May 3, 1938. E. F. PARKS 2,116,409

WINDING MACHINE

Filed Aug. 16, 1935 3 Sheets-Sheet 1

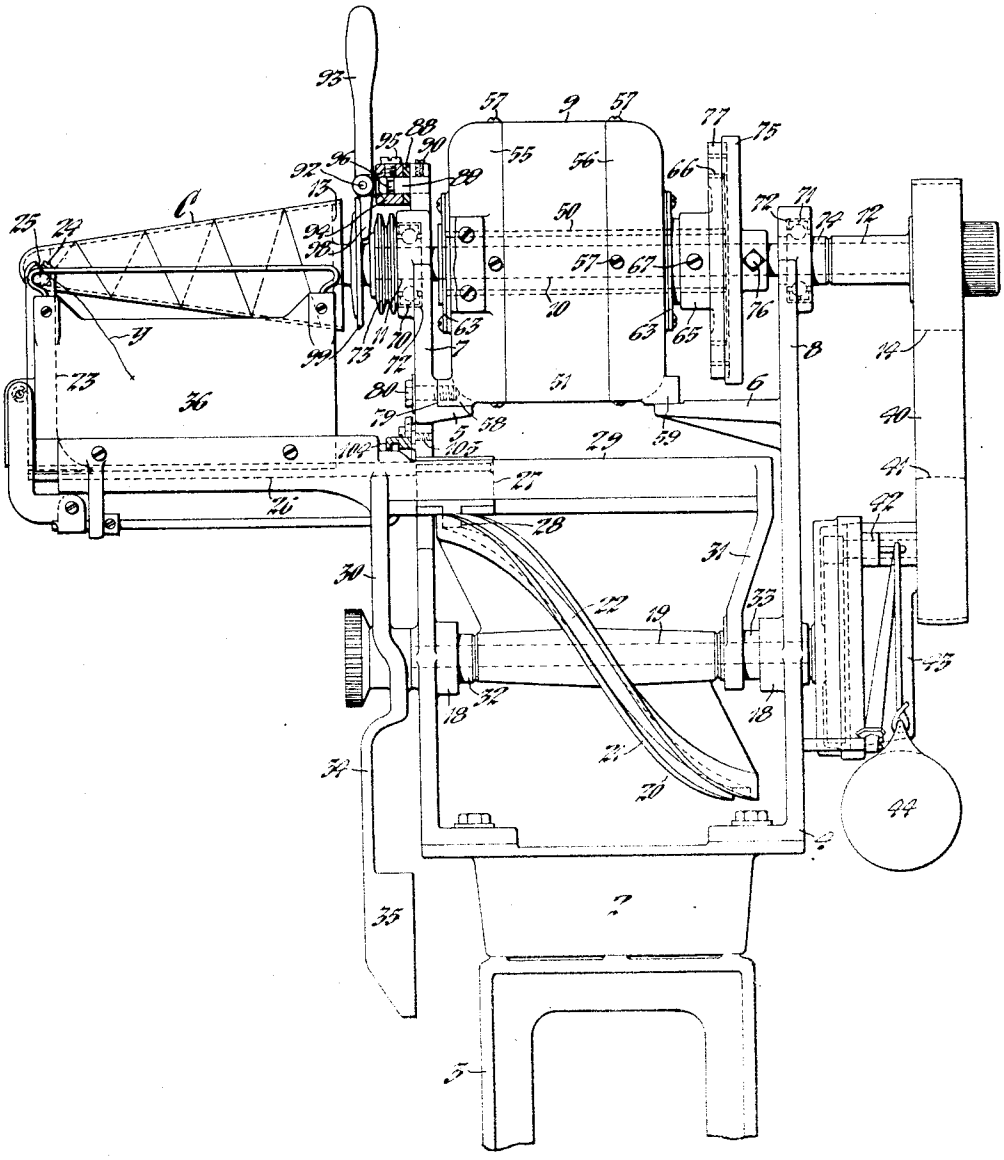

Fig. 1.

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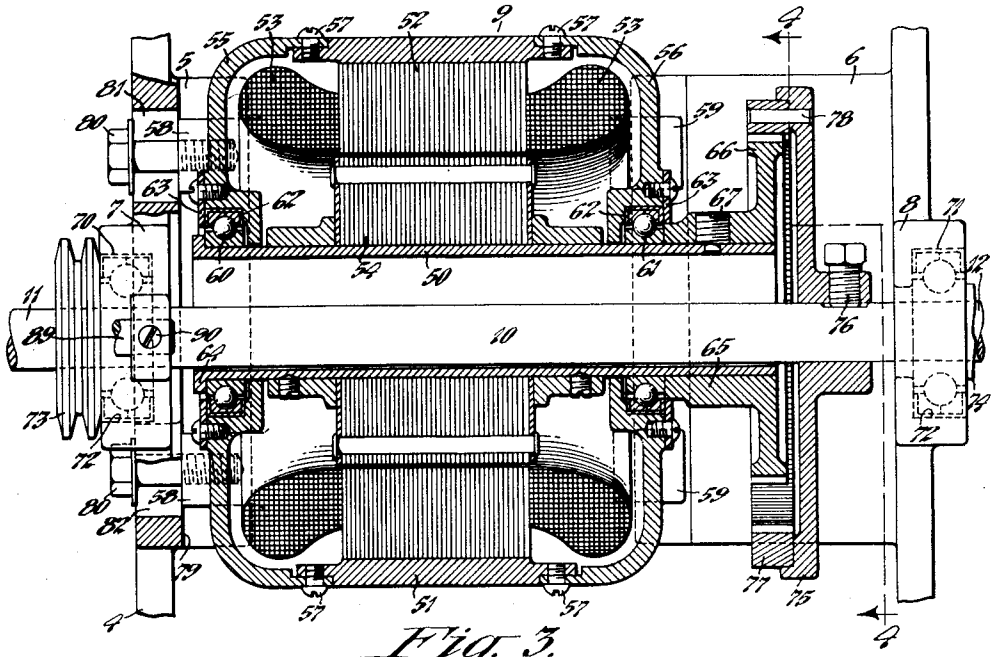

Fig. 3.

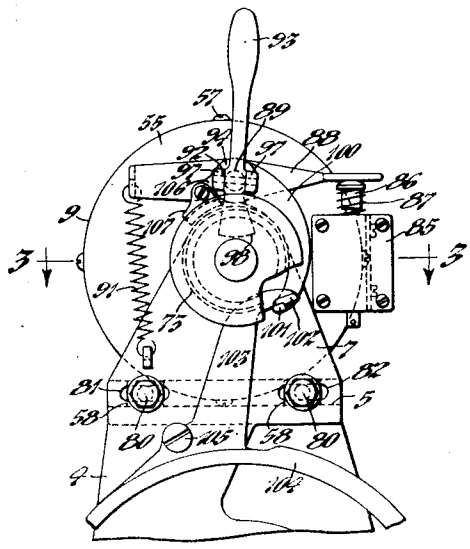

Fig. 2.

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WINDING MACHINE

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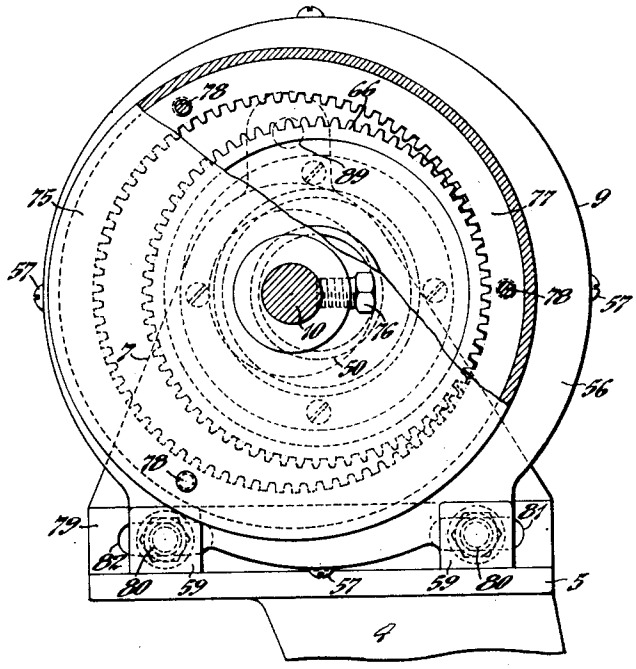

Fig. 4.

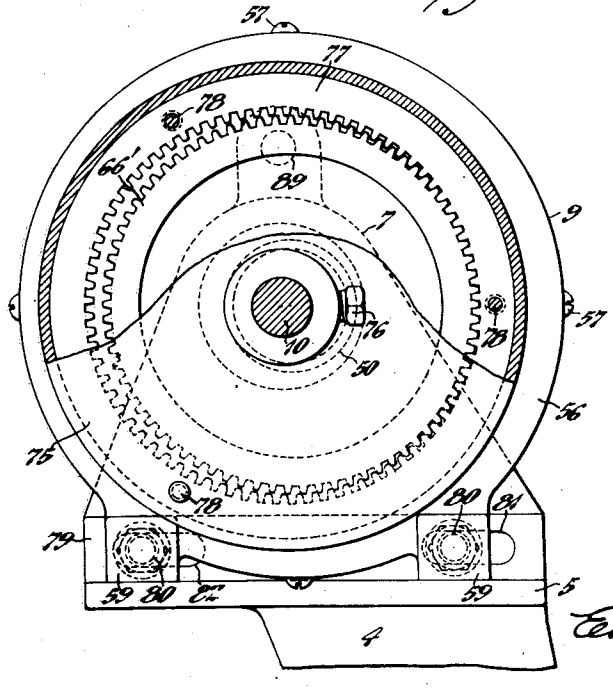

Fig. 5.

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UNITED STATES PATENT OFFICE

2,116,409

WINDING MACHINE

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Application August 16, 1935, Serial No. 36,597

4 Claims. (Cl. 242—18)

This invention relates to winding machines for winding thread, yarn, wire or other strand material into cops, cones, cheeses, coils or other types of packages and more particularly to an individual drive for each winding-spindle of a multiple spindle machine.

For convenience of description the material to be wound will hereinafter be referred to as "yarn" and the wound mass or body produced on the machine as a "package"; and it is to be understood that these terms are to be construed broadly as designating any kind of strand material, whether textile or otherwise, and any form of cop, cone, coil or package wound therefrom.

One object of the invention is to provide a drive of the type indicated wherein the winding-spindle extends through a hollow drive-shaft with gearing therebetween for providing a driving connection.

Another object of the invention is to provide an electric motor for each drive-shaft so that only those spindles of a multiple spindle machine need be driven that are performing a winding operation.

Another object of the invention is to provide a drive of the type indicated wherein the hollow drive-shaft is formed as the armature-shaft of an electric motor which is laterally adjustable with respect to the spindle to accommodate interchangeable gearing for altering the ratio of motor driving speed to driven spindle speed.

Another object of the invention is to provide an individual drive for each spindle of a winding machine which is of simple and rugged construction, efficient and reliable in operation and one which is particularly compact due to the arrangement of its parts, one within the other.

Further objects of the improvement are set forth in the following specification which describes a preferred form of construction of the invention, by way of example, as illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a side elevational view of one winding head of a multiple spindle machine showing the present improved spindle drive as applied thereto;

Fig. 2 is a front elevational view of the spindle and spindle drive illustrated in Fig. 1 showing the control mechanism therefor;

Fig. 3 is an enlarged sectional view taken on line 3—3 of Fig. 2 and showing the relationship of the elements forming the spindle drive;

Fig. 4 is a transverse sectional view taken on line 4—4 of Fig. 3 and showing the reduction gearing for operatively connecting the motor shaft with the spindle; and

Fig. 5 is a view similar to Fig. 4 showing the motor as moved transversely with respect to the spindle and a different reduction gearing substituted to provide a different speed ratio between the motor and spindle.

The present invention relates generally to an individual drive for each winding-spindle of a multiple spindle machine so that only those spindles which are performing a winding operation need be operated. The individual drive for each spindle comprises a hollow drive-shaft through which the spindle extends, and preferably constituting the armature-shaft of the motor. The hollow armature-shaft is rotatably mounted in the motor casing while the winding-spindle is journaled in a supporting frame independently of the motor, and the armature-shaft and spindle are drivingly connected, as by gearing or the like. The motor is adjustable on a supporting frame for lateral movement with respect to the spindle to provide for the substitution of interchangeable gearing whereby the speed ratio between the motor and winding-spindle may be altered.

Referring to Fig. 1 of the drawings, one winding head of a series is herein shown as mounted on a bed 2 supported at spaced intervals by suitable legs 3. The operating parts of each winding head are mounted in a box-like frame 4 having inwardly-directed brackets 5 and 6 forming a platform and upwardly-directed stanchions 7 and 8 at its sides. The drive constituting the subject-matter of the present invention includes an electric motor 9 mounted on the brackets 5 and 6 and a winding-spindle 10 journaled in the stanchions 7 and 8 in a manner as later more fully described. Suffice it to here state that the winding-spindle 10 extends through the motor 9 with its ends 11 and 12 overhanging the sides of the frame 4. A mandrel or cop-holder 13 is carried on the extended end 11 of the spindle 10 for mounting a suitable paper cop-tube C or other core on which the package is wound. Fast on the opposite extended end 12 is an expansible pulley 14 for driving the yarn-traversing mechanism later to be described.

Below the winding-spindle 10 the frame 4 carries bearings 18 in which a cam-shaft 19 is journaled. Fast on the cam-shaft 19 is a cam 20 having a cylindrical rim 21 in which a helical groove 22 is formed. The cam 20 is connected to reciprocate a thread-guide 23 of usual construction having a head 24 formed with a groove

or slot 25 through which the yarn *y* feeds to direct it onto the package being wound. The thread-guide 23 is carried at the end of a horizontal rod or traverse-bar 26 which is connected to a slide or crosshead 27 having a bowl or roller 28 engaging the helical groove 22 of the cam 20.

The thread-guide 23 and its reciprocable traverse-bar 26, together with the connected crosshead 27, are arranged to slide in suitable grooves formed in a traverse-frame 29 pivotally supported by the cam-shaft 19. As shown in Fig. 1, the traverse-frame 29 is provided with opposite legs 30 and 31 straddling the cam 20 and pivotally mounted on the axis of the cam-shaft 19. The legs 30 and 31 of the traverse-frame 29 have hubs at their ends surrounding bushings 32 and 33 in the bearings 18 of the frame 4 of the machine, which bushings serve as the journals for the cam-shaft 19. The outer leg 30 of the traverse-frame 29 is extended below its hub, preferably in a separate arm 34 attached thereto and terminating in a counterweight 35 which tends to maintain the frame in substantially erect position. Attached to the overhanging part of the traverse-frame 29 is a plate or back 36 against which the thread-guide 23 bears to direct it in a course parallel to the surface on which the winding is performed. In the present illustration of the machine the traverse-frame back 36 extends at an angle to the axis of the winding-spindle to direct the thread-guide in a course parallel to the side of the tapered holder or mandrel 13 which supports the tube C for winding a cone-shaped package.

The cam-shaft 19 is driven from the pulley 14 on the extended end 12 of the spindle 10 by a belt 40 passing over a pulley 41 at the end of a countershaft 42 journaled in a housing 43. Reduction gearing of usual construction is enclosed within the housing 43 for connecting the countershaft 42 with the cam-shaft 19 and the housing is rocked about the cam-shaft 19 by a weight 44 to tension the belt in the usual manner. The driving pulley 14 is radially adjustable to expand or contract its rim whereby to vary the speed ratio between the winding-spindle 10 and cam-shaft 19 to give the proper lead or gain to the thread-guide 23 to cause the yarn *y* to be laid in closely adjacent coils.

The present invention is directed particularly to an individual drive for the spindle 10 of the winding head including a hollow drive-shaft 50 through which the spindle extends. The drive-shaft 50 may take a variety of forms and may be operated from any suitable source of power but in the preferred embodiment of the invention as herein illustrated it is constituted as the armature-shaft of the electric motor 9, see Fig. 3. Preferably, the motor 9 is of the three-phase induction type to eliminate fire hazard and to provide for easy starting, but it may be of any other suitable type whether induction or repulsion, direct or alternating current, or single or multiple phase. The motor 9 has the usual hollow cylindrical casing 51 which carries the field magnets 52 and windings 53 for cooperation with an armature 54 fast on the shaft 50. End-bells 55 and 56, detachably connected to the opposite ends of the casing 51 by means of screws 57 or the like, have pairs of laterally-extending feet 58 and 59 for mounting the motor on the platform formed by the brackets 5 and 6 on the frame 4. The hollow cylindrical armature-shaft 50 is journaled in ball bearings 60 and 61 supported in suitable recesses 62 in the end-bells 55 and 56, the bearings being held in the recesses by annular plates 63 engaging the outer race of each bearing. The armature-shaft 50 is held from axial movement by a radial flange 64 at one end which engages the inner race of the bearing 60 and by the engagement of the end of the hub 65 of a spur-gear 66 with the inner race of the bearing 61 at the opposite end. The spur-gear 66 is detachably mounted on the extended end of the armature-shaft 50 and is rigidly fixed for rotation with the shaft by means of one or more set-screws 67 extending through the hub 65 and having reduced ends engaging suitable apertures in the shaft.

As shown most clearly in Fig. 3, the spindle 10 extends through the hollow armature-shaft 50 and is journaled in the stanchions 7 and 8 independently of the armature-shaft. Ball-bearings 70 and 71 for mounting the spindle 10 are carried in recessed pockets 72 at the upper end of the stanchions 7 and 8. A grooved brake-wheel 73 is mounted fast on the spindle 10 in abutting engagement with the inner race of the bearing 70 and the hub of the pulley 14, previously mentioned, engages the extended end 74 of the inner race of the bearing 71 to hold the spindle from axial movement. A disk 75 is mounted on the spindle 10 between the end of the armature-shaft 50 and the stanchion 8, being held fast for rotation with the spindle by a set-screw 76. An internal ring-gear 77 carried by the disk 75 in coaxial relation to the spindle 10 is rigidly fixed to the plate by means of pins 78. The internal ring-gear 77 fast on the spindle 10 has its teeth in mesh with the teeth of the spur-gear 66 carried at the end of the armature-shaft 50 to provide a driving connection between the armature-shaft and spindle. As herein illustrated, the spur-gear 66 and internal ring-gear 77 provide reduction gearing for driving the spindle 10 at a slower rotative speed than the armature-shaft 50. In some cases the arrangement of the gears may be reversed so that the internal ring-gear is carried by the armature-shaft 50 and the spur-gear is carried by the spindle 10 so that the spindle will be driven at a rotative speed greater than that of the armature-shaft.

The present invention also provides for substituting gears of different sizes for varying the ratio of motor speed to spindle winding speed. To this end the internal diameter of the hollow armature shaft 50 is considerably greater than the diameter of the spindle 10 so that the motor 9 may be moved laterally of the spindle to accommodate spur-gears of widely varying size to effect the desired changes in speed ratio. To provide for the lateral adjustment of the motor 9 to alter the distance between the centers of the armature-shaft 50 and spindle 10 the motor is adapted to slide as a unit on its platform formed by the brackets 5 and 6. As most clearly shown in Figs. 1 and 2, the bracket 5 has a vertical face 79 extending in a plane at right-angles to the horizontal seat or platform and the feet 58 on the end-bell 55 of the motor are correspondingly shaped to adapt them to bear against the vertical face. The motor 9 is clamped in adjusted position by means of bolts 80 extending through spaced slots 81 and 82 in the stanchion 7 and engaging tapped holes in the feet 58. The slots 81 and 82 are elongated laterally to provide for adjustment of the motor 9 and armature-shaft 50 with respect to the spindle 10 before the screws 80 are tightened to clamp the motor 9 in adjusted position. As shown in Fig. 4, the motor 9 is clamped in one extreme position of adjustment on the supporting brackets 5 and 6 and the

smallest of a series of interchangeable spur-gears 66 is mounted on the armature-shaft 50 to give the maximum variation in rotative speed of the armature-shaft 50 and winding-spindle 10. In Fig. 5, however, the motor casing 52 is shown as adjusted to an opposite extreme position where the largest spur-gear 66' of the series is shown mounted on the armature-shaft 50 to give the minimum speed variation. Spur-gears of any other size may be substituted for those shown and the invention also contemplates a concentric arrangement of the armature-shaft 50 and spindle 10 with any usual form of coupling for providing a direct drive. If desired, the speed of the motor 9 may be controlled through external resistances or the like in its electrical circuit.

As shown in Fig. 2, the motor circuit is controlled by a switch or circuit-breaker 85 mounted on the end-bell 55 of the motor in any suitable manner. The circuit-breaker 85 may be of any usual type for simultaneously opening or closing a three-phase power line. As herein illustrated the circuit-breaker is actuated by a plunger 86 normally held in raised position by a spring 87 to maintain the circuit open. The contacts of the circuit-breaker 85 are closed by the operation of an actuating lever 88, one arm of which engages the end of the plunger 86. The lever 88 is pivotally mounted on a pin 89 projecting from the side of the stanchion 7 on the frame 4, the pin being held in a bore therein by means of a set-screw 90 or the like. The lever 88 has its opposite arm connected to a spring 91 anchored at its opposite end to the frame 4. The lever 88 is adapted to be manually actuated by a handle or starting lever 93 carried by a hub 94 rotatably mounted on the pin 89 and suitably connected with the lever. The hub 94 of the handle 93 is held against axial movement on the pin 89 by means of a set-screw 95 having its end extending into a groove 96 in the pin. The handle 93 is pivoted on a pin 92 extending between spaced lugs 97 at the end of the hub 94 and is provided with an extension 98 for engaging a sliding sleeve 99 on the spindle 10. The actuating handle 93 is thus adapted for pivotal movement about the axis of the pin 89 to rock the lever 88 and actuate the circuit-breaker 85 and is also adapted for pivotal movement on the pin 92 to rock the extension 98 to operate the sliding sleeve 99 which expands and contracts the cop-tube holder 13 to grip or release the cop-tube C in a well-known manner. The circuit-breaker actuating lever 88 is locked in circuit-closing position by means of a curved arm 100 formed integrally with the hub 94 of the handle 93 and having a laterally-projecting detent-lug 101 at its end. The lug 101 is arranged to engage a correspondingly-shaped detent-lug 102 carried at the end of an extended arm 103 on a quadrant 104 pivotally mounted on a stud 105 screwed into the side of the frame 4. The hub 94 of the actuating handle 93 is formed with an arm 106 which carries a pivotally-mounted brake-shoe 107 for cooperation with the brake-wheel 73 when the handle is rocked to open the circuit to the motor. The quadrant 104 which normally holds the handle 93 latched is adapted to be rocked about its pivot in a counterclockwise direction as viewed in Fig. 2 when the package attains a predetermined size or when the yarn breaks; suitable stopping mechanism common to machines of the present type, but not herein shown, being provided for moving the quadrant 104 to release the detent means. The rocking of the quadrant 104 releases the curved arm 100 so that the spring 91 will rock the lever 88 to release the circuit-breaker plunger 86 and simultaneously apply the brake-shoe 107 to the brake-wheel 73. Having now described the invention its method of operation will next be explained.

To prepare the machine for a winding operation a suitable spur-gear 66 is mounted on the end of the armature-shaft 50 to mesh with the ring-gear 77 to give the desired ratio of motor speed to spindle speed. The gear-disk 75 may be removed from the spindle 10 and the latter withdrawn to the left as viewed in Fig. 1, to a sufficient extent to permit the spur-gear 66 to be applied to the armature-shaft 50. The spindle 10 is then replaced in the bearing 71 in the stanchion 8 after the disk 75 carrying the ring-gear 77 has been relocated thereon. The driving pulley 14 is then mounted on the extended end 12 of the spindle 10 with its hub engaging the inner race of the bearing 71 to coact with the brake-wheel 73 to hold the spindle against axial movement. The disk 75 is secured in place on the spindle 10 by tightening the set-screw 76, and the driving belt 40 for the gainer mechanism is then applied to the driving pulley 14 and the driven pulley 41.

The motor 9 is adjusted on its supporting platform formed by the brackets 5 and 6 by moving it laterally with respect to the spindle 10 until the teeth of the spur-gear 66 are properly meshed with the teeth of the internal ring-gear 77. After the gears are properly meshed the bolts 80 are tightened to clamp the motor casing 51 in adjusted position on the main frame 4.

The winding head is then ready for a winding operation and a suitable cop-tube C is applied to the holder 13 carried by the overhanging forward end 11 of the spindle 10. The end of the yarn y to be wound is drawn up from a suitable source of supply, passed through the slot or groove 25 in the thread-guide 23 and attached to the cop-tube C, it being understood that the yarn passes through a suitable tensioning device and across a drop-wire or the like for the stopping mechanism, not herein shown. The actuating handle 93 is rocked in a clockwise direction, as viewed in Fig. 2, about the pivot-pin 89 to cause the end of the actuating lever 88 to depress the plunger 86 of the circuit-breaker 85 against the action of the springs 87 and 91. This movement of the handle 93 causes the connected curved arm 100 to be rocked to engage the lug 101 at its end with the detent-lug 102 on the extended arm 103 of the quadrant 104. The engagement of the detent-lugs 101 and 102 locks the actuating lever 88 in position to hold the circuit-breaker 85 with the electrical contacts closed.

With the contacts of the circuit-breaker 85 closed the motor windings 53 are energized from a suitable source of current, not herein shown, to cause rotation of the armature 54 and its shaft 50. The intermeshing engagement of the spur-gear 66 on the armature-shaft 50 with the internal ring-gear 77 on the spindle 10 causes the spindle to be driven at a reduced rate of speed in accordance with the selection of the gears. The rotation of the spindle 10 causes the yarn to be wound onto the cop-tube C and the reciprocation of the thread-guide 23 by the cam 20 disposes the coils of winding in regular order to build up a package of overlying layers. The winding continues until a package of predetermined size has been formed or breakage or exhaustion of the yarn occurs which causes the quadrant 104 to be rocked about its pivot 105; for exam-

ple, by means such as shown in U. S. Letters Patent No. 1,799,153 dated April 7, 1931. The lug 102 on the arm 103 of the quadrant 104 is thus disengaged from the lug 101 to release the curved arm 100. The spring 91 then acts upon the lever 88 to rock it to a position which permits the spring 87 to raise the circuit-breaker plunger 86 to open the circuit. The broken ends of the thread are united or in other cases the package is doffed by rocking the actuating handle 93 to release the cop-tube C from the mandrel or holder 13. Another cop-tube is then applied on the holder if necessary, the yarn attached thereto and the circuit-breaker 85 again closed by rocking the handle 93 in a clockwise direction as viewed in Fig. 2 to start another winding operation.

When it is desired to change the speed ratio between the driving motor 9 and the winding-spindle 10 the spindle is withdrawn, a different size of spur-gear 66 is substituted and the parts reassembled in the manner previously described. The motor 9 is then adjusted transversely with respect to the spindle 10 to mesh the spur-gear 66 with the internal ring-gear 77 after which the screws 80 are tightened to clamp the motor to the frame 4. It will be understood that the housing 43 enclosing the reduction gearing for the gainer mechanism and supporting the driven pulley 41 is movable about the cam-shaft 19 to compensate for the lateral movement of the spindle 10.

It will be observed from the foregoing that the present invention provides an individual motor drive for each spindle of a multiple spindle winding machine in which the elements of the drive are positioned one within another to provide a simple and particularly compact arrangement. It will further be observed that the improved structure provides for adjustment of the motor with respect to the winding-spindle to accommodate interchangeable gearing whereby to provide for minute changes in the speed ratio between the driving motor and the winding-spindle. It will also be observed that the arrangement of the parts of the driving mechanism is such as to adapt it for use with the usual control and stopping mechanism heretofore used.

While I have herein described and illustrated one preferred embodiment of the invention, it is to be understood that various modifications may be made in the structure and arrangement of the parts without departing from the spirit or scope of the invention. Therefore, without limiting myself in this respect, I claim:

1. In a winding machine, a frame, an electric motor mounted on the frame and having a hollow shaft, a spindle extending longitudinally through the hollow motor-shaft and journaled in bearings on the frame, reduction gearing operatively connecting the hollow shaft and spindle, package-supporting means mounted on one end of the spindle, traversing means associated with said package-supporting means to guide yarn onto the package, a second shaft journaled on said frame and connected to operate the traversing means, and means operatively connecting the spindle and second shaft, said motor being adjustable on the frame with respect to said spindle whereby to permit changing said gearing to vary the ratio of spindle speed to motor speed.

2. In a winding machine, a frame having a platform thereon, an electric motor adjustably mounted on said platform and having a hollow shaft, a spindle of less diameter than the hollow shaft extending longitudinally therethrough and journaled in fixed bearings on the frame, reduction gearing connecting the hollow motor-shaft and spindle, said spindle extending beyond its bearings on the frame, package-supporting means mounted on one end of the spindle, traversing means associated with said package-supporting means to guide yarn onto the package, a countershaft journaled on the frame, a cam on said countershaft connected to operate the traversing means, and means for operatively connecting the spindle with the countershaft, said motor being adjustable on the platform with respect to the spindle whereby to permit changing the gearing to vary the ratio of spindle speed to motor speed.

3. In a winding machine, a frame, an electric motor mounted on the frame and having a hollow shaft, a spindle extending longitudinally through the hollow motor-shaft and journaled in bearings on the frame, reduction gearing operatively connecting the hollow shaft and spindle comprising a spur gear and an internal ring gear, package-supporting means mounted on one end of the spindle, traversing mechanism associated with the package-supporting means to guide yarn onto the package, a cam-shaft journaled on the frame, a cam on said cam-shaft for operating the traversing mechanism, and means operatively connecting the spindle and cam-shaft, said spindle being of less diameter than the hollow motor-shaft and said motor being adjustable on the frame whereby to permit changing the gearing to vary the ratio of spindle speed to motor speed.

4. In a winding machine, a frame having a platform thereon, an electric motor mounted on the platform and having a hollow shaft, a spindle extending longitudinally through the hollow motor-shaft and journaled in fixed bearings on the frame, reduction gearing for operatively connecting the spindle and motor-shaft comprising a spur gear and an internal ring gear, package-supporting means mounted on one end of the spindle, a cam-shaft journaled in the frame, a swinging traverse-frame mounted on said cam-shaft, traversing mechanism on said swinging frame associated with the package-supporting means to guide yarn onto the package, a cam on the cam-shaft connected to operate the traversing mechanism, and means operatively connecting the spindle and cam-shaft, said motor being adjustable on the platform and said spindle being of less diameter than the hollow-shaft whereby to permit adjustment therebetween for changing the gearing to vary the ratio of spindle speed to motor speed.

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