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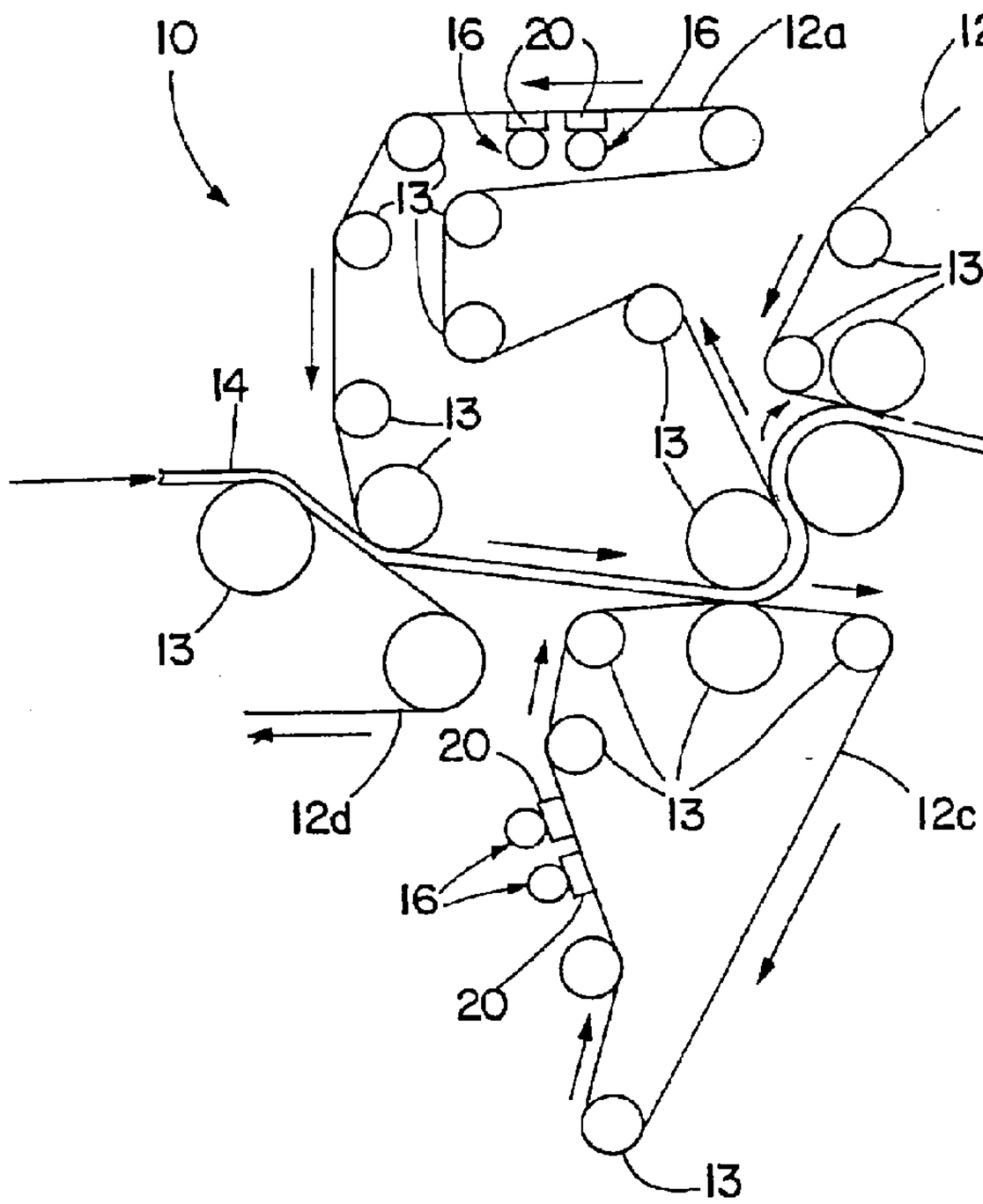
(54) **COUVERCLE DE CAISSE ASPIRANTE A REDUCTION D'USURE, POUR APPAREIL D'ESSORAGE**

(54) **REDUCED WEAR SUCTION BOX COVER FOR DEWATERING DEVICE**



(57) Suction box covers include at least one slot having an upper edge lined with a member having a wear-resistant material coating thereon. Each member includes a portion that is even with or extends above a plane of the cover face over which a fabric belt passes. A fabric belt passing over a suction box cover contacts a coated member of each slot and does not contact the face of the cover.

REDUCED WEAR SUCTION BOX COVER FOR DEWATERING DEVICE

Abstract of the Disclosure

Suction box covers include at least one slot having an upper edge lined with a member having a wear-resistant material coating thereon. Each member includes a portion that is even with or extends above a plane of the cover face over which a fabric belt passes. A fabric belt passing over a suction box cover contacts a coated member of each slot and does not contact the face of the cover.

Attorney Docket No.: 5689-203

REDUCED WEAR SUCTION BOX COVER FOR DEWATERING DEVICE

Field of the Invention

The present invention relates generally to papermaking machinery and, more particularly, to dewatering devices used with papermaking machinery.

Background of the Invention

In conventional papermaking processes, paper is formed and transported upon high speed, endless fabric belts that are designed to absorb moisture from the paper. Suction boxes are often placed at various locations along the belts to remove moisture. Suction boxes are typically included in the forming and press sections of a papermaking apparatus; they may be positioned directly beneath the belt as the paper rests thereon; or may be located in a "return" zone of the belt away from paper contact.

One specialized suction box is the so-called "Uhle" box, which is employed in conjunction with a press felt in the press section of a papermaking machine. A Uhle box is positioned downstream of the press nip formed by pressure rollers. Uhle boxes are often located near water or chemical showers used to

clean the felt of fillers and contaminants and to condition it for further use. As such, Uhle boxes remove water, cleaning solutions, and fillers and contaminants from the felt.

Conventional Uhle boxes include a hollow box-shaped receptacle and a perforated cover over which the press felt passes. Covers typically include one or more slots that extend transversely to the direction of travel of a fabric belt. As negative pressure is applied to the Uhle box, a vacuum is pulled on the press felt, thereby drawing water from the press felt through the slots and into the receptacle for disposal. The cover is typically formed of an inexpensive polymer (such as polyethylene), which may be filled with wear-resistant materials, such as mica dust. Alternatively, the perforated covers of conventional Uhle boxes may be covered with a layer of ceramic tile.

Unfortunately, portions of the press felt, particularly the seams, can become snagged on portions of the cover during use. Particularly troublesome are the edges of the slots in a suction box cover. In addition, the high speed contact between the press felt and Uhle box cover can cause significant wear to both the cover and the press felt, which is typically woven with weaker yarns than those of a forming fabric. Cover wear may be especially problematic for covers lacking a wear-resistant material. Unfortunately, the addition of wear-resistant material or coatings to the face of a suction box cover may add significantly to the cost of

a cover and, thus, to the manufacturing costs of paper.

Summary of the Invention

In view of the foregoing, it is an object of the present invention to cost-effectively reduce suction box cover wear caused by fabric belts passing thereover.

It is another object of the present invention to cost-effectively reduce wear and other damage to fabric belts passing over suction box covers.

These and other objects of the present invention are provided by suction box covers wherein contact between a fabric belt and a suction box cover is reduced while maintaining the ability to dewater the fabric belt. Suction box covers according to the present invention may include at least one slot disposed therewithin having an upper edge thereof lined with an endless member coated with a wear-resistant material. Each endless member can be even with, or include a portion that extends above, a plane of the cover face over which a fabric belt passes. Accordingly, a fabric belt passing thereover primarily contacts the endless member of each slot rather than the face of the cover. In addition, each endless member preferably has a generally rectangular cross-section with rounded edges. Accordingly, the contact area between a fabric belt and cover can be kept to a minimum, thereby reducing wear on both the fabric belt and the cover.

Suction box covers according to the present

invention may have various slot configurations. For example, a suction box cover may have a plurality of spaced-apart slots angularly disposed within the cover in a herringbone pattern. According to another aspect of the present invention, a suction box cover may have a slot therein with a generally sinuous configuration.

According to another aspect of the present invention, a fabric belt dewatering method includes passing a fabric belt over a face of a slotted cover, wherein an endless member is even with or extends above the cover so as to contact the fabric belt, and applying negative pressure to the cover to draw water from the fabric belt through the slots. Each endless member includes a coating of wear-resistant material.

Suction box covers incorporating the present invention are advantageous over conventional covers because wear and damage to both the cover and a fabric belt passing thereover can be reduced, thereby extending the life of both covers and fabric belts. Furthermore, suction box covers according to the present invention may be less expensive to produce than conventional covers that have an entire face coated with wear-resistant material, that have a solid hard surface, or that have a hard surface composite.

Brief Description of the Drawings

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention

and, together with the description, serve to explain principles of the invention.

Fig. 1 is a schematic side view of a press section of a papermaking apparatus wherein paper is traveling therethrough via a plurality of endless fabric belts.

Fig. 2 is a perspective view of a fabric belt passing over a suction box cover incorporating aspects of the present invention.

Fig. 3 is a section view of the suction box and cover of **Fig. 2** taken along lines 3-3.

Fig. 4 is a plan view of the suction box cover of **Fig. 2** having slots arranged in a herringbone pattern.

Fig. 5 is an enlarged perspective view of a portion of the suction box cover of **Fig. 4**.

Fig. 6A is an enlarged section view of the suction box cover of **Fig. 5** taken along lines 6A-6A.

Fig. 6B illustrates a portion of an endless member extending above a cover face according to an alternative embodiment of the present invention.

Fig. 7 is a plan view of a suction box cover according to another embodiment of the present invention.

Fig. 8 is a section view of the suction box cover of **Fig. 7** taken along lines 8-8.

Detailed Description of the Invention

The present invention now will be described more fully hereinafter with reference to the

accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

Referring now to **Fig. 1**, the press section of a papermaking apparatus **10**, including a plurality of endless fabric belts **12a-12d** (typically press felts) driven by a plurality of rollers **13**, is schematically illustrated. Paper **14** is transported through the press section **11** of the papermaking apparatus **10** via the moving endless fabric belts. Structures of exemplary press felts are shown in U.S. Patent Nos. 4,565,735 to Murka, Jr. et al. and 5,135,802 to Gstreina; those skilled in this art will recognize that any press felt or other papermaker's fabric may benefit from the advantages conveyed by the present invention.

Still referring to **Fig. 1**, the papermaking apparatus **10** also includes water removal devices **16** for removing water absorbed by a fabric belt in the "return" zones of each belt (*i.e.*, they are positioned downstream from where the paper **14** is separated from the endless fabric belts **12a** and **12c**). It is to be understood that, although not shown in **Fig. 1**, endless fabric belts **12b** and **12d** may also have water removal devices positioned downstream from where the paper **14**

is separated therefrom. Each water removal device **16** includes a vacuum source (not shown) and a suction box **20**, also referred to as a Uhle box.

Referring now to **Fig. 2**, a perspective view of one of the illustrated fabric belts (**12a**) of **Fig. 1** passing over a suction box **20** is illustrated. The illustrated suction box **20** includes a hollow base member **22** and a cover **24** overlying the hollow base member **22**. The hollow base member **22** and cover **24** define a suction chamber **25** into which moisture is drawn from the fabric belt **12a** passing over the cover **24**. The illustrated cover **24** includes an elongated edge portion **24a**, which is transverse to the direction of travel (indicated by arrow) of the fabric belt **12a**. The illustrated cover **24** also includes opposing first and second faces **26a** and **26b**; the first face **26a** directly underlies the fabric belt **12a**.

Referring now to **Figs. 2** and **4**, a plurality of spaced-apart slots **28** extend between the first and second faces **26a**, **26b** of the cover **24**, as illustrated. The slots **28** provide fluid communication between the cover first face **26a** and the suction chamber **25** to enable water to flow from the fabric belt **12a** into the suction chamber **25**. In the illustrated embodiment of **Fig. 2**, the slots **28** are angularly disposed within the cover **24** relative to the elongated edge portion **24a** and arranged in a "herringbone" configuration. It is to be understood that suction box covers incorporating aspects of the present invention may have various configurations of slots or perforations, and are not

limited to the illustrated herringbone configuration.

Referring now to **Fig. 3**, an enlarged section view of the suction box **20** of **Fig. 2**, taken along lines 3-3, is illustrated. The illustrated cover **24** is preferably an elongated plate of polymeric material, such as polyethylene, having generally planar first and second faces **26a** and **26b**, respectively. However, it is to be understood that the cover first and second faces **26a**, **26b** can be non-planar without departing from the spirit and intent of the present invention.

In the illustrated embodiment of **Fig. 3**, a collar **29** secures the cover **24** to the hollow base member **22** via a pair of dove-tail grooves **27a** and **27b** that engage respective elongated edge portions **24a** and **24b** of the cover **24**. However, it is to be understood that a cover incorporating aspects of the present invention may be secured to a base member in various ways and is not limited to the illustrated embodiment.

The illustrated hollow base member **22** has a generally U-shaped cross-section which preferably extends the full width of a fabric belt passing thereover. The suction chamber **25** is preferably maintained under a negative pressure by conventional vacuum means, which need not be described herein. Typically, the pressure applied is sufficient to draw air through the suction box **20** at a rate of at least about 15 cubic feet per minute (cfm) of air per square inch of open slot area. Water collected within the suction chamber **25** from a fabric belt passing over the cover slots **28** may be removed by conventional water

removal means, which need not be described herein. It is to be understood that the present invention is not limited to the illustrated configuration of the hollow base member **22**. Base members used in conjunction with a cover according to the present invention may have various shapes and configurations without limitation.

Referring now to **Fig. 5**, each slot **28** formed in the illustrated cover **24** includes an endless member **30** lining an upper edge portion **34** of each slot **28** adjacent the cover first face **26a**. An endless member **30** may be secured within an upper edge portion **34** of each slot **28** via fasteners that extend through the second face **26b** of the cover **24**. Exemplary fasteners may include screws, bolts, and the like. It is understood that a member lining an upper edge portion of a suction box cover slot, according to the present invention, need not have an endless configuration; instead, a member may extend around a portion of the circumference of a slot and still prevent a fabric belt from contacting the face of a cover.

Fig. 6A is a section view of the suction box cover of **Fig. 5** taken along lines 6A-6A and illustrates an endless member **30** in greater detail. Each endless member **30** is preferably formed from steel or any other types of material that will accept hard surface coatings. Each member **30** may be formed from solid wear surface materials such as ceramics, stainless steels, nickel alloys, and the like. Preferably, each member **30** has a substantially rectangular cross-section. However, a member **30** can also have other cross-sectional shapes,

such as ovoidal, trapezoidal, round, and the like, although it is preferred that even with these or other alternative shapes, the cross-sectional shape have rounded corners.

Illustratively and preferably, the member **30** includes a coating of wear-resistant material **32**. The coating of wear-resistant material **32** preferably conforms to the upper surface **30a** of the endless member **30**, as illustrated. The wear-resistant material **32** provides a smooth contact surface with no sharp edges for a fabric belt passing thereover. Preferable wear-resistant materials include ceramics such as chrome oxide, aluminum oxide, alumina titania, and the like. Preferably, the coating of wear-resistant material **32** has a thickness of between about 0.07 millimeters (mm) and about 0.254 mm. The wear resistant material **32** may be applied to each endless member **30** via known techniques such as spraying. Polishing may be performed to provide a specified surface finish.

Preferably, each endless member **30** is even with a plane defined by the cover first face **26a**, as illustrated in **Fig. 6A**. According to an alternative embodiment illustrated in **Fig. 6B**, a portion of each endless member **30** may extend above a plane defined by the cover first face **26a.** Each endless member **30** may extend above a plane defined by the cover first face **26a** by an amount between about 0.0 mm and about 0.254 mm. Accordingly, the endless fabric belt **12a** passing thereover primarily contacts the wear-resistant material **32** coating the endless member **30** of each slot

and has little contact with the first face **26a** of the cover **24**. Accordingly, the contact area between the fabric belt **12a** and cover **24** is kept to a minimum, thereby reducing wear on both the fabric belt **12a** and the cover **24**.

Referring now to **Fig. 7**, a plan view of a suction box cover **40** according to another preferred embodiment of the present invention is illustrated. The illustrated cover **40** has first and second opposing faces **40a**, **40b** and a slot **42** formed therethrough with a generally sinuous configuration. The sinuous configuration and advantages thereof are described in U.S. Patent No. 4,909,906 to Bartelmuss et al. and need not be described in detail herein.

As illustrated in the section view of **Fig. 8**, taken along lines 8-8 of **Fig. 7**, members **44a** and **44b** line respective upper edge portions **45a**, **45b** of slot **42** adjacent the cover first face **40a** and extend above a plane defined by the cover first face **40a**. Members **44a**, **44b** are preferably formed from steel and include a coating of wear-resistant material **46a** and **46b**, respectively, as illustrated. A fabric belt **41** passing over the cover **40** is in contact primarily with the wear-resistant material **46a**, **46b** of each respective member **44a**, **44b**.

Those skilled in this art will appreciate that, although the illustrated slot configuration as preferred, covers with other slot configurations, such as slots that are parallel or perpendicular with the direction of fabric travel, may also be suitable for

use with the present invention. As used herein, the term "slots" is intended to encompass openings in the cover that are elongate or nonelongate (such as round, square, pentagonal, and the like).

The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the appended claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

THAT WHICH IS CLAIMED IS:

1. A suction box for dewatering a fabric belt passing thereover, said suction box comprising:

a hollow base member; and

a cover overlying said base member, said hollow base member and cover defining a suction chamber, said cover comprising:

an elongated edge portion transverse to a direction of travel of a fabric belt;

opposing first and second faces;

a plurality of spaced-apart slots extending between said first and second faces and providing fluid communication between said first face and said suction chamber, wherein said slots are angularly disposed within said cover relative to said elongated edge portion; and

an endless member lining an upper edge of each slot on said cover first face, and wherein each endless member comprises a coating of wear-resistant material.

2. A suction box according to Claim 1 wherein each endless member comprises a portion extending above a plane of said cover first face.

3. A suction box according to Claim 1 wherein said cover comprises polymeric material.

4. A suction box according to Claim 1 wherein said slots are arranged in a herringbone configuration.

5. A suction box according to Claim 1 wherein said wear-resistant material comprises ceramic material.

6. A suction box according to Claim 5 wherein said ceramic material is selected from the group consisting of chrome oxide, aluminum oxide, alumina titania, and ceramics.

7. A suction box according to Claim 1 wherein each endless member comprises steel.

8. A suction box for dewatering a fabric belt passing thereover, said suction box comprising:

a hollow base member; and

a cover overlying said base member, said hollow base member and cover defining a suction chamber, said cover comprising:

an elongated edge portion transverse to a direction of travel of a fabric belt;

opposing first and second faces;

a plurality of spaced-apart slots extending between said first and second faces and providing fluid communication between said first face and said suction chamber, wherein said slots are angularly disposed within said cover relative to said elongated

edge portion in a herringbone configuration; and

an endless member lining an upper edge of each slot on said cover first face, and wherein each endless member comprises a portion extending above a plane of said cover first face.

9. A suction box according to Claim 8 wherein each endless member comprises a coating of wear-resistant material.

10. A suction box according to Claim 9 wherein said wear-resistant material comprises ceramic material.

11. A suction box according to Claim 8 wherein said cover comprises polymeric material.

12. A suction box according to Claim 10 wherein said ceramic material is selected from the group consisting of chrome oxide, aluminum oxide, alumina titania, and ceramics.

13. A suction box according to Claim 8 wherein each endless member comprises steel.

14. A fabric belt dewatering method comprising the steps of:

passing a fabric belt over a face of a slotted cover wherein the cover comprises a member

lining an upper edge slot on the cover face, and wherein a portion of each member extends above the cover so as to contact the fabric belt; and

applying negative pressure to the cover to draw water from the fabric belt through the slots.

15. A method according to Claim 14 wherein each member comprises a coating of wear-resistant material.

16. A method according to Claim 14 wherein the cover comprises polymeric material.

17. A method according to Claim 14 wherein the cover comprises a herringbone configuration of slots.

18. A method according to Claim 15 wherein the wear-resistant material comprises ceramic material.

19. A suction box cover for a papermaking machine, said cover comprising:

an elongated plate, comprising:

an elongated edge portion;

opposing first and second faces; and

a plurality of spaced-apart slots extending between said first and second faces, wherein said slots are angularly disposed within said elongated plate relative to said elongated edge portion; and

a plurality of members, each member lining an

upper edge of a respective slot on said elongated plate first face, and wherein each member comprises a coating of wear-resistant material.

20. A suction box cover according to Claim 19 wherein each member comprises a portion extending above a plane defined by said elongated plate first face.

21. A suction box cover according to Claim 19 wherein said elongated plate comprises polymeric material.

22. A suction box cover according to Claim 19 wherein said slots are arranged in a herringbone configuration.

23. A suction box cover according to Claim 19 wherein said wear-resistant material comprises ceramic material.

24. A suction box cover according to Claim 23 wherein said ceramic material is selected from the group consisting of chrome oxide, aluminum oxide, alumina titania, and ceramics.

25. A suction box cover according to Claim 19 wherein each member comprises steel.

26. A suction box cover according to Claim 19 wherein each member comprises an endless

configuration.

27. A suction box for dewatering a fabric belt passing thereover, said suction box comprising:

a hollow base member; and

a cover overlying said base member, said hollow base member and cover defining a suction chamber, said cover comprising:

a first face configured to underlie the fabric belt as the fabric belt travels in a first direction;

at least one slot providing fluid communication between said first face and said suction chamber; and

a member lining an upper edge of said at least one slot on said cover first face, and wherein each member comprises a coating of wear-resistant material.

28. A suction box according to Claim 27 wherein each member comprises a portion extending above a plane of said cover first face.

29. A suction box according to Claim 27 wherein said cover comprises polymeric material.

30. A suction box according to Claim 27 wherein said wear-resistant material comprises ceramic material.

31. A suction box cover for a papermaking machine, said cover comprising:

an elongated plate, comprising:

opposing first and second faces;

at least one slot extending between said first and second faces; and

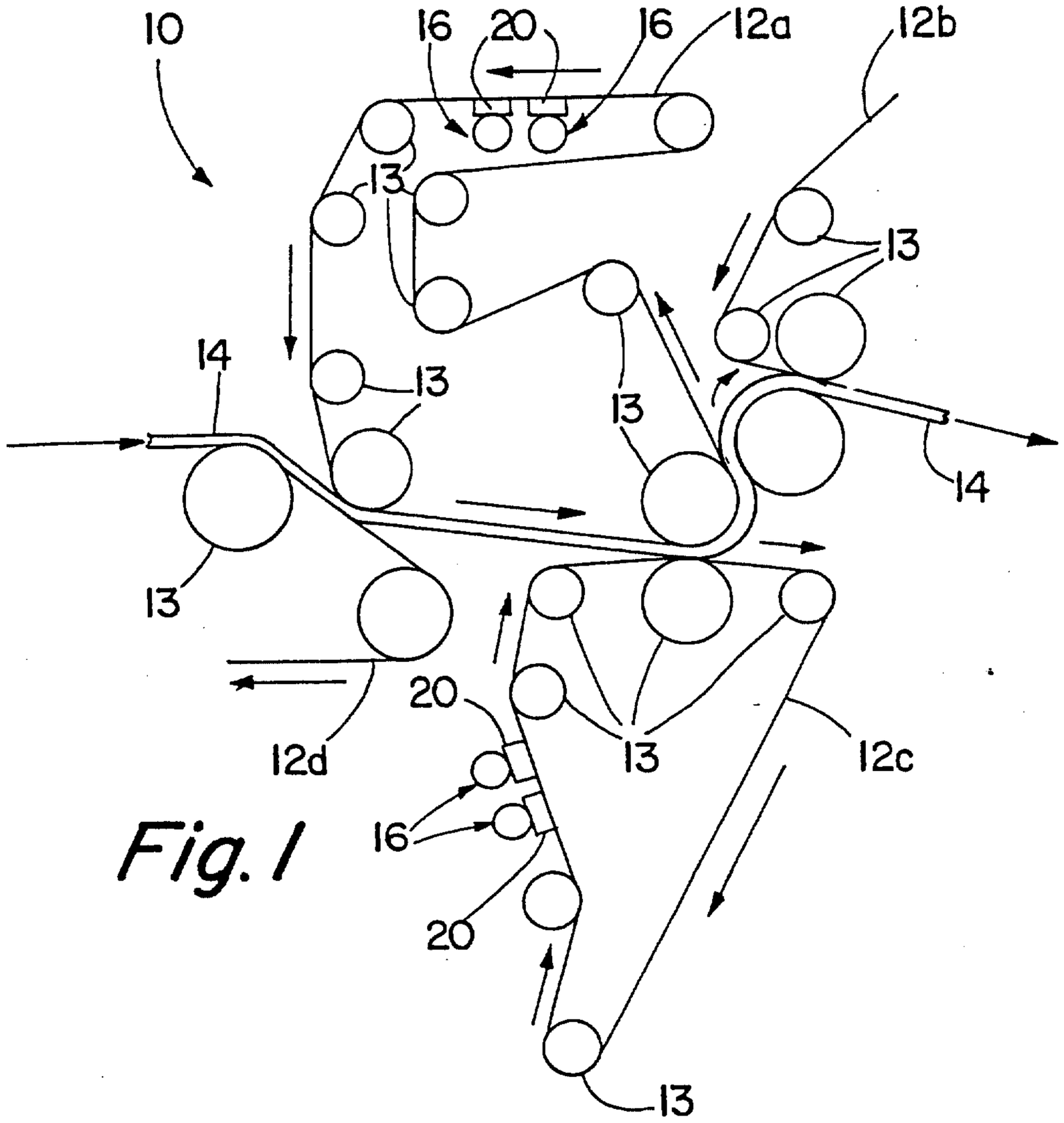
a member lining an upper edge of said at least one slot on said cover first face, and wherein said at least one member comprises a coating of wear-resistant material.

32. A suction box according to Claim 31 wherein each member comprises a portion extending above a plane of said cover first face.

33. A suction box according to Claim 31 wherein said cover comprises polymeric material.

34. A suction box according to Claim 31 wherein said wear-resistant material comprises ceramic material.

35. A suction box according to Claim 31 wherein each member comprises an endless configuration.


10
16
20
16
12a
12b
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12d
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12c
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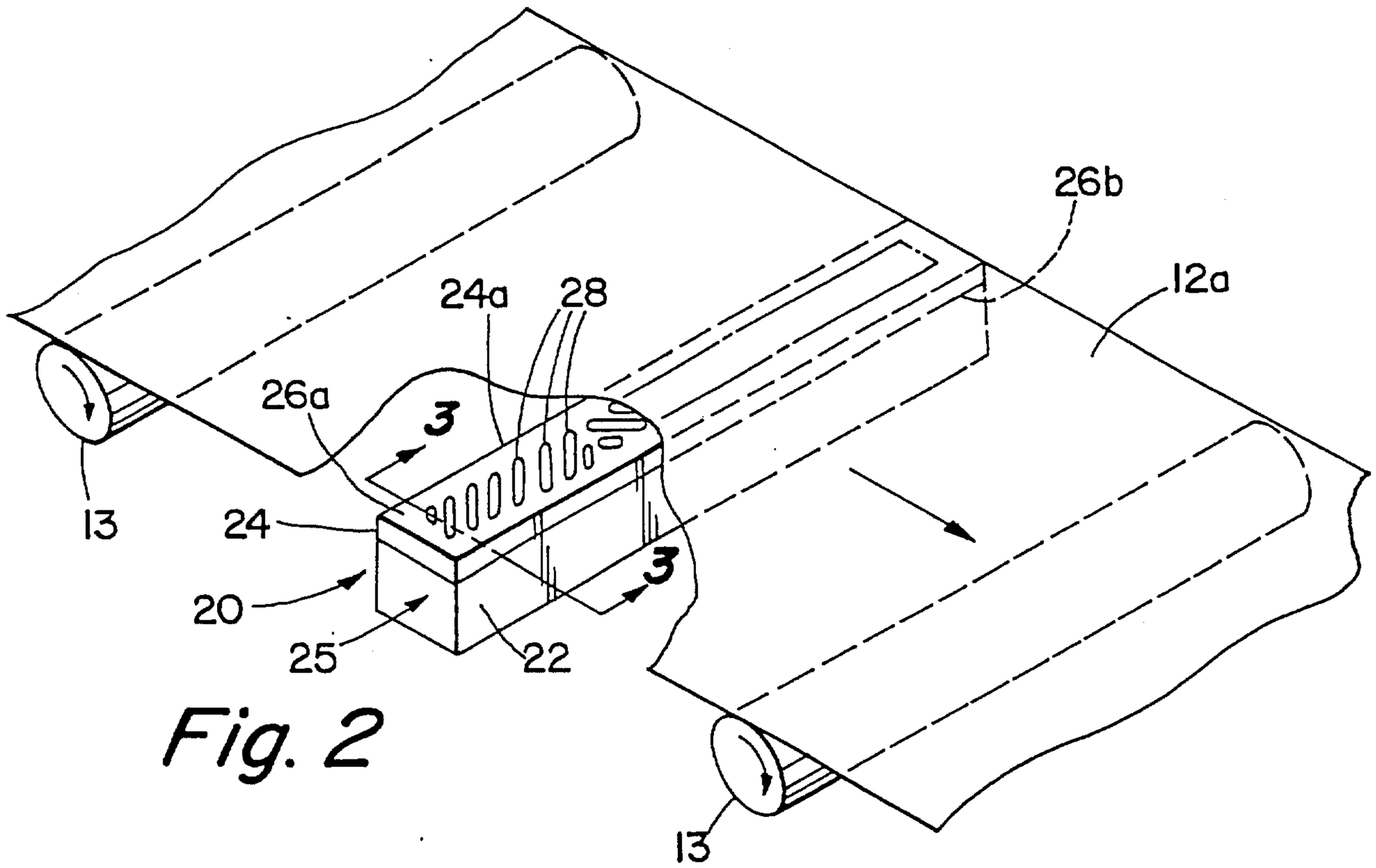
20
13

Fig. 1


26b
12a
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26a
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Fig. 2

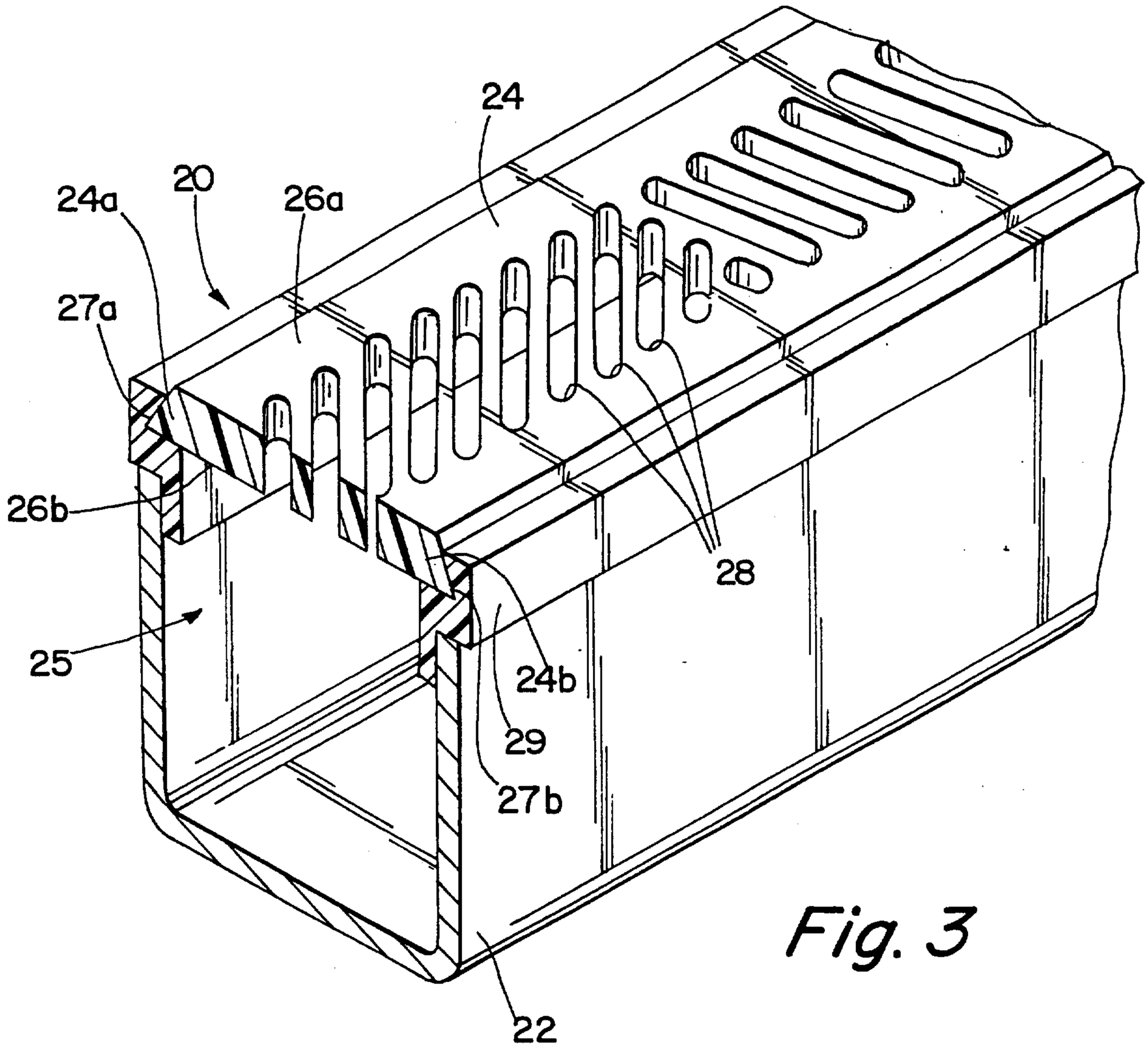

Fig. 3

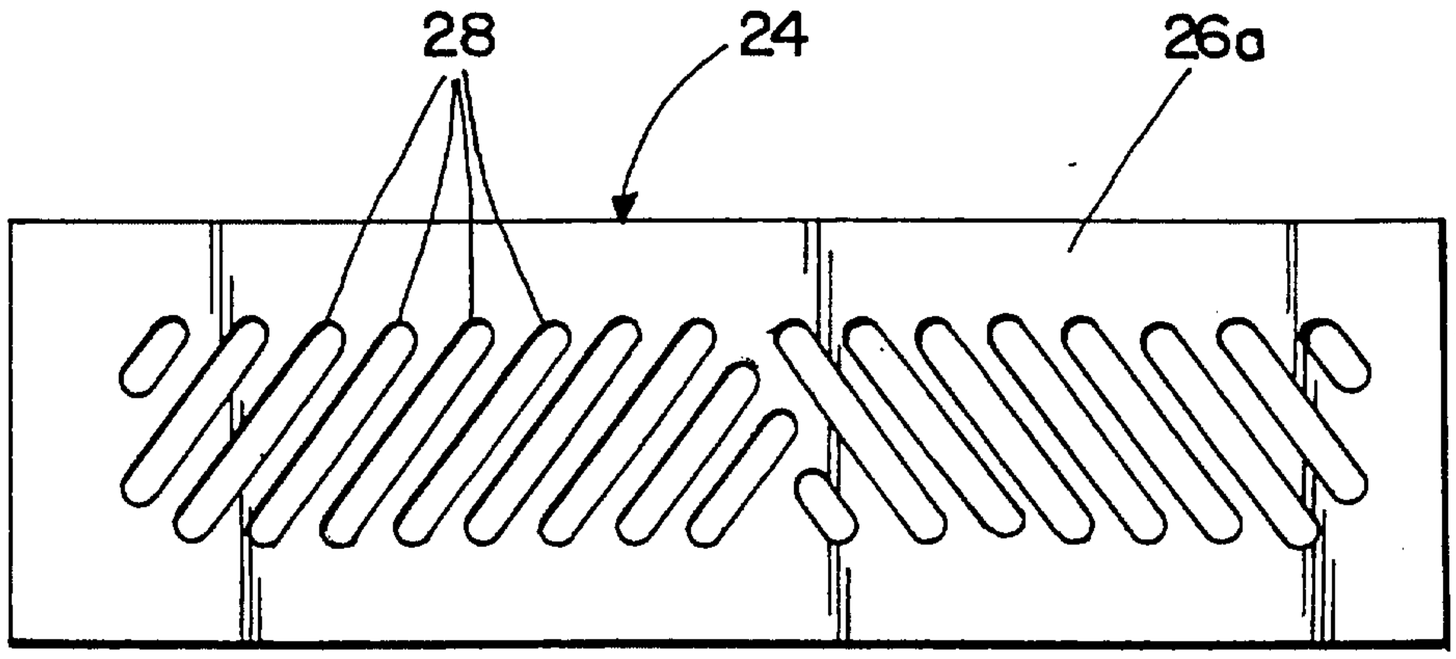

Fig. 4

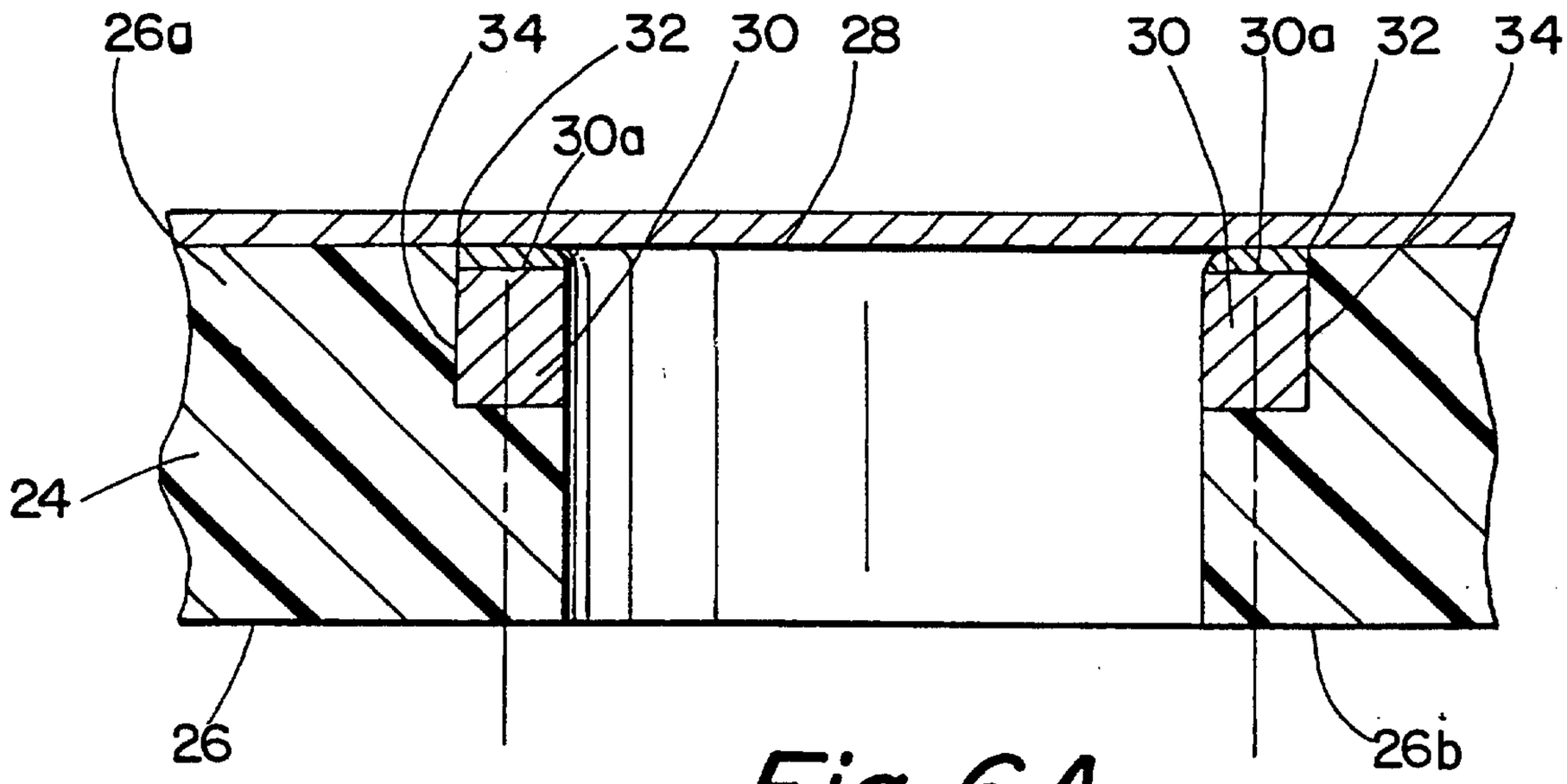

Fig. 6A

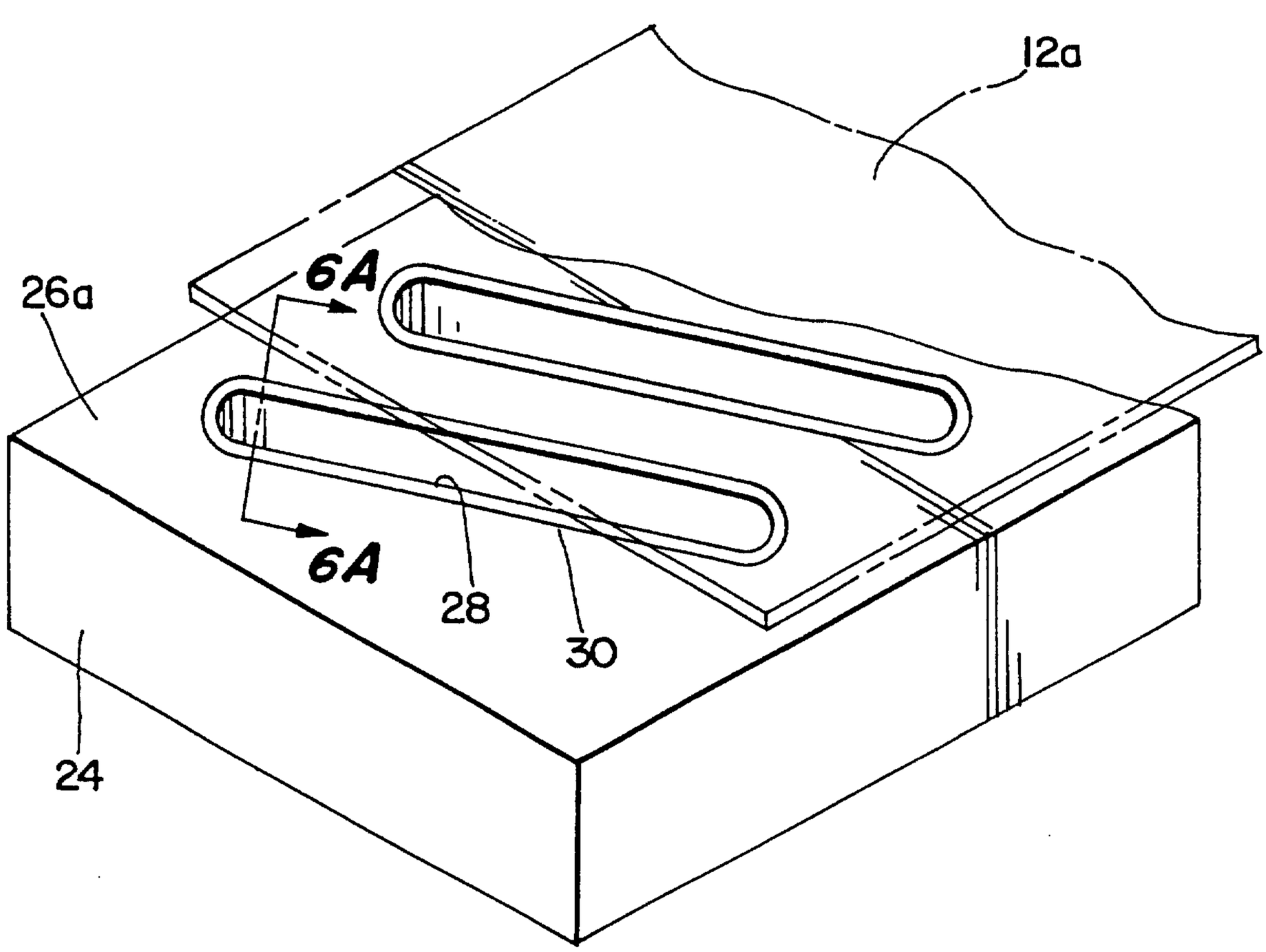

Fig. 5

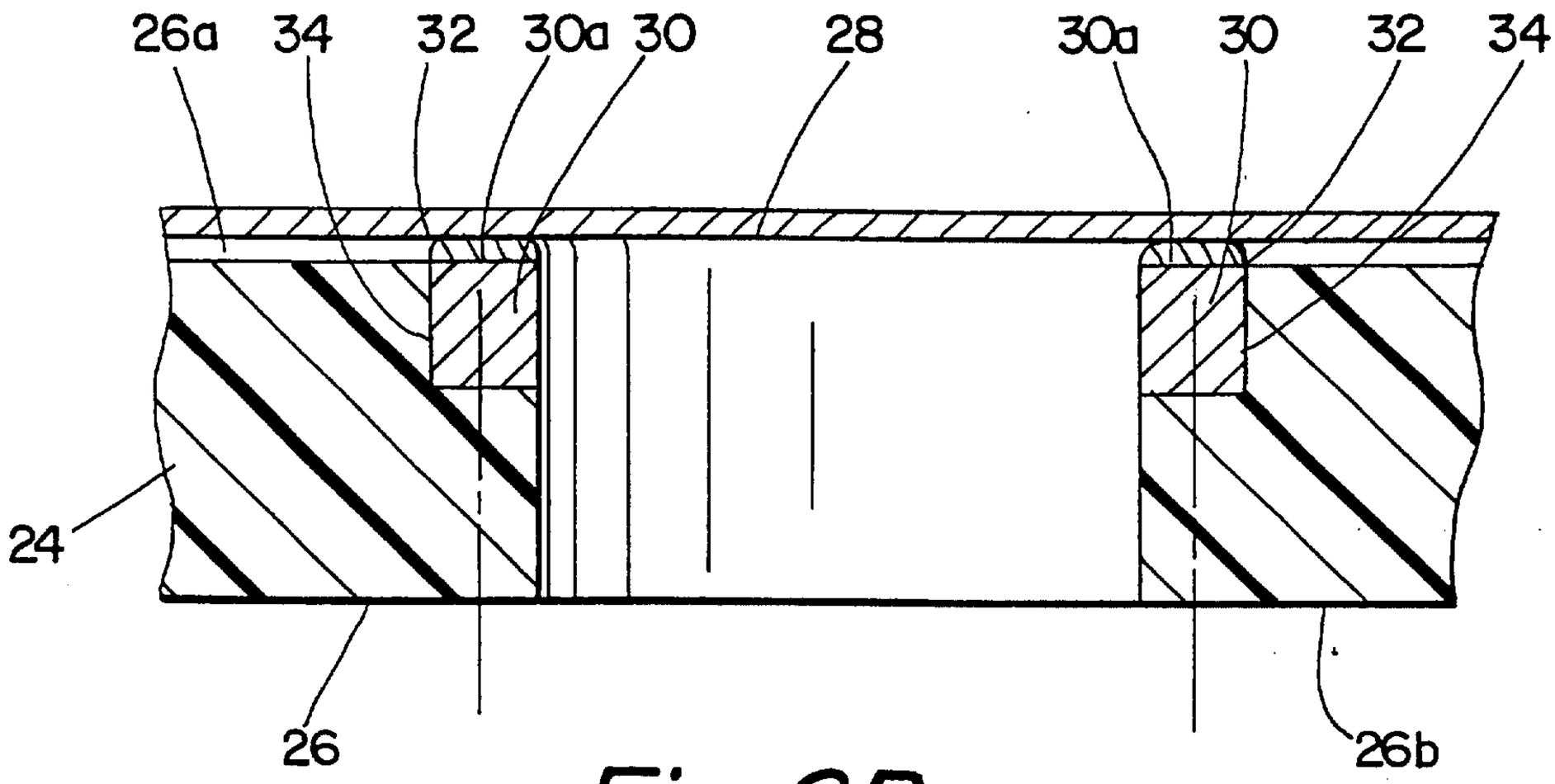

Fig. 6B

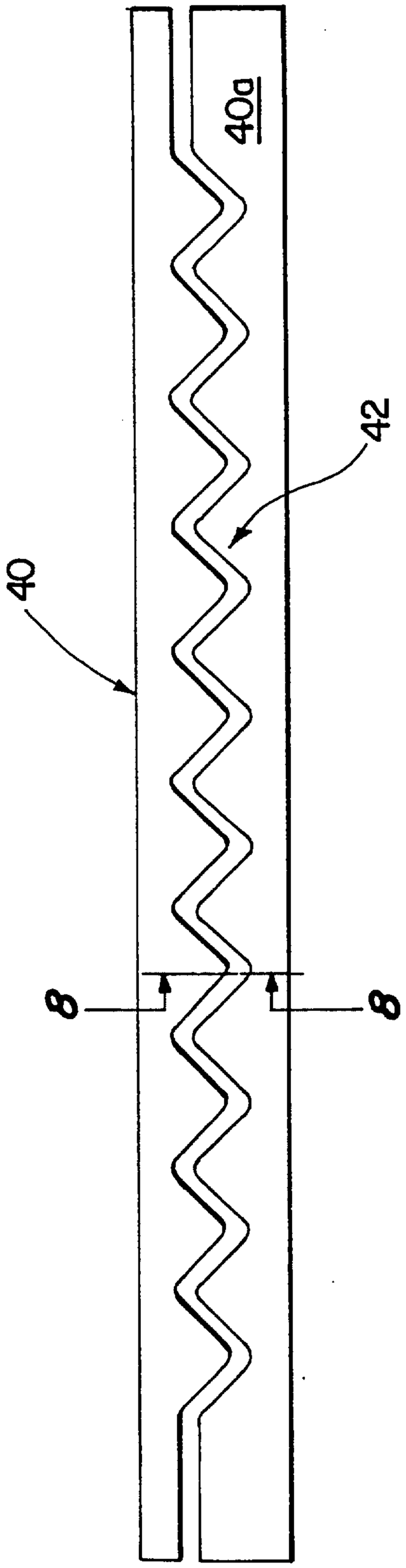

Fig. 7

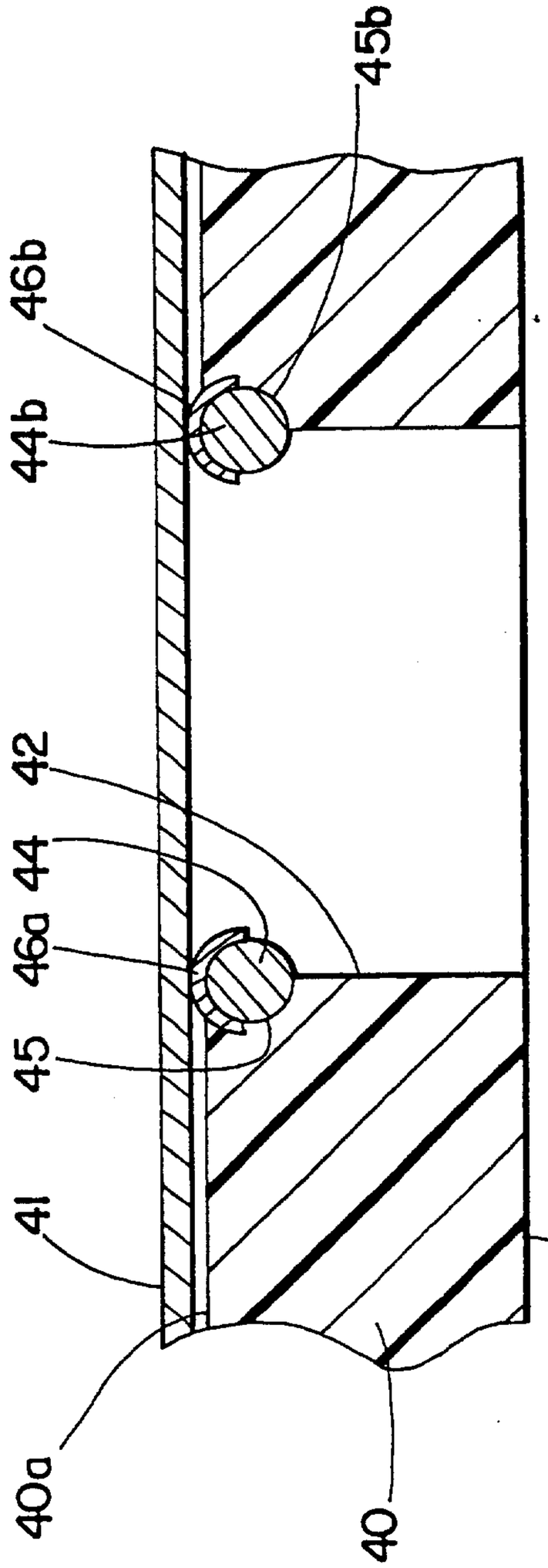

Fig. 8