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(12) (19) (CA) **Brevet-Patent**

(11) (21) (C) **2,054,272**
(22) 1991/10/25
(43) 1993/04/26
(45) 2001/01/02

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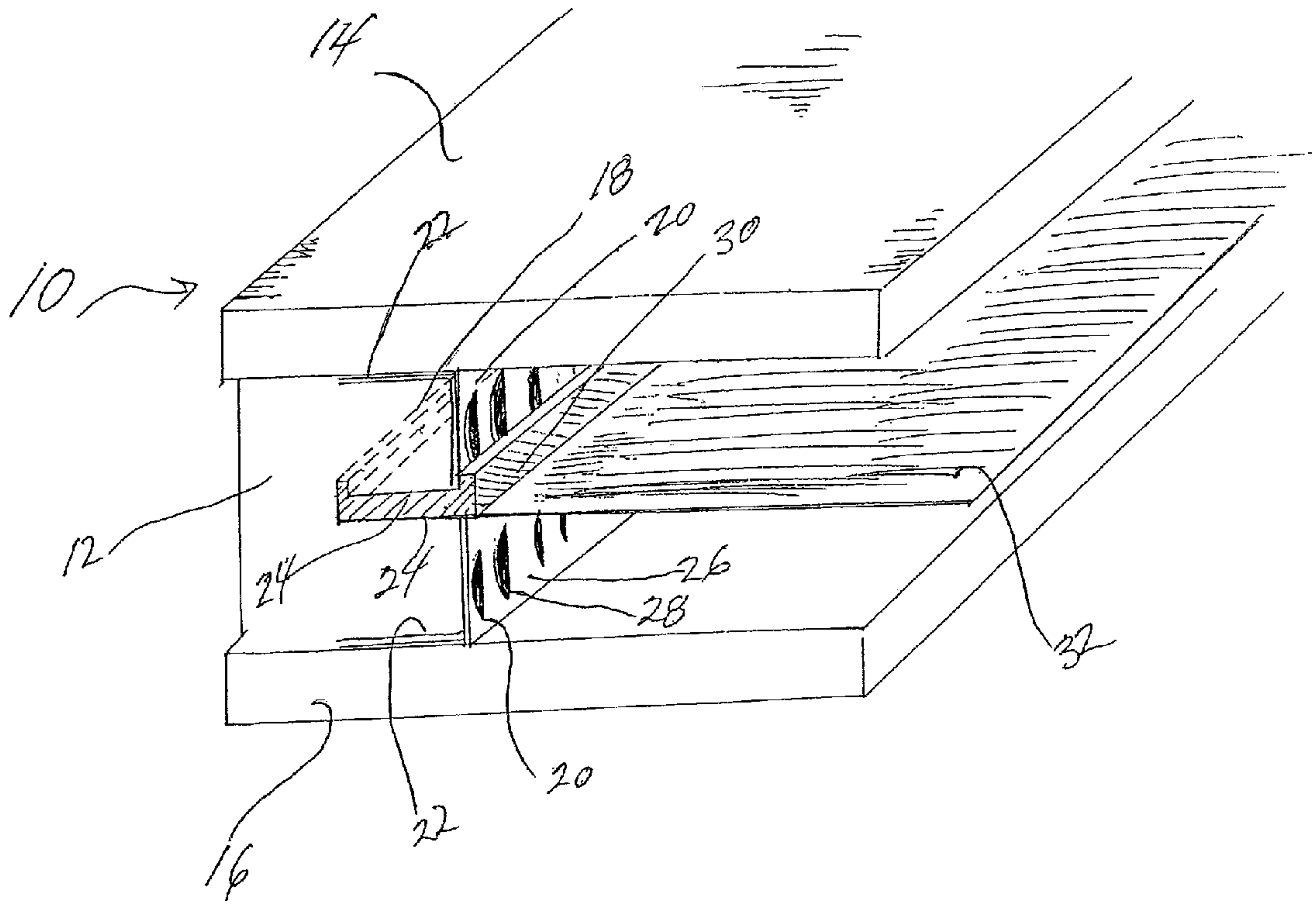
(73) Lafond, Luc, CA

(51) Int.Cl.[6] E06B 3/24, E06B 3/663

(54) **BANDE ISOLANTE POUR ENSEMBLES A CHAMBRE D'AIR SIMPLE OU MULTIPLE ET METHODE CONNEXE**

(54) **INSULATION STRIP AND METHOD FOR SINGLE AND MULTIPLE ATMOSPHERE INSULATING ASSEMBLIES**



(57) There are disclosed spacer elements for use in insulated glass assemblies of the single and multiple atmosphere type which incorporate non-thermally conductive materials as the main structural support member in the assembly. The result is a lightweight, warm edge assembly.

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ABSTRACT OF THE DISCLOSURE

There are disclosed spacer elements for use in insulated glass assemblies of the single and multiple atmosphere type which incorporate non-thermally conductive materials as the main structural support member in the assembly. The result is a lightweight, warm edge assembly.

INSULATION STRIP AND METHOD FOR SINGLE AND MULTIPLE ATMOSPHERE INSULATING ASSEMBLIES

The present invention relates to spacer elements for insulated glass assemblies having a single as well as a divided atmosphere therebetween.

The prior art provides a complete monopoly of insulated glass assemblies, sealant strips and spacer elements and improvements thereto used in insulated glass assemblies.

The modifications and improvements to the strips etc. have all had a common goal, namely, to improve the insulation capacity for such assemblies without sacrificing structural integrity or moisture degradation of the assembly.

Although the art is replete with such assemblies, etc., it fails to provide an insulating sealant strip which provides:

I) warm edge technology;
II) non-ultraviolet degradable material; or
III) elastic deformation between the glass lites.

Typical of the art in the field of the present invention includes U.S. 4,576,841. This patent discloses the use of an aluminum foil into which is positioned desiccant material. Such an arrangement has two inherent limitations, namely:

i) aluminum is a thermal conductor which results in thermal transmission and thus obvious energy expenditures and

ii) since the tube is solid, elastic recovery from the compression of glass lites engaged with the same is negligible.

Further, U.S. 4,113,905 discloses a composite foam spacer comprising an extruded tubular profile having an outer coating of foam material thereon. The spacer further includes projecting edges which project laterally relative to the longitudinal axis of the spacer. Although a useful arrangement, the spacer does not facilitate compression dampening and, if the spacer were compressed, this would result in unnatural force dispersion due to the projecting edges which may lead to breakage of the substrates. Further, if compressed, the spacer element may disrupt sealant material associated therewith thus leading to an ineffective seal.

Mucaria, in U.S. Patent No. 4,368,226 provides a glass assembly in which there is included aluminum spacers. As such, the arrangement is limited similar to U.S. 4.576,841 as discussed herein previously.

Further prior art in the field of the present invention includes United States Patent Nos. 4,536,424; 4,822,649; 4,952,430; 4,476,169; 4,500,572; and Canadian Patent Nos. 884,186; 861,839; and 1,008,307.

Thus, having regard to the prior art arrangements, there exists a need for a sealant strip which provides a partitioned atmosphere, high insulation value and hygroscopic capabilities without creating an unnecessarily complicated arrangement. The present invention fulfils this need by providing, according to one aspect of the present invention, an insulated glass spacer element comprising: a pair of spaced apart substrate engaging members each having a top and bottom surface; a base extending between and connected to each bottom surface of each of the substrate engaging members; and a diagonal support member extending between the substrate engaging member and connected to the top surface of one of the substrate engaging members.

The spacer element is preferably fabricated from a resiliently deformable material to allow flexure by the same.

In a preferred form, the support member extends diagonally between the substrate engaging surfaces. Applicant has found that such an arrangement is well suited to dampening compression between substrates engaged therewith in an insulated glass assembly and accordingly, it is a further feature of the present invention, that there is provided an insulated glass assembly comprising: a pair of glass lites; an elastically deformable tubular body having a first substrate engaging member associated therewith; a second substrate engaging member spaced from the first substrate engaging surface, the second substrate engaging surface being operatively associated with the body and extending tangentially therefrom, whereby when a glass lite is engaged with the first substrate engaging member and the second substrate engaging member, the second substrate engaging member facilitates limited resilient compression of the assembly.

In a further aspect of the present invention, there is provided a method of assembling an insulated glass assembly comprising the steps of: providing a pair of glass lites; providing an elastically deformable body having a first substrate engaging surface associated therewith; a second substrate engaging surface extending tangentially therefrom; and a diagonal support member extending between the first and second substrate engaging surfaces engaging a glass lite with each substrate engaging surface.

The spacer element according to a further embodiment of the present invention may be used in combination with a similar spacer element to provide a multiple atmosphere insulated assembly. Such an arrangement is extremely useful for dual insulated window assemblies used in highrises. Previously, aluminum extruded bodies not providing warm edge technology had to be used for such an application. Thus, according to a further aspect of the present invention, there is provided an insulated glass assembly having opposed substrates with an atmosphere therebetween and sheet material extending between the opposed substrates comprising: a pair of glass lites; a sheet of flexible material; a pair of insulating spacer members, each of the spacer members having a sheet engaging member for engaging the sheet material; a substrate engaging member, each of the substrate engaging member and the sheet engaging member having an upper and lower edge, a base extending between and connected to each the upper edge of each the substrate engaging member and the sheet engaging member; a diagonal support member extending between the engaging surfaces and connected to the lower edge of the substrate engaging surface whereby when the substrates are engaged with the substrate engaging surfaces of each of the spacer members and the engaging surface of each of the spacer members is in facing relation, the sheet material extends within the atmosphere spaced from the opposed substrates; whereby when the substrates are engaged with the substrate engaging surfaces the sheet material extends within the atmosphere spaced from each of the substrates engaged with the insulating bodies.

In applications where compressive forces are not so extreme, a further embodiment of the present invention is provided which comprises a support member for supporting and spacing opposed substrates in a window construction comprising: a self-supporting elastically deformable body having a pair of opposed and spaced apart arms each adapted to engage one of the substrates, the arms extending outwardly from the body at either end thereof, the body having a width sufficient to space the opposed substrates apart from one another; and desiccant receiving means associated with the main body and adapted to receive desiccant material therein.

The support member has been found to be particularly useful in insulated glass assemblies since the deformable body facilitates resilient compression absorption which conventional metal spacers impart forces applied thereto to the substrate often resulting in fracture of the substrate and/or seal disruption. Thus, according to another aspect of a further embodiment of the present invention, there is provided an insulated glass assembly comprising:

a pair of glass lites;

a self-supporting elastically deformable body having a pair of opposed and spaced apart arms each adapted to engage one of the substrates, said arms extending outwardly from the body at either end thereof, the body having a width sufficient to space the opposed substrates apart from one another; and

desiccant receiving means associated with the main body and adapted to receive desiccant material therein.

Having thus generally described the invention, reference will now be made to the accompanying drawings, illustrating preferred embodiments and, in which:

Figure 1 is a perspective view of the present invention in situ between a pair of opposed substrates;

Figure 2 is a side view of Figure 1;

Figure 3 is a perspective view of a spacer member according to a further embodiment of the present invention;

Figure 4 is a side view of Figure 3;

Figure 5 is a perspective view of yet another embodiment of a spacer member according to the present invention;

Figure 6 is a perspective view of the spacer member of Figure 5 in situ between a pair of opposed substrates; and

Figure 7 is a side view of a further embodiment of the present invention.

Referring now to Figure 1, the assembly generally represented by numeral 10, includes an adhesive backfill material 12 extending between a pair of opposed substrates 14 and 16 and continuously along the periphery thereof. The backfill 12 may be any suitable material known to those skilled in the art e.g. polysilicone, polyurethane, hot melt, butyl polymers, etc.,

The interior atmosphere of the assembly 10 contacts a face 18 of the material 12. Overlying the face 18 are a pair of spacer members 20. Each of the spacer members 20 comprises an elastically deformable body of insulating material.

Applicant has found that the use of the polyethylene terephthalate class of polymers as well as the polyvinyl halide polymers provide these properties and are extremely useful for highly efficient insulated glass assemblies. The spacer members 20 each include a pair of spaced apart arms 22, 24 with arms 22 of each adapted for adhesive engagement with a respective substrate 14 or 16; suitable materials known to those skilled in the art may be employed to achieve the adhesion.

A base 26 associated with each spacer 20 extends between and is connected to each of the arms 22, 24. The base 26 in one form, includes desiccant receiving means in the form of spaced apart and individual indentations 28 adapted to receive desiccant material therein. In an alternative form, the desiccant material may be associated with a layer of material, e.g. Tedlar™, overlying a planar form of base 26.

Arms 24 of each spacer member 20 extend within face 18 of the backfill material 12 for securement therein.

Extending between the spacer members 20 and more specifically adjacent arms 24 thereof, is a reinforcing member 30, as illustrated in Figure 1. The member 30 retains an insulating sheet extending between and spaced from each substrate 14 and 16 (disc used hereinafter). The reinforcing member 30 preferably comprises a rigid U-shaped member, which is partially embedded within the backfill material 12. The reinforcing member 30 includes, engaged therewith, a sheet of film 32. The film 32 divides the atmosphere between the substrates 14 and 16 into separate air spaces such as is known dual seal insulated glass units. The film 32 may comprise any of the known materials employed by those skilled in the art e.g. vinylidene polymers, PVC, polyethylene, terephthalate, etc. Where ultraviolet exposure is a concern, the sheet may comprise a suitable UV screening material e.g. Tedlar™. The use of an elastically deformable material for the spacer members incorporating desiccant material receiving means is particularly advantageous since these materials are capable of resilient compression and provide a warm edge assembly.

In a conventional arrangement, metal materials are chiefly employed for spacers and accordingly, do not permit any compression or provide a warm edge and thus have obvious negative energy ramifications. When plastic spacers are used, they provide an essentially tubular body which, when compressed, laterally buckles. The result of buckling causes the seal between the substrate to spacer interface to become disrupted hence causing the arrangement to be useless in terms of energy conservation and for the prevention of moisture penetration.

The spacer 20, according to the present invention, permits compression of the body and facilitates flexure pressure at the arm to substrate interface. Accordingly, previously known limitations are traversed with the spacer of the present invention.

Although illustrated in a dual air space or atmosphere arrangement in Figures 1 and 2, the spacer 20 shown more clearly in Figures 3 and 4, may be readily employed in single atmosphere arrangements. As discussed herein previously, the base 26 can include indentations 28 for receiving desiccant material. The indentations 28 may be stamped into the base 26 using any suitable procedure and will vary in size and depth depending on the particular application in which the spacer 20 is to be used.

Suitable desiccant material may be selected from, for example, zeolites, silica gel, calcium chloride, alumina etc. The material selected may be loose or dispersed in a permeable matrix. In the case of loose desiccant, a strip of material, e.g. Tedlar™, (not shown), may overlie the indentations 28.

Turning now to Figures 5 and 6, shown is a further embodiment of the present invention in which similar numerals denote similar components from the previous embodiments.

Figure 6 illustrates a perspective view of a spacer member, generally indicated by numeral 40, comprising a body resiliently compressible material such as those discussed herein previously.

The spacer 40, as illustrated in Figure 6, includes a base 42 extending between and connected to substrate engaging members 44 and 46. The members 44 and 46 project from the base 42. Extending diagonally between the members 44 and 46 is a support member which is pivotally connected at one end to one of the engaging members 44 and 46, shown in the illustrated example as member 48. The other end of the support member 48 is free and is adjacent substrate engaging member 46.

The spacer 40, according to this embodiment, may be fixed between a pair of opposed substrates 14 and 16 as illustrated in Figure 7, by providing a butyl material e.g. polyisobutylene between each substrate and a respective engaging member 44 or 46 or may be adhered thereto using other suitable materials or methods.

The structure of the spacer 40 of this embodiment is particularly efficient for compression damping to thus prevent seal disruption and/or substrate fracture. The support member 48, being diagonally disposed between the substrate engaging members 44 and 46, is useful for this purpose. Upon compression of the substrates 14 and 16, the engaging members 44 and 46 flex somewhat towards one another which, in turn, results in the support member moving into abutting contact with the corner formed between member 46 and the base 42. As such, the support 48 prevents disruptive or damaging compression.

The spacer 40 may be extruded in the form illustrated in the drawings, or may be formed from an elongated length of the materials described herein previously.

Further, the support member 48 as disposed between the members 44 and 46 provides longitudinal tubular opening into which may be charged desiccant butyl material, silicone etc.

Figure 7 illustrates yet a further embodiment of the invention in which the spacer 40 is in opposition with a similar spacer for a dual atmosphere assembly. In this arrangement, substrate engaging members 46 of each of the spacer 40 each function as sheet engaging members for maintaining the sheet material 32 taut between the substrates 14 and 16. Suitable adhesives or butyl material may be positioned between the facing engaging members 46 for securing the same and sheet material together. Similar to the embodiment of Figure 6, suitable adhesive materials will be provided for engaging members 44 for sealing engagement with substrates 14 and 16.

A bead 50 of butyl material can be positioned adjacent the free end of the support member 48 of each spacer 40 to maintain the same and adjacent with the corner formed by the base 42 and substrate engaging member 44.

Due to the disposition of the support member 48 in the spacer 40, a tubular form 52 is created which may receive desiccant material therein.

In an alternate form, the base 42 may include desiccant receiving means such as that illustrated in the embodiment of Figure 3.

Further, although the embodiment illustrated in Figure 7 comprises two separate spacers 40, it will be appreciated by those skilled in the art that the two may be coextruded as a single piece in which provision would be made to allow reception of the sheet material 32 therebetween.

As those skilled in the art will realize, these preferred illustrated details can be subjected to substantial variation, without affecting the function of the illustrated embodiments. Although embodiments of the invention have been described above, it is not limited thereto and it will be apparent to those skilled in the art that numerous modifications form part of the present invention insofar as they do not depart from the spirit, nature and scope of the claimed and described invention.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An insulated glass spacer element comprising:

a pair of spaced apart substrate engaging members each having a top and bottom edge;

a base extending between and connected to each bottom edge of each of said substrate engaging members; and

a diagonal support member extending between said substrate engaging members and connected to said top edge of a first of said substrate engaging members and extending through said spacer element adjacent a bottom edge of a second of said substrate engaging members.

2. The spacer element as defined in claim 1, wherein said spacer comprises a resilient material.

3. The spacer element as defined in claim 2, wherein said material is an elastically deformable material.

4. The spacer element as defined in claim 1, wherein said support member is pivotally connected to said top surface.

5. The spacer element as defined in claim 4, wherein said support member includes a free end.

6. The spacer element as defined in claim 1, wherein each of said substrate engaging members intersect with said base to each form a corner therewith.

7. The spacer element as defined in claim 6, wherein said support member has a free end, and wherein, when said spacer member is compressed, said free end abuts said corner formed by the intersection of one of said substrate engaging members with said base.

8. The spacer element as defined in claim 1, wherein said support member is integral with said top edge.

9. The spacer element as defined in claim 1, wherein said support member is unitary.

10. The spacer element as defined in claim 1, wherein said spacer is continuous.

11. The spacer element as defined in claim 1, wherein said base includes desiccant receiving means.

12. The spacer element as defined in claim 11, wherein said desiccant receiving means comprises indentations formed within a top edge of said base.

13. The spacer element as defined in claim 3, wherein said material comprises a polyethylene terephthalate.

14. An insulated glass assembly comprising:

a pair of glass lites;

an elastically deformable tubular body having a first substrate engaging member associated therewith;

a second substrate engaging member spaced from said first substrate engaging member, said second substrate engaging member being operatively associated with said body and extending tangentially therefrom; and

a support member extending diagonally between said first substrate engaging member and said second substrate engaging member, said support member connected at one end to said second substrate engaging member and having a free end adjacent said first substrate engaging member;

whereby when a glass lite is engaged with said first substrate engaging member and said second substrate engaging member, said second substrate engaging member facilitates limited resilient compression of said assembly.

15. The assembly as defined in claim 14, wherein each said substrate engaging member is pivotally connected to said body.

16. The assembly as defined in claim 14, wherein each said first and second substrate engaging member includes a top and bottom surface.

17. The assembly as defined in claim 16, wherein said support member is pivotally connected to said top surface of said second substrate engaging member.

18. The assembly as defined in claim 16, wherein a base extends between and is connected with each bottom surface of each said substrate engaging member.

19. The assembly as defined in claim 18, wherein each said substrate engaging member intersects with said base to each form a corner therewith.

20. The assembly as defined in claim 19, wherein said free end of said support member, when said spacer member is compressed, abuts said corner formed by the intersection of said first substrate engaging member with said base.

21. The assembly as defined in claim 14, wherein said tubular body is unitary.

22. The assembly as defined in claim 14, wherein said body includes desiccant material therein.

23. A method of assembling an insulated glass assembly comprising the steps of:

providing a pair of glass lites;

providing an elastically deformable body having a first substrate engaging surface associated therewith, a second substrate engaging surface extending tangentially therefrom and a diagonal support means extending between said first and second substrate engaging surfaces, said support means connected, at one end to said first substrate engaging surface, the other end being adjacent said second substrate engaging surface; and

engaging a glass lite with each said substrate engaging surface.

24. The method as defined in claim 23, further including the step of disposing adhesive means on said first and second substrate engaging surfaces.

25. The method as defined in claim 23, further including the step of providing desiccant means.

26. The method as defined in claim 25, further including the step of positioning said desiccant means in operative association with said body.

27. The method as defined in claim 23, further including the step of utilizing a body having an ultraviolet radiation screening material associated therewith.

28. An insulated glass assembly having opposed substrates with an atmosphere therebetween and sheet material extending between said opposed substrates comprising:

a pair of glass lites;

a sheet of flexible material;

a pair of insulating spacer members, each of said spacer members having a sheet engaging member for engaging said sheet material;

a substrate engaging member, each said substrate engaging member and said sheet engaging member having an upper and lower edge, a base extending between and connected to each said upper edge of said substrate engaging member and said sheet engaging member;

a diagonal support member extending between the engaging surfaces and connected to said lower edge of said substrate engaging surface whereby when said substrates are engaged with said substrate engaging surfaces of each of said spacer members and said engaging surface of each said spacer members and said engaging surfaces of each of said spacer members is in facing relation, said sheet material extends within said atmosphere spaced from said opposed substrates;

whereby when said substrates are engaged with said substrate engaging surfaces said sheet material extends within said atmosphere spaced from each of said substrates engaged with said insulating bodies.

29. The assembly as defined in claim 28, wherein each of said spacer members comprises an elastically deformable material.

30. The assembly as defined in claim 28, wherein said support member extends between said substrate engaging member and said sheet engaging member.

31. A method of assembling an insulated glass assembly comprising the steps of:

providing a pair of glass lites;

providing an elastically deformable body having a pair of opposed and spaced apart arms each for engaging a glass lite and a diagonal support means extending between said spaced apart arms, said diagonal support connected at one end to one of said spaced apart arms, the other end of said support being adjacent said other of said spaced apart arms; and

engaging a glass lite with each arm of said pair of arms.

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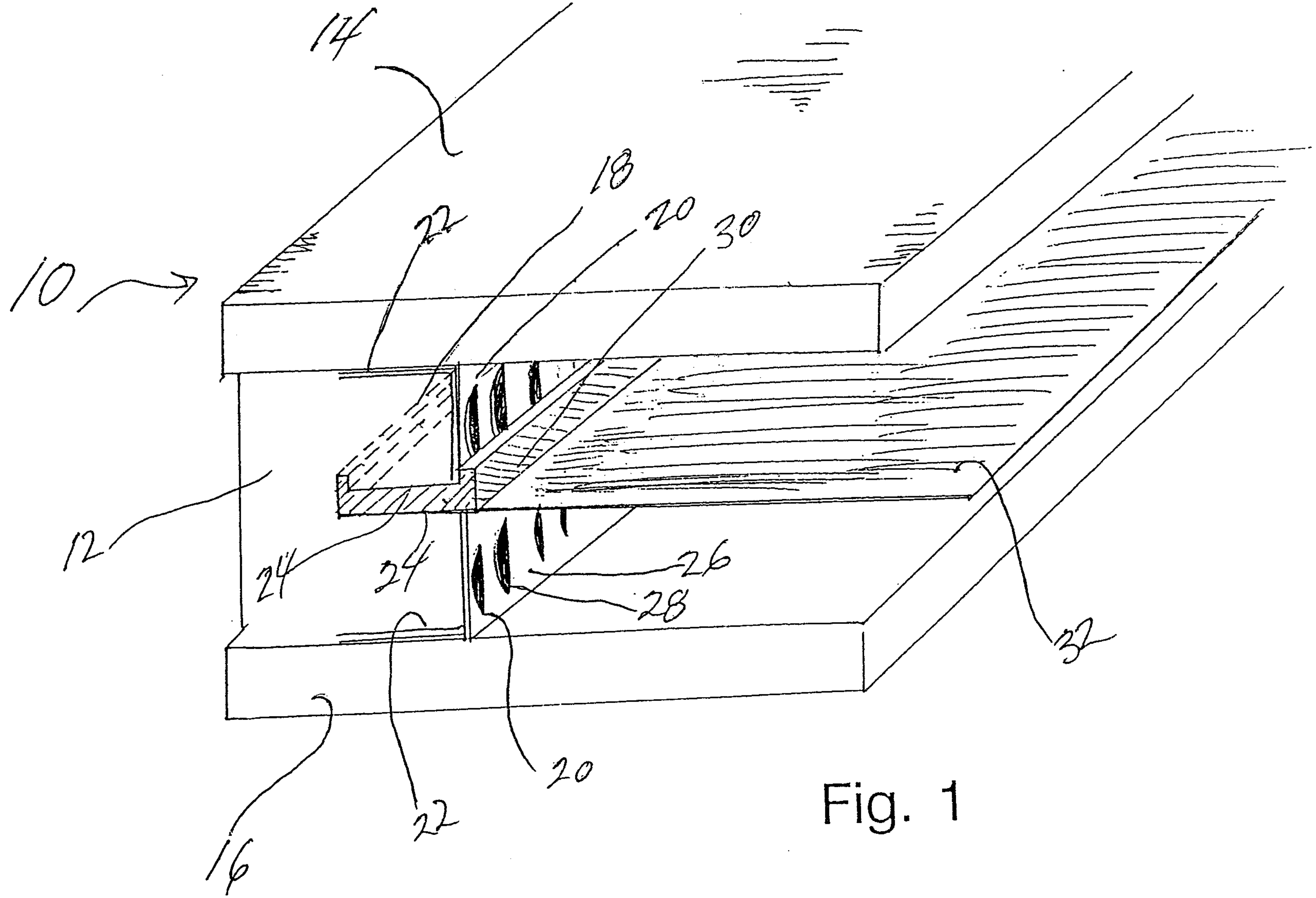


Fig. 1

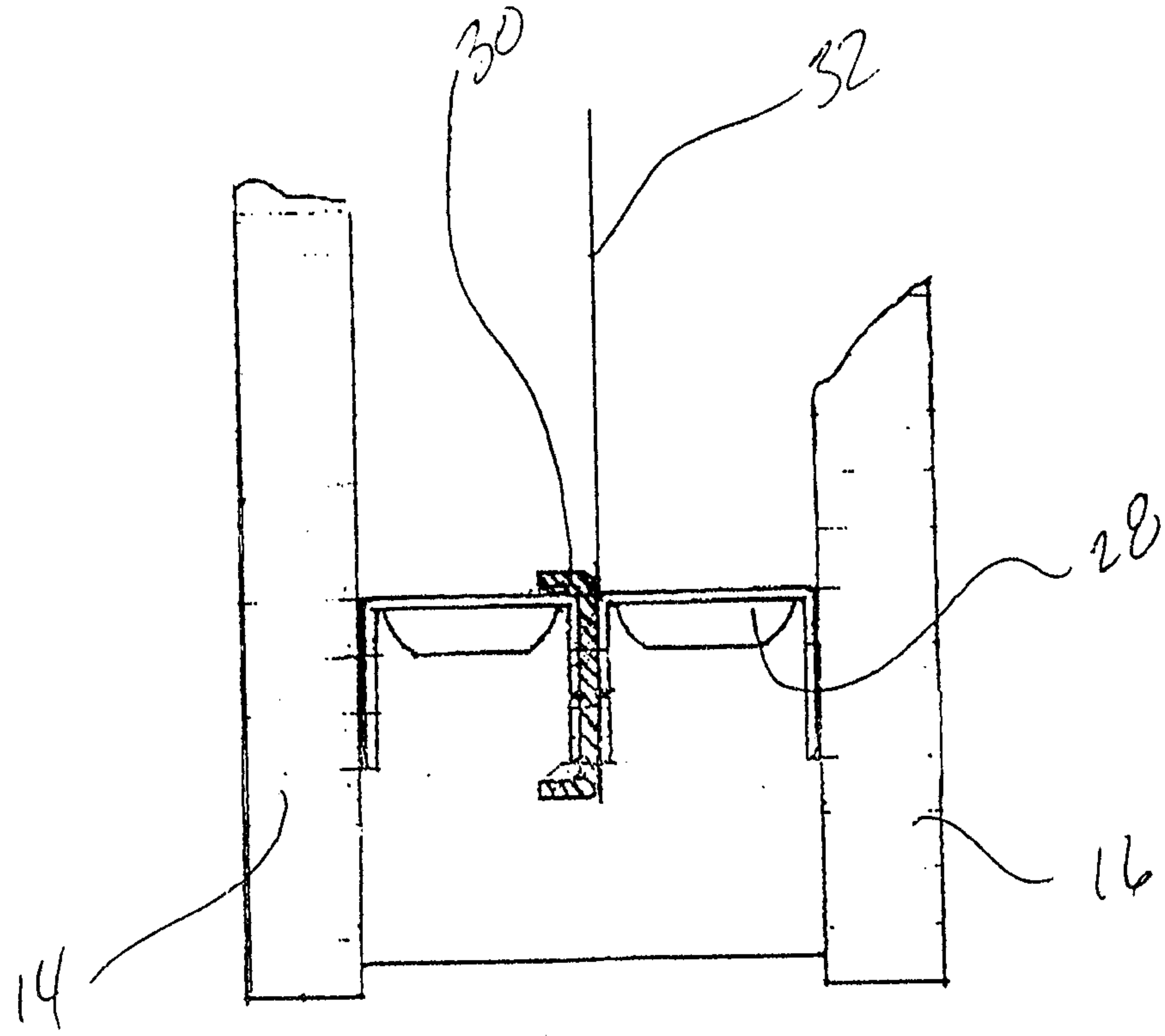
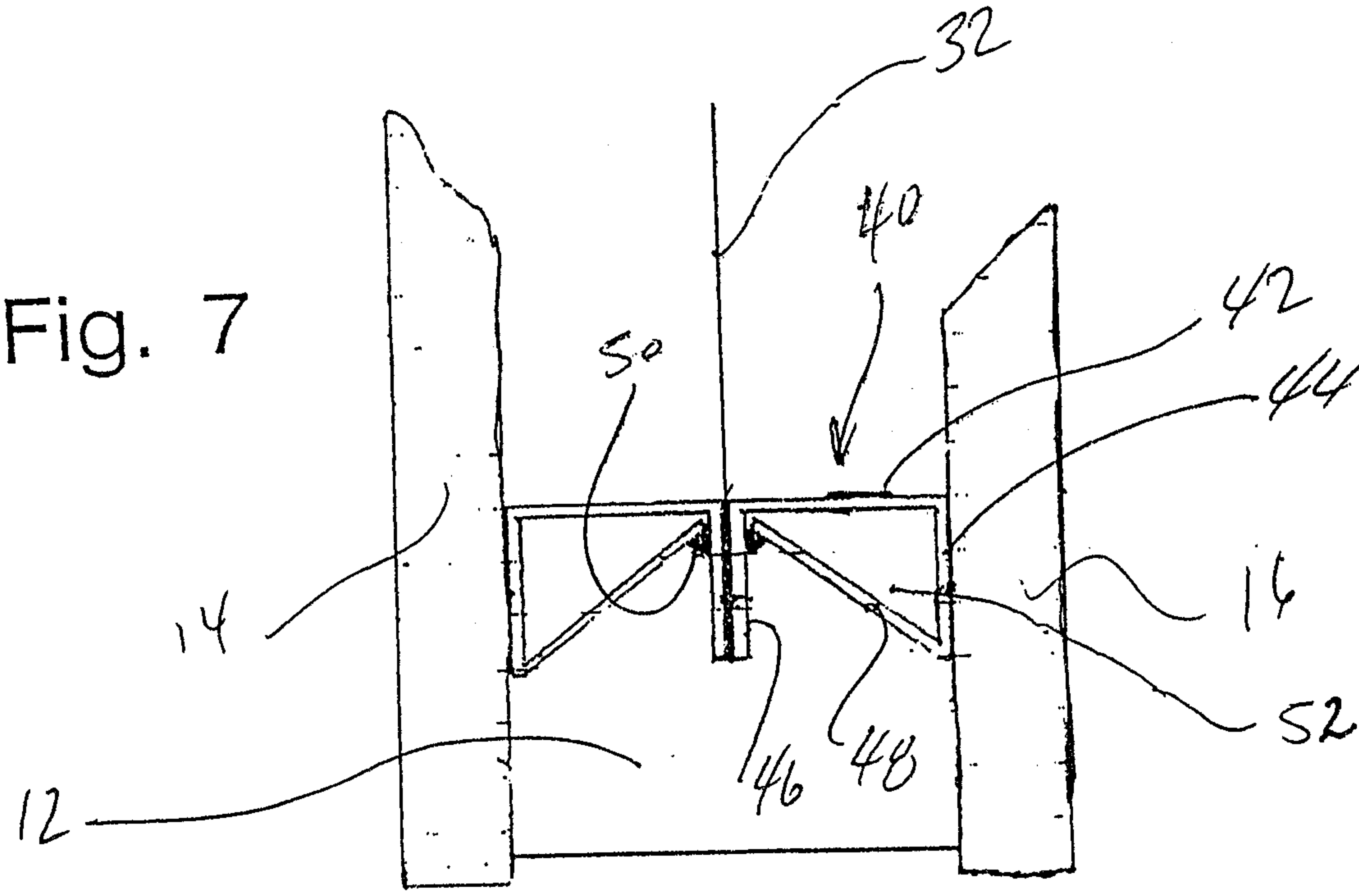


Fig. 2

Fig. 7



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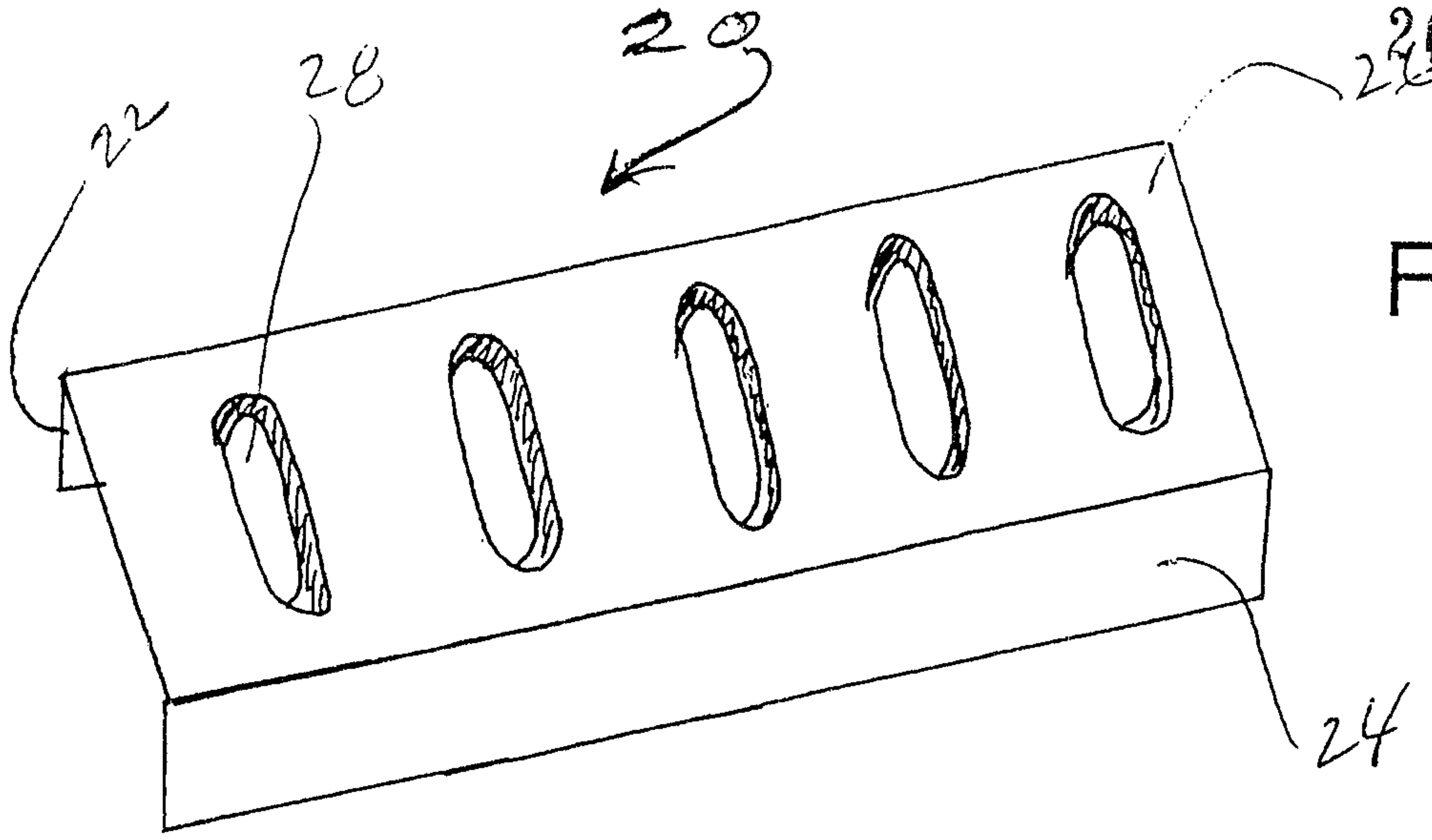


Fig. 3

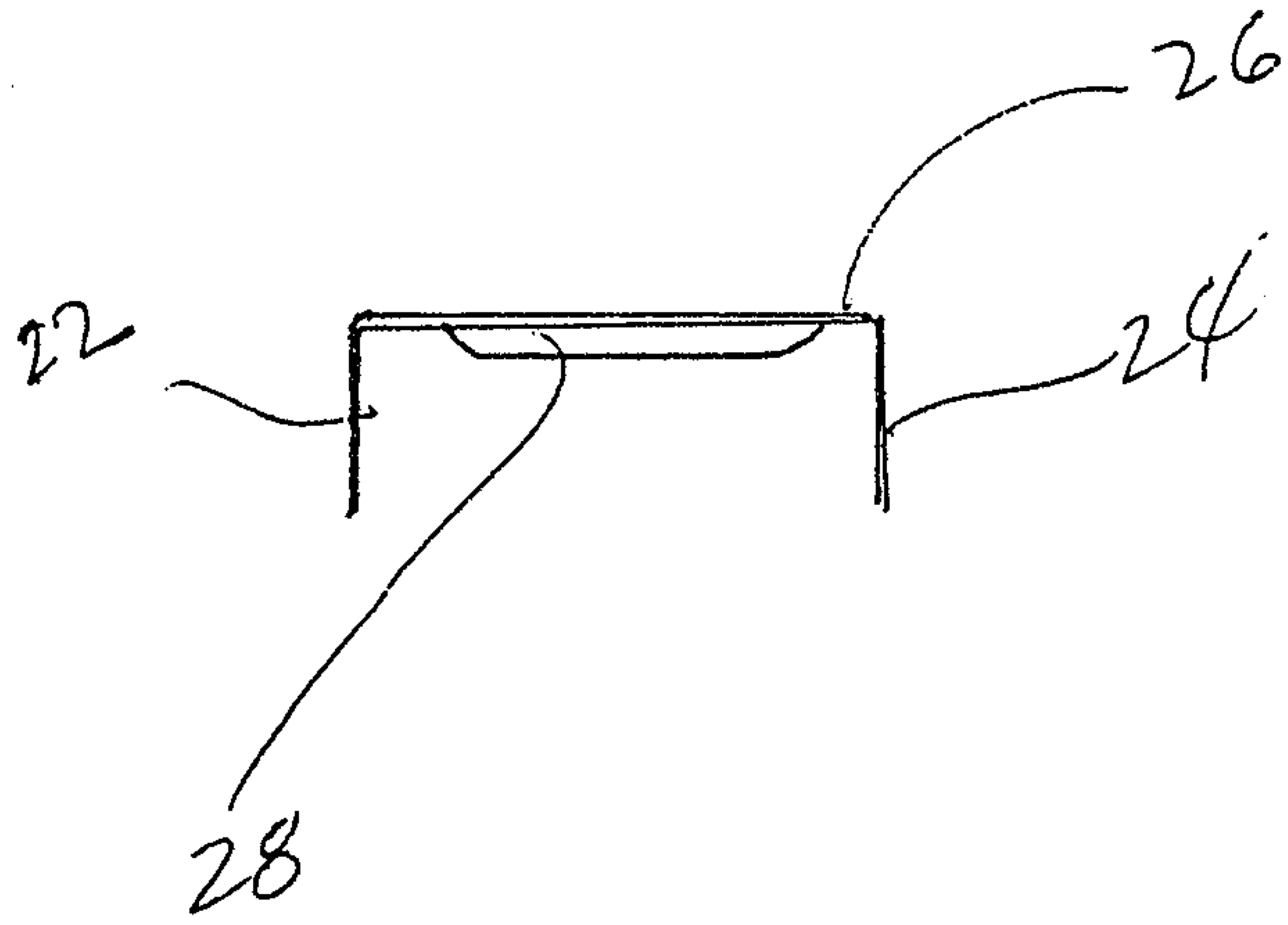
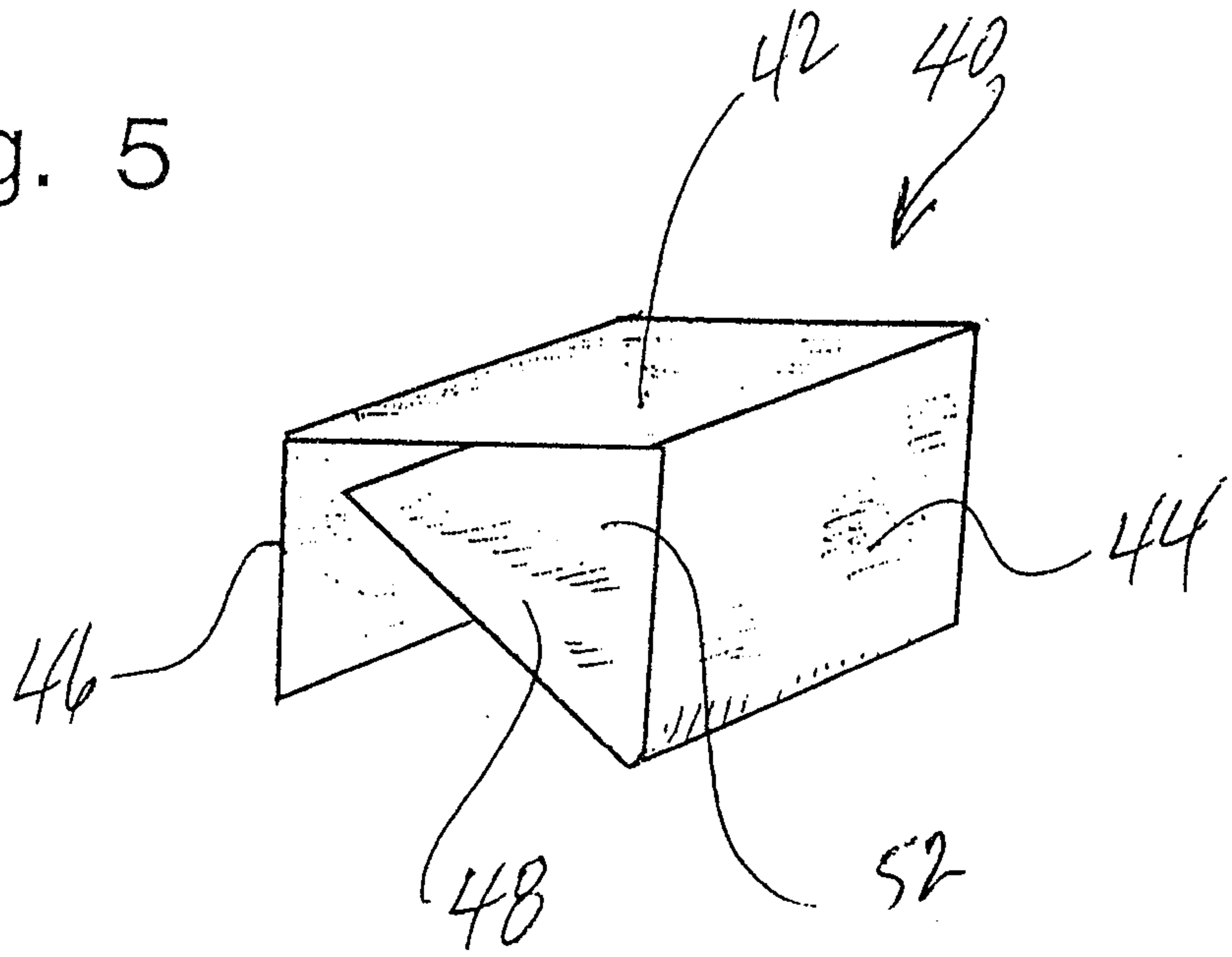


Fig. 4

Fig. 5



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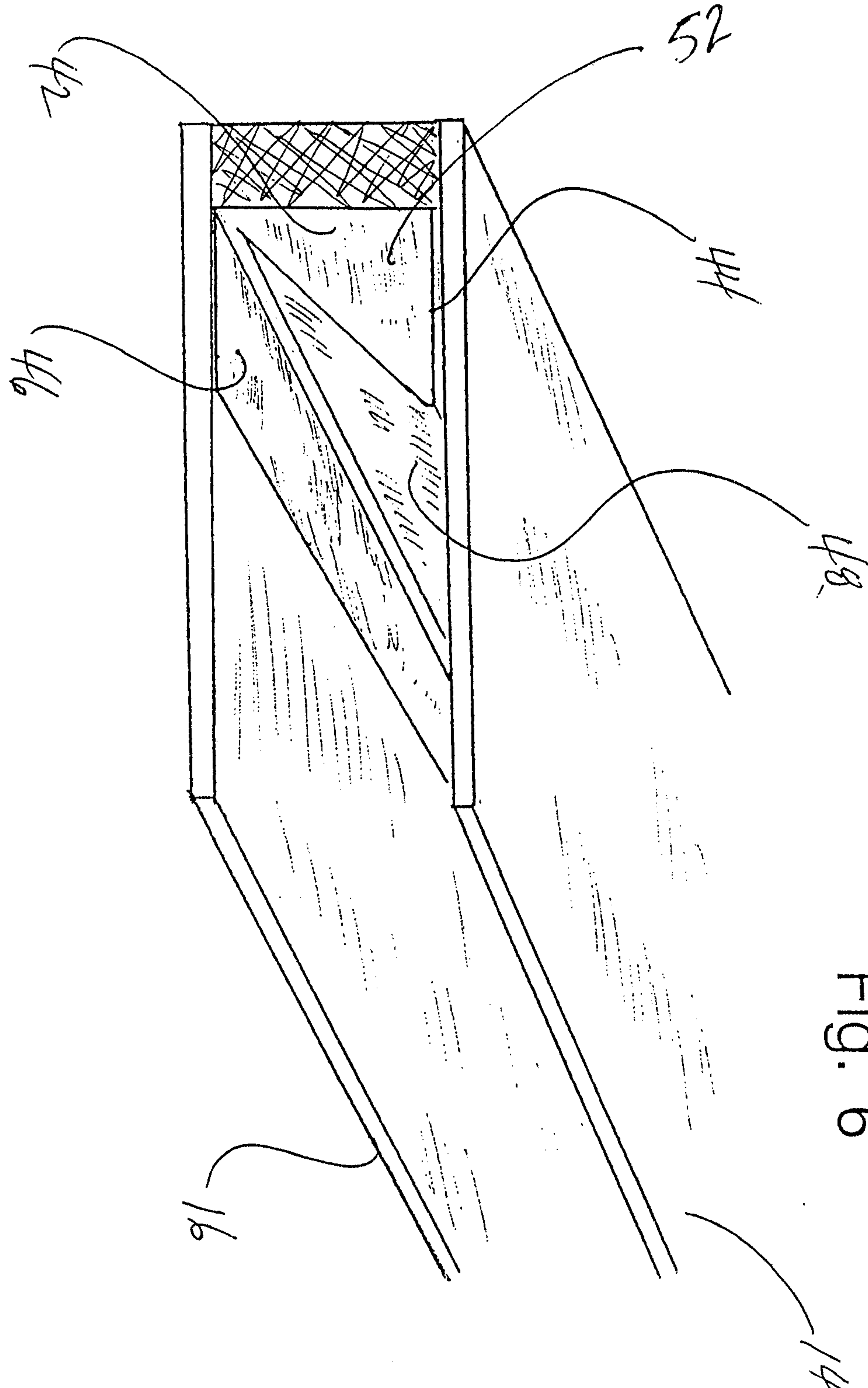

Fig. 6

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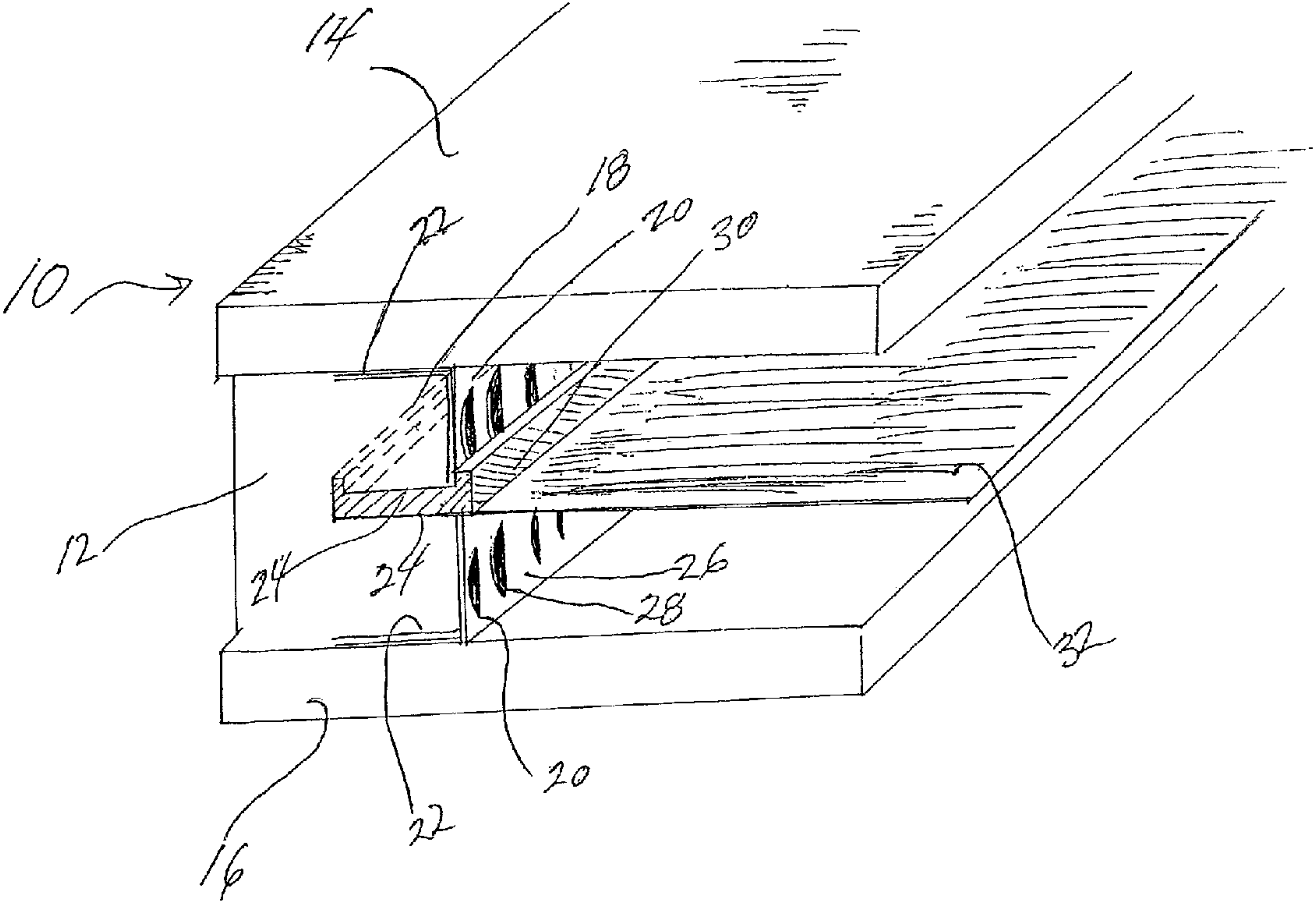
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