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Crowley

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[54] **PAPER GUIDING METHOD AND APPARATUS**

[75] Inventor: **H. W. Crowley**, Eliot, Me.

[73] Assignee: **Roll Systems, Inc.**, Burlington, Mass.

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[22] Filed: **May 24, 1995**

Related U.S. Patent Documents

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[51] **Int. Cl.**[6] **B65H 23/26**

[52] **U.S. Cl.** **226/88**; 226/196

[58] **Field of Search** 226/74, 88, 110, 226/196, 197; 242/548, 548.2, 568; 400/616.1

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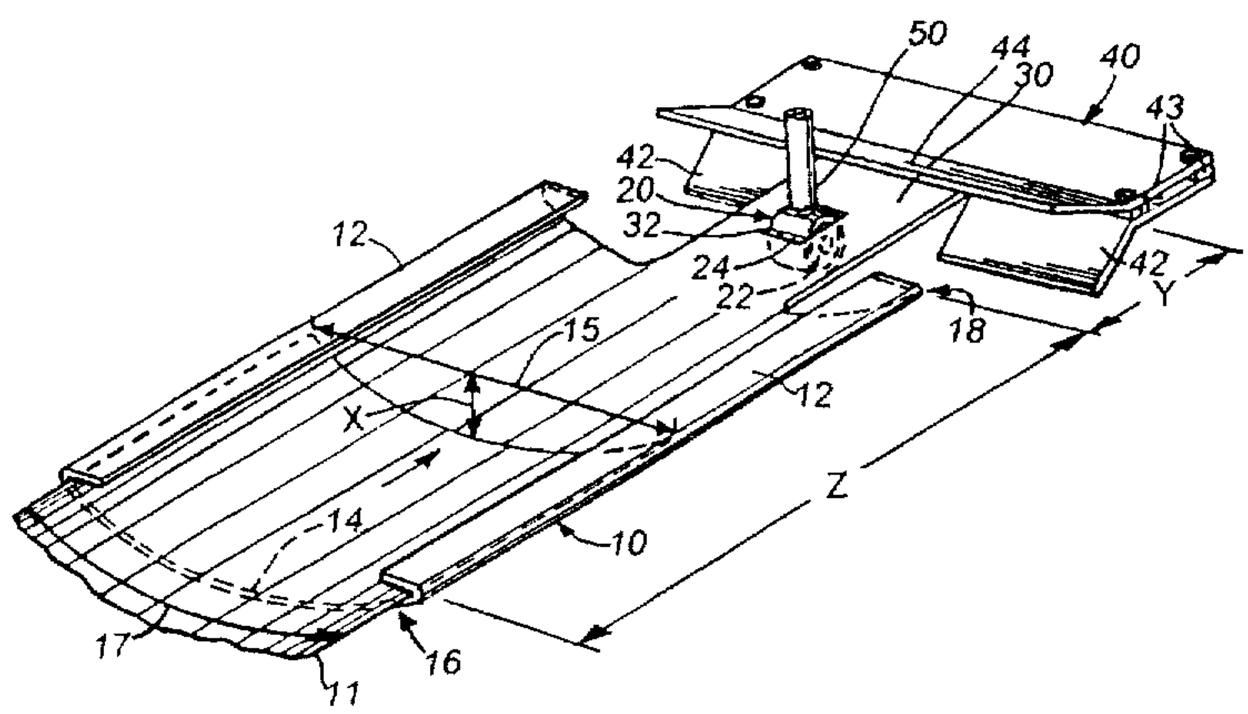
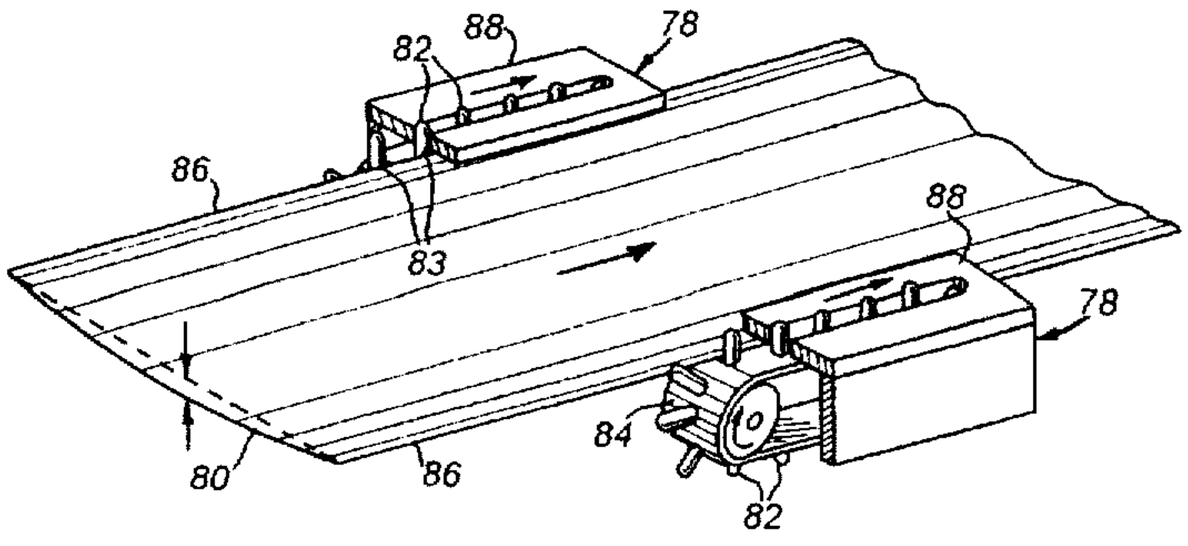
Primary Examiner—John P. Darling
Attorney, Agent, or Firm—Cesari and McKenna, LLP

[57] **ABSTRACT**

A trough structure is provided for bending a web of paper widthwise to provide beam strength and controllability to the web of paper, for aiding in guiding the web of paper in a straight path. The trough structure causes the paper to curl widthwise to conform with the shape of the trough structure. The trough structure comprises a concave or convex lower wall upon which the paper flows, open ends through which the paper flows, and shoulders which attach to both sides of the lower wall and extend substantially horizontally from the sides of the lower wall to symmetrical positions above the lower wall. The shoulders act to contain the paper in the trough structure and guide the paper through the trough structure. A drive roll is provided for driving the paper through the trough structure. No buckling of the paper is caused when any slight misalignment occurs between the paper and the drive roll, and this slight misalignment is self-correcting due to the edge guiding function of the trough structure.

27 Claims, 4 Drawing Sheets





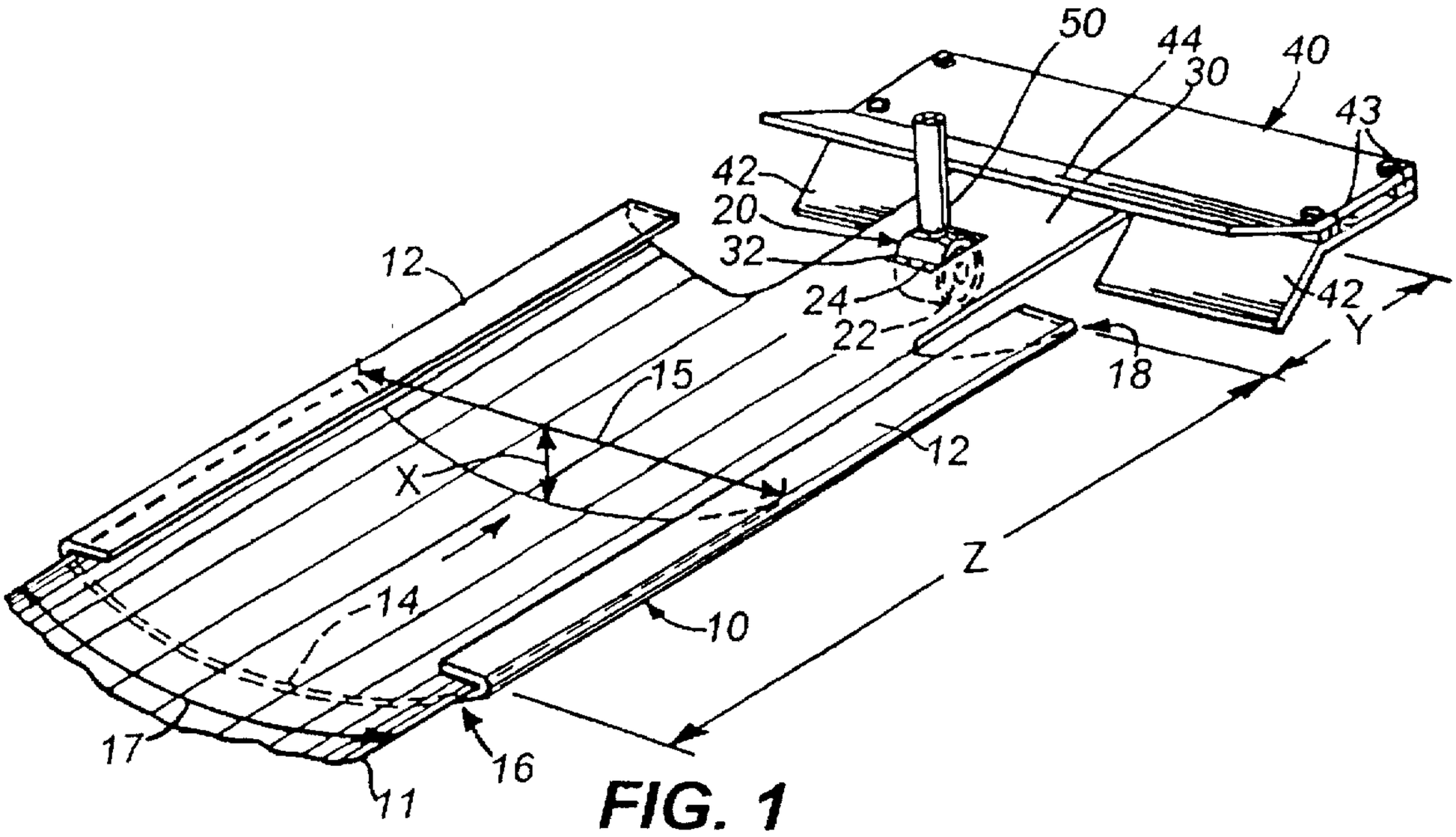


FIG. 1

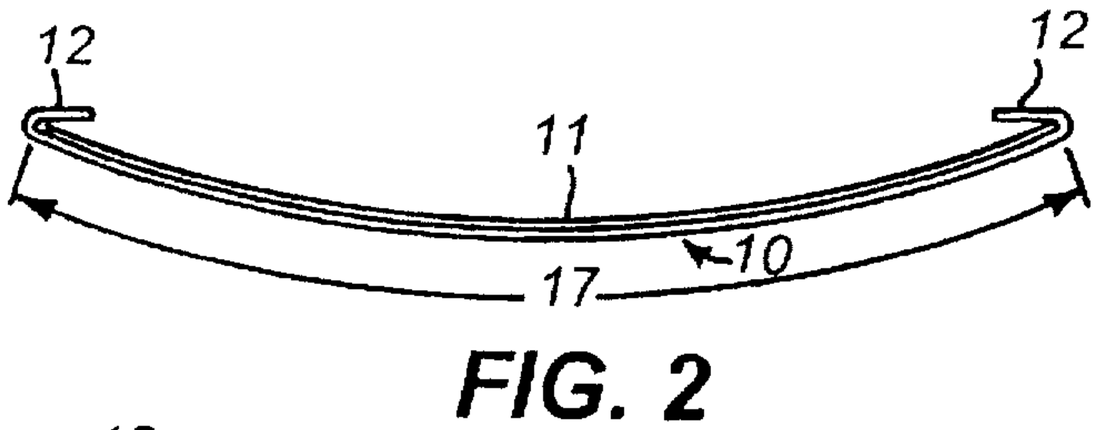


FIG. 2

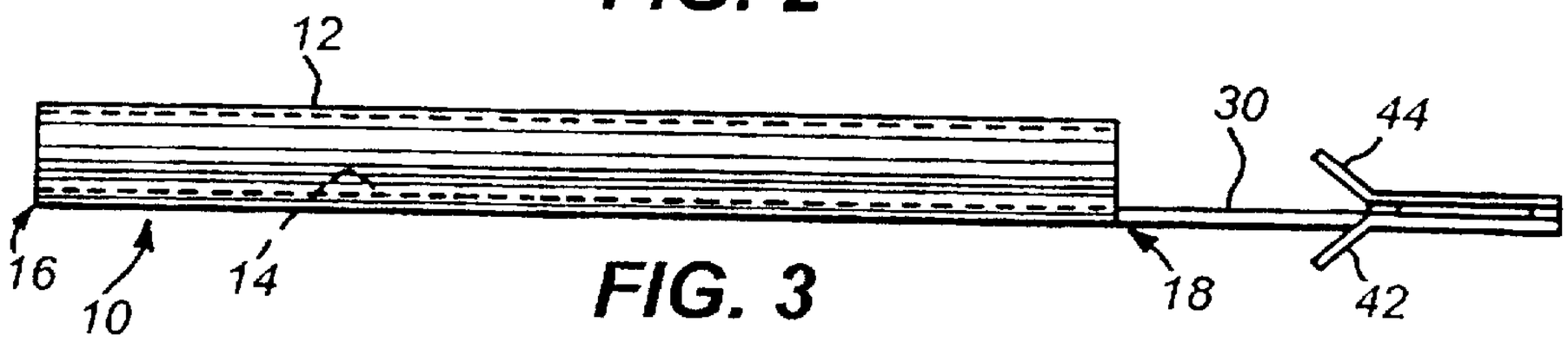


FIG. 3

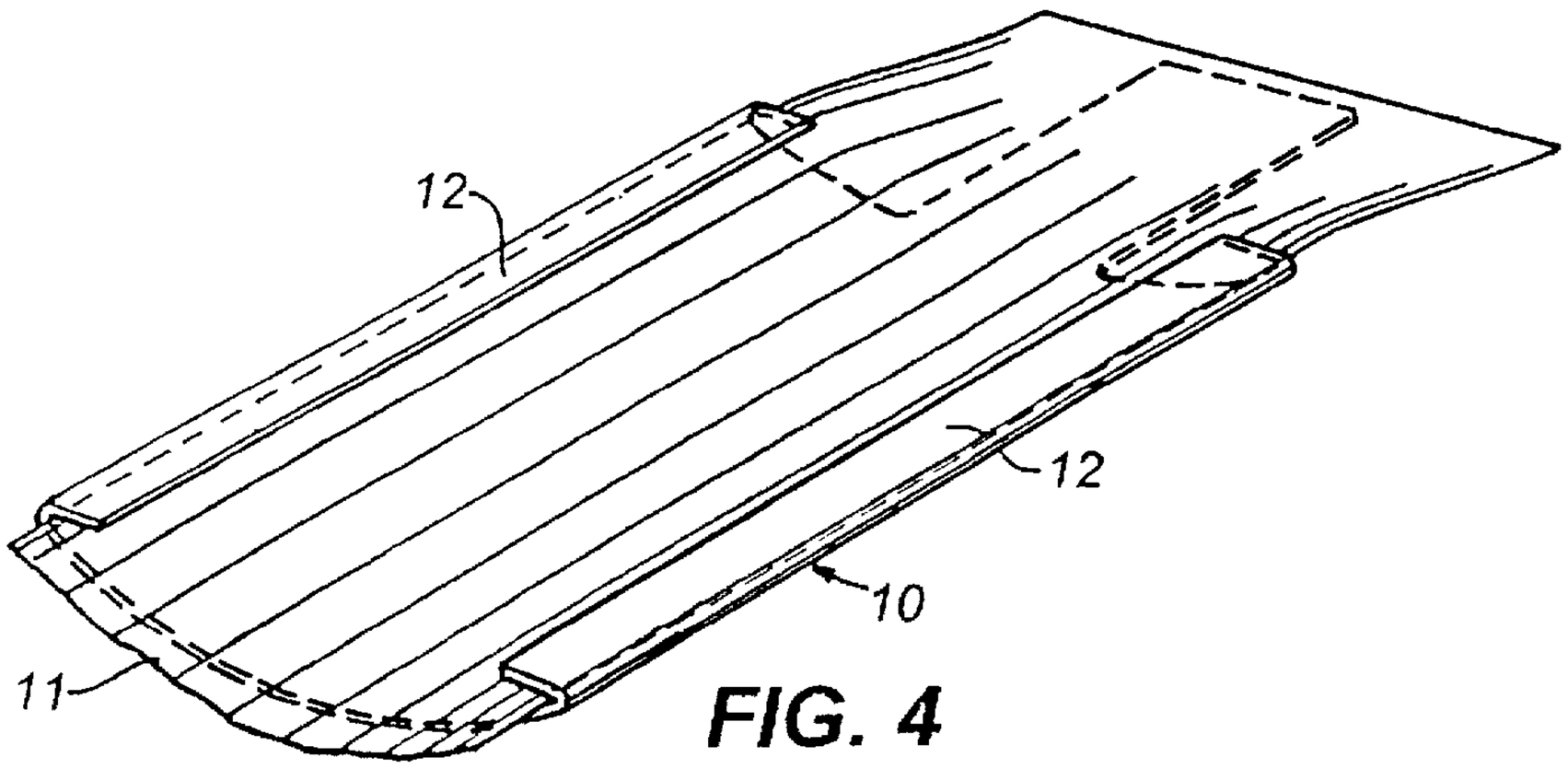


FIG. 4

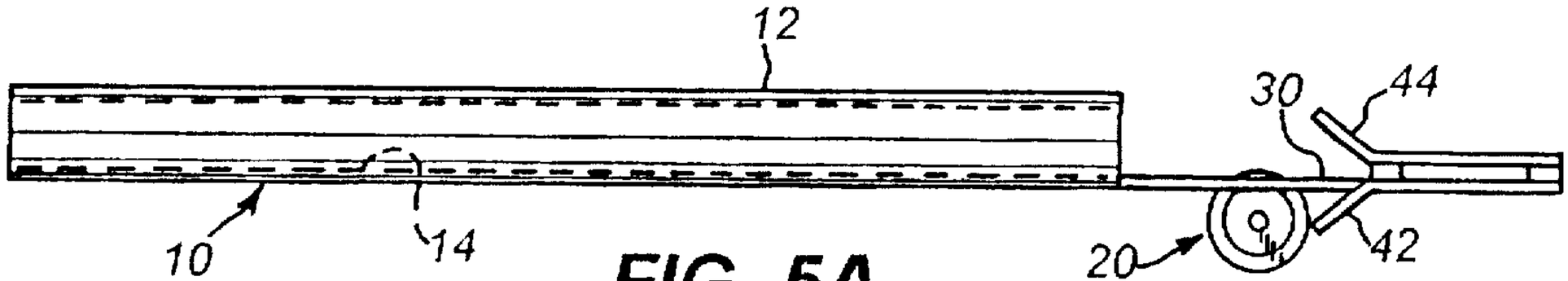


FIG. 5A

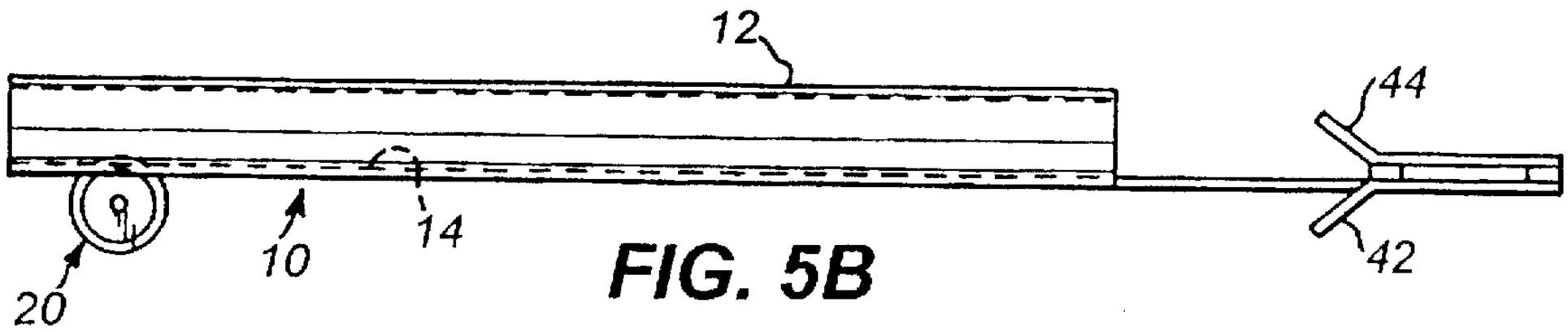


FIG. 5B

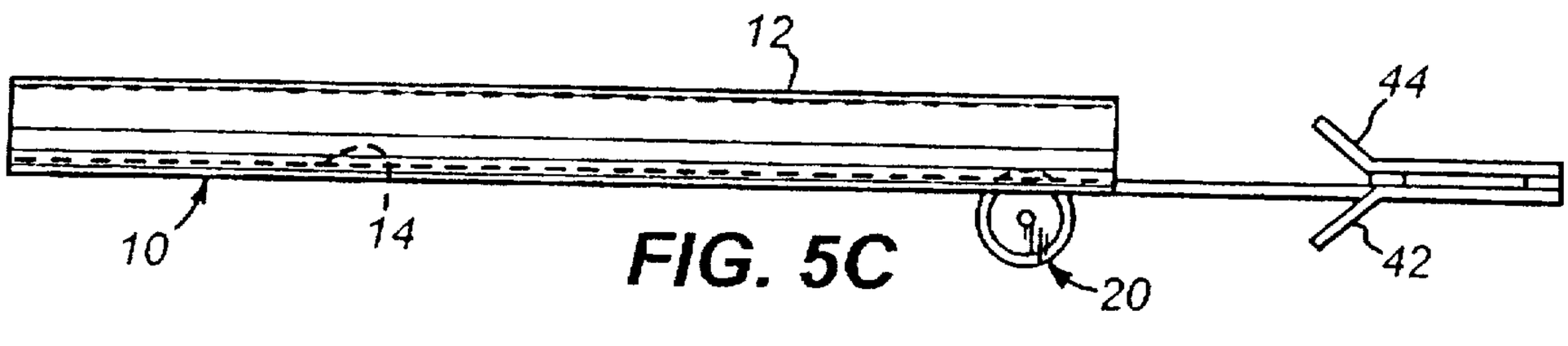


FIG. 5C

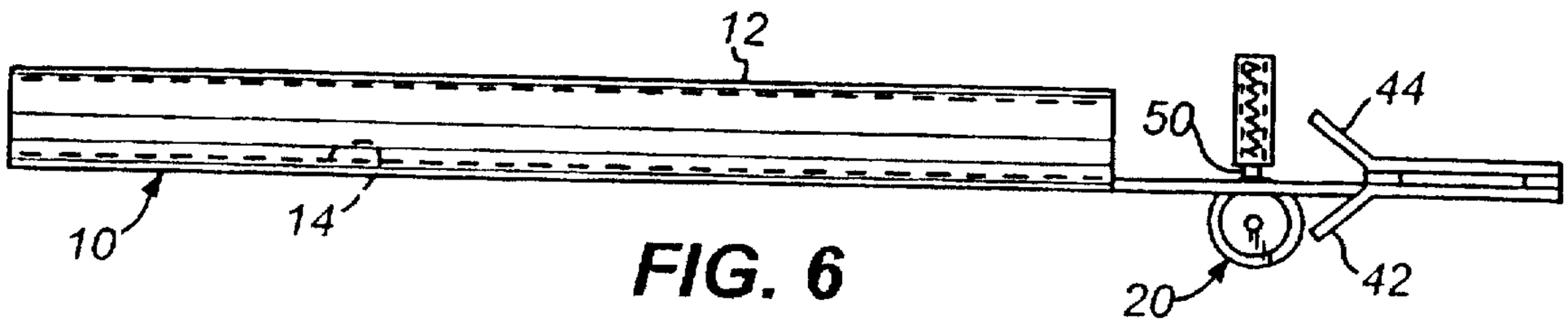


FIG. 6

FIG. 7

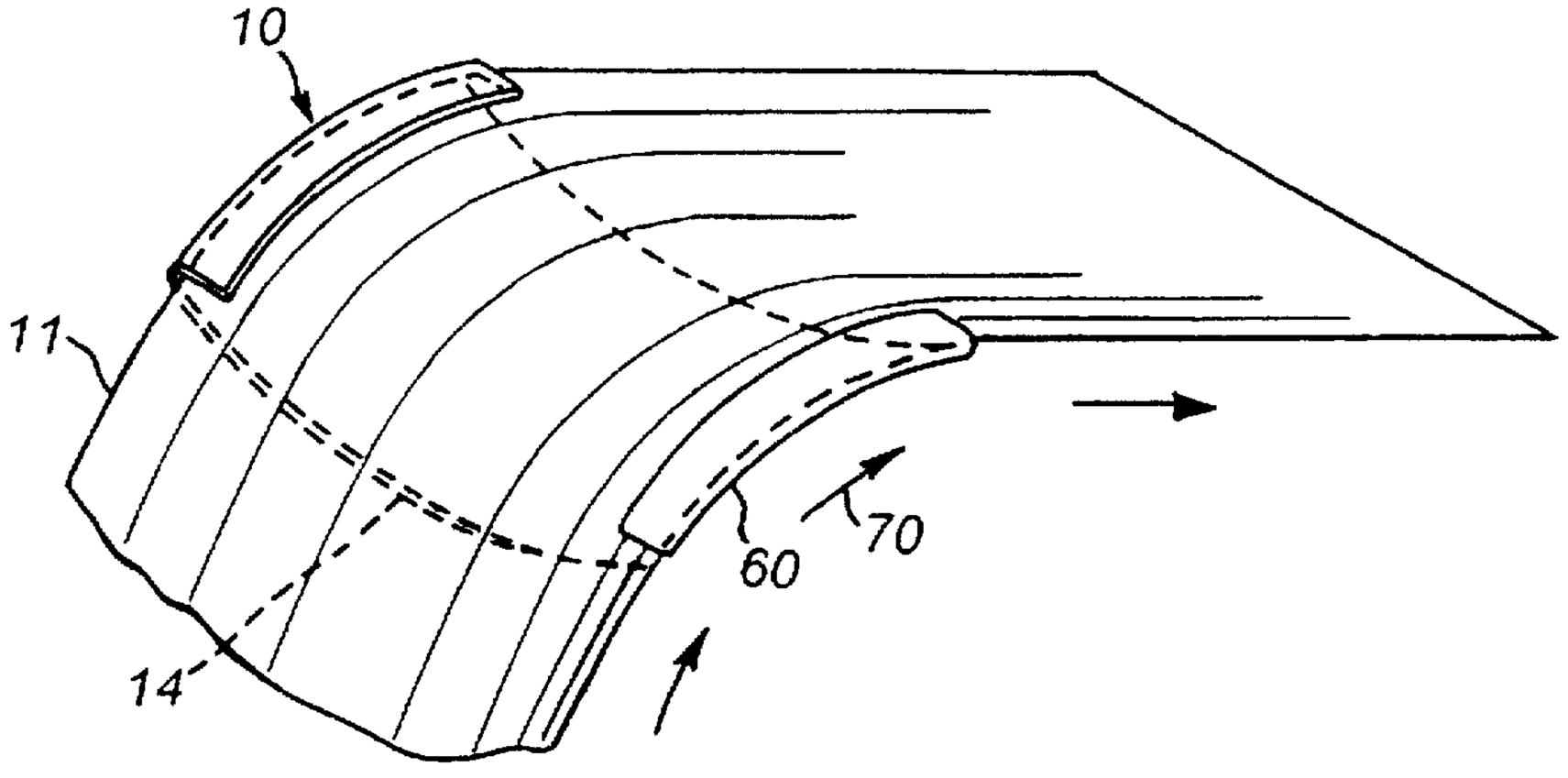


FIG. 8

FIG. 9

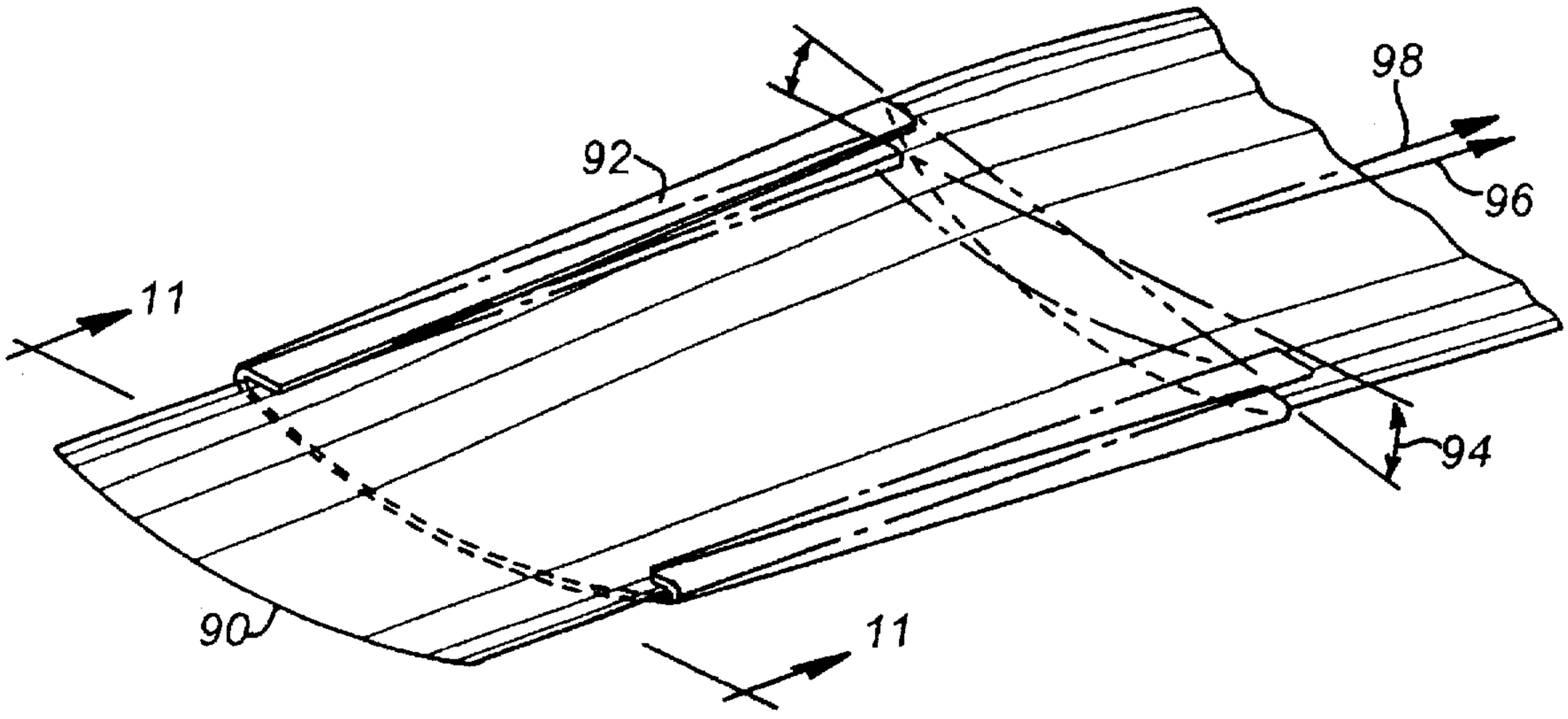


FIG. 10

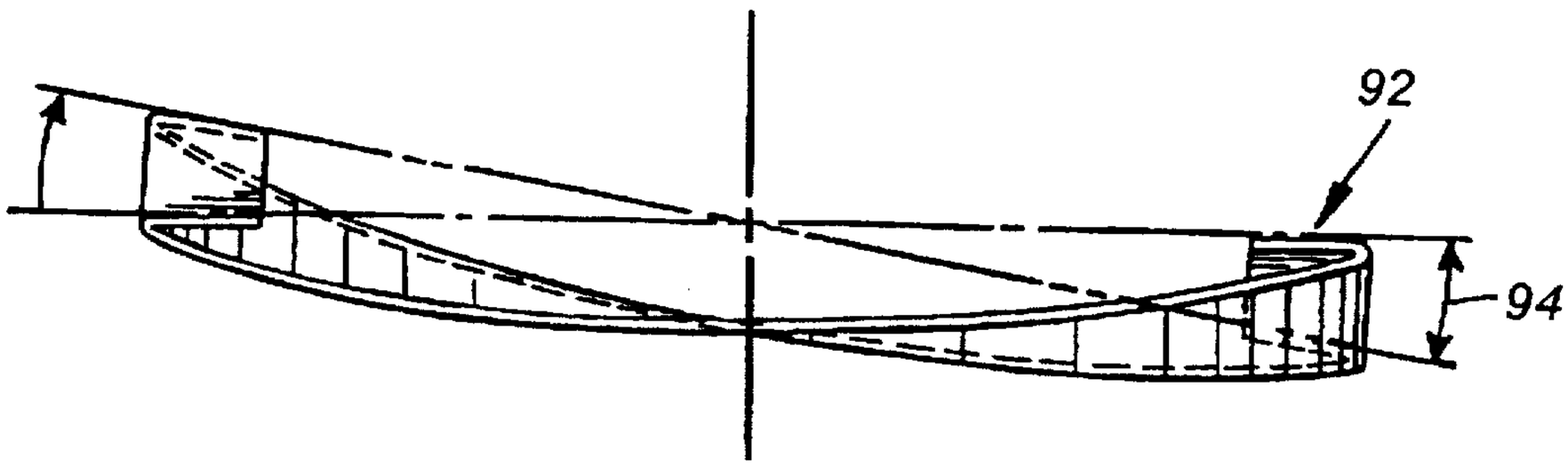


FIG. 11

PAPER GUIDING METHOD AND APPARATUS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a unique method and apparatus for guiding a web of material in a straight path.

2. Background of the Invention

When feeding a web of paper through printing and other value-added processes such as paper cutting and paper punching, it is desirable to keep the web of paper flowing straight. Widely used conventional means to accomplish this include tractor-feeding apparatuses wherein pins are provided which engage pinholes in the sides of the web of paper. Tractor-feed paper with pin-holes along the sides require an extra inch of paper when compared to standard 8 inch width paper. In addition, the use of pinholes requires that the paper be moved from paper mills to converters before it is usable by the end user. This tractor-feed technology currently processes more than $1 billion annually worth of paper, 10 percent or $100 million of which is wasted on the tractor-feed pinhole portion.

Therefore, it is an object of the present invention to provide an apparatus for guiding a web of paper in a straight line without the need for tractor-feed pinholes.

It is another object of the present invention to provide an apparatus that is compatible with pre existing tractor-feed devices.

It is a further object of the present invention to provide for an apparatus that will automatically realign any slightly misaligned paper during the feeding process.

SUMMARY OF THE INVENTION

To accomplish the foregoing and other objects, features and advantages of the invention, there is provided an improved method and apparatus for driving a web in a straight path which comprises means for bending a web widthwise in a trough shape for providing stiffness and controllability to said web, means for driving said web in the direction of its length, and means for guiding said web in said direction of its length. The trough shape has a cord length from side edge to side edge that is less than the width of the web when flat. In a preferred embodiment of the present invention, the web consists of paper.

More particularly, in accordance with the present invention, there is provided an apparatus for driving a web in a straight path wherein the means for bending comprises a trough structure. The trough structure causes the paper to curl widthwise to conform with the shape of the trough structure creating beam strength in the paper for controllability. The trough structure comprises a concave lower wall upon which the paper flows, open ends through which the paper flows, and shoulders which attach to both sides of the lower wall and extend substantially horizontally from the sides of the lower wall to symmetrical positions above the lower wall. The shoulders act to contain the paper in the trough structure and guide the paper through the trough structure. The means for driving includes a drive roll. The drive roll comprises a substantially round core which is adapted to rotate about an axis and is surrounded by an outer layer having a rubber-like texture.

BRIEF DESCRIPTION OF THE DRAWINGS

Numerous other objects, features and advantages of the invention should now become apparent upon a reading of the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. **1** is a perspective of the apparatus including the trough structure, drive roll, flat surface and straightening plows;

FIG. **2** is a front view of the paper illustrating the paper bent in a trough shape;

FIG. **3** is a side view of the apparatus illustrating the straightening plows;

FIG. **4** is a perspective of the apparatus illustrating the paper exiting from the trough structure and straightening;

FIG. **5a** is a side view of the apparatus illustrating a preferred location of the drive roll;

FIG. **5b** is a side view of the apparatus illustrating an alternative location for a drive roll;

FIG. **5c** is a side view of the apparatus illustrating a further alternative location for the drive roll;

FIG. **6** is a side view of the apparatus illustrating the drive roll and pressure roll in particular;

FIG. **7** is a front view of the paper in an alternative embodiment wherein the sides of the paper are curved inwards; and

FIG. **8** is a perspective of the paper in an alternative embodiment wherein the paper is both bent in the trough shape structure and around a curve in the direction of travel.

FIG. **9** is a perspective view of an alternative driving apparatus wherein the paper is formed into a trough shape by side force of conventional tractor feed pins and is driven by the pin belt without the need for holes;

FIG. **10** is a perspective view of a method for directing the paper by warping the trough; and

FIG. **11** is a front view of the warped trough of FIG. **10**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention employs the novel concept of bending a web of paper or other material widthwise to add stiffness and beam strength for controllability of the web. With the added stiffness and beam strength to the paper, unwanted buckling is avoided, and the paper can be guided easily.

The present invention employs a trough-shaped structure through which the paper flows for bending the paper in a corresponding trough shape and attached shoulders which engage the sides of the paper and guide it through the trough structure. The present invention eliminates the need for tractor-feed pinholes in the paper and provides for self-adjusting straightening of the paper when slight misalignment occurs.

Reference is now made to the drawings in which FIGS. **1–5a** show a preferred embodiment of the present invention. Further details of this embodiment are set forth in FIG. **6**. Alternative embodiments of the present invention are set forth in FIGS. **5b**, **5c**, **7** and **8**, in which FIGS. **5b** and **5c** show alternative locations for the drive roll, and FIGS. **7** and **8** illustrate multiple bending.

Referring now to FIG. **1**, the apparatus is shown which generally includes the trough structure **10** that acts as a support for the web and through which the web of paper **11** flows, a drive roll **20** for driving the web of paper, a flat

surface **30** upon which the paper flows after exiting the trough structure, and straightening plows **40**. The present apparatus is adapted to be used with printers and other value-added processes. The present invention is compatible existing tractor-feed printers which will function without the need for the tractors.

Referring now to FIG. **1**, the trough structure **10** is shown with the concave lower wall **14** and shoulders **12**. The trough structure has a cord length **15** from side edge to side edge that is less than the width **17** of the paper when flat. The width of the paper, which may be 15 inches, is substantially the same as or slightly less than the curvature dimension of the trough structure, as represented by width **17** in FIG. **1**, between the shoulders **12**. During use, the paper web would flow through the trough structure **10** from the entrance end **16** to the exit end **18**. The paper would conform to the shape of the trough structure. The shoulders **12** engage the edges of the paper for containing the paper in the trough structure and guiding the paper in a straight line. Due to the bending of the paper in the trough shape, beam strength is added to the paper which allows the paper to be guided easily.

Although a concave trough structure is utilized by the preferred embodiment, a convex structure could also be employed. Similarly, the beam strength of the web may be obtained by primarily guiding only the side edges of the web with no other support.

FIG. **2** illustrates a front view of the paper when bent in the trough shape and shoulders which engage the edges of the paper. The shoulders act to contain the paper and guide the paper.

Referring back now to FIG. **1**, the web of paper would flow through the trough structure onto the flat surface **30**. The flat surface **30** extends from the lower wall or support structure **14** of the exit end **18** of the trough structure **10** to the straightening plows **40**. The flat surface **30** has an aperture **32** centrally disposed therein. Within the aperture **32** sits the drive roll **20**. The drive roll **20** consists of a round core **22** which is motor driven and rotates about an axis, and an outer layer **24** of rubber-like material. The drive roll is located within the aperture **32** at a vertical level such that the rubber-like outer layer **24** of the drive roll **20** is just at or slightly above the level of the flat surface **30**. The outer layer **24** of the drive roll **20** engages the underside of the paper as it flows upon the flat surface **30** and drives the paper upon rotation of the drive roll.

The outer layer of the drive roll may be comprised of 45/50 Durometer Rubber or polyurethane.

Note that the sides of a trough themselves may translate (FIG. **9**), carrying the paper through a distance. In this way, the effects of friction upon the sides of the web are greatly reduced while accurate side guiding is still maintained. Moving side walls may be construed like a conveyor belt or similar continuously moving surface.

The paper, once exiting the trough structure, will flow upon the flat surface **30** and will seek its own geometry without external forces to restore it. The paper will, in a short distance, return to its flat natural state. This distance is established by the natural free energy bend of the paper. The straightness of the paper is also maintained by the inherent symmetry in the strength of the paper, so that any forces causing stress on one side of the paper will be balanced by relief of force on the opposite side of the paper.

To ensure that complete flattening occurs, the straightening plows **40** are provided at the end of the flat surface **30** opposite the trough structure **10** as illustrated in FIG. **3**. The straightening plows **40** include an upper lip **44**, a lower lip **42** and posts **43** to secure the two surfaces together at a spaced distance. The upper lip **44** and lower lip **42** project diagonally upward and downward respectively, both facing toward the trough structure **10**, at approximately 45 degree angles from the horizontal flat surface **30**. The paper enters the straightening plows **40** which flatten the paper out, allowing it to be worked on. This work may include cutting, punching, printing, or other value-added processes.

FIG. **4** shows the paper exiting from the trough structure and straightening out by natural bending forces. This occurs before the paper enters the straightening plows **40**.

FIG. **5**a illustrates a preferred embodiment of the present invention in which the drive roll **20** is located at the flat surface **30** between the trough structure **10** and straightening plows **40**. FIGS. **5**b and **5**c illustrate alternative locations for the drive roll **20**, at the entrance end of the trough structure and at the exit end of the trough structure, respectively.

The drive roll is optimally located, as illustrated in FIG. **5**a, at the flat surface **30** between the trough structure **10** and the straigtening plows **40**. With the drive roll located at either the entrance end or the exit end of the trough structure, as opposed to the optimal location at the flat surface **30** between the trough structure **10** and the straightening plows **40** the following disadvantage will result: any misalignment of the paper with respect to the driver roll causes buckling of the paper in a direction 90 degrees to the direction of travel; this buckling is exacerbated by friction between the edges of the paper and the shoulders **12** of the trough structure. The position illustrated in FIG. **5**c, at the exit end of the trough structure, is slightly more advantageous than the position illustrated in FIG. **5**b, at the entrance end of the trough structure, but buckling was still found to exist upon misalignment of the paper with respect to the drive roll **20**.

With the drive roll located at its optimal position, as illustrated in FIG. **5**a, with slight misalignment of the paper with respect to the drive roll **20**, no buckling will occur. In addition, the paper will automatically re-straighten itself due to the guiding of the paper by the trough structure. Thus, the objects of automatic re-straightening and no buckling are met with the drive roll located at the flat surface **30** between the trough structure **10** and the straightening plows **40**.

In a preferred embodiment of the present invention, a pressure roll **5** is employed for providing pressure to the top side of the paper for maintaining contact with the drive roll, and is illustrated in FIG. **6**. The pressure roll is spherical or otherwise round in cross section and is adapted to spin or rotate about a central axis. The pressure roll may be disposed of above the drive roll **20** such that the surface of the pressure roll would contact the drive roll and the drive roll would cause the pressure roll to spin or rotate. The paper flows between the pressure roll **50** and drive roll **20**, the pressure roll **50** providing pressure to the paper so that the paper maintains contact with the drive roll.

For moderate misalignment angles of the paper with respect to the drive roll of 5 degrees or less, no buckling will occur and the self-correcting edge guiding function will work properly. With the pressure roll employed, as the angle of misalignment increases up to 15 degrees, the paper will begin to buckle but the edge positions of the paper will be unaffected. Thus, it is concluded that the apparatus works effectively with employment of the pressure roll **50**, at least up to moderate misalignment angles.

In alternative embodiments of the present invention, as illustrated in FIGS. **7** and **8**, the web of paper **11** is bent more than one time in order to create further stiffness. For each additional ben added to the web of paper **11**, an additional

surface is required to trap the paper. FIG. **7** illustrates an alternative embodiment wherein the sides of the paper **11** are curled inward to provide additional strength without requiring the space necessary to curve the entire width of the paper.

FIG. **8** illustrates an alternative embodiment wherein further bending of the paper **11** around a curved surface **60** in the direction of travel is provided. Note, as illustrated in FIG. **8**, the bending provided by the concave lower wall **14** of the trough structure **10** remains in addition to the bending provided by the curved surface **60**. The direction of travel of the paper **11** is shown by the arrows **70**. Again, multiple bends can be made if multiple surfaces are provided to back up the paper. The bent paper has substantial strength once it turns a radius and therefore can accommodate substantial forces which may be needed to side-guide it. Thus, this device has widespread use with value-added processes such printers, paper cutting machines and paper punching machines.

The above-described benefits obtained through forming a web into a trough shape may also be derived without the use of a complete supporting trough structure. It is necessary only to specifically guide the edges of the web at a spacing distance that forms a trough shape. The natural beam strength of the web will provide the necessary stiffness to guide the web.

An alternative apparatus for forming and guiding a trough shaped web **80** is shown in FIG. **9**. This apparatus may actually utilize standard tractor feed units **78** having pins **82** mounted on a continuous drive belt **84**. The pins **82** have inner facing edges **83** that contact the web edges **86** to retain them laterally under pressure, forming the web **80** into a trough. The drive belt **84** may include a highly frictional surface to grip the web, driving it as the belt moves. Each tractor feed unit **78** in this example also includes an upper shield **88**. Each web edge **86** is disposed between this upper shield **88** and the belt **84** and is thus, restrained vertically with the shield acting as a trough shoulder.

Note that it is possible with an embodiment such as FIG. **8** to incorporate a variable geometry directing system. FIGS. **10** and **11** disclose a method for directing a web **90** laterally by warping (twisting) the trough **92** along its length. By applying a predetermined twist angle **94**, a predetermined degree of diversion **96** from the initial driving direction **98** is obtained. The trough, of course, may be warped only to its elastic limit, otherwise permanent deformation may occur. For larger diversions it may be possible to incorporate a segmented trough wherein one segment moves relative to another to obtain a sharp twist angle.

Tests were performed on the apparatus, the results of which are listed below:

1. Referring to FIG. **1**, if the curvature in the trough structure, represented by at least dimension X, is large, then the distance Y of the flat surface **30** must be increased in proportion. Furthermore, a large curvature causes wrinkling and distortion of the paper all the way back to the entrance end **16** of the apparatus.
2. If the curvature in the trough structure is very small, there is much less wrinkling and distortion, but the paper will not push through the straightening plows as well. A preferred amount of curvature is represented by a dimension X equalling, on the order of 1¼ inches. This corresponds to a length Y of the flat surface **30** of 4 inches and a length of the trough structure Z of 17 inches. Moreover, the trough structure itself, as indicated previously, has a corresponding dimension of 15 inches as indicated by dimension **17** in FIG. **1**.
3. Wrinkles in the paper are caused by the act of flattening the paper through the straightening plows **40** as well as any misalignment which puts edge pressure on the paper. Wrinkles can be minimized by adding hold downs which cause the paper to conform to the shape of the trough structure **10**. A hold down could be as simple as a weighted strap against the surface of the paper.

Having now described a limited number of embodiments of the invention, it should now be apparent to those skilled in the art that numerous other embodiments and modifications thereof are contemplated as falling within the scope of the present invention as defined by the appended claims.

What is claimed:

1. An apparatus for driving a web in a defined path comprising:

trough structure means having one of a concave and convex surface and having shoulders for engaging opposing widthwise edges of a web positioned therein, the shoulders being positioned to maintain the web against a surface of the trough structure along a lengthwise direction, the web therein having a conforming trough shape in which a straightline spacing between the widthwise edges is less than a spacing between widthwise edges of the web when laid flat, the trough shape providing stiffness to the web and causing said web to curl widthwise to conform to the shape of the trough structure creating beam strength in said web for controllability and means for driving said web in the lengthwise direction along the trough structure, the means for driving including a drive roll having a substantially round core being motor driven and adapted to rotate about an axis of the core, and an outer layer having a rubber-like texture surrounding said core for engaging said paper and driving said paper upon rotation of said drive roll

and, a flat surface positioned beyond said trough structure at one end thereof, upon which said web flows after flowing through said trough structure,

said flat surface having an aperture disposed therein, the width of said aperture being greater than the width of said drive roll,

said drive roll disposed out of the plane of said flat surface in said aperture so that said outer layer of said drive roll is at substantially the same level as said flat surface, for engaging the underside of said paper and driving said paper through said trough structure.

2. An apparatus as set forth in claim **1** further including web flattening means, said web flattening means including an upper lip and a lower lip,

said web flattening means disposed at one end of said flat surface opposite said trough structure,

said lips of said web flattening means straddle said flat surface and are adapted to receive said paper between said lips for straightening of said paper and returning said paper to its flat state.

3. An apparatus as set forth in claim **1** wherein said means for driving further includes a pressure roll, said pressure roll being of spherical shape and adapted to spin, said pressure roll located opposite said drive roll.

4. An apparatus as set forth in claim **1** wherein said means for driving further includes a pressure roll,

said pressure roll being of spherical shape and adapted to spin,

said pressure roll located opposite said drive roll such that said outer layer of said drive roll engages the surface of

said pressure roll and wherein rotation of said drive roll causes spinning of said pressure roll.

said paper adapted to flow between the surface of said pressure roll and said outer layer of said drive roll, said pressure roll maintaining sufficient pressure for keeping said paper against said outer layer of said drive roll.

5. An apparatus for moving a web in a defined path comprising:

means for bending a web widthwise in a trough shape, the web being substantially flexible in a lengthwise direction when laid flat and being substantially rigid in a lengthwise direction when formed into said trough shape, said means for bending comprising a trough structure, said trough structure comprising one of a concave and convex support upon which said web flows, in a lengthwise direction, open ends through which said web flows, and shoulder means disposed relative to the sides of said support and which extend from said sides of said support to positions above said support, said shoulder means containing said web in said trough structure and guiding said web through said trough structure said shoulder means having sides which face said support and said sides engaging the edges of said web for containing said web in said trough structure and guiding said web in a defined path,

means for driving said web including a drive roll having a web gripping texture for engaging said web and driving said web; and

a flat surface, said flat surface being attached to said trough structure at one end thereof, upon which said web flows after flowing through said trough,

said flat surface having an aperture, the width of said aperture being substantially equal to or greater than the width of said drive roll,

said drive roll disposed out of the plane of said flat surface in said aperture such that said outer layer of said drive roll is positioned at substantially the same plane as said flat surface, for engaging said web and moving said web through said trough structure.

6. An apparatus as set forth in claim **5** wherein said flat surface being contiguous with said trough.

7. An apparatus as set forth in claim **5** wherein the curvature of the trough structure is defined by a range of radii between an infinite radius and a radius defined by an arc length on the order of 15 inches and a distance along the radius between the cord and the arch on the order of 1.25 inches.

8. An apparatus for guiding a web in a defined path comprising:

a trough shaped guiding structure having shoulders for engaging widthwise edges of a web for creating a lengthwise bend along a web to provide stiffness and controllability thereto, said web having a cord length less than its flat width; a substantially flat surface proximate an end of the trough structure, the web passing over the substantially flat surface; and

an aperture positioned on the flat surface and a drive roll positioned in the aperture that engages the web to drive the web in the lengthwise direction.

9. An apparatus as set forth in claim **8** further comprising a driving belt **[**means**]** disposed proximate to **[**end**]** *and* aligned with at least one of said shoulders.

10. An apparatus as set forth in claim **9** wherein said driving belt means includes a plurality of projections therefrom for abutting an edge of said web.

11. An apparatus as set forth in claim **9** wherein said driving belt means comprises a tractor-pin feed mechanism having a conveyor belt with pins projecting therefrom, said pins having inner facing edges abutting an edge of said web.

12. An apparatus as set forth in claim **8** wherein said trough structure comprises a flexible trough for directing an output end of said web to a plurality of predetermined locations.

13. A method for driving a web in a defined path comprising the steps of:

distorting a web widthwise in a trough shape by engaging opposing widthwise web edges to maintain the web against a trough shaped surface for providing stiffness and controllability in a lengthwise direction to said web, said trough shape having a cord length less than the width of the web when flat, and the web being substantially flexible along a lengthwise direction when flat and being substantially rigid along a lengthwise direction when formed into a trough shape,

providing a substantially flattened surface proximate an end of the trough shaped surface so as to cause the web to become substantially flat along the substantially flattened surface,

driving said web in said lengthwise direction including providing a drive member at the substantially flat surface for engaging and propelling the web in a lengthwise direction, and

guiding said web in said lengthwise direction through said trough shaped surface and onto said substantially flattened surface.

14. **[**An**]** *A* method as set forth in claim **13** wherein said web comprises a web of paper.

15. **[**An**]** *A* method as set forth in claim **14** wherein the step of bending is accomplished by providing a trough structure,

said trough structure causing said paper to curl widthwise to conform with the shape of the trough structure, creating beam strength in said paper for controllability,

said trough structure comprising one of a concave and convex support upon which said paper flows, open ends through which said paper flows in said direction of its length, and a shoulder along at least one side of said trough structure and which extends from said side of said trough structure to an opposite side of said trough structure for containing said paper in said trough structure.

16. A method as set forth in claim **15** wherein said step of guiding is accomplished with said trough structure, said shoulder having an underside which faces said structure,

said underside of said shoulder engages the edges of said paper for guiding said paper in a defined path.

17. A method as set forth in claim **14** wherein the step of driving is accomplished by providing a drive means,

said drive means comprising a substantially round core, said substantially round core being driven and adapted to rotate about an axis, and an outer layer having web gripping texture surrounding said core for engaging said paper and driving said paper upon rotation of said drive roll.

18. An apparatus for guiding a web in a defined path comprising:

a tractor pin feed mechanism comprising a left tractor pin feed belt with pins projecting therefrom and a right tractor pin feed belt with pins projecting therefrom, the pins of the left tractor pin feed belt and the pins of the right tractor pin feed belt each having inner facing edges that are aligned along respective lines, the respective lines being substantially parallel to each other and being spaced apart at a first distance; and

wherein the first distance is less than a second distance that is equal to a spacing between widthwise edges of a web when the web is substantially flat, the inner facing edges of the pins of the left belt and the right belt being constructed and arranged to abut an edge of the web and form the web into a trough-shape to provide stiffness and controllability to the web as it passes through the tractor pin feed mechanism.

19. The apparatus as set forth in claim 18 further comprising a tractor pin feed drive that moves the pins in conjunction with the web as the web passes therebetween.

20. The apparatus as set forth in claim 18 further comprising an upper shield located adjacent the pins of at least one of the left tractor pin feed belt and the right tractor pin feed belt, the upper shield maintaining a widthwise edge of the web adjacent the pins of the at least one of the left tractor pin feed belt and the right tractor pin feed belt.

21. The apparatus as set forth in claim 20 wherein the upper shield extends away from the pins of the at least one of the left tractor pin feed belt and the right tractor pin feed belt and toward the pins of an opposing tractor pin feed belt.

22. A method for driving a web in a defined path comprising the steps of:

providing a web having widthwise edges that define a web width when the web is substantially flat and driving the web in a first direction;

engaging the web along the widthwise edges with opposing sets of pins having inner facing edges that abut a respective of the widthwise edges of the web and that move in conjunction with a movement of the web in the first direction; and

locating the opposing sets of pins so that the inner facing edges of the pins engage respective widthwise edges of the web so as to form the web therebetween into a trough shape wherein a distance between the widthwise edges of the web in the trough shape is less than the web width when the web is substantially flat, and wherein the trough shape provides stiffness and controllability to the web.

23. The method as set forth in claim 22 further comprising providing a plate adjacent at least one of the sets of pins and engaging a respective of the widthwise edges of the web with the plate to maintain the respective of the widthwise edges adjacent the plate.

24. The method as set forth in claim 23 wherein the step of engaging includes driving the web based upon a movement of the pins.

25. A method for driving a web in a defined path comprising the steps of:

directing a web having widthwise edges, that define therebetween a web width when the web is substantially flat, between pair of opposing moving upright surfaces having inner facing edges that engage the widthwise edges; and

locating the opposing moving upright surfaces so that the inner facing edges on the opposing moving upright surfaces are positioned at a spacing from each other that is less than the web width, wherein the step of directing thereby includes forming the web into a trough shape that provides stiffness and controllability to the web.

26. The method as set forth in claim 25, further comprising providing retaining surfaces that are positioned adjacent the upright surfaces and thereby maintaining the widthwise edges in engagement with the upright surfaces.

27. A method for driving a web in a defined path comprising the steps of:

providing a web having widthwise edges defining a web width when the web is substantially flat and driving the web in a first direction;

engaging the web along with widthwise edges with a pair of opposing upright surfaces that are spaced at a distance less than the web width to form the web into a trough-shape for increased stiffness and controllability; and

wherein the step of driving includes engaging a first face of the web at the location upon the web wherein the web is formed in the trough-shape with a drive roll and engaging an opposing second face of the web with a pressure roll located adjacent the drive roll.

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