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COIL WINDING MECHANISM

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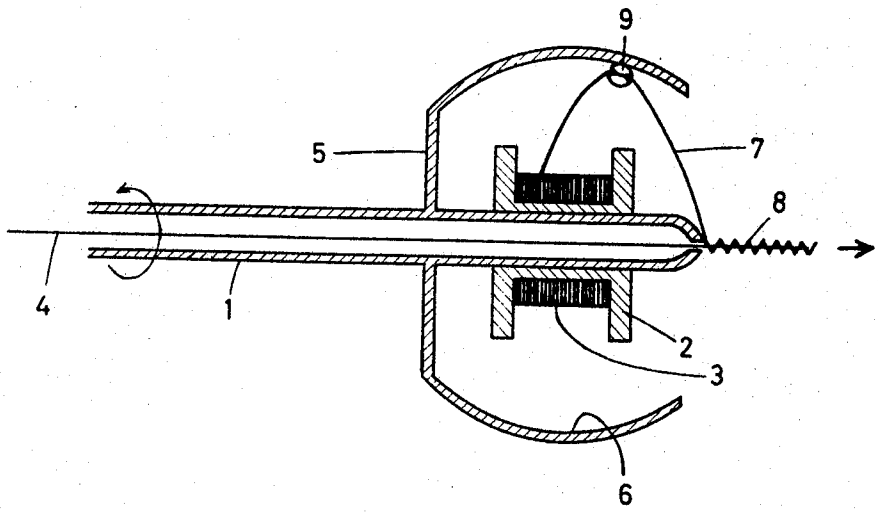


FIG. 1

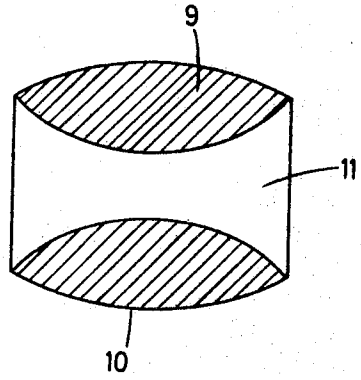


FIG. 2

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COIL WINDING MECHANISM

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ABSTRACT OF THE DISCLOSURE

Coil winding mechanism utilizing rotation of a supply reel fixed on a rotating spindle to produce centrifugal departure of wire from the reel in a loop to the longitudinally progressing mandrel or core, characterized by a loosely mounted floating bead on the wire in the loop thereof, the bead being propelled by centrifugal force to roll in contact against the inner surface of a barrel-shaped casing also mounted on and rotating with the spindle.

PROBLEM AND SOLUTION INVOLVED

Coil winding machines, such as used for producing coiled filaments for lamps of one sort or another inclusive of electronic tubes, have heretofore utilized rotating spindles through which a mandrel or core wire is fed longitudinally but non-rotatively, the filament wire being carried in bulk in a reel coaxially mounted with respect to the spindle and rotated therefrom with an intervening slippage clutch that permits but surpresses relative rotation. The filament wire is fed from the reel to a guide roller revolving with respect to the mandrel and with the filament wire passing from the roller to wrap around the mandrel. The highest speed heretofore permissively obtainable in such prior art machines without breakage of the filament wire, has been in the vicinity of six thousand revolutions per minute. Besides this relatively low speed of operation, the former machines include other disadvantages. For instance, due to the bearing clearance of the supply reel and to the fact that the suppression of the slippage clutch can be adjusted and measured only in static condition, and always of necessity introduces stress in the filament or coil wire with the stress varying as conditions change, a detrimental variation in the coil pitch results. Again, since the supply reel is rotated on its axis, it exercises a static inertia at the moment of starting, and introduces higher stress in the coil wire thereby constituting a limitation, due to breakage of the wire, of the permissive weight of the reel and its contents, and consequently reloading becomes a frequent necessity. Furthermore, since the reel with its slippage clutch requires a certain clearance from the spindle, unbalance accentuated thereby involves a restriction of admissible weight for the reel and the supply of coil wire. Finally, it may be added, that actuation of the guiding roller also presents a problem which the present invention overcomes by complete elimination thereof.

The present invention applies with respect to a coiling machine wherein the supply reel is made secure to the rotating spindle so as to rotate therewith without intervention of a slippage clutch. With such a construction, the spindle and reel may rotate at a high speed, for instance, to and above 10,000 r.p.m. and in so doing produces a high centrifugal force propelling the departing strand from the reel outwardly therefrom, and since that strand is winding upon the mandrel or core wire, it may have a slack which assumes the form of a loop from reel to mandrel. The outstanding feature of the present invention is directed to the control of that loop of the coil wire while both feeding longitudinally and while being actuated laterally from the reel by the centrifugal action. It is this feature which overcomes the need for the guiding roller of the prior art.

In the drawings:

FIG. 1 is an axial section of a coiling mechanism in accordance with the present invention; and

FIG. 2 is an axial section of a bead, enlarged from the showing thereof in FIG. 1, which receives the coiling wire loosely therethrough.

DETAIL DESCRIPTION

In the specific embodiment of the invention illustrated in said drawing, a hollow spindle **1** capable of operational speeds, say from 2,000 r.p.m. to above 10,000 r.p.m. about its longitudinal axis by suitable driving means, has a reel **2** applied thereto and fixed coaxially thereon near the forward end of the spindle. The reel therefore will be rotated simultaneously with and by the spindle without any lost motion existing between the two. The unwinding coil wire **3**, generally tungsten wire, with which the reel is loaded therefore is under no strain to obtain rotation of the reel. A non-rotating but forwardly advancing core wire or mandrel **4** passes through the hollow mandrel and out at the forward end thereof. As the reel and spindle rotate, the final convolution or strand of the coil wire leaving the reel, winds upon the mandrel. As a matter of information, it may be stated that in the manufacture of filament coils for electric lamps and the like of one type or another, it is customary to use molybdenum for the core wire or mandrel, and subsequently to chemically dispose of it to thereby obtain a coreless coil.

Also fixed with respect to the spindle and coaxial therewith, is a barrel-shaped casing **5** the inner concave surface **6** whereof encompasses the reel circumferentially with radial spacing therefrom. As shown, the axial length of the casing **5** is in excess of the axial width of the reel **2** so the concave surface **6** forms a ceiling or canopy projecting beyond the reel in an axial direction and at least as far as a radial plane at the forward end of the spindle. That end of the casing is open, thereby permitting the coil wire to pass forwardly outward to the mandrel. More specifically, the concave surface **6** here shown, is a section of a sphere the center whereof is at a point on the spindle axis inward from the forward end thereof at a location substantially midway of the axial length of the reel. Said casing **5**, or at least its inner concave surface **6** is a hard material, such as steel, aluminum, hard plastic of which Plexiglas is an example, alumina and so forth.

As the reel attains speed, centrifugal action tends to propel the wire thereon radially outwardly, and as the final strand or convolution has slack or a partial freedom to respond to the centrifugal force, which suffice at about 2,000 r.p.m., the slack wire, in its passage from reel to mandrel, forms as a loop **7** within the confinement of casing **5**. As a principal feature of the present invention, a floating bead **9** is provided on the looped portion of the coil wire through which said wire may loosely feed in transition from reel to mandrel. The bead, like the casing, is made of a suitably hard material such as steel, aluminum, etc., as above recited. Both the curvature of the casing where the bead engages and the centrifugal action tend to retain said bead at the zenith of the loop. The configuration of the circumferential outer surface **10** of the bead is convex or barrel-shape whereas the inner passage **11** has a venturi shape, that is, gradually constricting medially from larger open ends. The constriction is larger than the coil wire passing therethrough so as not to deter movement of the wire, and by virtue of the round character of the bead both inside and outside, it will roll readily both with respect to the wire and to the casing surface **5**. Just according to the consumption of coil wire, the bead makes a relatively slow orbital move-

ment relative to the winding head—which comprises the spindle, supply reel and casing—by rolling along the inner surface **6** of casing **5**, unwinding the coil wire from the supply reel as needed. Looping of the coil wire and use of the casing and bead entirely eliminates need for the heretofore used guide roller and its detrimental effects.

Owing to the fact that the supply reel **2** has no unbalance and concave surface **6** of casing **5** is at a considerable distance from the spindle **1**, supply reels of previously unusable large size may be used. The speed of rotation may be just the same as in prior art machines if so desired, so that the invention may be used on those machines without need for addition of expensive gearing. Thus it is possible with machine incorporating the present invention to manufacture coils for filaments for incandescent lamps for various lighting purposes and for fluorescent lamps, with employment of very large supply reels for the coil wire, as well as for other electronic tubes. Consequently the handling time for reloading the machine that idles the machine and stops production may be greatly reduced. Also, since the coil wire is not under any severe stresses even at higher speeds than heretofore possible to operate the prior art machines, the rate of production again may be very considerably increased. In this connection, it may be said that maximum speed usuable with prior are feeding mechanisms approximated 6,000 r.p.m., whereas the present invention permits much higher speeds of 10,000 r.p.m. and more, the rolling of the bead **9** within the casing **5** introducing negligible friction and wear at any convenient speed of operation.

I claim:

1. A coil winding mechanism comprising a winding head composed of a hollow rotatable spindle with a rotatable reel coaxial thereto and an annular casing encompassing the reel circumferentially, a mandrel wire passing through and out of the forward end of said spindle, the reel providing a supply of coil wire therefrom to the mandrel wire winding around said mandrel wire as said winding head rotates, said coil wire having slack in its passage from the reel to the mandrel wire, the slack forming a loop under centrifugal action, and a floating bead on the coil wire in said loop centrifugally engaging said casing in rolling contact therewith.

2. A coil winding mechanism in accordance with claim **1**, wherein said casing provides an inner concave surface against which said floating bead rolls.

3. A coil winding mechanism in accordance with claim **2**, wherein said bead has an exterior convex surface for engagement with and rolling against said concave surface of the casing.

4. A coil winding mechanism in accordance with claim **3**, wherein said inner surface of the casing and outer surface of the bead are barrel-shape.

5. A coil winding mechanism in accordance with claim **1**, wherein said casing rotates with the same speed of rotation as the spindle.

6. A coil winding machine in accordance with claim **5**, wherein said casing and spindle are connected firmly with each other.

7. A coil winding mechanism in accordance with claim **1**, wherein said bead has a passage therethrough for said coil wire, said passage being constricted intermediate of its ends.

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