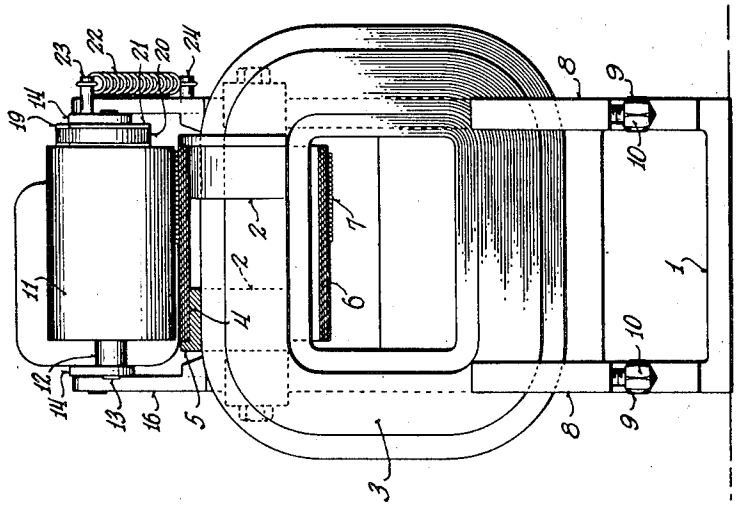
Jan. 21, 1947. R. D. NELSON 2,414,603

METHOD AND MACHINE FOR WINDING COILS

Filed Dec. 14, 1944 2 Sheets-Sheet 1

Fig. 2



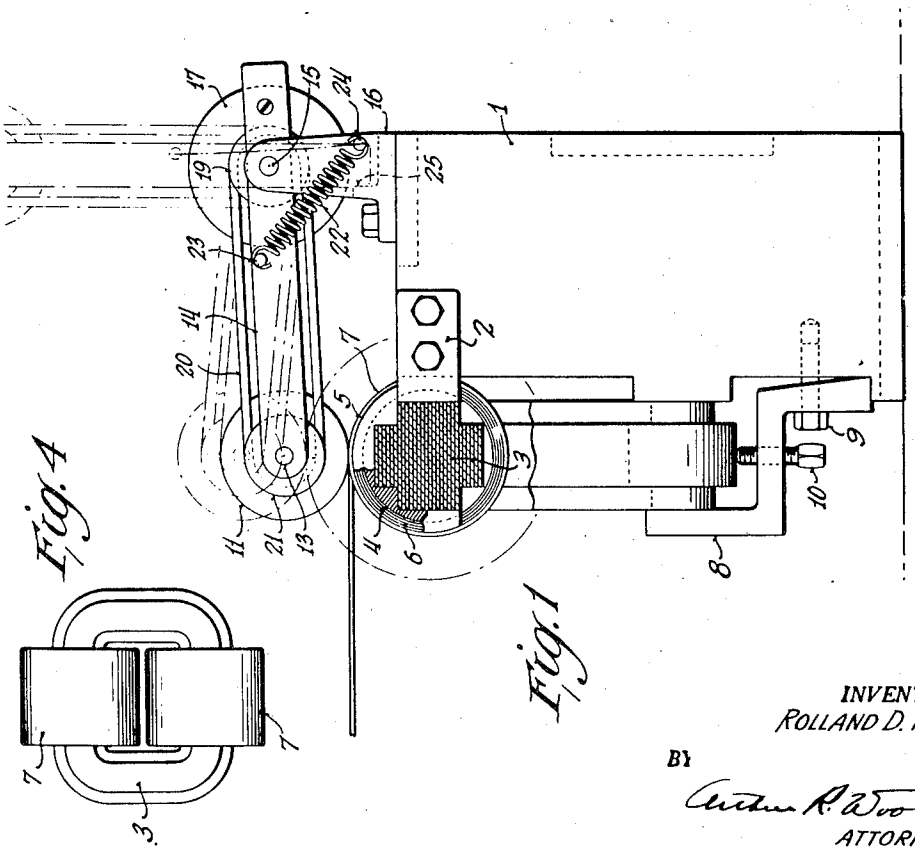


Fig. 4

Fig. 1

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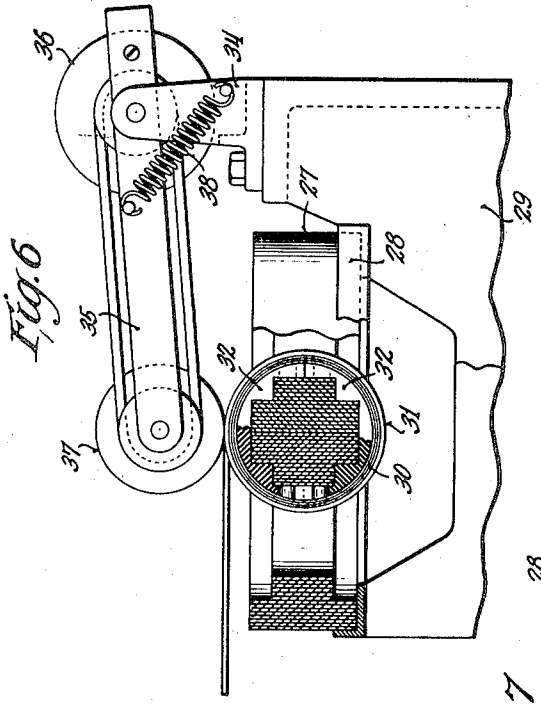

Fig. 6

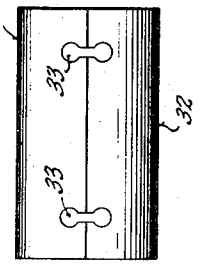

Fig. 8

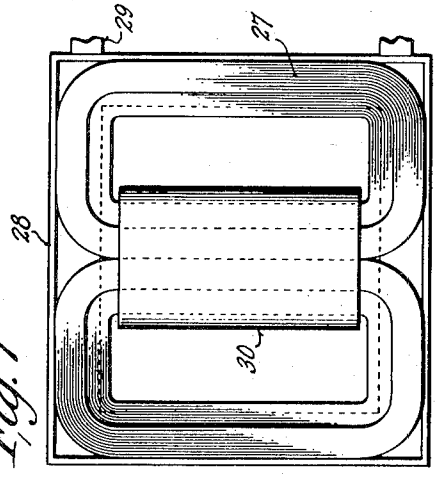

Fig. 7

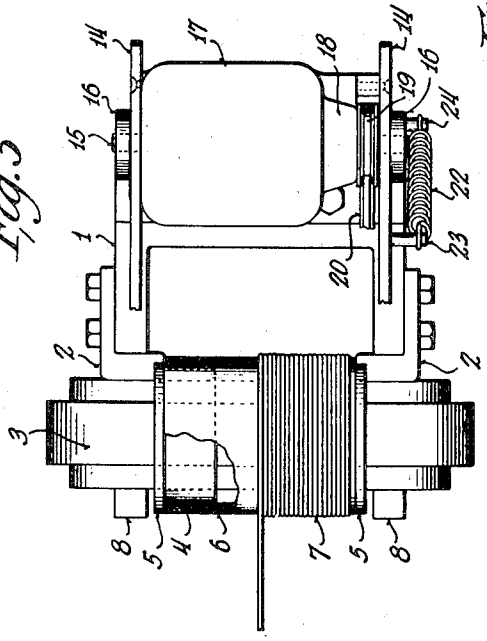

Fig. 3

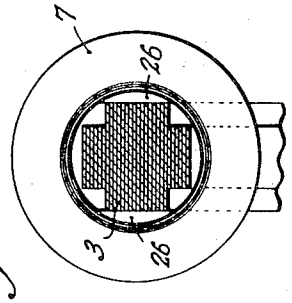

Fig. 5

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UNITED STATES PATENT OFFICE

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METHOD AND MACHINE FOR WINDING COILS

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Application December 14, 1944, Serial No. 568,079

6 Claims. (Cl. 242—4)

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This invention relates to a machine for winding coils and to a method of winding coils.

Objects of this invention are to provide a machine and a method for winding conducting coils on a magnetic core for an electromagnetic device such, for example, as a transformer, choke coil or the like, the invention contemplating particularly the winding of a conducting coil on a closed magnetic core after the core has been completely formed and annealed.

Further objects are to provide a machine for winding a conducting coil on a closed magnetic core, the machine being so constructed that the coil may be wound directly on a shell surrounding a portion of the core, the shell being devoid of end flanges, the machine having means whereby the coil is supported and whereby the coil is directly engaged by driving means for driving the coil by direct frictional engagement with the periphery of the coil.

In greater detail objects of this invention are to provide a winding machine for winding a coil on a magnetic core, such winding machine being provided with a driving roller which directly engages the coil itself and which is revolubly carried and also mounted for motion of translation, yielding means being provided for yieldingly holding the roller in contact with the coil, such yielding means and the translatory mounting means for the roller permitting the roller to move outwardly away from the coil as the coil builds up during winding.

Further objects are to provide a winding machine for winding a conducting coil on a core, the winding machine being so constructed that normally a roller is held in driving engagement directly with the coil, the machine being so constructed that it permits the rocking of the roller outwardly from the coil and being so arranged that means are provided for holding the roller out of contact with the coil to thus facilitate the positioning of the core and the shell in the machine and the removal of the core with the finished winding from the machine.

Further objects are to provide a method of winding a conducting coil on a magnetic core which method provides for the support of the shell on which the coil is wound and permits the direct driving of the coil itself by frictional engagement of a yielding roller with the peripheral portion of the coil thus permitting the coil to be directly driven.

Embodiments of this invention are shown in the accompanying drawings in which:

Figure 1 is a side elevation of one form of the machine, such view being partly broken away and partly in section.

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Figure 2 is an end view of the machine shown in Figure 1 with parts broken away and parts in section.

Figure 3 is a plan view of the machine shown in Figure 1 with parts broken away and parts in section.

Figure 4 is a view of the finished transformer.

Figure 5 is a fragmentary view showing the manner in which one of the coil assemblies is locked to the magnetic core.

Figure 6 is a fragmentary view of a further form of the machine.

Figure 7 is a plan view of the machine shown in Figure 6.

Figure 8 is a view of a moulded form or permanent sleeve used in connection with the machine shown in Figure 6.

Referring to the drawings, particularly Figures 1, 2, and 3, it will be seen that the machine comprises a body portion 1 to which are detachably attached a pair of bearing members 2. These bearing members approximately fit the cruciform closed magnetic core 3 which core is formed of wound magnetic ribbon. This is shown clearly in Figure 1 where a portion of one of the bearing members has been sectioned. The bearing members are each provided with partial cylindrical portions 4. These cylindrical portions consist of slightly more than a half cylinder as is obvious from an inspection of Figure 1. Each of the bearing members is provided with an end flange 5, see Figure 2. These partial cylindrical members 4 revolubly support an insulating sleeve 6 upon which the coil or winding 7 is adapted to be formed, the ends of the winding being tied in any suitable manner, for example, as shown in the Steinmayer et al. Patent No. 2,305,999 of December 22, 1942, for Method and machine for winding coils.

The cylindrical shell 6 may be formed in any suitable manner. For example, it may be formed by winding a heavy paper strip in place and gluing successive layers together or may be formed of sections of plastic or other material locked together in any suitable manner. The core 3 is held clamped to the body portion by means of the clamps 8 which are drawn into tight engagement with the core by means of the bolts 9, suitable screws or bolts 10 being provided for adjusting the height of the core so that the core can be accurately positioned at the correct place as indicated in Figure 1.

The means for rotating the winding 7 and

shell 6 comprises a yielding roller 11 made of rubber or other suitable material. This roller is preferably provided with a bearing sleeve 12 which rotates freely upon a pin or shaft 13. The shaft 13 is carried between the outer extremities of a pair of pivoted arms or levers 14 which are pivoted about the pins or stub shafts 15 carried by spaced brackets 16. The levers or rocking arms 14 are secured to the casing of a variable speed motor 17.

The motor is preferably provided with a speed reducing mechanism which may be built as a unitary part of the motor and may be located in the portion 18 thereof. The motor may be controlled by a rheostat, not shown, or in any of the usual ways. It is provided with a V pulley 19 which receives the V belt 20. The belt 20 passes over a V pulley 21 attached to the sleeve 12 of the roller 11. A tension spring 22 is secured to the pin 23 carried by one of the arms 14 and to a stationary pin 24 carried by one of the brackets 16. This tension spring normally urges the driving roller 11 into frictional and driving engagement with the outer periphery of the cylindrical conducting coil or winding 7. The spring yields as the winding builds up radially and the roller 11 therefore moves outwardly to accommodate this increase in radial depth. When the winding is completed the outer end is tied as previously described or otherwise secured. The arms 14 together with the roller 11 are rocked upwardly so that the pin 23 passes dead center, that is to say, passes to the right of the axis of the pins 15 as shown in the uppermost dot and dash position of the arms in Figure 1. The spring thus tends to hold the arms and roller in an elevated position. Further motion of the arms 14 in a clockwise direction is prevented by engagement of the projecting portion of the arms 14 with the lugs or webs 25 of the brackets 16.

The arrangement of the elements of the machine is such that there is no variation in the distance between the driving pulley 19 of the motor and the driven pulley 21 of the roller 11 no matter into what position the arms 14 are rocked. Further it will be seen that the roller 11 has both rotary and translatory motion for respectively driving the winding by direct frictional engagement with the periphery thereof and for accommodating the increase in radial depth of the winding as the coil builds up.

When one of the coil assemblies is completed on one section of the core the clamps 8 are loosened and the coil is turned end for end and the other winding is formed around the other section of the core so that the complete transformer as shown in Figure 4 has windings 7 on opposite legs of the core 3. The wire while the core is being wound is held under suitable tension in accordance with the usual practice.

It is to be understood the expression "winding" or the expression "coil" is to be interpreted as meaning any winding assembly whether it includes the primary and secondary as in a transformer or a single winding as a choke for instance.

When the coils 7 have been completed they are locked to the core 3 in any suitable manner as by means of wedges 26, see Figure 5.

If the transformer core is a shell type core, the machine, as shown in Figures 6 and 7, may be employed. The shell type core 27 of the transformer may be held in a rectangular box-like portion 28 formed rigidly with the body 29 of the machine. In this case the supporting means or

bearing members on which the shell 30 for the winding 31 is revolubly supported may be formed of two half sections of moulded insulating material. The bearing members are indicated by the reference character 32 in Figures 6 and 8. These half sections together form a smooth cylindrical member and may be locked together in any suitable manner as by means of the insertable locking keys 33, see Figure 8, such keys being formed of moulded plastic material. These moulded bearing members are so made that they accurately fit the core.

The machine shown in Figure 6 is provided with a pair of brackets 34 upon which the arms 35 are pivoted. The arms 35 are attached to the driving motor 36 and carry the resilient driving roller 37. A spring 38 is provided which functions in the same manner as the spring 22 of the first form of the invention. In this last disclosed form of the invention the roller 37 operates in exactly the same manner as the roller 11 hereinbefore described. Obviously if desired the core 27 may be clamped in place instead of being held as shown.

It is to be noted that the machine may be used to wind a conducting winding coil on any type of core whether the core is a single closed core construction or a shell type of core, the machine being equally applicable to either type of apparatus.

It will be seen that a novel form of coil winding machine has been provided by this invention of very simple construction and having a small number of parts.

Although this invention has been described in considerable detail it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. The method of winding a conducting coil on a magnetic core, said method comprising the steps of placing coil supporting means on a portion of the core, revolubly supporting a shell on said supporting means to thereby support said shell from said magnetic core, starting the winding around said shell, rotating the winding and shell by directly frictionally engaging and driving the winding at the periphery of the winding, and compensating for the radial increase in thickness of the winding as the coil builds up.

2. The method of winding a conducting coil on a magnetic core, said method comprising the steps of moulding a plastic supporting means about a part of said core, revolubly supporting a shell on said plastic supporting means, starting the winding around said shell, and rotating the winding and shell.

3. A machine for winding a conducting winding in the form of a cylindrical coil on a magnetic core comprising a pair of segmental bearing members, means for holding said bearing members in spaced relation with each bearing member partly encircling said core, said bearing members having partial cylindrical portions adapted to revolubly support a shell on which the winding is to be wound, and means having both translatory and rotary motion for directly frictionally engaging the periphery of the winding for directly driving said winding, the rotary motion being effective for rotating the winding and the translatory motion compensating for the increasing radial thickness of the winding as the coil builds up.

4. A machine for winding a conducting wind-

ing in the form of a cylindrical coil on a closed magnetic core comprising a pair of bearing members having partial cylindrical portions, means for holding said bearing members in spaced relation to each other and in close proximity to the core, the cylindrical portions of said bearing members being adapted to revolubly support a shell on which the coil is to be wound, a roller arranged to frictionally directly engage the periphery of the winding to rotate said winding, rocking means for supporting said roller and for allowing said roller to rotate and move outwardly with reference to said winding as the radial thickness of said winding increases, and power means for driving said roller.

5. A machine for winding a conducting winding in the form of a cylindrical coil on a closed magnetic core comprising a pair of bearing members having partial cylindrical portions, means for holding said bearing members in spaced relation to each other and in close proximity to the core, the cylindrical portions of said bearing members being adapted to revolubly support a shell on which the coil is to be wound, a roller arranged to frictionally directly engage the periphery of the winding to rotate said winding, rocking means for supporting said roller and for

allowing said roller to rotate and move outwardly with reference to said winding as the radial thickness of said winding increases, means for yieldingly holding said roller in contact with the periphery of said winding, and power means for driving said roller, said power means being mounted coaxially with the axis about which said rocking member is arranged to rock.

6. A machine for winding a conducting winding in the form of a cylindrical coil on a core having supporting means associated therewith with the supporting means arranged to revolubly support a shell on which the winding is to be wound, a roller adapted to directly frictionally engage the periphery of the winding for directly driving said winding, roller supporting means pivoted about an axis spaced from said roller and revolubly supporting said roller, said roller supporting means allowing said roller to move outwardly as the radial thickness of the winding increases, power means for driving said roller, and spring means normally urging said roller towards contact with said winding, said spring means being arranged to be rocked past dead center to hold the roller supporting means with the roller out of engagement with said winding.

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