May 27, 1969 J. G. BUCHANAN 3,446,702

WEAR INSERT FOR PAPER MACHINE DRAINAGE FOIL

Filed Jan. 24, 1966

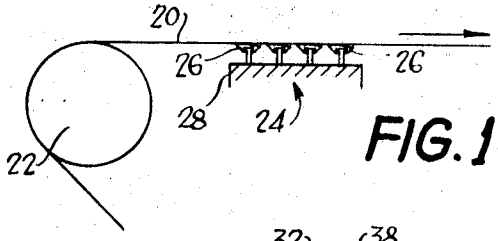


FIG. 1

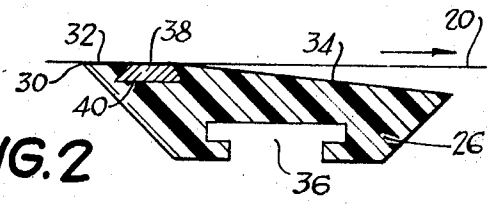


FIG. 2

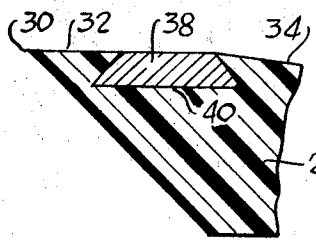


FIG. 3

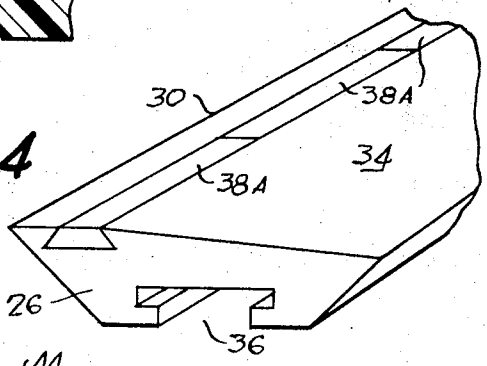


FIG. 4

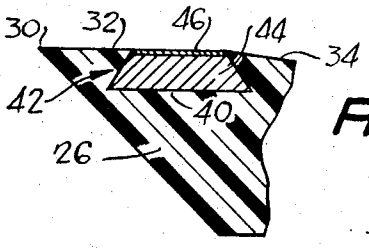


FIG. 5

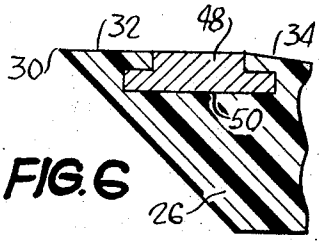


FIG. 6

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# WEAR INSERT FOR PAPER MACHINE DRAINAGE FOIL

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U.S. Cl. 162—374 7 Claims

This invention relates to web forming machines, such as Fourdrinier type paper machines wherein a pulp and water slurry is deposited onto a moving drainage or forming wire, and more particularly relates to drainage foils which are positioned in stationary supporting engagement beneath the moving drainage wire for purposes of increasing the drainage of water through the wire.

Such foils are well known and include a transverse leading edge which doctors or scrapes water from the underside of the moving wire, a land portion over which the wire passes, and a foiling portion which extends in a down-stream direction from the land portion and at a divergent angle to the wire. The divergent angle is usually between 0–5°. The action of the foiling portion is to produce a suction, beneath the moving wire, which draws water through the wire. The leading edge of the adjacent down-stream foil then scrapes this water from the underside of the wire. The use of such drainage foils is shown and described in U.S. Patent 2,928,465 issued Mar. 15, 1960, to P. E. Wrist, U.S. Patent 2,928,466 issued Mar. 15, 1960, to G. Burkhard et al., and U.S. patent application S.N. 419,131 filed Dec. 17, 1964 in the name of W. S. White, now U.S. Patent 3,337,394, issued Aug. 22, 1967.

The suction force along the foiling portion causes the moving wire to be urged downwardly thus increasing the drag of the wire moving over the land portion. This increased drag causes rapid wear of the land portion thereby increasing the area of the land portion and moving the foiling area in a down-stream direction towards the trailing edge. Eventually, after prolonged wear, the increased area of the land portion will result in reduction in the area of the foiling portion to the point where the effective suction and drainage action is impaired. Additionally, the land portion wears irregularly across the width of the machine, which again causes unsatisfactory operation.

Due to the small foiling angles involved it will be apparent that a small amount of wear of the land portion will greatly enlarge the area thereof and equally rapidly decrease the area of the foiling portion. Thus it becomes extremely important to provide foils which have a high degree of resistance to wear.

The most preferred abrasion resistant materials which have been discovered to date are extremely hard and brittle materials such as high density silicon carbide, aluminum oxide tungsten carbide, chromium oxide, etc. These materials are expensive and difficult to work with. It is obvious that such abrasive resistant materials do not have to be used for construction of the entire foil, but only on the wire contacting surface of the land portion.

Many attempts have been made to provide foils which incorporate abrasion resistant materials on the wire contacting surfaces. One such attempt provides a layer of abrasive resistant material bonded to the land portion of the foil and extending from the leading edge to the foiling portion.

This arrangement has many inherent disadvantages, two of which are as follows:

(a) The leading edge of the foil, which must be reasonably sharp to effectively scrape or doctor water from the underside of the wire, is extremely brittle and is thus vulnerable to chipping and other damage.



(b) The bonding of the wear resistant layer to the foil body is extremely difficult and it is equally difficult to guarantee the bonding even when satisfactorily completed. This factor is extremely important since loosening and debonding of the wear resistant layer from the foil would result in catastrophic failure of the expensive forming wire, and would also endanger the other expensive components on the paper machine.

This latter disadvantage can be overcome by constructing the entire foil from the expensive abrasion resistant material. However, the extremely high cost involved in such a solution would make it prohibitive, apart from the previously mentioned disadvantages.

It is, therefore, the main object of this invention to provide an improved paper machine drainage foil which securely incorporates an abrasion resistant material into the wire contacting surface thereof, thus effectively increasing the life of the foil and eliminating the risk of damage to the paper machine due to loosening or debonding of the abrasion resistant material from the foil.

Another object is to provide an improved drainage foil which embodies a groove in the wire contacting surface thereof for the secure positioning of a self-locking insert strip of abrasion resistant material therein, thus permitting the use of a wide variety of hard, brittle, and wear resistant materials on the wire contacting surface.

Another object is to provide an improved paper machine drainage foil which incorporates an abrasion resistant insert, on the wire contacting surface, extending from a point down-stream of the leading edge to a point adjacent the foil portion, thus permitting the foil body to be made of a material less brittle than the insert and eliminating many of the causes of damage to the leading edge of the foil.

Another object is to provide an improved paper machine drainage foil in which an insert of expensive abrasion resistant material is incorporated in the wire contacting upper surface thereof, thus permitting the remainder of the foil body to be made of inexpensive material.

Another object is to provide an improved paper machine drainage foil which allows greater flexibility in design for different leading edge and foiling angles and for different sizes, by securely incorporating an inert of brittle, hard wearing, material, into a foil body of inexpensive and less brittle material.

Another object is to provide an improved paper machine drainage foil which permits recovery of the expensive hard wearing insert material in cases of damage or deterioration of the remainder of the foil.

A further object is to provide an improved paper machine drainage foil which permits the use of a hard abrasion resistant material on the wire contacting surface of a replaceable type foil.

These objects are achieved in this invention by basically providing a paper machine drainage foil incorporating a groove in the wire contacting land portion thereof, the groove extending from a point down-stream of the leading edge to a point adjacent the foiling portion and securely positioning an insert of brittle abrasion resistant material in the groove.

These and other objects and advantages of this invention will be further apparent by referring to the following detailed specification and figures, in which:

FIGURE 1 is a diagramatic side view of a portion of a paper machine Fourdrinier incorporating drainage foils in accordance with this invention.

FIGURE 2 is an enlarged sectional view of one of the foils shown in FIGURE 1.

FIGURE 3 is a further enlarged partial sectional view of the foil and insert shown in FIGURE 2.

FIGURE 4 is a perspective partial view of the foil shown in FIGURE 2.

FIGURE 5 is a sectional view, similar to FIGURE 3, but illustrating another execution of insert.

FIGURE 6 is a sectional view, similar to FIGURE 3, but illustrating a further execution of insert.

Referring now to FIGURE 1, the Fourdrinier drainage wire **20** passes around breast roll **22** and over drainage foil unit **24**. The complete Fourdrinier may be composed entirely of a number of units **24** positioned beneath the upper span of wire **20**, or units **24** may be spaced between conventional table rolls, or other arrangements may be embodied as required by the type of paper being produced, speed of the machine, and other design considerations.

Drainage foil unit **24** comprises a plurality of drainage foils **26** which are removably attached to transversely extending fixed support member **28**. The arrangement for removably attaching foils **26** to support member **28** may be as disclosed in U.S. patent application S.N. 419,131 filed Dec. 17, 1964 in the name of W. S. White, or other arrangements may be embodied as required.

Referring now to FIGURES 2 and 3, the upper surface of drainage foil **26** comprises a leading edge **30**, a land portion **32**, and a foiling portion **34** which extends in a down-stream direction at a divergent angle of between 0–5° to wire **20**. Recess **36** is for attachment of foil **26** to support member **28**. The material from which foil **26** is constructed is preferably high rensity polyethylene, but other materials may equally well be used, such as nylons, nylatrons, polyurethanes, ceramics, laminated phenolics, and metals such as bronze, or stainless steel, or combinations of these.

In order to achieve the objectives of this invention, wear insert or element **38**, in the form of a dovetail, is securely positioned in a corresponding dovetail groove **40** in land portion **32**. The upper surface of wear insert **38** is flush with the upper surface of land portion **32**, and the fit between wear insert **38** and groove **40**, together with the dovetail configuration, is such as to securely retain wear insert **38** in groove **40**. Wear insert **38** may be made of any desirable material which has the required abrasion resistant characteristics. A preferred material is high density silicon carbide, which is a hard, brittle, sintered material, suitable for use on Fourdrinier machines where the wire is travelling at a high speed. However, as silicon carbide is extremely brittle and difficult to handle in long lengths, FIGURE 4 shows a modification in which wear insert **38** is composed of a number of short segments **38A**, thus facilitating the handling and manufacturing difficulties.

FIGURE 5 shows an alternative execution in which wear insert **42** is composed of a dovetail base **44**, of readily machinable and handleable material such as stainless steel, the upper surface of which is coated with a hard abrasion resistant material **46**. A preferred coating material is tungsten carbide, and this combination is particularly suitable for use in a paper machine Fourdrinier where the wire runs at a relatively slow speed. Combination wear inserts **42** may thus be manufactured in strips of length equal to the machine width, thus facilitating handling, storage, replacement of the inserts in the foils, etc.

It is thus seen that the secure positioning of a wear insert in the land portion of a foil provides a hard abrasion resistant surface extending from a point downstream of the leading edge to a point adjacent the foiling portion, which is the area of maximum wire pressure due to the suction of the foiling portion and, consequently, the area of maximum foil wear.



FIGURE 6 shows a further illustration in which insert **48** is formed in an inverted T-shape configuration, and is securely positioned in a corresponding inverted T-groove **50**, in land portion **32**. Wear insert **48** may be made of short segments of sintered high density silicon carbide, or may be a combination of stainless steel with a coating of tungsten carbide.

It will be understood that the improved features of this invention, namely the secure positioning of an insert of hard wearing material in the wire contacting surface of a drainage foil, can also be applied to other paper machine applications, such as forming boards and suction boxes.

While there are above disclosed but a limited number of embodiments of the structure of the invention herein presented, it is possible to product still further embodiments without departing from the inventive concept disclosed herein, and it is desired therefore that only such limitations be imposed on the appending claims as are stated herein, or required by the prior art.

What I claim is:

**1.** An elongated drainage foil positionable transversely under a moving drainage wire of a web forming machine, said foil including a front land portion having a leading edge and an upper surface and also including a rear suction portion having an upper surface sloped downwardly from the upper surface of said land portion, said land portion being provided in its upper surface with an undercut groove extending longitudinally of the foil, said groove having a front upper edge parallel to and spaced from the leading edge of said land portion in the direction of wire movement, and a wire engaging insert mounted in said groove and having a cross-section corresponding to that of the groove, said insert having a wire engaging upper surface coplanar with the upper surface of said land portion and at least the upper surface portion of said insert being composed of abrasion resistant material.

**2.** The device as defined in claim **1** which is further characterized in that said abrasion resistant material of said insert is selected from the group consiting of high density silicon carbide and tungsten carbide.

**3.** The device as defined in claim **1** wherein said insert comprises a plurality of short sections disposed in end-to-end relation in said groove.

**4.** The device as defined in claim **1** wherein said groove and said insert have a rear upper edge extending along and coinciding with the junction of said rear suction portion with said front land portion of the foil.

**5.** The device as defined in claim **1** wherein said groove and said insert are of a complemental inverted T-shaped cross-section.

**6.** The device as defined in claim **1** wherein said groove and said insert are of complemental dovetail shaped cross-section.

**7.** The device as defined in claim **6** wherein said dovetail cross-section of said insert provides the insert with a front edge surface edge at an obtuse angle to said upper surface of the insert.

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U.S. Cl. X.R.

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