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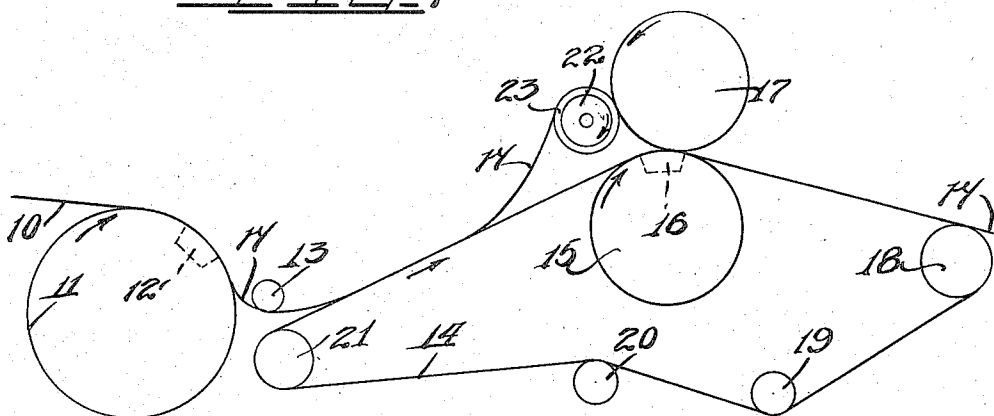
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PROCESS AND APPARATUS FOR DRYING FIBROUS WEBS

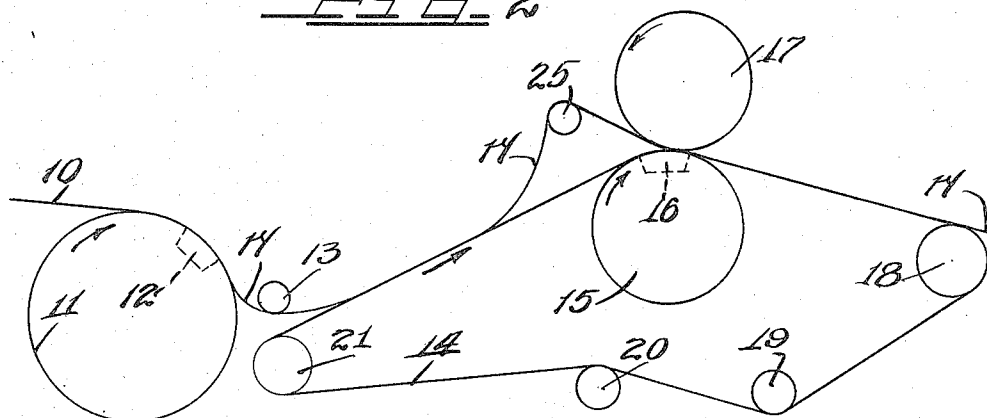
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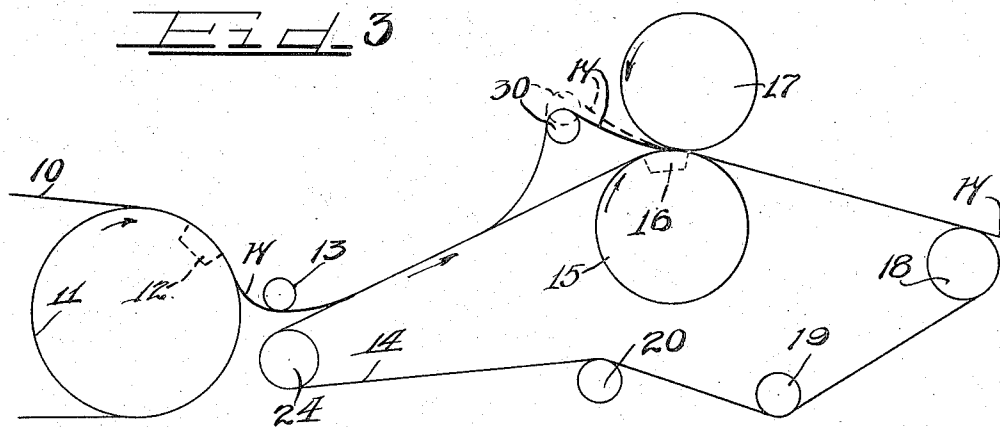
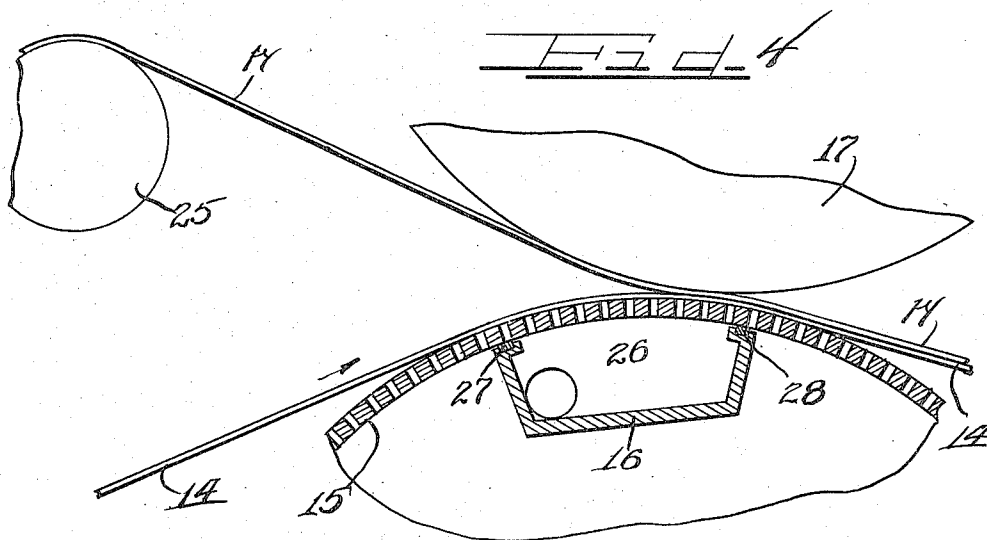
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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PROCESS AND APPARATUS FOR DRYING
FIBROUS WEBS

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13 Claims. (Cl. 92—49)

This invention relates to methods for efficiently removing water from fibrous webs and includes apparatus for carrying out the methods.

More specifically, this invention relates to methods for removing water from paper webs and carrier felts by the combined action of suction and pressure.

In the customary conveying of newly formed paper webs from the wet end of paper machines, conveyor bands for supporting the webs are used to direct the webs through water removing devices, such as suction rolls, press rolls, and the like. When suction press rolls are used as water extracting devices, the wet web and carrier felt are directed together over the suction area of the suction roll and through the nip of the rolls. I have found, however, that increased drying capacity for any suction press roll device can be obtained by lifting the web off of the conveyor felt before the felt reaches the suction area of the suction roll, and then directing the web into contact with the felt as it passes between the nip of the rolls. In this manner, the conveyor felt has considerably more water removed therefrom as it passes over the suction area of the suction roll, since the top surface of the felt is exposed and the fibers thereof opened up for the free passage of air and water therethrough. When the fibrous web then contacts the felt, the felt is in a drier condition and can absorb moisture from the web. By placing the top press roll inside of the suction area of the suction roll, it is also possible to squeeze out water from the web and immediately remove this squeezed out water from contact with the web by suction applied through the felt.

The passage of the felt alone over a portion of the suction area of the suction roll also effects a cleaning of the felt. It is known that conveyor felts fill up with fine fibers and lignins pressed from the web of paper therein. At times, it is therefore necessary to shut down the machine and wash the felt. According to this invention, however, the felt being subject to suction while freed from the web can have large volumes of air sucked therethrough. This passage of air through the felt opens up the fibers thereof and permits a removal of the fine web fibers and lignins. These materials are sucked through the felt and carried along with the large volumes of air acting as a cleansing and drying medium. This cannot be accomplished when the web covers the felt as in the conventional suction press, since the web seals off the passage of large amounts of air through the felt.

It is, therefore, an object of this invention to provide methods for removing water from fibrous webs in a highly efficient manner.

A further object of this invention is to provide methods for removing water from paper webs carried by felt conveyor bands.

Another object of this invention is to increase the water removing capacity of suction press rolls.

A further object of this invention is to provide combinations of apparatus for removing water from newly formed webs.

Another object of this invention is to provide a method for cleaning conveyor felts.

A further object of this invention is to provide apparatus for increasing the efficiency of suction press rolls.

Other and further objects of this invention will become apparent from the following detailed description of the annexed sheets of drawings which form a part of the specification.

On the drawings:

Figure 1 is a diagrammatic side elevational view of one form of apparatus according to this invention.

Figure 2 is a diagrammatic side elevational view of an alternative form of apparatus according to this invention.

Figure 3 is a diagrammatic side elevational view illustrating another modified form of apparatus according to this invention.

Figure 4 is an enlarged vertical cross sectional view, with parts in elevation, illustrating in detail the operation of the suction press roll in the modified form of apparatus shown in Figure 2.

As shown on the drawings:

In Figures 1 to 3, inclusive, the reference numerals 10 indicate the forming wire of a Fourdrinier type of paper machine. The wire 10 is entrained around a suction couch roll 11 having a suction box 12 for removing water from the paper web W carried on the forming wire 10.

It should be understood that while all of these forms of apparatus are shown in combination with the couch roll end of a Fourdrinier type of paper machine, the apparatus of this invention can also be used on other types of paper machines wherein the newly formed web is removed from the forming surface to a conveyor band.

After the web W passes over the suction area defined by the suction box 12, it is removed from the wire 10 and directed under a guide roll 13 onto a conveyor band 14 which is preferably com-

posed of felt similar to the pickup felt on cylinder type paper machines. The felt 14 is trained over a suction roll 15 having a suction box 16 therein defining a suction area over which the felt 14 must travel. A top press roll 17 is urged against the suction roll 15 for pressing the felt 14 and web W, as will be hereinafter described.

The carrier felt 14 is trained around guide rolls, such as 18, 19, 20, and 21, back to the couch roll end of the paper machine for receiving the paper web therefrom.

The conveyor felt 14 is driven to travel at the same rate of speed as the forming wire 10 to convey the paper from the wet end of the paper machine as it leaves the forming wire. The conveyor belt 14 may be driven by the suction press or by any of the other rollers around which it is trained.

In the modification shown in Figure 1, the web W is lifted off of the felt 14 before it reaches the suction roll 15 and is directed around a guide roll 22 having a resilient covering, such as a rubber sleeve 23 therearound. The web W is pressed against the top press roll 17 by the roll 22 so that the web will hug the roll 17 and travel therewith.

After the web W passes between the nips of the rolls 22 and 17, it is held tightly against the roll 17 and travels therewith down into contact with the conveyor felt 14 near the end of the suction area defined by the suction box 16 of the suction roll 15. However, the felt 14 before re-contacting the web W has already traveled over a portion of the suction area and has had large amounts of the water therein removed by suction. The felt is, therefore, in a comparatively dry condition when it again contacts the web W and absorbs water from the web. In this respect the dried felt is similar to a blotter.

As the carrier felt 14 and web W pass between the nip of the suction roll 15 and press roll 17, they are subjected to pressure exerted by the rolls and additional amounts of water are squeezed from the web. This squeezed out water is immediately absorbed by the felt 14. Since the nip of the rolls 15 and 17 is located within the suction area of the suction box 16, the water absorbed by the felt is immediately sucked through the felt into the suction box.

After passing through the nip of the rolls 15 and 17, the felt 14 conveys the dried web toward the end guide roll 18, at which point the web can be removed and subjected to additional water extracting or drying operations for producing the finished dried paper. Ordinarily, the drying effect of a single suction press operated according to this invention is so substantial that the web W can be passed directly from the felt 14 to the drier drums.

The modification of the apparatus shown in Figure 1 provides for a pressing of the web between a resilient roll and the top press roll of the suction press, and also for the holding of the web tightly against the top press roll. This hugging of the web tightly against the top press roll effects a smoothing of the web.

In Figure 2, there is shown a modification of the apparatus described above in connection with Figure 1, in which the web W, instead of being lifted off of the felt 14 around a rubber covered roller, such as 22, and then pressed against the top press roll 17, is merely lifted off of the felt 14 and conveyed around a guide roller 25 which is spaced from the top press roll 17. The web, after leaving the guide roller 25, is then directed against the top press roll 17 to tightly hug this

roll and be smoothed thereby before re-contacting the felt 14 and passing between the nips of the suction press roll. The web, between the nip of the suction press and the guide roll 25 is held in a taut condition, so as to be smoothed by the press roll 17.

The operation of the apparatus shown in Figure 2 is more clearly illustrated in Figure 4. As shown in this figure, the web W upon leaving the guide roll 25 is directed downwardly against the press roll 17 and then between the nip of the suction press consisting of the suction roll 15 and the top press roll 17. At this point, the web W re-contacts with the felt 14 but, as is readily apparent, the felt 14 has already traveled over a considerable portion of the suction area defined by the suction box 16. During this travel, the felt 14 has had the water therein removed therefrom by suction. Since the upper surface of the felt 14 is not covered with the web W, as is conventional when passing wet webs through suction presses, it is considerably more porous and permits the passage of larger quantities of air therethrough, thereby opening up the fibers of the felt and rendering it more absorbent. When the web W is allowed to contact the felt, it seals off the felt and requires the use of higher vacuum to draw water from the web through the felt. However, according to this invention, the felt is first separately treated to remove water therefrom and render it absorbent, so that when it re-contacts with the web W at the nip of the suction press, any water removed from the web by the combined action of suction and pressure is immediately absorbed by the web and directed into the suction box.

Since the web has already had a considerable suction treatment before reaching the suction press, most of the water therein that can be removed by suction alone has already been removed and, therefore, the cleaning and drying of a conveyor felt for rendering the same more absorbent to water squeezed by pressure from the web greatly increases the drying capacity of suction presses.

As is customary in suction rolls, the suction box 16 is stationary, while the perforated periphery of the drum revolves thereover. The suction box 16 is evacuated through a vacuum and drain line indicated diagrammatically at 26, while the sides of the suction box are sealed by resilient packings 27 and 28 frictionally engaging the inner periphery of the perforated roll 15.

In the modification of the apparatus shown in Figure 3, the web W is lifted off of the carrier felt 14 and directed around a vertically adjustable guide roller 30 which can be raised or lowered as desired to direct the web W over the suction area defined by the suction box 16 of the suction roll 15 for any desired length before the web is directed through the nip of the rolls 15 and 17. The web W is allowed to sag between the roll 30 and the suction press, so as to re-contact the conveyor felt 14 before contacting the press roll 17. This permits of an adjustable amount of suction treatment for the web before it is subjected to pressure. The amount of contact of the web with the suction area can be readily regulated by raising or lowering the roll 30, as indicated. However, the roll 30 should not be lowered sufficiently to contact the web W with the felt before the felt has passed over at least a part of the suction area.

From the above, it should be understood that the modifications of apparatus according to this

invention provide for the contacting of a conveyor felt alone with a part of the suction area of a suction roll before the conveyor felt again receives the web. The amount of contact of the felt alone with the suction area, as well as the amount of contact of the web with the suction area, can be varied throughout a wide range without departing from the scope of this invention.

The invention provides a process of removing additional amounts of water from fibrous webs that have been considerably dried on forming surfaces. Ordinarily, paper removed from the forming wires of modern paper machines cannot be further dried by suction alone, but this invention provides for the use of conventional suction presses in a manner which will remove considerable additional quantities of water from suction dried fibrous webs and at the same time effect a cleaning of the web conveyor felt.

The freeing of the conveyor felt from the paper web so that large volumes of air can be sucked therethrough by the suction roll to clean and dry the felt alone will save enormous amounts of power which, in the past, was required for operating the vacuum pump in connection with the suction press.

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. The process of removing liquid from fibrous webs which comprises conveying a wet web on an absorbent carrier, removing the web from the carrier, sucking liquid from the carrier alone, recontacting the web with the carrier while the same is still subject to suction, and squeezing the web to force liquid therefrom for absorption into the carrier.

2. The process of removing liquid from fibrous webs which comprises conveying the wet web on an absorbent carrier, removing the web momentarily from the carrier, sucking liquid from the carrier alone, recontacting the web with the carrier while the same is still subject to suction, and removing liquid from the web by suction and pressure.

3. The process of removing water from fibrous webs which comprises conveying the wet web on an absorbent carrier, removing the web from the carrier, directing the carrier alone into contact with the suction area of a suction press, removing water from the carrier by suction while in contact with said area, and recontacting the web with the dried carrier as it passes through the suction press to squeeze water from the web for absorption into the carrier.

4. The process of removing water from fibrous webs which comprises conveying the wet web on an absorbent carrier, removing the web from the carrier momentarily, directing the carrier alone into contact with the suction area of a suction press, removing water from the carrier by suction while in contact with said area, recontacting the web with the dried carrier as it passes through the suction press to squeeze water from the web for absorption by the carrier, and immediately sucking the absorbed water from the carrier.

5. The process of increasing the water-removing capacity of suction presses which comprises directing an absorbent carrier alone into contact

with the suction area of the suction press for drying the carrier, directing a wet fibrous web into contact with the press roll of the suction press, and conveying the web and carrier through the nip of the suction press to squeeze water from the web for absorption into the dried carrier.

6. The process of increasing the water-removing capacity of suction presses which comprises directing an absorbent carrier alone into contact with the suction area of the suction press for drying the carrier, directing a wet fibrous web against the press roll of the suction press, conveying the web and carrier through the nip of the suction press to squeeze water from the web for absorption into the dried carrier, and immediately sucking the absorbed water from the carrier.

7. The process of removing water from wet fibrous webs which comprises conveying a wet web on an absorbent carrier band, momentarily removing the web from the carrier band, pressing the web against the press roll of a suction press, conveying the carrier band alone over the suction area of the suction press, allowing the web to travel against the press roll back into contact with the dried carrier band, squeezing the web against the carrier band as it passes through the nip of the suction press to force water therefrom for absorption by the carrier band, and sucking water from the carrier band as it is absorbed therein from the web.

8. The process of removing water from wet fibrous web which comprises conveying a wet web on an absorbent carrier, momentarily removing the web from the carrier around a guide roll, conveying the carrier alone over the suction area of a suction press for drying the carrier, allowing the web to slack off the guide roll back into contact with the dried carrier while the latter is still subject to suction, and squeezing the web against the carrier to force water therefrom for absorption into the carrier.

9. In combination with a suction press, an endless absorbent carrier band trained through the nip of said suction press, and a guide roll adjacent the press roll of said suction press for directing a fibrous web into contact with the absorbent carrier band as it passes through the nip of said suction press after the band has passed at least partly across the suction area of the suction press.

10. In combination with a Fourdrinier paper machine having a suction couch roll, means for receiving a wet fibrous web from the Fourdrinier forming wire after it has passed around the suction area of the couch roll comprising an endless absorbent carrier band, a suction press roll within the loop of said carrier band in spaced relation from said couch roll, said suction roll having a suction area for contacting the carrier band, a top press roll cooperating with said suction roll near the end of said suction area, and a guide roll adjacent the top press roll for receiving the wet web thereover to direct the web on the carrier band as it passes through the nip of the suction roll and the top press roll after the band alone has passed at least partly across the suction area of the suction roll.

11. Apparatus for removing water from wet fibrous webs comprising an absorbent carrier band, a suction press for receiving the carrier band through the nip thereof, and a guide roll having a resilient surface pressed into contact with the press roll of the suction press for receiving the fibrous web therearound to lift the

web off of the carrier band and cause it to travel with the press roll.

12. A felt cleaning and fibrous web drying apparatus comprising a looped conveyor felt, a suction roll within the loop of the felt, a fibrous web carried by said felt, means for momentarily separating the web from the felt as the felt contacts the suction roll, and a press roll cooperating with the suction roll for squeezing the separated felt and web together after the felt has passed over at least part of the suction area of the suction roll.

13. A fibrous web drying apparatus comprising

a press roll assembly, an absorbent carrier band trained through the nip of the rolls of the assembly, a fibrous web carried by the band, means ahead of the nip of the press rolls for temporarily removing the web from the band and providing for the return of the previously removed portion of the web with the band before the same passes through the nip of the press rolls and mechanical suction means for removing liquid from the band alone while the web is temporarily removed therefrom.

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