Nov. 29, 1927.

1,651,099

E. F. PARKS ET AL.

WINDING MACHINE

Original Filed March 13, 1919 5 Sheets-Sheet 1

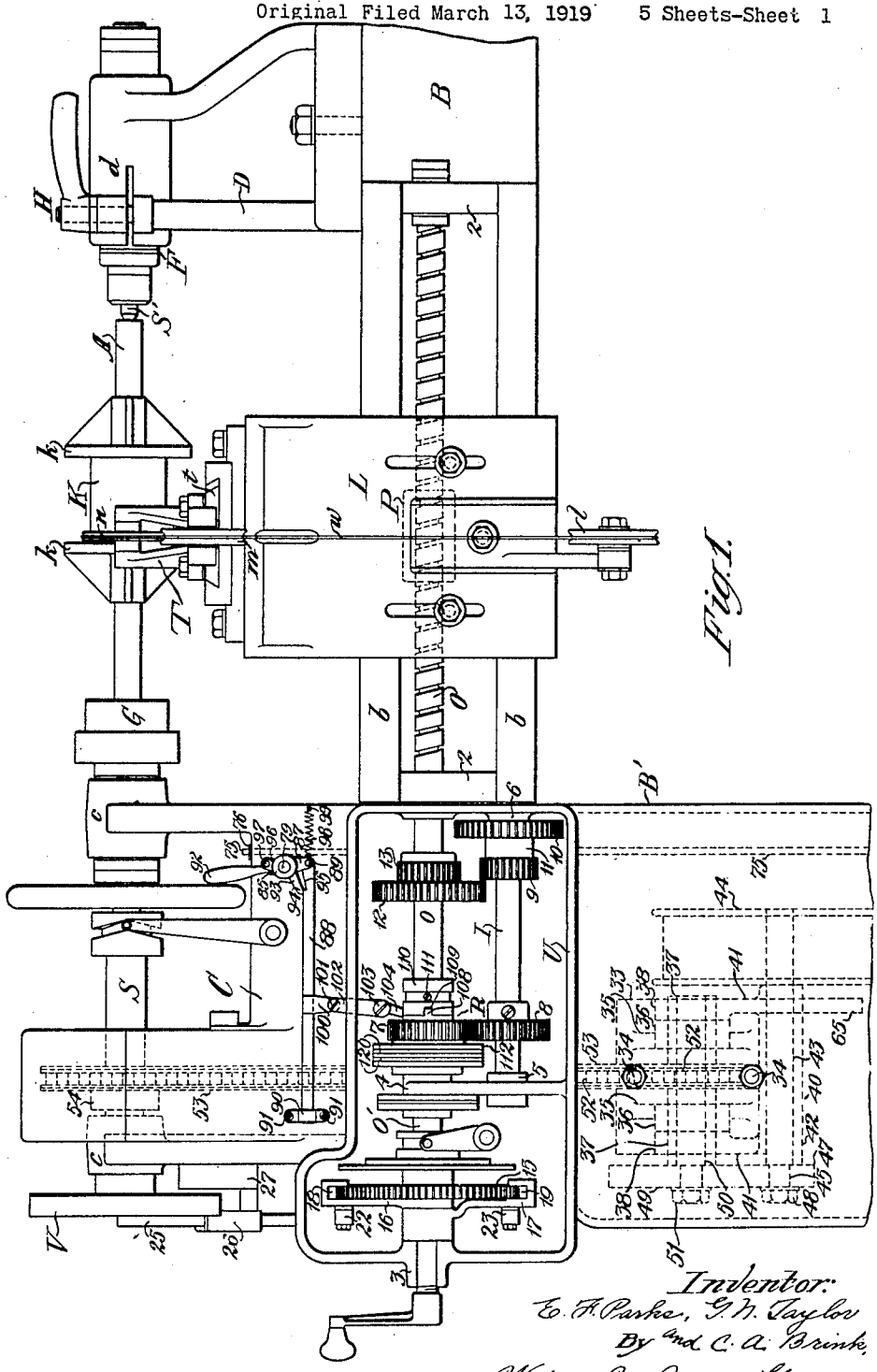


Fig. 1.

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WINDING MACHINE

Original Filed March 13, 1919 5 Sheets-Sheet 2

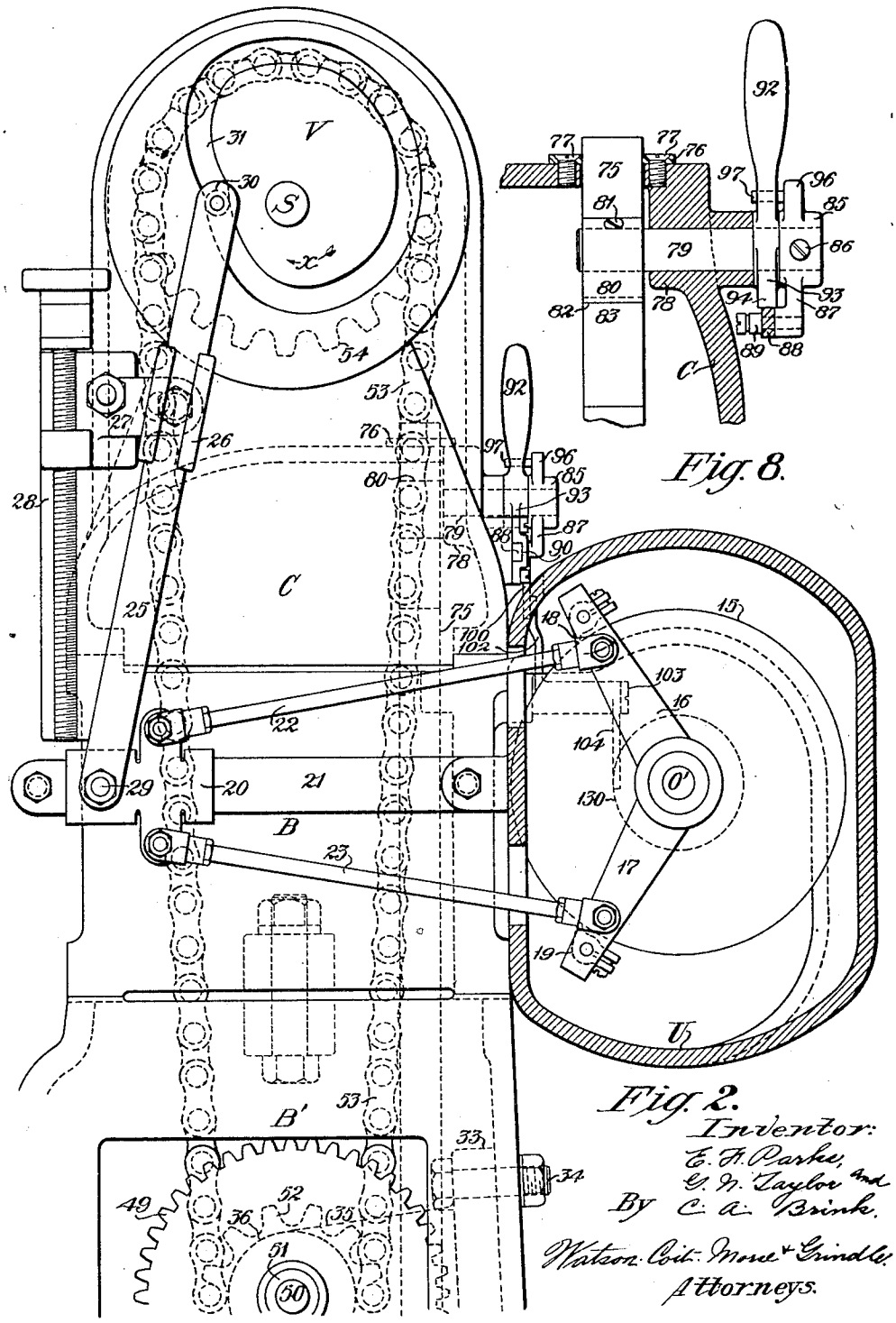


Fig. 8.

Fig. 2.

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WINDING MACHINE

Original Filed March 13, 1919 5 Sheets-Sheet 3

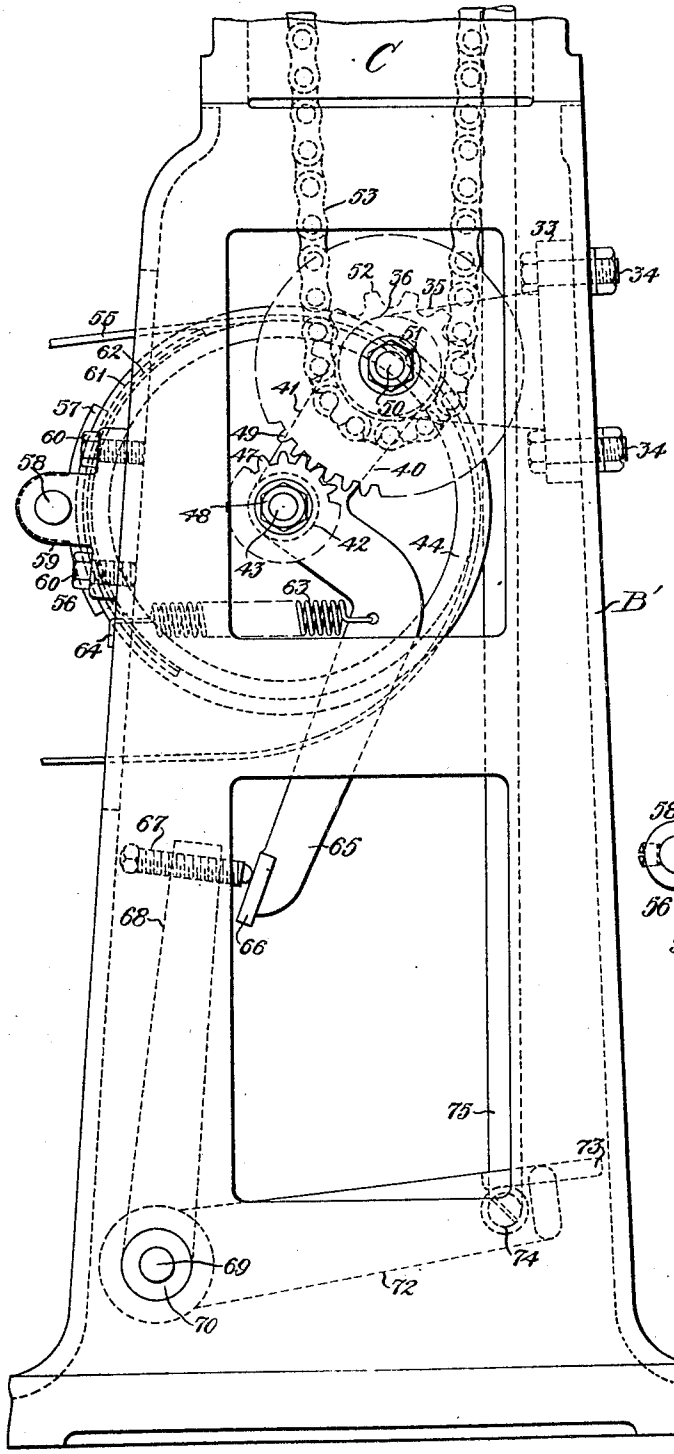


Fig. 3.

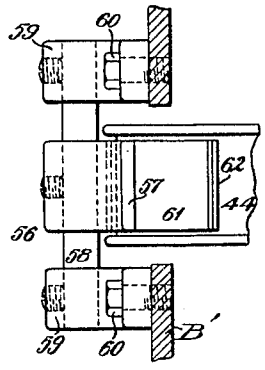


Fig. 9.

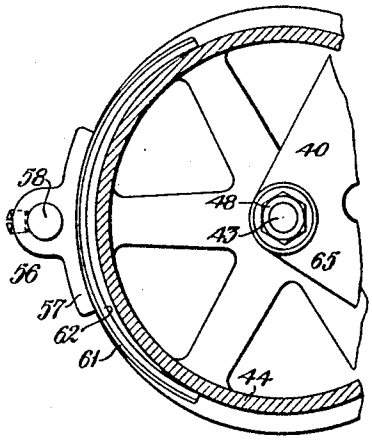


Fig. 10.

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Nov. 29, 1927. 1,651,099

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WINDING MACHINE

Original Filed March 13, 1919 5 Sheets-Sheet 4

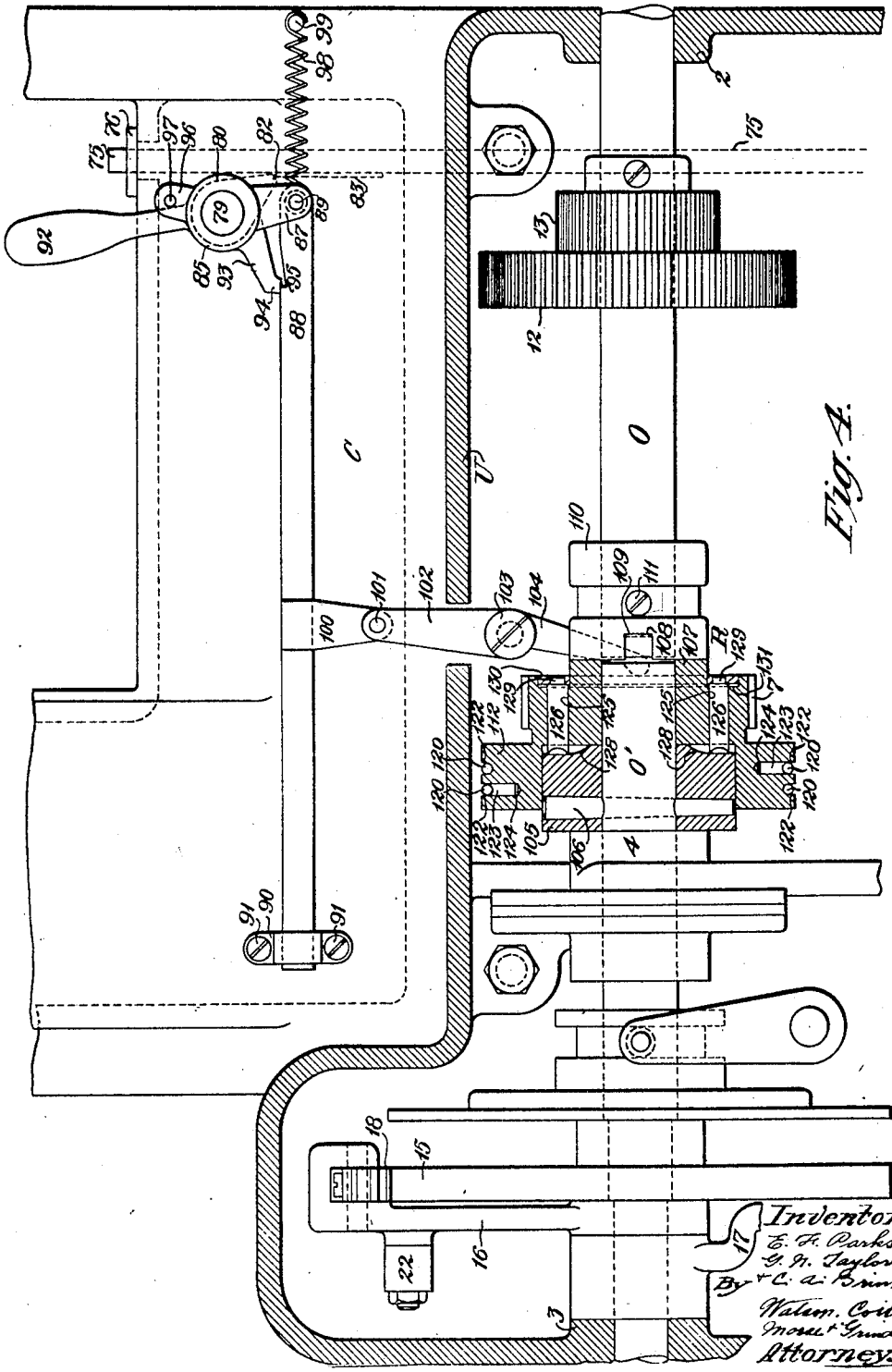


Fig. 4.

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Nov. 29, 1927. 1,651,099

E. F. PARKS ET AL

WINDING MACHINE

Original Filed March 13, 1919 5 Sheets-Sheet 5

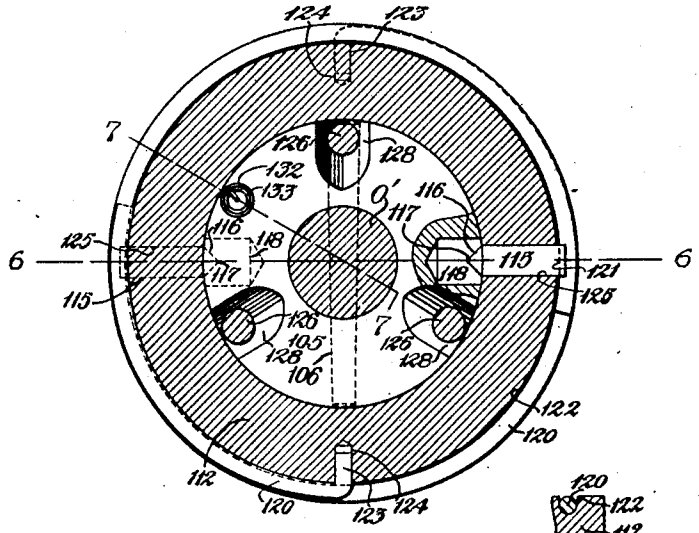


Fig. 5.

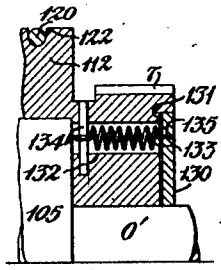


Fig. 7.

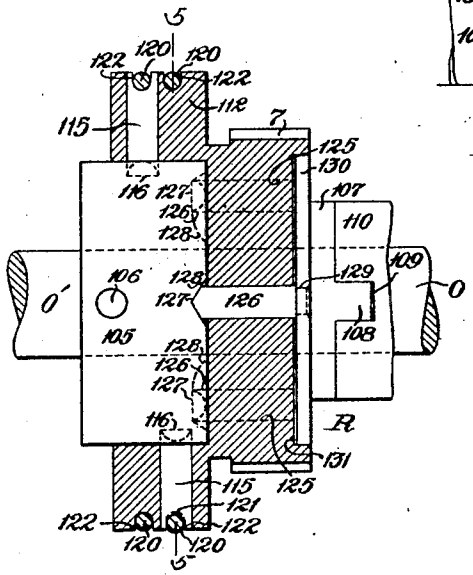


Fig. 6.

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Patented Nov. 29, 1927. 1,651,099

UNITED STATES PATENT OFFICE.

EDWARD F. PARKS, CARL A. BRINK, AND GEORGE N. TAYLOR, OF EAST PROVIDENCE, RHODE ISLAND, ASSIGNORS TO UNIVERSAL WINDING COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

WINDING MACHINE.

Original application filed March 13, 1919, Serial No. 282,349. Divided and this application filed May 9, 1923. Serial No. 637,892.

Our invention relates to improvements in means for controlling the operation of winding machines or other apparatus and particularly to automatic stopping-mechanism for arresting the operation of the machine in cases of emergency. Our improvements are herein shown as applied to a machine for winding electrical-coils in which the winding-spindle or mandrel is continuously rotated, and the wire-guide, which deposits the turns of the winding in place on the mandrel, is given an intermittent feed or traverse with a reversal in the direction of feed at opposite ends of the coil.

Such a type of winding machine is described and illustrated in our U. S. Letters Patent No. 1,458,194, dated June 12, 1923, and No. 1,463,834, dated Aug. 7, 1923, from the former of which the present case is divided; but it is to be understood that the present improvements are applicable to various types of apparatus employed for other purposes, and the invention is not therefore limited in this respect to the particular embodiment herein shown and described.

The principal object of our improvement is, in general, to provide a stopping-mechanism for arresting the operation of the apparatus in case of abnormal conditions tending to resist the proper functioning of the mechanism; and in particular, as applied to a winding machine, to stop the machine whenever the wire-guide encounters undue resistance to its feed so that the operating-parts of the feeding-mechanism shall not be strained, broken or disrupted in their organization.

The manner and means for carrying out the improvement are fully described in the following specification, illustrated by the accompanying drawings, in which like reference characters designate like parts. In the drawings:—

Fig. 1 is a front elevation of the winding machine, giving a general view of its several coordinated mechanisms and illustrating our improved stopping-device as applied thereto;

Fig. 2, an enlarged, end view of the machine showing the main drive-mechanism and the driving-connections for the guide-feeding means.

Fig. 3, a similar view showing the lower part of the machine and illustrating the manually-operated starting- and stopping-devices for the driving-means in the non-driving or stopped position;

Fig. 4, an enlarged, front elevation of the traverse- or feed-shaft driving-connections showing the improved automatic stop-control in relation thereto and in the running position;

Fig. 5, a sectional view in detail of the stop-control clutch-device, taken on the line 5—5 of Fig. 6;

Fig. 6, a part sectional view of the same taken on the line 6—6 of Fig. 5;

Fig. 7, a part sectional view of the same taken on the line 7—7 of Fig. 5;

Fig. 8, an enlarged, detail view of the stopping-device control-lever mechanism;

Fig. 9, a plan view of the brake-device for the driving-means; and

Fig. 10, a side elevation of the same in detail.

Referring first to Fig. 1, the winding machine herein illustrated comprises, in general, a horizontal frame or bed B mounted on suitable legs or standards, one of which B′ is partly shown at the left and more completely illustrated in end elevation in Fig. 3. Surmounting the bed B at its left-hand end is a fixed headstock C provided with bearings *c*, *c* for the rotating winding-spindle S. At the right-hand end of the bed B is an adjustable tailstock D carrying a sleeve F slidable in a split-bearing *d* which may be clamped therearound by a hand-screw H extending through the split portion of the bearing. Journaled in the sleeve F is a live-spindle S′ formed with a pointed end adapted to support the outer extremity of the winding-mandrel A, the opposite end of which is secured to the winding-spindle S by means of a suitable chuck G. The above described arrangement is similar to that employed on lathes and other machine-tools and provides for removal and replacement of the mandrel or arbor A, as occasion requires, by sliding the sleeve F outwardly in its bearing *d*. The mandrel A carries a detachable former or core K on which the wire is wound to produce the coil, and at its ends are removable heads or flanges *k*, *k* which serve to hold the windings in place.

Arranged opposite the winding-mandrel

A is the wire-guide T which is mounted on a carriage L slidable on ways or tracks *b*, *b* supported on the front of the bed B. The wire-guide T comprises a slide *t* carrying a grooved guiding-pulley *n* over which the wire *w* leads to the core K. The slide *t* is movable in a slot on the top of the carriage L to adapt the guiding-wheel *n* to recede from the axis of the winding-mandrel A as the layers of winding are built up on the core K. At the bottom of the carriage L is a guide-wheel *l* over which the wire *w* leads from its source of supply, not herein shown, and thence it passes up over a second guide-wheel *m* on the slide *t* to the main grinding-wheel *n*.

The wire-guide T is fed along the winding-arbor A by means of a screw-shaft O which engages a nut or follower P on the back of the carriage L. The feed-shaft O is journaled in bearings 2, 2 at the ends of the tracks *b*, *b*, and extends to the left through the side of a gear-casing or housing U mounted on the front of the bed B. The shaft O is connected to be rotated from an alining stud-shaft O′ journaled in bearings 3, 4 in the gear-box U and driven from a ratchet-mechanism as later explained. The feed-shaft O may be connected directly with its drive-shaft O′ by means of a clutch-device shown at R, or in some cases, where a variation in speed is required between the shafts, a train of change-gears is provided for this purpose. As shown in Fig. 1, a countershaft I is journaled in bearings 5 and 6 in the casing U and arranged below and parallel with the shaft O. At the end of the shaft O′ is a gear 7, mounted on one of the coacting members of the clutch R, in the manner as later described, and arranged to mesh with a gear 8 fast on the countershaft I. The shaft I also carries a pair of change-gears 9 and 10 connected by a hub 11 and keyed to the shaft while slidable therealong. The gears 9 and 10 are adapted to be engaged with gears 12 and 13, respectively, on the shaft O and through this arrangement after the clutch R has been uncoupled the shaft O may be driven from the shaft O′ through the intermediary of the countershaft I at a different rate of speed as determined by the ratio in the gearing.

At the left-hand end of the shaft O′ is a ratchet-wheel 15, keyed fast thereon and adapted to be rotated from two oscillating arms 16 and 17 carrying pawls 18 and 19, see Fig. 2, which engage the teeth of the ratchet. The pawl-arms 16 and 17 are pivoted on the shaft O′ and are oscillated from a reciprocating slide 20 which is slidable on a horizontal track 21. The slide 20 is connected to the pawl-arms 16 and 17 by rods 22 and 23 and the pawls 18 and 19 are under the control of reversing-means which is operated automatically to render one pawl active while the other is maintained inactive. Through this arrangement the pawl 18 on the arm 16 operates to turn the ratchet 15 to the left, as viewed in Fig. 2, while the pawl 19 when active turns the ratchet clockwise, or to the right. In this manner the shaft O′ is rotated to turn the feed-shaft O in one direction to feed the carriage L to the right, and in the opposite direction to return it to the left, with the reversal of direction of feed controlled by the position of the guide T in accordance with the extent of full traverse required. The means for reversing the action of the pawls 17 and 18, and thereby the direction of feed of the wire-guide T, is described and illustrated in detail in our U. S. Letters Patent No. 1,463,834, above referred to, but since it is not essential to the present improvement it is not herein shown.

The slide 20 for oscillating the pawl-arms 16 and 17 is reciprocated on its track 21 under the action of a rockable lever 25. The lever 25 is slidable in a bearing 26 pivoted on a bracket 27 which is adjustable vertically on a standard 28 to vary the throw of the lever. At its lower end the lever 25 is pivotally connected to the slide 20 by a stud 29, while at its upper end it carries a roller 30 engaging a groove 31 in the face of a cam V. The cam V is fast on the end of the winding-spindle S and as the latter rotates in the direction indicated by the arrow *x*, Fig. 2, during the operation of the machine the lever 25 is rocked back and forth to reciprocate the slide 20 which, in turn, oscillates the pawl-arms 16 and 17 to turn the ratchet 15. The groove 31 in the cam V is so formed as to rock the lever 25 to reciprocate the slide 20 with a relatively slow movement to the right, and a quicker movement as it returns to the left. In this manner the pawl-arms 16 and 17 are moved back through their inoperative stroke at a slow rate, but as they are swung to the left to turn the ratchet 15 ahead, in one direction or the other, their movement is accelerated so that the wire-guide T is advanced along the winding-mandrel with relatively short, quick steps. Through this arrangement the wire-guide T is caused to halt while the winding-mandrel turns through nearly one complete revolution to cause the wire being wound to lay in a turn in a plane at right-angles to the axis of the coil. As each turn is completed, however, the guide T is shifted a distance equal to the width of the wire so that the next turn will be laid at the side of and in parallel, contiguous relation with the previously laid convolution. The complete arrangement of the means for controlling this intermittent feed of the wire-guide T is fully described in our previous application before referred to and need not be further enlarged upon

herein. Suffice it to state that while the present improvements have been shown as applied to a traverse-mechanism of this type they are also adapted for apparatus of a different arrangement or method of operation and might be used on other styles of machines employed for entirely different work.

Referring to Figs. 1, 2 and 3, the driving-connections for the machine are arranged at its left-hand end and enclosed within the walls of the headstock C and the sides of the leg or standard B'. As shown more particularly in Fig. 3, a bracket 33, bolted to the inner side of the front walls of the leg B' at 34, 34 is formed with arms 35, 35 terminating in spaced-apart hubs 36, 36, see also Fig. 1. The hubs 36 are bored to receive bushings 37 which project beyond their outer ends to adapt them to enter the bores of two spaced-apart hubs 38, 38 serving as a pivotal support for a swinging bracket 40. The bracket 40 is formed with two arms 41, 41 depending from the hubs 38, 38 and joined together by a lower, elongated hub 42. Journaled in the hub 42 is a shaft 43 which carries a flanged belt-pulley 44 fast on one end. The opposite end of the shaft 43 is reduced in diameter at 45 where it enters the bore of a pinion 47 which is held in place thereon by a nut 48. The pinion 47 meshes with a gear 49 which is held fast on the shouldered end of a shaft 50 by means of a nut 51. The shaft 50 extends through the bore of the bushings 37 in the spaced hubs 36 of the fixed bracket 33, and is free to rotate therein when driven from the shaft 43 through the gears 47, 49. Secured fast on the shaft 50 centrally thereof is a sprocket-wheel 52 arranged between the hubs 36, 36 of the bracket 33 whereby to hold the shaft in place in its bearings. The sprocket-wheel 52 is connected by a drive-chain 53 with a sprocket 54 keyed to the winding-spindle S and enclosed within the headstock C, as shown in Fig. 1. Through these connections the spindle S is driven from the belt-pulley 44 through the gearing 47, 49 at a reduced rate of speed. The pulley 44 is connected with the source of power, which may be a motor, line-shaft or any other prime-mover, by means of a belt 55 which passes through the rearward side of the standard B' as shown in Fig. 3. Normally, when the machine is at rest, the belt 55 runs slack over the pulley 44, as here illustrated, and the pulley is held from turning by a friction-brake 56 which bears against its periphery on its rearward side. The brake 56 comprises a main brake-shoe 57 mounted on a rod 58 which extends between two brackets 59, 59 fastened to the rear wall of the standard B' by bolts 60, see Fig. 9. The brake-shoe 57 carries a curved, spring-metal plate 61 which is faced with a lining 62 constructed of leather or other friction-producing material which forms the contact-element for the pulley 44. As shown particularly in Fig. 10, the plate or auxiliary brake-shoe 61 is bent on a radius slightly less than that of the rim of the pulley 44 so that as the latter moves into contact with it the outer extremities of the shoe 61 will engage the pulley first. As the pulley 44 is carried firmly against the shoe 61, however, the ends of the latter will expand so that finally its entire braking-surface makes frictional contact with the periphery of the pulley as illustrated in Fig. 3. The purpose of this arrangement is to provide for regulating the braking action so that the rotation of the pulley 44 will be stopped with a gradual retardation and started with a corresponding acceleration in its speed. In other words, the yielding spring brake-shoe 61 acts as a cushioning-device or shock-absorber for overcoming momentum and inertia and preventing sudden strains being imposed on the moving parts.

The pulley 44 is moved into and out from contact with its brake 56 by the swinging action of its supporting bracket 40 under the control of a tension-spring 63. As shown in Fig. 3 the spring 63 is anchored at 64 to the rear wall of the standard B' with its opposite end connected to an elbow-shaped arm 65 on the bracket 40. The arm 65 forms a continuation of one of the arms 41 of the bracket 40 and reaches downwardly with a flat plate 66 at its end. The plate 66 makes contact with the end of a stud 67 screwed through the upper end of an upright lever 68, the head of the stud 67 being adapted to engage the rear wall of the standard B' to limit the throw of the lever. The lever 68 is mounted fast on a rod or shaft 69 journaled in bearings 70 on the opposite sides of the base of the standard B'. Extending forwardly from the rod 69 is a lever 72, mounted fast thereon and formed at its outer end with a treadle 73 arranged in convenient position to receive the operator's foot as he stands at the front of the machine.

Pivotally connected to the outer end of the treadle-lever 72 at 74 is a flat rod or bar 75 which reaches up through the machine-bed B and projects above the top of the base of the headstock C. The rod 75 is guided at its upper end in a plate-like bearing 76 secured to the headstock C at 77, 77, see Figs. 4 and 8. The rod 75 serves as a control element for holding the treadle-lever 72 depressed during the operation of the machine, and for this purpose it is adapted to be engaged by suitable detent-means as next described. Journaled in a bearing 78 on the base of the headstock C is a rock-shaft 79, see Fig. 8, carrying a detent-lever 80 secured fast on its inner end by a set-screw 81. As shown in Fig. 4, the lever 80 is formed with a depending toe 82 adapted to engage with

the edge of a flat plate 83 fastened to the side of the rod 75. On the outer end of the rock-shaft 79 is a lever 85 secured thereto by a set-screw 86, and formed with a depending arm 87 which is pivotally connected with the end of a horizontal, sliding bar 88 by means of a stud 89. The opposite end of the bar 88 slides in a cleat or bearing 90 fastened to the base of the headstock C at 91, as shown in Fig. 4. Between the hub of the lever 85 and the bearing 78 is a hand-lever 92 arranged free to turn on the shaft 79, see Fig. 8. Referring particularly to Fig. 4, the lever 92 is formed with an arm 93 reaching out above the slide-bar 88 and terminating in a squared toe 94 adapted to engage with a notch 95 on the top of the bar. Extending upwardly from the hub of the lever 85 is an arm 96 carrying a cross-pin 97 which projects across the handle of the lever 92 as shown in Fig. 8. A spring 98 is connected to the right-hand end of the sliding bar 88 by means of the stud 89 and anchored to a pin 99 driven into the headstock C. Normally the spring 98 tends to move the bar 88 to the right to rock the shaft 79 through the lever 85 to carry the toe of the detent-lever 80 into engagement with its stop-plate 83 on the vertical rod 75 so that the latter is free to slide up and down under the action of the treadle-lever 72. When the rod 75 is slid to the left, against the action of the spring 98, its notch 95 will be carried into position to be engaged by the toe 94 on the hand-lever 92, this engagement being effected by the tilting of the lever 92 through the action of gravity. With the bar 88 locked against the action of its spring 98, in the manner as above described, the shaft 79 will be held in position to maintain the detent-lever 80 away from the stop 83 on the vertical rod 75 so that the latter is free to slide up and down under the action of the treadle-lever 72. The shaft 79 may be rocked manually to free the detent-lever 80 from the bar 75 by throwing the hand-lever 92 to the right, as viewed in Fig. 4, this action carrying it against the pin 97 in the arm 96 of the lever 85 to rock the latter which is fast on the shaft. The slide-bar 88 is moved to the left to release the detent-means to arrest the operation of the machine through an automatic control as next described:

Fastened to the side of the bar 88 is a depending arm 100 which is pivotally connected at 101 to the upper arm of a rock-lever 102. The lever 102 is pivoted on a stud 103 screwed into the side of the gear-casing U and is formed with a lower arm 104 extending downwardly adjacent the side of the shaft O. The lever 102 is rocked to slide the stop-control-bar 88 through the action of the clutch-device R which is automatically uncoupled when the rotation of the shaft O is resisted under abnormal stress or strain. Referring now to Figs. 4, 5 and 6, the clutch-mechanism R comprises a hub 105 held fast on the end of the ratchet-shaft O′ by means of a tapered pin 106. At the right of the hub 105 is the gear 7 which is free on the shaft O′ and provided with a hub 107 formed with a key or spline 108 adapted to engage a slot 109 in the end of a female clutch-member 110. The clutch-member 110 is held fast on the end of the feed-shaft O by a set-screw 111, see Fig. 4, and when it is desired to drive the shaft O from the shaft O′ through the train of gears 7, 8, 9, 12 or 10, 13, (Fig. 1), as previously explained, the screw 111 is released and the member 110 slid to the right. Overhanging the left-hand side of the gear 7 is a ring 112 formed integral therewith and fitted to turn freely on the periphery of the hub 105, see Fig. 6. Referring also to Fig. 5, the gear 7 is normally maintained rotatively connected with the hub 105 by a pair of plunger-pins 115 which are slidable in radial bores in the overhanging ring 112. The inner ends of the pins 115 are beveled on opposite sides to form V-shaped points 116 which seat in correspondingly shaped recesses 117 on the periphery of the hub 105. Preferably the recesses 117 are formed in the ends of hardened plugs 118 set in radial bores in the hub 105 with their outer extremities flush with the periphery thereof. The plunger-pins 115 are held in engagement with the recesses 117 in the plugs 118 by means of a wire spring-ring 120 coiled around the circumference of the ring 112 and passing through slots 121 in the ends of the pins. The spring-ring 120 is seated in a spiral groove 122 on the ring 112 with one of its ends 123 bent radially inward and held in a bore 124 as illustrated in Fig. 5. As shown in Fig. 6, the body of the gear 7 is provided with a plurality of transverse bores 125 to which are fitted transverse pins 126 which are free to slide therein. The inner ends of the pins 126 project through the side of the gear 7 and are formed with opposite, beveled faces 127 similar to the bevels on the radial pins 115, but of slightly less inclination. Formed in the vertical face of the hub 105 are beveled recesses 128 with which the beveled ends 127 of the pins 126 engage. At their outer ends the pins 126 are reduced in diameter at 129 and riveted through a plate or disk-washer 130. The washer or disk 130 is fitted to slide on the hub 107 of the gear 7 and normally is received within an undercut recess 131 on the side of the gear. As shown in Fig. 4, the outer face of the disk 130 bears against the rounded end of the lower arm 104 of the lever 102. Referring to Fig. 7, the gear 7 is formed with a transverse bore 132 which provides a pocket for a coiled spring 133. One end of the spring 133 is anchored to a pin 134 driven into the gear 7 to extend across the bore or pocket

132 while its opposite end 135 is riveted through the plate 130, tending to maintain the latter within its recess 131.

It will be seen from the foregoing description that the gear 7 forms the connection between the drive-shaft O′ and driven shaft O, both when the gear is active to drive the train of gearing on the countershaft I, or when it is employed solely as a clutch-member to couple the shafts together by means of its hub 107 and the opposite clutch-element 110. It is also to be observed that the gear 7 is connected rotatively with the drive-shaft O′ through the hub 105 inductively. That is to say, the gear 7 may be turned rotatively of the hub 105 against the resistance of the plunger-pins 115 bearing against the beveled recesses 117 in the hub. Should the rotation of the driven shaft O be resisted under abnormal stress then the tendency will be for the hub 105 to turn within the gear 7 and this action will cause the pins 115 to ride up the sides of their beveled sockets while expanding the spring-ring 120. Meanwhile this relative rotation between the hub 105 and gear 7 will also cause the transverse pins 126 in the gear 7 to be slid to the right, as viewed in Figs. 4 and 6, under the action of the inclined pockets 128 on their beveled ends 127. In this way the disk 130 is slid to the right to rock the lever 102 to slide the bar 88 to the left, whereby to release the detent-means and arrest the operation of the driving-mechanism. The method of operation of the complete apparatus is as follows:

Referring first to Fig. 3, when the treadle-lever 72 is in its raised position, as here shown, the bracket 40 will be swung back to press the driving-pulley 44 against its brake 56, and the belt 55 will run slack over the pulley without turning it. When it is desired to start the machine the operator places his foot on the treadle 73 to depress the lever 72 and this action rocks the arm 68 on the shaft 69 to the right, causing it to act through the arm 65 on the bracket 40 to swing the latter in the same direction against the tension of its spring 63. The pulley 44 will thus be carried away from the brake 56 which releases it gradually while the ends of the brake-shoe 61 contract inwardly as shown in Fig. 10. As the pulley 44 moves to the right it takes up the slack in the belt 55, which, as it tightens on the periphery of the pulley, starts its rotation with a gradually accelerated speed until the full driving speed is attained. As before explained, the pulley 44 is fast on the shaft 43 and the rotation of the latter is transmitted through the gears 47 and 49 to the shaft 50. The shaft 50 turns the sprocket 52 and through its chain 53 transmits rotation to the upper sprocket 54 which drives the winding spindle S. As shown in Fig. 1, the spindle S is connected to rotate the mandrel A to wind the wire *w* onto the former or core K as it is fed thereto by the traverse-guide T. Referring now to Fig. 2, it has before been explained that the spindle S drives the shaft O′ through the operation of the cam V acting on the lever 25 to turn the ratchet-wheel 15. The rotation of the shaft O′ is transmitted either directly through the clutch R, or through the train of gears on the countershaft I, as may be selected, to turn the screw-shaft O. The rotation of the shaft O under the impulse of the ratchet-drive is intermittent and as the winding-mandrel completes each turn in its rotation the screw O acts through the nut or follower P, see Fig. 1, to advance the wire-guide T along the core K to an extent equal to the thickness of the wire being wound. As the guide T moves from one end of the former K to the other it deposits the wire onto the coil in a series of parallel, adjacent turns or convolutions which form a layer extending between the guiding-flanges or heads *k*, *k*. As each layer of the coil is completed the direction of feed of the guide is reversed through the automatic operation of instrumentalities not herein shown or described, but which are fully explained in our U. S. Letters Patent No. 1,463,834 before referred to.

Under normal conditions the machine operates continuously to feed the wire *w* into place on the former K while traversing it back and forth to build up the coil in superimposed layers of parallel turns or convolutions. At the start of the winding, or sometimes in finishing the coil, it is desirable to maintain the machine under full control of the operator in order that its operation may be immediately arrested should the apparatus be incorrectly adjusted or fail to function properly. To provide for this the detent-devices which render the driving-mechanism active for continuous operation are not engaged automatically but must be set by hand to hold the starting-treadle 72 depressed. When the machine is at rest the slide-bar 88, see Fig. 4, is held against the action of its spring 98 by the engagement of the toe 94 on the lever 92 with the notch 95. With the parts thus engaged the rock-shaft 79 will be maintained by the arm 87 on the lever 85 in position to hold the detent-lever 80 free from the stop-plate 83 on the vertical rod 75, see Figs. 4 and 8. With the detent-lever 80 thus restrained from action the rod 75 is free to slide up and down under the movement of the treadle-lever 72. Hence, when the foot is first pressed down on the treadle 73 to start the machine if any condition requires instant stopping of the winding the operator has only to release the treadle to allow the bracket 40 to swing back to the left, as viewed in Fig. 3, to arrest the rotation of the pulley, 44 which is carried thereby. Through this arrangement the ma-

chine is maintained under manual control so that the operator may observe its operation and make sure of the proper functioning of the winding elements before setting it to operate continuously. Now, as the treadle-lever is held depressed, if the operator is satisfied that the proper adjustment of the feed of the guide has been made, to render the operation of the machine continuous it is only necessary to throw the hand-lever 92, see Fig. 4, to the right. This action lifts its toe 94 out from the notch 95 in the bar 88 and the latter will therefore be slid to the right under the tension of its spring 98. As the bar 88 moves to the right it acts through the lever 85 to rock the shaft 79 to carry the toe 82 of the detent-lever 80 into engagement with the edge of the stop-plate 83 on the rod 75, as shown in Fig. 4. The rod 75 will thus be locked in position to hold the treadle-lever 72 depressed and consequently the driving-mechanism will be maintained active to continue the operation of the machine without further attention on the part of the operator. When it is desired to stop the machine the lever 92 is rocked to the right again until its handle, coming against the pin 97 in the arm 96 of the lever 85, turns the lever 85 to rock the shaft 79 to release the detent-lever 80. When the toe 82 of the lever 80 is removed from the edge of the stop-plate 83 the rod 75 will be allowed to slide upwardly as the treadle-lever 72 rises under the impulse of the bracket 40 as moved by its spring 63, see Fig. 3. As the rod 75 slides upwardly in its bearing 76 the plate 83 rides under the toe 82 of the detent-lever 80 and holds the latter so that the lever 92 can now be released to allow its toe 94 to drop into engagement with the notch 95 in the slide-bar 88. This action locks the bar 88 against the action of its spring 98 and with the parts in this relation the machine is now ready to be started again in the manner as first explained.

The operation of the machine is arrested automatically as a precaution against accident to its parts through the functioning of the yielding clutch-device R on the shaft O'. It has before been explained that the gear 7, see Figs. 4, 5 and 6, is connected rotatively with the shaft O' through the engagement of the plunger-pins 115 with the recesses 117 in the hub 105. When, therefore, the turning of the gear is resisted to an abnormal degree the hub will have a tendency to free itself from the gear by forcing the pins 115 radially outward from their beveled seats 117. This abnormal resistance to the drive may be occasioned by obstruction to the feed of the wire-guide T or from other causes. For instance, a turn of wire *w* might become misplaced on the coil in such manner that it would project above the surface on which the winding is being performed. In such case the guide-wheel *n* would be hindered in its feeding-movement as its edge came in contact with the misplaced wire and there would be danger of straining or rupturing the guide T or the parts of its feeding-means, particularly the delicate ratchet-mechanism for the shaft O'. In other instances, should the feeding-mechanism of the machine not be properly adjusted to provide an extent of traverse of the guide T in conformity with the distance between the end-flanges *k*, *k* on the core K, one of the flanges might interfere with the feed of the guide. That is to say, if the machine were improperly adjusted whereby the guide T had too long a traverse its feed would carry it against one of the flanges *k* with such force as to bend or break the guide-wheel *n* or otherwise damage the operating parts. It is therefore to guard against such accidents that our improved emergency stopping-device is provided to function as follows: If the guide T is restricted in its feeding movement then there will be a tendency to withhold its feed-shaft O from turning. The shaft O being driven from the shaft O', either through the clutch-connection at 108—109 or through the countershaft I, as previously explained, resistance to its rotation will cause the gear 7 to be released from its hub 105. As the hub 105 turns within the gear 7, while forcing the pins 115 out of their seats 117, the beveled seats 128 on the side of the hub will act to slide the transverse pins 126 through their bores in the gear. That is to say, the pins 126 will be moved to the right, as viewed in Fig. 6, and consequently the disk 130 will be slid outwardly on the hub 107 of the gear 7. As before stated the disk 130 bears against the lower end of the arm 104 of the lever 102, see Fig. 4, and therefore the lever will be rocked to cause its upper arm to slide the bar 88 to the left. This movement of the bar 88 acts through the lever 85 on the shaft 79 to rock the latter to release the detent-lever 80 from the rod 75. The release of the detent-device allows the rod 75 to slide upwardly to effect the operation of the stopping-mechanism of the machine in the manner as before explained. It is to be noted that the bevels on the ends of the transverse plunger-pins 126 are relatively flatter or of less inclination as compared to those on the radial plunger-pins 115. Therefore, the gear 7 may have a slight relative turning movement with respect to its hub 105 before the pins 126 are slid longitudinally to an appreciable extent. That is to say, the gear 7 may be partially released from its hub 105 as the pins 115 slide up out of their beveled sockets 117, but before the pins 115 are entirely released from engagement with their sockets in the hub 105 the pins 126 will have been slid outwardly to the right as viewed in Fig. 6 to displace the disk 130 sufficiently to

actuate the stopping-mechanism of the machine in the manner and for the purpose as hereinbefore explained. It is to be understood that the gear 7 is never completely disengaged from its hub 105; that is, the pins 115 cannot ride entirely out of their beveled sockets before the machine is stopped through the operation of the sliding disk 130. The purpose of the action last described is to allow the wire-guide T to be held for an instant without arresting the operation of the whole machine. That is to say, if the guide meets with a slight resistance to its movement which is quickly overcome, for instance, if the guide-wheel *n* should strike against a misplaced turn of the wire in the coil and then ride up over it, the connections between the gear 7 and its hub 105 will yield sufficiently to allow for this slight halt in the feed. If the resistance to the feed is not immediately overcome, however, then the continued turning of the hub 105 with respect to the gear 7 will act to slide the disk 130 to effect the disengagement of the detent-devices as before explained.

It will be observed that our improvement provides an extremely simple and efficient stopping-mechanism which may be maintained under the control of the operator or which may be set to render the operation of the machine continuous as desired. Furthermore, means are provided to stop the machine automatically in case of emergency should the operating parts be hindered in their proper functioning and in this way the corelated mechanisms are saved from damage or rupture under abnormal stress or strain.

Various modifications might be made in the structure or arrangement of the parts of our improved mechanism without departing from the spirit or scope of the invention. Moreover, the stopping-apparatus of itself might be applied to other types of machines than that herein shown, or employed for other purposes. Therefore, without limiting ourselves to the exact embodiment of the invention herein shown and described, what we claim is:—

1. In a winding machine, the combination with a winding-mandrel and means for feeding strand-material thereto, of driving-means, a driven-element operated therefrom to actuate the strand-feeding means, means connecting the driving-means with the driven-element to permit a predetermined amount of lost motion therebetween when the motion of the driven-element is resisted under abnormal stress on the strand-feeding means, and stopping-means for arresting the operation of the driving-means when the resistance to the driven-element is continued.

2. In a winding machine, the combination with a winding-spindle and traversing-means for feeding strand-material to the spindle, of driving-means, a driven-element operated therefrom to actuate the traversing-means, a yieldable clutch connecting the driving-means with the driven-element to permit a predetermined amount of lost motion therebetween when the driven-element is withheld from operation under abnormal resistance to the action of the traversing-means, and stopping-means operated from the clutch to arrest the operation of the driving-means when resistance to the driven-element is continued.

3. In a winding machine, the combination of a winding-mandrel and means for feeding strand-material thereto, of a clutch member, a member adapted to be driven therefrom to operate the traversing-means, resiliently-held means connecting the clutch-member with the driven-member to permit a predetermined amount of lost motion therebetween, stopping-means for arresting the operation of the clutch-member, and means operated through the release of the clutch-connecting means to actuate the stopping-means.

4. In a winding machine, the combination of a winding-spindle and traversing-means for feeding strand-material thereto, of a drive-shaft, a second shaft adapted to be driven therefrom, means connecting the second shaft to operate the traversing-means, a clutch-member fast on the first shaft, a transmission-element connected to drive the second shaft, releasable means connecting the clutch-member and transmission-element to rotate together while permitting a predetermined amount of lost motion therebetween, stopping-means for arresting the operation of the drive-shaft, and means operated upon the release of the clutch-connecting means to actuate the stopping-means.

5. In a winding machine, the combination with the winding-spindle and traversing-means for feeding strand-material to the spindle, of a drive-shaft, a clutch-member on said shaft, a transmission element, resiliently-held means connecting the clutch-member to drive the transmission element, means for connecting the transmission-element to operate the traversing-means, stopping-means for arresting the operation of the drive-shaft, and means operated upon the release of the connecting-means to actuate the stopping-means.

6. In a winding machine, the combination with the winding-spindle and traversing-means for feeding strand-material to the spindle, of a clutch-member, a member adapted to be driven therefrom, yieldable-means for connecting said members to rotate together, means connecting the driven-member to operate the traversing-means, stopping-means for arresting the operation of

the clutch-member, and means operated through the movement of the clutch-member with respect to the driven-member to actuate the stopping-means.

7. In a winding machine, the combination with the winding-spindle and traversing-means for feeding strand-material to the winding-spindle, of a drive-member, a member adapted to be driven therefrom, yieldable-means connecting the drive-member to the driven-member to rotate the latter, means connecting the driven-member to operate the traversing means, stopping-means for arresting the operation of the drive-member, and means operated from the movement of the drive-member when the driven-member is withheld from rotation to actuate the stopping-means.

8. In a winding machine, the combination with the winding-spindle and traversing-means for feeding strand-material to the spindle, of a drive-member, a member adapted to be driven therefrom, means connecting the drive-member to rotate the driven-member, means for connecting the driven-member to operate the traversing-means, stopping-means for arresting the operation of the drive-member, and means carried by the driven-member to be moved from the drive-member to actuate the stopping-means when the driven-member encounters undue resistance to its rotation.

9. In a winding machine, the combination with the winding-spindle and traversing-means for feeding strand-material to the spindle, of a drive-member, a member adapted to be driven therefrom, yieldable-means carried by the driven-member and connecting it to be rotated from the drive-member, means connecting the driven-member to operate the traversing-means, stopping-means for arresting the operation of the drive-member, and means slidable on one member through the rotation of the other member with respect thereto to actuate the stopping-means when the driven-member is withheld from rotation.

10. In a winding machine, the combination with a drive-member, of a member adapted to be driven therefrom, yieldable-means connecting the drive-member to rotate the driven-member while permitting a slight amount of lost motion therebetween, stopping-means for arresting the operation of the drive-member, a plunger slidable on one member, a bevel on the other member for sliding the plunger when one member is moved in relation to the other member, and means operated from the movement of the plunger to actuate the stopping-means when the driven-member is withheld from rotation.

11. In a winding machine, the combination with a rotatable drive-member, of a driven-member rotatable therefrom, one of said members being provided with beveled seats, plungers slidable on one member to engage the bevels on the other member to connect said members to rotate together, stopping-means for arresting the operation of the drive-member, and means operated from the sliding movement of the plungers when the driven-member is withheld from rotation to operate the stopping-means.

12. In a winding machine, the combination with a rotatable drive-member, of a driven-member rotatable therefrom, one of said members being provided with beveled seats, slidable plunger-pins on one member engaging the bevels on the other member to connect said members to rotate together, stopping-means for arresting the operation of the drive-member, and a second set of plunger-pins slidable on the driven-member when the drive-member is rotated with respect thereto to actuate the stopping-means when the driven-member is withheld from rotation.

13. In a winding machine, the combination with a rotatable hub formed with beveled seats on its periphery, of a driven-member rotatable on the same axis with the hub, plunger-pins slidable in said driven-member to adapt their ends to engage the seats on the hub, and a spring-ring coiled around the periphery of the driven-member and engaging plunger-pins to maintain them in yielding engagement with the hub.

14. In a winding machine, the combination with a rotating clutch-member having beveled recesses on its face, of a driven-member rotatable on the same axis with the hub, a disk slidable axially with respect to the hub, pins on said disk slidable in the driven-member to engage their ends with the recesses in the clutch-member, stopping-means for arresting the rotation of the clutch-member, and means operated from the sliding movement of the disk to actuate the stopping-means.

15. In a winding machine, the combination with a rotating drive-shaft, of a transmission-member adapted to be driven therefrom, a clutch-member fast on the drive-shaft, yieldable-means for connecting the clutch-member to drive the transmission-member, stopping-means for arresting the operation of the drive-shaft, means slidable axially of the transmission-member to actuate the stopping-means, and means carried by the transmission-member and engaging the clutch-member to slide the actuating-means when the transmission-member is withheld from rotation.

16. In a winding machine, the combination with the driving-mechanism, of starting-means to render said mechanism operative, a manually-operable lever to operate the starting-means, detent-means to lock the starting-lever in operative position, and a

second detent-means for maintaining the first detent-means inoperative.

17. In a winding machine, the combination with the starting-mechanism therefor, of a lever to operate the starting-mechanism, detent-means for holding said lever in starting position, means to lock the detent-means against operation, and a second lever for releasing the detent-locking means.

18. In a winding machine, the combination with the driving-mechanism therefor, of manually-controlled starting-means for rendering the driving-mechanism operative, detent-means for maintaining the starting-means operative, automatically-operated stopping-means for releasing the detent-means, and manually-releasable means for holding the detent-means inoperative after it has been released by the stopping-means.

19. In a winding machine, the combination with the driving-mechanism therefor, of a lever for rendering the driving-means operative, a spring-operated detent for locking the lever in operative position, stopping-means for releasing the detent, means to lock the detent in released position, and manually-operable means for releasing the detent-locking means.

20. In a winding machine, the combination with the driving-means therefor, of a treadle-lever for holding the driving-means operative, a detent for locking the treadle-lever in starting position, a slide-bar for releasing the detent, and a lock for engaging the slide-bar to maintain the detent released.

21. In a winding machine, the combination with the starting-mechanism therefor, of a treadle connected to operate the starting mechanism, a slidable rod moved from the treadle, detent-means for locking the rod to hold the treadle depressed, automatically-operated stopping-mechanism for releasing the detent-means, and a hand-lever for locking the detent-means in released position.

In testimony whereof we affix our signatures.

EDWARD F. PARKS.
GEORGE N. TAYLOR.
CARL A. BRINK.

CERTIFICATE OF CORRECTION.

Patent No. 1,651,099. Granted November 29, 1927, to

EDWARD F. PARKS, CARL A. BRINK, and GEORGE N. TAYLOR.

It is hereby certified that error appears in the above numbered patent requiring correction as follows: In the grant, and in the heading to the printed specification, the residence of the two first mentioned patentees was erroneously written and printed as "East Providence, Rhode Island", whereas said residence should have been written and printed as "Providence, Rhode Island"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of December, A. D. 1927.

M. J. Moore,
Acting Commissioner of Patents.

Seal.