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3,201,308

ADJUSTABLE DRAINAGE FOIL FOR PAPER MACHINE

Filed Oct. 2, 1963

3 Sheets-Sheet 1

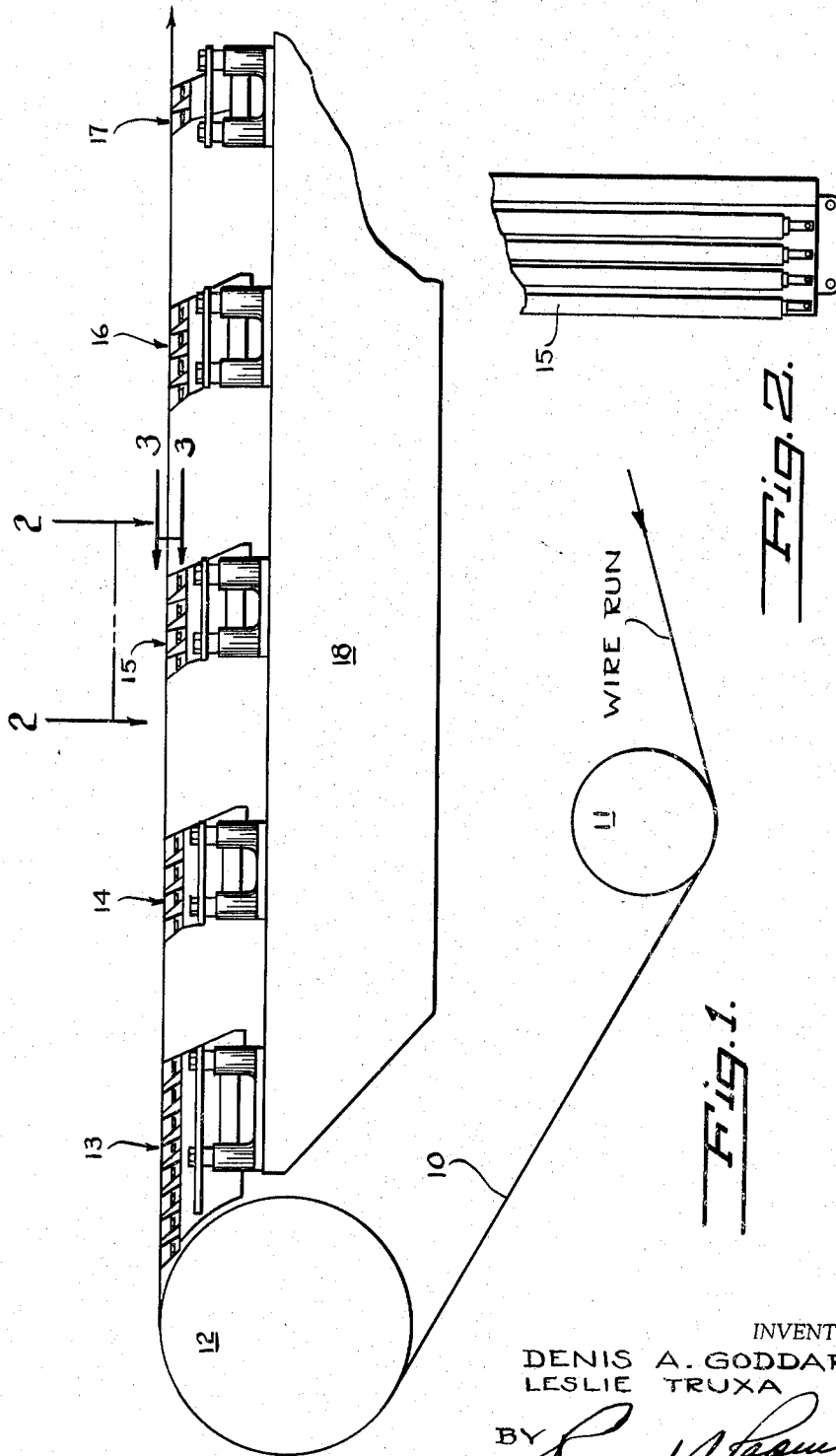


Fig. 2.

Fig. 1.

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3 Sheets-Sheet 2

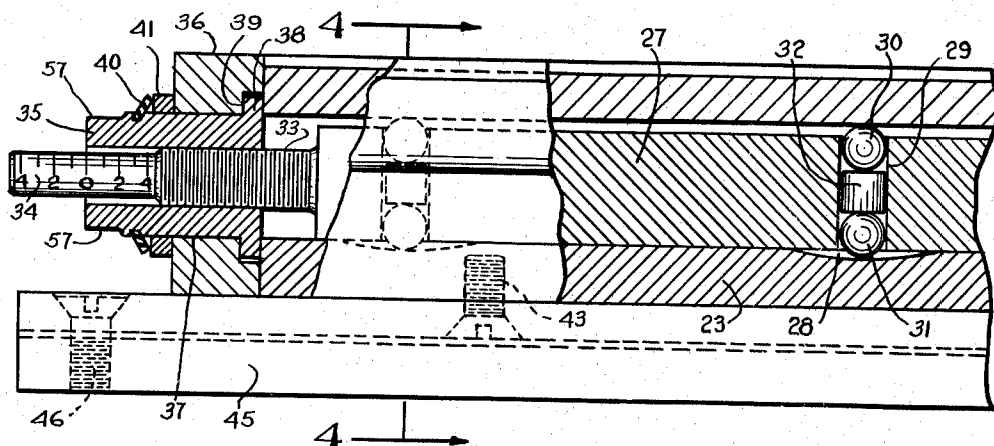


Fig. 3.

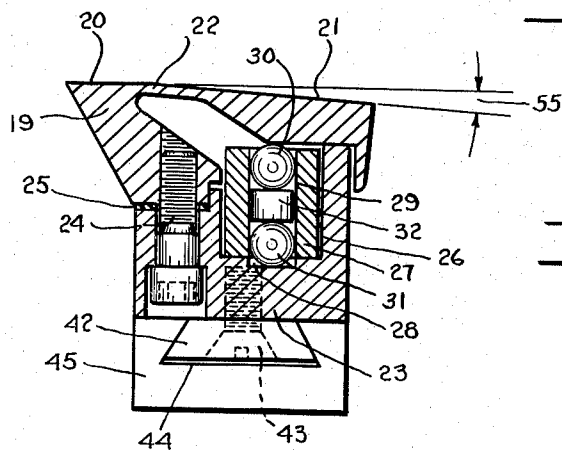


Fig. 4.

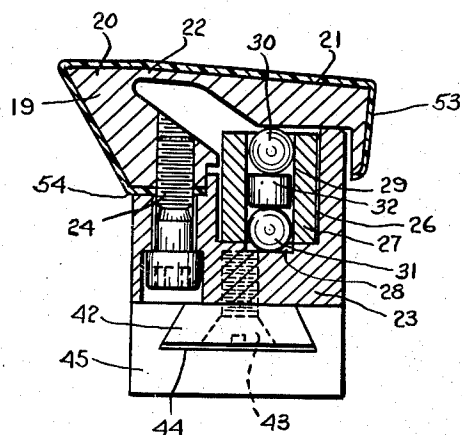


Fig. 7.

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3 Sheets-Sheet 3

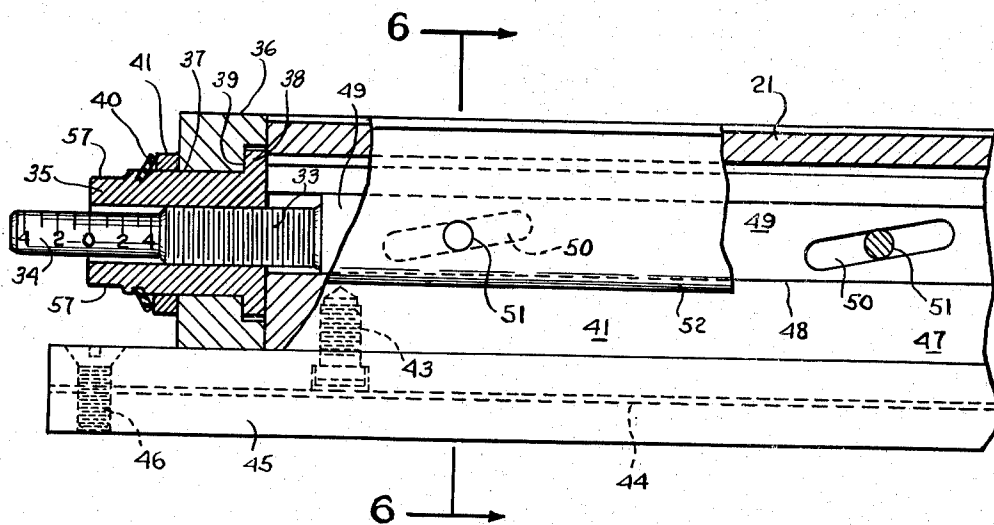


Fig. 5.

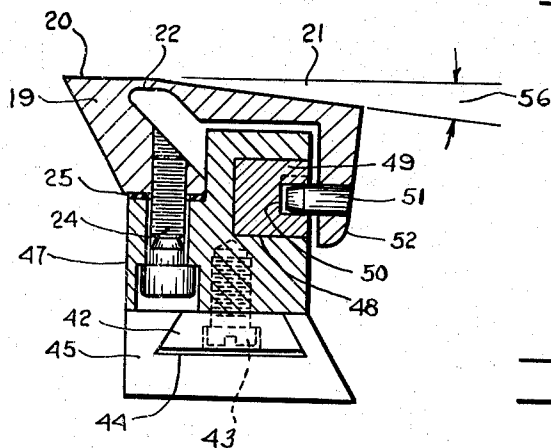


Fig. 6.

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ADJUSTABLE DRAINAGE FOIL FOR PAPER MACHINE

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2 Claims. (Cl. 162—352)

This application is a continuation-in-part of our application Serial No. 134,875 filed August 30, 1961, now abandoned.

This invention relates to Fourdrinier type paper machines and more particularly to drainage foils, as used in Fourdriniers.

In Fourdrinier type paper machines an aqueous suspension of fibers, called "stock," is discharged through an orifice, known as a "slice," onto a moving endless wire or non-metallic screen. The moving screen passes around a roll known as the "breast roll" and leaves the breast roll in a substantially horizontal direction. The stock issuing from the slice is deposited on the moving screen close to its tangency with the breast roll. After leaving the breast roll the screen passes over one or more "forming boards"; next, the screen passes over a plurality of "table rolls," whose function is to accelerate drainage of water from the stock on the screen; on leaving the last of the table rolls the screen passes over a number of "suction boxes" which are piped up to a vacuum pump after which the screen passes over the "suction couch roll" and is led back to the breast roll again by way of various rolls having functions such as driving, tensioning, and guiding the screen.

About ninety-eight percent of the water originally contained in the stock is removed by the Fourdrinier screen so that the aqueous suspension of fibers is converted, during its residence on the screen, into a continuous web of paper.

Many disadvantages associated with conventional Fourdrinier type paper machines, are overcome in the device of Canadian Patent No. 586,544, in which a plurality of stationary drainage members, or "foils," is substituted for one or more of the table rolls. This results in Fourdrinier sections of shorter length and eliminates many of the disadvantages associated with table rolls.

The present invention relates to a means of varying the drainage capacity of drainage foils, as disclosed in said Canadian Patent No. 586,544.

The general object of this invention is to provide a simple device for changing the drainage capacity of a drainage foil by varying the angle of the foil trailing surface with respect to the Fourdrinier wire.

Another object is to be able to perform said general object with the machine in operation. In this way, the results of such adjustment can be easily observed.

Another object is to design this device so that it can be easily mounted on conventional Fourdrinier support beams, to facilitate conversion of existing equipment for use with drainage foils.

Another object is to provide an adjustable drainage foil with easily replaceable wear elements.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings in which the preferred forms of the invention have been given by way of illustration only.

Referring to the drawings:

FIG. 1 is a general view of the wet end of a paper machine Fourdrinier section, which embodies the invention.

FIG. 2 is a view on 2—2 in FIG. 1, showing a partial plan view embodying the invention.

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FIG. 3 is a view, to an enlarged scale, on 3—3 in FIG. 1. This figure shows a partially sectioned side view of the invention.

FIG. 4 is a section through 4—4 of FIG. 3, and shows details of one execution of the invention.

FIG. 5 is a view similar to FIG. 3, but embodying an alternative execution.

FIG. 6 is a section through 6—6 of FIG. 5, and shows details of the alternative execution.

FIG. 7 is a section through the invention, similar to FIG. 4, and shows a further alternative execution, in which the upper surface of the drainage foil is covered with a non-metallic material.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout:

Referring now to FIG. 1, this is a general side elevation of the wet end of a Fourdrinier section, in which the Fourdrinier wire 10 passes under roll 11, around breast roll 12, and over drainage sections 13, 14, 15, 16 and 17, which are mounted on Fourdrinier side beams 18, and are each composed of a number of drainage foil assemblies embodying the invention.

FIG. 2 is a view on 2—2 in FIG. 1, showing a partial plan view of a drainage section containing a number of drainage foil assemblies.

Referring to FIGS. 3 and 4, the foil element 19 of the drainage foil assembly is composed of two surfaces, fixed foil surface 20 and adjustable foil surface 21, connected by a relatively flexible "necked" portion 22. The shape of foil element 19 is such that in its natural unstressed position, adjustable foil surface 21 is in a position of maximum angular deflection, with respect to the Fourdrinier wire. Foil element 19 is attached to body 23 with bolts 24, with spacer 25 between the adjoining surfaces. Machined in body 23 is channel 26, in which, slidably fitted, is adjusting bar 27. At approximately 6" spacings, arcuate recesses 28 are machined into the lower surface of channel 26. At spacings corresponding with the arcuate recesses 28 in channel 26, bores 29 are machined through adjusting bar 27. Positioned in each bore 29 are upper and lower adjusting balls 30 and 31 respectively, which are spaced apart by spacer 32.

Fixed to and extending from one end of adjusting bar 27 is adjusting screw 33, from which extends position indicator 34. Adjusting nut 35 is internally threaded to correspond with the external thread of adjusting screw 33 and is rotatably positioned thereon. End plate 36 is fixed to body 23 and covers the end of the drainage foil assembly. Rotatably positioned in bore 37 of end plate 36 is adjusting nut 35, which is restrained axially in one direction by shoulder 38 on adjusting nut 35 and recess 39 in end plate 36, and in the other direction by spring retainer 40 and washer 41.

Dovetail bar 42 is attached to body 23 by screws 43. Dovetail bar 42 fits into a corresponding dovetail slot 44 in support block 45 and is restrained from movement by screw 46, at one end only.

Referring to FIGS. 5 and 6. Refer also to FIGS. 3 and 4 for similar piece numbers where applicable.

Machined in body 47 is a channel 48 in which is slidably fitted adjusting bar 49. Sloping grooves 50 are machined into adjusting bar 49 at suitable spacings. Guide pins 51 are fixed in the lower trailing edge 52 of the adjustable foil surface 21, at spacings corresponding with the spacings of the grooves 50 in adjusting bar 49.

In this execution, the shape of foil element 19 is such that in its natural unstressed position, adjustable foil surface 21 is in mid-position of angular deflection, with respect to the Fourdrinier wire.

In the two executions described, the foil element 19 is

manufactured from stainless steel or similar material, and is for use with non-metallic screens.

With reference to FIG. 7, this figure is similar to FIG. 4. Spacer 25 in FIG. 4 is removed and the exposed surfaces of foil element 19 are covered with a non-metallic material 53. This non-metallic material, which may be an extruded section or a pre-formed shape, is securely clamped at the leading edge 54 between foil element 19 and body 23. An adhesive is used to obtain a secure bond between the non-metallic cover 53 and foil element 19. The non-metallic cover 53 could be applied to either execution of the drainage element and would be used with Fourdriniers using conventional metallic wire screens.

The main objective of this invention is to obtain approximately 4° angular adjustment of the adjustable foil surface 21, as shown at 55 in FIG. 4 and 56 in FIG. 6. With reference to FIGS. 3 and 4, it will be seen that when adjusting nut 35 is rotated using flats 57 machined thereon, adjusting screw 33 will be moved axially and therefore adjusting bar 27 will move in channel 26. Thus, the bore 29 containing upper and lower adjusting balls 30 and 31 respectively, will be moved relative to the arcuate recesses 28. It will be seen from FIG. 3 that any movement of balls 31 relative to arcuate recesses 28, will cause balls 31 to ride up the slopes of arcuate recesses 28, at the same time spacers 32 and upper adjusting balls 30 will also rise, thereby lifting the adjustable foil surface 21, which is permitted to do so by virtue of the flexible "necked" portion 22.

As will be seen from the drawings, the present invention comprises a substantially-rigid, fixed-foil surface 20 and a substantially-rigid, adjustable-foil surface 21, with said fixed and adjustable-foil surfaces being connected by a transverse, locally-flexible neck portion 22 and being relatively rigid as compared with said neck portion. The adjustable-foil surface 21 is longer than the fixed-foil surface 20 as measured in the direction of the wire run.

The flexible neck portion 22 is formed by a groove in the underside of the foil element 19, which groove is upwardly inclined from the bottom of the foil element substantially toward the leading edge of the fixed-foil surface 20.

Referring now to FIGS. 5 and 6, it will again be seen that when adjusting nut 35 is rotated, adjusting bar 49 will be moved axially, thus causing sloping grooves 50 to move relative to guide pins 51. This movement will cause guide pins 51 and thereby the adjustable foil surface 21, to be lifted or lowered according to the direction of axial movement of adjusting bar 49.

One advantage of the invention, in being able to vary the angle of relief of the drainage foil, whilst the machine is in operation, is that the paper machine operator can vary the drainage rate of the Fourdrinier table and so obtain optimum paper quality.

Another advantage of the invention is that the drainage foil assemblies can be easily replaced, thereby allowing Fourdrinier "wires" of different materials to be interchanged, without the need for long periods with the paper machine non-operational.

The arcuate recesses 28 shown in one execution of the invention, could be replaced by straight line slopes.

In the same execution rollers could be substituted for the adjusting balls.

In the second execution shown, the guide pins could be fixed in the adjusting bar and corresponding sloping slots machined in the trailing edge portion of the adjustable foil surface.

From the foregoing it will be seen that we have provided new and improved means for obtaining all of the objects and advantages of the invention.

We claim:

1. An adjustable drainage foil for a Fourdrinier machine having a forming wire travelling in a given direction, said foil extending under said wire transversely of said direction, said foil having a rigid leading portion and a rigid trailing portion joined by a thin-necked flexible portion, said leading portion, flexible portion and trailing portion having a continuous upper surface, said leading portion having an acute-angled leading edge and having a flat upper surface in supporting relationship to said wire, said leading portion being firmly attached to a fixed supporting body, said trailing portion having a flat upper surface divergent from said wire by an adjustable angle of divergence, an adjusting bar carried by said supporting body, projections and linear cam elements on said adjusting bar and said trailing portion, said linear cam elements operatively engaging said projections, whereby linear translation of said adjusting bar adjusts said angle of divergence of said flat upper surface of said trailing portion relative to said wire.

2. An adjustable drainage foil for a Fourdrinier machine having a forming wire travelling in a given direction, said foil extending under said wire transversely of said direction, said foil having a rigid leading portion and a rigid trailing portion joined by a thin-necked flexible portion, said leading portion, flexible portion and trailing portion having a continuous upper surface, said leading portion having an acute-angled leading edge and having a flat upper surface in supporting relationship to said wire, said leading portion being firmly attached to a fixed supporting body, said trailing portion having a flat upper surface divergent from said wire by an adjustable angle of divergence, an adjusting bar carried by said supporting body, arcuate recesses which constitute cam profiles in said supporting body below said adjusting bar, cam followers located within openings in said adjusting bar, said cam followers communicating motion between said arcuate recesses and said trailing portion, whereby linear translation of said adjusting bar adjusts said angle of divergence of said flat upper surface of said trailing portion relative to said wire.

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