

Feb. 23, 1960

F. SCHNEIDER
TRANSFORMER COIL

2,926,319

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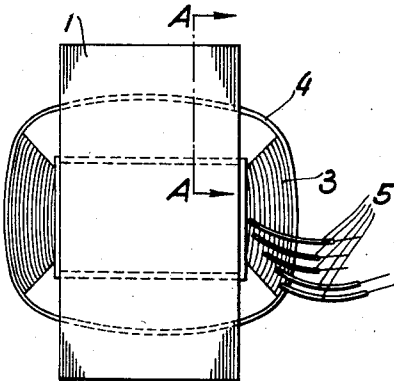


Fig. 1

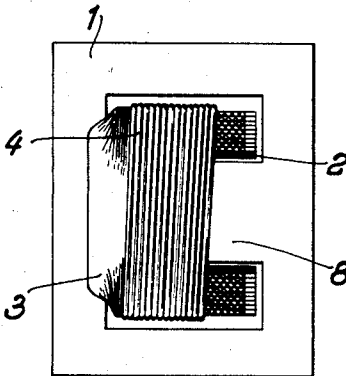


Fig. 2

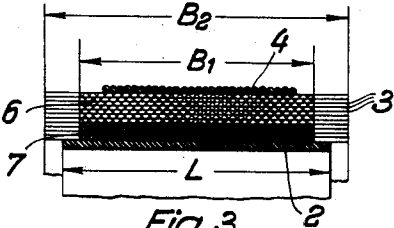


Fig. 3

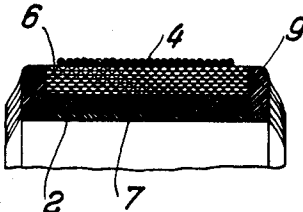


Fig. 4

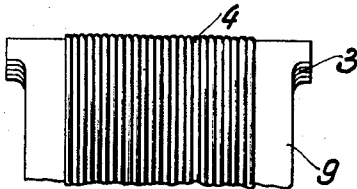


Fig. 5

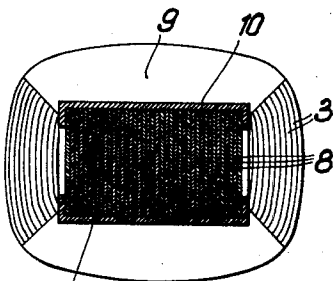


Fig. 6

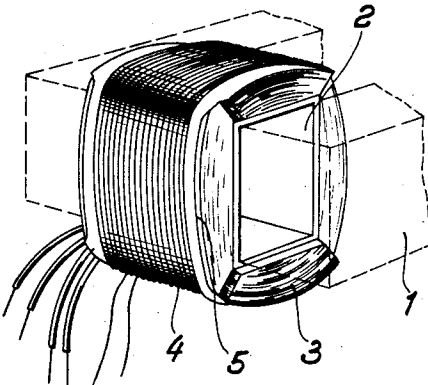


Fig. 7

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2,926,319

TRANSFORMER COIL

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Claims priority, application Germany April 10, 1952

1 Claim. (Cl. 336—206)

This invention relates to an improved construction of multi-layer coil. Such coils, which are normally wound in a flanged coil former with the winding layers interleaved by insulating material such as paper, are used in the construction of aircored inductances and iron-cored devices such for example as chokes, reactors, power transformers, low frequency and video frequency transformers, and so on.

More particularly in the case of transformers the dimensions, and thus the cost, depend to a large extent on the permissible operating temperature. In most cases the highest permissible operating temperature for enamelled copper wire cannot be used since the paper insulation can only be operated at a maximum temperature which is of the order of 80% of the maximum operating temperature for the copper wire.

This difficulty can be overcome by using as insulation between layers a foil having a temperature limit of 120° C. of 150° C. f.i.a. foil of cellulose triacetate; this limit is approximately equal to that of the wire; the foil is a good insulator and has a general similarity to paper. It has however been found that it cannot be applied and used in the same manner as paper. When applying paper insulation to a coil wound on a flanged coil former the paper strip is usually prepared by forming lateral cuts, so that it will lie more closely on the winding layers at the corners of the coil. Such incision must be avoided when using an insulating foil since the foil will be easily torn apart at the place of the incision. It has therefore been necessary to develop a new process for forming the sides of the transformer coils.

It is therefore an object of my invention to provide a new method of forming a transformer coil and of insulating the sides of the coil lying towards the iron core.

According to the invention the winding layers are interleaved with insulating material having a width greater than the width of the layers and the protruding edges of the insulating material are secured together over at least part of the face of the coil to form a flat insulating surface covering the edges of the winding layers.

Preferably the insulating material is formed of a thermoplastic material and the edges are secured together by the application of heat and pressure.

The advantages of the coils made in accordance with the invention consist chiefly among others in the following:

By increasing the operating temperature of the transformer to the upper limit given by the wire used in the transformer it is possible to use less copper. This saving of copper amounts to approximately 20% Cu for each 10° C. increase in operating temperature. The costs are reduced furthermore in case it is possible to use an iron core having smaller dimensions, whereby the amount of copper for the windings is again reduced.

Even if the insulating foil is more expensive than paper, this difference in price is compensated because a flangeless coil former can be used instead of the usual flanged

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coil former. In some cases the coil former can be omitted entirely.

When applying paper insulation to flanged coil formers it is general practice to form lateral cuts in the edges of the paper insulation before the paper insulation is applied to the winding layers. This step is omitted and the foil is used without such preparatory steps.

For additional objects and advantages, and for a better understanding of the invention, attention is now directed to the following description and accompanying drawings. The features of the invention believed to be novel are particularly pointed out in the appended claim.

In the drawings:

Fig. 1 shows a transformer according to the invention;

Fig. 2 shows a side view of the transformer;

Fig. 3 shows a cross-section of a transformer coil along the line A—A of Fig. 1;

Fig. 4 shows a cross-section similar to Fig. 3;

Fig. 5 shows a view of the transformer coil;

Fig. 6 shows an end view of the coil of Fig. 5; and

Fig. 7 shows a perspective view of a transformer employing a coil according to the invention.

Figs. 1 and 2 show one example of a low-frequency transformer having a closed iron core comprising E-shaped stacked laminations. A coil is arranged on the center core 8. This coil consists of a primary winding 7, a secondary winding 6, and a heater winding 4 in the form of a single layer of wires. The winding layers are separated by insulating foils 3. The ends 5 of the windings are brought out separately, so that the connections can be made in the usual manner. The coil is formed on a former 2 which can best be seen from Figs. 3 and 4. The foils 3 have such a width, that they extend beyond the edges of the winding layers 6 and 7. The former 2 extends also beyond the edges of the winding layers but not so far as the foil. The length of the coil former is designated with L, the width of the coil windings with B_1 , and the width of the foils with B_2 . The dimensions are chosen so that $B_2 > L > B_1$. The difference between B_2 and L being in the order of 1 to 3 mm. and between L and B_1 also 1 to 2 or 3 mm. The width B_1 of the winding space is not smaller than that of coils with paper insulation and the conventional flanged coil former.

Fig. 4 shows how the edges of the foils are formed by applying a heated tool to the edges and pressing them down while in a plastic state. The foil edges are partly melted and fused together to form an insulating portion 9 which is rigid, self-supporting, coherent and has a flat smooth surface. This process is carried out only on those portions of the circumference of the coil, which are lying closely adjacent to the core, as can be seen from Figs. 1 and 2.

The formation of the rim 9 secures the winding layers in their position. The tool may have a temperature of 260° C. so that the foil f.i. of cellulose triacetate is brought into a plastic state.

The foil may consist of thermoplastic materials such as synthetic resins, polyvinyl chloride, cellulose triacetate, cellulose-triaceto-butylate, or of glass silk impregnated with a lacquer, or of any heat resistive insulating material which may be formed by application of heat and pressure.

Fig. 6 shows an embodiment in which the former has been removed and has been replaced by two spaced form pieces 10 and 11. These form pieces are inserted into the opening of the coil and then the laminations 8 of the transformer are introduced and closely packed to form the iron core. The form pieces have the purpose to protect the coil windings from being damaged by the sharp edges of the laminations during the insertion. The form pieces may be removed after packing or may remain in the transformer as the case may be.

I claim:

A multi-layer induction coil adapted for use on a laminated magnetic core and having a central opening of rectangular cross section adapted to accommodate between opposite outside portions of the core an intermediate portion of the core having substantially the same cross section as the opening, and said coil comprising a plurality of superimposed winding layers, thermoplastic foil layers interleaved with said winding layers, the thermoplastic foil layers having edges extending beyond opposite edges of the winding layers and over said opposite outside portions of the core axially of the coil, and leads from said winding layers and projecting outside said edges of the thermoplastic foil layers, said thermoplastic foil layers at opposite ends of said coil being locally fused together forming reinforcing rims outside the winding edges, said rims being between and adjacent to said opposite outside portions of the magnetic core to insulate said winding layers from said opposite outside portions of the core when said coil receives said intermediate portion of the core in said central opening.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,926,319

February 23, 1960

Fritz Schneider

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 2 and 11, and in the heading to the printed specification, line 4, name of assignee, for "Blaupunkt-Werke" read -- Blaupunkt-Werke G.m.b.H. --.

Signed and sealed this 2nd day of August 1960.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

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