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(54) **Curtain wall bracket and method of attachment**

(57) There is provided a method of attaching bracket apparatus (14) to a curtain wall mullion (12) having a fastening channel (18) for receiving screw-threaded fasteners for a bracket element (30) having upper and lower attachment ports (54, 56). The method comprises the steps of : a) positioning the bracket element (30) on the fastening channel (18) so that a longitudinal opening (44) of the channel is blocked along the longitudinal extent of the bracket element (30), and providing upper and lower blocking elements (32) within the fastening channel (18) so that the upper and lower attachment ports (54, 56) are in between the upper and lower blocking elements (32) ; and b) forcing an adhesive (34) into one of the said upper and lower attachment ports (54, 56) until it appears in the other of the upper and lower attachment ports (54, 56). There is also provided curtain walling bracket apparatus (14) for use in such a method, and curtain wall mullion apparatus (10) wherein said curtain walling bracket apparatus (14) is attached to a curtain wall mullion (12) using said method.

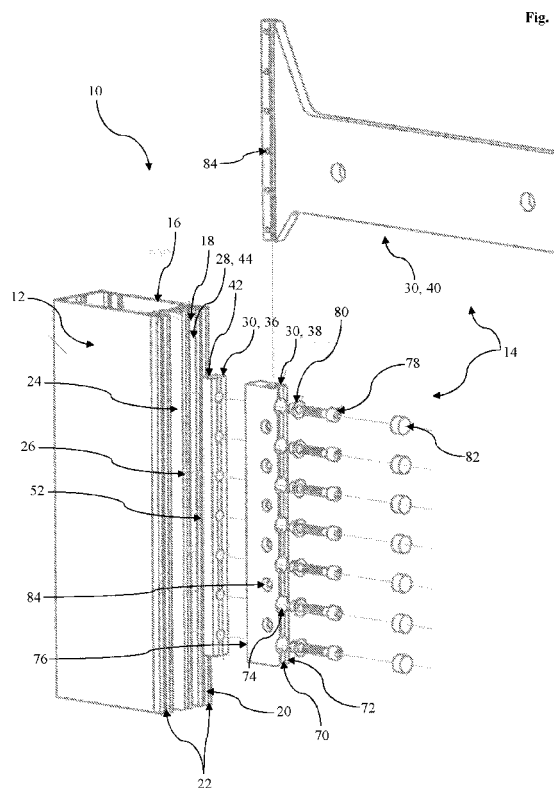


Fig. 1

Description

[0001] The present invention relates to a method of attaching bracket apparatus to a curtain wall mullion, curtain walling bracket apparatus for use in such a method, and curtain wall mullion apparatus having the curtain walling bracket apparatus installed according to the said method.

[0002] It has been a long standing issue within the curtain wall industry to have the ability to easily and economically attach an external bracket to a curtain wall mullion, and which can then offer a high load capability such as found with the application of exterior building louvres.

[0003] Thermal isolation is especially important in today's environment. It has been found that, typically extruded metal, curtain wall mullions inevitably offer heat transfer paths from the interior of a building to the exterior. However, this energy transfer path has been exacerbated by the use of metal brackets which have traditionally been attached to the curtain wall mullion via screw-threaded fasteners which pierce the curtain wall mullion, thus providing a good heat transfer path.

[0004] Presently, due to the complex and large nature of the bracket installation onto the exterior of a building, the curtain wall mullion is typically prepared off-site so as to be able to accept the specific bracket designated by the architect or designer. Following installation of the pre-prepared curtain wall mullion, the curtain wall bracket can thus be installed on-site.

[0005] However, this is a time-consuming and more expensive route, whilst also making retrofitting of brackets to existing curtain wall mullion particularly difficult. An existing building may require the brackets for the application of exterior solar shading and/or signage. To date, the exterior glass of the building which is attached and held by the curtain wall mullion typically has to be removed in order to affix the bracket. This in itself is often an enormous and expensive undertaking. Following this, a bracket which is adapted to be fastenable to the particular kind of curtain wall mullion already installed must then be selected and used, which may not be the preferred choice for the designer.

[0006] Additionally, even when a bracket is attached to the curtain wall mullion, it is attached via screw-threaded fasteners which typically inevitably only engage along opposing sides of a bracket channel of the curtain wall mullion. This provides a weaker loading characteristic, since there is only a small portion of threaded engagement between the fasteners and the interior sides of the channel. Consequently, the intended loading which will be applied to the brackets must be very carefully considered and moderated. This again may not be the preferred option for a designer in terms of aesthetics, interior building temperature regulation, and also environmental issues.

[0007] The present invention seeks to provide a solution to these problems.

[0008] According to a first aspect of the invention, there

is provided a method of attaching bracket apparatus to a curtain wall mullion having a fastening channel for receiving screw-threaded fasteners for a bracket element having upper and lower attachment ports, the method comprising the steps of : a) positioning the bracket element on the fastening channel so that a longitudinal opening of the channel is blocked along the longitudinal extent of the bracket element, and providing upper and lower blocking elements within the fastening channel so that the upper and lower attachment ports are in between the upper and lower blocking elements; and b) forcing an adhesive into one of the said upper and lower attachment ports until it appears in the other of the upper and lower attachment ports.

[0009] Preferably, the method further comprises a step c) subsequent to step b) of inserting screw-threaded fasteners into the upper and lower attachment ports. Additionally, the screw-threaded fasteners may be inserted prior to setting of the adhesive.

[0010] Beneficially, the screw-threaded fasteners preferably do not penetrate a bottom surface of the fastening channel, so as to prevent or limit moisture ingress.

[0011] Furthermore, the upper and lower blocking elements may be further screw-threaded fasteners which engage with walls of the fastening channel and which bottom or substantially bottom out on the bottom surface of the fastening channel.

[0012] Advantageously, the bracket element may include upper and lower blocking ports for receiving the upper and lower blocking elements. In this case, the upper and lower blocking elements when provided in the upper and lower blocking ports are preferably engagable in the fastening channel to hold the bracket element to the curtain wall mullion whilst the adhesive is inserted.

[0013] The bracket element may include at least one further attachment port intermediate the upper and lower attachment ports, and in step a) a removable plug element is inserted into the further attachment port to prevent or limit leakage of adhesive from the further attachment port during step b). As such, a plurality of spaced apart said further attachment ports and a plurality of said removable plug elements may be provided. Additionally, the plurality of said removable plug elements is preferably interengaged with each other to form a plug strip.

[0014] Preferably, the bracket element is a thermal break member to which a bracket member of the bracket apparatus can be directly or indirectly mounted. Advantageously, the bracket apparatus may further include an adaptor member which is mountable on the thermal break member so as to be thermally isolated from the curtain wall mullion, and to which the bracket member is engagable.

[0015] In step b), an adhesive applicator may be provided for forcing the adhesive into one of said upper and lower attachment ports. Consequently, the adhesive applicator may include a nozzle which is insertable into one of said upper and lower attachment ports in step b), the nozzle being tapered so as to be tightly fittable in the said

upper and lower attachment ports.

[0016] In step b), adhesive is preferably forced into the said lower attachment port until it appears in the said upper attachment port.

[0017] The upper and lower blocking elements preferably do not penetrate a bottom surface of the fastening channel, so as to maintain thermal isolation between interior and exterior sides of the curtain wall mullion.

[0018] According to a second aspect of the invention, there is provided curtain walling bracket apparatus for use in a method according to the first aspect of the invention, the bracket apparatus comprising a bracket element having upper and lower attachment ports, blocking elements for blocking a fastening channel of a curtain wall mullion, and adhesive for insertion into one of the upper and lower attachment ports.

[0019] The bracket element may further include at least one further attachment port intermediate the upper and lower attachment ports. As such, the curtain walling bracket apparatus may further comprise a removable plug element for the or each said further attachment port.

[0020] Preferably, the curtain walling bracket apparatus further comprises an adhesive applicator for the adhesive, the adhesive applicator having a nozzle adapted to fit the upper and lower attachment ports.

[0021] The blocking elements may be screw-threaded fasteners, and the bracket element includes upper and lower blocking ports whereby the upper and lower attachment ports are in between the upper and lower blocking ports.

[0022] Furthermore, the curtain walling bracket apparatus preferably further comprises a screw-threaded fastener for each said attachment port.

[0023] Advantageously, the bracket element may include at least a thermal isolation member for seating on a fastening channel of a curtain wall mullion and for providing a thermal break, and a bracket member for attaching an exterior louvre, the thermal isolation member having the upper and lower attachment ports. In this case, the bracket element preferably further includes an adaptor element which is mountable on the thermal isolation member and to which the bracket member is engagable. The adaptor element may thus be engagable with the thermal isolation member via the said attachment ports.

[0024] The blocking elements are preferably receivable in blocking ports in the thermal isolation member.

[0025] According to a third aspect of the invention, there is provided curtain wall mullion apparatus comprising a curtain wall mullion and curtain walling bracket apparatus in accordance with the second aspect of the invention, the bracket element being engaged with a fastening channel of the curtain wall mullion via said adhesive.

[0026] Preferably, the adhesive extends into the attachment ports to engage the bracket element.

[0027] Furthermore, the bracket element may include retainer fasteners which engage the adhesive.

[0028] Beneficially, the fastening channel may include

non-planar interior side surfaces for promoting engagement with the adhesive.

[0029] The adhesive preferably engages the blocking elements.

5 **[0030]** Advantageously, the bracket element may be further engaged with the fastening channel via the blocking elements.

10 **[0031]** The invention will now be more particularly described, by way of example only, with reference to the accompanying drawings, in which :

Figure 1 shows a perspective view of one embodiment of curtain walling bracket apparatus, exploded relative to a curtain wall mullion and in accordance with the present invention; and

Figure 2 is a perspective view showing the installation of part of the curtain walling bracket apparatus to the curtain wall mullion, and in accordance with the present invention.

[0032] Referring to the drawings, there is shown curtain wall mullion apparatus 10 which comprises a curtain wall mullion 12 and curtain walling bracket apparatus 14.

25 The curtain wall mullion 12 is elongate and typically formed from extruded metal, such as aluminium. The curtain wall mullion 12 has a rigid box-section tubular hollow body 16, an integral fastening channel 18 which typically extends centrally along the entire longitudinal extent of exterior surface 20 of the hollow body 16, and pane-

30 mounting strips 22 which again are typically integrally formed as one-piece with the hollow body 16 at or adjacent to longitudinal perimeter edges of the exterior surface 20 of the hollow body 16.
35 **[0033]** The fastening channel 18 of the curtain wall mullion 12 has two parallel and spaced apart longitudinal side walls 24 and a bottom surface which interconnects the two side walls 24. Each side wall 24 may have an in turned and/or out turned lip 26 at or adjacent to its distal free edge. The lip 26 is preferably continuously uniform and unbroken along the longitudinal extent of the curtain wall mullion 12. The in turned lip 26 is beneficial for adhesive engagement and retention purposes as will be appreciated hereinafter, but also acts as seating for part of the curtain walling bracket apparatus 14 as will be understood below.

45 **[0034]** Preferably, the interior side surfaces 28 of the fastening channel 18 are non-planar by incorporating striations or thread engagement grooves along the longitudinal extents thereof.
50 **[0035]** The curtain walling bracket apparatus 14 comprises bracket element 30, blocking elements 32, and a, preferably resin, adhesive 34. In this embodiment, the bracket element 30 includes a thermal break member 36, an adaptor member 38, and a bracket member 40.

55 **[0036]** The thermal break member 36 is formed of a thermally insulating material, such as plastics for example, nylon. The thermal break member 36 is elongate to

preferably substantially match or exceed a base length of the adaptor member 38, and is preferably thick enough so as to be rigid or substantially rigid. The thermal break member 36 also has a lateral extent which substantially matches or exceeds a lateral extent of the fastening channel 18, so that it can be seated thereon as mentioned above. This enables the thermal break member 36 to extend in a lateral direction fully across a longitudinal opening to the fastening channel 18, and in a longitudinal direction so as to cover at least a portion of the longitudinal opening.

[0037] The thermal break member 36 may be formed with a protruding spine or other first locator 42 on or along the inwardly facing longitudinal surface which locates in the longitudinal opening 44 of the fastening channel 18, thus aiding positioning.

[0038] An adaptor channel or other second locator 46 may be provided on or along the outwardly facing longitudinal surface of the thermal break member 36 to aid positioning of the adaptor member 38.

[0039] The thermal break member 36 is provided with two blocking ports 48 at opposite end portions. The blocking ports 48 are apertures which extend through the body of the thermal break member 36 from the outwardly facing longitudinal surface 50 to the inwardly facing longitudinal surface 52. The blocking ports 48 are dimensioned to receive the blocking elements 32 as a tight close fit.

[0040] In between the blocking ports 48 are provided upper and lower attachment ports 54, 56 which, in this case, are close to the blocking ports 48.

[0041] In between the upper and lower attachment ports 54, 56 is a plurality of further attachment ports 58 provided in spaced relationship along the longitudinal extent of the body of the thermal break member 36.

[0042] The attachment ports 54, 56, 58, like the blocking ports 48, are apertures which extend through the body of the thermal break member 36 from the outwardly facing longitudinal surface 50 to the inwardly facing longitudinal surface 52.

[0043] To attach the thermal break member 36 to the fastening channel 18, blocking elements 32 in the form of screw-threaded fasteners 60 are placed into the blocking ports 48 and screw-threadingly engaged with the interior side surfaces 28 of the fastening channel 18. The threads of the blocking elements 32 engage with the striations on the interior side surfaces 28, and preferably also cut further into the material of the side walls 24 of the fastening channel 18. The blocking elements 32 also have a sufficient longitudinal extent so that they bottom out on the bottom surface of the fastening channel 18. It is important that the blocking elements 32 are dimensioned to fully occlude or sufficiently block the fastening channel 18 whilst also engaging the thermal break member 36 so as to uniformly or substantially uniformly cover a corresponding portion of the opening 44 to the fastening channel 18.

[0044] The curtain walling bracket apparatus 14 further includes a plurality of plug elements 62, which in this case

are interconnected in spaced apart fashion to provide a plug strip 64. Each plug element 62 is adapted for an interference fit in a respective one of the further attachment ports 58 in between the upper and lower attachment ports 54, 56.

[0045] With the plug strip 64 in place and blocking the further attachment ports 58, an adhesive applicator 66 having a tapered nozzle 68 is utilised to force the resin adhesive 34 into the lower attachment port 56. The tapering of the nozzle 68 provides a tight interference fit in the lower attachment port 56 to prevent or limit back flow there out. Due to the blocking elements 32 liquidly closing off the lower and upper portions of the fastening channel 18, the adhesive 34 is forced along the fastening channel 18 until it reaches and flows into the upper attachment port 54. Although the adhesive 34 can be inserted via the upper attachment port 54, this will more likely leave voids in the blocked off portion of the fastening channel 18 which is not preferable.

[0046] The plug strip 64 also prevents or limits leakage of the adhesive 34 from the further attachment ports 58, as the adhesive 34 is being forced along the fastening channel 18.

[0047] Out flow through the channel opening 44 of the fastening channel 18 is also prevented or limited by the thermal break member 36 extending thereacross.

[0048] Once the adhesive 34 is in place, the plug strip 64 can be removed. The adaptor member 38 can now be fastened to the thermal break member 36. The adaptor member 38 is preferably a rigid elongate metal element adapted to provide engagement for the bracket element 30. In this way, a specific adaptor member 38 can be utilised for providing an attachment interface for any specific bracket member 40. This is far more cost-effective than having to remove the glass panes from the already installed curtain wall mullion 12, or having to specify specific curtain wall mullions at the time of installation or construction in order to accommodate particular bracket members.

[0049] In this embodiment, the adaptor member 38 has longitudinal and lateral extents which substantially match those of the thermal break member 36. A bracket channel 70 is provided centrally longitudinally along an outermost surface 72 of the adaptor member 38. Retainer apertures 74 are provided in spaced relationship along a bottom surface of the bracket channel 70, and the retainer apertures 74 break out on an innermost surface 76 of the adaptor member 38. The retainer apertures 74 align with the attachment ports 54, 56, 58 of the thermal break member 36.

[0050] The adaptor member 38 is engaged with the thermal break member 36 by screw-threaded adaptor fasteners 78 which extend through the retainer apertures 74 and the attachment ports 54, 56, 58 and which engage in the adhesive 34. The blocking elements 32 may be initially removed either immediately if the adhesive is suitably viscous or once the adhesive is or starts to set. The adaptor fasteners 78 are preferably dimensioned so as

to be slightly spaced from the interior side surfaces 28 of the fastening channel 18, so that the threads are completely embedded within the adhesive 34. This provides improved fixing strength and should not lead to bowing of the walls of the fastening channel 18, which has to date been a problem with bracket fastening. However, additional direct engagement with the interior side surfaces 28 of course can be considered whereby a majority of the circumference of the threads is still engaged with the adhesive 34.

[0051] The adaptor fasteners 78 preferably do not penetrate into the interior of the hollow body 16 of the curtain wall mullion 12

[0052] The cured adhesive 34 prevents or inhibits pull-out of the adaptor fasteners 78 due to the striations and in turned lip 26 of the fastening channel 18.

[0053] To maintain thermal isolation, the adaptor fasteners 78 are located within thermal break sleeves 80, and have a thermal break cap 82 provided on a head of each adaptor fastener 78. The adhesive 34 also acts as a thermal isolator by encasing the typically metal adaptor fasteners 78 and keeping a separation between them and the curtain wall mullion 12. The thermal break sleeves 80 and caps 82 are preferably of a thermally nonconductive material, such as plastics or rubber.

[0054] The desired bracket member 40 can then be engaged in the bracket channel 70 of the adaptor member 38, and fastened in place by bracket fasteners, such as screws, bolts, rivets or pins, which extend through lateral bracket ports 84 in the adaptor member 38 and the bracket member 40.

[0055] Following that, the required exterior solar shading louvres, signage and/or mounts can be connected to the or each bracket member 40.

[0056] Although the bracket apparatus described above comprises the thermal break member, adaptor member and bracket member, it is feasible that in some installations only the bracket member would be required. To this end, the bracket member may have upper and lower attachment ports for engagement via retainer fasteners with the fastening channel. Preferably, the bracket member would therefore also have the blocking ports for the blocking elements as described above, or the blocking elements could be separate of the bracket member. In this case, for example, the blocking elements could be further plugs which are adapted to block or occlude the fastening channel whilst not actually taking any bearing weight from the bracket apparatus. This would also be applicable to the thermal break embodiment described above, whereby the blocking ports actually forming part of the thermal break member could be dispensed with in favour of independent blocking elements.

[0057] Additionally or alternatively, the thermal break member can be dispensed with in favour of just the adaptor member and bracket member. As above, the blocking ports can be provided on the adaptor member for the blocking elements, or the blocking elements can be provided separately.

[0058] Although the bracket member is received in the adaptor member, it may sit on or straddle the adaptor member.

[0059] The plug elements may not be required if the adhesive is being applied in the horizontal plane. However, if the adhesive is being applied with the curtain wall mullion in situ and typically being vertical, extrusion of adhesive out of the further attachment ports can be messy and thus the plug strip would be preferable.

[0060] It is feasible that only one or no further attachment ports may be required, and thus only the upper and lower attachment ports are utilised. In this case, the plug strip can be dispensed with in favour of only one plug element or no plug elements.

[0061] In the above described embodiments, it is of primary importance that the adhesive retains the retainer fasteners. It is not intended that the mating element with the fastening channel, such as the thermal break member, is actually bonded to the fastening channel, although this may occur.

[0062] It is feasible that the mating element with the fastening channel, being the thermal break member, adaptor member or the bracket member, could include integrally formed blocking elements.

[0063] The mating element may also include one or more protrusions, which may be integral and one-piece with the mating element, which project into the fastening channel for engagement with the adhesive. In this way, a bracket member could be connected to such a formed adapter member without the retainer fasteners projecting into the fastening channel. Alternatively, the retainer fasteners may be the aforementioned protrusion or protrusions whereby the bracket member can be directly bonded in the fastening channel without separate screw-threaded fasteners. In these cases, the upper and lower attachment ports are still provided for the application of the adhesive.

[0064] It is thus possible to utilise an adhesive to improve the mounting of bracket apparatus to a curtain wall mullion, which in turn improves the load bearing capability of the bracket. It is also possible to provide an improved mounting method which utilises an adhesive to embed fasteners, thereby dispensing with the need for fasteners having an outside thread diameter which may cause deformation of the fastening channel. The use of blocking elements and plug elements prevents the application of adhesive being messy leading to undesirable running, and improves local application of the adhesive. The use of an adhesive also aids in improving thermal isolation and to provide a complete thermal break between a curtain wall mullion and a bracket element attached directly or indirectly thereto.

Claims

1. A method of attaching bracket apparatus (14) to a curtain wall mullion (12) having a fastening channel

- (18) for receiving screw-threaded fasteners for a bracket element (30) having upper and lower attachment ports (54, 56), the method comprising the steps of : a) positioning the bracket element (30) on the fastening channel (18) so that a longitudinal opening (44) of the channel is blocked along the longitudinal extent of the bracket element (30), and providing upper and lower blocking elements (32) within the fastening channel (18) so that the upper and lower attachment ports (54, 56) are in between the upper and lower blocking elements (32); and b) forcing an adhesive (34) into one of the said upper and lower attachment ports (54, 56) until it appears in the other of the upper and lower attachment ports (54, 56).
2. A method as claimed in claim 1, further comprising a step c) subsequent to step b) of inserting screw-threaded fasteners (78) into the upper and lower attachment ports (54, 56).
 3. A method as claimed in claim 2, wherein the screw-threaded fasteners (78) are inserted prior to setting of the adhesive (34).
 4. A method as claimed in claim 2 or claim 3, wherein the screw-threaded fasteners (78) do not penetrate a bottom surface of the fastening channel (18), so as to prevent or limit moisture ingress.
 5. A method as claimed in any one of the preceding claims, wherein the upper and lower blocking elements (32) are further screw-threaded fasteners (60) which engage with walls of the fastening channel (18) and which bottom or substantially bottom out on the bottom surface of the fastening channel (18).
 6. A method as claimed in any one of the preceding claims, wherein the bracket element (30) includes at least one further attachment port (58) intermediate the upper and lower attachment ports (54, 56), and in step a) a removable plug element (62) is inserted into the further attachment port (58) to prevent or limit leakage of adhesive (34) from the further attachment port (58) during step b).
 7. A method as claimed in claim 6, wherein a plurality of spaced apart said further attachment ports (58) and a plurality of said removable plug elements (62) are provided.
 8. A method as claimed in any one of the preceding claims, wherein the bracket element (30) is a thermal break member (36) to which a bracket member (40) of the bracket apparatus (14) can be directly or indirectly mounted.
 9. A method as claimed in any one of the preceding claims, wherein, in step b), an adhesive applicator (66) is provided for forcing the adhesive (34) into one of said upper and lower attachment ports (54, 56).
 10. A method as claimed in any one of the preceding claims, wherein the upper and lower blocking elements (32) do not penetrate a bottom surface of the fastening channel (18), so as to maintain thermal isolation between interior and exterior sides of the curtain wall mullion (12).
 11. Curtain walling bracket apparatus (14) comprising a bracket element (30) having upper and lower attachment ports (54, 56), blocking elements (32) for blocking a fastening channel (18) of a curtain wall mullion (12), and adhesive (34) for insertion into one of the upper and lower attachment ports (54, 56).
 12. Curtain walling bracket apparatus (14) as claimed in claim 11, wherein the bracket element (30) further includes at least one further attachment port (58) intermediate the upper and lower attachment ports (54, 56).
 13. Curtain walling bracket apparatus (14) as claimed in claim 12, further comprising a removable plug element (62) for the or each said further attachment port (58).
 14. Curtain wall mullion apparatus (10) comprising a curtain wall mullion (12) and curtain walling bracket apparatus (14) as claimed in any one of claims 11 to 13, the bracket element (30) being engaged with a fastening channel (18) of the curtain wall mullion (12) via said adhesive (34).
 15. Curtain wall mullion apparatus (10) as claimed in claim 14, wherein the bracket element (30) includes retainer fasteners (78) which engage the adhesive (34).

Fig. 1

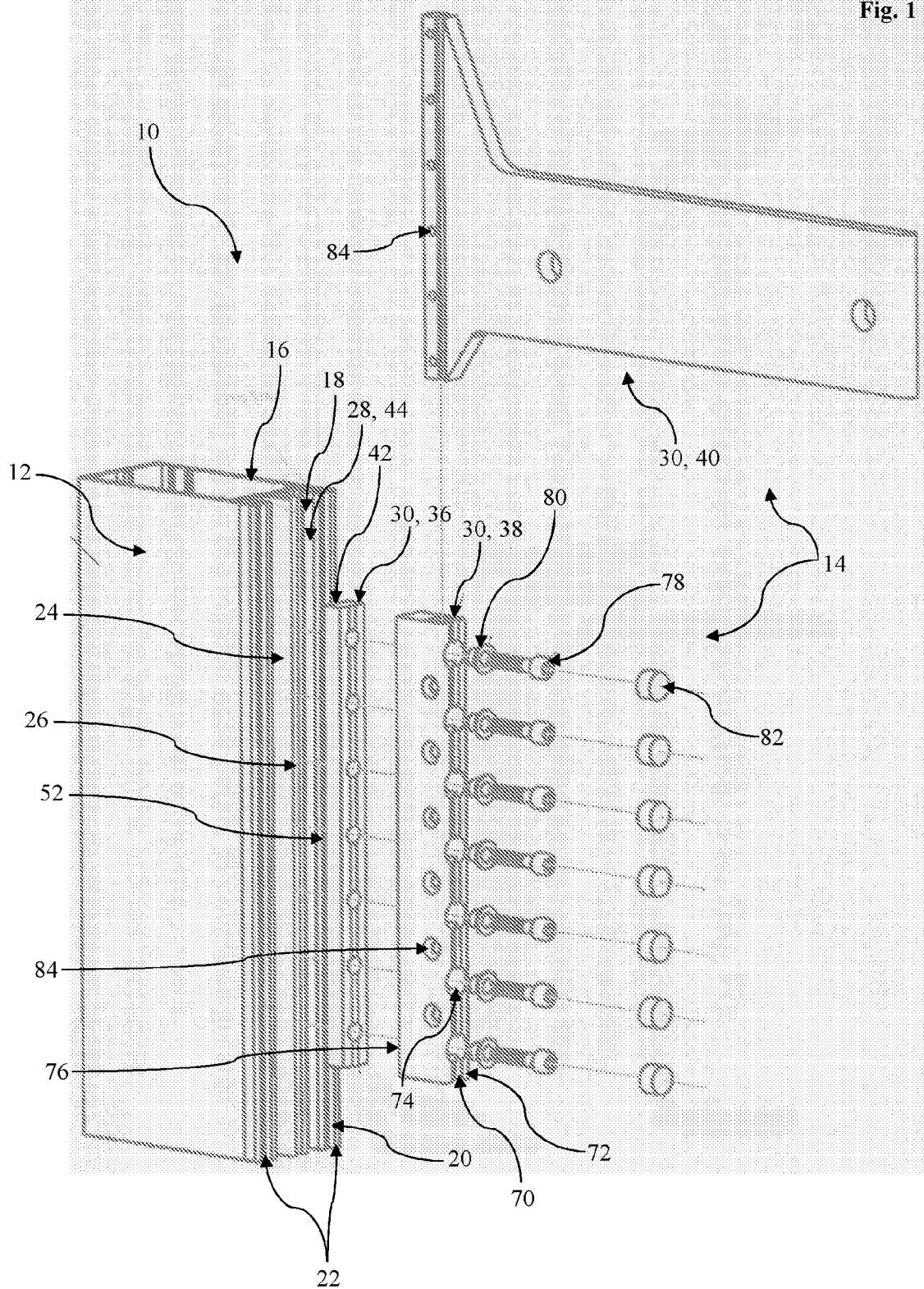


Fig. 2

