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INSULATED METAL STRUCTURE

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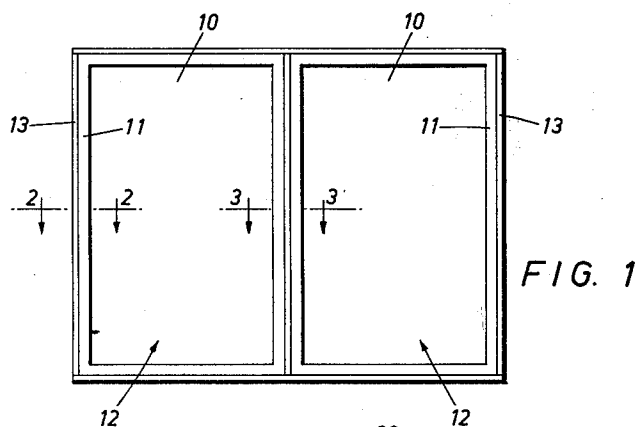


FIG. 1

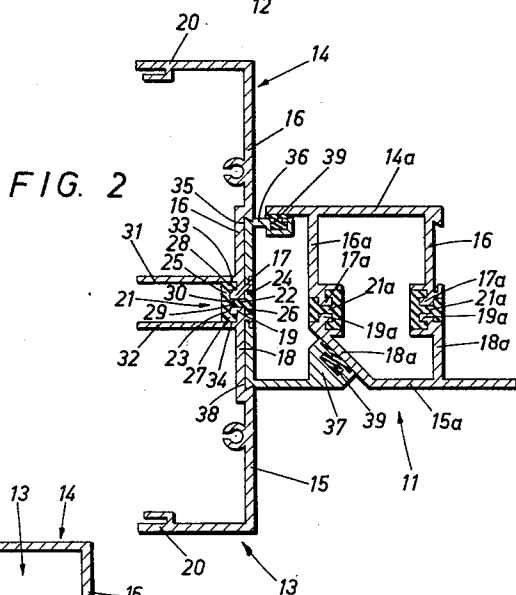


FIG. 2

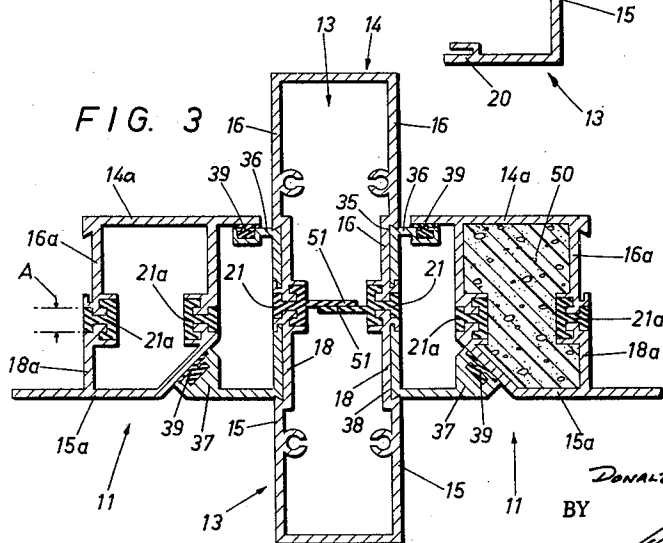


FIG. 3

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## INSULATED METAL STRUCTURE

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This invention relates to an insulated metal structure which is especially suited for use as a door frame, window frame, door sash or window sash. More particularly, this invention relates to a structure comprising two metal sections and an insulator that locks the two sections together and provides an insulating break between the two metal sections.

As is well known, the use of metal frames and sashes, especially those made of aluminum, has become widespread in the construction of buildings. Since aluminum is an extremely good thermal conductor, early in the development of aluminum frames and sashes the problem arose of preventing the formation of frost on the side of the frame or sash which is inside the building in which the frame or sash is provided. It was found that a one-piece aluminum frame or sash which had a part thereof exposed to the elements and another part inside the building quickly developed frost on the inside surfaces thereof when the temperature outside dropped below freezing. Even when the temperature outside was not below freezing there existed the problem of condensation forming on the interior cold surfaces of such a frame or sash. In order to obviate these problems it was suggested to make the frame or sash in two sections, an exterior and an interior section, and to provide a frost-break in the form of a thermal insulator therebetween. A typical structure of the aforementioned type is shown in United States Patent 2,872,713 issued February 10, 1959 in the name of G. B. Haas, wherein the generally cross-shaped member designated as 18 forms a frost-break between inner and outer metal sections 30. There are numerous disadvantages, however, in the structure shown in the aforementioned patent. For example, the inner and outer metal sections which form a part of the sash can be relatively easily pulled off of the cross-shaped insulating member 43. In addition, the sash shown in this patent requires retaining walls on both sides of the arms of the cross-shaped member to restrain sideways movement of one metal section with respect to the other, and consequently the metal frame sections are both complex and expensive.

Accordingly it is one object of my invention to provide an insulated metal structure which inherently is extremely rigid in construction.

An additional object of my invention is to provide an insulated metal structure constructed in such a manner that the metal sections thereof cannot be pulled off of the insulating member or members.

Yet another object of my invention is to provide an insulated metal structure which requires only one member in each section rather than two walls in each section to restrain sideways movement of the metal sections making up the frame with respect to each other.

A further object of my invention is to provide an insulated metal structure in which the metal sections are not complex and can be extruded readily and simply manufactured at a comparatively low cost.

Yet another object of my invention is to provide an insulated metal structure which is extremely simple to assemble and hence inexpensive to assemble.

In brief, an insulated metal structure embodying my invention is especially suited for use as a window frame, door frame, window sash or door sash. The insulated metal structure comprises a first metal section, a second metal section and an insulating member. The first metal

section includes a first wall having an inwardly turned first flange, while the second metal section includes a second wall having an inwardly turned second flange. The first and second sections are positioned side-by-side with the aforementioned flanges adjacent to and spaced-apart from each other. The insulating member is positioned between the sections and locks the sections together. The insulating member is of T-shaped configuration and comprises a first portion having first, second, third and fourth arms. The first and second arms extend away from the first portion on one side thereof and are spaced-apart from each other. The third and fourth arms extend away from the first portion on another side thereof opposite the one side and are spaced-apart from each other. The first and third arms each have inwardly turned arms which are positioned remote from the first portion and which extend towards the second and fourth arms respectively. The first and second arms and one of the inwardly turned arms define a first channel, while the third and fourth arms and the other of the inwardly turned arms define a second channel. The first portion is slidably positioned between the flanges with the first flange being positioned in the first channel and the second flange being positioned in the second channel. The second and fourth arms overlap the first and second walls respectively.

My invention will become more apparent from the following detailed description taken in conjunction with the appended drawings in which:

FIGURE 1 is an elevation of a window having a frame and sash constructed in accordance with my invention,

FIGURE 2 is a section along line 2—2 in FIGURE 1, and

FIGURE 3 is a section taken along line 3—3 in FIGURE 1.

Referring to FIGURE 1, I have shown a window which comprises two window lights 10 each mounted in a sash 11 to form two windows 12, the windows 12 being mounted in a frame 13.

As best shown in FIGURE 2, frame 13 is an insulated metal structure which comprises an inner metal section 14 and an outer metal section 15. Inner section 14 is positioned inside the building in which frame 13 is mounted, while outer section 15 is positioned outside of this building, in the sense that outer section 15 is exposed to the elements. Inner section 14 has a wall 16 which has an inwardly turned flange 17. Outer section 15 has a wall 18 which has an inwardly turned flange 19. Each of sections 14 and 15 are provided with walls 20 which are adapted to be affixed to the building in which the frame is mounted in a conventional manner. Inner and outer sections 14 and 15 respectively are positioned side-by-side with flanges 17 and 19 adjacent to and spaced-apart from each other.

An insulating member 21 which is rigid in nature and may be made of any low thermal conductivity material such as polyvinyl chloride or polyethylene is positioned between sections 14 and 15 and locks these sections together. Insulating member 21 is of T-shaped configuration and comprises a first portion 22 which has arms 23, 24, 25 and 26. Arms 23 and 24 extend away from portion 22 on one side thereof and are spaced-apart from each other. Arms 25 and 26 extend away from the opposite side of portion 22 and also are spaced apart from each other. Arms 23 and 25 have inwardly turned arms 27 and 28 respectively which are positioned remote from portion 22 and extend towards arms 24 and 26 respectively. Arms 23 and 24 and inwardly turned arm 27 define a channel 29, while arms 25 and 26 and inwardly turned arm 28 define another channel 30. Insulating member 21 is slidably positioned between sections 14 and 15 with portion 22 being positioned between flanges 17

and 19, flange 19 being positioned in channel 29 and flange 17 being positioned in channel 30. Arms 24 and 26 overlap walls 18 and 16 respectively.

It will be seen that a frame 12 so constructed is extremely rigid in nature, and that sections 14 and 15 cannot be pulled off insulator 21 which is rigid in nature. Moreover, each section 14 and 15 requires only one member, namely flanges 17 and 19 to restrain sideways movement of one section with respect to the other. Sections 14 and 15 are not complex in nature and can be readily extruded and simply manufactured. Furthermore frame 13 is very simple to assemble, as it is required only that sections 14 and 15 be positioned adjacent one another and insulating member 21 slid therebetween.

A further feature of frame 13 is the provision of flanges 31 and 32 which extend inwardly from walls 16 and 18 respectively, flange 31 being spaced from flange 17, and flange 32 being spaced from flange 19, whereby flanges 17 and 31 define a channel 33 therebetween, while flanges 32 and 19 define a channel 34 therebetween. Inwardly turned arm 28 is positioned in channel 33, while inwardly turned arm 27 is positioned in channel 34.

Dovetailed in a channel 35 in wall 16 is an arm 36, a corresponding arm 37 being dovetailed in a channel 38 formed in wall 18. Each arm 36 and 37 carries weather-stripping 39.

Also shown in FIGURE 2 is a sash 11 embodying my invention. It will be noted that sash 11 is constructed in the same manner as frame 13, but that inner and outer sections 14a and 15a respectively of sash 11 are generally U-shaped, so that inner section 14a has two side walls 16a each having a free end, while outer section 15a has two side walls 18a each having a free end. In the case of sash 11 two insulating members 21a are provided, the U-shaped sections 14a and 15a being positioned side-by-side with the flanges 17a and 19a respectively thereof adjacent to and spaced-apart from one another, the insulating members 21a each being positioned between sections 14a and 15a and locking these sections together in the same manner as sections 14 and 15 of frame 13 are locked together. Similar parts in sash 11 to those previously described in connection with the structure of frame 13 are designated by the same reference numerals followed by an "a." In view of the similarity of the construction of sash 11 and frame 13 it is not necessary to elaborate in detail upon the structure of sash 11, as this is readily apparent from the drawings and from the previous description of the structure of frame 13. It will be noted, however, that sash 11 abuts against weather-stripping 39 and is sealed thereagainst. Window lights 10 (FIGURE 1) may be glazed in sash 11 in any suitable manner to form windows 12 which may either be fixed or movable with respect to frame 13, and is known in the art.

Frame 13 and sashes 11 shown in FIGURE 3 are constructed in the same manner as previously described in connection with FIGURE 2, and the same reference characters as used in FIGURE 2 are employed in FIGURE 3. Consequently no detailed description of FIGURE 3 is necessary. However, it should be noted that in the case of the structure shown in FIGURE 3, frame 13 comprises an inner section 14 and an outer section 15 each of which is generally U-shaped in character, and consequently section 14 has two walls 16, while section 15 has two walls 18. Inner and outer sections 14 and 15 and insulating members 21 form a compartment, as do inner and outer sections 14a and 15a and insulating member 21a. In order to provide better insulation this compartment may be filled with foamed polyurethane 50. As an alternative to employing polyurethane and as best seen in FIGURE 3, insulating members 21 may be provided with fingers 51 which extend from arms 23 and 25 away from arms 24 and 26 and towards the other of the insulating members 21. Fingers 51 engage each other and separate the

dead air space formed in the interiors of sections 14 and 15, thereby providing more effective insulation.

It has been found by testing that if the width "A" of arms 24 and 26 or 24a and 26a is about  $\frac{5}{16}$ ", this is sufficient to prevent surface bridging by moisture or frost which would lower the insulating value of insulating members 21 and 21a,  $\frac{5}{16}$ " being sufficiently effective to obviate moisture bridging under the following conditions: inner temperature  $+70^{\circ}$  F., outer temperature  $-40^{\circ}$  F., relative humidity 20%, or alternatively, inner temperature  $+70^{\circ}$  F., outer temperature  $-20^{\circ}$  F., relative humidity 30%. If width "A" is increased to about  $\frac{7}{16}$ ", moisture bridging can be avoided under the following conditions: inner temperature  $+70^{\circ}$  F., outer temperature  $-40^{\circ}$  F., relative humidity 35%, or alternatively, inner temperature  $+70^{\circ}$  F., outer temperature  $-20^{\circ}$  F., relative humidity 50%.

Those skilled in the art will appreciate that while I have described certain preferred embodiments of my invention, changes and modifications may be made thereto without departing from the spirit and scope of my invention.

What I claim as my invention is:

1. An insulated metal structure especially suited for use as a window frame, door frame, window sash and door sash, said insulated metal structure comprising a first metal section and a second metal section, said first metal section including a first wall having an inwardly turned first flange, said second metal section including a second wall having an inwardly turned second flange, said first and second sections being positioned side-by-side with said flanges adjacent to and spaced apart from each other; a member of rigid thermal insulating material positioned between said sections and locking said sections together, said insulating member being adapted to be readily slidable between said sections for slidable insertion between said sections and for slidable removal from between said sections, said insulating member being of T-shape configuration and comprising a first portion having first, second, third and fourth arms, said first and second arms extending away from said first portion on one side thereof and being spaced apart from each other, said third and fourth arms extending away from said first portion on another side thereof opposite said one side and being spaced apart from each other, said first and third arms each having inwardly turned arms positioned remote from said first portion and extending towards said second and fourth arms respectively, said first and second arms and one of said inwardly turned arms defining a first channel, said third and fourth arms and the other of said inwardly turned arms defining a second channel, said first portion being slidably positioned between said flanges with said first flange being positioned in said first channel and said second flange being positioned in said second channel, said second and fourth arms being positioned in recesses in said first and second walls respectively, the outer surfaces of said second and fourth arms being substantially flush with the outer surfaces of said first and second walls; a third flange extending inwardly from said first wall and spaced from said first flange, said first and third flanges defining a third channel therebetween; and a fourth flange extending inwardly from said second wall and spaced from said second flange, said second and fourth flanges defining a fourth channel therebetween, said one inwardly turned arm completely occupying said third channel and abutting said first and third flanges, said other inwardly turned arm completely occupying said fourth channel and abutting said second and fourth flanges, whereby said first and third flanges and said second and fourth flanges are adapted to guide said insulating member during insertion thereof between said sections.

2. An insulated metal structure according to claim 1 including a finger extending from said first and third arms away from said second and fourth arms.

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3. An insulated metal structure especially suited for use as a window frame, door frame, window sash and door sash, said insulated metal structure comprising a first generally U-shaped metal section having two first side walls each having a free end; a second generally U-shaped metal section having two second side walls each having a free end, each of said first side walls having an inwardly turned first flange at said free end of said first side wall, each of said second side walls having an inwardly turned second flange at said free end of said second side wall, said first and second sections being positioned side-by-side with said first flanges adjacent to and spaced apart from said second flanges; two members of rigid thermal insulating material each positioned between said sections and locking said sections together, each of said insulating members being adapted to be readily slidable between said sections for slidable insertion between said sections and for slidable removal from between said sections, each of said insulating members being of T-shaped configuration and comprising a first portion having first, second, third and fourth arms, said first and second arms extending away from said first portion on one side thereof and being spaced apart from each other, said third and fourth arms extending away from said first portion on another side thereof opposite said one side and being spaced apart from each other, said first and third arms each having inwardly turned arms positioned remote from said first portion and extending towards said second and fourth arms respectively, said first and second arms and one of said inwardly turned arms defining a first channel, said third and fourth arms and the other of said inwardly turned arms defining a second channel, said first portions of said insulating members each being slidably positioned between a different adjacent set of said first and second flanges with said first flanges being positioned in said first channels of said insulating members and said second flanges being positioned in said second channels of said insulating members to form a compartment defined by said first and second sections and said insulating members, said second and

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fourth arms of said insulating members being positioned in recesses in said first and second walls respectively, the outer surfaces of said second and fourth arms being substantially flush with the outer surfaces of said first and second walls; third flanges extending inwardly from said first side walls and spaced from said first flanges, each pair of said first and third flanges defining a third channel therebetween; and fourth flanges extending inwardly from said second side walls and spaced from said second flanges, each pair of said second and fourth flanges defining a fourth channel therebetween, said one inwardly turned arms of said insulating members completely occupying said third channels and abutting said first and third flanges, said other inwardly turned arms of said insulating members completely occupying said fourth channels and abutting said second and fourth flanges, whereby said first and third flanges and said second and fourth flanges are adapted to guide said insulating members during insertion thereof between said sections.

4. An insulated metal structure according to claim 3 including finger means extending from each of said insulating members towards the other of said insulating members, said finger means engaging each other and separating the interiors of said first and second sections.

5. An insulated metal structure according to claim 3 wherein said compartment is filled with a foamed insulating material.

6. An insulated metal structure according to claim 3 wherein said compartment is filled with foamed polyurethane.

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