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(56) Documents Cited:
EP 0108754 A1 **DE 020111702 U1**
KR 101016344 B1 **US 5531539 A1**

(58) Field of Search:
INT CL **E04B, E04C**
Other: **EPODOC, WPI**

(54) Title of the Invention: **Connector assembly for connecting precast concrete sections**
Abstract Title: **Connector assembly for connecting precast concrete sections**

(57) The connector assembly comprises a first socket 10a comprising a front wall (12, Fig 1) and a back wall (13, Fig 1) and are spaced apart by at least one side wall extending therebetween. The back wall is configured for fixing (via holes 14) onto a first construction panel. The front wall comprises a slot 15 extending through at least one end of the front wall. The connector assembly also comprises a second socket identical to the first socket. The connector assembly additionally comprises a locking member 40 configured to be inserted into a at least one open end of the slot of each of the first and second sockets to lock the first and second construction panels in place relative to one another. Also defined is a method for connecting construction panels such as precast concrete wall panels.

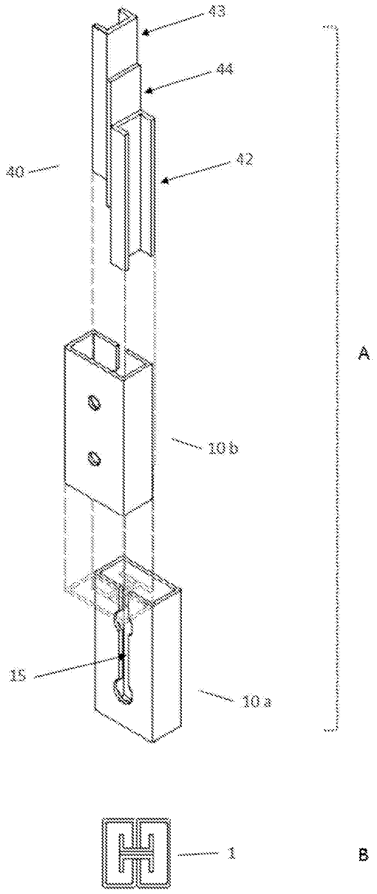

Figure 4

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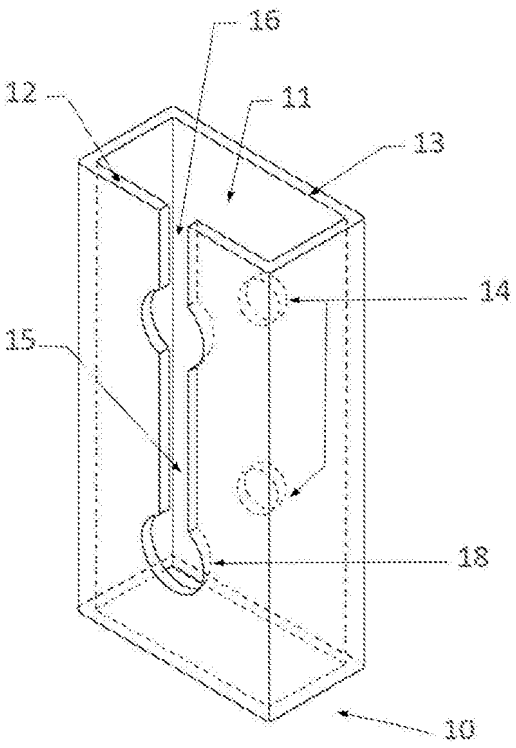
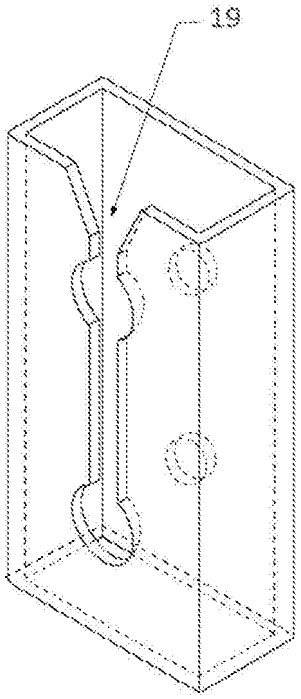
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

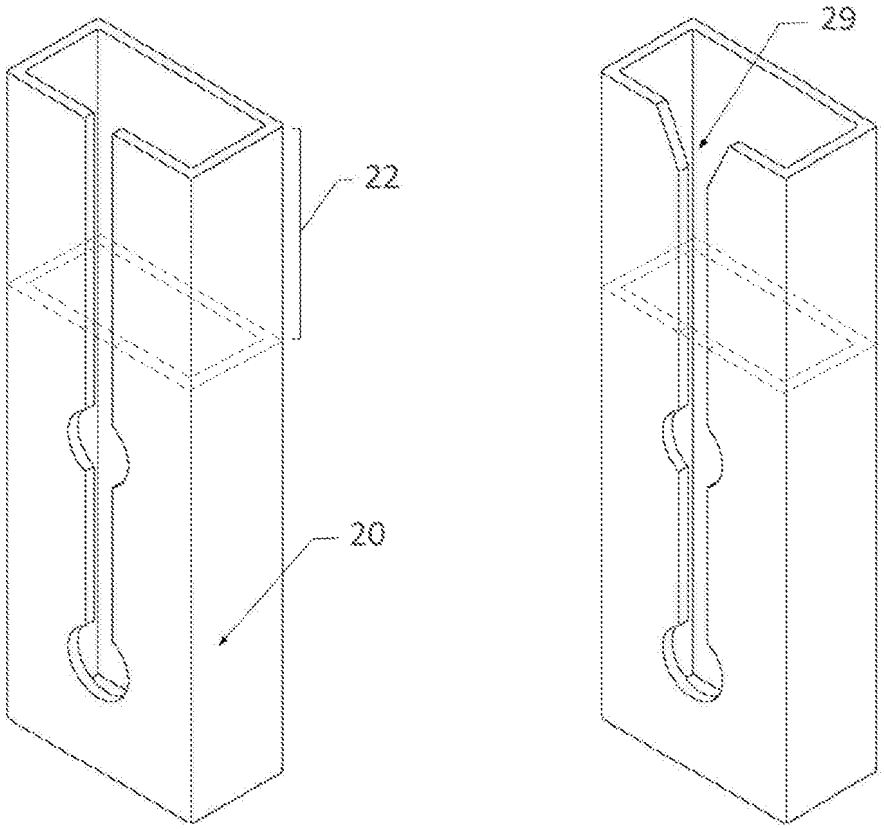


A



B

Figure 1



A B

Figure 2

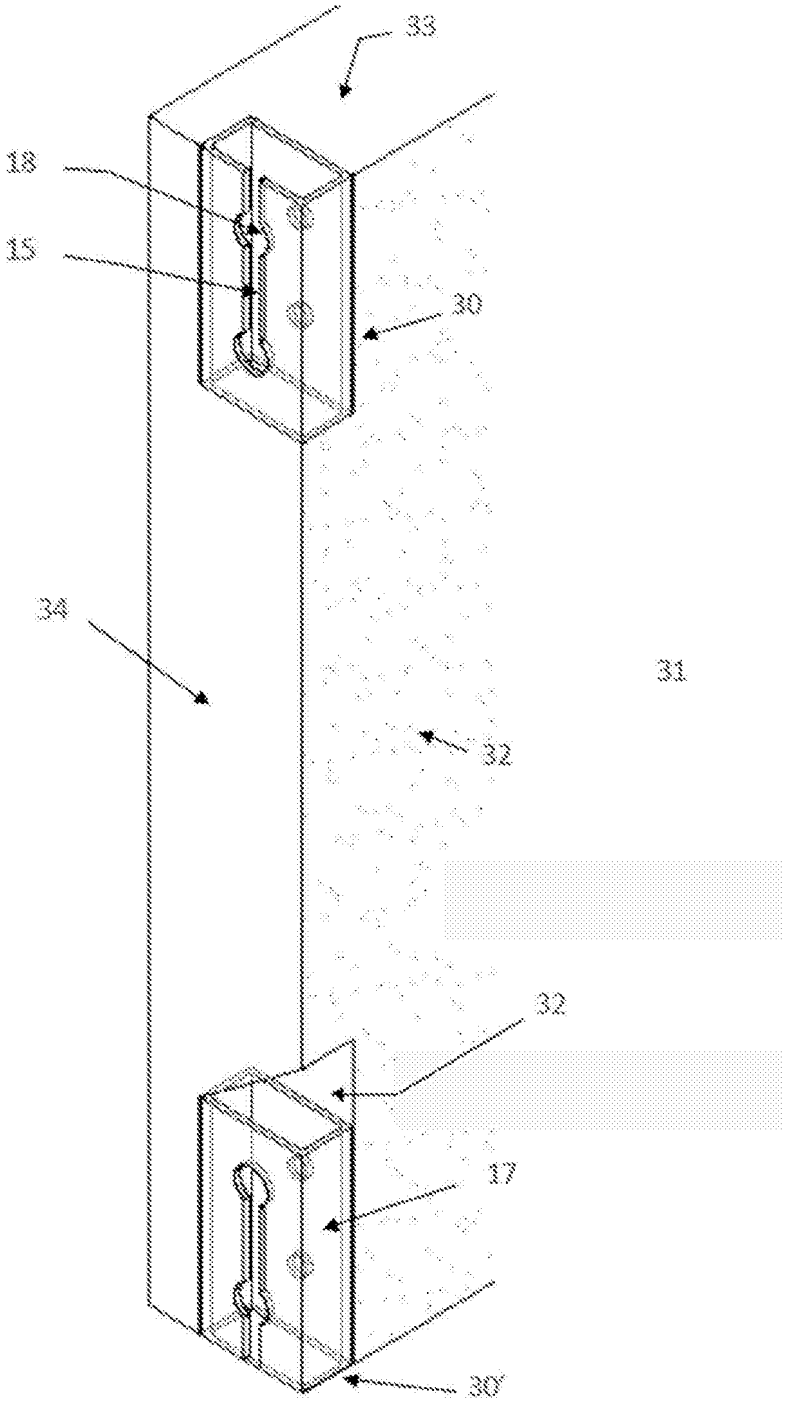


Figure 3

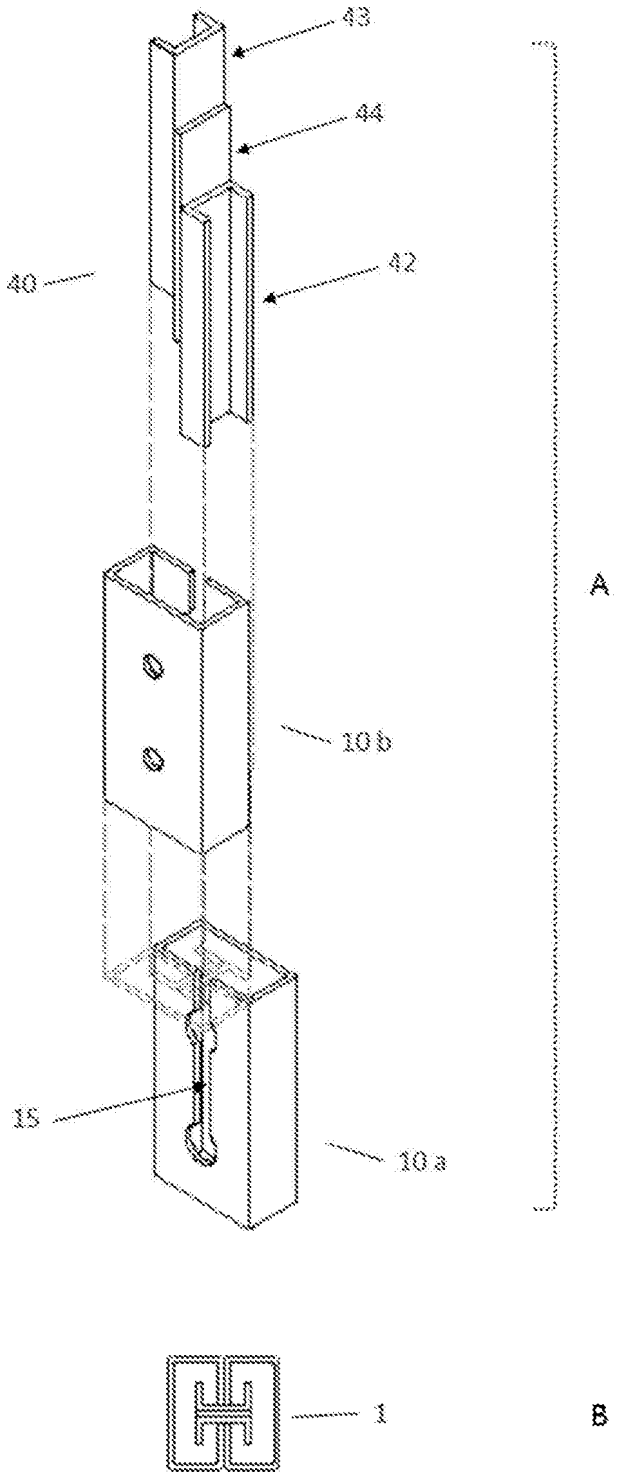


Figure 4

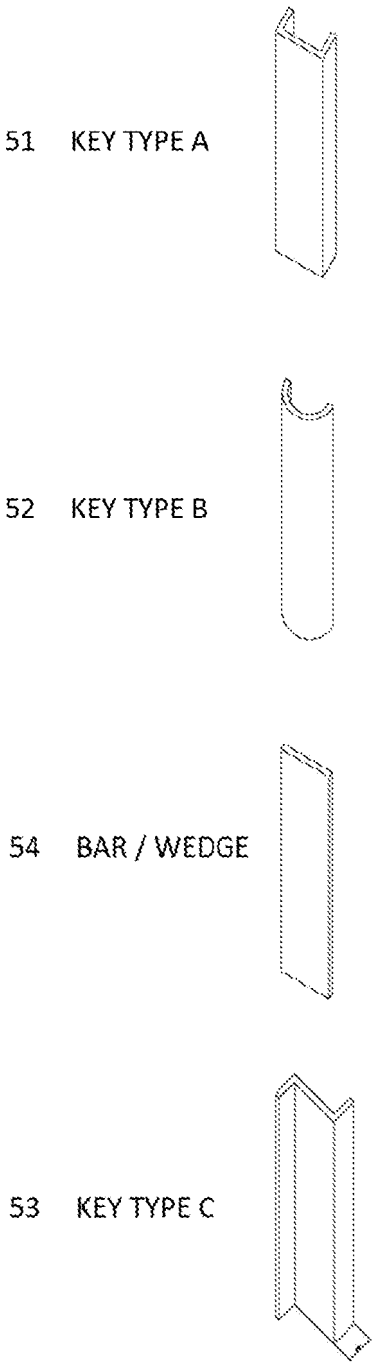
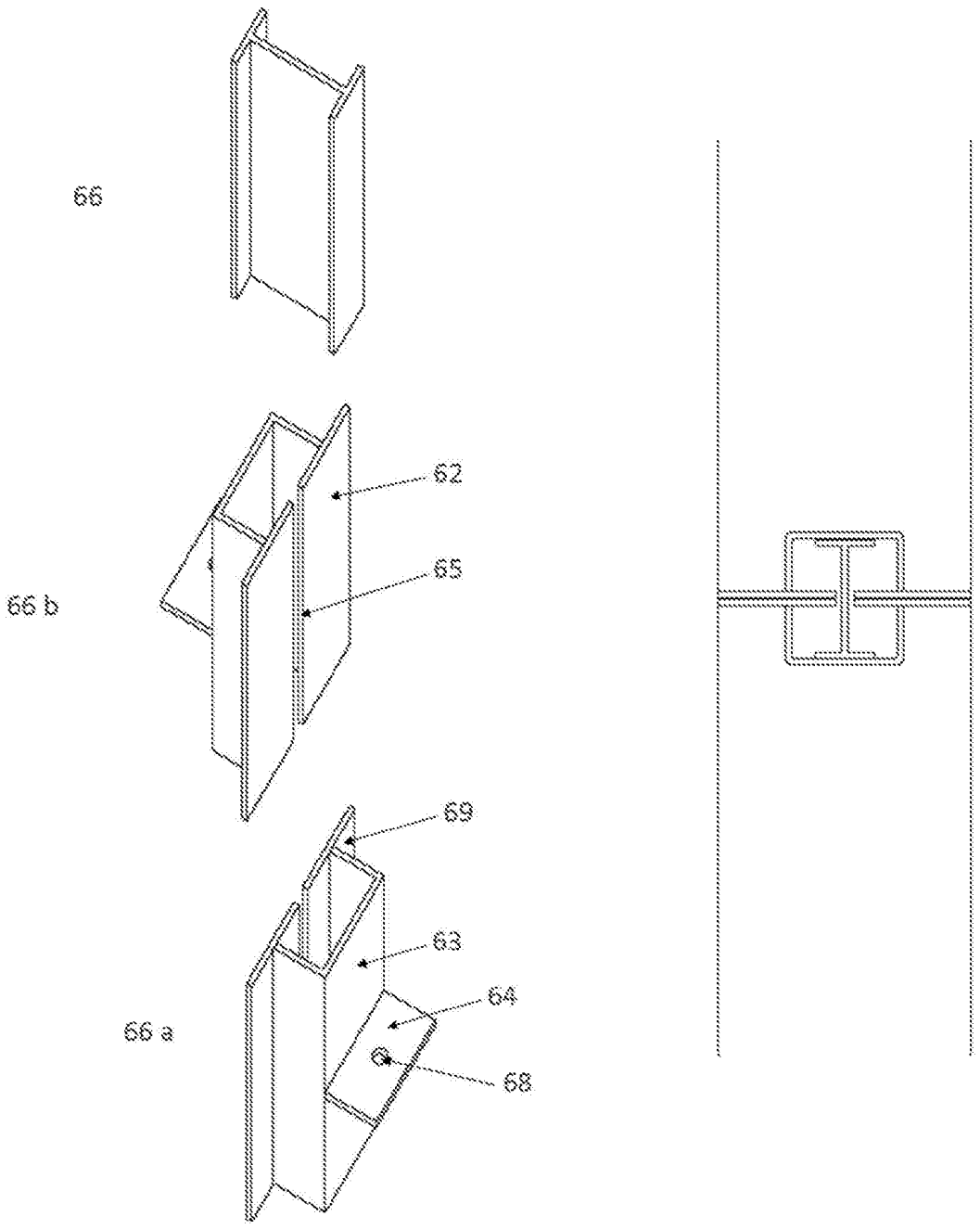


Figure 5



A B

Figure 6

Connector Assembly for Connecting Precast Concrete Sections

Field of the Invention

The present invention relates to a connector assembly and a method for joining or connecting precast concrete sections for building and site amenities.

Background to the Invention

Precast concrete is widely used in building construction. Precast concrete is a construction product produced by casting concrete in a mould. The concrete is then cured in a controlled environment, transported to the construction site and installed using suitable connectors to create building structures.

Compared with conventional in-situ construction, precast concrete construction provides many advantages including reduced construction time and costs, increased quality of structural elements, and increased durability and load capacity of the structure.

Because precast concrete is fabricated off-site in a controlled environment, the fabrication process has high quality control on both material and framework. Excellent mechanical strength and finish can therefore be achieved. Furthermore, as concrete is fabricated by casting, it can have improved material density and integrity which may provide improved thermal and sound insulation.

Precast concrete can reduce or eliminate work such as formworks, scaffoldings and curing during on-site constructions which tend to be time-consuming and manpower-intensive. The concrete structural elements or panels are fabricated off-site using modern techniques and machinery. This may greatly reduce time and manpower required for construction and improves productivity. As a result, the overall costs involved in construction may be reduced.

As precast concrete forms are transported to and installed on site, the building industry therefore requires simple, fast and effective mechanisms for connecting the concrete sections or panels in order to ensure productivity and quality.

Various connectors are in use for connecting precast concrete sections, such as concrete wall and floor panels. Connectors comprising multiple U-shaped loops are typically mounted on the edge of each of the two concrete sections to be connected. The concrete sections are positioned into a joining position such that the U-shaped loops of each of the two concrete sections are interleaved and overlapped. The loops are then held in place by a reinforcing rod vertically inserted through the overlapped loops. Concrete grout is then poured or pumped into the joint to secure the connection. Detail of connectors of this kind can be found in documents such as US Patent No. 6,102,607 and US Patent Application Publication No. US2010229490.

Although widely used in the building and construction industry, connectors of this kind have several disadvantages. For example, after the reinforcing rod is inserted through the overlapped loops, the relative position of the concrete sections is not locked until the concrete grout has been poured and cured. It is therefore necessary to fix the position of the concrete panels in order to perform the subsequent concrete grouting by propping the panels in position until the grout is cured. Another issue is that there is a large gap created by the loops, which project from the edge of the concrete sections. With such a large gap in between the concrete sections, shuttering of the joint is necessary in order to hold the grout in place until it is cured. Thus, the handling and installation of these connectors requires special setup which increases cost and reduces efficiency.

It is therefore desirable to provide a connector assembly for connecting precast concrete sections, such as wall panels, which overcomes at least in part the disadvantages identified above.

Summary of the Invention

The present invention provides a connector assembly and a method for connecting construction panels such as concrete sections or panels.

The connector assembly comprises a first socket comprising a front wall and a back wall and at least one side wall extending therebetween. The front and back walls are spaced apart from one another. The back wall is configured for fixing onto a first concrete section or panel. The front wall comprises a slot extending through at least one end of the front wall. The connector assembly further comprises a second socket comprising a front wall and a back wall and at least one side wall extending therebetween. The front and back walls are spaced apart from one another. The back wall is configured for fixing onto a second concrete section. The front wall comprises a slot extending through at least one end of the front wall. The first and second sockets may be identical. The connector assembly additionally comprises a locking member configured to be inserted into the at least one open or through-end of the slot of each of the first and second sockets to lock the first and second concrete sections in place relative to one another.

The locking member may comprise at least one key. The or each key may comprise a first arm portion configured to be received in the first socket and a second arm portion configured to be received in the second socket and a body portion extending between the first arm and the second arm.

A thickness of the body portion of the at least one key may be less than a width of the slot in each of the first and second sockets, such that the or each key fits loosely in the slots of the first and second sockets.

The locking member may further comprise a bar dimensioned such that a thickness of the bar and the body portion of the or each key is substantially equal to the width of the slot in each of the first and second sockets.

A width of the slot in each of the first and second sockets may be equal to a thickness of the locking member.

The or each key may have a U-shaped, a C-shaped, an H-shaped, or a Z-shaped cross section, or a flat plane shape.

The locking member may be a single key. The single key may have a U-shaped, a C-shaped, an H-shaped, or a Z-shaped cross-section, or a flat plane shape.

Each socket may be configured to be fitted and fixed in a recess formed in the first concrete section.

Each socket may be configured to be retrofitted to the respective concrete section.

The back wall of each socket may comprise at least one mounting hole.

The slot in the front wall of each socket may comprise at least one enlarged portion aligned with the at least one mounting hole.

Each socket may be configured to be cast into the respective concrete section during fabrication of the concrete section.

The connector assembly may further comprise a flange extending outwardly from the back wall of each socket for fixing the socket to the concrete section.

A width of one or both of the slots may be increased at the open or through-end thereof.

One or both of the sockets of the connector assembly may comprise an extension portion configured to extend beyond an end of the respective concrete section.

When assembled, a gap of a predetermined size may be defined between the first and second sockets.

The elements of the connector assembly may be fabricated using any material for providing suitable hardness and strength for particular connecting applications. The connector may also be in any size suitable for applications for connecting concrete panels sections in various sizes and dimensions. The embodiments described herein relate to connecting precast concrete sections. A skilled person would understand that the connector assembly may be used to connect other types of prefabricated structures and sections such as, but not limited to metal, plastic, wood, etc. Depending on the application and the material of the sections to be connected, the connector may be fabricated with but not limited to materials such as cast iron, mild steel, stainless steel, plastic, etc. Depending on the application, the size of the connector may be in the range of, but not limited to, a few centimetres or tens of centimetres.

The connector assembly according to the present invention provides simple and effective connection of concrete sections at low cost.

Unlike connectors currently in use, wherein the concrete sections to be connected are not locked in place until concrete grout is applied and completely cured, the connector assembly according to the present invention locks the concrete sections in place once the key and socket assembly of the connector is completed. Therefore, temporary external forces for propping the sections in place for subsequent grout pouring are eliminated using the invention.

The gap between the pair of concrete sections connected using the connector according to the invention may be small. As a result of the small gap, a concrete grout may be applied to the gap without requiring any temporary bracing setup or shuttering to hold the grout in place until cured.

The installation process of the connector assembly of the present invention is thus simple and straightforward, and does not require any special equipment or tools. This greatly reduces cost and improves efficiency.

The socket and key configuration of the connector assembly also allows easy adjustment of the distance between the concrete sections without affecting the connection mechanism and quality.

The connector assembly also allows adjustment of the position of the sockets to compensate any small misalignment of the concrete sections and the sockets to provide tolerance. This tolerance is useful and may be important during installing precast concrete structures on site where precise alignment may be difficult in practice.

Brief Description of Drawings

Figure 1A is a perspective view of a socket according to a first embodiment of the invention;

Figure 1B is a perspective view of a socket according to a second embodiment of the invention;

Figure 2A is a perspective view of a socket according to a third embodiment of the invention;

Figure 2B is a perspective view of a socket according to a fourth embodiment of the invention;

Figure 3 is a perspective view of an end portion of a concrete section with a socket fixed to each of the top and bottom ends of the concrete section;

Figure 4A is an exploded perspective view of a connector assembly according to an embodiment of the invention;

Figure 4B is a top plan view of the connector assembly of **Figure 4A**;

Figure 5 shows locking members according to various embodiments of the invention;

Figure 6A is an exploded perspective view of a connector comprising two cast-in type sockets and an H-shape key according to an embodiment of the invention; and

Figure 6B is a top plan view of a pair of concrete sections connected with the cast-in type connector assembly of **Figure 6A**.

Detailed Description of Drawings and Embodiments

The present invention will now be described in detail with reference to the accompanying drawings.

A connector assembly 1 according to one embodiment of the invention is illustrated in **Figure 4**. The connector assembly shown in in **Figure 4** comprises a first socket 10a and a second socket 10b and a locking member 40 for insertion into the sockets. The sockets 10a and 10b are matching sockets having essentially the same configuration as the socket 10 shown in **Figure 1A**. The locking member 40 of the connector

assembly comprises two keys 42, 43 and a bar 44. The configuration of the sockets will be described in detail in subsequent paragraphs in connection with **Figure 1**.

Referring to **Figure 1A**, a socket 10 of a connector assembly 1 according to an embodiment of the invention is shown. The socket 10 is a hollow cuboid structure. In the embodiment shown, the socket is 200 cm in length, 100 cm in width, and 50 cm in depth. However, the socket may be any suitable size depending on the application and is therefore not limited to the dimensions provided above and shown in **Figure 1A**.

The socket 10 comprises a front wall 12 and a back wall 13 and two side walls extending therebetween. The back wall 13 defines a pair of holes 14 for mounting the socket 10 to a concrete section. In the embodiment shown, the holes 14 have a diameter of 18 mm. The mounting may be achieved using threaded mounting elements such as bolts (not shown).

The front wall 12 comprises a slot 15. The slot 15 is disposed longitudinally and extends through one end of the front wall 12 such that the slot is open-ended. In the embodiment shown, the slot has a width of 15 mm. The slot 15 extends through the top of the front wall to provide an opening 16. The opening 16 allows one or more keys to be inserted into the socket along the slot for connection purposes. In another embodiment of the invention, the slot 15 may extend along the entire length of the front wall through both ends of the front wall, thereby also provide an opening at the bottom of the front wall. A full-length slot 65 is illustrated in **Figure 6** in connection with cast-in type sockets 60a and 60b.

The slot 15 in the front wall 12 of the socket further comprises a pair of enlarged portions 18. The enlarged portions 18 are in alignment with the mounting holes 14 located in the back wall. The enlarged portions 18 allow passage of and access to suitable mounting elements such as bolts, to allow the socket to be mounted to a concrete section. For example, the enlarged portion may have a diameter of 32 mm and is suitable for passage of a 16⌀ bolt. Although a pair of holes 14 and enlarged portions 18 are shown in the figure, depending on the size and structure of the socket, any other number of holes may be used to facilitate mounting.

According to another embodiment of the socket shown in **Figure 1B**, the slot 15 may have an enlarged or widened opening 19. The enlarged opening 19 may facilitate easier insertion of the locking member. As shown in **Figure 1B**, the enlarged opening 19 tapers toward the bottom as it joins the main section of the slot 15.

According to a further embodiment of the invention, there is provided a socket with elongated profile. **Figure 2A** shows an elongated socket 20 as part of an elongated connector. The side surrounding walls of the socket 20 are elongated as compared to the socket shown in **Figure 1**. Although not shown in the figure, the elongated socket 20 is configured to be used with corresponding elongated locking members (not shown) for insertion into the socket 20. The elongated section 22 may have a length equal to the depth of a floor structure. The elongated section may be configured to be fitted into the floor structure. A similar elongated socket with an enlarged slot opening 29 is shown in **Figure 2B**.

Figure 3 shows a wall panel 31 with two sockets 30 and 30' mounted on the edge of the wall panel. The socket 30 is mounted at the top of the edge and the socket 30' is mounted at the bottom of the edge. The sockets are substantially as described above with reference to **Figure 1A**. As shown in **Figure 3**, the wall 31 is fabricated with two recesses in which the sockets are fitted and mounted. One recess is located at the top corner defined by an external face 32, a top face 33 and a joint face 34 of the concrete panel. The open end 16 of the slot 15 of socket 30 is accessible from the top face 33 of the concrete panel to allow insertion of locking members into the socket and pouring of concrete grout into the socket after the concrete panel has been connected and locked with another concrete panel. The slot 15 and the enlarged portions 18 are accessible from the joint face of the concrete panel. The side wall 17 of the socket is flush with the external face of the concrete panel. The socket 30' is located in a recess at a corresponding bottom corner as shown in the figure. The arrangement of bottom socket 30' is similar to that of the top socket 30 except that the recess comprises a grout hole 35 accessible from the external face 32 to allow injecting or pouring concrete grout into the bottom socket 30'. The open end 16 of slot 15 of socket 30' is directed towards the bottom end of the panel.

The position of the connected concrete sections is securely fixed and locked by the connector assembly located at the top of the concrete sections, as described below. Therefore, during installation, the sockets located at the bottom of the concrete sections, such as the socket 30' in **Figure 3**, may first be loosely linked by a single key without inserting further keys or bars to provide further locking of the sockets. The panels are then locked in place by connecting the socket 30 at the top end of the panel to a corresponding socket on the other panel as described below. The sockets at the bottom end of the panel are then grouted via the grouting hole 35.

The mechanism of assembling a connector assembly according to the invention is demonstrated with reference to **Figure 4**. To implement the connection of two concrete sections, a socket 10a is fitted and fixed onto a first concrete section. As mentioned above in connection with **Figure 1**, the socket 10a may be retrofitted using a threaded mounting element such as a bolt. Alternatively, the socket 10a may be cast into the concrete during the fabrication of the concrete section. Such a cast-in type socket is shown in **Figure 6**. In either case, the socket is fitted and fixed in a recess on the surface of the concrete section, for example, as shown in **Figure 3**.

Another identical socket 10b is fitted and fixed in a recess of a second concrete section. The sockets are fitted such that when the concrete sections are brought together, the sockets are aligned with one another, such that the slot 15 of socket 10a and the slot 15 of socket 10b are aligned to allow the locking members to be inserted to link and lock the two sockets.

To insert the locking members, a first key 42 and a second key 43 are inserted into the void created jointly by the two sockets through the top openings 16 of the slots. Upon insertion, the keys 42 and 43 are loosely fitted in the sockets, as the combined thickness of the keys 42, 43 is less than the width of the slots 15. Such a loosely fitted configuration allows further adjustment of the position of the sockets before the sockets are locked to provide tolerance in installation. This tolerance is useful and may be important during installing precast concrete structures on site where precise alignment may be difficult in practice. After inserting key 42 and key 43 and after relevant adjustment has been completed, a third locking member may be inserted into the sockets. The third locking member is a bar or wedge 44. The bar or the wedge

may be inserted with force to lock the keys and sockets in place. The bar 44 is dimensioned to fit tightly into the gap left by the key 42 and key 43 to securely lock the position of all components of the connector in place. As shown in **Figure 4B**, the slots have a width substantially equal to the sum of the thicknesses of the locking members. The bar 44 may alternatively be formed in the shape of a wedge to facilitate easy insertion into the gap.

In the embodiment shown in **Figure 4**, the bar is inserted in between the two keys. In alternative embodiment, the bar may be inserted at any position adjacent to the keys and the edge of the slot to achieve the same locking effect.

The joining faces of the connected concrete sections may or may not abut depending on applications. In either case, concrete grout may be poured or injected to fill any void left in the socket and any gap between the concrete sections. The filled grout is left to cure until solid.

Unlike the prior art wherein the concrete sections to be connected are not locked in place until concrete grout is applied and completely cured, the connector assembly according to the present invention locks the concrete sections in place once the key and socket assembly of the connector is completed. Therefore temporary external forces for holding the sections in place for subsequent grout pouring are eliminated using the invention. Furthermore, the gap between the pair of concrete sections connected using the connector according to the invention is small. As a result of the small gap, a concrete grout may be applied to the gap without requiring any temporary bracing setup to hold the grout in place until cured.

A further advantage of the present invention is that the socket and key configuration of the connector allows easy adjustment of the distance between the concrete sections without affecting the connection mechanism and quality. During connection, the pair of sockets, together with the concrete sections, may be brought closer to or further away from each other to adjust the gap therebetween. The adjustment can be made to any extent which is allowed by the length of the keys. The adjustment is simple and straightforward without requiring adding or altering any components of the connector assembly. Such flexibility in positioning of the concrete sections is useful in practice. On the one hand, it provides tolerance during connection and installation to

compensate the fact that precise alignment may be difficult on site. On the other hand, it may be desirable to create a gap of a predetermined size in many applications. The gap may be created to support certain mechanical and acoustic features of the finished concrete structure. For example, the gap may be adjusted so that after grouting and curing, the joint section may have a matching mass density, strength, temperature insulation, and/or acoustic property to those of the original precast portions of the structure.

Various configurations of keys are shown in **Figure 5**. Key type A 51 has a U-shaped cross section which corresponds to the keys shown in **Figure 4**. Key type B 52 has a C-shaped cross section. Key type C 53 has a Z-shaped cross section, and can be used to connect sockets which are offset from one another. Locking bar 54 is in the shape of a thin cuboid with uniform thickness over the entire length. As previously mentioned, bar 54 may also be in the shape of a wedge. Such a wedge shape may facilitate easy insertion of the bar. The or each key may alternatively have a flat plane shape (not shown).

The embodiment described above and shown in **Figure 4** uses a locking member including two keys and a bar for locking the sockets and in turn the positions of the concrete sections relative to one another. It is possible to use only two keys to lock the position without requiring a bar. In this case, a first key is inserted into the sockets first, followed by a second key. The second key is configured to fill in the gap left by the first key to securely lock the keys and the sockets in position. Another alternative is to use a single key and a bar to lock the sockets. The single key is loosely fitted in to the sockets and a bar is inserted with force to lock the key and the sockets. A further alternative is to use a single key on its own without using any bar to performing locking. In this case, the thickness of the key is configured to be the same as or even slight thicker than the width of the slot to provide tight grip and secure connection. For this single-key configuration, the key may be in an H-shape such as the one shown in **Figure 6**. The single key may alternatively have a U-shaped, a C-shaped, an H-shaped, or Z-shaped cross-section, or a flat plane shape.

Figure 6A shows an exploded view of a cast-in type connector according to an embodiment of the invention. As previously mentioned, the socket may be cast into

the joining face of a concrete section during the fabrication of the concrete section. Such a cast-in fitting of the socket may further reduce the installation work required on site. The socket of this cast-in type may comprise a flange 64 extending from the back wall 63 of the socket 60. The flange may comprise one or more holes 68 for passage of a U-shaped bar (not shown) to provide grip or connection to the concrete. Similar to socket 10, the cast-in socket 60 comprises a slot 65 in the front wall 62. In this embodiment, however, the slot extends through both the top and bottom edges of the front wall. The front wall 62 of the cast-in type socket 60 may be larger than the back wall. For example, the front wall 62 may extend transversely beyond the side wall 67 as shown in **Figure 6A** in conjunction with **Figure 6B**. The extended portion 69 may be configured to cover a portion of the joining face of the concrete section. To lock the sockets, a key 66 is inserted from the top opening through the slot into the sockets 60a and 60b. Although only a single locking member which is an H-shaped key is shown in **Figure 6**, it will be readily understood that locking members, similar to those described in connection with the retrofit type connector, may be used interchangeably for the cast-in type connectors. Additional features as those demonstrated in connection with the retrofit type connector may also be implemented for the cast-in type connector where applicable with suitable modifications depending on applications. A pair of concrete sections connected using such a cast-in type connector is shown in **Figure 6B**.

The words "comprises/comprising" and the words "having/including" when used herein with reference to the present invention are used to specify the presence of stated features, integers, steps or components but do not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination.

Claims

1. A connector assembly for connecting construction panels, comprising:

a first socket comprising a front wall and a back wall and at least one side wall extending therebetween, the front and back walls being spaced apart from one another, the back wall configured for fixing onto a first construction panel, the front wall comprising a slot extending through at least one end of the front wall;

a second socket comprising a front wall and a back wall and at least one side wall extending therebetween, the front and back walls being spaced apart from one another, the back wall configured for fixing onto a second construction panel, the front wall comprising a slot extending through at least one end of the front wall; and

a locking member configured to be inserted into the at least one through-end of the slot of each of the first and second sockets to lock the first and second construction panels in place relative to one another.

2. The connector assembly of claim 1, wherein the locking member comprises at least one key.

3. The connector assembly of claim 2, wherein in the or each key comprises a first arm portion configured to be received in the first socket and a second arm portion configured to be received in the second socket and a body portion extending between the first arm and the second arm.

4. The connector assembly of claim 3, wherein a thickness of the body portion of the at least one key is less than a width of the slot in each of the first and second sockets, such that the or each key fits loosely in the slots of the first and second sockets.

5. The connector assembly of claim 4, wherein the locking member further comprises a bar dimensioned such that a total thickness of the bar and the body portion of the or each key is substantially equal to the width of the slot in each of the first and second sockets.

6. The connector assembly of any preceding claim, wherein a width of the slot in each of the first and second sockets is equal to a thickness of the locking member.

7. The connector assembly of any of claims 2 to 6, wherein the or each key has a U-shaped, a C-shaped, an H-shaped or a Z-shaped cross-section.

8. The connector assembly of claim 1, wherein the locking member is a single key.

9. The connector assembly of claim 8, wherein the single key has an H-shaped cross-section.

10. The connector assembly of any of the preceding claims, wherein each socket is configured to be fitted and fixed in a recess of the first construction panel.

11. The connector assembly of any of the preceding claims, wherein each socket is configured to be retrofitted to the respective construction panel.

12. The connector assembly of any of the preceding claims, wherein the back wall of each socket comprises at least one mounting hole.

13. The connector assembly of claim 12, wherein the slot in the front wall of each socket comprises at least one enlarged portion aligned with the at least one mounting hole.

14. The connector assembly of any of claims 1 to 9, wherein the construction panels are precast concrete panels and each socket is configured to be cast into the respective concrete panel during fabrication of the concrete panel.

15. The connector assembly of claim 14, further comprising a flange extending outwardly from the back wall of each socket for fixing the socket to the concrete panel.

16. The connector assembly of any of the preceding claims, wherein a width of one or both slots is increased at the through-end thereof.

17. The connector assembly of any of the preceding claims, wherein one or both sockets comprise an extension portion configured to extend beyond an end of the respective concrete section.

18. The connector assembly of any of the preceding claims, wherein when assembled, a gap of a predetermined size is defined between the first and second sockets.

19. A socket for a connector assembly for connecting construction panels, comprising:

a front wall and a back wall and at least one side wall extending therebetween, the front and back walls being spaced apart from one another, the back wall configured for fixing onto a construction panel, the front wall comprising a slot extending through at least one end of the front wall,

wherein the slot is configured to receive a locking member configured to be inserted into the at least one through-end of the slot.

20. A method for connection of construction panels, comprising:

providing a first construction panel with a first socket, the first socket comprising a front wall and a back wall and at least one side wall extending therebetween, the front and back walls being spaced apart from one another, the back wall fixed to the first construction panel, the front wall comprising a slot extending through at least one end of the front wall;

providing a second construction panel with a second socket, the second socket comprising a front wall and a back wall and at least one side wall extending therebetween, the front and back walls being spaced apart from one another, the back wall fixed to the second construction panel, the front wall comprising a slot extending through at least one end of the front wall;

inserting a locking member into the at least one through-end of the slot of each of the first and second sockets to lock the first and second construction panels in place relative to one another.

21. A connector assembly substantially as hereinbefore described with reference to and/or as illustrated in the accompanying drawings.

Intellectual Property Office

Application No:	GB1812203.6	**Examiner:**	Mrs Judith Peake
Claims searched:	1-21	**Date of search:**	25 January 2019

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-4, 6-10, 14-15, 18-20	KR101016344 B1 (IS DONGSEO CO LTD) See EPODOC abstract and Figures 1-3 showing precast concrete connector with dual sockets 10 and H-shaped locking member 20 inserted via slots 12 in the sockets
X	1-2, 8, 10, 12, 14, 17-20	DE20111702 U1 (PFEIFER HOLDING GMBH & CO KG) See WPI Abstract Accession Number 2003-104496 and Figs 1-6c showing connector 1 for precast concrete panels 15, 15', the connector comprising two sockets 5 and two fixer loops 2 and detent key13 serving to lock the connectors together.
X	1-4, 8, 11, 12, 13, 16, 18-20	EP0108754 A1 (MAATELA PENTTI) See Figs 1-5 and 11 shows a coupling 1 for connecting two construction panels 2, 3 comprising dual sockets 4, 5 and a locking member 10
X	1-3, 6, 8, 10-11, 18-20	US5531539 A1 (EXPOSYSTEM INC) See Figs 1 and 2 showing two construction panels 12 connected by assembly 10 comprising dual sockets 28, which receive a locking member 50

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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Field of Search:

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Worldwide search of patent documents classified in the following areas of the IPC

E04B; E04C

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI

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International Classification:

Subclass	Subgroup	Valid From
E04B	0001/61	01/01/2006