ELONGATED SUPPORTING ELEMENTS FOR THE FOURDRINIER WIRE OF A PAPERMAKING MACHINE

Filed Feb. 4, 1965 5 Sheets-Sheet 1

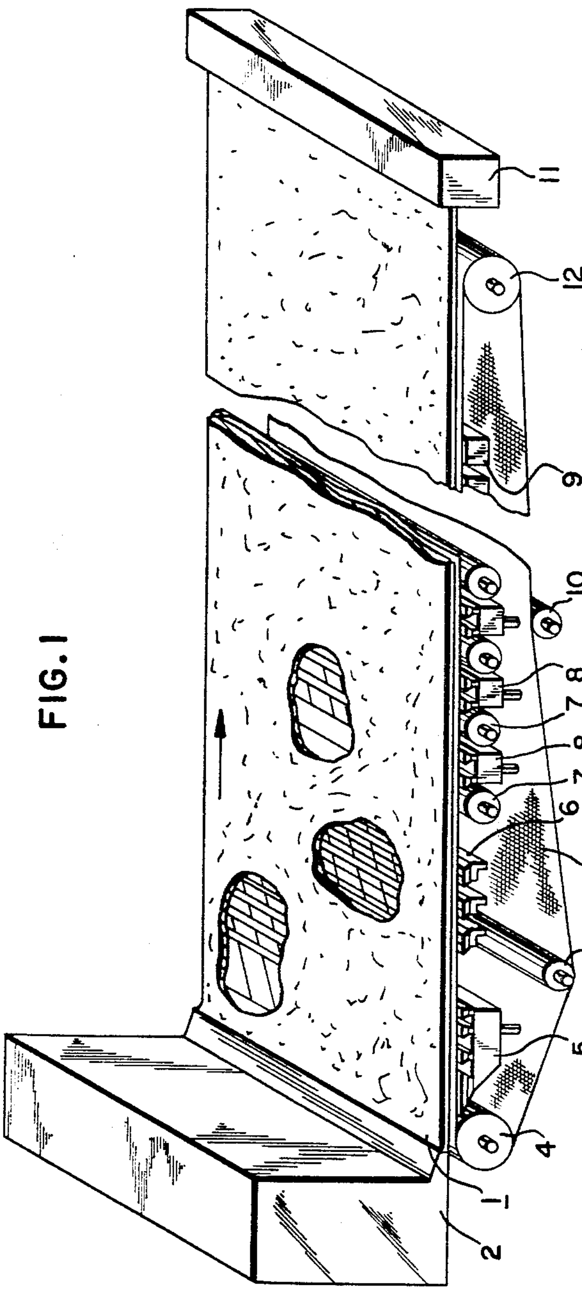

FIG. 1

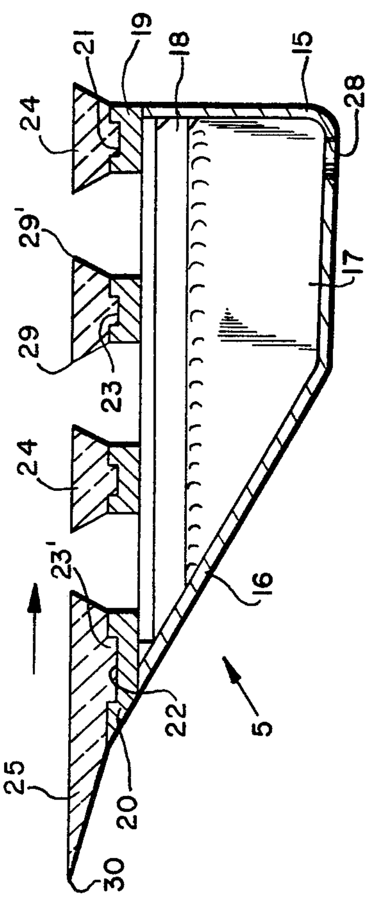

FIG. 2

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FIG.6

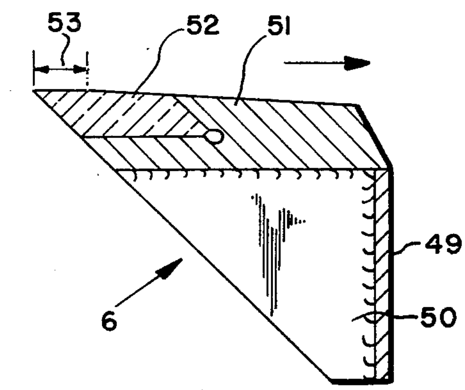

FIG.3

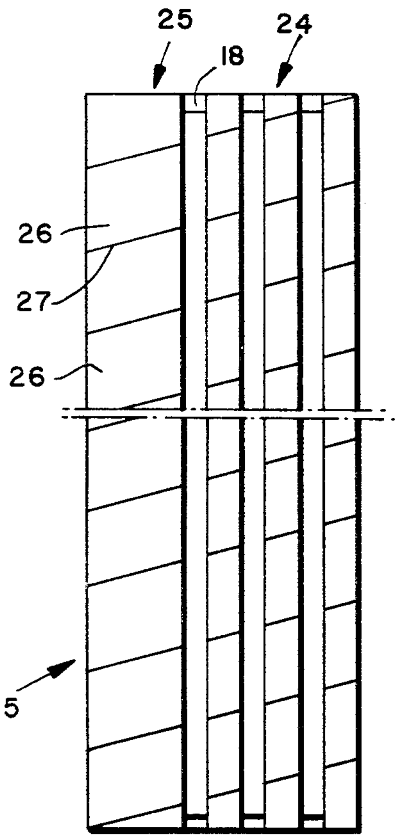

FIG.7

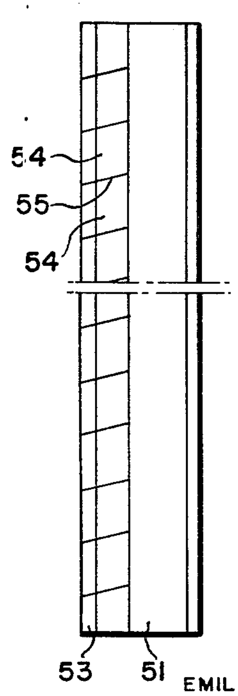

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FIG. 4

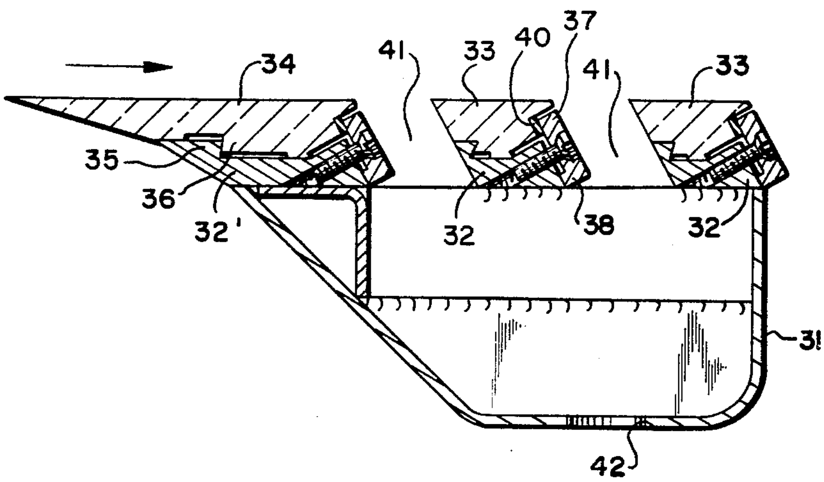

FIG. 5

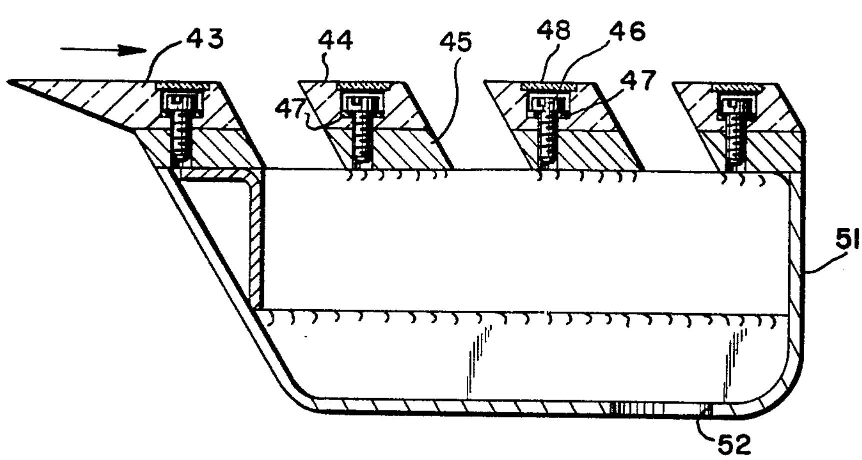

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FIG.10

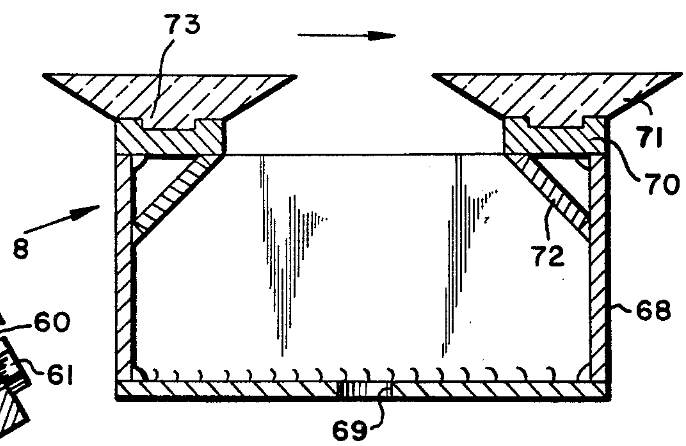

FIG.8

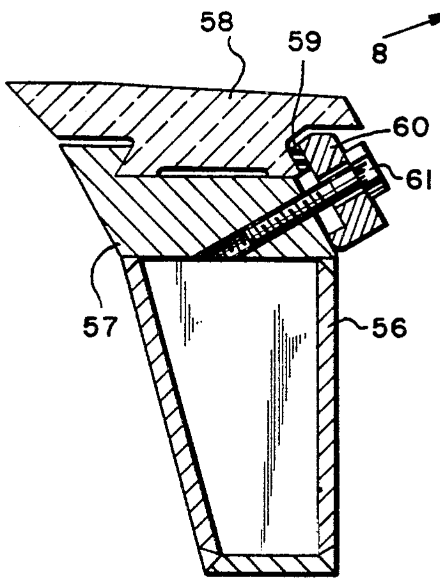

FIG.11

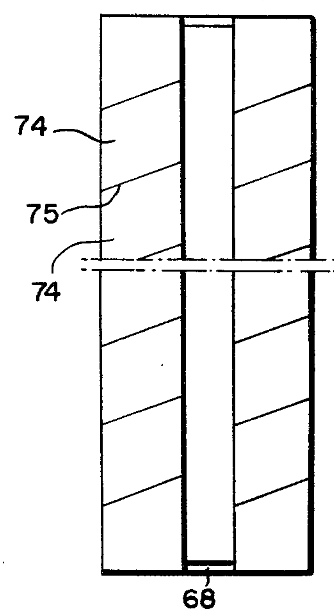

FIG.9

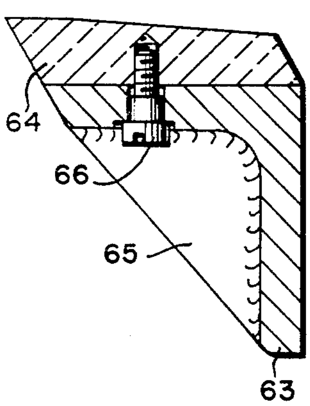

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FIG. 12

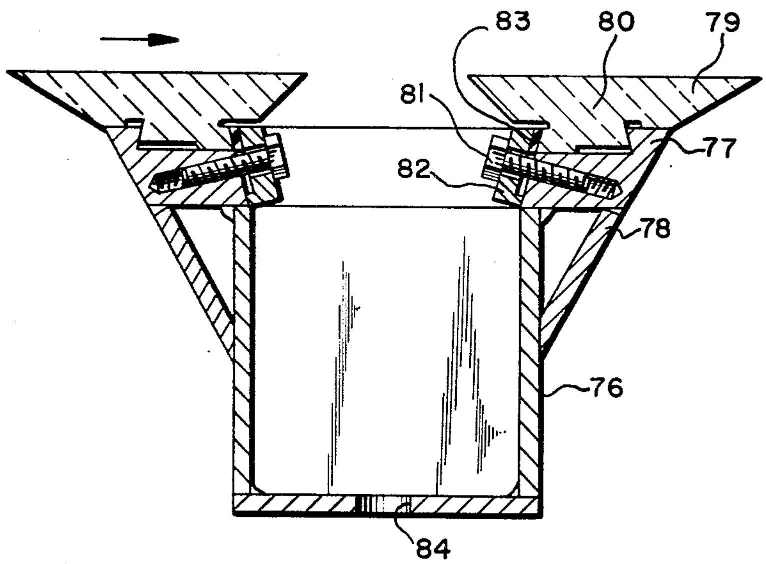
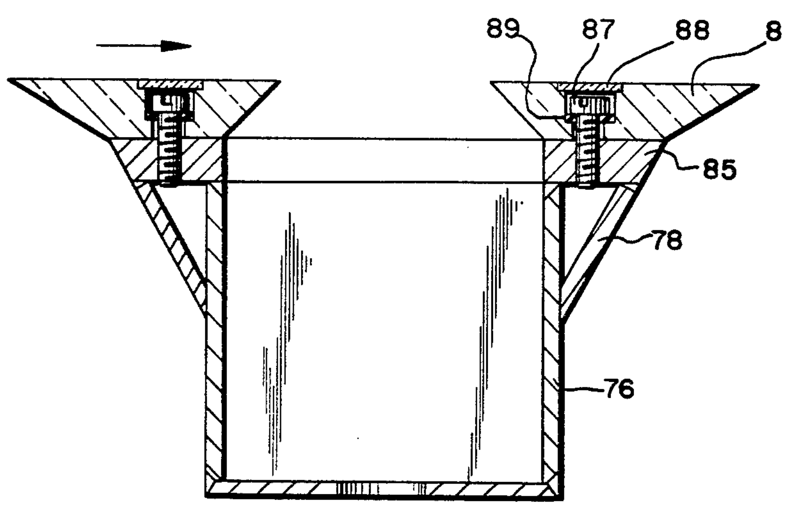


FIG. 13



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United States Patent Office

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3,393,124

ELONGATED SUPPORTING ELEMENTS FOR THE FOURDRINIER WIRE OF A PAPERMAKING MACHINE

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Claims priority, application Germany, Feb. 7, 1964, F 25,361, F 25,362, F 25,364
7 Claims. (Cl. 162—352)

ABSTRACT OF THE DISCLOSURE

Forming boards, water stripping foils, and deflector elements for a Fourdrinier paper machine which support the wire, and which have sharply angular leading edges retain their dimensions and their finish over long periods when made from sintered aluminum oxide, a brittle ceramic material, if the transversely elongated forming board, foil, or deflecting element is longitudinally subdivided into a plurality of conformingly juxtaposed sections. The sections are fastened to a common carrier, but are not otherwise attached to each other.

This invention relates to papermaking machinery of the Fourdrinier type, and particularly to elements which support the Fourdrinier wire or screen of such a machine at the wet end thereof and are elongated transversely of the direction of movement of the wire to constitute a forming board, water stripping foils, and the wire supporting portions of deflector arrangements interposed between table rolls. The supporting elements of the invention thus are normally interposed between the breast roll and the suction boxes of the papermaking machine.

It is known to arrange stationary, transversely elongated elements under the Fourdrinier wire to prevent sagging of the wire under its own weight and under the weight of the stock carried on the wire. Such sagging is known to have a harmful effect on the useful life of the wire and to interfere with web formation. The need for providing such elements increases with the width of the wire. Greater wire width makes it necessary to increase the diameter of breast rolls and table rolls for adequate structural strength and stiffness. The lines of tangential engagement of the traveling wire with two adjacent rolls therefore are spaced wider apart as the screen width increases, and additional support is needed between the rolls.

Stationary transversely elongated elements, hereinafter referred to as water stripping foils, have also been found advantageous for supplementing or replacing the table rolls in a papermaking machine operating at very high wire speeds. Such foils occupy less space than table rolls of comparable effect, and are capable of withdrawing more water from the forming web than table rolls at very high wire speeds.

The relatively narrow, transversely elongated elements which are in contact with the moving wire and are parts of the forming board, the water stripping foils, and the wire supporting portions of deflector arrangements are subjected to severe frictional forces which are particularly concentrated on the leading edges of the elements. Even when these edges are made of originally smooth wood, bronze, steel, or plastic, they are worn away quite rapidly. The loss of smoothness in the stationary elements in turn leads to rapid wear of the Fourdrinier wire, normally made of bronze mesh. Even minor changes in the configuration of the transversely elongated elements traveled over by the wire are reflected in the properties of the paper web

produced from stock on the wire. It is not normally possible to compensate fully for the effects of wear on the wire supporting elements by changing other process variables. It has therefore been common practice heretofore to replace the stationary wire supporting elements at relatively frequent intervals, each replacement requiring an extended shutdown of the machine.

The object of the invention is the provision of stationary wire supporting elements for use in the wet portion of a papermaking machine which are not subject to significant wear when in contact with the rapidly moving metallic Fourdrinier wire, and which therefore do not require the prolonged periods of machine shutdown involved in the replacement of conventional wire supporting elements.

We have found that very hard, relatively brittle, ceramic, non-metallic materials are capable of being shaped to the contours required for performing the functions of a forming board, of a water stripping foil, or of the wire contacting portion of a deflector arrangement and involving sharply angular leading edges, and that these edges retain their original finish if the transversely elongated element is longitudinally subdivided into a plurality of conformingly juxtaposed sections. The sections are fastened to a common carrier, but are not otherwise attached to each other.

The invention will hereinafter be described with reference to wire-contacting elements which consist essentially of aluminum oxide, and wire contacting elements of this material have been found to retain their edges and their general configuration over a particularly long period, but other ceramic materials whose hardness approaches that of corundum and which are capable of being shaped in the required manner may be substituted for aluminum oxide and the advantages of this invention may be obtained thereby at least to some extent. Silicon carbide is typical of such other very hard ceramic materials.

The sections of transversely elongated wire contacting elements of the invention are preferably prepared by compacting an aluminum oxide powder, and by firing the green compacts at temperatures above 1000° C., and preferably above 1200° C. The Al_2O_3 content of the fired material should not be substantially lower than 95%, and is preferably higher than 95%. The density of the sintered material should closely approach that of corundum, and its crystals should be extremely small. A method of producing such dense, finely crystalline, sintered aluminum oxide bodies has been disclosed in the commonly owned copending application Ser. No. 240,735, filed Nov. 28, 1962, now abandoned.

Aluminum oxide bodies containing more than 5 percent of impurities have been found to deteriorate in contact with a rapidly moving Fourdrinier wire at a rate substantially higher than that which is observed with purer material even if the density, the surface finish, and other properties considered relevant to friction are initially satisfactory. It is believed that chemical substances present in the water withdrawn from the stock on the papermaking machine cause intergranular attack on the less pure aluminum oxide product.

It has been found, rather surprisingly, that the smoothest possible surface finish and a practically perfectly dense structure of the surface layer in the aluminum oxide material is not associated with longest service life of the transversely elongated wire-supporting elements of the invention. A relatively rough surface of these elements causes initial rapid Fourdrinier wire wear. The wire contacting surfaces of the elements are simultaneously worn down, and replacement of the first wire by a second wire frequently results in a useful life of the second wire which is much longer than that observed when other materials of construction are employed for the elongated elements.

The third and all subsequent Fourdrinier wires then have approximately the same long service life.

If the wire-contacting surfaces of the stationary supporting elements are given the best possible microfinish, the life of the first wire is somewhat longer than that of a wire used with rough contacting surfaces under otherwise analogous conditions, and the life of each subsequent wire is further increased. It may take a relatively long time, however, until the performance achieved with a set of highly polished wire-contacting surfaces reaches that of originally rough elements after one or at most two wires have been consumed.

We have found that optimum wire life from the very beginning can be had if the wire contacting surfaces of the stationary supporting elements are given a finish in which solid aluminum oxide material does not occupy more than 75% nor less than 10% of a surface which lies 0.5 micron below the enveloping surface defined by the high points of the outer face on the aluminum oxide body. Such a configuration is achieved by suitable selection of the sintering conditions, particularly the sintering temperature, the density generally increasing with the sintering temperature. The porosity of the sintered materials tends to increase near the surface, and it can therefore be reduced by grinding the surface layer away until it meets the requirements. A denser surface can also be obtained by afterfiring under carefully controlled conditions of temperature and time, and by flame polishing.

It is believed that a relatively rough surface of aluminum oxide retains a film of aqueous liquid under the operating conditions of a high-speed papermaking machine, and that this film provides lubrication which extends the life of the wire and practically prevents wear of the aluminum oxide elements.

Other features and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing in which:

FIG. 1 shows as much of the wet end of a papermaking machine as is needed for an understanding of this invention, the view being in perspective;

FIG. 2 shows the forming board of the machine of FIG. 1 in side-elevational section;

FIG. 3 shows the forming board of FIG. 2 in plan view on a smaller scale;

FIG. 4 shows a modified forming board of the invention in a view corresponding to that of FIG. 2;

FIG. 5 is a side elevational sectional view of yet another forming board of the invention;

FIG. 6 shows a water stripping foil of the machine of FIG. 1 in side-elevational cross section;

FIG. 7 shows the foil of FIG. 6 in plan view on a reduced scale;

FIGS. 8 and 9 show modified water stripping foils in side elevational section;

FIG. 10 shows a deflector arrangement of the machine of FIG. 1 in side elevational section;

FIG. 11 illustrates the deflector arrangement of FIG. 10 in plan view on a reduced scale; and

FIGS. 12 and 13 show modified deflector arrangements in side elevation.

Referring now to the drawing in detail, and initially to FIG. 1, there are shown the principal working elements at the wet end of a papermaking machine of the invention which may be entirely conventional in all non-illustrated aspects.

Stock **1** is discharged from a pressure-type slice **2** to a Fourdrinier wire **3** which moves in a closed loop between a breast roll **4** and a couch roll **12** which are horizontally spaced. The wire **3** is a fine-meshed bronze screen whose upper strand travels in the direction of the arrow from the breast roll **4** over a forming board **5**, a group of water stripping bars **6**, and an array of alternating table rolls **7** and deflector arrangements **8**.

In the next section of the machine, largely broken away in the drawing, the wire **3** moves over suction boxes **9** to the couch roll **12**. The returning strand of the wire is guided and tensioned by rolls **10** in a manner well known in itself, and only partly illustrated. The couch roll **12** is driven in a conventional manner (not shown).

The stock **1** gradually loses its water content while traveling from the slice **2** to the couch roll **12** and forms a web of interengaged fibers sufficiently self-supporting to permit the web to be lifted from the supporting wire **3** for transfer to the press section of the machine, not illustrated in the drawing. The devices which control transfer of the web from the screen **3** to the press section, not themselves relevant to this invention, are represented by the housing **11** of a trimming device, not otherwise shown, which cuts the web by means of a traveling squirt in the event of difficulties, and thereby causes the web to drop into a non-illustrated couch pit.

This invention is particularly concerned with the stationary elements of the paper-making machine which are in direct frictional contact with the wire **3**, and which must present sharp leading edges to the approaching wire. These stationary elements are represented in FIG. 1 by the forming board **5**, the water stripping foils **6**, and the deflector arrangements **8**.

FIGS. 2 and 3 show a first forming board of the invention whose supporting structure includes a narrow steel trough **15** horizontally arranged at right angles to the direction of wire movement indicated by an arrow in FIG. 2. A wall **16** of the trough is inclined relative to the horizontal bottom and top of the trough at an angle of about 30° so as to permit the trough to be placed close to the breast roll **4** in the manner shown in FIG. 1.

The tops of the narrow end walls **17** of the trough **15** are reinforced by L-section steel bars **18** which have top faces flush with the corresponding tank edges, and are welded in place. Three relatively narrow flat steel carrier bars **19** and a wider carrier bar **20** connect the bars **18** and are spaced in the direction of wire movement. They are welded to the afore-mentioned top faces of the L-section bars **18**.

The top faces of the carrier bars **19**, **20** have central grooves **21**, **22** of shallow rectangular cross section which extend over the entire operating width of the Fourdrinier section. Facings **24** of sintered aluminum oxide cover the carrier bars **19**, and the bar **20** is covered by an aluminum oxide facing **25**.

Each facing consists of a multiplicity of individual sections **26** which are juxtaposed along the carrier bars **19**, **20** transversely of the direction of wire movement, and abuttingly engage each other in that direction along joints **27** which are obliquely inclined to the direction of wire movement.

As best seen in FIG. 2, the undersides of the facings **24**, **25** conform to the top faces of the associated carrier bars **19**, **20** and their ribs **23**, **23'** engage the grooves **21**, **22**. The top, front, and rear surfaces of the facings **24** are offset relative to each other by about 60° so as to form corresponding acutely angular leading and trailing edges **29**, **29'** at the aligned, flat horizontal top faces. The angle defined by the leading edge **30** of the facing **25** is only approximately 15°, and thus permits the wire **3** to be supported by the forming board **5** at a point very closely adjacent the breast roll **4**.

The illustrated forming board functions in a manner well known in itself to prevent sagging of the wire **3** at a critical stage of web formation, and to control the passage of water through the screen at that stage. The spacing of the several carrier bars **19** is chosen accordingly. The water that passes through the wire **3** as the same moves over the forming board **5** is drained from the trough **15** through a bottom opening **28** and through conduits not shown in detail.

The aluminum oxide facings **24**, **25** are bonded to the associated carrier bars 19, 20 by an epoxy resin cement, the adhesive layer being too thin to permit pictorial representation on the scale of FIG. 2. The adhesive bond is relieved of a major stress component in the direction of wire movement by the conforming engagement of the ribs 23, 23' with the grooves 21, 22 in the carrier bars.

The use of sintered aluminum oxide meeting the quality requirements pointed out hereinabove as a material of construction for the facings 24, 25 greatly extends the useful life of the wire 3, particularly at very high wire speeds, as compared to the wire life with forming boards made of conventional materials such as metals. The facings, and particularly the facing 25 nearest the breast roll 4 may be provided with leading edges 29, 30 which are acutely angular at very small angles without risk of scoring, chipping, uneven wear, or denting of the facing that would lead to rapid destruction of the wire 3. The angle at the leading edge 30 of the facing 25 determines the minimum spacing between the forming board 5 and the breast roll 4.

As is well known, fine metal edges are subject to rapid corrosion even in relatively mild liquid media. The corrosion resistance of forming boards of the invention against all types of paper stock in current commercial use is infinitely greater than that of the best metallic materials practically available for the same application. The hardness and non-metallic nature of the materials of construction thus makes it practical to provide elements which are in continuous frictional engagement with the rapidly moving wire 3 with leading edges that are very sharply angular.

The greater width of the facing 25 provides an uninterrupted support to the wire 3 in a critically important area and substantially prevents passage of liquid through the wire in that area. The facing 25 is asymmetrical in cross section, but its sections 26, with the exception of the terminal ones, are identical and interchangeable. The facings 24 consist almost entirely of interchangeable sections that are of symmetrical cross section, and are therefore easily assembled. The oblique arrangement of the joints 27 prevents interference with web formation.

The modified forming board shown in FIG. 4 has a trough 31 closely similar in external shape to the trough 15, and internally reinforced to provide firm welded anchorage for two narrow carrier bars 32 and a somewhat wider leading carrier bar 32' equipped with respective facings 33, 34 composed of obliquely abutting individual sections of sintered aluminum oxide in the manner shown in FIGS. 1 and 3.

Projecting ribs 35 on the top faces of the carrier bars 32, 32' have undercut rear faces that cammingly cooperate with corresponding front faces on downward projections 36 on the facings 33, 34 to push the facings downward toward the associated carrier bars when pressure is exerted on the facings in a direction opposite to the direction of wire movement. Such pressure is provided by a clamping arrangement which mainly consists of a flat clamping bar 37 and screws 39 whose heads are received in recesses of the bars 39 and whose threaded stems engage correspondingly threaded bores in the associated carrier bars 32, 32'. A rib 38 on one edge of the bar 37 provides a fulcrum about which the bar is pivoted when the screws 39 are tightened, thereby driving the other side of the bar against the associated facing 33, 34'. A resilient spacer 40 is interposed between the metallic bar 37 and the sintered alumina sections of the facing to prevent stress concentration.

The facings 33, 34 are recessed conformingly to receive the corresponding bars 37 and thereby to present a smooth, uninterrupted surface for the unimpeded flow of water from the wire through the gaps 41 between the carrier bars 32, 32' toward a bottom opening 42 in the trough 31. The leading edges of the facings 33, 34 are contoured in the same manner as shown in FIG. 2, and described hereinabove. The trailing edges are formed by surfaces which meet at an obtuse angle.

FIG. 5 illustrates yet another forming board of the invention in which sintered aluminum oxide facings 43, 44 have flat top faces in a common plane, and leading edges at these top faces which are acutely angular in all instances, the edge angle of the leading facing 43 being substantially smaller than 30° and not much greater than 15°. The facings are secured to respective carrier bars 45 by screws 46 distributed over the length of the bar, at least one screw engaging each section of the facing.

The screws have enlarged heads which are recessed in the facings 43, 44 and are provided with resilient washers 47. The recesses receiving the screw heads are closed flush with the top surface of the facing 43, 44 by flat plugs or plates 48 of sintered aluminum oxide which are held in place by epoxy resin adhesive. The same adhesive is preferably used between the flat contacting surfaces of the facings 43, 44 and of the associated carrier bars 45.

FIGS. 6 and 7 show one of the water stripping foils of the machine illustrated in FIG. 1 on a larger scale, the other foils being substantially identical. Water stripping foils are employed on high-speed papermaking machines to replace table rolls. The latter are effective in drawing water through the rapidly moving Fourdrinier wire. It is known that the diameter and the number of the table rolls must be increased with the traveling speed of the screen, and the space required by the table rolls greatly increases the overall length of the machine. Stationary water stripping foils have been found to be more effective than table rolls in an equal length of wire path, and at speeds in excess of about 850 meters per minute at which the efficiency of table rolls declines.

The water stripping foils which extend over the width of the screen depend for their effect on having a first surface portion near the leading edge which is parallel to the direction of wire movement and in contact with the moving wire, and a second portion nearer the trailing edge of each foil which slopes away from the first portion and the moving wire at a very small angle, 1° to 4° being a representative range.

The water stripping foils may completely replace the table rolls, they may be interposed between adjacent table rolls singly or in groups, and they may be arranged in a separate group preceding or following a set of table rolls, or both. A group of water stripping foils 6 preceding a set of table rolls 7 has been shown in FIG. 1 and is preferred, but it will be understood that the invention is not limited to the specific arrangement shown.

The water stripping foils 6 can be closely spaced, and thus provide better support to the moving wire than table rolls. They permit therefore a reduction in the longitudinal tension of the wire under otherwise similar conditions. The suction effect produced by the stripping foils is more uniformly distributed over the wire surface than is possible with table rolls, and uniform web formation is thereby favored. Obviously, the stationary water stripping foils do not require the labor consuming static and dynamic balancing which is mandatory for the rapidly rotating table rolls.

Although the afore-described advantages of water stripping foils over table rolls have been fully appreciated for some time, the foils were not universally accepted heretofore. Steel, brass, and bronze were the best materials of foil construction available for cooperation with a bronze Fourdrinier wire. Water stripping foils made of these materials, while not overly destructive of the screen, were themselves subject to relatively rapid wear, and their effectiveness dropped sharply with even minimal wear. We now have found that water stripping foils whose critical face portions consist of extremely hard, non-corrodible, non-metallic material, such as the afore-described sintered aluminum oxide, cause even less wire wear than the best conventional metallic water stripping foils, and have a very long useful life.

Referring now to FIG. 6, there is seen a support structure of welded steel consisting of a narrow steel sheet **49** extending across the width of the machine in a vertical plane, a heavy carrier bar **51** arranged at right angles to the sheet **49**, and a plurality of connecting webs **50** of which only one is illustrated. The leading edge of the carrier bar **51** is cut out to form a V-notch, and an aluminum oxide insert **52** replaces the cut-away portion of the bar **51**.

The leading edge of the insert **52** is formed by a face that slopes obliquely downward from the direction of wire movement indicated by an arrow and is flush with a corresponding face of the bar **51**, and by a portion **53** of the insert topface which is parallel to the wire movement. The remainder of the top face of the insert, and the corresponding top face of the bar **51** slope downward in a direction toward the trailing edge of the foil at a very small angle to the face portion **53**, and the supplement of this angle is enclosed between the two faces.

As better seen in FIG. 7, the insert **52** consists of numerous sections **54** which are conformingly juxtaposed and form joints **55** obliquely inclined in a horizontal, or substantially horizontal plane relative to the direction of wire movement for the reasons described with reference to FIG. 2.

The insert sections **52** are secured in the notch of the carrier bar **52** by epoxy resin adhesive, and the strength of the bond may be improved by slightly roughening the bonded steel and aluminum oxide surfaces prior to application of the adhesive. The stresses transmitted by the moving wire to the insert **52** tend to drive the insert into the notch of the bar **51**, thereby minimizing the stresses in the adhesive bond.

Although the water stripping foils of the invention are very effective under most practical conditions when the angle between the face portion **53** and the remainder of the top portion of the insert **52** is anywhere between 1° and 4°, optimal results are achieved within this range at a specific angle depending on such process variables as the properties of the fibers in the stock, the dilution of the stock, wire velocity, and the like, and requiring experimental determination in each case.

The surface texture of the aluminum oxide insert has an appreciable influence on the useful life of the insert and of the associated wire **3**. We generally prefer to provide at least the face portion **53** with a surface microfinish which is characterized by not more than 75% solid material (25% voids) nor less than 10% solid material at a level 0.5 micron below the enveloping surface defined by the high points of the surface. This surface finish is determined by scanning the surface with a microscopic stylus and tracing an enlarged diagram of the stylus movement. A first line is drawn to connect the high points, and a second line drawn at a distance from the first line corresponding to 0.5 micron. The portions of the second line which intersect areas of the diagram corresponding to solid material should not be more than three times the portions of the second line which pass through areas of the diagram representing surface voids. Lines drawn in all directions on the surface should be closely similar.

Modified water stripping foils are illustrated in FIGS. 8 and 9. The foil assembly illustrated in FIG. 8 has a narrow, trough-shaped support **56** the top of which is closed by a carrier bar **57**. The top of the bar **57** is faced by aluminum oxide sections **58** of which only one is seen in FIG. 8. A projection on the underside of each section **58** and a corresponding recess in the top of the bar **57** form a dovetail joint. The rear face of the section **58** in the joint is covered by a resilient spacer **59** which is backed by a clamping bar **60** attached to the carrier bar **57** by screws **61**. The sections **58** are firmly held in the dovetail joint by the pressure of the bar **60** when the screws **61** are tightened.

The top face of the section **58** extends in the direction of wire movement over the full width of the supporting structure. The top face has a portion near the leading

edge which is parallel to the wire movement, and frictionally engages the wire during machine operation, and the remainder of the top face slants downwardly away from the moving wire at a very small angle.

The water stripping foil shown in FIG. 9 has a supporting structure which consists of an L-section steel bar **63** whose top carries an aluminum oxide facing **64** composed of sections in the manner shown in FIG. 7, and which is reinforced by webs **65**. The facing **64** forms the leading edge, the afore-described two portions of the top face of the foil, and its trailing edge, and is attached to the bar **63** by screws **66**.

It is conventional to arrange deflectors between adjacent table rolls on a papermaking machine to prevent the water extracted by the first roll from being thrown by centrifugal forces into the nip of the second roll. In high-speed machines having table rolls of relatively large diameter, the deflectors may be modified to perform additional necessary functions. When they engage the traveling wire, they prevent its sagging between the relatively widely spaced table rolls, and if they are suitably contoured, they hasten extraction of water from the stock carried by the wire, and tend to equalize the suction applied to the wire in the table roll section.

This invention provides a deflector arrangement which performs the functions outlined above more reliably over an extended period of operations than similar arrangements made heretofore from conventional materials of construction. The arrangement illustrated in FIGS. 10 and 11 includes a welded steel trough **68** whose length extends across the width of the papermaking machine, and whose cross section is rectangular. A drain opening **69** in the bottom trough is connected with a conduit in a manner not further illustrated.

The long upright walls of the trough **68** each have a carrier bar **70** mounted thereon. The bar extends over a marginal portion of the open top of the trough and carries an adhesively secured aluminum oxide facing **71**. Struts **72** connect the free edge of the bar **70** to the inner trough wall. A rib **73** on the underside of each facing **71** engages a corresponding groove in the top of the associated carrier bar **70** in the manner described in more detail with reference to the forming board shown in FIG. 2. Each facing **71** consists of sections **74**, most of which are interchangeable, and which abut against each other along obliquely inclined joints **75**.

The deflector arrangement **8** is adjustably mounted on the non-illustrated frame of the papermaking machine shown in FIG. 1. During operation of the machine, the top surfaces of the facings **71** are in frictional contact with the moving wire. The sharply angular edges of the facings permit the deflector arrangement to be mounted closely to the adjacent table rolls **7** as is evident from FIG. 1. An even closer spacing, if so desired, is possible if the angle of the leading edge of the facing **71** first met by the wire moving in the direction of the arrow is reduced, and by reducing the trailing edge angle of the other facing **71**, or by modifying the supporting structure in the manner illustrated in FIGS. 12 and 13.

The supporting trough **76** of the arrangement shown in FIG. 12 is of welded steel construction and narrower than the trough **68** in the direction of wire movement indicated by an arrow. Carrier bars **77** project from its long upright walls in opposite outward directions and are connected to the outer faces of the supporting walls by struts **78**. Aluminum oxide facings **79** are secured on the top faces of the carrier bars **77** by dove-tail shaped ribs **80** on the undersides of the facings **79** which are held in corresponding recesses in the bars **77** by clamping devices each of which consists of a clamping bar **82** extending over the width of the machine and several screws **81** rotatably passing through the clamping bar **82** and engaging mating threads in the carrier bar **77**. The clamping arrangement is closely similar to those described with reference to FIGS. 4 and 8. A resilient spacer **83** is interposed between the clamping bar **82** and the surface of the facing **79** which consists of a multiplicity of sections in the manner illustrated in FIG. 12. A drain opening **84** is provided in the bottom of the trough **76**.

The deflector arrangement shown in FIG. 12 can be positioned closer to table rolls of relatively large diameter than that described hereinabove with reference to FIGS. 10 and 11, and the arrangement shown in FIG. 13 is capable of similar mounting.

Its trough **76** supports two carrier bars **85** which project in a common horizontal plane outward of the trough in opposite directions, are connected to the outer wall faces of the trough by struts **78**, and carry respective aluminum oxide facings **86**. The flat top faces of the carrier bars **85** and the corresponding contacting surfaces of the facings **86** are bonded by an epoxy resin cement, not visible in FIG. 13, and are additionally secured to each other by screws **87** recessed in the facings **86** as described hereinabove in more detail with reference to FIG. 5. The recesses of the facings **86** are covered by aluminum oxide plugs **88** flush with the top surface which frictionally engages the moving Fourdrinier wire, and secured in place by epoxy resin cement. A resilient washer **89** made of rubber, cork, or leather is interposed between the head of each screw **87** and the cooperating surface in the facing **86**.

The facings **86** consist of multiple sections which are joined in the manner described hereinabove. The width of the Fourdrinier screen **3** may be of the order of 20 feet. While it is feasible to produce unitary elongated aluminum oxide bodies of such length and having the required configuration, it has been found that aluminum oxide structures composed of multiple sections are better capable of absorbing the unavoidable bending stresses. The individual sections preferably have a length of approximately 8 to 16 inches transversely of the direction of wire movement, and their length should not normally exceed one tenth of the wire width so that there are at least ten sections conformingly juxtaposed and forming joints therebetween which are obliquely inclined relative to the direction of wire movement. Substantially the same dimensional limitations are applicable to the facings of the forming board and of the water stripping foils.

It should be understood, of course, that the foregoing disclosure relates only to preferred embodiments of the invention, and that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purpose of the disclosure which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

What we claim is:

1. In a papermaking machine having a Fourdrinier wire mounted for movement in a predetermined path, and a stationary supporting element elongated in a direction transverse of said path, the improvement in the supporting element which comprises:

(a) a carrier; and

(b) a facing mounted on said carrier and extending substantially over the width of said wire in said direction,

(1) said facing having a face frictionally engaging said wire during said movement of the latter, and another face,

(2) said faces jointly forming a leading edge of said facing,

(3) said edge being elongated in said direction,

(4) said faces enclosing an acute angle, and

(5) said facing consisting essentially of hard, dense, ceramic, non-metallic material.

2. In a machine as set forth in claim **1**, said angle being not substantially greater than thirty degrees.

3. In a machine as set forth in claim **1**, said facing essentially consisting of a plurality of sections juxtaposed in said direction and jointly forming said faces and the leading edge of said facing.

4. In a machine as set forth in claim **3**, a plurality of pressure means for respectively securing said sections to said carrier, each pressure means including a pressure member and threaded means for urging said pressure member against the associated section in a direction toward said carrier.

5. In a machine as set forth in claim **3**, said sections consisting of at least 95 percent aluminum oxide.

6. In a machine as set forth in claim **1**, said material being sintered aluminum oxide.

7. In a machine as set forth in claim **5**, said sections being adhesively bonded to said carrier.

References Cited

UNITED STATES PATENTS

3,250,671 5/1966 Walker ---------- 162—352 X

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