Aug. 12, 1947. R. M. CONKLIN 2,425,511

TOROIDAL COIL WINDING MACHINE

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FIG. 1

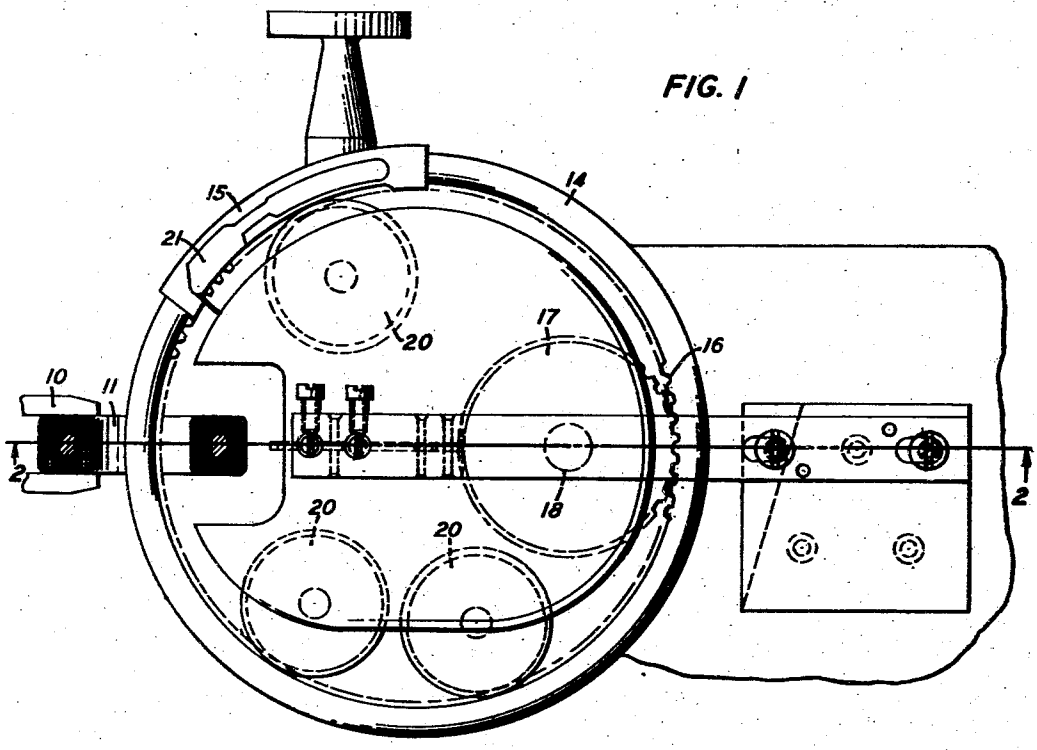
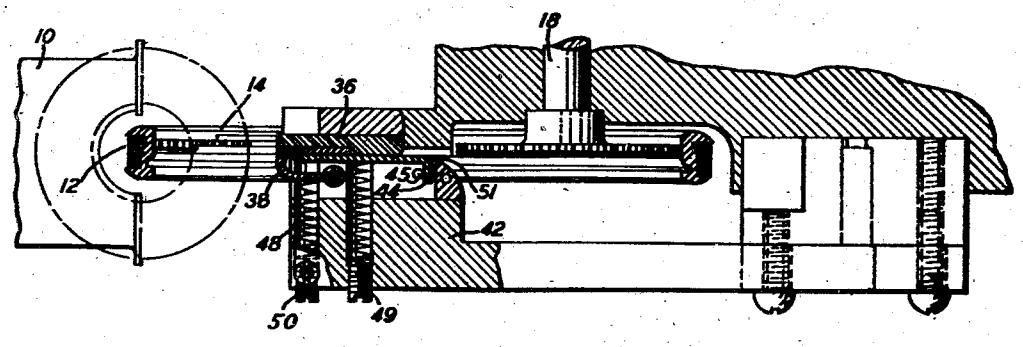


FIG. 2



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FIG. 3

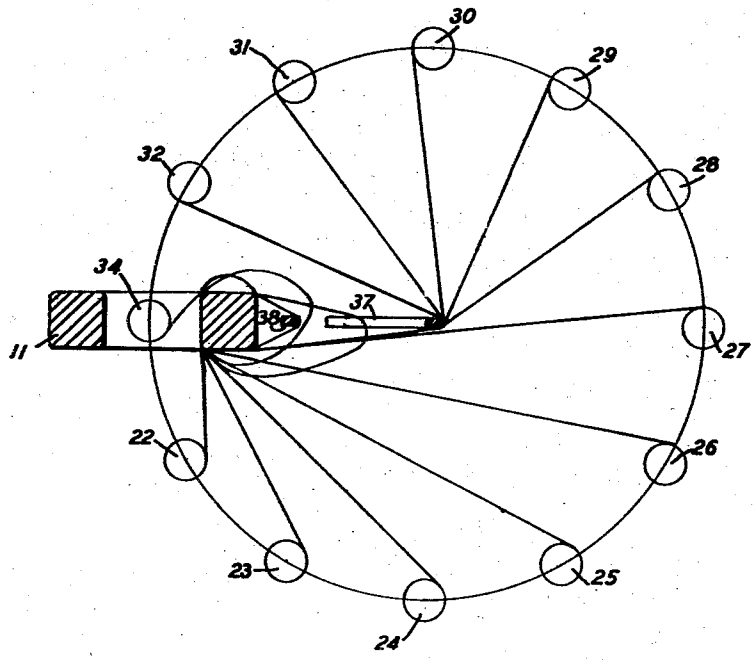
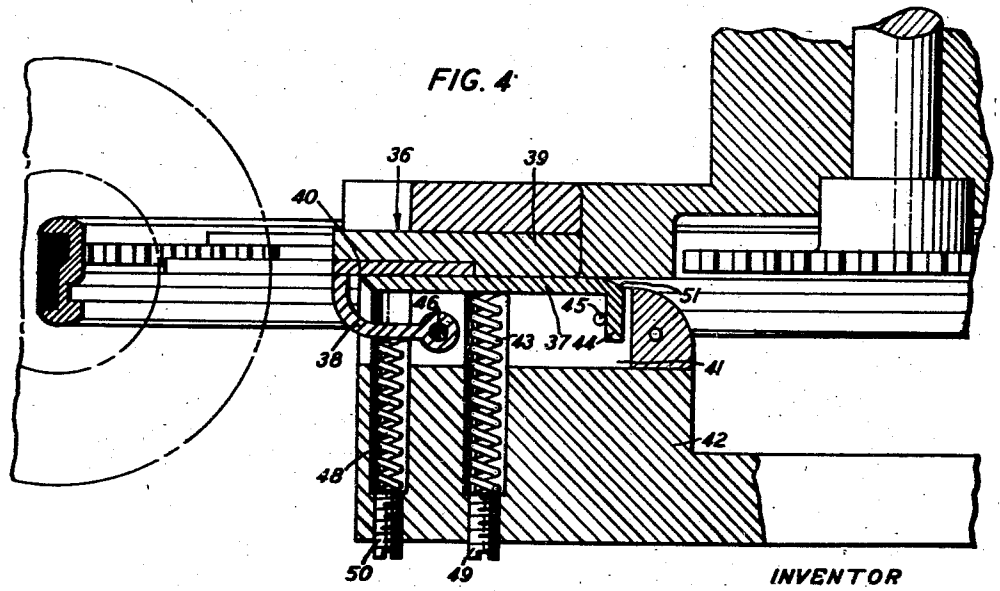


FIG. 4



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TOROIDAL COIL WINDING MACHINE

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Application August 22, 1945, Serial No. 611,935

3 Claims. (Cl. 242—4)

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This invention relates to winding machines, and more particularly to improvements in toroidal coil winding machines.

In winding toroidal coils, difficulties occasionally occur as a result of the forming of a loop in the wire during rotation of the winding ring in its circular path through the annular core upon which the wire is being wound. The loop, or length of wire which is to form the next turn upon the core, is withdrawn from the winding ring as the wire guide thereof leaves the core and travels toward the farthest position away from the core. One of the difficulties arising from the existence of the loop in the wire is that, during the travel of the wire guide from the farthest position toward the core, occasional breakage of the wire occurs due to the jerking of the wire in closing the loop about the core. Another difficulty lies in the overlaying of the turns of wire on the core as a result of the loop in the wire being uncontrolled and allowed to whip from one side to the other. An attempt was made to eliminate these difficulties by the provision of a spring loaded pressure pad functioning in cooperation with a stationary pad to control the loop of wire during its advancement of the core as disclosed in Patent 2,367,489, issued to A. J. Dowd, January 16, 1945. It has been found, however, in actual practice that a single set of pressure pads will control only about half of the wire loop and will not eliminate entirely the undesirable conditions which exist in the uncontrolled remaining portion of the loop.

An object of this invention is to provide a winding machine, particularly of the toroidal coil winding type wherein the wire forming each turn on the core is controlled to a point closely adjacent the core.

In the present invention, movable pressure pads are disposed at spaced positions relative to a fixed pad and closely adjacent a core upon which a wire is to be wound to control the wire in its advancement to the core, particularly the loop formed in the wire. The space between the pressure pads allows for the reduction in the size of the loop prior to the final releasing of the wire so that it may complete its turn on the core.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein:

Fig. 1 is a fragmentary side elevational view of a toroidal coil winding machine embodying the invention;

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Fig. 2 is a fragmentary sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a schematic illustration of the various positions of the wire withdrawn from the winding ring during the forming of one turn on the core; and

Fig. 4 is an enlarged fragmentary sectional view of the structure shown in Fig. 2.

To illustrate the invention, only those portions of the toroidal coil winding machine essential for this purpose have been shown in the drawing. In general, the machine includes a chuck or clamp 10 for supporting an annular core 11 upon which turns of wire 12 are to be formed. The chuck 10 is supported by suitable means (not shown) to rotate the core about its axis back and forth for approximately one-half revolution to cause distribution of the wire, first upon approximately one-half of the core and then upon the other half of the core. A supply of the wire 12 for one-half of the coil is wound in a reverse direction on a winding ring 14. The winding ring 14 is either split or provided with a removable section 15 so that the core may be positioned about the ring as illustrated in the drawings. The winding ring is provided with gear teeth 16 at its inner periphery for interengagement with a driving gear 17. The gear 17 is mounted upon a shaft 18 which is driven in reverse directions, one for the winding of the supply of the wire upon the ring, and the other for the winding of the wire upon the core. Rollers 20, rotatably mounted at suitably spaced positions have annular grooves in their peripheries to straddle the teeth 16 of the ring 14. The ring 14 or the segment 15 thereof is provided with suitable wire guiding means 21 to guide the wire as it pays off the ring and is advanced toward the core.

During the normal operation of the machine for winding the wire on the core, a length of wire sufficient for the forming of one turn on the core is withdrawn from the ring 14 during the movement of the ring with the guide 21 through positions 22 to 27, inclusive, as illustrated in Fig. 3. During the movement of the ring 14 with the guide 21 from the position 27 to the position 34, a loop is formed in the length of wire.

The primary object of this invention, as previously stated, is to control this loop and to direct it to the portion of the core where it is to be laid substantially parallel with the previous turn on the core. This is accomplished through the aid of a stationary pad 36 and companion pads 37 and 38. The pad 36 may be

formed of suitable materials, the main portion 39 being formed of a more wear-resisting material, such as steel, while the insert or other portion 40 may be formed of brass or other material which may provide a better gripping surface to cooperate with the movable pads 37 and 38. The pad 37 is supported in a slot 41 of a bracket 42 so as to be able to float therein under the control of its spring 43. The bracket 42 is mounted on the main frame of the machine at the rear of the ring 14, the portion in which the slot 41 is disposed being adjacent the center of the ring. A laterally extending portion 44 of the pad 37 engages a pin 45 which limits longitudinal movement of the pad, the pad, however, being free except under the force of the spring 43, to move away from the pad 36 a distance sufficient to allow for the movement of the wire between the pads. The pad 38 is pivotally supported at 46 in the groove 41 of the bracket 42. A spring 48 normally urges the free end of the pad 38 into engagement with the insert 40 of the pad 36 at a position spaced from the exit end of the pad 37 and closely adjacent the core. The force of the springs 43 and 48 may be varied by movement of adjusting screws 49 and 50.

During the operation of the winding machine, the central portion of the length of wire extending from the core 11 to the guide 21 at position 27 in Fig. 3, engages the entrance end 51 of the pressure pad 37. During the advancement of the ring 14 and guide 21, through positions 28 to 34, inclusive, the wire is pulled between the pressure pads 37 and 36. This pulling of the wire, which is in the form of a loop, does not disturb the wire which constitutes the lower half of the loop. That portion of the wire originally positioned between the pressure pad 37 and the pad 36 continues to move therebetween without advancing the wire to present any portion of the lower half of the loop between these pads. Therefore, if the wire should be allowed to pass directly upon the core from between the pressure pads 36 and 37, a loop of appreciable size would exist and could not be controlled against whipping from one side to the other, nor from being jerked onto the core. The space between the pressure pads 37 and 38 releases the loop so that it may be drawn tightly about the pressure pad 38. The loop is thus reduced to a size substantially close to the loop or turn it will form on the core before the wire is released to finally lay on the core. This is clearly illustrated in Fig. 3, wherein the loop of wire is reduced to substantially the size of the turn it will form on the core and is directed to the portion on the core where it is to lie. By so guiding the wire on the core, a greater number of turns of wire may be laid on the core in the same winding space allowed. This improved space factor results in wider inductance range and in higher quality factors which improve the performance of such coils for the particular apparatus for which they are to be used.

Although specific improvements of the invention have been shown and described, it will be understood that they are but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined by the appended claims.

What is claimed is:

1. In a toroidal coil winding machine, a winding ring, for a supply of wire, rotatable in a circular path through an annular core to wind turns of the wire on the core, a stationary pad extending inwardly of the winding ring from a position adjacent the core, an inner pressure pad having its entrance end for the wire positioned adjacent the center of the winding ring and its exit end disposed short of the end of the stationary pad adjacent the core, means to normally urge the inner pressure pad towards the stationary pad to cause the pads to grip and control movement of a loop of the wire moving toward the core, and an outer pressure pad normally engaging the stationary pad at the end thereof adjacent the core and spaced from the exit end of the inner pressure pad whereby the loop of wire will be held until it is reduced to substantially the size of the turn it will form on the core.

2. In a toroidal coil winding machine, a winding ring, for a supply of wire, rotatable in a circular path through an annular core to wind turns of the wire on the core, a stationary pad extending inwardly of the winding ring from a position adjacent the core, an inner pressure pad having its entrance end for the wire positioned adjacent the center of the winding ring and its exit end disposed short of the end of the stationary pad adjacent the core, means to normally urge the inner pressure pad toward the stationary pad to cause the pads to grip and control movement of a loop of the wire moving toward the core, an outer pressure pad spaced from the exit end of the inner pressure pad adjacent the outer end of the stationary pad, and means to cause the outer pressure pad to hold the wire against movement onto the core after it leaves the exit end of the inner pressure pad until the loop in the wire has been reduced to substantially the size of the turn it will form on the core.

3. In a toroidal coil winding machine, a winding ring, for a supply of wire, rotatable in a circular path through an annular core to wind turns of the wire on the core, a stationary pad extending inwardly of the winding ring from a position adjacent the core, an inner pressure pad having its entrance end for the wire positioned adjacent the center of the winding ring and its exit end disposed short of the end of the stationary pad adjacent the core, means to normally urge the inner pressure pad toward the stationary pad to cause the pads to grip and control movement of a loop of the wire moving toward the core, an outer pressure pad normally engaging the stationary pad at the end thereof adjacent the core and spaced from the exit end of the inner pressure pad whereby the loop of wire will be held until it is reduced to substantially the size of the turn it will form on the core, and means to vary the pressures of the inner and outer pressure pads on the stationary pad and the loop of wire when passing therebetween.

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