July 30, 1940. E. E. BERRY 2,209,756

HORIZONTAL PRESS ROLL ASSEMBLY

Filed May 18, 1936 4 Sheets-Sheet 1

Fig. 1

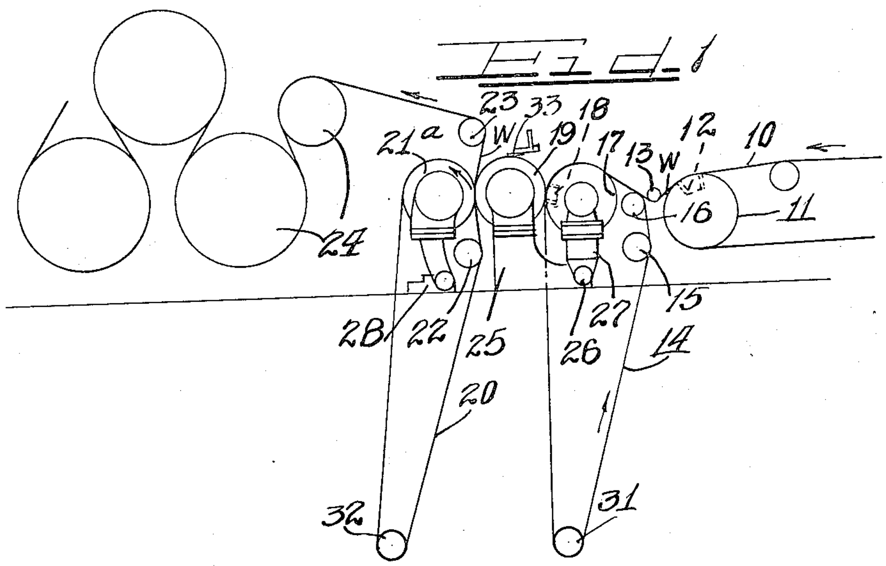
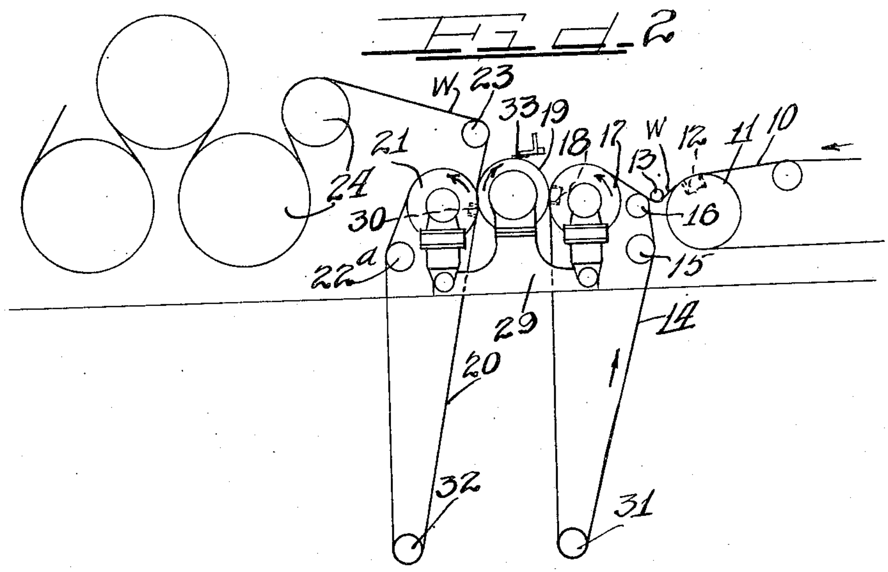


Fig. 2



Inventor
Earl E. Berry
by Charles W. Hills
Attys.

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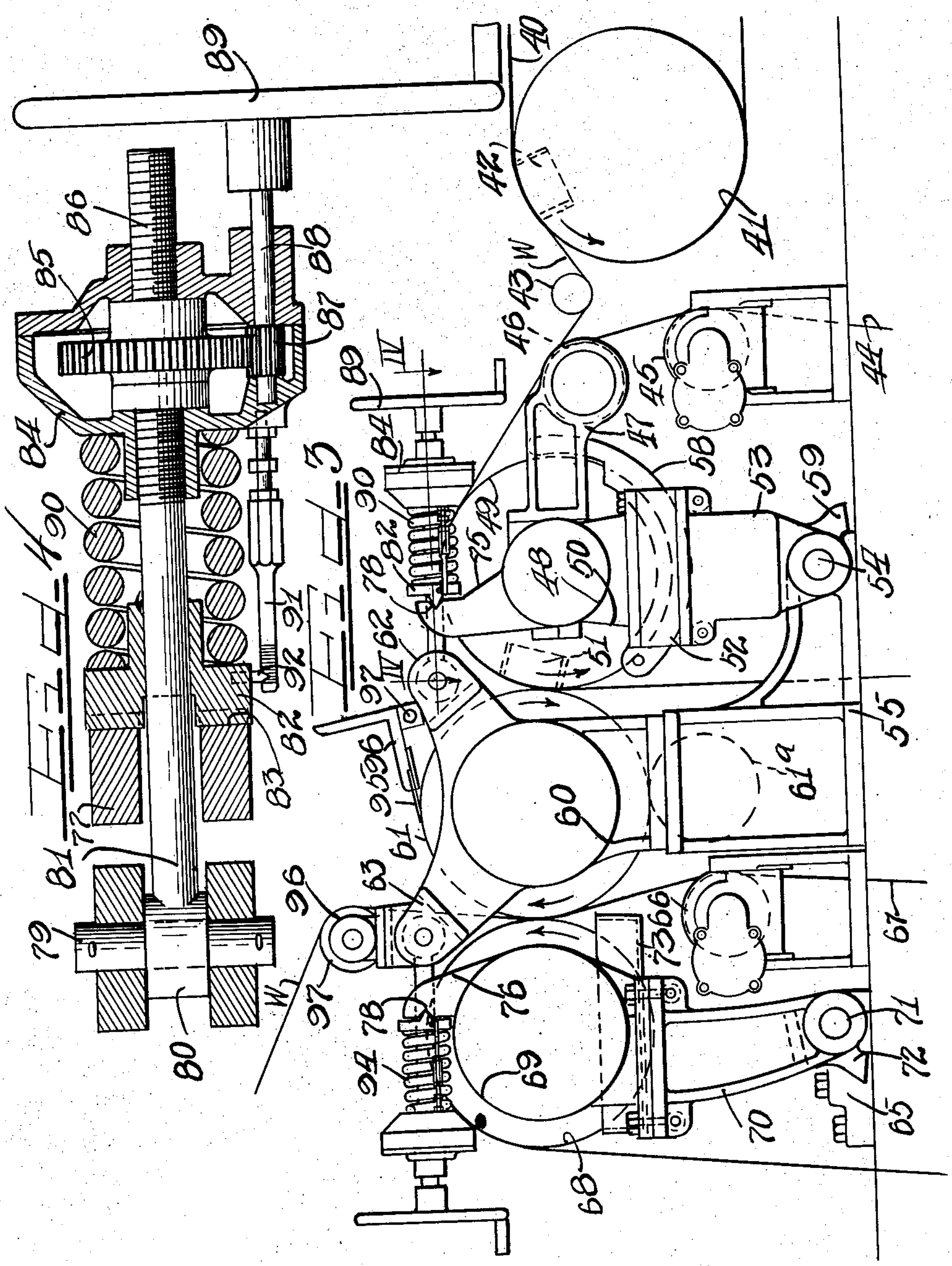
HORIZONTAL PRESS ROLL ASSEMBLY

Filed May 18, 1936 4 Sheets-Sheet 2



Inventor
Earl E. Berry.
by Charles W. Hills Attys.

July 30, 1940.

E. E. BERRY

2,209,756

HORIZONTAL PRESS ROLL ASSEMBLY

Filed May 18, 1936

4 Sheets-Sheet 3

Fig. 5

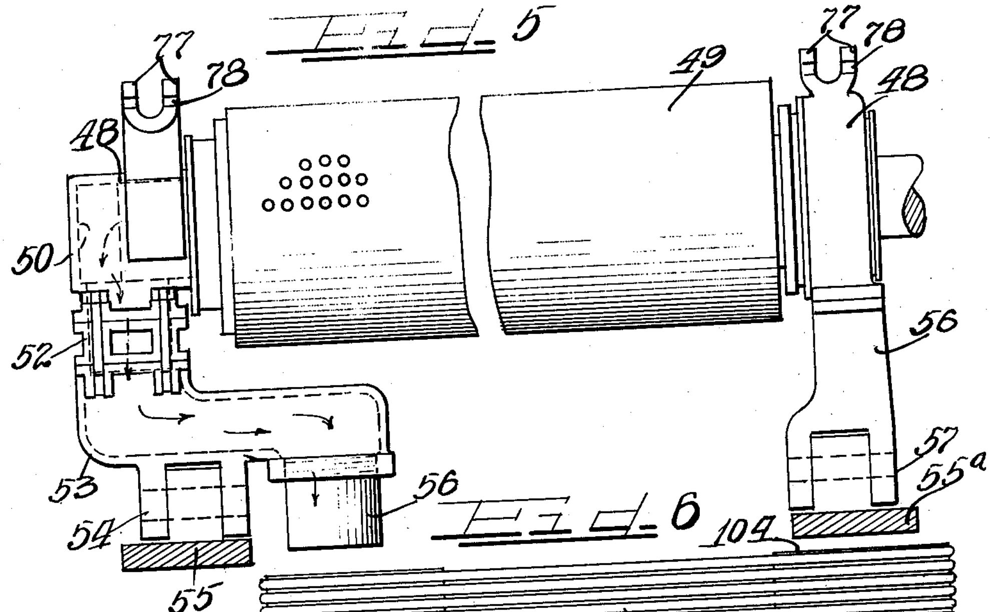
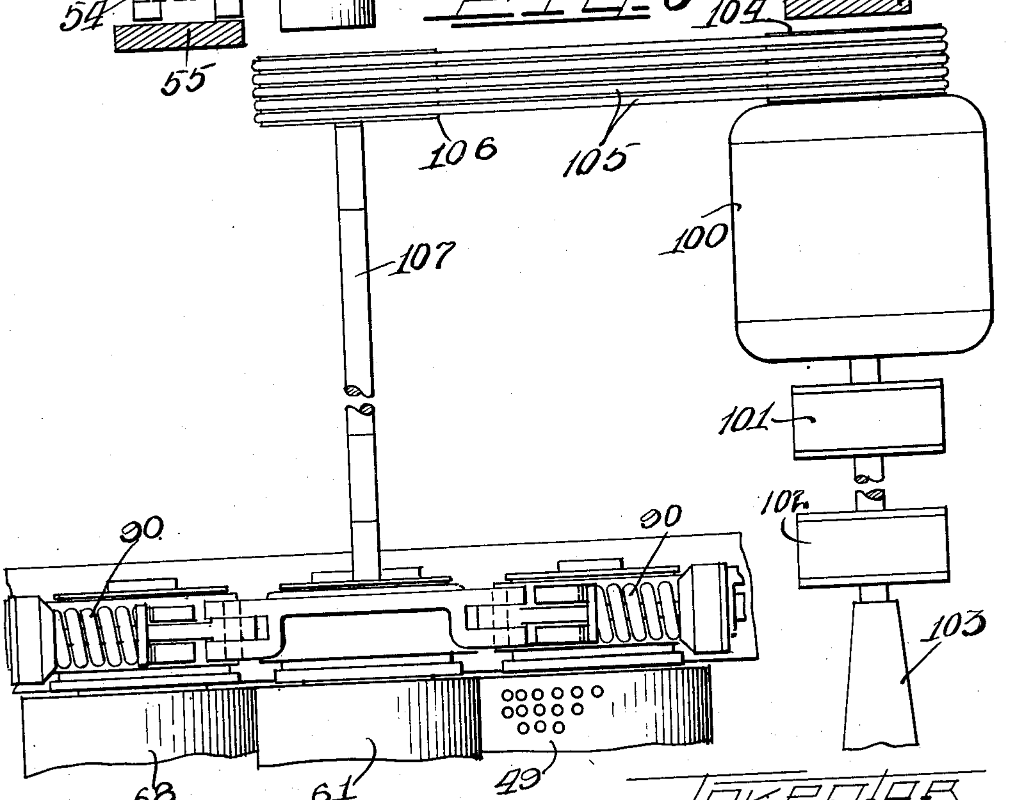


Fig. 6



Inventor
Earl E. Berry.

by Charles W. Hills
Attys.

July 30, 1940.

E. E. BERRY

2,209,756

HORIZONTAL PRESS ROLL ASSEMBLY

Filed May 18, 1936

4 Sheets-Sheet 4

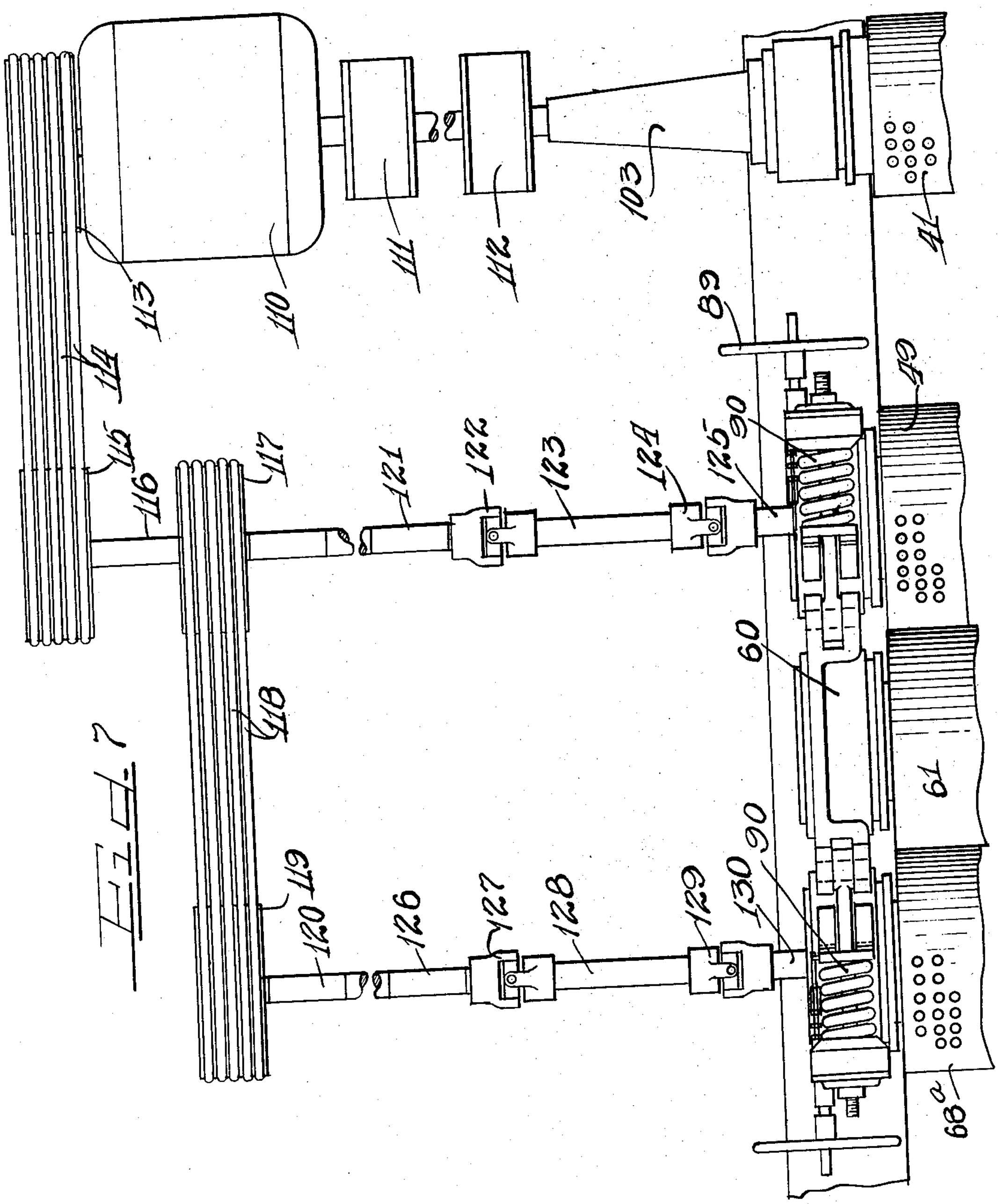


FIG. 7

Inventor
Earl E. Berry
by Charles O. Willett
Attys.

Patented July 30, 1940

2,209,756

UNITED STATES PATENT OFFICE

2,209,756

HORIZONTAL PRESS ROLL ASSEMBLY

Earl E. Berry, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

Application May 18, 1936, Serial No. 80,253

10 Claims. (Cl. 92—49)

This invention relates to press roll assemblies for paper machines.

More specifically, this invention relates to press roll assemblies having the rolls therein mounted in horizontal relation whereby a single center roll performs the functions of two top press rolls in heretofore known assemblies.

Paper as it comes from the web forming part of a paper machine is wet and soggy and is passed through a press section of the machine for the extraction of large amounts of water therefrom by pressure and suction. The press roll sections heretofore used contained one or more suction or plain press rolls each equipped with a top roll in vertical alignment above the suction or plain press roll.

The present invention dispenses with top rolls and provides for the mounting of the suction and/or plain presses in horizontal alignment whereby a single center roll replaces at least two of the heretofore necessary top rolls.

According to this invention the wet soggy web from the web forming section of the paper machine is carried by a felt around a suction roll over the suction area thereof where water is removed by suction and the absorbing action of the felt. The web then passes through the nip between a center roll and the suction roll where additional water is squeezed from the web. The web next follows around a part of the periphery of the center roll and through the nip between a second suction or plain press roll and the center roll for the removal of additional amounts of water. The web then passes through similar press and suction roll sections or directly to the drier.

Since the rolls are mounted in horizontal alignment, passage of the paper web through the nips between the rolls is in a vertical direction. As the additional amount of water is removed from the web when it passes through the nip between the second press roll and the center roll, it can fall out of the nip because the nip opens downwardly.

Preferred structure for the horizontal press roll sections of this invention includes a pivotal mounting of the end rolls relative to the stationarily mounted but rotatable center roll. Mechanism is provided for carefully adjusting the pressure between the end rolls and the center roll and for tilting the end rolls away from the center roll. Drive mechanisms are also provided to drive either the center roll or both of the end rolls of each press section from the same motor driving the couch roll of the web forming section to insure a uniform speed of operation.

It is then an object of this invention to provide a horizontal press roll section for extracting water from wet webs.

A further object of this invention is to replace the top rolls used with each suction or plain press roll in the press roll section of a paper machine with a center roll capable of serving two plain or suction rolls.

Another object of this invention is to reduce the space occupied by the press section of a paper machine.

A further object of this invention is to provide a press roll assembly for paper machines wherein end rollers separate by gravity from a center roller.

A further object of this invention is to provide a press roll assembly for paper machines that can be driven directly with the couch roll of the web forming section of the paper machine.

Another object of this invention is to increase the life of felts for conveying webs from the web forming section of a paper machine through the press roll section of the machine.

A further object of this invention is to eliminate the breaks of paper which frequently occur between the first and second presses of a paper machine.

Other and further objects of this invention will become apparent from the following detailed description of the annexed sheets of drawings which illustrate preferred embodiments of the invention.

On the drawings:

Figure 1 is a diagrammatic side elevational view of a press roll assembly according to this invention disposed between the couch roll end of the web forming section and the drying section of a paper machine;

Figure 2 is a diagrammatic side elevational view similar to Figure 1 but illustrating a modified form of press roll assembly;

Figure 3 is a side elevational view of a press roll assembly according to this invention;

Figure 4 is an enlarged cross-sectional view, with parts in elevation, taken substantially along the line IV—IV of Figure 3;

Figure 5 is an end elevational view of a pivotally mounted suction press roll according to this invention;

Figure 6 is a fragmentary top plan view of a center roll drive mechanism for press roll assemblies of this invention; and

Figure 7 is a fragmentary top plan view of an end roll drive mechanism for press roll assemblies of this invention.

As shown on the drawings:

In Figures 1 and 2 the reference numeral 10 indicates the forming wire of a paper machine of the Fourdrinier type having a web W thereon. The forming wire is trained around a suction couch roll 11 having a suction head 12 therein for removing water through the wire from the web. The web W after passing over the suction area of the couch roll 11 is trained under a guide roll 13 and onto a conveyor felt 14 of a press roll assembly according to this invention. The felt 14 is disposed around guide rolls 15 and 16 and over a suction roll 17 having a suction head 18 therein adjacent the nip defined by the roll 17 and a center roll 19 of the press roll assembly.

As the web W on the felt 14 passes over the suction area defined by the suction head 18 water is removed from the felt and web by suction. As the felt and web advance through the nip of the rolls 17 and 19 additional water is removed from the web by pressure exerted between the rolls. The web W then follows the center roll 19 around its bottom portion thereof into contact with a second felt 20 trained around a second suction roll 21, as shown in Figure 2, or around a plain press roll 21a as shown in Figure 1.

As shown in Figure 1, the felt 20 is trained over a guide roll 22 mounted between the center roll 19 and the plain press roll 21a. The felt 20 in the structure shown in Figure 1 therefore contacts the web W on the center roll 19 as the web passes through the nip of the rolls 19 and 21a where additional water is squeezed from the web. The felt 20 follows around the plain press roll 21a while the web W is trained over a guide roll 23 mounted above the plain press roll 21a and is then directed around drier drums 24.

In the structure shown in Figure 1, the center roll 19 is rotatably mounted on a base 25 which also supports a shaft or a pair of shafts 26 for pivotally mounting supports such as 27 for the suction roll 17. However, the plain press roll 21a is pivotally mounted on a separate base 28 spaced from the base 25.

In the structure shown in Figure 2 a single base 29 supports both the center roll 19 and the end suction rolls 17 and 21. The center roll is stationarily but rotatably mounted on the base 29 while the end rolls 17 and 21 are pivotally mounted on the base 29. The suction roll 21 has a suction head 30 defining a suction area in advance of the nip of the center roll 19 and the suction roll 21. The felt 20 therefore contacts the suction area before the web W contacts the felt. In this manner the felt 20 can be dried by suction to render the same more absorptive so that when the felt and web are passed through the nip of the rolls 19 and 21 water squeezed from the web is readily absorbed by the felt. If desired, the suction area can extend into the nip of the rolls 19 and 21. I should be noted that the guide roll 22a of the structure shown in Figure 2 is mounted to the left of the suction roll 21, whereas in Figure 1 the guide roll 22 is mounted between the plain press roll 21a and the center roll 19.

In the structure shown in Figure 2 the web W after passing through the nip of the rolls 19 and 21 is trained around a guide roll 23 and directed around the drier drums 24 identically with the arrangement shown in Figure 1.

In both Figures 1 and 2 the felts 14 and 20 are trained around stretcher rolls 31 and 32 respectively for maintaining the felts in the desired taut condition. The center rolls 19 are each equipped with wipers 33 for removing water and foreign material from the periphery of the rolls.

From the above descriptions of Figures 1 and 2 it should be understood that the wet, soggy web from the web forming section of the paper machine is conveyed around a suction press roll over the suction area thereof and through the nip of the suction roll and a center roll. The web then follows around the center roll and through the nip of the center roll and either a suction or plain press roll where additional amounts of water are removed by pressure and/or suction.

Suitable mechanical structure for the press roll assemblies shown diagrammatically in Figures 1 and 2 are illustrated in the remaining Figures 3 to 7 and will now be described in detail.

As best shown in Figure 3, a forming wire 40 carrying a wet soggy web W thereon is trained around a couch roll 41 having a suction head 42 for removing water from the web by suction. The web W is then directed under a guide roll 43 into contact with a felt 44 as the web and felt pass over a guide roll 46 rotatably carried in supports such as 47 depending from bearing housings such as 48 for a suction roll 49 of the press roll assembly. An automatic guide roll 45 is provided for properly centering the felt 44 on the guide roll 46. The structure of the automatic guide 45 does not form a part of this invention.

As shown in Figures 3 and 5, one of the bearing housings 48 has a suction manifold 50 extending therethrough in communication with a suction head 51 of the suction roll 49. The manifold 50 is bolted through an intermediate member 52 onto a manifold supporting member 53 which is pivoted at 54 to the main supporting base 55 of the assembly. The passageway in the manifold supporting member 53 communicates with a flexible pipe or coupling 56 (Fig. 5) for joining the suction head 51 of the suction roll 49 with a vacuum pump (not shown).

The other bearing housing 48 for the suction roll 49 is directly mounted on a supporting member 56 which is pivoted as at 57 (Figure 5) to the other main supporting member 55a of the assembly.

A catchall or pan 58 (Fig. 3) is mounted under the roll 49 for collecting water as it drips from the felt and roll. This pan 58 is suitably supported on the supporting members 53 and 56.

A foot 59 is formed on the supporting member 53 to prevent the roll from being tilted away from the center roll beyond a desired amount. A similar foot is provided on the other supporting member 56.

The main supporting members 55 and 55a for pivotally supporting the roll 49 carry bearing housings 60 for rotatably supporting a center roll 61. The bearing housings have yoked arms 62 and 63 extending therefrom.

A second main supporting base 65, or a pair of such bases, is provided in spaced relation from the bases 55 and 66a. An automatic guide roll 66 is disposed between the base 65 and the bases 55 and 55a for guiding a felt 67 around a second press roll 68 rotatably mounted at its ends in bearing housings 69 carried by supports such as 70 which are pivotally mounted as at 71 to the base or bases 65. Feet such as 72 are provided on the supports 70 to limit the backward movement of the roll 68.

A pan or catchall tray 73 is mounted under the roll 68 for receiving water squeezed from the nip. The roll 68 as shown is of the plain type.

Each of the bearing housings 48 and 69 for the rolls 49 and 68 have upwardly extending arms 75 and 76 respectively with bifurcated ends 77 (Figure 5) having notches 78 cut therein.

The yoked arms 62 of the bearing housings 60 for the center roll 61 having pivot pins such as 79 extending therethrough (Figure 4) for pivotally carrying the apertured ends 80 of rods 81 as shown in Figure 4. Each rod 81 extends between the fingers of the bifurcated ends 77 of an arm 75 of a bearing housing 48 and through a boss member 82 which is slidable on the rod and has notched portions 83 fitting in the grooves 78 of the fingers of the bifurcated ends 77.

The rod 81 extends through a gear housing 84 containing a geared member 85 rotatably mounted therein. This end of the rod 81 is threaded, as at 86, and is in threaded relation with the member 85. A small pinion gear 87 is mounted on a shaft 88 rotatably supported by the housing 84. The gear 87 meshes with the geared member 85 and the shaft 88 is keyed to a hand wheel 89 to permit manual rotation of the gear 87. A coiled spring 90 is disposed around the rod 81 between the gear housing 84 and the boss 82. The compression of the spring therefore urges the bosses 82 against the bifurcated end 77, thus tending to move the roll 49 against the center roll 61 because of the pivotal mounting of this roll. The amount of compression of the spring 90 is manually adjusted by rotation of the hand wheel 89. The amount of compression of the spring can be measured by an indicating device 91 carried from the gear housing 84 and a finger 92 carried from the boss 82.

When the compression of the spring 90 is released the roll 49 can be tilted backward until the feet 59 of the supporting member 53 rest against the floor. In this open position the paper web W can be threaded through the press roll assembly or the assembly can be cleaned.

The plain press roll 68 carries an identical mechanism such as described in Figure 4. This mechanism is indicated generally by the reference numeral 94.

A wiper 95 rides on top of the center roll 61 and is carried from an angle member 96 which is pivotally mounted as at 97 and is carried from the frame structure of the machine.

The arms 63 of the bearing housing 60 also support bearing housings such as 96 for a guide roll 97 to direct the web W away from the press roll assembly.

If desired a marking roll or a smoothing roll 61a can act against the web W as it passes around the center roll 61. This roll 61a can be positioned under the center roll 61 as shown in Figure 3 or on top of the center roll if desired. As is known, a marking roll will watermark the web and a smoothing roll will remove wire marks from the bottom of the web. Smoothing rolls are generally rubber covered with a comparatively soft rubber.

From the above description it should be understood that the web W upon leaving the forming wire 40 is carried by the felt 44 over the guide roll 46 and around the suction roll 49. It is then passed through the nip of the suction roll 49 and the center roll 61 at the same time passing over the suction head 51 of the suction roll. The amount of pressure between the rolls 49 and 61 is carefully adjusted by a manipulation of the hand wheels 89. The web W is then separated from the felt 44 and is passed around the lower portion of the center roll 61 where if desired it may be marked with a marking roll 61a. The web follows the roll 61 into contact with the second felt 67. The web W and felt 67 then pass through the nip of the center roll 61 and the plain press roll 68. The web W is then separated from the felt 67 and passed around the guide roll 97 into the drier section of the machine or through another press assembly.

As shown in Figure 6, a single motor 100 is used to drive both the couch roll of the web forming section and the center roll of the press roll section. The motor 100 is connected through flexible couplings 101 and 102 to the shaft 103 of the couch roll (not shown). At the same time a pulley 104 at the other end of the motor drives a plurality of belts 105 which in turn drive a pulley 106 keyed to a shaft 107 which is coupled with the center roll 61 of the press roll section. The center roll then drives both of the end rolls 49 and 68 by frictional contact therewith.

If desired, as shown in Figure 7, the end rolls of each press roll section can be driven instead of the center roll.

In Figure 7, the motor 110 is connected through flexible couplings 111 and 112 to the shaft 103 of the suction couch roll 41. The other end of the motor is provided with a pulley 113 having a plurality of belts 114 trained therearound for driving a second pulley 115 secured to shaft 116. The shaft 116 has a pulley 117 keyed thereon with a plurality of belts 118 trained therearound for driving another pulley 119 keyed to a second shaft 120.

The shaft 116 is coupled to a shaft 121 which shaft 121, in turn, is coupled through a universal joint 122 to an intermediate shaft 123. The shaft 123 is coupled through a second universal joint 124 to the drive shaft 125 of the suction roll 49 in the press roll assembly.

The shaft 120 driven by the pulley 119 is coupled to a shaft 126 which shaft in turn is coupled through a universal joint 127 to an intermediate shaft 128. The shaft 128 is coupled through a second universal joint 129 to the drive shaft 130 of a second suction roll 68a of the press roll assembly.

Universal joints 122, 124, 127 and 129 permit the suction rolls 49 and 68a to be tilted about their pivot points without interfering with the driving of these rolls.

It is obvious that the motor 110 drives the suction couch roll 41 of the web forming section of the machine and at the same time drives both of the suction press rolls 49 and 68a through the belts 114 and 118.

As shown in Figure 7, the roll to the left of the center roll 61 is a suction press roll whereas the roll 68 described in Figure 3 is a plain press roll.

In the diagrammatic views described in Figures 1 and 2, Figure 1 illustrates a press roll assembly in which the roll to the left of the center roll is a plain press roll while Figure 2 illustrates the roll to the left of the center roll to be a suction press roll. Thus according to this invention a press roll assembly may contain a pair of suction rolls or may contain one suction roll and one plain press roll.

From the above description it should be understood that this invention provides a press roll assembly in which a single center roll serves the purpose of a pair of press rolls of either the plain or suction type. The press rolls can be manually adjusted without effort to exert any desired pressure against the center roll and either the center roll or both of the press rolls can be driven.

Since pressure is exerted on both sides of the center roll, the bearings of this roll are not subjected to undue stresses.

The center roll can be rubber covered, or can have a periphery composed of plain or gun metal steel, stone or composition material. The side rolls can also be rubber covered. The rollers do not need to be highly crowned since they are mounted in horizontal alignment and are not subjected to the bowing action occurring in vertical alignment of press rolls. The felts used in the press roll assembly are not subjected to reverse bends and therefore have a much longer life.

The horizontal press roll assemblies of this invention can be placed closely adjacent the couch roll end of the web forming sections of paper machines as illustrated in Figures 1, 2 and 3 thereby eliminating the long draw of the wet web between the couch roll and the conventional press roll sections. This elimination of the long draw of the wet web contributes to an elimination of the stretching of the plastic web thereby producing a stronger sheet.

Furthermore in the conventional type of press section the sheet is carried a considerable distance by the felts after passing through the nips of the rolls. Since the felts carry large amounts of water after leaving the nips of the rolls, the sheet carried thereon can reabsorb water therefrom. In the press roll assemblies of this invention the sheet does not contact the felts after leaving the nips of the rolls and cannot reabsorb water therefrom.

As a result the press roll assemblies of this invention also produce drier sheets.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. A web dewatering press roll assembly having a free draining nip allowing gravity drainage of water therefrom and not requiring crowning of the rolls to offset against vertical deflection thereof for maintaining uniform pressures throughout the lengths of the rolls comprising three rolls having their axes lying in horizontal alignment, bearings for rotatably supporting said rolls, means urging the side rolls toward the center roll on opposite sides thereof to exert pressure in the two nips between the rolls whereby stresses on the center roll bearings are lessened by the opposed forces acting on the center roll and means feeding a wet web down through one of the nips between the rolls and up through the other nip between the rolls whereby liquid squeezed from the web in the upward passage nip can drain by gravity away from the web.

2. A web dewatering press roll assembly having a free draining nip allowing gravity drainage of water therefrom and not requiring crowning of the rolls to offset against vertical deflection thereof for maintaining uniform nip pressures throughout the lengths of the nips therebetween, comprising a center roll, rolls on each side of the center roll having their axes in horizontal alignment with the axis of the center roll, means urging the side rolls toward the center roll to exert pressure in the two nips between the rolls, means feeding a wet web to the assembly for passage down through one nip and up through the other nip and a suction device at the downward passage nip for removing water therefrom, said upward passage nip being free draining for gravity drainage of water away from the web.

3. A web dewatering press roll assembly having a free draining nip and not requiring crowning of the rolls to offset against vertical deflection thereof for maintaining uniform nip pressures throughout the lengths of the nips therebetween comprising three rolls having their axes in horizontal alignment, means urging the side rolls toward the center roll to create pressure between the rolls at the nips therebetween, guide rolls disposed beneath the assembly, a first felt looped around the first roll and a guide roll, a second felt looped around the third roll and a guide roll, means for supplying a wet web to the first felt for downward passage therewith through one nip so that said web may pass around the center roll and upwardly through the other nip with the second felt, and a mechanical suction device associated with the first roll to remove water above the nip between the first and center roll away from the web and center roll.

4. In the press roll assembly for dewatering wet webs of paper wherein the assembly provides a free draining nip and does not require crowning of the rolls to offset against vertical deflection thereof for maintaining uniform nip pressures throughout the lengths of the rolls, the improvement which comprises three rolls having their axes in horizontal alignment, means urging the side rolls against the center roll, a guide roll disposed beneath the assembly, a felt trained around the first roll of the assembly and said guide roll, means driving the felt to convey a wet web of paper down through the nip between the first roll and center roll so that said web may pass around the center roll and up through a free draining nip between the center roll and third roll, and a mechanical suction device for removing water above said nip between the first and center roll away from the web and center roll.

5. A press roll assembly comprising a base, arms projecting upwardly from the base, a center roll rotatably mounted on said arms, standards pivoted to the base on either side of said arms, side rolls rotatably carried on said standards and means for swinging said standards about their pivot points to bring the side rolls into peripheral pressure relation with opposite sides of the center roll and with the axes of the side rolls in horizontal alignment with the axis of the center roll.

6. A press roll assembly comprising a base, bearing supports extending upwardly from said base, a center roll rotatably carried at its ends on said supports, supporting structure on each side of the base, standards pivoted to said structure, bearing housings carried on said standards, side rolls rotatably carried at their ends in said housings, rods pivoted to said bearing supports for the center roll, arms extending from said bearing housings for the side rolls receiving the rods therethrough, springs disposed around said rods between the arms and the ends of the rods, and means threaded on the ends of the rods for compressing the springs to swing the standards about their pivots and to urge the side rolls into peripheral pressure relation with opposite sides

of the center roll with the axes of all three rolls in horizontal alignment.

7. The process of deliquefying wet paper webs in a horizontal press roll assembly having rolls in pressure relation with axes in horizontal alignment, which comprises conveying the web on an absorbent carrier in a downward direction through the nip between the first two rolls to squeeze water from the web, sucking water from said nip away from the web and second roll, separating the web from the carrier after passage through said nip, conveying the web on the second roll up through the nip between the second and third rolls of the assembly to squeeze additional liquid from the web, and allowing the squeezed out liquid to drop by gravity out of said nip between the second and third rolls.

8. The process of dewatering wet webs in a horizontal press roll assembly having three rolls in pressure relation with axes in horizontal alignment which comprises passing the web in a downward direction through the nip between the first two rolls to squeeze water from the web, sucking water from said nip, passing the web around the second roll up through the nip between the second and third rolls of the assembly to squeeze additional liquid from the web, and allowing the squeezed-out liquid to fall by gravity away from the web.

9. The process of dewatering wet sheets of paper in a press roll assembly having three rolls which comprises urging the first and third rolls toward the center roll to create nip pressures therebetween, maintaining the axes of all three rolls in horizontal alignment to render uniform nip pressures throughout the lengths of the rolls irrespective of vertical deflection of the rolls, passing a wet sheet downwardly through one of the nips between the rolls to squeeze water from the sheet, sucking water squeezed from the sheet out of said nip away from the sheet, passing the sheet around the center roll up through the other nip between the rolls to squeeze additional water from the sheet, and allowing the squeezed-out water to fall away from the sheet.

10. The process of dewatering wet paper webs in a horizontal press roll assembly having a center roll and suction rolls on each side thereof in peripheral pressure relation therewith which comprises disposing the axes of the rolls in horizontal alignment to maintain uniform nip pressures throughout the lengths of the rolls, conveying a wet web on a felt downwardly through the nip between the first section roll and the center roll, applying suction through said first roll as said nip to remove water from the web by combined suction and pressure, separating the web from the felt after passage through said nip, conveying the web on the center roll into contact with a second felt, passing the web and second felt up through the nip of the third roll and center roll to squeeze more water from the web, allowing the squeezed-out water to fall by gravity away from the web, and applying suction through the third roll to remove water from the second felt before the felt contacts the web.

EARL E. BERRY.

CERTIFICATE OF CORRECTION.

Patent No. 2,209,756. July 30, 1940.

EARL E. BERRY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 20, claim 10, for the word "section" read --suction--; line 22, same claim, for "as" read --at--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of August, 1940.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)