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3,269,893

MACHINE FOR MAKING EXTENSIBLE PAPER

Filed Dec. 17, 1963

2 Sheets-Sheet 1

FIG-1

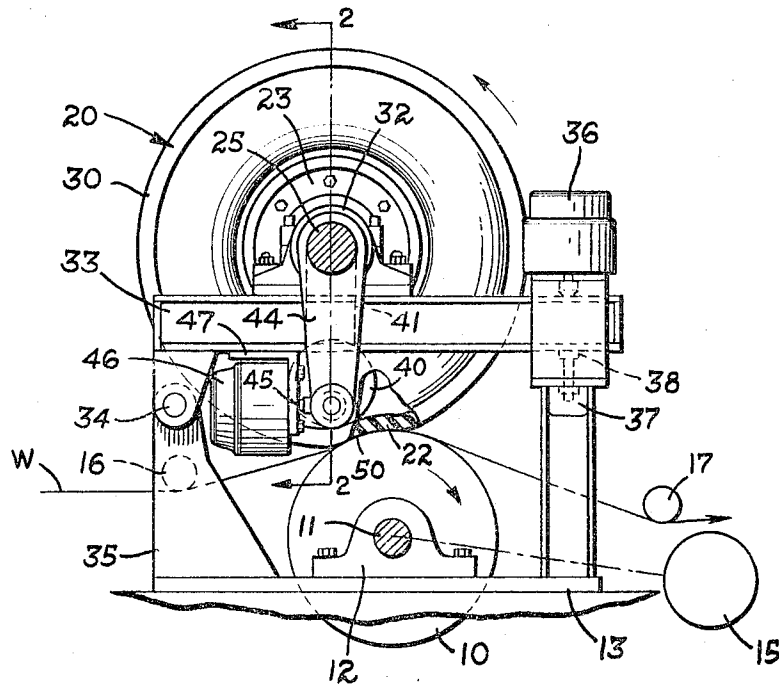
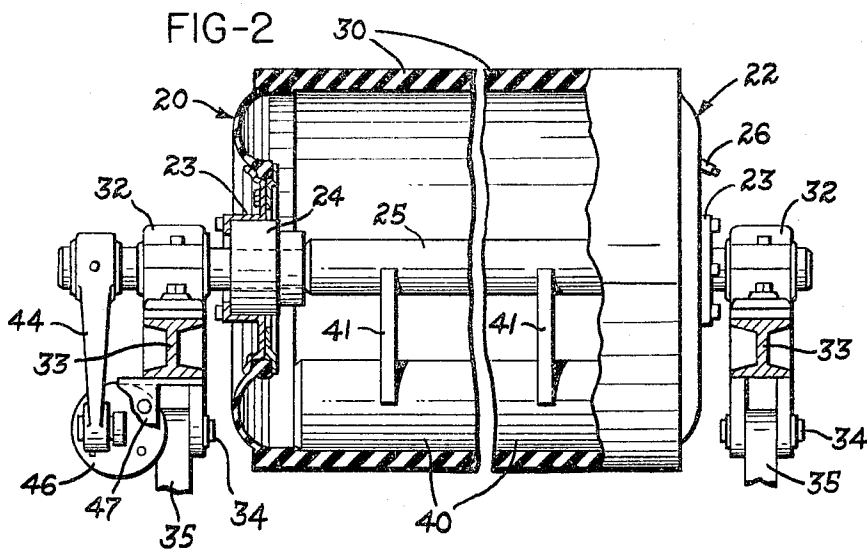


FIG-2



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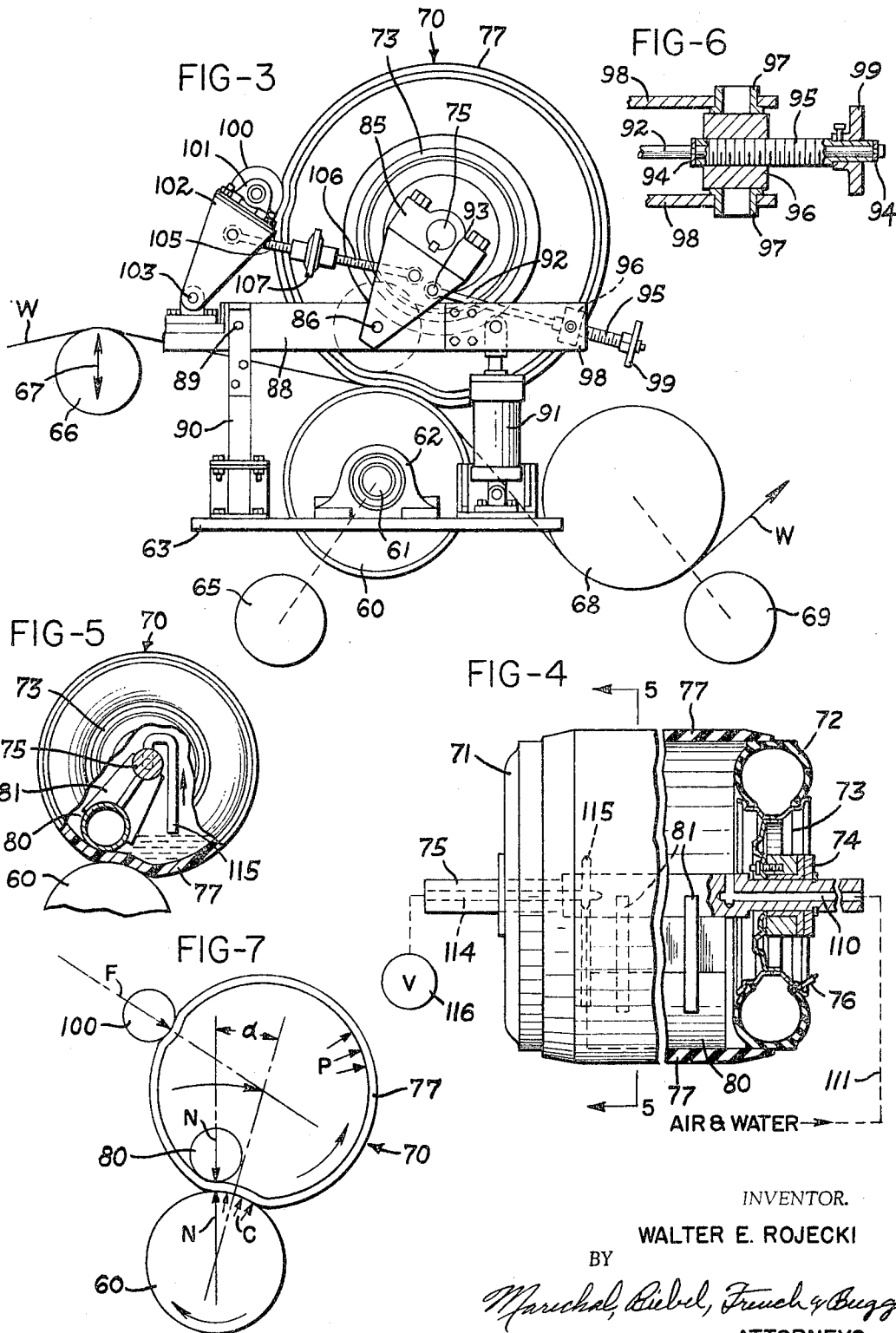
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MACHINE FOR MAKING EXTENSIBLE PAPER

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10 Claims. (Cl. 162—361)

This invention relates to paper machinery, and particularly to a press assembly for use in the production of extensible paper.

The invention has special application to the production of extensible paper by apparatus wherein a resilient blanket is urged against a paper web over a substantial angular area of the surface of a cooperating heating press roll as shown, for example, in Cluett Patent No. 2,624,245, issued January 6, 1953. The invention is particularly concerned with the provision of apparatus operating on similar principles which will offer significant advantages of economy of both initial installation and maintenance over previously available apparatus for the same general purposes.

Thus it is a primary object of the present invention to provide a press assembly for the production of extensible paper which includes a resilient blanket but which does not require guide, stretch or tension rolls for the blanket, with corresponding economy of initial production and installation.

Another object of the invention is to provide a press assembly for the production of extensible paper which includes a resilient blanket and a cooperating press roll, and which is constructed to make it possible to change the blanket quickly and easily without the necessity of special equipment.

A particular object of the invention is to provide a press assembly for the production of extensible paper wherein the resilient blanket of the press assembly is a part of an inflatable roll which thus constitutes in a single component unit both the blanket and its guiding and tensioning mechanism.

It is also an object of the invention to provide a press assembly as outlined in the preceding paragraph wherein the inflatable roll which includes the resilient blanket incorporates an internal adjustable pressure mechanism for establishing the desired pressure nip of the blanket against its cooperating press roll.

A further object of the invention is to provide a press assembly for the production of extensible paper as outlined above which is so constructed and arranged that the angular extent to which the resilient blanket laps is cooperating press roll is readily adjusted and controlled to suit desired operating conditions or results.

Still further objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

FIG. 1 is a side elevational view, partly broken away, showing a press assembly constructed in accordance with the invention;

FIG. 2 is a view partly in side elevation and partly in section on the line 2—2 of FIG. 1;

FIG. 3 is a side elevational view showing another form of press assembly constructed in accordance with the invention;

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FIG. 4 is a view partly in side elevation and partly in axial section of the inflatable roll in the assembly of FIG. 3;

FIG. 5 is a view looking from right to left in FIG. 4 which is partly in end elevation and partly in section on the line 5—5 of FIG. 4;

FIG. 6 is an enlarged fragmentary section of FIG. 3; and

FIG. 7 is a force diagram.

Referring to the drawing, which illustrates a preferred embodiment of the invention, the press roll 10 has journals 11 mounted by bearings 12 on a base frame 13. The roll 10 is preferably a heated roll having a smooth, hard, imperforate surface, and it is provided with suitable driving means as indicated diagrammatically at 15. The paper web W is guided to and from the press assembly by suitably located guide rolls 16 and 17.

Cooperating with the press roll 10 is an inflatable roll indicated generally at 20, which comprises an inflatable body 22 of rubber or like material mounted by suitable disk hubs 23 and bearings 24 for free rotation on a supporting shaft 25 and provided with conventional valve means 26 by which it can be inflated to a desired maintained pressure. The body 22 may be similar in construction to the pneumatic tires employed for use on vehicles built to travel over desert or other country having no roads, but it is shown as formed of two half-sections of a pneumatic rubber tire secured to an outer circumferential face portion 30 of rubber or like resilient material which forms an endless resilient blanket of substantial thickness, for example a thickness of the order of 1.25 inch.

The rolls 10 and 20 are mounted for operation with their axes in predetermined closely spaced parallel relation such that the surface of the roll 10 deforms a portion of the blanket 30 into lapping relation with a corresponding angular portion of the surface of roll 10, and this mounting is preferably adjustable as shown in FIG. 1. Thus each end of the shaft 25 is mounted by a bearing 32 on an arm 33 having one end pivoted at 34 on a portion 35 of the base frame 13. The other end of each arm 33 is provided with a fluid pressure loading cylinder 36 mounted on another frame portion 37 and provided with an opposed adjustable stop 38 limiting movement of the roll 20 toward roll 10.

The roll 20 is provided internally with means for compressing the blanket 30 against the surface of roll 10 to form a pressure nip. Thus a nip bar 40 is mounted within the roll body 22 on the shaft 25 by rigid arms 41, and these parts are so proportioned that in the operating positions of the rolls, the radially outer surface of the bar 40 is located at a greater distance from the axis of shaft 25 than the distance of the axis of the shaft 25 to the surface of roll 10. The bar 40 is shown as having a directly welded connection to the arms 41 which causes it to be non-rotating, but a rotary mounting can be provided if desired, as by locating the arms 41 at the ends of the bar 40.

The shaft 25 is provided at one or both ends with a crank arm 44 which is connected with the piston rod 45 of a fluid pressure cylinder 46 mounted on the adjacent loading arm 33 by a bracket 47. With this arrangement, when pressure is applied to the arm 44 by the cylinder 46, the arm 44 is urged to the right as viewed in FIG. 1

and thereby causes the shaft 25 to rotate in clockwise direction to act as a torque shaft forcing the nip bar 40 to compress the blanket 30 against the surface of roll 10 and thereby to form a pressure nip 50 therebetween.

In the operation of this press assembly in accordance with the invention, the roll body 22 is inflated to a relatively low pressure, for example 2-5 p.s.i.g., and the parts are so proportioned and arranged that with the arms 33 held against the stops 38 by the cylinders 36, the blanket 30 is deformed to lap approximately 20° of the surface of roll 10. The cylinders 46 are similarly actuated to load the nip bar 40 against roll 10 with relatively substantial pressure, for example 250 p.s.i., to effect corresponding compression of the blanket 30 across the nip 50. The roll 10 is driven in the direction to cause the blanket 30 to travel through nip 40 and then along the lapped surface portion of roll 10, and the roll 20 is similarly driven, either through friction with roll 10 or by a separate drive connection.

The guide roll 16 is preferably located to guide the relatively wet web W directly into the nip 50 or to the surface of blanket 30 just ahead of nip 50 for passage there-through. After passing through nip 50, the web W is held between roll 10 and the deformed lapping portion of blanket 30 until the latter leaves the surface of roll 10. The outer surface of blanket 30 first curves convexly around the relatively small radius of nip bar 40, and then after the blanket has been compressed by passage through the nip 50, it expands and reverses its curvature while in contact with the lapped surface portion of roll 10 through the web W, thereby effecting longitudinal contraction of the web which imparts the desired extensible properties thereto. If this operation develops an undesirable amount of heat in the blanket 30, this can readily be controlled by circulating a small supply of water through the interior of roll 20, as by means of inlet and siphon means of essentially the same construction commonly employed in paper machine dryer rolls, and this may also be desirable to provide lubrication between the contacting surfaces of the nip bar 40 and the roll body 22.

It will accordingly be seen that the press assembly of the invention provides substantial practical advantages of simplicity and economy in both installation and maintenance. Thus the single inflatable roll 20 includes not only the necessary rubber blanket member but also the supporting, guiding and tensioning means for the blanket, thereby eliminating the necessity for separate guide rolls such as have been required in the past. In addition, the construction of the invention greatly facilitates exchange of blankets necessitated by wear, since this can be readily done by simply exchanging a complete spare inflatable roll 20 with its own supporting shaft. The absence of separate guide rolls reduces the time required for such exchange to a minimum, and a new body and blanket can then be mounted on the removed shaft unit without further interruption of production.

The construction of the invention also makes it readily possible to change operating conditions as desired. Thus the pressure of the deformed portion of the blanket 30 against the roll 10 can be increased or decreased by correspondingly varying the air pressure within the roll body 22. Similarly, the pressure across the nip 50 can be adjusted and controlled through regulation of the pressure supply to the cylinders 46. The extent of deformation and lap of the blanket 30 can also be regulated, by means of the adjustable stops 38, and in this connection it should be noted that the relative proportions of the rolls 10 and 20 are not critical and in general that the maximum practical variation in the extent of the deformed portion of the blanket is obtained when the roll 20 is of substantially larger diameter than the roll 10.

FIGS. 3-7 show another form of press assembly in accordance with the invention which is in many respects similar to the press assembly described in connection with FIGS. 1 and 2.

Referring particularly to FIG. 3, the press roll 60 has journals 61 mounted by bearings 62 on a base frame 63. The roll 60 corresponds in function to the roll 10 and should similarly be a heated roll, having a smooth, hard, imperforate surface. The roll 60 is provided with suitable driving means as indicated diagrammatically at 65, and the paper web W is guided to the press assembly by a guide roll 66 which is preferably mounted for vertical adjustment as indicated by the arrow 67. A roll 68 receives the web W after it leaves the roll 60 and is separately driven, as indicated at 69, at a slower speed than roll 60 to allow for the contraction of the web as a result of its treatment in the press assembly.

Cooperating with the press roll 60 is an inflatable roll indicated generally at 70, which comprises a pair of pneumatic rubber tires 71 and 72 each mounted by a rim 73 and hub 74 for free rotation on a supporting shaft 75 and each provided with a valve 76 for controlled inflation. A blanket member 77 of rubber or like resilient material extends in overlapping relation between the tires 71 and 72 and is bonded to their peripheral surfaces to complete the inflatable roll 70.

Within the roll 70 is a nip bar 80 which corresponds in function to the nip bar 40 and comprises a heavy metal tube rigidly secured to the shaft 75 by an arm structure 81. The bar 80 and arm structure 81 are so proportioned that when the roll 70 is supported out of contact with its cooperating rolls, the outermost surface of the bar 80 will just touch the inner surface of the blanket 77.

The mounting structure for the roll 70 is duplicated at each end of the press assembly, and only the structure at one end of the roll is shown. It comprises an arm 85 which is keyed and clamped to the outer end of the shaft 75 in non-rotating relation. The outer end of this arm 85 is connected by a pivot pin 86 to a load arm 88, and these parts are preferably so proportioned that the pin 86 is coaxial with the nip bar 80. The load arm 88 is in turn mounted at one end by a pivot pin 89 on an end stand 90 mounted on the base 63. The other end of the load arm 88 is adjustably supported by a fluid pressure cylinder 91 which is also mounted on the base 63.

An adjustable rigid connection is provided between each arm 85 and its associated load arm 88, which is shown as comprising a rod 92 having one end pivoted at 93 to the arm 85. A threaded bushing 95 (FIGS. 3 and 6) is rotatable on the outer end portion of the rod 92 but is confined at both ends as by snap rings 94. The bushing 95 is threaded through a block 96 pivoted at 97 between two plates 98 which forms extensions of the arm 88. A hand wheel 99 is secured on the outer end of the bushing 95 for manual operation thereof, and it will be seen that rotation of the bushing 95 will cause the inflatable roll 70 to swing back and forth about the axis of the pivot pins 86.

A supplemental roll 100, which may be of relatively small diameter, is mounted for adjustable pressure engagement with the outer surface of inflatable roll 70. Referring particularly to FIG. 3, the roll 100 is supported at each end by a bearing 101 secured to one end of arm 102 having its opposite end provided with a pivotal mounting 103 on the adjacent load arm 88. An adjustable rigid connection is provided between each arm 102 and the adjacent arm 85, and such connection is shown as formed by a pair of threaded rods 105 and 106 connected at their adjacent ends by a turnbuckle 107 and having their opposite ends pivoted to the arms 85 and 102 respectively.

In addition to the valves 76 for effecting inflation of the individual tires 71 and 72, provision is made for controlled inflation of roll 70 as a whole. One end of the shaft 75 is provided with a bore 110 through which air, water or both may be introduced to the interior of the roll 70 as indicated at 111. The purpose of introducing water is primarily to lubricate the interface of the bar 80 with the inner surface of the blanket 77, and it also provides a cooling action. The level of water within the roll 70 is readily controlled by providing the other end of the shaft

77 with a similar bore 114 having a siphon tube 115 mounted therein within the roll 70 as shown and having its outer end connected to a source 116 of controlled suction.

The arrangement of the mounting structure for the roll assembly of FIGS. 3-6 is preferably such that the center of the nip bar 80 and the axis of the pivot pin 86 lie in the same plane with the axis of roll 60, and conveniently all of these points will lie in the same vertical plane as shown. This arrangement will cause the roll 60 to deform the blanket 77 to an extent which is determined and controlled initially by the extent to which the roll 70 is displaced about the pivot pin 66 by adjustment of the rod 92.

The supplemental roll 100 is capable of performing two functions in the operation of this press assembly. In the first place, it will be apparent that if this roll is forced to a greater extent against the inflatable roll 70 than is shown in FIG. 3, by movement to the right as viewed in FIG. 3, it will produce an increased deformation of the surface of the blanket 77 on the opposite side of the nip bar 80, thus increasing the extent to which the blanket 77 wraps the roll 60. In addition, in all adjusted positions of the several rolls, the roll 100 has a stabilizing effect in eliminating vibrations and insuring uniformly maintained angular wrap of the surface of the roll 60 by the blanket 77.

FIG. 7 illustrates diagrammatically the forces involved in the form of the invention shown in FIGS. 3-6. The two arrows N represent the nip force squeezing the blanket 77 between the bar 80 and roll 60, and this force may be relatively high, for example 250 pounds per linear inch. The angle α is defined by lines from the center of roll 60 to the centers of bar 80 and roll 70 respectively, and this angle may be changed as described by swinging the roll 70 about the axis of pins 86. The pressure C represents the contact pressure between the blanket 77 and roll 80, which is a function both of the angle α and of the force F produced by the roller 100. The internal pressure P of roll 70 may be relatively low, for example 3 p.s.i. and is primarily for the purpose of maintaining the roll in proper shape.

The press assembly of FIGS. 3-7 accordingly offers substantial advantages from the standpoint of the range of operating conditions which can be produced. It is not necessary that the internal pressures in the inflatable roll 70 be particularly high, typical examples being 3 p.s.i. for the interior of the roll, as already noted, and 6 p.s.i. for the individual tires 71 and 72, and these pressures can be readily changed as dictated by the results to be obtained. It is also simple and easy to change the other operating conditions as desired, including the nip pressure between the roll 60 and bar 80, by changing the pressure in cylinder 91, or the degree of wrap of roll 60 by blanket 77, which can be varied either by movement of the roll 70 about the pivot pin 86 at an axis or by adjustment of roll 100 inwardly or outwardly of roll 70.

Another advantage of this press assembly, as well as that of FIGS. 1 and 2, is its adaptability to press rolls of different sizes and the ease with which the inflatable roll can be removed and replaced after its blanket portion becomes worn through use. With the press assembly of the invention, it is unnecessary to provide cantilevered rolls as in conventional presses, and changing of the blanket is achieved by simple removal of one inflatable roll and replacement by a similar spare roll, which is accomplished by lifting of the supporting shaft 25 or 75 from its bearings without disturbing the remainder of the press assembly.

Cross reference is made to the copending application of Frederick A. Martin, Serial No. 315,052, filed October 9, 1963 and assigned to the same assignee as this application.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made

therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A press assembly for use in the preparation of extensible paper, comprising a press roll, an inflatable roll of substantially the same length as said press roll having a circumferential outer face portion of resilient material forming a blanket of substantial thickness, means mounting said rolls with the axes thereof in predetermined parallel and closely spaced relation causing said press roll to deform a portion of said blanket into lapping relation with a corresponding area of the surface of said first roll, means within said inflatable roll for compressing one end of said deformed blanket portion thereof against said press roll to form a pressure nip, and means for causing said rolls to rotate in the direction to cause a paper web to travel through said nip and then between said deformed blanket portion and said press roll.

2. A press assembly as defined in claim 1 comprising means for selectively regulating the angular extent of said deformed blanket portion.

3. A press assembly as defined in claim 1 comprising means for adjusting and controlling the operation of said compressing means to regulate the pressure in said pressure nip.

4. A press assembly as defined in claim 1 comprising means for adjusting the relative spacing of said roll axes to vary the extent of said deformed blanket portion.

5. A press assembly as defined in claim 1 comprising means for adjusting and controlling the operation of said compressing means to regulate the pressure across said pressure nip independently of the extent of said deformed blanket portion.

6. A press assembly as defined in claim 1 comprising additional roll means supported outside said inflatable roll in angularly spaced relation around the circumference thereof from said press roll, and adjustable means for forcing said additional roll means into deforming pressure engagement with said blanket.

7. A press assembly for use in the preparation of extensible paper, comprising a press roll, an inflatable roll of substantially the same length as said press roll having a circumferential outer face portion of resilient material forming a blanket of substantial thickness, shaft means mounting said inflatable roll with the axis thereof in predetermined parallel and closely spaced relation with the axis of said press roll causing said press roll to deform a portion of said blanket into lapping relation with a corresponding area of the surface of said press roll, means carried by said shaft means within said inflatable roll for compressing one end of said deformed blanket portion thereof against said press roll to form a pressure nip, and means for causing said rolls to rotate in the direction to cause a paper web to travel through said nip and then between said deformed blanket portion and said press roll.

8. A press assembly as defined in claim 7 comprising frame means supporting said shaft in such spaced relation with said press roll that said shaft is removable with said inflatable roll and said compressing means from the remainder of said press assembly by movement in a direction transverse to the axis of said shaft.

9. A press assembly for use in the preparation of extensible paper, comprising a press roll, an inflatable roll of substantially the same length as said press roll having a circumferential outer face portion of resilient material forming a blanket of substantial thickness, means including a shaft supporting said inflatable roll with the axis thereof in predetermined parallel and closely spaced relation with the axis of said press roll causing said press roll to deform a portion of said blanket into lapping relation with a corresponding angular area of the surface of said press roll, said inflatable roll being mounted for free rotation on said shaft, a pressure bar secured to said shaft within said inflatable roll in parallel relation with said shaft and with the radially outer surface thereof spaced

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from the axis of said shaft by a distance greater than that from said shaft axis to the surface of said press roll, means outside said inflatable roll for moving said shaft in a direction causing said bar to compress one end of said deformed blanket portion thereof against said press roll to form a pressure nip, and means for causing said rolls to rotate in the direction to cause a paper web to travel through said nip and then between said deformed blanket portion of said press roll.

10. A press assembly as defined in claim 9 comprising means outside said inflatable roll for moving said shaft

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in a direction transverse to the axis thereof to change the extent of said deformed blanket portion without varying the pressure across said pressure nip.

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