Jan. 19, 1932. F. W. WALTON 1,842,223

MANDRELLESS SPACED COILING MACHINE

Filed March 17, 1928 5 Sheets-Sheet 1

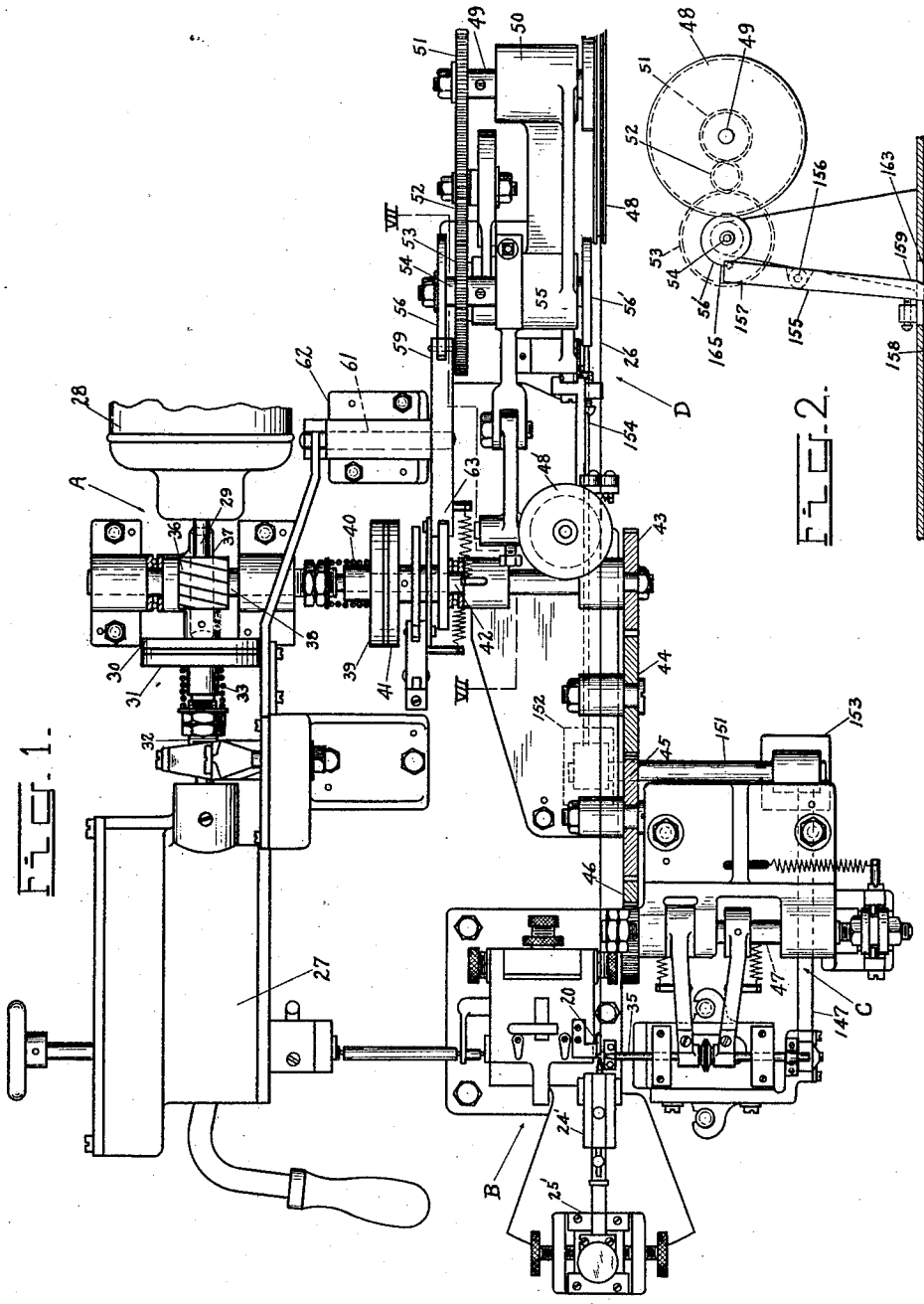


FIG. 1.

FIG. 2.

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MANDRELLESS SPACED COILING MACHINE

Filed March 17, 1928 5 Sheets-Sheet 2

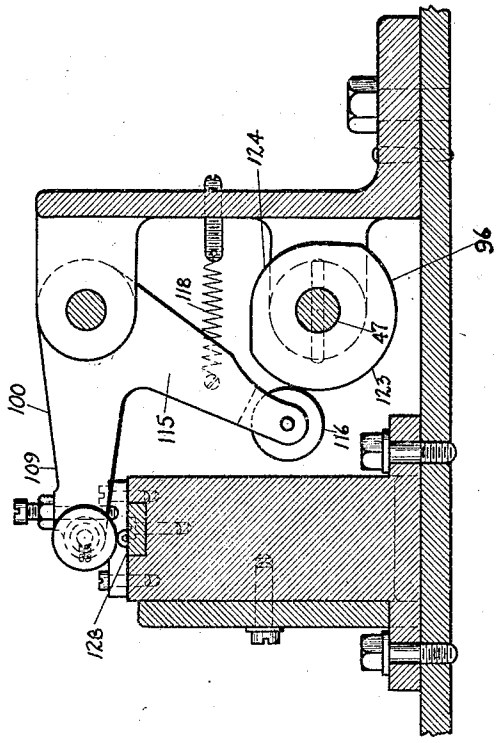


FIG. 4.

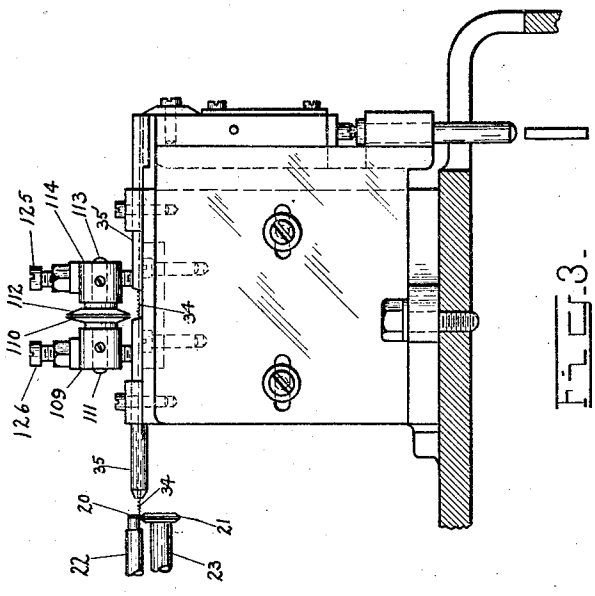


FIG. 3.

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MANDRELLESS SPACED COILING MACHINE

Filed March 17, 1928 5 Sheets-Sheet 3

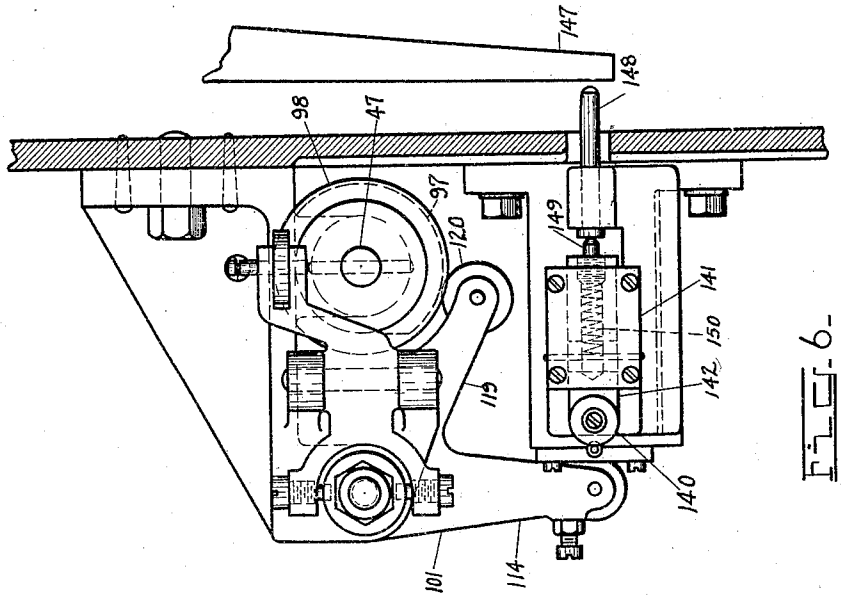


FIG. 6.

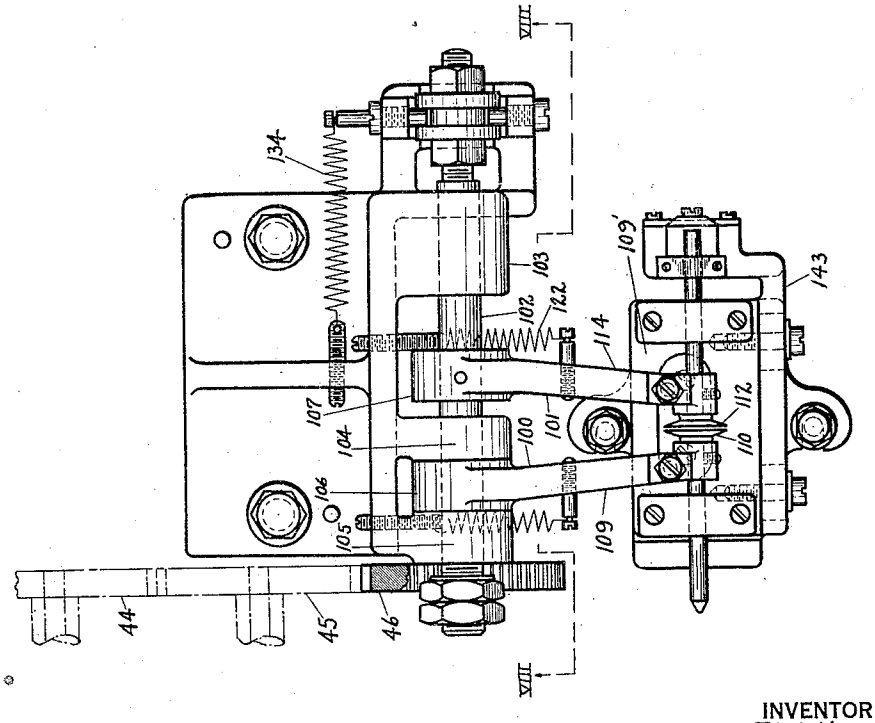


FIG. 5.

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MANDRELLESS SPACED COILING MACHINE

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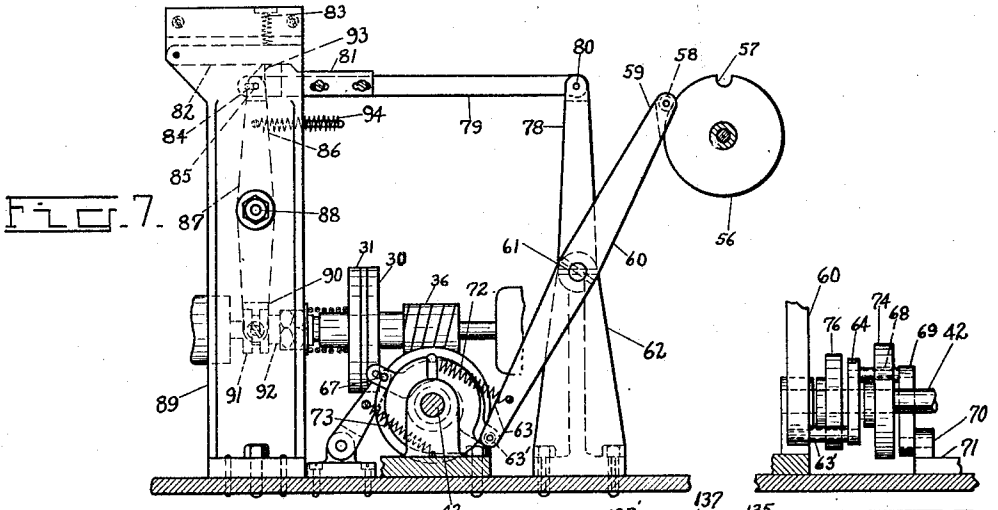


Fig. 7.

Fig. 7C.

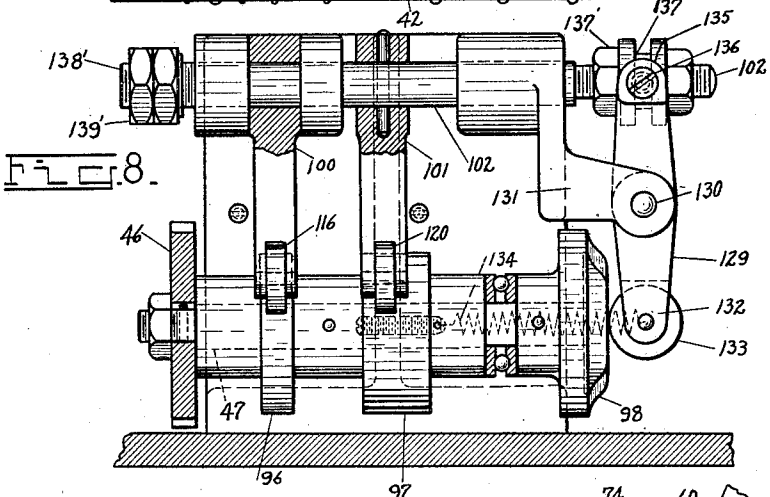


Fig. 8.

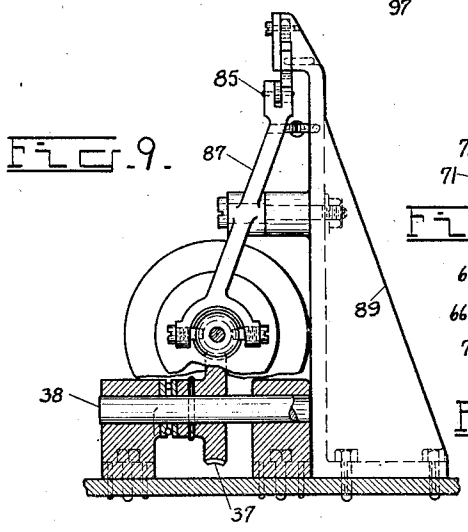


Fig. 9.

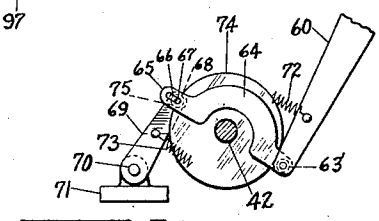


Fig. 7A.

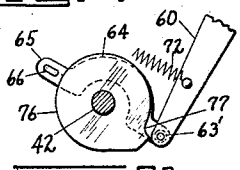


Fig. 7B.

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MANDRELLESS SPACED COILING MACHINE

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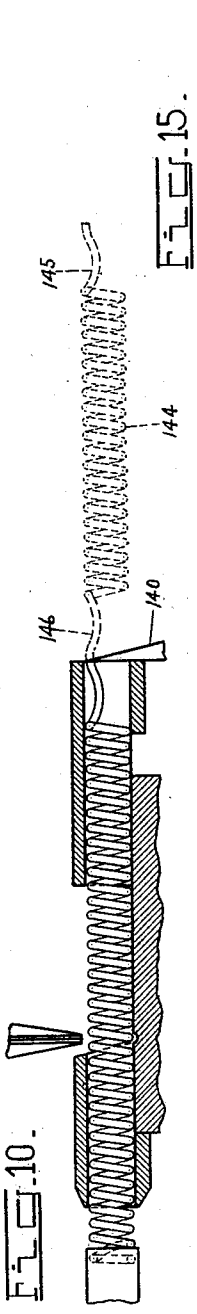


FIG. 10.

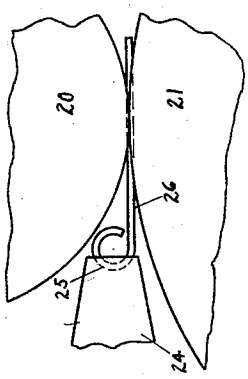


FIG. 15.



FIG. 16.

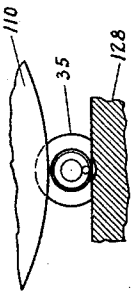


FIG. 14.

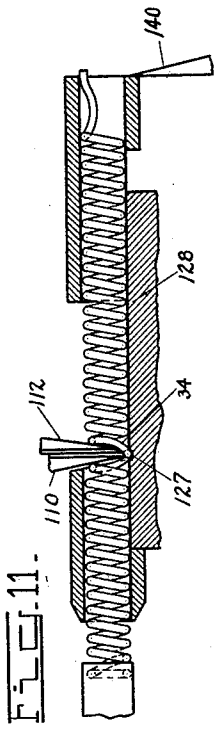


FIG. 11.

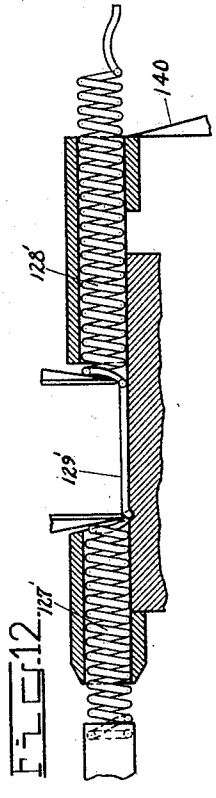


FIG. 12.

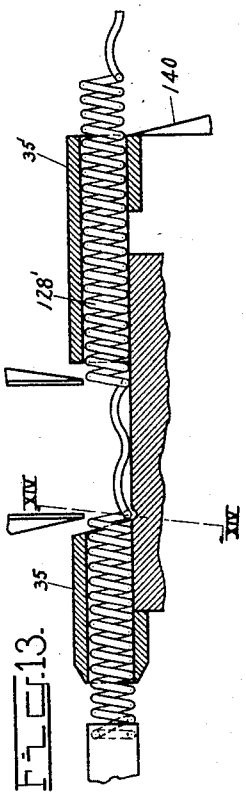


FIG. 13.

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UNITED STATES PATENT OFFICE

FRANK WILLETT WALTON, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO WESTINGHOUSE LAMP COMPANY, A CORPORATION OF PENNSYLVANIA

MANDRELLESS SPACED COILING MACHINE

Application filed March 17, 1928. Serial No. 262,566.

This invention relates to a machine for producing helically coiled sections of wire having straight terminals, and relates more particularly to the production of sectional coils such as filaments for incandescent electric lamps or the like.

In the manufacture of certain types of incandescent electric lamps, the light source or filament therefor is formed from a highly refractory wire such as tungsten, coiled to helical form. Certain types of filaments are wound in continuous helixes and severed to given lengths, each length being of such dimensions as to have the required resistance for a given type lamp. Filaments of this character are usually secured to the leading-in conductors of the lamp by clamping or welding directly to the coiled end of the sections. When securing a completely coiled section to a leading-in wire, certain disadvantages arise in that the clamping or welding operation may include more or less of the coiled sections thus changing the effective filament length and consequently changing the resistance of the element to the end that the desired rating of the filament is altered.

It is desirable, therefor, in certain cases, to produce a coiled section having straight portions as terminals so that the welding or clamping operation for securing the ends of the coiled section to the lead-in wire is facilitated. When straight ends are provided as terminals for a filament, the welding or clamping operation, to secure the filament to leading-in conductors, may be accomplished in a more uniform manner, thus making the mounting operation more accurate.

Heretofore, filament wire has been wound to helical form so as to produce a series of sections of closely wound turns of wire separated by one or more turns of greater pitch than the turns composing the closely wound sections, thus providing relatively closely wound sections of wire terminating in uncoiled or comparatively straight portions. The above operation, however, has previously been performed on what is known as a mandrel wound coil winding machine and the spacing of the coils was accomplished by changing the relative movement of the mandrel and the degree of rate of winding.

It is the object of the present invention, however, to produce what may be termed spaced or sectional coils in the absence of a mandrel.

Another object of the invention is to produce spaced or sectional coils in a more accurate and uniform manner than had heretofore been accomplished.

Another object of the invention is to provide for the manufacture of spaced or sectional coils in an expeditious and efficient manner.

A machine for producing helically wound lamp filaments in the absence of a mandrel is shown and described in application of John W. Ekstedt, Machine for making filamentary bodies, Serial No. 121,156, filed July 8, 1926, and assigned to the same assignee as is the present invention which application has become Patent No. 1,670,499 granted May 22, 1928.

In the above-mentioned mandrelless coil winding machine, the filament wire is led over a measuring drum and threaded through a pair of driving or force rollers. Adjacent to the force rollers is disposed a cavity die so arranged that as the wire is driven endwise by the force rollers it enters the die and is diverted from its path of movement into a helical path and issues from the die in a series of coils.

Mechanism is provided in cooperation with the measuring drum so that after a given number of turns of wire have been wound, the section containing the said given amount of turns is automatically severed. The severing means is so controlled by the measuring drum that each section of severed filament contains exactly the same amount or length of wire.

The present invention provides mechanism which operates in conjunction with the mandrelless coil winding machine and receives the filament as it issues from the die. The said mechanism is so arranged that after a length of coiled filament having a given number of turns is formed, the coiling operation is temporarily terminated. Means in the

form of spreading members consisting of a pair of knife-like disks are actuated and descend upon the coil, one of the disks operating to grip the wire of the coil while the other is moved along the longitudinal axis of the coil, spreading the same into two coiled sections having a substantially straight or uncoiled portion of filament therebetween. A cutter element is then operated so as to separate the sections by cutting the wire at a point in the straight portion intermediate the two coiled sections.

Mechanism for performing the spacing operation may be controlled by certain of the operative elements which actuate the measuring drum. The said measuring drum rotates a given degree in accordance with the length of wire desired in a coiled section. After the drum has moved a predetermined distance, mechanism operates to terminate the movement of the filament driving rollers and consequently the movement of the drum, and at the same time mechanism is put into operation which performs the coil spacing and severing operations.

The above brief description gives a general idea of the various operative elements and their relation. A more complete understanding of the invention will, however, be obtained from the following description and the accompanying drawings in which:

Fig. 1 is a plan view of a mandrelless coil winding machine with the present invention for producing spaced coils applied thereto, parts of the machine being shown in section;

Fig. 2 is a diagrammatic view of a portion of the measuring and cutting off mechanism;

Fig. 3 is a front end view of the coil-spacing mechanism;

Fig. 4 is a side elevational view of a coil spacing mechanism shown in Fig. 3, portions of the machine being shown in section to more clearly illustrate movable parts;

Fig. 5 is a plan view of the coil spacing portion of the machine shown in Fig. 3;

Fig. 6 is a side elevational view of the coil spacing mechanism shown in Fig. 5;

Fig. 7 is a view taken substantially on line VII—VII in Fig. 1;

Fig. 7^A is a detail view of a portion of the mechanism for controlling the coil spacing mechanism;

Fig. 7^B is a view showing one of the cams and a lever forming part of the mechanism for controlling the coil spacing mechanism;

Fig. 7^C is a fragmentary end view of the mechanism for controlling the coil-spacing mechanism;

Fig. 8 is a view taken on line VIII—VIII in Fig. 5;

Fig. 9 is a view of the left side of the mechanism shown in Fig. 7 partly broken away to show a worm drive;

Fig. 10 is an enlarged fragmentary view of a helically wound wire with spacing members disposed in position prior to a spacing operation;

Fig. 11 is a view similar to Fig. 10 but shows the spacing members engaging the wire;

Fig. 12 is a view similar to Figs. 10 and 11 showing the spacing members separated to uncoil the wire;

Fig. 13 is a view similar to Fig. 12 but showing the spacing members lifted;

Fig. 14 is a fragmentary view taken substantially on line XIV—XIV in Fig. 13;

Fig. 15 is a fragmentary view greatly enlarged in size to show the driving members for moving a wire into a die for a coiling operation; and

Fig. 16 is a portion of a length of coiled wire having coiled sections separated by straight portions and represents the result of the present machine.

Although the present attachment for producing spaced coils may be utilized in connection with any source of supply of coiled wire not having a mandrel therein, the invention is shown and described in connection with a mandrelless coil winding machine of the type set forth in the above-mentioned patent.

As illustrated, the present machine may comprise a primary driving mechanism A, mandrelless coil winding mechanism B, coil spacing mechanism C, and wire measuring mechanism D. The primary driving mechanism is constructed with intermediate elements for the transmission of motion to the coil winding machine and also for the transmission of motion to the coil separating mechanism.

In order that the invention may be more readily understood, the coil winding mechanism will be first described. This mechanism includes a pair of driving or force rollers 20 and 21. These rollers as shown in Figs. 1, 3 and 15 are mounted on shafts 22 and 23 respectively and a die 24 having a cavity 25 is disposed adjacent to the tangential points of the rollers. The die may be mounted in a holder 24′ having means 25′ for effecting a micrometer adjustment of the die to vary the pitch and diameter of the coil formed.

The wire 26 to be coiled is led from any suitable source of supply (not shown) between the rollers which are rotated in opposite directions by means of suitable gearing in a gear box 27, power being supplied from a motor 28. The motor is not, however, positively connected with the mechanism in the gear box 27 since a shaft 29 of the motor is provided with a friction plate 30 to engage with a friction plate or disk 31 mounted on a shaft 32 for the transmission of motion to the gear box 27. A spring 33 normally holds the friction plates in operative relation. The purpose of this slip drive or friction engagement between the motor and the

gear box 27 will be presently more fully described.

As the wire 26 is driven into the coil winding die 24, it is diverted from its path of movement and into helical or coiled formation to produce a coil 34 which is led into a guide 35 of the coil spacing mechanism C. The motor 28 serves as a common source of power for the coil winding mechanism B and for the coil separating mechanism C. The shaft 29 of the motor 28 is provided with a worm 36 disposed in operative relation to a worm wheel 37 on a shaft 38. The said shaft 38 is provided with a friction plate 39 normally held by a spring 40 to engage with a friction plate 41 on a shaft 42. The said shaft 42 is provided with a gear wheel 43 disposed in mesh with a gear wheel 44 which in turn is in mesh with a gear wheel 45, the said latter gear wheel meshing with a gear wheel 46 on a shaft 47. The gear train just described serves for the transmission of motion from the source of power to the coil separating mechanism C.

It has been found desirable to operate the coil winding mechanism to produce a coiled section of a given length and to then terminate the coil winding operation and actuate the coil separating mechanism. In order to obtain separated coiled sections with equal amounts of coiled wire therein, the interruption of the coil winding operation is controlled by the wire measuring means D which actuates cutting mechanism. This measuring and severing means is generally the same as that set forth in the above-mentioned patent and is more specifically set forth in application of Sten Wadsten, Serial No. 165,857 filed February 4, 1927, and entitled Adjustable measuring and cutting device for coil-winding machines, and assigned to the same assignee as is the present invention which application has become Patent No. 1,680,489 granted August 14, 1928.

The measuring and severing mechanism includes a measuring drum 48 around which the wire 26 is led in a bight from the source of supply, as a spool 48′. In the said Patent No. 1,680,489, the measuring drum operates, upon a given rotation thereof, to actuate mechanism for severing a coiled section, which operation is also utilized in the present construction. In the present invention, a movement of the measuring drum also serves to terminate the coil winding operation and to put into operation the coil spacing mechanism.

The measuring drum is mounted on a shaft 49 journaled in a suitable bearing 50. The said shaft 49 is provided with a spur gear 51 in mesh with an idler 52 which in turn is in mesh with a spur gear 53 mounted on one end of a shaft 54 journaled in a bearing 55. On shaft 54 and adjacent to the gear 53 is mounted a notched wheel 56. The opposite end of the shaft 54 is provided with a cam 56′ for operating a cutting-off device to be later described. A rotation of the measuring drum results, by reason of the gears 51, 52 and 53, in a rotation of the notched wheel 56.

The gear train between the measuring drum for the movement of the notched wheel is provided for the purpose of changing the degree of rotation of the measuring wheel to actuate severing mechanism and to vary the amount of wire in a coiled section. This adjustable feature constitutes the subject-matter of the Wadsten patent.

When the measuring wheel 48 has made a partial or complete rotation, depending upon the amount of wire to be wound into a coil, the notched wheel 56 will have rotated so that a notch 57 will have moved to receive a roller 58 at one end 59 of a lever 60 (see Figs. 7, 7^A, 7^B and 7^C). The said lever is secured to a shaft 61 journaled in bearing 62. An opposite end 63 of the lever 60 is provided with a roller 63′ and pivotally connected to one end of a link 64 which spans the shaft 42, which shaft, as above set forth, serves for the transmission of motion to the coil separating mechanism C. An opposite end 65 of the link 64 is provided with a slot 66 to receive a pin 67 upon which a roller 68 is mounted. The said pin is secured to an arm or what may be termed a stop-lever 69 pivoted at 70 in a bearing 71. The end 63 of the lever 60 is normally urged toward the shaft 42 by a spring 72, thus causing the link to engage the pin 67 at one end of the slot 66, thereby normally tending to move the roller 68 away from the shaft 42. A spring 73 of lesser strength than the spring 72 is, however, provided to urge the roller toward the shaft 42.

The lever 69 operates to terminate a movement of the shaft 42, thus preventing the transmission of motion to the coil spacing mechanism C. For this purpose, the shaft 42 is provided with a disk 74 having a notch 75, and when the roller 68 of the lever 69 is disposed in the notch 75 the shaft 42 may be held unmovable by reason of the slip plates 39 and 41. The shaft 42 is also provided with a cam-member 76 having a depression 77. When the raised surface of the cam 76 engages the roller 63′ as shown in Fig. 7 the roller 68 of the lever 69 will, owing to the slot 66, be free to enter the notch 75 in the disk 74.

When the measuring roll has rotated a given degree and the notch 57 in the wheel 56 has moved to receive the roller 58, the end 63 of the lever 60 will tend to move toward the cam 76 at which time the depressed portion 77 of the cam-member will be in position to permit a movement of the end 63 of the lever 60. This movement of the lever will cause the link 64 to exert a thrust on the pin 67 and

remove the roller 68 from the notch 75 permitting a rotation of the shaft 42 and an operation of the coil-spacing mechanism C.

The notched wheel 56 however, also operates to cause a termination of the coil winding mechanism B. This is accomplished by the provision of a lever 78 pinned or otherwise secured to the shaft 61. This lever is provided with an arm 79 having one end pivotally connected with the lever 78 at 80 and having on its free end an adjustable latch 81 adapted to engage a pivoted latch bar 82. A spring 83 normally urges the latch bar toward the latch. The free end of the arm 79 is provided with a slot 84 to receive a pin 85 at one end 86 of a lever 87 pivoted at 88 on a bracket 89. An opposite end 90 of the lever 87 is provided with a forked portion having opposite pins to engage a collar 91 on a sleeve 92 whereby a movement of the lever 87 will cause a movement of friction plate 31 toward or away from friction plate 30, thus causing the termination or the actuation of the coil winding mechanism.

Normally the friction plates 30 and 31 are held in operative contact by reason of the latch 82 which is provided with a lug 93 to engage the upper end of the lever 87, a spring 94 serving to urge the pin 85 of the lever to an end of the slot 84 whereby the lug 93 will lock the lever from movement to disengage the friction plates 30 and 31. When the lever 78 is moved, by reason of the roller 58 on the lever 60 dropping into notch 57, the latch 81 will engage the latch bar 82 to release the upper end of the lever 87 from engagement with the lug 93 at which time the pin 85 will move to the opposite end of the slot 84 and provide sufficient lost motion to permit the operation of the latch and latch-bar. This operation causes a termination of the operation of the coil winding mechanism and inasmuch as the lever 60 and the lever 78 move simultaneously, the coil spacing mechanism will be put into operation.

Referring now to the coil spacing mechanism C, it will be evident that when the friction plates 39 and 41 are effectively engaged, motion will be transmitted to the countershaft 47 of the spacing mechanism through the gear train including gears 43, 44, 45 and 46 as hereinbefore described.

The shaft 47 is suitably supported in bearings and is provided with two control cams 96 and 97 and a lateral or end cam 98. The control cams 96 and 97 are so disposed as to engage with rocker members 100 and 101 respectively. The rocker member 100 is loosely mounted on a spindle 102 journaled in suitable bearings 103, 104 and 105.

A hub 106 of the rocker member 100 is held from lateral movement between bearings 104 and 105, while a hub 107 of the rocker member 101 is pinned to the spindle and disposed in spaced relation to bearings 103 and 104 to allow for a lateral movement of the rocker member 101 with the spindle 102. Inasmuch as the rocker member 100 is loose on the spindle 102 it may rock independent of any endwise movement of the spindle, whereas, since the rocker member 101 is pinned to the spindle it may rock therewith but will be moved laterally with an endwise movement of the spindle.

The rocker members 100 and 101 perform the coil spacing operation and are substantially of bell-crank construction. An end of an arm 109 of the member 100 is provided with a disk-like member 110. This disk may be mounted on a stub shaft 111 and may be either held from movement or free to rotate. The edge of the disk is of knife-like formation and arranged for disposition in close relation with a similar disk 112 carried on a stub shaft 113 at an end of arm 114 of the rocker member 101.

An arm 115 of rocker member 100 is provided with a roller 116 normally disposed in contact with a cam 96 secured to the countershaft 47. A spring 118 normally retains the roller in contact with the cam (see Fig. 4). The rocker member 101 is provided with an arm 119 having a roller 120 normally held in contact with a cam 97 by a spring 122 (see Figs. 5 and 6). The cams 96 and 97 are of substantially the same configuration and when the rollers are on the raised portion 123 of the cams, the arms 114 and 109 of the rocker members are raised, thus lifting the disks 110 and 112 above a section of coiled wire 34 (see Figs. 3 and 10 to 14).

As the cams 96 and 97 are rotated with the shaft 47 and the rollers 116 and 120 traverse the reduced surface 124 of the cams, the disks will be lowered to engage the wire as shown in Fig. 11. The degree of pressure with which the disks engage the wire may be determined by set-screws 125 and 126 on the arms 109 and 114 respectively. The set-screws may bear upon the top of a plate in the supporting structure 128 of the machine and may be adjusted so that when the rocker members are lowered, the disks will engage the wire with the proper degree of pressure. The set-screw 126 may, however, be adjusted to allow the disk 110 to move slightly farther downwardly than the disk 112 so that the wire of the coil 34 is pressed into a notch 127 of the plate 128 through which the coil moves.

When in position as shown in Fig. 11, the disks are ready to be separated to uncoil a portion of the coiled section, thus producing coiled sections 127′ and 128′ separated by an uncoiled portion 129′. A continuation of the rotary movement of the shaft 47 causes cam 98 to actuate a lever 129 pivoted at 130 of an extended bearing 131 (see Fig. 8). An end 132 of the lever 129 is provided with a roller 133 normally held against the cam 98 by a spring 134. The upper end 135 of the

lever 129 is provided with a forked portion having pins 136 disposed in an annular slot 137 provided on an adjustable collar 137′ on the shaft 102, thus permitting a rotation of the shaft and an endwise movement thereof upon an actuation of the lever 129. The opposite end 138′ is provided with lock nuts 139′ to afford a variable stop so that the stroke of the spindle 102 may be altered to change the spacing between coiled sections.

When the disks 110 and 112 are in position as shown in Fig. 11, the cam 98 actuates to permit the end 132 of the lever 129 to move toward the cam with a consequent movement of the end 135 of the lever which causes an endwise movement of the spindle 102, causing a lateral movement of the rocker member 101 with a consequent separation of the disks 110 and 112 to a position as shown in Fig. 12. It will be noted that the disk 110 remains fixed to secure the wire, while the disk 112 moves to provide a spaced relation between the coiled sections.

After this operation has been performed, a continuation of the machine causes the disks to be lifted by reason of the cams 96 and 97 while the configuration of the cam 98 causes a return of the disk 112 to position adjacent to the disk 110 ready for another operation. At this time, the shaft 42 is rotated until the notch 75 is in position to receive the roller 68 on the stop-lever 69, thus causing a termination of the coil spacing mechanism of the machine. The cam member 76 will at this time have rotated to move the end 63 of the lever 60, thereby lifting the roller 58 from the notch 57 of the notched wheel 56. At the same time, the lever 78 which moves with the lever 60 will have actuated the arm 79 to rock the lever 88 and cause a contact between the disks 30 and 31 of the friction clutch to put into operation the coil winding mechanism B.

For the purpose of cutting the wire into sections consisting of coiled portions having straight terminals, means in the form of a cutting knife or shearing member 140 is provided, as more clearly shown in Figs. 5 and 6. A guide 141 is provided to hold a slide member 142 having the said knife 140 at one end thereof. The knife is movable across the path of the coil as it emerges from a guide 35′, the guide cooperating with the knife to cause the severing operation.

As shown in Fig. 10, the cutter operates to sever the wire at a point in the straight or uncoiled portion 129′ intermediate the coiled sections 127′ and 128′. It is, of course, important to effect the severing operation at the proper point and the guide 141 is therefore provided with an extension 143 adjustably attached to the supporting structure 109′ of the machine, guide 35′ being also adjustable with the cutter. The cutting device may be adjusted to any suitable position to perform the cutting operation at the proper point on the uncoiled portion of the wire.

The cutting operation is performed just prior to the spacing operation, that is, after the machine has been in operation and the coiled section separated to provide an uncoiled section, the next coiling operation moves the coiled wire until the uncoiled section is in position as shown in Fig. 10. The cutter 140 then operates to sever the uncoiled portion of the wire, thereby producing a coiled section 144 having uncoiled terminals 145 and 146 as shown in dotted lines in Fig. 10.

After this cutting operation has been performed, the separator disks 110 and 112 may then be actuated to straighten another portion of the coiled wire. After the disks have been lifted the coiled wire will move to position the uncoiled section for the cutting operation as shown in Fig. 10. It will thus be seen that the cutting operation is performed on the uncoiled portion of the wire just prior to the coil separating operation so that after the machine is in operation each actuation of the coil separating elements will produce a complete coiled section having substantially straight terminals.

Mechanism for actuating the coil cutting device may comprise a lever arm 147 adapted to engage a plunger 148, the said plunger making contact with a pin 149 to cause an upward movement of the cutter 140, the cutter being normally held in a lower position by a spring 150. The lever 147 is secured to a shaft 151 journaled in bearings 152 and 153 which may be attached to the under side of the machine. To said shaft 151 is provided with a lever 154 which is oscillated by a rotation of the cam wheel 56′. Means connecting the lever 154 with the cam 56′ is diagrammatically shown in Fig. 2 and more clearly illustrated in the first above-mentioned patent.

As herein illustrated, however, the cam 56′ is disposed to engage with a lever 155 pivoted at 156 on a suitable bracket provided on the stationary structure of the machine. An end 157 of the lever 155 is normally held in contact with the cam 56′ by a spring 158. The other end 159 of the lever 155 is provided to engage with a trigger member 160 at an end 160′ of lever 154. The said trigger member is normally held against a stop-pin 161 by a spring 162. The lever 154 causes an actuation of the cutter when a given amount of wire has been wound.

For the purpose of operating the cutter at predetermined intervals, the measuring roller is provided with a cam 56′ which engages the lever 155 which may be termed a trigger actuating lever. A rotation of the measuring wheel, therefore, causes a rotation of the cam member which moves end 157 of the actuating lever outwardly and brings a

lower end 163 of the said lever against the trigger member 160, causing it to move and permit the end 163 to pass.

When a raised portion 165 of the cam member causes the upper end of the trigger actuating lever to move away from the measuring wheel, the end 163 engages the trigger member 160 which, being relatively immovable, by reason of the stop-pin 161, effects a downward movement of the adjacent end of the lever 154, which movement is transmitted to the shaft 151 and thence to the lever arm 147, causing the free end of the lever arm 147 to move upwardly and engage the plunger 148 and cause an actuation of the cutter 140. It will be evident, therefore, that the cutting off operation is controlled in timed relation to the coiling operation.

From the foregoing description, it will be readily appreciated that a wire may be automatically coiled to helical form and given sections of the coiled wire may be automatically separated by straight uncoiled portions and subsequently severed to provide individual sections of coiled filament having substantially straight terminals.

Although the present machine is shown and described for the production of single lengths of coiled wire having straight terminals it is obvious that the machine may be modified to make a length of wire having a plurality of coiled sections separated by straight portions. This may be accomplished by having more than one notch 57 in the wheel 56 and additional notches in the disk 74. A further description of mechanism for producing a plurality of coiled sections separated by straight portions is not thought to be necessary, since anyone skilled in the art would readily be able to so modify the present construction without departing from the present inventive idea.

Inasmuch as the foregoing detailed description is combined with a description of operations, a general description of operations is thought to be unnecessary.

Although a preferred embodiment of the invention is shown and described, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A wire working machine comprising means for supporting a helically wound wire, a pair of movable members, means for introducing said members between adjacent turns of said wire, and means for effecting a relative movement between said members along said wire to uncoil a portion of said wire.

2. A wire working machine comprising means for supporting a helically wound wire, a pair of knife-like members, means for moving said members to engage said wire between adjacent turns, and means for moving said members along said wire to uncoil a portion thereof.

3. A wire working machine comprising means for supporting a helically wound wire, a pair of separator members, means for moving said members in contact with said wire, at a point between adjacent turns thereof means for causing one of said members to firmly engage said wire, and means for moving the other member along said wire to uncoil a portion of said wire.

4. A machine for producing spaced coils comprising means for winding a wire to helical form, means for supporting said helically wound wire, a pair of movable members, means for introducing said members between two adjacent turns of said wire, and means for effecting a relative movement between said members to move the members along said wire and uncoil a portion of said wire.

5. A machine for producing spaced coils comprising means for winding a wire to helical form, means for supporting said helically wound wire, a pair of knife-like members, means for moving said members to engage said wire between two adjacent turns thereof, and means for moving said members along said wire to uncoil a portion of said wire.

6. A machine for producing spaced coils comprising means for winding a wire to helical form, means for supporting said helically wound wire, a pair of separator members, means for moving said members in contact with said wire, between two adjacent turns thereof means for causing one of said members to firmly engage said wire, and means for moving the other member along said wire to uncoil a given portion thereof.

7. A machine for winding a wire to helical form in the absence of a mandrel, comprising a wire coiling die, means for moving a wire into operative relation with said member to produce a helix, a measuring drum, means cooperating with said measuring drum and said means for moving the wire for terminating the operation of said last-mentioned means upon a predetermined movement of said measuring drum.

8. A machine for winding a wire to helical form in the absence of a mandrel, comprising a wire bending die, means for moving a wire into operative relation with said die to produce a helix, a measuring drum, means cooperating with said measuring drum and said means for moving the wire for terminating the operation of said last-mentioned means upon a predetermined movement of said measuring drum, and means for uncoiling portions of said helix.

9. A machine for winding a wire to helical form in the absence of a mandrel, comprising a wire bending die, means for moving a wire into operative relation with said die to produce a helix, a measuring drum, means cooperating with said measuring drum and

said means for moving the wire for terminating the operation of said last-mentioned means upon a predetermined movement of said measuring drum, and means operating in timed relation to said wire coiling means to produce coiled sections of wire of uniform lengths separated by uncoiled sections of wire.

10. A machine for producing spaced coils comprising a supporting plate for a portion of a coiled section, a pair of movable members, means for moving said members between adjacent turns of the coiled section to press the wire against said plate, and means for separating said members along said wire to uncoil a portion thereof.

11. A machine for producing spaced coils comprising a supporting plate for a portion of a coiled section, a pair of movable members, means for moving said members between adjacent turns of the coiled section to press the wire against said plate, and means for moving one of said members along said wire to uncoil a portion thereof.

In testimony whereof, I have hereunto subscribed my name this 16th day of March, 1928.

FRANK WILLETT WALTON.