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(54) IMPROVEMENTS IN OR RELATING TO CONNECTING MEMBERS FOR JOINING EXTRUDED OR OTHER SECTIONS

(71) We, ALUMINIUM SYSTEMS LIMITED, of Keeton's Hill, Sheffield 2, Yorkshire, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to connection members for making joints between separate lengths of extruded or other sections each having at least one outwardly facing, open-ended, undercut channel formation along at least one face thereof.

The connection member of the invention may be used in constructional systems employing metal or other extrusions and other sections having one of a family of related cross-sections which confer advantageous properties, e.g. of strength, and also enables the metal or other sections to form the basis of a very versatile system of construction, including these sections and other extrusions.

According to one aspect of the invention, there is provided a connection member for making joints between separate lengths of extruded or other sections, a first such length having an outwardly facing, open-ended, undercut channel formation along one face thereof and the second such length having such a channel in each of two opposite faces thereof, the member comprising a base which is arranged to be passable into an end of said channel formation along one face of the first said section and being of such form as to be prevented thereby from passing through the channel mouth whilst movable to any desired position therealong, securing means accessible for actuation through the mouth of the channel in said first section whereby the connection member may be secured to said first section at said desired position therealong, and, carried by the base so as to project through the mouth of the channel in the first section, a spaced pair of

side members each extending along a respective one of a pair of parallel axes and arranged to be passable in its axial direction into the end of a respective one of the pair of channel formations along opposite faces of the second said section, each side member having a tapped hole therethrough inclined to the axis thereof and each such hole having a threaded member screwed therein and accessible for actuation via the mouth of the associated channel in the second section whereby tightening of the threaded members serves to draw or urge the second section into a rigid fixed relationship with the first section.

According to another aspect of the invention, there is provided a constructional system comprising at least one connection member as defined above, and two or more extruded aluminium or other rigid sections, each section comprising inner webs forming an inner rectangle or core, intermediate webs extending outwardly from at least the corners of the core and outer webs carried by the intermediate webs and defining at least the corner portions of an outer rectangle concentric with the inner rectangle, a longitudinal slot being provided between the webs extending from the corners of at least one side of the outer rectangle of one section whereby such section has an undercut channel formation along at least one face thereof with said slot forming the mouth thereof, and a longitudinal slot being provided between the webs extending from the corners of two opposite sides of the outer rectangle of another section whereby such other section has an undercut channel formation along two opposite faces thereof with said slots forming the mouths thereof.

The sections can be made of any materials giving the requisite properties, but are desirably made by extrusion from extrudable materials; plastics materials are among the

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materials which come into consideration. However, the most suitable materials are metals and, in particular, aluminium and its alloys. For clarity of description, the metal or other sections according to the invention are described hereafter as "aluminium sections", though it is to be understood that, as already indicated, they need not in practice be made of aluminium.

A significant advantage of the invention resides in the fact that the securing means and the threaded members are arranged to be accessible via the slots in the sections. Consequently, no drilling or complex alignment is necessary in assembling a construction using the connection members of the invention, apart from an indenting operation which may be necessary when using one embodiment of the invention, and thus construction can be carried out simply and quickly by relatively unskilled labour.

Preferably, at least one longitudinal slot is provided in each side of the outer rectangle of a section whereby such section has at least one undercut channel formation along each face thereof. One of the inner webs of the section forms a base for each undercut channel, the nearest intermediate webs form sides for the channels and the outer webs provide internal surfaces parallel to and facing the bases of the channel on either side of the slots to render the channels undercut.

Preferably the aluminium sections are made so that the outer rectangles of their cross-sections have sides which are equal to or are simple integral multiples of a unit distance; this unit distance may be 1", for example, or for a metric system, 25 mm. A very versatile constructional system can be based upon three aluminium sections which have sides which are in the ratios of, respectively 1×1, 1×2 and 2×2, based upon the aforementioned unit distance.

In its simplest form, a preferred 1×1 aluminium section comprises four inner webs defining an inner square or core, four intermediate webs extending diagonally outward from the corners of the core and four pairs of outer webs and defining the corner portions of an outer square, each pair of outer webs forming a side of the outer square with a central longitudinal slot forming a channel mouth. There is thus provided an undercut, outwardly facing, open ended trapezoidal channel-like formation on each face of the section. In a 2×2 aluminium section, which has a square overall cross-section of 2 units side, the square core is joined to outer webs not only by the diagonal intermediate webs at its corners, but also by perpendicular intermediate webs at the mid-points of its sides, each side of the overall square cross-section being formed by three outer webs, the central one of which is carried by one of the

perpendicular intermediate webs and co-operates with the others to define two longitudinal slots and thus two channels in each side of the aluminium section. In a 1×2 aluminium section, one slot and hence one channel is formed in each single-unit side and two in each double-unit side. Sections can also be formed with higher numbers of unit distances, e.g. 1×3, 1×4, 2×4 and 4×4.

The undercut channel formations in the aluminium sections can be used, not only for joining lengths of the sections together by means of the connection member of the invention, but also for receiving any of a great variety of other extrusions and mounting members for decorative and assembly purposes, as will appear in more detail below.

A constructional system incorporating aluminium sections connected by connection members embodying the invention has great versatility and can be used to make partitions, shelves, floor-mounted and wall-mounted cupboards, work-units, counters, tables, display cabinets, wardrobes and other items of furniture for domestic use and for shop-fitting and similar purposes. Also, larger units can be readily made, such as information kiosks, reception centres, exhibition stands, sheds, garages and also inhabitable structures and also dividing structures such as parti-walls, shopfronts and curtain-walls. Such a constructional system can be used, for example, to provide an existing open-plan shop structure comprising say three walls around a prepared rectangular floor, with all the components required for the roof, frontage, access-doors, shelves, counters, display units, gondolas (island counters) and other items required for fitting out the structure.

Such a constructional system can be readily made up in construction kit form of pre-cut sections, connection members, associated fitting and filler panels for the assembly of any item of shop or domestic work furniture and the only tools required for the assembly are a key or screwdriver for tightening screws and, possibly, a hacksaw or other tool for minor cutting of the components.

In order that the invention may be readily understood, reference is made to the accompanying drawings, in which:

Figs. 1 to 3 show on the same scale three different forms of three basic aluminium sections, in cross-sectional view,

Fig. 1 showing a 1×1 unit section of simple form,

Fig. 2 showing a 1×2 unit section of a first modified form, and

Fig. 3 showing a 2×2 unit section of a second modified (and most preferred) form;

Figs. 4 to 8 show examples of various

forms of ancillary extrusions which can be used in conjunction with the basic sections of Figs. 1 to 3;

Fig. 9 shows a connection member embodying the invention in perspective view;

Fig. 10 shows a right-angle joint formed between two aluminium sections, shown in cross-section, using the connection member of Fig. 9 and;

Fig. 11 shows a preferred form of securing screw for use with the connection member.

Referring to Fig. 1, this shows in cross-section, a simple form of aluminium section having one longitudinal slot forming a channel mouth along each side. The section shown in Fig. 1 is an integral structure formed by extrusion from aluminium or aluminium alloy and it consists of an inner square or core of four inner webs 10. This core is extremely strong and yet light in weight. Extending outwardly from the edges forming the corners of the inner square are four diagonal intermediate webs 12. The outer edges of the intermediate webs 12 are each joined to two outer webs, which are arranged in pairs as shown at 14a, 14b, one web 12 carrying one web 14a of the pair another web 12 and carrying the other web 14b of the pair. Each pair of outer webs 14a, 14b defines one of the sides of an outer square which is concentric with the inner square. Between the webs 14a, 14b at each side of the outer square, an elongated slot 16 is formed and, as the extrusion is symmetrical about any of four planes through the axis of the section, i.e. the planes containing the midpoints of the squares and those containing their corners, the slots 16 lie along the centre-lines of the four sides of the section. These slots 16 give access throughout the length of the section to an undercut, outwardly facing, open ended channel-like formation having a base 18 formed by the outer surface of one of the inner webs 10, sloping sides 20 formed by the surfaces of the nearest diagonal webs 12 and internal surfaces 22 on the insides of the webs 14a, 14b which are parallel to and spaced from the base 18. These channel-like formations are symmetrically trapezoidal in cross-sectional shape.

Referring to Fig. 2, this shows an aluminium section which has a rectangular shape with sides of 1×2 units, as opposed to the 1×1 units of Fig. 1. The four inner webs of the rectangular core are shown at 24, 26, the "diagonal" intermediate webs at 28 (which are in fact at approximately 45° to the webs 24, 26) and the corner portions of the outer rectangle are shown as outer webs 30a, 30b. At the midpoints of the longer sides of the inner rectangle, i.e. of the inner webs 26, further intermediate webs 32 are formed which project perpendicularly out from the webs 26 and carry further outer

webs 34. The webs 34 are co-planar with the adjacent webs 30a, 30b of the longer sides of the outer rectangle and the 1×2 unit section of Fig. 2 includes slots 16 along the centre lines of the single unit sides and two slots 36 along the centre lines of each half or unit of the double unit sides. In addition shoulders 38 are formed at the junctions between the corners of the inner square and the "diagonal" intermediate webs 28, which give added strength and also provide side locating surfaces 40 along either side of the channel bases 18, at the single unit sides, and along one side of each of the bases 42 of the asymmetric trapezoidal section channels formed at the double unit sides.

Referring to Fig. 3, this shows a 2×2 unit section having the features present in the 1×2 unit section of Fig. 2. The inner webs of the inner square are shown at 44, the diagonal and perpendicular intermediate webs at 46 and 48 respectively, and the outer webs at the corners and centres of the outer squares at 50a, 50b and 52 respectively. Shoulders 54 are provided along the inner square corners, similar to the shoulders 38, and the webs 44 are thickened at 56 adjacent the intermediate webs 48 so that side locating surfaces 58 are provided at the bases of all the channel-like formations, each pair of opposing surfaces 58 being symmetrically disposed relative to its associated elongated slot 60.

Figs. 4 to 8 shows in cross-section some examples of a wide variety of extrusions which can be used in conjunction with the aluminium sections, by fitting into the slots 16, 36 or 60. As shown in Fig. 4, each of the extrusions includes an opposed pair of feather-edge ribs 62 having parallel inside and convergent outside faces and these are joined by a web 64 for bridging one of the slots 16, 36 or 60, the ribs 62 having small return surfaces 66 for lodging under the inside edges of the slot 16, 36 or 60 and so holding the extrusion in place. The extrusion shown in Fig. 4 is a narrow flat strip 68 for filling the slot 16, 36 or 60 so as to leave exposed the face of the section on either side of the strip 68, which is integral with the web 64 but projects slightly beyond it at either side to provide further return surfaces 70 for lodging above the edges of the slots 16, 36 or 60 and so preventing excessive insertion of the extrusion into the slot. The extrusion of Fig. 4 can be made of plastics material, aluminium or other suitable material and so can match or contrast with the aluminium section, giving a wide variety of surface effects. If both the extrusion and the section are of aluminium, they combine to produce a flat aluminium surface having a slightly raised flat central bead. If the extrusion is of coloured polyvinyl chloride and the section colour-anodised aluminium,

they combine to produce, for example, a bronze anodised section having, say, a red, flat central stripe therealong.

Fig. 5 shows an extrusion of hollow box shape having side walls 72 and a top wall 74 extending from the ribs, with the surfaces 66 and 70; the latter is the underside of a small triangular fillet 70a formed at the base of one of the walls 72. This extrusion can be used to provide a projecting bead, suitable for many uses; for instance, it can constitute a draught strip or framing; if two lengths of it are fitted into a 2-unit side, with their fillets 70a outermost, the intermediate channel so formed can secure in place that edge of a wall panel fitted within a frame of the aluminium sections.

Fig. 6 shows an extrusion for facing the full width of a 2-unit side and comprises a flat strip 76 of 2-unit width having two sets of the ribs 62 for locating in the two slots 36 or 60 of a 2-unit side. Alternatively, only one set of ribs 62 need be provided where the double security of two sets is unnecessary. A modification shown at the left of Fig. 6 comprises an inturned rim 78 at the edge of the strip 76; this can form a location for the edge of a card or other flat sheet material; a second such rim 78 can be provided at the opposite edge of the strip 76. This extrusion is suitable for attachment, for instance to a 2-unit section in a supermarket counter construction, for receiving price tickets or other printed information. Another modification is shown at the right of Fig. 6 and comprises an upstanding web 80 having inward ribs 82 defining a small tubular channel for reception of, for instance, a bead formed upon a resilient draught excluder strip.

Fig. 7 shows an extrusion for facing a 1-unit section and consists of a flat strip 84 of 1-unit width having a set of the ribs formed centrally of its inside face. This Fig. illustrates a preferred form of the ribs, shown at 62a, wherein the feather-edge type 62 have been improved by developing them into a "horse-shoe" shaped cross-section; it is found that any of the ancillary extrusions (such as those shown in Figs. 4 to 8) can be provided with ribs 62a instead of 62 and they locate more firmly and precisely with this type of securement. The extrusions of Figs. 5, 6 and 7 can be made of the same kinds of materials as mentioned in connection with Fig. 4.

Fig. 8 shows a more complex extrusion comprising a double box channel. The ribs 62 are provided upon the inside face of a base web 86 having upstanding webs 88, 90 at the edges and centre thereof with short inward-facing rims 92 on their free edges. This extrusion is suitable, for instance, for providing for a double sliding

door structure. Polyvinyl chloride is a suitable material.

The sections shown in Figs. 1—3 are connected together by the connecting member shown in Fig. 9. In Fig. 9 the connection member shown has a base 132 of rectangular cross-section, which is an easy sliding fit in a channel formation of a first aluminium section. At its centre, this base 132 has securing means comprising a hole housing a set screw 140 for securing the base in a channel of such first aluminium section, at any chosen point along the length thereof. At each end, the base 132 carries a pair of spaced parallel side limbs 134 having rectangular notches 136 where they join the base 132, for reception of the edges of outer webs of said first section. The side limbs 134 have tapered ends, as at 135, for easy insertion into the channel formations of a second section. The side limbs 134 accommodate inclined threaded apertures containing pointed-end grub screws 141 which are positioned so as to form an angle of about 60° relative to the adjacent face of the base 132. The side limbs 134 are preferably tapered both on their opposed flank faces and on their outermost faces, as shown in Figs. 9 and 10; the taper on the outermost faces can advantageously be related, in a manner not shown in the drawings, to the angle of the apertures and the screws 141 therein, so that those apertures are formed in the tapered end faces and extend at least approximately at right-angles, which greatly facilitates the requisite drilling and tapping operations.

A preferred form of screw for use in the connection member shown in Figs. 9 and 10 in place of the screw 141 shown in Fig. 9 is shown in Fig. 11; this consists of a grub-screw 141a having a socket 162 at one end for reception of a hexagonal-section key and at the other a frusto-conical knurled section 163 having a recess therein forming cup end 163a. In use, this knurled section 163 bites into the metal surface against which the screw 141a is being tightened, this action being especially assisted by the cutting action of the reverse cup edge. The rigidity of the securement so obtained is so satisfactory that it is usually unnecessary to pre-form dents in the sections, such as are shown at 137 in Fig. 10.

Use of the connecting member of Fig. 9 is illustrated in Fig. 10. The base 132 is shown inserted into a channel in a first aluminium section 142, of the type shown in Fig. 1, with the set screw 140 tightened against one of its inner webs, 143, and the notches receiving the outer webs, one of which is shown at 144. The side limbs 134 have been inserted into two opposite channel formations of a second aluminium section 145 also of the type shown in Fig. 1. In order to provide adequate

purchase for the inclined screws 141, the relevant places in the inner webs 146 of the second section 145 are notched or indented before assembly, as shown at 147, for instance by means of a manual indentation tool. If, as mentioned before, the preferred screws illustrated in Fig. 11 are used, this operation of denting or notching is not necessary. The edges of the knurled section cut their own indentations in the section 145. Access to the screws 141 is obtained via the slots of the section 145 and, owing to their inclined positions, on being tightened, they tend to draw the sections 142 and 145 together, forming a very accurate and rigid joint. Due to the fact that access is easily obtained to the slots 140 and 141 by means of the slots in the sections, no drilling of the sections, is necessary, and joints can thus be simply and quickly effected by relatively unskilled labour.

WHAT WE CLAIM IS:—

1. A connection member for making joints between separate lengths of extruded or other sections, a first such length having an outwardly facing, open-ended, undercut channel formation along one face thereof and the second such length having such a channel in each of two opposite faces thereof, the member comprising a base which is arranged to be passable into an end of said channel formation along one face of the first said section and being of such form as to be prevented thereby from passing through the channel mouth whilst movable to any desired position therealong, securing means accessible for actuation through the mouth of the channel in said first section whereby the connection member may be secured to said first section at said desired position therealong, and carried by the base so as to project through the mouth of the channel in the first section, a spaced pair of side members each extending along a respective one of a pair of parallel axes and arranged to be passable in its axial direction into the end of a respective one of the pair of channel formations along opposite faces of the second said section, each side member having a tapped hole therethrough inclined to the axis thereof and each such hole having a threaded member screwed therein and accessible for actuation via the mouth of the associated channel in the second section whereby tightening of the threaded members serves to draw or urge the second section into a rigid fixed relationship with the first section.

2. A connection member according to claim 1, in which the side members have their free ends tapered.

3. A connection member according to claim 1 or 2, in which notches are provided in the side members where they are carried

upon the base for the reception of webs which serve to define the mouth of the channel formation in said first section receiving the base.

4. A connection member according to claim 1, 2 or 3, in which the securing means comprises a screw located in a tapped hole through the base.

5. A connection member according to any preceding claim, in which each said threaded member is a pointed-end grub screw.

6. A connection member according to any one of claims 1 to 4, in which each said threaded member is a screw having knurled, frusto-conical end portion, said end portion having a recess therein whereby a circular cutting edge is provided.

7. A connection member as claimed in claim 5 or 6, in which the other end of each said threaded member is provided with a socket arranged for reception of a key.

8. A connection member as claimed in claim 7, in which the socket is arranged for reception of a hexagonal-shaped key.

9. A connection member substantially as herein described with reference to Figs. 9 and 10 or Figs. 9, 10 and 11 of the accompanying drawings.

10. A constructional system, comprising at least one connection member as claimed in any preceding claim and two or more extruded aluminium or other rigid sections, each section comprising inner webs forming an inner rectangle or core, intermediate webs extending outwardly from at least the corners of the core and outer webs carried by the intermediate webs and defining at least the corner portions of an outer rectangle concentric with the inner rectangle, a longitudinal slot being provided between the webs extending from the corners of at least one side of the outer rectangle of one section whereby such section has an undercut formation along at least one face thereof with said slot forming the mouth thereof, and a longitudinal slot being provided between the webs extending from the corners of two opposite sides of the outer rectangle of another section whereby such other section has an undercut channel formation along two opposite faces thereof with said slots forming the mouths thereof.

11. A constructional system according to claim 10, in which at least one longitudinal slot is provided in each side of the outer rectangle of a section, whereby such section has at least one undercut channel formation along each face thereof.

12. A constructional system according to claim 10 or 11, wherein the outer rectangle of the cross-sections of the sections have sides which are equal to or are integral multiples of a unit distance.

purchase for the inclined screws 141, the relevant places in the inner webs 146 of the second section 145 are notched or indented before assembly, as shown at 147, for instance by means of a manual indentation tool. If, as mentioned before, the preferred screws illustrated in Fig. 11 are used, this operation of denting or notching is not necessary. The edges of the knurled section cut their own indentations in the section 145. Access to the screws 141 is obtained via the slots of the section 145 and, owing to their inclined positions, on being tightened, they tend to draw the sections 142 and 145 together, forming a very accurate and rigid joint. Due to the fact that access is easily obtained to the slots 140 and 141 by means of the slots in the sections, no drilling of the sections, is necessary, and joints can thus be simply and quickly effected by relatively unskilled labour.

WHAT WE CLAIM IS:—

1. A connection member for making joints between separate lengths of extruded or other sections, a first such length having an outwardly facing, open-ended undercut channel formation along one face thereof and the second such length having such a channel in each of two opposite faces thereof, the member comprising a base which is arranged to be passable into an end of said channel formation along one face of the first said section and being of such form as to be prevented thereby from passing through the channel mouth whilst movable to any desired position therealong, securing means accessible for actuation through the mouth of the channel in said first section whereby the connection member may be secured to said first section at said desired position therealong, and carried by the base so as to project through the mouth of the channel in the first section, a spaced pair of side members each extending along a respective one of a pair of parallel axes and arranged to be passable in its axial direction into the end of a respective one of the pair of channel formations along opposite faces of the second said section, each side member having a tapped hole therethrough inclined to the axis thereof and each such hole having a threaded member screwed therein and accessible for actuation via the mouth of the associated channel in the second section whereby tightening of the threaded members serves to draw or urge the second section into a rigid fixed relationship with the first section.

2. A connection member according to claim 1, in which the side members have their free ends tapered.

3. A connection member according to claim 1 or 2, in which notches are provided in the side members where they are carried

upon the base for the reception of webs which serve to define the mouth of the channel formation in said first section receiving the base.

4. A connection member according to claim 1, 2 or 3, in which the securing means comprises a screw located in a tapped hole through the base.

5. A connection member according to any preceding claim, in which each said threaded member is a pointed-end grub screw.

6. A connection member according to any one of claims 1 to 4, in which each said threaded member is a screw having knurled, frusto-conical end portion, said end portion having a recess therein whereby a circular cutting edge is provided.

7. A connection member as claimed in claim 5 or 6, in which the other end of each said threaded member is provided with a socket arranged for reception of a key.

8. A connection member as claimed in claim 7, in which the socket is arranged for reception of a hexagonal-shaped key.

9. A connection member substantially as herein described with reference to Figs. 9 and 10 or Figs. 9, 10 and 11 of the accompanying drawings.

10. A constructional system, comprising at least one connection member as claimed in any preceding claim and two or more extruded aluminium or other rigid sections, each section comprising inner webs forming an inner rectangle or core, intermediate webs extending outwardly from at least the corners of the core and outer webs carried by the intermediate webs and defining at least the corner portions of an outer rectangle concentric with the inner rectangle, a longitudinal slot being provided between the webs extending from the corners of at least one side of the outer rectangle of one section whereby such section has an undercut formation along at least one face thereof with said slot forming the mouth thereof, and a longitudinal slot being provided between the webs extending from the corners of two opposite sides of the outer rectangle of another section whereby such other section has an undercut channel formation along two opposite faces thereof with said slots forming the mouths thereof.

11. A constructional system according to claim 10, in which at least one longitudinal slot is provided in each side of the outer rectangle of a section, whereby such section has at least one undercut channel formation along each face thereof.

12. A constructional system according to claim 10 or 11, wherein the outer rectangle angles of the cross-sections of the sections have sides which are equal to or are integral multiples of a unit distance.



13. A constructional system according to claim 10, 11 or 12, in which one of the sections has an intermediate web extending normally outwardly from an inner web to provide a side surface normal to the base of at least one channel in such section.
14. A constructional system as claimed in claim 10 substantially as herein described
- with reference to the accompanying drawings.

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