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APPARATUS FOR COILING FILAMENTARY ARTICLES

Filed Sept. 26, 1951

2 Sheets-Sheet 1

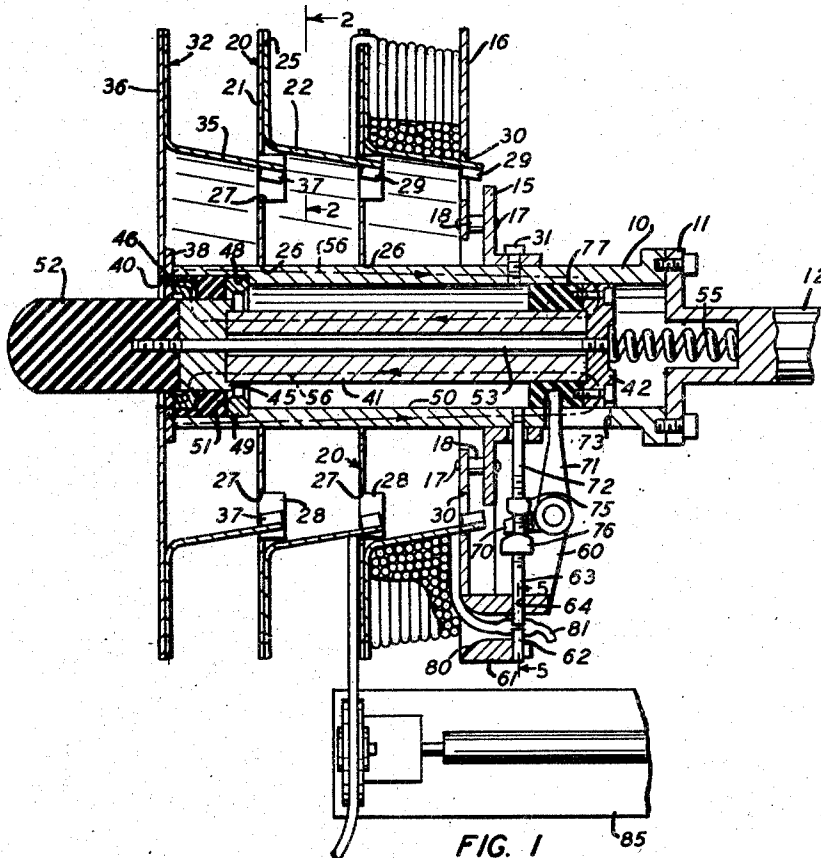


FIG. 1

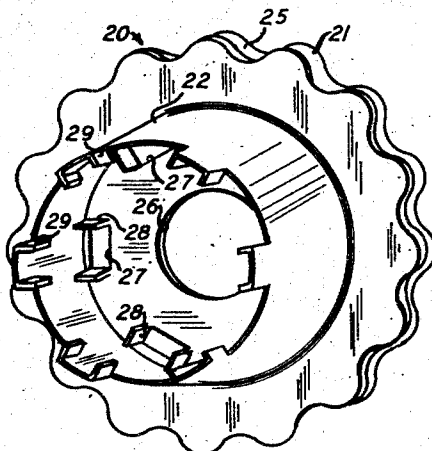


FIG. 3

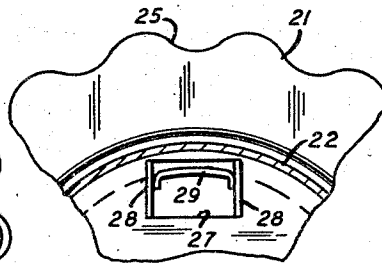


FIG. 2

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2 Sheets-Sheet 2

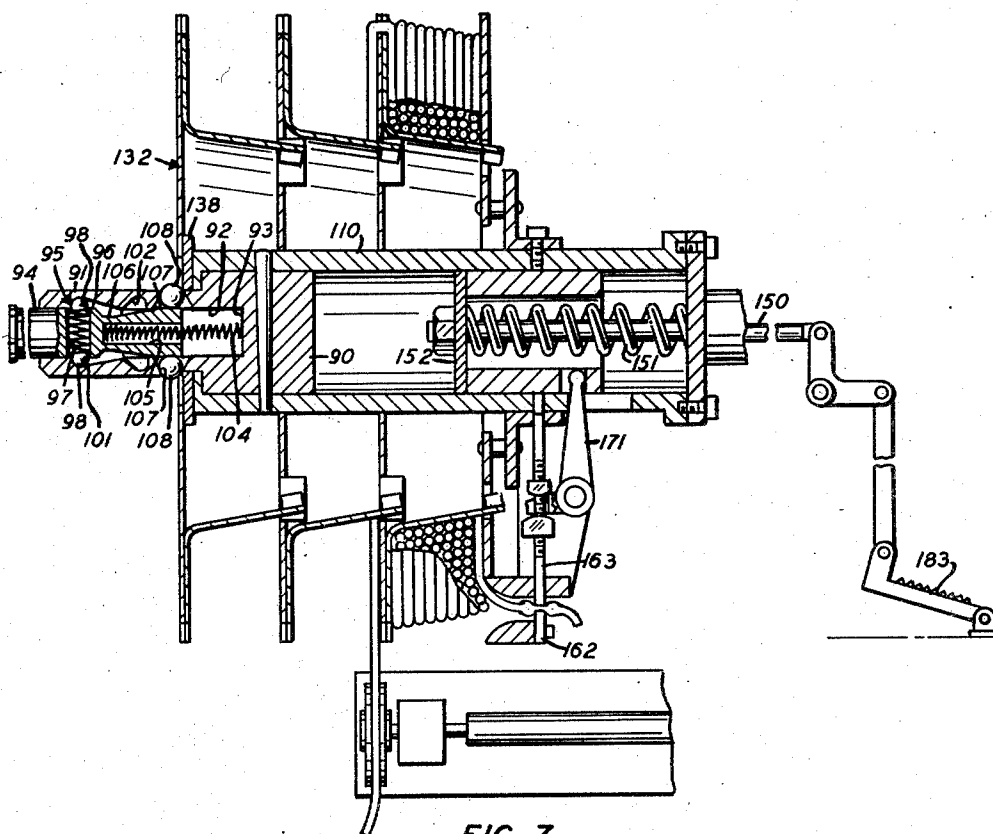


FIG. 7

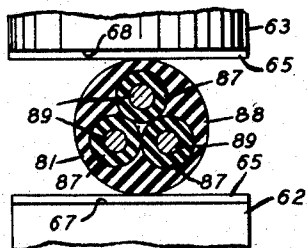


FIG. 4

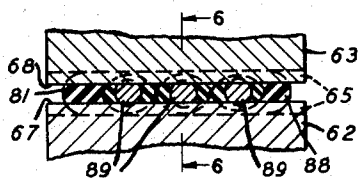


FIG. 5

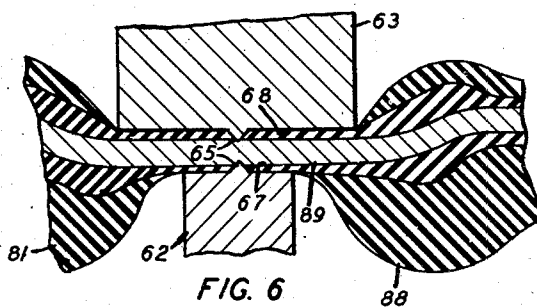


FIG. 6

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APPARATUS FOR COILING FILAMENTARY ARTICLES

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Application September 26, 1951, Serial No. 248,327

11 Claims. (Cl. 242—116)

This invention relates to apparatus for coiling filamentary articles, and more particularly to apparatus for coiling insulated conductors.

It is particularly desirable in some coiling operations to coil a continuous length of wire into separate coils containing predetermined amounts. One method of obtaining this result is the use of a segmental coiling head, which permits measured lengths of continuous wire to be wound successively upon different coiling sections mounted on the same arbor. The problem of separating the coils of wire from their respective coiling sections necessitates the use of separable sections which can be rapidly removed from the arbor and easily separated from the coils.

Since it is standard practice to perform certain electrical tests, such as insulation breakdown and continuity tests, simultaneously with the coiling operation, it is necessary that a ground connection be provided on the coiling head to assure a proper test and as a safety measure to protect the operator. In order to facilitate the rapid removal of loaded coiling sections from the arbor it is essential that a quick engagement-release grounding means be provided.

It is an object of this invention to provide a new and improved apparatus for coiling filamentary articles.

Another object of this invention is to provide new and improved coiling heads made of several nested coiling sections.

These and other objects of the invention will become apparent from the following detailed description of specific embodiments thereof, when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a vertical section of a coiling apparatus embodying the invention;

Fig. 2 is a fragmentary section taken along line 2—2 of Fig. 1;

Fig. 3 is a view in perspective of an intermediate coiling section forming a part of the apparatus;

Fig. 4 is an enlarged fragmentary view of clamping jaws forming part of the apparatus;

Fig. 5 is an enlarged fragmentary section taken along line 5—5 of Fig. 1;

Fig. 6 is a fragmentary section taken along line 6—6 of Fig. 5, and

Fig. 7 is a vertical section of another coiling apparatus embodying the invention.

Referring to Fig. 1 of the drawings, there is shown a tubular coiling arbor 10 secured to a flanged end 11 of a drive shaft 12. An annular flange 15 fixedly mounted on the arbor 10 supports a coil backing plate 16 which is secured thereto and spaced therefrom by rivets 17 and spacers 18.

Removably mounted on the arbor 10, are intermediate coiling sections 20—20. The coiling sections 20—20 are identical, and the construction thereof is shown more clearly in Fig. 3, in which one of the sections is illustrated. The section is made up of a flange plate 21 and a flanged frustoconical coiling drum 22. The edges of the flange

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plate 21 and flanged drum 22 are scalloped as shown at 23. A central aperture 25 is provided in the flange plate 21 to receive the arbor 10 for removably mounting the sections thereupon. A plurality of spaced rectangular slots 27—27 with guide tabs 28—28 are formed in the plate 21 and the outer edges of the drum 22 are provided with an equal number of similarly disposed tongues 29—29, as shown in Fig. 3.

The tongues 29—29 on one of the sections 20—20 are designed to cooperate with the slots 27—27 and guide tabs 28—28 of the adjacent section 20 to interlock the two sections (Figs. 1 and 2), said slots receiving the tongues therein and thereby preventing relative rotation between the cooperating sections. Relative rotation between the coiling sections 20—20 and the arbor 10 is prevented by the engagement of the tongues 29—29 on the innermost of the intermediate sections 20—20 with rectangular slots 30—30 formed in the backing plate 16. Since the backing plate is fixed to the annular flange 15 fastened upon the coiling arbor 10 by cap screws, one of which is shown at 31, there can be no rotational movement between the arbor and the interlocked sections.

As shown in Fig. 2, only the sides of a tongue 29 engage the guide tabs 28—28, since the radial length of the slot 27 has been made much greater than the effective thickness of the tongue 29. This feature is designed to prevent the coiling sections 32 and 20—20 from binding, which might prevent the separation of the sections upon completion of a coiling operation. Warpage and the pressure of the wound material cause appreciable changes in the radii of the drums 35 and 22—22, but the radial clearance provided by the slot 27 permits these changes to occur without binding.

An outer coiling section 32 is provided with means for forcing the other sections together against the backing plate 16 and for holding the sections 20—20 upon the arbor. The outer section 32 is very similar to the intermediate sections 20—20 and consists of a flanged drum 35 and a flange plate 36. The drum 35 is provided with tongues 37—37 for engagement with the slots 27—27 and guide tabs 28—28 of the adjacent coiling section 20. However, the flange plate 36 is void of the slots and has no scalloped edge, since on the outer section they would be of no utility.

A retaining ring 38 of paramagnetic material is mounted on the flange plate 36 concentrically with a central aperture 40 formed therein. The retaining ring 38 constitutes part of a latching means for forcing the sections together and for holding them on the arbor.

The particular embodiment of the invention shown in Fig. 1 is provided with a magnetic latching means, the broad concept of which has been disclosed and claimed in my copending application, Serial No. 97,832, filed June 8, 1949, now Patent No. 2,656,127, granted October 20, 1953.

A cylindrical bar magnet 41 is provided with a cup-shaped pole piece 42 secured to the right end thereof and a cup-shaped pole piece 45 secured to the left end thereof. The external diameter of the pole piece 42 is substantially the same as the internal diameter of the tubular arbor 10 to allow the pole piece to be slidably received within the arbor. A secondary pole piece 46, which comprises a flanged ring of paramagnetic metal of high saturation characteristics, is mounted in a cup-shaped ring 51 of nonmagnetic material. The ring 51 is secured to a recessed portion 48 of the arbor wall 50 and spaces the secondary pole piece therefrom. An annular ring 49 of paramagnetic material is secured in the recessed portion 48 and spaced from the secondary pole piece 46 by the ring 51 of nonmagnetic material.

A cylindrical knob 52, of a nonmagnetic material, is secured to the pole piece 45 by one end of an elongated

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threaded rod 53, also of nonmagnetic material, which passes through the bar magnet 41 and threadedly engages at its other extremity the pole piece 42. The external diameters of the knob 52 and the pole piece 45 are substantially the same as the internal diameters of the retaining ring 38, pole piece 46 and ring 51, permitting a sliding engagement therebetween. The ring 38, secured to section 32, is designed to abut the left end of the arbor 10 and the flanged edge of the secondary pole piece 46, when the outer section is mounted in position upon the knob 52. For the purposes of this type of latching means, the arbor itself must be made of a paramagnetic material, preferably of high saturation characteristics.

In this position, with the ring 38 contacting the arbor and the secondary pole piece 46, a magnetic circuit as indicated by flux lines 56—56, is completed. The retaining ring 38 is held firmly in place, bridging the secondary pole piece 46 and the end of the arbor, by the magnetic force of attraction. This action prevents the removal of the outer section 32.

Disengagement of the nested sections 32 and 20—20 from the arbor is accomplished by moving the knob 52 to the right so as to cause the pole piece 45 to be separated from the secondary pole piece 46, thereby breaking the magnetic circuit 56. When the magnetic circuit 56 is broken, the ring 38 will no longer be held against the arbor 10 and pole piece 46 by the magnetic force of attraction, and the sections 32 and 20—20 can be removed from the knob 52 and arbor 10.

A quick engagement-release grounding clamp also shown in Fig. 1, includes a pair of mounts, one of which, designated 60, is shown secured to the rear of the annular flange 15. The mounts support a block 61, upon which a stationary jaw 62 is fastened. A reciprocating jaw 63 is slidably engaged in an aperture 64 in the block 61 for cooperation with the stationary jaw 62. The jaws 62 and 63 are provided with flat surfaces 67 and 68 of predetermined area and cooperating chisel-like teeth 65—65, as shown in Figs. 4, 5 and 6.

A forked arm 70 of a bell crank 71 pivotally secured between the mounts, such as the one, designated 60, is linked to a threaded rod-like extension 72 of the reciprocating jaw 63 by nuts 75 and 76. The nuts 75 and 76 are threadedly engaged to the extension 72 and facilitate compensatory adjustments in the predetermined separation of jaws 62 and 63 for variations in conductor size. The bell crank 71 is attached, through a longitudinal slot 73 in the arbor 10, to a connecting ring 77 of nonmagnetic material. The connecting ring 77 is secured to the pole piece 42 by cap screws, whereby horizontal sliding movement of the pole piece 42 is translated into vertical reciprocating movement of the jaw 63. The block 61 is further provided with a bell-mouthed aperture 80 through which a wire end 81 may be inserted between the jaws 62 and 63.

Operation

The above-mentioned coiling head operates in the following manner:

The intermediate sections 20—20 are mounted on the arbor with the tongues 29—29 on the innermost section 20 inserted in the slots 30—30 of the backing plate 16 and the tongues 29—29 on the other intermediate section 20 are inserted in the slots 27—27 of the innermost section 20. The outer section 32 is slidably mounted up on the knob 52 with its tongues 37—37 interlocking with the slots 27—27 on the adjacent section 20. The retaining ring 38 is then held firmly against the arbor 10 and the secondary pole piece 46 by the magnetic force of attraction caused by completion of a magnetic circuit. With the outer section 32 in place, the sections 20—20 are forced together and held upon the arbor 10.

The sections 32 and 20—20 may be nested prior to mounting them on the arbor and may, therefore, be

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mounted as a unit. This method reduces the loading time.

Before the coiling operation commences, the wire end 81 is inserted in the aperture 80 and between the jaws 62 and 63, which are momentarily separated by forcing the knob 52 to the right, operating the bell crank 71.

Upon releasing the knob 52, the spring 55 forces the pole piece 42 and attached ring 77 to the left, actuating the bell crank 71, which causes the insulation 87—87 and jacket 88 of the wire end 81 to be crushed by the flat surfaces 67 and 68 of the jaws 62 and 63. The cooperating flat surfaces 67 and 68 force conductors 89—89, which were previously in a standard equilateral spacial arrangement (Fig. 4), into the coplanar arrangement shown in Fig. 5, simultaneously reducing the combined thickness of insulation 87—87 and jacket 88, separating the conductors 89—89 from the jaws, to a predetermined value, which is slightly less than the height of the teeth 65—65. This deforming action prevents the teeth 65—65 from severing the conductors of multi-conductor wires. The teeth 65—65 are held into clamping engagement with coplanarly disposed conductors 89—89, as shown in Figs. 5 and 6, grounding them through metallic members of the coiling head.

The use of the teeth 65—65 on the cooperating jaws 62 and 63 is optional. If sufficient force is applied to the bell crank 71, it is unnecessary to provide the jaws 62 and 63 with teeth. The flat surfaces 67 and 68 on the jaws 62 and 63 crush the wire 81 and cause the insulation 87—87 and jacket 88 to be forced from therebetween, exposing the bare conductors 89—89 for a grounding contact with the jaws 62 and 63.

The coiling operation is commenced by operatively connecting the drive shaft 12 to a drive motor (not shown), causing the coiling head to rotate. A distributor mechanism 85, the details of which are not essential to the disclosure of this invention, aids in evenly distributing the wire upon the coiling sections 20—20 and 32. After a predetermined length of wire has been wound upon the innermost section 20, the distributor 85 indexes to a position opposite the adjacent section 20. Thereupon the scalloped edges 25 on the innermost section 20 engage the strand of wire and facilitate the transfer of the strand therefrom to the adjacent section 20. This transfer operation is repeated to fill the outer section 32. The coiling operation ceases and the wire is severed when the outer section has received a predetermined amount of wire.

To remove the filled sections from the arbor, the knob 52 is forced to the right breaking the magnetic circuit and releasing the retaining ring 38 which holds the outer section 32 in place. This action also releases the grounding clamp and allows disengagement of the wire end 81. The sections 32 and 20—20 are then removed from the knob 52 and arbor 10 and separated. The resulting product is a continuous length of wire in separate coils of predetermined length.

Alternate embodiment

Fig. 7 illustrates another embodiment of the invention, in which the magnetic latching means of the first embodiment has been replaced by a ball type latch. In this alternate embodiment, a cylindrical stub shaft 90 is secured within a tubular arbor 110 with a shank 91 extending axially therefrom. The shank 91 of said housing has a reduced cross section of substantially the same diameter as the internal diameter of a retaining ring 138 secured to an outer section 132. The stub shaft 90 is provided with a chamber 92 in which a plunger 94 is slidably engaged.

A spring pressed detent 95, which comprises a spring 96 mounted in a transversely disposed bore 97, and a pair of steel balls 98—98, retains the plunger in either of two alternative positions within the chamber. Annular recesses 101 and 102 provided in the wall of the

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chamber are designed to alternately engage the balls 98—98, which are forced radially outward by the spring 96. A bias spring 104, one end of which is secured to a closed end 93 of the chamber 92 and the other end of which is received within a bore 105 provided in the plunger 94, forces the plunger to the left and normally aids in preventing disengagement of the spring pressed detent 95 from the recess 101.

The right end of the plunger 94 is frustoconical in shape, tapering from a maximum diameter at the extremity to a minimum diameter at a groove 106. A plurality of circumferentially spaced tapered apertures 107—107 are formed in shank of the housing 91. An equal number of balls 108—108, of slightly larger diameter than the minimum diameter of the apertures 107—107, are retained therein by the right end of the plunger 94. In the "locked" position (shown in Fig. 7), the balls 108—108 are wedged outward by the frustoconical end of the plunger 94 and protrude beyond the periphery of the shank 91. The projecting portions of the balls 108—108 hold the retaining ring 138 tightly against the arbor 110 and prevent its removal from the shank 91.

In releasing the latch mechanism, the plunger is forced manually to the right against the pressure of the spring 104, allowing the balls 108—108 to recede into the apertures 107—107, wherein they are retained by the groove 106 located at a position on the plunger 94 at which the cross-sectional diameter is a minimum. At this position the spring pressed detent 95 is engaged in the recess 102 and the outer section 132 may be slipped off the shank 91, permitting the removal of intermediate coiling sections 120—120 from the arbor 110.

A modification in the operation of the grounding clamp is shown in Fig. 7. In this apparatus the clamp is not operated by the latching means, but instead, is separately actuated by a foot lever 183. The foot lever 183, when depressed by the operator, actuates a push rod 150 secured at its left end to a reciprocating ring 152 slidably mounted within the arbor 110. The ring 152 slides to the right, rotating a bell crank 171 connected thereto and releasing the clamp in a manner previously described in connection with the preferred embodiment shown in Fig. 1. The push rod 150 is normally biased to an extreme left-hand position by the spring 151, thereby exerting a force upon the reciprocating ring 152 and the connected bell crank 171, causing blades 162 and 163 to firmly engage a conductor and maintains a ground connection.

Obviously, the features of this invention are not limited to the embodiments herein described, but may be utilized in many varied applications.

What is claimed is:

1. A coiling head, which comprises an arbor, a plurality of separate coiling sections removably mounted on the arbor each section having a plurality of slots formed therein, a member fixedly mounted on said arbor and provided with a plurality of similarly disposed slots, tongues provided on each section for cooperation with the slots to prevent relative rotation between said sections and the arbor, and means for forcing the sections together and holding them on the arbor.

2. A coiling head, which comprises an arbor of paramagnetic material, a plurality of separate intermediate coiling sections, an outer coiling section, means provided on all the sections designed for cooperation with portions of adjacent members of the coiling head to prevent relative rotation therebetween, and a magnetically actuated latching means comprising a permanent magnet slidably mounted within the arbor so that magnetic flux may flow through the arbor when a magnetic circuit is completed, a retaining ring fixedly mounted on the outer coiling section, said retaining ring forming a removable part of the magnetic circuit, means for completing a closed magnetic circuit to hold the ring in place, and means for breaking the magnetic circuit to release the retaining

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ring thereby allowing the sections to be removed from the arbor.

3. A coiling head, which comprises an arbor, a plurality of separate coiling sections removably mounted on the arbor, means for holding the sections nested together on the arbor, and means to prevent relative rotation between the nested sections and the arbor, each of said sections comprising a flange plate, a drum secured thereto, interlocking means provided on the drum and complementary means on the flange plate designed for cooperation with the interlocking means on an adjacent section to prevent relative rotation between sections.

4. A coiling head, which comprises a rotatable arbor, a plurality of separate coiling sections removably mounted on the arbor, means for holding the sections nested together on the arbor, and means to prevent relative rotation between the nested sections and the arbor, each of said coiling sections comprising a flange plate having a plurality of slots therein, a drum secured thereto and a plurality of tongues provided on the drum designed to cooperate with the slots of an adjacent section to prevent relative rotation between sections.

5. A coiling head, which comprises an arbor, a plurality of separate coiling sections removably mounted on said arbor, interlocking means on the coiling sections, complementary means on the coiling sections designed for cooperation with the interlocking means of an adjacent section to prevent relative rotation therebetween, latching means provided for holding the sections nested together on the arbor, means for preventing relative rotation between the nested coiling sections and the arbor, and clamping means actuated by the latching means for grounding conductors.

6. A coiling head, which comprises an arbor, a plurality of separate coiling sections removably mounted on said arbor, interlocking means on the coiling sections, complementary means on the coiling sections designed for cooperation with the interlocking means of an adjacent section to prevent relative rotation therebetween, latching means provided for holding the sections nested together on the arbor, means for preventing relative rotation between the nested coiling sections and the arbor, and clamping means comprising a support secured to the arbor, a stationary jaw mounted thereupon, a reciprocating jaw slidably engaged in said bracket for cooperation with said stationary jaw, and means actuated by the latching means to clamp a conductor therebetween.

7. A coiling head, which comprises an arbor, a plurality of separate intermediate coiling sections, an outer coiling section, means provided on all the sections designed for cooperation with portions of adjacent members of the coiling head to prevent relative rotation therebetween, latching means for urging the sections together and holding them on the arbor, and a clamping device comprising a support, a pair of relatively movable jaws having substantially flat cooperating surfaces and means operatively connected to the latching means for urging said jaws together with sufficient force to cause an insulating material surrounding conductors of a wire positioned therebetween to be forced aside, baring said conductors to allow the jaws to make a grounding contact therewith.

8. A coiling head, which comprises an arbor, a plurality of separate intermediate coiling sections, an outer coiling section, means provided on all the sections designed for cooperation with portions of adjacent members of the coiling head to prevent relative rotation therebetween, a latching means slidably mounted within the arbor, and clamping means comprising a support, a stationary jaw mounted on the support, a reciprocating jaw slidably engaged in said support, substantially flat surfaces on each of said jaws, and means connected to the latching means for actuating the reciprocating jaw upon movement of said latching means, said reciprocating jaw cooperating with said stationary jaw to cause the insulating material

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surrounding conductors placed therebetween to be forced aside, baring said conductors to allow the jaws to make a grounding contact.

9. A coiling head, which comprises an arbor of paramagnetic material, a plurality of intermediate coiling sections removably mounted on the arbor, an outer coiling section, means provided on all the sections designed for cooperation with portions of adjacent members of the coiling head to prevent relative rotation therebetween, a magnetically actuated latching means comprising a permanent magnet slidably mounted within the arbor so that magnetic flux may flow through the arbor when a magnetic circuit is completed, a ring of paramagnetic material secured to the end section, said ring forming a removable part of the magnetic circuit, means for completing a closed magnetic circuit to hold the ring in place, and means for breaking the magnetic circuit to allow the ring to be removed permitting disengagement of the outer coiling sections, and clamping means comprising a support, a pair of relatively movable jaws having substantially flat cooperating surfaces and means actuated by the latching means for moving said jaws together with sufficient force to cause an insulating material surrounding conductors of a wire positioned therebetween to be forced aside, baring said conductors to allow the jaws to make a grounding contact therewith.

10. A coiling head, which comprises an arbor, a plurality of separate coiling sections removably mounted on the arbor, means for holding the sections together on the arbor, each of said sections comprising a flange plate having a plurality of slots therein, a drum secured thereto, and a plurality of tongues provided on the drum

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designed to engage the sides of the slots of an adjacent section to prevent relative rotation between the sections, the radial clearance of engagement of said tongues in the slots being greater than any relative radial movement therebetween caused by radial deflections of the tongues.

11. A coiling head, which comprises an arbor, a plurality of individual coiling sections removably mounted on the arbor, each section having a plurality of slots formed therein, a member fixedly mounted on said arbor for rotation therewith and provided with a plurality of similarly disposed slots, projecting tongues provided on the coiling sections for interlocking cooperation with the slots in adjacent sections and the fixedly mounted member to prevent relative rotation between said sections and the arbor, and latching means comprising a tubular member secured to the end of said arbor and having a multiplicity of apertures spaced around the periphery thereof, a multiplicity of stops slidably retained in the apertures and wedging means slidably mounted within the tubular member for selectively wedging the stops into positions wherein portions of said stops protrude beyond the periphery of said tubular member and prevent the removal of the sections from the arbor.

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