United States Patent

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[54] **CURVED FOIL ABOVE THE FOURDRINIER WIRE**
6 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **162/312,** 162/210, 162/361
[51] **Int. Cl.** **D21f 7/00**
[50] **Field of Search** 162/312, 344, 347, 210, 205, 305, 361, 374, 308, 311, 313, 314

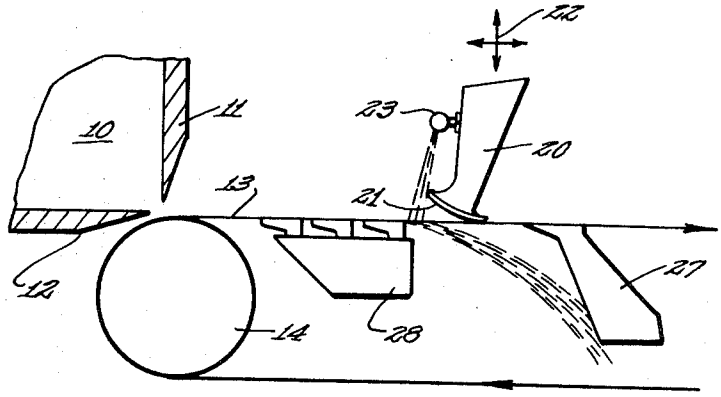
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ABSTRACT: A curved foil member is positioned above the paper web extending transversely across the width of the web and is adjustably supported. A shower head is mounted on the foil support to clean the leading edge of the foil member. The foil member squeezes the web from above and forces air which has been entrained immediately above the path of the moving web down through the web to create a dewatering force.



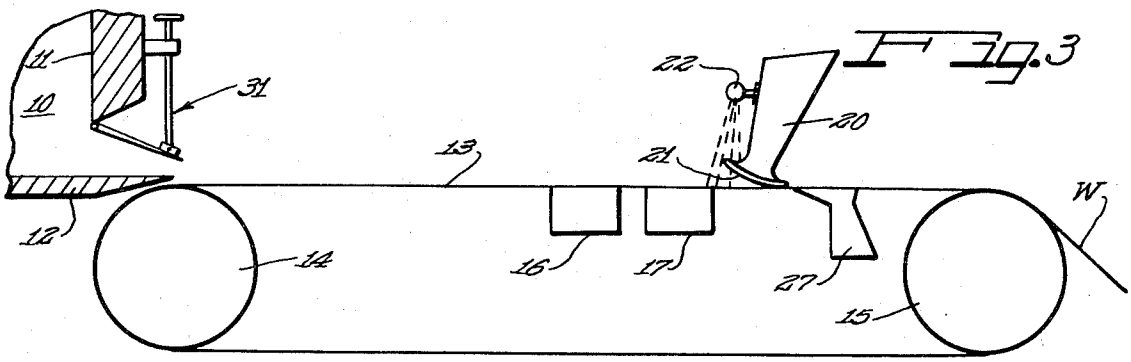


Fig. 3

Fig. 2

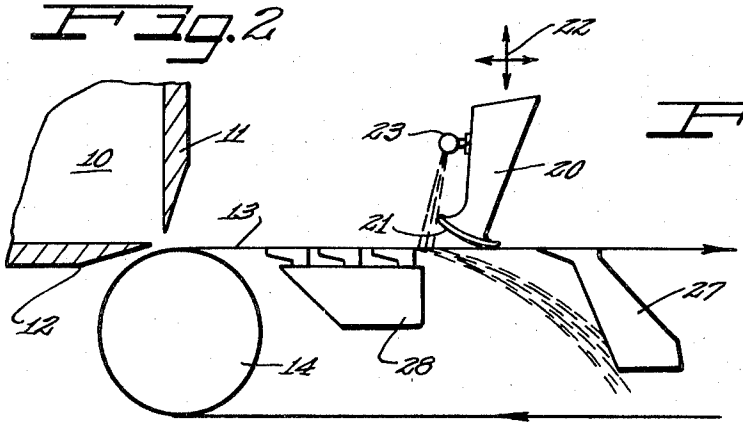


Fig. 4

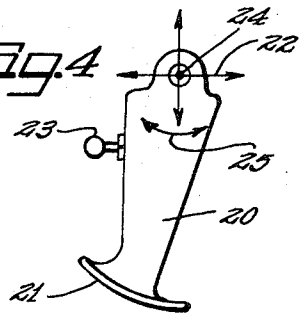


Fig. 1

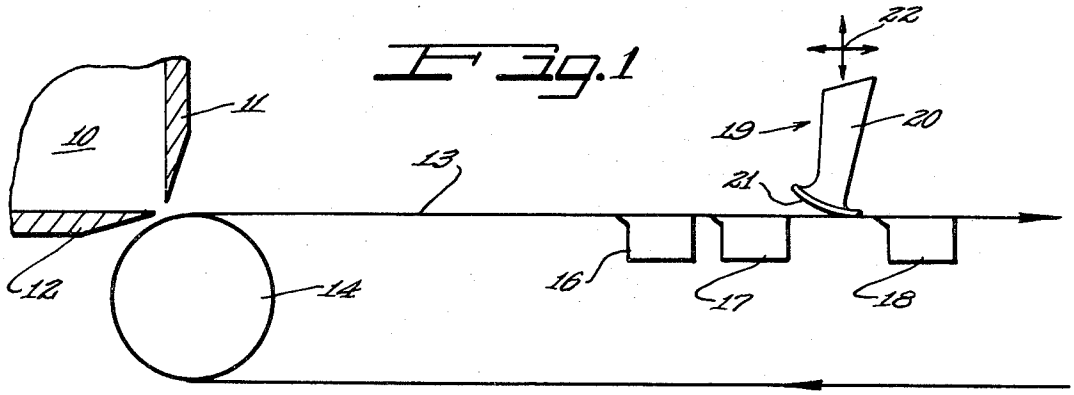
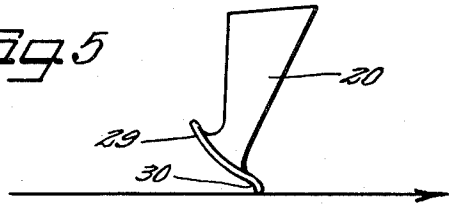


Fig. 5



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CURVED FOIL ABOVE THE FOURDRINIER WIRE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to papermaking machines and in particular to apparatus for removing water from a traveling paper web.

2. Description of the Prior Art

The most generally used processes for making paper, for example the Fourdrinier process, employs a relatively heavy transporting medium, such as water, for carrying paper stock fibers along the path of equipment which forms a papermaking machine. In the wet section of the papermaking machine the mixture of water and paper stock fibers are deposited as a flowing liquid sheet on a moving porous or perforate supporting surface, usually called a forming wire, at the same speed as the speed of the forming wire. At this point the mass of the paper web so formed is almost totally water by weight.

It is desirable to remove the water from the traveling web for several reasons. Of course, paper products are usually dry and it is necessary to remove the water to provide a dry product. In addition, inasmuch as water is a relatively heavy medium, heavy machinery is required for supporting and moving the traveling web; therefore, removal of the water early in the process would permit the utilization of lighter supporting structures by relaxing the design criteria for such equipment. Also, the total drying process would be decreased.

The correctional method of removing water from the web begins with the application of a vacuum, through the medium of suction boxes, below the forming wire to draw water from the web. The method then squeezes water from the web by passing the web through pressing rollers. Blotting the wet web by continuously running felts is also employed as is passing the web over heated rollers to evaporate water therefrom. The drying requirements of each would be decreased if techniques immediately downstream of the point of deposition or initial web formation can be improved.

It is therefore the object of the present invention to provide an improved method and means for removing water from a traveling paper web while on the Fourdrinier wire.

Another object of the invention is to permit the utilization of lighter structures in a papermaking machine for supporting a traveling web.

Another object of the invention is to remove water from a traveling paper web at a point immediately downstream of the point of web formation.

A still further object of this invention is to decrease the drying time required in making paper.

SUMMARY OF THE INVENTION

According to the present invention, and in fulfillment of the above objects, additional amounts of water may be removed from the traveling web as it is carried on the perforate forming surface by advantageously utilizing the flow of air immediately above the web created by the movement of the web to establish through the construction of such airflow, a pressure for forcing water from the web. According to the invention, a foil above the web is used which squeezes the web from above; also a constriction of airflow is accomplished by the provision of a curved foil member immediately above the surface of the traveling web having a generally downwardly directed foil surface which extends transversely across the width of the web. The air passing between the foil member and the traveling web creates a pressure above the surface of the web for effecting removal of water in the web through the perforate supporting surface.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, its organization and construction will be best understood by reference to the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an elevational and schematic illustration of a Fourdrinier type papermaking machine and process incorporating the principles of the present invention;

FIG. 2 is an elevational and schematic illustration of a portion of a papermaking machine and process employing the foil apparatus of the present invention positioned immediately downstream of the slice of the head box;

FIG. 3 is an elevational view of a papermaking machine showing a modification of the foil apparatus of FIG. 1;

FIG. 4 is an elevational view of the foil apparatus of the present invention; and

FIG. 5 is an elevational view of another foil apparatus of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows, in fragmentary section, a head box **10** including a forward wall **11** and a bottom wall **12** forming a slice for the deposition of stock material onto a traveling porous, or perforate, surface **13**, as is well known in the papermaking art. The perforate surface **13** is usually in the form of a continuous or endless forming wire which travels a circuit including supporting roller **14**. Below the perforate surface are deposed a plurality of suction boxes **16**, **17** and **18**, as is commonly practiced, to aid in removing water from the traveling web. As the web travels at a predetermined speed, an air current is established immediately above the surface of the traveling web. This flow of air is advantageously utilized in practicing the present invention to remove water from the traveling web. To this end, a foil apparatus **19**, is positioned immediately above the surface of the traveling web to constrict the aforementioned flow of air and establish a pressure in the area of constriction to effect a removal of water downwardly through the web and its supporting surface **13**. The foil apparatus **19** comprises a curved foil member **21** which extends generally downwardly and in the direction of web travel and further extends across the web in its transverse direction, the curved foil member **21** being supported by one or a plurality of supporting members **20** which are mounted for both longitudinal and vertical adjustment as indicated by the set of double-headed arrows **22**. The curved foil member **21** and the upper surface of the traveling web form an air passage of decreasing cross-sectional area between the leading and trailing edges of member **21**. The air flowing above the surface of the web is therefore constricted in this area to create a pressure for removing water from the traveling web.

FIG. 2 also illustrates a head box **10** having a forward wall **11** and a bottom wall **12** which form a slice opening for the deposition of paper stock onto a traveling forming surface **13** which traverses a circuit partially defined by roller **14**. In this particular illustration, a multiple-inlet suction box **28** is provided below the forming surface **13** immediately downstream of the head box. Also, immediately downstream of the head box. Also, immediately downstream of the suction box **28**, a curved, downwardly sloping foil member **21** is positioned above the surface of the traveling web. As in FIG. **1**, the curved foil member **21** is supported by a support member (or members) **20** which is mounted for longitudinal and vertical adjustment, as again indicated by the double-headed arrows **22**. Further, mounted on the support member **20** is a shower head **23** directed to clean the leading edge of the curved foil member **21**. Positioned immediately downstream of the foil apparatus **19** is a deflector **27** for deflecting water flowing from the underside of the forming surface **13**.

FIG. 3 illustrates the foil apparatus **19** and its cooperating deflector **27** being disposed immediately before the couch roll **15** of the papermaking machine. In FIG. **3** the head box **10** is further shown as including adjusting apparatus **31** for changing the size of the slice opening, and further shows that the traveling web leaves the circuit of the forming surface at couch roll **15**, as indicated by the reference W. In some instances it may be to advantage to employ the foil apparatus at several locations along the traveling web. For example, a foil

apparatus positioned as shown in both FIGS. 2 and 3 may be advantageously utilized for certain paper types.

FIG. 4 illustrates an adjustably mounted foil apparatus having a foil member 21 and a supporting member 20 carrying a shower head 23, the foil apparatus being adjustable longitudinally and vertically, as indicated by the double-headed arrows 22. Further, the foil apparatus is pivotally mounted on a shaft 24 for arcuate movement thereabout, as indicated by the curved double-headed arrow 25. This full range of available adjustments permits positioning of the curved foil member 21 at any desired position and at any desired angle with respect to the traveling web.

FIG. 5 illustrates a foil apparatus having a supporting member 20 to which is attached a foil member having a convex surface 29 toward its leading edge and a concave surface 30 at its trailing edge. The curvature of surface 30 provides an additional constriction of airflow by directing the trailing edge of the foil downward to additionally throttle the airflow at the trailing edge and create an increase in pressure for removing water from the traveling web.

Although I have described my invention by reference to certain illustrative embodiments herein, it is to be understood that many changes and modifications of the invention will become apparent to those skilled in the art and such changes and modifications should be included in the spirit and scope of my invention as set forth in the appended claims.

What I claim as my invention:

1. In a papermaking machine, the combination comprising a porous traveling forming surface;

means for depositing a flow of stock containing water and paper fibers onto the traveling forming surface to form a traveling web,

said traveling web effecting a flow of air along its upper surface; means beneath the porous forming surface for receiving water from the web formed on the forming surface; and

a stationary foil member disposed above the traveling web and extending transversely across the web and including a lower curved surface sloping downwardly toward the upper surface of the web and including a leading and trailing edge and extending at its trailing lower edge in close running relation thereto, said surface being at an acute angle to the oncoming web and being of substantial length in the machine direction sufficient to capture the layer of air traveling with the moving web and to establish a downward dewatering pressure in the area where the surface is in close running relation with the web to aid in forcing water down through the web and through the porous surface.

2. In a papermaking machine in accordance with claim 1 wherein the angle of the lower surface of said foil member is adjustable relative to the upper surface of the web.

3. In a papermaking machine in accordance with claim 1 including a water spray positioned in advance of said foil member for directing water against the leading portion of the foil member.

4. In a papermaking machine in accordance with claim 1 wherein said foil member is carried on a support pivotally mounted above the foil member and said support is adjustable about its pivotal point.

5. In a papermaking machine in accordance with claim 1 wherein the lower surface of the foil member has a convex curvature on its leading edge and a concave curvature on its trailing edge.

6. In a papermaking machine in accordance with claim 1, wherein the foil member is positioned immediately downstream of the point of stock deposition onto said forming surface.

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