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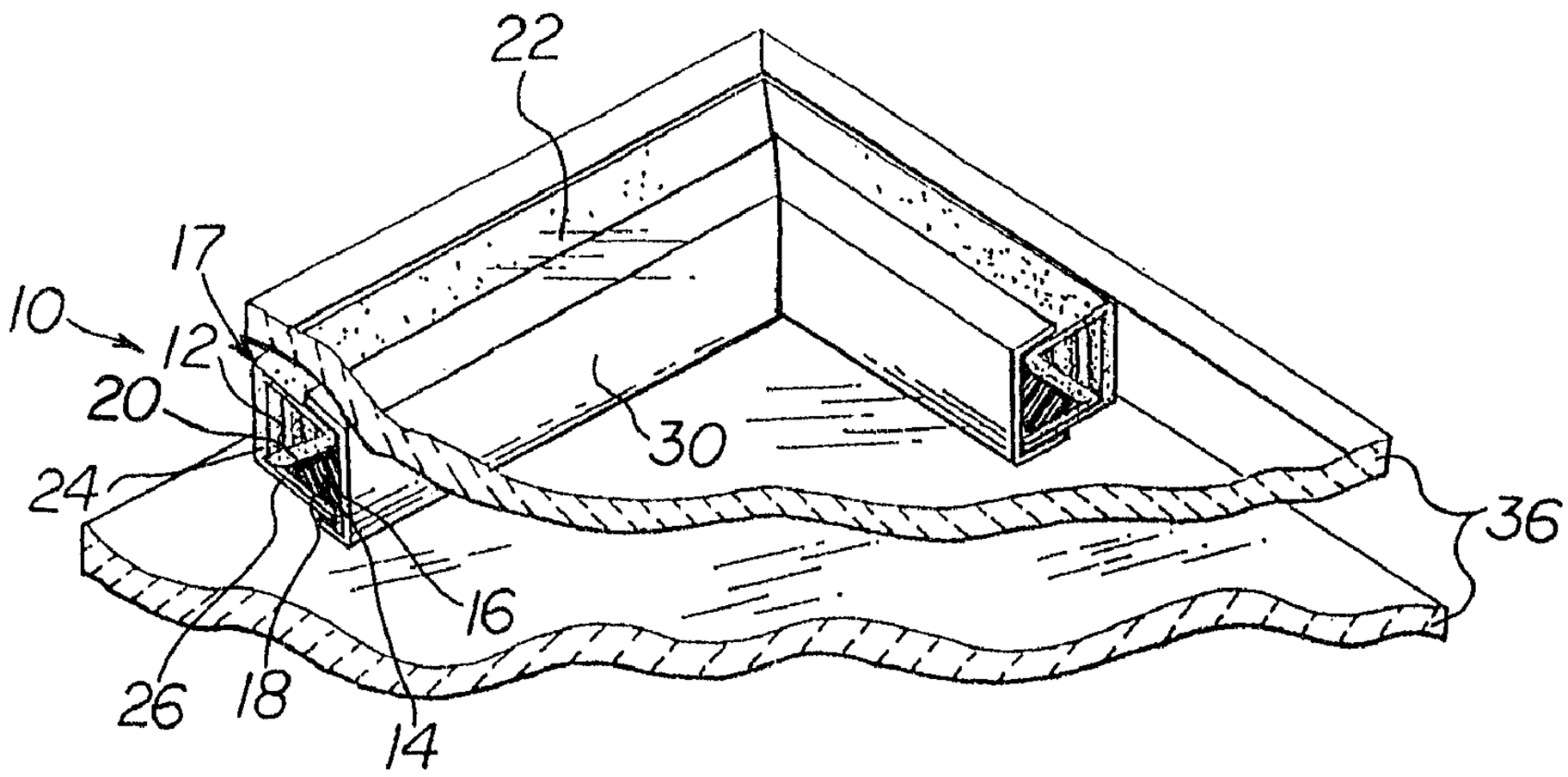
(54) **INSULATING SPACER STRIP INCLUDING TWO INSULATIVE CHAMBERS**



(57) The present invention relates to an insulative spacer strip adapted to be positioned between opposed substrates to insulate the opposed substrates. The insulative spacer strip comprises: a rigid polymeric support frame, the support frame member forming first and second adjacent insulative bodies and having first and second substrate engaging means; the first insulative body including a hollow passage therein; and the second insulative body having a desiccant material therein.

ABSTRACT

The present invention relates to an insulative spacer strip adapted to be positioned between opposed substrates to insulate the opposed substrates. The insulative spacer strip comprises: a rigid polymeric support frame, the support frame member forming first and second adjacent insulative bodies and having first and second substrate engaging means; the first insulative body including a hollow passage therein; and the second insulative body having a desiccant material therein.

INSULATING SPACER STRIP INCLUDING TWO INSULATIVE CHAMBERS

The present invention relates to an insulative spacer for insulating opposed substrates.

More particularly, the present invention relates to an insulative spacer for insulating opposed panes or sheets of glass.

Sealed window units are known which include a pair of panes of glass sealed together around their inner peripheries by an insulative strip of material which spaces the panes part and includes a desiccant to aid in removal of moisture from between the panes of glass. Typically, there is also provided a backfill material which fills the area between the edges of the panes of glass and the insulative strip.

In one typical prior art arrangement an aluminum channel is used to space and support the panes of glass in a sealed window unit. The aluminum channel together with a desiccant is positioned between the glass panes spaced inwardly from the outer edges thereof and a backfill material is inserted between the edges of the glass panes and the aluminum channel. One disadvantage of this type of spacer is that aluminum is a poor insulator, i.e. the temperature transfer of aluminum is very high. A further disadvantage is that in order to be able to go around the corners of a pane of glass, the aluminum channel must be cut at the corner and an additional section started on the next straight edge.

Another prior type of insulative spacer known is in the form of a strip of aluminum surrounded by butyl rubber which has a desiccant milled therein. Although the thermal conductivity of this strip is somewhat better than that of an aluminum channel alone, the heat transfer of this strip is still quite high.

A self-supporting foam layer including a desiccant has also been utilized as an insulative spacer between two panes of glass. Such an insulative spacer is costly to manufacture.

In accordance with an embodiment of the present invention there is provided an insulative spacer strip adapted to be positioned between opposed substrates to insulate the opposed substrates. The insulative spacer strip comprising: a rigid polymeric support frame, the support frame member forming first and second adjacent insulative bodies and having first and second substrate engaging means; the first insulative body including a hollow passage therein; and the second insulative body having a desiccant material therein.

In the structure of the present invention, Applicant has found that by providing a structure preferably of a one-piece integral nature, sufficient and reliable spacers can be provided without the costly necessity of utilizing e.g. rigid aluminum spacers or the integral foam spacers, which overcome the inherent disadvantages of such spacers. More particularly, the spacers of the present invention have a configuration and

structure which permits the formation of an internal chamber or first insulative body capable of providing an air body, and a second insulative body or chamber which is capable of receiving a desiccant or an insulation material containing a desiccant, thus providing a highly efficient insulation body which has low thermal conductivity extending between two panes of glass or the like.

In the preferred form of the structure of the present invention, the rigid polymeric support frame of the spacer strip or element includes a pair of supporting members, one of which extends between the strip portions engaging or adapted to be placed against the surfaces of the glass panes or lites, and in which the supporting member is angularly disposed relative to the strip portions which engage the glass lites while the other of the supporting members is preferably generally vertically oriented or slightly inclined and which is further located in a position spaced from the first mentioned angularly disposed supporting member. In this way, an interior chamber or insulative body may be formed and further, the second chamber or insulative body positioned to receive a desiccant material between the upper and lower glass engaging members of the spacer element.

By utilizing a pair of supporting members as described above, one chamber or insulative body formed within the spacer element may be completely enclosed; within this enclosed chamber, an insulating material may be utilized if desired, e.g. a foam insulating material, or even a non-foamed substance. Depending on the type of

window structure to be used in conjunction with the spacer element of the present invention, additional desiccant containing material may also be included in this enclosed chamber.

In one variation of the present invention, the generally vertically oriented support member may function solely as a supporting member; alternately, this supporting element may be of a corrugated nature which functions to permit some flexing of the support member to relieve stress on double glass lites formed into an assembly where stress may be encountered due to wind or atmospheric conditions which will cause flexing of the glass panes or lites with consequent flexing of the spacer element or strip. In this way, where large surface areas of glass panes are used in conjunction with the spacer element, a degree of flexibility can be provided without disrupting the integrity of the spacer element.

In a still further embodiment, the vertically oriented as well as the angularly disposed supporting members of the spacer element may include additional reinforcing means such as by including an embossed structure thereon. Such an embossed structure could be in the form of a plurality of spaced apart ribs, etc.

The outer chamber or insulative body of the spacer element, which forms a chamber facing the interior of the window assembly, is conventionally provided with desiccant material. Such desiccant material may be incorporated either as pure desiccant material or more

conventionally, in a carrier such as a polymeric carrier which may be of a foamed or non-foamed nature. The desiccant material preferably fills the entire outer chamber.

A coating may be applied over the outer chamber or insulative body to protect the material therein, such a coating may be in the form of a silicon coating. Alternatively, a suitable end cap may be provided to protect the material within the outer chamber.

Preferably, the spacer strip of the present invention includes a integral polymeric support frame which includes a first generally horizontal arm; the angularly disposed support arm forming a second arm extending from one end of the first horizontal arm; a third generally horizontal arm extending from one end of the angularly disposed support arm; the vertically oriented support arm forming a fourth arm extending downwardly from the third horizontal arm. The first and third horizontal arms being generally parallel. In this arrangement, the first and third horizontal arms form the strip portions which engage the glass lites.

In a particularly preferred arrangement, the polymeric support frame is also provided with a fifth horizontal arm which extends from the fourth arm and is adjacent and parallel to the first horizontal arm. In this arrangement, the third horizontal arm and the fifth horizontal arm form the strip portions which engage the glass lites.

In accordance with another embodiment of the present invention there is provided a rigid polymeric support frame for use in an insulative spacer strip, comprising: a first generally horizontal arm; a second angularly disposed arm extending from one end of the first horizontal arm; a third generally horizontal arm extending from an end of the second vertical arm, the third generally horizontal arm being generally parallel with the first generally horizontal arm; a fourth generally vertical arm extending from an end of the third generally horizontal arm; a fifth generally horizontal arm extending from the fourth generally vertical arm, the fifth generally horizontal arm being adjacent and parallel to the first generally horizontal arm; wherein the rigid polymeric support frame forms first and second adjacent insulative bodies, the second angularly disposed arm forming a common border between the first and second insulative bodies.

In accordance with yet another embodiment of the present invention there is provided an insulated window assembly having at least two spaced apart window panes, an insulative spacer strip between the at least two spaced apart window panes the spacer strip being positioned around inner peripheries of the at least two spaced apart window panes and affixed thereto, the improvement wherein the insulative spacer strip comprises: a rigid polymeric support frame member, the support frame member forming first and second adjacent insulative bodies; the first insulative body including a hollow passage therein; and the second insulative body having a desiccant material therein.

The rigid polymeric support frame may be of any suitable material which is self-supporting and suitably rigid. Preferably, the rigid polymeric support frame is a material selected from polyolefins, polyesters, polyamides and silicones; polyesters being particularly preferred. In addition, if desired, the polymeric support frame may include a metallized surface or surfaces.

Preferably, the support frame has a thickness in the range of approximately .005" to .030".

Having thus generally described the present invention, reference will now be made to the accompanying drawings which illustrate preferred embodiments of the present invention wherein:

Figure 1 is a perspective view of a part of a insulated window assembly utilizing one embodiment of the insulative spacer strip of the present invention;

Figure 2 is an end view of the spacer strip illustrated in Figure 1;

Figure 3 is a laid open view of the rigid polymeric support frame of the spacer strip illustrated in Figure 2;

Figure 4 is an end view of an alternate embodiment of the spacer strip of the present invention;

Figure 5 is an end view of another alternate embodiment of the spacer strip of the present invention; and

Figure 6 is an end view of a further alternate embodiment of the spacer strip of the present invention.

Reference will be initially made to Figures 1 and 2, which illustrate one preferred embodiment of the spacer strip of the present invention.

The spacer strip of the present invention, generally designated by reference numeral 10, includes a first insulative body 12 and a second insulative body 14. The first insulative body 12 is a generally hollow body which includes air therein, air being known as a good insulative material. Alternately, the first insulative body 12 may include any suitable insulative material therein (not shown). The second insulative body includes a desiccant material 16 therein. The desiccant material 16 may be a desiccant, a polymeric material including a desiccant therein, a desiccant and a polymeric insulating material or any other suitable combination.

The insulative bodies 12 and 14 are formed by a rigid polymeric support frame structure, generally designated by reference numeral 17.

The rigid polymeric support frame member 17 is preferably of a one-piece unitary construction, although other constructions may be utilized such as two or more different coextruded or laminated strips.

The rigid polymeric support frame 17, as best illustrated in Figure 2, includes a first arm 18 which is generally horizontally oriented, a second arm 20 which is generally angularly oriented, a third arm 22 which is generally horizontally oriented and is generally parallel

to the first arm 18, a fourth arm 24 which is generally vertically oriented and a fifth arm 26 which is generally horizontally oriented.

The support frame 17 preferably has a thickness of approximately .005" to .030 inch and is of any suitable material which is self-supporting and suitably rigid such as polyolefins, polyesters, silicones and polyamides; polyesters being particularly preferred. If desired, the support frame 17 may also have a metallized surface or surfaces. Preferably the material of the support frame 17 has the following properties: low moisture vapour transmission, thermal expansion stability and low thermal conductivity.

As best seen from Figure 2, the fifth arm 26 is preferably parallel, adjacent and coextensive with the first arm 18; although the first arm 18 may be shorter or larger than the fifth arm 26. In a particularly preferred form, the fifth arm 26 and the first arm 18 are fixedly secured together by way of any suitable adhesive means (not shown) and the first arm 18, the second arm 20 and the third arm 22 form a generally "Z" shaped configuration.

Both the second arm 20 and the fourth arm 24 preferably have embossments 28 thereon. Such embossments 28, which may be in the form of spaced apart ribs, add strength to the support frame structure 17. It is contemplated that the embossed structures 28 may also include a desiccant material therein (not shown).

As will be noted, from Figure 2 in particular, the second arm 20 forms a common border for each of the insulative bodies 12 and 14.

An end member 30 may be provided which covers and protects the desiccant material 16 in the second insulative body 14 and extends from the fifth arm 26 to the third arm 22. Such an end member may be in the form of any suitable polymeric coating or may be in the form of an end cap of any suitable material. Preferably, such an end member is in the form of a silicon coating having a UV resistance additive and further having the property of preventing rapid moisture absorption and saturation of the desiccant material 16 when exposed to atmospheric conditions, and providing sufficient necessary moisture absorption when between two panes of glass.

As best illustrated in Figure 1, when the spacer strip 10 of the present invention is assembled between two panes of glass 36, the third arm 22 and the fifth arm 26 are fixedly secured to the panes of glass 36 by way of any suitable adhesive.

Figure 3 illustrates the rigid polymeric support frame 17, as described above with reference to Figures 1 and 2, in a laid out condition. The embossments 28 on the second arm 20 and the fourth arm 24 are readily apparent from this Figure. Although in Figure 3, the embossments 28 on the second arm 20 are shown on the top surface and the embossments 28 on the fourth arm 24 are shown on the bottom surface, it will be understood that the embossments 28

could be on either or both of the surfaces of arms 20 and 24.

To form the spacer strip, the rigid polymeric support frame 17 is bent along the margins 29 to form the first horizontal arm 18, the second angularly disposed arm 20, the third horizontal arm 22, the fourth generally vertical arm 24 and the fifth horizontal arm 26 (see polymeric support frame 17 in the spacer strip illustrated in Figures 1 and 2).

Figure 4 illustrates an alternative embodiment of the present invention. The embodiment of Figure 4 is very similar to the embodiment illustrated in Figure 2, with like reference numerals designated like parts.

In the embodiment of Figure 4, however, the fourth arm 24 is of a corrugated construction, which permits some flexing of this support member to release stresses. All other elements of this embodiment are as shown and described with reference to Figures 1 to 3.

Figure 5 illustrates another embodiment of the spacer strip 10 of the present invention, which again is very similar to the embodiment of Figure 2, with like reference numerals designating like parts. In the Figure 5 embodiment, the support frame 17 does not include a fifth arm. The end cap 30 covering the desiccant material 16 extends from the first arm 18 to the third arm 22. In this embodiment, the first arm 18 and the third arm 22 form the strips which engage the glass panels, and are affixed

thereto by any suitable adhesive.

A further embodiment of the present invention is illustrated in Figure 6. In this embodiment, a first arm 40 is provided which is generally horizontal. A second arm 42, which is generally vertical, extends upwardly from one end of the first arm 40. A third arm 44 which is parallel to the first arm 40 extends from the second arm 42 and a fourth arm 46 is angularly disposed and extends downwardly from the third arm 44, the fourth arm 46 has a free end which is adjacent the point where the first arm 40 and the second arm 42 are joined. The fourth arm 46 forming a common border between the first and second insulative bodies 12 and 14. In this arrangement, the first arm 40 and the third arm 44 form the glass lite engaging strips and the end cap 30 covering the desiccant material 16 extends from the first arm 40 and the third arm 44.

Having described preferred embodiments of the present invention, it will be understood that various modifications or alterations can be made to the above described embodiments without departing from the spirit and scope of the invention.

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

1. An insulative spacer strip adapted to be positioned between opposed substrates to insulate the opposed substrates, said insulative spacer strip comprising:

a rigid polymeric support frame, said support frame having a pair of spaced apart substrate engaging means a connecting arm extending between and connecting said pair of spaced apart substrate engaging means and a diagonal support member extending between said pair of spaced apart substrate engaging means forming first and second adjacent insulative bodies;

said second insulative body having a desiccant material therein.

2. The insulative spacer strip as defined in claim 1, wherein said desiccant material is an insulative polymeric substance including a desiccant therein.

3. The insulative spacer strip as defined in claim 1, wherein there is provided a desiccant material and a polymeric substance in said second insulative body.

4. The insulative spacer strip as defined in any one of claims 1 to 3, wherein said pair of spaced apart substrate engaging means are generally parallel and said diagonal support member forms a common border between said first and second insulative bodies.

5. The insulative spacer strip as defined in any one of claims 1 to 4, wherein said pair of spaced apart substrate engaging means are first and second horizontal arms.

6. The insulative spacer strip as defined in claim 5, further including a further generally horizontal arm extending from and connected to said diagonal support arm, said further generally horizontal arm being adjacent and parallel to said first generally horizontal arm.

7. The insulative spacer strip as defined in claim 5 or 6, wherein said first generally horizontal arm, said diagonal support arm and said second generally horizontal arm form a generally "Z" shaped configuration.

8. The insulative spacer strip as defined in any one of claims 1 to 7, wherein said diagonal support arm is pivotally connected to one of said pair of substrate engaging means.

9. The insulative spacer strip as defined in claim 6, wherein said first generally horizontal arm and said further generally horizontal arm are generally co-extensive.

10. The insulative spacer strip as defined in claim 6, wherein said further generally horizontal arm is shorter than said first generally horizontal arm.

11. The insulative spacer strip as defined in claim 5, 6, 8, 9 or 10, wherein said connecting arm is generally vertical and is corrugated.

12. The insulative spacer strip as defined in claim 6, 9 or 10, wherein said first generally horizontal arm and said further generally horizontal arm are fixedly secured together.

13. The insulative spacer strip as defined in claim 5 or 6, wherein said diagonal support arm of said polymeric support frame forms a common border between said first and second insulative bodies.

14. The insulative spacer strip as defined in claim 1, 2, 3, 4, 5, 6, 8, 9 or 10, wherein said rigid polymeric support frame is a one-piece continuous member.

15. The insulative spacer strip as defined in claim 5, wherein said diagonal support arm and said connecting arm each have an embossed structure for added strength.

16. The insulative spacer strip as defined in claim 15, wherein at least one embossed structure includes desiccant therein.

17. The insulative spacer strip as defined in claim 1, wherein there is further provided a polymeric coating covering said desiccant material of said second insulative body and extending from one of said pair of substrate engaging means to the other of said pair of substrate engaging means.

18. The insulative spacer strip as defined in claim 1, wherein there is further provided an end cap covering said desiccant material of said second insulative body and extending

from one of said pair of substrate engaging means to the other of said pair of substrate engaging means.

19. The insulative spacer strip as defined in claim 17, wherein said polymeric coating is a silicon coating having the property of controlling rapid moisture absorption and UV protection.

20. The insulative spacer strip as defined in claim 1, 2, 3, 4, 5, 6, 8, 9, 10, 15, 17, 18 or 19, wherein said rigid polymeric support frame comprises a material having a low moisture vapour transmission, thermal expansion stability and low thermal conductivity.

21. The insulative spacer strip as defined in claim 1, 2, 3, 4, 5, 6, 8, 9, 10, 15, 17, 18 or 19, wherein said rigid polymeric support frame comprises a material selected from the group consisting of polyolefins, polyesters, polyamides and silicones,

22. The insulative spacer strip as defined in

claim 1, 2, 3, 4, 5, 6, 8, 9, 10, 15, 17, 18 or 19, wherein said rigid polymeric support frame is a polyester material.

23. The insulative spacer strip as defined in claim 1, 2, 3, 4, 5, 6, 8, 9, 10, 15, 17, 18 or 19, wherein said rigid polymeric support frame has a thickness of from about .005" to about .030".

24. The insulative spacer strip as defined in claim 1, 2, 3, 4, 5, 6, 8, 9, 10, 15, 17, 18 or 19, wherein said rigid polymeric support frame is comprised of two or more different plastic materials in the form of a coextruded or laminated strip.

25. A rigid polymeric support frame for use in an insulative spacer strip, comprising:

a first generally horizontal arm;

a second angularly disposed arm extending from one end of said first horizontal arm;

a third generally horizontal arm extending from an end of said second vertical arm, said third generally horizontal arm being generally parallel with said first generally horizontal arm;

a fourth generally vertical arm extending from an end of said third generally horizontal arm;

a fifth generally horizontal arm extending from said fourth generally vertical arm, said fifth generally horizontal arm being adjacent and parallel to said first generally horizontal arm;

wherein said rigid polymeric support frame forms first and second adjacent insulative bodies, said second angularly disposed arm forming a common border between said

first and second insulative bodies.

26. The rigid polymeric support frame as defined in claim 25, wherein one of said first and second adjacent insulative bodies is a hollow member and the other of said first and second adjacent insulative bodies is adapted to receive a desiccant material.

27. The rigid polymeric support frame as defined in claim 25, wherein said first generally horizontal arm, said second angularly disposed arm and said third generally horizontal arm form a generally "Z" shaped configuration.

28. The rigid polymeric support frame as defined in claim 25, wherein each of said third generally horizontal arm and said fifth generally horizontal arm are adapted for engagement with a pane of glass.

29. The rigid polymeric support frame as defined in claim 25, wherein said first generally horizontal arm and said fifth generally horizontal arm are generally coextensive.

30. The rigid polymeric support frame as defined in claim 25, wherein said polymeric support frame is a continuous one-piece member.

31. The rigid polymeric support frame as defined in claim 25, 26, 27, 28, 29 or 30, wherein said fourth generally vertical arm is corrugated.

32. The rigid polymeric support frame as defined

in claim 25, wherein said second angularly disposed arm and said fourth generally vertical arm each have an embossed structure for added strength.

33. The rigid polymeric support frame as defined in claim 25, wherein said polymeric support frame comprises a material selected from the group consisting of polyolefins, polyesters, polyamides and silicones.

34. The rigid polymeric support frame as defined in claim 33, wherein said polymeric support frame is a polyester material.

35. The rigid polymeric support frame as defined in claim 25 or 34, wherein said polymeric support frame has a thickness of from about .005" to about .030".

36. The rigid polymeric support frame as defined in claim 25, wherein said polymeric support frame has a low moisture vapour transmission, thermal expansion stability and low thermal conductivity.

37. The rigid polymeric support frame as defined in claim 25, wherein said first generally horizontal arm and said fifth generally horizontal arm are fixedly secured together.

38. In an insulated window assembly having at least two spaced apart window panes, an insulative spacer strip between said at least two spaced apart window panes said spacer strip being positioned around inner peripheries of said at least two spaced apart window panes and affixed

thereto, the improvement wherein said insulative spacer strip comprises:

a rigid polymeric support frame member, said support frame member forming first and second adjacent insulative bodies;

said first insulative body including a hollow passage therein; and

said second insulative body having a desiccant material therein.

39. The insulated window assembly as claimed in claim 38, wherein said rigid polymeric support frame comprises a first generally horizontal arm, a second generally vertical arm extending upwardly from an end of said first horizontal arm, a third generally horizontal arm extending from said second vertical arm, said first and third generally horizontal arms being generally parallel and a fourth angularly disposed arm extending downwardly from said third horizontal arm wherein said fourth angularly disposed arm forms a common border between said first and second insulative bodies.

40. An insulated window assembly as claimed in claim 38, wherein said rigid polymeric support frame member includes a first generally horizontal arm, a second angularly disposed arm extending from one end of said first horizontal arm, a third generally horizontal arm extending from an end of said second angularly disposed arm, said first and third generally horizontal arms being generally parallel, a fourth generally vertical arm extending from an end of said third horizontal arm, and a fifth generally horizontal arm extending from said fourth generally

vertical arm, said fifth generally horizontal arm being adjacent and parallel to said first generally horizontal arm.

41. The insulated window assembly as claimed in claim 40, wherein said first generally horizontal arm, said second angularly disposed arm and said third generally horizontal arm form a generally "Z" shaped configuration.

42. The insulated window assembly as claimed in claim 40, wherein said second angularly disposed arm forms a common border between said first and second insulative bodies.

43. The insulated window assembly as claimed in claim 40, wherein said second and fourth generally vertical arms have an embossed structure for added strength.

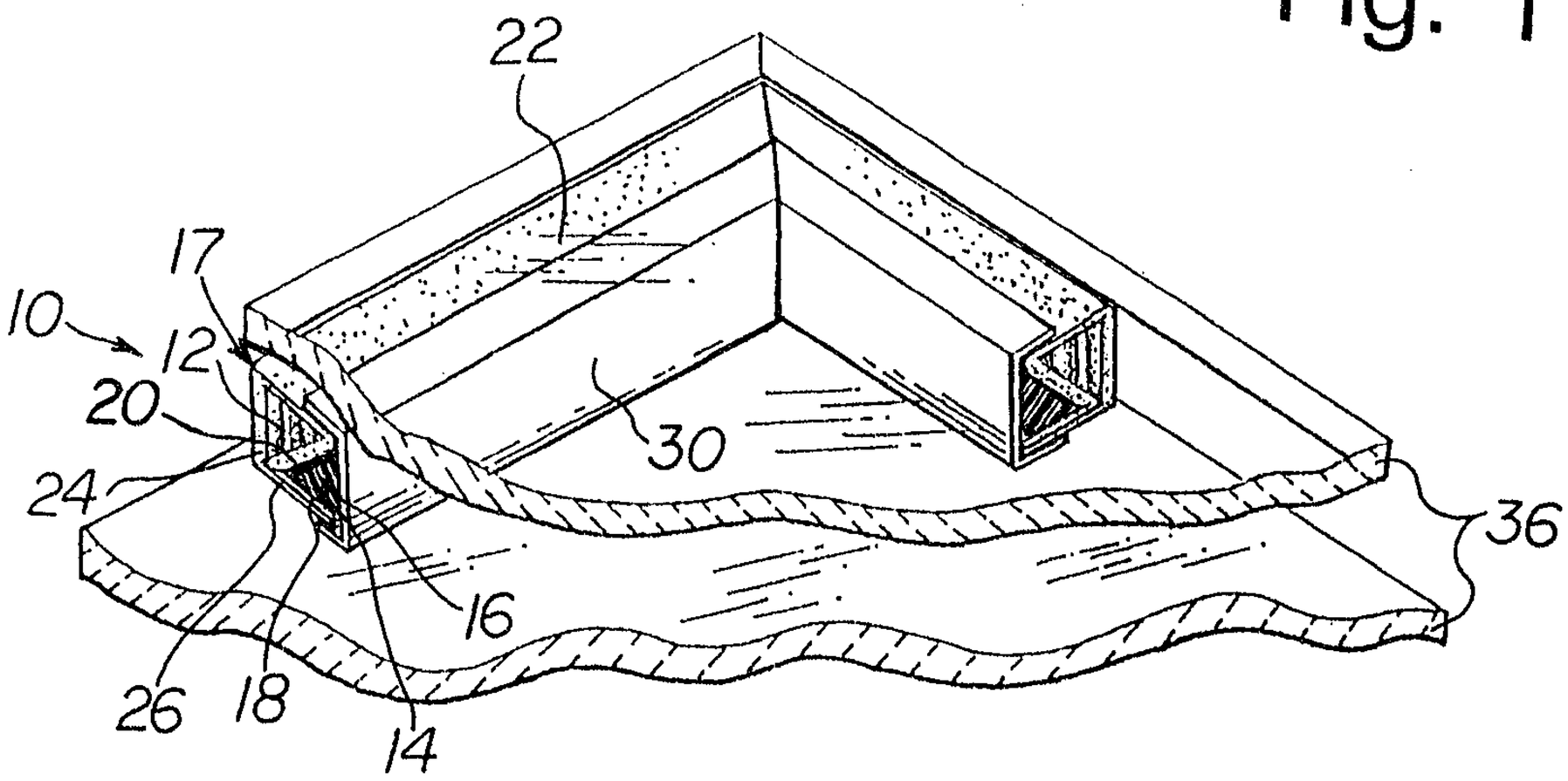
44. The insulated window assembly as claimed in claim 40, wherein said rigid polymeric support frame member is comprised of suitable polyester material.

45. The insulated window assembly as claimed in claim 40, wherein said rigid polymeric support frame member has a thickness of from about .005" to about .030".

46. The insulated window assembly as claimed in claim 40, wherein said rigid polymeric support frame member is a continuous one-piece member.

47. The insulated window assembly as claimed in claim 40, 41, 42, 44, 45 or 46, wherein said fourth generally vertical arm is corrugated.

Fig. 1



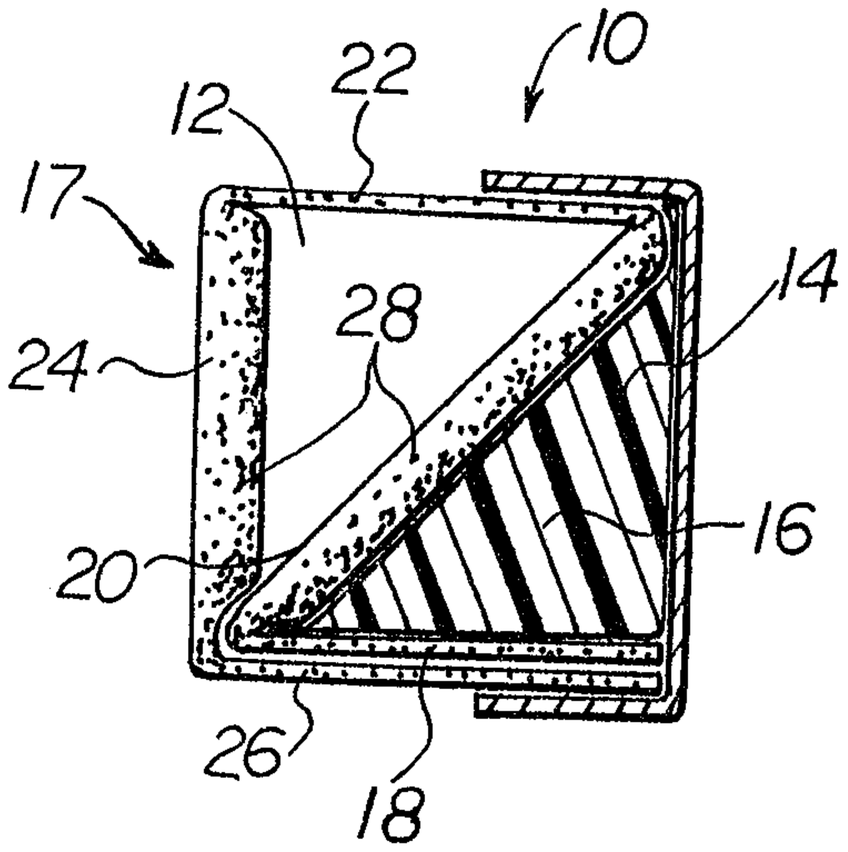
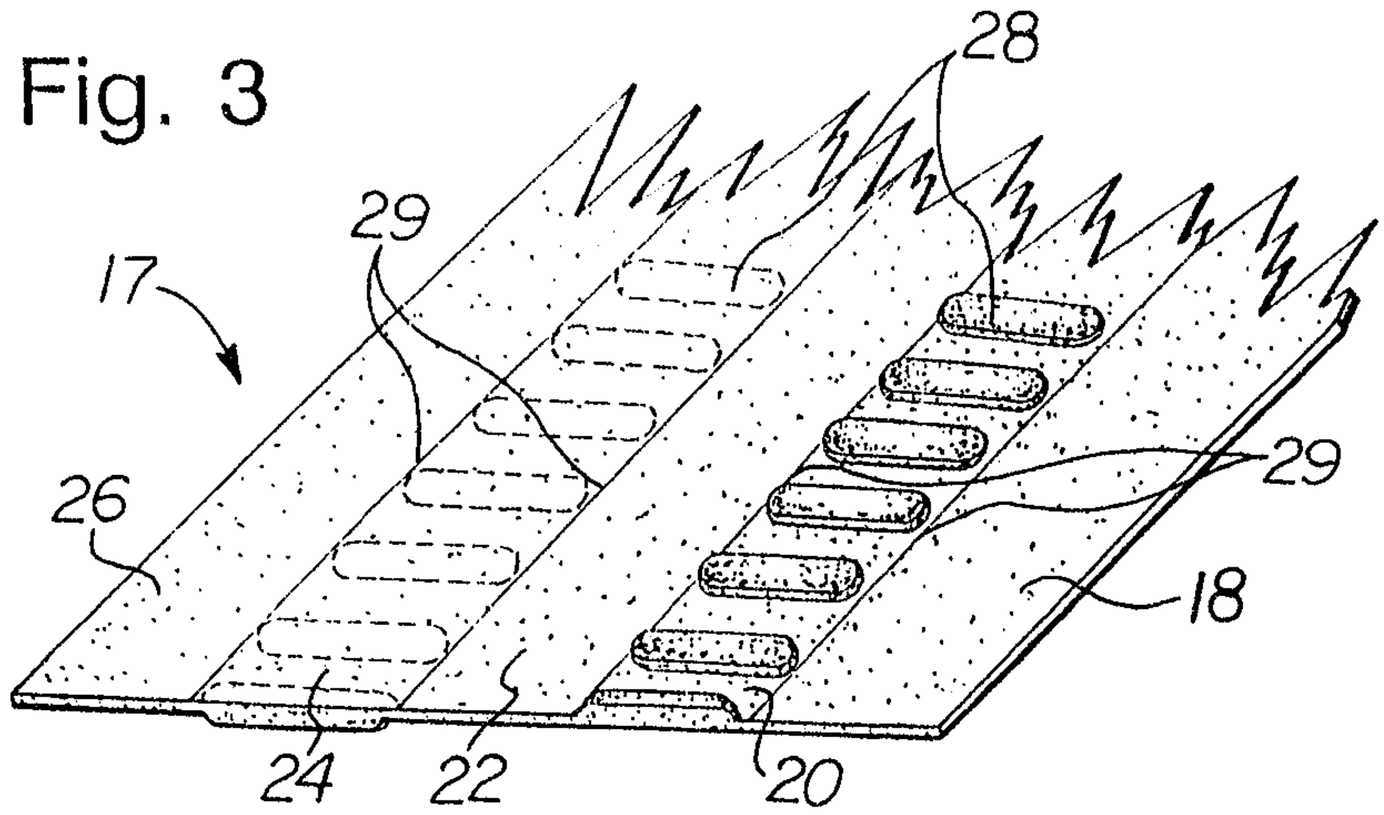


Fig. 2

Fig. 3



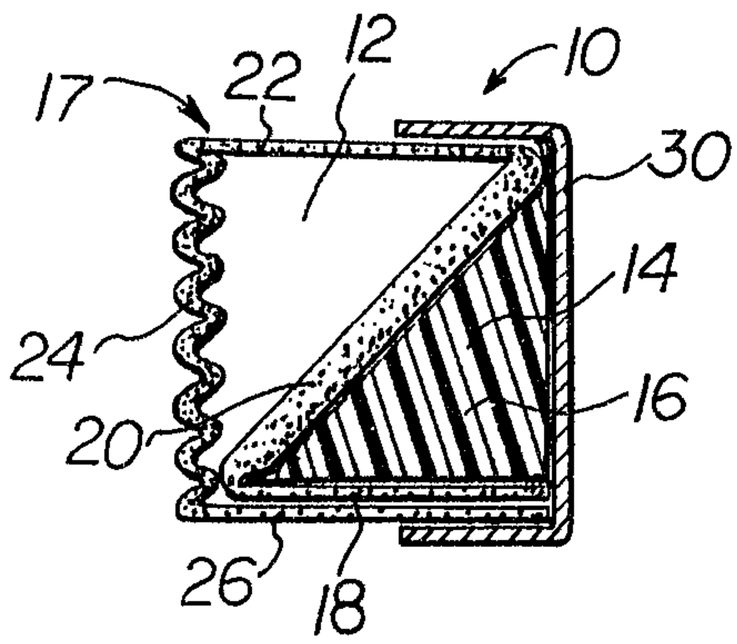


Fig. 4

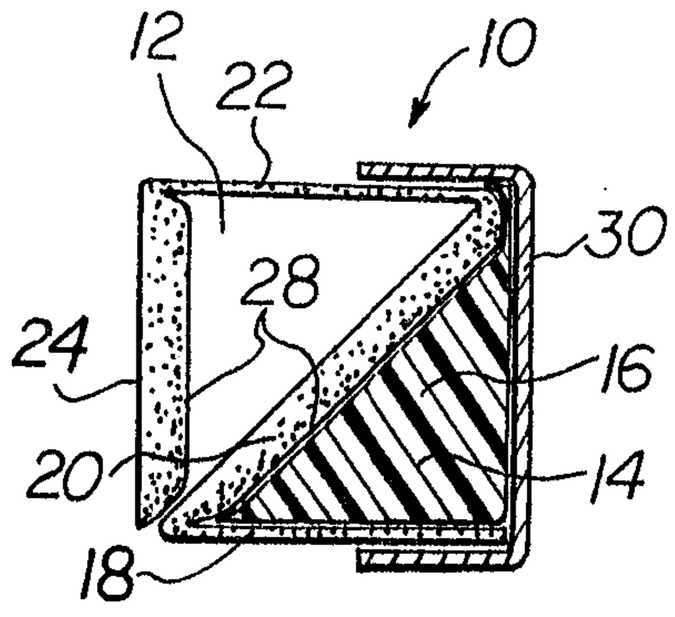


Fig. 5

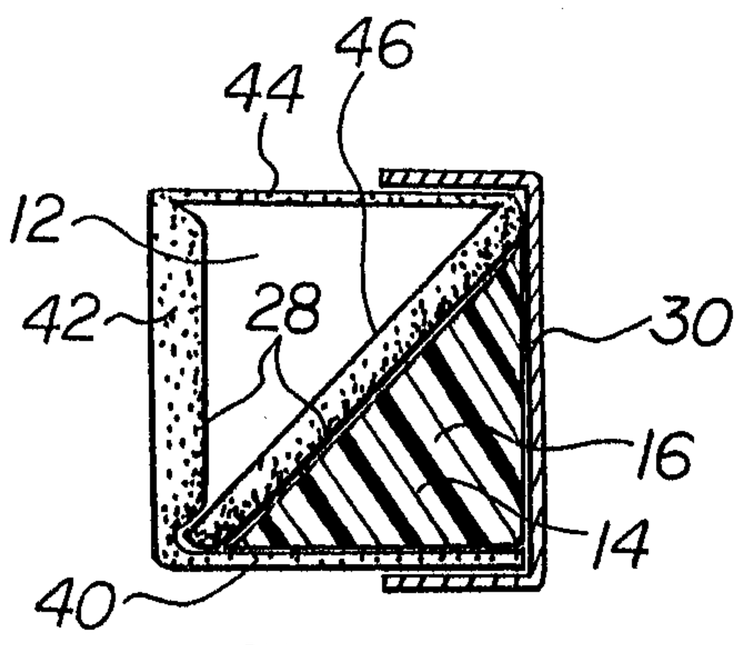


Fig. 6

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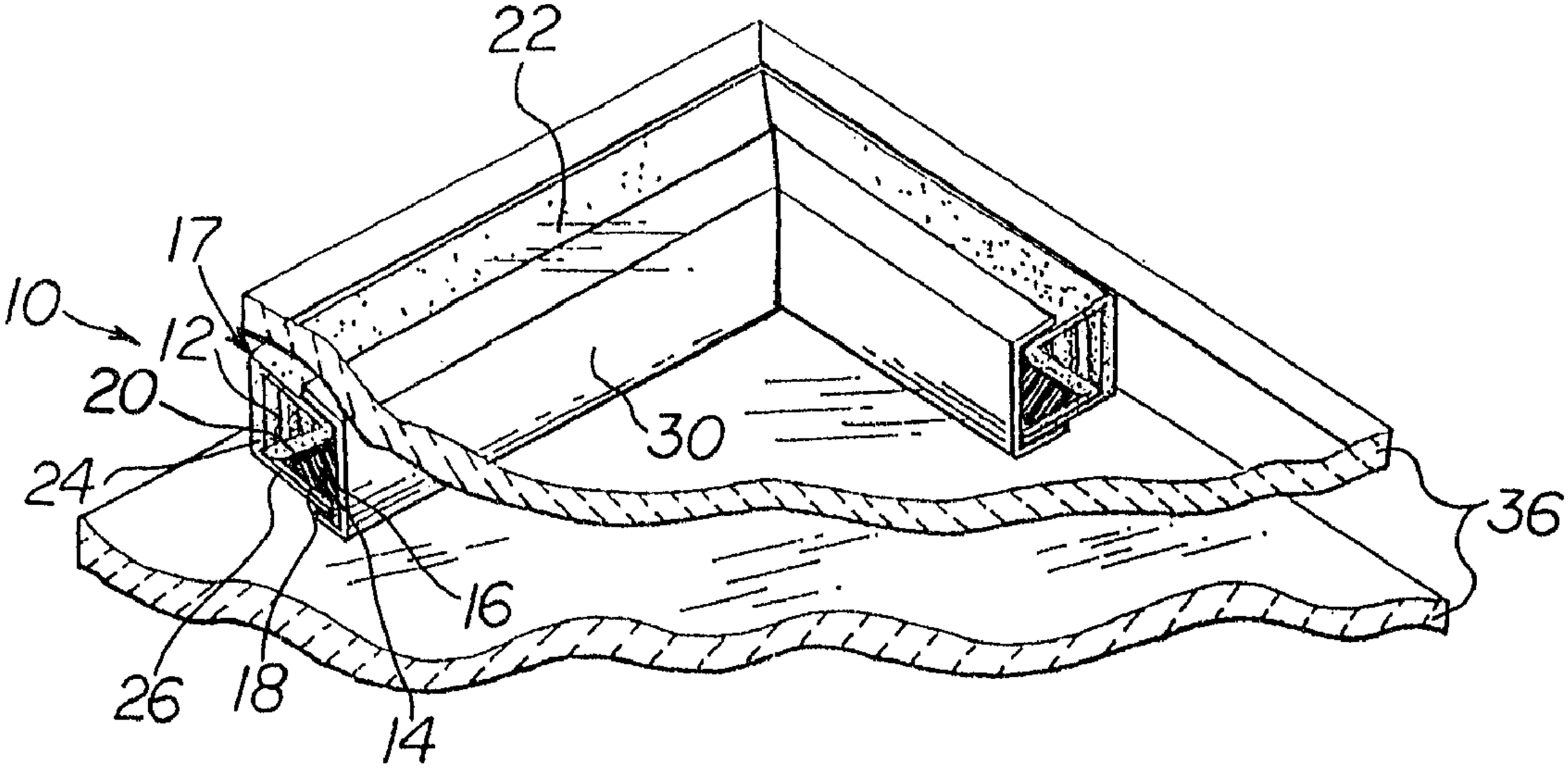
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