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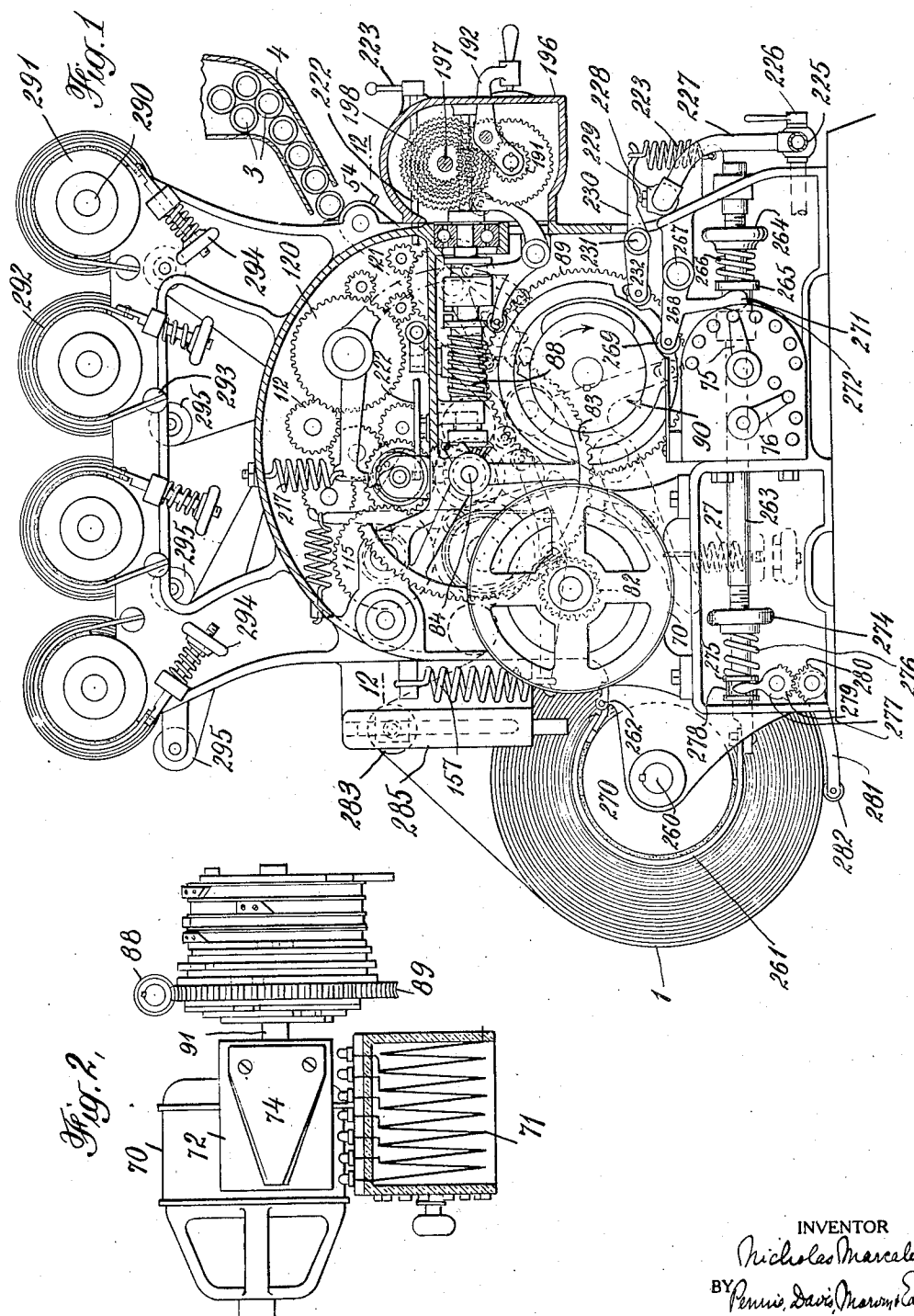
N. MARCALUS

1,776,263

WINDING MACHINE

Filed Dec. 27, 1924

13 Sheets-Sheet 1



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Sept. 23, 1930.

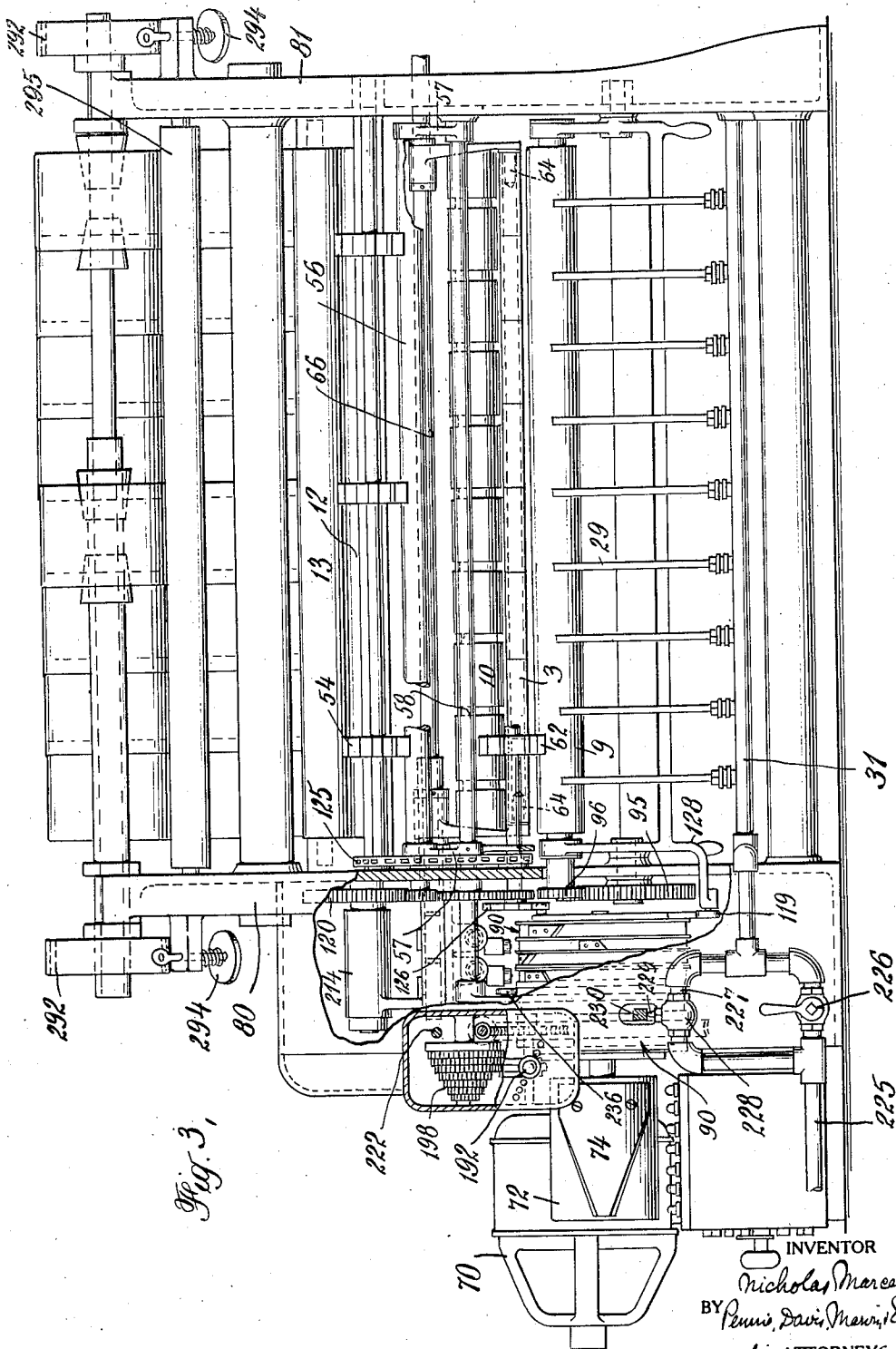
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WINDING MACHINE

Filed Dec. 27, 1924

13 Sheets-Sheet 2



Sept. 23, 1930.

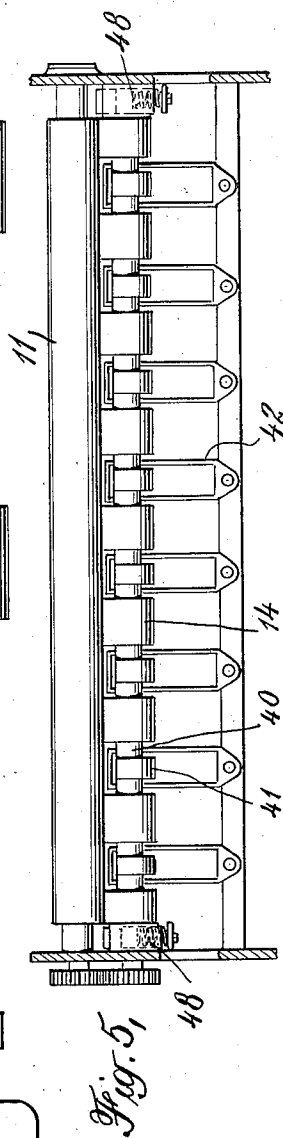
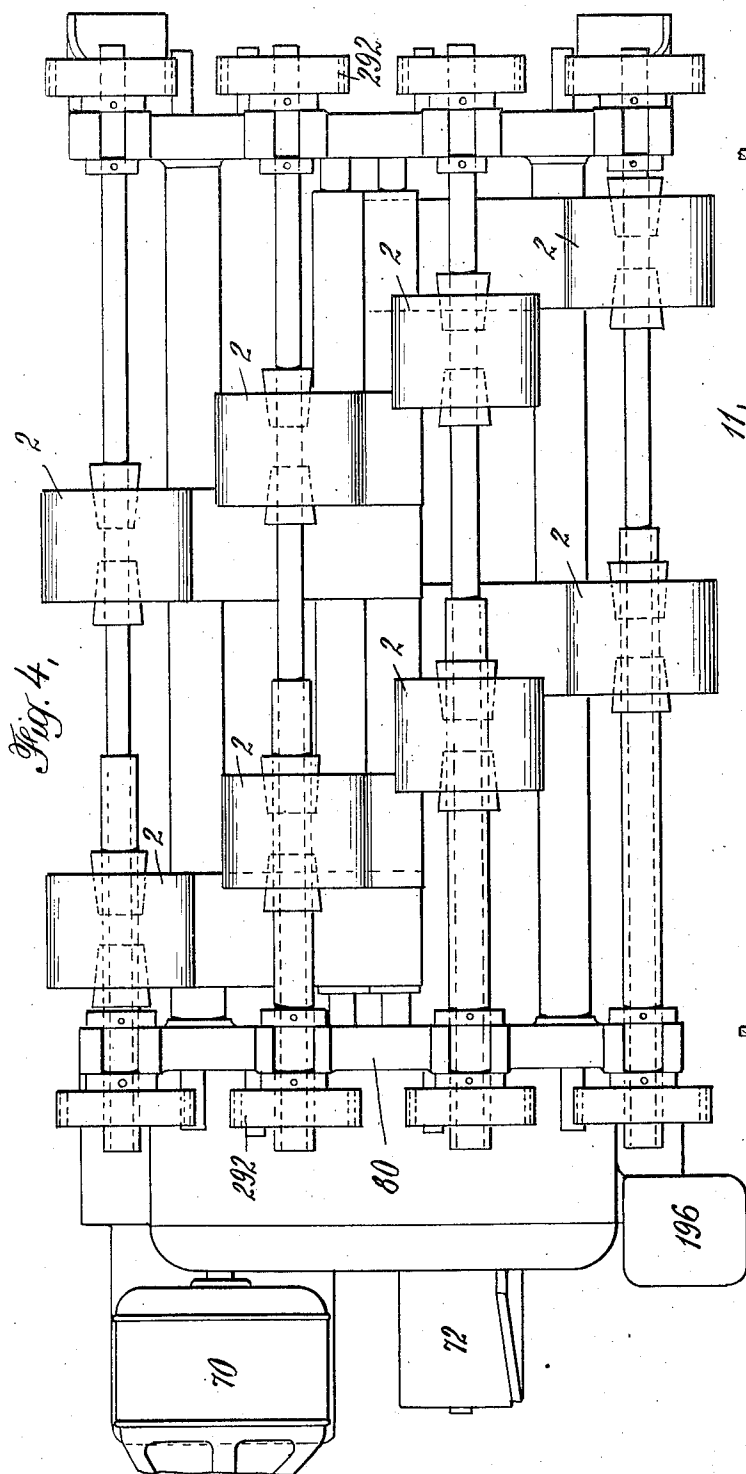
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WINDING MACHINE

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13 Sheets-Sheet 3



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WINDING MACHINE

Filed Dec. 27, 1924

13 Sheets-Sheet 4

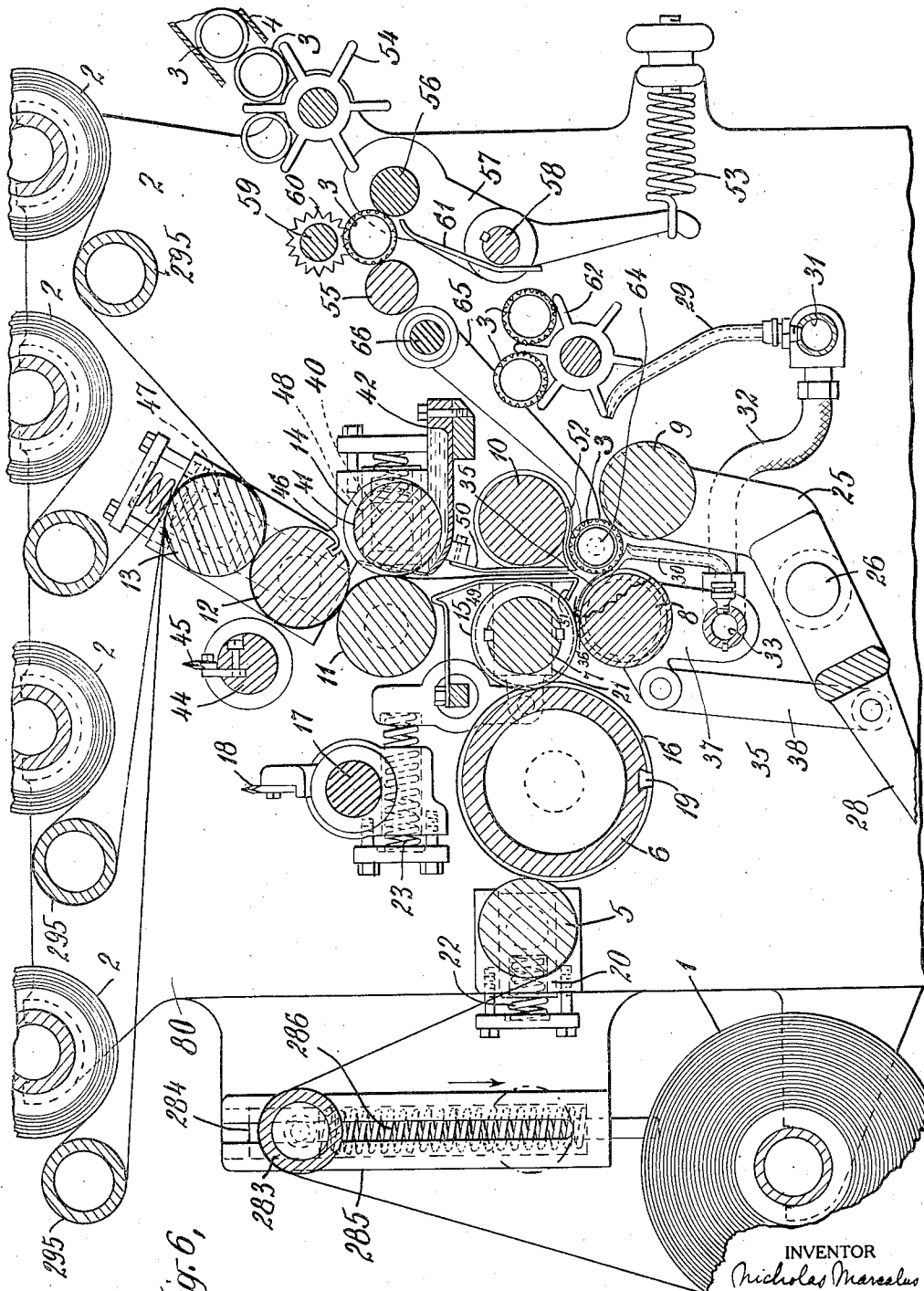


Fig. 6,

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WINDING MACHINE

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13 Sheets-Sheet 5



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WINDING MACHINE

Filed Dec. 27, 1924

13 Sheets-Sheet 6

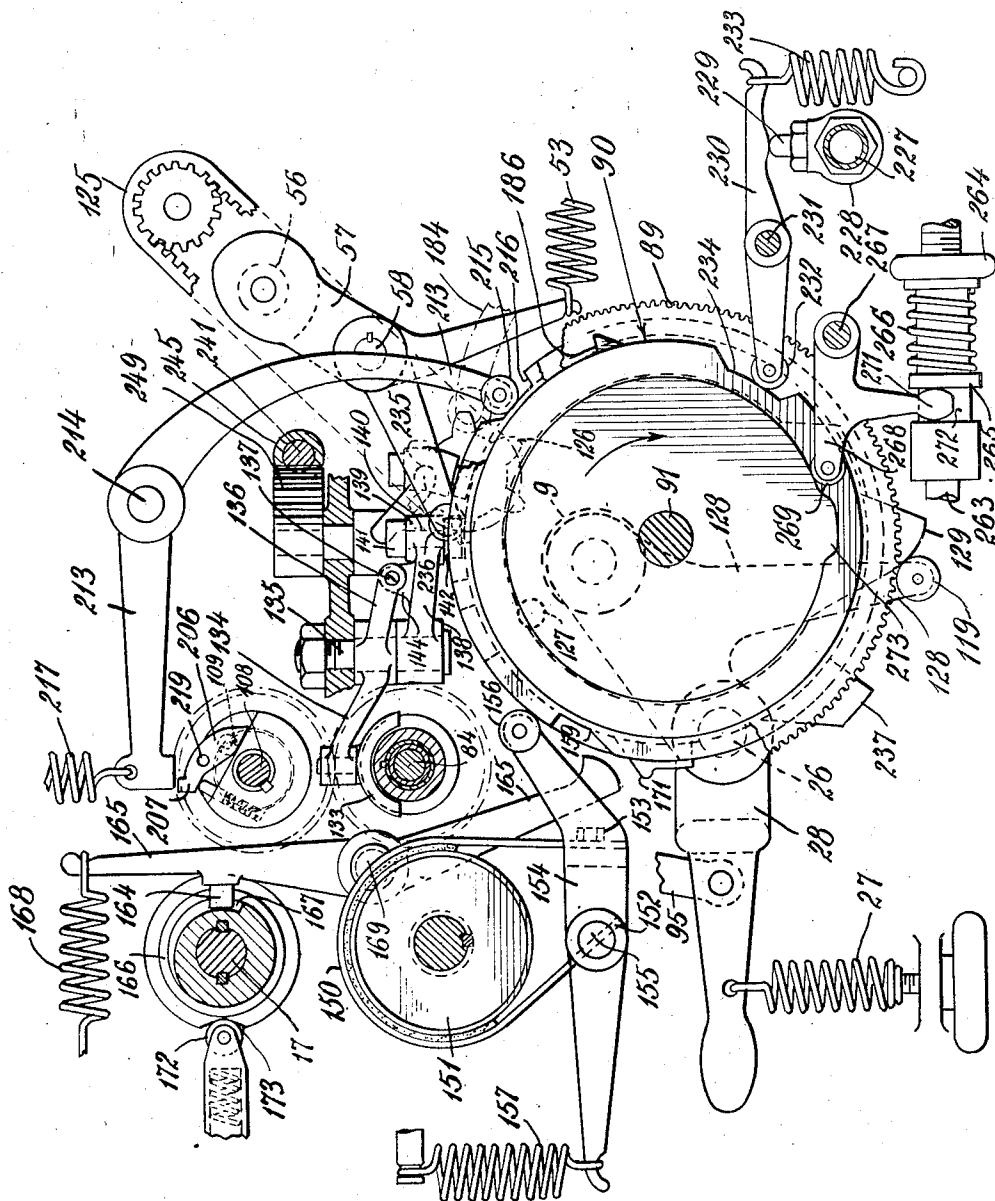


Fig. 8,

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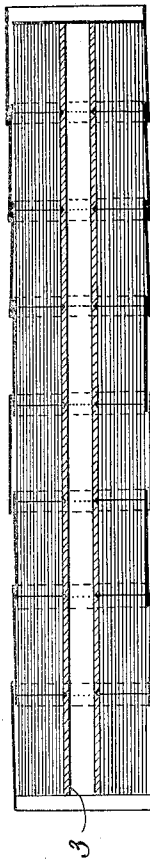
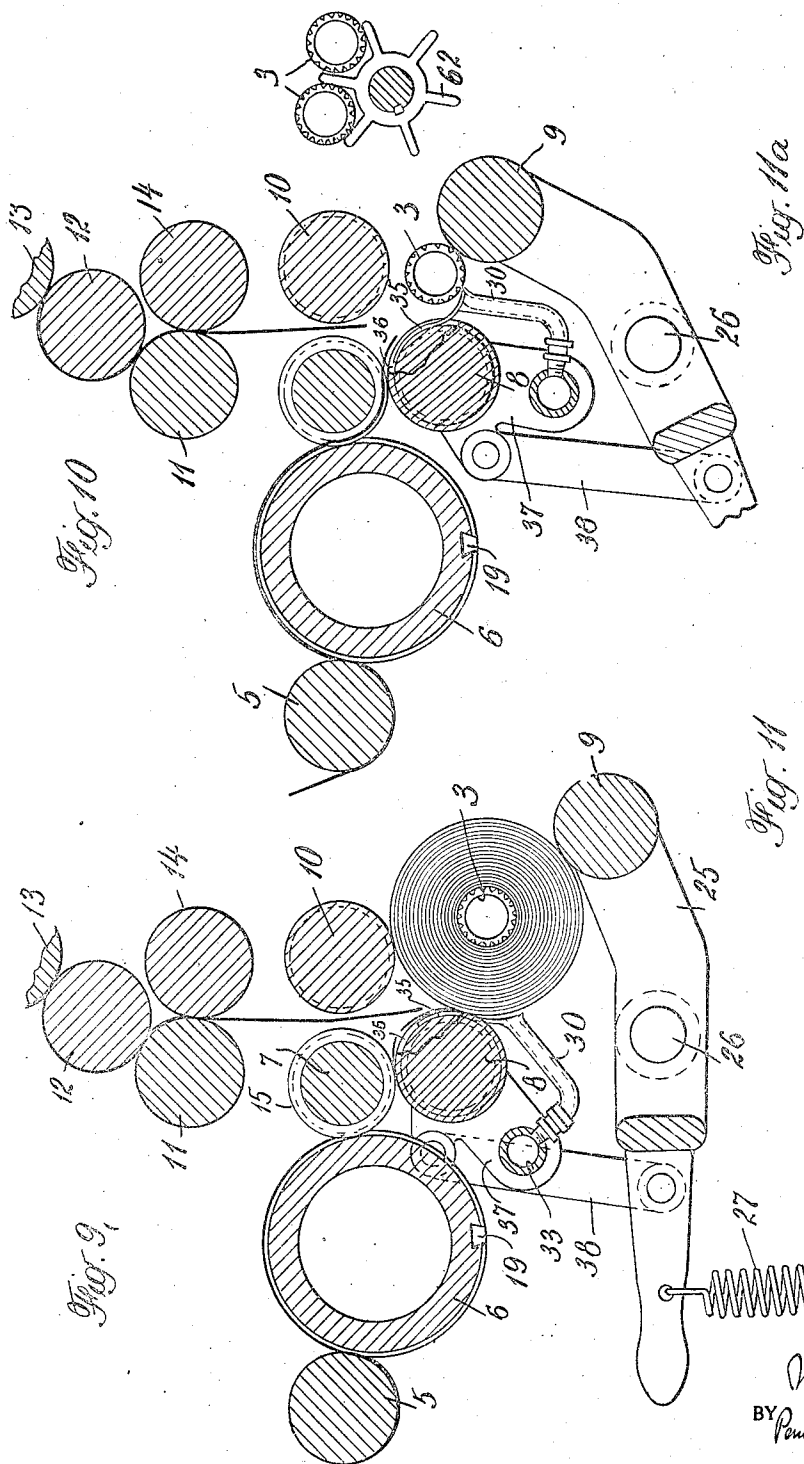
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WINDING MACHINE

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13 Sheets-Sheet 7



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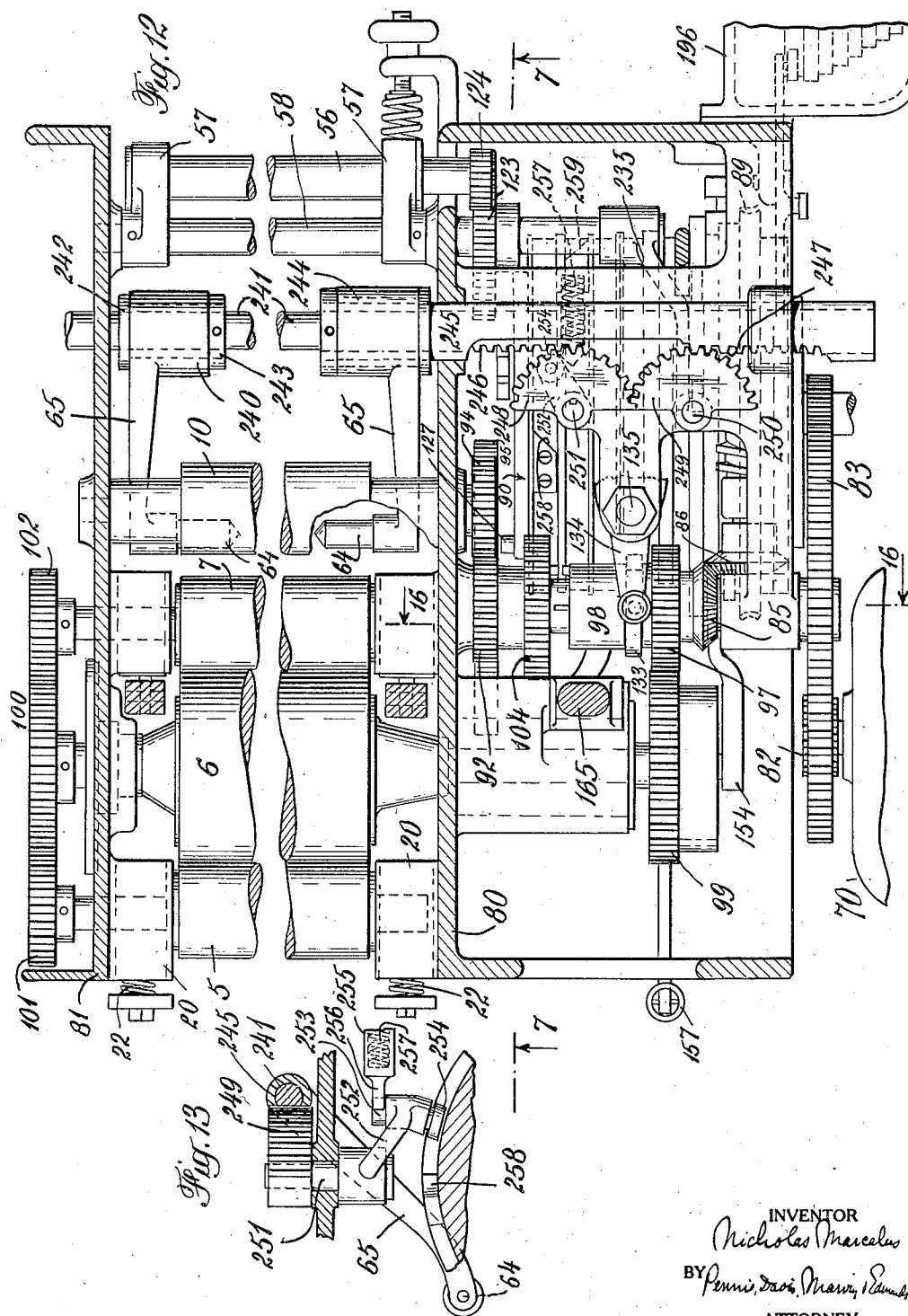
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WINDING MACHINE

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13 Sheets-Sheet 8



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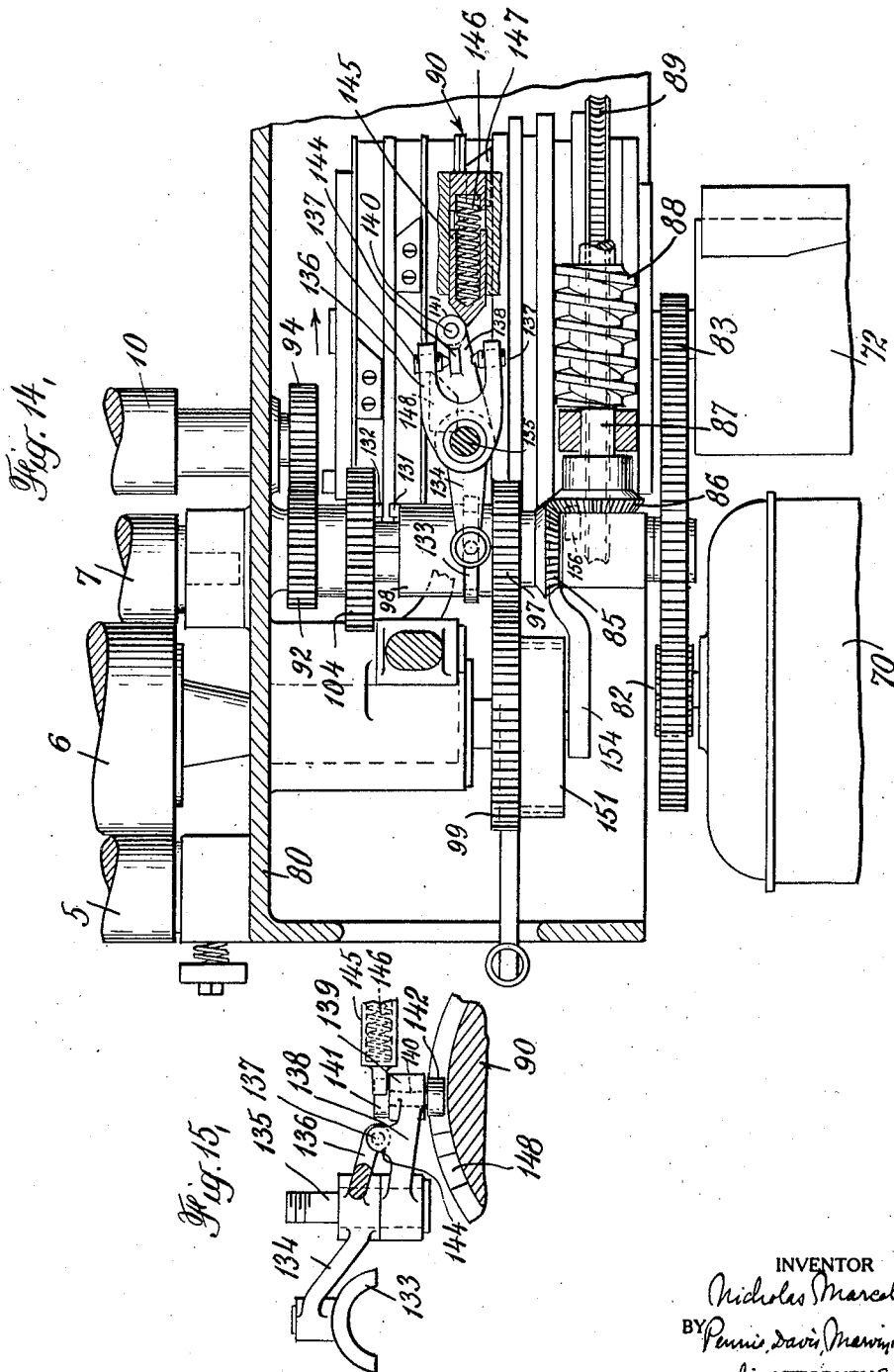
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WINDING MACHINE

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13 Sheets-Sheet 9



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WINDING MACHINE

Filed Dec. 27, 1924

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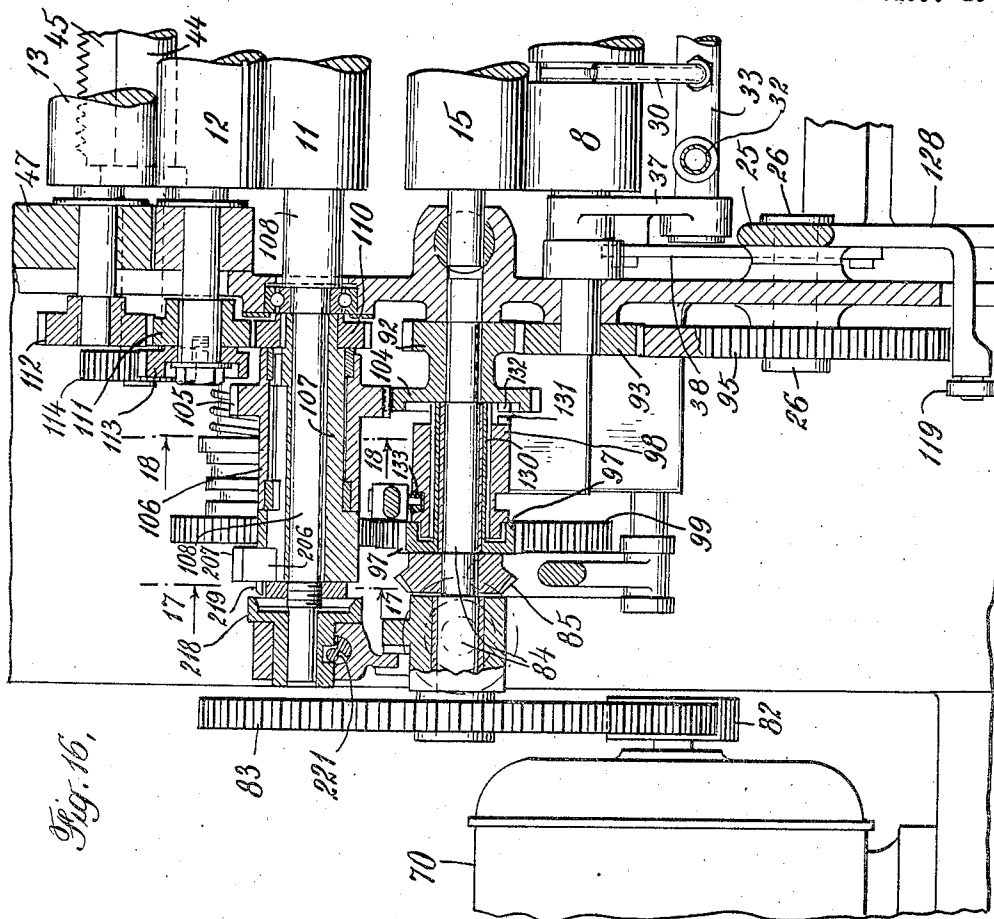


Fig. 16,

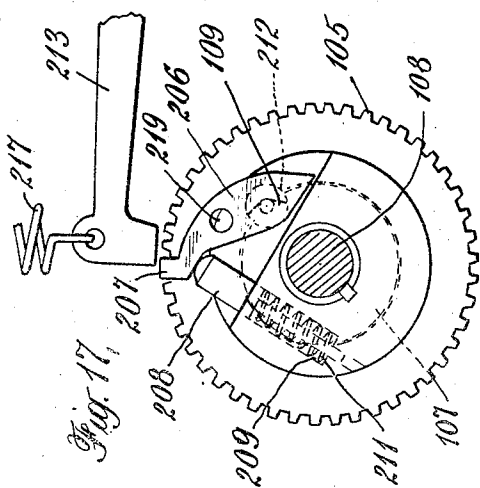
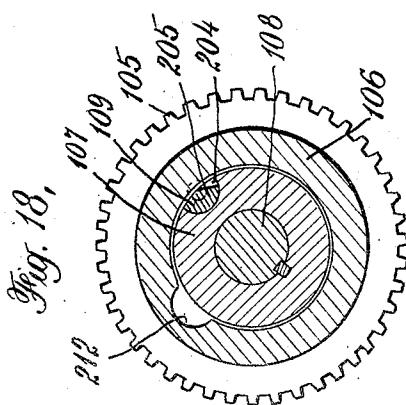


Fig. 17,



Sept. 23, 1930.

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WINDING MACHINE

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Fig. 19,

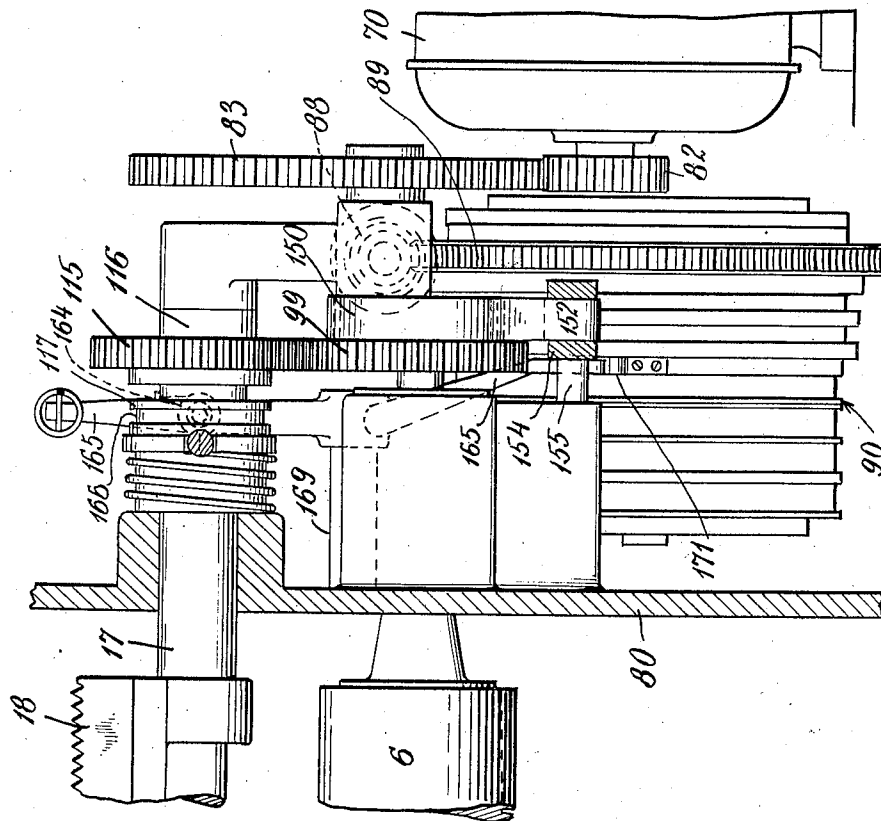
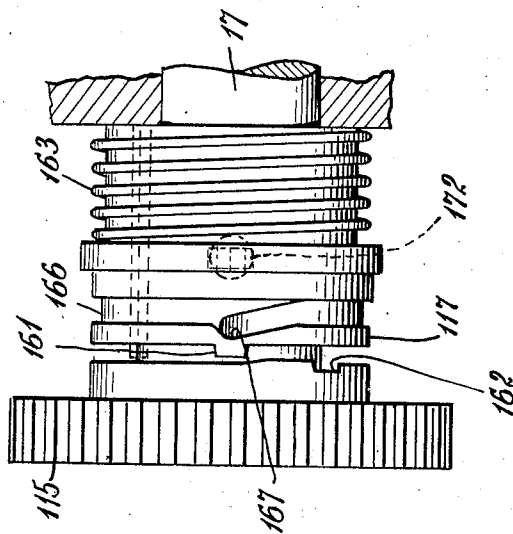


Fig. 20



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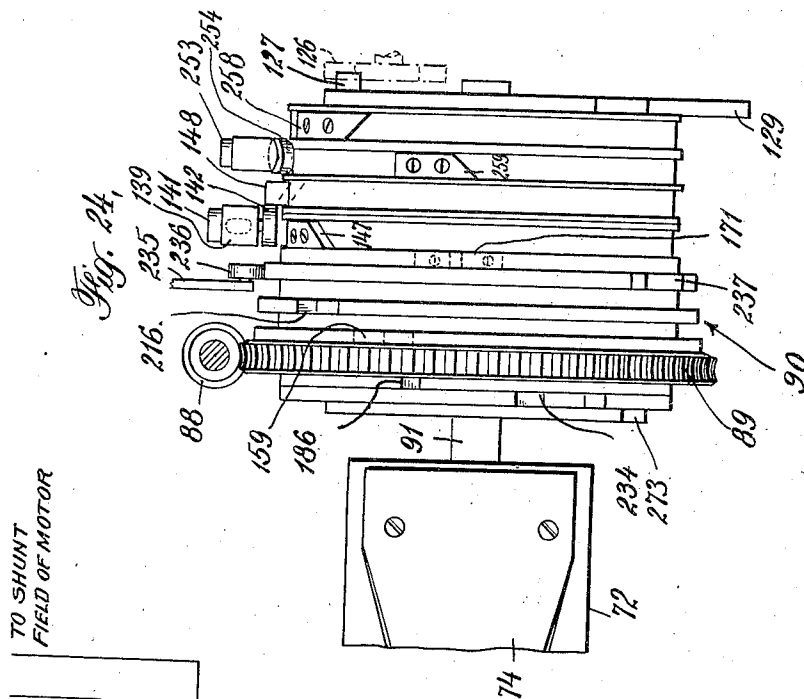
N. MARCALUS

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WINDING MACHINE

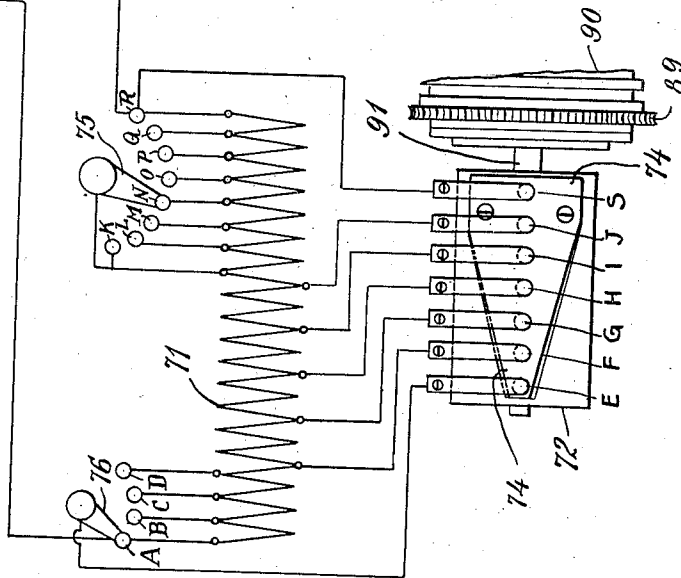
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TO SHUNT
FIELD OF MOTOR

Fig. 23,



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UNITED STATES PATENT OFFICE

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WINDING MACHINE

Application filed December 27, 1924. Serial No. 758,342.

This invention relates to web-winding machines.

In my copending application Serial No. 624,357 (now Patent No. 1,628,322) I have disclosed a machine 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 machine is 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 materials 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 machine is 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 rela-

tions 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.

It is broadly the object of the present invention to make further improvements in automatic web-winding machinery and in particular to modify and improve certain features of the machine described above.

One of these improvements is the provision of means for automatically accelerating and decelerating the movement of the web at the initiation and termination respectively of the winding action. In operating any web winding machine it is advantageous to initiate the winding action slowly, and gradually increase it to maximum winding speed. This is particularly true of rewinding machines where the web is unwound from an initially stationary parent roll of considerable mass, the inertia of which must be overcome by the pull exerted through the web itself. If an attempt is made to speed up the winding action too quickly the strain imposed upon the web is severe and will result either in its distortion or fracture. This inertia of the parent roll also makes it advantageous to decrease the winding speed gradually at the termination of the winding action, for if the winding mechanism is stopped suddenly from high speed, the parent roll, tending to continued rotation due to its own momentum, will tend to form a loop or slackness in the web which will result in imposing a sudden strain upon it when the winding is resumed. In accordance with the present invention I effect this automatic acceleration and deceleration by means of a commutator, operated by the machine, which cooperates with a plurality of contacts tapped from a series of resistances in series with the shunt field of the driving motor to throw these resistances progressively in and out at the initiation and termination respectively of the winding action.

Another of the improvements of this invention relates to the mechanism for controlling the starting and stopping of the feeding rollers. It is important that the web coming over the feeding rollers to the winding rollers be stopped and started at exactly the right times in order that its movements shall cooperate in properly timed relation with the other automatic actions which take place during the cycle of operations. In accordance with the present invention, the feeding roller gear train is thrown into and out of operative engagement with a constantly rotating driving shaft by means of a sliding clutch, and in order that the engagement and disengagement of this clutch shall be made at exactly the right times I provide means operated by the cam drum for delivering to it sharp hammer blows, properly timed and directed, when the feed rollers are to be started or stopped. In order to insure instantaneous stoppage of the feeding rollers when the clutch is disengaged I also provide a brake which is applied as the clutch is moved into disengaging position.

Another of the improvements of this invention is the provision of additional means for overcoming the inertia of the parent roll at the termination of each winding operation, and insuring an instantaneous stoppage of both parent roll and web when the feeding rollers stop. The additional means which I employ are (1) a brake automatically applied at the end of each winding operation and released when the feed is resumed, (2) a continuously acting tensioning device automatically decreasing the drag on the web as the size of the parent roll decreases and with it its mass and momentum, and (3) take-up means.

I have also made other improvements in various details of construction and operation of winding machines not specifically discussed above, but which will be brought out in the description of the preferred embodiment of the invention illustrated in the accompanying drawings. In these drawings,

Figure 1 is an end view partly in section of a machine constructed in accordance with the present invention showing in general the relation between the main parent roll, the wrapper rolls, the core feed hopper and the various feeding, winding and wrapper feeding rolls;

Figure 2 is a detail of part of the accelerating and decelerating mechanism showing the rotary contact plate, the contact buttons and the resistance box;

Figure 3 is a side elevation of the machine with part of the gear housing broken away;

Figure 4 is a plan view of the machine showing the staggered position of the wrapper rolls;

Figure 5 is a detail plan view of the glue-applying roller and glue troughs;

Figure 6 is a transverse section through the machine showing, somewhat diagrammatically, the relation among the parent rolls, the core feed and the various rollers;

Figure 7 is a transverse section through the gear housing taken along line 7—7 of Fig. 12 showing the relations of the various gear trains;

Figure 8 is a detail of the controlling cam drum showing the various control levers upon which it operates, the frame being omitted for the sake of clearness;

Figure 9 is a transverse section through the feeding, winding and wrapper feed rolls showing their relation at the termination of a winding action and at the initiation of the wrapping;

Figure 10 is a view similar to Figure 9 showing the relation of the rollers just after a new core has been fed to the winding rollers;

Figure 11 is a transverse section through a wound slit and wrapped roll as it is discharged from the machine ready for manual separation into its units, and showing the over-lapping wrappers;

Figure 11^a is a view similar to Figure 11 showing a roll of lesser diameter and wider individual wrappers;

Figure 12 is a horizontal section taken along line 12—12 of Figure 1 showing the gear trains and showing in particular the core centering mechanism;

Figure 13 is a detail showing the cam actuated mechanism which controls the core centering members;

Figure 14 is a horizontal section through the main gear housing showing the feed roller clutch control mechanism;

Figure 15 is a detail showing the cam control for this cam operating mechanism;

Figure 16 is a vertical section taken along line 16—16 of Figure 12 showing the relation between the various gear trains and in particular the feeding roller clutch, the wrapper roller clutch and in particular, the wrapper roller clutch release;

Figure 17 is a detailed section taken along line 17—17 of Figure 16 and illustrating the wrapper feed roller clutch;

Figure 18 is a detailed section taken along line 18—18 of Figure 16, likewise illustrating the construction of the wrapper feeding roller clutch;

Figure 19 is a vertical longitudinal section through the front of the main gear housing and illustrating in particular the perforating knife clutch and its control mechanism;

Figure 20 is a detail of the perforating knife clutch viewed in the reverse from Figure 19 and illustrating the clutch in disengaging position;

Figure 21 is a sectional detail showing the

means for arresting the rotation of the cam drum to permit rolls of various sizes to be wound;

Figure 22 is a section taken along line 22—22 of Figure 21 and illustrating the gears which control the length of the wound roll;

Figure 23 is a wiring diagram of the resistances in series with the shunt field of the driving motor and illustrating the manner in which this resistance is varied to accelerate and decelerate the driving speed; and

Figure 24 is a detailed side view of the controlling cam drum.

In describing the construction and operation of the machine illustrated in these drawings, I shall first describe briefly the general functions of the various feeding, winding, wrapping, cutting and discharge elements without specific reference to their operating mechanism, and then describe the operating mechanism generally. After this, I shall take up in detail the various mechanisms which control the operation of the various parts, explaining first, their individual construction and operation and then making clear the manner in which they all cooperate to produce the ultimate product, i. e. a wound, wrapped and glued roll of unit length.

General functions, Figs. 6, 9, 10, 11, and 11^a

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. The cores 3 about which the web is rewound, are mounted within a core hopper 4 and fed thence into winding position. 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 are positively driven. The winding rollers, which are continuously rotated, receive a blank core, wind the web about it, and then after the wound roll has been severed from the web, wind a wrapper about the wound roll and discharge it from the machine. 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. I shall now de-

scribe 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. The feeding roller 7 is provided with spaced annular slitting knives 15 which 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. In order to insure positive contact between the feeding rollers, rollers 5 and 7 are mounted in sliding journals 20 and 21 which are urged toward the roller 6 by means of compression springs 22 and 23 respectively.

The function of the winding rollers is to hold the roll being wound, wind it, wrap it and discharge it from the machine. Of these three winding rollers, 8 and 10 are fixed; roller 9, however, is mounted upon a frame 25 for swinging movement about stub shafts 26 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. Springs 27 secured to handle extensions 28 on the frame 25 constantly urge 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, the roller 9 is swung downward and the wrapped roll permitted to fall out of the machine by gravity.

Before leaving the winding rollers, I shall describe the air jet pipes which direct the advancing end of the web about the core at the initiation of the winding action and which, cooperate with the winding rollers. There are two sets of such air pipes, 29 and 30, both of which receive their air from a duct 31, the pipes 29 directly, and the pipes 30 indirectly through a flexible pipe 32 and a secondary duct 33. The pipes 30 are situated between the rollers 8 and 9 and direct the web between the core and the roller 9, while the pipes 29 situated beyond the roller 9 cause the web to follow the core back under roller 10. Pipes 30 are provided with extensions 35 which lie within annular grooves 36 in the face of roller 8 and act as guides in directing the oncoming web between the core and the roller 8 and toward the roller 9. It will be observed that the discharge orifices of the pipes 30 are closely adjacent the core at the initiation of the winding action. This makes the action very effective, but would also interfere with the winding operation, were they not withdrawn. In order to

withdraw the pipes 30 as the diameter of the wound roll increases, I mount the duct 33 to which they are secured upon an arm 37 pivoted about the axis of roller 8. This arm 37 is connected by means of a link 38 with the frame 25 and thus it follows that as the roller 9 is swung downwardly by the increasing diameter of the roll, the pipes 30 and their extensions 35 are likewise swung downwardly and eventually assume a position as indicated in Figure 9.

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 40 of reduced diameters (in this connection see also Figure 5), 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, all as clearly shown in Figure 6. 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 rollers 13 and 14 are mounted within sliding spring-pressed journals 47 and 48 respectively.

In order to guide the wrapper from the wrapper feeding rolls through the winding rolls, I provide a series of guides 49 and 50. The lower end of guide 49 is provided with an up-turned portion 51 which assists in directing the oncoming main web between the winding roller 8 and the core, and the lower end of guide 50 is provided with an extension 52 which serves to guide the main web between the roller 10 and the core. The roller 10 is provided with a series of suitably spaced annular grooves 11 which receive the guides 50 and their extensions 52.

I shall now describe the manner in which the cores are fed to the machine, scored, fed to the winding rollers and centered. The cores are fed from the lower end of the hopper 4 by an intermittently rotated star wheel 54 and onto two positively driven supporting rollers 55 and 56, of which the latter is mounted upon an arm 57 for swinging movement about a shaft 58. A lower extension of the arm 57 is provided with a spring 53 which always urges the roller 56 upwardly and toward the roller 55 and the scoring knives to

be described. Immediately above the two rollers 55 and 56 is a positively driven shaft 59 carrying a number of suitably spaced saw-toothed scoring knives 60, spaced apart a distance equal to the length of the finished unit rolls, which distance is, of course, the same as that between the web slitting knives 15 on the roller 7. Furthermore, the corresponding knives in the series 15 and 60 are in the same plane. The function of the knives 60 is to score without severing so that the cores proceed as one piece and not as a series of units. When the scoring is complete, the roller 56 is swung downward and the core dropped over a series of guides 61 to a second intermittently rotated star wheel 62, and thence fed to the winding rollers. In order to insure a proper alignment of the cores during winding and to prevent any weaving back and forth of the cores or telescoping of the web the ends of the cores are held between centering plugs 64 on the ends of arms 65 loosely pivoted about shaft 66.

By reference to Figure 4, it will be seen that the parent wrapper rolls are in staggered relation and the individual wrapper webs, as they pass between the wrapper feeding rolls, overlap each other. These overlaps come at the junctions of adjacent roll units so that the completed roll, before being divided into units, appears as illustrated in section in Figures 11 and 11^a.

I shall now briefly review the entire sequence of operations described above. Figure 10 represents the relative positions of the various rolls just after a wound and wrapped roll has been discharged, and a new core fed into winding position with the swinging roller 9 returning to winding position. The forward end of the main web is shown overlying roller 8 and guide 35. In Figure 6 the swinging roller 9 is shown returned to winding position and everything in readiness for winding. The winding rollers are in constant rotation. At this point, the feeding rollers are started and air ejected from the air pipes 29 and 30. The web is thus unwound from the parent roll, fed to the core and guided around it. After the first revolution, the forward end of the web is tucked under, the air jets shut off, and the feeding and winding continued. This goes on until the roll has assumed the desired size. When this point is reached, the shaft 17 and its perforating knife 18 are given a single rotation, perforating the web. When the perforation reaches a point beyond rollers 7 and 8, as indicated in Figure 9, the feeding rollers are suddenly stopped while the winding rollers continue 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 end 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 follows the roll. The glue stripes are applied to the wrapper by means of the roller 39 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 knives 45. The wrapper feeding rolls are then stopped and the winding rolls continue long enough to tighten the wrapper about the wound roll; the roller 9 is thereupon swung downward and the wound wrapped and glued roll discharged from the machine. These long rolls are then broken into units along the scored lines on the cores which also correspond with the slits made by the knives 15. Each individual unit is thus provided with a wrapper which extends beyond its ends an amount depending upon the width of the wrappers and the extent of overlap. These extending portions can then be turned in and secured by means of a glued disc or otherwise.

General operating mechanism, Figs. 7, 8, 12, 16 and 19

I shall now describe, generally, the various gear trains and other mechanism which actuate the feeding, winding and wrapper feeding rollers and their associated elements, and the core feed and scoring elements. These 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 (except for a period when it is arrested to permit the roll to be wound to the desired size, as will be explained later) and controls all of the sequential operations of the various parts of the machine, as will be explained more fully when the operation of these parts is described in detail.

The winding rollers are continuously rotated through a pinion 92 keyed to the drive shaft 84 and meshing with pinions 93 and 94 on the shafts of winding rollers 8 and 10, respectively. Pinion 93 meshes with a gear 95 journaled on the outer end of one of the stub shafts 26, and this gear meshes in turn with a pinion 96 on the shaft of winding roller 9.

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 98 actuated at the proper times 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 100 which meshes with pinions 101 and 102 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 and integral with the pinion 92. This pinion 104 meshes with a pinion 105 integral with a sleeve 106 loosely mounted in turn upon a sleeve 107 which is keyed to 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 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 the cam drum.

The core scoring knives and the rollers which hold the core during scoring are rotated during the rotation of the wrapper rollers through a pinion 120 which meshes with pinion 112 and also meshes directly with pinions 121 and 122 on the shaft 59 of the scoring knives and the shaft of the roller 55 respectively. Pinion 122 meshes with gear 123 loosely mounted on shaft 58, and this gear in turn meshes with pinion 124 on the shaft of roller 56. The two star wheels which feed the cores from the core hopper first to the scoring rollers and thence to the winding rollers are rotated step by step by means of a chain 125 actuated by a pinion 126 which in turn is moved by a pin 127 on the cam drum.

The downward swinging movement of the frame 25 carrying the winding roller 9 which results in the discharge of the wound and wrapped rolls is effected by an arm 128 carry-

ing a roller 119, acted on by a cam 129. As the roller 9 swings outwardly, either under the pressure of the increasing roll or through the action of swing arm 128, the pinion 96 continues to mesh with and be driven by gear 95. Keyed to the shaft 58 to which the arms 57 are also keyed, is a lever 235 provided at its end with a roller 236 designed to co-operate with a cam 237 on the cam drum to swing the roller 236 outward and permit the scored roll to fall upon the star wheels 62. As in the case of the swing roller 9 of the winding set, this swinging movement of roller 56 does not interfere with its positive drive, the pinion 124 always meshing with gear 123.

I shall now describe in detail the several mechanisms which control and modify the operations described above, with particular reference to the cam drum.

Speed control (accelerating and decelerating), Figures 1, 2, 3 and 23

The motor 70 which drives the machine is a shunt-wound direct current motor. The speed of such a motor varies inversely with the strength of the shunt field and can therefore be varied by varying the strength of this field, as is well understood. In Figures 1, 2, 3 and 23 I have illustrated means whereby this well-known property of shunt-wound motors can be utilized automatically to accelerate and decelerate the winding speed of this machine at the initiation and termination respectively of the winding action.

In Figure 23 I have illustrated a series of resistances 71 in series with the shunt field of the motor. These resistances are provided with taps which terminate in contacts A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R and S. A contact cylinder 72 is mounted upon the shaft 91 of the cam drum. This contact cylinder has on its face a metallic trapezoidal commutator segment 74 curved to fit the face of the cylinder. A manually operable swinging contact arm 75 is mounted adjacent the contacts K—R and designed to make contact with any one of them, and a similar contact arm 76 is similarly mounted adjacent contacts A—B. In the positions shown in Figure 23 the shunt field current of the motor passes through contact S, commutator segment 74, contact E, arm 76 and contact A. Thus, in this position, all of the resistances 71 are cut out, the shunt field current is at a maximum, and the motor is rotating at minimum speed. If now the cylinder 72 is rotated the contact E will be the first to leave the segment 74, and thus the current will be forced to pass through contact F and through the resistance F—A, thus increasing the speed of the motor. Upon further rotation of the cylinder, the contact F leaves the segment 74 and the current passes through contact G and resistance

G—A. Finally, the contacts J and S are the only ones on the segment 74 and the resistance J—A is in series with the shunt field of the motor. Upon still further rotation of the cylinder, the segment 74 is removed from contact with any of the contacts E—S, and with arm 75 in the position illustrated, the current passes through resistances R—N through the arm 75 and through resistances J—A. This condition remains unchanged until, upon continued rotation of the cylinder the other edge of the segment 74 is brought into contact with the contacts J—E successively, and the resistances are thrown out in the reverse order. Thus, by means of the arrangement shown in Figure 23 the speed of the motor is brought from a minimum to a maximum and is maintained at that maximum for the major part of the rotation of the drum and then gradually reduced to the minimum again.

The absolute maxima and minima can be manually controlled by means of the arms 75 and 76 respectively. Thus, if the arm 75 is swung to the left, more and more resistance is included in series with the shunt field during the major part of the winding operation and the actual operating speed of the motor is increased. When the arm 75 contacts with K the operating speed is at a maximum; when it contacts with R it is at a minimum. In a similar manner the arm 76 controls the minimum speeds. When in contact with A, as shown, the starting speed is at a minimum because all of the resistances are thrown out. As the arm 76 is swung to the right, more and more resistance is included at the initiation of the winding and the initial speed is therefore higher.

Feeding roller control, Figures 8, 14, 15, 16 and 24

As explained before, the feeding rollers are intermittently driven from a constantly rotating drive shaft 84 through the operation of a sliding clutch 98. This clutch sleeve 98 is keyed to a sleeve 130 integral with the pinion 97 and loosely mounted on the drive shaft 84. The inner end of the clutch sleeve 98 is provided with a single clutch tooth 131 designed to engage a similar clutch tooth 132 on the outer face of pinion 104. As pinion 104 is keyed to the drive shaft 84 and is in constant rotation, it is only necessary to slide the clutch sleeve 98 to the right, engaging the teeth 131 and 132, to impart the rotation of the drive shaft to the sleeve 98 and thence to the sleeve 130, the pinion 97 and the meshing train of the feeding roller gears. It is important, however, that the engagement and disengagement of this clutch take place very quickly so that the perforation across the web shall always stop at exactly the same position just beyond the rollers 7 and 8, and so that the web shall always

start to wind in timed relation with the air jets.

I shall now describe the mechanism which effects this instantaneous engagement and disengagement. A trunnion 133 straddles the clutch sleeve 98 and is pivoted on the end of a lever 134 free to rotate about a stud 135. Integral with this lever and extending beyond the other side of the stud are two arms 136 each of which carries near its extremity a horizontal inwardly projecting screw 137. Also loosely mounted upon the stud 135, but below the lever 134 is a second lever 138 terminating in a boss 139 through which extends a pin 140 carrying upper and lower horizontal rollers 141 and 142 respectively. This lever also carries a centrally disposed lug 144 extending upward between the adjacent ends of the two screws 137. Mounted in the frame of the machine adjacent the roller 141 is a plunger 145 provided with a V-shaped end constantly urged into contact with the roller 141 by virtue of a spring 146. That zone of the cam drum which rotates immediately below the stud 135 and its associated levers carries two cams 147 and 148, each having oppositely disposed angular faces designed to contact in succession with the roller 142. In the position shown in Figures 14 and 15, the clutch sleeve 98 is shown in disengaged position so that the feeding rollers are stationary. Cam 148 is approaching the roller 142. When it contacts with this roller it will slowly force the lever 138 to the right (viewing Figure 14 with the sheet vertical), the roller 141 forcing the plunger 145 back against the pressure of spring 146. The moment the roller 141 passes the center of plunger 145, it is driven suddenly to the right through the action of the compressed spring, and the lug 144 strikes the right-hand screw 137 a sharp hammer blow which results in a quick movement of the clutch lever 98 into engaging position, and the feeding action starts. When cam 147 comes around again the roller 142 and lever 138 are moved to the left in a similar manner, and the clutch disengaged with the same quick movement which engaged it.

In order to insure instantaneous stoppage of the feeding rollers when the clutch 98 is disengaged, I have provided a brake band 150 which encircles a brake drum 151 keyed to the shaft of the feeding roller 6. One end of this brake band is bolted to the frame of the machine at 152 and the other is secured at 153 to a brake lever 154 pivoted about a stud 155. The inner end of this brake lever is provided with a roller 156 which is constantly urged toward the brake drum by means of a spring 157 secured to the outer end. For the greater part of the rotation of the cam drum the roller 156 is in a relatively elevated position so that the brake 150 exerts no pressure upon the brake drum.

A cut-out 159, however, is provided in the cam drum and so placed that the moment the clutch 98 is slid into disengaged position the spring 157 forces the roller 156 into this cut-out and momentarily applies the brake to the drum 151. The brake is shortly thereafter released when the roller 156 rides out of the cut-out.

Web perforating control, Figures 8, 19, 20 and 24

During the major part of the feeding operation the perforating knife 18 remains stationary. When the desired length of web has been wound upon the core, it becomes necessary to perforate the web in order that, when the feeding rollers are stopped, a continued rotation of the winding rollers will sever the web along a straight and predetermined line. The perforating knife is thrown in at this point and allowed to make a single revolution and then stopped. It is important that when this happens the knife cooperates exactly with the longitudinal slot 19 in the feeding roller 6, for even slight deviations, if cumulative, would break the knife. I shall now describe in detail means for effecting this single and accurately timed revolution of the knife 18.

As described earlier in the specification, the shaft 17 of the perforating knife is driven, when it is driven, through gear 115 which meshes with gear 99 of the feeding roller 6, this gear 115 rotating continuously during the feeding operation, and the shaft 17 is thrown into operative relation with the gear 115 through the operation of a sliding clutch 117 keyed to the shaft 17. This clutch sleeve 117 is provided with a single clutch tooth 161 designed to fit within a single slot 162 in the face of the gear 115 when the knife 18 is to be operated. A compression coil spring 163 interposed between the clutch sleeve and the frame of the machine constantly urges the sleeve toward the gear 115 and into engaging position. This movement, however, is normally prevented by means of a roller 164 upon a lever 165 which fits within a groove 166 in the sleeve. This groove 166 is provided with an off-set portion 167 slightly deeper at its terminus than the rest of the groove, but having a sloping bottom which rises to meet the bottom of the groove 166 as most clearly shown in Figure 8. The roller 164 normally lies within the end of this off-set portion 167 and is held there by means of a spring 168 attached to the upper end of lever 165. This lever 165 is pivotally mounted upon a shaft 169 and held there against axial movement so that the roller 164 always remains in the same vertical plane and can therefore accurately determine the position of the clutch sleeve 117 upon the shaft 17. The lever 165 extends beyond the pivot point and terminates

adjacent the cam drum. When the desired length of the web has been wound and it is desired to perforate it, a cam 171 on the cam drum contacts with the lower end of the lever 165 and lifts the roller 164 out of the off-set depression 167 in the groove 166. Thereupon, the spring 163 forces the clutch sleeve 167 outwardly and the tooth 161 into the slot 162 as soon as the rotation of gear 115 brings this slot into registry with the tooth. The moment this engagement takes place, the shaft 17 is rotated. Meanwhile, however, the contour of cam 171 has permitted the roller 164 to return to the groove 166 and remain there during the rotation of the shaft 17. As the single rotation is completed, the roller 64, under the urge of the spring 168, again follows the off-set 167 and automatically forces the clutch sleeve 117 inwardly and disengages the clutch. The shaft 17 has therefore been permitted to make a single revolution and is returned to its initial position. The clutch sleeve 117 is held against accidental displacement by means of a spring-pressed roller 172 which fits within a groove 173 in the clutch sleeve. The relation between the gears 115 and 99 being fixed and the clutch 117 having but a single tooth, the knife 18 must always fit within the longitudinal groove 19. The roller 6 and the knife 18 are designed as intermeshing gears would be, with the same pitch line speed.

Roll size control, Figures 3, 21 and 22

A constant rotation of the cam drum 90 would fix the size of the wound roll. In order to be able to vary the size of this roll at will, I have provided means for arresting the rotation of the cam drum during the winding operation and causing it to resume rotation after any predetermined amount of material has been wound. When the driving is resumed, it is very important that the relation between the drum and its drive be precisely the same that it was when rotation was arrested, otherwise, the subsequent sequence of operations would not be properly timed. I shall now describe the means for doing this.

The worm 88 which drives the drum is journaled upon a sleeve 175 coaxial with the shaft 87 and is moved into and out of driving relation with the shaft by means of a sliding clutch sleeve 176 keyed to the drive shaft. The clutch sleeve 176 is provided with a single tooth 177 which is designed to engage with a single tooth 178 on the end of the worm. This clutch sleeve 176 is slid into and out of engagement with the worm by means of a compound lever 179 pivoted upon a stud 180 and provided with a trunnion 181 which terminates in a pair of oppositely disposed rollers 182 which lie within a groove 183 in the clutch sleeve. The lever 179 is also provided with an arm 184 carrying a roller 185.

This roller 185 is designed to contact with a cam 186 on the drum and to be swung upward, thus sliding the clutch sleeve 176 to the right and arresting the rotation of the worm and the drum. Thus, the drum is effectively stopped without in any way interfering with the continued rotation of the feeding and winding rollers. It now remains to provide means for resuming the rotation of the drum in order that the wrapper may be fed to the wound roll at the desired time and the discharge take place in regular order.

The shaft 87 is provided at its outer end with a worm 187 which engages with a worm wheel 188 on a shaft 189. Keyed upon this shaft 189 is a pinion 191 affixed to a tumbler lever 192. This tumbler lever also carries another pinion 193 which meshes with the pinion 191. The tumbler lever 192 and its two pinions may be slid longitudinally of the shaft 189 and the tumbler lever 192 and pinion 193 swung within a limited arc about the shaft 189. The tumbler lever 192 is also provided at its outer end with a longitudinally movable pin 194 adapted to be inserted within any one of a series of holes 195 in an auxiliary housing 196 within which the parts just described are held. Mounted within this housing, and above the worm 187 is a shaft 197 upon which a cone 198 of various sized pinions are journaled. These pinions are fixed to one another and also to a disc 199 carrying a cam 200. The arrangement of the parts just described is such that the pinion 191 through its companion pinion 193 may be made to mesh with any of the pinions of cone 198 by a proper manipulation of the tumbler lever 192. As the worm wheel 188, shaft 189 and pinion 191 are rotated at a constant speed, the speed of rotation of the disc 199 can be varied by shifting the tumbler lever relative to the pinions of cone 198.

The clutch lever 179 is provided with an arm 202 extending within the housing 196 and carrying at its upper end a roller 203 designed to be acted on by the cam 200. This cam contacting with the roller 203 slides the clutch sleeve 176 to the left into engaging position with the worm 88, thus resuming the rotation of the cam drum.

By means of the foregoing mechanism it is possible to permit any given length of web to be wound during the rest period of the cam drum and to cause a resumption of rotation of the drum at the desired time. As the clutch lever 176 and the worm itself are each provided with only one clutch tooth, the drum resumes rotation in exactly the same position relative to the drive that it was in when it stopped.

Wrapper roller control, Figures 8, 16, 17, and 18

I have already explained before how by employing a plurality of parent wrapper

rolls and feeding the wrapper webs to the wound roll in overlapping condition, I obtain a plurality of wound rolled units each of which has a wrapper which extends beyond the end of the roll. I have also explained the desirability of pinching the forward end of the wrapper between the wound roll and the tail-end of the web, and the manner of applying glue to the wrapper. I shall now describe more in detail the manner of starting and stopping the wrapper gear train, explaining in detail a novel clutch which I have designed for this purpose, the manner in which the wrapper webs are severed, and means for permitting manual adjustment of the wrapper rolls to permit a nice positioning of the wrapper when necessary.

As also briefly explained before, the wrapper gear train is actuated through constantly rotating pinion 104, on drive shaft 84, which meshes with a pinion 105, integral with a sleeve 106, journaled upon a second sleeve 107, keyed to an extension of the shaft of the wrapper roller 11 and this sleeve 106 is thrown into operative relation with the sleeve 107 by means of the clutch 109. I shall now describe the construction and operation of this novel clutch. The sleeve 107 is provided with a longitudinal semi-cylindrical slot 204 in which a semi-cylindrical key 205 is designed to fit. To the end of this key is affixed an arm 206 terminating in an outwardly extending projection 207. A plunger 208, mounted within a bore 209, in the outer end of the sleeve 107, is normally urged outwardly against the underside of the arm 206 by means of a spring 211. The sleeve 106 integral with the pinion 105 is provided with a semi-cylindrical groove 212 corresponding in curvature with the groove 204 in the sleeve 107 and designed, when in registry therewith, to form a complete cylindrical bore. Were the arm 206 free to move outwardly under the pressure of the plunger 208, the key 205 would rotate through about 30° and enter the groove 212, when, during the normal rotation of the sleeve 106, this groove 212 registers with the groove 204. This would lock the two sleeves 106 and 107 together and the wrapper gear train would be rotated. This action, however, is normally prevented by means of a lever 213 pivoted about a stud 214 and having an arm carrying a roller 215 and terminating adjacent the cam drum. The cam drum normally cooperates with this roller to hold the outer end of the lever 213 down and thus prevent rotation of the key 205. The cam drum is provided, however, with a cut-out 216 which operates during every revolution of the drum to permit the roller 215 to drop, and the lever 213 to be raised under the urge of a coil spring 217, thus clearing the projection 207 on the arm 206 and permitting the spring-pressed plunger 208 to rotate the key 205,

when the groove 212 comes in registry therewith. As long as the lever 213 is in raised position, the wrapper roller train will continue to rotate and this length of time is determined by the length of the cut-out 216. When this cut-out passes beyond the roller 215, the roller is swung outward, the upper end of the lever 213 is moved downward and upon the next revolution of the sleeve 107 and the arm 206, the upper end of the lever 213 rides upon this arm, rotates the key 204 back into unlocked position and brings the sleeve 107 and the wrapper feed rollers to rest when the projection 207 is reached. The clutch is always in the same position when locked and unlocked so that the relation of the wrapper feed gear train to the rest of the drive is unchanged.

It sometimes happens, particularly if the wrapper bears printed matter, that it must be nicely adjusted to insure that none of the printing is covered up by the end of the wrapper. In order to free the projection 207 from the lever 213 and permit manual rotation of the wrapper rollers, without actually engaging the clutch, I provide a clutch release 218 on the outer end of the shaft 108. This clutch release, by being slid inwardly, contacts with a pin 219 projecting from the outer side of the arm 206 and swings that arm downwardly, an amount sufficient to permit the projection 207 to clear the lever 213. In order to permit the slide necessary to the rotation of the key 205, I have made this key somewhat less in angular extent than the groove 204, as shown most clearly in Figure 18. The axial movement of this clutch release 218 is effected through a key 221 on the inner end of a rod 222 terminating in a handle 223.

As explained before, the wrapper is severed by means of a knife 45 mounted upon the shaft 44 which is intermittently rotated by means of a Geneva movement 113—114 as illustrated, the pinion 114 of this Geneva movement makes one revolution for each two revolutions of the pinion 113. This ratio can, of course, be varied so that in the event that more wrapper is fed by increasing the length of cut-out 216, the operation of the severing knife can be controlled accordingly.

Air jet control, Figures 1, 3, 6, and 8

I have already described the function and general operation of the air jets which guide the advancing end of the web at the initiation of each winding action, explaining that one set of air pipes 30 is swung downward as the wound roll increases in size, thereby preventing any interruption of the winding action. This swinging is effected during the winding operation directly by the increasing diameter of the wound roll itself and no additional mechanism is necessary. It is necessary, however, to provide means for automatically

turning the air on and off at the proper times. I shall now describe this means.

Compressed air for these jets is furnished from an air main 225 between which and the duct 31, a manually operable valve 226 is interposed. This valve is normally closed and the air by-passed through a pipe 227 containing a valve 228. This valve 228 is provided with a vertical pin 229 which, when depressed, opens the valve and permits the air to pass. A lever 230 is pivoted adjacent the valve on a stud 231 and is provided on its inner end with a roller 232 designed to cooperate with the cam drum. The outer arm of this lever bears against the valve pin 229 and is held there by means of a spring 233, which causes the lever always to tend to depress the pin and open the valve; but this action is prevented by means of the roller 232 bearing against the cam drum. This drum, however, is provided with a cut-out 234 which, once in every rotation of the drum, permits the spring 233 to depress the valve pin and open the valve, thereby allowing compressed air from the main 225 to pass through the ducts 31 and 33 and to the air pipes 29 and 30. The length of this cut-out is sufficient to enable the air jets to blow long enough to start the web around the core, and further continued rotation of the drum automatically closes the valve 228. If for any reason it becomes desirable to turn on the air at some other point in the cycle, this can be done by means of hand valve 226 without interfering with any of the automatic sequential operations of the machine.

Core holding and centering, Figures 3, 12, and 13

I have already described how the cores as they are fed into winding position are seized at their ends by arms 65 and centered by means of centering plugs 64. I shall now describe the mechanism which actuates these arms causing them to approach each other to seize an unwound core and separate to release a wound roll.

The arm 65 adjacent the frame 81 is loosely mounted upon a sleeve 240 pinned to a shaft 241 and provided with a flange 242 and a collar 243 preventing axial movement of the arm relative to the shaft. The other arm 65 mounted adjacent the frame 80 is loosely mounted on a similar sleeve 244 which is pinned to a hollow shaft 245. This hollow shaft 245 is mounted for longitudinal movement within the gear housing of the frame 80 and extends completely across and beyond said housing. The shaft 241 is slidably mounted at one end in the frame 81 and at the other within the hollow shaft 245. The outer end of the shaft 241 is provided with a rack 246 and the outer end of the hollow shaft 245 with a rack 247.

Mounted upon the gear housing and meshing with the racks 246 and 247, are gear segments 248 and 249 respectively, these gear segments not only meshing with their respective racks, but with each other. Gear segment 249 is loosely mounted upon a stud at 250, and gear segment 248 is keyed to a stud 251 journaled within the housing frame. The lower end of this stud 251 is provided with an arm 252 likewise keyed thereon which terminates in a boss carrying upper and lower horizontally disposed rollers 253 and 254, respectively. Mounted within the frame of the machine and adjacent to roller 253 is a plunger 255 terminating in a V-shaped point 256, and constantly urged outward under the pressure of a spring 257. The zone of the cam drum situated below the gear 248 is provided with two oppositely disposed cams 258 and 259 which are designed to contact with the roller 254 in succession. In the position shown in Figure 12, the cam 258 is approaching the roller 254. Upon contact it will swing the roller as well as the arm 252 and the gear 248 to the right (viewing Figure 12 with the sheet vertical), this movement of the roller 254 forcing the roller 253 against the inclined V-shaped end of the plunger 255 and compressing the spring 257. As soon as the roller 253 reaches the center of the plunger, it is forced suddenly to the right through the action of the spring 257. The net result of the action of the cam 258, therefore is to telescope the shafts 241 and 245 and draw the arms 65 and their centering plugs toward each other, the latter half of the movement being a sudden one, due to the action of the spring 257. When the cam 259 comes around again the roller 254 and its associated parts are moved to the left in a similar manner and the arms 65 and their plugs separated.

Parent roll control, Figures 1, 3, 4, 6, and 8

By means of the accelerating and decelerating mechanism described before, the momentum of the parent roll at the termination of each feeding action is much less than it would be were the feeding rollers stopped directly from operating speed. Nevertheless, there is certain residual momentum which may cause trouble, and moreover it may become necessary to stop the feed in the middle of a cycle. I have therefore provided three means for overcoming the momentum, (1) a brake, (2) a tensioning device, and (3) a take-up roller, which I shall now describe in turn.

The parent roll 1 is mounted on a spindle 260 having a brake drum 270 keyed on one end. A brake band 261 surrounds this drum and is anchored at one end to the frame of the machine at 262 and at the other end to a rod 263. This rod is provided with an adjustable hand-wheel 264, a sliding collar

265 and a coil spring 266 interposed between them. Mounted above the rod 263 on a stud 267 is a lever 268 terminating in a roller 269 adjacent the cam drum and having a depending arm 271 which terminates within a groove 272 in the sliding collar 265. A cam 273 on the cam drum is adapted to contact with the roller 269 and force the arm 271 to the right, thus applying the brake. The actual pressure applied to the brake is determined by the resistance offered by the spring 266 which in turn is controlled by the hand-wheel 264. The cam 273 is so positioned and proportioned that the brake is applied the instant the feeding roller clutch is thrown out, and released immediately thereafter.

In order to vary the tension on the unwinding web directly with the momentum of the parent roll, I have provided the following mechanism. The rod 263 is provided upon its end adjacent the parent roll with a second hand-wheel 274, a sliding collar 275 and an interposed spring 276. Mounted below the collar 275 is a pivoted lever 277 which extends within a groove 278 in the collar 275. The lower end of this lever is provided with gear teeth 279 which mesh with gear teeth 280 on a pivoted arm 281 which carries on its outer end a roller 282 contacting with the face of the parent roll. The hand-wheel 274 is so positioned that a drag is exerted upon the roll through the spring 276, the collar 275, the lever 277, the arm 281 and the roller 282. As the web is unwound and the diameter of the roll decreases, the pressure exerted by the roller 282 decreases. The actual pressure exerted can, of course, be controlled by means of the hand-wheel 274.

As a still further means of insuring that a slack shall not form in the web upon the termination of each feeding operation, I lead the web to the feeding rollers over a take-up roller 283, supported in sliding journals 284 in slotted guides 285 on the frame of the machine. Springs 286 mounted within these guides 285 always tend to move the roller 283 upward. Under normal operation, the roller 283 is in an intermediate position, but upon a sudden cessation of the feeding rolls any slack occasioned by a continued rotation of the parent roll would be taken up by the springs 286.

As I employ a plurality of parent wrapper rolls the mass of each roll and its inertia is relatively small. It is therefore unnecessary to provide means for accelerating and decelerating the speeds of these rolls, or automatic braking, tensioning or take-up means. I have, however, provided the spindles 290 which support the parent wrapper rolls with brake drums 291 each provided with a brake band 292 anchored to a frame of the machine at 293 and provided at the other end with a spring-pressed hand-wheel 294, by means of which the tension of the brake band can be

controlled. The wrapper webs before passing to the wrapper feed rollers are guided over rollers 295.

Conclusion

The machine is operated as follows: The main parent roll is placed upon its supporting brackets inside the machine and the web threaded over the take-up roller and around the three feeding rollers into a position just beyond the first winding roller as illustrated in Figures 6 and 10. A scored core is placed between the winding rollers and two more upon the lower star wheel. A fourth core is placed upon the two supporting scoring rollers ready for scoring, two unscored cores upon the upper star wheel and an adequate supply of cores within the core hopper. The several parent wrapper rolls are mounted on their spindles, placed in a position at the top of the machine and the individual wrapper webs threaded over the guide rollers, around the various wrapper feeding rollers and extended to a point adjacent the forward end of the main web, as also illustrated in Figures 6 and 9. When the parts are in this position the machine is ready to be started. The contact cylinder of the accelerating and decelerating control should now be in such position that the motor will start at minimum speed.

As the machine starts the feeding roller clutch is thrown in at slow speed and the rollers themselves rotated at first very slowly so as not to tear the web. As soon as the feeding rollers start the air valve is turned on so that the formed end of the web is properly guided about the slowly rotating core. In a short time the machine has reached the maximum operating speed and the winding continues. At this time the worm which drives the cam drum is disengaged from the power shaft and the winding continues until a roll of predetermined size has been wound, when the worm is again connected with the power shaft and the rotation of the drum is resumed. The speed control now operates to decelerate the speed of the motor so that the machine is gradually slowed down. It is at this time that the perforating knife clutch is thrown in and the knife forced to make one complete revolution cooperating with the slotted feeding roller to perforate the web transversely. When this perforation reaches a point slightly beyond the first winding roller, the clutch controlling the feeding rollers is disengaged and the brakes applied both to the winding rollers and to the parent roll. This instantly stops the feed and the continued rotation of the winding rollers severs the wound roll from the web. At this moment, however, the clutch controlling the wrapper feeding rollers is thrown in, and the wrapper fed downwardly between the tail end of the severed web and the wound roll. The wrapper in being fed is furnished with the necessary glue

to seal it, and after a sufficient length of wrapper has been fed the wrapper perforating knife cooperates with one of the wrapper fed rolls to perforate it. When this perforation has reached the point from which the forward end of the wrapper started, the wrapper feeding roll clutch is disengaged and a continued rotation of the winding rollers tears the wound roll from the wrapper web. After a few more rotations to tighten the wrapper the swinging winding roller is swung downwardly and the wound and wrapped roll discharged.

During the rotation of the wrapper feeding rollers scoring knives have been in operation scoring the core supported upon the scoring rollers so that this core is now in readiness to be fed to the lower star wheel. After the discharge of the wound roll, the first scored core on the star wheel is fed forward and is caught by the winding roller returning from its downward swing. At the same time the core holding and centering arms approach each other and hold and center the newly fed core. Meanwhile, a new core has been fed to the scoring rollers. The machine is now in readiness to wind a second roll and the operations are repeated.

Among the many advantages inherent in the use of the improved winding machine of the present invention, the following may be noted:

The speed of the machine is gradually accelerated at the beginning of the winding action so that the danger of tearing the web in a sudden effort to overcome the inertia of the parent roll is eliminated, and a similar deceleration toward the close of the feeding operation tends to prevent the formation of any slack in the web.

Three of the clutches which control the operation of the rotating parts are thrown into and out of engaging position during the accelerating or decelerating period.

The feeding rollers are under accurate control and can be started and stopped with the precision necessary to insure properly timed cooperation of the web with the machine.

The web perforating knife is so operated that it always cooperates properly with one of the feeding rollers to perforate the web, being revolved at a speed which corresponds exactly with the peripheral speed of the cooperating feeding roller, and always fitting within the longitudinal groove in that roller reserved for it.

The size of the roll is not dependent upon the size and rate of rotation of the cam drum, but can be varied at will without disturbing the sequential operations of the machine.

The slitting knives are placed in advance of the winding rollers and do not cooperate with them so that it is not necessary to slit the wrapper at the same time that the web is slit and thereby produce a roll having un-

wrapped ends. I am therefore able to feed to the slit, wound unit rolls overlapping unit wrappers, each of which extends beyond the ends of its particular unit roll and can thus be utilized to wrap its ends.

The wrapper is fed between the tail end of the wound web and the roll so that the use of additional means for guiding the wrapper is unnecessary.

As it is unnecessary to use glue to initiate the wrapping action I do not have to apply continuous stripes of glue to the wrapper, but only short stripes. This is not only economical in glue but prevents wrinkling of the wrapped rolls.

The starting and stopping of the wrapper roller is under perfect control so that the forward end of the wrapper is in a position to be fed between the tail of the web and the wound roll at the proper time.

The wrapper perforating mechanism can be made to operate to perforate at different intervals to provide for wrappers of different lengths.

The wrapper roller can be manually adjusted without disturbing the other parts of the machine.

The air jets which initiate the winding action of the main web about the core are most efficiently utilized by placing the air pipes adjacent the core and swinging them away as the roll is wound and increases in size.

In view of the fact that the winding rollers have no slitting means the cores are scored before being fed to these rollers. This scoring, although making the core units readily separable, nevertheless enables the entire tube to be wound as a single core.

The cores are not fed loosely to and supported by the winding rollers, but are held and centered so that the roll cannot weave back and forth during the winding operation.

The parent roll is provided with a brake which is automatically applied when the feeding rollers stop, thus preventing formation of slack, and a tensioning device and take-up roller are also provided for counteracting the momentum of the parent roll, especially when the machine is stopped in the middle of a cycle.

The entire sequence of operations is automatic and the only manual labor necessary is the mounting of the parent rolls, the supplying of cores to the hopper, the separation of the wound and individually wrapped unit rolls as they are discharged from the machine in one long continuous tube, and the crimping of the wrapper ends.

I claim:

1. Winding mechanism comprising the combination of winding means, means for feeding a web to the winding means, means for slowly increasing the speed of the feeding means during the initiation of the winding action and slowly decreasing the speed at its

termination, means for arresting the feeding means when the desired length of material has been wound, and means for detaching the wound roll from the web.

2. In a web-winding machine, the combination of winding rollers designed to hold and rotate a roll, feeding rollers designed to feed a web to the roll, means for accelerating the feed of the web at the initiation of the winding action, means for perforating or cutting the web, means for decelerating the feed of the web at the termination of the winding action and means for stopping the rotation of the feeding rollers when the desired length of the material has been wound while the winding rollers continue to rotate, thus detaching the wound roll from the web.

3. In a web-winding machine the combination of a shunt wound driving motor and means operated by the machine for decreasing the field strength of the driving motor at the initiation of the winding action and increasing it at the termination thereof, thereby accelerating and decelerating the winding speed.

4. In a web-winding machine the combination of a shunt-wound driving motor and means operated by the machine for progressively throwing resistance into the shunt field at the initiation of the winding action and progressively throwing resistance out at its termination thereby accelerating and decelerating the winding speed.

5. In a web-winding machine the combination of a shunt-wound driving motor, a variable resistance in series with the shunt field of the motor spaced contact elements on said resistance, a rotary contact member operated by the machine for progressively contacting with the elements on the resistance to vary the strength of the shunt field of the driving motor.

6. In a web-winding machine the combination of a shunt-wound driving motor, means operated by the machine for progressively throwing resistance into the shunt field at the initiation of the winding action and progressively throwing resistance out at its termination thereby accelerating and decelerating the winding speed and means for manually controlling the minimum resistance of the shunt field at the initiation and termination of the winding action.

7. In a web-winding machine the combination of a shunt-wound driving motor means operated by the machine for progressively throwing resistance into the shunt field at the initiation of the winding action and progressively throwing resistance out at its termination thereby accelerating and decelerating the winding speed and means for manually controlling the maximum resistance of the shunt field at full winding speed.

8. In a web-winding machine, the combination of feeding rollers, a drive shaft, a

sliding clutch for placing the feeding rollers into and out of driving relation with the drive shaft, an arm for sliding the clutch, and means for delivering a sharp hammer blow to the arm when the feeding rollers are to be started or stopped.

9. In a web-winding machine, the combination of feeding rollers, a drive shaft, a sliding clutch for placing the feeding rollers into and out of driving relation with the drive shaft, a pivoted arm for sliding the clutch, a loosely pivoted arm adjacent the clutch arm and designed to be swung into contact therewith, a spring-pressed plunger mounted adjacent the loosely pivoted arm and having a V-shaped end designed to contact therewith, a cam designed to contact with and move the loosely pivoted arm against the V-shaped end of the plunger and compress its spring, the arrangement of the parts being such that when the loosely pivoted arm passes the center of the plunger the plunger spring suddenly moves the plunger outward, swinging the loose arm to one side where it delivers a sharp hammer blow against the clutch arm and moves the clutch in the required time.

10. In a web-winding machine, the combination of feeding rollers, a drive shaft, a sliding clutch for placing the feeding rollers into and out of driving relation with the drive shaft, a pivoted arm adjacent the clutch, one end contacting with the clutch and the other being bifurcated, a loosely pivoted arm adjacent the clutch arm and having a projection thereon lying within the bifurcated end thereof, a plunger mounted adjacent the loosely pivoted arm and having a V-shaped end designed to contact therewith, a pair of cams having oppositely inclined faces designed to contact with the loosely pivoted arm in alternation and move it against the V-shaped end of the plunger and beyond its center, and a spring bearing against the plunger which, when the arm passes its center, suddenly moves the plunger outward and forces the projection on the loosely pivoted arm to strike a hammer blow against one side of the bifurcated end of the clutch arm and quickly move the clutch into or out of engaging position.

11. In a web-winding machine the combination of feeding rollers, means for intermittently connecting and disconnecting them with a source of power, and means for applying a brake to the rollers as they are disconnected from the source of power.

12. In a web-winding machine designed to unwind a web from a parent roll, and rewind it into a succession of smaller rolls in successive winding operations, the combination of a brake for the parent roll and means positively actuated by the machine for auto-

matically applying the brake at each termination of the winding action and releasing the brake prior to the initiation of each winding action.

5 13. In a web-winding machine designed to unwind a web from a parent roll and rewind it into a succession of smaller rolls in successive winding operations, the combination of a spindle for the parent roll, a brake drum on said spindle, a brake co-operating with
10 said brake drum, a rod connected to the brake, a sliding collar on the rod, an adjustable hand-wheel on the rod, a compression spring between the collar and the hand-wheel,
15 a cam drum, a lever pivoted on the frame of the machine, one end bearing against the cam drum and the other against the sliding collar, the cam acting through the lever, sliding collar, spring, hand-wheel and rod to apply
20 the brake at the termination of each winding action and release it prior to the initiation of the succeeding winding action.

14. In a web-winding machine designed to unwind a web from a parent roll, the combination of a spindle for the parent roll, a
25 brake drum on said spindle, a brake co-operating with said brake drum and a rotary cam operated by the machine for automatically applying the brake at the termination
30 of each winding action and releasing the brake prior to the initiation of each winding action.

15. In a web-winding machine designed to
35 unwind a web from a parent roll and rewind it into a succession of smaller rolls in successive winding operations, the combination of a brake for the parent roll, means for automatically applying the brake at the termination
40 of each winding action, and means for releasing the brake prior to the initiation of each winding action.

16. In a web-winding machine designed to
45 unwind a web from a parent roll and rewind it into a succession of smaller rolls in successive winding operations the combination of winding rollers designed to hold and rotate a roll, feeding rollers designed to feed a web
50 to the roll, means for stopping the rotation of the feeding rollers when the desired length of material has been wound while the winding rollers continue to rotate thus detaching the wound roll from the web, a brake for the parent roll and means for applying the brake
55 when the feeding rollers are stopped.

17. In a web-winding machine designed to unwind a web from a parent roll and rewind it into a succession of smaller rolls in successive winding operations, the combination of
60 winding means, means for feeding the web to the winding means, means for arresting the feeding means when the desired length of material has been wound, a brake for the parent roll, means for applying the brake
65 when the feeding rollers are stopped, means

for restarting the winding means, and means for releasing the brake prior to restarting the winding means.

In testimony whereof I affix my signature.

NICHOLAS MARCALUS. 70

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