March 19, 1935. A. RITTENHOUSE 1,995,227

COIL WINDING MACHINE

Filed Nov. 7, 1932

Fig. 1.

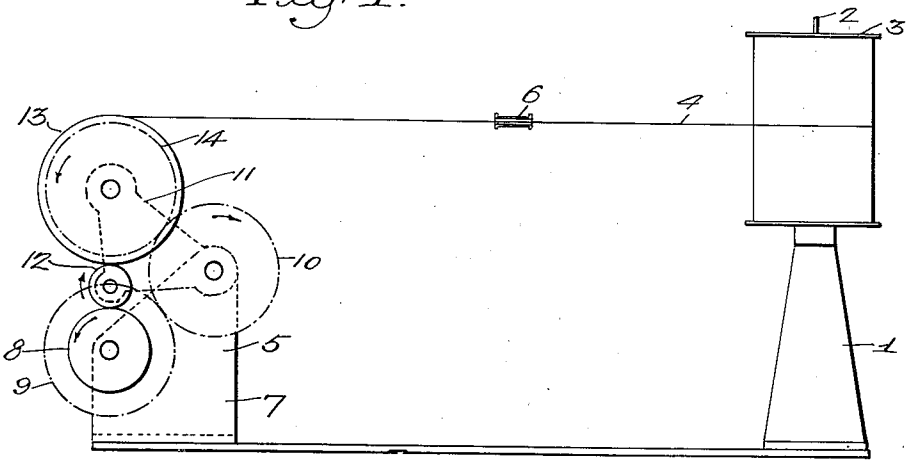


Fig. 2.

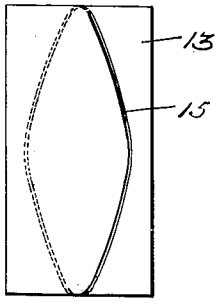
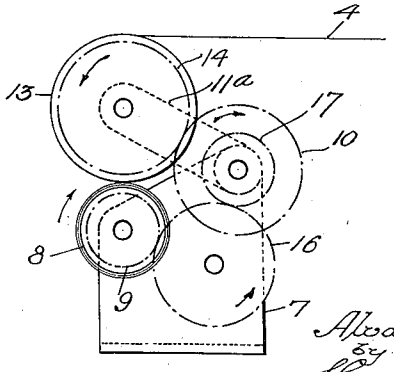


Fig. 3.



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Patented Mar. 19, 1935 1,995,227

UNITED STATES PATENT OFFICE

1,995,227

COIL WINDING MACHINE

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Application November 7, 1932, Serial No. 641,674

3 Claims. (Cl. 242—9)

This invention relates broadly to apparatus for winding material upon mandrels or bobbins and specifically to apparatus for winding a stand in one or more helical layers. While it is capable of general application and may be practiced in any instance where it is desired to wind spools or the like, the invention is directed specifically to the winding of electrical coils commonly used in radio apparatus and commonly known as "honeycomb" coils. Such a coil comprises a plurality of superposed helices, the turns of alternate helices being generally parallel, while the turns of adjacent helices lie at an angle to each other. In winding such a coil, the mandrel or bobbin upon which it is wound is rotated and the continuous strand is fed from a take-off roll. At the same time that the strand is fed to the bobbin, it is reciprocally moved axially of the bobbin so that the superposed helices above mentioned are wound.

An object of the invention is to provide novel apparatus for tightly winding a strand upon a bobbin or mandrel, which apparatus functions to gently but firmly position the individual turns of the strand upon the bobbin without subjecting the strand to excessive strain or tension.

A more specific object of the invention is to provide apparatus for winding "honeycomb" coils comprising novel means for feeding the insulated electrical conductor to the mandrel or bobbin while reciprocally moving the conductor axially of the bobbin to effect the desired helical winding. The means heretofore used for reciprocally moving the strand in order to effect the helical winding of a coil have been objectionable for various reasons. The present invention overcomes these objections.

The invention is illustrated on the accompanying drawing and described hereinafter for the purpose of disclosure with particular reference to the winding of "honeycomb" coils, but it will be understood that the invention is not thus limited as above stated.

In the drawing:

Fig. 1 is a diagrammatic elevational view of apparatus embodying the invention;

Fig. 2 is a detail view illustrating the cylindrical grooved cam member which constitutes an important feature of the invention; and

Fig. 3 is a diagrammatic elevational view of a portion of a modified form of the apparatus.

Referring to Fig. 1, a support 1 having a vertically extending spindle 2 rotatably carries a spool or bobbin 3 upon which the continuous insulated conductor 4 is wound. The spool or bobbin 3 constitutes a take-off roll and serves to feed the conductor to the coil winding assembly 5 through a suitable supporting guide 6. Any other means for supplying the strand may be used.

The assembly 5 comprises a support 7 which is adapted to removably and rotatably carry a mandrel or bobbin 8 upon which the coil is to be wound. In the specific apparatus illustrated, the mandrel support carries a gear 9 which meshes with a driving gear 10 journaled in support 7. The shaft of gear 10 pivotally carries a supporting member 11 which, in turn, rotatably carries a relatively small diameter roll 12 and a cylindrical cam member 13. Support 11, roll 12 and member 13 constitute a unitary assembly which is pivotally mounted about the shaft of gear 10. The small roll 12 is disposed immediately above the mandrel or bobbin 8 and engages the same. Cam member 13 is disposed above and engages roll 12. The pivotally mounted assembly is gravitationally urged downward so that constant pressure of the desired magnitude is exerted upon the mandrel or bobbin 8 by roll 12. A gear 14 is carried by cam member 13 and also meshes with gear 10 so as to be driven thereby.

Gear 10 may be rotated by means of any suitable source of power (not shown), such as a motor connected to the shaft of the gear or other actuating means. The direction of rotation of gear 10 is as indicated by the arrow. This gear serves to drive the driven gears and the elements to which they are attached in the directions of the arrows. Due to its frictional engagement with mandrel 8 and cam member 13, roll 12 is driven in the direction indicated. It will be seen then that mandrel 8 and cam member 13 are rotated in a counter-clockwise direction, while roll 12 is rotated in a clockwise direction. The conductor or strand 4, after passing through guide 6, passes circumferentially of cam member 13, between the cam member and roll 12, around the right-hand circumferential portion of roll 12, and between the roll and mandrel 8. By virtue of the reverse bend of the conductor in passing around roll 12 very tight winding of the coil is had and any tendency of the conductor to kink or take undesired paths is corrected. Thus, the conductor is gently but tightly wound upon the mandrel or bobbin. Because of the pivotal mounting or roll 12 and cam member 13, these elements move as a unit away from the mandrel as the coil builds up thereon.

In Fig. 2, the construction of cam member 13 is shown more clearly. This member is provided with a circumferential cam groove 15 which is

of such depth that it will just nicely receive the strand or conductor 4 and serve as a retaining guide for the conductor. The conductor approaches the cam member tangentially thereof, as shown clearly in Fig. 1, and enters the groove 15. Due to the cam formation of the groove, the conductor is, of course, moved transversely or axially of the mandrel or bobbin 8 at the same time that it is fed to the bobbin. The cam member 13, in the specific apparatus of Fig. 1, feeds the strand or conductor to roll 12, at the same time moving the conductor transversely as just noted. Cam 13 then constitutes the specific means for effecting reciprocal movement of the conductor axially of the mandrel or bobbin. By virtue of the fact that the cam member is located in close proximity to the bobbin, the reciprocal movement of the strand or conductor is effected gently and without any whipping action. The strand is thus laid upon the mandrel or bobbin gently but firmly in the desired reverse helical fashion without being subjected to excessive strain or tension. Devices used heretofore have been objectionable for the reason that the reciprocating means has caused whipping of the conductor or strand while it is being fed, thereby subjecting it to strain or tension oftimes sufficient to injure or break the conductor. This objectionable characteristic has also resulted in loosely wound coils. The present apparatus eliminates entirely these objections of prior devices.

It is to be understood that the invention is not limited to a specific arrangement of parts illustrated in Fig. 1. The gear arrangement of Fig. 1 is merely illustrated as a possible way in which the elements may be driven. Obviously, any other suitable arrangement may be used. The details of construction of cam member 13, as well as the relative speeds of the various parts are also subject to variation depending upon the requirements in any particular instance. It will be understood, however, that the axial dimension of the cam portion of member 13, as well as that of roll 12, will be substantially equal to the portion of the bobbin or mandrel 8 upon which the coil is being wound. This is essential in order that the conductor will be properly wound over desired length of the mandrel or bobbin and in order that it will be tightly pressed into engagement with the bobbin or the turns previously wound thereupon by roll 12.

As it is illustrated in Fig. 2, the groove of cam member 13 is formed to provide at least one complete reciprocating cycle during one revolution of the cam member. The construction of the groove may, however, be varied to provide any desired number of reciprocating cycles during a revolution of the cam member. This will necessarily depend upon the speed at which it is desired to rotate the cam member relative to the speed of the bobbin or mandrel. As the apparatus is illustrated in Fig. 1, the mandrel and cam member will rotate at substantially the same speed and the groove 14 is for this reason constructed as above noted.

No attempt has been made herein to illustrate the various refinements which may be incorporated in the apparatus disclosed. Such features as are well known in the art and are commonly provided in connection with apparatus of this nature may be incorporated in the apparatus, as will be readily understood. For example, automatic stopping means may be provided in order that a coil of a predetermined number of turns or layers will be automatically obtained. Also, mechanism for counting the number of turns as they are wound upon the coil may be utilized. Such devices are conventional and there is no need for further mention of them here.

Although the arrangement disclosed in Fig. 1 is preferred, roll 12 is really not essential in practicing the general principles of the invention. In Fig. 3, there is illustrated a modified form of apparatus in which this roll has been omitted. In this instance, the driving gear 10 is provided as before and serves to drive gear 14 in a counterclockwise direction, the cam member 13 being pivotally supported upon arm 11*a*. In this case, the conductor 4 passes about the left-hand circumferential portion of cam member 13, between the cam member and the mandrel or bobbin 8, and about the mandrel in a reverse fashion as compared to that of Fig. 1. It is necessary in this case to drive the mandrel or bobbin in a clockwise direction, and to this end, a gear 16 is driven by gear 17 carried upon the shaft of gear 10. Gear 15, in turn, drives the gear 9 carried by the mandrel or bobbin. In this case, the operation is substantially the same as before, but the cam member itself feeds the conductor directly to the mandrel or bobbin and gravitationally engages the bobbin. The conductor is thus gently but tightly wound upon the bobbin in the desired reverse helical fashion. Here again, various changes and modifications may be made in the arrangement shown. It is only necessary to drive the bobbin 8 mechanically, as the other elements may be frictionally driven by the bobbin and the material being wound upon it.

Element 12, here shown as a roller, may alternatively be a smooth pin.

Although two embodiments involving the teachings of the invention have been disclosed herein, it is evident that various other modifications are possible and may be utilized without departing from the spirit of the invention. The invention is, therefore, not to be limited by the specific disclosure but only as indicated by the scope of the appended claims.

I claim:

1. In radio coil-winding apparatus, means for winding a wire strand at relatively high speed upon a rotating bobbin or mandrel, comprising a roll of substantially smaller diameter than said bobbin adjacent the bobbin and engaging the same, a cylindrical cam member of substantially larger diameter than said roll, having a surface groove therein, disposed adjacent said roll and engaging the same, and means for feeding said strand to said cam member tangentially of the same at a point substantially distant from the point of engagement of said roll with said cam member, said strand passing circumferentially of said cam member, between said cam member and said roll, circumferentially of said roll, and between said roll and said bobbin, whereby said strand is guided at high speed by said cam member and a reverse bend of said strand is produced and it is laid on said bobbin tightly without kinking or whipping.

2. In radio coil-winding apparatus, means for winding a wire strand at relatively high speed upon a rotating bobbin or mandrel, comprising a roll of substantially smaller diameter than said bobbin adjacent the bobbin and engaging the same, a cylindrical cam member of substantially larger diameter than said roll, having a surface groove therein, disposed adjacent said roll and engaging the same at a point substantially dia-

metrically opposite the point of engagement of said roll with said bobbin, and means for feeding said strand to said cam member tangentially of the same at a point substantially diametrically opposite the point of engagement of said roll with said cam member, said strand passing semi-circumferentially of said cam member, between said cam member and said roll, semi-circumferentially of said roll, and between said roll and said bobbin, whereby said strand is guided at high speed by said cam member and two reverse bends of said strand are produced and it is laid on said bobbin tightly without kinking or whipping.

3. In radio coil-winding apparatus, means for winding a wire strand at relatively high speed upon a rotating bobbin or mandrel, comprising a gear associated with said bobbin, a driving gear meshing with said first gear, a support pivotally carried on the shaft of said driving gear, a roll of substantially smaller diameter than said bobbin carried by said support above the bobbin and gravitationally engaging the same, a cylindrical cam member of substantially larger diameter than said roll, having a surface groove therein, rotatably carried by said support above said roll and engaging the same at a point substantially diametrically opposite the point of engagement of said roll with said bobbin, a gear associated with said cam member and meshing with said driving gear, and means for feeding said strand to said cam member tangentially of the same at a point substantially diametrically opposite the point of engagement of said roll with said cam member, said strand passing semi-circumferentially of said cam member, between said cam member and said roll, semi-circumferentially of said roll, and between said roll and said bobbin, whereby said strand is guided at high speed by said cam member and two reverse bends of said strand are produced and it is laid on said bobbin tightly without kinking or whipping.

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