3–3 of FIG. 2, with the U-bolt removed to show details.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing and particularly to FIG. 1 thereof, there is shown a presently preferred form of the improved transformer **10** of the present invention. The transformer **10** is mounted on a portion of a shielding wall or other suitable support **11** that is provided within the housing of a television receiver or similar device (not shown). A pair of U-shaped sections **12** and **13**, which may be molded of a ferrite or other suitable magnetic material, are assembled such that the legs of the U-shaped sections **12** and **13** confront each other. When so assembled, these magnetic sections form generally rectangular core means **14** for the transformer **10** and define a core window **15** at the center of the rectangle.

In order to hold the transformer **10** in its assembled position, a U-bolt **16** is provided. The U-bolt **16** has a pair of legs **17**, which are threaded at their distal ends and extend through matching grooves **18** provided in the legs of the core members **12** and **13**. The legs of the U-bolt **16** may be passed through apertures provided in the support plate **11** and the entire transformer **10** retained in its assembled position by means of a pair of nuts **19**.

In accordance with the present invention, the improved transformer **10** is provided with novel slotted coil form means **20** around which the transformer coils are wound.

Heretofore, the windings for such a transformer have been concentrically wound in layers, one layer directly over another, around an electrically insulative hollow cylindrical coil form that surrounded a portion of the core means. The windings have been arranged on these prior-art cylindrical coil forms with the higher voltage windings located radially farthest from the core and thus having the greatest insulative gap between them and the core in order to inhibit electric arcing between the coil and the core. While this prior-art concentric layer-wound coil construction has served to inhibit electric arcing between the coil and the core, the tapes and insulating sheets which have been used between the layers of wire forming the coils and the overlapping of the coil layers over one another have retarded the transfer of heat away from the coil to the surrounding atmosphere. This problem of retarded heat transfer has, on occasions, resulted in thermal destruction of these prior-art transformers and of the receivers employing them.

In an initial effort to overcome the aforenoted problem of poor heat transfer, it was proposed that the windings be axially spaced along the cylindrical coil form such that the winding surface area exposed to the surrounding atmosphere would be vastly increased and the rate of heat transfer from the coil to the atmosphere would consequently be greatly accelerated. However, these first attempts, while improving heat transfer from the coil, were otherwise unsuccessful in that considerable electric arcing occurred between the high voltage windings and the core when a simple cylindrical coil form was employed.

In accordance with the present invention, it has been found that the novel coil form means **20** provide a solution to the prior-art problem of retarded heat transfer from the transformer coil to the surrounding atmosphere while avoiding any new problem with electric arcing between the coil high voltage windings and the core means **14**. In the form of the present invention illustrated in the drawing, the novel coil form means **20** is formed of an electrically insulative material. While various electrically insulative materials may be utilized to produce the novel coil means **20**, good results have been obtained with flame-retardant polypropylene material, such as Escon 185 or Avisun 2356. And, although it might also be made of a plurality of parts, the novel coil form means **20** illustrated comprises a lone hollow member, the interior of which surrounds a portion of the core means **14** and the exterior of which is provided with a plurality of axially spaced circumferential slots **29—39** in which the coil windings are wound. As shown, the interior of the novel coil form means **20** comprises a hollow tubular portion **21** that is adapted to be slipped over and to surround the portion of the core means **14** that is defined by the legs of the core members **12** and **13** which comprise the upper "wall" of the core window **15**. The exterior of the novel coil form means **20** comprises a generally frustoconical portion **22** having its convergent end joined to one end of the tubular interior portion **21** of the coil form means **20** and its divergent end being spaced apart from the tubular interior portion **21** by a gap **23** containing air or some other gaseous material. The axially spaced circumferential coil-receiving slots **29—39** are provided in the generally frustoconical exterior portion **22** of the coil form means **20** and are separated from one another by partition members or ribs **40—49**.

As best shown in FIG. 3, the slots **29—39** in the exterior of the novel coil form means **20** may be considered as being di-

vided into two groups, Groups I and II. Group I includes two narrow slots **29** and **30** and one wide slot **31**. The two narrow slots **29** and **30** receive the transformer auxiliary windings **50** for such auxiliary functions as boost voltage, AFC pulse, AGC keyer pulse, etc. The wide slot **31** receives the transformer primary windings **51**. Group II includes the remaining slots **32**—**39** which receive the transformer high voltage windings **52**. The sizes of the slots **29**—**39** are of course determined by the size of the wire to be used and the number of turns required. The first three slots **29**—**31** adjacent the convergent end of the coil form means **20** receive the auxiliary windings **50** and primary windings **51** for the transformer **10**. These three slots **29**—**31** and at least one slot for the high voltage windings **52** (the slot **32** nearest the primary winding slot **31** as illustrated in the drawing) are spaced at substantially the same radial distance R_1 from the portion of the core means **14** which the coil form means **20** surrounds, while the remaining high voltage winding slots **33**—**39** are located at progressively increasing radial distances R_2, R_3, ... R_n from that portion of the core means **14** such that a sufficiently great insulative barrier is provided between the transformer coil and the core means to prevent electric arcing therebetween.

By way of example, if R_1, R_2, R_3, ... R_n are the radial distances between the successive slots in the high voltage winding Group II from the core means, then:

$(R_2-R_1)=(R_3-R_2)=\ldots (R_n-R_{n11}) > D$ where D is the necessary insulative barrier or gap required to prevent arcing between the coil slot sections and the core and distances R_n and X and Y are > the necessary insulative gap or barrier required to prevent electric arcing between the coil and the core at the maximum voltage at which the transformer **10** is to be operated.

As further shown in FIG. **1**, each of the partitions or ribs **40**—**49** on the exterior of the coil form means **20** is provided with a narrow slit **40***s*—**49***s* to permit continuous winding of the coil-forming wires from slot to slot. While slotted bobbins having slits between their slots to provide for continuous winding are well known, the slits **40***s*—**49***s* which the present invention provides are advantageously novel in that they are canted at an angle with respect to the long central axis of the portion of core means **14** that is surrounded by the novel coil form means **20**. Thus, with their canted arrangement, the novel slits **40***s*—**49** provide a longer and, thus, greater, electrically insulative barrier to electrical arcing between coil sections located in adjacent ones of the slots **29**—**39** than has been the case with prior-art slotted coil forms or bobbins wherein such slits have been arranged parallel to the long central axis of the surrounded portion of the core means. Also, the novel canted slits **40***s*—**49***s* of the present invention prevent bulging of the coil windings in adjacent ones of the slots **29**—**39** toward one another through the slits; a problem which had existed with the conventional parallel slits.

Still further, in accordance with the present invention, as best shown in FIG. **3**, the outer edges of the partitions or ribs **40**—**49** of the novel coil form means **20** are rounded over. This rounding over of the edges of the partitions or ribs **40**—**49** has been found to increase the corona start voltage from coil form means **20** and to thus further insure against electrical arcing. And, by providing the interior of the novel coil form means **20** with the electrically insulative tubular portion **21** shown in the drawing, the surface leakage path between the high voltage windings in the slots at the divergent end of the coil form means **20** and the core means **14** is greatly lengthened. With the coil form means **20** shown, such surface leakage must take the long path defined by the divergent end of the coil form means exterior portion **22**, the inner surfaces of the slots **33**—**39** and the length of the tubular portion **21** of the coil form means **20** that is exposed to the air- or gas-filled gap **23**.

Thus, from the foregoing, it seems adequately clear that the present invention provides a greatly improved high frequency pulse transformer **10** which can be used as a horizontal output and high voltage transformer for television receivers and the like. The novel slotted coil form means **20** employed by the transformer **10** of the present invention permits solution of the longstanding prior-art problem of retarded heat transfer from the coil of conventional transformers used for this service, while avoiding any new problems with electric arcing between the coil high voltage windings **52** and the core means **14**. The novel coil form means **20** of the present invention is further advantageous in that it permits continuous winding of the transformer coil windings and consequent reduction in manufacturing costs over the layer-wound coils which have heretofore been utilized for this purpose.

While the herein-illustrated embodiment of the coil form means **20** of the present invention is shown as being provided with the ribs or partitions **40**—**49** on the sides of the winding-receiving slots **29**—**39**, it should be understood that these ribs might be omitted, with the exterior portion **22** of the core form means **20** thus presenting a "stair-step" configuration.

It should be apparent to those skilled in the art that while there has been described what, at present, is considered to be the preferred embodiment of this invention in accordance with the Patent Statutes, changes may be made in the disclosed apparatus without actually departing from the true spirit and scope of this invention.

We claim:

1. An improved high voltage transformer for television receivers and the like, comprising:

a. core means;

b. slotted coil form means comprising hollow electrically insulative means comprising a first and a second portion, said first portion surrounding a portion of said core means and having a substantially constant inside diameter, said second portion being disposed about said first portion and having a progressively increasing inside diameter, said second portion having a plurality of axially spaced circumferential slots formed thereon for receiving high voltage windings; and

c. said circumferential slots being located at progressively increasing radial distances from said core means portion so as to provide a sufficiently great insulative barrier between the coil and the core means to prevent electric arcing therebetween.

2. The invention of claim **1**, wherein said high voltage winding slots are spaced apart from said core means portion by a gap of gaseous material.

3. The invention of claim **2**, wherein said gaseous material comprises air.

4. The invention of claim **1**, wherein:

a. said slots are separated from one another by electrically insulative partitions; and

b. said partitions are provided with slits canted at an angle with respect to the long central axis of said core means portion for permitting continuous coil winding from one slot to another while providing sufficiently great insulative barriers in said partitions to prevent electric arcing between winding sections in adjacent ones of said slots.

5. The invention of claim **4**, wherein the edges of said partitions are rounded.

6. The invention of claim **3**, further including primary windings disposed in ones of said circumferential slots located at a common, smallest radial distance from said core means, and secondary windings disposed in ones of said winding slots located at progressively increasing radial distances from said core means.

7. The invention of claim **3**, wherein said first portion of said coil form means comprises an electrically insulative, generally tubular element, said first portion being joined to said second portion at the smallest diameter end of said second portion.