Sept. 1, 1970 E. D. BEACHLER ET AL 3,526,574

VACUUM TRANSFER DEVICE IN PAPERMAKING MACHINE

Filed March 27, 1967

Fig-1

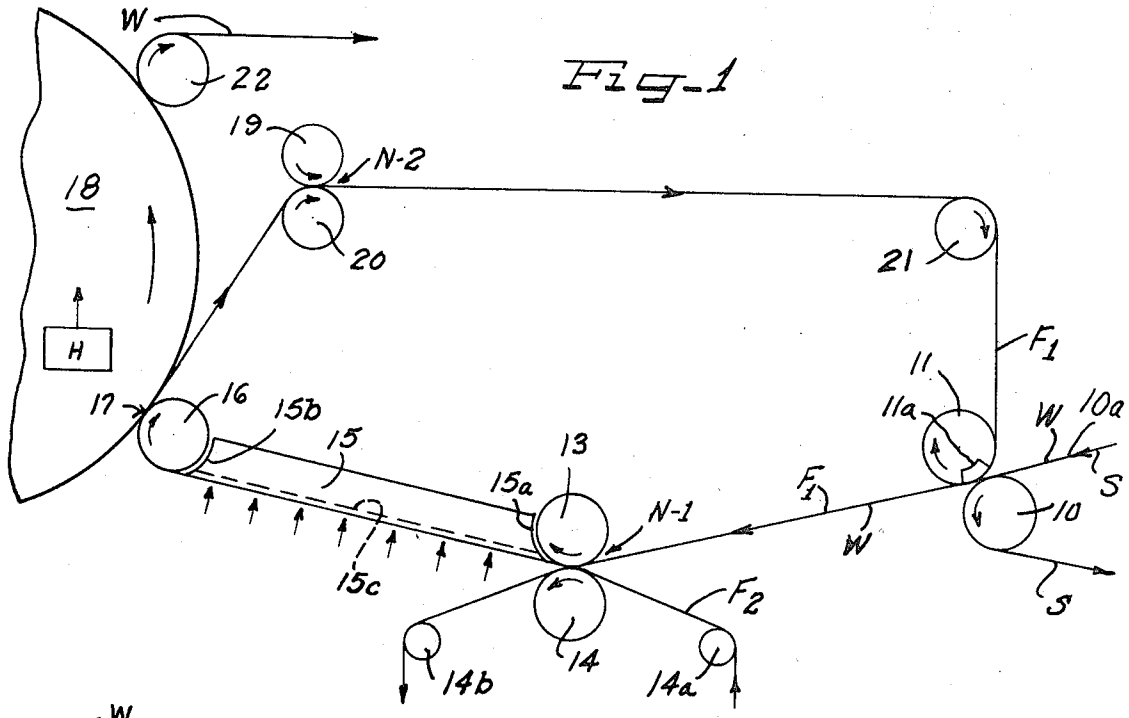
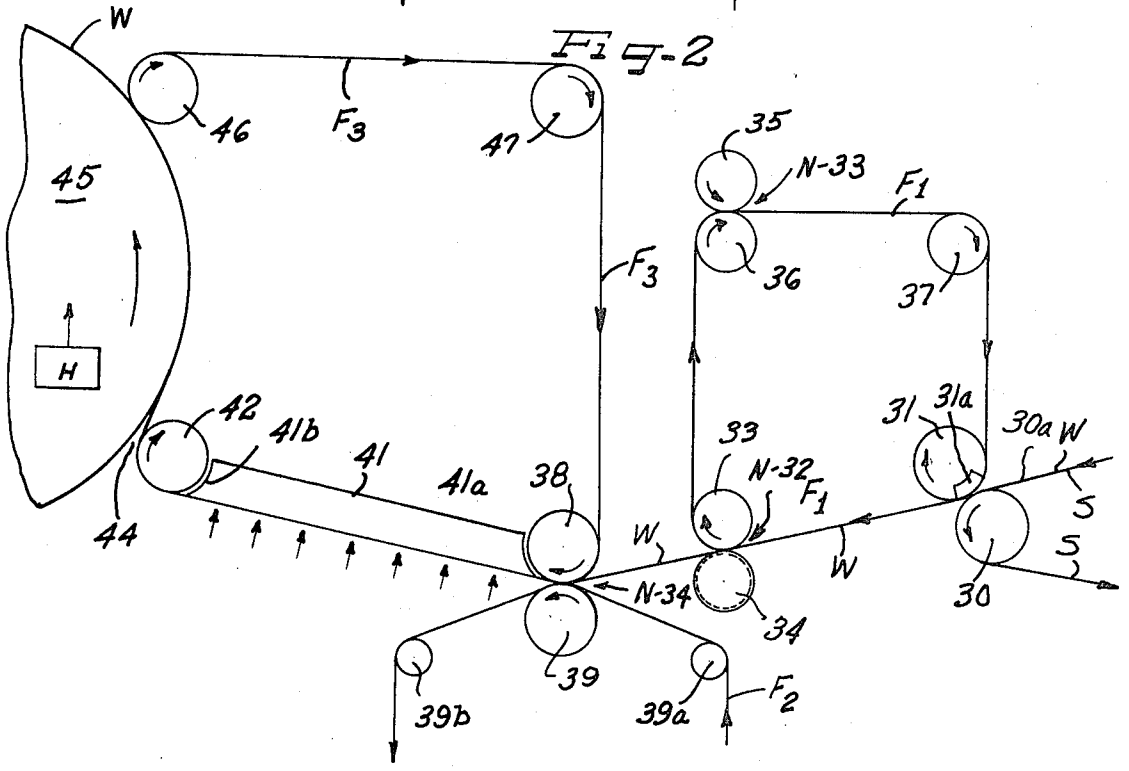


Fig-2



INVENTORS
Edward D. Beachler
John W. Amend

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

United States Patent Office 3,526,574 Patented Sept. 1, 1970

3,526,574

VACUUM TRANSFER DEVICE IN PAPERMAKING MACHINE

Edward D. Beachler and John W. Amend, Beloit, Wis., assignors to Beloit Corporation, Beloit, Wis., a corporation of Wisconsin

Filed Mar. 27, 1967, Ser. No. 626,024
Int. Cl. D21f 2/00
U.S. Cl. 162—205 4 Claims

ABSTRACT OF THE DISCLOSURE

A device and method for transferring a travelling moist paper web onto the surface of a dryer drum in a paper machine. An inverted elongated suction box is trained on a felt carrying the paper web to maintain a pressure differential across the traveling felt and web thereby maintaining the web against the felt as the felt and web approach the dryer drum surface so that uniform application of the web to the dryer drum is achieved.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to paper machinery and more particularly to a lightweight or tissue forming paper machine producing paper webs of high quality.

Description of the prior art

Modern-day paper making machines include various different constructions which are especially adapted for making one type of paper web or another. One category of paper machines is known as the "Yankee" machine, which involves the use of a Yankee dryer. The Yankee dryer is a large diameter heated roll to which a moist web is trained or pasted onto, after the moist web has ordinarily undergone controlled pressing for purposes of dewatering. The moist generally lightweight and delicate web is carried by a traveling web from the press section to the Yankee dryer and trained or pasted onto the surface of the dryer for perhaps 90° to 270° of rotation of the dryer surface so as to obtain a relatively dry web when operating at comparatively high speeds. The lightweight paper web must be handled with a minimum of disruptive forces and must be uniformly and smoothly applied to the Yankee dryer surface. Present practice is to train the web and felt over guide rolls which apply the web to the dryer surface, however, because of the relatively high speed of operation and the lightweight and delicate nature of the paper web, the web tends to flutter and otherwise deviate in its path of travel so as to approach and be applied to the dryer surface in a non-uniform wrinkled manner.

SUMMARY

It is an important object of the instant invention to provide an apparatus and a method of uniformly transferring a moist lightweight delicate paper web from a press section to a dryer surface in a paper machine.

It is another object of the instant invention to provide an apparatus and method of maintaining the felt and web in intimate contact with each other as they approach a dryer surface, thereby eliminating deviations in the path of travel of the web in relation to the felt to allow uniform application of the web to the dryer surface.

Other and further objects, features and advantages of the instant invention will become more apparent to those skilled in the art from the following detailed disclosure and drawings attached hereto and made a part hereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an essentially diagrammatic view in elevation of a paper machine embodying the instant invention; and

FIG. 2 is a diagrammatical view in elevation of a modified form of a paper machine embodying the instant invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. 1, a looped forming wire or screen S is shown traveling from a conventional breast roll (not shown) around a couch roll **10** which defines a downwardly inclined web forming run **10***a*. The downward inclination is at an angle of about 20° to 70° from the horizontal. Suction transfer roll **11** transfers the newly formed moist web from the forming screen S to a felt F–**1** by means of suction gland **11***a*. The felt F–**1** may be looped around a number of rolls including suction roll **11**, press roll **13**, guide roll **16**, press roll **20**, and guide roll **21**. The felt is of a fibrous structure which may be composed of natural or synthetic fibers or mixtures thereof so as to be substantially fluid-permeable, that is, allowing relatively easy passage therethrough for air or liquid.

The suction transfer roll **11** creates a partial vacuum through the felt at the suction gland **11***a* so that the wet web W adheres to the outer surface of the traveling felt F–**1**. The web W then continues maintaining contact with the felt F–**1** by means of capillary action and travels with the felt F–**1** to a press section. The press section may be composed of one or more press couples each defined by a pair of press rolls, such as **13** and **14**, forming a dewatering nip N–**1**. The press rolls **13** and **14** may be plain surfaced rolls, as shown, or blind-drilled rolls, i.e., having a myriad of fine water retaining recesses. In addition, press roll **14**, which is wrapped by a second felt F–**2**, may also be a suction roll with a conventional suction gland or a grooved roll having its peripheral surface provided with alternating generally circumferentially aligned grooves and ridges. A more detailed disclosure of such a grooved roll may be found in E. J. Justus, U.S. Pat. No. 3,198,697, which is owned by the instant assignee and which is incorporated herein by reference. Generally, the ridges of such a grooved roll are so constructed as to present smooth generally cylindrically closely axially spaced land areas supporting the felt F–**2** and permitting the felt F–**2** to bridge the grooves and thereby protect the web W against substantial marking at the nip N–**1**. The grooves are vented to ambient atmosphere at the oncoming and off-running sides of the nip N–**1** to facilitate reception of the water from the web and felt at the nip N–**1**. It will be appreciated that in the case of a lightweight delicate web W, such as tissue paper, the amount of pressure used at a press couple must be carefully controlled so as not to damage the delicate nature of the web.

The second felt F–**2** is guided through the nip N–**1** and around press roll **14** by means of guide rolls **14***a* and **14***b*. As will be appreciated, the felt F–**2** may then be directed into a suitable felt only press (not shown) to recondition the felt so that it may again be guided into the nip N–**1** to facilitate in water removal from the web W. Such structures are well known in the art and need not be discussed further herein.

As the felt F–**1** and the web W leave nip N–**1** and travel toward a Yankee dryer drum **18** they pass a means which maintains the web in relatively intimate contact with the felt F–**1** so as to eliminate any deviations in the path of travel of the web in relation to the felt F–**1** as the web and felt approach the dryer surface. Preferably, such means consists of an inverted suction box **15** having concave curved end portions **15***a* and **15***b* in close running

relationship with rolls **13** and **16**, respectively. The inverted suction box **15** maintains a pressure differential across the traveling web and felt by means of vacuum within the box supplied from an appropriate vacuum source (not shown). It will be noted that the working surface of the stationary box contacts only the inner surface of felt F–**1** and thereby forces the web W to maintain intimate contact with the outer surface (which is free from contact with any restraining means) of the felt F–**1**. The working surface (shown diagrammatically by the dotted line **15***c*) of the box **15** is generally smooth and substantially frictionless so as not to cause excessive wear on the felt F–**1**.

The amount of pressure differential can readily be controlled by increasing or decreasing the amount of vacuum applied to the stationary working surface of the inverted box **15**. It has been found that as a general practice, it is preferable to employ approximately 10 to 30 inches of water vacuum at such stationary fluid-permeable surface. It will be understood, nevertheless, that under particular circumstances it may be desirable to operate under relatively higher or lower pressure and that such operation is included within the scope of the invention.

As the traveling web W and felt F–**1** move across and beyond the stationary box **15** they contact guide roll **16** which is in working contact (i.e., forming a "pasting nip") with the Yankee dryer **18** at point **17** to "paste" the web onto the surface of the Yankee dryer **18**. The concavely curved end portion **15***b* of the stationary box **15** is in extremely close running relationship with the peripheral surface of guide roll **16** so that the web W is continuously maintained in relatively intimate contact with the felt F–**1** and does not deviate from its path of travel prior to being applied to the surface of the Yankee dryer drum **18**. This manner of application allows the web to be uniformly and smoothly, i.e., with no wrinkles, applied to the highly polished surface of the dryer drum. As will be appreciated, the web W does not contain any substantial amount of water at this phase of the operation.

The Yankee dryer **18** is a comparatively large metal roll that is provided with a smooth (mirror) finish for receiving and dewatering the web W thereon and is also generally provided with a means for heating the interior thereof (indicated diagrammatically at H) in order to accelerate the dewatering of the web moving on the traveling Yankee dryer surface. This structure is essentially conventional and need not be described further. After the web has sufficiently dried it is guided away from the dryer surface **18** by means of a guide roll **22** for further processing as desired.

After the felt F–**1** has guided the web W onto the dryer drum surface it is then guided away from the dryer drum surface to a felt only press couple defined by press rolls **19** and **20** which form a felt only nip N–**2**. Rolls **19** and **20** may be grooved, as previously described, or may be suction rolls, plain rolls, blind-drilled rolls, or a combination thereof. The felt only press couple dewaters the felt F–**1** and conditions the same prior to its return around guide roll **21** to recontact the newly formed web W. Relatively high pressure may be used at the felt only press couple as the felt F–**1** is substantially impervious to marking and is not easily damaged.

Referring now to FIG. 2, it will be seen that a paper machine is shown somewhat similar to that described in conjunction with FIG. 1 except that an additional press couple is provided for the web prior to its contacting the dryer surface. Thus, a looped forming wire or screen S is shown traveling around a couch roll **30** and carrying thereon a newly formed, extremely delicate web W. A suction transfer roll **31** transfers the newly formed moist web W from the forming screen S to a relatively highly absorbent felt F–**1** by means of suction gland **31***a* within the suction roll **30**. The felt F–**1** is in the form of an endless loop, trained around a number of rolls, i.e., rolls **31**, **33**, **36** and **37**. The felt F–**1** is of a fibrous structure

which may be composed of natural or synthetic fibers or mixtures theerof, and preferably such fibers have a highly absorbent nature so as to aid in dewatering the newly formed web W and thereby tending to maintain contact with the web W by means of capillary action as it travels from the suction transfer roll **31** to the first press couple defined by press rolls **33** and **34**.

Press rolls **33** and **34** define a dewatering nip N–**32** wherein a certain amount of water is removed from the newly formed web W. As shown in FIG. 2, roll **34** may be a grooved roll similar to that previously described. It will, nevertheless, be appreciated that roll **34** may also be a suction roll, a plain roll or a blind-drilled roll. Roll **33** may have a structure similar to roll **34** as desired, or may be of different structure. The felt F–**1** is then guided upwardly into a felt only press couple defined by rolls **35** and **36** to form a felt only nip N–**33**. The nip N–**33** dewaters and conditions the felt F–**1** to place it in condition for recontacting the newly formed web W at suction transfer roll **31**. The felt only press nip N–**33** may employ similar pressures to that described in conjunction with FIG. 1 and need not be described further.

The web W leaves the press nip N–**32** and travels through a relatively short open space into a second press couple defined by rolls **38** and **39**, forming a nip N–**34** for additional dewatering. Press roll **39** is wrapped with a second felt F–**2** which is guided through the nip N–**34** by means of guide rolls **39***a* and **39***b*. As will be appreciated, a felt only couple may also be provided for the felt F–**2**. Press roll **38** is also wrapped with a separate felt, F–**3**, which is guided through nip N–**34** by means of rolls **42**, **34** and **35**.

In a press section where more than one press couple contacts the web W it is generally preferred that the last press couple be composed of plain surfaced rolls. Thus, rolls **38** and **39** are preferably plain surfaced rolls, however, they may have other structures if desired. It will be noted that the web W is sandwiched between felts F–**3** and F–**2** as it travels through the nip N–**34**. Such an arrangement substantially protects the web W and allows a smoothing effect of the web faces to take place. On the off-running side of the nip N–**34** the web W adheres to the outer surface of the felt F–**3** while the inner surface of the felt F–**3** contacts a stationary fluid-permeable substantially frictionless surface **41** which tends to maintain a pressure differential across the traveling felt F–**3** and web W thereby maintaining intimate contact between the web and the felt F–**3**. The fluid-permeable stationary surface **41** is generally in the form of an inverted suction box having curved end portions **41***a* and **41***b* in close running relationship with rolls **38** and **42**, respectively.

The felt F–**3** and web W travel beyond the stationary surface **41** and pass around guide roll **42** which is spaced a distance **44** away from Yankee dryer drum **45** and guides the web W and felt F–**3** onto the surface of the Yankee dryer **45**. The web W is in direct contact with the highly polished surface of the Yankee dryer **45** (which is provided with internal heat, indicated diagrammatically by H) while the felt F–**3** firmly presses the web W into more intimate contact with the Yankee dryer surface so that the web is uniformly and smoothly applied to the dryer surface to yield a high quality paper product. The felt F–**3** maintains contact with the web W for a portion of the rotary surface and is then guided away from the dryer surface by means of guide roll **46** and then around guide roll **47** down into the nip N–**34**. Of course, if desired a felt only press couple may also be provided for the felt F–**3** at a position on the oncoming side of the nip N–**34**. The web W remains on the surface of the Yankee dryer **45** for a distance sufficient to obtain a relatively dry web, however, generally about 270° of rotation is more than sufficient to adequately dry the web.

Generally, the modified structure of paper machine shown in FIG. 2, particularly the spacing of guide roll **42** from the surface of the Yankee dryer **33**, has been found

to be somewhat more preferable for use in extremely delicate and extremely lightweight paper webs as less disruptive forces tend to act on the web in such an arrangement. In addition, this type of arrangement prevents a buildup of water at the point where the moist web contacts the dryer drum, in those instances where sufficient dewatering was undesirable in the press section because of the delicate nature of the web W.

While the invention has been described with reference to the transfer of a web from a press couple to the surface of a web drying cylinder it will be readily apparent to those skilled in the art that the principles of the present invention are equally applicable to the transfer of webs from one drying cylinder to another.

For example, the press couple **38**, **39** of FIG. 2 may be replaced with a drying cylinder such as the cylinder **45** from which the web may be transferred to the cylinder **45** in a manner herein above described.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

We claim as our invention:

1. A method of transferring a traveling moist web onto a dryer drum without producing wrinkles on the web consisting of contacting the web with a traveling looped fluid-permeable felt, pressing said felt and web to remove water from said web, guiding the traveling felt and web past a stationary fluid-permeable smooth surface positioned closely adjacent to the dryer drum and in contact with only the felt and maintaining a pressure differential across the felt and web for maintaining intimate contact between the felt and the web as it approaches the dryer drum, and immediately guiding the felt and web onto the dryer drum for substantially uniform smooth application of the web on the dryer drum.

2. In a paper machine, in combination, a dryer drum having a heated peripheral surface; an endless fluid-permeable traveling felt trained over a plurality of rolls to define a loop and having an inner and outer surface, said loop carrying a moist web on its outer surface from a press couple to said dryer drum surface, said press couple defined by two press rolls, one of which is within the felt loop, said felt having a portion of its outer surface in working contact with said dryer drum surface; a guide roll within the loop of said felt and spaced a distance from said dryer drum surface for pasting the moist web onto the dryer drum surface; and means within the loop of the felt between said press couple and said guide roll extending from the off-running side of said press couple to the on-coming side of said guide roll and maintaining a pressure differential across said felt and web without contacting said web, said means consisting of an elongated suction box having a fluid-permeable generally smooth stationary surface positioned within the loop of the felt and engaging the inner surface of said felt and being in close running relationship to the off-running side of the press couple and the on-coming side of the guide roll to cause uniformly intimate contact between said felt and web as they travel together from said press couple to said guide roll.

3. The paper machine as defined in claim **2** wherein said suction box is provided with oppositely concave curved end portions in close running relationship with the off-running side of the press couple and the on-coming side of the guide roll.

4. In a paper machine as defined in claim **2** wherein the guide roll is positioned to define a pasting nip with the surface of the dryer drum and pastes the web onto said drum surface.

References Cited

UNITED STATES PATENTS

2,888,074	5/1959	Hornbostel	162—358 XR
3,440,137	4/1969	Russell et al.	162—306
3,224,928	12/1965	Lee et al.	162—359 XR

S. LEON BASHORE, Primary Examiner

R. H. TUSHIN, Assistant Examiner

U.S. Cl. X.R.

162—305, 358, 363