

Feb. 23, 1954

C. JOHNSON

2,670,144

COIL WINDING APPARATUS AND POWER MECHANISM THEREFOR

Filed June 11, 1947

4 Sheets-Sheet 2

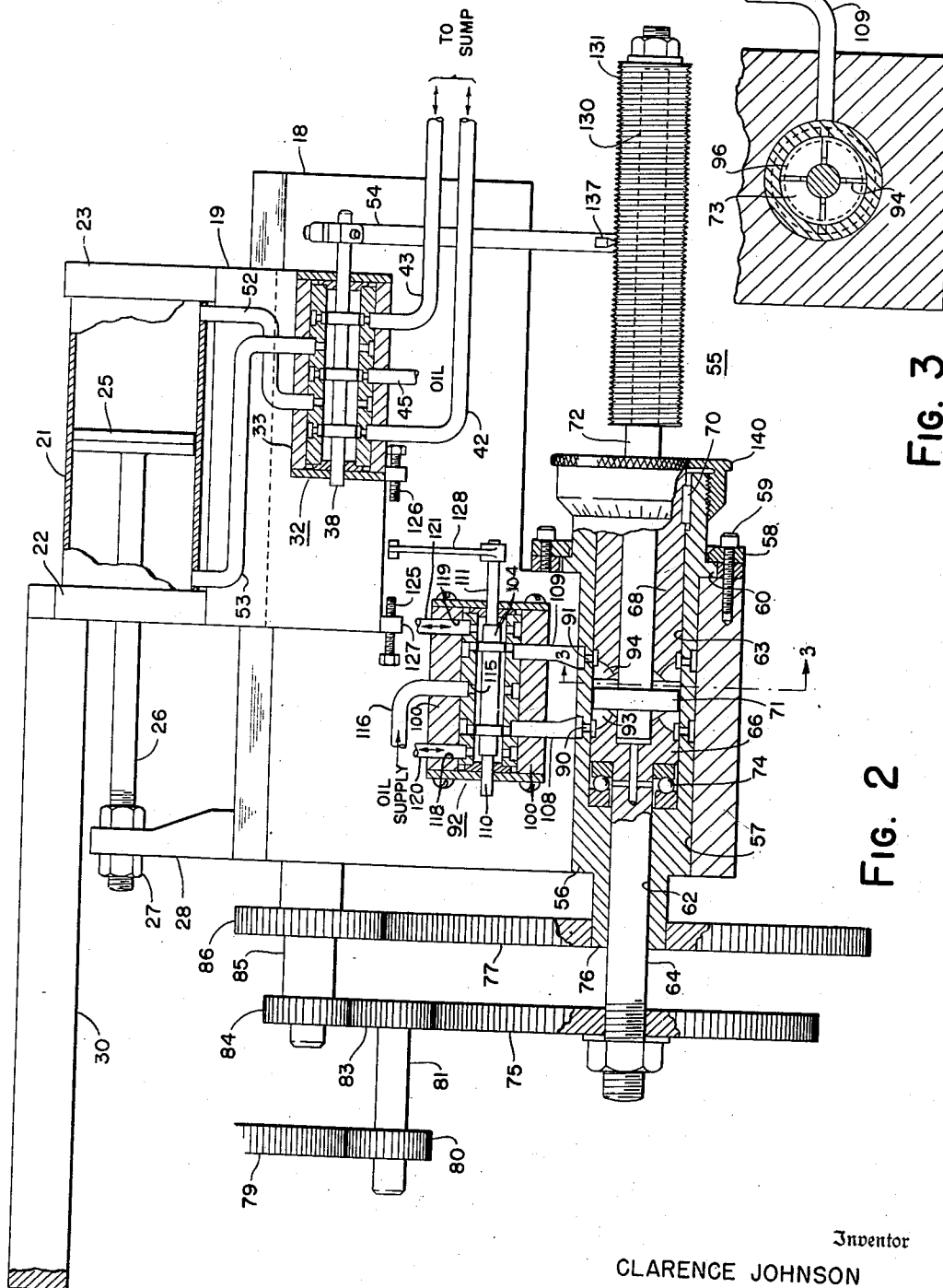


FIG. 3

FIG. 2

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4 Sheets-Sheet 3

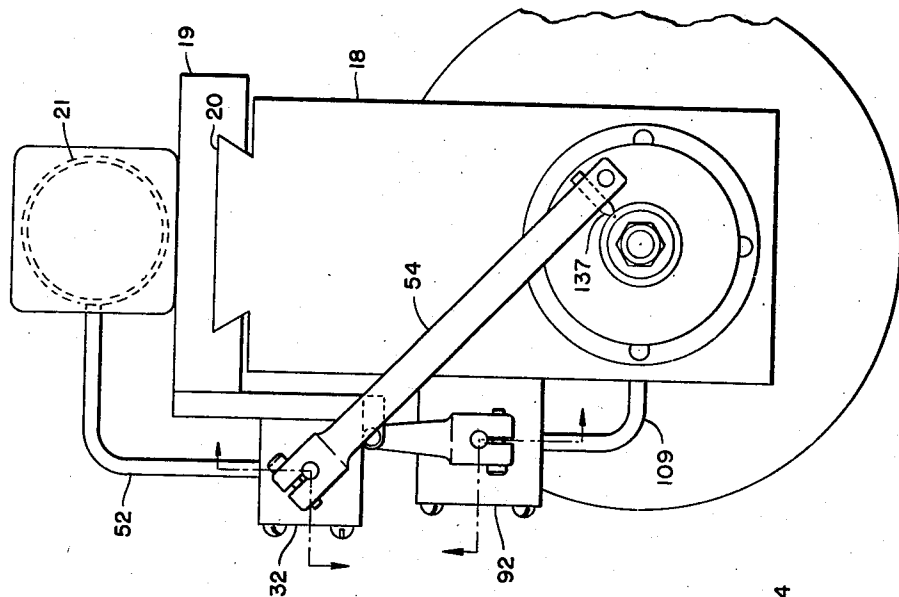


Fig. 4

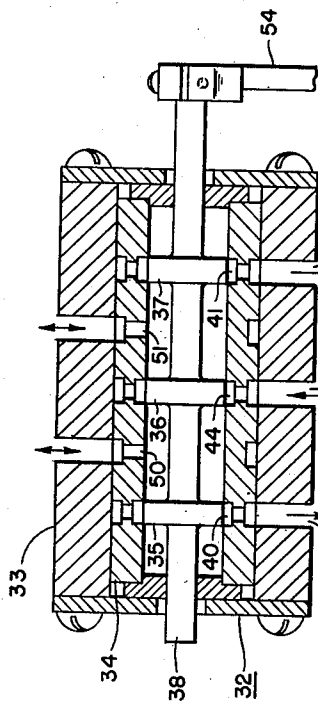


Fig. 5

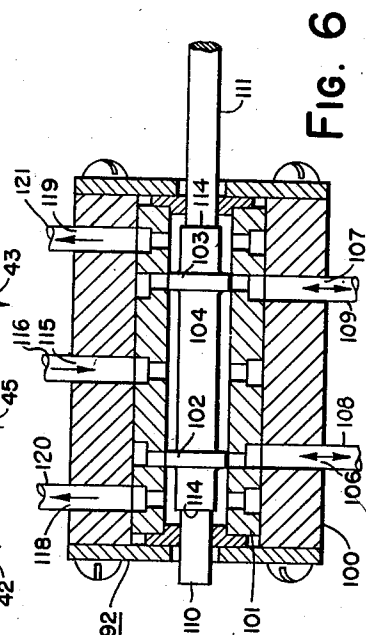


Fig. 6

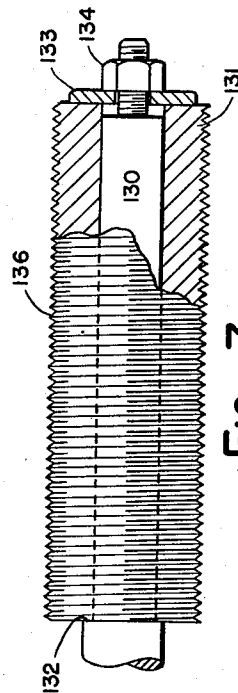


Fig. 7

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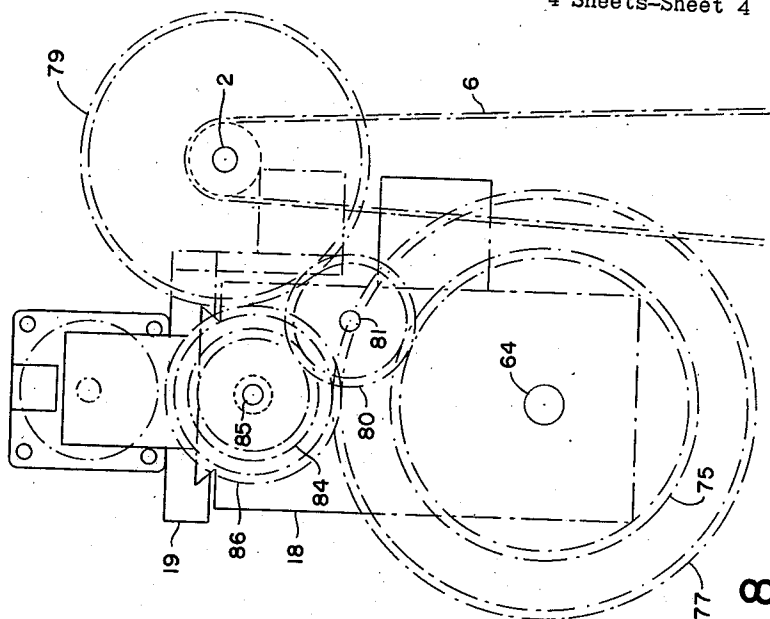


FIG. 8

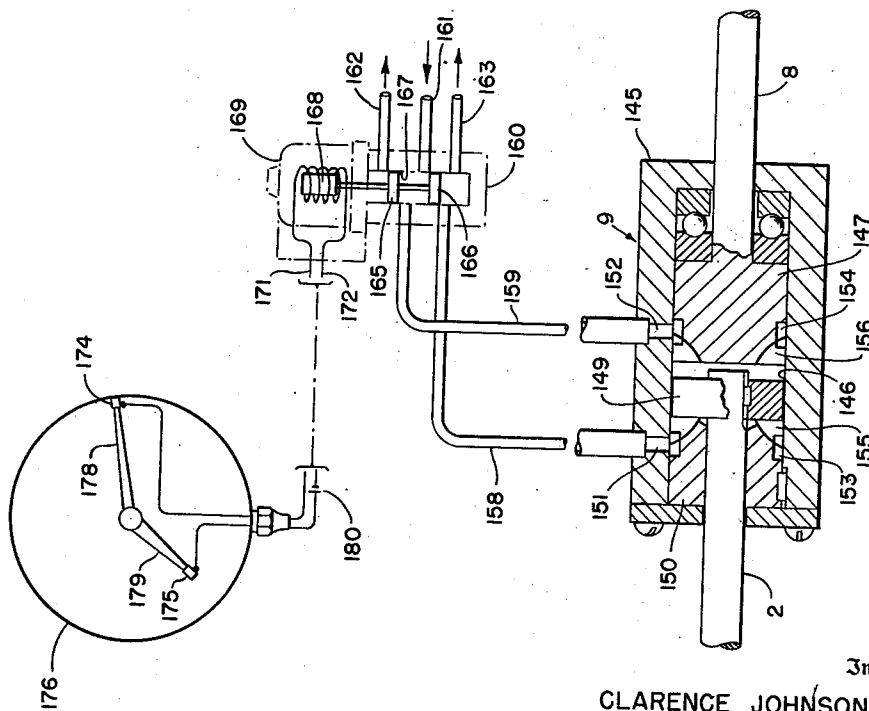


FIG. 9

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COIL WINDING APPARATUS AND POWER MECHANISM THEREFOR

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Application June 11, 1947, Serial No. 753,874

21 Claims. (Cl. 242—9)

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My invention relates to power mechanisms for producing a reciprocating motion, and more particularly to motors of the reciprocating type adapted especially for use with coil winding machines.

The winding of wire, cable, cord, or any such material in layers on a spool or core member is usually accomplished by attaching the material to the spool or core member and rotating the latter while the material is guided thereon by a reciprocating member. If desired, the spool or core member may be both rotated and reciprocated longitudinally relative to a stationary guide to cause the material to be wound in the manner desired. In either case, it will be seen that the strand of material must be inclined relative to the spool or core member to cause the turns to progress along its length. The angle of inclination and the speed of longitudinal movement depend, of course, upon the diameter of the strand and the rate at which the spool or core member is rotated. When the end of one layer is reached, it is necessary that the strand be inclined relative to the spool in the opposite direction so that the turns will follow each other to form the next layer. If there is some delay in reversing the direction at which the strand leads the turns on the spool, there will be a piling up of turns at the ends of each layer. It is therefore desirable that there be a rapid longitudinal movement at the beginning of each reciprocation, and then a slower steady movement as the strand is wound upon the spool.

An object of my invention is to provide improved means for positioning wire or stranded material so that it is wound in smooth layers on a spool or core member. Another object is to provide an improved motor of the reciprocating type. Yet another object is to provide a power mechanism including relatively reciprocable cylinder and piston elements, and means for controlling the supply of fluid to said elements for effecting relative reciprocation in an improved manner. Still another object is to provide improved means for actuating a valve mechanism controlling the supply of fluid to a cylinder containing a reciprocable piston. Other objects will appear in the course of the following description.

In the accompanying drawings, in which there is shown for purposes of illustration, one form which my invention may assume in practice:

Fig. 1 is a perspective view of a coil winding machine in which my invention is incorporated.

Fig. 2 is an enlarged front elevational view

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of my improved power mechanism with parts shown in section to facilitate illustration.

Fig. 3 is a sectional view taken on the plane of the line 3—3 of Fig. 2.

Fig. 4 is an elevational view of the power mechanism taken from the right-hand end in Fig. 2.

Fig. 5 is an enlarged sectional view of a valve mechanism taken on the plane of the line 5—5 of Fig. 4.

Fig. 6 is an enlarged sectional view of another valve mechanism, taken on the plane of the line 6—6 of Fig. 4.

Fig. 7 is an enlarged view of an actuating means for the valve of the mechanism shown in Fig. 5.

Fig. 8 is an elevational view of the power mechanism taken from the left-hand end in Fig. 2.

Fig. 9 is a schematic diagram of a clutch and control means for the machine of Fig. 1.

Referring to the drawings, and more particularly to Fig. 1, it will be noted that I have shown my invention incorporated in a coil winding machine generally designated 1. This machine comprises a spindle 2 rotatably supported by a framework 3 and driven by a motor 4 contained within a housing 5. The motor is shown herein connected by a belt 6 to a pulley 7 mounted on a shaft 8 which is connected by a clutch mechanism 9, shortly to be described more in detail, to the spindle 2. It will be understood that the motor may be connected, if desired, by suitable gearing to the shaft 8 instead of by the belt. Mounted upon the spindle are spools or core members 10, about which layers of wire are to be wound from reels 11 supported by projecting arms 12. As shown herein, a separate reel of wire is provided for each spool, and the wire passes from each reel over a guide member 13 to the spool upon which it is to be wound. The guide members are fixed to a rod 14 which is reciprocably supported by a frame 15 and is operatively connected to my improved mechanism 16 to be reciprocated thereby in a manner to be shortly described.

The mechanism 16 comprises a guide block 18 supported within the housing 5, as shown in Fig. 1, and having a carriage 19 slidably mounted upon it for movement in a plane parallel to the axis of the spindle 2. Formed integral with the guide block is a dovetail portion 20 fitting into a recess of similar shape in the carriage for guiding the latter in a path extending longitudinally of the spindle. Fixed to the carriage for movement therewith is a cylinder 21, which is closed at its ends by head blocks 22 and 23. Slideably received within the cylinder, as shown

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in Fig. 2, is a piston 25 having a piston rod 26 which extends through an opening in the head 22 and is attached by a nut 27, to a member 28 fixed to the guide block 18. Attached to the cylinder head 22, as by welding, is a member 30 which is adapted to be connected to the rod 14 for transmitting motion to the latter. It will be noted that a supply of fluid to the cylinder 21 at one side of the piston, while the other end of the cylinder is connected to exhaust, will result in a movement of the cylinder and carriage along the guide block, and the rod 14 carrying the wire guides 13 will be caused to move longitudinally by reason of its connection to the member 30.

For controlling the supply of fluid to the cylinder there is provided a valve mechanism, generally designated 32, including a casing 33 fixed to the carriage 19 for movement therewith. Arranged within the casing, as shown in Fig. 5, is a valve sleeve 34 reciprocally receiving piston-like valve portions 35, 36 and 37 formed on a valve member 38. The valve portions 35, 37 cooperate with annular grooves 40, 41 in the valve sleeve for controlling communication between the latter and passage means 42 and 43 leading to a sump, shown in Fig. 1. The valve portion 36 cooperates with an annular groove 44 for controlling communication between the sleeve and a passage means 45 leading to a pump 46 driven by a motor 47 and having its intake connected to the sump. Opening through the sleeve at opposite sides of the groove 44 are passages 50 and 51 which are connected by conduits 52 and 53, as shown in Fig. 2, to opposite ends of the cylinder 21. The ends of the valve member 38 project through opposite ends of the valve casing, and an arm 54 is connected to the valve member and is adapted to be actuated by a mechanism 55 for moving the valve relative to the casing.

When the arm 54 is actuated to move the valve portions 35, 36, 37 to the right in Fig. 2, a liquid, such as oil, is delivered by the pump through passage means 45 and past the left-hand edge of the valve portion 36 to the valve sleeve where it enters the passage 50 and is carried by the conduit 52 to the cylinder 21 at the right-hand side of the piston 25. The opposite end of the cylinder is connected through the conduit 53, the valve sleeve, the annular groove 41, and the passage means 43 to the sump. The oil supplied to the cylinder acts to move the latter to the right and, since the cylinder, the carriage 19 and the valve casing 33 are connected together, the valve sleeve 34 will be moved in the direction in which the valve was displaced until the annular grooves 35, 36 and 37 are again covered by their respective valve portions and the flow of oil relative to the cylinder is cut off. A displacement of the valve to the left results in a movement of the cylinder, the carriage, and the valve casing in the opposite direction.

The mechanism 55 for actuating the arm 54 comprises a cylindrical shaped member 56 rotatably received within a bore 57 formed in the block 18. An annular member 58 is attached to the block by screws 59 and cooperates with a flange 60 on the member 56 for holding the latter against longitudinal movement in the bore 57. Formed in the member 56 are stepped bores 62 and 63, and a shaft 64 extends through the bore 62 and is provided with an enlarged head 66 rotatably received within the bore 63. A sleeve shaped member 68 is received within the

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bore 63 and is keyed at 70 to the member 56 for rotation therewith. Arranged within the bore 63 between the head 66 and the member 68 is a piston 71 having a piston rod 72 extending through the sleeve member 68. The adjacent ends of the head 66 and the member 68 are provided with friction surfaces 73, as shown in Fig. 3, and the piston 71 is adapted to be moved into engagement with one or the other of these surfaces. A ball bearing 74 is arranged between the inner end of the bore 63 and the head 66 to form a rotatable end support for the latter.

Connected to the shaft 64 is a gear 75, and connected to a portion 76 of the member 56 projecting beyond the block 18 is a gear 77. Fixed to the spindle 2 of the coil winding machine, as shown in Figs. 1 and 8, is a gear 79 meshing with a gear 80 on a shaft 81 rotatably supported by the housing 5. Another gear 83 fixed to the shaft 81, Fig. 2, meshes with the gear 75 and with a gear 84 on the shaft 85 rotatably supported by the block 18. Another gear 86 fixed to the shaft 85 meshes with the gear 77. It will be seen that the shaft 64 and its head 66 will be rotated in one direction through the gears 79, 80, shaft 81 and gears 83, 75, while the member 56 and the member 63 keyed thereto are rotated in the opposite direction through the gears 79, 80, shaft 81, gears 83, 84, shaft 85, and gears 86, 77. The gearing is designed so as to rotate the shaft 64 and the member 56 at the same speeds. The piston 71 is driven either with the shaft 64 or the member 56 depending upon its engagement with the head 66 or the member 68.

For moving the piston 71 into engagement with the head 66 or the member 68 there are provided ports 90 and 91 opening through the member 56 into the bore 63 at opposite sides of the piston 71, and these ports are connected selectively to a liquid supply or to a sump by a valve mechanism, generally designated 92. To prevent any trapping of liquid between the piston 71 and the end surfaces of the head 66 and the member 56, there are provided grooves 93 and 94 in these surfaces as shown in Figs. 2 and 3. It will be noted also that communication is always provided between the piston and the ports 90, 91 through the grooves 93, 94 and annular grooves 96 in the head 66 and the member 58 so that operation of the piston is assured.

The valve mechanism 92 comprises, as shown in Figs. 2 and 6, a housing 100 connected to the block 18 and containing a valve sleeve 101 in which piston-like portions 102 and 103 of a valve member 104 are reciprocally received. Opening through the valve housing and the sleeve 101 are passage means 106 and 107 which are connected by conduits 108 and 109 to the ports 90, 91 opening into the bore 63. The valve portions 102 and 103 are arranged to cover the openings of the passage means 106 and 107 when the valve member 104 is in its mid-position. Reduced portions 110 and 111 of the valve member extend through the ends of the valve housing and provide abutments 114, which limit sliding movements of the valve to positions in which its portions 102 and 103 are at one side or the other of the passage means 106 and 107. Communicating with the interior of the valve sleeve at its mid portion is a passage means 115 which is connected by a conduit 116 to the discharge side of the oil pump 46. Opening into the valve sleeve near its ends are passage means 118 and 119 which are connected by conduits 120 and 121 to the oil sump.

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When the valve member 104 is moved into engagement with the valve housing at its left-hand end as viewed in Fig. 6, the supply passage 115 is connected through the passage means 106 and the conduit 108 to the bore 63 at the left-hand side of the piston 71 in Fig. 2. The opposite side of the piston is connected through the conduit 109, passage means 107, valve sleeve 101, passage means 119, and conduit 121 to the sump. The piston is then moved to the right into engagement with the end of the member 68 so that it is caused to rotate with the latter in one direction. When the valve member 104 is moved into engagement with the opposite end of the valve housing, the supply passage 115 is connected through the passage 107 and the conduit 109 to the right-hand side of the piston 71 while the left-hand side of the piston is connected through the conduit 108 and the valve sleeve to the conduit 120 leading to the sump. The piston is then moved into engagement with the head 66 and rotated with the latter in the opposite direction.

In order to move the valve member 104 into one or the other of its limiting positions, there are provided adjustable abutments in the form of screws 125 and 126 threaded into bosses 127 formed on the movable carriage 19. An arm 128 fixed to the reduced portion 111 of the valve member is adapted to be engaged by the screws 125 and 126 for effecting longitudinal movement of the valve member.

Mounted on a reduced portion 130 of the piston rod 72, as shown in Figs. 2 and 7, is a sleeve-shaped member 131 which is clamped between a shoulder 132 on the rod and a washer 133 by a nut 134 threaded on the end of the rod. Formed on the member 131 are threads 136, which are adapted to be engaged by a pointed member 137 carried by the arm 54. As the member 131 is rotated, the pointed member 137 follows along the threads 136 and causes the arm 54 to move and position the valve member 38 within the sleeve 34. When the piston 71 is moved between the head 66 and the member 68, the member 131 is moved longitudinally and carries the pointed member 137 with it to effect an adjustment of the valve member 38. The space provided between the head 66 and the member 68 may be adjusted by a cap 140 threaded on the cylindrical member 56 and engaging the member 68 for positioning the latter. As the cap is threaded on to the member 56, the member 68 is forced toward the head 66 to reduce the space between them. Rotation of the cap in the opposite direction provides a clearance between the cap and the member 68. If oil is then supplied to the piston 71 for moving it into engagement with the member 68, the latter is forced against the cap, thereby providing a larger space for movement of the piston.

The clutch mechanism 9 for transmitting power from the shaft 8 to the spindle 2 comprises, as shown in Fig. 9, a casing 145 supported by any suitable means within the housing 5 and having a bore 146 in which an enlarged head portion 147 on the shaft 8 is rotatably received. The spindle 2 extends into the casing to a point adjacent the head portion and has a piston 149 slideably keyed thereon for movement into engagement with either the head portion 147 or a braking member 150 fixed to the casing. Passages 151 and 152 open through the casing at opposite sides of the piston and communicate with annular grooves 153 and 154 which are connected by grooves 155 and 156 with spaces at the ends of the piston. 75

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The passages 151 and 152 are connected through conduits 158, 159 and a valve mechanism 160 to either a supply conduit 161 or to exhaust conduits 162, 163, the supply conduit being connected through a valve 164, Fig. 1, to the pump 46, and the exhaust conduits communicating with the sump.

The valve mechanism 160 is shown herein as comprising valve pistons 165 and 166 slideably received in a valve bore 167 and connected to a plunger 168 of a solenoid 169. When the solenoid is energized, the valve pistons are moved to the positions shown in Fig. 9 for connecting conduits 158 and 159 respectively to the exhaust conduit 163 and the supply conduit 161. On de-energizing the solenoid, the valve pistons move to positions connecting conduits 158 to the supply conduit and connecting conduit 159 to the exhaust conduit 162. The winding of the solenoid is connected at its ends to conductors 171, 172 leading to adjustable contacts 174, 175 of a clock mechanism 176 driven by suitable means, not shown, from the spindle 2. The clock mechanism is provided with two arms 178, 179 pivotally supported on a common axis and driven so that one of the arms swings through 360° for a predetermined number of turns of the spindle, while the other arm moves between two adjacent figures, as shown on Fig. 1. The contacts are arranged to be contacted by the arms and connected electrically by the latter as they swing about their pivot. It will be seen that one of the contacts will be connected by the faster moving arm each time it swings around, but both contacts will be made only when a predetermined number of turns of the spindle has been completed. A source of power, such as a battery 180, energizes the solenoid through the arms 178, 179 when they engage the contacts. Suitable means may be provided for moving both arms to a zero position when the winding of coils begins.

The winding of coils is accomplished by connecting the wires to the core members 10 on the spindle and adjusting the arms of the clock mechanism to their zero positions. The solenoid is deenergized at this time, and the valve pistons are in positions connecting conduit 153 to supply and conduit 159 to the sump. The valve 164 may then be opened to supply oil through conduit 158 to the piston 149 for moving it against the head 147 driven by the motor 4. The spindle is then caused to rotate, and by reason of the gear 79 on the spindle meshing with the gear 80 on the shaft 81, a rotation of the shaft 84 and the member 56 in opposite directions is obtained. The carriage 19 is in a position at this time to locate the wire guides 13 for starting turns at one end of the core members. The valve 104 is positioned by the carriage to supply oil under pressure to one side of the piston 71 and to connect the other side of the piston to the sump. Assuming that the piston is forced by the oil into engagement with the rotating member 68, it will be caused to rotate with the latter and turn the member 131 in a direction to cause the pointed member 137 to travel along it and position the valve member 38 for supplying oil to the cylinder 21 so that the latter moves and carries the guide members in a manner to effect a smooth winding of wire on the core members in one direction. It will be seen that movement of the member 137 along the member 131 continues until the carriage reaches a position where one of the adjustable abutments 125, 126 engages the arm 128 and moves the valve 104 to a position for supplying oil through conduit 109 to the pis-

ton 71 and forcing the latter against the rotating head 66. The longitudinal movement of the piston is such as to position the valve 38 at the opposite sides of its fluid passages a sufficient distance to effect a rapid movement of the carriage in the opposite direction until the guide members direct the wire for turns following each other along the core toward its other end. The engagement of the piston 71 with the head 66 causes it to rotate in a direction to feed the member 137 along the member 131 and effect a continuous movement of the carriage for positioning the guide members to obtain a smooth layer of wire in the opposite direction. It will be seen that the movement of the piston between the member 68 and the head 66 produces rapid movement of the carriage in the opposite direction as a new layer of wire is started, thus preventing the piling up of turns at the end of the spool. The distance of travel by the carriage in each direction may be easily adjusted by changing the positions of the abutments 125, 126. The travel of the piston between the member 68 and the head 66 may be adjusted by rotating the cap 140, and the speed of movement of the carriage while turns are made on the core members is determined by the threads on the member 131 which may easily be replaced by another with threads of a different pitch, when desired. When the required number of turns have been made, the arms of the clock mechanism engage the contacts 174, 175 and energize the solenoid 159 for positioning the valve 160 to supply oil to conduit 159 and connect conduit 158 to the sump. Piston 149 is then moved to the left in Fig. 9 against the stationary member 150, which causes the spindle to be quickly stopped.

While there is shown in this application one form which my invention may assume in practice, it will be understood that it may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

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

1. A power mechanism of the reciprocating type comprising, in combination, a cylinder, a piston reciprocably received within said cylinder, means for supporting said cylinder for longitudinal movement, means for supporting said piston in a fixed position, passage means communicating with said cylinder at opposite sides of said piston, valve means for connecting said passage means alternatively to a fluid supply and to exhaust for effecting reciprocation of said cylinder relative to said piston, said valve means comprising a valve casing fixed for movement with said cylinder, a valve member movable in opposite directions from a neutral position and connecting said cylinder to said passage means in a manner to effect movement of said cylinder in the direction in which said valve member moves, means for reciprocating said valve member in a predetermined path and at different speeds in each direction of travel and means responsive to a predetermined movement of said cylinder to control said last mentioned means.

2. A power mechanism of the reciprocating type comprising, a cylinder, a piston reciprocably received within said cylinder, means for supporting said cylinder for longitudinal movement, means for supporting said piston in a fixed position, passage means communicating with said cylinder at opposite sides of said piston, valve means for connecting said passage means alter-

natively to a fluid supply and to exhaust for effecting reciprocation of said cylinder relative to said piston, said valve means comprising a valve casing fixed for movement with said cylinder, a valve member movable in opposite directions from a neutral position and connecting said cylinder to said passage means in a manner to effect movement of said cylinder in the direction in which said valve member moves, and means for reciprocating said valve member in a predetermined path and at different speeds in each direction of travel comprising a rotatable member having a threaded surface, an element fixed to said valve member and engaging said threaded surface, means for rotating said rotatable member in one direction and then in the other, and means for moving said rotatable member longitudinally as it reverses its direction of rotation.

3. A power mechanism of the reciprocating type comprising, a cylinder, a piston reciprocably received within said cylinder, means for supporting said cylinder for longitudinal movement, means for supporting said piston in a fixed position, passage means communicating with said cylinder at opposite sides of said piston, valve means for connecting said passage means alternatively to a fluid supply and to exhaust for effecting reciprocation of said cylinder relative to said piston, said valve means comprising a valve casing fixed for movement with said cylinder, a valve member movable in opposite directions from a neutral position and connecting said cylinder to said passage means in a manner to effect movement of said cylinder in the direction in which said valve member moves, and means for reciprocating said valve member in a predetermined path and at different speeds in each direction of travel comprising a rotatable member having a threaded surface, an element fixed to said valve member and engaging said threaded surface, a clutch piston fixed to said rotatable member and received in a bore, driving members rotatably received in said bore at opposite sides of said clutch piston, means for rotating said driving members in opposite directions, and means for connecting the opposite sides of said clutch piston alternatively to a fluid supply and to exhaust for effecting its movement into engagement with one or the other of said driving members.

4. A power mechanism of the reciprocating type comprising, a cylinder, a piston reciprocably received within said cylinder, means for supporting said cylinder for longitudinal movement, means for supporting said piston in a fixed position, passage means communicating with said cylinder at opposite sides of said piston, valve means for connecting said passage means alternatively to a fluid supply and to exhaust for effecting reciprocation of said cylinder relative to said piston, said valve means comprising a valve casing fixed for movement with said cylinder, a valve member movable in opposite directions from a neutral position and connecting said cylinder to said passage means in a manner to effect movement of said cylinder in the direction in which said valve member moves, and means for reciprocating said valve member in a predetermined path and at different speeds in each direction of travel comprising a rotatable member having a threaded surface, an element fixed to said valve member and engaging said threaded surface, a clutch piston fixed to said rotatable member and received in a bore, rotatable driving

members at opposite sides of said clutch piston, means for rotating said driving members in opposite directions, means including a valve mechanism movable from one limiting position to another for connecting the opposite sides of said clutch piston alternatively to a fluid supply and to exhaust, and spaced abutments movable with said cylinder and engageable with said last mentioned valve mechanism for moving the latter between its limiting position.

5. In a power mechanism for a coil winding machine, having a spindle having spools mounted thereon, means for rotating said spindle, and guide means for guiding wire on said spools; means for reciprocating said guide members in a manner to cause the wire to be wound on said spools in smooth continuous layers, said reciprocating means comprising relatively reciprocable cylinder and piston elements, means for connecting one of said elements to said guide members, means for supporting the other of said elements in a fixed position, means including a valve mechanism for connecting the opposite ends of said cylinder element to a fluid supply and to exhaust, said valve mechanism including a valve element connected for movement with said guide members, another valve element movable relative to the first valve element in opposite directions from a neutral position for controlling said fluid supply and exhaust connections, and means for periodically positioning said last mentioned valve element at opposite sides of said neutral position.

6. The mechanism of claim 5 in which said valve element positioning means comprises a member having threads formed on its periphery, a member connected to said last mentioned valve element and engaging said threads for movement along the latter, and means for rotating said threaded member first in one direction and then in the other to cause said thread engaging member to reciprocate in a predetermined path.

7. The mechanism of claim 5 in which said valve element positioning means comprises a member having threads formed on its periphery, a member connected to said last mentioned valve element and engaging said threads for movement along the latter, means for rotating said threaded member first in one direction and then in the other to cause said thread engaging member to reciprocate in a predetermined path, and means for moving said threaded member longitudinally as it reverses its direction of rotation.

8. The machine of claim 5 in which said valve element positioning means comprises a member having threads formed on its periphery, a member connected to said last mentioned valve element and engaging said threads for movement along the latter, a piston fixed to said member and received in a cylinder bore, rotatable members at opposite sides of said piston, means for rotating said last mentioned members in opposite directions, means including a reversible valve mechanism for connecting said bore at opposite sides of said piston to a fluid supply and to an exhaust, and means for reversing said last mentioned valve mechanism at the ends of predetermined intervals.

9. The machine of claim 5 in which said valve element positioning means comprises a member having threads formed on its periphery, a member connected to said last mentioned valve element and engaging said threads for movement along the latter, a piston fixed to said threaded member and received in a cylinder bore, rotatable

members at opposite sides of said piston, means for rotating said last mentioned members in opposite directions, means including a reversible valve mechanism for connecting said bore at opposite sides of said piston to a fluid supply and to exhaust, and means fixed for movement with said guide members and operating on predetermined travel of the latter for reversing said last mentioned valve mechanism.

10. In a power mechanism for a coil winding machine having a spindle having spools mounted thereon, and guide members for guiding wire on said spools; means for reciprocating said guide members in a manner to guide the wire on said spools in smooth layers as the latter is rotated, said reciprocating means comprising a cylinder, a piston reciprocably received in said cylinder, means supporting said cylinder for longitudinal movement, means for supporting said piston in a fixed position, means for connecting said guide members to said cylinder for movement therewith, means including a valve mechanism for connecting the opposite ends of said cylinder alternatively to a liquid supply and to a sump, said valve mechanism including a valve element movable in opposite directions from a neutral position and controlling the flow of liquid in a manner to effect movement of said cylinder in the direction in which said valve element moves, means including a member rotatable in opposite directions for effecting reciprocation of said valve element, drive members adapted to be connected selectively in driving relation with said rotatable member, a power unit, and means including a clutch mechanism for connecting said power unit in driving relation with said spindle and said drive members.

11. In a power mechanism for a coil winding machine having a spindle having spools mounted thereon, and guide members for guiding wire on said spools; means for reciprocating said guide members in a manner to guide the wire on said spools in smooth layers as the latter is rotated, said reciprocating means comprising a cylinder, a piston reciprocably received in said cylinder, means supporting said cylinder for longitudinal movement, means supporting said piston in a fixed position, means for connecting said guide members to said cylinder for movement therewith, means including a valve mechanism for connecting the opposite ends of said cylinder alternatively to a liquid supply and to a sump, said valve mechanism including a valve element movable in opposite directions from a neutral position and controlling the flow of liquid in a manner to effect movement of said cylinder in the direction in which said valve element moves, means including a member rotatable in opposite directions for effecting reciprocation of said valve element, drive members adapted to be connected selectively in driving relation with said rotatable member, means connecting said drive members in driving relation with said spindle and operating on rotation of the latter to effect rotation of said drive members in opposite directions, a power unit, and means for connecting said spindle selectively in driven relation with said power unit and with a braking member.

12. The mechanism of claim 11 in which said last mentioned means includes a piston slidably keyed to said spindle and received in the bore of a stationary cylinder, a member rotatably received in one end of said bore, means connecting said last mentioned member for rotation by said power unit, a braking surface arranged at the op-

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posite end of said bore, means including a valve mechanism for connecting said bore at opposite sides of said piston alternatively to a fluid supply and to exhaust for effecting movement of said piston into engagement with said last mentioned rotatable member or with said braking surface, and means operating automatically when said spindle has rotated a predetermined number of times for actuating said last mentioned valve mechanism and controlling fluid flow in a manner to move said piston into engagement with said braking surface.

13. In a power mechanism for a coil winding machine having a spindle having spools mounted thereon, means for rotating said spindle, and means for guiding wire on said spools; means for reciprocating said guiding means in a manner to guide the wire on said spools in smooth layers as the latter is rotated, said reciprocating means comprising a cylinder member reciprocably receiving a piston member, means for supporting one of said members for reciprocation in a path parallel to the axis of said spindle, means for supporting the other of said members in a fixed position, means connecting said guiding means to the reciprocable one of said members for movement therewith, means including a valve mechanism for connecting the opposite ends of said cylinder member alternatively to a liquid supply and to a sump, said valve mechanism including a first valve element supported for movement with said guiding means, and a second valve element movable in opposite directions from a neutral position and controlling the flow of liquid relative to said cylinder member in a manner to effect movement of the reciprocable one of said members in the direction in which said second valve element is moved, and means for reciprocating said second valve element in a predetermined path.

14. The machine of claim 13 in which said last mentioned means comprises a rotatable threaded member, a member fixed to said second valve element and engaging the threads of said threaded member, rotatable driving members spaced from each other, a member fixed to said threaded member and movable longitudinally with the latter into driven engagement with one or the other of said driving members, means for moving said last mentioned member selectively into engagement with said driving members, and means for rotating said driving members in opposite directions.

15. The machine of claim 13 in which said last mentioned means comprises a rotatable threaded member, a member fixed to said second valve element and engaging the threads of said threaded member, a piston reciprocably received in a bore and fixed to said threaded member, rotatable driving members spaced from each other and located at opposite sides of said piston for engagement by the latter, means for rotating said driving members in opposite directions, means including a valve mechanism for connecting the opposite ends of said piston alternatively to a liquid supply and a sump, said last mentioned valve mechanism including a valve element supported in a fixed position, a valve element movable to opposite limiting positions for reversing the connections of said piston to said liquid supply and said sump, and means movable with said guiding means and operating on predetermined movement of the latter for moving said last mentioned valve element from one limiting position to the other.

16. A power system for effecting correlated

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movement of a rotatable element and an element movable in a linear path comprising a first power unit for rotating said rotatable unit, a second power unit for reciprocating said linearly movable element, a control element for said second power unit, means responsive to the rotation of said rotatable element for actuating said control element, means responsive to a predetermined movement of said linearly movable element for controlling said last mentioned means, and means actuated by the rotation of said rotatable element through a predetermined number of revolutions operable to disconnect said first power unit from said rotatable element after a predetermined number of revolutions of said rotatable element.

17. A power mechanism of the reciprocating type comprising, a cylinder element, a piston element reciprocably received within said cylinder element, means for supporting said elements for relative movement, passage means communicating with said cylinder at opposite ends of said piston, valve means for connecting said passage means alternately to a fluid supply and to exhaust for effecting relative movement of said elements, said valve means comprising a valve casing fixed for movement with one of said elements, a valve member movable in opposite directions from the neutral position and connecting said one of said elements to said passage means in a manner to effect movement of said one of said elements in a direction in which said valve member moves, and means for reciprocating the valve member in a predetermined path and at different speeds in each direction of travel comprising a rotatable member operable upon rotation to move said valve member, means for rotating said rotatable member in one direction and then in the other, and means for moving said rotatable member longitudinally as it reverses its direction of rotation.

18. A power system for effecting correlated movement of a rotatable element and an axially movable element comprising a first power unit for rotating said rotatable element, means for axially shifting said rotatable element, a second power unit for reciprocating said axially movable element, a control element for said second power unit, means responsive to the rotary and axial movement of said rotatable element for actuating said control element, and means responsive to a predetermined movement of said axially movable element for controlling said last mentioned means.

19. In a coil winding mechanism having rotatable spools and guide means for guiding strands of material onto said spools, a mechanism for controlling movement of said guide means to deposit said strands on said spools in even layers comprising a power unit for reciprocating said guide means, a control element for said power unit, means responsive to the rotation of said spools for moving said control element, means responsive to a predetermined axial movement of said guide means for reversing the direction of movement of said last mentioned means, means for accelerating said control element at each reversal of direction, and means for moving said power unit in the same direction and velocity as said control element.

20. A power system for effecting correlated movement of a rotatable element and a member movable in a linear path comprising means for rotating said rotatable element in one direction and then in the other, means for axially shifting said rotatable element at each change of direction of rotation thereof, a power unit for reciprocating

ing said member, control means for said power unit, said control means being operatively associated with said rotatable element and movable both by rotation and axial shifting movement of said rotatable element.

21. Means for effecting correlated movement of a rotatable member and reciprocable member, comprising a rotatable element, means selectively connecting said rotatable element to said rotatable member for rotation therewith in first one direction and then in the other, a power unit for reciprocating said reciprocable member, a movable control element for said power unit, means responsive to a predetermined movement of said reciprocable member for reversing the direction of rotation of said rotatable element and simultaneously axially shifting said rotatable element, means responsive to rotary and axial movement of said rotary element for moving said control element, and means for moving said reciprocable member in the same direction as said control element.

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