July 18, 1967 W. E. ROJECKI 3,331,734

PAPER MACHINE PRESS AND FELT ASSEMBLY

Filed Sept. 1, 1965 2 Sheets-Sheet 1

FIG-1

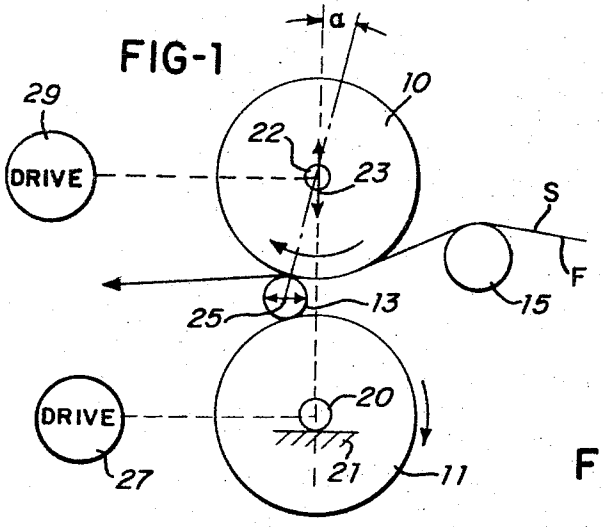


FIG-3

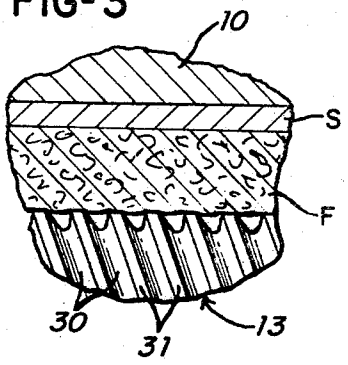


FIG-2

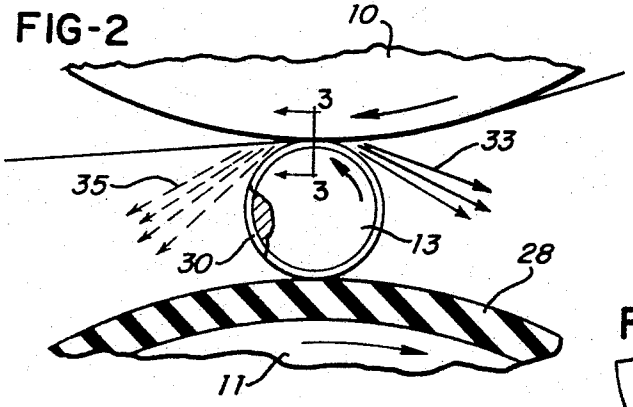


FIG-4

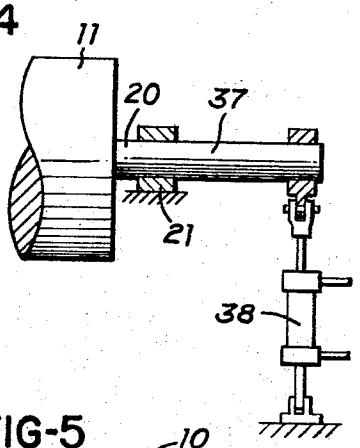


FIG-5

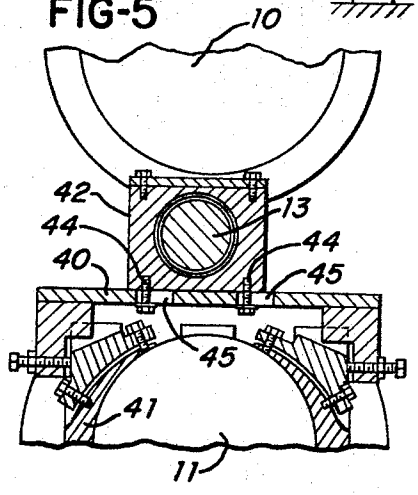
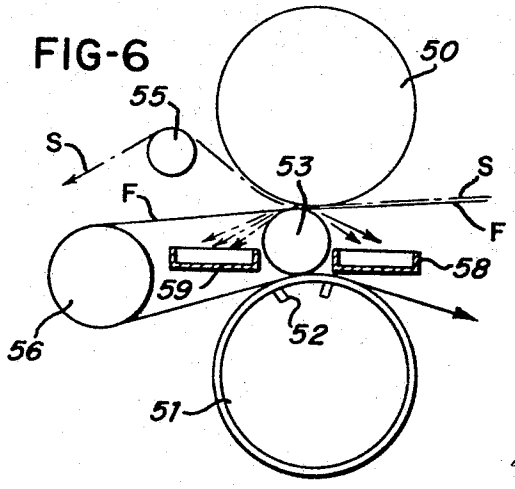


FIG-6



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PAPER MACHINE PRESS AND FELT ASSEMBLY

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FIG-7

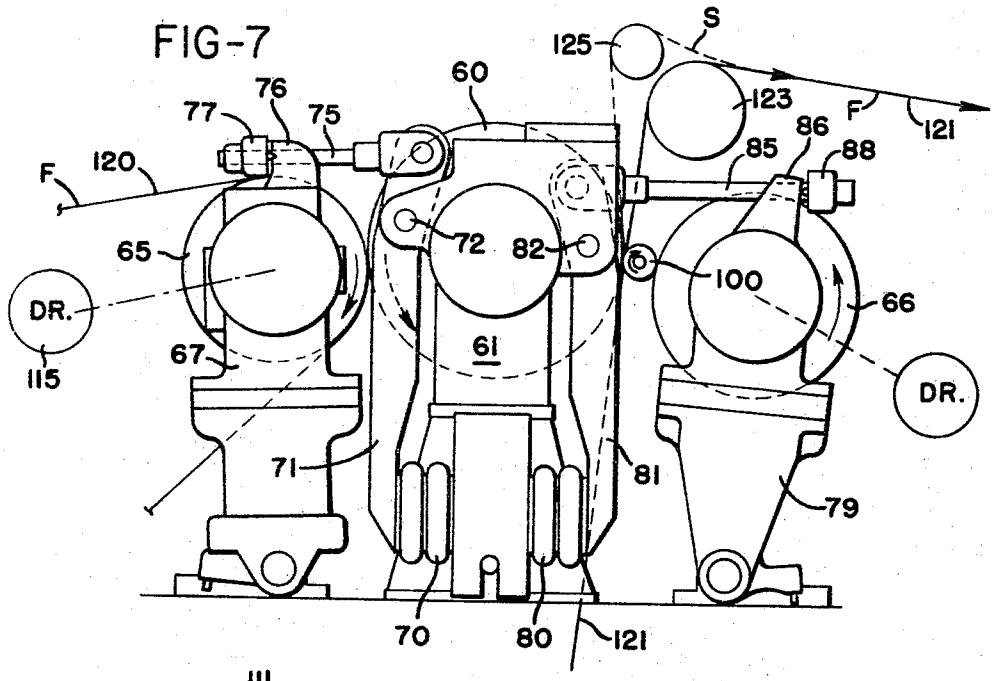


FIG-8

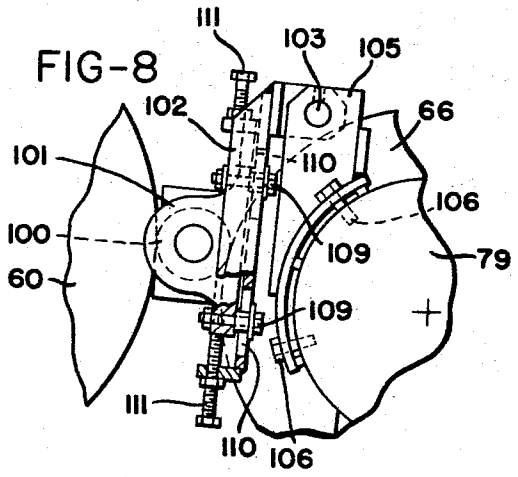


FIG-9

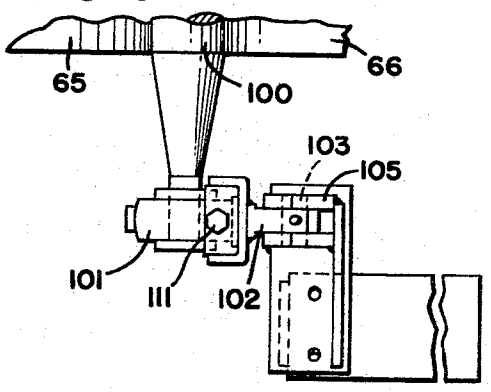
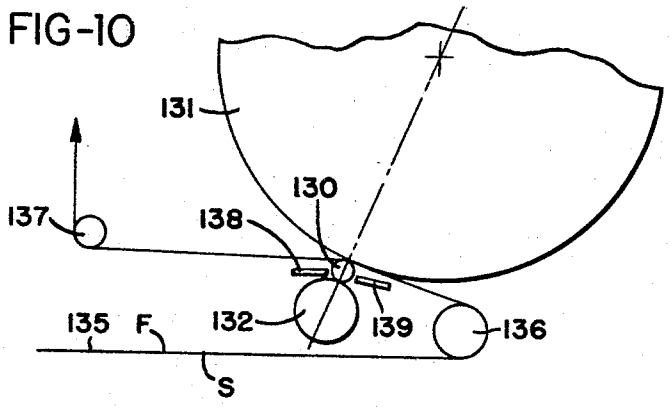


FIG-10



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3,331,734

PAPER MACHINE PRESS AND FELT ASSEMBLY

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Filed Sept. 1, 1965, Ser. No. 484,388
10 Claims. (Cl. 162—358)

ABSTRACT OF THE DISCLOSURE

In a paper machine press section, an intermediate roll of relatively small diameter is positioned between two rolls of conventional diameters, and the intermediate roll is maintained with its axis in offset relation with the plane defined by the axes of the other two rolls such that the pressures tending to force the intermediate roll away from such plane balance the tangential force tending to drive it toward such plane.

This application relates to paper making machinery, and more particularly to paper machine press sections, and it is a continuation-in-part of my application Ser. No. 406,333, filed Oct. 26, 1964, now abandoned.

The invention has as a main objective the provision of a paper machine press section of novel construction such that it is capable of effecting substantially greater water removal from a newly formed paper web than a conventional press section operating under comparable total pressure loads.

Another object of the invention is to provide a press section having the characteristics and advantages noted above which possesses more effective water removing properties than conventional suction presses, but which does not require the use of a suction press roll.

An additional major object of the invention is the provision of a press section having the operating advantages noted above which is of economical construction, and particularly to provide such a press section whose characteristic principles may be inserted or otherwise incorporated in a conventional press section by readily simple modification thereof to render it capable of comparable operating advantages.

It is also an object of the invention to provide a press section as outlined above which is characterized by the ability to develop higher effective specific unit pressures on the paper web than comparable press sections for the same total pressure loading while minimizing the danger of rupturing the web.

These and other objectives are achieved in accordance with the invention by the provision of a paper machine press section wherein the main components are a plain press roll, which may be of conventional construction and size, an imperforate roll of relatively much smaller diameter which forms the effective pressure nip with the plain press roll, and a support for the small roll, which may be a second press roll of conventional construction and which preferably is provided with a yieldable surface for effective driving engagement with the small roll. The small roll has a diameter many times smaller than each of the other rolls, for example in a ratio of from 1:5 to 1:20 or even very much larger when the pressure nip of the small roll is with a Yankee dryer, and the small roll is preferably provided with circumferential grooves in its surface for reasons explained hereinafter.

It is accordingly a further object of the invention to provide a paper machine press section having the components and operating characteristics outlined in the preceding paragraph, and still further objects and advantages of the invention will be apparent from the following description, the accompanying drawing, and the appended claims.

In the drawings:

FIG. 1 is a diagrammatic view illustrating a paper machine press section assembly constructed in accordance with the invention;

FIG. 2 is an enlarged schematic view taken in radial section through the central portion of the section of FIG. 1 and illustrating diagrammatically certain of its operating characteristics;

FIG. 3 is an enlarged fragmentary and diagrammatic section taken approximately on the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary and somewhat diagrammatic view looking at right angles to FIG. 1 and showing means for adjusting the crown of the lower press roll of FIG. 1;

FIG. 5 is a fragmentary view illustrating a portion of one form of mounting structure for the press assembly of FIG. 1;

FIG. 6 is a diagrammatic view similar to FIG. 1 showing a modified arrangement of press section according to the invention;

FIG. 7 is a view similar to FIG. 1 illustrating another form of paper machine press section assembly constructed in accordance with the invention;

FIG. 8 is an enlarged view of a fragment of FIG. 7 showing one end of the small roll in the press of FIG. 7 and its mounting mechanism;

FIG. 9 is a fragmentary plan view of the same mechanism shown in FIG. 8; and

FIG. 10 is a diagrammatic view similar to FIG. 1 showing the use of the invention in conjunction with a Yankee dryer.

Referring to the drawings, which illustrate preferred embodiments of the invention, FIGS. 1 and 2 show a press section in accordance with the invention wherein the main components are an upper press roll **10**, a lower press roll **11**, and a substantially smaller roll **13** positioned between and in nip forming relation with both of rolls **10** and **11**. These three rolls cooperate as described thereinafter to treat a press felt F which has a newly formed paper web S on the upper surface thereof, and which is guided by a suitable guide roll **15** to the nip of rolls **10** and **13** so that the web S engages the surface of the press roll **10** ahead of its nip with roll **13**, it being understood that the term "felt" is used herein as generic to any suitable foraminous carrier web for a new formed paper sheet or web.

As shown in FIG. 1, the journals **20** of the lower press roll **11** preferably have fixed mountings as indicated at **21** while the journals **22** of the upper press roll **10** have adjustable mountings providing for variation of the pressure load on rolls **11** and **13**, as indicated by the arrow **23**. The roll **13** is preferably provided with an adjustable mounting for its journals providing for adjustment thereof toward and away from the vertical plane containing the axes of the journals **20** and **22**, as indicated by the arrow **25**.

The rolls **10** and **11** may be of conventional construction and sizes commonly used in paper machine press sections, for example with diameters from 20 inches to 30 inches or more, and the upper roll **10** may advantageously be formed of granite or other material providing a comparably smooth and hard imperforate surface. The roll **11** is normally the driven roll of the press section as indicated diagrammatically by the drive **27**. It is therefore desirable to provide roll **11** with an elastomeric or comparably yieldable surface covering **28** for firm driving engagement with the small roll **13**. The roll **10**, however, may be provided with a helper drive as indicated at **29**, especially for starting purposes.

The press section of the invention relies primarily for its operating characteristics and advantages upon certain phenomena which are developed in a roll combintation as as just described wherein the intermediate roll **13** is very much smaller in diameter than the other rolls, and par-

ticularly than the roll **10** with which it forms the nip for treating the paper web. For example, tests indicate that the roll **13** can be a solid metal roll of a diameter of 3 to 4 inches and that the ratio of its diameter to that of the roll **10**, and also the roll **11**, should be at least 1:5 and preferably substantially higher, namely with the other rolls of diameters from approximately 20 inches to 36 inches or more up to as high as a diameter ratio as 1:20 for ordinary presses and substantially higher where one of the press rolls is a dryer roll.

It has also been found, for reasons explained in detail hereinafter, that preferred results are obtained if the surface of the roll **13** is provided with circumferentially extending grooves **30**. As shown diagrammatically in FIG. 3, the grooves **30** are preferably proportioned and arranged to provide lands **31** therebetween of sufficient width to eliminate cutting edges, and they are also preferably V-shaped but rounded to a small radius at their bottoms, as shown in FIG. 3. In addition, these grooves should have a substantial axial component, as can be provided by forming the grooves as helical threads having substantial leads, for example, a lead of an inch or more, so that they extend at a corresponding substantial angle with respect to a plane extending radially of roll **13**.

This groove arrangement as just described contributes to the elimination of a cutting action on the felt, and optimum results have been obtained in this manner, utilizing a plurality of parallel threads arranged in side by side relation with each other. In addition, it appears that the grooves should be relatively shallow and with their sides converging inwardly, since if they are too deep or straight-sided, they tend to lose their self-cleaning properties and to plug up with fiber. As an illustrative example of the dimensions of individual threads, satisfactory results have been obtained with each thread having a width of 0.027 inch, a depth of 0.027 inch, a pitch of 0.10 inch, and with its opposing sides defining an angle of 45° and its bottom rounded about a radius of the order of .002 inch, such grooves being readily made by a conventional thread forming operation. In this example, the lands between grooves are of the order of 0.73 inch in width.

The operation of this press section is illustrated somewhat diagrammatically in FIG. 2. The felt F is guided to the nip of rolls **10** and **13** so that the paper web S meets the surface of the upper press roll **10** slightly ahead of the nip, and it is not material to the invention whether or not the felt and web are separated immediately after passing through the nip. Careful observation of the press section of the invention as described establishes that under these conditions, there is no pool of water formed at the ingoing side of the nip as with conventional presses. On the contrary, at relatively moderate paper machine speeds such as 600 feet per minute and more, water is removed from the sheet and felt at this nip in the form of a free jet directed downwardly and rearwardly with respect to the felt, as indicated by the arrows **33** in FIG. 2. In addition, there is a relatively fine spray of water directed downwardly and forwardly of the felt from the outgoing side of the nip, as indicated by the arrows **35** in FIG. 2.

It appears that these results are due to more than one factor. For example, if the roll **13** were removed and the rolls **10** and **11** brought into nip forming relation, a pool of water would appear and be maintained at the ingoing side of the nip apparently at least in part because the surface of the lower roll **11** initially departs only slightly from the horizontal as it leaves the nip. In contrast, the sharp curvature of the surface of the small roll **13** downwardly and away from the surface of the roll **10** eliminates a supporting surface area for the expressed water at the nip and thus causes it to be discharged from the nip in the form of a jet rather than maintained as a pool at the nip.

Another factor contributing to the novel operating characteristics achieved by the invention is the high rotative

speed of the small roll **13** with relation to that of roll **10** and roll **11**. This causes the development of substantially higher centrifugal forces effective on the water as it is expressed from the felt, for example, forces of the order of 64 G's for a roll of the size noted above at a machine speed of 1,000 feet per minute. Not only do these high forces promote the rapid removal of water from the nip, but they also have a self-cleaning action on the roll **13** minimizing retention of water and fiber on its surface.

A third significant feature contributing to the effectiveness of the invention derives from the nip dimensions which result when a nip is formed between rolls of the relatively very different diameters used in the practice of the invention. Thus the same total pressure loading which causes the nip of rolls 10 and 13 to be 0.25 inch in width would produce a nip width in excess of 1.50 inches for rolls of the diameter of rolls **10** and **11**. The results is that for the same total loading, the effective pressure across the nip of rolls **10** and **13** will be higher by a factor of six or more.

It appears that it is because of the high effective pressures obtained in the press of the invention that the small roll **13** should have grooves in its surface as described, as now explained. Satisfactory results have been obtained with a press section arranged as described but using a smooth roll **13** at low and moderate machine speeds, e.g., below 800 feet per minute. At higher speeds, however, it appears that water particles are trapped in the nip and cause rupture of the paper web as they seek to escape. This rupturing effect is eliminated when the small roll is provided with grooves **30**, which apparently provide an escape path for such water particles, and these particles are then in large measure carried through the nip in the grooves for discharge at the outgoing side of the nip in the spray **35**. These results are also aided by the minimizing of hydraulic pressure in its nip due to the short escape path for the water around the small diameter roll **13**.

It is desirable that the three rolls **10**, **11** and **13** be mounted in such relation as to establish substantial equalization of the several forces effective on the small roll **13**. Thus if the three rolls were mounted with their axes in the same vertical plane, the tangential forces on the roll **13** resulting from its driven engagement with the roll **11** would urge it upstream with respect to the felt, i.e., to the right as viewed in FIGS. 1 and 2. Such movement would then subject it to off-center pressure between rolls **10** and **11** which would supplement the tangential forces and similarly urge roll **13** to the right as viewed in FIGS. 1 and 2.

Preferred results are obtained if the roll arrangement is such that the tangential forces on roll **13** are in the opposite direction from the pressure effects of rolls **10** and **11** on roll **13**. Thus as shown in FIG. 1, the small roll **13** is so located on the ingoing side of its nip with roll **11** that the line defined by the axes of rolls **10** and **13** forms a small angle *a* with the line defined by the axes of rolls **10** and **11**, and this angle is preferably so adjusted that the pressure forces tending to urge roll **13** to the left in FIG. 1 are balanced by the tangential forces in the opposite direction. While this angle will vary depending upon roll sizes, speeds, etc., tests indicate that it will usually be of the order of 5° or less. Since the roll **13** is thus balanced force-wise, it is effectively stressless from the standpoint of bending moments, and its diameter is independent of the forces to which the roll is subjected. As a result, the requirements of roll **13** with respect to strength are low, and also its bearing loads approach zero so that the requirements for its mounting and bearing structure are correspondingly low and economical in cost.

It has also been found desirable in the practice of the invention, especially with press sections of considerable width, to provide means for controlling the degree of crown of the press roll which serves as the backup roll

for the small roll, namely the roll **11** in FIG. 1. For example, as shown in FIG. 4, the journals **20** of the roll **11** may be provided with extensions **37** beyond their fixed mountings **21**, and a double acting fluid pressure cylinder **38** or similar jacking device may be connected between the outer ends of these extensions **37** and the floor to apply a bending moment to the roll **20** about its fixed journal mountings **21**.

The addition of variable crown control to the roll **11** as illustrated in FIG. 4 makes it possible to maintain its nip with the small roll **13** in a substantially straight line, and with the roll **13** mounted as described in dynamically balanced position between the rolls **10** and **11**, correspondingly straight line nip conditions are established throughout the length of the pressure nip between rolls **10** and **13**. It will be understood that both the axial position of the small roll **13** and the crown of roll **11** are preferably adjusted as required to maintain optimum nip conditions in accordance with changed operating conditions of pressure and/or speed of the press.

The mounting arrangement for the roll **13** may take a variety of forms consistent with the simplicity of its requirements as discussed above, and one form of suitable mounting arrangement for one end of the roll is shown in FIG. 5, it being understood that a similar mounting arrangement is provided at the other end of roll **13**. As shown, a saddle **40** is mounted on the bearing housing **41** for the roll **11**, and a bearing block **42** for the journal of the roll **13** is in turn mounted on the saddle **40**. Preferably the mounting between parts **40** and **42** is adjustable, as by the use of bolts **44** received in slots **45** in the saddle. By this means, the block **42** can be adjusted as required to establish the desired position of the roll with relation to rolls **10** and **11** as described in the preceding paragraph.

FIG. 6 shows a modified arrangement of press in accordance with the invention which has a secondary dewatering action on the felt after the paper web is removed therefrom. The rolls **50** and **51** in FIG. 6 correspond to rolls **10** and **11** in FIG. 1, but the roll **51** is a suction roll as indicated by the diagrammatic showing of a suction box **52** therein. The roll **53** corresponds in structure and function to the roll **13** as already described, and it forms upper and lower pressure nips with the rolls **50** and **51** respectively.

In the use of the press arrangement of FIG. 6, the felt F having a paper web S thereon is guided to the nip of rolls **50** and **53** in the same manner as described in FIG. 1, and the dewatering action will be carried out in the manner described in FIG. 2. After the felt and sheet leave this nip, they are separated by a paper roll **55**, and the felt is looped around a guide roll **56** back to the press and through the nip of rolls **51** and **53**. Residual water in the felt is removed as the felt passes through the nip, and this water is removed into the suction box **52** for removal therefrom in the usual way.

Since the return run of the felt from the nip of rolls **51** and **53** in FIG. 6 passes under the upper run of the felt to the press, a suitable tray **58** is mounted therebetween and close to roll **51** to receive the water discharged from the nip of rolls **50** and **53**. If desired, a similar tray **59** may be located between the felt runs in the opposite side of the press to receive the water discharged at the exit side of the upper press nip as described in connection with FIG. 2. It will accordingly be apparent that the press arrangement of FIG. 6 offers all of the operating advantages of the press of FIG. 1 together with the additional function of further dewatering of the felt before it returns to receive the paper web thereon. It will also be apparent that the press arrangement of FIG. 6 may be used without returning the felt therethrough, in which case the suction roll **51** will serve to receive and remove some of the water expressed at the upper press nip of rolls **50** and **53**.

One still further advantage of the invention which will now be apparent, and which is provided by both of the press arrangements described, is the ease with which it may be incorporated in an existing press, with minimum requirements of structural changes. In fact, the only necessary rearrangement of existing parts is lifting of the top press roll of an existing press for insertion of the small roll, and the location of a suitable mounting for the small roll such as that described in connection with FIG. 5. The advantages of the invention are then available whether the existing bottom press roll be a plain roll or a suction roll, and where the latter is the case, the arrangement of FIG. 6 is especially useful.

While the invention has thus far been described in connection with a vertical press, since such presses are the most commonly used in paper machines, it is equally applicable to presses arranged in other planes, and FIGS. 7–9 illustrate a typical application to a horizontal press of the three-roll, dual nip type. This press comprises a center roll **60** having fixed mountings **61**, and a pair of outer rolls **65** and **66**. The roll **65** is movable on its pivotal mountings **67** into controlled pressure engagement with roll **60**, by means of a pressure cylinder or bellows **70** connected between each mounting **61** and one end of a lever **71** which is pivoted at **72** on the mounting **61**. The other end of lever **71** carries a pivoted link **75** which extends through a boss **76** on top of the adjacent mounting **67** and has a nut **77** threaded on its outer end, and this construction is repeated at the other end of roll **65**. Thus pressure applied on bellows **70** causes the upper ends of the levers **71** to move toward roll **60**, thereby forcing roll **65** to move into correspondingly increased pressure engagement with roll **60**.

The roll **66** has pivoted mountings **79** at each end similar to the mountings **67**. Each is similarly provided with a pressure bellows **80** operating one end of a lever **81** pivoted at **82** on mounting **61** and carrying a link **85** which extends through a boss **86** on top of mounting **79** and has a nut **88** threaded on its opposite end. Operation of bellows **80** will thus similarly cause controlled movement of roll **66** toward roll **60**.

In the press of FIGS. 7–9 the roll **65** does not engage roll **60** directly, but a small roll **100** is positioned between these two rolls in nip forming relation with both thereof. The roll **100** is preferably of essentially the same characteristics described in connection with the small roll **13**, and it is similarly provided at each end with adjustable mountings on the mountings **79** for the roll **66**, one of which is shown in FIGS. 8–9. Thus the bearing **101** journaling one end of roll **100** is mounted for sliding movement in an arm **102** pivoted at **103** in bracket **105** secured as by bolts **106** to a part of the mounting **79**. The bearing **101** is adjustable in arm **102**, by means of bolts **109** slidable in slots **110** in arm **105** and cooperating with stop bolts **111** extending through each end of arm **102** to locate and control the position of bearing **101**.

In the operation of the press shown in FIGS. 7–9, a drive is connected to one or more of the rolls **60**, **65** and **66** so that all three rolls rotate in the directions indicated by the rotational arrows, and satisfactory results have been obtained with a main drive **115** connected to roll **65** and a helper drive connected to roll **66**. The roll **65** is shown as a suction roll, and a first felt **120** carrying a sheet S on the upper side thereof wraps the roll **65** from above and transfers the sheet to the roll **60** as it passes through the nip of rolls **60** and **65**. The sheet travels around the under side of the roll **60** and meets a second felt **121** just in advance of the nip of rolls **60** and **100**, and in passing through this nip, water is expressed downwardly from the sheet and felt through the open space below rolls **60** and **66**, whence it may be received in any conventional save-all. The felt **121** then travels upwardly and around a felt roll **123**, and the sheet is shown as initially separating from the felt but then passing around a paper roll **125** and back onto the felt after the latter leaves roll **123**.

Since the main drive to roll **100** is through its driven surface engagement with roll **66**, the driving torque will tend to urge it downwardly in FIGS. 7 and 8. Accordingly, it is shown as positioned in accordance with the invention on the ingoing side of its nip with roll **66**, so that its axis is located above the plane defined by the axes of rolls **60** and **66**. As already described in connection with the press shown in FIG. 1, the position of the roll **100** is preferably adjusted for different conditions of speed and pressure so that the roll is effectively dynamically balanced between rolls **60** and **66**, and such adjustment is readily made by loosening the bolts **109** and appropriately manipulating the stop bolts **111**.

FIG. 10 illustrates still another application of the invention wherein a small roll **130** of the characteristics described for roll **13** is mounted in nip forming relation between a Yankee dryer **131** or other dryer roll and a second press roll **132** which may be a conventional rubber covered or metal press roll. In this installation, a felt **135** carrying a sheet S on its lower surface wraps a turning roll **136** and then passes through the nip of rolls **130** and **131**. The sheet is transferred to the dryer roll **131** at this nip, and the felt separates and is guided away as by means of the felt roll **137**.

Since the ratio of the diameter of the roll **130** to that of roll **131** in FIG. 10 is even greater than in the other cases described, for example 1:30 or more, the conditions in the nip of these two rolls will be comparable to those described in connection with FIG. 3, and similar expression of water will take place, as indicated by the diagrammatic showing of save-all pans **138** and **139**. Otherwise the same operating conditions will obtain, with the roll **130** preferably slightly offset on the ingoing side of its nip with roll **132**. It should also be noted that this form of the invention may very well incorporate means for adjusting the crown of roll **132** as described in connection with FIG. 4.

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 paper machine press assembly adapted for use in combination with a press felt, comprising a first press roll having an imperforate surface, an imperforate small roll of substantially smaller diameter than said press roll arranged to form with said press roll a pressure nip for receiving the felt therethrough with a paper web on the surface of the felt adjacent said press roll, a second press roll of substantially larger diameter than said small roll and positioned in nip forming relation with said small roll on the side thereof opposite said first press roll to support said small roll in pressure engagement with said first press roll, means positioning said first and second press rolls with the axes thereof defining a predetermined plane, means for driving said second press roll to drive said small roll through surface engagement therewith, and mounting means for said small roll for positioning said small roll with the axis thereof in slightly offset relation with said plane on the ingoing side of the nip formed by said small and second rolls.

2. A press assembly as defined in claim **1** comprising means for adjusting said mounting means to maintain said small roll with the axis thereof in such laterally spaced relation with said plane defined by the axes of said press rolls that the pressures tending to force said small roll away from said plane balance the tangential forces tending to drive said small roll toward said plane under different conditions of operating pressure and speed of rotation.

3. A press assembly as defined in claim **1** wherein said small roll is provided with circumferentially extending grooves in the surface thereon.

4. A press assembly as defined in claim **3** wherein said grooves in the surface of said small roll comprise a continuous helical groove having a substantial lead causing said groove to define a substantial angle with respect to a plane extending radially of said groove.

5. A press assembly as defined in claim **3** wherein said grooves in the surface of said small roll are shallow and are defined by side walls which converge inwardly at a substantial included angle, and wherein the adjacent sides of adjacent grooves are spaced from each other to define a land therebetween of sufficient width to eliminate a cutting edge.

6. A press assembly as defined in claim **1** wherein said first press roll is a dryer roll.

7. A press assembly as defined in claim **1** wherein said second press roll is a suction roll.

8. A press assembly as defined in claim **1** comprising means for guiding the felt away from the nip of said small roll and said first press roll and back to the nip of said small roll and said suction roll after removal of the paper web therefrom.

9. A paper machine press assembly for use in combination with a press felt, comprising an imperforate upper press roll and a lower press roll both of relatively large diameter positioned with the axes thereof defining a generally upright plane, an imperforate small roll of substantially smaller diameter than said press rolls arranged therebetween in nip forming relation with each of said press rolls, means for guiding the felt with a paper web on the upper surface thereof through the nip of said small roll and said upper press roll, means for driving said lower press roll to drive said small roll through surface engagement therewith, adjustable means supporting said small roll with the axis thereof in slightly offset relation with said plane defined by said press roll axes on the ingoing side of the nip thereof with said lower press roll substantially balancing the pressures tending to force said small roll away from said plane with the tangential forces tending to drive said small roll toward said plane, and variable means for applying a bending moment to said lower press roll in said plane to maintain the nip thereof with said small roll in a substantially straight line.

10. A paper machine press assembly comprising a first press roll having an imperforate surface, an imperforate small roll of substantially smaller diameter than said press roll arranged to form a pressure nip with said press roll, a second press roll of substantially larger diameter than said small roll and positioned in nip forming relation with said small roll on the side thereof opposite said first press roll to support said small roll in pressure engagement with said first press roll, means positioning said first and second press rolls with the axes thereof defining a predetermined plane, means for driving said second press roll to drive said small roll through surface engagement therewith, and adjustable means supporting said small roll with the axis thereof in slightly offset relation with said plane on the ingoing side of the nip thereof with said second press roll substantially balancing the pressures tending to force said small roll away from said plane with the tangential forces tending to drive said small roll toward said plane.

References Cited

UNITED STATES PATENTS

1,803,926	5/1931	Vedder	100—160
3,198,695	8/1965	Justus	162—359
3,198,697	8/1965	Justus	162—358 X
3,230,138	1/1966	Berges	162—358 X

FOREIGN PATENTS

750,222	12/1944	Germany.

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