

Dec. 5, 1944.

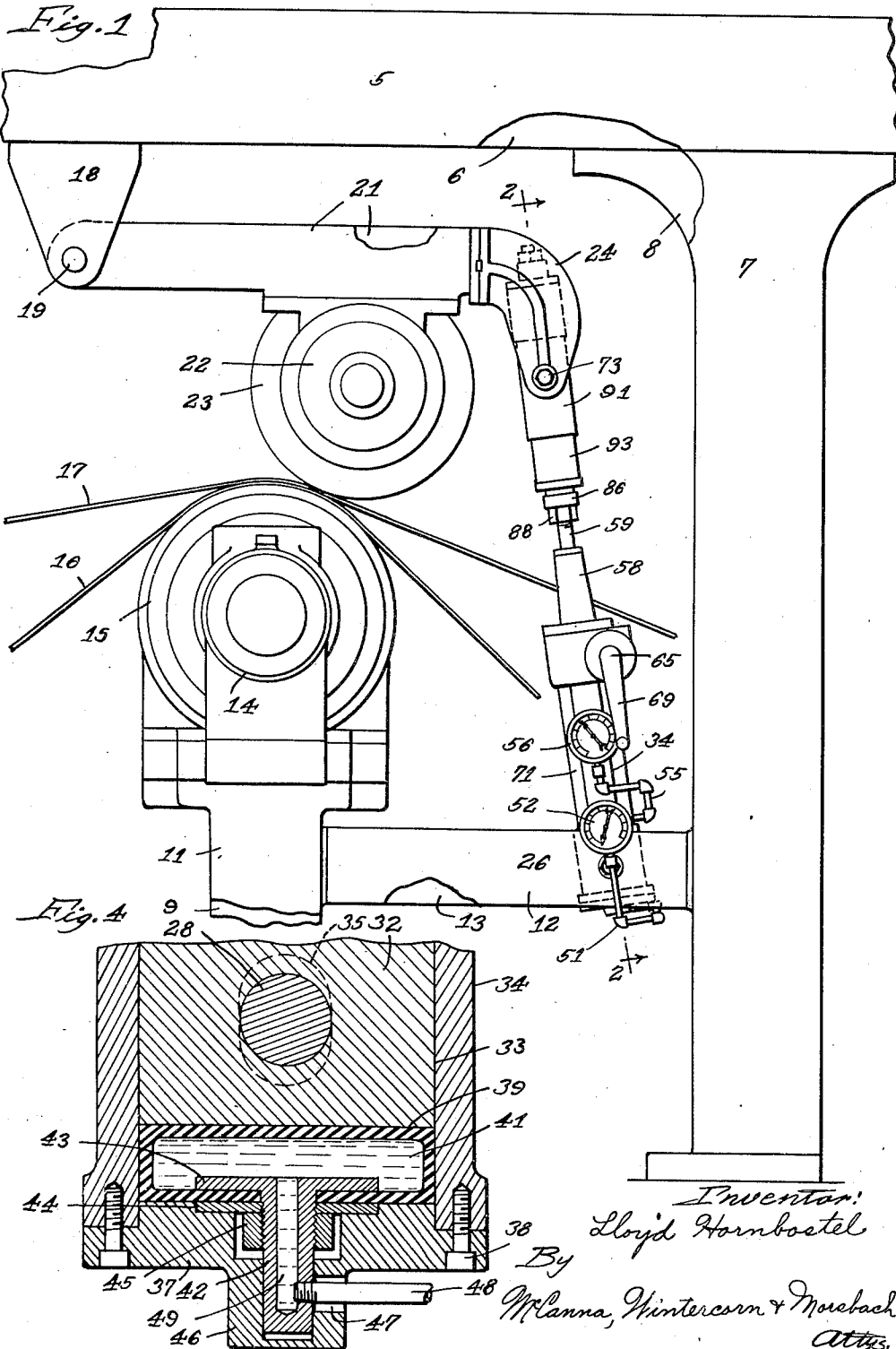
L. HORNBOSTEL

2,364,443

ROLL ACTUATING MECHANISM

Filed Nov. 7, 1940

2 Sheets-Sheet 1



Dec. 5, 1944.

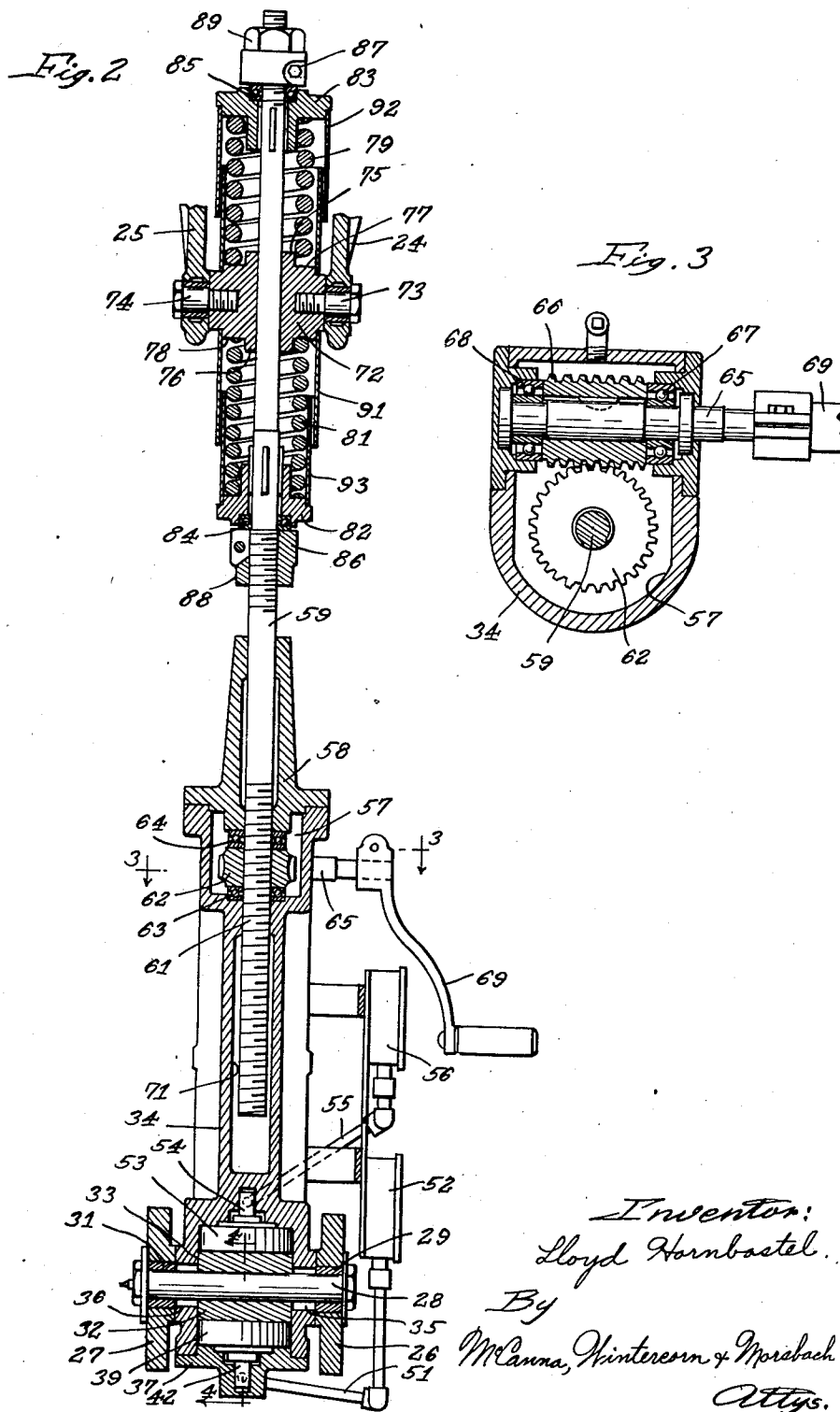
L. HORNBOSTEL

2,364,443

ROLL ACTUATING MECHANISM

Filed Nov. 7, 1940

2 Sheets-Sheet 2



Inventor:
Lloyd Hornbostel.
By
McAnna, Winterer & Morabach
Attys.

UNITED STATES PATENT OFFICE

2,364,443

ROLL ACTUATING MECHANISM

Lloyd Hornbostel, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

Application November 7, 1940, Serial No. 364,642

10 Claims. (Cl. 73—141)

This invention relates to paper making machines, processing machines and the like, and more particularly to improved means for controlling the position of movable rolls of such machines and controlling and indicating the application of pressure between the rolls of such a machine.

A source of considerable difficulty in the paper making and analogous arts, and one which to a substantial degree affects the quality of the product of paper making and processing machines, is that of maintaining a uniform or a preselected difference in pressure on the sheet of paper throughout the width of the sheet as it passes between rolls of the machine, and of returning the machine to the point where a duplicate product will be produced after the rolls have been separated or the pressure released. It will be understood, of course, that in some applications, small variations in pressure do not greatly affect the quality of the product, while in other applications a similar difference in pressure causes a very marked difference in the quality of the product, but throughout the art this difficulty has been more or less severe. In paper making machines this matter of uniformity is of importance in the couch rolls, press rolls, and at other locations, due to the fact that differences in pressure affect the wetness of the sheet across its width and the thickness of the resultant sheet.

Innumerable expedients have been tried through the years in an effort to produce some means by which this pressure could be accurately controlled, but so far as I know, no successful solution has heretofore been developed. Also during the years, the problem has become more acute due to increase in the width of the machine, and consequently the length of the rolls, the speed of the machine and changes in the type of paper stock. The problem is complicated by the fact that the mechanism must be such that the rolls can be separated, by the fact that the mechanism must have resiliency to accommodate for slight eccentricities in the rolls, and by the fact that the compressibility of the rolls is relatively small.

The present invention has for its primary object the provision of means for controlling the position and the pressure applied by a pressure applying roll of a paper machine.

Among the other objects of the invention are the provision of a novel form of pressure applying mechanism in which the pressure is applied through resilient means and through hydraulic means, whereby the pressure on the roll is indicated by the pressure on the hydraulic means; of

a device wherein the pressure is generated at a point between the hydraulic means and the resilient means so that the hydraulic means is subjected to what might be termed the counterforce of that applied to the rolls.

Another object of the invention is the provision of a novel form of pressure measurement device.

Other objects and uses will appear from the following description and the accompanying drawings, in which—

Figure 1 is a fragmentary side elevation of a paper making machine showing the invention as embodied in a press roll assembly;

Fig. 2 is a section on the line 2—2 of Figure 1;

Fig. 3 is a section on the line 3—3 of Fig. 2, and

Fig. 4 is an enlarged section on the line 4—4 of Fig. 2.

In the drawings, the invention is shown as embodied in a paper making machine for the control and actuation of a press roll. In Figure 1, one end of a pair of press rolls is shown, the opposite ends of the press rolls being identical with the exception of the changes required for the change in position, the parts being in effect a mirror image of Figure 1, as will be understood by those skilled in the art. In this figure, a portion of the frame section of the paper machine is shown which includes top rails 5 and 6 on opposite sides of the machine supported on uprights such as those shown at 7 and 8, it being understood that similar supporting uprights are disposed at intervals longitudinally of the machine. Other uprights, such as shown at 9 and 11, are connected by horizontal bars 12 and 13 (which act as supports as will presently appear) to the uprights 7 and 8 forming part of the interconnected frame structure.

Positioned on the uprights 9 and 11 are bearings 14 at opposite sides of the frame which receive and rotatably support the opposite ends of a stationary press roll designated generally by the numeral 15 over which a felt 16 and a sheet 17 are trained in the manner conventional in paper machine practice.

Depending from the top rails 5 and 6 are supporting brackets 18 having pivots 19 to which are attached supporting arms 21, the arms being pivotally attached to the brackets 18 for rotation about the pins 19. Attached to the lower side of the arms 21 are bearings 22 within which are journaled the ends of a movable press roll 23 for rotation in the bearings and for movement with the arms 21 about the pivots 19 for moving the press roll 23 toward and away from the press roll 15 and for applying pressure between the rolls.

Positioned on the ends of each of the arms 21 opposite the pivots 19 are fingers 24 and 25 (Fig. 2) which extend outwardly and downwardly for actuation of the arms 21 and the roll 23.

A novel form of roll actuating mechanism shown more in detail in Fig. 2 is positioned at each side of the machine and cooperate with the arms 21 through the fingers 24 and 25 to move the upper roll 23. The actuating mechanisms act between the horizontal supporting bars 12 and 13 and the respective arms 21, and since they are substantially identical in construction, only one will be specifically described. Each of the horizontal bars 12 and 13 comprises spaced members 26 and 27 (Fig. 2) extending between the uprights 7 and 8 and the uprights 9 and 11. Extending between the members 26 and 27 is a pin 28 journaled in bearings 29 and 31 for rotation in the bar members 26 and 27. Fixed on the pin 28 is a stationary plunger 32 forming the stationary element of a pressure applying train presently to be more fully described. In this instance the plunger 32 is of cylindrical cross-section, and is closely received in a cylinder 33 in the end of a thrust frame 34. The walls of the cylinder 33 are provided with oblong openings 35 and 36 for the passage of the pin 28, said openings having parallel sides spaced a distance substantially equal to the diameter of the pin 28 but of substantially greater width, the ends thereof having an acute face complementary to the pin, the shape of the openings permitting a small amount of movement between the pin and the thrust frame longitudinally of the frame in order to permit the plunger 32 to float back and forth to a limited degree. The end of the cylinder 33 is closed by a cap 37 removably secured in place by cap screws such as shown at 38.

Positioned in the end of the cylinder 33 adjacent the cap 37 is a hydraulic pressure transmitting element in the form of a bladder designated generally by the numeral 39. This bladder is formed of a flexible material capable of holding a volume of oil or other liquid as indicated at 41, and in this instance consists of rubber molded to shape. Where oil is employed, this is preferably rubber of a synthetic character such, for example, as that sold under the trade-mark "neoprene." This bladder is molded to fit the end of the cylinder as best shown in Fig. 4. Positioned in one side of the bladder is a stem 42 passing through the bladder and having a head 43 disposed against the inner surface thereof. A washer 44 is positioned against the outer surface and held in place by a nut 45 threaded onto the stem. Preferably the head 43 and washer 44 are vulcanized directly to the opposed surfaces of the bladder so as to preclude the possibility of leakage therebetween. The cap 37 has a projection 46 for the reception of the stem 42, the projection 46 having a laterally disposed opening 47 through which a pipe 48 passes, the end of the pipe 48 being threaded into the stem 42 and the bore thereof communicating with a centrally disposed passage 49 open to the interior of the bladder, whereby variations in the pressure on the liquid 41 within the bladder is transmitted through the pipe 48. The pipe 48 is connected through suitable high pressure piping as indicated at 51 to a pressure responsive element for indicating changes in pressure on the liquid 41. In this instance the means comprises a gauge designated generally by the numeral 52, but it will be understood that the invention contemplates any type of indicating mechanism, and this

may equally well be a recorder such as any of the well known pressure recording devices.

Disposed in the opposite end of the cylinder 33 is a bladder 53 identical with the bladder 39 having a stem 54 identical with the stem 42 and attached to the bladder in like manner. A pipe 55 communicating with a pressure gauge 56 similar to the pressure gauge 52, which may also be a recorder where desired or deemed expedient, is connected to the stem 54. The size and proportion of the bladders 39 and 53 and the plunger 32 is such as to substantially fill the cylinder 33 so that when the plunger 32 is moved in either direction from a central position, pressure will be applied to one of the bladders and the amount of this pressure will be indicated at the appropriate gauge.

The opposite end of the thrust frame 34 has a gear chamber 57 closed by a guide member 58, the guide member and frame having a longitudinal opening for the reception of a rod 59 which is supported therein and guided by the frame and guide member as best shown in Fig. 2. The rod 59 is threaded as shown at 61 and has positioned thereon a worm gear 62, the gear being supported for rotation and against longitudinal movement by ball bearings 63 and 64 disposed on opposite sides thereof and in abutting relationship with the thrust frame and the guide member. Also positioned within the chamber 57 is a shaft 65 (Fig. 3) disposed transversely of the thrust frame and supported for rotation in the walls thereof, the shaft carrying a worm 66 engaging the worm gear 62, the shaft and worm being supported for rotation on ball bearings 67 and 68. The shaft 65 may be rotated in any well known manner, in this instance by a crank 69, to rotate the worm and worm gear. It will be seen that upon rotation of the worm gear in opposite directions the rod 59 can be projected or retracted from the thrust frame 34, the frame having a chamber 71 into which the threaded end of the rod retracts when the worm gear is rotated in one direction. The thrust frame 34, rod 59, gear 62, shaft 65, worm 66 and associated elements form a mechanical jack or pressure producing means which serves to actuate the roll.

Slidably disposed on the rod 59 is a block 72 positioned between the fingers 24 and 25, the fingers being attached thereto by cap screws 73 and 74 for relative rotation between the block 72 and the fingers. Bosses 75 and 76 surround the rod 59 and provide shoulders 77 and 78 against which the ends of compression springs 79 and 81 act. The opposite ends of the springs 79 and 81 bear against sleeves 82 and 83 positioned on the rod 59. The sleeves 82 and 83 bear through ball bearings 84 and 85 against split collars 86 and 87, threaded onto the rod 59 and having squared portions 88 and 89. A metal tube 91 is attached to the block 72 and extends in opposite directions to partly enclose the springs, and tubes 92 and 93 are attached to the sleeves 82 and 83 telescoping with the tube 91 to complete the enclosure of the springs. It will be seen that when the rod 59 is moved in either direction by actuation of the handle 69, the movement is transmitted to the block 72 and to the fingers 24 and 25 through either the sleeve 82 and spring 81 or the sleeve 83 and spring 79, depending upon the direction of movement.

In operation, the squared portions 88 and 89 are normally drawn up to apply a certain predetermined small pressure as between the collars 75 and the block 72 slightly more than required to

prevent slack or looseness in the pressure train. However, the compression on the springs 79 and 81 will be varied somewhat to care for different operating conditions. For example, when there is only a small pressure being applied between the rolls and there may consequently be a tendency for the movable roll to chatter against the stationary roll because of small eccentricities in the rolls, the pressure on the springs may be increased to act as a snubber on the movable roll.

It will be understood that the particular embodiment herein shown is double-acting, in that springs are disposed on opposite sides of the block 72 and two hydraulic pressure transmitting elements are employed, one positioned on each side of the plunger 32. However, under certain conditions one of the springs and the corresponding pressure transmitting element may be eliminated from the construction where pressure is to be applied and measured only in one direction.

The operation of the device is as follows: Assuming the movable roll occupies an elevated position with the surface thereof in spaced relation to the surface of the stationary roll 15 and the felt and sheet 16 and 17 are trained over the stationary roll in the above-mentioned manner as shown in Figure 1, under these circumstances the weight of the roll 23 and associated parts is carried on the springs 81 at opposite ends of the roll and the pressure resulting from this weight is transmitted directly onto the pressure transmitting elements 53 and thence through the pins 28 to the supports 12 and 13. The amount of this pressure is indicated on the gauges 56. The movable roll is then lowered by rotation of the cranks 69 and as the surface of the roll contacts the sheet and the web, pressure is applied thereto and to the stationary roll depending upon the amount of rotation applied to the cranks 69. During the initial rotation of the cranks, the compression will gradually be removed from the springs 81 and the gauges 56 will be subjected to a decreasing pressure and will indicate increasing pressure between the rolls. This action continues until the movable roll and associated parts are resting freely on the stationary roll under their own weight. Continued rotation of the cranks 69 causes the rods 59 to be drawn downward, compressing the springs 79. As this occurs, the housings 71 are also drawn upward so that pressure is applied to the bladders 39 and indicated on the gauges 52. Continued rotation of the cranks in this direction increases the pressure, and the amount of pressure at any given time is indicated by the gauges 52. It will thus be seen that the pressure between the rolls can be regulated as desired from zero to the maximum capacity of the machine by actuation of the cranks 69 and that at all times the pressure at each end of the roll will be indicated by the pressure gauges associated with the pressure applying mechanism at the opposite ends thereof. In order to remove the pressure or to separate the rolls entirely, the cranks 69 are rotated in the opposite direction, causing a reversal of the action. It will be seen that if desired the shafts 65 may be driven from a motor or other sort of power drive.

Attention is directed to the novel manner in which the present invention meets the demands of the problem. It will be seen that in effect the housings 34 and rods 59 constitute a rigid pressure applying member which acts against the

arms 21 through the springs 79 and 81 and against the supports 12 and 13 through the fluid pressure transmitting members 39 and 53, so that there is no opportunity for a binding action to occur in the pressure applying mechanism, and, since the fluid pressure transmitting means is disposed directly in this train and all of the pressure is transmitted therethrough, the gauges 52 and 56 give an accurate indication of the pressure applied between the rolls. The springs 79 and 81 make this pressure resilient in nature and allow for small movements occasioned by slight eccentricities in the rolls. It will be seen that the pressure indication at the gauges is in no wise dependent upon the calibration of these springs, and even though these springs may change with time, the indication at the gauges will still be correct.

The use of the pressure applying mechanism allows the operator to place any desired pressure on the ends of the rolls, within the capacity of the mechanism, and likewise allows the operator to duplicate these pressure conditions when it becomes necessary to lift the movable roll because the gauges offer a true and accurate measure of the pressure at each end of the roll.

While I have herein shown a specific embodiment of the invention, it will be understood that this is by way of illustration of a preferred embodiment thereof, and I do not wish to be limited except as required by the scope of the appended claims, in which I claim:

1. The combination in a machine of the character described of a stationary roll and a movable roll positioned for the passage of a fibrous sheet therebetween, a movable supporting member at each end of said movable roll for supporting said movable roll for movement toward and away from said stationary roll, a link structure for each of said supporting members, each of said link structures having a portion pivotally connected to one of said movable supporting members and another portion pivotally connected to a stationary supporting member, each of said link structures comprising a rigid force transmitting member, a resilient force transmitting element connected between said rigid member and one of said pivotal connections, a closed fluid pressure transmitting member connected between said rigid member and one of said pivotal connections and means carried by said link structure for varying the length of said rigid member whereby the pressure between said rolls can be varied and the pressure of said fluid varies with the pressure between said rolls.

2. The combination in a machine of the character described of a stationary roll and a movable roll positioned for the passage of a fibrous sheet therebetween, a movable supporting member at each end of said movable roll for supporting the same for movement toward and away from said stationary roll, a link structure for each of said supporting members, each of said link structures having a portion pivotally connected to one of said supporting members and another portion pivotally connected to a stationary member, each of said link structures comprising an extensible force transmitting member, a resilient force transmitting member connected between said extensible member and one of said pivotal connections, a closed fluid pressure transmitting member connected between said extensible member and one of said pivotal connections, and mechanical means carried by said link structure for varying the length of said

extensible member, whereby the pressure between said rolls can be varied and the pressure on said fluid varies with the pressure between said rolls.

3. The combination in a machine of the character described of a stationary roll and a movable roll positioned for the passage of a fibrous sheet therebetween, a movable supporting member at each end of said movable roll for supporting said roll for movement toward and away from said stationary roll, a link structure for each of said supporting members, each of said link structures having a portion pivotally connected to one of said support members, and another portion pivotally connected to a stationary member, each of said link members comprising a rigid force transmitting member, a resilient force transmitting member connected between said rigid member and one of said pivotal connections, a closed fluid pressure transmitting member connected between said rigid member and one of said pivotal connections, means for varying the length of said rigid member whereby the pressure between said rolls can be varied and the pressure of said fluid varies with the pressure between said rolls, and means for limiting relative approach movement between said rigid member and the last mentioned one of said pivotal connections in case of failure of said fluid pressure transmitting member.

4. The combination in a machine of the character described of a stationary roll and a movable roll positioned for the passage of a fibrous sheet therebetween, a movable supporting member at each end of said movable roll for supporting said roll for movement toward and away from said stationary roll, a link structure for each of said supporting members, each of said link structures having a portion pivotally connected to one of said support members, and another portion pivotally connected to a stationary member, each of said link members comprising a rigid force transmitting member, resilient force transmitting members connected between said rigid member and one of said pivotal connections for resiliently transmitting force in either direction to said one pivotal connection, closed fluid pressure transmitting members connected between said rigid member and one of said pivotal connections for transmitting force in either direction to said last mentioned pivotal connection, means for varying the length of said rigid member whereby the pressure between said rolls can be varied and the pressure of the fluid in said fluid pressure transmitting members varies with the pressure between said rolls, and means for limiting relative movement in either direction between said rigid member and said last mentioned pivotal connection in case of failure of either of said fluid pressure transmitting members.

5. The combination in a machine of the character described of a stationary roll and a movable roll positioned for the passage of a fibrous sheet therebetween, a movable supporting member at each end of said movable roll for supporting said movable roll for movement toward and away from said stationary roll, a link structure for each of said supporting members, each of said link structures having a portion pivotally connected to one of said movable supporting members and another portion pivotally connected to a stationary supporting member, each of said link structures comprising a rigid force transmitting member, a resilient force transmitting element connected

between said rigid member and one of said pivotal connections, fluid pressure transmitting means disposed between said rigid member and one of said supporting members comprising a cylinder on one of the last two mentioned members, a plunger in said cylinder, a closed fluid pressure transmitting element between said cylinder and said piston and trunnions on said plunger projecting through the walls of said cylinder and having bearing support for said plunger on the other of said two members, said cylinder having openings for the passage of said trunnions shaped for limited longitudinal movement of said plungers and trunnions to accommodate for compressibility of said fluid and serving as a stop to limit relative movement of the cylinder and plungers upon loss of fluid from said fluid pressure transmitting element, and means for varying the length of said rigid member whereby the pressure between said rolls can be varied and the pressure of said fluid varies with the pressure between said rolls.

6. The combination in a machine of the character described, of a stationary roll and a movable roll positioned for the passage of a fibrous sheet therebetween, a movable supporting member at each end of said movable roll for supporting said movable roll for movement toward and away from said stationary roll, a link structure for each of said supporting members, each of said link structures having a portion pivotally connected to one of said supporting members, and another portion pivotally connected to a stationary member, one of said portions comprising a bearing block, each of said link structures comprising a rigid force transmitting member slidably disposed in said block, springs disposed between said block and said force transmitting member operable to apply resilient force to said block upon movement of the force transmitting elements in the opposite directions, closed fluid pressure transmitting members connected between said rigid member and one of said pivotal connections, and means for varying the length of said rigid member whereby the pressure between said rolls can be varied and the pressure of the fluid in said fluid pressure transmitting members varies with the pressure between said rolls.

7. The combination in a machine of the character described of a stationary roll and a movable roll positioned for the passage of a fibrous sheet therebetween, a movable supporting member at each end of said movable roll for supporting said movable roll for movement toward and away from said stationary roll, a link structure for each of said supporting members, each of said link structures comprising a portion pivotally connected to one of said supporting members, and another portion pivotally connected to a stationary supporting member one of said portions including a block pivotally carried on one of said members, a rigid force transmitting member slidable in said block, coiled springs disposed on said force transmitting member on opposite sides of said block and acting between said block and said force transmitting member, the other of said portions being disposed between one of said supporting members and said force transmitting member, and comprising a cylinder connected to one of the last two mentioned members, a piston in said cylinder attached to the other of said last two mentioned members, and closed pressure fluid transmitting members disposed in said cylinder on opposite ends of said piston, and means for varying the length of said rigid member whereby

the pressure between said rolls can be varied and the pressure of said fluid in said fluid pressure transmitting members varies with the pressure between said rolls.

8. The combination recited in claim 1, wherein said rigid force transmitting member comprises a threaded rod, a housing member for receiving said rod in telescoping relation, a worm gear in said housing having engagement with said threaded rod, and means for driving said gear to project and retract said rod to change the length of said pressure transmitting member and thereby vary the pressure of said resilient force transmitting element, said fluid pressure transmitting member and the pressure between said rolls.

9. The combination in a machine of the character described, of a pressure transmitting means comprising a cylinder, a plunger disposed in said cylinder, a fluid bladder in said cylinder between said plunger and the end of said cylinder, said fluid bladder being the sole means for transmitting motion and pressure between said cylinder and said plunger, whereby pressure-responsive means may be connected to said bladder for indicating the pressure transmitted thereby, and a pin fixed in said plunger, said cylinder having oppositely positioned oblong openings for the reception of said pin to permit of relative movement between the pin and the cylinder to pro-

vide for compression of said fluid, said openings departing from cylindrical to an extent insufficient for approach of the plunger to the end of the cylinder and consequent complete collapse of the bladder should the fluid be lost from the bladder.

10. The combination in a machine of the character described, of a pressure transmitting means comprising a cylinder, a plunger disposed in said cylinder for movement in either direction axially of said cylinder, a fluid pressure bladder positioned in said cylinder between each end of said plunger and each end of said cylinder, said bladders being the sole means for transmitting motion and pressure between said cylinder and said plunger, whereby pressure responsive means may be connected to said bladders for indicating the pressure transmitted thereby, and a pin fixed in said plunger, said cylinder having oppositely positioned oblong openings for the reception of said pin to permit of relative movement between the pin and the cylinder to provide for compression of the fluid in said bladders, said openings departing from the cylindrical to an extent insufficient for the approach of the plunger to the ends of the cylinder and consequent complete collapse of either of said bladders should the fluid be lost therefrom.

LLOYD HORNBOSTEL.