Oct. 25, 1949. E. W. CLEM 2,486,006

APPARATUS FOR UNWINDING AND WINDING WEB MATERIAL

Filed May 31, 1945 3 Sheets-Sheet 1

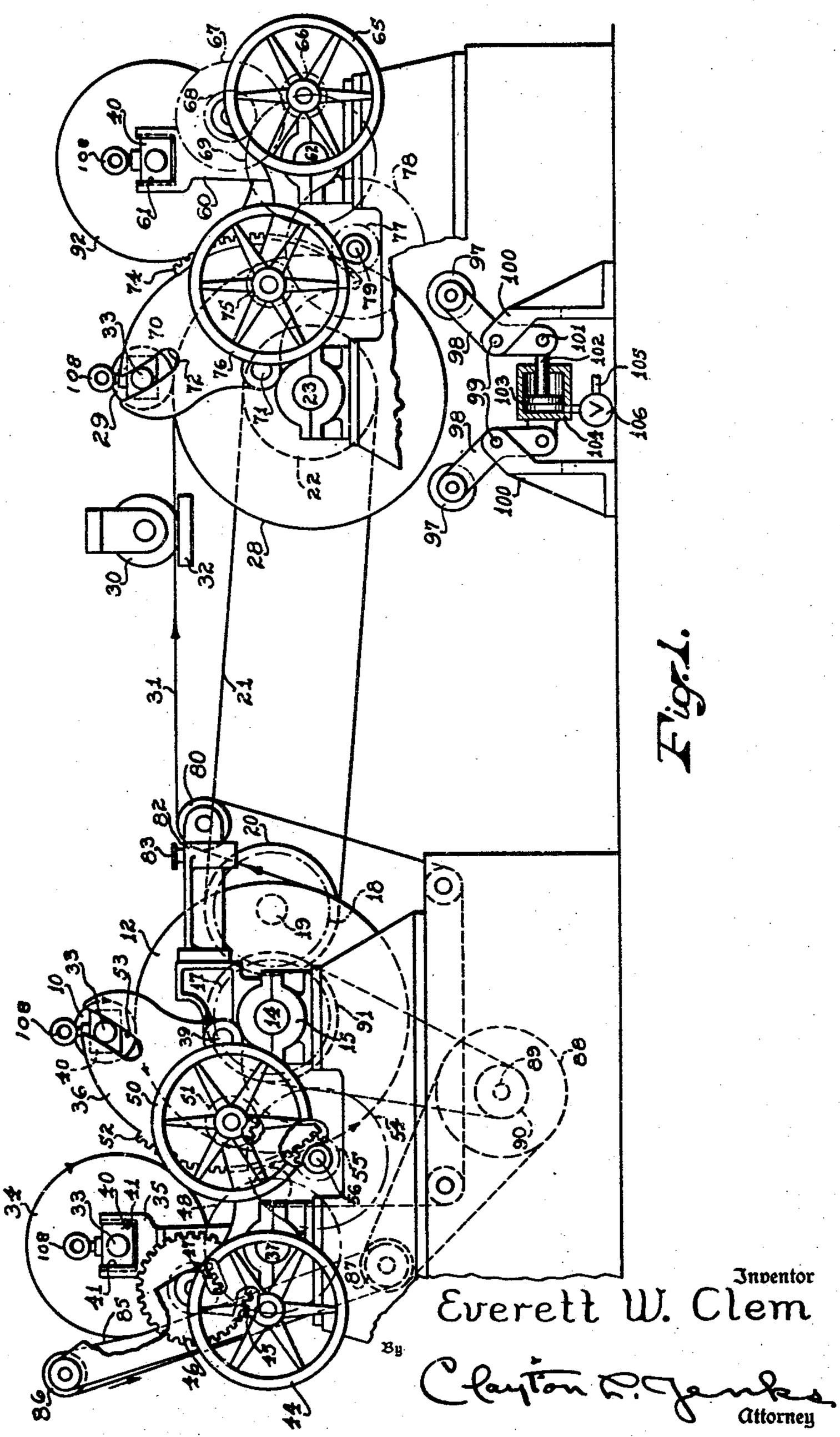

Fig. 1.

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APPARATUS FOR UNWINDING AND WINDING WEB MATERIAL

Filed May 31, 1945 3 Sheets-Sheet 2

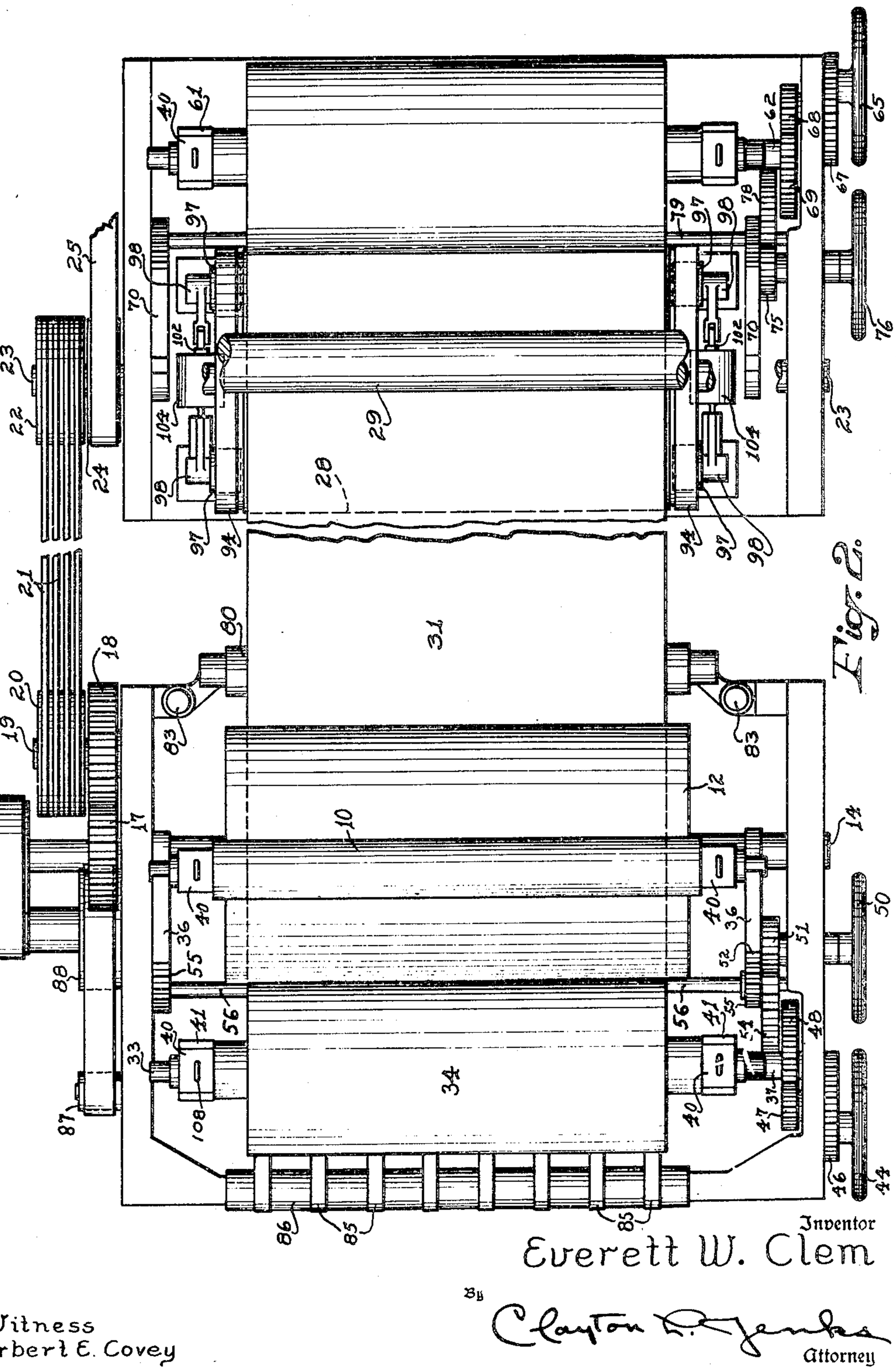

Fig. 2.

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APPARATUS FOR UNWINDING AND WINDING WEB MATERIAL

Filed May 31, 1945 3 Sheets-Sheet 3

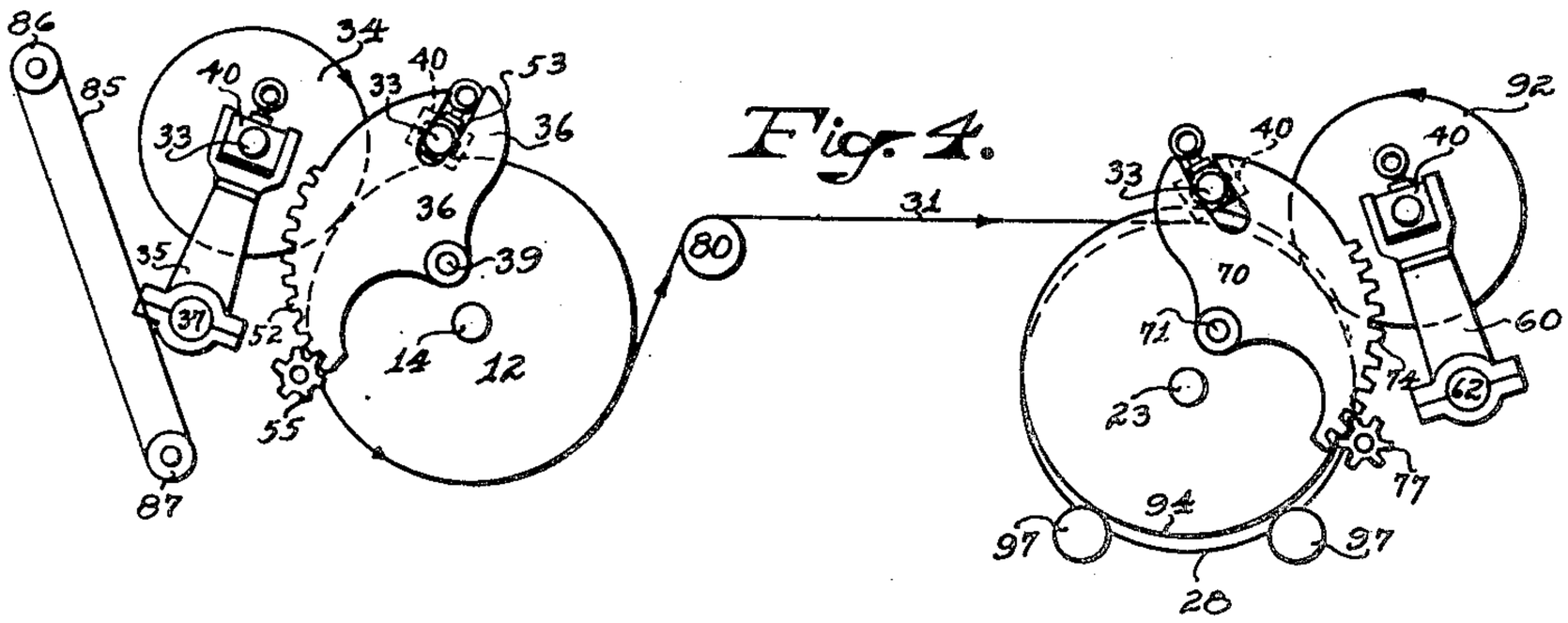

Fig. 4.

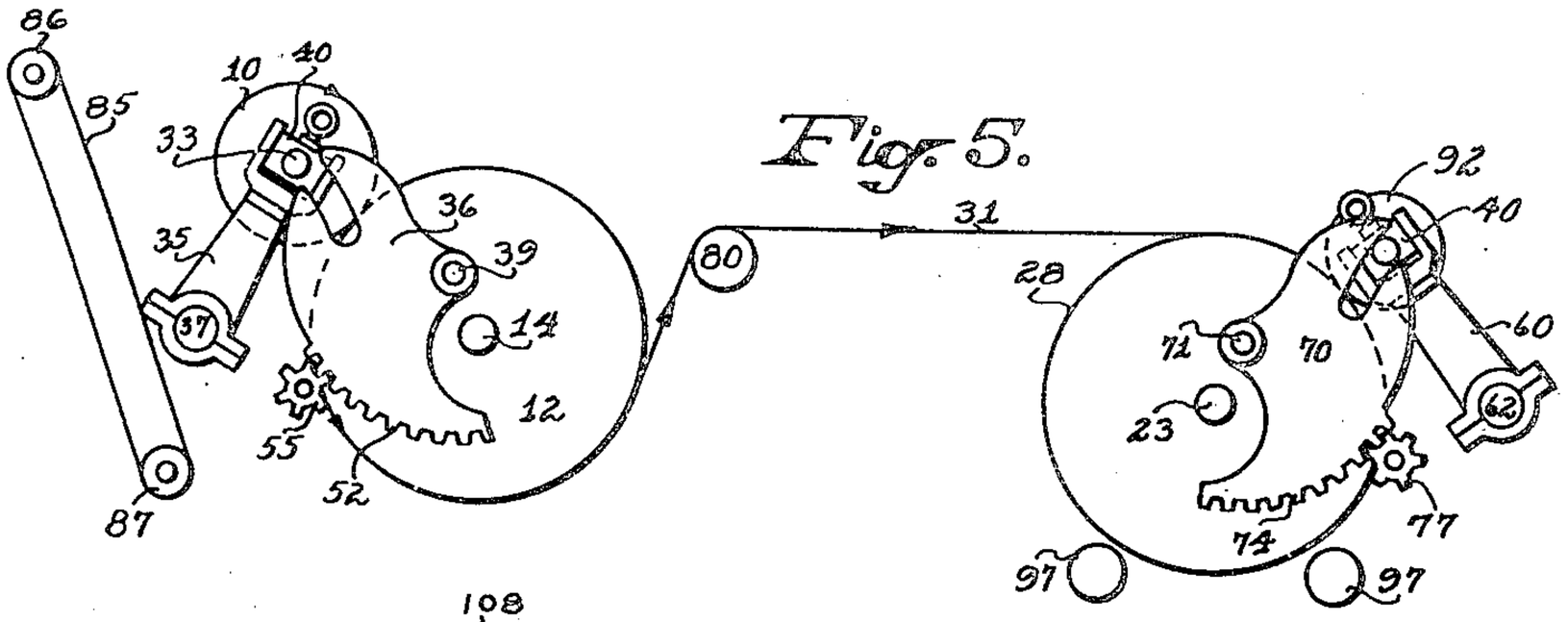

Fig. 5.

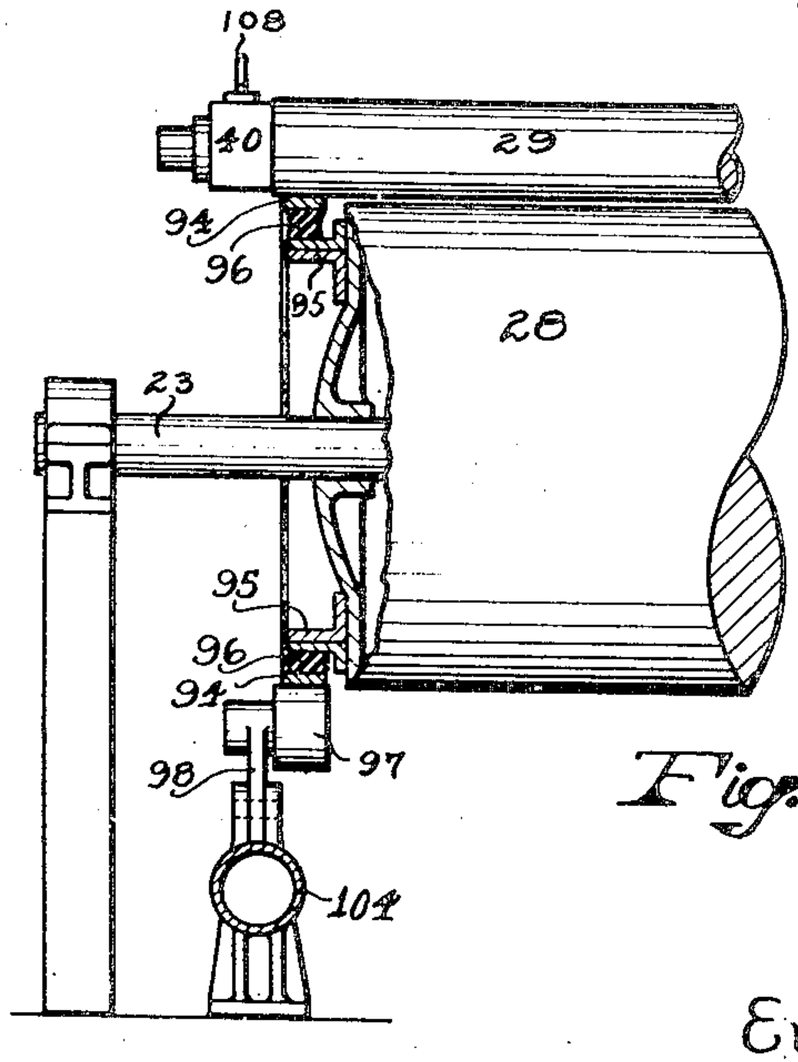

Fig. 3.

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2,486,006

UNITED STATES PATENT OFFICE

2,486,006

APPARATUS FOR UNWINDING AND WINDING WEB MATERIAL

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Application May 31, 1945, Serial No. 596,854

8 Claims. (Cl. 242—65)

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This invention relates to paper winding apparatus and more particularly to apparatus arranged for unwinding thin or fragile paper from a roll and rewinding it on a cylinder roll.

In the production of paper, a suspension of wood pulp is flowed onto an endless wire in a Fourdrinier machine, or the screen surface of a cylinder mold, and the formed web is then passed continuously through a series of driers and calendering rolls, after which it is wound onto a spool by means of a reel, such as a Pope reel of the type shown in the patent to Pope #1,248,542 of September 4, 1917. In that system, the paper must be wound without stopping as fast as it is produced by the paper making machine, and the resultant roll may have many imperfections and breaks in the paper. Hence, it is customary to mount the spool of paper on a freely rotatable support and to rewind the paper as a full width roll, or to pass the strip over slitters and form separate narrow rolls. The paper making machine requires an initial winding of the paper as it comes from the calenders at a high rate of perhaps 1500 feet per minute. But, in the rewinding of this paper, it is necessary to run the rewinder at perhaps twice that speed in order to give the operator ample time within which he may stop the machine and make suitable splices where the paper has been broken.

The standard rewinding operation serves for many types of paper, particularly those which are strong and capable of withstanding the comparatively high tensions involved in unwinding the first roll by drawing the paper therefrom by sufficient tension to rotate the spool, but it is found that this standard procedure is not suitable for crepe and tissue or other light weight and fragile papers. The supply spool of paper that is to be rewound may weight several thousand pounds; hence there is a high tensional pull involved in drawing the paper from this roll, and that tension will change as the roll decreases in size. Also, if it becomes necessary to stop the rewinding mechanism in order to make an invisible slice in the paper where there has been a break, then the momentum of the rapidly moving supply spool will unroll a long strip of the paper onto the floor. It has been customary to provide a brake for the unwinding supply roll which gives a required tension on the roll at all times and stops it when the winding roll is stopped. But the changing size and mass of the unwinding roll creates problems in acceleration and deceleration and the standard brake mechanisms will not provide a uniform tension and a constant speed of unwinding. The mechanical

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brake as commonly used comprises a brake band on a small drum connected with the shaft of the unwinding spool, and its frictional grip is provided by a manually adjusted screw applying force through a fixed leverage. However, as the unwinding roll becomes smaller in size, the frictional force automatically increases because of the decreasing leverage of the pull of the paper which serves to rotate the unwinding roll. An electrical brake mechanism may comprise an electric generator adapted to be driven by the unwinding roll which sends power back into the line. The amount of braking effort required may vary from a positive to negative value and pass through the zero point; hence electrical regulation has been found to be inadequate. Also, the windage of the armature and other forces cause a variation in the braking effect. For such reasons, the standard methods will not serve for unwinding and rewinding a crepe or thin tissue paper.

It is the primary object of this invention to overcome these various problems and to provide an unwinding-winding apparatus in which a roll of paper may be unwound at a given rate and rewound on another roll at a desired peripheral rate and wherein the paper is held under a controlled positive or negative tension between the unwinding and winding zones.

A further object of the invention is to provide an apparatus of this type wherein a massive roll of paper to be unwound is initially brought up to a correct speed of rotation and the paper is thereafter led forward to the winding part of the apparatus and rewound at that required speed, so that no undesirable tension is imposed on the paper when a new supply roll is mounted for rotation.

A further object of the invention is to provide a construction whereby spools of paper may be unwound and rewound continuously without stopping the apparatus, and the leading edge of a new strip of paper from another supply roll may be carried through from the unwinding half to the winding portion of the machine while the end of the paper of the first supply roll is passing through the machine, so that the apparatus need not be stopped for changing supply rolls or for removing a finished rewound roll.

Another object of the invention is to provide a mechanism of this general type wherein an empty spool which is to receive the paper is brought up to full speed before it is permitted to contact the paper that is being wound on a nearly completed roll, and which thereby permits the strip of paper to be cut and automatically brought into

winding engagement with the second empty spool and to start on its path of winding without interrupting the operation of the machine or endangering the paper because of the accelerating load. Various other objects will be pointed out or made apparent in the following disclosure.

In accordance with this invention, I propose to use two machines of the general type shown in said Pope patent, or equivalent constructions, wherein one is used for unwinding and supplying paper to a second machine which receives and winds the same in a finish roll. These machines are arranged back to back, as it were, and are so inter-connected so that the paper rolls are driven at the same or a desired peripheral rate. Mechanism is provided for starting a supply spool into full speed rotation before it engages the driving drum of the unwinding machine, and the winding machine comprises mechanism for rotating an empty spool at full peripheral speed rotation prior to its receiving the paper to be wound thereon. The parts are so constructed and arranged that the unwinding-winding operation may be carried on continuously and without interruption.

Referring to the drawings illustrating a preferred embodiment of this invention:

Fig. 1 is a side elevation of the complete winding and unwinding apparatus in which the unwinder has a new supply roll being initially brought up to speed while the old supply roll is nearing the end of its run, and in which the winder has the paper starting on an empty spool while a full size roll is positioned for removal;

Fig. 2 is a top plan view of the machine;

Fig. 3 is a fragmentary detail showing the mechanism for starting the empty spool in rotation;

Fig. 4 is a diagrammatic view showing the operation of the machine and the positions of the parts of the two machines, in which a new supply roll of the unwinding machine has been started in rotation and swung into contact with the main driving drum just before the paper has run off a previous supply roll, and in which an empty spool is positioned on the winding machine for starting rotation while an almost completed spool continues to wind the paper; and

Fig 5 is a similar diagrammatic view in which the now empty first supply spool has been removed from the unwinding machine, and the new unwinding spool is about to be swung to a second unwinding position; while the winding machine has the roll transfer arms arranged to transfer a partly filled spool to a secondary final position so that a new spool may be put into place.

In Fig. 1 I have shown an unwinding machine at the left and a winding machine at the right which may be constructed as shown in said patent, or as desired, except as herein described. Referring first to the unwinding machine, a roll of paper 10 may be unwound and fed forward to the winding zone by means of a power rotated drum 12 having a cylindrical surface arranged to engage the periphery of the paper roll and unwind the same by frictional contact therewith. This drum 12 has its axle 14 suitably mounted in bearings 15 carried by side standards of the machine. Although the drum may be driven by electrical drive mechanism, such as a constant speed direct current motor provided with a suitable variable speed and other desired controls, I have shown it, for the sake of simplicity of illustration, as driven by means of a gear 17 (Fig. 2) at the end of shaft 14 which in turn meshes with a further gear 18 mounted on a

short shaft 19 suitably supported in its bearings and this shaft 19 is in turn driven by means of expansion sheaves 20 driven by V belts 21 (Fig. 2) from a further sheave 22 carried on the axle 23 mounted in suitable bearings on the framework of the winding machine at the right hand side of the assembly. The shaft 23 is driven by a pulley 24 and driving belt 25, which receives its power from a suitable electric or other type of motor. The shaft 23 carries a further drum 28 which is the driving power for winding the paper on the spool 29 of the winding machine. If desired, one or more suitably shaped cutters 30 (Fig. 1) may be arranged to slit the paper 31 as it travels from the unwinding to the winding side of the machine, and in that case the paper may be wound on several cores suitably assembled on the same spool. The slitters 30 may be a set of cutting discs or knives of circular form suitably driven by a power drive so as to rotate at high speed and slit the paper 31 held thereagainst by a guide 32.

In order that the unwinding operation may be continuous, I first mount the shaft 33 of the supply spool 34 on a pair of side arms 35 of the unwinding machine and then transfer the same to a pair of running arms 36 which hold the supply roll against the drum 12. The side arms 35 are fixed on a suitable pivot shaft 37 carried in bearings on the framework. The arms 35 are so arranged that a new supply roll 34 in its full size may be held initially out of contact with the driving drum 12 but can be moved downward into peripheral engagement therewith. Similarly, the other arms 36 are pivoted on short shafts 39 on the side frames arranged above the axis of the shaft 14. Each of these arms 35 and 36 is provided with a slotted or yoke portion so constructed and located that the yokes may be moved to positions, as indicated at the left hand of Fig. 5, where the spool axle 33 carrying the paper roll 34 may be transferred from arms 35 to arms 36. To effect this transfer of the paper roll, each end of the shaft 33 of each spool is mounted in suitable bearings carried by a slide block 40. These slide blocks 40 are so constructed that each will fit between the two parallel spaced ends 41 of the yoke arm 35 and slide freely therein. The yokes 41 are flanged and the slide blocks are suitably shaped to slide between the flanges without permitting endwise movement of the spool shaft and the paper roll carried thereby. The supporting shaft 37 passes through the machine, and each of the arms 35 is keyed to the shaft so that the shaft will rock the arm 35 as required. The shaft 37 is rocked by suitable mechanism, such as the hand wheel 44 having a small gear 45 fixed to its shaft and in turn meshing with another gear 46 on a small shaft which carries a further gear 47 meshing with a large gear 48 fixed to the shaft 37, so that turning the hand wheel will swing the arms simultaneously as required.

The quadrant shaped yoke arms 36 are likewise swung about their supporting shafts 39 by means of the hand wheel 50 whose shaft has a gear 51 keyed thereon and which meshes with a further gear 54 on a cross shaft 56 carrying gears 55 at its opposite ends which mesh with the teeth of an arcuate shaped rack bar 52 carried on the edge of each arm 36. The arms 36 are bifurcated by slots 53 forming the yoke, and the arms are so spaced as to engage the outer projecting ends of the shaft 33 and to slide against the outer sides of the slide blocks 40 and thus guide and position the same.

When each swinging arm 35 is vertical, as shown in Fig. 1, the flanges of the yoke arms 41 hold the bearing blocks 40 in position, and this support operates for all positions of the arms 35 as shown in Figs. 4 and 5. When, however, the quadrant arms 36 are swung to the position of Fig. 5, the yoke slot 53 of each of these arms is located substantially beneath the projecting end of the spool shaft 33, and the arms 35 may then be swung down further so as to deposit the spool ends in the quadrant arms 36. While the arms 35 are in their lowermost position, the quadrant arms 36 may be swung upwardly and toward the right and thus remove the bearing blocks 40 from the first pair of arms 35. This frees the latter so that they may return toward the left for receiving a new supply spool.

The construction of the winding up machine at the right hand side of Fig. 1 is substantially the same as that of the unwinding machine above described. This winder likewise comprises a pair of swinging arms 60 having yoked ends 61 adapted to carry the slide block 40 at each end of the spool shaft. These arms 60 are made and mounted the same as arms 35. That is, they are keyed to the cross shaft 62 suitably mounted in bearings on the framework of the machine. That shaft 62 is likewise rotated by a train of gearing operated by the hand wheel 65, which transmits power through the small gear 66 fixed on its shaft. The gear 66 meshes with a gear 67 on a short shaft carrying the small gear 68 which in turn meshes with the gear 69 keyed to the shaft 62. The arms 60 support the paper roll in its final winding position.

The roll is initially supported by a pair of quadrant arms 70 pivotally mounted on pivots 71 suitably carried by the framework of the machine. The quadrant arms are provided with yoke slots 72 adapted to receive the outer ends of the spool shaft 33 on which the paper is to be wound. These arms 70 are moved by rack bar quadrants each of which has the gear teeth 74 meshing with the teeth of a small gear 77 keyed on each end of the through shaft 79 which has a gear 78 keyed to it and meshing with the small gear 75 on the shaft of the hand wheel 76. The two pairs of yoke arms operate the same as those of the unwinding machine to transfer the paper spool from one position to another.

Referring to Fig. 1, a paper roll 10 is being unwound by peripheral contact with the driving drum 12. The paper strip passes from the roll 10 towards the left and around and down under the driving drum 12 and thence up over an adjustably mounted roll 80 having its shaft carried by bearings which are suitably carried by a slide block 82 movable up and down by an adjusting screw 83, as will be understood. From this roll the paper 31 passes over the top of the winding drum 28 and then to the spool 29 arranged to receive the same.

Since the fragile paper passes downwardly around the left hand side of the first drum 12, it is imperative that the massive roll 34 of the new supply be brought up to speed before that roll 34 is allowed to contact with the driving drum if the paper web is still coming off the initial supply roll 10, and that condition is required for continuous operation of the machine. To this end, I bring the roll 34 up to full speed while it is out of contact with the driving drum 12. The driving mechanism preferably comprises a set of endless bands 85 of canvas or other suitable material arranged to engage the periphery

of the new supply roll and bring it up to speed while it may be freely rotated on its bearing blocks 40. These bands 85 are mounted on two driving rolls 86 and 87 suitably carried by brackets mounted on the framework of the machine. The bands 85 preferably ride in shallow grooves in the driving rolls 86 and 87 so that they will be properly guided and lie in alignment with the roll surface. The lower driving roll 87 is driven by a belt connection with a sheave 88 on a shaft 89 which is further connected by a pulley 90 with a pulley 91 keyed on the shaft 14 of the driven drum. These various pulleys are of such size and arrangement that the endless bands 85 will be driven at the same peripheral speed as that at which the driving drum 12 is rotated.

If a new paper roll 34 is put into position on the yoke arms 35 and then moved towards the left into contact with the driving bands 85, as shown in Fig. 1, the massive roll will be brought up to full speed by frictional engagement with the bands, and this speed will persist because of inertia when the arms 35 are swung over to engage the roll with the periphery of the drum 12. Then the paper from the new roll 34 is caught by the paper on the drum 12 which is coming off the roll 10 and the two strips pass together in contact around the driving drum 12 and to the winding drum 28 for reception by the old or a new spool on the winding machine. It will be understood that various procedures well known in the art may be employed for causing the paper strips to adhere and thus make the unwinding operation continuous. Standard practice in the paper industry involves applying adhesive manually to the top of the leading end of the strip on the new roll, so that when the roll is moved forward to contact with the drum the adhesive will stick to the paper of the expiring roll and be drawn forward thereby to the winding machine. Thus, the roll 34 is brought up to full speed and when it contacts with the paper from the old roll 10 the tissue paper passing from the old supply will not be broken or injured, since the two strips are travelling at the same speed. By the time the old supply is exhausted, the new supply is winding properly on the winding spool and there is no interruption or slowing down in the unwinding operation.

A further problem is presented at the wind up end of the machine when a new and empty spool 29 is to be brought into place for receiving the paper after the old roll has been wound to full size. The spool has considerable weight and if it were dropped into contact with the fragile paper 31 passing over the top face of the drum on its way to the right hand roll 92 (Fig. 4) that is still receiving the paper, it would tend to break or injure the fragile paper. It is therefore desirable that this new and empty spool 29 be rotating at full speed before it is allowed to drop down into engagement with the driving drum 28. Then the paper that is still going to the old spool 92 may be suitably cut in accordance with well known methods in the paper industry and be thrown into contact with and forced to be rolled on the new supply spool. One standard procedure involves applying an air blast momentarily beneath the paper which breaks the paper and causes the free end that is being fed forward by the drum and empty spool rolling thereon to fly upwardly over and around the spool and to get caught in the nip and so be forced to wind on the spool, as is explained in said patent to Pope No. 1,248,542.

The preferred mechanism for starting the empty spool 29 into rotation comprises, as shown in Figs. 2 and 3, two rings 94 mounted on the opposite ends of the main driving drum 28 which are so resiliently supported that they may be moved upwardly to positions where they may engage the central shaft of the driving spool and hold it just out of contact with the driving drum while at the same time starting that spool shaft into rotation. Each ring 94 is a steel band having a cylindrical outer periphery. It is mounted on a supporting flange 95 carried on the end of the driving drum 28. The ring 94 is secured to that supporting flange by means of a ring 96 of compressible rubber. This may be done by vulcanizing a suitable resilient compound of rubber and sulfur to the inner side of the steel ring 94 and to the outer side of the supporting flange 95. The ring 94 rests on a pair of rollers 97 which are pivotally mounted on suitable bearings carried by the ends of the first class rock levers 98. The lower end of the right hand lever 98 (Fig. 1) is pivotally connected through a pin 101 with the rod 102 that carries the piston 103 located within a pressure cylinder 104. The left hand lever 98 is pivotally connected at its bottom to the casing 104 of the fluid pressure mechanism. A pipe 105 and a suitable valve 106 serve to introduce fluid under pressure, such as air or oil, to the piston chamber formed at the left hand side of the piston 103 and thus force the lower lever arms outwardly and the rollers 97 inwardly. The parts are so constructed and arranged that these rollers 97 may be brought into engagement with the outer periphery of the steel ring 94 and thus lift it enough to prevent the spool 29 from touching the paper traveling over the periphery of the drum 28. The thickness and the resiliency of the rubber ring 96 is such as to permit this slight lifting motion of a fraction of an inch. If desired, various other constructions, such as springs, may be substituted for the rubber ring.

By means of this mechanism, the ring 94 may be moved upwardly to a position where it rotates about an axis that is slightly above that of the driving drum 28. Then a new supply spool 29 is dropped into place in the slotted yoke arms of the quadrants 70. The spool 29 is made longer than the driving drum 28 so that the cylindrical periphery of its central portion will engage the ring 94, while the bearing block 40 is located outside of that ring driving portion. When the spool 29 has been brought up to full speed rotation, then by suitable manipulation of the valve 106 the rollers 97 are dropped back and the ring 94 then becomes concentric with the driving drum 28 and the spool 29 is lowered into contact with the periphery of the drum and is thereafter rotated directly by the drum with the rings 94 still in engagement therewith.

The operation of the above described apparatus will be readily apparent. During the normal running of the machine while paper is unwinding from the roll 10 in peripheral contact with the drum 12, a new supply spool 34 has its bearings 40 inserted in the yoke 41 of the vertically positioned pair of arms 35, and then it is moved toward the left into engagement with the driving bands 85 which frictionally engage the periphery of the paper roll and bring it up to full unwinding speed. In the meantime, the roll 10 is nearing the end of its supply, but before the paper strip has become exhausted the new supply roll 34 is moved down from the position

of Fig. 1 to that of Fig. 4 while it is rotating at substantially its full speed. The paper of the new roll is caused to cling to the paper passing from roll 10 around the drum 12 and the two strips pass together to the winding drum. Thereafter, when the roll 10 has become completely exhausted the empty spool is removed from its yoke arms 36, and these arms are then moved over to the position of Fig. 5 where the open slots thereof are located below the ends of the supply spool shaft 33 and as that paper supply grows smaller in diameter, the spool shaft will ultimately engage the sides of the slot in the arms 36, and the arms may then be swung towards the right and so lift the spool bearings 40 from the yokes of the arms 35. Thus the arms 36 are returned to the position of Fig. 1 and the yoke arms 35 may be moved upwardly, as shown in the same figure, for reception of a new supply roll.

At the winding end of the machine, the paper roll 92 may be held by the yoke arms 60 in the position of Fig. 4 in driving contact with the drum. At the same time, the yoke arms 70 are held at their left hand end position for receiving an empty spool. Prior to the empty spool being put into place, the hydraulic mechanism is operated to thrust the driving ring 94 upwardly to the positions of Figs. 3 and 4 so that the periphery of the spool 29 cannot engage the drum 28. The ring 94, however, is travelling at the peripheral speed of the drum 28 and by frictional contact with the spool starts it into full speed rotation. Then the spool may be dropped down onto the drum by suitable manipulation of the valve 106. By methods well known to paper makers the paper sheet that has been winding on the spool 92 is severed and the advancing free end is caused to wrap around the empty spool and thus be wound thereon. Then the fully wound spool 92 is swung to the right away from the driving drum 28 and the paper roll may be removed by means of the eyelets 108 secured to the bearing blocks which may be engaged by the hooks of a chain hoist.

When the new winding roll has attained a sufficient size so that preparation must be made for putting an empty spool into place, then the two pairs of supporting arms 60 and 70 are moved into the positions of Fig. 5 and the paper spool is transferred to the arms 60 where its bearings 40 are held in position by the yokes. Then as the spool 92 grows in size the ends of the spool shaft 33 are gradually withdrawn from the yoke slots of the arms 70 and ultimately the arms 70 may be swung back to the receiving position of Figs. 1 and 4 where a new supply spool may now be put into position. When the spools are held in the arms 36 and 70, the eyelets 108 tend to swing to a lowermost position and by their weight hold the bearing blocks 40 from revolving. The eyelets are shown upright in the yoke arms 36 and 70 for the sake of clarity of illustration. Thus the operation of unwinding and rewinding web material is carried on continuously and at a uniform speed for both the unwinding and winding spools.

It will now be appreciated that various modifications may be made in both the unwinding and winding halves of the machine, and that the apparatus is adapted for winding various other types of fragile webs such as delicate fabrics. At the unwinding end of the apparatus the new supply roll may be brought up to full speed by other mechanical devices such as an electric

motor connected temporarily to the roll that is driven at the required rate to obtain peripheral synchronism of the supply spool with the drum. Also, the reeling device illustrated particularly in Fig. 3, which includes the resiliently positioned ring 94 for starting an empty spool into rotation on the winding apparatus may be employed in association with a paper making machine so that the dried web of paper may be fed directly from the machine to that winder and it will not be injured by contact of the stationary empty spool with the rapidly moving paper. This supplemental spool rotating mechanism may therefore be employed in association with a winding reel of the type shown in said Pope patent or other suitable winding apparatus where it is required to wind web material continuously and to bring an empty spool up to full speed before it is permitted to contact with the winding drum. Also, other types of drum reel may be used in place of the Pope reel above described. For example, the swinging arms which support the paper spools may be replaced by inclined planes, either fixed or movable, along which the spools may roll or their bearings slide as the paper roll increases or decreases in size. In such a construction, a new roll may be put into contact with the top of the drum and then later, as it changes in size, slid down to a lower contacting position so that a new roll may be placed in the top location. Hence, such an inclined plane is to be considered as the full equivalent of the swinging arms and the slideways thereon which hold the paper spool in position against the driven drum. Also, it will be understood that the winding drum and associated spool may be driven at a different peripheral rate from that of the unwinding drum and spool, such as where a creped paper is stretched out to a desired extent during winding. That is, I drive the two drums at a related or regulated peripheral rate so that the process of winding is continuous. This is accomplished by using a Reeves variable speed drive or by means of interrelated electrical regulating mechanism or by manual control, as is well understood.

It is therefore to be understood that the above disclosure is to be interpreted as describing the principles of my invention and a preferred embodiment and not as imposing limitations on the claims appended hereto.

I claim:

1. Apparatus for unwinding and winding web material comprising rotatable cylindrical unwinding and winding drums, a set of rock arms associated with each drum and arranged to removably hold two spools of web material in two peripheral rolling contacting positions on the associated drum, means whereby a spool may be transferred from one position to the other during operation of the machine and means for rotating the two drums at the same peripheral rates and causing the web to be unwound by one drum as it is wound up by the other and to maintain a substantially uniform tension thereon.

2. Winding apparatus comprising a power driven rotatable cylindrical drum, a support for holding an empty supply spool in or out of peripheral contact with the drum, a rotatable ring engageable with the periphery of the supply spool and means for moving the ring into engagement with said spool and rotatably holding it out of contact with the drum and initially starting the spool into rotation before it engages the drum.

3. Winding apparatus comprising a rotatable cylindrical drum, mechanism for rotating the same at a fixed rate, a spool for winding web material having a peripheral surface portion extending beyond the drum, a support arranged to hold the winding spool in peripheral engagement with the drum, a driven ring engageable with said peripheral surface portion of the spool for rotating the same, and means for moving the driven ring into and out of peripheral engagement with the spool so that it may cause rotation of the spool prior to its contacting with the drum.

4. A web winding apparatus comprising a power driven rotatable cylindrical drum, means for holding a spool in peripheral driving engagement with the drum but with a peripheral surface portion extending beyond the drum, a driving ring of substantially the same diameter as the drum which is releasably engageable with said peripheral portion of the spool, means for resiliently securing the ring to the drum and causing rotation thereof at the peripheral rate of the drum, and controllable means for releasably moving the ring directly into peripheral engagement with the spool in opposition to its resilient support and which starts rotation of the spool prior to its contacting the drum, said ring moving automatically out of contact with the spool when released.

5. Apparatus for unwinding and winding web material comprising unwinding and winding machines having each a power driven cylindrical drum arranged for peripherally engaging and moving a web from a supply roll to a rewinding roll, means for rotating the drums at substantially the same peripheral rate and moving the web under a controlled equalized tension, supports for holding two web rolls simultaneously in peripheral rotating contact with each drum which provide for a radially free movement of the axis of each roll, said supports being arranged for transferring a roll from one to another of two positions of rolling contact with each drum, means for moving the roll supports of the unwinding drum so that as one supply roll expires another may be brought into operative rotative relationship with the drum, and means for moving the roll supports of the winding drum so that an empty spool may be brought into rotative contact with the drum prior to removal therefrom of a full roll, so that web from a succession of supply rolls may be rewound successively on spools while a controlled web tension is maintained.

6. Apparatus for unwinding and winding web material comprising unwinding and winding machines having each a power driven drum, means for rotating the drums at the same peripheral rate and controlling the tension on a web moved therebetween, supports for holding two web rolls simultaneously in a radially free peripheral rotating contact with the drum of each machine and which are arranged for transferring a roll from one to another of two circumferential positions in relation to each drum while it is maintained in a freely rotating peripheral contact with the associated rotating drum, and means for rotating a new supply roll of the unwinding machine at substantially full speed prior to its contact with the old web on its associated drum, so that a web may be unwound from a succession of supply rolls and rewound.

7. Apparatus for unwinding and winding web material comprising unwinding and winding machines having each a power driven drum, means for rotating the drums at the same peripheral rate and controlling the tension on a web moved therebetween, supports for holding two web rolls

simultaneously in a radially free peripheral rotating contact with the drum of each machine and which are arranged for transferring a roll from one to another of two circumferential positions in relation to each drum while it is maintained in a freely rotating peripheral contact with the associated rotating drum, and means for rotating an empty spool at substantially said rate prior to its contacting the web and drum of the winding machine so that web material from several supply rolls may be rewound continuously as a succession of rolls.

8. Winding and unwinding apparatus comprising a cylindrical unwinding drum and a cylindrical winding drum arranged with parallel axes to move web material from one to the other, mechanism for rotating the drums at substantially the same peripheral rate, two pairs of pivoted yoke arms associated with the unwinding drum and arranged to move a spool into and away from peripheral engagement with the drum and to effect transfer of a spool from one pair to another, a power driven band moving at said rate which is arranged to rotate a full supply spool, one pair of yoke arms being arranged to hold the full supply spool in peripheral rotatable engagement with said driven band while out of contact with the drum and thereafter transfer the rotating spool into engagement with the drum, two pairs of yoke arms arranged to hold a spool in peripheral contact with the winding drum and to effect transfer thereof from one pair to the other, a rotatable ring driven by the winding drum and engageable with the periphery of an empty winding spool, means for moving the ring so as to rotate the empty spool while holding it out of contact with the drum and means for thereafter swinging the associated yoke arms and moving the rotating spool into peripheral engagement with the drum while it is supported thereby, said parts being so constructed and arranged that web material may be unwound and rewound continuously at a substantially uniform rate.

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