

Dec. 8, 1925.

1,564,480

M. B. GROUT

WINDING MACHINE

Filed Jan. 2, 1924

7 Sheets-Sheet 1

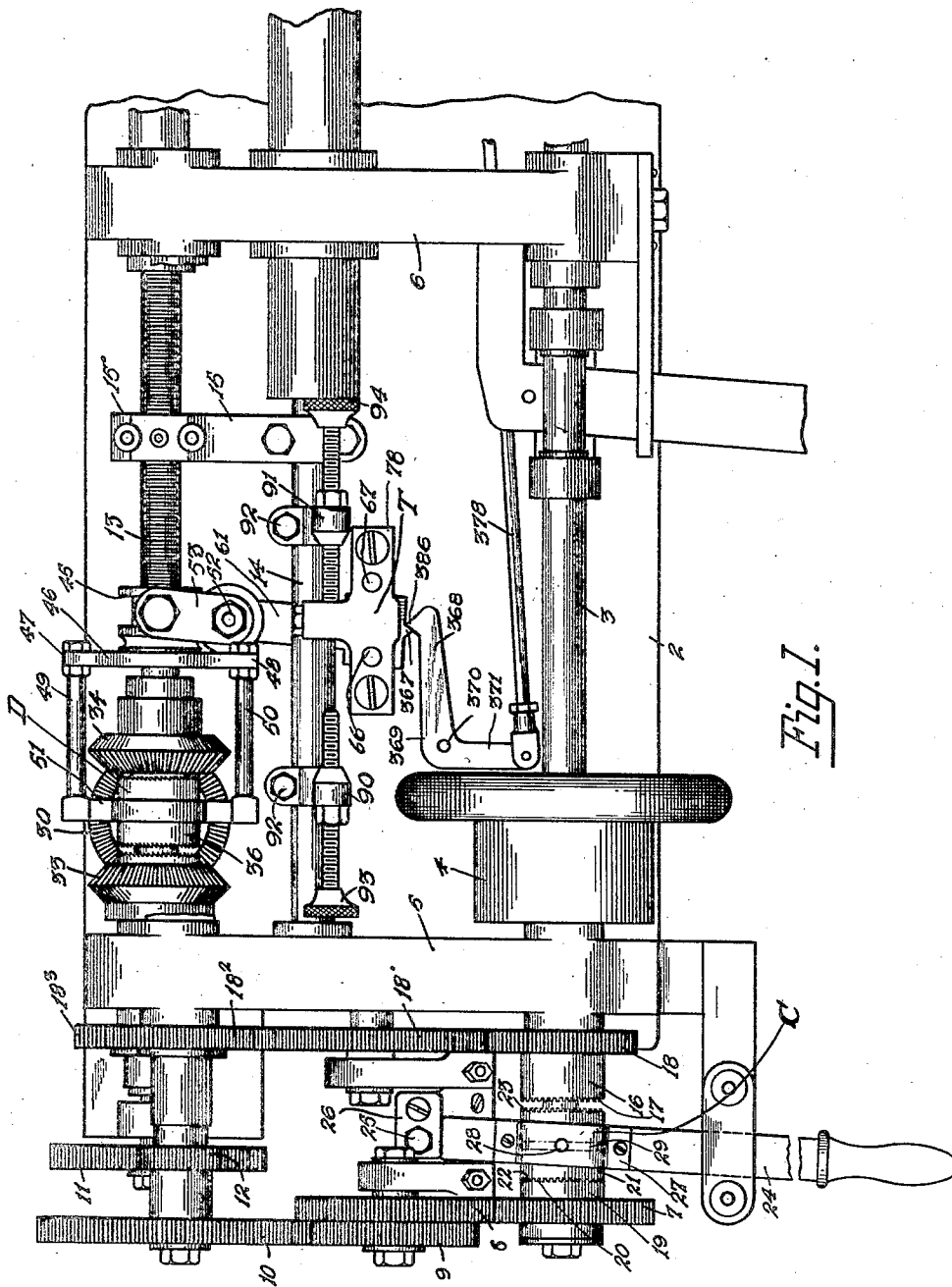


Fig. 1.

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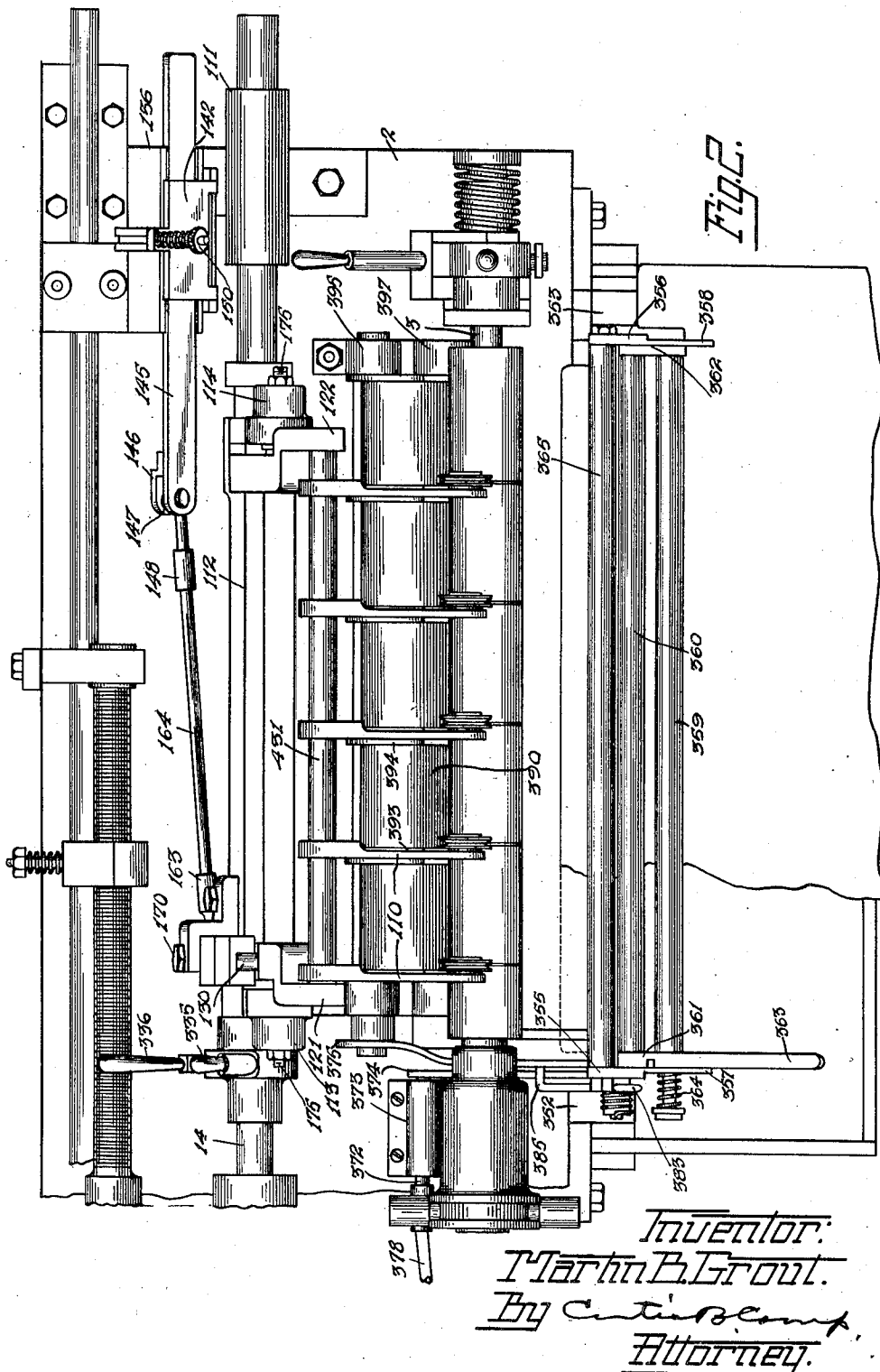
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M. B. GROUT

WINDING MACHINE.

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7 Sheets-Sheet 2



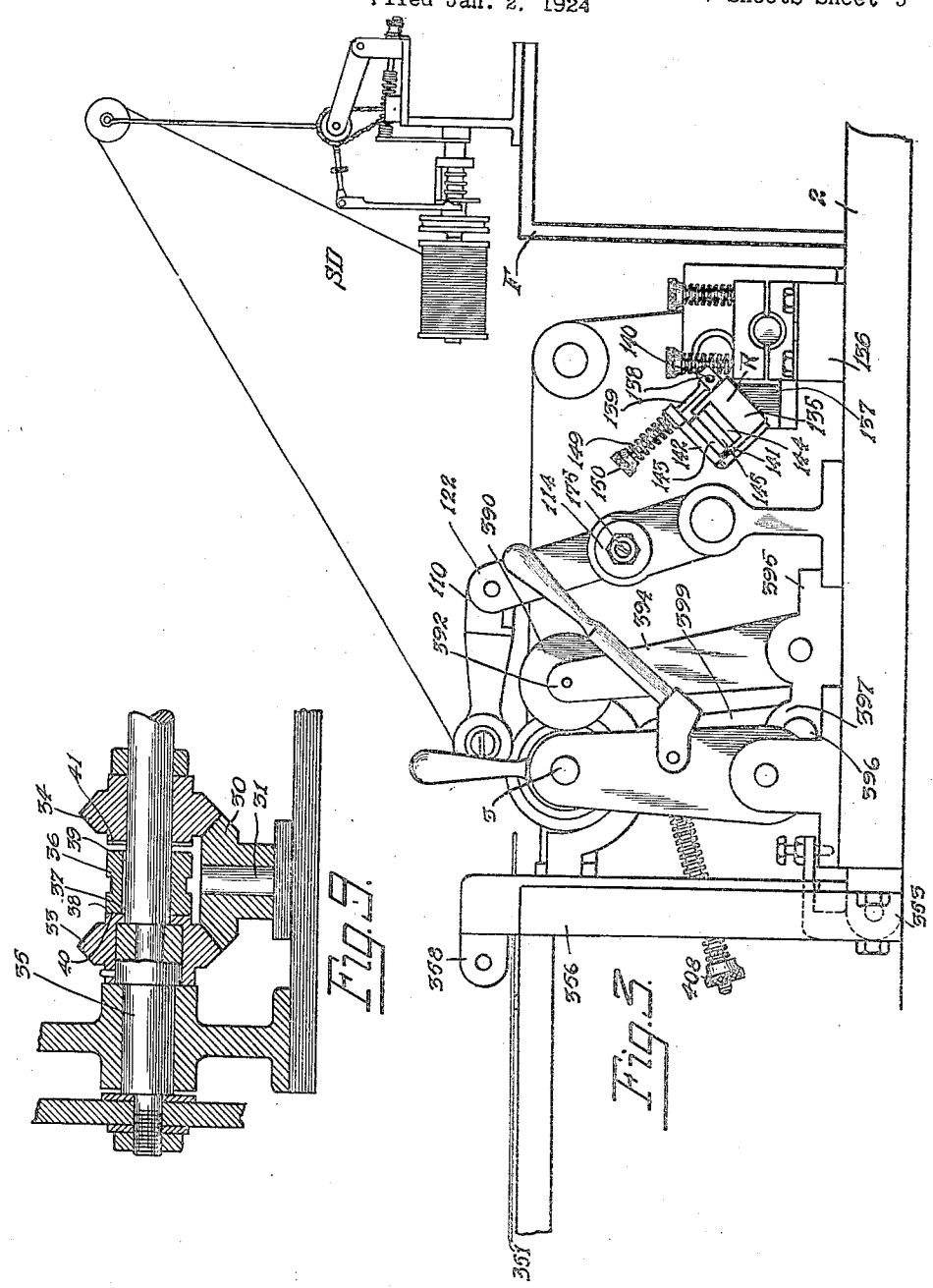
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M. B. GROUT
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7 Sheets-Sheet 3



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M. B. GROUT

WINDING MACHINE

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7 Sheets-Sheet 4

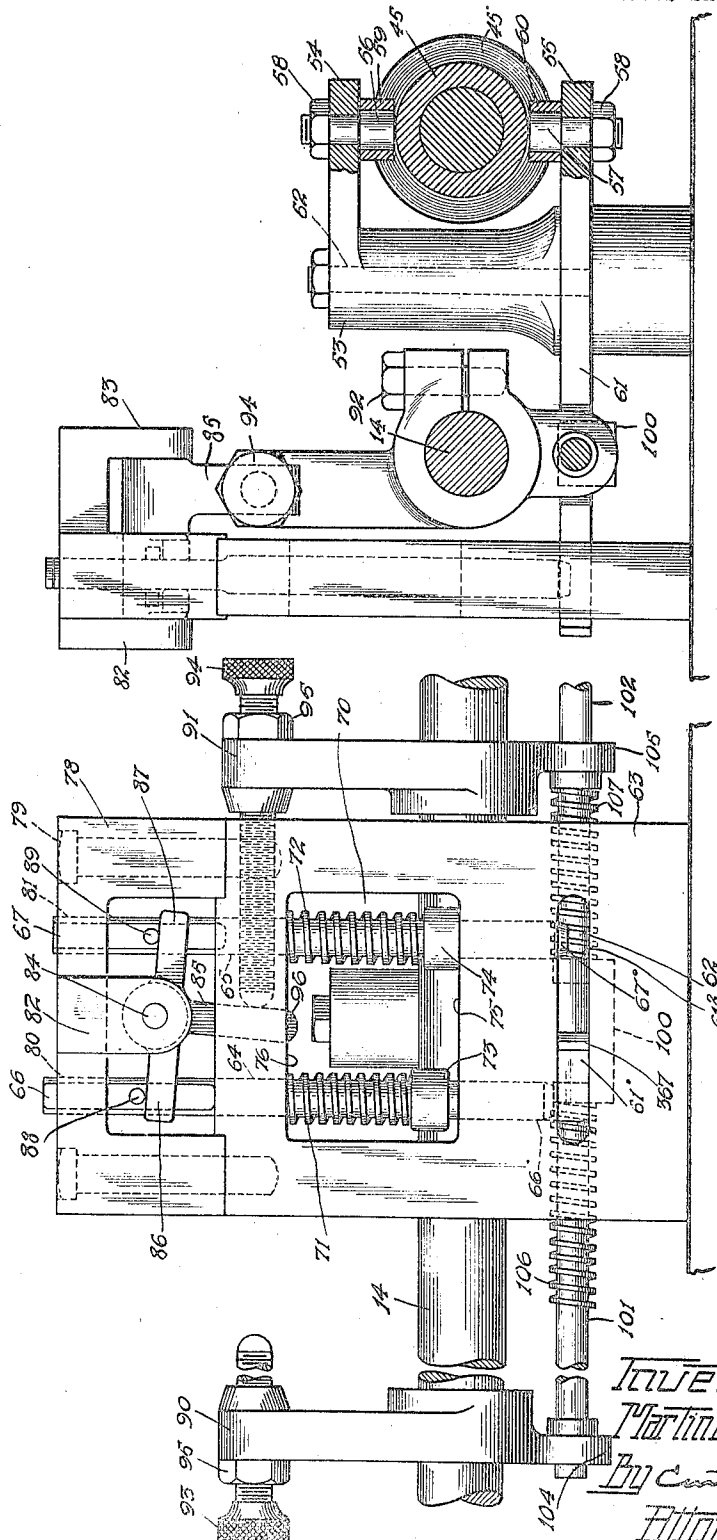


Fig. 5.

Fig. 4.

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M. B. GROUT

WINDING MACHINE

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7 Sheets-Sheet 5

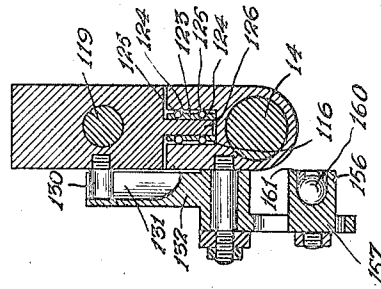
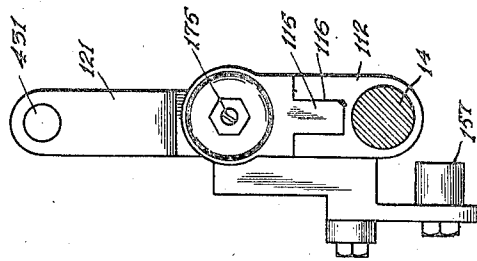


Fig. 2.



FD-36

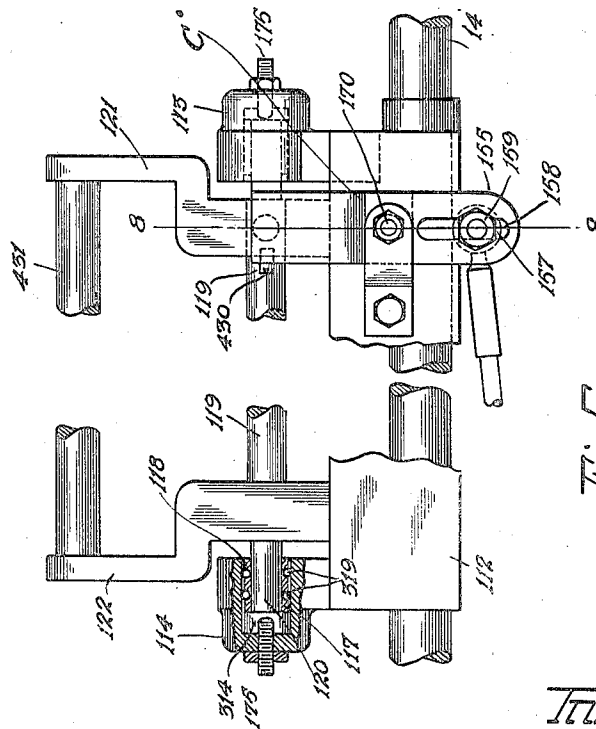


Fig.

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M. B. GROUT

WINDING MACHINE

Filed Jan. 2, 1924

7 Sheets-Sheet 6

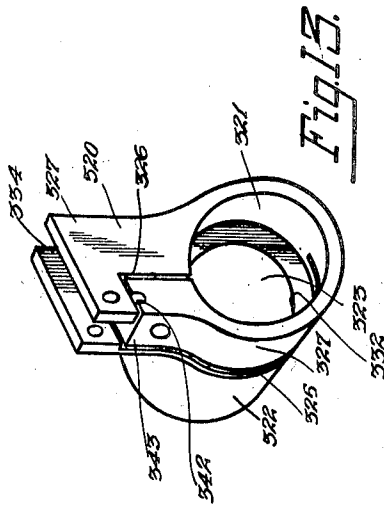


Fig. 13.

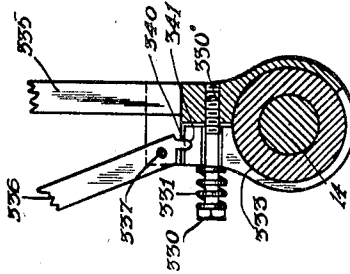


Fig. 12.

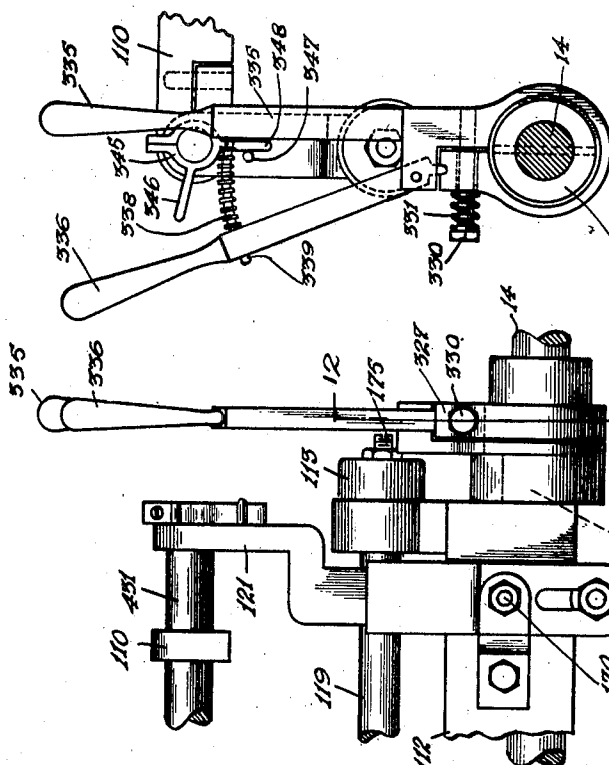
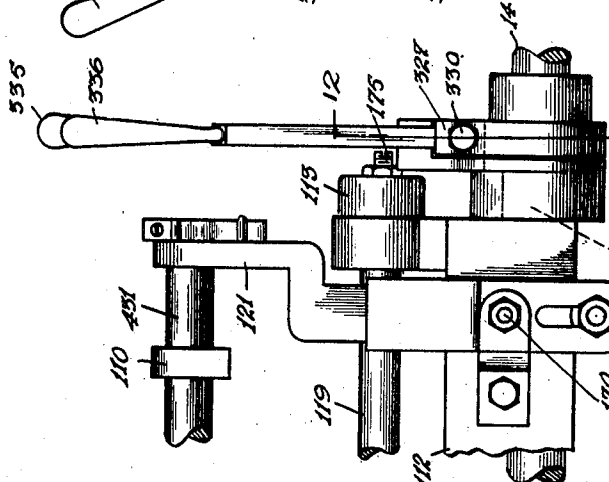


Fig. 11.



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M. B. GROUT
WINDING MACHINE

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7 Sheets-Sheet 7

Fig. 15.

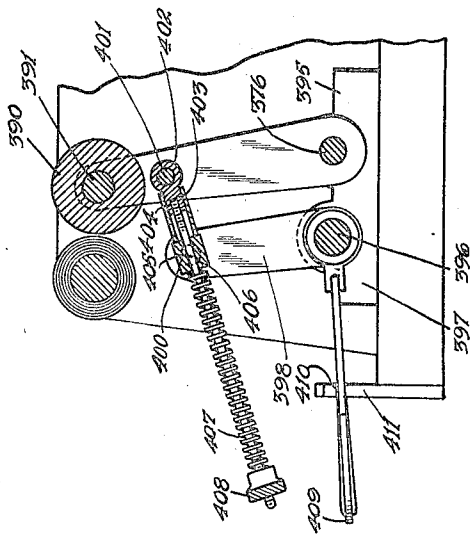
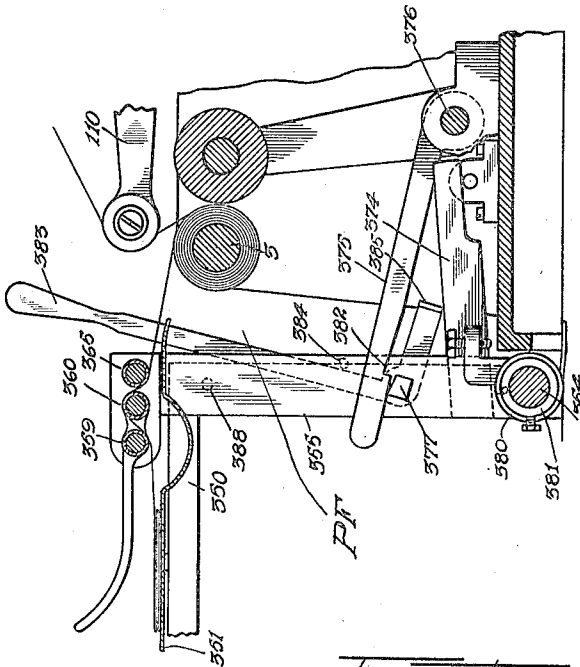


Fig. 14.



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UNITED STATES PATENT OFFICE.

MARTIN B. GROUT, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

WINDING MACHINE.

Application filed January 2, 1924. Serial No. 683,923.

To all whom it may concern:

Be it known that I, MARTIN B. GROUT, a citizen of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Winding Machines, of which the following is a specification.

My invention relates to coil winding machines, and has to do more particularly with winding machines of the multiple type in which a plurality of electromagnet coils are wound simultaneously, and an object of my invention is to provide a machine of the above type by which the work can be done in a rapid, efficient and economical manner.

In machines of the present multiple type, a plurality of coils may be wound simultaneously, and when a number of coils are wound simultaneously a single tube common to all of them is used and the wire is wound upon it in separated zones or spaces and each sheet of insulating paper between each layer of convolutions of wire is common to all of the coils so as to mechanically connect all of the coils together. When the predetermined number of convolutions have been placed upon the coils, the common tube upon which the coils are simultaneously wound is removed from the winding mandrel, and thereafter the plurality of coils may be separated into individual coils by sawing or cutting through the spaces between the zones of the coils.

The coils wound simultaneously by the multiple winding machine of the above type are built up of a plurality of layers of wire, each layer having a predetermined number of convolutions, while the convolutions of wire in one layer are insulated from those in the adjacent layer by means of several layers of interposed paper. The number of convolutions per layer to be placed upon the tube is gauged by means of suitable gearing mechanism, and the travel of the wire from left to right, and vice versa is controlled by suitable reciprocating mechanism.

A sheet of paper common to all the coils on the tube is introduced between each suc-

cessive layer of convolutions of the coils and is of such length as to place several layers of paper insulation between each layer of convolutions of wire. The winding machine of the above type by means of suitable shifting mechanism and a reciprocating shaft, travels from left to right, and vice versa, to wind successive layers of wire on the core or tube, and by means of suitable mechanism, a sheet of insulating paper is introduced into the coil at the instant one layer is finished, and the next one begins, and is grasped by the strands of wire and wound into the coils simultaneously with the first, second and third convolutions of windings in the new layers, depending on the number of layers of paper insulation which are to be inserted between each layer of wire of the coils.

One of the objectional features of the winding machine of the above type is that after the first layer of paper insulation is wound into the coils simultaneously with the first convolution of winding of the new layers and the second layer of paper is wound into the coils, a space equal to the thickness of the paper is placed between the first and second wire turns of the new layer of the coils. Should a third layer of paper be required, a space equal to the thickness of the paper is placed between the second and third wire turns of the new layer of the coils, and it may readily be seen that the thickness of the paper between the first and second turns of a new layer on the coils and the second and third turns places the beginning of the fourth wire turn slightly in advance of the predetermined feed which has been set to wind a certain number of convolutions of wire per layer. This slight advance is brought about by the two thicknesses of paper between the first and second, and second and third wire turns of a new layer. Now, as the machine operates, the feed arms which carry the wire across the coil are traveling at a predetermined rate, which rate of travel is regulated by means of suitable gearing, and as the beginning of the fourth turn is slightly in advance of the feed arms, it may readily be seen that

the next few turns will naturally pile up until the feed arms catch up through the course of their predetermined rate of travel. This piling up at the beginning of each new layer is very objectional, as it produces a coil which is not uniform in diameter and there is more or less liability for short circuited turns. In winding coils manually, the operator guides the wire by hand and the insertion of the paper at the beginning of a new layer and the first two or three wire turns of a new layer can be so spaced by the operator as to overcome this piling up of the first few turns. The multiple winding machines of the above type will not operate satisfactorily to prevent the above mentioned piling up when the convolutions of wire are wound closely together, and it is one of the objects of my invention to provide means which overcomes this piling up of the first few turns of a new layer as described above.

To overcome and prevent this objectionable feature of the piling up of the first few turns of wire at the beginning of a new layer, I provide automatic means for automatically advancing or shifting the feed arms in the same direction in which the new layer is being wound upon the rotatable winding spindle or mandrel.

I provide a novel compensating device which brings about the shifting of the feed arms at the beginning of a new layer of the coils and which is adjustable and may be adjusted to shift the arms to any degree desired, the spacing of the first few wire turns of a new layer of course depending upon the adjustment of the compensating device. The compensating device prevents the piling up of the first few turns, as for example, when carrier or reciprocating shaft and its supported feed arms is set to place "X" number of convolutions of wire per inch to a layer, the instant a new layer is started and the first convolution is complete, the feed arms are automatically shifted in the same direction in which the new layer is being put on, and for the next few turns the number of turns per inch is reduced to "Y" turns per inch and this spacing of the first few turns of each new layer is brought about by means of the shifting of the feed arms in the same direction in which the new layer is being put on through the agency of the compensating device which device is one of the novel features of my invention.

Another feature of my invention is the provision of a novel adjustable trip mechanism which cooperates with the feed arm carrier or reciprocating shaft upon which the feed arms are secured, and which travels from left to right and vice versa. The length of the coil is predetermined by means of suitable adjustable means supported on the reciprocating shaft, and when this pre-

determined length is covered by the feed arms, the trip mechanism is actuated by the adjustable means secured to the reciprocating shaft to reverse the direction of travel of the said reciprocating shaft which carries the feed arms to start another layer of convolutions.

Another feature of my invention is the provision of a semi-automatic paper feed mechanism into which the required length of paper is inserted by the operator, and through suitable connection means which cooperate with the trip mechanism, the instant the trip mechanism actuates to reverse the travel of the reciprocating shaft which carries the feed arms to start a new layer of convolutions of wire, the paper feed mechanism is simultaneously tripped to insert a length of paper between the last layer of convolutions and the new layer of convolutions started, due to the reversal of the direction of travel.

Still another feature of my invention is the novel means provided which holds the sheet of paper in position in readiness to be inserted the instant the trip mechanism is actuated. The paper is held by suitable means which prevents the paper from wrinkling during its passage from its holding roller to the coils being wound thus permitting the multiple coil tube to be wound evenly assuring the construction of coils of uniform diameter.

Another feature of my invention is the provision of means whereby the rack and the guide arm support and guide arms which are supported as a whole upon the reciprocating shaft may be moved backward and forward by means of a suitable clutch mechanism to place the guide arms in the proper position in relation to the coils on the winding spindle. The guide arms and their supporting shaft are also adapted to be raised away from the coils on the winding spindle without effecting the adjustment of the reciprocating shaft and its supported parts.

Another feature of my invention is the provision of a plurality of rubber rollers each rotatably supported there being as many rollers as there are coils being wound on the winding spindle. The rollers may be moved forward to place their peripheral faces in engagement with the peripheral faces of the coils on the winding spindle to permit the paper insulation to be placed on the coil smoothly. The movement of the rollers to or away from the coils on the winding spindle is under the control of a suitable lever.

The above named features, as well as others, will be more fully hereinafter described in the ensuing specification, and for a more complete understanding of my invention, reference may be had to the accom-

panying drawings, in which like reference characters in the several views denote like parts. The entire coil winding machine is of considerable size, and for the purpose of more clearly illustrating the winding machine of my invention, I have placed the controlling mechanism, which is the left hand portion of the machine on one sheet, and the feed and compensating devices, which is the right hand portion of the machine, on another sheet.

Fig. 1 is a plan view of the controlling mechanism of the machine which is the left hand portion of the machine;

Fig. 2 is a plan view of the feeding mechanism of the machine, which is the right hand portion of the machine;

Fig. 3 is a right end view of the machine;

Fig. 4 is a front view of the trip mechanism which brings about the shifting of the reversing mechanism to cause the reciprocating shaft to travel from left to right and vice versa;

Fig. 5 is a side view of Fig. 4;

Fig. 6 is a partial view of the shifting mechanism which spaces the first few turns of a new layer;

Fig. 7 is a side view of Fig. 6 showing another view of the shifting mechanism;

Fig. 8 is a sectional view along the line 8-8 of Fig. 6;

Fig. 9 is a sectional view of the reversing gearing;

Fig. 10 is a fragmentary view of the clutch mechanism which controls the movement of the guide arms and its supporting rails as a whole;

Fig. 11 is a side view of Fig. 10 illustrating another view of the clutch mechanism;

Fig. 12 is a sectional view along the line 12-12 of Fig. 10;

Fig. 13 is a perspective view of the clutch;

Fig. 14 is a partial view of the winding machine illustrating the trip mechanism for inserting the insulating paper in the coil on the winding machine the instant the reciprocating shaft is reversed to start a new layer of convolutions of wire;

Fig. 15 is a partial view of the machine illustrating the rubber rollers associated with the winding spindle.

Referring now more in detail to my invention as illustrated in the accompanying drawings, and first describing the main parts of the winding machine, it comprises a main frame or mounting plate 2 suitably supported upon a table or legs, not shown. The spindle shaft 3 has secured thereto a pulley wheel 4 which is connected to a power shaft by means of a suitable belt which is in turn connected to suitable tight and loose pulleys to transmit power to the pulley wheel 4 to rotate the spindle or winding shaft 3. The power transmission mechanism is not shown, as it is not a part of my

invention, and any suitable power transmission may be used for transmitting power to the spindle shaft.

The spindle shaft 3 is supported at its one end by means of an end or bearing plate 5 which is secured to a base plate 2 in any suitable manner, and the orifice through which the shaft extends is provided with a suitable bearing for the winding shaft. The winding shaft 3 is also supported intermediate its end in an end plate 6 and the orifice in the end plate 6 through which the winding shaft 3 extends is provided with a suitable bearing for the winding shaft 3. The winding shaft 3 has secured to its one end a gear wheel 7 and through the medium of the train of gearing comprising gear wheels 7, 8, 9, 10, 11 and 12, rotary motion is transmitted to a screw shaft 13 and the ratio of the gear wheels 7, 8, 9, 10, 11 and 12 to each other determines the number of convolutions per inch which are placed in each layer of wire of the coils that are to be wound on the winding shaft 3. The screw shaft 13 is threaded and is suitably journaled in the end plates 5 and 6 and associated with the screw shaft 13 is a reversible gearing device D for purposes as will presently be described. A reciprocating shaft 14 is provided which is journaled at its one end in the end plate 5 and at an intermediate point in the end plate 6. An arm 15 is suitably secured to the reciprocating shaft 14, the free end of which is provided with a threaded face which is adapted to mesh with the threads of the screw shaft 13. The arm is held in mesh with the threads of the screw shaft 13 in its travel from left to right, and vice versa by means of a suitable clamping means 15' attached to the arm.

Referring now to Fig. 2, I illustrate the right hand portion of the winding machine which comprises a plurality of supply devices SD illustrated in Fig. 3 which are supported upon a suitable rack or frame F mounted upon a suitable table or base. The supply devices SD used in connection with the winding machine of my invention are for the purpose of keeping a substantially constant tension on the wire strands between the point of supply of the supply spools of the supply devices SD and the winding point on the winding mandrel 3 of the winding machine. The supply devices SD are of the type illustrated and described in a co-pending application filed November 14, 1923, and bearing S. N. 674,623, and for a more complete understanding of these combined tension and supply devices SD in association with the winding machine of my invention, reference may be had to the above entitled application.

Having described in general the essential parts of the multiple winding machine of

my invention, I will now describe in detail the operation of the control mechanism for bringing about the operation of the winding machine. The main or winding shaft 3 to which the pulley wheel 4 is keyed extends through the end or bearing plate 5 and this protruding portion of the shaft suitably supports a clutch mechanism C. The clutch mechanism C comprises a sleeve member 16 provided with a toothed face 17 and secured to the said sleeve member 16 is a gear wheel 18; the said sleeve member 16 and gear wheel 18 as a whole being loosely supported on the main or winding shaft 3. Another sleeve member 19 provided with a toothed face 20 and having suitably secured to it the gear wheel 7, are, as a whole, loosely supported on the winding shaft 3. I provide a collar member 21 which is slidably supported on the main or winding shaft 3 by means of a key and key way and which cooperates with the sleeve members 16 and 19. The collar member 21 rests between the sleeve members 16 and 19 on the shaft 3 and is provided with toothed faces 22 and 23, the said toothed face 22 being adapted to mesh the toothed face 20 of the sleeve member 19 when in one position and adapted to engage the toothed face 17 of the sleeve member 16 when in its other position. The collar member 21 may also be moved to a neutral position, in which position neither of the toothed faces of the sleeve members 16 and 19 and collar member 21 are in engagement for purposes as will presently be described. To control the movement of the slidable collar member 21 to the left or right into engagement with either the sleeve member 19 or sleeve member 17 as the case may be, I provide a lever 24 which is pivoted at its one end by the pivot screw 25 to a bracket 26 supported by the base 2 the said bracket 26 also forming supporting means for the intermediate gear wheels 8 and 9 of the gear train. A split yoke member 27 is provided which straddles the collar member 21, one half of the said yoke member 27 being integrally formed with the lever 24, the other half of the yoke member 27 being secured to the lever 24 by means of suitable screw studs and nuts. Pins 28 secured to the yoke portions rest in a suitable annular groove 29 in the collar member 21 so that when the lever 24 is moved to the left or right, as the case may be, the collar member 21 is also moved to either engage the toothed face 20 of the sleeve member 19 or the toothed face 17 of the sleeve member 16. When the toothed face 22 of the collar member 21 is in engagement with the toothed face 20 of the sleeve member 19 as illustrated in Fig. 1, motion is transmitted through the agency of the gear train comprising the gear wheels 7, 8, 9, 10, 11 and 12 to the screw shaft 13, and

through the agency of the reversible gearing mechanism D the travel of the reciprocating shaft 14 to the right or left is accomplished. The reversible gearing mechanism D comprises a bevel gear 30 rotatably supported upon a bearing 31 which is secured to the base plate 2 and which meshes with a pair of bevel gears 33 and 34 operatively associated with the screw shaft 13. A shaft 35 is provided which is suitably journaled in the end plate 5 to permit its rotation, and keyed to it is the gear wheel 11, which, through its association with the train of gearing 7, 8, 9, etc., transmits motion to the screw shaft 13. The bevel gear 33 is keyed to the shaft 13 in any suitable manner, and is thus rotated with it, and being in mesh with the bevel gear 30 motion is transmitted to the said bevel gear 30 and the said bevel gear 30 in turn transmitting motion to the bevel gear 34. The bevel gear 34 is loosely secured to the shaft 13 and suitably collared to prevent lateral movement of the same on the shaft 13. A sleeve 36 is provided which is slidably mounted upon the shaft 13 between the bevel gears 33 and 34 by means of a suitable keyway 37. The plane faces 38 and 39 of the sleeve 36 are toothed, as are the plane faces 40 and 41 of the bevel gears 33 and 34 so that when the sleeve 36 is moved to the left, its toothed face 38 meshes with the toothed face 40 of the bevel gear 33. When the said sleeve 36 is moved to the right, its toothed face 39 meshes with the toothed face 41 of the bevel gear 34, and the meshing of these toothed faces 38 and 40 or 39 and 41 of the sleeve 36 and bevel gears 33 and 34 determines the direction of travel of the reciprocating shaft 14 as will presently be described.

I provide an automatic shifting or trip mechanism T which brings about the shifting of the sleeve 36 the instant the reciprocating shaft 14 which carries the feed arms 110 has reached the end of its travel in one direction in placing a layer of convolutions of wire on the tube on the main or winding shaft 3 to start the travel of the reciprocating shaft 14 in the opposite direction to start a new layer of convolutions of wire on the tube. A collar 45 is slidably supported on the shaft 13 and has suitably secured to it a plate member 46 provided with extended portions 47 and 48 to which are secured a pair of arms 49 and 50 which extend parallel to the shaft 13 from the extended portions 47 and 48 of the plate 46. A yoke member 51 is suitably secured to the arms 49 and 50 and spans the sleeve 36 which is slidably supported on the shaft 13 between the bevel gears 33 and 34. The link connection comprising the arms 49 and 50 secured to the plate extensions 47 and 48 of the plate 46 secured to the slidable collar 45 on the shaft 13 and the slidable

sleeve 36 on the shaft 13 brings about the movement from left to right and vice versa of the slidable sleeve 36 between the toothed faces 38 and 40 of the bevel gears 33 and 34, as will presently be described.

I provide a pivot member 52 which is secured to the base 2 in any suitable manner, and pivotally supports a U-shaped member 53. The arms 54 and 55 of the U-shaped member extend rearwardly and span the slidable collar 45 on the shaft 13. The arms 54 and 55 have secured to them studs 56 and 57 by means of nuts 58 which have threaded engagement with threaded extensions of the studs 56 and 57. Rollers 59 and 60 supported by the studs 56 and 57 rest in an annular groove 45' in the collar 45 slidably supported on the shaft 13. The U-shaped member 53 pivotally supported by the pivot 52 is provided with an integrally formed arm extension 61 which extends forward in a slot 62 in the lower portion of a rectangularly shaped block 63 secured to the base 2 in any suitable manner. The block 63 is provided with a pair of longitudinal orifices 64 and 65 of a size to receive rods 66 and 67 which cooperate with the end 61' of the arm extension 61 of the U-shaped member 53 as will presently be described. The rods 66 and 67 extend through a square orifice 70 in the block 63 and the portion of said rods 66 and 67 which extend through this orifice 70 support spiral springs 71 and 72. The rods 66 and 67 have secured to them collars 73 and 74 which rest against the face 75 of the square orifice 70 and support the rods 66 and 67 in the orifices 64 and 65 in the block 63. The spiral springs 71 and 72 around the rods 66 and 67 rest between the collars 73 and 74 secured to the rods 66 and 67, and the face 76 of the square orifice 70 in the block 63 and the tension of the spiral springs 71 and 72 is such as to tend to hold the collar 73 and 74 on the rods 66 and 67 against the face 75 of the square orifice 70 in the block 63. The ends 66' and 67' of the rods 66 and 67 extend through their respective orifices 64 and 65, and are adapted to cooperate with the arm extension 61 of the U-shaped member 53 for purposes as will presently be described. A U-shaped member 78 is secured to the rectangular block 63 by means of screw 79 and is provided with orifices 80 and 81 in alignment with the orifices 64 and 65 in the block 63, the orifices 80 and 81 being adapted to receive the rods 66 and 67 which extend through the said orifices. A pair of depending members 82 and 83 integrally formed with the U-shaped member 78 pivotally supports by means of a pivot pin 84 a T-shaped member 85. The member 85 is provided with integrally formed wings 86 and 87 which are provided with bifurcated ends which straddle the rods 66 and 67 and

pins 88 and 89 secured to the rods 66 and 67 engage the wings 86 and 87 of the member 85, the said wings being for purposes as will presently be described.

The reciprocating shaft 14 supports a pair of arms 90 and 91 which are suitably clamped to the shaft 14 against movement by means of clamping screws 92. The arms 90 and 91 are provided with adjustable screws 93 and 94 which have screw-threaded engagement with suitable tapped orifices in the arms 90 and 91, the said adjustable screws 93 and 94 being provided with nuts 95 for locking the screws 93 and 94 in any of their adjustable positions. The leg 96 of the T-shaped member 85 pivotally supported by the U-shaped member 78 extends downward and lies in the path of travel of the adjustable screws 93 and 94 and as illustrated in Fig. 4, I show a fragment of the reciprocating shaft 14 and its supported arms 90 and 91 in their extreme left position in which position the last turn of a layer of convolutions has been placed on the tube on the main or winding shaft 3. As the reciprocating shaft 14 travels to the left, the end 94' of the adjustable screw 94 will engage the leg 96 of the T-shaped member 85 and rock it about its pivot 84. The wing 86 of the member 85 being in engagement with the pin 88 on the rod 66 will start to move the rod 66 upward causing the spring 71 to be compressed against its normal tension.

A yoke member 100 which spans the arm extension 61 of the U-shaped member 53 is provided with a pair of integrally formed rod extensions 101 and 102 which pass through suitable orifices in the integrally formed depending members 104 and 105 of the arms 90 and 91 secured to the shaft 14, thus supporting the yoke member 100 in position in association with the arm extension 61. Spiral springs 106 and 107 rest around the rod extensions 101 and 102, and as the arms 90 and 91 travel to the left, with reference to Fig. 4, the spring 107 on the rod extension 102 is compressed against its normal tension. The instant that the rod 66 is raised in the position illustrated in Fig. 4, as before described, the spring 107 around the rod extension 102 which was compressed acts upon the arm extension 61 of the U-shaped member 53 and rocks the U-shaped member 53 about its pivot 52. This movement causes the arm extension 61 to be moved to the left with reference to Fig. 4, and causes the arms 54 and 55 of the U-shaped member 53 to be moved to the right, and due to the connection between the arms 53 and 54 and the collar 45, the said collar 45 is moved to the right. The connection between the collar 45 and the sleeve 36 in the form of a link connection which comprises the arms 49 and 50 also causes the

toothed face 38 of the sleeve 36 which was in engagement with the toothed face 40 the bevel gear 33 to disengage the same and move its toothed face 39 into engagement with the toothed face 41 of the bevel gear 34. The instant that the arm extension 61 is forced to the left, its edge 61² is moved beyond the orifice 65 which extends into the slot 62. The spring 72 around the rod 67 was placed under tension, due to the raising of the rod 67 by the wing 87 of the member 85 when the reciprocating shaft 14 was traveling in a direction from left to right, now forces the rod 67 downward until the collar 74 again engages the face 75 of the orifice 70 in the block 63; this collar 74 as is readily apparent serves as a stop to limit the movement of the rod 67 in a downward direction. The end 67' of the rod 67 now protrudes slightly into the slot 62 in the block 63 and holds the arm extension 61 of the U-shaped member 53 in its position illustrated in Fig. 4, to hold the toothed face 39 of the sleeve 36 slidably mounted on the shaft 13 in engagement with the toothed face 41 of the bevel gear 34. The instant that the arm extension 61 of the U-shaped member 53 is tripped, a just described, the reciprocating shaft 14 starts its travel in a direction from left to right with reference to Fig. 4. As the reciprocating shaft 14 continues its travel from left to right, the adjustable screw carried by the arm 93 will engage the leg 96 of the member 85 and cause the said member 85 to rock about its pivot 84. The wing 87 of the member 85 now engages the pin 89 on the rod 67 and starts the movement of the rod 67 in an upward direction. The wing 86 of member 85 now disengages the pin 88 on the rod 66, but the rod 66 is held in its shifted position as the face of the arm extension 61 when in the position illustrated in Fig. 4, covers the orifice 64 through which the end 66' of the rod 66 is adapted to protrude, and, therefore, the end 66' of the rod 66 rests against the face of the arm extension 61, thus holding the spring 71 around the rod 66 under compression. As the rod 67 moves upward, the spring 72 supported on it is placed under compression. The instant that the end 67' of the rod 67 is raised free of the edge 61² of the arm extension 61, the spring 106 around the pin extension 101 of the yoke 100 which was placed under tension, due to the movement of the arm 90 on the shaft 14 to the right now forces the arm extension 61 to the right. This movement again shifts the sleeve 36 causing its toothed face 39 to disengage the toothed face 41 of the bevel gear 34 and move its toothed face 38 into engagement with the toothed face 40 of the bevel gear 33. This movement again causes the reciprocating shaft 14 to travel from right to left. The spring 71 around the

rod 66 which was under compression as before described, is now free to force the rod 66 downward permitting its end 66' to again protrude into the slot 62 to hold the arm extension 61 of the U-shaped member 53 in its tripped position until the reciprocating shaft 14 has reached the end of its travel, when the tripping mechanism will again function in a manner that is obvious from the description just given.

From the above description, it may be seen that I provide a trip mechanism which is most positive in its operation and the reversal of travel of the reciprocating shaft 14 is brought about the instant the required number of turns is placed in a layer wound on the tube supported by the winding shaft 3. The adjustable screws 93 and 94 on the arms 90 and 91 secured to the reciprocating shaft 14 provide micrometer means by which the length of the coils being wound on the winding shaft 3 can be gauged exactly, and in combination with the gearing ratio between the main or winding shaft 3 and the screw shaft 13 a coil may be wound that will contain the required number of turns per inch. The adjustable screws 93 and 94 are also for the purpose of permitting various lengths of coils to be wound in multiple, and in combination with the gearing ratio between the winding shaft 3 and the screw shaft 13, the required number of turns per inch may be placed on the coil depending upon the length of the coil to be wound.

The description up to this point gives in detail a description of the shifting or trip mechanism for reversing the travel of the reciprocating mechanism for placing successive layers of wire on the coils being wound in multiple. I will now describe in detail the arrangement of the compensating mechanism of my invention for preventing the piling up of the first few turns of wire at the beginning of a new layer being wound upon the coils of the spindle shaft.

The reciprocating shaft 14 with which the guide arms 110 are associated, and the connection means for associating them therewith so that they travel with the reciprocating shaft 14 in its travel from left to right and vice versa will now be described. The reciprocating shaft 14 extends across the machine and is slidably supported at its one end in a supporting bearing 111 secured to the base 2 in any suitable manner and intermediate of its end in the end plate 6. I provide a supporting member or rack 112 which is securely clamped to the reciprocating shaft 14 in any suitable manner to prevent movement of the same on the reciprocating shaft 14. The left end portion of the rack 112 secured to the reciprocating shaft 14 supports the compensating mechanism C' of my invention. This compensating device C'

provides means for shifting the guide arms 110 so as to prevent the piling up of the first few turns of wire at the beginning of a new layer being wound upon the coil supported on the winding shaft 3. A pair of bearing supports 113 and 114 are secured to each end of the rack 112 and are provided with depending members 115 which fit into suitable slots 116 in each end of the rack 112 and suitable fastening means are provided to secure the bearing supports 113 and 114 to the rack 112. The bearing supports 113 and 114 are provided with suitable orifices 314 which are adapted to receive the sleeves 117 which are provided with orifices 118 which receives ball bearings 319 which are held rotatably in said orifices 118 against displacement by suitable means. A shaft 119 having reduced end portions 120 of a size to fit in the sleeves 117 in the bearing supports 113 and 114 slidably support the shaft 119 in the said sleeve members 117 to permit the said shaft 119 to shift to the right or left a limited distance for purposes as will presently be described. A pair of arms 121 and 122 are secured to the shaft 119 by means of suitable clamping screws and rotatably support a shaft 431 upon which the guide arms 110 are secured. A rectangular shaped member 123 rests in the slots 116 in the rack 112 and is provided with orifices 124 which receive ball bearings 125 which are contained in the orifices 124 in the faces of the rectangular shaped member 123. The arms 121 and 122 are provided with rectangular shaped extending portions 126 which are of a size to fit into the rectangular shaped members 123 in the slots 116 in the rack 112. As before described, the shaft 119 is adapted to shift to the right or left, and as the arms 121 and 122 are secured to the shaft 119 they also move along with the said shaft. The rectangular members 123 into which the extensions 126 of the arms 121 and 122 rest are provided with the ball bearings 125 as before described, and serve as bearings to permit the free movement of the said arms 121 and 122 in the slots 116 of the rack 112. The bearing sleeves 117 which support the shaft 119 and the bearings 123 in the slot 116 into which the arm extensions 126 rest gives the shaft 119 which is adapted to shift from left to right and vice versa a ball bearing support which insures free movement of the shaft 119 in its limited travel. The arm 121 has secured to it a pin 130 which extends in a slot 131 in a pivoted member 132 pivotally secured to the rack 112 and an adjustable screw 430 threaded in the member 132 extends into the slot 131 and cooperates with the pin 130 for purposes as will presently be described.

The clutch mechanism for controlling the backward and forward movement of the guide arms and its associated parts is sup-

ported as a whole on the reciprocating shaft and its relation to the coils being wound on the winding spindle will now be described. The clutch member 320 is provided with a central orifice 321 and an integrally formed extended portion 322 is provided with an orifice 323 of a size to receive the integrally formed collar 324 of the rack 112. The clutch member 320 which is supported on the rack 112 is keyed to the collar 324 of the rack 112 to secure the same thereto against movement. The clutch member 320 is provided with a vertical slot 325 cut therein by a suitable milling operation and extends into the clutch member 320 about half way as clearly illustrated in Fig. 13. Another slot 326 cut in the face 327 of the clutch member 320 extends into the clutch member 320 to a depth to intersect the vertical slot 325. The two slots 325 and 326 thus cut in the member 320 form a clamp member 327 for purposes as will be presently described. A collar 328 secured to the reciprocating shaft 14 by means of a pin is of a size to fit in the orifice 321 of the clutch member 320. A bolt 330 passing through a suitable orifice in the free end of the clamp member portion 327 of the member 320 has screw threaded engagement with a suitable tapped orifice 330' in member 320 and a spring 331 resting between the bolt head and the member 320 may be placed under an adjustable tension to cause the inner circumferential face 332 of the clamping portion of the member 320 to grip the circumferential face 333 of the collar 328 for purposes as will presently be described.

The member 320 is provided with a transverse slot 334 which is adapted to receive a hand lever 335 secured therein by suitable means against movement and a hand lever 336 pivotally secured therein by means of a pivot pin 337. The lever 336 is held in its normal position by means of a spring 338 which is supported on a rod 339 secured to the lever 335 and passing through a suitable orifice in the lever 336. The lever 336 is provided with a suitable integrally formed lug 340 which rests in a notch 341 in the face 342 of the free end 343 of the clamp portion 327 of the member 320 to operate the clamp portion 327 as will now be described. The movement of the rack 112 and its supported parts including the guide arms 110 forward or backward in relation to the winding spindle to permit the said arms 110 to be placed in the proper position for feeding the wire to the coils on the winding spindle will now be described. The hand lever 336 is grasped and pressed forward causing the lug 340 in the groove 341 to force the free end 343 of the clamp portion 327 of the member 320 against the normal tension of the spring 331. This movement of the hand lever 336 causes the clamp

member 327 to move outward causing the inner circumferential face 332 of its orifice 321 to disengage the circumferential face 333 of the collar 328 to permit the rack 112 and its supported parts and guide arms 110 to be rocked about the reciprocating shaft 14 to place the guide arm 110 in proper relation to the winding spindle 3. When the proper adjustment of the guide arms 110 has been made the hand lever 336 is released and the spring 331 which was placed under tension due to the movement of the free end 343 of the clamp member 327 of the clutch member 320 forces the clamp member 327 back to its normal position. This movement permits the inner circumferential face 332 of the orifice 321 to again grip the circumferential face 333 of the collar 328 to hold the rack 112 and its supported parts including the guide arms 110 in their adjusted position. The hand lever 336 is also restored through the agency of the spring 338 and spring 331. The guide arms 110 may be moved away from the winding spindle 3 without affecting their adjusted position as before described as the guide arms 110 are secured to the shaft 431 which is rotatably supported between the arms 121 and 122. A member 345, clamped to the shaft 431, is provided with a wing extension 346 which engages the stop pin 347 to limit the movement of the arms 110 when they are turned to their raised position. The wing 348 engages the stop pin 347 when the arms 110 are in their normal position.

I also provide a semi-automatic paper feed mechanism PF into which the required length of paper is inserted by the operator and which paper is injected the instant a new layer of convolutions of wire is started. The paper feed mechanism comprises a suitable supporting frame 350 secured to the base 2 in any suitable manner. A plate member or shelf 351 is secured to the frame 350 by means of suitable screws upon which the operator may place the paper sheets which are fed into the machine. I provide a pair of bearings 352 and 353 secured to the base 2 which support a shaft 354. A pair of upright members 355 and 356 are secured to the shaft 354 and are provided with angular extensions 357 and 358. A pair of rollers 359 and 360 are connected by yokes 361 and 362, the said roller 359 being provided with extended end portions which are supported in suitable orifices in the angular extensions 357 and 358. The yoke 361 is provided with an extension to form a handle 363 which when raised rotates the roller 359 in its bearing orifices in the angular extensions 357 and 358 and due to the yoke connections 361 and 362 the roller 360 is moved downward. The left end extension of the roller 359 extends through the

extension 357 and a spring 364 having one end secured to the roller extension and its other end secured to the upright member 355 hold the connected rollers 361 and 362 in their position as illustrated in Fig. 14. A roller 365 is also supported between the upright members 355 and 356 and co-operates with the rollers 359 and 360 for purposes as will presently be described. To insert a strip of paper the handle 363 is grasped by the operator and raised causing the roller 359 to rotate and due to the yoke connections 361 and 362 the roller 360 swings downward. A strip of paper is now inserted between the rollers 359 and 360 and under the roller 365 with the forward edge of the strip of paper resting on top of the coils on the winding spindle 3.

When in this position the handle 363 is released permitting the rollers 359 and 360 to assume their normal position under the influence of the spring 364. The strip of paper is now in position to be inserted in the coils on the winding spindle 3 as will now be described. The instant the arm 61 of the trip mechanism is moved to bring about the operation of the reversing gearing to start the travel of the reciprocating shaft 14 in the opposite direction as previously described to start a new layer, a nose 367 integrally formed with the arm 61 engages the arm 368 of the bell crank lever 369 which is pivotally secured to the base 2 by the pivot pin 370 and causes its arm 371 to be moved to the left. I provide a pin member 372 slidably supported in a casing 373 secured to the base 2, the said pin 372 being held in its position as illustrated in Fig. 2 by suitable spring means. An arm 374 suitably secured to the upright member 355 extends rearwardly and normally rests on the pin 372 which protrudes from its supporting casing 373. A pivoted arm 375 pivotally secured to a shaft 376 extends forward and normally rests on a substantially square shaped stop 377 secured to the upright member 355. Now the instant the arm 61 is tripped the lever 369 is rotated about its pivot 370 and due to the link 378 between the arm 371 of the lever 369 and the pin 372, the pin is drawn to the left and permits the arm 374 which normally rests upon the pin 372 to move downward. The upright members 355 and 356 are secured to the shaft 354 and through the influence of a spring 380 which has one end secured to the base 2 and its other end secured to a collar 381 tight on the shaft 354 the said upright members 355 and 356 and their supported parts are now moved forward, this forward movement being permitted when the pin 372 is drawn to the left to disengage the arm 374. This forward movement of the upright members 355 and 356 which carry the roll-

ers 359 and 360 and 365 which hold the paper strip in readiness is now injected and the wire strands from the supply members SD feed the paper strip into the coils on the winding spindle 3. As the paper strip is drawn into the coils the paper strip passes over and under its respective rollers and keeps the paper smooth while being inserted.

When the upright members 355 and 356 and their supported parts move forward the stop 377 enters the notch 382 in the arm 375 and permits the arm 375 to move downward a short distance. A lever 383 pivotally secured to the upright member 357 and held in its normal position against its stop 384 is provided with an angular extension 385 upon which the arm 375 rests when it moves downward. After the paper strip has been inserted and the shaft 14 is traveling in its reversed direction, the arm 61 which was tripped to bring about this reversal having shifted, its nose 367 has passed the nose 386 of the arm 368 of the lever 369, but the lever 369 remains in its shifted position due to the fact that the arm 374 has moved downward in the path of the pin 372. To restore the upright members 355 and 356 the operator now grasps the lever 383 and draws it forward. This movement of the lever 383 causes its angular extension 385 to engage the arm 375 and move it upward. This movement of the arm 375 causes its notch 382 to disengage the stop 377 on the upright member 355 and when the lever 383 engages the stop pin 388 on the upright member 355 the continued pull on the lever 383 causes the upright members 355 and 356 and its supported parts to move forward and as the arm 374 is secured to the upright member 355 it is also raised. When the bottom edge of the arm 374 is raised above the pin 372, the pin 372 is moved out under spring tension. The lever 369 is restored to normal again placing the nose 386 of the arm 368 in the path of the nose 367 of the arm 61 and when the upright members 355 and 356 and its supported parts are restored the arm 374 will again rest on the pin 372 and hold the paper feed mechanism in position to insert another strip of paper when the trip mechanism is operated as before described.

I also provide a plurality of rollers 390 of pliable material such as rubber individually supported on shafts 391, there being as many rollers 390 as there are coils being wound on the winding spindle 3. Each roller 390 is rotatably supported by its shaft 391 which is supported in suitable bearings 392 in the supporting arms 393 and 394. Each pair of supporting arms 393 and 394 and roller 390 form a unit structure and each roller 390 and its sup-

porting arms 393 and 394 is rotatably secured to a shaft 376 which is supported in a pair of block bearings 395 secured to the base 2. A shaft 396 rotatably supported in block bearings 397 secured to the base 2 has secured to it a pair of arms 398 and 399 which rotatably support a square shaft 400 between them. A rod 401 supported between the arms 393 and 394 of each of the roller units has rotatably secured thereto a thimble 402 which is provided with an extending member 403 provided with a threaded orifice 404. A rod 405 is provided which passes through suitable orifices 406 in the square shaft 400 and has screw threaded engagement with the tapped orifices 404 of the thimbles 402. Springs 407 supported on the rods 405 rest between the square shaft 400 and the thumb nuts 408 which have screw threaded engagement with the threaded ends of the rods 405. A lever 409 secured to the shaft 396 is adapted to rock the shaft 396 in its bearing supports 397 to move the arms 398 and 399 forward or backward. The lever 409 when in position as illustrated in Fig. 15 holds the rollers 390 in engagement with the coils being wound on the spindle shaft 3. To move the rollers 390 away from the coils on the winding spindle 3, the trigger of the lever 409 is actuated to disengage it from the notch 410 in the plate 411 secured to the base 2 and raised to rock shaft 396 in its bearings 397. The arms 398 and 399 are also moved back and as the square shaft 400 is supported by the arms 398 and 399 and as the sleeves are supported by the extensions 403 of the thimbles 402 and since the square shaft 400 is common to the rollers 390, the rollers 390 which are individually supported by the shaft 376 are also moved back away from the coils on the winding spindle 3. When the lever 409 is moved down to cause the trigger to again engage the notch 410 in the plate 411 the rollers 390 are again moved into engagement with the coils on the winding spindle 3. As the lever 409 is moved downward the arms 398 and 399 are moved forward and square shaft 400 bears against the springs 407 and compresses the springs 407 and this tension draws the rollers 390 and their supporting arms 393 and 394 forward again moving the roller 390 into engagement with the coils on the winding spindle 3. I provide an individual roller 390 for each coil on the spindle shaft 3 an individual tension adjusting means of each roller 390 so that each roller 390 will bear with an equal tension on each coil being wound of the spindle shaft 3. These rollers 390 insure the placing of the paper on smoothly and insure a coil tightly wound also insuring a coil of minimum diameter for a predetermined number of coils.

To the right end portion of the rack 112 I associate a frictional device R which comprises a U-shaped member 135 which is secured to an integrally formed angular extension 137 of a supporting block 136 which is secured to the base 2 by suitable means. The U-shaped member 135 is provided with integrally formed ears 138 intermediate its ends, between which a rod 139 is pivotally supported by means of a pin 140 suitably secured to the base. The U-shaped member 135 is provided with a pair of extending members 141 between which is pivotally supported a plate 142. The bottom face of the plate 142 has secured thereto a frictional member 143 which may be of leather, or any substance which will give a frictional effect. The U-shaped member 135 is also provided with a strip of frictional material 144, such as leather, and secured thereto in any suitable manner. A flat sliding plate 145 is slidably supported between the friction members 143 and 144 and has secured to its one end an angular member 146. The inner faces of the member 146 and the plate 145 are provided with counter-sunk portions which are adapted to receive a ball 147 to form a ball and socket joint, the said ball 147 being provided with a connecting knuckle 148. The plate 145 rests between the legs of the U-shaped member 135 and engages the faces of the frictional members 143 and 144 secured respectively to the U-shaped member 135 and the hinged plate 142. In order to obtain a positive frictional engagement between the plate 145 and the frictional members 143 and 144, I provide a coil spring 149 which rests around the rod 139 which is pivotally supported on the U-shaped member 135, the said rod 139 also passing through an orifice in the hinged plate 142. The spring 149 rests between the hinged plate 142 and a thumb nut 150 having screw-threaded engagement with the end of the rod 139 the said nut 150 being used for placing the spring 149 under compression to force the frictional member 143 of the hinged plate 142 into engagement with the plate 145. The member 132 pivotally secured to the rack 112 is provided with a slotted extension 155 which is adapted to receive a cup member 156 provided with an integrally formed extension 157 which rests in the slot 158 of the member 132 and a nut 159 having screw-threaded engagement with the threaded extension 157 secures to the cup member 156 in the slot 155 of the member 132. The cup member 156 is adapted to receive a ball 160 which is held therein by means of a retaining ring 161 which is secured to the cup member by screws 162 and this supporting means for the ball 160 in the cup member 156 forms a ball and socket joint. The ball 160 is provided with

a connecting knuckle 163 and a connecting rod 164 and has its ends secured respectively to the connecting knuckle 163 of the ball and socket joint supported by the member 132 and the ball and socket joint supported by the plate 145 for purposes as will presently be described.

Having described the apparatus which comprises my compensating device, I will now describe in detail its operation in connection with the winding of a coil. When the lever 24 has moved to the position shown in Fig. 1, which is the position of the lever when the winding machine is adapted to place a predetermined number of turns per inch on each layer, and the trip mechanism is in the position illustrated, the reciprocating shaft 14 is adapted to start its travel from left to right. The operator now actuates the clutch pedal and causes the rotation of the main or winding shaft 3 and through the agency of the train of gearing 7, 8, 9 etc., and the reversible mechanism D, the screw shaft 13 is rotated.

For the sake of explanation and a clear understanding of the operation of the machine let us assume that the ratio of the train of gearing of the machine is such as to wind or place 169 convolutions of wire per inch per layer on the coil, and that three layers of insulating paper are also to be placed between each new layer of the coil. With this assumption the instant power is applied, the main or winding shaft 3 begins to rotate and through the agency of the train of gearing as before described the screw shaft 13 is rotated. The arm 15 secured to the reciprocating shaft 14 is in engagement with the rotating screw shaft 13 and this engagement caused the reciprocating shaft 14 to travel to the right. The combination of the rotating shaft 3 and the traveling reciprocating shaft 14, permits the wire from the supply devices SD to be placed on the coil at a predetermined number of convolutions per inch. The instant that the reciprocating shaft 14 starts its travel to the right a strip of paper insulation is inserted and wound on the coil. Due to the adjustment of the compensating device, the first turn or turns or a half of wire may be put on at the rate of 169 turns per inch, and the next few turns may be put on say at the rate of sixty turns per inch, due to the adjustment of the compensating device. When the winding shaft 3 begins to rotate, the screw-shaft 13 also rotates due to the train of gearing and as the arm 15 secured to the reciprocating shaft 14 engages the screw shaft 13, the said reciprocating shaft 14 starts its travel to the right, and the wire will be put on at the rate of 169 turns per inch. The instant that the shaft 14 moves to the right, the member 132 of the compensating device C will rotate about its pivot 170 to the right, due to the

pressure exerted upon it by the movement of the shaft 14 to the right, and also due to the frictional device which grips the plate 145 between the friction member 143 and 144 and the frictional engagement between the plate 145 and the friction members 143 and 144 being of sufficient strength at this time to prevent lateral movement of the plate 145 which is connected to the member 132 by means of the connecting rod 164. The member 132 is rotated about its pivot 170 until the left side of the slot 131 engages the pin 430 secured to the arm 121 which we have assumed will be immediately after the completion of the first turn or turn and a half of wire, and paper on the coil. The continued movement of the reciprocating shaft 14 to the right now causes the arms 121 and 122 which are supported in the slot 116 of the rack 112 to move to the right. The shaft 119 which is supported in the sleeves 117 of the bearing supports 113 and 114 secured to the rack 112 to which the arms 121 and 122 are secured, is also moved to the right until the end 120 of the shaft 119 engages the adjustable screw stop 175 in the member 114 secured to the rack 112. The shaft 431 which is supported by the arms 121 and 122 and carries the guide arms 110 is also moved to the right, thus spacing the next few convolutions of wire on the coil at the rate of sixty turns per inch. When the shaft end 120' engages the screw stop 175 further movement of the arms 121 and 122, shaft 119, and the shaft 431 with its supported guide arms 110 as a whole is arrested. The continued movement of the reciprocating shaft 114 now overcomes the frictional power applied to the plate 145 by the frictional members 143 and 144 and the continued movement of the reciprocating shaft 14 now forces the plate 145 to the right between the friction members and the convolutions of wire are now placed on the coil on the winding shaft 3 at the rate of 169 turns per inch.

It is to be understood that the turns of wire of the coils associated with the other guide arms 110 will be wound in the same manner and at the same rate of turns of wire per inch as that described, since the guide arms 110 are all secured to the shaft 431 and the said arms 110 move simultaneously in the same direction.

Now, as the reciprocating shaft continues in its travel, the adjustable screw 93 carried by the arm 90 secured to the reciprocating shaft 14 engages the leg 96 of the T-shaped member 85 pivotally supported and rocks it about its pivot 84. When the shaft 14 reaches the end of its predetermined travel, which is regulated by the adjustable screws 93 and 94 as before described, the adjustable screw 93 will have rocked the T-shaped member 85. The wing 87 which was moved upward due to the rocking of

the T-shaped member 85 in the travel of the shaft 14 from left to right, raised the rod 67 until its end 67' is free of the edge of the pivoted arm 61 of the U-shaped member 53. The arm 61 is now free and due to the pressure of the spring 106 which was compressed by the movement of the arm 90 to the right, forces the arm 61 to the right to permit the rod 66 to move down to permit its end 66' to enter the slot 62 and engage the arm 61 and hold it in its shifted position. The movement of the arm 61 causes the legs 54 and 55 of the U-shaped member 53 to swing to the left, and due to the link connection between the sliding sleeve 36 and the collar 45, the sleeve 36 is moved so that its toothed face 38 disengages the toothed face 40 of the bevel gear 33 and causes its toothed face to engage the toothed face 41 of the bevel gear 34. This movement of the sleeve 36 causes the screw-shaft 13 to reverse its direction of rotation to cause the reciprocating shaft 14 to move from right to left. The instant that the arm 61 is tripped its nose 367 engages the nose 386 of the lever 368 and brings about the tripping of the paper feed mechanism PF as already described.

I also provide a train of gearing which comprises gears 18, 18' and 18² and 18³, the gear 18 being loosely secured to the shaft 3 and 18³ being secured to the screw shaft 13, to transmit motion to the screw shaft 13 for purposes as will now be described. When the arm 24 is moved to the right to move the sleeve 21 into mesh with the collar 16 fast with the gear wheel 18 motion is transmitted through the gear train 18, 18' etc., to the screw shaft 13 and the ratio of the gear train 18, 18' etc., is such as to cause the screw shaft 13 to rotate causing the reciprocating shaft 14 to travel to space the turns at the rate of say fifty per inch. This spacing of the turns of wire is especially adapted for use when finishing a coil when the required number of turns have been placed on the coil.

While I have described my invention operating in connection with a particular type of multiple winding machine, I do not wish to be limited to this application of my invention to a particular type of winding machine, as my invention is applicable to other types of winding machines. I also do not wish to be limited to the exact structure as shown, as changes and modifications will readily suggest themselves by those skilled in the art, and, therefore, aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patents, is:

1. A machine of the character described

including a winding shaft, a reciprocating shaft having a to and fro movement, guide means associated with said reciprocating shaft for guiding and feeding strands of wire to said winding shaft, means for rotating said winding shaft to wind said strands of wire in layers on said winding shaft, reversing mechanism and trip mechanism controlled by said reciprocating shaft for causing the operation of said reversing mechanism to cause the to and fro movement of said reciprocating shaft, and means for shifting said guide means a predetermined degree in the direction of travel of said reciprocating shaft.

2. A machine of the character described including a winding shaft, a reciprocating shaft having a to and fro movement, guide means associated with said reciprocating shaft for guiding and feeding strands of wire to said winding shaft, means for rotating said winding shaft to wind said strands of wire in layers on said winding shaft, reversing mechanism, trip mechanism, adjustable means secured to said reciprocating shaft adapted to engage said trip mechanism at a predetermined point in the travel of said reciprocating shaft to actuate said trip mechanism to operate said reversing mechanism, and means for shifting said guide means a predetermined degree in the direction of travel of said reciprocating shaft at the beginning of each layer.

3. A machine of the character described including a winding shaft, a reciprocating shaft having a to and fro movement, guide means associated with said reciprocating shaft for guiding and feeding strands of wire to said winding shaft, means for rotating said winding shaft to wind said strands of wire in layers on said winding shaft, reversing mechanism and trip mechanism, adjustable means secured to said reciprocating shaft adapted to engage said trip mechanism at a predetermined point in its travel, and means for associating said trip mechanism with said reversing mechanism actuated by said trip mechanism to shift said reversing mechanism to cause the to and fro movement of said reciprocating shaft, and means for shifting said guide means a predetermined degree in the same direction as the travel of said reciprocating shaft.

4. A machine of the character described including a winding shaft, a reciprocating shaft having a to and fro movement, and guide means associated with said reciprocating shaft for guiding and feeding strands of wire to said winding shaft to place successive layers of wire on said winding shaft through the agency of said to and fro movement of said reciprocating shaft, trip mechanism controlled by the to and fro movement of said reciprocating shaft and re-

versing mechanism operated by said trip mechanism to bring about the travel of said reciprocating shaft in its to and fro movement, and means operated at the beginning of each reversal of travel of said reciprocating shaft to shift the said guide arms in the same direction of travel as the said reciprocating shaft.

5. A machine of the character described including a winding shaft, a reciprocating shaft having a to and fro movement and guide means associated with said to and from moving reciprocating shaft for guiding and feeding strands of wire to said winding shaft to place successive layers of wire on said winding shaft, trip mechanism, adjustable means on said reciprocating shaft for engaging said trip mechanism at a predetermined point in its to and fro movement, reversing mechanism, connecting means between said trip mechanism and said reversing mechanism actuated by the operation of said trip mechanism to shift said reversing mechanism to reverse the travel of said reciprocating shaft to start a new layer on said winding shaft, and means for shifting said guide means in the direction of travel of said reciprocating shaft at the beginning of each layer.

6. A machine of the character described including a winding shaft, a reciprocating shaft having a to and fro movement and guide means associated with said to and from moving reciprocating shaft for guiding and feeding said strands of wire to said winding shaft to place successive layers of wire on said winding shaft, trip mechanism and adjustable means on said reciprocating shaft for actuating said trip mechanism at a predetermined point of travel of the reciprocating shaft, to reverse the travel of said reciprocating shaft, paper mechanism, connecting means between said trip mechanism and said paper feed means actuated when said trip mechanism is operated to trip said paper feed means to insert a strip of paper the instant the reciprocating shaft starts its reversal of travel.

7. A machine of the character described including a winding shaft, a reciprocating shaft and guide means associated with said reciprocating shaft for guiding and feeding strands of wire from a supply source to said winding shaft to place successive layers thereon, a trip mechanism, adjustable means on said reciprocating shaft actuating said trip mechanism at a predetermined point of travel of said reciprocating shaft in its to and fro movement, reversing mechanism actuated by said trip mechanism to reverse the direction of travel of said reciprocating shaft and paper feed means and a connecting link between said paper feed means and said trip mechanism actuated when said trip mechanism is operated to

trip said paper feed means to insert a strip of paper on said winding shaft the instant the direction of travel of the reciprocating shaft is reversed to place a new layer of wire on said winding shaft.

8. A machine of the character described including a winding shaft, a reciprocating shaft and guide arms associated with said reciprocating shaft for guiding and feeding strands of wire from a source of supply to said winding shaft to place successive layers thereon, a rack supported on said reciprocating shaft, and supporting means for said guide arms on said rack, clutch mechanism for holding said rack on said reciprocating shaft for maintaining said guide arms in position relative to said winding shaft.

9. A machine of the character described including a winding shaft, a reciprocating shaft and guide arms associated with said reciprocating shaft for guiding and feeding strands of wire from a source of supply to said winding shaft to place successive layers of wire thereon, a rack supported on said reciprocating shaft, arms supported on said rack and a rod supported by said arms having said guide arms secured thereto, clutch mechanism for holding said rack on said reciprocating shaft, and means for actuating said clutch mechanism to move said rack and guide arms as a whole on said reciprocating shaft to adjust said arms relative to said winding.

10. A machine of the character described including a winding shaft, a reciprocating shaft and guide arms associated with said reciprocating shaft for guiding and feeding strands of wire from a source of supply to said winding shaft to place successive layers of wire thereon, a rack supported on said reciprocating shaft, arms supported by said rack and a rod supported by said arms having said guide arms secured thereto, clutch mechanism for holding said rack on said reciprocating shaft, means for actuating said clutch mechanism to move said rack and guide arms as a whole on said reciprocating shaft to adjust said arms relative to said winding shaft, and means independent of said clutch mechanism for shifting said guide arm without affecting the adjustment of said guide arm relative to said winding shaft.

11. A machine of the character described including a winding shaft, a reciprocating shaft and guide means supported thereon for guiding and feeding strands of wire from a source of supply to said winding shaft to place successive layers thereon, trip mechanism controlled by the to and fro movement of said reciprocating shaft and reversing mechanism operated by said trip mechanism to cause the to and fro movement of said reciprocating shaft, a paper feed mechanism, a catch for holding said paper feed mechanism at rest, a link connection between said catch and said trip mechanism actuated when said trip mechanism is operated to release said catch to permit said paper feed to operate to insert a strip of paper on said winding shaft.

12. A machine of the character described including a winding shaft, a reciprocating shaft and guide arms associated with said reciprocating shaft for guiding and feeding strands of wire from a source of supply to the winding shaft to place successive layers thereon, a rack supported on said reciprocating shaft, a pair of arms slidably supported in said rack and a shaft supporting said guide arms secured to said arms, and means associated with said reciprocating shaft for moving arms and guide arms as a whole a predetermined distance in the direction of travel of said reciprocating shaft at the beginning of each layer.

13. A machine of the character described including a winding shaft, a reciprocating shaft and guide arms associated with said reciprocating shaft, a rack supported on said reciprocating shaft, a pair of arms slidably supported in said rack and a shaft supporting said guide arms secured to said arms, a rod connecting said arms, and cooperating with adjustable means on said rack, and means for shifting said arms and its supported guide arms as a whole in the direction of travel of said reciprocating shaft at the beginning of each layer a distance determined by said adjustable means in relation to said rod.

Signed by me at Chicago in the county of Cook and State of Illinois, this 31st day of December, 1923.

MARTIN B. GROUT.