June 21, 1932. M. B. GROUT 1,864,194

WINDING MACHINE

Original Filed May 23, 1924 2 Sheets-Sheet 1

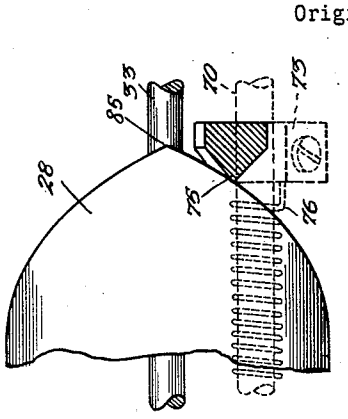
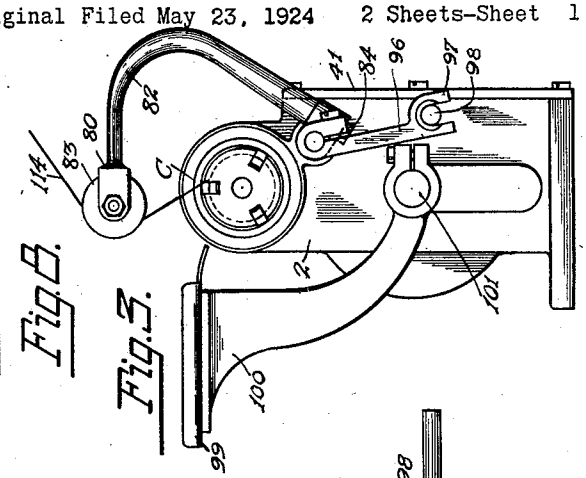


Fig. 3.



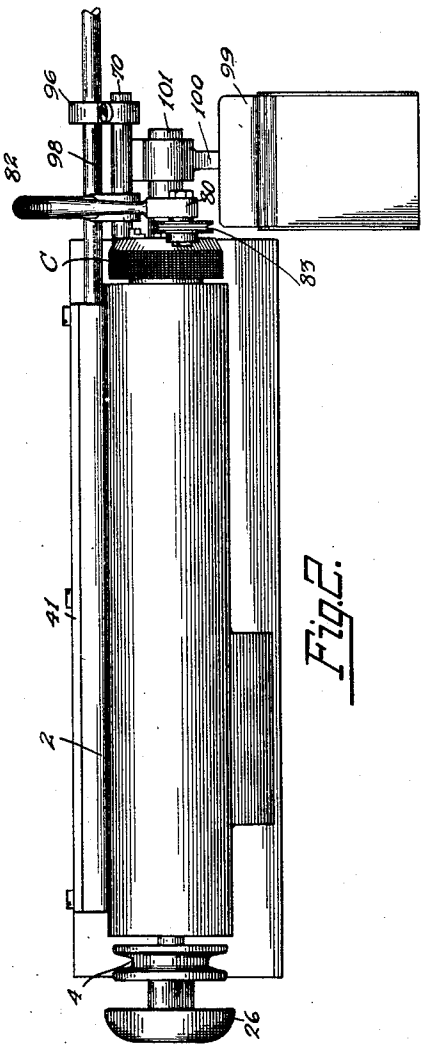


Fig. 2.

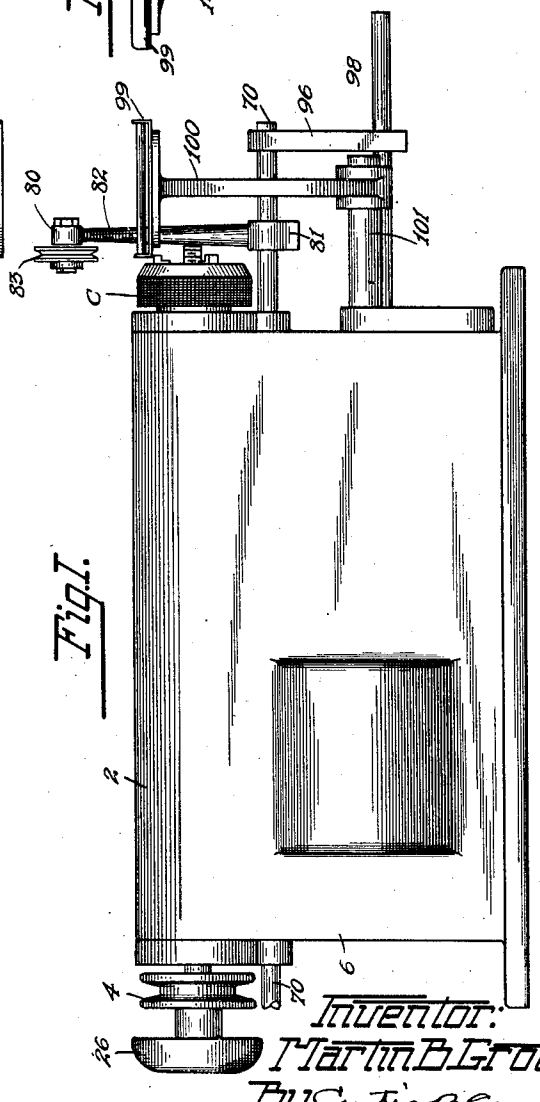


Fig. 1.

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WINDING MACHINE

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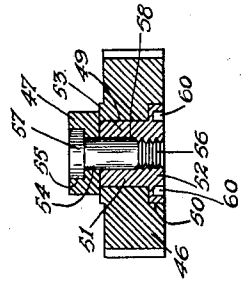


Fig. 7.

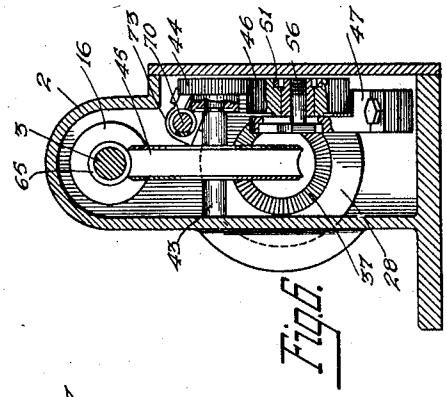


Fig. 6.

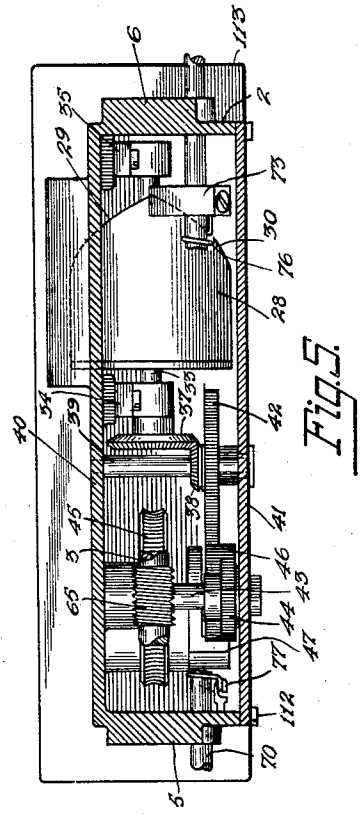


Fig. 5.

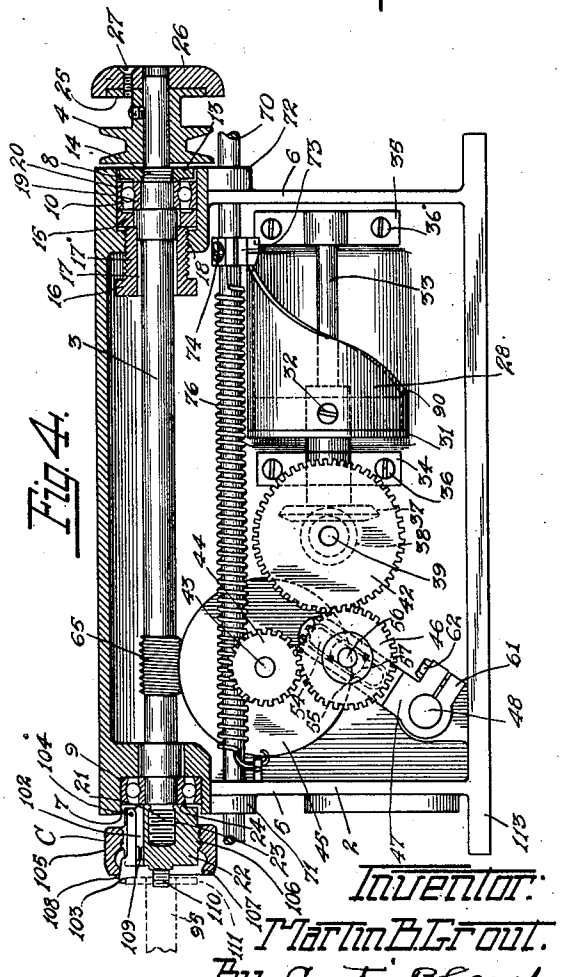


Fig. 4.

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Patented June 21, 1932 1,864,194

UNITED STATES PATENT OFFICE

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WINDING MACHINE

Application filed May 23, 1924, Serial No. 715,358. Renewed February 15, 1926.

My invention relates to winding machines which are used for winding a material, such as a strand of wire, into electromagnetic coils, and has to do more particularly with a coil winding machine such as is used in the winding of a conducting wire upon a suitable spool to serve as a winding for an electromagnet, and an object of my invention is to provide a machine of the above type which is simple in construction, and by which the work of winding an electromagnet coil may be done in a rapid, efficient and economical manner.

Various types of winding machines have been devised for winding electromagnet coils in which a distributing arm distributes the wire from a supply source from left to right, and vice versa. This travel of the distributing arm is controlled by suitable mechanism to place the required number of convolutions on the spool which is supported on the rotatable winding spindle, and a feature of my invention is the provision of a novel cam arrangement in association with a reciprocating shaft or distributing arm carrying bar and suitable gearing mechanism which accomplishes the to and fro movement of the distributing arm from left to right, and vice versa, to place a predetermined number of convolutions of wire on the spool supported on the winding spindle.

Another feature of my invention is the provision of a novel chuck which is secured to the spindle shaft for securing the electromagnet spool to the winding spindle during the winding operation.

Still another feature of my invention is the provision of a novel reciprocating rod or shaft which carries the distributing arm and its association with a cam for bringing about this to and fro movement of the reciprocating shaft and distributing arm, as a whole. The above features of my invention, as well as others, will be more fully described in the ensuing specification.

For a more complete understanding of my invention reference may be had to the accompanying drawings in which like reference characters in the several views denote like parts, and in which:

Fig. 1 is a front elevation of the winding machine of my invention illustrating the distributing arm in its extreme left position.

Fig. 2 is a right side elevation of the machine.

Fig. 3 is a plan view of Fig. 1.

Fig. 4 is a rear view of Fig. 1 with the cover plate removed and parts in section to more clearly illustrate the interior mechanism.

Fig. 5 is a sectional view of the winding machine looking down into the interior with the enclosing casing in section to illustrate another view of the mechanism.

Fig. 6 is a sectional view along the line 6—6 of Fig. 1.

Fig. 7 is a sectional view along line 7—7 of Fig. 4.

Fig. 8 is a fragmentary view of the cam and the cam follower member secured to the reciprocating shaft and associated with the cam.

Referring now more in detail to my invention as illustrated in the accompanying drawings, the winding machine comprises a suitable enclosing casing or housing 2 which encloses the mechanism of the winding machine of my invention.

A spindle shaft 3 has secured thereto a pulley wheel 4 which is connected to a power shaft by means of a suitable belt, the said power shaft being in turn connected to a suitable starting and stopping means, and as the power transmission for rotating the spindle shaft 3 forms no part of my invention, it is not shown in the drawings. The sides 5 and 6 of the housing 2 are provided with counter bores 7 and 8 through which the spindle shaft 3 extends, and ball bearings 9 and 10 are provided which rest in counter bores 7 and 8 in the sides 5 and 6 of the housing 2, and

rotatably support the spindle shaft 3. A lock nut 13 is provided which has screw-threaded engagement with the threaded portion 14 of the spindle shaft 3 and a collar 15 fitting loosely on the shaft 3 rests in the counter bore 8. An adjustable member 16 provided with a central orifice 17 is slipped on the spindle shaft 3 and its extended body portion 17′ is threaded and is adapted to have screw-threaded engagement with a suitable tapped orifice 18 in the housing 2. The lock nut 13 when threaded in position on the shaft 3 engages the bearing bushing 19 and the adjustable member 16 engages the collar 15 and moves the same into engagement with the bearing race 20, and the collar 15 and lock nut 13 retain the ball bearing 10 as a whole in the counter bore 8 and the adjustable member 16 engaging the collar 15 may be adjusted in its tapped orifice 18, and through the agency of the loose collar 15, take up any lateral movement of the spindle shaft 3. The chuck C which is secured to the threaded end 21 of the spindle shaft 3 comprises a body member 22 which is provided with a tapped orifice 23 in which the end 21 of the shaft 3 is threaded. The body 22 of the chuck C is provided with an annular shoulder 24 which engages the ball bearing 9 and retains the same in the counter bore 7. The pulley wheel 4 which is secured to the spindle shaft 3 is provided with an integrally formed flange 25 which has secured thereto a knob 26 by means of screws 27, and permits the manual rotation of the winding spindle 3 when the operator prepares a new spool which is held by the chuck C.

A cam member 28 is provided which is tubular in form and is provided with a pair of receding helical faces 29 and 30, and a collar 31 of a size to receive the tubular cam member 28 supports the cam member 28 and secured thereto by means of screws 32 which pass through suitable orifices in the peripheral face of the body of the cam member 28 and have screw-threaded engagement with suitable tapped orifices in the collar 31. The collar 31 is provided with a central orifice for receiving a shaft 33 to which the collar 31 and its supported cam member 28 are secured, as a whole, in any suitable manner, as by means of a key or set screw. The shaft 33 which supports the collar 31 and cam member 28, as a whole, is rotatably supported in a pair of bearings 34 and 35 secured to the housing 2 by means of screws 36 and 36′. The end of the shaft 33 which extends through the bearing 35 has secured to it a bevel gear 37 which meshes with a bevel pinion 38 secured to a transverse shaft 39, which shaft 39 is rotatably supported in suitable bearings in the front wall 40 of the housing 2 and the rear movable cover 41. A gear wheel 42 is also secured to the transverse shaft 39 upon which the bevel pinion 38 is secured for purposes as will presently be described. Another transverse shaft 43 rotatably supported in suitable bearings in the front wall 40 of the housing 2 and the removable rear cover 41 has secured to it a pinion 44 and a worm gear 45 also for purposes as will presently be described.

A gear wheel 46 which meshes with the gear wheel 42 on the transverse shaft 39 and the pinion 44 on the transverse shaft 43 is adjustably and rotatably supported on an arm 47 which arm 47 is also adjustably secured to a stud 48 which stud 48 is suitably secured to the housing 2 in any suitable manner.

To adjustably support the gear wheel 46 on the arm 47, the gear 46 is provided with a central orifice 49 and a counter bore 50 and a lock nut 51 having a circular head 52 and a body portion 53 rest respectively in the counter bore 50 and the central orifice 49 in the gear wheel 46. The arm 47 is provided with a longitudinal slot 54 and a channel 55 and a bolt 56 provided with a rectangular shaped head 57 rests in this channel 55, the body of the bolt 56 extending through the longitudinal slot 54 in the arm 47. The lock nut 51 is provided with a central orifice 58 which is partially threaded to permit screw threaded engagement with the threaded end of the bolt. When the lock nut 51 and bolt 56 are in position as just described, the gear wheel 46 is thus supported on the arm 47 and the said arm 47 and supported gear wheel 46 may now be adjusted in mesh with the gear wheel 42 on the transverse shaft 39, and the pinion 44 on the transverse shaft 43, the bolt 56 permitting the gear wheel 46 and its supporting parts to be moved up or down in the longitudinal slot 54 of the arm 47, as the case may be. When in this position, the lock nut 51 may be turned down on the bolt 56 by means of a suitable spanner wrench for which I provide a pair of orifices 60 in the head 52 of the lock nut 51 to secure the gear wheel 46 in its adjusted position in mesh with the gear wheel 42 and pinion 44. The arm 47 is provided with an integrally formed lug 61 which is split, and a bolt 62 passing through a suitable orifice in the upper split portion of the lug 61 has screw-threaded engagement with a suitable tapped orifice in the lower split portion of the lug 61 to clamp the arm 47 on its supporting stud 48. The gear wheel 46 is thus rotatably supported on the arm 47 with the body portion 53 of the lock nut 51 forming a bearing upon which the gear wheel 46 rotates.

The spindle shaft 3 has a worm portion 65 cut thereon and meshes with the worm gear 45 secured to the transverse shaft 43 to which the pinion 44 is secured. Now as the spindle shaft 3 is rotated, the worm 65 which meshes with the worm gear 45, causes rotation of the said worm gear 45, and through the agency

of the pinion 44 on the transverse shaft 43 and the gear wheel 46 rotatably supported on the arm 47 and the gear wheel 42 and bevel pinion 38 on the transverse shaft 39, and the bevel gear 37 on the shaft 33, rotary motion is transmitted to the shaft 33 which carries the cam member 28 to cause rotation of the cam member 28.

Having described the apparatus through the agency of which the cam member 28 is rotated, I will now describe the mechanism associated with the cam member 28 and reciprocating shaft 70 for causing the movement of the reciprocating shaft 70 from left to right, and vice versa. The distributing or reciprocating shaft 70 is slidably supported in bearings 71 and 72 in the sides 5 and 6 of the housing 2, and has secured to it a cam follower member 73 suitably secured to the reciprocating shaft 70 by means of a clamping screw 74. The cam follower member 73 is provided with a knife edge nose 75 which is held in engagement with either of the faces 29 or 30 of the cam member 28, depending upon the position of the cam member 28, by means of a helical spring 76 around the shaft 70, and which spring 76 has one end secured to a suitable hook member 77 secured to the side 5 of the housing 2, the other end of the spring 76 being secured to the cam follower member 73 in any suitable manner.

Referring now to Fig. 1 I show a distributor 80 secured to the distributing or reciprocating shaft 70 by means of a suitable clamping member 81. The goose neck arm 82 which supports the ball bearing guide wheel 83 is provided with a threaded end which extends through suitable orifices in the clamping member 81 and nut 84 having screw-threaded engagement with the threaded end of the goose neck arm 82 secures the said arm 82 and its supported guide wheel 83, as a whole, to the member 81, and also clamps the member 81 to the distributing or reciprocating shaft 70. The distributing arm 80 is shown in its extreme left position and ready to start on its travel to the right. At that instant, the nose 75 of the cam follower member 73 has just passed the apex 85 of the cam member 28, causing the distributing or reciprocating shaft 70 to start its travel to the right, and the continued rotation of the cam member 28 permits the cam follower member 73 to follow the receding pitch or contour of the cam face 29 and, as the follower member 73 is secured to the reciprocating shaft 70, the tension of the spring 76 is such as to draw the distributing or reciprocating shaft 70 to the left with reference to the rear view of Fig. 4, and to the right with reference to Fig. 1.

Now, when the nose 75 of the cam follower 73 reaches the base 90 of the receding pitch face 29 of the cam member 28, the nose 75 again engages the face 30 and rides upon the pitch face 30 of the cam member 28, and the continued rotation of the cam member 28 causes the nose 75 to follow the contour of the pitch face 30 and forces the cam follower 73 to the right with reference to Fig. 4, and as the follower is secured to the reciprocating shaft 70 the shaft 70 is also moved to the right again placing the spring 76 under tension.

From the above description it may be seen that the rotation of the cam member 28 through the agency of the cam follower 73 brings about the movement of the distributing or reciprocating shaft 70 from left to right, and vice versa, and that for one complete revolution of the cam member 28, the distributing or reciprocating shaft 70 will have traveled from left to right and from right to left, and as the distributing arm 82 is secured to the shaft 70, two layers of convolutions of wire have been placed on the spool 95 gripped by chuck C secured to the spindle shaft 3. I provide a guide arm 96 secured to the reciprocating shaft 70, which is provided with a bifurcated end 97 which straddles a rod 98 secured to the side 5 of the housing 2 and guides the reciprocating shaft 70 from left to right, and vice versa, and prevents rotation of the shaft 70 in its bearings in its to and fro travel. I also provide a plate member 99 suitably secured to a bracket 100 which bracket 100 is in turn secured to a rod 101 secured to the side 5 of the housing 2. This plate member 99 is for the purpose of placing strips of paper thereon, and which may be interposed between the layers at intervals, so that the winding will build up evenly so as to furnish a foundation for the next few layers and so on throughout the coil at the will of the operator.

The chuck for gripping the electromagnet spools 95 is provided with a body portion 22 which, as already described, is secured to the spindle shaft 3. The body 22 is provided with slots 102 in which the jaws 103 are pinned by the pivot pins 104. An internally threaded ring member 105 has screw-threaded engagement with the threaded portion 106 of the body 22 of the chuck, and is provided with an annular internal lip 107. The jaws 103 are provided with tapered faces 108 and through the agency of a helical spring 109 which rests between the jaws 103 and the bottom of the slots 102, the free ends of the jaws 103 are forced outward. The body portion 22 is also provided with a threaded stud 110 integrally formed therewith, and the core of the spool 95 in its one end is provided with a suitable tapped orifice which is adapted to be threaded on the tapped stud 110 to rotatably secure it to the spindle shaft 3 as shown in dotted lines in Fig. 4. To secure the spool 95 against rotation relative to the spindle shaft 3, after being threaded upon the stud 110, the ring member 105 is turned to

move forward causing its lip 107 to engage the tapered faces 108 of the jaws 103 forcing them inward against the tension of the helical spring 109 causing the chuck to engage the head 111 of the spool and grip the same to clamp the spool 95 in the chuck C against movement on the spindle shaft 3.

The removable cover 41 is secured to the housing 2 by suitable screws 112 which have screw-threaded engagement with suitable tapped orifices in the housing 2. This cover may be removed to permit access to the mechanism of the machine. The housing 2 is also provided with a suitable base 113 and the machine may be secured to a suitable bench and a wire strand 114 from a suitable source led over the guide wheel 83 of the distributing arm 80 to the spool 95 to be wound.

While I have illustrated and described a preferred embodiment of my invention, I do not wish to be limited to the same, as changes and modifications will readily suggest themselves, and I therefore aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a winding machine of the class described, including a winding spindle, a spool supported by said spindle, a reciprocating means for placing material in layers upon said spool, a train of gearing associated with said winding spindle, provided with means to permit the substitution of different gears, a tubular cam member, a cam shaft for rotatably supporting said cam member, said shaft being parallel to said winding spindle and said reciprocating means and connected to said winding spindle through said train of gearing, transverse shafts supporting said train of gearing, said cam member having receding faces, and means secured to said reciprocating means and associated with the receding faces of said tubular cam member to cause movement of said reciprocating means, said train of changeable gearing providing different predetermined speeds of rotation for said cam to permit said reciprocating means to be moved in its to and fro movement at different predetermined speeds for different sizes of material which may be placed in layers upon said spool.

2. In a winding machine of the class described including a winding spindle, a winding spool supported by said spindle, a reciprocating shaft and a distributing arm secured thereto for placing material in layers upon said spool to form a coil, a tubular cam member having receding faces, a cam shaft for rotatably supporting said cam member, said cam shaft being parallel to said winding spindle and said reciprocating shaft and a train of gearing for connecting said cam shaft with said winding spindle provided with means to permit the substitution of different size gears, transverse shafts supporting said train of gearing, and means secured to said reciprocating shaft and associated with the receding faces of said tubular cam member to cause the to and fro movement of said reciprocating shaft, said changeable gearing providing different predetermined speeds of rotation for said cam to permit said reciprocating shaft to be moved in its to and fro movement at different predetermined speeds to permit the use of different sizes of material which may be placed in layers upon said winding spool.

3. In a winding machine of the class described, the combination of a source of power, a winding spindle, a winding spool supported by said spindle, reciprocating means for feeding strand material in layers to form a coil upon said spool, means for associating said winding spindle with said source of power, a tubular cam member having receding faces, a cam shaft for rotatably supporting said cam member, said cam shaft being parallel to said winding spindle and said reciprocating means, a train of gearing provided with means to permit the substitution of different diameter gears, transverse shafts supporting said train of gearing, and means associated with the receding faces of said tubular cam member and secured to said reciprocating means to cause the to and fro movement of said reciprocating shaft, said changeable gearing providing different predetermined speeds of rotation for said cam to permit said reciprocating shaft to be moved in its to and fro movement at different predetermined speeds to permit the use of different size strands of material which may be placed in layers on said winding spool.

4. In a winding machine of the class described including a rotatable winding spindle, a reciprocating shaft, a tubular cam member, a cam shaft for rotatably supporting said cam member, said cam shaft being parallel to said winding spindle and said reciprocating shaft, a train of gearing for connecting said cam shaft with said winding spindle, transverse shafts supporting said train of gearing, a pair of receding cam faces on said cam member, a follower member secured to said reciprocating shaft, and spring means for maintaining said member in engagement with the cam member and to cause said member to follow the contour of said cam faces to cause the to and fro movement of said reciprocating shaft, said train of gearing provided with means to permit the substitution of different gears to rotate said cam shaft at different predetermined speeds to cause said reciprocating shaft to be moved in its to and fro movement at different predetermined speeds.

5. In a winding machine of the class described including a rotatable winding spindle,

a reciprocating shaft, a tubular cam member, a cam shaft for rotatably supporting said cam member, said cam shaft being parallel to said winding spindle and said reciprocating shaft, a train of gearing for connecting said cam shaft with said winding spindle for transmitting rotation to said cam shaft, said train of gearing provided with means to permit the substitution of different gears to rotate said cam shaft at different predetermined speeds, a plurality of transverse shafts supporting said train of gearing, a pair of receding cam faces on said cam member, a cam follower member secured to said reciprocating shaft, spring means for holding said follower member in engagement with said cam member, said cam follower member being adapted to follow the contour of said cam faces to cause the to and fro movement of said reciprocating shaft, said changeable gearing through the agency of said cam adapted to move said reciprocating shaft to and fro at different predetermined speeds.

6. In a winding machine of the class described including a rotatable winding spindle, a reciprocating shaft and a tubular cam member, a cam shaft for rotatably supporting said cam member, said cam shaft being parallel to said winding spindle and said reciprocating shaft, a train of gearing for transmitting rotation to said cam shaft from said rotatable winding spindle, said train of gearing provided with means to permit the substitution of different gears to rotate said cam shaft at different predetermined speeds, transverse shafts supporting said train of gearing, a pair of receding cam faces on said cam member, a cam follower member secured to said reciprocating shaft and held in engagement with the receding faces of said cam member by spring means supported by said reciprocating shaft, said follower member adapted to follow the contour of said cam faces of said rotating cam member to cause the to and fro movement of said reciprocating shaft, said changeable gearing through the agency of said cam adapted to move said reciprocating shaft to and fro at different predetermined speeds.

7. In a winding machine of the class described for winding strand material into coils, a rotatable winding spindle, and a chuck secured to said winding spindle for rotatably supporting a spool, a reciprocating shaft and a distributor arm secured thereto for feeding strand material thereon in layers to form a coil, a tubular cam member, a cam shaft for rotatably supporting said cam, said cam shaft being parallel to said winding spindle and said reciprocating shaft, a train of gearing to connect said cam shaft to said rotatable spindle shaft, transverse shafts supporting said train of gearing, an adjustable arm for supporting one of said gears and adapted to be adjusted to permit the insertion of different sized gears to rotate said cam at different predetermined speeds, and means associated with said cam member for imparting to and fro movement to said reciprocating shaft and said distributor arm, said changeable gearing permitting said reciprocating shaft through the agency of said cam to be moved at different predetermined speeds to permit the use of different size strands of material to be wound into coils.

8. In a winding machine of the class described for winding strand material into coils, a rotatable winding spindle and a chuck secured to said winding spindle for rotatably securing a spool on said winding spindle, a reciprocating shaft and a distributor arm secured thereto for feeding strand material thereon in layers to form a coil, a tubular cam member, a cam shaft for rotatably supporting said cam, said cam shaft being parallel to said winding spindle and said reciprocating shaft, a train of gearing to transmit motion to said cam shaft from said spindle shaft, transverse shafts supporting said train of gearing, said train of gearing provided with means to permit the substitution of different gears to rotate said cam shaft at different predetermined speeds, means associated with said cam member and secured to said reciprocating shaft for imparting to and fro movement to said reciprocating shaft and said supported distributor arm to place successive layers of strand material on said coil, and spring means for maintaining said last means in association with said cam member, said changeable gearing permitting said reciprocating shaft to be moved at different predetermined speeds through the agency of said cam to permit the use of different size strands of material to be wound into coils.

9. In a winding machine of the character described comprising a housing for rotatably supporting a winding spindle, a reciprocating shaft slidably supported in said housing, a tubular cam member, a cam shaft for rotatably suporting said cam member, said cam shaft being parallel to said winding spindle and said reciprocating shaft, transverse shafts rotatably supported on said housing having secured thereto a gear train for transmitting rotary motion to said cam shaft, means secured to said reciprocating shaft and operatively associated with said cam member to transmit to and fro movement to said reciprocating shaft, and an adjustable arm for supporting one of said gears and adapted to be adjusted to permit the insertion of different sized gears.

10. In a winding machine of the character described comprising a housing, a winding spindle rotatably supported by said housing, a reciprocating shaft slidably supported in said housing, a tubular cam member and a cam shaft for rotatably supporting said cam member, said cam shaft being parallel to said winding spindle and said reciprocating

shaft, transverse shafts rotatably supported in said housing and having secured thereto gears for transmitting rotary motion to said cam shaft, an adjustable arm for supporting one of said gears and adapted to be adjusted to permit the insertion of different sized gears, and a cam follower member secured to said reciprocating shaft and operatively associated with said cam member and spring pressed into engagement therewith to follow said cam contour to transmit to and fro movement to said reciprocating shaft.

11. In a winding machine of the character described comprising a housing, a winding spindle rotatably supported by said housing, a reciprocating shaft slidably supported in said housing, a cam shaft and a tubular cam member secured thereto, said cam shaft being parallel with said winding spindle and said reciprocating shaft, receding cam faces for said cam member, transverse shafts rotatably supported in said housing and gears secured thereto, an adjustable arm supporting a gear for connecting said gears on said transverse shafts to said cam shaft to transmit rotary motion to said cam shaft, a cam follower member secured to said reciprocating shaft and a spring having one end secured to said cam follower and its other end secured to said housing for holding said cam follower in engagement with said cam member to permit the same to follow the contour of said cam faces to cause the to and fro movement of said reciprocating shaft.

12. A winding device of the character described including an enclosing housing, a spindle extending across said housing and having its ends protruding therefrom, driving means connected to one end of said spindle, chucking means connected to the other end of said spindle, an auxiliary spindle extending across said enclosing casing and protruding therefrom, a guide device connected to said auxiliary spindle, a tubular cam, a cam shaft parallel to said spindle and said auxiliary spindle rotatably supporting said cam and means connecting said driving spindle to said cam shaft to rotate the same, a cam follower and a helical spring adapted to maintain said follower in engagement with said cam within said housing to cause the said cam to impart a rectilinear movement to said auxiliary spindle, said means provided with interchangeable means to rotate said cam shaft at different predetermined speeds to cause said auxiliary spindle to be moved in its to and fro movement at different predetermined speeds.

13. A winding device of the character described including an enclosing housing, a spindle extending across said housing and having its ends protruding therefrom, driving means connected to one end of said spindle, chucking means connected to the other end of said spindle, an auxiliary spindle extending across said enclosing casing and protruding therefrom, a guide device connected to said auxiliary spindle, a tubular cam, a cam shaft parallel to said spindle and said auxiliary spindle rotatably supporting said cam, means within said housing connecting said driving spindle to said cam shaft to rotate the same, a cam follower secured to said auxiliary shaft and spring pressed into engagement with said cam to cause said cam to impart a rectilinear movement to said auxiliary spindle, said means provided with interchangeable means to rotate said cam shaft at different predetermined speeds to cause said auxiliary spindle to be moved in its to and fro movement at different predetermined speeds, and an adjustable arm for supporting one of said gears adapted to be adjusted to permit the insertion of different sized gears.

14. A device of the character described including a gear casing, a spindle extending across said casing and having its ends projecting therefrom, driving means connected to one end of said spindle, means connected to the other end of said spindle to hold a winding form, an auxiliary shaft protruding from said housing and a guiding device connected to said auxiliary shaft for directing the material to be wound to said winding form, a tubular cam having receding faces, a cam follower secured to said auxiliary shaft and spring pressed into engagement with said cam, a cam shaft parallel to said spindle and said auxiliary shaft rotatably supporting said cam, means including a train of gears for connecting said spindle with said cam shaft to rotate the same to cause said cam to impart rectilinear movement to said auxiliary shaft, and an adjustable arm for supporting one of said gears and adapted to be adjusted to permit the insertion of different sized gears to rotate said cam at predetermined speeds to permit said auxiliary shaft to be moved in its to and fro movement at different predetermined speeds to permit the use of different sizes of material to be wound on said winding form.

15. A device of the character described including a casing, a spindle extending across said casing, driving means connected to one end of said spindle, coil supporting means connected to the other end of said spindle, an auxiliary spindle extending across said casing and parallel to said first spindle, guiding means connected to said auxiliary spindle, a tubular cam, a cam follower secured to said auxiliary shaft and spring pressed into engagement with said cam, a camshaft parallel to said spindle and said auxiliary spindle for rotatably supporting said cam, means including a train of gears within said casing connecting said first spindle to said cam shaft to rotate the same to cause said cam to impart a reciprocating

movement to said auxiliary spindle, and an adjustable arm for supporting one of said gears adapted to be adjusted to permit the insertion of different sized gears to rotate said cam at different predetermined speeds to cause said auxiliary spindle to move in its to and fro movement at different predetermined speeds.

16. A device of the character described including a rotatable winding spindle, a reciprocating shaft, a cam shaft parallel to said winding spindle and said reciprocating shaft, said spindle, reciprocating shaft and cam shaft all having bearings in said casing, a cam member supported on said cam shaft, a train of gearing to transmit motion to said cam shaft from said winding spindle, transverse shafts supporting said train of gearing, an adjustable arm for supporting one of said gears and adapted to be adjusted to permit the insertion of different sized gears, and an oil tight enclosing casing for enclosing all of said apparatus.

17. A device of the character described including a rotatable winding spindle, a reciprocating shaft, a cam shaft parallel to said winding spindle and said reciprocating shaft, a cam member rotatably supported by said cam shaft, a train of gearing to transmit motion to said cam shaft from said winding spindle, transverse shafts supporting said train of gearing, an adjustable arm for supporting one of said gears and adapted to be adjusted to permit the insertion of different sized gears to rotate said cam at different predetermined speeds, means for imparting a to and fro movement to said reciprocating shaft, said changeable gearing through the agency of said cam causing said reciprocating shaft to move in its to and fro movement at different predetermined speeds, and an oil tight enclosing casing for all of said apparatus, said casing having orifices allowing the ends of said winding spindle and said reciprocating shaft to extend beyond the confines of said enclosing casing.

18. A device of the character described including a supporting frame, a rotatable winding spindle, a reciprocating shaft, a rotatable cam shaft parallel with said reciprocating shaft and said winding spindle, a cam member rotatably supported by said cam shaft, a train of gearing to transmit motion to said cam shaft from said winding spindle, transverse shafts supporting said train of gearing, an adjustable arm for supporting one of said gears adapted to be adjusted to permit the insertion of different sized gears to rotate said cam shaft at different predetermined speeds, means for imparting a to and fro movement to said reciprocating shaft, said changeable gearing through the agency of said cam causing said reciprocating shaft to move in its to and fro movement at different predetermined speeds, and an enclosing casing adapted to fit said supporting frame so as to form an oil tight casing for all the said apparatus.

19. A device of the character described including a supporting frame, a reciprocating shaft, a rotatable cam shaft parallel to said winding spindle and said reciprocating shaft, a cam member rotatably supported by said cam shaft, a train of gearing for transmitting motion to said cam shaft from said winding spindle, an adjustable arm for supporting one of said gears adapted to be adjusted to permit the insertion of different sized gears to rotate said cam shaft at different predetermined speeds, means including a cam follower secured to said reciprocating shaft and spring pressed into engagement with said cam member for imparting a to and fro movement to said reciprocating shaft, an oil tight enclosing casing for all of said apparatus having orifices allowing the ends of said winding spindle and said reciprocating shaft to extend beyond the confines of said enclosing member, a chuck rotatably supported upon one of the extending ends of the winding spindle, for holding a spool upon which a strand material is to be wound, said changeable gearing through the agency of said cam causing said reciprocating shaft to be moved in its to and from movement at predetermined speeds for different size strands of material to be wound upon said spool, and a distributing arm supported on an extending end of said reciprocating shaft for feeding the strand to said spool.

20. A device of the character described including a winding spindle, a rotatable cam shaft, a reciprocating shaft parallel to said winding spindle and said cam shaft, a cam member supported by said cam shaft, a cam follower secured to said reciprocating shaft and spring pressed into engagement with said cam member, a train of gearing to transmit motion to said cam shaft from said winding spindle, an adjustable arm for supporting one of said gears adapted to be adjusted to permit the insertion of different sized gears to cause said cam shaft to rotate at different predetermined speeds, an oil tight enclosing casing for all of said apparatus, a threaded portion of said winding spindle extending beyond the said enclosing casing, a chuck supported by said threaded portion and comprising a stud adapted to enter into screw-threaded engagement with a spool upon which a strand material is wound, and means secured to the winding spindle for connecting power thereto to impart movement to the said apparatus to cause the strand material to be wound upon the spool, said changeable gearing through the agency of said cam causing said reciprocating shaft to be moved at predetermined speeds for placing different sizes of material on said spool.

21. In a winding machine of the character described including an oil tight enclosing casing containing a spindle shaft supported in said casing, a reciprocating shaft supported in said casing, a cam shaft parallel to said spindle shaft and said reciprocating shaft and supported in said casing, a cam member rotatably supported by said cam shaft, a train of gearing to transmit motion to said cam shaft from said spindle shaft, transverse shaft supporting said train of gearing, and means whereby the relative position of the gears may be adjusted to permit the insertion of different sized gears to rotate said cam shaft at different predetermined speeds to cause said reciprocating shaft to move in its to and fro movement at different predetermined speeds to wind different sized coils.

22. In a winding machine of the character described including a winding spindle, a reciprocating shaft, a cam shaft parallel to said winding spindle and said reciprocating shaft, a cam member rotatably supported by said cam shaft, a train of gearing to transmit motion to said cam shaft from said winding spindle, an enclosing casing for all of said apparatus, said casing having orifices for permitting the winding spindle and reciprocating shaft to extend beyond the confines of the casing, a chuck, supported on said extending portion of said winding spindle, for securing a spool upon which a coil of strand material is to be wound, a distributing arm supported on said extending reciprocating shaft for feeding the strand material to the spool and means supported by said enclosing casing for inserting paper strips between the layers of the strand wound upon the spool.

23. In a winding machine of the character described including a winding spindle, a reciprocating shaft, a cam shaft parallel to said winding spindle and said reciprocating shaft, a cam member rotatably supported by said cam shaft, a train of gearing to transmit motion to said cam shaft from said winding spindle means supported on said winding spindle for attaching power to rotate the said spindle, a chuck on the end of the spindle opposite the power attaching means, said chuck adapted to secure a spool adapted to have a strand material wound thereon, a distributing arm supported by said reciprocating shaft for feeding the strand to the spool, means for inserting paper strips between the layers of said strand upon said coil and an oil tight enclosing casing for enclosing all the said apparatus except the chuck, power attaching means, distributing arm and paper inserting means.

24. In a winding device of the character described an oil tight enclosing casing containing and supporting a winding spindle, a reciprocating shaft having bearings in said casing, a cam shaft parallel to said winding spindle and said reciprocating shaft, a train of gearng to transmit motion to said cam shaft from said winding spindle, adjustable means comprising a slotted arm whereby the gears may be adjusted to permit the insertion of different sized gears to rotate said cam shaft at different predetermined speeds to cause said reciprocating shaft to move in its to and fro movement at different predetermined speeds to wind different sized coils, a cam member rotatably supported by said cam shaft, a cam follower secured to said reciprocating shaft and spring pressed into engagement with said cam member.

25. In a winding machine of the class described an enclosing casing containing a winding spindle supported thereby, a reciprocating shaft supported by said casing, a cam shaft parallel to said reciprocating shaft and said winding spindle and supported by said casing, a cam member rotatably supported by said cam shaft and means including a train of gearing for imparting a to and fro movement to said reciprocating shaft, transverse shafts supporting said train of gearing.

26. In a device of the character described an enclosing casing supporting a winding spindle, external means for connecting power means to said winding spindle, internal means comprising a train of gearing, transverse shafts supporting said train of gearing, said means adapted to transmit motion to a reciprocating shaft and adapted to be adjusted to control the speed of the to and fro movement of said reciprocating shaft and speed of rotation of a cam shaft parallel to said reciprocating shaft and to said winding spindle and supported in said enclosing casing.

27. A winding machine of the character described comprising an enclosing casing containing a winding spindle, a reciprocating shaft, a cam shaft parallel to said spindle and said reciprocating shaft, said spindle and shafts having bearings in said casing, and means for imparting motion from said spindle to said cam shaft and from said cam shaft to said reciprocating shaft, said means comprising a train of gearing, transverse shafts supporting said train of gearing, said means adapted to be adjusted to regulate the speed of rotation of said cam shaft which in turn governs the speed of the to and fro movement of said reciprocating shaft.

28. A winding machine of the character described comprising an enclosing casing containing a winding spindle, a reciprocating shaft, a cam shaft parallel to said spindle and said reciprocating shaft, said spindle and shafts having bearings in said casing, and means for imparting motion from said spindle to said cam shaft and from said cam shaft to said reciprocating shaft, said means comprising a train of gearing and transverse shafts supporting said train of gearing

adapted to be adjusted to regulate the speed of rotation of said cam shaft which in turn governs the speed of the to and fro movement of said reciprocating shaft and supporting means for feeding paper strips to a coil.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 21st day of May, 1924.

MARTIN B. GROUT.