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(54) INSULATED CHANNEL SEAL FOR GLASS PANES

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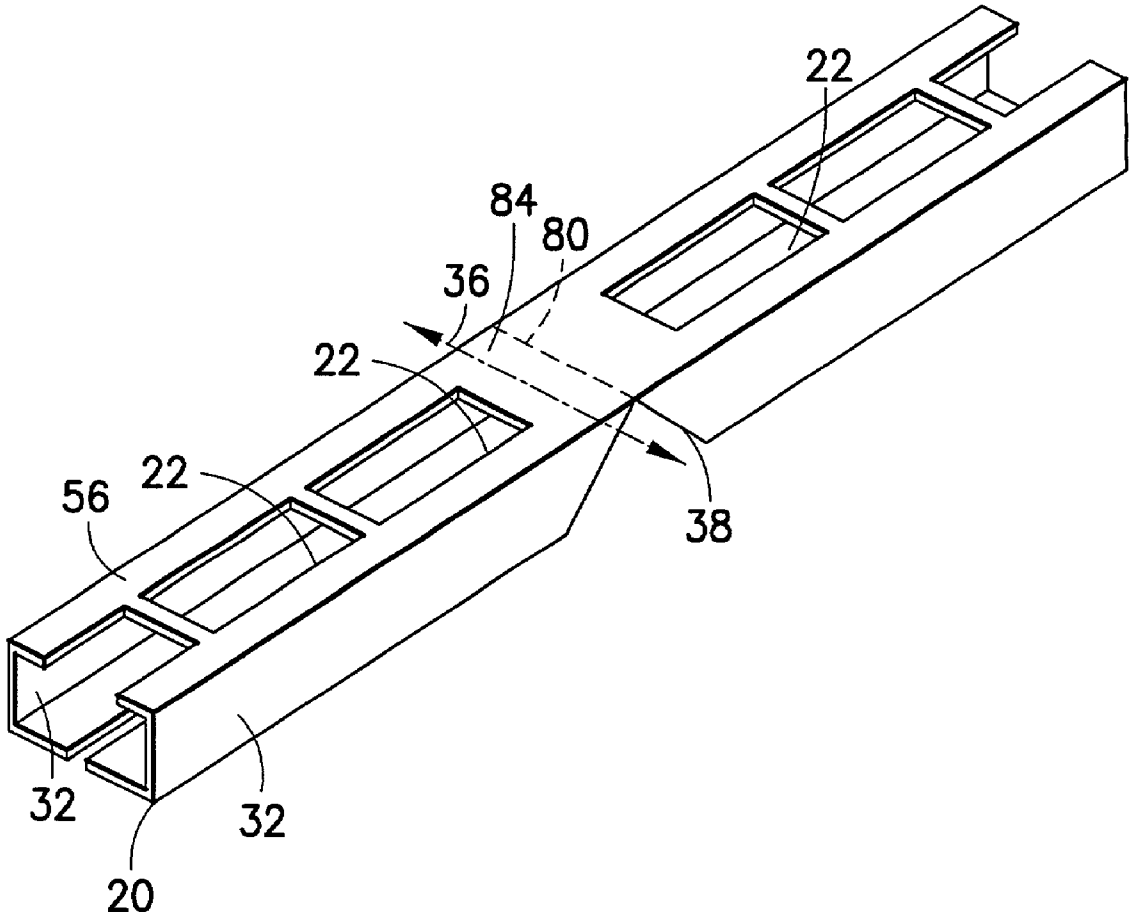
(57) **ABSTRACT**

A spacer channel for a frame which separates window panes to form an insulated window has a plurality of openings through a wall of the channel that faces outward along the periphery of the frame and glass sandwich. The openings are designed to prevent significant passage of sealant from the outside of the channel to the inside of the channel through the openings. This is done by the cross sectional area of each opening being so small that it resists viscous flow of the sealant through the opening, or by a cover over the opening.



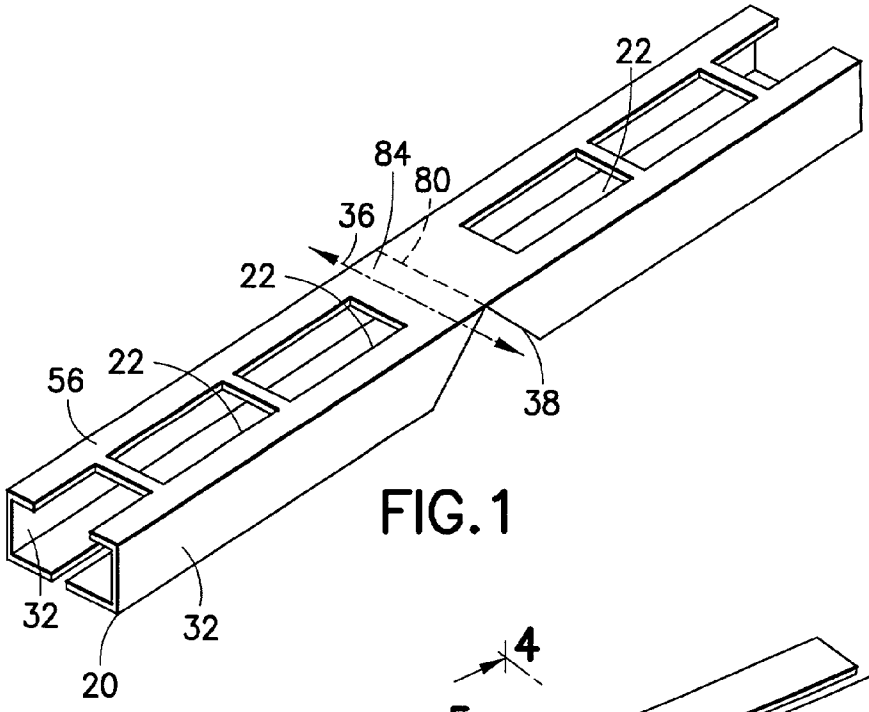


FIG. 1

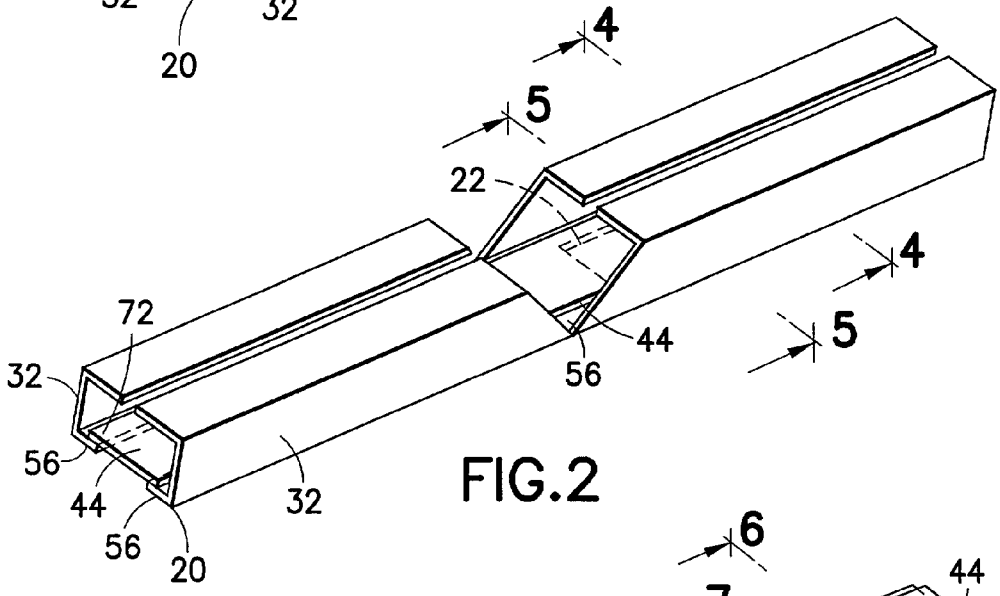


FIG. 2

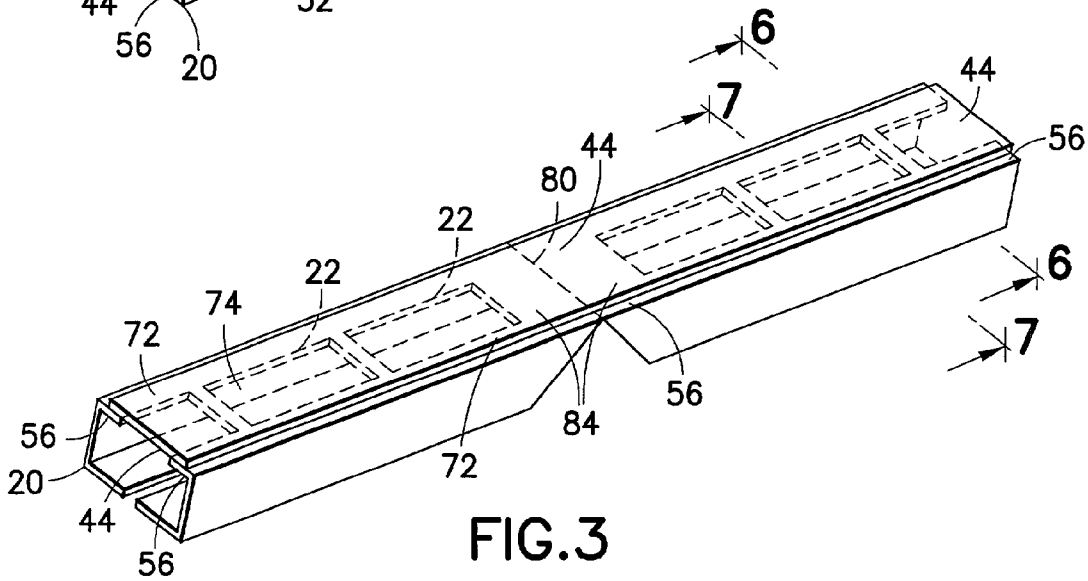
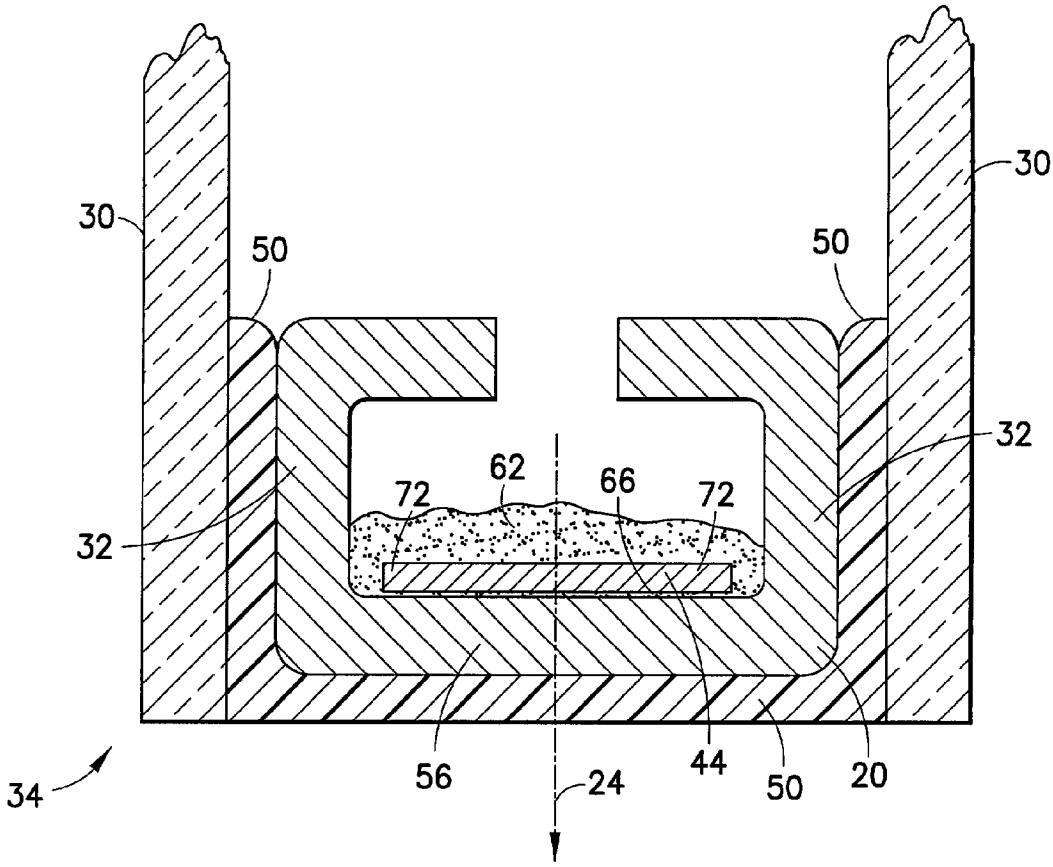


FIG. 3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32
72
62
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34
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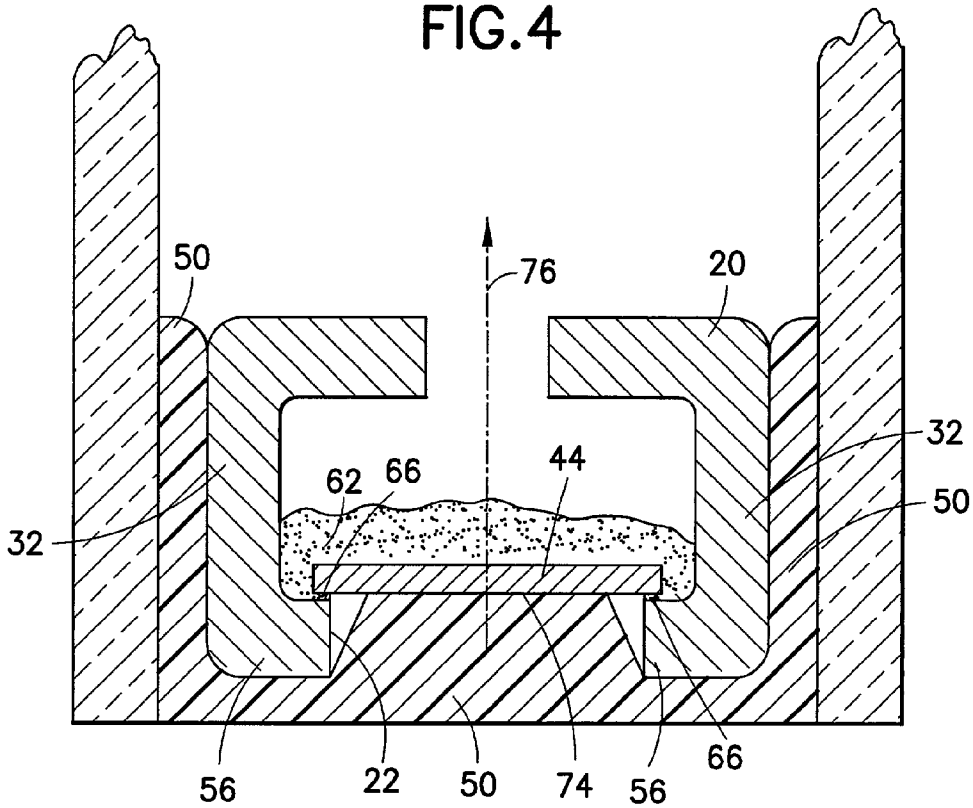
44
50
20

FIG.4


50
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22
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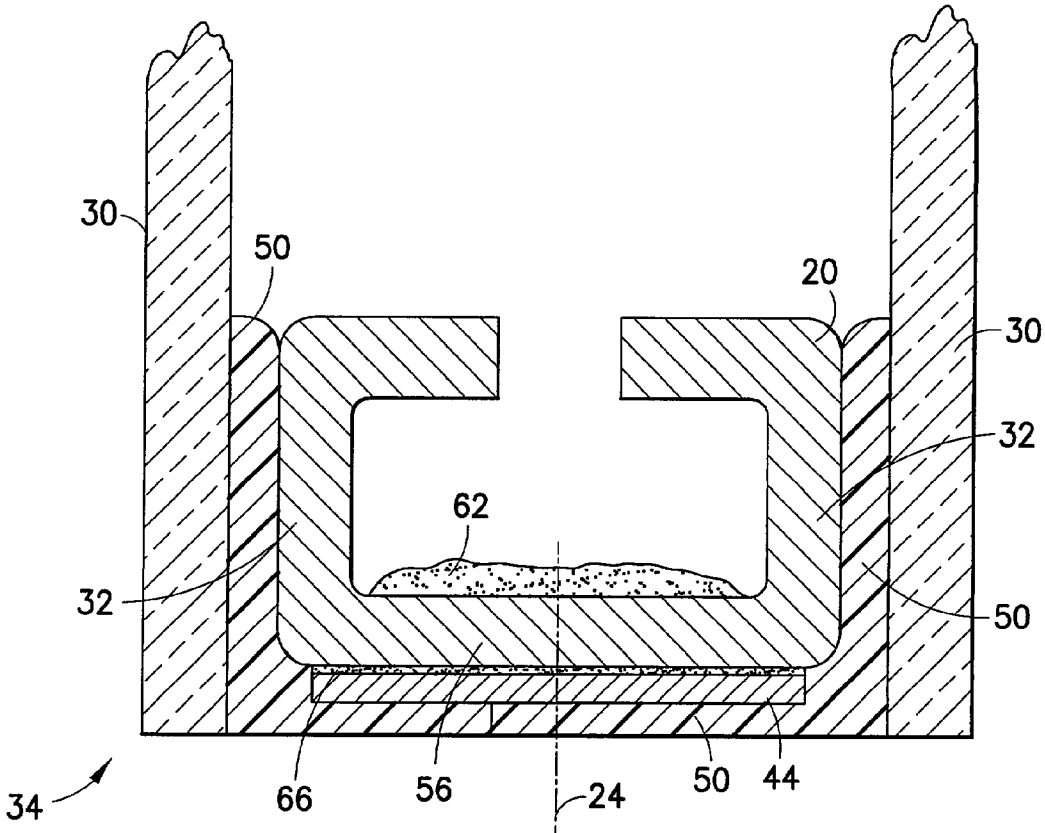
66

FIG.5


30
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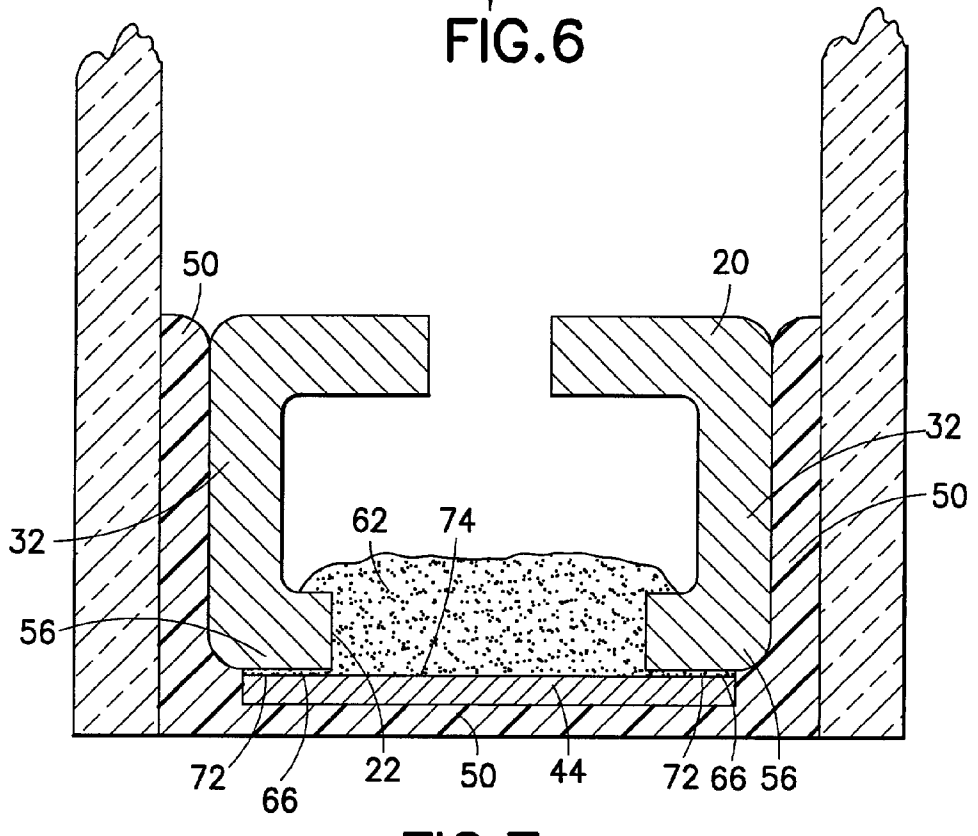
44

FIG.6


50
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62
74
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66
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56

FIG.7

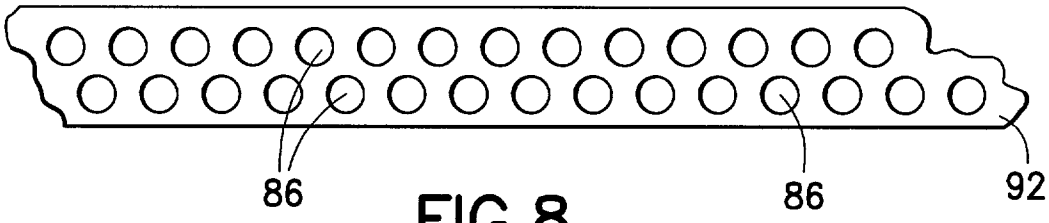


FIG.8

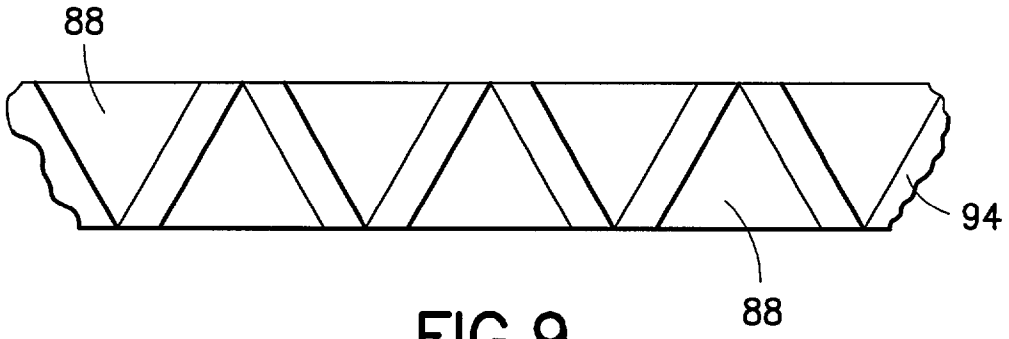


FIG.9

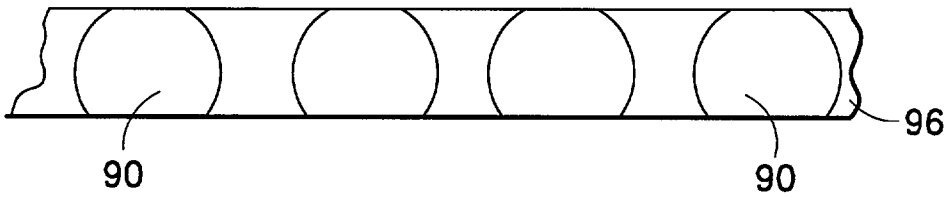


FIG.10

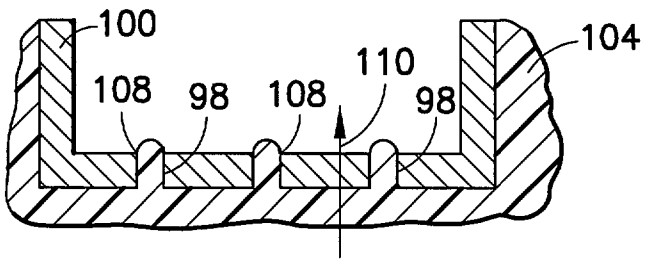


FIG.11

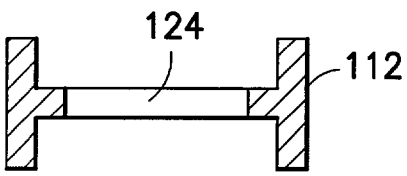


FIG.12

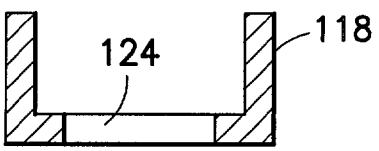
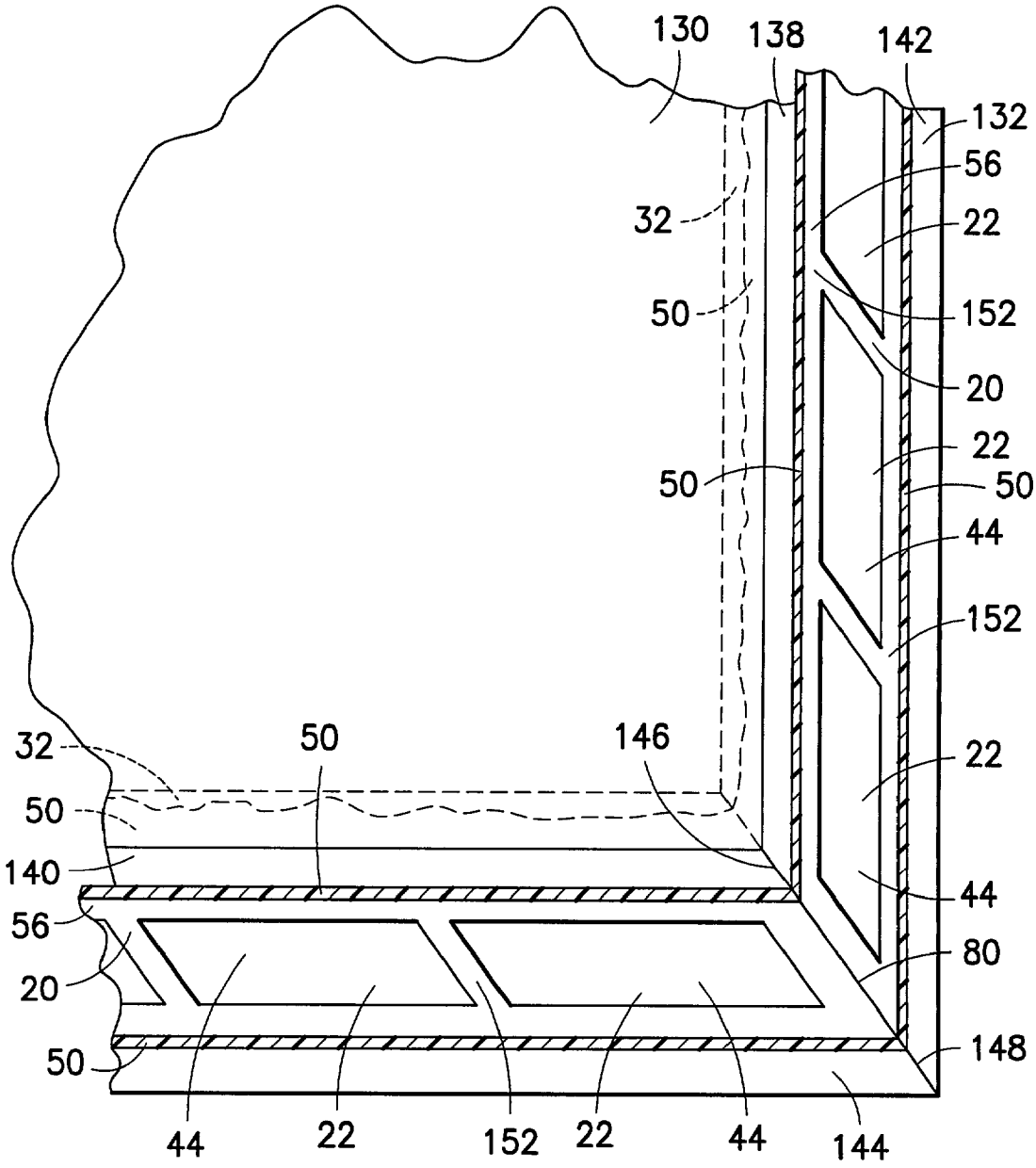


FIG.13


130
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146
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140
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56
80
20
148
50
44
22
152
22
44
144

FIG. 14

INSULATED CHANNEL SEAL FOR GLASS PANES

[0001] This application claims benefit of U.S. Provisional Application No. 60/188,646, filed Mar. 10, 2000

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The invention relates to insulated spacer frames for parallel window panes, more specifically to thermally insulated channel for the spacer frames.

[0004] 2. Description of the Prior Art

[0005] Farbstein in U.S. Pat. No. 5,424,111 patented Jun. 13, 1995 describes a pair of metal U shaped channels separated by a rigid bar of insulating material that contains a moisture absorbent. Each U channel encloses a side of the bar. The resulting split metal longitudinal shell of the channel is made by casting the insulating bar within a C shaped metal channel shell and after the bar is hardened, cutting along the length of the channel completely through the C channel shell to the insulating material.

SUMMARY OF THE INVENTION

[0006] It is one object of the invention to reduce thermal conduction across a metal channel that forms the spacer frame for mounting between glass panes of a thermal window.

[0007] A spacer channel for a frame which separates window panes to form an insulated window has a plurality of openings spaced from each other along the length of a straight portion of the channel. The openings are through a wall of the channel that faces outward along the periphery of the frame and glass sandwich when the frame is between panes of glass. The openings are designed to prevent significant passage of sealant from the outside of the channel to the inside of the channel through the openings. This is done by (a) the cross sectional area of each opening being so small that it resists viscous flow of the sealant through the opening, or by (b) a cover over the opening, or by (a)+(b).

[0008] In an insulated window assembly comprising a first pane, a second pane, a spacer channel mounted between the first and second panes for separating the panes to form a channel and pane sandwich insulated window, the spacer comprises a first elongate wall facing the first pane, a second elongate wall facing the second pane, a third elongate wall connected to the first and second walls, facing outward along the periphery of the channel and pane sandwich, and a plurality of openings through the third elongate wall along the length of the third elongate wall.

[0009] The total cross sectional area of the openings comprises 80 to 95 percent of the cross sectional area of the third elongate wall.

[0010] In one arrangement the cross sectional size of each of the plurality of openings is small enough so that sealant cannot significantly enter the channel to the area between the first and second elongate walls by way of the openings.

[0011] In another arrangement a low thermal conductivity strip covers the plurality of openings, and a sealant extends over the first, second and third elongate walls of the channel, covering the plurality of openings, and against the thermal conductivity strip.

[0012] In another arrangement a low thermal conductivity strip covers the plurality of openings, and a sealant extends over the first and second walls and the low thermal conductivity strip.

[0013] Other objects and advantages of the invention will become apparent to persons skilled in the art from the ensuing description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] In order that the invention will be more fully comprehended, it will now be described, by way of example, with reference to the accompanying drawings, in which:

[0015] **FIG. 1** is a perspective view of a portion of a channel of the invention showing predominantly the outward and back walls of the channel and a plurality of openings through the outward wall.

[0016] **FIG. 2** is a perspective view of the channel of **FIG. 1** showing predominantly the inward and front walls of the channel and a strip of material inside the channel that prevents passage of sealant through the openings in the outward wall into the channel.

[0017] **FIG. 3** is a perspective view of the channel of **FIG. 1** showing predominantly the outward and back walls, and a strip of material outside the channel that prevents passage of sealant through the openings in the outward wall into the channel.

[0018] **FIG. 4** is a cross section of the channel of **FIG. 2**, viewed at **4-4**. Added is sealant, two glass panes, and desiccant material.

[0019] **FIG. 5** is a cross section of the channel of **FIG. 2**, viewed at **5-5**. Added is sealant, two glass panes, and desiccant material.

[0020] **FIG. 6** is a cross section of the channel of **FIG. 3**, viewed at **6-6**. Added is sealant, two glass panes, and desiccant material.

[0021] **FIG. 7** is a cross section of the channel of **FIG. 3**, viewed at **7-7**. Added is sealant, two glass panes, and desiccant material.

[0022] **FIG. 8** is a schematic view of the outward wall of a channel of the invention showing a form of openings according to the invention.

[0023] **FIG. 9** is a schematic view of the outward wall of another channel of the invention showing a form of openings according to the invention.

[0024] **FIG. 10** is a schematic view of the outward wall of another channel of the invention showing a form of openings according to the invention.

[0025] **FIG. 11** is a schematic cross section view of another channel of the invention showing penetration of sealant into openings in the outer wall.

[0026] **FIG. 12** is a schematic cross section view of another channel of the invention.

[0027] **FIG. 13** is a schematic cross section view of another channel of the invention.

[0028] **FIG. 14** is a schematic perspective view of a lower left corner of a channel and pane sandwich of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] Before explaining the invention in detail, it is to be understood that the invention is not limited in its application to the detail of construction and arrangement of parts illustrated in the drawings since the invention is capable of other embodiments and of being practiced or carried out in various ways. It is also to be understood that the phraseology or terminology employed is for the purpose of description only and not of limitation.

[0030] Referring to **FIGS. 1, 2, 4**, and **5**, strip metal is stamped and rolled to form C-channel **20**. Openings **22** are formed through outer wall **56** which faces outward **24** along the periphery of the spacer frame and glass sandwich **34**. This reduces the rate of heat transfer across **36** outer wall **56**, and therefore reduces the rate of heat transfer between glass panes **30** by channel **20**.

[0031] A strip **44** of material having stiffness and low thermal conductivity such as a paper sheet or a plastic sheet is laid on wall **56** over openings **22** inside channel **20** so that strip **44** seals the openings.

[0032] Desiccant **62** is installed within channel **20**. Strip **44** prevents passage of the desiccant out of the channel by way of covered openings **22**.

[0033] Semi-viscous sealant **50** is applied outside the channel to outer wall **56** and vertical walls **32**. Strip **44** prevents passage of sealant **50** into the channel by way of covered openings **22**.

[0034] Strip **44** is fastened to wall **56** inside channel **20** by adhesive **66**. The adhesive is of high strength to resist force from semi-viscous sealant that is applied to the outside of the channel to separate the strip from wall **56** by pushing the strip **44** away from wall **56** inward into the channel as the sealant enters into openings **22**.

[0035] The adhesive is also designed to survive the high temperature of sealant as it is applied on the channel, and to survive ambient temperature extremes that the completed window sandwich is likely to encounter. For example, hot melt butyl sealant can be applied at a high temperature of 250 degrees F. The adhesive is preferably designed to survive and stick from −20 degrees F. to 300 degrees F. and not to release gas or moisture into the channel that would contaminate the space between the panes of glass.

[0036] Preferably the adhesive is designed to prevent passage of gas or liquid past the adhesive. The adhesive is also chemically compatible with the sealant so that it is not weakened by chemical constituents of the sealant.

[0037] The adhesive can be applied to the lateral borders **72** of the strip, so that the adhesive will not come into contact with the sealant at the middle region **74** of the strip so that the sealant is in direct hermetically sealing contact with the strip.

[0038] The adhesive and strip are preferably impervious to gas and moisture transfer. If the sealant forms a moisture and gas seal over the openings after the sealant hardens, the strip does not have to be impervious to gas and moisture.

[0039] The sealant can be applied after the adhesive cures. Suitable adhesives include pressure sensitive contact, air-cure, and epoxy materials.

[0040] The strip can be paper, plastic, metal, or other material that meets the above performance descriptions.

[0041] V-cutout **38** is used to form a corner by folding of wall **56**.

[0042] The strip can be slightly elastic if it crosses fold line **80** of the channel, so that the strip does not break when the corner is folded.

[0043] The strip can be cut or be discontinuous at the fold line to avoid tearing it when the channel is bent at the fold line to make a comer of the spacer frame.

[0044] In **FIGS. 3, 6**, and **7**, strip **44** is laid on wall **56** outside channel **20** over openings **22** so that it seals the openings.

[0045] Strip **44** prevents passage of the desiccant out of the channel by way of covered openings **22**, and prevents passage of sealant **50** into the channel by way of openings **22**.

[0046] Preferably the openings comprise 80 to 95 percent of the cross sectional area of the outer wall of the straight portion of the channel, allowing for bend margin **84** on each side of fold line **80**.

[0047] Preferably the openings do not have sharp corners, but are curved around the circumference so that viscous sealant will flow into contact with the entire edge of the circumference of the opening. The openings can be any shape.

[0048] If the strip is not used to dam the hole against flow of the sealant through the hole into the channel, the holes are at least so small that the sealant cannot flow through the hole into the channel, that is, the sealant is not lost into the channel when it is applied to the outside of the channel. In that arrangement, the opening could be about 1/16 inch in diameter for example, calculated according to the viscosity of the sealant.

[0049] FIGS. **8-10** show three different shapes of openings **86, 88**, and **90** respectively of channel outer walls **92, 94**, and **96**.

[0050] In **FIG. 11**, openings or holes **98** of channel **100** are designed so that they are narrow enough to prevent significant flow of viscous sealant **104** through each hole **98** into the channel.

[0051] The sealant only wells upward into the hole, and may extend only slightly above the hole inner opening **108**, but not significantly into **110** the channel.

[0052] The invention comprises the outer wall of a window spacer frame, and is not meant to be limited by the shape of the rest of the frame stock.

[0053] **FIGS. 12 and 13** show two, **112** and **118**, of many frame stock cross sections that can contain the invention. Each of the two contains openings **124**.

[0054] In **FIG. 14**, channel **20** is mounted between panes **130, 132** adjacent to edges **138, 140** from corner **146** of pane **130** and edges **142, 144** from corner **148** of pane **132**. Semi-viscous butyl sealant **50** is shown between the panes and the channel, but is omitted from the drawing over outward side **152** of outer wall **56** of the channel for clarity of viewing. Butyl sealant **50** between elongate wall **32** of

channel **20** and pane **130** seen through pane **130** is shown in dashed lines. Low thermal conductivity strip **44** seals openings **22** against passage of sealant from outward side **152** through openings **22** into the space between vertical walls **32**.

[**0055**] Although the present invention has been described with respect to details of certain embodiments thereof, it is not intended that such details be limitations upon the scope of the invention. It will be obvious to those skilled in the art that various modifications and substitutions may be made without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. A spacer channel for mounting between a first window pane having a first edge and a second edge from a corner of the first pane, and a second window pane, adjacent to said first edge for separating the window panes to form a channel and pane sandwich insulated window when said spacer channel is mounted between the panes, said spacer channel comprising:

a first elongate wall for facing the first pane, a second elongate wall for facing the second pane, a third elongate wall connected to the first and second walls, said channel being configured so that said third elongate wall faces outward along the periphery of the channel and pane sandwich when said spacer channel is mounted between the panes extending along the first and second edges, and a plurality of openings through said third wall along the length of said third wall.

2. The spacer channel of claim 1 wherein said openings are made by removing a substantial portion of the area of said third elongate wall.

3. The spacer channel of claim 1 wherein the total cross sectional area of said openings comprises 80 percent to 95 percent of the cross sectional area of said third elongate wall.

4. The spacer channel of claim 1 further comprising a low thermal conductivity strip covering said plurality of openings.

5. The spacer channel of claim 1 further comprising a sealant extending over the first, second and third elongate walls of the channel and covering said plurality of openings.

6. The spacer channel of claim 4 further comprising a sealant extending over the first, second and third elongate walls of the channel, covering said plurality of openings, and against said low thermal conductivity strip.

7. The spacer channel of claim 4, further comprising a sealant extending over the first and second elongate walls and said low thermal conductivity strip.

8. The spacer channel of claim 5 further comprising the cross sectional size of each of said plurality of openings being small enough so that sealant cannot significantly enter the channel to the area between the first and second elongate walls by way of the openings.

9. In an insulated window assembly comprising a first pane, a second pane, a spacer channel mounted between the first and second panes for separating the panes to form a channel and pane sandwich insulated window, said spacer channel comprising:

a first elongate wall facing said first pane, a second elongate wall facing said second pane, a third elongate wall connected to the first and second walls, facing outward along the periphery of the channel and pane sandwich, and a plurality of openings through said third elongate wall along the length of said third elongate wall.

10. The spacer channel of claim 9 wherein said openings are made by removing a substantial portion of the area of said third elongate wall.

11. The spacer channel of claim 9 wherein the total cross sectional area of said openings comprises 80 percent to 95 percent of the cross sectional area of said third elongate wall.

12. The spacer channel of claim 9 further comprising a low thermal conductivity strip covering said plurality of openings.

13. The spacer channel of claim 9 further comprising a sealant extending over the first, second and third elongate walls of the channel and covering said plurality of openings.

14. The spacer channel of claim 12 further comprising a sealant extending over the first, second and third elongate walls of the channel, covering the plurality of openings, and against said low thermal conductivity strip.

15. The spacer channel of claim 12 further comprising a sealant extending over the first and second walls and said low thermal conductivity strip.

16. The spacer channel of claim 13 further comprising the cross sectional size of each of said plurality of openings being small enough so that sealant cannot significantly enter the channel to the area between the first and second elongate walls by way of the openings.

17. In a spacer channel for a frame for separating window panes to form a frame and glass sandwich insulated window, said spacer channel comprising a plurality of openings through a first wall of the spacer channel that faces outward along the periphery of the frame and glass sandwich, the openings being spaced from each other.

18. The spacer channel of claim 17 wherein the openings comprise 80 to 95 percent of the cross sectional area of said first wall of a straight side of said sandwich.

19. The spacer channel of claim 17 further comprising a low thermal conductivity strip covering said plurality of openings.

20. The spacer channel of claim 19 further comprising a sealant extending over said plurality of openings and against said strip.

21. The spacer channel of claim 17 further comprising the cross sectional size of the openings being small enough so that a predetermined sealant as it is applied cannot significantly enter the channel from the outward side of said first wall by way of said openings.

* * * * *