L. A. HAWORTH.

ELECTRICAL APPARATUS.

APPLICATION FILED OCT 13, 1920.

1,424,016. Patented July 25, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

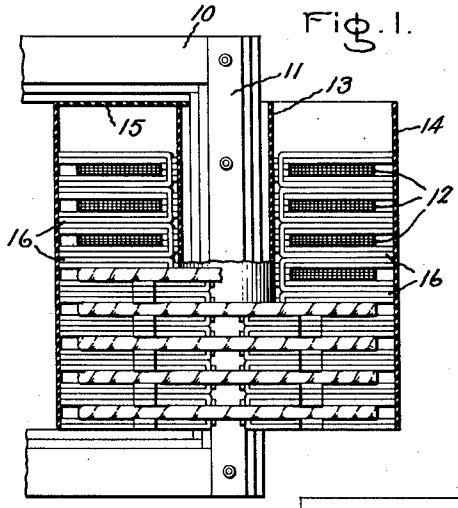


Fig. 2.

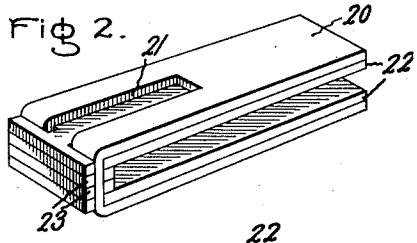


Fig. 3.

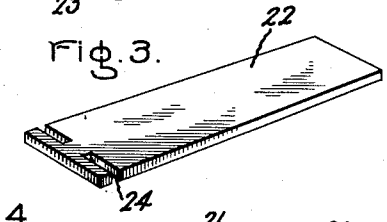


Fig. 4.

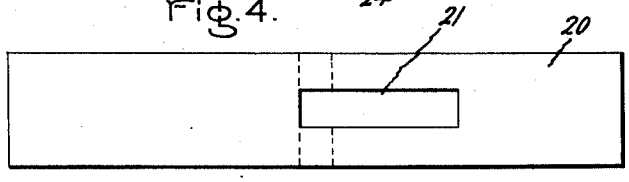


Fig. 5.

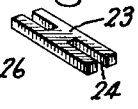


Fig. 6.

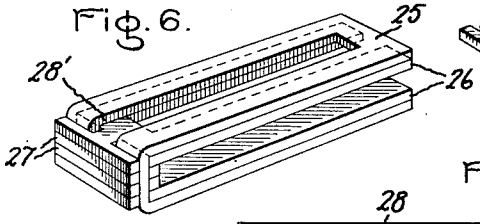


Fig. 7.

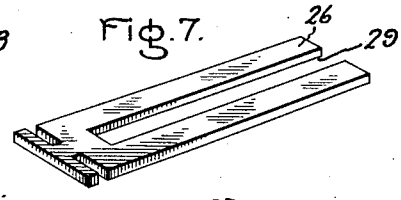


Fig. 8.

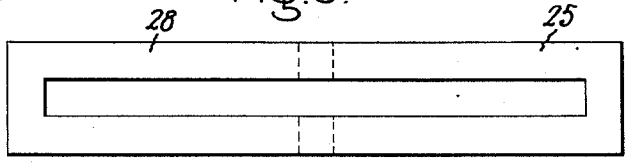


Fig. 9.

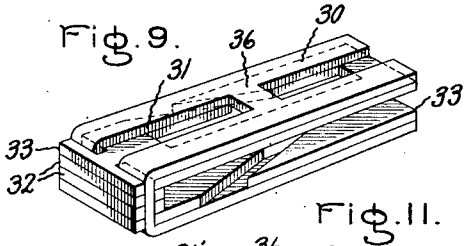


Fig. 10.

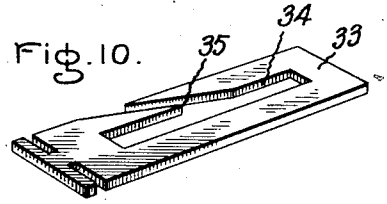
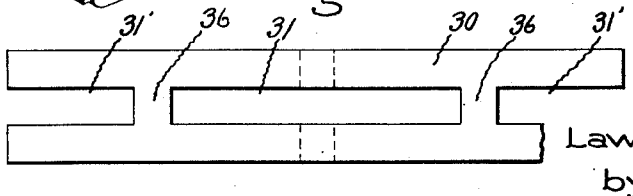


Fig. 11.



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2 SHEETS—SHEET 2.

Fig. 12.

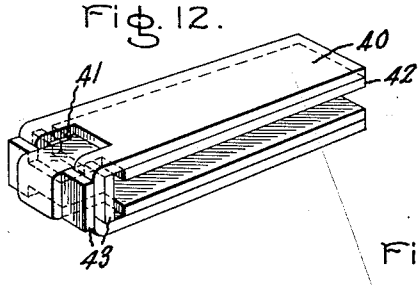


Fig. 13.

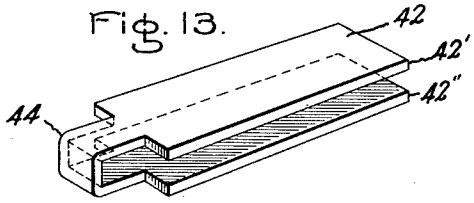


Fig. 14.

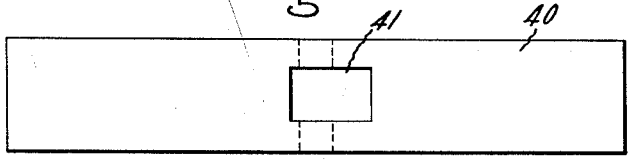


Fig. 15.

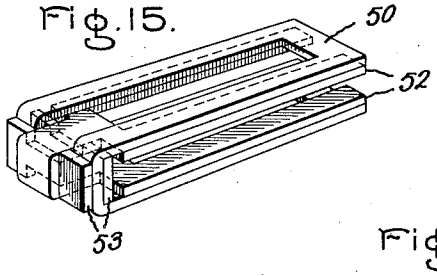


Fig. 16.

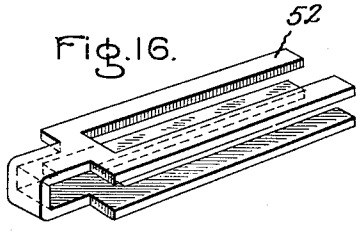


Fig. 17.

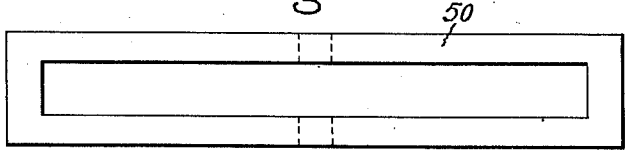


Fig. 18.

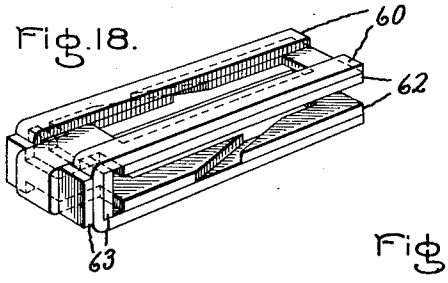


Fig. 19.

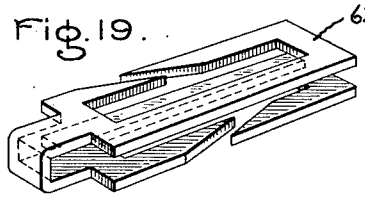


Fig. 20.

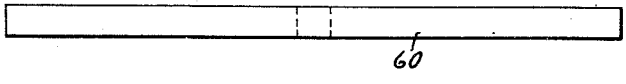
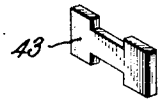


Fig. 21.



Inventor:
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His Attorney

UNITED STATES PATENT OFFICE.

LAWRENCE A. HAWORTH, OF DALTON, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRICAL APPARATUS.

1,424,016. Specification of Letters Patent. Patented July 25, 1922.

Application filed October 13, 1920. Serial No. 416,677.

To all whom it may concern:

Be it known that I, LAWRENCE A. HAWORTH, a citizen of the United States, residing at Dalton, in the county of Berkshire, State of Massachusetts, have invented certain new and useful Improvements in Electrical Apparatus, of which the following is a specification.

My invention relates to electrical apparatus and particularly to apparatus having windings supported about the legs of magnetic cores, such as are employed in transformers, reactances and the like.

The object of my invention is to provide an improved means for retaining the windings in a predetermined spaced relation which is reliable, safe and readily manufactured.

When assembling windings about the leg of a magnetic core, in the manufacture of electrical apparatus, it is necessary that certain predetermined spaced relations shall be maintained both between the winding groups and between the windings and the core; hence to secure this end, spacing devices placed in both radial and axial directions are relied upon for maintaining the windings in the desired relations.

Where the ends of the spacing devices extend beyond the edges of the windings, it is generally customary to place distance pieces between these ends, or if the spacing device should have a bent over portion then the distance pieces are placed between the bent portion and the windings so that the one device maintains the desired spacing effects in both directions. In either of these ways of putting in the distance pieces the mutual friction between the parts has generally been relied upon to retain the spacing devices and the distancing parts completely intact. In drying, however, these parts not infrequently become loosened, and occasionally become displaced.

In the practice of my invention I have provided a spacing device having a member with which the other parts are adapted to interlock whereby a rigid and self retaining device is produced from which the parts cannot become accidentally displaced.

For a more complete understanding of the nature and objects of my invention reference should be had to the following detailed description when taken in connection with the accompanying drawings in which:

Fig. 1 is a view partly in section and partly in elevation of a transformer winding provided with spacing devices embodying my invention. Fig. 2 is a perspective view of the spacing device embodying my invention which is employed in Fig. 1; while Figs. 3, 4 and 5 show details of the device shown in Fig. 2. Figs. 6, 7 and 8 show details of a modified type of device embodying my invention. Figs. 9 to 21 inclusive show still other modifications and the details thereof.

Referring now to Fig. 1 of the drawings, 10 denotes a magnetic core, of any suitable type, on the leg 11 of which are mounted interleaved disc coil windings 12. These windings would be suitably connected as high and low voltage windings where the apparatus embodying my invention is a transformer; this being the type of electrical apparatus to which my invention will have its widest application.

The windings 12 are insulated from the core 11 by the inner insulating cylinder 13, shown as interposed between the core 11 and the windings 12. An outer insulating cylinder 14 is provided to insulate the windings shown on leg 11 from other windings, or from exterior grounds such as the housing which may inclose the apparatus, or from other portions of the core. For this reason portions of the ends of the cylinders are illustrated as closed by insulating material 15 inserted between the windings and adjacent portions of the core.

The windings, however, are themselves maintained in a predetermined spaced relation, after they have been assembled, by the spacing devices shown at 16 in order that proper ventilation and insulation shall be at all times provided.

The spacing devices shown at 16 in Fig. 1 may be any one of the forms shown in Figs. 2, 6, 9, 12, 15 or 18, the simplest form being illustrated in Fig. 2. The form shown in Fig. 2 comprises a slotted member 20 with which the other members are adapted to interlock. The member 20 is shown developed in a plane in Fig. 4; dotted lines indicating the places this member is to be folded to produce the form shown in Fig. 2. The sides of the slot 21 in member 20 serve as guides for the grooved or recessed ends of the filling members 22 and 23.

The members 22 serve as main fillers and

are adapted, when in place, to engage with the faces of a coil 12, one such member being shown in perspective in Fig. 3.

The small members 23, on the other hand, serve merely as back or end fillers intervening between the coils 12 and an insulating cylinder; one such member 23 being shown in perspective in Fig. 5.

The several members of the insulating device shown in Fig. 2 may be made of any suitable insulating material, hard fiber and press-board being well adapted to the purpose. When the members are fashioned as indicated in Figs. 3, 4 and 5, and the interlocking member 20 has been properly bent into shape, they may readily be assembled into the form shown in Fig. 2. The members 23 are generally taken in sufficient number to equal the thickness of a coil. Two or more members 22 and two or more members 23 are taken and arranged with their transverse grooves 24 in register, the members 22 being disposed in equal numbers at each side of the members 23. These members thus arranged are then inserted with their grooved ends held longitudinally of the slot 21, the slotted portion of member 20 being pushed back sufficient to permit of this operation. When the grooves in the ends of members 22 and 23 register with the edges of slot 21, the members 22 are then partially rotated about their longitudinal axis, thus twisting the same into place as shown.

A form of spacing device adapted to permit a circulation of the cooling and ventilating medium therethrough and over the face of a coil is shown in Fig. 6. In this form an interlocking member 25 holds in place the filling members 26 and 27. The interlocking member 25 is slotted at 28, as shown in Fig. 8, which shows a development of the member 25. One member 26 is shown in perspective in Fig. 7; the members 27 being identical with members 23 shown in Fig. 5.

The member 26 differs from the members shown in Fig. 3 by the provision of a slot 29 in one end which extends nearly to the other end. This slot at 29 is substantially the same in width as slot 28 and is adapted to register therewith when the members are assembled, thereby permitting the cooling medium to enter between the prongs at 29, pass through the two slots in register, and find egress through the portion of the slot denoted 28′ in Fig. 6.

Another form of spacing device permitting a slightly more rapid circulation of the cooling and ventilating medium across the face of a coil is shown in Fig. 9. Here an interlocking member 30 is provided having a slot 31 with which the other members are adapted to engage. The other members comprise large and small fillers shown respectively at 32 and 33; the members 32 being identical with members 23 shown in Fig. 5.

One of the members 33 is shown in perspective in Fig. 10, where it is seen to have a central slot 34 but is not open ended as was the member shown in Fig. 7. In this instance the cooling medium is adapted to enter by way of the obliquely disposed passage 35 which is cut from the side of member 33 and communicates with slot 34.

A development of member 30 is shown in Fig. 11 where it is seen to have a central slot 31 and end slots 31′. This construction provides bridges as shown at 36, which act as deflectors for the cooling medium entering by way of passage 35 dividing the same into two streams one finding egress through a forward slot at 31′, another through a rear slot, as at 31.

In Fig. 12 a spacing device is shown in which a somewhat different mode of interlocking is employed from that hitherto described. An interlocking member 40, provided with a slot 41, is adapted to retain the other members 42 and 43 in place.

A development of member 40 is shown in Fig. 14, the member 42 being illustrated in perspective in Fig. 13, while member 43 is illustrated in similar fashion in Fig. 21.

In Fig. 13, member 42 is clearly seen to comprise upper and lower end portions 42′ and 42″ respectively, which are united by a narrow intermediate portion 44, the latter being of the same width as slot 41 and adapted to engage with recesses of similar width cut in the upper and lower edges of members 43.

To assemble the several members to make the spacing device here shown, a member 42 has its narrow portion 44 inserted into the slot 41 of a properly formed member 40, the portion 44 being first permitted to take a position lengthwise of slot 41. A member 43 is then slipped into the loop formed by the portion 44 protruding from the back of slot 41, and another member 43 inserted just in front thereof under the bent portion of member 40; and adapted to engage with portion 44, the whole being brought into position, as indicated in Fig. 12, by a partial rotation of member 42 about its longitudinal axis until portion 44 is transverse of slot 41.

In Fig. 15 is illustrated a spacing device similar to the one in Fig. 12 but adapted in the same manner as that shown in Fig. 6 to permit the circulation of a cooling medium across the face of a coil.

The device here shown comprises a slotted interlocking member 50, whose development is shown in Fig. 17, a member 52 shown in perspective in Fig. 16, and members 53 which are identical with members 43 as shown in Fig. 21.

In Fig. 18 still another form of spacing

device adapted to permit circulation and ventilation is disclosed. In this form two U-shaped strips 60 together serving as the interlocking member hold in place the main filling member 62 and end filling members 63. A development of strip 60 is shown in Fig. 20, while Fig. 19 shows member 62 in perspective. The members 63 are identical with members 43 which are shown in Fig. 21.

Having now described what is at present the best means known to me for carrying out an embodiment of my invention, I would have it understood that such means are merely illustrative and that I do not mean to be limited thereby to the exact details shown nor restricted in the choice of recognized equivalents except as defined in my claims hereunto appended.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In an electrical apparatus, the combination with windings composed of coils in assembled relation, of spacing devices for holding said windings in spaced relation, each of said devices comprising a member having portions extending over the faces of a coil, and filling members engaged in interlocked relation with said first member.

2. In an electric apparatus, the combination with windings composed of coils in assembled relation, of spacing devices for holding said windings in spaced relation, each of said devices comprising a member provided with a slot and having portions extending over the faces of a coil, and filling members provided with recesses, the slotted portion of said slotted member being in engagement with the recessed portions of said filling members to lock the slotted and filling members together.

3. In an electrical apparatus, the combination with windings composed of coils in assembled relation, of spacing devices for holding said windings in spaced relation, each of said devices comprising a member provided with a slot and having portions extending over the faces of a coil, and main and end filling members provided with recesses, the slotted portion of said slotted member being in engagement with the recessed portions of said main and end filling members to lock the slotted and filling members together.

4. A spacing device for disc-coil electrical windings, said device comprising a member having portions adapted to extend over the face of a coil and provided with a slot, and filling members laterally recessed, the slotted portion of said slotted member being in engagement with the edges of said recesses to lock the slotted and filling members together.

5. A spacing device for disc-coil electrical windings, said device comprising a member having portions adapted to extend over the face of a coil and provided with a slot, and large and small filling members each provided with lateral recesses which are in register, the slotted portion of said slotted member being in engagement with the edges of said recesses to lock the slotted and filling members together.

In witness whereof, I have hereunto set my hand this eighth day of Oct., 1920.

LAWRENCE A. HAWORTH.