

UNITED STATES PATENT OFFICE

2,563,393

CORE AND COIL FORM

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Application October 20, 1948, Serial No. 55,453
In the Netherlands November 21, 1947

3 Claims. (Cl. 175—21)

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This invention relates to a coil former consisting of moulding material for low-frequency transformers (which are to be understood to include also choke coils) comprising at least three sections separated by partitions and a core space exhibiting a rectangular cross-section at right angles to the axis of the coil. Such a coil former may be used with advantage for very small transformers, for instance for portable low frequency amplifiers, which are wound from very thin wire (for instance 0.03 mm.). The narrow sections in the coil former may be moulded with exactly parallel, rigid walls so that they are particularly suitable for winding with very thin wire, if desired without paper layers between the winding layers.

A difficulty consists, however, in taking the inner end of a winding, which is enclosed by other windings at both sides, out of the coil former. The lead-out wire may be taken out in a radial direction along the inner side of a partition, but in this event the wire occupies part of the winding space. It is possible to provide a radial groove in the material of a partition and to pass the lead-out wire through this groove, but the partition wall should then be much thicker which likewise involves a loss of winding space, so that the advantage over cardboard coil formers, i. e. the possibility of very small dimensions, may be lost.

Cardboard coil formers for not particularly small transformers have for a long time been known, which exhibit a round aperture for the passage of the core (coil aperture) and which consequently permit a conductor to be passed on the inside along the core to a winding enclosed by other windings. However, this construction exhibits the disadvantage that the space between core and winding is deducted from the "window" in the closed iron core. For a given desired cross-section (in a plane extending through the axis) of the winding this window should consequently be larger than with a rectangular coil aperture, so that the size of the core and consequently the space occupied by the transformer become greater. Due to this the losses, the cost of manufacture and the leakage increase.

According to the invention these disadvantages are avoided by providing with at least one section, between the core space and the winding space, along at most three of the four rectangle sides of the cross-section of the core space more clearance than along the remaining side(s) and by providing in this enlarged clearance at least one channel in the moulding material, through which

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channel a supply conductor for a winding passes in an axial direction, the aperture in the coil former being so formed as to maintain the limitation of the core space by this coil aperture. A greater clearance is preferably provided only along one of the sides of the core space cross-section. In a transformer comprising a coil former according to the invention, the core is provided in such manner that no enlarged clearance is present along the side of the core space cross-section embraced by the core. Along this side only little clearance is available between core and winding, so that practically no loss of winding space occurs.

The uncommon shape of the coil former is not objectionable for moulded coil formers.

Maintaining the limitation of the core space is essential, since otherwise the supply conductor could be damaged when stacking the core.

In order that the invention may be clearly understood and readily carried into effect it will now be explained more fully with reference to the accompanying drawing which represents, by way of example, several transformers comprising coil formers according to the invention. It is to be noted, that these transformers may be much smaller than in the drawing.

In the drawing:

Fig. 1 shows a coil former according to the invention;

Fig. 1a shows a variant of the construction of Fig. 1;

Fig. 2 shows another embodiment of the coil former;

Fig. 3 shows a perspective view of a transformer employing a coil former according to the invention;

Fig. 4 shows a cross-sectional view of the transformer;

Fig. 5 shows an axial cross-sectional view of another transformer employing a coil former according to the invention; and

Fig. 6 shows still another transformer in cross-section employing a coil former according to the invention.

Fig. 1 shows one example of a low-frequency transformer having a closed core 1 (partly broken away) comprising U-shaped stacked laminations, viewed in the direction of the axis of the coil former 3. This coil former is, for example, moulded from synthetic resin and comprises three sections (such a construction clearly appears from Figs. 3 and 4 discussed hereinafter). The core space 5, which contains one of the limbs of the core 1, exhibits a rectangular section (at right

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angles to the axis of the coil). However, clearance is provided between core space and winding space along one of the rectangular sides (5a), which clearance is greater than along the remaining rectangle sides, where the clearance is determined only by the wall thickness of the coil former. A channel 7 provided in the enlarged clearance serves for the passage in an axial direction of a conductor 9 which leads to the inner end of the middle coil section. This conductor may, for instance, be secured to the inner wall of the coil former by means of adhesive tape.

From the drawing it appears that in spite of the not entirely rectangular shape of the coil opening 5, 7 the cross-section of the core space is actually limited to a rectangular form. In this manner damaging of the supply conductor 9 by the core laminations is practically avoided when stacking the core.

If the coil comprises a great number of sections, so that the channel 7 is not sufficiently wide to contain all supply conductors additional clearances may be provided along those of the other sides of the core space which are not embraced by a core window, as shown in Fig. 1a. However, the construction comprising only one enlarged clearance is to be preferred, since in this event the leakage and the required quantity of wire are as small as possible.

Naturally the supply conductors to the foremost coil section may be passed without any difficulty through the apertures 11 and 13 provided in the foremost partition.

Fig. 2 represents a slightly modified construction of the coil former according to the invention. In the enlarged clearance a number of grooves 15 are provided in the moulding material. In these grooves may be embedded the supply conductors to the inner ends of the coil sections, which are difficult of access.

Figs. 3 and 4 are perspective and cross-sectional views respectively, according to a vertical plane extending through the axis of the coil, of a low-frequency transformer comprising a moulded coil former 21 according to the invention, this former comprising three compartments 23, 25 and 27 and containing an iron core 29 consisting of stacked E-shaped laminations. In each of the three compartments 23, 25 and 27 a coil section is wound. Each of these coil sections should comprise a separate lead-out conductor for the outermost and for the innermost end. For this purpose the internal dimension of the winding space with one of the two outermost coil sections (in the drawing the left-hand section) is at the top greater than with the remaining coils. The clearance thus formed is filled with moulding material, wherein a channel 31 is formed which extends parallel with the coil axis and is connected to the middlemost winding space enclosed at both sides. The inner end of the middle coil section is connected to a lead-out conductor 33 which is passed to the outside through the channel 31.

In this event the leakage and the required quantity of copper wire are smaller than if the enlarged clearance extends over all sections. The shape of the coil former is comparatively complicated, but this is not objectionable for moulded coil formers.

Passing the lead-out conductor in a radial direction along the winding is avoided in the coil former according to the invention. In this manner the whole cross-section of the winding space is available for the coil wire and the width of

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the winding space is the same throughout, which permits the wire to be wound as regularly as possible. This, and the fact that the partitions between the winding spaces need only be thin, yield a satisfactory copper filling factor.

Fig. 5 is an axial section of a transformer comprising a coil former according to the invention exhibiting five compartments or sections 43—51 in which the two left-hand sections 43 and 45 and the extreme right-hand section 51 exhibit an internal dimension which is enlarged at the top. At the right, the situation corresponds to that at the left in Fig. 4. At the left two axially directed channels are provided, of which only one (53) is visible in the drawing. This channel gives access to the winding space 47, whereas the other, which is provided behind the channel 53 in the drawing, gives access to the winding space 45 through a short vertical part.

Finally, Fig. 6 shows an example comprising three sections, in which the internal dimension of the middle section is enlarged to such a degree that the axially directed channel 55 giving access to the inner end of the middle winding empties above the neighbouring winding space. In this manner, also, the necessity of a lead-out conductor passing along or through the winding space is avoided. In this event the said inner end is easily accessible, whereby the manufacture of the transformers is facilitated.

What I claim is:

1. In combination, a closed magnetic core having a leg and windows for the windings of a low frequency transformer, said core having a rectangular cross section with given dimensions, and a hollow coil form of insulating material surrounding said leg, the coil form comprising a hollow tubular base and a plurality of outwardly extending partitions forming with the base a plurality of adjoining sections for supporting the transformer windings, each base portion of each of said coil form sections having a generally rectangular cross section of approximately the same dimensions as the dimensions of the core leg to define an opening therefor including four walls, one wall of at least an outermost section of the coil form having a thickness greater than that of the other walls, said one wall being outside of said windows, said one wall having a passageway therein for the passage of internal lead-in-wires to the windings of an inner section of the form.

2. In combination, a closed magnetic core having a leg and windows for the windings of a low frequency transformer, said core having a rectangular cross section with given dimensions, and a hollow coil form of insulating material surrounding said leg, the coil form comprising a hollow tubular base and a plurality of outwardly extending partitions forming with the base a plurality of adjoining sections including outermost sections and an intermediate inner section for supporting the transformer windings, each base portion of each of said coil form sections having a generally rectangular cross section of approximately the same dimensions as the dimensions of the core leg to define an opening therefor including four walls, one wall of one outermost section of the coil form having a thickness greater than that of the other walls of the section, said one wall being outside of said windows, said one wall having a passageway therein for the passage of internal lead-in-wires to the windings of an inner section of the form.

3. In combination, a closed magnetic core hav-

ing a leg and windows for the windings of a low frequency transformer, said core having a rectangular cross section with given dimensions, and a hollow coil form of insulating material surrounding said leg, the coil form comprising a hollow tubular base and a plurality of outwardly extending partitions forming with the base a plurality of adjoining sections including outermost sections and intermediate inner sections for supporting the transformer windings, each base portion of each of said coil form sections having a generally rectangular cross section of approximately the same dimensions as the dimensions of the core leg to define an opening therefor including four walls, one wall of at least one outermost section and one wall of at least one adjoining intermediate section of the coil form having a thickness greater than that of the other walls of the respective sections, said one wall being out-

side of said windows, said one wall of said one outermost section and said one wall of said adjoining intermediate section having a passageway therein for the passage of internal lead-in-wires to the windings of an inner section of the form.

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