Sept. 29, 1953 F. B. TURNER 2,653,771

ELECTRIC COIL WINDING MACHINE

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FIG. 1.

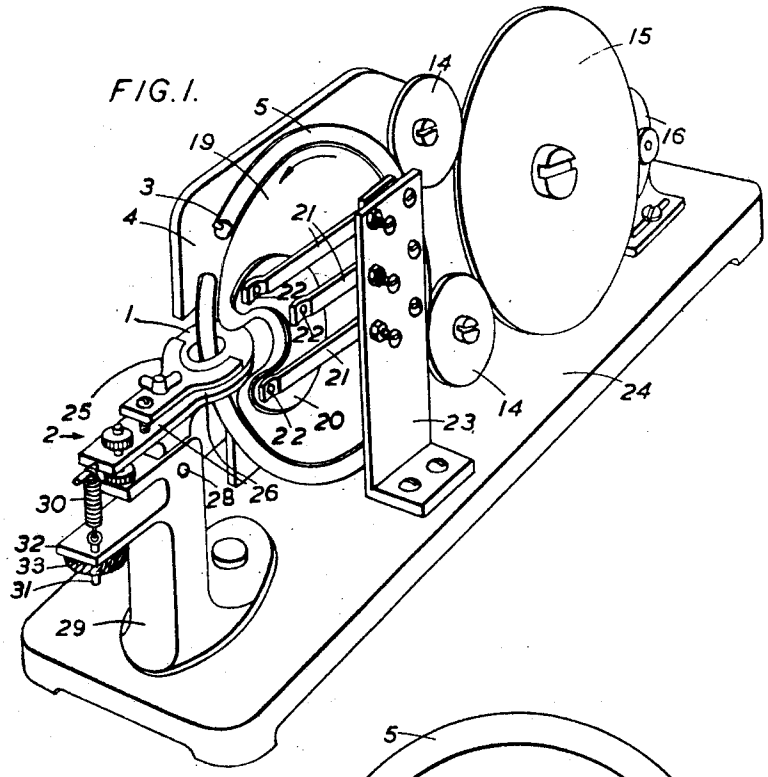


FIG. 2.

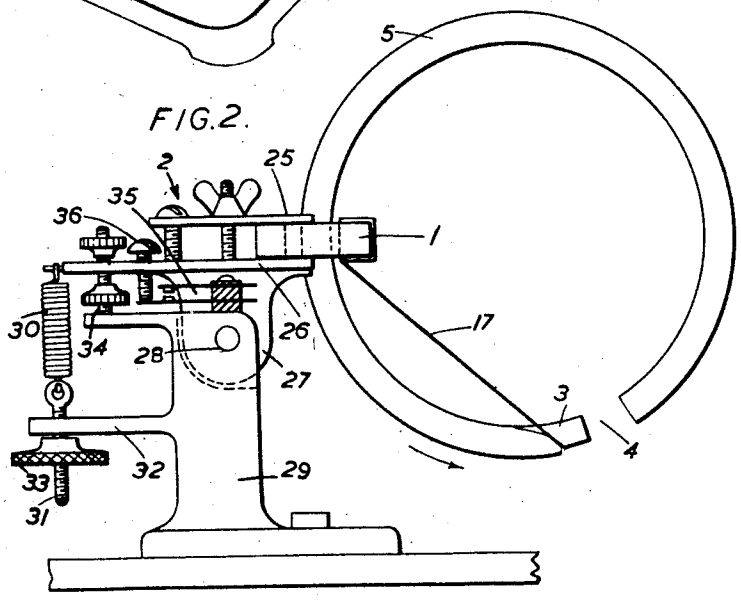


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FIG. 3.

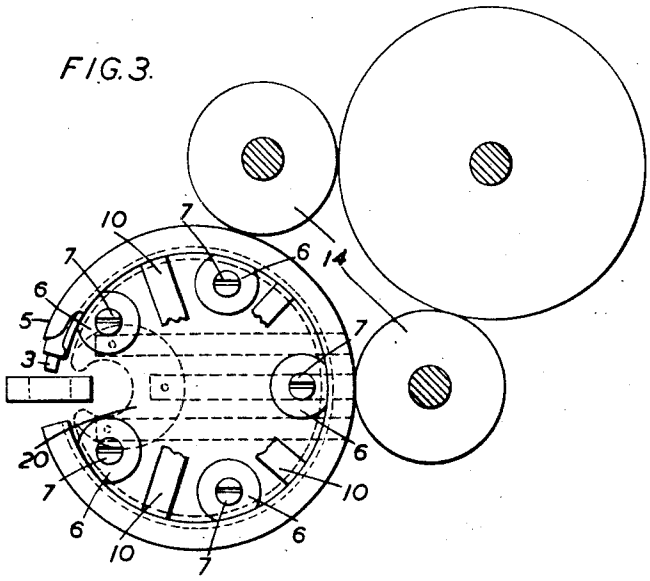
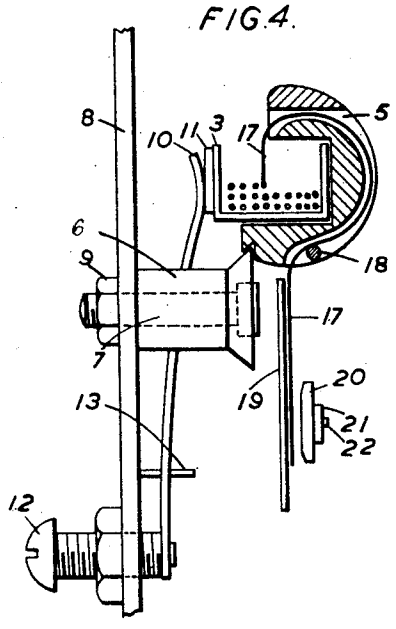



FIG. 4.

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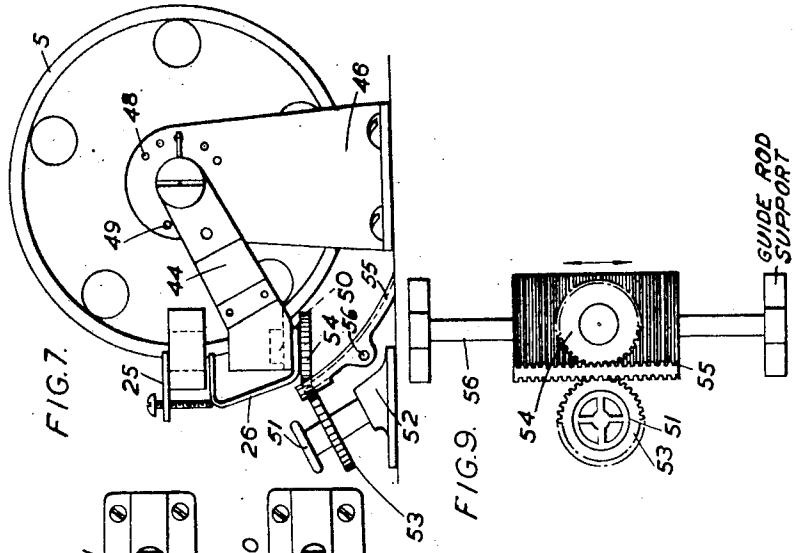


FIG. 7.

FIG. 9.

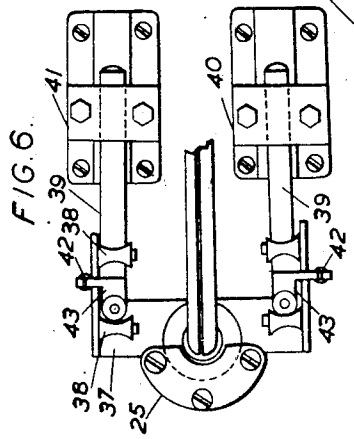

FIG. 6.

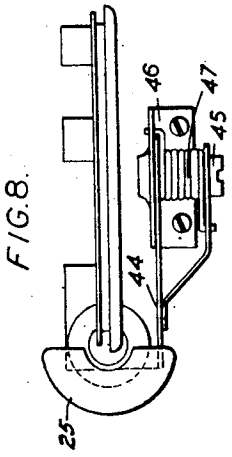

FIG. 8.

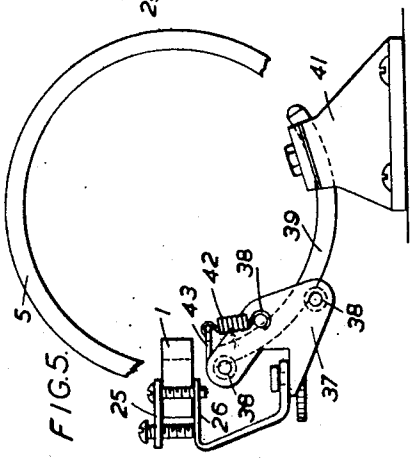

FIG. 5.

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## ELECTRIC COIL WINDING MACHINE

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Application May 8, 1948, Serial No. 25,865
In Great Britain June 13, 1947

3 Claims. (Cl. 242—4)

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This invention relates to coil winding machines and more particularly to machines for winding wire (or tape) around annular cores, hereafter called toroidal winding machines.

According to the present invention a toroidal winding machine is provided with a carrier for the core being wound so mounted as to allow it to move a limited extent to relieve the tension on the material being wound thereon.

The carrier may be so mounted as to be moved in one direction by the tension on the material being wound, spring or gravity means being provided for restoration to its original position when the tension slackens, or the carrier may be reciprocated by gearing in such manner as to reduce tension on the winding material almost to zero. The invention is particularly of value for winding cores with fine wires viz: from 40 S. W. G. to 46 S. W. G. since it avoids difficulties hitherto experienced of breaking of such wires during winding operations.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a general view of one form of toroidal winding machine according to the invention.

Fig. 2 is a view of the carrier for the core in the machine of Fig. 1.

Figs. 3 and 4 show details of the machine of Fig. 1.

Fig. 5 is a vertical elevation and Fig. 6 a plan of an alternative form of carrier for the core.

Figs. 7, 8 and 9 show yet another form of carrier for the core, Fig. 7 being an elevation, Fig. 8 a plan and Fig. 9 showing details of the gearing used to reciprocate the carrier.

Referring to the drawings and first to Figs. 1 to 4 thereof, a toroidal core 1 to be wound with wire is mounted in a carrier 2. A spool ring 3 in the form of an annulus with a gap 4 therein is carried within a guide ring 5 of similar shape, the spool ring 3 protruding from the guide ring 5 a little at one side of the gap 4. The spool ring 3 and guide ring 5 are shown in cross section in Fig. 4.

The guide ring 5 is rotatably supported upon five rollers on sleeves 6 which are journalled on spindles 7 fixed into the machine frame 8, held by nuts 9 (Fig. 4). The spool ring 3 is held within a recess in the guide ring 5 by means of a tension spider 10, a tension ring 11 being interposed between the spool ring 3 and the spider 10. The spider 10 is mounted in the frame 8 by means of a tension adjusting screw 12 (Fig. 4). A pin 13 is fixed to the frame 8 to prevent rotation of the spider 10.

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The guide ring 5, carrying with it the spool ring 3, is rotated by means of friction wheels 14, driven by a friction wheel 15, which in turn is driven by a motor 16. It is to be understood that toothed gearing may be used for the drive instead of friction gearing.

The wire 17, Fig. 4, being wound on the core 1 is drawn from the end of the spool ring 3 which is shown protruding slightly beyond the guide ring 5, passes over the latter and between the guide ring 5 and a guide rod 18. Thence it passes between a face plate 19 (Figs. 1 and 4) and a crescent shaped pressure pad 20 which is positioned partly round the core. Leaf springs 21 are located against the pad 20 by means of pins 22 on the latter. The springs 21 are fixed to a bracket 23 fastened to the base plate 24 of the machine. The springs 21 press the pad 20 against the face plate 19. More specifically, assuming that at the start of the operation the winding ring is in the position shown in Figure 1, and the wire is about to be passed through the core. The winding ring carrying the spool passes through the core as shown in Figure 2 and approximately at this point a first tension will be exerted on the core by the wire; this tension is relieved by the pivotal movement of the core. The winding ring continues in its rotational path and the wire being unwound passes between the pressure pad and plate. Thus, the ring will reach another position in which a second tension is exerted on the wire; this being when the wire leaves the pressure pad and plate, and sharply hits the core. However, this tension is minimized because the spool which is frictionally maintained will slightly slip relative to the winding ring.

The guide ring 5 gives or tends to give the spool ring 3 a forward motion in the required direction due to friction between spool ring 3 and guide ring 5. Thus the only force exerted on the winding wire 17 is that necessary to impart a momentary acceleration to the already moving spool ring 3, this acceleration being required once per turn.

During part of the rotation of the guide ring 5 more wire is pulled off the spool ring 3 than is needed to supply winding wire to the core and this excess is stored and guided by the pressure pad 20.

The carrier for the core consists of clamping jaws 25 and 26, Figs. 1 and 2. The lower jaw 26 is fixed to a body 27, Fig. 2, mounted on a pivot 28 journalled in a pillar 29. The carrier for the core 1 is thus able to follow in the path of the wire 17 to a limited extent, so that when the wire receives an initial shock when imparting accel-

eration to the spool ring 3 the shock is minimised as pointed out above. The extent to which the core carrier moves is limited by a spring 30 tensioned between the plate 26 and a threaded rod 31 screwing into a projection 32 on the pillar 29, a knurled nut 33 being provided to regulate the tension of the spring 30. An adjustable stop 34 is provided to limit the movement of the core carrier in one direction and if desired, a stop may be provided to limit the movement in the other direction.

Electrical contacts 35 are mounted on the pillar 29 and opened and closed at each reciprocation of the carrier 1 by means of a screw or pin 36 projecting from the lower jaw 26 of the clamp. These contacts may be used for any one or more of several different purposes, viz:

(*a*) to apply and release electrically operated brakes acting upon the spool ring 3 and/or the guide ring 5 during winding

(*b*) to control the operation of core traversing mechanism which could thus be arranged to operate at a chosen instant during the application of each turn. This is of value where accurate placing of turns is required.

(*c*) accurate counting of the number of turns of wire applied.

In the machine shown in Figs. 1 to 4 the traversing of the core is done by hand, but mechanism for doing this automatically is well known and it will be clear that the form of the invention shown in these figures could be applied to such a machine.

Figs. 5 and 6 show a form of carrier for the core mounted so as to move in a curved path. The core 1 is clamped between jaws 25 and 26 as in the preceding figures, but the lower jaw 26 is bent as shown and mounted on a pivot on a carriage 37 carrying rollers 38 running on curved tracks 39 mounted in brackets 40, 41 on the machine base. There are three rollers 38 running on each track 39 but in Fig. 6, one of the rollers on each track is omitted for the sake of clearness. It should also be noted that there is a slight out of scale difference between Figs. 5 and 6. The force of gravity on the carriage 37 is counteracted by springs 42. Each spring is attached at one end to the carriage 37 and at the other end to a bracket 43 fixed to one of the tracks 39.

Figs. 7 and 8 show another form of mounting for the carrier. Instead of running on rollers on a curved track as in Figures 5 and 6 the carrier is fixed to a bracket 44 which in turn is pivotably mounted through pivot 45 on another bracket 46 which is fixed to the base plate of the machine. The pivot 45 is arranged to be mounted along the axis of ring 5 so that the carrier (25 and 26) reciprocates in a path concentrically with the path of the ring 5, being pulled down by the material being wound on the core and being returned by the spring 47. The amount of tension of the spring 47 may be regulated by positioning one end in any selected hole 48 in bracket 46. Many other ways of adjusting this tension could be devised. The carrier is prevented from rising too high on its return by means of the stop 49 in the path of bracket 44. The carrier bracket 26 is fixed to the bracket 44 by means of a pivot 50 on which it can rotate. During the course of making a winding the core and carrier have to be rotated (traversed). It would be difficult to do this directly by hand since the carrier and core would be moving up and down at a fairly fast rate depending upon the speed of the machine. Moreover the movement of the carrier, necessary to minimise shock on the wire, would be impeded by its being held. So some kind of mechanism has to be devised to traverse the core about its axis without impeding its up and down motion, and at the same time allow the operator's hand to remain steady. One possible means of doing this is indicated in Fig. 7 and shown in plan in Fig. 9.



The hand wheel 51 joined to gear wheel 53 is rotatably mounted on bracket 52 fixed to the base of the machine. Teeth on the gear ring 53 mesh in with teeth on one side of the curved rack 55. Rotation right or left of the hand wheel will move the rack 55 backwards and forwards on the guide rod 56. On the side of the curved rack 55 remote from the handwheel are further teeth which mesh in with teeth on gear wheel 54 this said gear 54 being fixed to the jaw 26 of the core carrier. It will be seen that movement, of the handwheel moves the rack which in turn rotates the core carrier. But when the machine is in action the toothed rack has to be deep enough to prevent gear 54 coming out of mesh and also curved concentrically with ring 5 so that gear 54 may remain in mesh while moving up and down. This avoids the reciprocating motion being transmitted to the operator's hand.

What is claimed is:

1. A toroidal coil winding machine having a winding ring rotatable in a circular path through an annular core for winding turns of wire on to said core comprising a carrier supporting said core, a pivotal mounting for said carried for tilting said core in the direction of rotation of said winding ring, a resilient link member attached to said carried for normally holding said core in a predetermined position and permitting a limited pivotal movement of said core in response to the pull of the wire being wound thereon, a recess formed in said winding ring, and a spool containing said wire positioned in said recess in frictional sliding engagement with said ring, whereby the movement of the spool relative to said winding ring in response to the pull of wire further minimizes the tension in the wire.

2. A machine according to claim 1, further comprising a support for said carrier, a clamp on said carrier for engaging said core, said resilient link member being connected between said support and said carrier.

3. The machine according to claim 1 further comprising means for rotating said carrier to rotate the core in a plane normal to the plane of rotation of said winding ring.

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