March 6, 1934. E. E. BERRY 1,950,159

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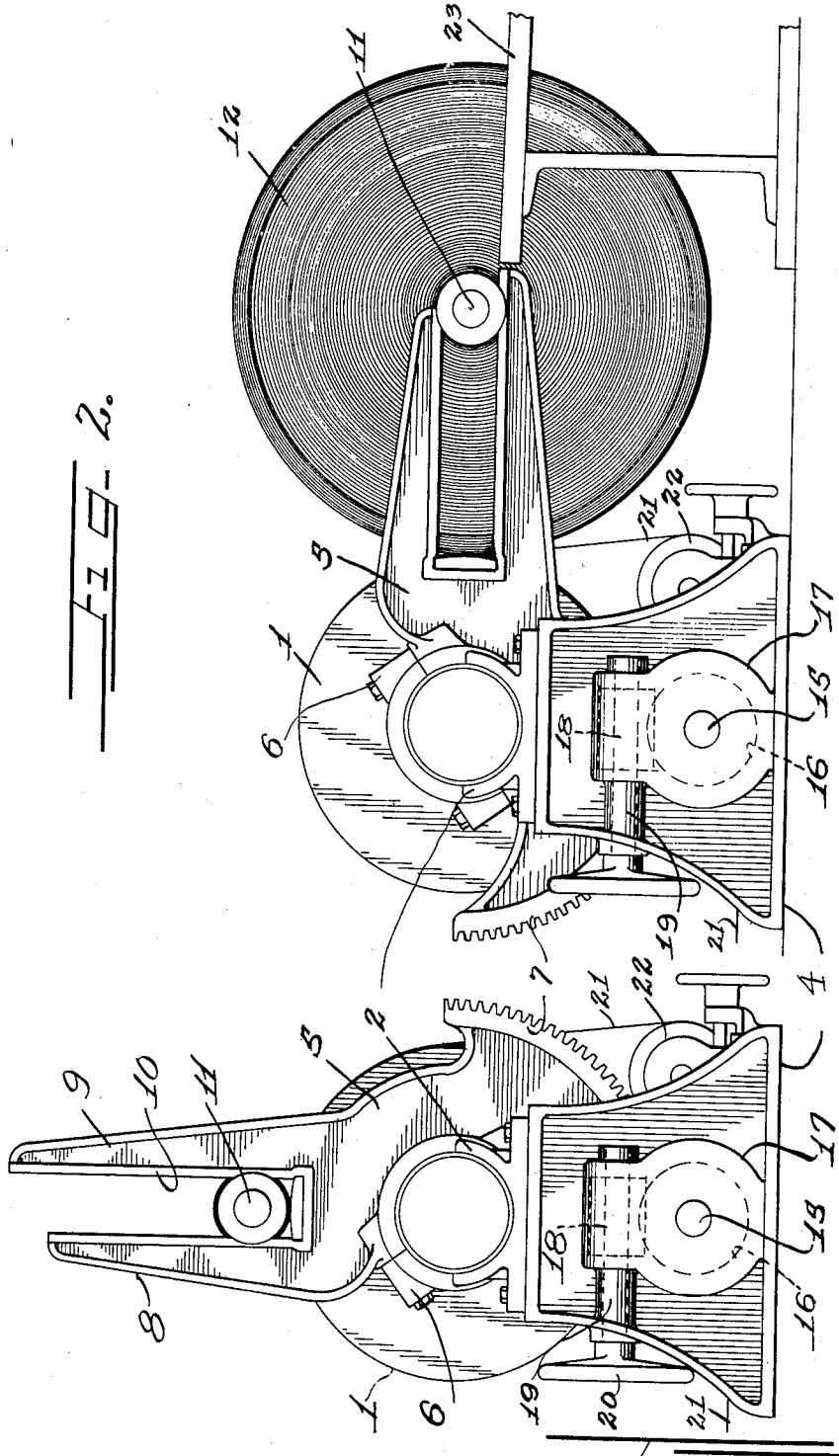


FIG. 2.

FIG. 1.

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Fig. 3.

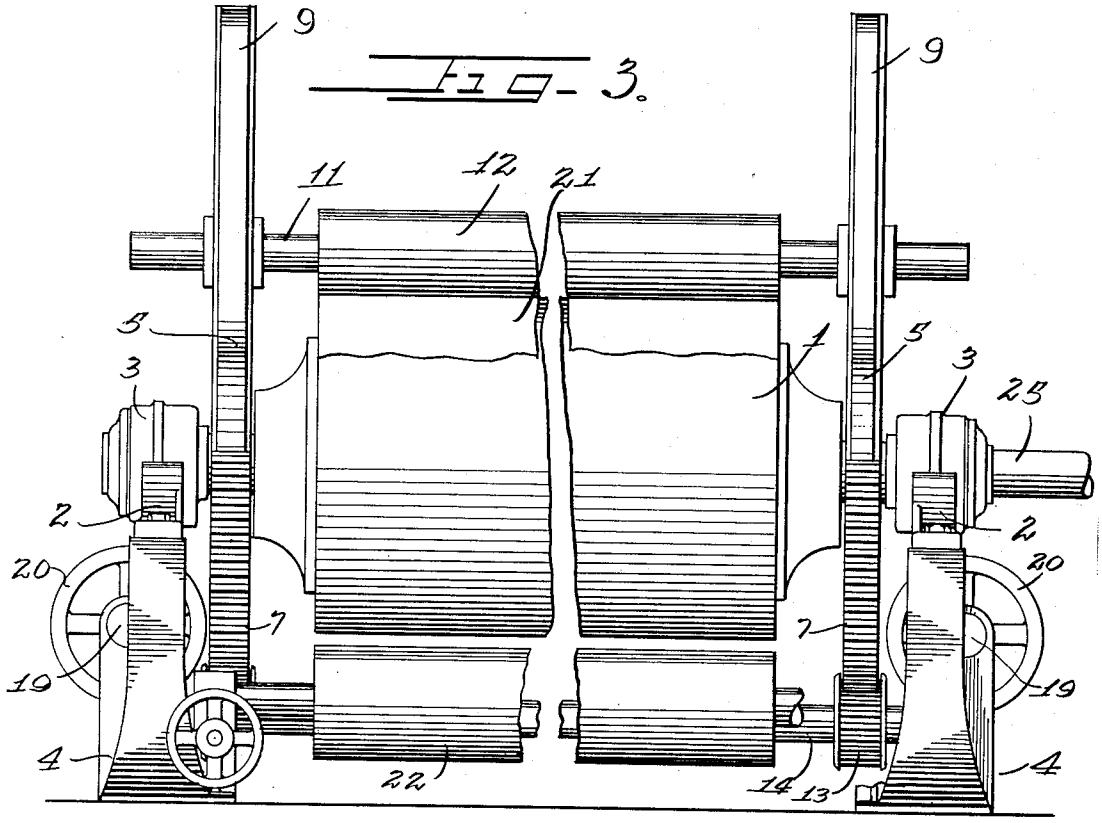
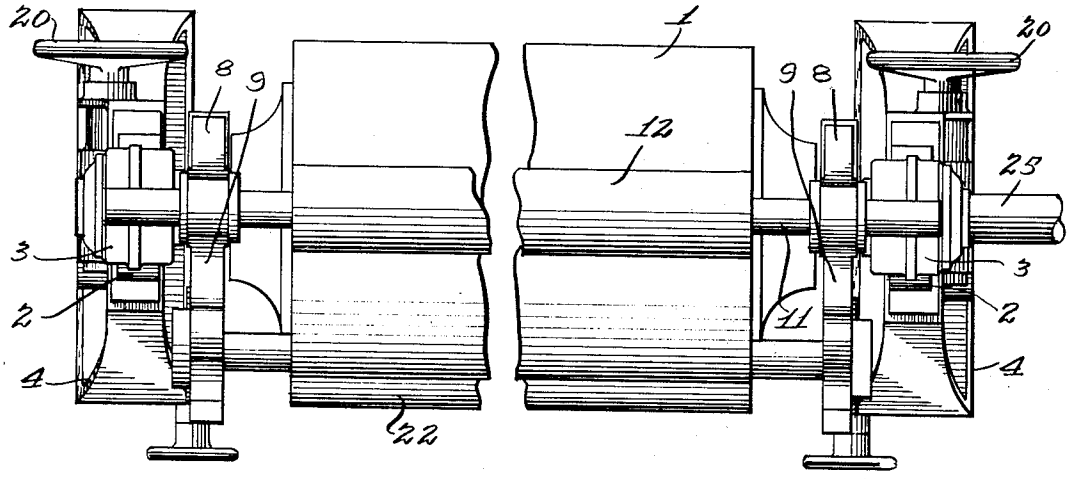


Fig. 4.



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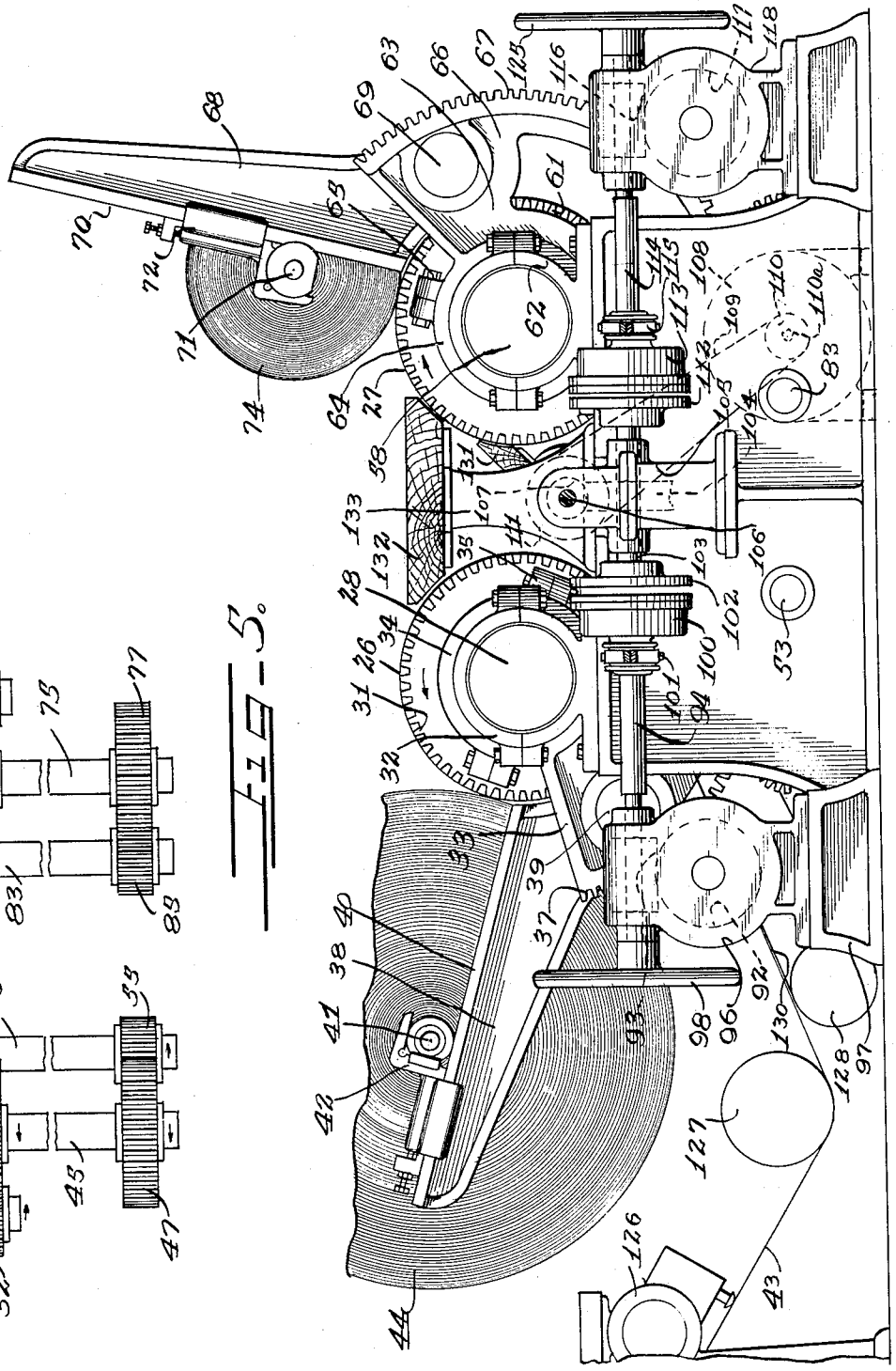


Fig. 5.

Fig. 7.

Fig. 8.

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March 6, 1934. E. E. BERRY 1,950,159

PAPER WINDER

Filed April 6, 1931 6 Sheets-Sheet 4

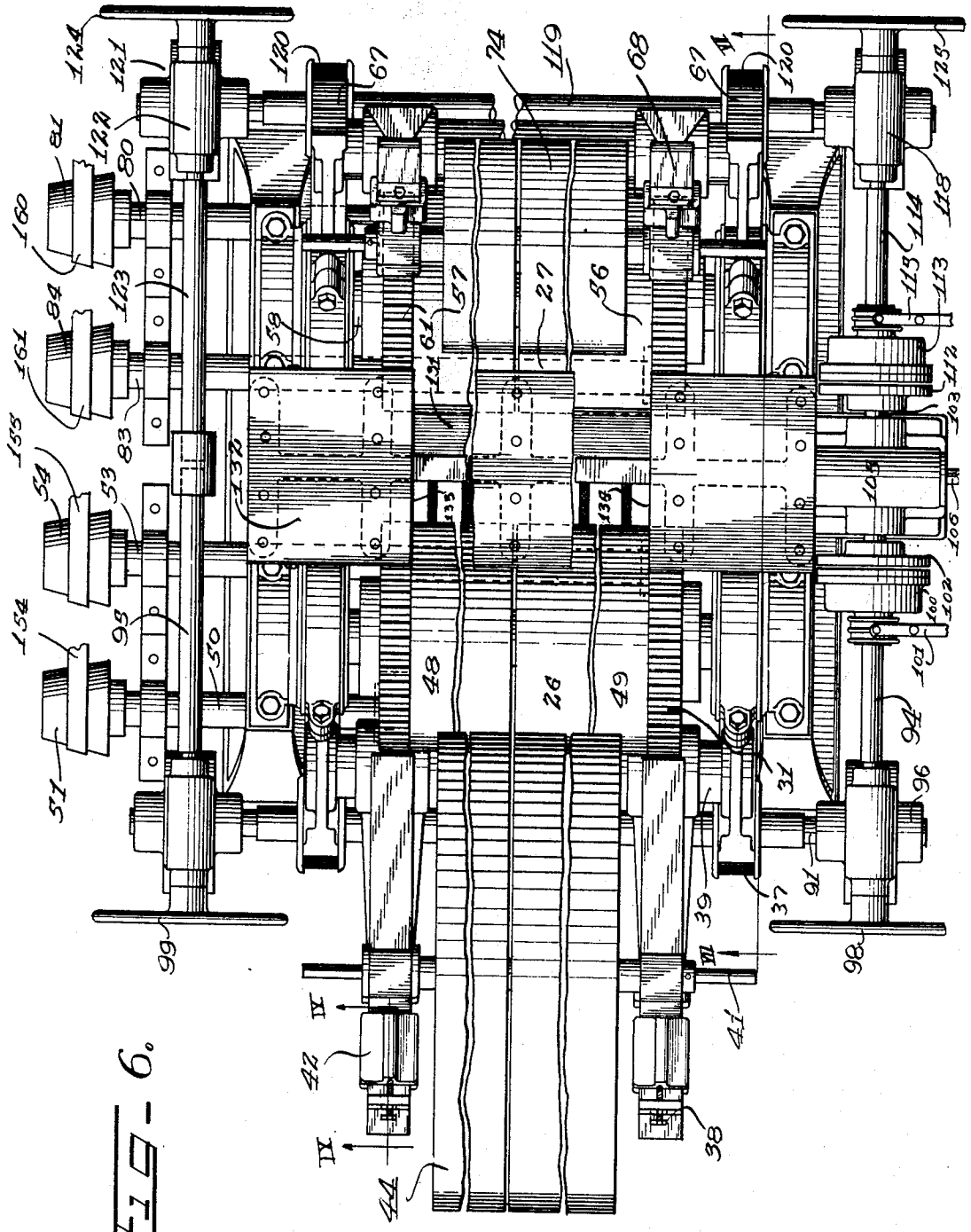


FIG. 6.

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PAPER WINDER

Filed April 6, 1931 6 Sheets-Sheet 5

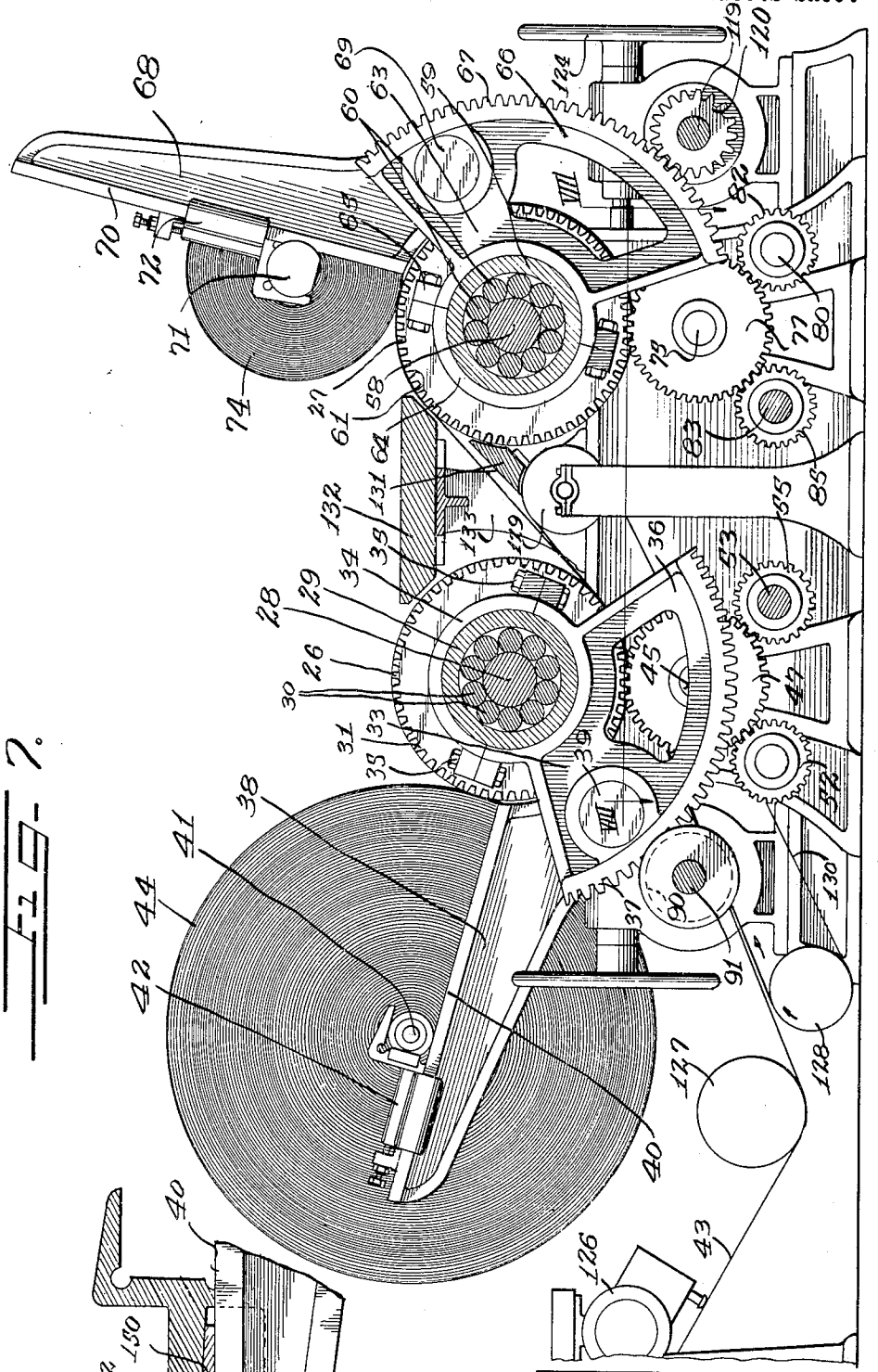


Fig. 7.

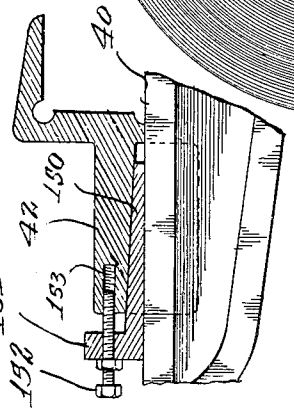


Fig. 9.

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PAPER WINDER

Filed April 6, 1931 6 Sheets-Sheet 6

Fig. 10.

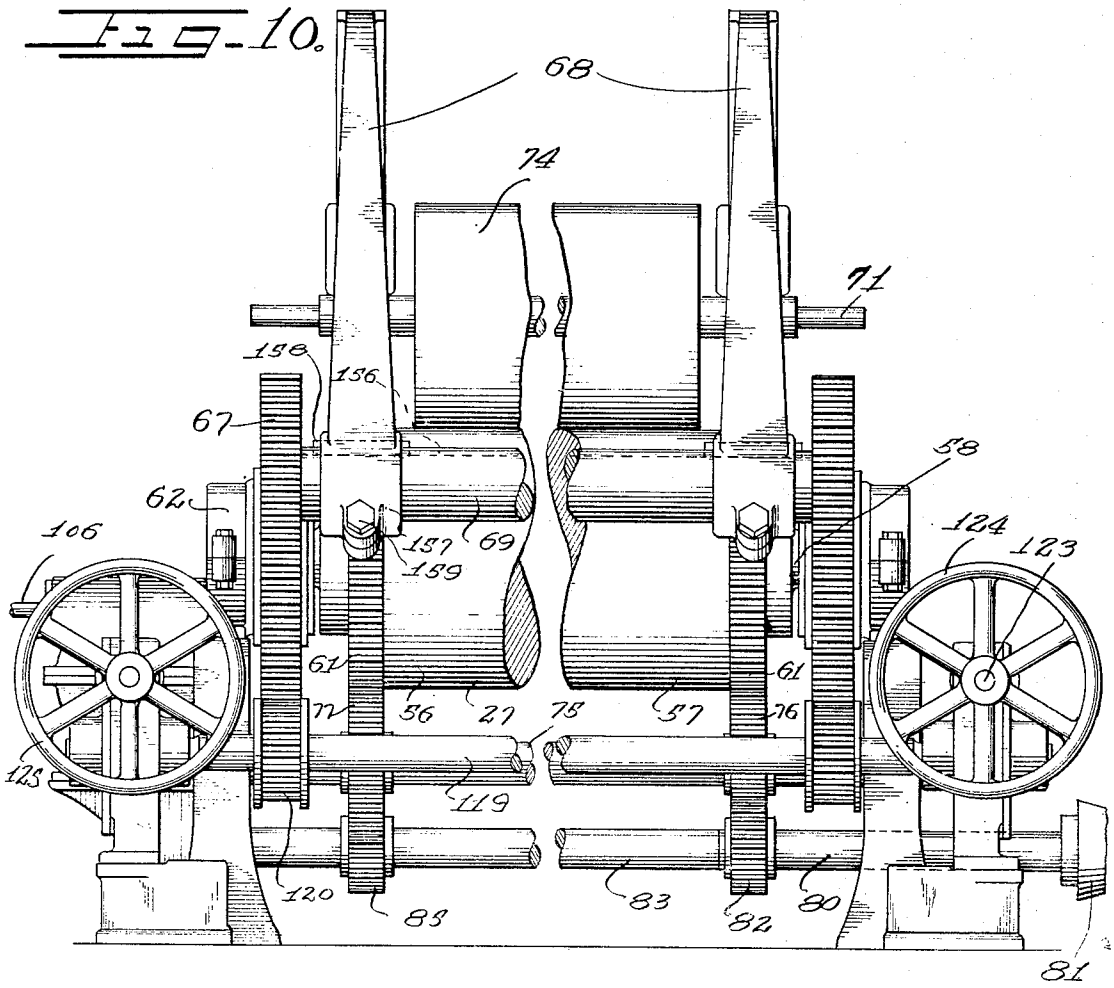


Fig. 11.

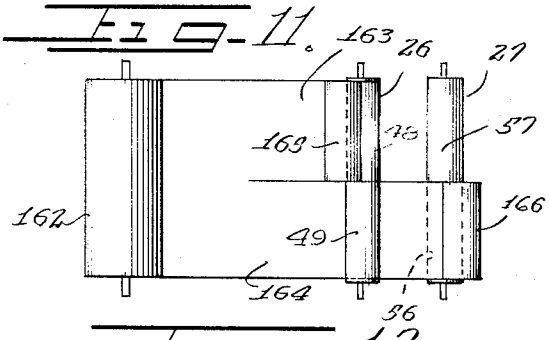


Fig. 13.

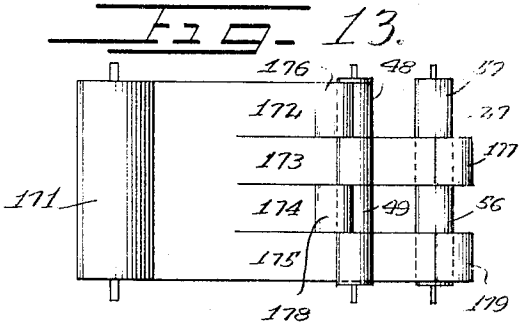
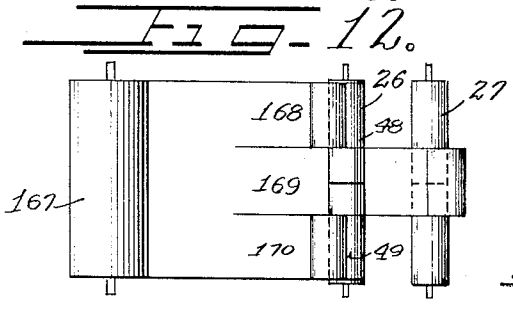


Fig. 12.



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Patented Mar. 6, 1934

1,950,159

UNITED STATES PATENT OFFICE

1,950,159

PAPER WINDER

Earl E. Berry, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

Application April 6, 1931, Serial No. 527,883

21 Claims. (Cl. 242—65)

This invention relates to a paper winding apparatus, commonly referred to as a paper "rewinder".

It has been common practice heretofore to rewind paper produced on the paper machine by winding the paper on a winder shaft that is revolved by surface contact through the paper with one or two driven under drums. One disadvantage of this type of rewinder is that, as the size and weight of the roll of wound paper increase, the paper becomes increasingly more tightly wound. This is frequently objectionable from the consumer's stand-point since the paper from such rolls will not dispense uniformly when subjected to a uniform tension.

A further problem in the winding of paper that has been accentuated by the use of high speed, very wide paper machines is that of winding rolls on the rewinder of uniform hardness across the width of the machine. As paper is produced on the paper machine, there is always a slight variance in the thickness of the paper web across the sheet and frequently on the very wide paper machines there is actually a slight difference in length of the web at different portions across its width. These variations may be due to slight variations in the contours of the press rolls and calender rolls. For instance, if the calender rolls are pinching the sheet harder in the center for a narrow width than at either edge, this would result in the sheet being slightly longer in the center than at the edges. More often, there is a tendency for the press rolls and calender rolls to press slightly harder at the edges than at the central portion of the sheet and thus cause the web to be actually longer at the edges than at the central portion. That this is the case is frequently indicated by the floppy edges noticed on a web of paper as it passes from the calender stack to the reel.

Rewinders have heretofore been built employing a single winding drum, or a set of twin winding drums or, more recently, two sets of twin winding drums. With the latter type of rewinder, employing two sets of twin winding drums, it is only possible to secure different tensions in two different webs, as the paper is wound between each set of two drums and the drums are of continuous construction the full width of the machine. If the unwinding roll is slit into two webs, then with the four drum winder it is possible to secure a different tension in each web by winding one web on one set of two drums while the other web is being wound on the other set of two drums. If the unwinding roll is being slit into three webs, then two of the webs can be wound on one set of two drums, while the third web is wound on the other set of two drums. In any case, it is possible to vary the tension only as between two sections of the slit web and if there are more than two sections, then at least two of the webs are being wound with the same tension.

The present invention provides a rewinder having sectional winding drums and a variable speed application to each section, whereby it is possible to secure a different tension in two, three or four webs slit from the unwinding roll. This provision not only compensates for variations in the length of the web at points along its width, but also permits the use of shorter winding shafts. The present one-piece shaft now in use is very heavy to handle and furthermore, because of its necessarily long length and relatively small diameter, deflects easily and becomes bent, and at high speeds has a tendency to cause the roll to jump. In the case of my present invention, the winding shaft never need be more than a few inches longer than the individual web, or split web section, being wound. Consequently, where heretofore on four widths news machines, the present winding shafts are approximately 320 inches long, with the winder of my invention, each winding shaft need be only approximately 85 inches long.

There is also the further advantage in using separate winder shafts for winding the individual slit web sections, as in my invention, that there is no tendency for the ends of the slitted rolls to run together. This tendency is quite apparent in the winding of paper on a single drum or on a pair of winding drums, but is entirely eliminated in a rewinder having sectional winding drums, since the ends of the winding rolls are separated by a relatively considerable distance due to their being wound on separate drums or separate drum sections.

Another advantage of employing a plurality of sectional winding drums, as in my present invention, is that when a bad place occurs in the paper being wound, it frequently is necessary only to cut out a section of one of the individual slit webs instead of having to cut out a section the full width of the unwinding web. With the particular type of rewinder of my invention, this is possible because each winder drum section has its own independent tension and it makes no difference if there is a variation in the relative diameters of the various rolls being wound. Consequently, a considerable saving in paper may thus be effected.

In general it is desirable in winding paper to

have the paper at the start wound quite hard in order to prevent what is known as a soft center in the finished roll and also to prevent difficulties arising from the paper slipping on the core at the time of unwinding in the printing presses or converting machine. Furthermore, it is preferable that the outer layers of the wound roll of paper be relatively soft wound in order to prevent rolls from cracking or corrugating in case the paper is a little over dried and takes up moisture from the atmosphere, thereby causing the roll to expand.

It is therefore an object of this invention to provide a paper rewinder having means for varying the relative position of the roll being wound circumferentially of the under contact drum to regulate the hardness of the roll during the progressive winding thereof.

It is a further important object of this invention to provide in a paper rewinder means for simultaneously winding the paper into separate rolls under independently variable tension produced by varying the relative positions of the rolls circumferentially of the under drums and also by varying the speed of the individual drum sections.

It is a further important object of this invention to provide a paper rewinder having two independently driven under drums, each comprising two independently driven, coaxial drum sections, and rotatable, transversely adjustable guiding arms for progressively guiding the winder shafts associated with the under drums into different positions relative thereto to enable the hardness of the wound rolls to be regulated.

It is a further important object of this invention to provide a rewinder having a plurailty of sectional winder drums with means for driving each of said drum sections at a variable speed in order to compensate for inequalities in the length of the paper web at various points along its width.

It is a further important object of this invention to provide a rewinder having a plurality of sectional under drums each capable of being driven independently of the other at a variable speed, and means for supporting and guiding the ends of individual winder shafts for cooperation with one or more of the drum sections, whereby the slit web sections may be independently wound upon the individual winder shafts under the proper tension, irrespective of variations in the length of the web across its width.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is an end elevational view of a simple form of apparatus embodying my invention.

Figure 2 is a similar end view of the apparatus in discharging position.

Figure 3 is a broken front elevational view of the same.

Figure 4 is a broken top plan view of the same.

Figure 5 is an end elevational view of a modified form of my invention.

Figure 6 is a broken top plan view of the apparatus shown in Figure 5.

Figure 7 is a sectional view taken substantially on line VII—VII of Figure 6.

Figure 8 is a broken top plan view of the driving mechanism taken along line VIII—VIII of Figure 7.

Figure 9 is an enlarged sectional view taken substantially on line IX—IX of Figure 6.

Figure 10 is a broken end elevational view of the rewinder.

Figures 11, 12 and 13 are diagrammatic views indicating different arrangements for winding a paper web where the unwinding web is slit into two, three and four sections, respectively.

As shown on the drawings:

In Figures 1 to 4 inclusive, the reference numeral 1 indicates an under or contact drum journaled at its ends in bearings 3 supported in bearing brackets 2 upon bases 4. At its rear end, the shaft of the under drum 1 is continued as at 25 (Figures 3 and 4) for connection with a suitable source of power (not shown). A guiding member 5 is loosely mounted upon the shaft of the under drum 1 between each end thereof and the corresponding bearings 3.

Each of said guiding members 5 is provided with a cooperating yoke 6 (Figures 1 and 2) for receiving the shaft of the under drum and a segment gear 7, preferably integrally formed therewith. Each of said guiding members 5 is likewise formed with radially extending spaced arms 8 and 9, one of the arms, such as 9, being longer than the other. Said arms 8 and 9 provide guideways 10 for receiving the ends of a winder shaft 11, upon which a roll of paper 12 (Figure 2) may be wound by surface contact through the paper with the traveling surface of the under drum 1. As the diameter of the roll 12 increases, the winder shaft 11 moves radially farther from the surface of the under drum 1.

Each of the segment gears 7 meshes with a pinion gear 13 (Figure 3) keyed or otherwise secured to a transverse shaft 14. Said shaft 14 is mounted in the base support 4 with one of its ends extending therethrough as at 15. Said extended end 15 (Figures 1 and 2) carries a worm wheel 16 secured thereto and incased within a housing 17. Said worm wheel 16 is adapted to be driven by means of a worm 18 on a shaft 19. Said shaft 19 can be rotated by means of a hand wheel 20, whereby the pinion gears 13 operate through the intermeshing segment gears 7 to rotate the guiding members 5 about the axis of the under drum 1.

A paper web 21 is passed around a tensioning roll 22 before coming in contact with the surface of the under drum 1 and being wound upon the winder shaft 11. In starting the rewinding operation, the end of the paper is secured to one or more cores placed upon the winder shaft 11 and said shaft and cores are then revolved by rotation of the under drum 1 through surface contact with the paper web. As the roll of paper 12 increases in diameter and consequently in weight, the surface friction between the paper and the under drum 1 increases, so that if the guiding arms 8 and 9 were allowed to remain in vertical position, as in Figure 1, the roll of paper would be increasingly more tightly wound. In accordance with the principles of this invention, means such as above described are provided for rotating the guiding members 5 progressively as the size of the wound roll 12 increases so as to diminish the proportional radial component of weight to the total weight of the wound roll 12 acting upon the under drum 1. The hand wheel 20 is accordingly rotated from time to time to move the winder shaft 11 from the top of the under drum 1 over into substantially horizontal position of the

guide arms 8 and 9, as shown in Figure 2. In this position there is substantially no radial component of weight acting upon the under drum 1 and the roll 12 is ready to be discharged over the longer guide arms 9 onto a receiving platform 23.

It will be understood that the progressive rotation of the guide arms 8 and 9 from vertical to horizontal position can be accomplished by power driven means instead of by hand and that the rotatory movement can be effected either from time to time during the winding operation or may be gradually and continuously accomplished by power means. The advantage of the construction of rewinder shown is that the hardness of the wound roll of paper may be regulated as desired, by varying the position of the guide arms 8 and 9 and accordingly the proportional radial weight component of the total weight of the roll.

In Figures 5 to 10 inclusive, there is shown a more complicated type of rewinder having a pair of under drums 26 and 27 instead of a single under drum. Each of said under drums 26 and 27 comprises two drum sections mounted for separate rotation on the same shaft. For instance, the under drum 26 consists of two drum sections 48 and 49 of equal length rotatably mounted upon a common, stationary shaft 28. For this purpose, the ends of the drum sections are drawn out to form hollow trunnions 29 (Figure 7) mounted for rotation about the shaft 28 on anti-friction bearings 30. Each of the drum sections of the under drum 26 is provided at its outer end with a gear 31. On the extended trunnions 29 between said gears 31 and bearings 32 for said trunnions, guiding members 33 are loosely mounted for rotation.

Each of said guiding members 33 comprises a split hub 34 adapted to be loosely clamped upon the trunnions 29 by means of bolts 35 and an integrally formed sector plate 36 provided with a segment gear 37. A guiding arm 38 is mounted from each of the sector shaped plates 36 upon a cross shaft 39 that extends between the pair of members 33.

Each of said guiding arms 38 is provided with a guiding surface 40 that extends substantially radially from the axis of the under drum 26. The ends of a winder shaft 41 are releasably held in flanged blocks 42 slidably mounted upon said guiding surfaces 40 with their flanges engaging the edges of said guiding arms 38.

Each of the slide blocks 42 (Figure 9) is provided with means for varying the friction between the blocks and the guiding surfaces of the arms 38. As shown, this means for varying the friction comprises a wedge shaped shoe 150 positioned between the body of the slide block 42 and the surface 40 of the guide arms. Said shoe 150 is provided with a flange 151 at its extended end, through which is threaded a bolt 152 that extends into a threaded bore 153 in the end of said block. By tightening up or loosening the bolt 152, it is obvious that the frictional pressure between the shoe 150 and the guiding surface 40 may be varied.

As will later be explained in greater detail, a web of paper, after being slit, is wound upon the shaft 41 to form a roll 44.

The drive for the under drum 26 will be more clearly apparent from Figures 6 and 8. A transverse shaft 45, extending parallel to and below the under drum 26 is suitably secured in the frame of the apparatus. On said shaft 45 are loosely mounted a pair of pinion gears 46 and 47 at the rear and front sides, respectively, of the machine. The pinion gear 46 meshes with a gear 31 on the rear drum section 48 of the under drum 26. The pinion gear 47 similarly meshes with a similar gear 31 on the front drum section 49 of the under drum 26 (Fig. 7). A drive shaft 50 extends through the rear frame of the machine and is provided on its outer end with a tapered pulley 51 and on its inner end with a pinion gear 52, or otherwise secured to the shaft 50. Power is applied through a belt 154 to the tapered pulley 51 to drive the shaft 50 and pinion gear 52, which latter gear meshes with the pinion gear 46 loosely mounted upon the shaft 45. The pinion gear 46, in turn, meshes with the gear 31 on the rear drum section 48 to effect its rotation.

A full length shaft 53 extends transversely of the rewinder and is suitably mounted for rotation in the frame walls thereof. A second tapered pulley 54 is rigidly mounted on the rear extended end of the shaft 53 for connection with a suitable source of power, as by means of a belt 155.

On the inner end of the shaft 53 just within the front side wall of the frame is keyed or otherwise secured a pinion gear 55 for meshing with the pinion gear 47. The train of gears 55 and 47 and front gear 31 accordingly serves to drive the front drum section 49.

The construction above described with reference to the sectional under drum 26 and its driving connections is substantially duplicated with respect to the other sectional winder drum 27. Said under drum 27 is similarly divided into a front drum section 56 and a rear drum section 57 (Figure 6) each rotatably mounted upon a stationary shaft 58 by means of hollow trunnions 59 and anti-friction bearings 60. Gears 61 are formed on the outer ends of the respective drum sections 56 and 57. The ends of the shaft 58 are stationarily held in split bearing clamps 62 (Fig. 5), between which and the respective outer ends of the drum sections 56 and 57 are mounted guide members 63. Each of said guide members 63 is provided with a split hub 64 adapted to be loosely clamped by means of bolts 65 about a hollow trunnion 59.

Each of the guide members 63 comprises a sector shaped plate 66 carrying a segment gear 67. A guide arm 68 is mounted from each of the sector shaped plates 66 upon a cross shaft 69 that extends between the said guide members 63. Said shaft 69 is provided with a key way 156 (Fig. 10) extending its full length and the hubs 157 of the arms 68 carry keys 158 that fit within said keyway. Said hubs 157 are split and provided with bolts 159, which may be loosened to permit the arms to be adjusted to any desired position along the shaft 69.

Each of said guide arms 68 is provided with a guiding surface 70 that extends substantially radially from the axis of the shaft 58. A winder shaft 71 is releasably held by means of a clamp member 72 at each of its ends, said clamp members 72 being freely slidable upon the guiding surfaces 70. As will later be explained in greater detail, the web of paper 43 or a slit section thereof is wound up upon the shaft 71 to form a roll 74.

The mechanism for driving the under drum 27 comprises a transverse shaft 75 on which are loosely mounted pinion gears 76 and 77, (best shown in Figure 8) at the rear and front ends thereof, respectively, and inside the respective walls of the supporting frame. The pinion gear 76 meshes with a smaller pinion gear 82 secured upon a stub shaft 80 that is driven through a belt

160 and tapered pulley 81 from a suitable source of power. The pinion gear 77 is driven through a smaller pinion gear 85 secured on a full length transversely extending shaft 83. Said shaft 83 is driven through a belt 161 and tapered pulley 84 from a suitable source of power.

The rear drum section 57 of the under drum 27 is thus driven through the train of gears, best shown in Figure 8, including the pinion gears 82 and 76 and the rear gear 61. The front drum section 56 of the under drum 27 is driven through the train of gears including the pinion gears 85 and 77 and the forward gear 61.

Each of the segment gears 37 at the respective ends of the under drum 26 meshes with a pinion gear 90 (Figure 7) mounted upon a transversely extending shaft 91. Said shaft 91 is provided at each of its ends with a worm gear 92 (Figure 5). One worm gear 92 meshes with a worm 93 formed upon a longitudinally extending shaft 94 on the front side of the rewinder and the other worm gear 92 meshes in a similar manner with a worm on a shaft 95 at the rear side of the rewinder. Said worm wheels 92 and worm gears 93 are enclosed within casings 96 supported from bases 97 forming a part of the main rewinder frame. The shafts 94 and 95 are provided with hand wheels 98 and 99, respectively.

The shaft 94 is provided with a clutch member 100 that can be moved by means of a hand lever 101 into engagement with another clutch member 102 mounted upon a shaft 103. Said shaft 103 carries a worm wheel 104 (Figure 5) housed within a casing 105. A driven shaft 106 extends at right angles to the shaft 103 and carries a worm 107 for meshing with said worm wheel 104. The worm shaft 106 may be driven from any suitable source of power, such as a motor 108 (Figure 5) by means of a belt or chain 109 passing around pulleys 110 and 111 on the motor drive shaft 110A and shaft 106, respectively.

The shaft 103 extends through the other side of the casing 105 and carries on its end a clutch member 112. Said clutch member 112 is adapted to cooperate with another clutch member 113 carried by a shaft 114 upon operation of a clutch lever 115 (Figure 6). Said shaft 114 is adapted to transmit a drive through a worm 116 and worm wheel 117, both incased within a housing 118, to a transversely extending full length shaft 119 (Figure 7). Said shaft 119 carries pinion gears 120 for meshing with the segment gears 67 at the front and rear sides of the rewinder. The rear end of the shaft 119 carries a worm wheel at 121 that meshes with a worm at 122 formed on a longitudinally extending shaft 123. Said shafts 123 and 95 extend longitudinally along the rear side of the machine and are provided with hand wheels 124 and 99, respectively, to enable the operator to rotate the guiding arms 63 and 33, respectively, by hand from the rear of the machine.

Hand wheels 125 and 98 are similarly provided on the front side of the machine for the same purpose, or if desired, movement of the guide members 63 and 33 may be power operated from the motor 108 by manipulation of the clutch levers 115 and 101. Obviously, each pair of guide members 63 and 33 may be separately operated through the manipulation of the various hand wheels or through the separate clutches described.

The web of paper 43, as it comes from a large reel of paper or jumbo roll, passes under slitters, indicated generally at 126 (Figure 5), and thence under an idler roll 127. A conveying mechanism is provided for guiding the slit sections of the paper web 43 into operative relation with either of the under drums 26 or 27. Said conveying mechanism comprises a lower roll or series of wheels 128 and an upper roll or series of wheels 129 (Figure 7) around which are trained a plurality of tapes 130. Said tapes 130 on the upper side travel upwardly into contact with the lower surface of the under drum 26, so that when the web 43 is deposited on the upper run of tapes 130, it is carried by them into contact with the under side of the under drum 26. If the paper is to be wound up by contact with the under drum 26, the web, or one or more of the slit sections of the paper web 43 is brought around said under drum 26 and secured to the winder shaft 41.

If, however, the paper web, or one or more of the slit sections, is to be wound up upon the winder shaft 71 by surface contact with the under drum 27, the web or slit section is brought over into contact with the under drum 27 and secured to the winder shaft 71. A stationary guide board 131 bridges the space between the upper roll or series of wheels 129 and the under drum 27. A transversely extending foot board 132, supported at its ends by means of standards 133, enables the operator to thread the paper web 43 as desired. To facilitate the manipulation of the paper web 43, the foot board 132 is cut away at intervals, as at 134 and 135 (Figure 6) so that the operator may reach down and thread the paper web 43 conveniently.

If the winder drums 26 and 27 are to be used merely as two separate winding units, without taking advantage of the sectional and variable speed drive features of my invention, the paper web 43 may be started upon the winder shaft 71 with the guide arms 68 in a substantially vertical position as shown in Figures 5 and 7. The fully wound roll 44 on the winder shaft 41 is then supported on the guide arms 38 in substantially horizontal poistion, ready for removal. As the paper continues to wind upon the winder shaft 71, the guide arms 68 may be moved into more nearly horizontal position, either by means of the hand wheels 125 or 124, or by manipulation of the clutch lever 115, the guide members 63 may be power driven. Preferably, the guide members 63 are progressively rotated to bring the guide arms 68 into substantially horizontal position through the power driven train of gears from the drive shaft 106. This gear train (Figure 5) includes the worm 107, worm wheel 104, clutch members 112 and 113, worm 116 and worm wheel 117, and pinion gears 120 (Figure 6) meshing with the segment gears 67.

The relative poistion of the roll 74 being wound with respect to its position on the circumference of the under drum 27 can thus be varied at will to regulate the degree of hardness of the wound roll, all as previously explained. In this way, it is possible to avoid alternately hard and soft winding of the roll, and rolls of uniform hardness can be produced.

It will, of course, be understood that while roll 74 is being wound to the desired full size, the roll 44 is removed and a fresh winder shaft 41 replaced in operative position in the guide arms 38, so that as soon as the roll 74 is fully wound, the web 43 can be severed and started around the empty winder shaft 41. In starting up on the winder shaft 41, the guide arms 38 will be in vertical, or substantially vertical position and are

thereafter moved toward the horizontal position shown in Figure 5.

Instead, however, of winding the entire slit web of paper upon a single winder shaft by contact with but one of the under drums 26 and 27 at a time, it is preferable in the case of very wide webs of paper to wind the individual slit sections of the web simultaneously upon both under drums 26 and 27, or particular sections thereof. The preferred manner of winding the paper web is illustrated in Figures 11, to 13 inclusive, wherein the unwinding web is slit into, two, three or four web sections. By this means, the optimum tension can be applied to each individual slit web of paper as it is being wound.

In Figure 11, there is shown a parent roll of paper 162 that is slit into two web sections 163 and 164, respectively. The slit web section 163 is wound into a roll 165 by surface contact with the section 48 of the drum 26, while the slit web section 164 is wound into a roll 166 by surface contact with section 56 of the drum 27. Obviously, this arrangement can be reversed and the web sections 163 wound upon the drum section 57, while the web section 164 is being wound on the drum section 49. In either case, the web sections 163 and 164 may be subjected to independent tension during the entire winding operation and in this way, the quality of the wound rolls of paper may be greatly improved over what was heretofore possible when winding the entire web after being slit upon a single winding drum or a pair of winding drums.

Furthermore, it should be noted that in the winding arrangement illustrated in Figure 11, the individual wound rolls 165 and 166 do not require full length winder shafts, since the adjustably mounted guide arms 38 and 68 may be moved along the corresponding cross shafts 39 and 69 to accommodate winding shafts that need be only slightly more than one-half of full length. The shorter winder shafts are not only much lighter and therefore easier to handle, but they are less likely to be deflected or become bent, since they are less flexible because of their shorter length.

Furthermore, the winding of the web sections upon separate winding shafts rather than in side by side relation upon a common winding shaft eliminates entirely the difficulty that is often experienced in separating rolls of paper wound upon a common shaft. The result is that there is never any use for winding rolls with ends that are not entirely smooth and uniform.

Figure 12 illustrates a preferred winding arrangement where the unwinding web is being slit into three sections. In this case, the unwinding web from a parent roll 167 is slit into sections 168, 169 and 170. Web sections 168 and 170 are wound by surface contact with the drum sections 48 and 49, respectively, while web section 169 is carried under the winding drum 26 to be wound in contact with the winding drum 27 and both sections of that drum operated as a unit. By this arrangement, the web sections 168, 169 and 170 may all be individually tensioned to satisfy their individual requirements. This is very advantageous, since it frequently happens that the edge portions of the unwinding web are slightly longer than the central portion. Furthermore, it quite frequently happens that whatever bad places may occur in the unwinding web are localized either in one of the two edge portions, 168 or 170, or else in the central portion 169, and where this is the case, the bad portions may be cut out without severing the entire unwinding web and therefore with a consequent saving in paper.

Figure 13 illustrates a winding arrangement when the unwinding web is to be severed into four web sections. In this case, a web from a parent roll 171 is slit into four web sections, 172, 173, 174 and 175. Alternate web sections, such as sections 172 and 174 are wound by surface contact with the drum sections 48 and 49, respectively, of the under drum 26, while the other sections, sections 173 and 175, are wound by surface contact with the drum sections 57 and 56 of the other under drum 27. Entirely separate wound rolls 176 to 179, inclusive, are thus formed from the web sections 172 to 175, respectively.

It will be understood that in the winding arrangement illustrated in Figures 12 and 13, additional guide arms will be mounted upon the cross shafts 39 and 69 in order that each separate web section may be wound upon a short length winding shaft and each winding shaft may be supported at its ends in a pair of guide arms.

In all of the various winding arrangements, the tensioning of the separate webs of paper during the winding operation may be effected individually either by adjusting the belt on the respective pulleys to vary the speed of the proper drum section, or by varying the position of the particular winding shaft circumferentially of the contacting drum section, or by adjusting the frictional pressure between the slide blocks and the guide arms. Any or all of these various tensioning means may be employed to insure the proper character and quality of the rolls being wound. The divided draw provided by my construction is particularly helpful in wide machines in preventing the ends of the wound roll from being soft wound.

It will be appreciated that in very wide machines, often as wide as 20 feet, there is an appreciable torsional stress set up in a full width winder drum and an appreciable sagging at the center of the drum. By employing drum sections on a stationary full length shaft, as in my invention, this stress and sagging is greatly minimized, with the result that more uniform rolls of paper can be produced.

Likewise, the provision of sectional winder drums facilitates the separation of the rolls wound on a single winder shaft, since there is less tendency for the web after being slit to weave from one roll into the other on the same winder shaft across the slit.

While I have described my invention in connection with the rewinding of paper from large size rolls, it will be understood that the principles of my invention are applicable to the winding of any web material.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. In a paper winding apparatus, an under drum, a winding shaft for receiving paper to be wound thereon into a roll by contact with the under drum, arms pivotally mounted about the axis of said under drum and providing guides for the ends of said winding shaft, power operated means for swinging said arms to move said winding shaft and roll of paper thereon over the sur-

face of said under drum and thereby maintain the component of the gravity pressure exerted by said roll of paper against said under drum substantially independent of the weight of the roll and means for driving said under drum.

2. In a paper rewinder, a single driven under drum, members having guiding arms pivotally mounted upon the journals of said drum, a winding shaft having ends slidably cooperating with said guiding arms, said winding shaft cooperating with the said under drum to receive and wind the paper into a roll, sector gears carried by said members and driven gears meshing with said sector gears to revolve said arms from vertical to horizontal position and thereby diminish the radial component of the total weight of the roll as such weight increases until the roll is finally discharged.

3. In a paper winding apparatus, a pair of spaced parallel under drums, means for independently driving said under drums, a pair of guiding members rotatably mounted upon the ends of the respective under drums, a winder shaft for association with each of said under drums and having its ends slidably held by one of said pairs of guiding members and power operated means for independently rotating said pairs of guiding members to vary the positions of said winder shafts circumferentially of said under drums to compensate for the increasing weight of paper wound upon said winder shafts.

4. In a paper winding apparatus, a pair of spaced parallel under drums, means for independently driving said under drums, a pair of guiding members rotatably mounted upon the ends of the respective under drums, a winder shaft for association with each of said under drums and having its ends slidably held by one of said pairs of guiding members, traveling endless members guiding a paper web into contact with one of said under drums to be wound upon a winder shaft and means for independently rotating said pairs of guiding members to vary the positions of said winder shafts circumferentially of said under drums to compensate for the increasing weight of paper wound upon said winder shafts.

5. In a paper winding apparatus, independently driven under drums, winder shafts upon which the paper is wound by surface contact with said under drums, pivotally mounted guiding means for said winder shafts to permit radial movement thereof as the rolls of paper increase in size and power means independently connected to said guiding means to rotate the same slowly during the winding operation.

6. In a paper winding apparatus, independently driven under drums, winder shafts upon which the paper is wound by surface contact with said under drums, means including endless tapes for guiding a paper web into operative winding relation with said under drums and winder shafts, pivotally mounted guiding means for said winder shafts to permit radial movement thereof as the rolls of paper increase in size and power means independently connected to said guiding means to rotate the same slowly during the winding operation.

7. In a paper winding apparatus, independently driven under drums, winder shafts upon which the paper is wound by surface contact with said under drums, sector gear members freely mounted for rotation on the ends of said under drums, guiding arms carried by said sector gear members, holders for the ends of said winder shafts slidably mounted on said guiding arms and power driven gears meshing with said sector gears to rotate said guiding arms to vary the positions of said winder shafts and rolls of paper wound thereon circumferentially of said under drums.

8. In a paper winding apparatus, independently driven under drums, winder shafts upon which the paper is wound by surface contact with said under drums, sector gear members freely mounted for rotation on the ends of said under drums, guiding arms carried by said sector gear members, holders for the ends of said winder shafts slidably mounted on said guiding arms, pinion gears meshing with said sector gears and clutch operated driving means for said pinion gears to rotate said guiding arms to vary the positions of said winder shafts and rolls of paper wound thereon circumferentially of said under drums.

9. In a paper winding apparatus, a pair of spaced parallel under drums, each of said drums consisting of coaxial drum sections, means for independently driving each of said drum sections, a winder shaft associated with each of said under drums for receiving and winding a paper web and means for guiding said winder shafts during the winding of paper thereon.

10. In a paper winding apparatus, a pair of spaced parallel under drums, each of said drums consisting of coaxial drum sections, means for independently driving each of said drum sections, a winder shaft associated with each of said under drums for receiving and winding a paper web, sector gear members rotatably mounted on the ends of said under drums, guide arms carried by said sector gear members, means slidably mounted on said guide arms for engaging the ends of said winder shafts and means including gears meshing with said sector gears for rotating said guide arms to vary the positions of said winder shafts circumferentially of said under drums.

11. In a paper rewinder, a pair of independently driven under drums, a winder shaft for receiving and winding paper thereon by surface contact with either one of said under drums, means pivotally mounted about the axis of said under drums including radially extending arms for slidably guiding the ends of said winder shafts, clutch connected power means for driving said pivotally mounted means and hand operated means for actuating said pivotally mounted means when said clutch connected power means are thrown out.

12. In a paper rewinder, a pair of independently driven under drums, means for guiding a paper web into contact with one of said drums, a winder shaft associated with each of said under drums for successively receiving and winding a paper web, guiding arms for initially holding a winder shaft in operative receiving position on top of one of said under drums and power driven means for progressively moving said guiding arms to lower said winder shaft into discharging position during continued winding of the paper web on said winder shaft.

13. In a paper rewinder, a pair of independently driven under drums, means for guiding a paper web into contact with one of said drums, a winder shaft associated with each of said under drums for successively receiving and winding a paper web, guiding arms for initially holding a winder shaft in operative receiving position on top of one of said under drums, power driven means for progressively moving said guiding arms to lower said winder shaft into discharging position during continued winding of the paper web on said

winder shaft and similar independently operable power driven means and guiding arms for changing the position of the other winder shaft with respect to the periphery of the other under drum.

14. In a paper rewinder, two under drums rotatably mounted in spaced parallel relation, means for driving said drums independently, means for feeding a web of paper to either of said under drums, a winder shaft in operative position for receiving and winding said web of paper by surface contact with a cooperating under drum and means for guiding said winder shaft circumferentially of said cooperating under drum during continued winding to diminish the radial component of the total weight of the roll as the diameter and weight of the wound roll of paper increases.

15. In a paper rewinder, two independently driven under drums, winder shafts on which a paper web is received and wound by surface contact with a revolving under drum, guiding members for said shafts rotatably mounted on the ends of said under drums and independent driving means clutch-connected to said guiding members, the driving means associated with the one of said under drums with which a winder shaft is cooperating being capable of moving the corresponding guiding arms from substantially vertical position to substantially horizontal position during the winding operation to diminish the proportional value of the radial component of weight to the total weight of the wound roll of paper and thereby prevent the roll from being increasingly hard wound as its weight increases.

16. In a paper rewinder, two under drums each consisting of independently driven coaxial drum sections, winder shafts on which a paper web is received and wound by surface contact with a revolving under drum, guiding members for said shafts rotatably mounted on the ends of said under drums and independent driving means clutch-connected to said guiding members, the driving means associated with the one of said under drums with which a winder shaft is cooperating being capable of moving the corresponding guiding arms from substantially vertical position to substantially horizontal position during the winding operation to diminish the proportional value of the radial component of weight to the total weight of the wound roll of paper and thereby prevent the roll from being increasingly hard wound as its weight increases.

17. In a paper rewinder, a plurality of single under drums each comprising coaxial sections and means for separately driving said drum sections.

18. In a paper rewinder, a plurality of single under drums each comprising coaxial sections, means for separately driving said drum sections, winder shafts for cooperation with said drum sections and means for supporting and guiding said winder shafts.

19. In a paper rewinder, a plurality of sectional under drums, means for variably driving each drum section independently of another and means associated with said drum sections for winding a web of paper into rolls by contact therewith.

20. In a paper rewinder, a plurality of sectional under drums, means for variably driving each drum section independently of another, means associated with said drum sections for winding a web of paper into rolls by contact therewith and means for varying the pressure between the winding rolls and the cooperating drum section.

21. In a rewinder for winding paper from a parent roll into a plurality of wound rolls, sectional winder drums for simultaneous cooperation with different sections of the unwinding paper web, separate winder shafts for receiving separate web sections and winding the same into individual wound rolls by surface contact with said drum sections and a variable speed driving means connected to each of said drum sections.

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