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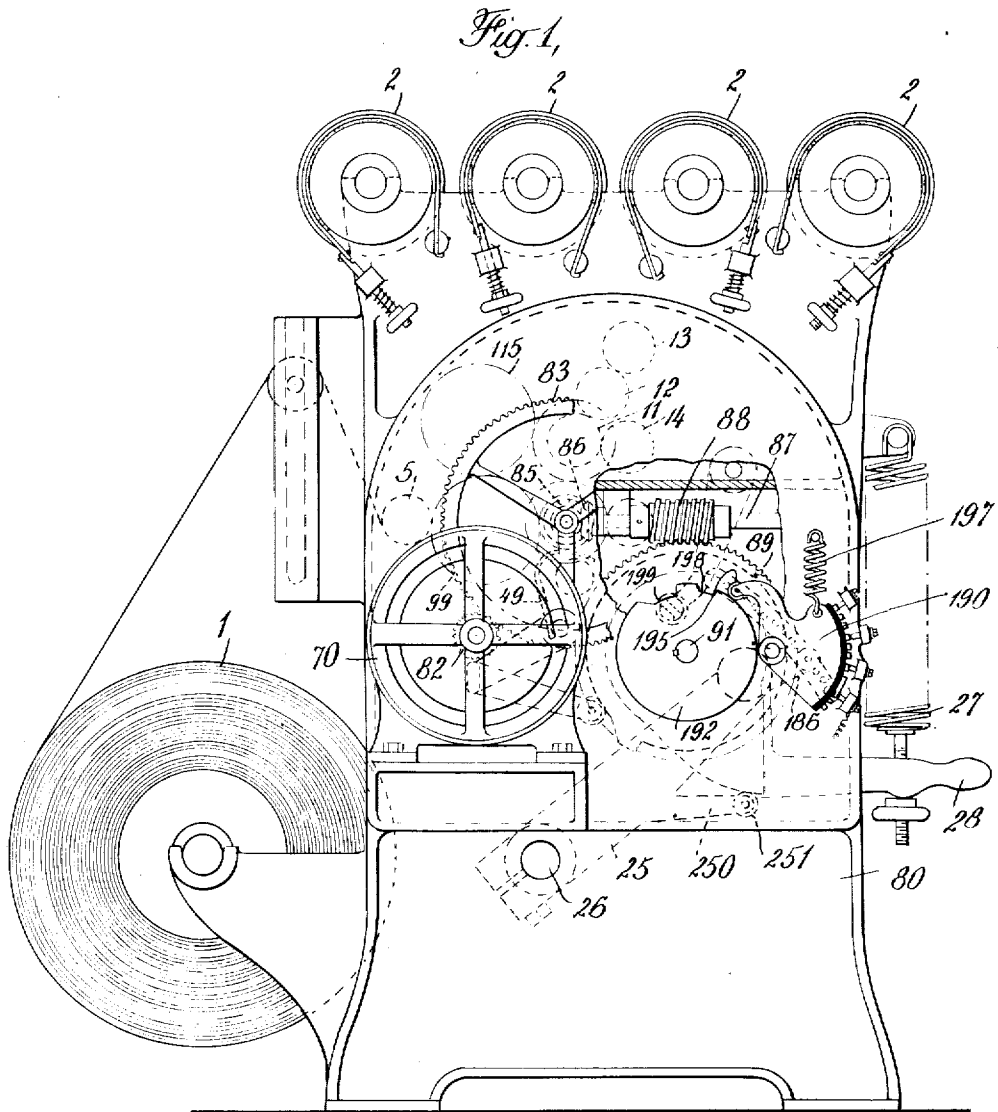
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WEB WINDING MACHINE

Filed Jan. 19, 1925

7 Sheets-Sheet 1



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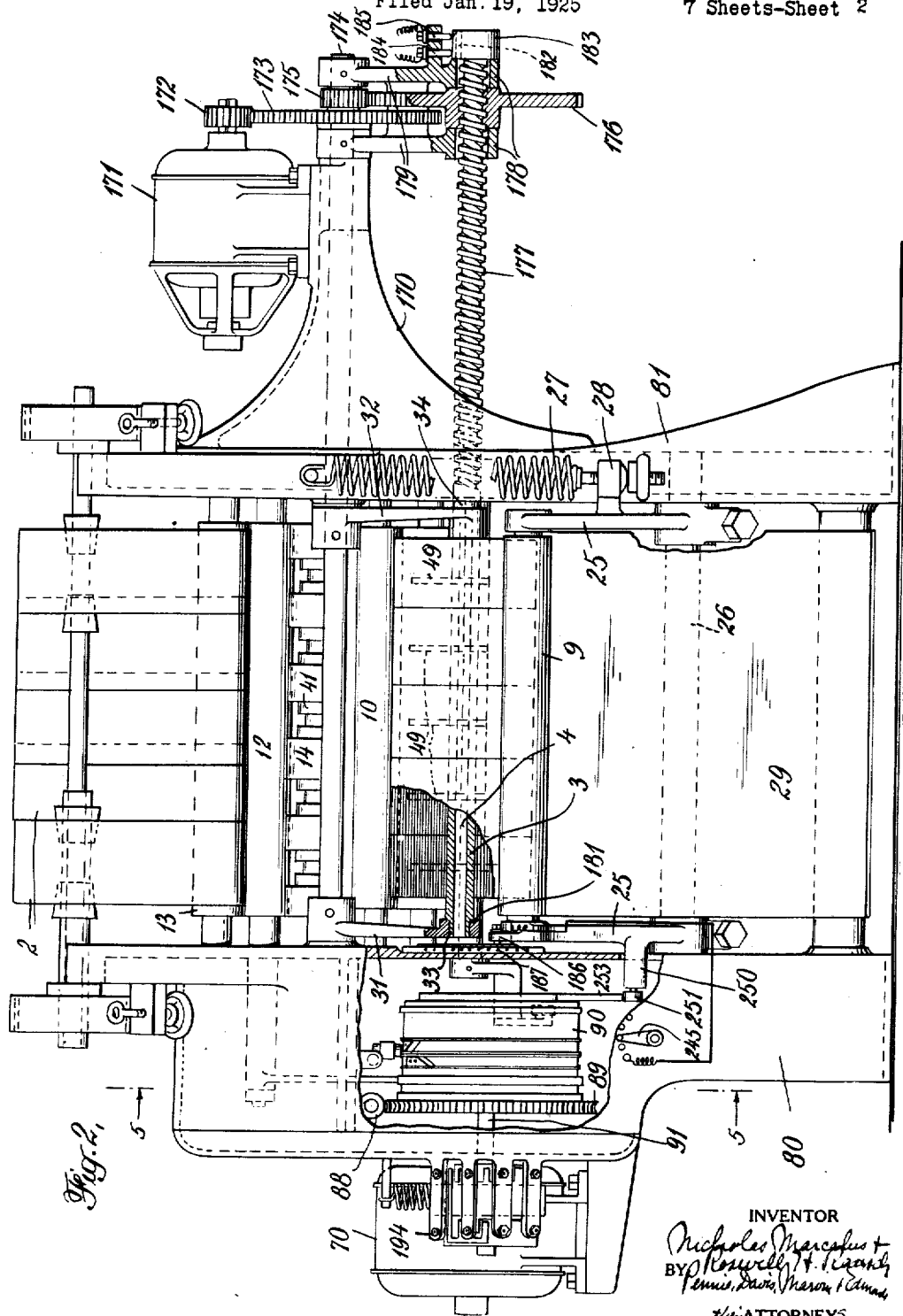
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WEB WINDING MACHINE

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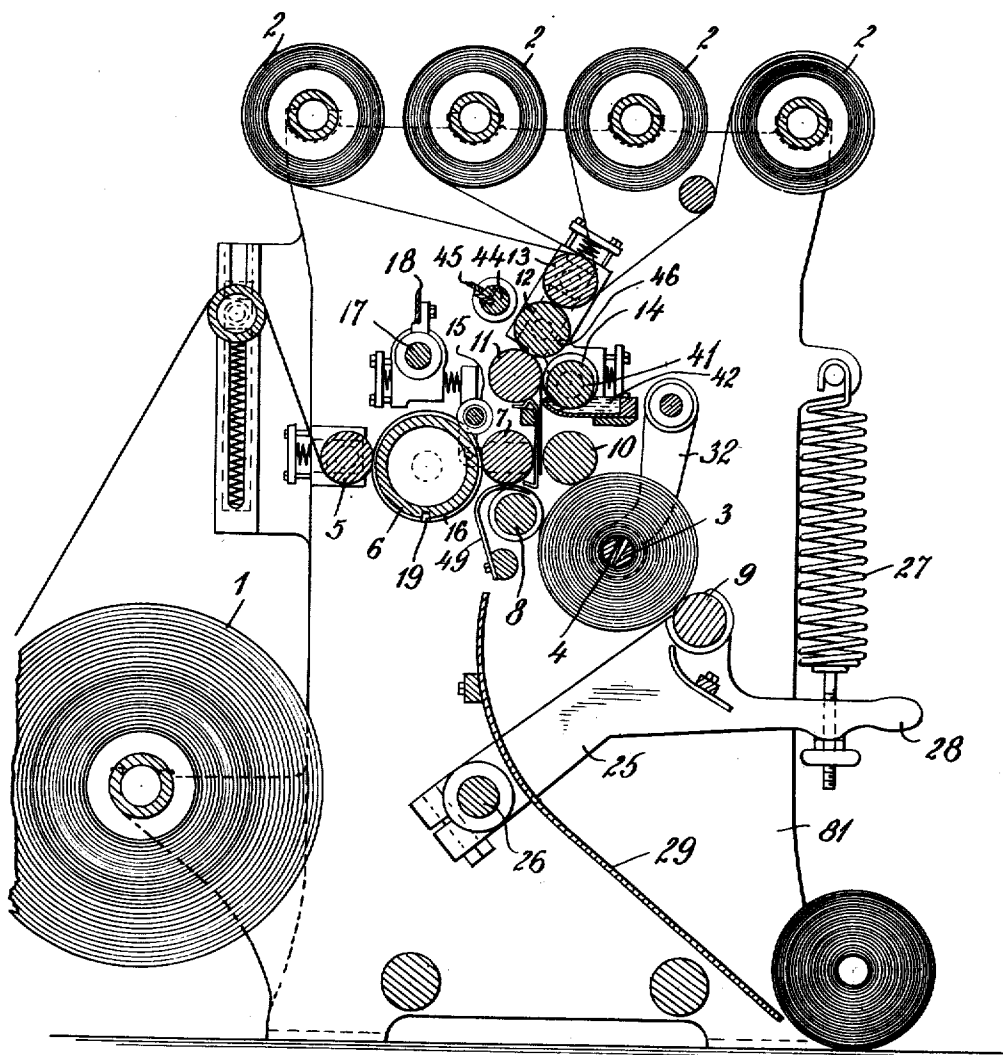
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WEB WINDING MACHINE

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Fig. 3,



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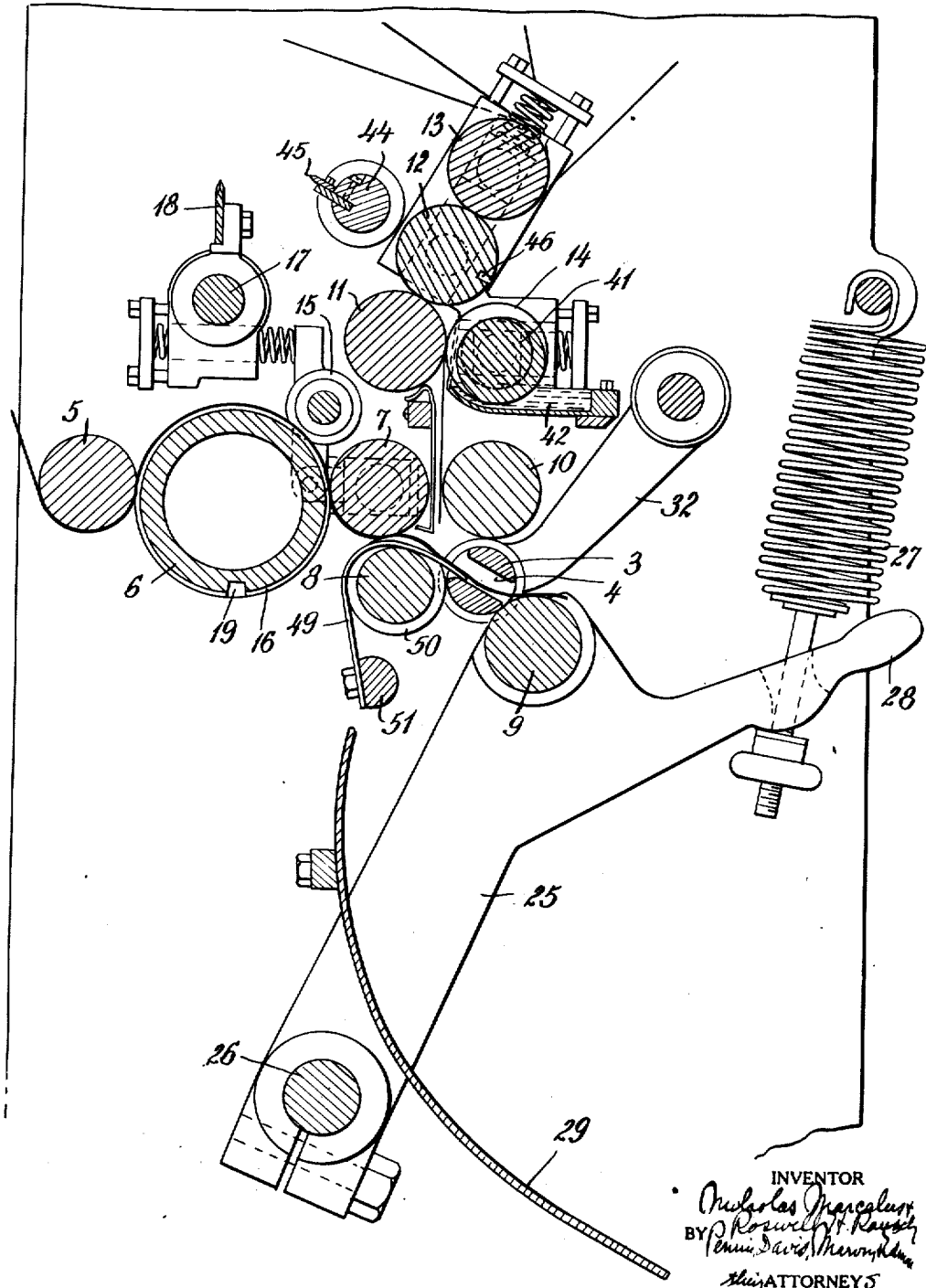
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WEB WINDING MACHINE

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Fig. 4,



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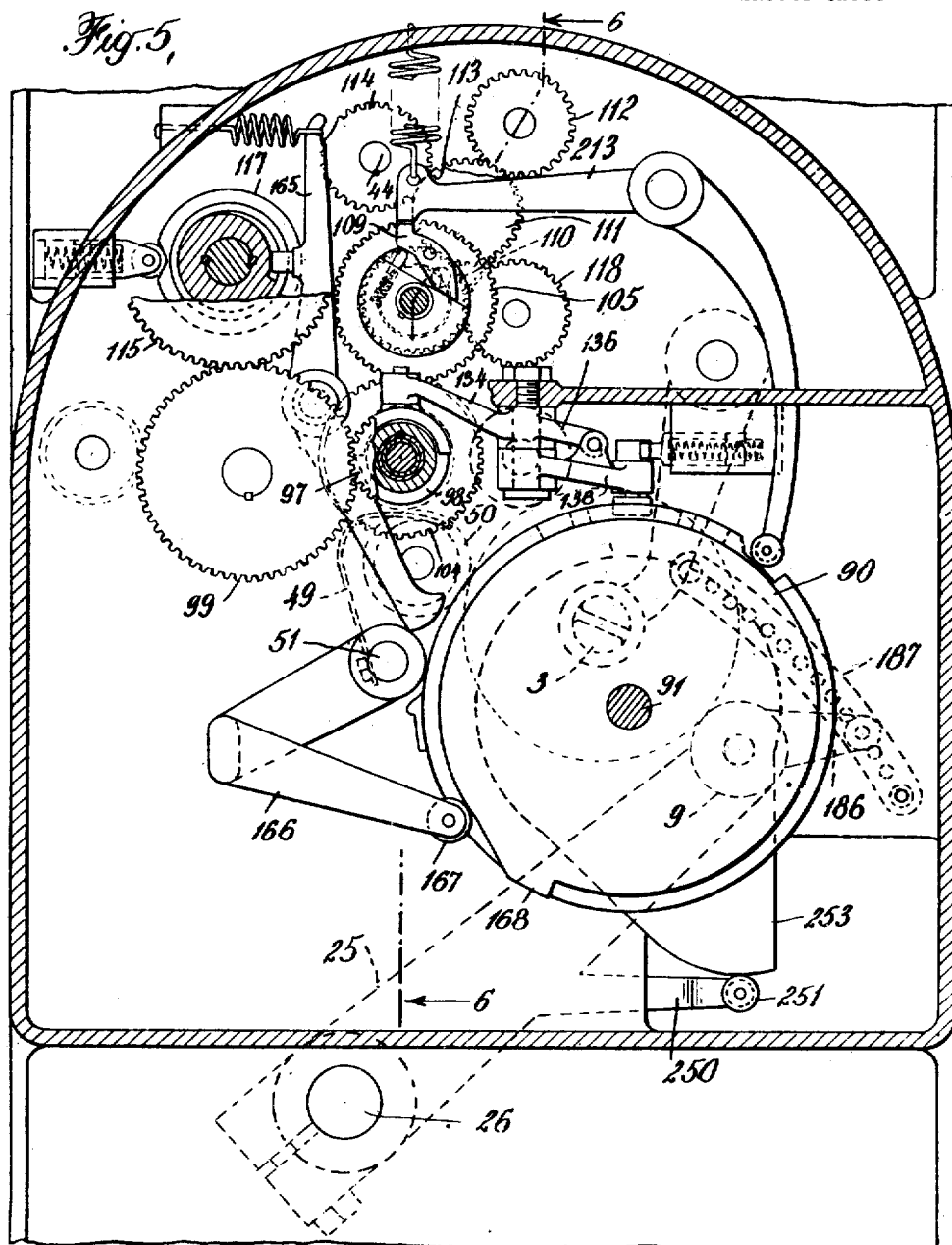
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WEB WINDING MACHINE

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7 Sheets-Sheet 5



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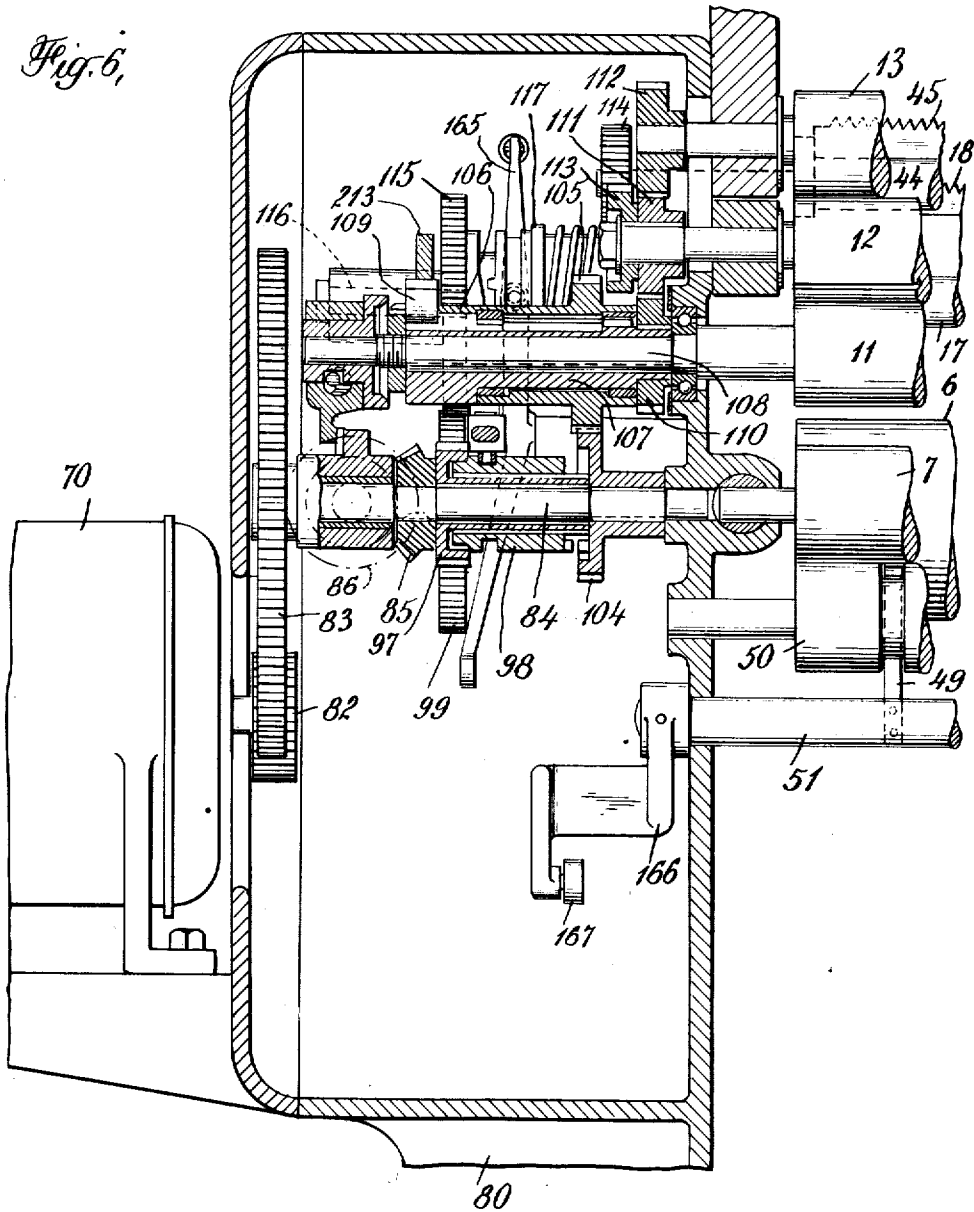
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WEB WINDING MACHINE

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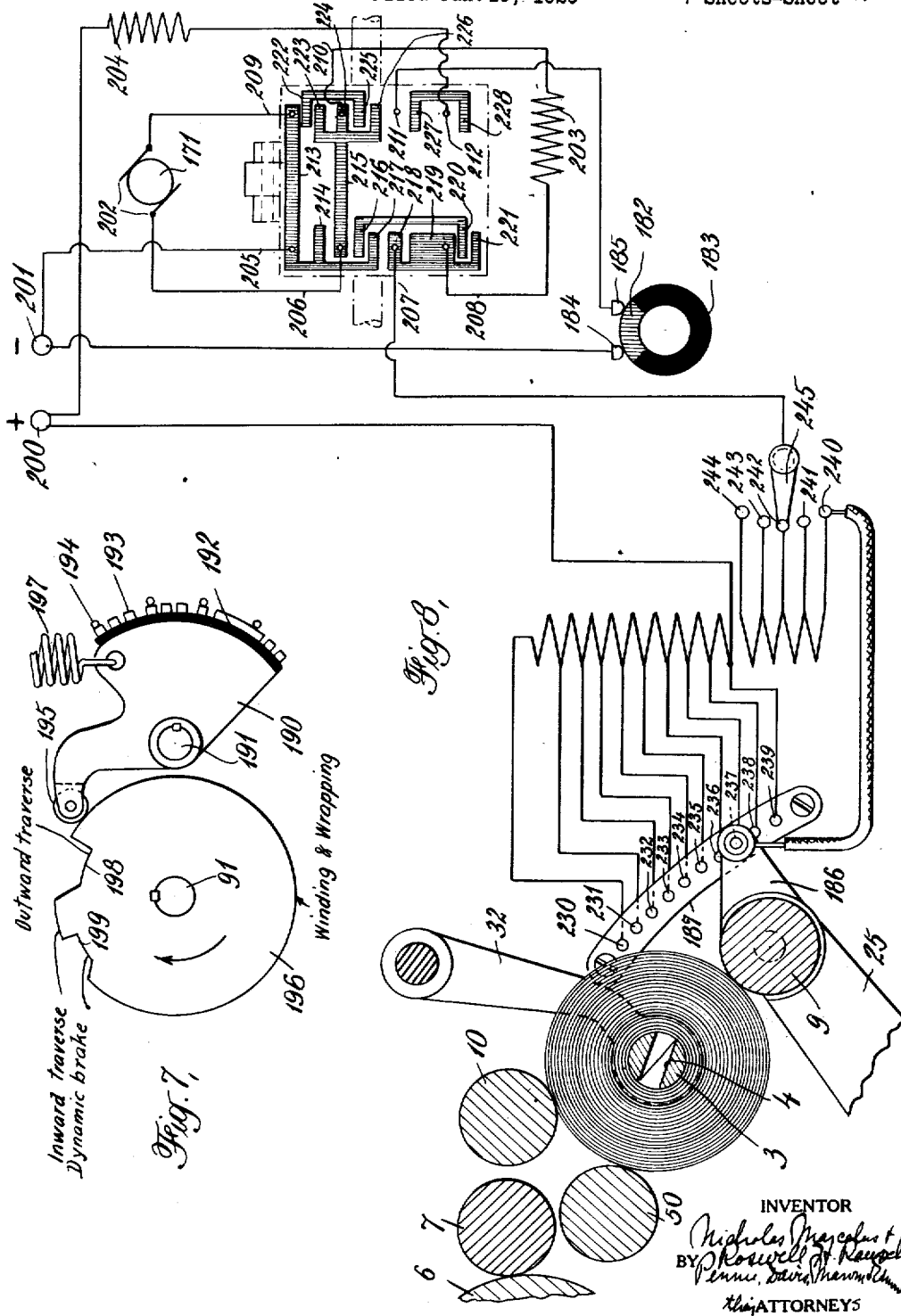
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- WEB WINDING MACHINE

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UNITED STATES PATENT OFFICE.

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WEB-WINDING MACHINE.

Application filed January 19, 1925. Serial No. 3,241.

This invention relates to web-winding machines.

In copending applications Serial Nos. 624,357 and 758,342, filed by one of the present joint inventors, machines are disclosed in which sheet material is unwound from a parent roll, slit into strips of the desired width, wound upon tubes or cores fed to the machine, cut to the desired length, wrapped, glued and discharged; all of these operations taking place automatically and continuing as long as any material remains upon the parent roll, and wrappers and cores are forthcoming. In order to perform these operations, the machines are provided with three sets of rollers which are automatically rotated in predetermined sequential combinations. One set, the winding and wrapping rollers hold and rotate the core and wind the material about it, slitting the material into sheets of appropriate widths at the same time. A second set, the feeding rollers, feed the material to the core from the parent roll and cooperate with a perforator to perforate it at intervals. When the desired length of material has been wound about the core, the feeding rollers stop while the winding rollers continue to rotate. This tears the material along a perforation and separates the wound roll from the web. Thereupon a third set of rollers, the wrapper rollers, feed a wrapper to the winding rollers and automatically apply glue to it. When the wound roll has been wrapped the wrapper is automatically cut from the wrapper web, the wrapper rollers stop, and the winding rollers continue to rotate long enough to tighten the wrapper about the roll and insure the adhesion of the glue. Thereupon the winding rollers separate to discharge the wound, wrapped and slit rolls, and a new core is fed into place. These operations are then repeated. In order that this sequence of operations may be carried out automatically the machines are provided with means for directing properly timed air jets against the oncoming end of the web to guide it about the core at the initiation of each winding action. These three sets of rollers, the feeding, winding and wrapper feed, are

operated in their sequential relations by means of three gear trains each controlling the rotation of a given set of rollers. These gear trains are thrown into and out of connection with a constant source of power in properly timed relation by means of a constantly rotating cam drum. This drum is also designed to control the core feed, the roll discharge mechanism, the perforator and the air jets.

The cores about which the rolls of these prior machines are wound are usually of cardboard and remain in the wound roll. This, of course, necessitates a constant supply of cores which adds expense and also involves the use of mechanism for feeding, scoring, holding and centering these cores. It is one of the objects of the present invention to design a web-winding machine which does not use cores which remain in the wound rolls, but which is equipped with a permanent spindle or mandrel about which successive rolls are wound and from which they are stripped. This spindle is mounted for axial traverse into and out of winding position, the outward traverse stripping the wound roll.

The machines of these prior applications are of the surface winding type, that is the winding power is applied by the winding rollers upon the surface of the roll being wound. It is a further object of the present invention to design an improved winding machine of the center winding type, that is a machine in which the winding power is applied through the core or spindle about which the roll is wound, but which, like the surface winding machines of the prior applications shall be automatic in its operation. The present machine does, in fact, embody many of the features of the earlier machines, notably the feeding rollers, the perforating knife, the wrapper rollers and the discharge, but it embodies an essentially different and improved winding mechanism.

Although it would be quite possible to provide separate means for traversing and rotating the spindle, we have provided, in accordance with the present invention, traversing and rotating means having many

elements in common. These means comprise a series wound motor driving a gear which makes threaded engagement with a threaded outer end of the spindle and causes it to traverse in the direction of its length. When the spindle reaches winding position between the now idling winding rollers farther longitudinal movement is arrested and it is then perforce rotated by the same gear which before caused it to traverse, the thread acting as a key. After the roll is wound and wrapped the withdrawing or stripping traverse is effected by reversing the direction of rotation of the spindle. This is done by changing the direction of the current through the armature of the motor while leaving the current through the series field unchanged.

The spindle proper is provided with a longitudinal slot extending its entire length and through which the forward end of the web is threaded to initiate the winding action, thus eliminating the necessity for air jets for directing the oncoming web about the core. It therefore becomes necessary that the spindle always be arrested in such a position that the slot shall be in alignment with the oncoming web and thus receive it. To do this we have equipped the spindle-driving motor with an auxiliary shunt field which is energized and the armature simultaneously short-circuited through the series field at the proper time, thus applying a dynamic brake to the motor and momentarily holding the spindle fast. The actuating of this dynamic brake is automatically timed to correspond with the correct position of the spindle slot. The means for applying this dynamic brake and the means for reversing the spindle driving motor are controlled by a cam on the shaft of the main cam drum.

In order to guide the forward end of the web from the feeding rollers over the first winding roller and through the slot in the spindle, we have provided a series of guide fingers which are moved at the proper time through grooves in the first winding roller and into the spindle slot. Before rotation of the spindle starts, these fingers are automatically withdrawn through the action of a cam on the cam drum.

In any web-winding machine it is very important to always maintain a constant tension on the web so that the rolls will be properly wound. In prior web-winding machines of the center drive type the spindle is driven by a friction mechanism which is supposed to slip at a constant torque. However, as the roll increases in size, the torque put on the drive shaft must increase proportionally if the tension on the web is to remain the same. In all existing machines this torque is increased by the operator by hand. This requires constant attention and if the operator is to maintain constant tension on the

web, he must continually tighten up on the friction device to constantly increase the torque on the winding spindle. In actual practice this is not done and the operator tightens up the friction intermittently; consequently the tension on the web is not maintained constant and the roll is not wound perfectly. In accordance with the present invention we have provided means for automatically increasing the torque on the spindle driving motor as the roll increases in diameter. These means comprise a contact arm which is moved by the growing roll to progressively throw out resistance in series with the field and armature of the motor and thus increase its driving torque.

In the accompanying drawings we have illustrated a preferred form of machine embodying the improvements of the present invention, a study of which will make clear the principles involved. In these drawings,

Figure 1 is an end view partly in section of a machine constructed in accordance with the present invention and showing the general relation of the parts,

Figure 2 is a side elevation of the machine with parts broken away showing in particular the means for traversing and rotating the spindle,

Figure 3 is a transverse section through the machine showing somewhat diagrammatically the relation among the parent rolls, the various rollers and the discharge. In Figure 3 the wound roll is shown in discharged position and a second roll held between the winding rollers but about ready to be discharged,

Figure 4 is a view similar to Figure 3 showing the rollers and spindle on somewhat larger scale. In this figure the parts are shown in position just before winding is initiated with the web guide fingers extending into the slot in the spindle,

Figure 5 is a transverse section taken along line 5-5 of Figure 2 showing in detail the various operating mechanisms,

Figure 6 is a longitudinal section through the gear housing taken along line 6-6 of Figure 5,

Figure 7 is a detailed side view of the control segment which controls the operation of the spindle driving motor showing this segment in relation to the cam which operates it, and

Figure 8 is a diagrammatic layout showing a development of the contacts on the face of the control segment the wiring for the dynamic brake and the manner in which the swinging contact arm controlled by the roll throws out resistance to increase the torque of the driving motor. Manual means of varying this torque is also shown.

In describing the construction and operation of the machine illustrated in these drawings, we shall first describe briefly the gen-

eral functions of the various feeding winding, wrapping, cutting and discharge elements without specific reference to their operating mechanism. We shall then describe the various operating mechanisms with particular emphasis on the spindle control features.

General functions, Figs. 2, 3 and 4.

The parent roll containing the web of material which is to be unwound and wound again about cores into a series of smaller rolls, is mounted at the side of the machine and is indicated by reference numeral 1. The wrappers for the wound rolls are supplied from a series of staggered wrapper parent rolls 2 mounted upon the top of the machine. There are three main sets of rollers, the feeding rollers 5, 6 and 7, the winding rollers, 8, 9 and 10, and the wrapper feeding and gluing rollers 11, 12, 13 and 14, all of which extend the entire width of the machine and, except for the winding rollers, are positively driven. The idling winding rollers, receive the spindle 3 and bear against the surface of the roll during winding and wrapping. The feeding rollers feed the web from the parent roll to the winding rollers, slit it longitudinally and cooperate with other means to perforate it transversely. These rollers operate only during the winding action and are stationary during wrapping. The wrapper rollers feed the wrappers to the wound roll held between the winding rollers, apply glue to them and cooperate with means for severing them transversely into appropriate lengths. These rollers are stationary for the major part of the operation and rotate only during the wrapper feed. We shall now describe these three sets of rollers and their associated parts starting with the feeding rollers.

The functions of the feeding rollers are to feed, slit and perforate the web. A series of spaced annular slitting knives 15 are mounted adjacent the roller 6 and cooperate with similarly spaced annular grooves 16 in the face of the feeding roller 6 to slit the web as it is fed between them into strips the width of which is equal to the length of the unit rolls. Mounted above the feeding roller 6 is a shaft 17 to which is affixed a perforating knife 18. This shaft 17 and the knife 18 are designed to make a single revolution when the desired length of web has been wound, cooperating with a longitudinal slot 19 in the face of the roller 6 to perforate the web transversely.

The function of the winding rollers is to bear against the roll being wound and wrapped thus insuring a tight evenly wound roll, to support the wrapped roll after the spindle has been withdrawn, and discharge it from the machine. Of these three wind-

ing rollers, 8 and 10 are fixed; roller 9, however, is mounted upon arms 25 fixed to a shaft 26 for swinging movement about the axis of that shaft so that as the diameter of the wound roll increases, room is automatically made for it between the roller 9 and the stationary rollers 8 and 10. A spring 27 secured to a handle extension 28 on one of the arms 25 constantly urges the roller 9 upward toward the rollers 8 and 10, thus tending to wind a tight roll. When a roll has been wound and wrapped and the spindle withdrawn, the roller 9 is swung downward and the wrapped roll permitted to fall out of the machine by gravity, being directed in this movement by a guide apron 29.

The function of the wrapper feeding rollers is to feed the wrapper to the wound roll, apply glue to it and sever it transversely into units of the proper length. The gluing is performed by means of the roller 14 which is provided at suitable intervals with sections of reduced diameters, each of which carries an eccentric 41. These eccentrics are machined so that for about one-third of their circumference they are of the same diameter as the roller 14 and have faces which lie in the same cylindrical surface. The eccentric portions 41 are mounted to dip into individual glue troughs 42. Thus, as the roller 14 rotates, it applies a series of spaced stripes of glue upon the wrapper, the length of each stripe being equal to the length of that portion of the eccentric 41 which contacts with the wrapper.

A shaft 44 carrying a knife 45, is mounted adjacent the roller 12 and is adapted to cooperate with a slot 46 in the roller 12 to sever the wrapper web so that a predetermined length of wrapper is employed for each wrapping operation.

The cores of our prior machines are replaced here by the permanent spindle 3 journaled within two swinging arms 31 and 32 having bearings 33 and 34 respectively. The spindle is provided with a longitudinal slot 4 extending the entire length of the spindle proper and designed to receive the forward end of the web as shown in Figure 4. The web is directed through this slot by means of a series of guide fingers 49 extending through annular grooves 50 in winding roller 8 and into the slot. These guides are mounted upon an oscillatable shaft 51 which is turned to withdraw them from the slot just before the winding begins. The spindle is traversed at the termination of the winding and wrapping and stripped of the roll by the arm 32. A slight taper on the spindle facilitates this withdrawal.

We shall now briefly review the entire sequence of operations described above. Figure 4 represents the relative positions of the

various rolls and the spindle just previous to the initiation of the winding action. The guide fingers 49 are shown projecting into the slot 4 of the spindle and the forward end of the main web extends over these guides and through the slot. The shaft 51 is now oscillated withdrawing the guide fingers 49 and the rotation of the spindle begun. The projecting end of the web is bent backward by the roll 10 and after one revolution is securely held between the spindle and the second lap of the web. The winding now continues until the roll has assumed the desired size when the shaft 17 and its perforating knife 18 are given a single rotation perforating the web. When this perforation reaches a position between roller 7 and guide fingers 49, the feeding rollers are suddenly stopped while the spindle continues to rotate thus detaching the wound roll from the web along the perforations. At this moment, however, and before the severed end of the web has been wound about the roll the wrapper feeding rollers are started and the forward end of the wrapper interposed between the tail of the web and the roll, thus pinching it in place and making unnecessary the use of glue at this point to insure that the wrapper follow the roll. The glue stripes are applied to the wrapper by means of the roller 14 and cause the rear end of the wrapper to adhere to the roll. Meanwhile shaft 44 has been rotated, thereby severing the wrapper by means of knife 45. The wrapper feeding rollers are then stopped and the spindle continues long enough to tighten the wrapper about the wound roll. The spindle is thereupon traversed outwardly and the wound and wrapped roll being held axially fixed by means of the arm 32, is stripped. The roller 9 is thereupon swung downward and the wound, wrapped and glued roll discharged from the machine rolling down apron 29. The discharged roll is made up of a series of unit rolls end to end and held temporarily together by means of the overlapping wrappers. It is a simple matter to separate the roll into its units and the extending wrappers can then be turned in and secured by means of a glued disk or otherwise.

Web and wrapper feed control, Figures 1, 2, 5 and 6.

We shall now describe the mechanism which operates the above-described parts in their sequential relations, starting first with the main web and wrapper feed control. As the main web and wrapper feed mechanisms are identical with the ones illustrated, described and claimed in my co-pending application No. 758,342, and as none of the improvements of the present invention relates directly to them, we shall describe them here only briefly. The various rollers and their

associated parts are supported by and journaled within two end frames 80 and 81, the frame 80 comprising a housing for the major part of the operating mechanism. Power is supplied by a driving motor 70 provided with a pinion 82 on its shaft which meshes with a gear 83 keyed to a shaft 84 which constitutes the main drive shaft for the machine. Keyed to this shaft 84 is a bevel pinion 85 which meshes with a similar bevel pinion 86 keyed to a shaft 87 of a worm 88. This worm 88 engages a worm wheel 89 on a cam drum 90 mounted upon a shaft 91. This cam drum is constantly rotated throughout the entire cycle of operations and controls all of the sequential operations of the various parts of the machine.

The feeding rollers are driven through a pinion 97 loosely mounted on driving shaft 84 but which can be made to rotate therewith through operation of a sliding clutch sleeve 98 actuated at the proper times by levers 134, 136 and 138 which are controlled by the cam drum. This pinion 97 meshes with a gear 99 on the shaft of feeding roller 6. At the other end of this shaft and carried by the frame 81 is another gear, not shown, which meshes with pinions (not shown) on the shafts of feeding rollers 5 and 7, respectively. Thus, feeding roller 6 drives its companion feeding rollers 5 and 7.

The wrapper feeding rollers are driven through a pinion 104 keyed to the driving shaft 84. This pinion 104 meshes with a pinion 105 integral with a sleeve 106 loosely mounted in turn upon a shaft 108, an extension of the shaft of the wrapper feeding roller 11. The sleeve 107 is made to rotate with the sleeve 106 when necessary by means of a rocking clutch 109 controlled by a lever 213 which is in turn controlled by the cam drum. Keyed to this sleeve 107 is a pinion 110 which meshes with a pinion 118 on the shaft of the gluing wrapper roller 14, and with a pinion 111 on the shaft of wrapper feeding roller 12, which pinion meshes in turn with a pinion 112 on the shaft of wrapper feeding roller 13. Fixed to and coaxial with the pinion 111 is a mutilated pinion 113 of a Geneva movement, of which the other pinion 114 is keyed to the shaft 44 of the wrapper severing knife 45.

Meshing with the gear 99 is a gear 115 bearing a 1 to 1 ratio therewith and keyed upon a stub shaft 116 coaxial with the shaft 17 of the web perforating knife 18. This gear 115 rotates with the gear 99 which drives the feeding rollers, and, during the major part of the feeding operation, is unconnected with the shaft 17 carrying the web perforating knife 18. At the proper time, however, the shaft 17 and its knife are thrown into operative engagement with the gear 115 by means of a one tooth sliding

clutch 117, the operation of which is controlled by a lever 165 which is in turn controlled by the cam drum.

The guide fingers 49 mounted upon the oscillatable shaft 51 are controlled by means of an arm 166 pinned to one end of the shaft 51 which arm carries a roller 167 actuated by a cam 168 on the cam drum to swing the guide fingers forward and through the slot in the spindle at the proper time. When the web has been threaded the cam 168 passes and the weight of arm 166 causes the retraction of the guide fingers, although, of course, a spring might be utilized for this purpose.

Spindle control, Figures 1, 2, 7 and 8.

We shall now describe in detail the mechanism for traversing and rotating the spindle and the various electrical controls which govern its operation. Mounted upon the frame 81 is a bracket 170 which supports an electric motor 171 which normally operates as a series wound motor. A pinion 172 on the shaft of this motor meshes with a gear 173 loosely journaled upon a shaft 174. This gear 173 is keyed to a pinion 175 coaxial therewith and likewise journaled upon the shaft 174, which pinion meshes with a gear 176, the hub of which is internally threaded and receives the outer threaded end 177 of the spindle 3. This threaded end of the spindle is supported by and journaled within bearing 178 in the lower ends of swinging arms 179 pinned to shaft 174. The arms 31 and 32 which support the spindle in winding position are likewise pinned upon the shaft 174, which shaft is journaled within the frame of the machine and the bracket 170. Thus, as the roll increases in diameter and the arms 31 and 32 are swung outwardly, the arms 179 are free to follow.

From the foregoing description it will be obvious that the traversing movements of the spindle are effected through rotation of the motor 171, the direction of the traverse being determined by the direction of rotation of gear 176, which in turn is determined by rotation of the motor. The apparatus just described, however, does more than traverse the spindle. When the inner end of the spindle has entered the bearing 33 in the lower end of arm 31, further longitudinal movement is prevented by means of the shoulder 181 on the spindle which abuts against the hub of the bearing 33. Further rotation of gear 176 in the same direction therefore rotates the spindle, the thread of screw 177 acting as a key. It is not enough, however, to traverse the spindle into winding position and immediately transform its longitudinal into rotary movement. The spindle must pause long enough to permit the guide fingers 49 to enter the slot 4

to permit the feeding rollers to project the forward end of the web over the guides and through the slot. The spindle must also therefore not only pause, but pause in the correct angular position. This is effected by means of a dynamic brake which is applied to the motor at the proper time, this time being when the conducting segment 182 of ring 183 fixed to the end of the spindle contacts with two brushes 184 and 185, as will be explained in detail presently.

In order, progressively and automatically, to increase the torque of the motor 171 as the roll increases in size, we have provided one of the arms 25 with a contact member 186 which swings over a series of contacts 187 as the roll grows and thereby throws out resistance in series with the motor and increases its torque.

We shall now describe in detail, with particular reference to Figures 7 and 8 the electrical means which control the rotation, reversal, braking and torque of the motor 171. This control is effected through oscillation of a control segment 190 about the axis of a shaft 191, said segment having an arcuate, insulated face 192 which carries a series of movable contacts 193 designed to be moved into various relations with eight fixed contacts 194 on the frame of the machine which are connected with the motor. This segment 190 is provided with a roller 195 which is constantly urged into contact with the periphery of a cam disk 196 by means of a spring 197. The configuration of this cam disk 196 which is mounted upon the shaft 91 of the cam drum, thus determines the position of the control segment 190 and the operation of the spindle driving motor 171. This cam disk is provided with two cut-outs 198 and 199 the effect of which upon the control will be described presently.

In Figure 8 we have illustrated a wiring diagram of the various controls. In this diagram, 200 and 201 represent the positive and negative leads respectively from any outside source of direct electrical current; 202 the armature of the spindle driving motor; 203 the series field of this motor; 204 the shunt field; 205, 206, 207, 208, 209, 210, 211 and 212, the eight fixed contacts previously referred to collectively as 194; 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227 and 228 the movable contacts on the arcuate face of the control segment 190, previously referred to collectively as 193; 230, 231, 232, 233, 234, 235, 236, 237, 238 and 239, the contact buttons with which the contact member 186 makes sliding contact and previously referred to collectively as 187; and 240, 241, 242, 243 and 244 additional contacts with which the manually controlled contact member 245 is adapted to successively contact. In the positions of all of the control ele-

ments illustrated in Figures 7 and 8, the roll has been wound and wrapped and the time is approaching when the spindle must be traversed outwardly to strip the wound and wrapped roll. As shown, however, the motor is rotating the spindle counter-clockwise which is the direction of rotation during winding and inward traverse. We shall trace the current from the leads 200 and 201 as follows: 200 through resistance 239—237, contact 186, resistance 240—242, contact member 245, fixed contact 207, movable contacts 218, 219, fixed contact 208, series field 203, fixed contact 210, movable contact 215, fixed contact 206, the armature 202 of the motor 171, fixed contact 209, movable contact 213, fixed contact 205 and back to the negative side of the line 201. In this position of the control segment, it will be noted that the shunt field 204 is disconnected and the motor is, in effect, an ordinary series motor. This is the condition which obtains during the inward traverse of the spindle, and the winding. The series winding, the armature, and the armature resistance are so proportioned that the current may flow continuously even though the motor is stopped without damage to the motor. It will be understood that as the roll has increased in size, the movable member 186 has been swung over the contacts 187, progressively throwing out resistances from 230 to its present position 237 and as these resistances are in series with the motor increasing its torque. This torque can also be varied manually by moving contact 245.

We shall now assume that the roll has been wrapped and the time has come for the outward traverse of the spindle. The cam disk 196 has now rotated to the point where the roller 195 on the control segment 190 drops abruptly into cut-out 198. This swings the control segment upward and changes the relation among the series of contacts 193 and 194. Thus, the current now passes from the positive side of the line through the variable resistances, through 240—242, fixed contact 207, movable contact 221, fixed contact 208, series field 203, fixed contact 210, movable contact 226, movable contact 223, fixed contact 209, the armature 202, fixed contact 206, movable contact 217, movable contact 214, fixed contact 205, and back to the negative side of the line. Thus, in this position of the control segment the current passes through the series field in the same direction as previously, but is reversed through the armature, thus reversing the direction of the motor and rotating the spindle in a clockwise direction, resulting in its outward traverse and the stripping of the wound roll. In this position too the shunt field 204 is thrown out. The length of the cut-out 198 is sufficient to completely withdraw the spindle. As soon as the withdraw-

al is complete, however, and the wound and wrapped roll stripped and discharged the direction of the motor must be again reversed and the inward traverse begun. Thus, the roller 195 soon rides again up to the periphery of the cam and the control segment is returned to the position illustrated in the drawings and first described.

As soon as the inward traverse is complete, it is necessary momentarily to hold the spindle fixed against rotation and in the proper position to receive the forward end of the web. We do this by means of a dynamic brake which is applied to the motor as follows: At the proper time the roller 195 drops abruptly into cut-out 199 which is not so deep as cut-out 198; the control therefore assumes a position intermediate the two which have been previously described. In this position the armature and the series field 203 are short circuited through fixed contact 209, movable contact 222, movable contact 225, fixed contact 210, series field 203, fixed contact 208, movable contact 220, movable contact 216 and fixed contact 206. At the same time the shunt field 204 is energized as follows starting from the positive side of the line 200: the shunt field 204 is energized only when the contact 228, movable contact 227, fixed contact 211, brush 185, segment 182, brush 184 and back to the negative side of the line at 201. It will be observed, however, that the shunt field 204 is energized only when the segment 182 makes contact with both brushes 184 and 185. The action of the dynamic brake is therefore as follows: As soon as the roller 195 drops into the cut-out 199, the current to the motor is shut off. The momentum, however, would turn it over a few times and leave the spindle in an indeterminate angular position, but as soon as the segment 182 bridges the gap between the brushes 184 and 185, the dynamic brake is applied and the drifting rotation of the spindle instantly checked. As the segment 182 bears a definite predetermined relation to the slot it is clear that the spindle will always be stopped with the slot in the desired position.

The roll discharge, Figures 1, 2, and 5.

The withdrawal of the spindle leaves the wound and wrapped roll supported between the winding rollers and before a subsequent roll can be wound, it is necessary that the wound and wrapped roll be discharged from the machine. This is automatically effected as follows: The arm 25 nearest the cam drum is provided with off-set extension 250 carrying a roller 251 designed to be acted on by cam 253 on the cam drum. The position of this cam 253 is so fixed that the arms 25 carrying winding roller 9 are swung downward as soon as the spindle is with-

drawn and the wound and wrapped roll thus dropped upon the apron 29 and allowed to roll out of the machine.

Conclusion.

5 In the concluding paragraph of the section of this specification entitled "General functions" we have reviewed the entire operation of the machine, but without refer-
10 ence to the various control means. It is believed, however, that the cooperation of these control means will be clear from the detailed individual descriptions of them and a further general review of the operation at
15 this point unnecessary.

Among the several advantages which inhere in the use of the improved machine of the present invention, the following may be noted:

20 The use of cores which remain within the wound rolls is eliminated and rolls wound upon a permanent spindle which is withdrawn at the termination of each winding action. The machine, nevertheless, remains
25 entirely automatic in its operation.

The machine is of the center winding type, and yet wholly automatic in its winding, slitting, perforating, wrapping, gluing and discharge operations.

30 Automatic means are provided for traversing the spindle into and out of winding position.

The same mechanism which traverses the spindle cooperates with a stop to convert
35 the longitudinal into rotary movement.

The web is threaded through a slot in the spindle so that separate means for causing the web to follow the spindle at the initiation of the winding action are un-
40 necessary.

Automatic control means are provided for reversing the direction of traverse of the spindle. This is accomplished by driving the spindle through a series wound motor
45 and reversing the current through the armature while permitting the current through the series field to remain unchanged.

A dynamic brake is provided for momentarily arresting the spindle with its slot in the proper position to receive the forward
50 end of the web.

The torque of the spindle driving motor is automatically increased as the roll increases in size by throwing out resistance in
55 series with it.

The entire sequence of operations is automatic and the only manual labor necessary is the mounting of the parent rolls, the separation of the wound and individually
60 wrapped unit rolls as they are discharged from the machine, and the crimping of the wrapper ends.

We claim:

65 1. In a web-winding machine the combination of a spindle about which the web

is wound, means for directly rotating the spindle throughout the winding operation, a fixed roller contacting with the roll during winding, and a transversely movable support for the spindle.

2. In a web-winding machine the combination of a spindle about which the web is wound, a screw for traversing the spindle longitudinally into winding position, means
70 for arresting the traversing movement whereby the traversing movement is transformed into a rotary winding movement, and means for reversing the direction of rotation to withdraw the spindle.

3. In a web-winding machine the combination of a spindle about which the web is wound, a screw on the outer end of the spindle, an axially fixed gear making threaded engagement with the screw, means
80 for rotating the gear to traverse the screw and spindle into winding position and to rotate the spindle when in winding position, and means for reversing the rotation of the gear to withdraw the spindle and strip the wound roll.

4. In a web-winding machine the combination of a spindle about which the web is wound, a screw on the outer end of the spindle, an axially fixed gear making threaded engagement with the screw, means
90 for rotating the gear to traverse the screw and spindle into winding position, means for arresting the traversing movement of the spindle whereby the spindle is rotated to wind a roll, and means for reversing the rotation of the gear to withdraw the spindle and strip the wound roll.

5. In a web-winding machine the combination of a spindle about which the web is wound, a screw on the outer end of the spindle, an axially fixed gear making threaded engagement with the screw, a series wound motor for rotating the gear to traverse the screw and spindle into winding
105 position, and means for reversing the current through the armature of the motor while the direction of the current through the series field remains unchanged, thereby reversing the rotation of the gear to withdraw the spindle and strip the wound rolls.

6. In a web-winding machine the combination of a spindle about which the web is wound, a slot in the spindle, means for threading the web through the slot, a series wound motor for rotating the spindle, a shunt field
120 on the motor and means for energizing the shunt field and short-circuiting the series field and the armature to apply a dynamic brake to the motor and arrest the rotation of the spindle with its slot in position to receive the web.

7. In a web-winding machine the combination of a spindle about which the web is wound, a screw on the outer end of the spindle, an axially fixed gear making
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threaded engagement with the screw, means for rotating the gear to traverse the screw and spindle into winding position, a slot in the spindle, means for threading the web through the slot, means for arresting the traversing movement of the spindle whereby the spindle is rotated to wind a roll, and means for momentarily arresting the rotation of the spindle and holding it in position to receive the web.

8. In a web-winding machine the combination of a spindle about which the web is wound, a screw on the outer end of the spindle, an axially fixed gear making threaded engagement with the screw, a series wound motor for rotating the gear to traverse the screw and spindle into winding position, a slot in the spindle, means for threading the web through the slot, means for arresting the traversing movement of the spindle whereby the spindle is rotated to wind a roll, a shunt field on the motor, means for energizing the shunt field and short-circuiting the series field and the armature to apply a dynamic brake to the motor and arrest the rotation of the spindle, and means on the spindle for determining the angular position of the spindle when the brake is applied, the slot in the spindle being thus held in proper position to receive the web.

9. In a web-winding machine the combination of a spindle about which the web is wound, a slot in the spindle, guides extending into the slot to direct the web there-through, means for feeding the web over the guides and through the slot, means for rotating the spindle, and means for withdrawing the guides prior to the rotation.

10. In a web-winding machine the combination of a spindle about which the web is wound, means for rotating the spindle to wind a roll and means for automatically increasing the torque of the rotating means as the diameter of the wound roll increases.

11. In a web-winding machine the combination of a spindle about which the web is wound, a series wound motor for rotating the spindle to wind a roll, and means responsive to the increasing diameter of the winding roll to increase the torque of the motor.

12. In a web-winding machine the combination of a spindle about which the web is wound, a series wound motor for rotating the spindle to wind a roll, a resistance in series with the motor, a movable arm bearing against the peripheral face of the winding roll, a contact member on the arm making sliding contact with the resistance so that as the roll increases in size the current through the motor is increased and therefore its torque.

13. In a web-winding machine the combination of a spindle about which the web is wound, a series wound motor for rotating the spindle to wind a roll, a resistance in se-

ries with the motor, a swinging arm, means for holding the arm in contact with the winding roll, a contact member on the arm making sliding contact with the resistance so that as the roll increases in size the current through the motor is increased and therefore its torque, and means for manually varying the resistance.

14. In a web-winding machine the combination of a spindle about which the web is wound, a screw on the outer end of the spindle, an axially fixed gear making threaded engagement with the screw, a series wound motor for rotating the gear to traverse the screw and spindle into and out of winding position, means for arresting the traversing movement of the spindle whereby the spindle is rotated by the motor to wind a roll, a slot in the spindle, means for threading the web through the slot, a shunt field on the motor, a contact segment, and a cam driven by the machine for moving the contact segment first, to operate the motor to traverse the spindle inward, second, to energize the shunt field and short circuit the series field and armature to apply a dynamic brake and momentarily arrest the rotation of the spindle in position to receive the web, third to continue the operation of the motor to rotate the spindle and wind a roll, and fourth to reverse the current through the series field without reversing it through the armature to reverse the rotation of the motor to withdraw the spindle and strip the wound roll.

15. In a web-winding machine, the combination of a spindle about which a web is wound, feeding rollers for feeding the web to the spindle, winding rollers bearing against the peripheral face of the roll throughout the winding operation, one of these being fixed and co-operating with the feeding rollers to lead the web to the spindle or the winding roll and one being movable, transversely movable journals for the spindle and means for directly rotating the spindle throughout the winding operation.

16. In a web-winding machine the combination of a spindle about which the web is wound, means for traversing the spindle longitudinally into winding position, and means for arresting the traversing movement, the traversing means thereafter acting to rotate the spindle to wind a roll.

17. In a web-winding machine the combination of a spindle about which the web is wound, a slot in the spindle, means for traversing the spindle longitudinally into winding position, means for arresting the traversing movement, means for holding the spindle with its slot in position to receive the web and means for threading the web through the slot, the traversing means acting after the web has entered the slot to rotate the spindle to wind a roll.

18. In a web-winding machine the combination of a spindle about which the web is wound, a slot in the spindle, means for traversing the spindle longitudinally into and out of winding position, means for feeding the web to the spindle, guides for directing the web into the slot, means for inserting said guides into the slot prior to the introduction of the web and withdrawing them subsequently, and means for rotating the spindle.

19. In a web-winding machine, the combination of a spindle about which the web is wound, means for rotating the spindle to wind a roll, and means contacting with the peripheral face of the roll movable outward as the roll increases in size for increasing

the torque of the rotating means to maintain a constant tension on the web.

20. In a web-winding machine the combination of a spindle about which the web is wound, a series wound motor for rotating the spindle to wind a roll, a resistance in series with the motor, and means responsive to the increasing diameter of the winding roll for decreasing the resistance in series with the motor so that the torque of the motor is increased as the roll increases in size and the tension on the web held substantially constant.

In testimony whereof we affix our signatures.

NICHOLAS MARCALUS.
ROSWELL H. RAUSCH.

CERTIFICATE OF CORRECTION.

Patent No. 1,669,832.

Granted May 15, 1928, to

NICHOLAS MARCALUS ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 107, for the misspelled word "initated" read "initialed"; page 5, line 34, for the word "bearing" read "bearings"; page 6, line 94, strike out the words "is energized only when the" and insert instead the comma and words ", fixed contact 212, movable"; page 7, line 115, claim 5, for the word "rolls" read "roll"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of June, A. D. 1928.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

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