Sept. 17, 1968 C. SCHIEL 3,402,101

ROLLER PRESS FOR PAPER MACHINES

Filed Dec. 22, 1964 2 Sheets-Sheet 1

Fig. 1

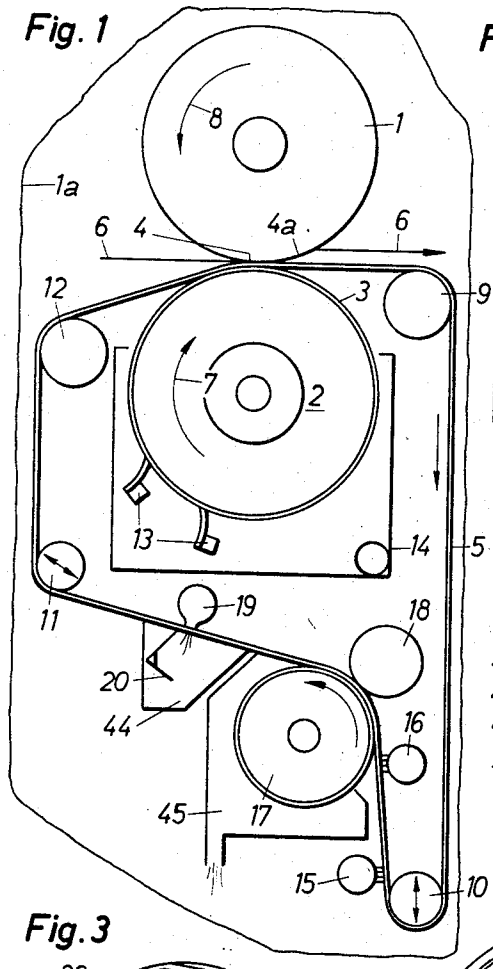
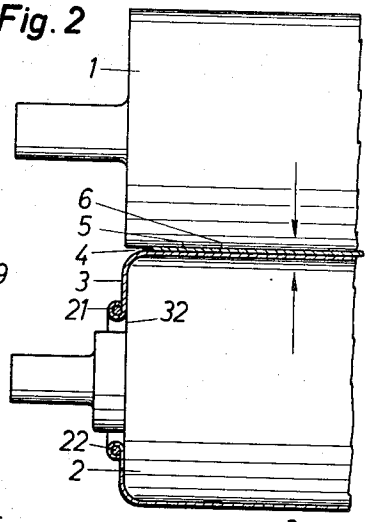


Fig. 2



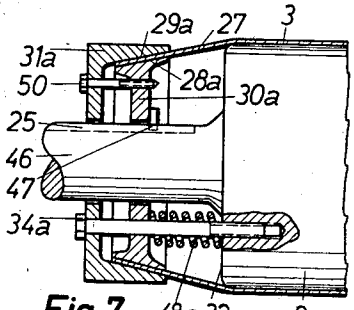
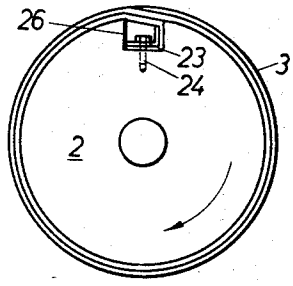


Fig. 7

Fig. 3



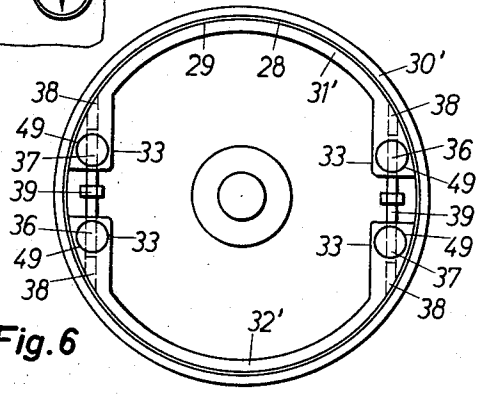


Fig. 6

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Fig. 8

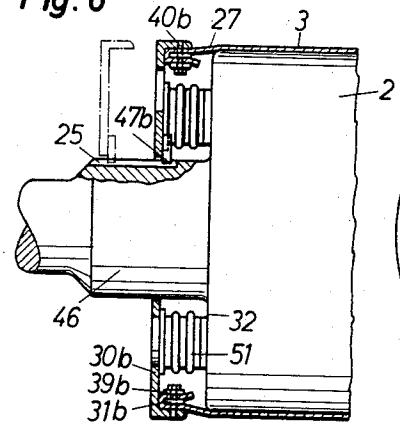


Fig. 9

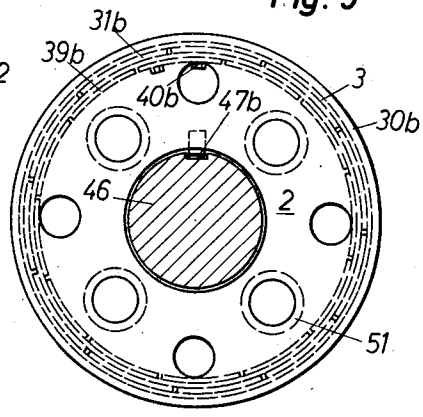
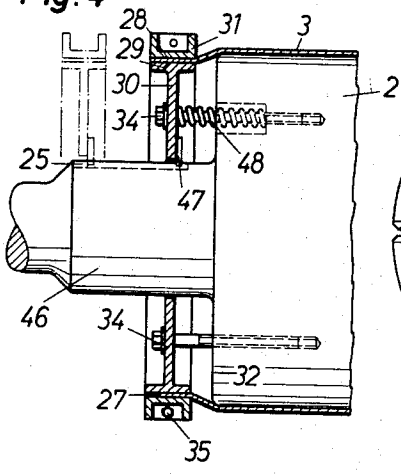


Fig. 4



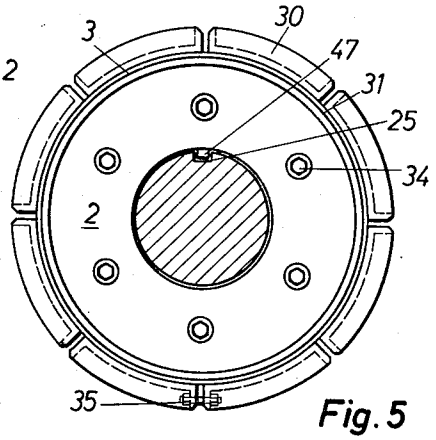
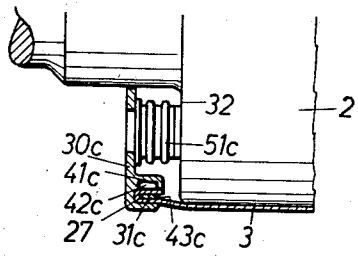


Fig. 5

Fig. 10



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ROLLER PRESS FOR PAPER MACHINES

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5 Claims. (Cl. 162—358)

ABSTRACT OF THE DISCLOSURE

Roller press in which a pervious conveyor belt conveys a wet web through the press nip and in which the roller which engages the side of the belt opposite the web is provided with a substantially incompressible open mesh textile-like close fitting cover or mantle.

This invention relates to paper making machines and is particularly concerned with a method and apparatus for dewatering a wet paper web formed in the paper machine.

More particularly still, the present invention relates to an improved roller press for pressing out at least a portion of the water from a wet paper web coming from the screen of a paper machine.

Roller presses of the nature referred to are known and comprise a lower pressure roller and an upper pressure roller, both journalled in the frame of the roller press and in pressure engagement with each other to form a nip so as to receive a wet paper web and press water therefrom. A paper web when bearing a large amount of water has very little strength of its own and is, therefore, supported on conveyor belts while being passed between the pressure rollers.

In practice, the upper pressure roller is pressed downwardly with a controlled force, while the lower pressure roller is journalled for rotation on a fixed axis. The conveyor belt supporting the paper web is substantially immediately separated from the paper web after leaving the rollers so that water is not reabsorbed from the conveyor belt by the paper web.

With the known constructions, the degree of dewatering of the paper web depends principally on the water absorbing ability of the conveyor belt which is usually a felt or a woven fabric having relatively little water retention ability. Furthermore, only a limited amount of water can be withdrawn from such fabrics during their return travel to the nip of the rollers and the dewatering ability of such known roller presses is relatively small and difficulties are, therefore, presented in dewatering paper webs leaving modern high-speed paper machines.

Various suggestions have been made to increase the dewatering ability of such roller presses, such as the provision of an endless belt of extremely porous fabric passing between the conveyor belt and the lower pressure roller to absorb water from the conveyor belt and thereby increase the amount of water that can be picked up by the conveyor belt. This particular system has never come into practical use probably due to the difficulty of finding any suitable fabric to act as a secondary water absorbing element.

The newer synthetic fibers makes it possible to produce new fabrics useful for drying paper webs but, heretofore, no secondary water absorbing belts of the nature referred to above have been manufactured.

It is also known in roller presses to make auxiliary belts of porous compressed plastics and of felt, rubber, sponge, and the like, for secondary dewatering. Such belts, however, are greatly compressed in the nip between the rollers, whereby their porosity is greatly diminished and their ability to absorb water is likewise diminished,

and, therefore, the greater portion of the water delivered to the belt remains in the conveyor belt.

Substantially incompressible fabrics have been made, woven from monofilament plastic threads, and these fabrics can absorb water passing through the conveyor belt and retain the water. This assists in keeping the conveyor belt dry and the water picked up by the incompressible auxiliary belt can be removed therefrom in any of the several known manners. Such auxiliary fabrics have been made with rhomboidal meshes positioned at an angle to the axes of the rollers, which facilitates the dewatering of the auxiliary belt.

Any system using an auxiliary belt has the disadvantage that supporting rollers and guide means must be provided to carry the auxiliary belt over a different path from that of the main conveyor belt. The added equipment necessary for supporting and guiding the auxiliary belt substantially increases the cost of the installation and the cost of maintaining it in operation, and substantially increases the bulk of the equipment.

Furthermore, the auxiliary belts are expensive and do not have a particularly long life so that expensive shutdowns are required to replace the expensive auxiliary belts.

With the foregoing in mind, the present invention proposes to overcome the drawbacks and disadvantages referred to above that obtain with known constructions by applying to the rotatable lower pressure roller in a roller press a water permeable cover which is substantially incompressible.

The construction referred to avoids the disadvantage of expensive auxiliary belts and expensive space consuming supporting and guiding means for auxiliary belts. The dewatering of the auxiliary belt according to the present invention, and which is applied as a cover or a mantle around one of the pressure rollers, is easily effected because the fabric can be made with large portions and water removed therefrom by a centrifugal force or by scraping, or by other known methods.

When the water content of the paper web is large, water in excess of the water absorbing ability of the fabric mantle may be present and it is advantageous, under these circumstances, to separate the conveyor belt from the mantle immediately upon the conveyor belt leaving the nip of the rollers. In this manner, continued contact of the conveyor belt with the water saturated fabric mantle is eliminated.

While it is known to provide a pressure roller with a yieldable mantle, such as rubber, such rollers have no dewatering capacity and thus do not solve the problem underlying the present invention.

It is also known to provide pressure rollers with tubular felt sleeves but these also do not possess any effective amount of water absorbing ability and do not solve the problem underlying the present invention.

In one form of the present invention, a woven or knitted sleeve is pulled over or shrunk on the pressure roller and in this manner the sleeve is firmly supported. A cover of this nature is able to sustain large distortions in its plane and the crossed threads forming the meshes of the fabric can change their angular relation so that rectangular formed meshes will become parallelogram shaped meshes.

The streching property of a knitted fabric makes it ideal for fitting the fabric to rollers of different sizes and insures close embracing of the rollers by the fabric. The mantle or cover can thus be made to a larger diameter than the roller, whereby it can readily be mounted on the roller and, thereafter, upon stretching the cover in the axial direction, will closely embrace the roller. One end of the mantle can be clamped to the roller and the other

end be drawn up by lacing or the like, so that the cover tightly embraces the roller, but can easily be removed therefrom.

Continuous tensioning means such as springs, or hydraulic or pneumatic devices, can be employed by maintaining the cover under tension.

In one form of the invention, a clamping ring engages the end of the cover and is pressed away from the adjacent end of the roller by springs. This maintains tension on the cover and is convenient to use.

The arrangement of the present invention includes provision for dewatering the mantle or cover and may include scrapers, suction boxes, stripping rollers, air jets, or the like, and in certain cases the use of centrifugal force.

The fabric mantle or cover is in this manner dewatered so that when it again enters the nip between the rollers it will readily pick up more water from the conveyor belt.

The conveyor belt itself is also provided with dewatering means of known construction disposed along the conveyor belt at some point preceding the point of entry of the conveyor belt into the nip between the rollers.

With the foregoing in mind, it will be apparent that the primary object of the present invention is the provision of a greatly improved paper web dewatering roller press having simplified construction and being more compact than heretofore known high capacity roller presses and being relatively economical to construct and maintain and involving a minimum of down time in the event of replacement of the auxiliary belt.

The exact nature of the present invention will be more clearly understood upon reference to the following detailed specification taken in connection with the accompanying drawings, in which:

FIGURE 1 is a somewhat schematic side view of a roller press installation, the lower roller being equipped with a fabric mantle or cover according to the present invention;

FIGURE 2 is a fragmentary view of the rollers of FIGURE 1;

FIGURE 3 is a cross section through a roller carrying a fabric mantle;

FIGURE 4 shows, partly in section, a fastening ring for a fabric mantle;

FIGURE 5 is an end view of the same roller in cross section with the fastening ring on it;

FIGURE 6 is an end view of a modified form of fastening ring;

FIGURE 7 is a side view, partly in section, of a modified form of roller;

FIGURE 8 is a view, similar to FIGURE 7, showing another modification;

FIGURE 9 is a profile view of FIGURE 8; and

FIGURE 10 is a fragmentary side view, partly in section, of a modification of FIGURE 8.

In FIGURE 1 the upper pressure roller **1**, in conjunction with the lower pressure roller **2** carrying the fabric mantle or cover **3**, forms a nip **4** through which an endless conveyor belt **5** passes with the wet paper web **6** that has been deposited on the belt. The two pressure rollers are rotatably mounted in a mainframe **1***a* and are adjustable toward or from each other transversely of their axes. The lower roller **2** which carries the fabric mantle or cover is rotated in the direction of the arrow **7** while the upper roller **1** is generally kept in rotation in the direction of the arrow **8** by the lower roller.

The wet paper web **6** during its passage through the nip **4** has a portion of its water pressed out. The pressed out water then passes through the pervious conveyor belt **5** and into the water absorbing fabric mantle **3** of the lower roller. The partially dewatered but still moist paper web **6** after being carried through the nip **4** remains adhering to the surface of the upper roller **1**, as at **4***a*, but is pulled away therefrom at a place a short distance ahead. The paper web is thus separated from the conveyor belt as soon as the web leaves the nip between the rollers, thereby preventing any water from returning from the conveyor belt into the paper web.

The fabric mantle **3** consists of a substantially incompressible fabric woven or knitted with synthetic threads and shrunk upon the body of the roller. The water which is taken up by the fabric mantle **3** and carried along by the rotation of the lower roller **2** is removed by scrapers **13** for collection in the receptacle **14**. The scrapers **13** are positioned in about diametrically opposite positions from the region where the rollers **1** and **2** come into contact with each other.

The conveyor belt **5** after leaving the nip **4** of the rollers passes around several deflecting rollers **9, 12** and tensioning rollers **10, 11**. In order to remove from the conveyor belt any water which it received in the nip **4** between the rollers and which the fabric mantle was not able to remove therefrom, several dewatering devices of known constructions are positioned along the path of the conveyor belt **5**, e.g. suction boxes **15, 16**, a rotating suction roller **17** with an upper pressure roller **18**, an air blower **19**, and a scraper **20**. The suction roller **17** and the scraper **20** are provided with water discharge troughs **44** and **45** for receiving and conveying away the water removed from the conveyor belt **5**.

FIGURE 2 shows the rollers of FIGURE 1 as seen in the direction of travel of the belt **5**, with the paper web **6** resting on the belt during its movement between the rollers. The fabric mantle is shrunk upon the lower roller. This is accomplished by providing the end of the mantle which extends beyond the end of the roller **2** with a tubular hem portion **21** to receive a cord **22** that is drawn tight to stretch the fabric mantle **3** longitudinally of the roller to cause it to shrink in diameter and to grip the roller tightly.

In the construction shown in FIGURE 3, the roller **2** is provided with a longitudinal groove **26** to receive a free end of the fabric mantle which is wound several times around the roller in a direction opposite to the direction of rotation of the roller. During rotation of the roller the fabric mantle will be drawn tight and will adhere closely to the periphery of the roller. A bar **23** of L-shaped cross section is fastened in groove **26** by screws **24** to hold the end of the fabric in place.

In the construction shown in FIGURES 4 and 5 the tubular fabric mantle or cover is somewhat longer than the roller. The end **27** of the cover which extends beyond the end **32** of the roller **2** is clamped between the coaxial cylindrical surfaces **28, 29** of the sectional or segmented holding or clamping ring **31** and the tensioning or inner ring or disc **30**. In order to permit the end of the fabric mantle to be clamped tightly in place between the cylindrical surfaces **28, 29** the ring **31** is provided with at least one slit bounded by a flange on each side to receive a tangential bolt **35** to tighten the ring **31**, the flanges being provided with boreholes to receive the bolt.

The axial tension which has to be applied to the mantle to cause it to grip the roller is exerted by springs **48** which are interposed between the end of the roller and the tensioning ring **30**. The ring or disc **30** is connected to the roller by screws **34**, the springs **48** surrounding the said screws. To prevent the ring **30** from rotating relative to the roller, which would damage the fabric mantle, the axle **46** of the roller is longitudinally slotted at **25** to receive a lug or key **47** of the ring **30**. This will prevent relative rotation between the ring and roller but will permit relative longitudinal movement thereof.

In the construction shown in FIGURE 6, the end of the fabric mantle is clamped between an outer ring **30'** and a transversely divided inner expansible ring, thereby avoiding the necessity for a sectional outer ring of the kind shown is FIGS. 4 and 5 which could separate and result in accidents while running at high speeds. In FIG. 6 the outer ring is smooth and cannot catch onto any-

thing while its inner periphery is cylindrical for cooperation with the expansible segments **31'**, **32'** to clamp the end of the fabric mantle by tightening the threaded bolts **39**, each of which has right hand threads at one end and left hand threads at the other end. The arrangement of these threaded bolts in the segments **31'**, **32'** of the holding ring is as follows: each axially parallel end of the two segments **31'**, **32'** is formed with a thickened portion **33** which has an axially parallel borehole **49** for receiving an externally smooth cylindrical bolt **36** or **37** with a threaded transverse borehole through it, the thickened portions being also provided with axially perpendicular aligned and coplanar boreholes **38** equally spaced from the axis. The diameters of the boreholes **38** are larger than the outside diameters of the threaded portions of bolts **39** which are screwed into the threaded boreholes of the smooth bolts **36** and **37**, the bolts **36** being provided with left hand threads while the bolts **37** have right hand threads, or vice versa. Each of the two segments **31'**, **32'** is equipped with one bolt **36** and one bolt **37** so that when the parts **31'** and **32'** are assembled with a bolt **39** in each aligned pair of boreholes **38**, the threads of the bolts **36** and **37** correspond to the threads of the bolts **39**. By rotation of the oppositely threaded bolts **39** in one direction or the other, the segments **31'** and **32'** can therefore be expanded or contracted.

In order to avoid the exertion of pressures by the segments in only two restricted regions diametrically opposite from each other, the middle portions of segments **31'** and **32'** intermediate their thickened ends **33** have shallow rectangular cross sections with only small radial thickness so that when the segments are stressed they can bend to adapt themselves to the inner periphery of the outer ring **30'**. The rotatable positioning of the bolts **36**, **37** in the axially parallel boreholes **49** will permit such adjustment to be made without any binding of the screw-threads of bolts **39**.

The construction in FIGURE 7 differs from that of FIGURES 4 and 5 in that both the tensioning ring **30*a*** and the holding ring **31*a*** are of one-piece construction. To make this possible, both the outer surface **29*a*** of the holding ring **31*a*** and the corresponding inner surface **28*a*** of the tensioning ring **30*a*** are of conical form and with equal inclinations to the axis of the roller. Between the conical surfaces **28*a***, **29*a*** the free end of the fabric mantle which extends beyond the end of the roller is clamped. For this purpose the two rings are connected by screws **50**. The axial force that is necessary for shrinking the tubular fabric mantle upon the roller **2** can be exerted in the same manner as in FIGS. 4 and 5, by means of axially parallel coiled springs **48*a*** surrounding bolts **34*a***.

In the construction shown in FIGS. 8 and 9 portion **27** of the fabric mantle **3** which extends beyond the end **32** of the roller **2** is folded around a holding ring **31*b*** consisting of a plurality of circumferentially aligned sections of flat rectangular cross section and then fastened to the inner flanged periphery of ring **30*b*** by means of an inner sectional ring **39*b*** held in place by screws **40*b***. The inner sectional ring **39*b*** also has a rectangular cross section with the long sides of the rectangle extending in the axial direction. The holding ring **31*b*** and the inner ring **30*b*** can also be formed integral with a single gap. The tensioning ring **30*b*** is L-shaped in cross section with the shorter leg extending axially and the longer leg radially. The inwardly facing cylindrical surface of the shorter leg is at a radius which is greater than that of the outer surface of the holding ring **31*b*** by an amount not less than the thickness of the fabric of the mantle **3**. In the built-up structure the folded over end **27** of the fabric mantle with the inner ring **39*b*** and the holding ring **31*b*** are pressed tightly against the inner surface of the tensioning ring **30*b***.

Instead of the coiled springs it is also possible, as shown in FIGS. 8 and 9, to use pneumatic springs, namely axially expansible hollow bodies filled with a pressure medium such as compressed air. These hollow bodies are positioned between the flat portion of the tensioning ring **30*b*** and the end face **32** of the roller in the same manner as the coiled springs in FIGS. 4 and 5. One of the flat ends of the hollow body **51** will then bear against the end **32** of the roller while the other flat end surface bears against the platelike portion of the tensioning ring **30*b***. By increasing and diminishing the air pressure in the cylindrical hollow bodies **51** the axial tension in the fabric mantle can be increased or diminished so as to control the shrinking of the mantle **3** on the cylinder **2**.

In order to prevent relative rotation between the fastening ring and the roller, the tensioning ring **30*b*** is provided with a radially inwardly extended lug **47*b*** for free longitudinal but non-rotatable movement in the groove **25** of the roller extension **46**.

In the construction of FIGURE 10, the end **27** of the fabric mantle **3** is held in place by pneumatic means instead of by screws as in FIGS. 8 and 9. The tensioning ring **30*c*** which, in this case, is F-shaped in cross section carries on its axially directed flat inner leg a radially outwardly directed channel **41*c*** containing a pneumatically inflatable hose **42*c***. The tensioning ring **30*c*** also presents a circular channel **43*c*** of rectangular cross section between the outer cylindrical portion and the channel **41*c***. The channel **43*c*** is of such a size that the holding ring **31*c*** with the end of the fabric mantle folded around it, as in FIGS. 8 and 9, will fit in this channel. After the holding ring **31*c*** with the folded over end **27** of the fabric mantle has been securely seated in the channel **43*c***, the inflatable hose **42*c*** is filled with compressed air to keep the end of the mantle connected to the ring **30*c***. The tensioning of the mantle or cover in the axial direction to shrink it upon the roller can then be effected by any of the methods previously described, e.g. by means of pneumatic springs **51*c*** like those of FIGURE 8.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions; and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. A roller press for dewatering wet paper webs comprising; a frame, a lower pressure roller rotatable in the frame, an upper pressure roller rotatable in the frame and forming a nip with the lower roller, a water pervious conveyor belt passing through said nip and adapted to receive a wet paper web and to convey the web through the nip, and an auxiliary water absorptive cover element mounted on the one of said rollers which engages said conveyor belt on the side thereof opposite said paper web, said cover element being tubular and formed so as to reduce in diameter when stretched lengthwise, said cover element extending beyond the ends of said one roller, and means connected to the ends of said cover element for exerting an axial pull thereon.

2. A roller press for dewatering wet paper webs comprising; a frame, a lower pressure roller rotatable in the frame, an upper pressure roller rotatable in the frame and forming a nip with the lower roller, a water pervious conveyor belt passing through said nip and adapted to receive a wet paper web and to convey the web through the nip, and an auxiliary water absorptive cover element mounted on the one of said rollers which engages said conveyor belt on the side thereof opposite said paper web, said cover element being tubular and formed so as to reduce in diameter when stretched lengthwise, said cover element extending beyond the ends of said one roller, clamping means clamped to at least one end of said tubular cover element, and means biasing said clamping means in a direction axially away from said one roller thereby to exert an axial pull on said cover element.

3. A roller press according to claim **2**, which includes means keying said clamping means to said one roller

for rotation therewith while permitting axial movement of the clamping means relative to the said one roller.

4. A roller press according to claim 1 which includes means adjacent said one roller but spaced circumferentially thereof from said nip operable for extracting water from said cover element and for conveying the removed water away from said one roller.

5. In a roller press; a frame, a lower pressing roller rotatably supported in the frame, an upper pressure roller rotatable in the frame and forming a nip with the lower roller, an endless pervious conveyor belt passing through said nip and adapted to receive a wet paper web and to convey the web through said nip, supporting and guiding rollers in the frame engaging said belt in supporting and guiding relation thereto and including rollers guiding said belt in a straight line as it leaves said nip, and an auxiliary substantially incompressible open mesh textile-like cover element mounted on the one of said rollers which engages the side of said conveyor belt on the side thereof opposite said paper web, said cover element forming a close fitting mantle around the said one roller, and means adjacent said conveyor belt and spaced from the nip between said roller and operable for extracting water from said belt and for conveying the extracted water away from said belt.

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