May 1, 1951 E. W. CLEM 2,550,774

LUMP-BREAKER ROLL FOR PAPERMAKING MACHINES

Filed June 22, 1946 3 Sheets-Sheet 1

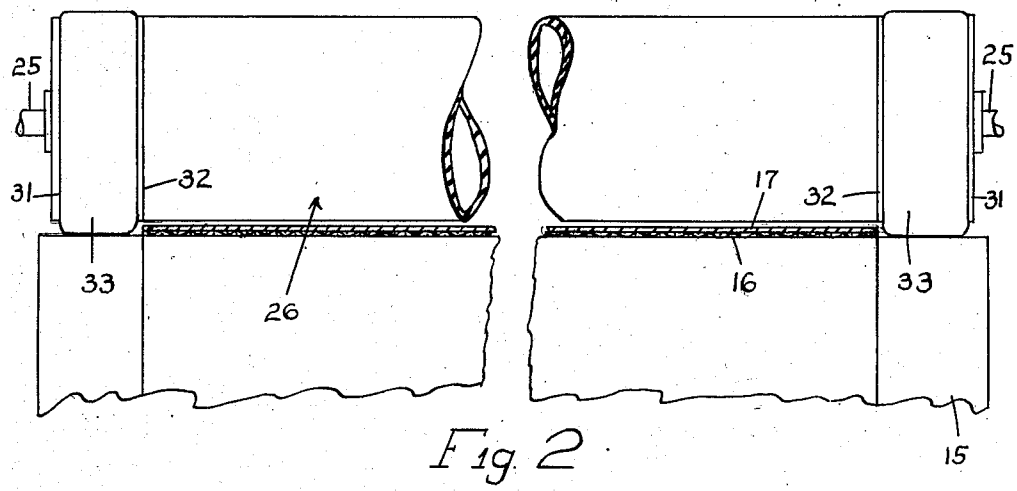


Fig. 2

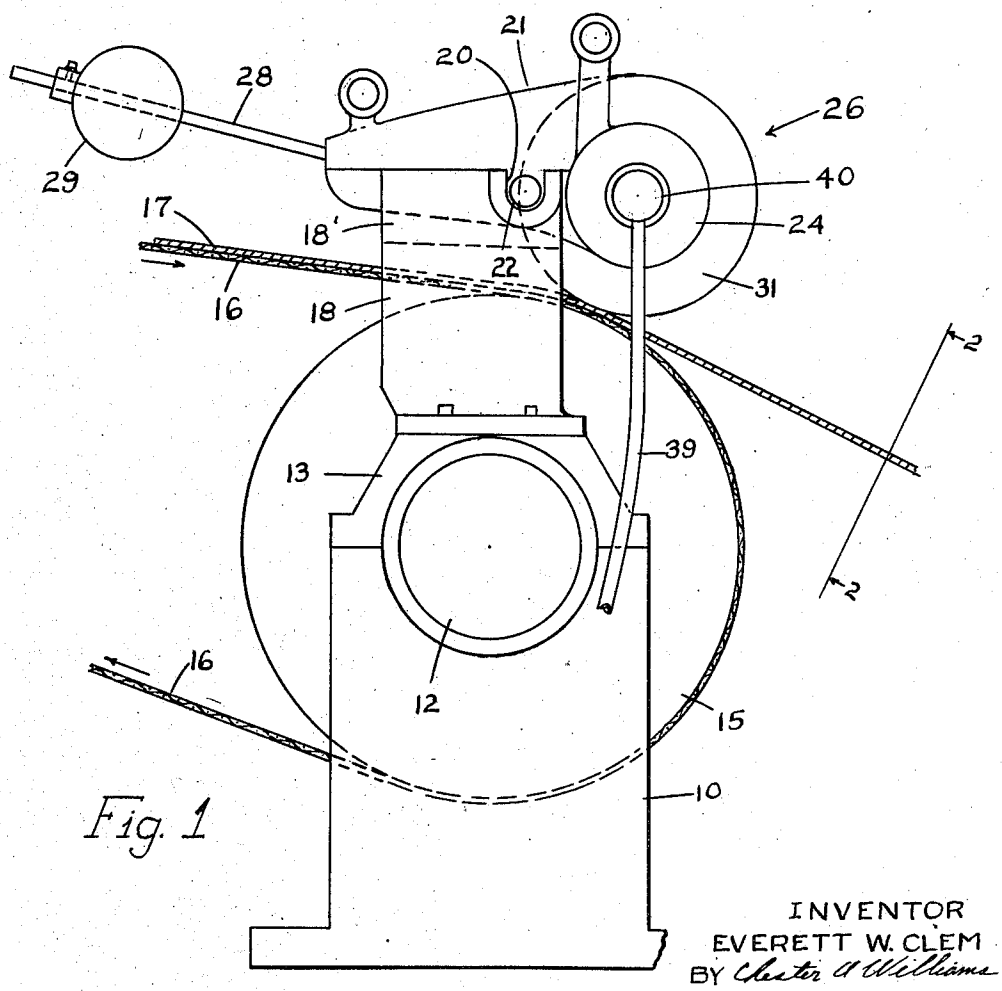


Fig. 1

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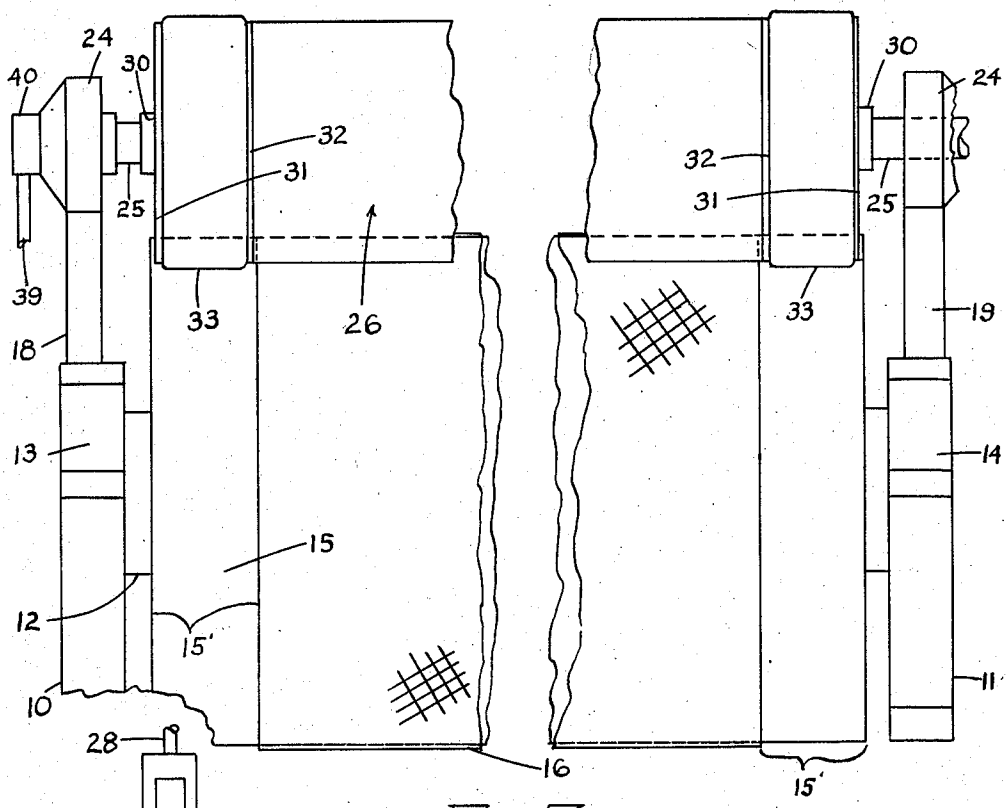


Fig 3

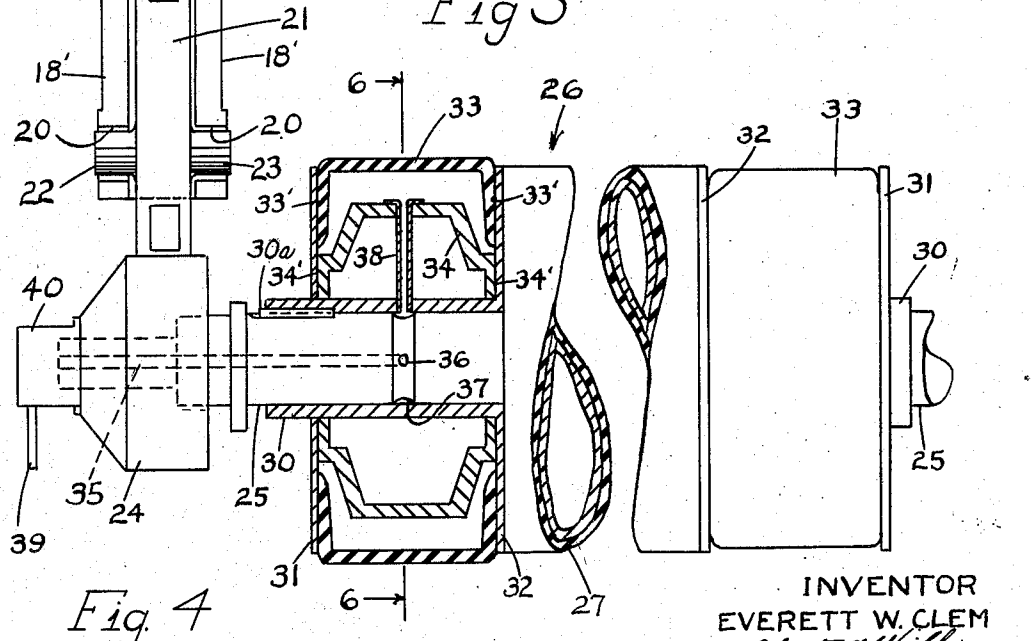


Fig. 4

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LUMP-BREAKER ROLL FOR PAPERMAKING MACHINES

Filed June 22, 1946 3 Sheets-Sheet 3

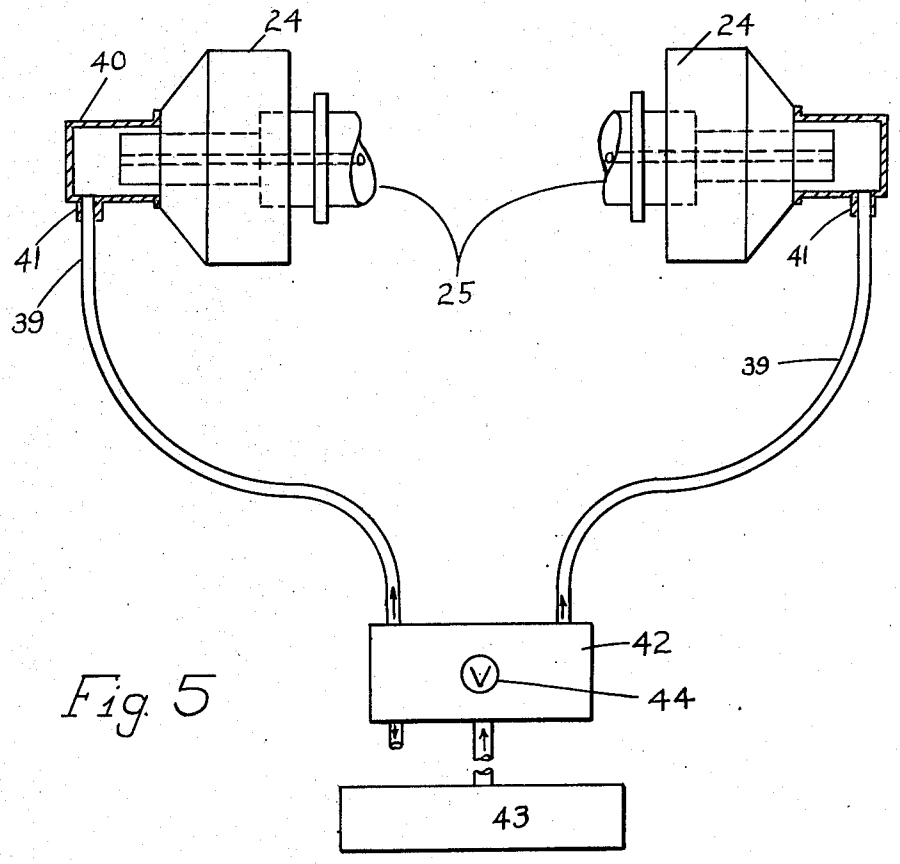


Fig. 5

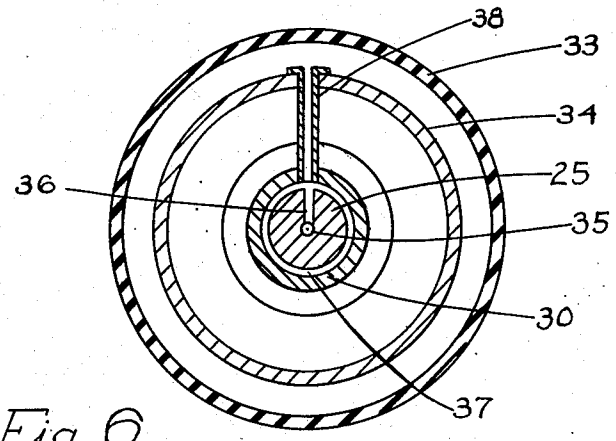


Fig. 6

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Patented May 1, 1951

2,550,774

UNITED STATES PATENT OFFICE

2,550,774

LUMP-BREAKER ROLL FOR PAPERMAKING MACHINES

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Application June 22, 1946, Serial No. 678,563

7 Claims. (Cl. 92—48)

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The present invention relates to paper making machines, and more particularily to a lump-breaker roll used in connection with the couch roll of a Fourdrinier machine.

As is well known in the paper making art, the couch roll of a Fourdrinier machine is disposed at the so-called wet end of the machine at a point between the suction boxes and the press rolls. The couch roll used in the modern Fourdrinier machine is frequently provided with suction to remove the water from the pulp web which is carried over the couch roll by means of an endless screen belt or apron. The pulp web, after leaving the couch roll, is fully formed into a wet paper web which then passes through the usual press rolls to the dry end of the machine.

The use of a lump-breaker roll in connection with a couch roll is well known in the art and the former element usually takes the form of a lightweight hollow roll having a soft rubber covering, and ordinarily this roll rests, under the force of gravity, on the pulp web at a point above the couch roll. The couch roll is power driven, but the conventional lump-breaker roll derives its rotation simply from its frictional contact with the moving web. It is the function of this lump-breaker roll to smooth out or crush up any lumps which from time to time are encountered in the pulp web. Such a lump-breaker roll is usually provided with adjustable counter-balancing weights for the purpose of providing means whereby its effective downward pressure against the pulp web may be varied.

Heretofore considerable difficulty has been experienced in the use of such a lump-breaker roll, because the need for always driving it by frictional contact with the moving web imposes considerable strain on the web, even though the roll is of lightweight material; the principal difficulty coming from the fact that the pulp web at this stage still retains considerable water and hence is frequently not strong enough, structurally, to drive the roll without danger of breakage. This difficulty is, of course, greatly magnified whenever the roll is started from rest as the drag of the roll upon the pulp web is oftentimes sufficient to sever, or greatly damage the web.

It is, therefore, an object of the present invention to overcome the above noted difficulties by providing a lump-breaker roll whose rotation may be initiated and in whole or in part maintained by means other than said roll's frictional contact with the pulp web.

A further object of this invention is to provide

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such a roll with means whereby the roll may be driven directly by the couch roll whenever the need arises, such means being under the direct control of an operator.

A still further object of the present invention is to provide a lump-breaker roll with means, remotely controlled, for raising the roll a desired distance above the couch roll during the operation of both rolls.

With the above and other objects in view, as will hereinafter appear, the invention comprises the arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the accompanying drawings,

Fig. 1 represents a side elevation of a couch roll and lump-breaker roll combination with the present invention incorporated therewith.

Fig. 2 represents a partial end view of the couch and lump-breaker roll combination as seen from line 2—2 of Fig. 1 and illustrating the lump-breaker roll in its elevated position.

Fig. 3 represents an end elevation of the machine parts disclosed in Fig. 1.

Fig. 4 represents a larger scale partial top plan view of said parts, with certain of said parts shown in section.

Fig. 5 represents a front elevation of the lump-breaker bearing mounts with junction caps in section and disclosing the fluid supply system.

Fig. 6 is a sectional view taken substantially along line 6—6 of Fig. 4. Like reference characters refer to like parts in the different figures.

In the embodiment of the invention selected for illustration, 10 and 11 represent the side frame members of a couch roll assembly. Rotatably mounted on the members 10 and 11 is a shaft 12 which is held in place upon the members 10 and 11 by means of the usual bearing blocks 13 and 14. Shaft 12 carries the usual couch roll 15 about which is trained an endless screen belt or apron 16 which functions in the usual manner to carry a pulp web 17 over the couch roll for the purpose of removing water therefrom. The couch roll 15 may be provided with the usual suction means (not herein shown) for removing water from the pulp web.

Mounted respectively upon the bearing blocks 13 and 14 are a pair of lump-breaker supporting members 18 and 19 each of which has formed on its top portion a pair of spaced cheeks 18', 18' having trunnion-receiving notches 20, 20,

formed therein. Rockably mounted between each pair of cheeks 18', 18' is an arm 21 having trunnion shafts 22 and 23 extending from opposite sides thereof for reception in the notches 20, 20 to support said arm. The forward end portion of each of the arms 21, only one of which is shown herein, is provided with a bearing head 24 in which an end portion of a lump-breaker shaft 25 is rotatably journaled. Carried upon the shaft 25, and rotatable therewith, is a lump-breaker roll 26 which is provided with the usual soft rubber covering 27. Projecting backwardly from each of the members 21, is an arm 28 upon which is adjustably mounted a counter weight 29. The weights 29, are adapted to be shifted lengthwise of the arms 28 for the purpose of adjusting the effective pressure which the lump-breaker roll 26, under the force of gravity, may exert upon the pulp web 17. As is usual in such lump-breaker roll operation, the present roll 26 is adapted to bear lightly upon the pulp web 17 and to be frictionally driven thereby. Thus, the roll 26 is effective to smooth out any lumps or imperfections that may be encountered on the surface of the pulp web 17. Different conditions will, of course, require the roll 26 to exert various pressures upon the web. As above described, such pressure changes may be effected by the adjustment of the weights 29.

As previously noted, conditions frequently arise under which it is highly desirable to relieve the pulp web, in whole or in part, of the strain of driving the lump-breaker roll by frictional contact therewith; furthermore, under certain conditions, such as in starting up the lump-breaker roll from a rest position, said roll should be slightly spaced from the wet pulp web. In order to attain these objectives the present lump-breaker roll 26 is provided at each end thereof with an expandable cylindrical element which is adapted, when expanded, to engage the periphery of the couch roll 15 beyond the edges of the screen belt 16 thereby to elevate the roll 26 and at the same time to effect a direct driving relation between the upper roll 26 and the lower roll 15. Thus, the couch roll 15 may directly drive the lump-breaker roll 26 through the medium of these expandable elements.

More specifically, each of these expandable elements comprises, a hub member 30 from which extends a pair of spaced circular disks 31 and 32, the latter of which elements is adapted to abut an end portion of the roll 26. This hub is secured to the shaft 25 by means of a key 30*a*, or any other suitable means. Bonded, or otherwise suitably secured, to the inner face portions of the elements 31 and 32, as at 33', 33', is an expandable annular diaphragm 33 which may be constructed of rubber or other such suitable elastic material. Mounted within the diaphragm 33, and secured to the opposite inner walls of the disks 31 and 32, as at 34', 34', is a rigid annular baffle 34 which is spaced from the diaphragm 33 thereby to provide an air tight fluid-receiving chamber therebetween. The shaft 25 is provided at each end thereof with an axial bore 35 which communicates at its inner end with a radial bore 36 which in turn is in communication with an annular groove 37 provided about the shaft 25 within the confines of the disks 31 and 32. The hub 30 is provided with a radial aperture which is located so as to communicate with the annular groove 37 and which has secured therein a tube 38. This tube 38 extends radially from the hub through the baffle 34 for

the purpose of communicating with the air chamber formed between the baffle and the diaphragm 33. Thus, it is to be understood that each of the diaphragms 33, 33 may be expanded by means of a fluid introduced into the axial bores 35, 35 of the shaft 25. It is the primary purpose of the baffle 34 to provide, in conjunction with the diaphragm 33, an air chamber having as little volumetric capacity as possible, thereby to make for a more sensitive control over the expansion and contraction of the diaphragms 33, 33.

In certain conditions of operation the lump-breaker roll is adapted to be frictionally driven by means of the pulp web 17 and thus the diaphragms 33, 33 are constructed so that they do not extend beyond the periphery of the roll 26 when they are in their deflated condition (see right hand diaphragm of Fig. 4). Referring particularly to Fig. 3, it is to be seen that the screen belt 16 does not extend to the extreme end portions of the couch roll 15 but, on the contrary, the edge portions thereof are spaced inwardly from the ends of the couch roll, thus providing substantially wide wire-free marginal portions 15', 15' on the couch roll. The pulp web, of course, does not extend beyond the edges of the screen belt 16. Consequently, when the diaphragms 33, 33 are expanded, by admission of fluid, such as compressed air, to the respective annular chambers enclosed thereby, the resulting increase of each diaphragm's radius causes its engagement with the underlying wire-free marginal portion 15' of the couch roll 15 thereby to raise the lump-breaker roll off the pulp web 17 and simultaneously to couple the roll 26 with the couch roll so that the latter will frictionally drive the roll 26. Fig. 2 illustrates this latter condition, it being understood that such elevation of the lump-breaker roll is permitted, by the rocking of its support arms 21, 21 about the axis provided by the seating of trunnions 22, 23 in the notches 20, 20.

In order selectively to control the inflation and deflation of the diaphragms 33, 33, means remote from the lump-breaker roll for this purpose are shown by Fig. 5 in the form of flexible fluid-conducting conduits 39, 39, each of which is connected with one of a pair of junction caps 40, 40 as at 41, 41. Each of these junction caps 40 is in turn disposed over one end of the shaft 25 and upon one of the heads 24 thereby to permit relative rotation between the caps 40, 40 and the shaft 25.

The other ends of the conduits 39 extend away from the caps for connection to a valve box 42 which in turn is in communication with a supply source 43 of fluid under pressure. A two-way valve 44 is provided on the valve box 42 so that an operator may control the expansion and contraction of the diaphragms 33, 33 by opening or closing the valve. This valve mechanism may be of a standard commercial type and thus the details thereof need not be described herein.

Referring to Fig. 2, the lump-breaker roll 26 is illustrated with its diaphragms 33, 33 inflated and engaging the couch roll to the end that the lump-breaker roll proper is raised off the pulp web 17. However, the diaphragms 33, 33 may be so controlled by the valve mechanism that the roll 26 may be eased off the web 17 without entirely losing contact therewith. Thus, the effective pressure exerted upon the web by the roll 26 may be very closely regulated by the use of the present mechanism. Of course, as soon as the dia-

phragms engage the ends of the couch roll the latter element becomes effective to drive the lump-breaker roll in a direct manner.

It is obvious from the above description that the present mechanism provides a most efficient means for raising a lump-breaker roll off the pulp web as well as to provide a means whereby the frictional drive of the web against the lump-breaker roll may be supplemented or supplanted entirely by means of a direct couple between the couch roll and the lump-breaker roll.

I claim:

1. In a paper making machine having a couch roll, a wire belt trained over said couch roll for carrying a sheet being formed, means to rotate said couch roll, a lump-breaker roll above said couch roll for operation on said sheet, means to support said lump-breaker roll for free rotation about its longitudinal axis and for free movement towards and away from said couch roll, said lump-breaker roll normally being adapted to engage the upper surface of said sheet, annular expansible means carried adjacent the opposite end portions of said lump-breaker roll for engaging, when expanded, the periphery of said couch roll near each end thereof to move said lump-breaker roll away from said couch roll and simultaneously to effect a direct drive between said couch roll and said lump-breaker roll, and fluid means selectively to control the expansion and contraction of said expansible means.

2. In a paper making machine having a couch roll, a wire belt trained over said couch roll for carrying a sheet being formed, means to rotate said couch roll, a pair of spaced arms coaxially and rockably supported above said couch roll, a lump-breaker roll rotatably supported between and upon the end portions of said arms so as normally to engage the upper surface of said sheet and to be frictionally driven thereby, means effective to move said rolls relatively away from each other and simultaneously to couple said lump-breaker roll with said couch roll so that the former roll may be directly driven by the latter roll, said last mentioned means comprising, an expansible cylindrical element adapted, when expanded, to so move and couple said rolls, and fluid means selectively to control the expansion and contraction of said expansible cylindrical element.

3. In a paper making machine having a couch roll, a wire belt trained over said couch roll for carrying a sheet being formed, means to rotate said couch roll, a lump-breaker roll above said couch roll for operation on said sheet, means to support said lump-breaker roll for free rotation about its longitudinal axis and for free movement toward and away from said couch roll, said lump-breaker roll normally being adapted to engage the upper surface of said sheet, expansible means adjacent the opposite end portions of said lump-breaker roll for engaging, when expanded, the periphery of said couch roll near each end thereof for moving said lump-breaker roll away from said couch roll and simultaneously effecting a direct drive between said couch roll and said lump-breaker roll, said expansible means comprising a flexible cylindrical diaphragm carried rigidly upon and coaxially of said lump-breaker roll, means disposed axially of said lump-breaker roll for supplying fluid to said diaphragms, and means including a valve disposed remote from said lump-breaker roll for directing the flow of fluid to said diaphragms thereby selectively to control the expansion and contraction of said diaphragms.

4. In a paper making machine having a traveling apron upon which a wet pulp web or sheet is formed, the combination with a driven couch roll over which said apron is trained and having an end portion extending beyond the edge of said apron, of a lump-breaker roll for operation on said web or sheet above said couch roll, means for supporting said lump-breaker roll for rotative movement about its axis and for substantially vertical movement, bodily, toward and away from said couch roll, an annular diaphragm substantially concentric with and carried by said lump-breaker roll, in overlying relation to said extending end portion of said couch roll, and means for inflating said diaphragm to a diameter slightly greater than that of said lump-breaker roll, thereby to raise the latter relative to said web or sheet, and to obtain its frictional drive, in whole or in part, from said couch roll.

5. In a paper making machine having a traveling apron upon which a wet pulp web or sheet is formed, the combination with a driven couch roll over which said apron is trained, of a lump-breaker roll for operation on said web or sheet above said couch roll, means for supporting said lump-breaker roll for rotative movement about its axis and for substantially vertical movement, bodily, toward and away from said couch roll, one of said rolls having an end portion extending beyond the edge of said apron, an annular diaphragm substantially concentric with and carried by the other of said rolls in opposed relation to said extending end portion, and means for inflating said diaphragm to a diameter slightly greater than that of its associated roll, thereby to raise, relative to said sheet, said lump-breaker roll, and to obtain the latter's frictional drive, in whole or in part, from said couch roll.

6. In a paper making machine having a traveling apron upon which a wet pulp web or sheet is formed, the combination with a driven couch roll over which said apron is trained and having at each end a portion extending beyond said apron's edges, of a lump-breaker roll for operation on said web or sheet above said couch roll, means for supporting said lump-breaker roll for rotative movement about its axis and for substantially vertical movement, bodily, toward and away from said couch roll, two annular diaphragms, both substantially concentric with and carried by said lump-breaker roll, and overlying respectively the extending end portions of said couch roll, means for inflating both diaphragms to a diameter slightly greater than that of said lump-breaker roll, thereby to raise the latter relative to said web or sheet, and to obtain its frictional drive, in whole or in part, from said couch roll.

7. In a paper making machine having a traveling apron upon which a wet pulp web or sheet is formed, the combination with a driven couch roll over which said apron is trained, of a lump-breaker roll for operation on said web or sheet above said couch roll, means for supporting said lump-breaker roll for rotative movement about its axis and for substantially vertical movement, bodily, toward and away from said couch roll, one of said rolls having end portions extending beyond both edges of said apron, two annular diaphragms substantially concentric with and carried by the other of said rolls in opposed relation to said extending end portions, and means for inflating said diaphragms to a diameter slightly greater than that of their associated roll, thereby to raise, rel-

ative to said sheet, said lump-breaker roll, and to obtain the latters' frictional drive, in whole or in part, from said couch roll.

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