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(54) **LOW THERMAL CONDUCTIVITY FRAME MEMBER, ESPECIALLY FOR WINDOWS, DOORS, FACADES AND THE LIKE**

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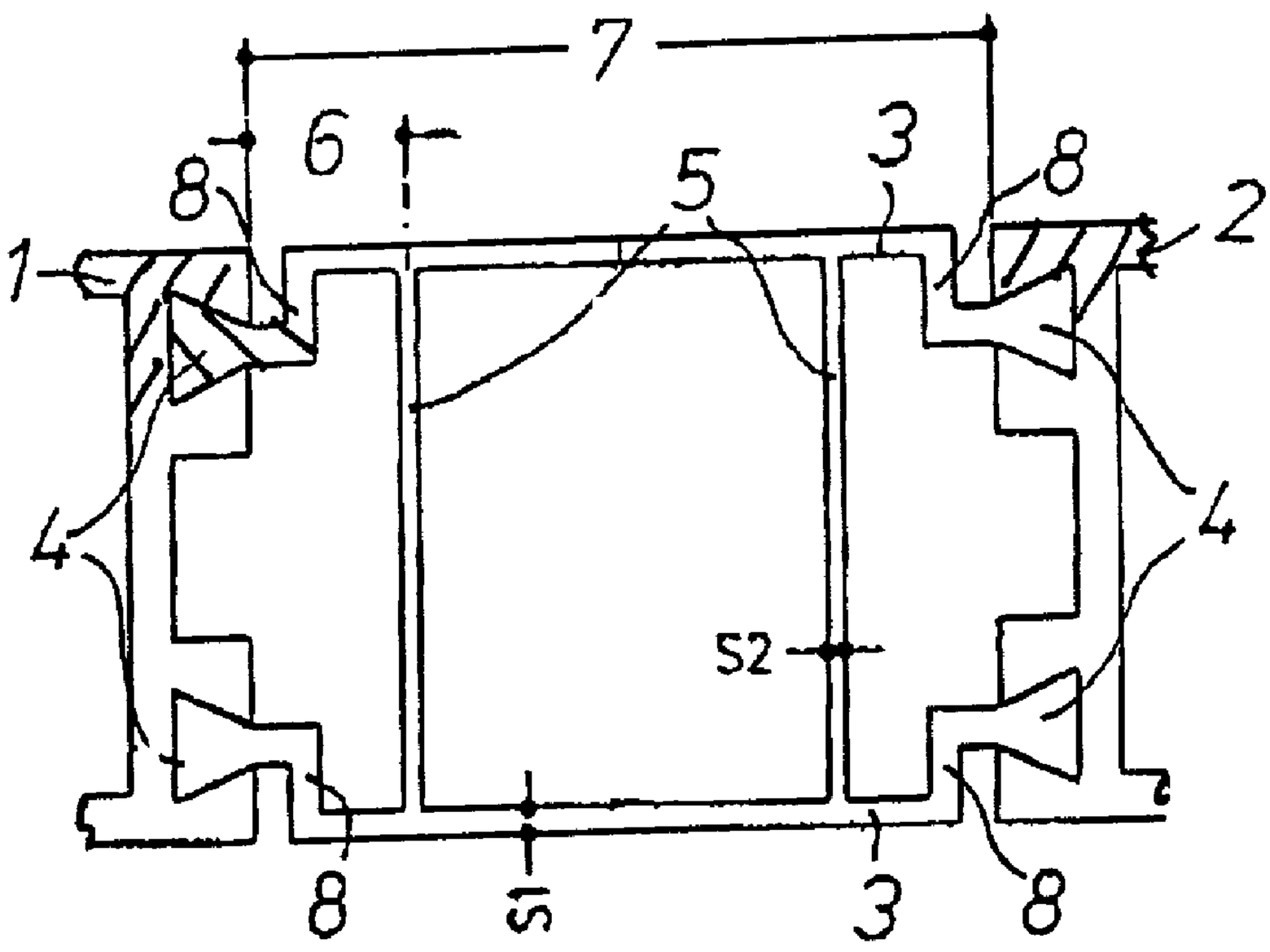
(57) **ABSTRACT**

A composite frame or profile member for windows, doors, facades and the like, has low thermal conductivity between the region separated by the frame member and has two spaced apart profiles connected by conductivity-limiting webs which have cleats engaged in grooves of the structural shapes. The webs are bridged by two or more ribs which can be perpendicular to the webs or inclined to them and the sum of the rib and web thicknesses when the ribs are perpendicular to the web should be not less than 3.8 mm, and when the ribs are inclined to the webs should be not less than 1.6 mm.



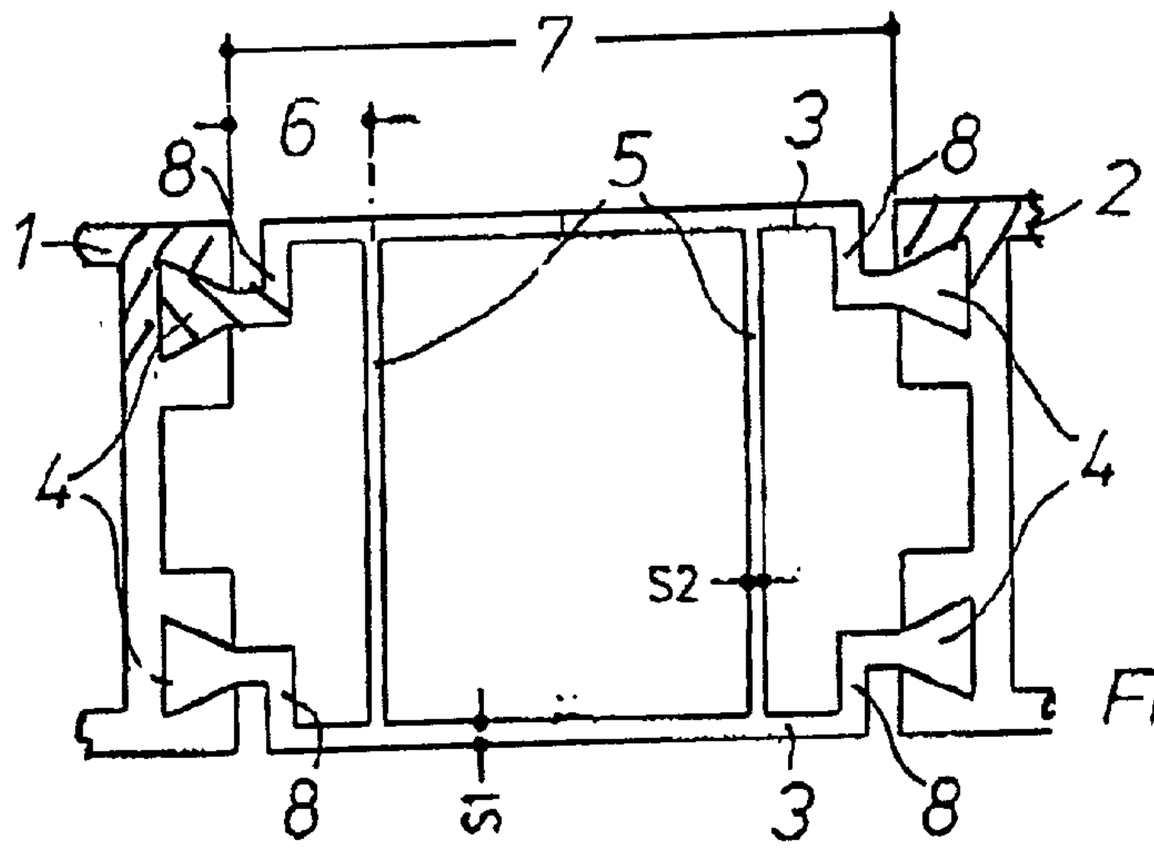


Fig. 1

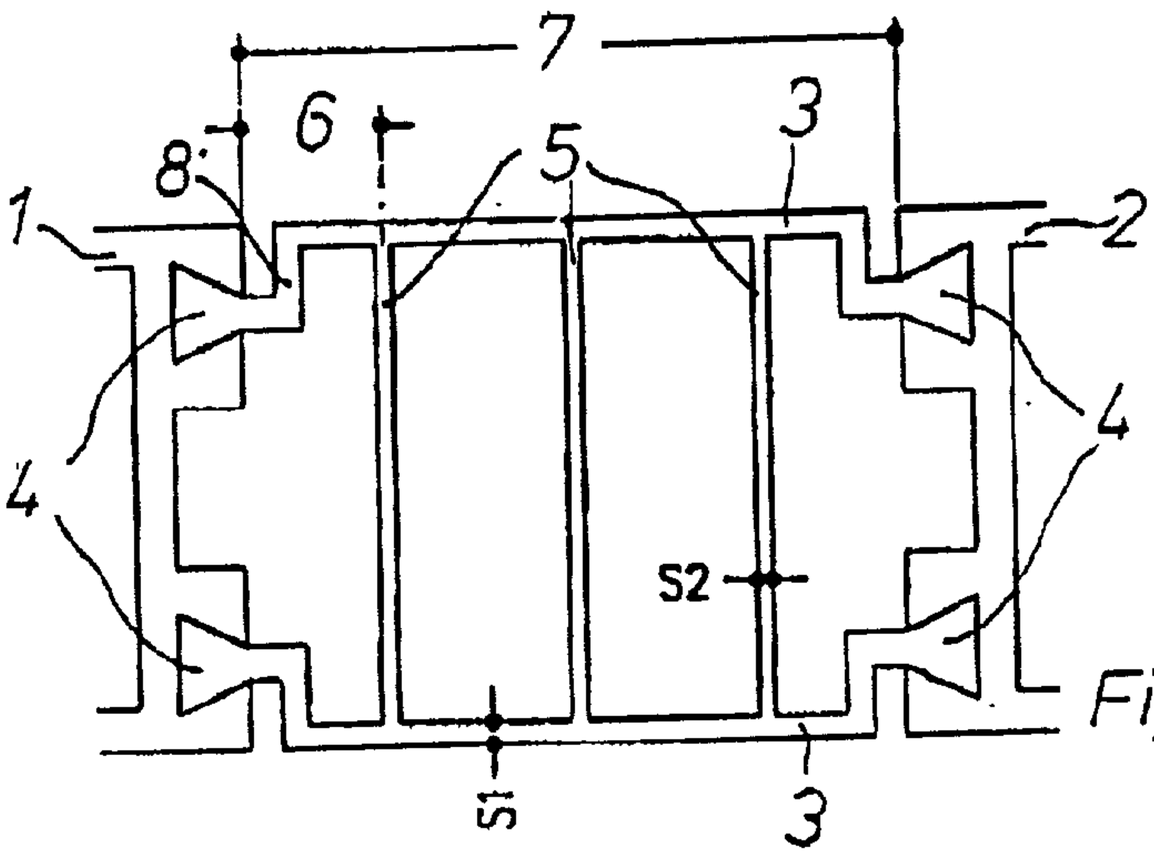


Fig. 2

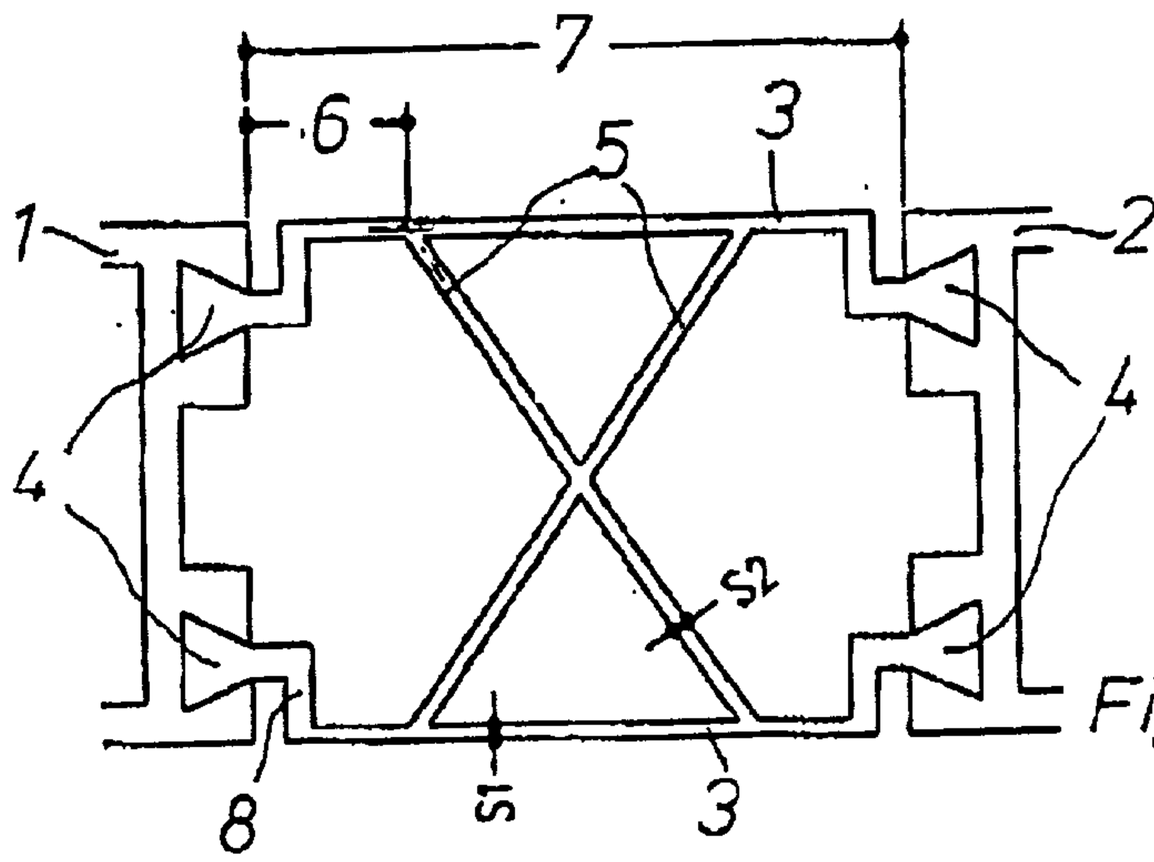


Fig. 3

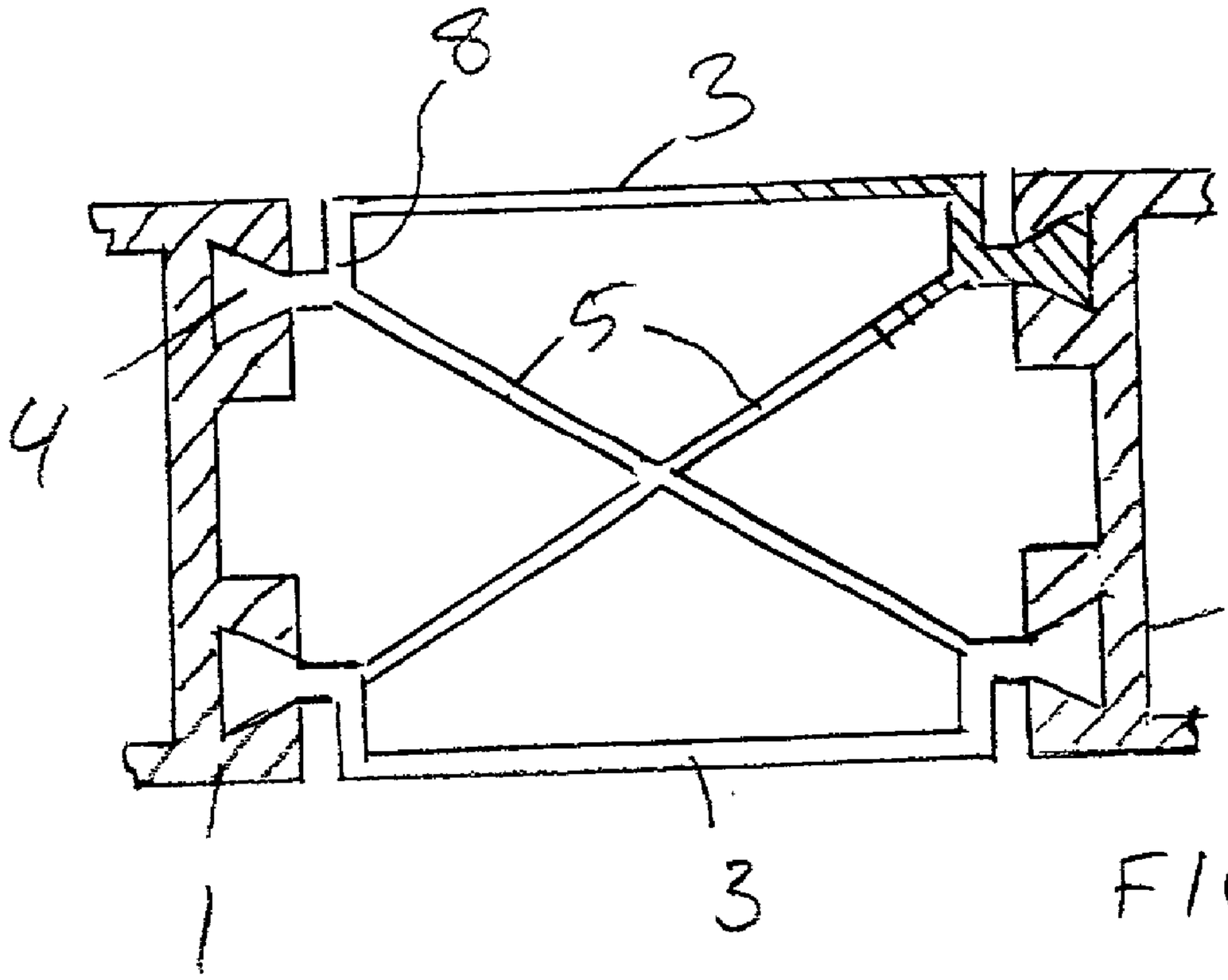


FIG. 4

LOW THERMAL CONDUCTIVITY FRAME MEMBER, ESPECIALLY FOR WINDOWS, DOORS, FACADES AND THE LIKE

FIELD OF THE INVENTION

[0001] My present invention relates to a frame member of low thermal conductivity, serving as a heat-transfer-limiting member, especially for windows, doors, facades and the like. More particularly, the invention relates to a heat-transfer-limiting composite member, which may be referred to as a profile, and which is comprised itself of two structural shapes or profiles which preferably are composed of metal, bridged by two thermal conductivity-limiting ribs which space the structural shapes apart.

BACKGROUND OF THE INVENTION

[0002] Frame members of low thermal conductivity are provided in a great variety of shapes and configurations and serve as members of low thermal conductivity in frames for windows, doors, facades and the like which are to have insulating capability, i.e. are capable of blocking the flow of heat from one side to the other of the window, door or other member provided with the frame. The panel or panels of the window or door, e.g. a double-pane window, are thermally insulated between two zones and by utilizing frame members or profiles of low thermal conductivity to support the panel or panels, the heat flow across the structural element can be greatly limited.

[0003] One of the more common constructions of such composite frame members has a pair of structural shapes or metal profiles which can be extruded from aluminum or some other light metal or light metal alloy and which can be held apart by the aforementioned conductivity-limiting webs. These webs, in turn, may be formed at their edges engageable with the structural shapes, with formations that mate with and engage in complementary formations of the structural shape. In a typical construction of this type, the formations on the webs are cleats or beads which are engageable in grooves of the structural shapes and preferably have dovetail cross sections.

[0004] While such composite frame members are effective in providing structural support in door, windows, facades and the like and have low thermal conductivity, at least in part because of the low conductivity cross sections of the webs, it is desirable to further improve the thermal properties of such members, i.e. to reduce the heat flow thereacross still further.

[0005] While theoretically such further reduction in heat flow could be reduced by reducing the thicknesses of the webs, there is a limit to the extent to which the thicknesses can be reduced without loss of mechanical and structural strength.

OBJECTS OF THE INVENTION

[0006] It is, therefore, the principal object of the present invention to provide a frame member or composite profile of low thermal conductivity, i.e. thermal barrier properties, whereby drawbacks of earlier systems are avoided and whose thermal and mechanical properties are optimized.

[0007] Another object of this invention is to provide an improved composite profile for windows, doors, facades and the like which is free from the drawbacks of earlier composite profiles for these purposes.

SUMMARY OF THE INVENTION

[0008] These objects and others which will become apparent hereinafter are attained, in accordance with the invention, in a frame member of low thermal conductivity for use as described and which comprises:

[0009] two spaced apart mutually parallel structural shapes each having a pair of connecting formations along sides of the structural shapes facing one another;

[0010] a pair of mutually spaced conductivity limiting webs each formed along respective opposite edges with a connecting formation mating with a respective one of the connecting formations of a respective one of the structural shapes whereby the conductivity limiting webs bridge between and interconnect the structural shapes, the webs being of substantially uniform thickness between the connecting formations thereof; and

[0011] a plurality of substantially planar ribs of substantially uniform thickness interconnecting the webs between the connecting formations thereof and running substantially perpendicular to the webs or at an inclination thereto, a sum of the wall thicknesses of the webs and all of the ribs being no less than 3.8 mm where the ribs are perpendicular to the webs and no less than 1.6 mm where the ribs are inclined to the webs.

[0012] When I refer to ribs which are inclined to the webs, I intend to so describe ribs which may not intersect or cross and are so inclined as well as crossing pairs of ribs.

[0013] The advantages of the frame member of the invention reside in the combination of thin wall webs which have low thermal conductivity with connecting ribs which provide good mechanical properties with respect to compressive strength, tensile strength, transverse torsional strength, shear stress resistance and rigidity, as well as other strength parameters, together with good heat-blocking characteristics.

[0014] Advantageously the wall thicknesses of the individual conductivity-limiting webs is in a range between 0.5 and 1.5 mm, and more preferably between 0.6 and 1.0 mm. The wall thicknesses of the individual webs can also be between 0.8 and 2.0 mm. Best results are obtained with frame members which have two such ribs and each of the ribs has a wall thickness between 0.8 and 2.0 mm and preferably between 1.0 and 1.5 mm. A particularly effective combination of parameters in the case of the thickness of the individual webs can also be between 0.8 and 2.0 mm.

[0015] In the case of frame members with three such ribs, each of the ribs can have a wall thickness between 0.3 and 2.0 mm and preferably between 0.8 and 1.5 mm.

[0016] The ribs can run perpendicularly to the webs or can be inclined, e.g. can cross. According to another feature of the invention a spacing between each of the formations of a respective one of said webs and a rib proximal thereto is 20 to 40% of a spacing between structural shapes and preferably 25 to 30% thereof. Furthermore, it has been found to be

advantageous in the case of inclined ribs to have them adjoin the webs at transverse segments connected to the respective formations or cleats of the ribs.

BRIEF DESCRIPTION OF THE DRAWING

[0017] The above and other objects, features, and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

[0018] **FIG. 1** is a cross sectional view through a composite profile according to the invention illustrating a first embodiment;

[0019] **FIG. 2** is a view similar to **FIG. 1** of a second embodiment;

[0020] **FIG. 3** is a view similar to **FIG. 1** of a third embodiment; and

[0021] **FIG. 4** is a view similar to **FIG. 1** of a fourth embodiment.

SPECIFIC DESCRIPTION

[0022] The frame member or composite profile shown in the drawing can be utilized for windows, doors, facades and wherever structural strength is required in a frame but transmission of heat between opposite sides of the frame is to be suppressed. A composite profile according to the invention can comprise two preferably metallic structural shapes or profiles **1**, **2** which are interconnected by individual conductivity-limiting webs **3** which hold the structural shapes **1** and **2** apart and connect the profile into a structurally strong member. The structural shapes **1** and **2** have dovetail cross section grooves or formations in which dovetail cross section cleats **4** of the webs **3** formfittingly engage. These cleats are located along the longitudinal edges of the webs **3**.

[0023] To provide structural strength while limiting thermal conductivity, the webs are bridged by a plurality of connecting ribs **5**. In the embodiment shown in **FIG. 1**, the ribs **5** are planar and lie perpendicular to the webs **3**.

[0024] In **FIG. 3**, the webs **5** cross while in the embodiment of **FIG. 4**, the webs **5** cross, i.e. are inclined to one another but engage the webs **3** at the transverse segments **8** which adjoin the cleats **4**.

[0025] In the embodiment of **FIG. 2**, three such ribs **5** are provided perpendicular to the webs **3**.

[0026] It has been found to be important, for the purposes of the invention, that the sum of the thicknesses **S1** of both webs **3** and **S2** of the two or three ribs **5** which are at right angles to the webs **3** be a minimum of 3.8 mm, a value defined as the minimum wall thickness.

[0027] The maximum wall thickness sum can be 10 mm and preferably is around 6 mm.

[0028] The wall thicknesses of the webs **3** should be between 0.5 and 1.5 mm each, preferably between 0.6 and 1 mm. The wall thicknesses of the ribs **5** in the embodiment of **FIG. 1** should be between 0.8 and 2.0 mm and preferably between 1 and 1.5 mm.

[0029] For the three rib embodiment of **FIG. 2**, the wall thicknesses of the connecting ribs **5** should be between 0.3 and 2.0 mm and preferably between 0.8 and 1.5 mm.

[0030] The distance **6** between one of the connecting ribs **5** and the respective dovetail **4** should be 20% to 40% of the total distance **7** between the structural shapes **1** and **2** and preferably 25% to 35% thereof. The distance **7** between the structural shapes **1** and **2** can be between 20 and 100 mm and the separation of the webs **3** midway between the structural shapes **1** and **2** can be between 10 and 100 mm. When the ribs **5** are inclined to the webs **3**, the sum mentioned above should not be less than 1.6 mm.

I claim:

1. A frame member of low thermal conductivity comprising:

two spaced apart mutually parallel structural shapes each having a pair of connecting formations along sides of said structural shapes facing one another;

a pair of mutually spaced conductivity limiting webs each formed along respective opposite edges with a connecting formation mating with a respective one of the connecting formations of a respective one of said structural shapes whereby said conductivity limiting webs bridge between and interconnect said structural shapes, said webs being of substantially uniform thickness between the connecting formations thereof; and

a plurality of substantially planar ribs of substantially uniform thickness interconnecting said webs between the connecting formations thereof and running substantially perpendicular to said webs or at an inclination thereto, a sum of the wall thicknesses of said webs and all of said ribs being no less than 3.8 mm where said ribs are perpendicular to said webs and no less than 1.6 mm where said ribs are inclined to said webs.

2. The frame member defined in claim 1 wherein the wall thickness of each of said webs is between 0.5 and 1.5 mm.

3. The frame member defined in claim 2 wherein the wall thickness of each of said webs is between 0.6 and 1.0 mm.

4. The frame member defined in claim 1 which comprises two of said ribs and each of said ribs has a wall thickness between 0.8 and 2.0 mm.

5. The frame member defined in claim 4 wherein each of said ribs has a wall thickness between 1.0 and 1.5 mm.

6. The frame member defined in claim 1 which comprises three of said ribs and each of said ribs has a wall thickness between 0.3 and 2.0 mm.

7. The frame member defined in claim 6 wherein each of said ribs has a wall thickness between 0.8 and 1.5 mm.

8. The frame member defined in claim 1 wherein said ribs are perpendicular to said webs.

9. The frame member defined in claim 1 wherein said ribs extend in a cruciform pattern between said webs.

10. The frame member defined in claim 1 wherein a spacing between each of said formations of a respective one of said webs and a rib proximal thereto is 20% to 40% of a spacing between said structural shapes.

11. The frame member defined in claim 10 wherein the spacing between each of said formations of a respective one

of said webs and a rib proximal thereto is 25% to 35% of the spacing between said structural shapes.

12. The frame member defined in claim 1 wherein said ribs are connected to said webs at transverse segments connected to the respective formations of said ribs.

13. The frame member defined in claim 1 wherein said structural shapes are composed of metal, said formations of said webs are cleats received in grooves of said structural shapes and said sum has a maximum of 10 mm.

14. The frame member defined in claim 13 wherein said cleats and said grooves are of dovetail cross section and said sum has a maximum of 6 mm.

15. The frame member defined in claim 14 wherein the wall thickness of each of said webs is between 0.6 and 1.0 mm.

16. The frame member defined in claim 15 which comprises two of said ribs and each of said ribs has a wall thickness between 1.0 and 1.5 nm.

17. The frame member defined in claim 15 which comprises three of said ribs and each of said ribs has a wall thickness between 0.8 and 1.5 mm.

18. The frame member defined in claim 17 wherein said ribs are perpendicular to said webs.

19. The frame member defined in claim 17 wherein said ribs extend in a cruciform pattern between said webs.

20. The frame member defined in claim 17 wherein a spacing between each of said formations of a respective one of FEIGN said webs and a rib proximal thereto is 25% to 35% of the spacing between said structural shapes.

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