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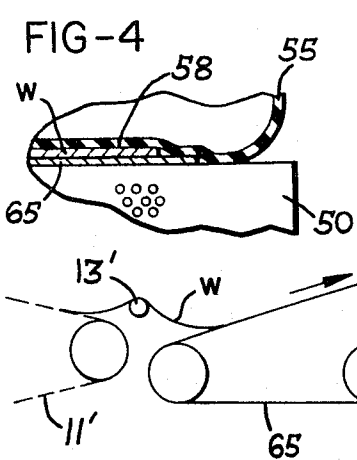
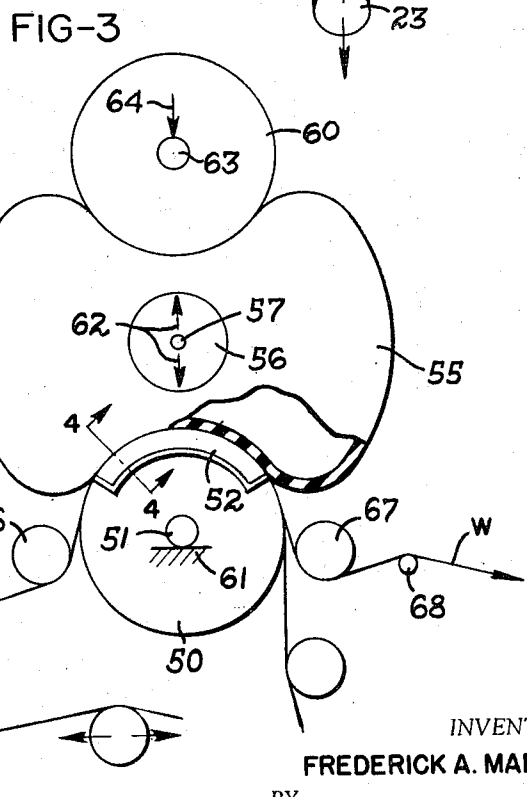
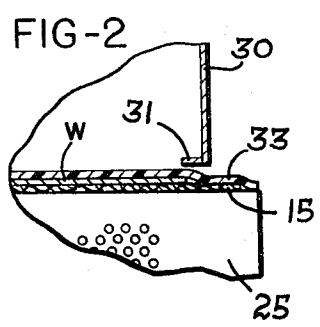
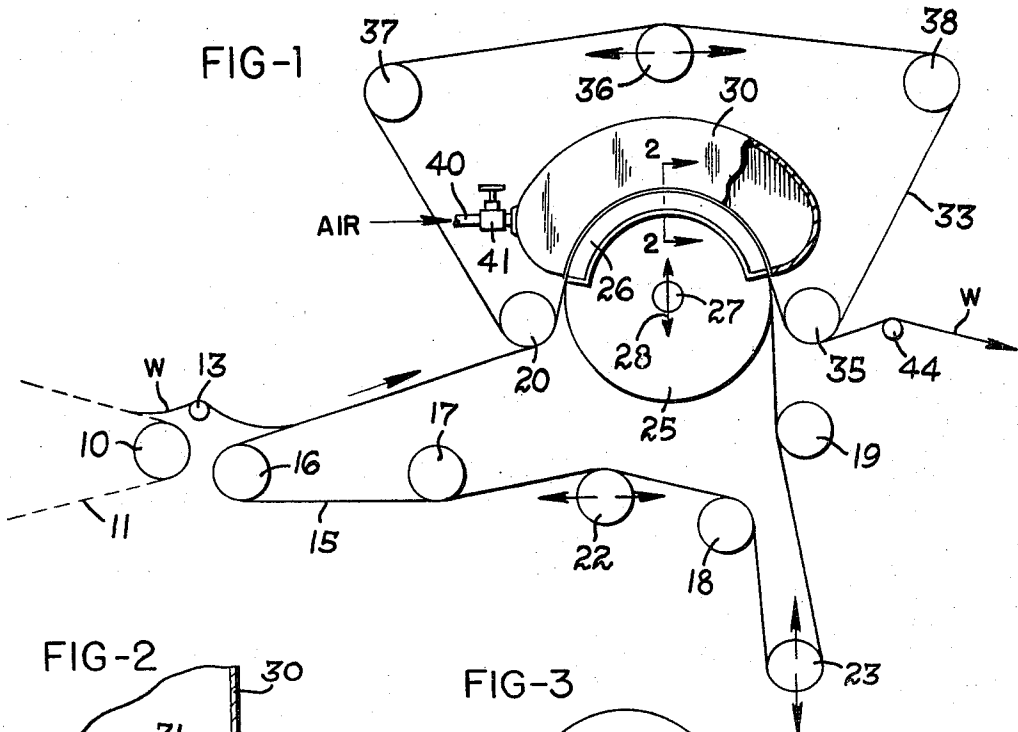
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3,293,121

PNEUMATICALLY PRESSURIZED PAPER WET PRESS ASSEMBLY

Filed Oct. 9, 1963

2 Sheets-Sheet 1



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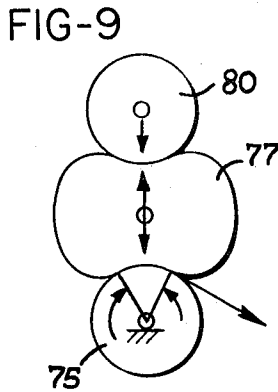
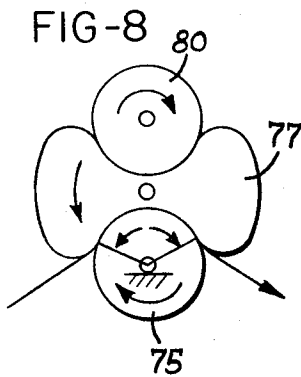
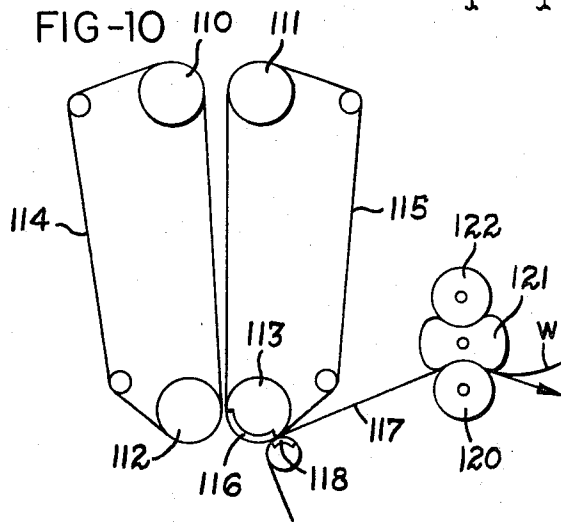
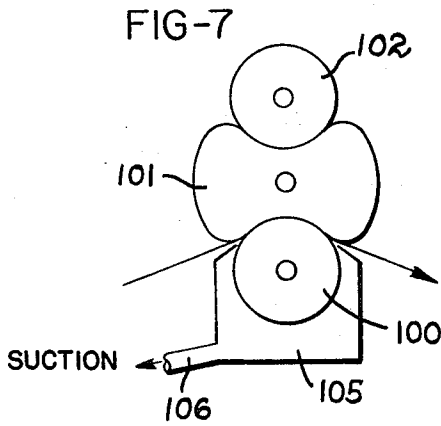
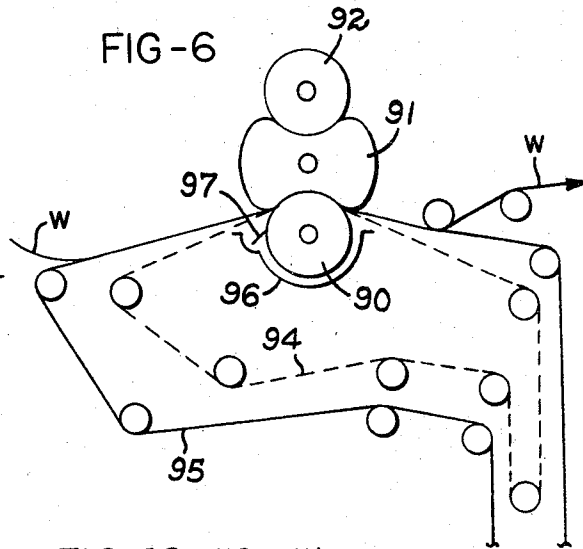
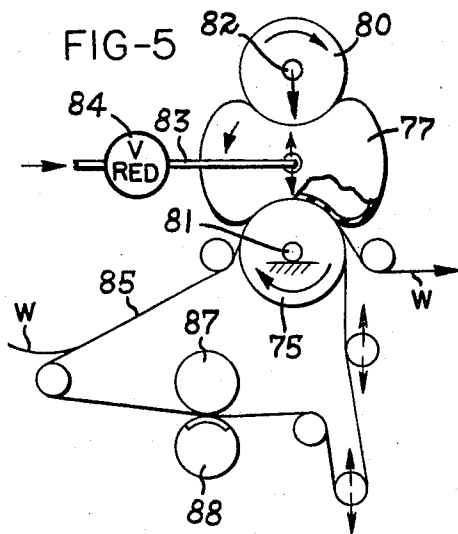
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PNEUMATICALLY PRESSURIZED PAPER WET PRESS ASSEMBLY

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2 Sheets-Sheet 2



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3,293,121

PNEUMATICALLY PRESSURIZED PAPER WET PRESS ASSEMBLY

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This invention relates to paper machinery, and more particularly to a press assembly for incorporation in a paper machine.

The invention has special relation to press assemblies for the purpose of removing water from the newly formed paper web which offer outstanding practical advantages over press assemblies of conventional construction as used in the past.

Thus it is a primary object of the present invention to provide a press assembly which will effect greater removal of water than a conventional press assembly while employing lower nip pressure than are customarily used and thus reducing the possibility of crushing or otherwise undesirably marking or damaging the paper web.

Another important object of the invention is to provide a press assembly which is of such construction and operating characteristics that water removal is effected over a substantially longer interval or dwell of the web in the press nip than with conventional press constructions.

A further object of the invention is to provide a paper machine press assembly which is of such structural and operational characteristics that crowning of the lower press roll is unnecessary, and the press accommodates itself automatically to maintain uniform nip pressure irrespective of the extent of crowning or sagging of the lower press roll.

Still further objects of the invention are to provide a paper machine press assembly of such structural and operational characteristics that the unit nip pressure can be changed while the press is running without change in the dwell time of the web therein, to provide a paper machine press assembly wherein the dwell time of the web can be varied independently of unit pressure and speed, and to provide a paper machine press assembly wherein both the unit pressure and the dwell time can be varied at the same time.

An additional object of the invention is to provide a suction press assembly which operates to remove water from the newly formed paper web without causing air to pass through the sheet, thereby reducing the possibility of undesirable marking of the web.

It is a specific object of the invention to provide a press assembly for a paper machine wherein there is one hard surfaced roll, which may be imperforate or a perforated suction roll, wherein the complementary press member is defined by a moving non-porous flexible belt member which also forms a wall of a fluid pressure chamber, and wherein the fluid pressure within this chamber exerts pressure through the belt member to compress the paper web and/or felt against the hard surfaced roll.

A further object of the invention is to provide a press assembly as outlined in the preceding paragraph wherein the hard surfaced roll is a suction roll having a suction area, and wherein the flexible belt member overlies this suction area to compress the paper web and/or felt thereagainst to force water therefrom directly into the suction roll.

It is a particular object of the invention to provide a suction press assembly as outlined in the preceding paragraph wherein the suction area of the suction roll is of substantial angular extent so that the water removing

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action takes place over a correspondingly substantial time interval without developing high localized nip pressures.

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

In the drawings:

FIG. 1 is a somewhat diagrammatic view in side elevation showing a press assembly constructed in accordance with the invention and arranged to receive the newly formed paper web from the forming wire;

FIG. 2 is an enlarged and somewhat diagrammatic sectional view taken on the line 2-2 of FIG. 1;

FIG. 3 is a view similar to FIG. 1 showing another form of press assembly in accordance with the invention;

FIG. 4 is a sectional view similar to FIG. 2 and taken on the line 4-4 of FIG. 3;

FIG. 5 is a view similar to FIG. 1 showing still another form of press assembly in accordance with the invention;

FIG. 6 is a view similar to FIG. 1 showing still another form of press assembly in accordance with the invention;

FIG. 7 is a view similar to FIG. 1 showing still another form of press assembly in accordance with the invention;

FIGS. 8 and 9 are diagrammatic views further illustrating the operation of the press assemblies of FIGS. 5-7; and

FIG. 10 is a diagrammatic view illustrating a press assembly in accordance with the invention arranged to receive the newly formed paper web from a different form of paper machine from the illustrations in FIGS. 1 and 3.

Referring to the drawings, which illustrate a preferred embodiment of the invention, FIG. 1 shows the couch roll 10 and a fragment of the forming wire 11 of a Fourdrinier paper machine on which the paper sheet or web W is formed. The paper web W is shown as passing over a guide roll 13 to a felt 15 running on felt rolls 16, 17, 18, 19 and 20, a guide roll 22, a tensioning roll 23 and a driven press roll 25 which forms a part of a press assembly constructed in accordance with the invention. The press roll 25 is shown as a suction roll having a suction area formed in the periphery thereof by the suction box 26, and it is mounted in the usual way as indicated diagrammatically by the journal 27 and the arrows 28 representing frame means by which the roll 25 is supported for adjusting movement transversely of its axis.

The complementary press member of the press assembly in FIGS. 1 and 2 includes a housing 30 of metal or other suitably rigid material having its under face curved to fit in close running relation with the surface of the roll 25 over the entire suction area provided by the suction box 26. This curved face of the housing 30 is open across substantially the entire length of the roll 25, as shown in FIG. 2, except that the open edge may be provided with a narrow flange 31 or the like. This open face of the housing 30 is provided with a separate wall in the form of a belt 33 of non-porous flexible material such as rubber or plastic. The belt 33 is trained around the felt roll 20 and a similarly located roll 35 at the opposite side of roll 25 so that belt 33 travels around the suction area of the press roll in driven relation with roll 25 and in close running relation with the edge flanges 31 of the housing 30, and the roll 35 may also be driven if this is found necessary. The return flight of the belt 33 is shown as lapping a guide roll 36 and additional idler rolls 37 and 38.

The housing 30 and belt 33 thus cooperate to form a chamber capable of being filled with a pressure fluid,

and the housing 30 is shown as provided for that purpose with an inlet 40 and control valve 41 of conventional design for admitting a controlled flow or pressure air. The parts are preferably so proportioned that the belt 33 normally runs in sufficiently close relation with the edge flanges 31 of the housing 30 to provide an air seal effect capable of retaining substantial fluid pressure within the housing 30 while permitting a slight outward flow sufficient to lubricate the adjacent surfaces of the flanges 31 and belt 33. The retained pressure within the housing 30 will therefore be effective to compress the belt 33 against the press roll 25 as it travels around the suction area of the suction box 26.

In operation with this press assembly, the newly formed paper web W is conveyed to the press roll 25 on the felt 15, and the web and felt are guided by the roll 20 to the surface of the roll 25 just ahead of the on-coming side of the suction box 26. The web and felt then travel around the full angular extent of the suction area of the roll 25 between the belt 33 and the perforate surface of roll 25, and thereafter the web travels with the belt 33 to the guide roll 35 where it separates from the belt and travels over a paper roll 44 to the next station of the paper machine.

While the web and felt are traveling around the suction area of the roll 25, they are continuously subjected to the fluid pressure exerted thereon through the belt 33 by the pressure cushion within the housing 30. Water in the web and felt is accordingly expelled directly into the suction box 26 during this entire travel interval, which is substantially longer than the travel time of a felt through the press nip and across the suction box of a conventional suction press assembly. In addition, the belt 33 has the effect of shielding the web from the passage of air therethrough, thereby insuring that all of the pressure and suction are effective to cause water removal, as distinguished from conventional suction press assemblies wherein substantial air is drawn through the web from the outside atmosphere.

Other advantages of the operation of the invention as described above are both that the application of pressure to the web is relatively gradual, as distinguished from the relatively sudden application which occurs in the press nip between two conventional press rolls, and also that the invention eliminates the possibility of crushing or otherwise undesirably marking the web in the manner which can occur when the web passes through a conventional narrow press nip between two hard surfaced rolls. In the practice of the invention, there is no condition like the sudden and relatively severe pressure established by hard rolls in a conventional press nip, but the total pressure applied to the web in the press assembly of the invention, over the comparatively long dwell period during which it is traveling around the suction area of the suction roll, makes it possible to remove more water and at a more gradual rate than is the case in a conventional press. In addition, since the pressure on the belt 33 is uniform over its entire area lapping the roll 25, it will maintain uniform pressure against roll 25 irrespective of crowning or sagging of roll 25, and the roll 25 therefore requires no crowning as in conventional presses.

FIGS. 3 and 4 illustrate another form of the invention wherein the driven press roll 50 is shown as a suction roll having supporting journals 51 and provided with a suction box 52 of substantial angular extent. The complementary press member comprises essentially a pneumatic tire or inflated roll 55 having supporting journals 56 and constructed of substantially greater diameter than and substantially the same axial length as the press roll 50. For example, the tire or roll 55 may be similar in construction to the pneumatic tires employed for such uses as vehicles built to travel over desert or other country having no roads, it being necessary only that the roll 55 be constructed of sufficient proportions for cooperation with the pressure roll 50 as described herein, and the roll 55 is provided with suitable valve means 57 of conventional con-

struction by which it can be inflated to a desired maintained pressure.

Referring again to FIGS. 3-4, with the inflatable roll 55 of the type described, it is free of internal structure throughout at least a sufficient major portion of its interior inwardly of its circumferential outer face portion 58 to provide for deformation of a substantial angular portion of its face portion 58 by roll 50. Thus as shown in FIG. 3, the rolls 50 and 55 are mounted in suitable frame means, not shown, with their axes in such parallel and spaced relation that the press roll 50 deforms the circumferential outer face portion 58 of the roll 55 into overlapping relation with the entire suction area of the roll 50. This arrangement, as shown in FIG. 3, causes the face portion 58 of the roll 55 to function in essentially the same manner as the belt 33 in FIGS. 1 and 2. Preferably, the roll 55 is provided with a back-up roll 60, which may advantageously be a plain surfaced driven roll, mounted in the same relative spacing as roll 50 with the axis of roll 55 to equalize the deformation of roll 55. For example, the journals 51 may have a fixed mounting as indicated at 61, the journals 56 of the inflatable roll 55 may float as indicated by the arrows 62, and the roll 60 may have its journals 63 provided with a pressure loaded mounting, indicated at 64, to vary the spacings of the journals 51 and 63.

As further shown in FIG. 3, the newly formed paper web W is guided from the forming wire 11' over the roll 13' to the felt 65 which carries the web around the roll 66 to the surface of the press roll 50 ahead of the suction box 52. The web and felt therefore travel around the entire suction area of the roll 50 while sealed against the perforate surface of the roll 50 by the belt-like portion 58 of the roll 55 under the influence of the pressure within the roll 55. The operation of the form of the invention will therefore be effectively the same with respect to the web and felt, and after they pass beyond the suction area of the roll 50, the web is separated from the felt and guided further in the paper machine by the rolls 67 and 68.

The form of the invention shown in FIGS. 3 and 4 accordingly offers essentially the same operating advantages as the form first described, as well as some practical advantages of its own. For example, it is more easily mounted in operating position, as well as readily adjustable to vary the extent to which its outer face portion laps the cooperating press roll, and it will retain a desired air pressure without the continual bleeding required for the form of FIGS. 1 and 2. In addition, the pressure across the suction area 52 can be varied as desired by changing the maintained pressure within the inflated roll 55, and this can readily be done while the machine is in operation, particularly if the valve 57 is located on the axis of roll 55 as shown. It should also be noted that while the invention has been described with particular reference to a suction press assembly, it is not essential that the cooperating roll be a suction press roll, since it may have a smooth imperforate surface, a grooved imperforate surface, or any other type of surface construction which will adequately support the felt and/or paper web passing through the press for the purpose of the operation to be carried out thereon.

FIG. 5 shows an example of a press assembly in accordance with the invention wherein the main press roll 75 is a plain roll and cooperates with an inflatable roll 77 and backup roll 80 which correspond to the rolls 55 and 60 in FIG. 3. The rolls 75 and 80 are shown as provided with similar fixed and adjustable mountings 81 and 82, respectively, and the roll 77 has an automatic air supply system connected thereto and comprising a supply line 83 having adjustable pressure control valve 84. The felt 85 carries the web W through the press nip formed by the deformed face portion of the roll 77 which laps the surface of the roll 75. The felt and web separate after passing through this nip as shown, and the felt then passes through a suction press comprising a plain press roll 87

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and a suction roll 88 for removing from the felt the water transferred thereto from the web during their passage through the nip of rolls 75 and 77.

FIG. 6 illustrates the application of the invention to a press assembly of the type disclosed in Brauns et al. Patent No. 3,093,535, issued June 11, 1963. Thus the roll 90 is a plain roll similar to the roll 75, and the inflatable roll 91 and backup roll 92 correspond to the rolls 77 and 80. A porous plastic belt 94 runs inside the felt 95 through the nip of rolls 90 and 91, and the water which is forced from the web W and felt 95 into the interstices of this belt 94 is transferred to the surface of the roll 90 and thence to the trough 96. A doctor 97 may be provided as shown to complete the removal of water from the surface of roll 90 ahead of its nip with roll 91.

FIG. 7 shows still another form of press assembly in accordance with the invention wherein the press roll 100 has a porous surface, such as a wire covering of the type commonly employed on a cylinder mold, and the other two rolls 101 and 102 are respectively an inflatable roll and a backup roll similar to the rolls 55 and 60. The roll 100 is mounted within a housing 105 having a close running fit with its outer periphery, and the interior of this housing is under suction applied through an outlet 106. In this press assembly, the roll 101 forces water from the felt 107 and any web carried thereby through the surface of roll 100 into the interior of the housing 105, whence it is removed through the suction outlet 106.

FIGS. 8 and 9 illustrate adjacent operating positions which can be established for different operating conditions of the press assembly shown in FIG. 5. In FIG. 8, the roll 80 is shown as forced closer to roll 77 than in FIG. 5, and it will be seen that this has the effect of increasing the deformed portion of the face of roll 77 which laps roll 75. Since this adjusted position increases the length of the press nip, it will have the effect of correspondingly increasing the dwell time of the felt and web in the press nip without changing the speed of the paper machine. At the same time, the pressure within inflatable roll 77 will remain at the same value as before, by operation of valve 84, or this valve can be adjusted as desired to change the unit pressure across the press nip.

FIG. 9 shows a different position of roll 80 with respect to roll 75 wherein the axes of these rolls are more remotely spaced than in FIG. 5, with a resulting decrease of the lapped area of the roll 75 and a corresponding decrease in the length of the press nip and the dwell time of the web and felt. FIGS. 8 and 9 with FIG. 5 thus show how the dwell time of the web in the nip can be changed by simple adjustment of roll 80 without change of the speed of the machine. It will also be understood that the unit pressure across the press nip can be increased or decreased through the valve 84 with or without adjustment of the length of the nip, and the same versatility of control applies to each of the press assemblies shown in FIGS. 3 and 6-7.

FIG. 10 illustrates the use of a press assembly in accordance with the invention in combination with another type of paper machine and pickup arrangement. The paper machine in FIG. 10 is shown as of the construction disclosed in Baxter Patent Re. 25,333, issued February 19, 1963, and it comprises a pair of breast rolls 110 and 111, a pair of couch rolls 112 and 113, and a pair of forming wires 114 and 115. The web W is formed in the spaced between the downwardly traveling converging runs of wires 114 and 115, and it travels around the lower face of the couch roll 113 due to the suction box 116 therein. The web is then transferred to the felt 117 by suction box 118, and it travels on the felt 117 to the press assembly shown as comprising a press roll 120, inflatable roll 121 and backup roll 122 which may correspond to any of the press assemblies shown in FIGS. 3-7.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to

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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.

5 What is claimed is:

1. A paper machine press assembly comprising a press roll, means for guiding a non-porous flexible belt in lapping relation with said press roll, means for guiding a porous web between said belt and said press roll, and means for applying fluid pressure to the opposite surface of said belt from said press roll to compress said porous web against said press roll.

2. A paper machine press assembly comprising a press roll, means forming a fluid pressure chamber in side-by-side relation with said press roll and of substantially the same length as said press roll, said chamber means including a non-porous flexible belt forming a wall of said chamber and arranged in lapping relation with said press roll, and means for guiding a porous web between said belt and said press roll for compression by said belt against said press roll.

3. A paper machine press assembly comprising a press roll, a non-porous continuous flexible belt arranged in lapping relation with said press roll, means cooperating with said belt to form a substantially fluid tight chamber for containing fluid under pressure causing said belt to be forced thereby against said press roll, and means for guiding a porous web between said belt and said press roll for compression by said belt against said press roll.

4. A paper machine press assembly as defined in claim 3 comprising means for maintaining a selectively variable fluid pressure within said chamber to effect corresponding variation of the pressure between said belt and said press roll.

5. A paper machine press assembly comprising a first press roll, an inflatable roll of substantially the same length as said first roll having a circumferential outer face portion of non-porous flexible material, said inflatable roll being free of internal structure throughout the major portion of its interior thereof inwardly of the outer wall thereof to provide for deformation of a substantial angular portion of the outer surface thereof by said first roll, means mounting said rolls with the axes thereof in predetermined closely spaced parallel relation causing said first roll to deform said face portion of said inflatable roll into lapping relation with a predetermined area of the surface of said first roll, and means for guiding a porous web between said rolls for compression by said deformed face portion of said inflatable roll against said first roll.

6. A press assembly as defined in claim 5 comprising means for varying the relative spacing of the axes of said rolls to change the angular extent of said deformed face portion of said inflatable roll and of the area of said first roll lapped thereby.

7. A paper machine press assembly comprising a first press roll, an inflatable roll of substantially the same length as said first roll having a circumferential outer face portion of non-porous flexible material, said inflatable roll being free of internal structure throughout the major portion of its interior thereof inwardly of the outer wall thereof to provide for deformation of a substantial angular portion of the outer surface thereof by said first roll, a third roll located on the opposite side of said inflatable roll from said first roll, means mounting said rolls with the axes thereof in predetermined closely spaced parallel relation and in substantially the same plane causing said first and third rolls to deform said face portion of said inflatable roll into overlapping relation with predetermined angular areas of the surfaces of said first and third rolls, and means for guiding a porous web between said first and inflatable rolls for compression against said first roll by the portion of said face portion of said inflatable roll which is deformed by said first roll.

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8. A press assembly as defined in claim 7 comprising means for adjusting the relative spacing of the axes of said first and third rolls to effect relative variation in the angular extent of the portions of said face portion of said inflatable roll which are deformed by said first and third rolls.

9. A press assembly as defined in claim 7 comprising means for maintaining a selected variable pneumatic pressure in said inflatable roll to vary the pressure of said deformed face portions of said inflatable roll against said first and third rolls.

10. A press assembly as defined in claim 7 comprising simultaneously operable means for varying the pneumatic pressure in said inflatable roll and for varying the relative spacing of the axes of said first and third rolls in order to change selectively at least one of the pressure between said deformed face portions of said inflatable roll against said first and third rolls and the angular extent of said deformed face portions.

11. A paper machine suction press assembly comprising a suction press roll having a suction area, means forming a fluid pressure chamber in side-by-side relation with said suction roll and of substantially the same length as said suction roll, said chamber means including a non-porous flexible belt forming a wall of said chamber and arranged in lapping relation with said suction area, and means for guiding a porous web between said belt and said suction roll for compression by said belt against said suction area.

12. A paper machine suction press assembly comprising a suction press roll having a suction area, a non-porous continuous flexible belt arranged in lapping relation with said suction area, means cooperating with said belt to form a substantially fluid tight chamber for containing fluid under pressure causing said belt to be forced thereby against said suction area, and means for guiding a porous web between said belt and said suction roll for compression by said belt against said suction area.

13. A paper machine suction press assembly comprising a suction press roll having a suction area, a second roll including a supporting shaft and an annular body of

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non-porous flexible material forming a substantially fluid tight chamber for containing fluid under pressure and of substantially the same length as said suction roll, said second roll being free of internal structure throughout the major portion of the interior of said annular body inwardly of the outer wall thereof to provide for deformation of a substantial angular portion of said outer wall by said suction roll, means mounting said rolls with the axes thereof in predetermined closely spaced parallel relation causing said suction roll to deform said body of said second roll into overlapping relation with said suction area of said suction roll, and means for guiding a porous web between said body and said suction roll for compression by said body against said suction area.

14. A paper machine press assembly comprising a suction press roll having a suction area, an inflatable roll of substantially the same length as said suction roll having a circumferential outer face portion of non-porous flexible material, said inflatable roll being free of internal structure throughout the major portion of its interior thereof inwardly of the outer wall thereof to provide for deformation of a substantial angular portion of the outer surface thereof by said suction roll, means mounting said rolls with the axes thereof in predetermined closely spaced parallel relation causing said suction roll to deform said face portion of said inflatable roll into overlapping relation with said suction area of said suction roll, and means for guiding a porous web between said rolls for compression by said deformed face portion of said inflatable roll against said suction area.

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