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WEAR RESISTANT OUTSERT FOR A PAPER MACHINE FOIL

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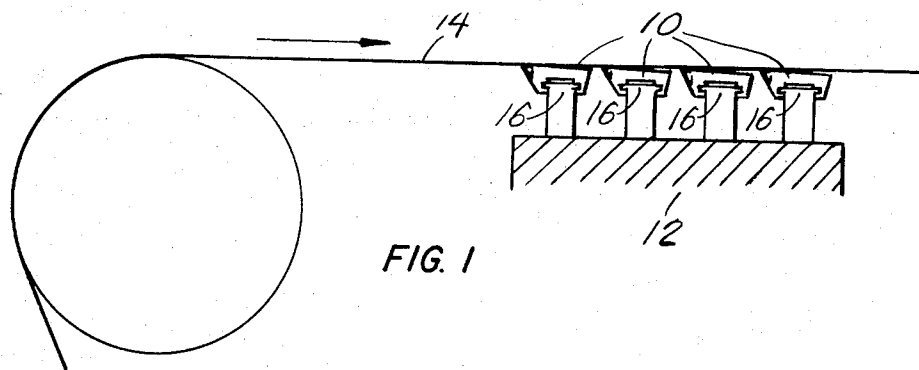


FIG. 1

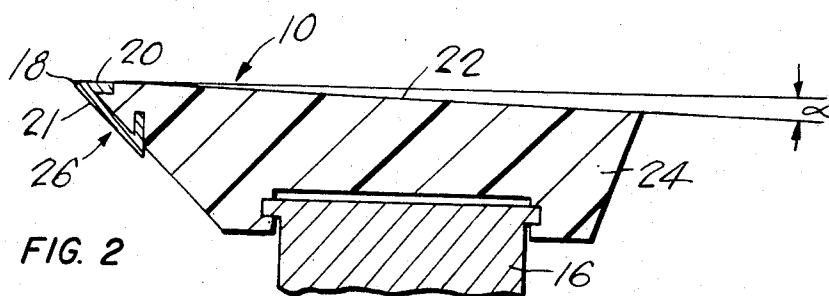


FIG. 2

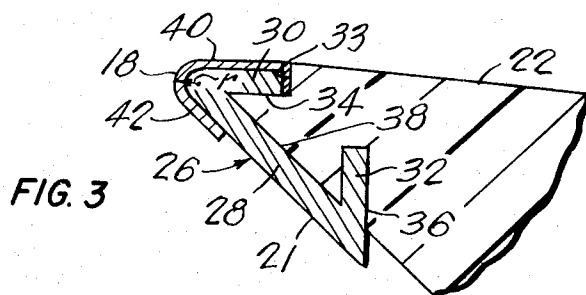


FIG. 3

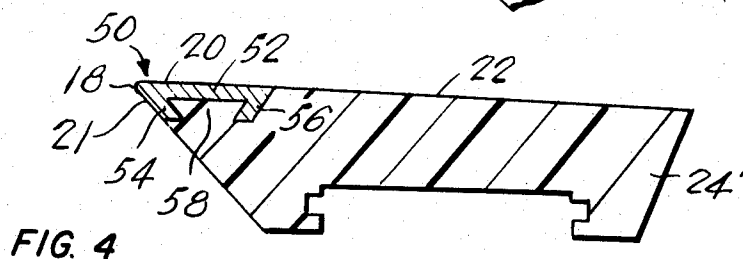


FIG. 4

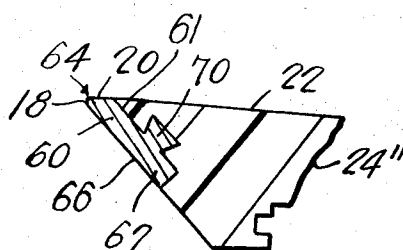


FIG. 5

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WEAR RESISTANT OUTSERT FOR A PAPER MACHINE FOIL

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22 Claims

ABSTRACT OF THE DISCLOSURE

A paper machine foil having a wear resistant outsert releasably yet securely positioned thereon to form the supporting surface, doctoring surface and leading edge of the foil. The leading edge of the outsert is formed by a small radius of curve and a wear resistant coating is applied to the supporting surface, the leading edge and a portion of the doctoring surface of the outsert.

BACKGROUND OF THE INVENTION

(a) Field of the invention

The present invention relates to a drainage foil. More specifically, the present invention relates to replaceable drainage foils for paper machines and incorporating a wear resistant outsert on its leading edge.

(b) Description of prior art

Drainage foils have been replacing table rolls on paper machines as it has been found such foils not only increase the rate of water drainage from the forming web but can also improve the web formation. One of the main problems with such foils is a wear factor in that the supporting land of the foil tends to wear.

Wear of drainage foils has resulted in considerable thought being given to simple, effective means whereby the replacement of foil elements can be made without necessarily stopping the machine and preferably without unduly disrupting the formation of a web on the wire. Such foil elements have been taught in U.S. Pat. 3,337,394 issued Aug. 22, 1967. In this patent, a T-bar connection between the foil element and its mounting structure has been described. This system has been found highly satisfactory.

It has also been proposed to reduce the wear of a foil element by means of wear resistant inserts in appropriate places on the foil. However, these inserts, particularly when used at the leading edge of the foil, have several main weaknesses. For example, the relatively sharp angle at the leading edge of the foil is subjected to excessive chipping which interferes with proper foil operation, also satisfactory bonding of the insert to the body of the blade is difficult and particularly where the insert must remain bonded in position over prolonged periods of time. Inserts as generally known in the trade are formed from solid ceramic blocks and are relatively expensive.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a foil incorporating a wear resistant outsert on its leading edge which outsert not only resists chipping at the leading edge but remains firmly locked in position during operation and yet is removable from the machine and from the body of the foil to facilitate repair.

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It is yet a further object of the present invention to provide a foil incorporating an outsert that is relatively inexpensive to manufacture.

To obtain the above objects, a system of forming relatively inexpensive outserts and marrying these outserts to a specific foil element wherein the different physical characteristics of the body of the foil element of the outsert are utilized to obtain the desired locking arrangement has been devised.

To minimize chipping at the leading edge of the foil, the said leading edge is formed by an arc connecting the supporting land surface of the foil with the doctor surface of the foil, the arc having a small radius of curvature and the outsert having a coating of wear resistant material extending around the radius of curvature part way down the doctor surface and across the supporting surface. Preferably the coating will also extend along at least a portion of the face at the end of the supporting surface remote from the doctor surface.

Broadly, the present invention relates to an outsert adapted to form the leading edge, the support surface on one side of the leading edge and a doctor surface on the other side of the leading edge of the foil, the leading edge being defined by a small radius curve connecting said support and doctor surfaces and a hard wear resistant coating covering the leading edge, the support surface, and a portion of the doctor surface. Preferably, the foil body is made of a suitable plastic material to provide a resilient base with a T-shaped slot for accurately slidably mounting the foil on the foil support, the outsert and plastic foil base being connected by a tongue and groove type connection which permits relative expansion between the plastic body of the foil and the outsert and utilizes the difference in coefficient expansions to tend to lock the outsert to the base. Preferably, the outsert is formed of formable material whereby it may be shaped, for example, by roll forming rather than machining before the coating is applied.

BRIEF DESCRIPTION OF DRAWINGS

Further features, objects and advantages will be evident from the following detailed description of preferred embodiments of the present invention taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic section of a Fourdrinier machine showing a set of foils in operative position under the wire; FIG. 2 is an enlarged section view of a preferred form of foil;

FIG. 3 is a further enlarged view of the outsert of FIG. 2 on the leading edge of the foil;

FIG. 4 illustrates a further form of outsert; and

FIG. 5 illustrates yet another form of outsert.

DESCRIPTION OF PREFERRED EMBODIMENTS

As shown in FIG. 1, the foils 10 are mounted on suitable support means 12 beneath the forming wire 14, preferably by means of a sliding T-connection generally indicated at 16 and fully described in the said U.S. Pat. 3,337,394. Each foil has a leading edge 18, a land or wire supporting section 20, and a foiling section 22 projecting from the support section 20 at a conventional foiling angle α which generally will not exceed about 5°. The leading edge 18 and the two sections 20 and 22 extend the full width of the forming wire.

The preferred form of foil will have its body section 24 formed from a suitable plastic material. It has been

found that a high density, preferably high molecular weight polyethylene is best for this purpose. The body portion 24 is suitably machined to adapt to the T-connection 16 (see FIGS. 2, 4 or 5).

Referring more specifically to FIGS. 2 and 3, the preferred form of the invention incorporates an outsert 26 which forms the leading edge 18 and the bearing surface 20 and the doctoring surface 21 of the foil. The outsert preferably is formed from a base member of a suitable metal such as a stainless steel that may be formed for example, by roll forming into the desired shape. In the arrangement illustrated, the shape has specifically been designed for roll forming, thereby substantially eliminating machining operations and reducing manufacturing costs.

The outsert 26 has a main web 28 with a pair of flanges 30 and 32 projecting therefrom and towards each other. These flanges project from the web 28 at an acute angle which is chosen to be equal to the leading angle 18 of the foil 10 so that the main web 28 may function as a doctoring surface 21 while the upper flange 22 forms the support land 20 of the foil. Preferably, the flanges 30 and 32 are symmetrical relative to the web section 28 and form a dovetail groove therebetween.

The leading edge 18 is preferably formed with a small radius of curvature r . This radius will be governed by the characteristics of the hard wear resistant coating to be described hereinbelow and the angle required to obtain the doctoring of water from the bottom of the wire with a minimum of cutting action on the wire. It has been found that a radius r of about .008 to .02 inch is satisfactory.

The leading edge of the body 24 is suitably machined to accommodate the flanges 30 and 32 by providing an open longitudinally extending groove 34 at the top and a longitudinally extending slit 36 on the front face, which groove 34 and slit 36 form between them a longitudinally extending tongue 38 machined to be snugly received within the dovetail groove formed between the flanges 30 and 32 on the outsert. The outsert 26 is mounted on the body 24 by longitudinally sliding same into position with the flange 30 in the groove 34 and the flange 32 in the slit 36.

The upper flange 30 has its upper outer surface 40 coated with a suitable abrasive and wear resistant coating 42. This coating extends from the edge of the flange 30 around radius r and part way down the leading or doctoring face 21 formed by the web section 28. Generally, this coating will extend about $\frac{1}{4}$ of an inch or less down the leading or doctoring surface 21 of the web 28. By continuing the coating part way down the surface 21, it has been found that the tendency for the coating to chip is greatly reduced. Preferably, the coating 42 will extend beyond the surface 40 down surface 33 at the end of flange 30 remote from the doctoring surface 21 of the web 28 as shown in FIG. 3.

Preferably, the coating 42 will be a tungsten carbide coating that possesses good wear resistant properties and resistance to chipping. Other suitable coatings such as aluminum oxide or other ceramic materials may be used.

In the above description, the outsert 26 has been indicated as extending the full length of the foil, however, the outsert may, if desired, be made up of a plurality of discrete elements in abutting end-to-end relationship extending the full width of the machine.

In the FIGS. 2 and 3 arrangement, the upper surface 40 and thus the coating 42 extend the full length in the direction of wire travel of the wire supporting surface 20 and the foiling surface 22 begins at the edge of groove 34 which accommodates the flange 30. Thus, the flange 30 has a width that is coordinated with the size of the land surface 20.

In operation on the paper machine, the foil becomes heated from the environmental temperature and the plastic body 24 expands much more than the metal outsert.

The tongue and groove type connection between the outsert 26 and the body section 24 permits relative longitudinal expansion in the longitudinal direction wherein the maximum relative expansion occurs. This tongue and groove connection also is tightened by the swelling of the tongue in the groove, thereby positively locking the outsert in position.

It is important that vertical surface dimensions such as the end of groove 34 be relatively shallow so that very little relative expansion between the body 24 and outsert 26 can take place at this point. If too much expansion occurs, a ridge will be formed at the edge of groove 34 and this ridge will interfere with the operation of the foil until it has worn off and can create problems in operation as well as a wear problem.

A second embodiment of the present invention is shown in FIG. 4. In this arrangement, the outsert 50 has its web section 52 extending along the upper surface of the foil 10. The web 52 forms the support surface 20 and may also form a portion of the foiling surface 22 in which case must either be machined or otherwise formed with the appropriate angle α .

A flange 54 forms a portion of the doctor surface 21 and the junction between the flange 54 and the surface of web 52 is formed with the small radius of curvature r described above. A further flange 56 cooperates with the flange 54 to form between them a dovetail groove adapted to receive the dovetail projection 58 machined on the body 24' of the foil. A suitable wear resistant coating will be applied to a portion of the surface of flange 54 around the leading edge 18 of the outsert and rearwardly on the web 52 at least to the end of the supporting land section 20 and preferably along the outward facing surface of flange 56 i.e. the surface of flange 56 remote from doctoring surface 21.

The outsert 50 operates much in the same manner as the outsert 26 upon relative expansion of the body member 24' and outsert 50. With this arrangement, there is a little greater tendency for a ridge to be formed on the upper surface of the foil at the joint of the flange 56 to the foil body 24' due to the longer vertical dimension of the body at this point relative to the similar dimension formed in FIG. 1. Also, the forming of the outsert 50 is a little more expensive than the forming of the outsert 26 and, therefore, the outsert 26 is preferred.

Yet another embodiment of the present invention is shown in FIG. 5. This arrangement incorporates an outsert 60 formed from a flat plate 62 having a corner adapted to form the leading edge 18 of the foil. The corner forming the leading edge 18 is formed by machining the surface 64 so that the surface 64 extends at the required angle from the surface 66 of the plate and joining the surfaces 64 and 66 by a small radius of curvature r having dimensions as indicated above. The surface 64 preferably extends the full extent of the land or bearing section 20 of the foil. The surfaces 64 and 66 will be coated in the same manner as the surfaces 40 and the front surface of the web 28 of the FIG. 3 embodiment. Also, the surface 61 at the trailing end of surface 20 will preferably be coated.

In the FIG. 5 arrangement, a dovetail tongue 70 is formed on the rear surface of the plate 62 and the body 24'' of the foil is machined to receive the outsert 60 with the tongue 70 in a complementary dovetail groove formed in the body 24''.

In all of the arrangements described above, the leading edge 18 is formed by a small radius of curvature r as described above and a surface of the outsert forms a land area 20 of the foil. This surface forming the land area of the foil together with the leading edge and where applicable at least a portion of the doctoring surface of the outsert are coated with a suitable abrasion resistant and wear resistant coating preferably of tungsten carbide and the outsert itself is made of a suitable formable or

easily machinable material such as stainless steel. Also, in each of the arrangements, the outserts 26, 50 or 60 is longitudinally slid into position in the foil body and is retained in position without requiring additional fixing means such as adhesive or the like and it is further locked in position by relative expansion between the body of the foil and the outsert.

I claim:

1. A wear resistant outsert for a paper machine foil comprising a longitudinal base member formed to provide a leading edge interposed between a wire supporting surface and a doctoring surface, said leading edge being defined by a short radius curve connecting said supporting and doctoring surfaces, a hard wear resistant coating covering said supporting surface, said leading edge and a portion of said doctoring surface; said base member having a web section and a projecting connector extending rearwardly of said web so that said longitudinal base member can be releasably mounted to said paper machine foil by horizontal sliding engagement to permit differential thermal expansion between said base member and said foil.

2. A wear resistant outsert as defined in claim 1, wherein said coating also covers at least a portion of a surface adjoining said supporting surface at the end thereof remote from said doctoring surface.

3. An outsert as defined in claim 2, wherein said base member has a web section and a pair of flanges projecting therefrom at an acute angle towards each other to form a dovetail groove therebetween.

4. An outsert as defined in claim 1, wherein said base member has a web section and a pair of flanges projecting therefrom at an acute angle towards each other to form a dovetail groove therebetween.

5. An outsert as defined in claim 4, wherein a surface of one of said flanges forms said supporting surface and a surface of said web forms said doctoring surface.

6. An outsert as defined in claim 4, wherein a surface of one of said flanges forms said doctoring surface and a surface of said web forms said supporting surface.

7. A foil for a paper machine, said foil having a doctoring surface, a leading edge, a supporting surface, and a foiling surface and comprising a body member, an outsert formed from a longitudinal base member, surfaces on said base member forming said doctoring surface, said leading edge and said supporting surface of said foil, said leading edge being defined by a short radius curve connecting said supporting and doctoring surface, and a wear resistant coating on said outsert covering said support surface, said leading edge and a portion of said doctoring surface; said base member having a web section and a projecting connector extending rearwardly of said web so that said outsert can be releasably mounted on said body member by horizontal sliding engagement to permit differential thermal expansion between said base member and said foil.

8. A foil as defined in claim 7, wherein said coating also covers at least a portion of a surface connected to said support surface at the end of said support surface remote from said doctoring surface.

9. A foil as defined in claim 8, wherein said base member has a web section and a pair of flanges projecting therefrom at an acute angle towards each other to form a dovetail groove therebetween, a dovetail projection machined in said body member, said dovetail groove and projection cooperating to form said means for releasably mounting.

10. A foil as defined in claim 9, wherein a surface of one of said flanges forms said supporting surface and a surface of said web forms said doctoring surface.

11. A foil as defined in claim 10, wherein said body member is formed of polyethylene and has a coefficient of thermal expansion higher than that of said base member and wherein said outsert is releasably mounted on said body member to permit said expansion of said body mem-

ber relative to said outsert and to tend to lock said outsert in position.

12. A foil as defined in claim 10, wherein said body member is formed of polyethylene and has a coefficient of thermal expansion higher than that of said base member and wherein said outsert is releasably mounted on said body member to permit expansion of said body member relative to said outsert and wherein said expansion tends to lock said outsert in position, said body member being further provided with a mounting slot for mounting same on a paper machine while permitting removal of the foil by lateral movement relative to the paper machine.

13. A foil as defined in claim 10, wherein said body member is formed of polyethylene and has a coefficient of thermal expansion higher than that of said base member and wherein said outsert is releasably mounted on said body member to permit expansion of said body member relative to said outsert and to tend to lock said outsert in position, said body member being further provided with a mounting slot for mounting same on a paper machine while permitting removal of the foil by lateral movement relative to the paper machine, said base member is formed by roll forming and is separable from said body member by relative longitudinal movement.

14. A foil as defined in claim 10, wherein said body member is formed of high density high molecular weight polyethylene and has a coefficient of thermal expansion higher than that of said base member and said base member is formed of stainless steel and wherein said outsert is releasably mounted on said body member to permit expansion of said body member relative to said outsert and to tend to lock said outsert in position, said body member being further provided with a mounting slot for mounting same on a paper machine while permitting removal of the foil by lateral movement relative to the paper machine, said base member is formed by roll forming and is separable from said body member by relative longitudinal movement.

15. A foil as defined in claim 9, wherein a surface of one of said flanges forms said doctoring surface and a surface of said web forms said supporting surface.

16. A foil as defined in claim 7, wherein said base member has a web section and a pair of flanges projecting therefrom at an acute angle towards each other to form a dovetail groove therebetween, a dovetail projection machined in said body member, said dovetail groove and projection cooperating to form said means for releasably mounting.

17. A foil as defined in claim 16, wherein a surface of one of said flanges forms said supporting surface and a surface of said web forms said doctoring surface.

18. A foil as defined in claim 16, wherein a surface of one of said flanges forms said doctoring surface and a surface of said web forms said supporting surface.

19. A foil as defined in claim 16, wherein said body member is formed of polyethylene and has a coefficient of thermal expansion higher than that of said base member.

20. A foil as defined in claim 19, wherein said expansion tends to lock said outsert in position, said body member being further provided with a mounting slot for mounting same on a paper machine while permitting removal of the foil by lateral movement relative to the paper machine.

21. A foil as defined in claim 20, wherein said base member is formed by roll forming and is separable from said body member by relative longitudinal movement.

22. A foil as defined in claim 16, wherein said body member is formed of high density high molecular weight polyethylene and has a coefficient of thermal expansion higher than that of said base member and said base member is formed of stainless steel and wherein said outsert is releasably mounted on said body member to permit expansion of said body member relative to said outsert

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and to tend to lock said outsert in position, said body member being further provided with a mounting slot for mounting same on a paper machine while permitting removal of the foil by lateral movement relative to the paper machine, said base member is formed by roll forming and is separable from said body member by relative longitudinal movement.

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