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A coil supporting device for use in stacking toroidal coils, and a loading coil assembly

There is disclosed in our United States Patent Specification No. 3,988,707 a coil supporting device for use in stacking toroidal coils in axially aligned relationship, the device, which has been moulded in one piece from plastic material, comprising a coil support for engagement by an end face of the coil, a coil locating structure having a free end and being upstanding from the coil support centrally thereof for reception in the central opening of a toroidal coil positioned on the coil support, and an electrical connector housing for receiving electrical terminals for connecting portions of the windings of the coil to electrical leads.

Such a device may be employed for stacking loading coils in a loading coil assembly which comprises a cable, generally referred to as a "stub cable", containing a plurality of pairs, of insulated wires and a plurality, equal to one half of the number of wire pairs in the cable, of bifilar toroidal coils arranged in an orderly cluster around the axis of the stub cable. A first pair of insulated wires extends from the stub cable to each coil and the ends of this first pair are connected to first ends of the two windings of the coil. The second ends of the coil windings are connected to a second pair of insulated wires which extend back to the stub cable. Load coil assemblies are employed to provide an inductance in each pair of conductors in a communications service cable and the ends of the wires in the stub cable are therefore spliced to the conductors of the service cable so that the individual coils are connected in series with the conductors of the service cable.

The manufacturing of loading coil assemblies thus requires a large number of coils and electrical connections between the coils and the wires of the stub cable. A variety of arrangements are in use, or have been proposed, for supporting individual coils in superposed relationship adjacent to the stub cable and for forming the electrical connections required; as disclosed for example in United States Patent Specification Nos. 3,845,435, 3,952,906, 3,865,980 and 3,988,707 referred to above.

The present invention is intended to provide a coil supporting device by the use of which a substantially simpler and more compact loading coil assembly than those hitherto known can be constructed, and also to provide such a simpler and more compact loading coil assembly.

The invention proceeds from the realisation that to provide for such simplification the coil supporting device should in itself be stackable with other identical coil supporting devices without the need for external means, for example a supporting column or a compartmented housing for connecting and relatively orienting the coil supporting devices of a stack and that the means for connecting the cable

wires to the windings of the coils should be contained within, and incorporated in, the stack.

According to one aspect of the invention, a coil supporting device as defined in the first paragraph of this specification is characterised in that the housing is supported by a support arm upstanding from the coil support, and being spaced from the locating structure to allow the coil to be positioned on the coil support, the housing and the free end of the locating structure being provided with first interengageable means, the support arm being deformable to displace the housing towards the support to interengage the first interengageable means to attach the housing to the free end of the locating structure and thus to retain the coil on the coil support, the housing and the coil support being provided with second interengageable means, such second means of the housing being interengageable with the second interengageable means of the coil support of a first further and identical coil supporting device and the second interengageable means of the coil support being engageable with the second interengageable means of the housing of a second further and identical coil supporting device; whereby a series of coils can be stacked in axially aligned relationship by means of the coil supporting devices.

According to another aspect of the invention, a loading coil assembly comprising a cable containing a plurality of pairs of wires and a plurality, equal to half the number of wire pairs, of bifilar toroidal induction coils arranged in stacks of axially aligned coils, clustered near the cable and extending substantially parallel to the axis thereof, first and second wire pairs extending from the cable to each of the coils, the ends of the wires of the first pair being connected to first ends of the windings of the coil and the ends of the wires of the second pair being connected to second ends of the windings of the coil, each coil having associated therewith an electrical terminal housing and coil supporting and securing means, each terminal housing comprising a rectangular block of insulating material disposed adjacent to the coil and extending transversely of the axis thereof, the housing having terminal receiving cavities and a terminal in each cavity, connecting the end of one of the wires to the end of one of the coil windings, each coil securing and locating means comprising a coil locating structure extending into the central opening of the associated coil; is characterised in that the housing is connected to the supporting means by way of an arm extending across the circumferential surface of the coil, the housing being disposed against one end face of the coil and against one end of the locating structure and extending diametrically across the coil, first interengaging means securing the housing to

one end of the locating structure, second interengaging means securing the housing and the supporting means associated with each coil excepting the end coils of the stack to the housing and to the supporting means of the two adjacent coils in the same stack, the stacks being supported by spaced stack supports surrounding the axis of the cable and between which the stacks are disposed.

For a better understanding of the invention reference will now be made by way of example to the accompanying drawings in which:—

Figure 1 is a perspective view of a device according to a first embodiment of the invention, for supporting a bifilar toroidal coil, showing the coil exploded from the device, electrical terminals of the supporting device not being shown;

Figure 2 is a perspective view of the device, showing the coil mounted on the device with the coil windings connected to two of the terminals of the device, the remaining terminals being shown as being exploded therefrom and the Figure also showing end portions of a plurality of insulated lead wires to be connected to the terminals;

Figure 3 is a similar view to that of Figure 2 but showing all the coil windings, and the lead wires, connected to the terminals;

Figure 4 is a perspective view showing the supporting device with the coil operatively mounted thereon, in stacked relationship with an identical supporting device having an identical coil operatively mounted thereon;

Figure 5 is an enlarged perspective view of one of the terminals;

Figure 6 is an enlarged sectional view of a detail of the coil supporting device;

Figure 7 is a diagrammatic elevational view of a loading coil assembly; and

Figure 8 is a perspective view of a coil supporting device according to a second embodiment of the invention, the terminals of the device not being shown.

Reference will now be made to Figures 1 to 3. A typical bifilar toroidal coil 2 for use in a loading coil assembly (as shown in Figure 7, for example), has an outer circumferential surface 4, a central opening 8, an inner circumferential surface 6 and opposite end surfaces 10 and 12. The two windings of the coil 2 which are of fine (e.g. of 0.05 mm² in cross-section or finer) wire coated with a varnish insulation e.g. polyvinyl formal resin, have end portions 14 and 14' and 16 and 16', respectively, extending from the coil 2.

In a load coil assembly, the windings are, as explained below, connected to end portions of pairs 18 and 18' of insulated lead wires extending from a cable, the wires 20 and 22 of the pair 18 being connected to the end portions 14 and 16, respectively, and the wires 20' and 22' of the pair 18' being connected to the end portions 14' and 16', respectively.

As best seen in Figure 1, a coil supporting

device 24, which is a one-piece moulding of insulating thermoplastics material, for example glass filled nylon, comprises a flat coil support 26 connected to an electrical terminal housing 36 by way of a flexible housing support arm 38 upstanding from the support 26. The support 26 comprises an arm the length of which is equal to the diameter of the coil 2 and from the centre of which upstands perpendicularly, a coil locating structure 28 in the form of a hollow arm of a length substantially equal to the thickness of the coil 2 and which is dimensioned to be received in the central opening 8 thereof. The structure 28 has respective upper and lower (as seen in Figure 1) end walls 30 and 31 in which are formed respective rectangular openings 32 and 34, the opening 32 being dimensioned to receive latching fingers 86 on one side wall 40 of the housing 36 with a snap action, and the opening 34 being dimensioned to receive, with a snap action, latching fingers 88 (Figure 4) on the opposite side wall 42 of the housing 36 of an identical coil supporting device. The opening 32 and fingers 86 constitute first interengageable means, of the device 24, the opening 34 and fingers 88 constituting second interengageable means thereof. The finger 88 are identical with, and are arranged in rotational symmetry with respect to, the fingers 86.

The housing 36 is positioned beyond the end wall 30 of the structure 28 by a distance which is such that by flexing the arm 38, the housing 36 can be moved towards the support 26 to engage the latching fingers 86 in the opening 32. Between the side walls 40 and 42, the housing 36 has a terminal receiving face 44, a base 46 and opposite end walls 48 of substantially smaller area than the walls 40 and 42.

Four cavities 50, 52, 50' and 52', respectively, each dimensioned to receive a double ended electrical terminal 54 (Figures 2 and 5), extend into the face 44. Each terminal 54 which has been stamped and formed from sheet metal comprises as best seen in Figure 4, a planar web 56 to opposite ends 58 and 60 of which, respective plates 64 and 74, extending parallel to the web 56, are connected by means of pairs of spaced straps 62 and 72, respectively, the plates 64 and 74 having at their ends remote from the straps by which they are connected to the web 56, respective stand-off flanges 66 and 76. Aligned slots 68 (only one of which is shown) provided in the plate 64 and in the web 56 to receive an end portion of one of the windings of the coil 2, are dimensioned so that when such end portion is moved into the slots 68 in a direction transversely of its length, the edges of the slots 68 pierce the varnish insulation of the end portion of the winding to make secure electrical connection with the metal therebeneath. At the entrance to each slot 68, the plate 64 has been sheared at 70, along an L-shaped shear line, the sheared out portions of the plate 64 having been subsequently forced back into the plane of the plate 64 to produce rough

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edges that serve to disrupt the varnish insulation as the winding end portion is forced into the slot, to assist the piercing of the insulation, mentioned above.

Aligned slots 78 provided in the plate 74 and in the web 56 are dimensioned to receive the end portion of one of the insulated lead wires when inserted into the slots 78 in a direction transversely of the length of such end portion, so that the edges of the slots 78 pierce the insulation of the end portion of the lead wire to make secure electrical connection with the metal core thereof.

The side walls 40 and 42 of the housing 36, have respective wire receiving slots 82 and 84 which extend from the face 44 towards the base 46 and each of which communicates with one of the cavities 50, 52, 50' and 52', each slot 82 being aligned with one of the slots 84. As best seen in Figure 6, each slot 82 and 84 has a wider part 81 adjacent to the face 44 to receive an end portion of a lead wire and a narrower part 80 between the part 81 and the base 46, to receive only an end portion of a winding of the coil 2. A column 85 adjacent to each side wall 40 and 42 extends from the base 46 up to the blind end of the slot part 80 to support such winding portion.

Ribs 41 extending parallel to, and between, the slots 82, are provided on the external surface of the side wall 40 of the housing 46, stiffly flexible wire retaining ears 43 extending laterally from the ribs 41 adjacent to the face 44 and having their free ends proximate to one another.

In order to secure a coil 2 on a coil support device 24 and to connect the windings thereof to leads, the coil 2 is placed with its surface 12 on the support 26 of the device and with the locating structure 28 extending through the central opening 8 of the coil 2, the arm 38 being spaced from the structure 28 (by at least the width of the surfaces 10 and 12 of the coil 2) to allow of this. Each winding end portion 14, 16, 14' and 16' is then threaded through a corresponding pair of the slots 82 and 84 as shown in Figure 2 so as to lie in the blind ends of the parts 80 of these slots, supported by the columns 85, a terminal 54 is then inserted into each cavity 50, 52, 50', 52' with the webs 56 of the terminals 54 parallel to the walls 40 and 42 of the housing, so that each winding end portion, is received in the slots 68 of the terminal. The end portions of the lead wires 20, 22, 20' and 22' are then inserted into the parts 81 of respective slots 82 and 84, resiliently deflecting the associated latching fingers 88, and thus into the slots 78 of the respective terminals the fingers 88 resiliing behind the inserted lead end portions to provide strain relief against tensioning of the leads (Figure 3).

The housing 36 is then bent down against the end surface 10 of the coil 2, flexing the arm 38, to interengage the said first interengageable means, i.e. to engage the latching fingers 86

in the opening 32 of the structure 28, with a snap action, the housing 36 then being positioned as shown in Figure 4.

Similar terminals and their manner of operation are described in detail in our United States Patent Specifications Nos. 3,979,615 and 4,118,103.

Tooling (not shown) may be provided for trimming any portions of the wires that extend beyond the side wall 42 of the housing 36.

As will be apparent from Figure 4 any convenient number of coils 2 each mounted as described above on a coil supporting device can be stacked by interengaging the second interengageable means i.e. by engaging the latching fingers 88 of one supporting device 24 in the opening 34 of the structure 28 of a first further coil supporting device 24' and by engaging in the opening 34 of the device 24, the latching fingers 88 of a second further coil supporting device (not shown) identical with the devices 24 and 24'; and so on, until the stack has been completed. The structures 28 so latchingly engaged with one another serve to support and to locate the coils of the stack.

Although the pairs 18 and 18' of lead wires may be inserted into the slots 82 and 84 to extend from the side wall 40 of the housing 36, as shown in Figure 3, so that these wires extend from beneath the housing 36 when stacked, as shown in Figure 4, the wires of one or both of the pairs 18 and 18' may if desired be inserted into the slots 82 and 84 to extend from the wall 42 of the housing 36 instead of from the wall 40.

As shown in Figure 7 a loading coil assembly comprises a stub cable 90 containing a number of wires 20, 22, 20' and 22' arranged in pairs, which is equal to twice the number of wire pairs in a service cable (not shown) to which the assembly is to be connected. The cable 90 extends centrally through superposed spaced retainer trays 92 and 94. Individual coils 2 operatively secured in coil support devices 24 as described above, are arranged between the trays 92 and 94 in a plurality of stacks 96 which have been built up as described above, the axes of the stacks 96 extending parallel to that of the cable 90 and the stacks 96 being clustered thereabout in orderly array. Rectangular cross-section projections 98 on the tray 92 engage in the openings 34 of the supporting devices 24 of the lowermost coils of the stacks 96; rectangular holes 100 in the tray 94 receiving the latching fingers 88 of the coil supporting devices 24 of the uppermost coils of the stack 96, whereby each stack 96 is supported at each end, so that no additional supporting means for the trays need, in many cases, be provided although the lengths of the stacks may be such as to make it desirable for the trays 92 and 94 to be connected by support rods (not shown). The terminals in the housing 36 of each device 24 have been connected to the coil windings and to

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the wires of the cable in the manner described above.

Shielding washers (not shown) may be provided between adjacent coils 2 of a stack 96 to prevent cross-talk between such coils, the spacing between these coils being sufficient to allow of this. Each stack 96 may for example be enclosed in an insulating tube (not shown) and the whole assembly may be potted in a resin, for example an epoxy resin.

As shown in Figure 8, a coil supporting device 24a has a coil support 26a, a housing support arm 38a, and an electrical terminal housing 36a.

The support 26a, which is cruciform as seen in plan view, better to support a coil 2, has a coil locating structure 28a, comprising four limbs 102 and 104 each upstanding from a different arm of the support 26a. The limbs 102, which are opposed, have at their free ends inwardly directed feet 106 with chamfered inner ends 107 directed towards one another, the limbs 104, which are also opposed, having at their free ends outwardly directed feet 108 with chamfered inner faces 109.

First latching fingers 86a on the inner side of the housing 36a which is otherwise similar to the housing 36 in all material particulars, have chamfered end surfaces 110. Second latching fingers (not shown) on the outer side of the housing 36a are identical with the fingers 86a and are arranged in rotational symmetry therewith.

The support 26a has a cruciform central opening 112 defining two pairs of opposed shoulders 114 (only one shoulder of each pair is shown), the shoulders 114 of each pair lying inwardly of, and on either side of, one of the limbs 102.

A coil 2 can be mounted on the support 24a by pressing the coil 2 down onto the structure 28a so that the limbs 104 are resiliently deformed inwardly by the lower margins of the opening 8 of the coil 2 thereby enabling the structure 28a to be received in the opening 8, the limbs 104 resiling when the structure 28a has been fully received in the opening 8, so that the feet 108 engage the surface 10 of the coil 2 to stabilize the coil 2 in its mounted position. The housing 36a is then moved against the surface 10 by flexing the arm 38a so that the latching fingers 86a are moved resiliently towards one another by engagement with the surfaces 107 of the limbs 102, subsequently resiling to latch beneath the feet 106. The chamfered surfaces 110 of the fingers 86a then abut the surfaces 109 of the limbs 104 to retain them in their outwardly resiled positions.

In stacking, the second latching fingers on the housing 36a are inserted into the opening 112 of another identical coil supporting device (not shown) upon which a coil 2 has similarly been mounted, so that the second latching fingers are depressed by the edges of the

shoulders 114 and subsequently resile to latch behind these shoulders.

The coil stacking operations may be carried out manually or by the use of machinery.

The embodiment of Figure 8 can of course be used in a load coil assembly according to Figure 7.

Claims

1. A coil supporting device (24 or 24a) for use in stacking toroidal coils (2) in axially aligned relationship, the device, which has been moulded in one piece from plastics material, comprising a coil support (26 or 26a) for engagement by an end face (12) of the coil (2), a coil locating structure (28 or 28a) having a free end (30 or 106, 108) and being upstanding from the coil support (26 or 26a) centrally thereof for reception in the central opening (8) of a toroidal coil (2) positioned on the coil support (26 or 26a), and an electrical connector housing (36 or 36a) for receiving electrical terminals for connecting portions (14 and 16) of the windings of the coil (2) to electrical leads (18 and 20); characterized in that the housing (36 or 36a) is supported by a support arm (38 or 38a) upstanding from the coil support (26 or 26a), and being spaced from the locating structure (28 or 28a) to allow the coil (2) to be positioned on the coil support (26 or 26a), the housing (36 or 36a) and the free end (30 or 106) of the locating structure (28 or 28a) being provided with first interengageable means (32, 86 or 86a, 107), the support arm (38 or 38a) being deformable to displace the housing (36 or 36a) towards the support (26 or 26a) to interengage the first interengageable means (32, 86 or 86a) to attach the housing (36 or 36a) to the free end (30 or 106) of the locating structure (28 or 28a) and thus to retain the coil (2) on the coil support (26 or 26a), the housing (36 or 36a) and the coil support (26 or 26a) being provided with second interengageable means (34, 88 or 112, 114) such second means (88) of the housing (36 or 36a) being interengageable with the second interengageable means (34 or 112, 114) of the coil support (26 or 26a) of a first further and identical coil supporting device and the second interengageable means (34 or 112, 114) of the coil support (26 or 26a) being engageable with the second interengageable means (88) of the housing (36 or 36a) of a second further and identical coil supporting device; whereby a series of coils (2) can be stacked in axially aligned relationship by means of the coil supporting devices.

2. A device according to Claim 1, characterised in that the coil locating structure is in the form of an arm (28), the free end (30) of which has a first opening (32) therein, the housing (36) having on one side thereof first latching means (86) engageable in the opening (32) with a snap action and on the other side thereof second latching means (88) engageable with a

the wires of the cable in the manner described above.

Shielding washers (not shown) may be provided between adjacent coils 2 of a stack 96 to prevent cross-talk between such coils, the spacing between these coils being sufficient to allow of this. Each stack 96 may for example be enclosed in an insulating tube (not shown) and the whole assembly may be potted in a resin, for example an epoxy resin.

As shown in Figure 8, a coil supporting device 24a has a coil support 26a, a housing support arm 38a, and an electrical terminal housing 36a.

The support 26a, which is cruciform as seen in plan view, better to support a coil 2, has a coil locating structure 28a, comprising four limbs 102 and 104 each upstanding from a different arm of the support 26a. The limbs 102, which are opposed, have at their free ends inwardly directed feet 106 with chamfered inner ends 107 directed towards one another, the limbs 104, which are also opposed, having at their free ends outwardly directed feet 108 with chamfered inner faces 109.

First latching fingers 86a on the inner side of the housing 36a which is otherwise similar to the housing 36 in all material particulars, have chamfered end surfaces 110. Second latching fingers (not shown) on the outer side of the housing 36a are identical with the fingers 86a and are arranged in rotational symmetry therewith.

The support 26a has a cruciform central opening 112 defining two pairs of opposed shoulders 114 (only one shoulder of each pair is shown), the shoulders 114 of each pair lying inwardly of, and on either side of, one of the limbs 102.

A coil 2 can be mounted on the support 24a by pressing the coil 2 down onto the structure 28a so that the limbs 104 are resiliently deformed inwardly by the lower margins of the opening 8 of the coil 2 thereby enabling the structure 28a to be received in the opening 8, the limbs 104 resiling when the structure 28a has been fully received in the opening 8, so that the feet 108 engage the surface 10 of the coil 2 to stabilize the coil 2 in its mounted position. The housing 36a is then moved against the surface 10 by flexing the arm 38a so that the latching fingers 86a are moved resiliently towards one another by engagement with the surfaces 107 of the limbs 102, subsequently resiling to latch beneath the feet 106. The chamfered surfaces 110 of the fingers 86a then abut the surfaces 109 of the limbs 104 to retain them in their outwardly resiled positions.

In stacking, the second latching fingers on the housing 36a are inserted into the opening 112 of another identical coil supporting device (not shown) upon which a coil 2 has similarly been mounted, so that the second latching fingers are depressed by the edges of the

shoulders 114 and subsequently resile to latch behind these shoulders.

The coil stacking operations may be carried out manually or by the use of machinery.

The embodiment of Figure 8 can of course be used in a load coil assembly according to Figure 7.

Claims

1. A coil supporting device (24 or 24a) for use in stacking toroidal coils (2) in axially aligned relationship, the device, which has been moulded in one piece from plastics material, comprising a coil support (26 or 26a) for engagement by an end face (12) of the coil (2), a coil locating structure (28 or 28a) having a free end (30 or 106, 108) and being upstanding from the coil support (26 or 26a) centrally thereof for reception in the central opening (8) of a toroidal coil (2) positioned on the coil support (26 or 26a), and an electrical connector housing (36 or 36a) for receiving electrical terminals for connecting portions (14 and 16) of the windings of the coil (2) to electrical leads (18 and 20); characterized in that the housing (36 or 36a) is supported by a support arm (38 or 38a) upstanding from the coil support (26 or 26a), and being spaced from the locating structure (28 or 28a) to allow the coil (2) to be positioned on the coil support (26 or 26a), the housing (36 or 36a) and the free end (30 or 106) of the locating structure (28 or 28a) being provided with first interengageable means (32, 86 or 86a, 107), the support arm (38 or 38a) being deformable to displace the housing (36 or 36a) towards the support (26 or 26a) to interengage the first interengageable means (32, 86 or 86a) to attach the housing (36 or 36a) to the free end (30 or 106) of the locating structure (28 or 28a), and thus to retain the coil (2) on the coil support (26 or 26a), the housing (36 or 36a) and the coil support (26 or 26a) being provided with second interengageable means (34, 88 or 112, 114) such second means (88) of the housing (36 or 36a) being interengageable with the second interengageable means (34 or 112, 114) of the coil support (26 or 26a) of a first further and identical coil supporting device and the second interengageable means (34 or 112, 114) of the coil support (26 or 26a) being engageable with the second interengageable means (88) of the housing (36 or 36a) of a second further and identical coil supporting device; whereby a series of coils (2) can be stacked in axially aligned relationship by means of the coil supporting devices.

2. A device according to Claim 1, characterised in that the coil locating structure is in the form of an arm (28), the free end (30) of which has a first opening (32) therein, the housing (36) having on one side thereof first latching means (86) engageable in the opening (32) with a snap action and on the other side thereof second latching means (88) engageable with a



snap action in a second opening (34) in the coil support (26) of the first further and identical coil supporting device (24 or 24a).

3. A device according to Claim 1, characterised in that the coil locating structure (28a) comprises a plurality of juxtaposed limbs (102) upstanding from the coil support (26a) and having free end portions (106) directed towards one another to engage with latching fingers (86a) on the housing (36a).

4. A device according to Claim 1 or 3, characterised in that the coil locating structure (28a) comprises a plurality of juxtaposed, resilient coil retaining limbs (104) upstanding from the coil support (26a), which is cruciform as seen in plan view, and having free end portions (108) directed away from one another to engage the adjacent end face (10) of the coil (2) when such is positioned on the coil support (26a).

5. A device according to Claim 4, characterised in that the first interengageable means (86a) of the housing (36a) when engaged with the first interengageable means (106) of the locating structure (28a) serve to restrain inward movement of the coil retaining limbs (104).

6. A device according to any one of the preceding claims, characterised in that the first (86 or 86a) and second (88) interengageable means of the housing (36 or 36a) are identical and are positioned opposite to one another in rotational symmetry.

7. A device according to any one of the preceding claims, characterised in that the housing (36 or 36a) has parallel side walls (40 and 42) and a terminal receiving face (44) therebetween, the side walls (40 and 42) being parallel to the longitudinal axis of the coil locating structure (28 or 28a), and the terminal receiving face (44) being parallel to the coil support (26 or 26a), wire admitting slots (80) in the side walls (40 and 42) communicating with terminal receiving cavities (50, 52) opening into the terminal receiving face (44) and being provided with resilient, wire strain relief projections (43) extending across the slots (80).

8. A loading coil assembly comprising a cable (90) containing a plurality of pairs of wires (18, 18') and a plurality, equal to half the number of wire pairs (18, 18'), of bifilar toroidal induction coils (2) arranged in stacks (96) of axially aligned coils (2), clustered near the cable (90) and extending substantially parallel to the axis thereof, first and second wire pairs (18 or 18') extending from the cable (90) to each of the coils (2), the ends of the wires (20 and 22) of the first pair (18) being connected to first ends (14 and 16) of the windings of the coil (2) and the ends of the wires (20' and 22') of the wires of the second pair (18') being connected to second ends (14' and 16') of the windings of the coil (2), each coil having associated therewith an electrical terminal housing (36 or 36a) and coil supporting and securing means (24, 38,

86 or 24a, 38a, 86a), each terminal housing (36 or 36a) comprising a rectangular block of insulating material disposed adjacent to the coil (2) and extending transversely of the axis thereof, the housing (36 or 36a) having terminal receiving cavities (50, 52) and a terminal (54) in each cavity (50, 52) connecting the end of one of the wires (20, 22, 20' or 22') the end (14, 16, 14', 16') of one of the coil windings, each coil securing and locating means comprising a coil locating structure (28 or 28a) extending into the central opening (8) of the associated coil (2); characterised in that the housing (36 or 36a) is connected to the supporting means (26 or 26a) by way of an arm (38 or 38a) extending across the circumferential surface (4) of the coil (2), the housing (36 or 36a) being disposed against one end face (10) of the coil (2) and against one end (30 or 106) of the locating structure (28 or 28a) and extending diametrically across the coil (2), first interengaging means (32, 86 or 86a, 102) securing the housing (36 or 36a) to one end (30 or 106) of the locating structure (28 or 28a), second interengaging means (34, 88 or 112, 114) securing the housing (36 or 36a) and the supporting means (26 or 26a) associated with each coil (2) excepting the end coils (2) of the stack (96) to the housing (36 or 36a) and to the supporting means (26 or 26a) of the two adjacent coils (2) in the same stack (96), the stacks (96) being supported by spaced stack supports (92 and 94) surrounding the axis of the cable (90) and between which the stacks (96) are disposed.

9. An assembly according to Claim 8, characterised in that the stack supports comprises superposed trays (92 and 94) having openings (100) in which are engaged latch arms (88) on the terminal housings (36 and 36a) at one end of each stack (96), and projections (98) engaged in openings (34 or 112) in the supporting means (26 or 26a) at the other end of each stack (96).

Patentansprüche

1. Spulenträgervorrichtung (24 oder 24a) zur Verwendung bei der Stapelung von Ringspulen (2) in axial ausgerichtetem Verhältnis, wobei die Vorrichtung, die in einem Stück aus Kunststoffmaterial geformt wurde, umfaßt: einen Spulenträger (26 oder 26a), an dem eine Stirnfläche (12) der Spule (2) angreift, eine Spulenfestlegekonstruktion (28 oder 28a), die ein freies Ende (30 oder 106, 108) aufweist und die zur Aufnahme in der zentralen Öffnung (8) einer auf dem Spulenträger (26 oder 26a) positionierten Ringspule (2) von der Mitte des Spulenträgers (26 oder 26a) hochsteht, sowie ein elektrisches Verbindergehäuse (36 oder 36a) zur Aufnahme von elektrischen Anschlüssen zum Verbinden von Bereichen (14 und 16) der Wicklungen der Spule (2) mit elektrischen Zuleitungen (18 und 20), dadurch gekennzeichnet, daß das Gehäuse (36 oder 36a) von



einem Tragarm (38 oder 38a) getragen ist, der von dem Spulenträger (26 oder 26a) hochsteht und von der Festlegekonstruktion (28 oder 28a) beabstandet ist, um ein Positionieren der Spule (2) auf dem Spulenträger (26 oder 26a) zu gestatten, daß das Gehäuse (36 oder 36a) und das freie Ende (30 oder 106) der Festlegekonstruktion (20 oder 28a) mit ersten miteinander in Eingriff bringbaren Einrichtungen (32, 86 oder 86a, 107) versehen sind, daß der Tragarm (38 oder 38a) zur Verlagerung des Gehäuses (36 oder 36a) in Richtung auf den Träger (26 oder 26a) biegsam ist, um die ersten miteinander in Eingriff bringbaren Einrichtungen (32, 86 oder 86a) zur Befestigung des Gehäuses (36 oder 36a) and dem freien Ende (30 oder 106) der Festlegekonstruktion (28 oder 28a) miteinander in Eingriff zu bringen, um somit die Spule (2) auf dem Spulenträger (26 oder 26a) festzuhalten, und daß das Gehäuse (36 oder 36a) und der Spulenträger (26 oder 26a) mit zweiten miteinander in Eingriff bringbaren Einrichtungen (34, 88 oder 112, 114) versehen sind, wobei derartige zweite Einrichtungen (88) des Gehäuses (36 oder 36a) mit den zweiten in wechselseitigen Eingriff bringbaren Einrichtungen (34 oder 112, 114) des Spulenträgers (26 oder 26a) einer ersten weiteren und identischen Spulenträgervorrichtung in Eingriff bringbar sind und die zweiten miteinander in Eingriff bringbaren Einrichtungen (34 oder 112, 114) des Spulenträgers (26 oder 26a) mit den zweiten in wechselseitigen Eingriff bringbaren Einrichtungen (88) des Gehäuses (36 oder 36a) einer zweiten weiteren und identischen Spulenträgervorrichtung in Eingriff bringbar sind, wodurch eine Reihe von Spulen (2) mittels der Spulenträgervorrichtungen in axial ausgerichteter Verhältnisse stapelbar ist.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Spulenfestlegekonstruktion die Form eines Armes (28) aufweist, dessen freies Ende (30) mit einer ersten Öffnung (32) versehen ist, und daß das Gehäuse (36) auf seiner einen Seite erste Verriegelungseinrichtungen (86) aufweist, die in der Öffnung (32) einrastend eingreifen können, und auf seiner anderen Seite zweite Verriegelungseinrichtungen (88) aufweist, die in einer zweiten Öffnung (34) in dem Spulenträger (26) der ersten weiteren und identischen Spulenträgervorrichtung (24 oder 24a) einrastend eingreifen können.

3. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Spulenfestlegekonstruktion (28a) eine Vielzahl nebeneinander angeordneter Glieder (102) aufweist, die von dem Spulenträger (26a) hochstehen und freie Endbereiche (108) aufweisen, die für den Eingriff mit Verriegelungsfingern (86a) an dem Gehäuse (36a) aufeinander zu weisen.

4. Vorrichtung nach Anspruch 1 oder 3, dadurch gekennzeichnet, daß die Spulenfestlegekonstruktion (28a) eine Vielzahl nebeneinander angeordneter, federnd nachgiebiger Spulen-

Festhaltglieder (104) aufweist, die von dem Spulenträger (26a) hochstehen, der in der Draufsicht gesehen kreuzförmig ausgebildet ist, und die freie Endbereiche (108) aufweisen, die voneinander wegweisen, um an der angrenzenden Stirnfläche (10) der Spule (2) anzugreifen, wenn eine solche auf dem Spulenträger (26a) positioniert ist.

5. Vorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die ersten in wechselseitigen Eingriff bringbaren Einrichtungen (86a) des Gehäuses (36a), wenn sich diese in Eingriff mit den ersten in wechselseitigen Eingriff bringbaren Einrichtungen (106) der Festlegekonstruktion (28a) befinden, zum Begrenzen der nach innen gerichteten Bewegung der Spulen-Festhaltglieder (104) dienen.

6. Vorrichtung nach einem der vorausgehenden Ansprüche, dadurch gekennzeichnet, daß die ersten (86 oder 86a) und die zweiten (88) in wechselseitigen Eingriff bringbaren Einrichtungen des Gehäuses (36 oder 36a) identisch sind und rotationssymmetrisch einander gegenüberliegend positioniert sind.

7. Vorrichtung nach einem der vorausgehenden Ansprüche, dadurch gekennzeichnet, daß das Gehäuse (36 oder 36a) parallele Seitenwände (40 und 42) und eine Anschlußaufnahmeseite (44) dazwischen aufweist, wobei sich die Seitenwände (40 und 42) parallel zu der Längsachse der Spulenfestlegekonstruktion (28 oder 28a) erstrecken und sich die Anschlußaufnahmeseite (44) parallel zu dem Spulenträger (26 oder 26a) erstreckt, und daß Drahteinführungsschlitze (80) in den Seitenwänden (40 und 42) mit Anschlußaufnahme-Ausnehmungen (50, 52) in Verbindung stehen, die in die Anschlußaufnahmeseite (44) münden und mit federnd nachgiebigen Draht-Zugentlastungsvorsprüngen (43) versehen sind, die sich über die Schlitze (80) erstrecken.

8. Pupinspulenordnung mit einem Kable (90), das eine Vielzahl von Drahtpaaren (18, 18') enthält, und mit einer Vielzahl bifilarer Ringinduktionsspulen (2), deren Anzahl gleich der Hälfte der Anzahl von Drahtpaaren (18, 18') ist, und die in Stapeln (96) axial ausgerichteter Spulen (2) angeordnet sind, die in der Nähe des Kabels (90) gebündelt sind und sich im wesentlichen parallel zu der Achse desselben erstrecken, wobei sich erste und zweite Drahtpaare (18 oder 18') von dem Kabel (90) weg zu jeder der Spulen (2) erstrecken und die Enden der Drähte (20 und 22) des ersten Paares (18) mit ersten Enden (14 und 16) der Wicklungen der Spule (2) verbunden sind und die Enden der Drähte (20' und 22') der Drähte des zweiten Paares (18') mit zweiten Enden (14' und 16') der Wicklungen der Spule (2) verbunden sind, wobei jeder Spule ein elektrisches Anschlußgehäuse (36 oder 36a) sowie Spulenträger- und Spulenbefestigungs-Einrichtungen (24, 38, 86 oder 24a, 38a, 86a) zugeordnet sind und jedes Anschlußgehäuse (36 oder 36a) einen rechteckigen Block aus isolierendem



Material umfaßt, der in der Nähe der Spule (2) angeordnet ist und sich quer zu der Achse derselben erstreckt, wobei das Gehäuse (36 oder 36a) Anschlußaufnahme-Ausnehmungen (50, 52) sowie einen Anschluß (54) in jeder Ausnehmung (50, 52) aufweist, der das Ende eines der Drähte (20, 22, 20' oder 22') mit dem Ende (14, 16, 14', 16') einer der Spulenwicklungen verbindet, und wobei jede Spulenbefestigungs- und Spulenfestlege-Einrichtung eine Spulenfestlegekonstruktion (28 oder 28a) aufweist, die sich in die zentrale Öffnung (8) der zugehörigen Spule (2) hinein erstreckt, dadurch gekennzeichnet, daß das Gehäuse (36 oder 36a) über einen Arm (38 oder 38a), der sich über die Umfangsfläche (4) der Spule (2) erstreckt, mit der Trägereinrichtung (26 oder 26a) verbunden ist, daß das Gehäuse (36 oder 36a) gegen eine Stirnfläche (10) der Spule (2) und gegen ein Ende (30 oder 106) der Festlegekonstruktion (28 oder 28a) angeordnet ist und sich über den Durchmesser der Spule (2) erstreckt, daß erste wechselseitig eingreifende Einrichtungen (32, 86 oder 86a, 102) das Gehäuse (36 oder 36a) an einem Ende (30 oder 106) der Festlegekonstruktion (28 oder 28a) befestigen und zweite wechselseitig eingreifende Einrichtungen (34, 88 oder 112, 114) das Gehäuse (36 oder 36a) und die jeder Spule (2) zugeordnete Trägereinrichtung (26 oder 26a) mit Ausnahme der Endspulen (2) des Stapels (96) an dem Gehäuse (36 oder 36a) und an den Trägereinrichtungen (26 oder 26a) der beiden benachbarten Spulen (2) in dem gleichen Stapel (96) befestigen, und daß die Stapel (96) mittels beabstandeter Stapelhalter (92 und 94) gehalten sind, die die Achse des Kabels (90) umgeben und zwischen denen die Stapel (96) angeordnet sind.

9. Anordnung nach Anspruch 8, dadurch gekennzeichnet, daß die Stapelhalter übereinander angeordnete Tafeln (92 und 94) umfassen, die Öffnungen (100) aufweisen, in die an den Anschlußgehäusen (36 und 36a) befindliche Verriegelungsarme (88) an dem einen Ende eines jeden Stapels (96) eingreifen, und die Vorsprünge (98) aufweisen, die in den Trägereinrichtungen (26 oder 26a) befindliche Öffnungen (34 oder 112) an dem anderen Ende jedes Stapels (96) eingreifen.

Revendications

1. Dispositif de support de bobines (24 ou 24a) à utiliser dans l'empilage de bobines toroïdales (2) en alignement axial, le dispositif, qui a été moulé d'une seule pièce en matière plastique, comprenant un support (26 ou 26a) de bobine contre lequel une face extrême (12) de la bobine (2) est destinée à s'appliquer, une structure (28 ou 28a) de positionnement de bobine ayant une extrémité libre (30 ou 106, 108) et s'élevant du centre du support (26 ou 26a) de bobine pour se loger dans l'ouverture centrale (8) d'une bobine toroïdale (2) position-

née sur le support (26 ou 26a) de bobine, et un boîtier (36 ou 36a) de connecteurs électriques destiné à recevoir des bornes électriques pour connecter des tronçons (14 et 16) des enroulements de la bobine (2) à des conducteurs électriques (18 et 20); caractérisé en ce que le boîtier (36 ou 36a) est supporté par un bras de support (38 ou 38a) s'élevant du support (26 ou 26a) de bobine, et étant espacé de la structure de positionnement (28 ou 28a) pour permettre à la bobine (2) d'être positionnée sur le support (26 ou 26a) de bobine, le boîtier (36 ou 36a) et l'extrémité libre (30 ou 106) de la structure de positionnement (28 ou 28a) comportant des premiers moyens d'enclenchement mutuel (32, 86 ou 86a, 107), le bras de support (38 ou 38a) étant déformable pour déplacer le boîtier (36 ou 36a) vers le support (26 ou 26a) afin d'enclencher les premiers moyens d'enclenchement mutuel (32, 86 ou 86a) pour fixer le boîtier (36 ou 36a) à l'extrémité libre (30 ou 106) de la structure de positionnement (28 ou 28a) et retenir ainsi la bobine (2) sur le support (26 ou 26a) de bobine, le boîtier (36 ou 36a) et le support (26 ou 26a) de bobine comportant des seconds moyens d'enclenchement mutuel (34, 88 ou 112, 114), ces seconds moyens (88) du boîtier (36 ou 36a) pouvant être enclenchés avec les seconds moyens d'enclenchement mutuel (34 ou 112, 114) du support (26 ou 26a) de bobine d'un premier autre dispositif identique de support de bobines, et les seconds moyens d'enclenchement mutuel (34 ou 112, 114) du support (26 ou 26a) de bobine pouvant être enclenchés avec les seconds moyens d'enclenchement mutuel (88) du boîtier (36 ou 36a) d'un second autre dispositif identique de support de bobines, afin qu'une série de bobines (2) puisse être empilée en alignement axial au moyen des dispositifs de support de bobines.

2. Dispositif selon la revendication 1, caractérisé en ce que la structure de positionnement de bobine se présente sous la forme d'un bras (28) dont l'extrémité libre (30) présente une première ouverture (32), le boîtier (36) comportant, sur un premier côté, des premiers moyens de verrouillage (86) pouvant s'enclencher dans l'ouverture (32), avec une action élastique, et sur son autre côté, des seconds moyens de verrouillage (88) pouvant s'enclencher, avec une action élastique, dans une seconde ouverture (34) du support (26) de bobine du premier autre dispositif identique (24 ou 24a) de support de bobines.

3. Dispositif selon la revendication 1, caractérisé en ce que la structure (28a) de positionnement de bobine comprend plusieurs branches juxtaposées (102) s'élevant du support (26a) de bobine et comportant des tronçons extrêmes libres (106) dirigés l'un vers l'autre pour s'enclencher avec des doigts de verrouillage (86a) situés sur le boîtier (36a).

4. Dispositif selon la revendication 1 ou 3, caractérisé en ce que la structure (28a) de positionnement de bobine comprend plusieurs bran-



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ches élastiques et juxtaposées (104) de retenue de bobine s'élevant du support (26a) de bobine, qui est cruciforme, vu en plan, et ayant des tronçons extrêmes libres (108) s'écartant les uns des autres pour porter contre la face extrême adjacente (10) de la bobine (2) lorsque celle-ci est positionnée sur le support (26a) de bobine.

5. Dispositif selon la revendication 4, caractérisé en ce que les premiers moyens d'enclenchement mutuel (86a) du boîtier (36a), lorsqu'ils sont unclenchés avec les premiers moyens d'enclenchement mutuel (106) de la structure (28a) de positionnement servent à limiter le mouvement vers l'intérieur des branches (104) de retenue de la bobine.

6. Dispositif selon l'une quelconque des revendications précédentes, caractérisé en ce que les premiers (86 ou 86a) et seconds (88) moyens d'enclenchement mutuel du boîtier (36 ou 36a) sont identiques et sont positionnés de façon à être opposés les uns aux autres, en symétrie de rotation.

7. Dispositif selon l'une quelconque des revendications précédentes, caractérisé en ce que le boîtier (36 ou 36a) comporte des parois latérales parallèles (40 et 42) et une face (44) de réception de bornes entre ces parois, les parois latérales (40 et 42) étant parallèles à l'axe longitudinal de la structure (28 ou 28a) de positionnement de bobine, et la face (44) de réception de bornes étant parallèle au support (26 ou 26a) de bobine, des fentes (80) d'admission de fils, situées dans les parois latérales (40 et 42), communiquant avec des cavités (50, 52) de réception de bornes débouchant dans la face (44) de réception de bornes et étant équipées de saillies élastiques (43) de soulagement des contraintes des fils s'étendant en travers des fentes (80).

8. Assemblage de bobines de charge comprenant un câble (90) contenant plusieurs paires de fils (18, 18') et un nombre, égal à la moitié du nombre de paires de fils (18, 18'), de bobines d'induction toroïdales bifilaires (2) agencées en piles (96) de bobines (2) alignées axialement, groupées à proximité du câble (90) et s'étendant à peu près parallèlement à l'axe de celui-ci, des première et seconde paires de fils (18 ou 18') s'étendant du câble (90) vers chacune des bobines (2), les extrémités des fils (20 et 22) de la première paire (18) étant connectées aux premières extrémités (14 et 16) des enroulements de la bobine (2) et les extrémités des fils (20' et 22') des fils de la seconde

paire (18') étant connectées à des secondes extrémités (14' et 16') des enroulements de la bobine (2), à chaque bobine étant associés un boîtier (36 ou 36a) à bornes électriques et des moyens (24, 38, 86 ou 24a, 38a, 86a) de support et de fixation de bobines, chaque boîtier (36 ou 36a) à bornes comprenant un bloc rectangulaire de matière isolante disposé à proximité immédiate de la bobine (2) et s'étendant transversalement à son axe, le boîtier (36 ou 36a) présentant des cavités (50, 52) de réception de bornes et une borne (54) dans chaque cavité (50, 52) connectant l'extrémité de l'un des fils (20, 22, 20' ou 22') à l'extrémité (14, 16, 14', 16') de l'un des enroulements de bobine, chaque moyen de fixation et de positionnement de bobine comprenant une structure (28 ou 28a) de positionnement de bobine pénétrant dans l'ouverture centrale (8) de la bobine associée (2); caractérisé en ce que le boîtier (36 ou 36a) est connecté aux moyens de support (26 ou 26a) à l'aide d'un bras (38 ou 38a) s'étendant en travers de la surface circonférentielle (4) de la bobine (2), le boîtier (36 ou 36a) étant disposé contre une face extrême (10) de la bobine (2) et contre une extrémité (30 ou 106) de la structure (28 ou 28a) de positionnement et s'étendant diamétralement en travers de la bobine (2), des premiers moyens d'enclenchement mutuel (32, 86 ou 86a, 102) fixant le boîtier (36 ou 36a) à une extrémité (30 ou 106) de la structure (28 ou 28a) de positionnement, des seconds moyens d'enclenchement mutuel (34, 88 ou 112, 114) fixant le boîtier (36 ou 36a) et les moyens de support (26 ou 26a) associés à chaque bobine (2), sauf les bobines extrêmes (2) de la pile (96) au boîtier (36 ou 36a) et aux moyens de support (26 ou 26a) des deux bobines adjacentes (2) dans la même pile (96), les piles (96) étant supportées par des supports espacés (92 et 94) de piles entourant l'axe du câble (90) et entre lesquels les piles (96) sont disposées.

9. Assemblage selon la revendication 8, caractérisé en ce que les supports de piles comprennent des plateaux superposés (92 et 94) présentant des ouvertures (100) dans lesquelles sont enclenchés des bras (88) de verrouillage situés sur les boîtiers (36 et 36a) à bornes à une extrémité de chaque pile (96) et des saillies (98) enclenchées dans des ouvertures (34 ou 112) des moyens de support (26 ou 26a), à l'autre extrémité de chaque pile (96).

