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E. P. COOK

2,664,792

MULTILENGTH CONTINUOUS DOCTOR BLADE

Filed Sept. 27, 1949

4 Sheets-Sheet 1

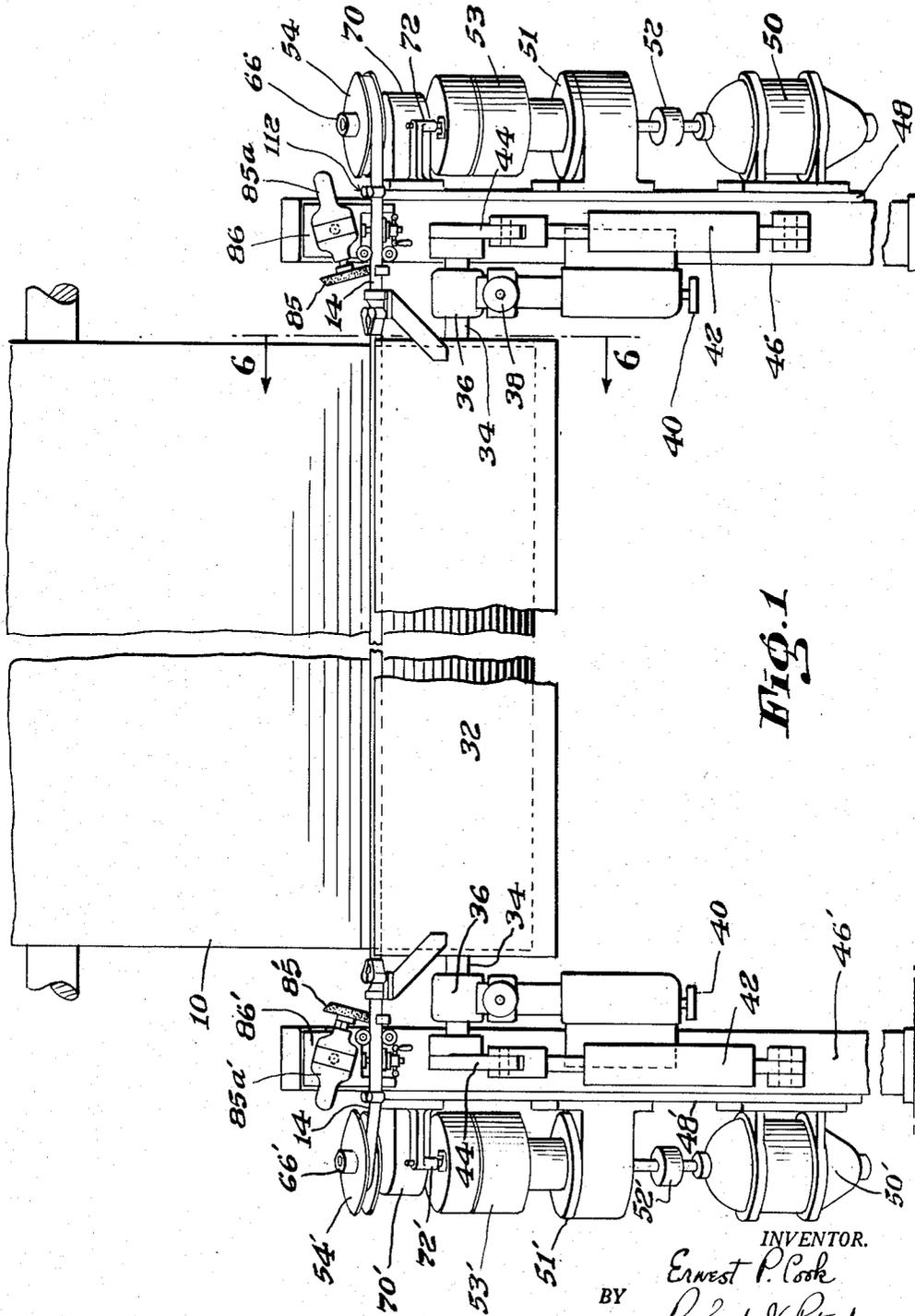


FIG. 1

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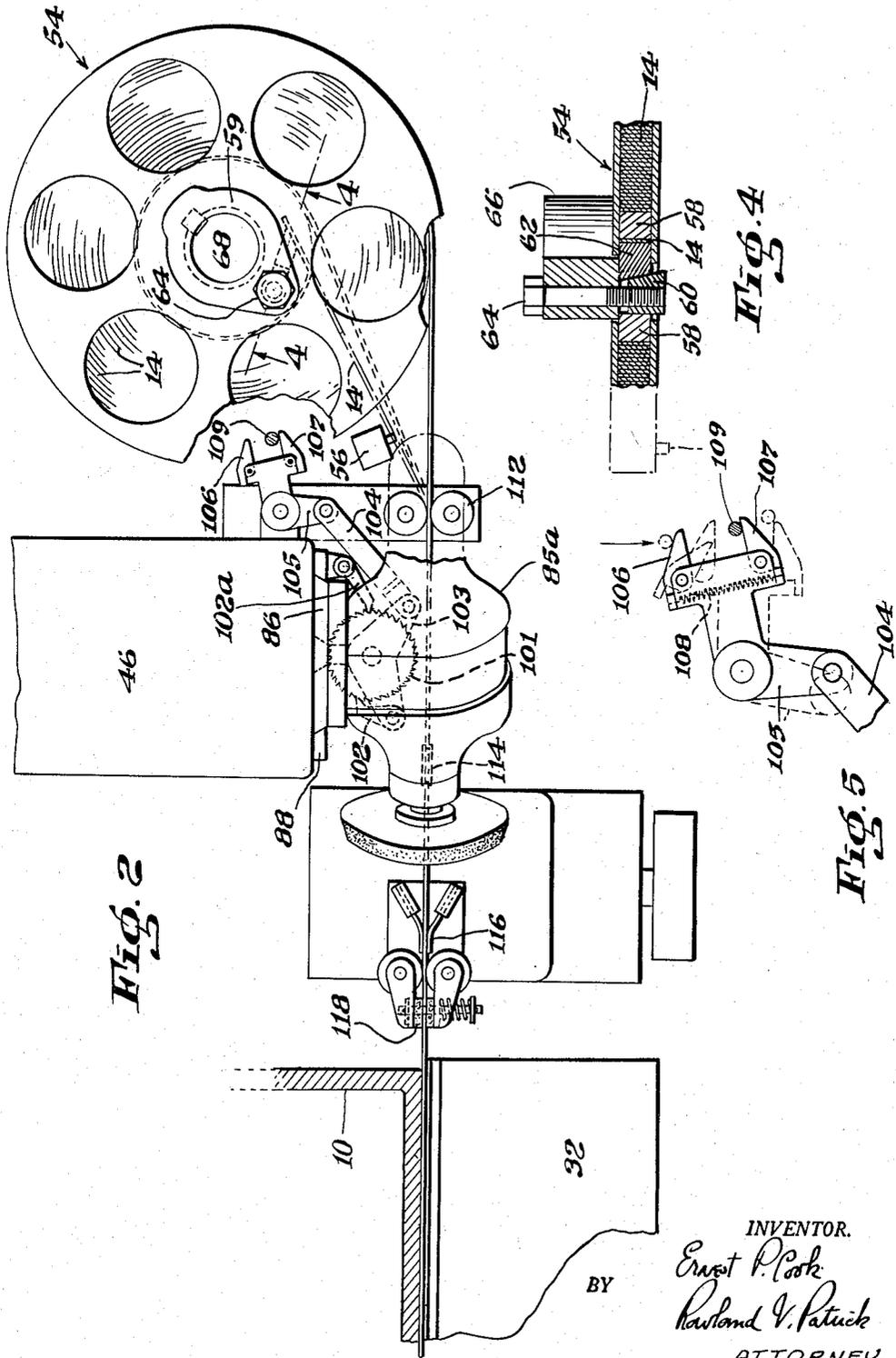
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4 Sheets-Sheet 2



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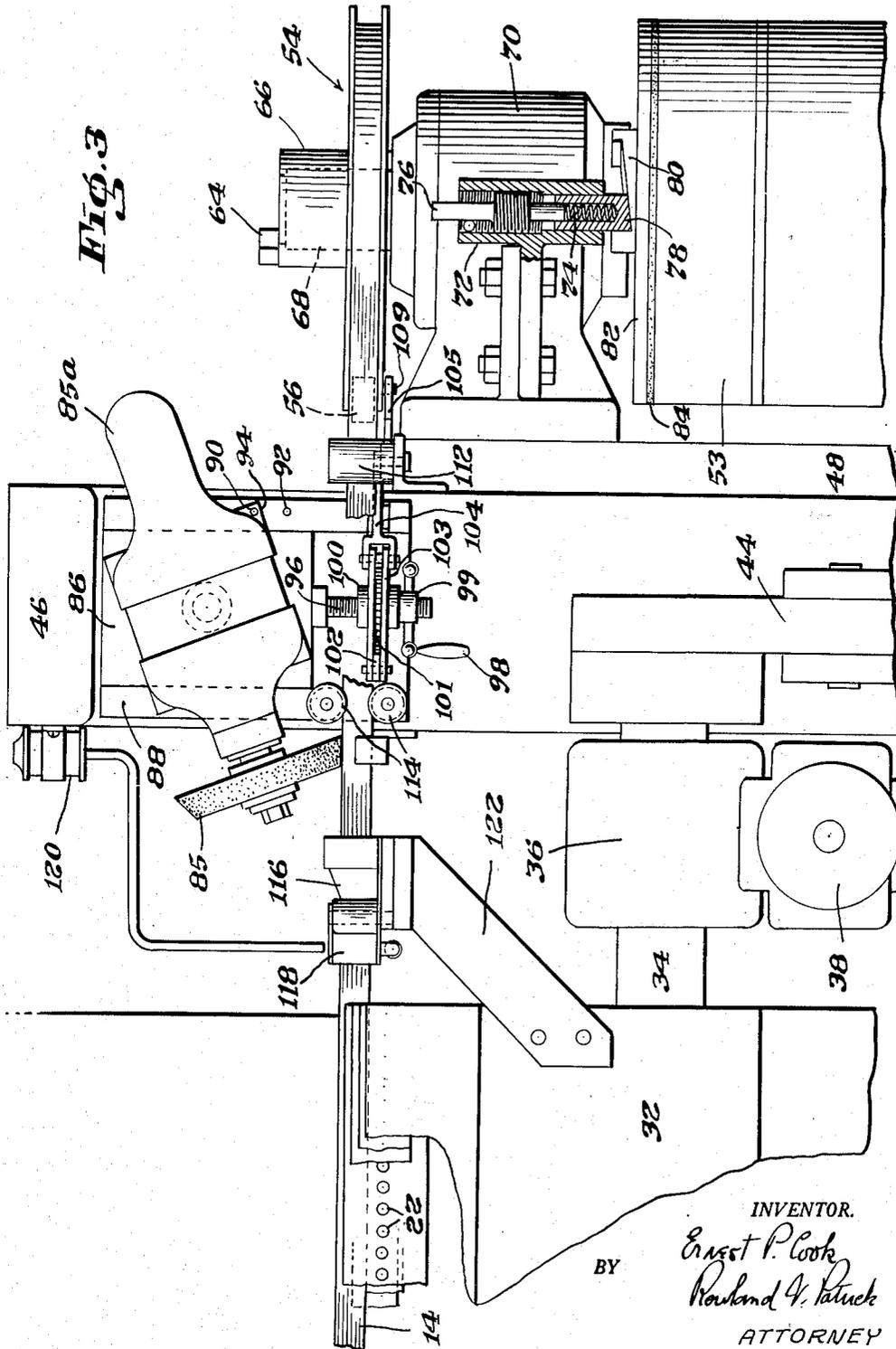
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MULTILENGTH CONTINUOUS DOCTOR BLADE

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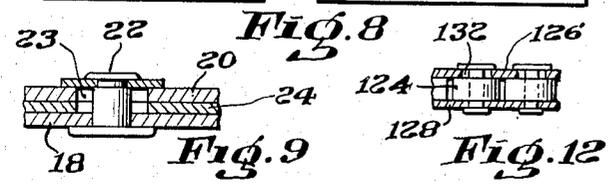
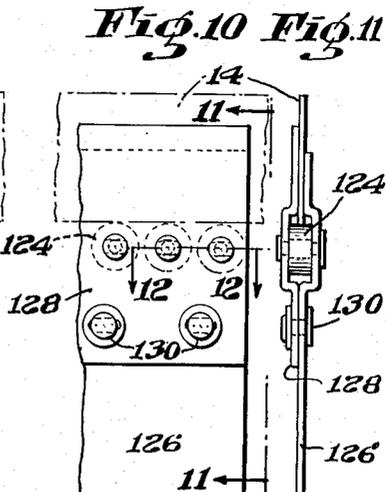
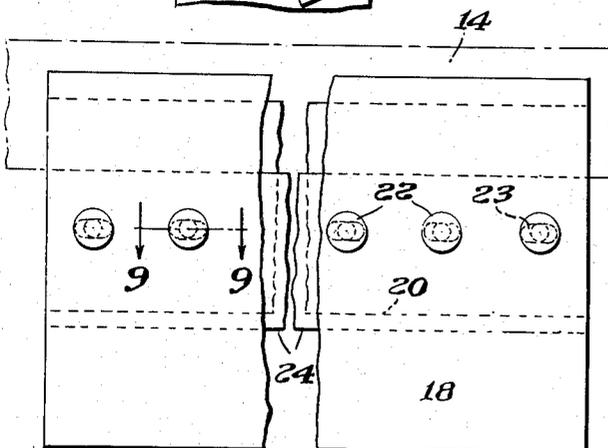
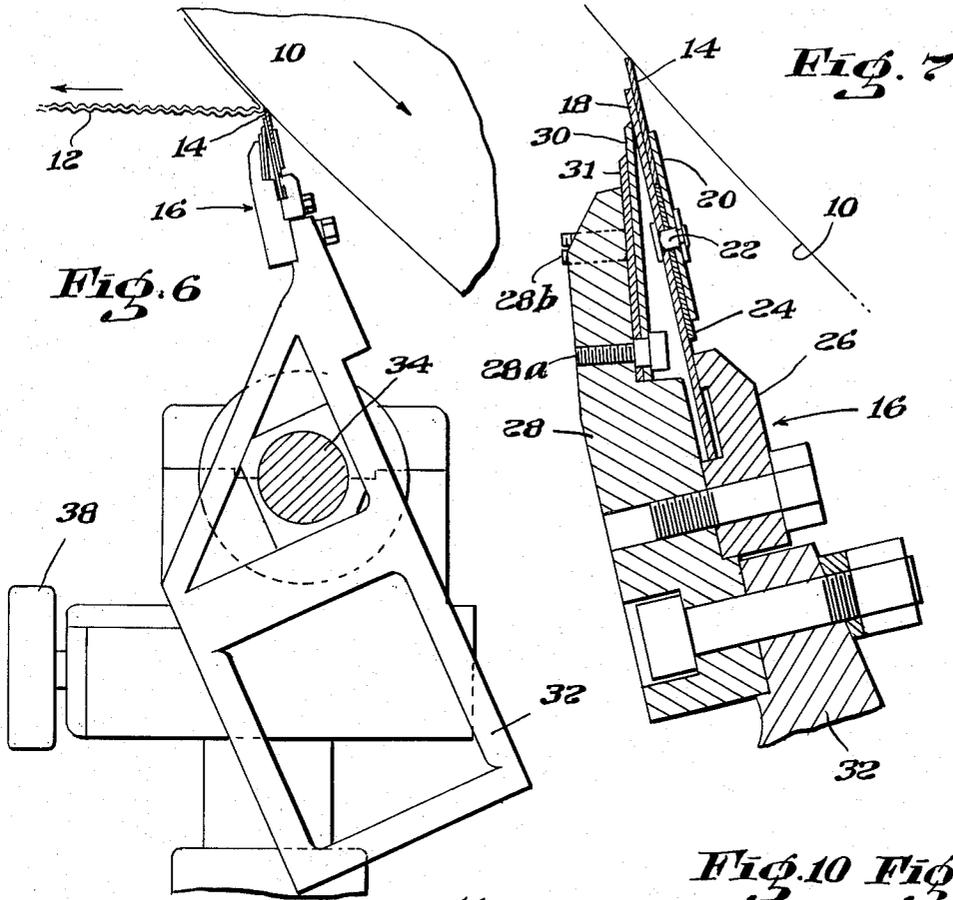
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MULTILENGTH CONTINUOUS DOCTOR BLADE

Filed Sept. 27, 1949

4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

2,664,792

MULTILENGTH CONTINUOUS DOCTOR  
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Application September 27, 1949, Serial No. 118,150

6 Claims. (Cl. 92-74)

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My invention concerns improved apparatus for removing paper or the like from rolls, as calender rolls, dryer cylinders, etc.

Devices of this character generally comprise a flexible strip of metal referred to in the paper industry as a "doctor blade" which is held against the roll in position to peel the paper from the roll as the roll revolves. Frequently, the working edge of the blade is so formed as to impart a crimp or crepe to the paper, the crimp or crepe being advantageous, for example, in the case of paper toweling, paper napkins and the like.

Heretofore, doctor blades have had a length exceeding by only a few inches that of the face of the roll against which they are operated. These blades, which may be either fixed or reciprocating, function satisfactorily for a varying period the duration of which depends upon the metal of which the blade is formed, the condition of the roll surface, the speed at which the roll is revolved, and other factors. It then becomes necessary to interrupt production to remove the bur which forms on the edge of the blade. This interruption is manifestly economically undesirable and is particularly serious in the case of creping blades, since the creping edge is soon lost.

My invention has as its principal object to eliminate these uneconomical interruptions in production.

I accomplish the stated object through the use of a system of apparatus comprising a doctor blade having a length substantially exceeding the length of the working portion of the face of the roll and further comprising means for continuously or intermittently moving the blade across such face and means for maintaining the working edge of the blade in substantially optimum condition at all times. The latter means in the preferred construction takes the form of one or more suitably positioned grinding wheels.

I feed the blade from a first reel or drum positioned at one end of the roll and collect or recover it on a powered second reel at the opposite end of the roll. With this arrangement it is possible to use a greater length of blade than would be the case, for example, should the blade be passed around and moved by frictional engagement or otherwise with pulleys at each end of the roll. Moreover, the arrangement provides for a more positive drive and for better tensioning of the blade.

In my preferred construction, both of the reels are powered to allow for continuous uninterrupted operation. Thus, when the original feed reel is substantially played out, it becomes a collector reel to complete the cycle, the reversal being effected automatically by means responsive to the change in the diameter of the coiled blade on the unwinding reel. The blade while engaging the roll is supported in a holder which is continuously urged toward the roll to maintain the blade in operative position.

The apparatus in its preferred construction may

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further include means for lubricating the blade so that it can be passed more readily through the holder, the lubrication serving incidentally to retard rusting of the blade, and scraper elements mounted to remove any fibrous accumulations from the blade before it is wound on either of the rolls.

I shall further describe my invention with the aid of the accompanying drawings illustrating a system of apparatus conforming therewith. In the drawings,

Fig. 1 is a view in elevation showing a dryer roll, partly broken away, and my apparatus at either side thereof;

Fig. 2 is a plan view taken at one end of the roll;

Fig. 3 is an elevation showing parts shown in Fig. 2 and drawn to the same scale;

Fig. 4 is a view on the line 4-4 of Fig. 2;

Fig. 5 is a detail illustrating the operation of one of the elements shown in Fig. 2;

Fig. 6 is a view on line 6-6 of Fig. 1;

Fig. 7 is a detail of the blade holder;

Fig. 8 is another detail showing parts of the blade holder;

Fig. 9 is a view on line 9-9 of Fig. 8;

Fig. 10 is an elevation similar to Fig. 8 illustrating a modified form of blade holder;

Fig. 11 is a view on line 11-11 of Fig. 10; and

Fig. 12 is a view on line 12-12 of Fig. 10.

Referring first particularly to Figs. 1 and 6, the dryer roll 10, which may be considered as a "Yankee" dryer positioned at the discharge of the wet end of a standard paper making machine, is operated at a speed somewhat exceeding the rate of withdrawal of the paper 12 (see Fig. 6) which usually contains 50-60% moisture. The edge of the blade 14 is square or approximately so in order that a crimp will be imparted to the paper.

The blade 14 is held in a holder 16, shown in vertical section in Fig. 7 (see also Fig. 8), between plates 18 and 20 connected by rivets 22 which pass through a filler plate 24 on which the blade rides. The slots 23 in the plates 20 and 24, which are subjected to radiant heat from the roll 10, allow these plates to expand at different rates relative to plate 18, thus eliminating any tendency of the blade holder unit to distort. Plate 18 is supported and retained in position by members 26 and 28. Leaf springs 30 and 31, backing the plate 18, are secured to the upper part of member 28 by screws 28a. Screws 28b provide for adjustment of the spring pressure applied to the plate.

The entire blade holder unit is secured by bolting to a platen 32 supported on and fixed to a shaft 34 journaled in bearings 36. Since the greater part of the weight of the platen lies rearward of the shaft 34 (to the right of the shaft in Fig. 6) the blade 14 is constantly urged against the face of the roll. Screw mechanisms actuated through knobs 38 and 40 provide for horizontal

and vertical adjustment, respectively, of the bearings 36. Fluid pressure units 42 can be used to supplement the action of the weighted platen in maintaining the blade against the roll and also provide a means of moving the doctor blade unit away from the roll 10 when it becomes necessary to change the blade. These units connect to the shaft 34 which extends beyond the bearings 36 through linkages 44 fixed to the ends of the shaft. Like the bearings, they are supported on the frame 46, 46' of the paper machine.

At either side of the machine and supported on a base plate 48, 48' secured to the frame 46, 46' is an assembly comprising an electric motor 50, 50', speed reducing gears 51, 51' connected to the motor through a flexible coupling 52, 52', an over-running clutch 53, 53', and a reel 54, 54'. The assemblies are seen in perspective in Fig. 1 as they are mounted on the plates 48, 48' at a slight angle with reference to the frame of the machine.

Motors 50, 50' are reversible and are under the control of micro-switches 56, 56' (see Fig. 2), the microswitch being actuated by the blade 14 after it has been unwound to an extent such that substantially none of it remains wrapped around the hub of the reel. The end of the blade (see Fig. 4) is secured within the core 58 by means of a frictional clamp comprising wedge elements 60 and 62 and an actuating bolt 64. Bolt 64 extends through the reel hub 66, 66' which is keyed on the upper end of the over-running clutch shaft 68, supported by bearings 70, 70'.

Extending from the base plate 48, 48' and adjacent the bearing 70, 70' is an adjustable brake 72, 72', the purpose of which will be hereinafter explained. The brake includes a spring component 74 (see Fig. 3) the extent of the compression of which is controlled by a screw element 76. Spring 74 is contained within a cup 78 bearing on a cam member 80 fixed to or integral with an annular shoe 82 which is undersurfaced with a suitable brake lining material 84 and which operates against the top surface of the upper part of the over-running clutch 53.

The brakes 72, 72' are effective only on clockwise rotation of the reel, the spring 74 on such rotation becoming compressed as the cup 78 is raised by the cam 80.

Inward of each of the reels 54, 54' and in the path of the blade 14 is a grinding wheel 85, 85' powered by a motor 85a, 85a'. Each grinding wheel is pivotally supported on a plate 86, 86' vertically slidable in guideways 88 (see Figs. 2 and 3). Dowel pins 90 and 92 receivable in an aperture in a spacer plate 94 secured to the casing of the motor of the grinding wheel unit provide for locking of the unit in either a horizontal non-operating position, as during changing of the blade, or in an inclined operating position as shown.

Below the plate 86 is a screw jack 96 hand actuatable through a crank 98. The sleeve or collar 99 to which the crank is connected is fixedly secured to or made integral with a larger collar 100 thereabove. Collar 100 is held fixed against vertical movement by upper and lower bearing members, not shown. Surrounding the collar is a ratchet wheel 101 controlled by a spring-actuated pawl 102 connected by a bell crank 103 to a linkage 104 and by a second spring-actuated pawl 102a supported by a fixed pivot mounted on one of the guideways 88. Linkage 104 at its end opposite the pawl 102 is joined to a second bell crank 105. Elements 106 and 107, pivoted to the

bell crank 105 at the free end thereof, are connected by a spring 108 and are capable only of inward movement. These elements coact with a pin 109 on the undersurface of the reel as subsequently explained.

Disposed between each grinding unit and the reel on the same side of the machine is a pair of guide rollers 112 for aligning the doctor blade 14 with the doctor blade holder unit and a pair of grooved rollers 114. The upper of the rollers 114 is spring loaded downwards (spring not shown), while the lower is fixed in position. These rollers provide a means of holding the doctor blade in proper position for grinding.

Beyond the grinding wheel 85 and in the path of the blade is a scraper element 116 and a felt lubricator 118 supplied with oil from a container 120 fastened to the upper portion of the frame 46. The scraper element and lubricator are supported by a bracket 122 fixed to the platen 32.

#### Operation

In describing the operation of the apparatus it will be assumed that the blade 14 is moving toward the right, reel 54 thus being the winding reel and reel 54' the unwinding reel. As the blade leaves the dryer roll 10 at the right it passes sequentially through the lubricator 118 and the cleaner or scraper 116. The latter, it should be noted, is effective only when the blade is traveling toward the reel 54. The blade next passes under the grinding wheel 85, which is in grinding contact with the blade, and thence between the rollers of the roller pairs 114 and 112 to the reel. At this stage the over-running clutch 53 is engaged and the brake 72 is off.

When the reel 54' has played out, the corresponding micro-switch is actuated to reverse both motors. Reel 54' now becomes the winding reel and reel 54 the unwinding reel. The purpose of reversing the motor powering the reel 54 is to eliminate the extra pull on the doctor blade which would otherwise be required to rotate the speed reducer and motor. In reverse direction the motor operates at a speed greater than its speed when reel 54 is serving as the winding reel and the upper portion of the over-running clutch 53 is disengaged from the lower portion. Brake 72, which becomes immediately effective when the motors are reversed, provides the retarding force necessary to prevent the doctor blade from becoming too loose on the unwinding reel.

On the change in the direction of rotation of reel 54, pin 109 on the undersurface of the reel strikes element 106, pivoted on the bell crank 105 (see Figs. 2 and 3), causing retraction of the pawl 102 so that on the next reversal of the reel the pawl will properly position the grinding wheel against the doctor blade. Pawl 102a serves to prevent rotation of the ratchet wheel 101 as pawl 102 is retracted. The distance through which the pawl 102 is adapted to move the grinding wheel is slight, being only sufficient to compensate for the wear incident to the preceding grinding.

As reel 54 plays out the blade draws progressively closer to the micro-switch 56 (see Fig. 2) until finally on near exhaustion of the reel the blade contacts the switch, again reversing the motors to start a new cycle. With the reel rotating counterclockwise, pin 109 strikes element 107 (see Fig. 5) after previously striking element 106 which yields to the pin, and pawl 102 forces the ratchet wheel 101 to rotate, thereby lowering the grinding wheel into grinding contact with the edge of the doctor blade.

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It should be noted that while the shank of the screw 96 lies well forward of the plate 88, the head of the screw is extended and fastened to the bottom of the plate.

During stripping of the paper from the roll 18 and impartation of the crimp, the blade 14, as previously explained, is held by the stationary holder 16, the lower edge of the blade riding on the upper edge of the filler plate 24. In the case of the modified construction shown in Figs. 10-12, the blade rides on anti-friction elements, shown as rollers 124 supported between plate 128 and a backing plate 128 which is joined to plate 128 by rivets 130 beneath the rollers. The slots 130 in the plates through which the roller shafts pass are made oversize to allow for heat expansion.

From the foregoing it is believed apparent that my invention, by eliminating the frequent interruptions heretofore necessary in order to sharpen or replace the dulled blade, markedly speeds up production and allows for many operating economies.

Many changes and modifications other than those which have been indicated may, of course, be made in the apparatus disclosed without departing from the spirit and scope of the invention.

I claim:

1. Apparatus for removing paper from a revolving roll to which it tends to adhere, comprising a flexible doctor blade of an indeterminate length exceeding the length of the roll, a weighted holder for the blade serving to automatically maintain the blade in operative position against the face of the roll and to compensate for reduction in the width of the blade due to wear and means for drawing the blade through the holder including a reel at either end of the roll in which one of the ends of the blade is secured, each of said reels being powered by reversible means connected to the reel through clutch means adapted for automatic disengagement on winding rotation of the opposite reel.

2. Apparatus for removing paper from a revolving roll to which it tends to adhere, comprising a flexible doctor blade of an indeterminate length exceeding the length of the roll, a weighted holder for the blade serving to automatically maintain the blade in operative position against the face of the roll and to compensate for reduction in the width of the blade due to wear, means for drawing the blade through the holder including a reel at either end of the roll in which one of the ends of the blade is secured, each of said reels being powered by reversible means connected to the reel through clutch means adapted for automatic disengagement on winding rotation of the opposite reel, and blade grinding means positioned mediate at least one of the reels and the corresponding end of the roll.

3. Apparatus for removing paper from a revolving roll to which it tends to adhere, comprising a flexible doctor blade of an indeterminate length exceeding the length of the roll, a weighted holder for the blade serving to automatically maintain the blade in operative position against the face of the roll and to compensate for reduction in the width of the blade due to wear, means for drawing the blade through the holder including a reel at either end of the roll in which one of the ends of the blade is secured, each of said reels being powered by reversible means connected to the reel through clutch means adapted for automatic disengagement on winding rota-

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tion of the opposite reel, and scraper means mediate each reel and the corresponding end of the roll serving to clean the blade prior to the winding thereof on the reel.

4. Apparatus for removing paper from a revolving roll to which it tends to adhere, comprising a flexible doctor blade of an indeterminate length exceeding the length of the roll, a weighted holder for the blade serving to automatically maintain the blade in operative position against the face of the roll and to compensate for reduction in the width of the blade due to wear, means for drawing the blade through the holder including a reel at either end of the roll in which one of the ends of the blade is secured, each of said reels being powered by reversible means connected to the reel through clutch means adapted for automatic disengagement on winding rotation of the opposite reel, and blade lubricating means positioned mediate at least one of the reels and the corresponding end of the roll.

5. Apparatus for removing paper from a revolving roll to which it tends to adhere, comprising a flexible doctor blade of an indeterminate length exceeding the length of the roll, a weighted holder for the blade serving to automatically maintain the blade in operative position against the face of the roll and to compensate for reduction in the width of the blade due to wear, means for drawing the blade through the holder including a reel at either end of the roll in which one of the ends of the blade is secured, each of said reels being powered by reversible means connected to the reel through clutch means adapted for automatic disengagement on winding rotation of the opposite reel, blade grinding means mediate each reel and the corresponding end of the roll automatically actuated on winding rotation of the reel, a scraper element mediate each grinding means and the end of the roll for cleaning the blade prior to winding thereof on the corresponding reel and blade lubricating means positioned mediate at least one of the scraper elements and the corresponding end of the roll.

6. Apparatus for removing paper from a revolving roll to which it tends to adhere, comprising a flexible doctor blade having a length exceeding the length of that portion of the face of the roll contacted by the paper or the like, a holder through which the blade is passed, reel means at one end of the roll for feeding the blade to or receiving the blade from the holder, reversible means for powering said reel, an over-running clutch mediate said reel and said reversible powering means and a brake coactively associated with the driven portion of said clutch tending to retard rotation of the reel on unwinding rotation thereof to an extent precluding loosening of the blade on the reel.

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