(12) UK Patent Application (19) GB (11) 2 205 624 (13) A

(43) Application published 14 Dec 1988

(21) Application No 8713077

(22) Date of filing 4 Jun 1987

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(51) INT CL⁴
F16B 5/07

(52) Domestic classification (Edition J):
F2M 201 209 224 234 271 D6
U1S 1705 F2M

(56) Documents cited

GB A 2042874	**GB 1604231**	**GB 1438627**
GB 1389517	**GB 1139008**	**GB 1125861**
GB 1061981	**GB 0904935**	

(58) Field of search
F2M
Selected US specifications from IPC sub-class F16B

(54) Structural frame components

(57) A structural frame includes angle irons 1 and connectors 2. Each angle iron comprises at least two rows of spaced wedge-in engaging holes 18 formed respectively along the different corner portions thereof. Each connector comprises an L-shaped part 23 with a pair of right angle flanges 23, 24 and an arm 22 projecting perpendicularly therefrom. At least one wedge-in pin 27 is formed in said L-shaped base, extending obliquely therefrom. By simply engaging the wedge-in pins with the engaging holes, the angle irons and connectors can be easily assembled into an open frame. A locking pin 31 may be provided.

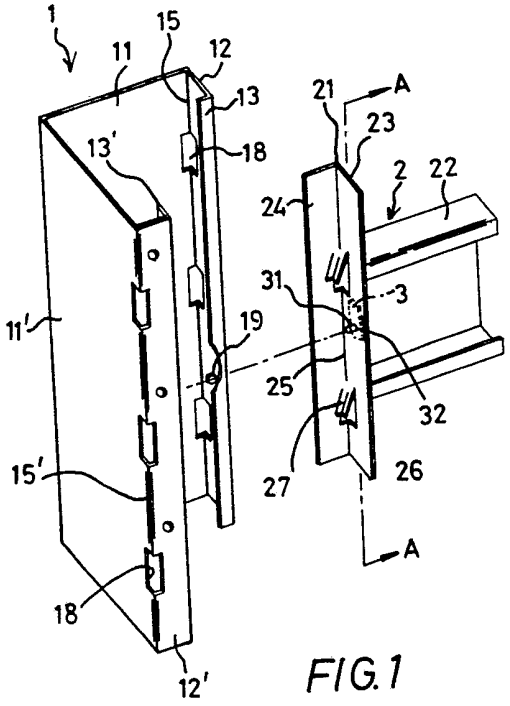

FIG.1

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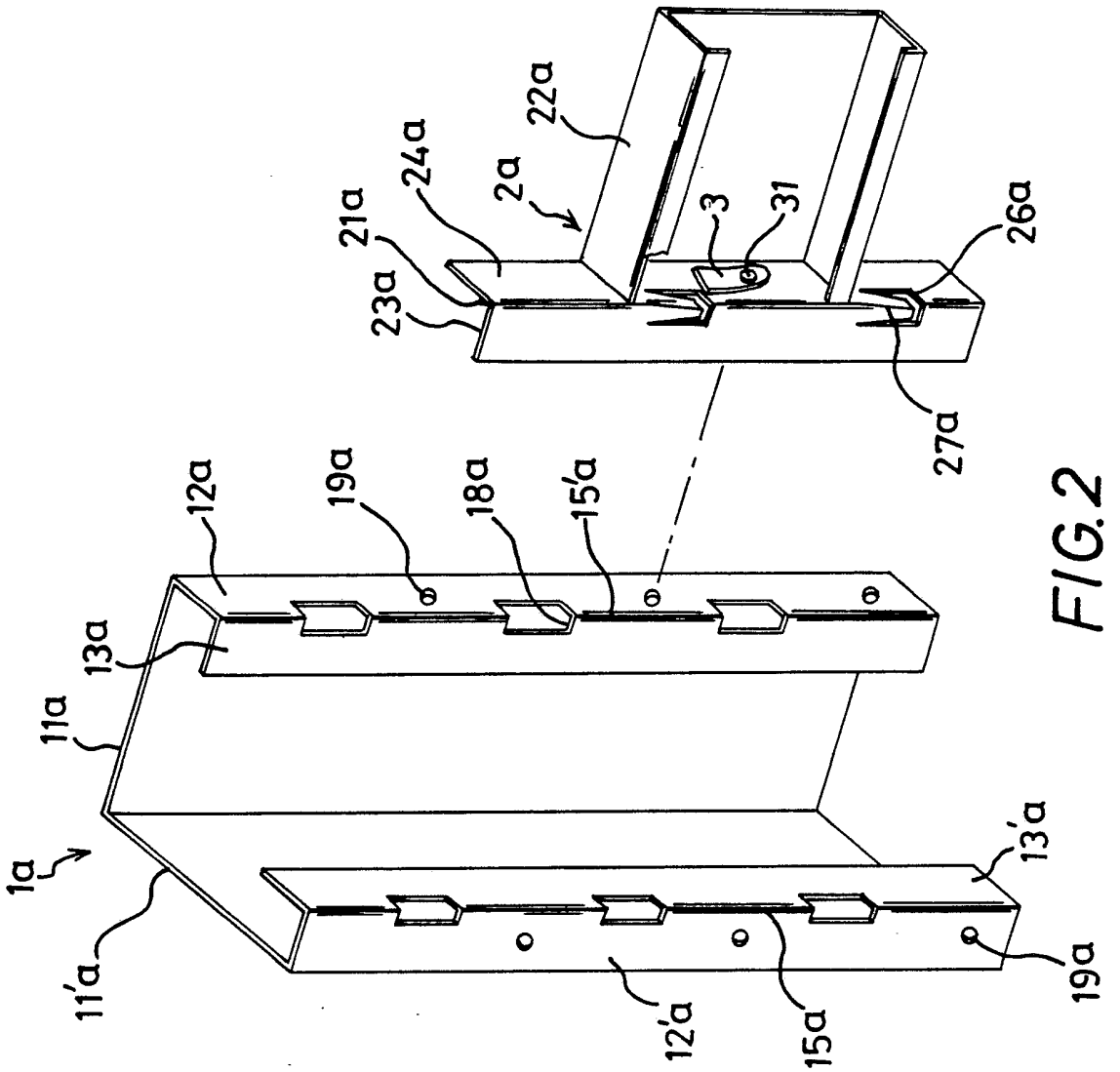


FIG.2

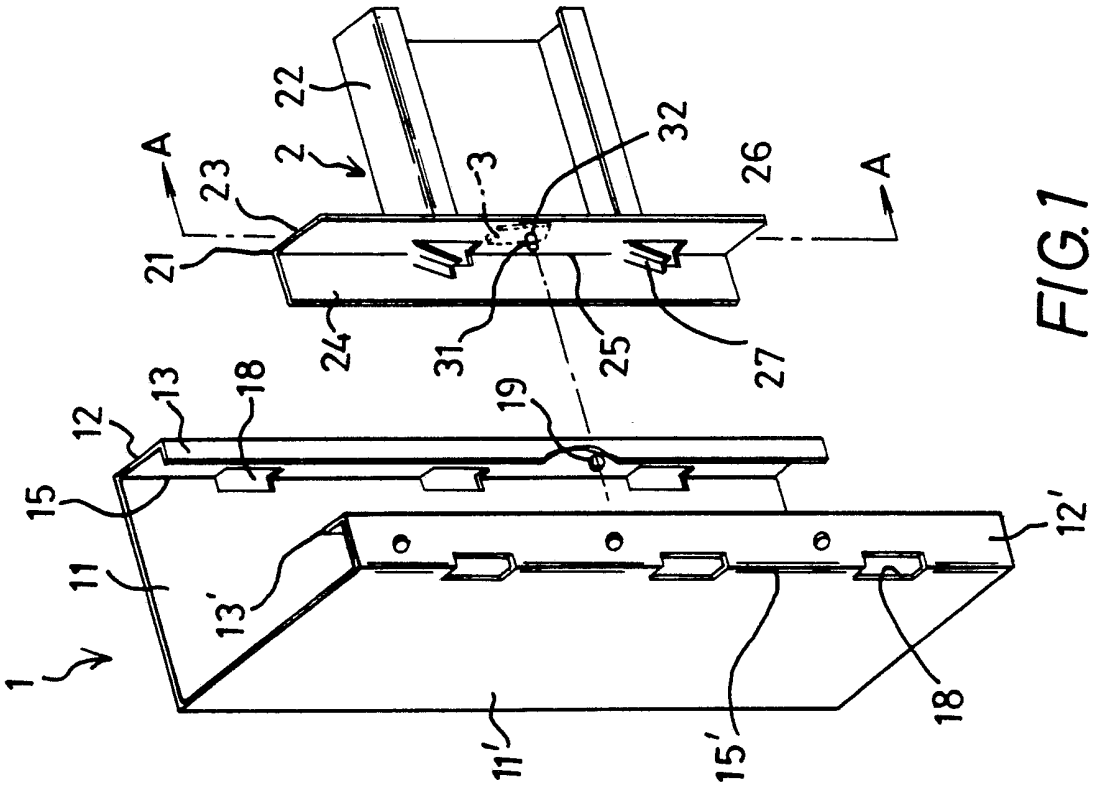


FIG.1

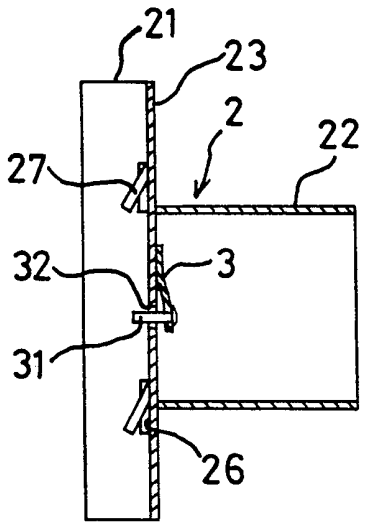
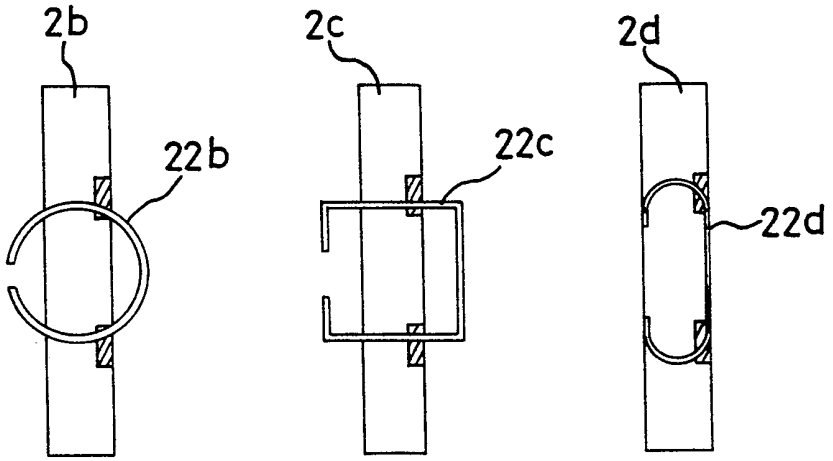
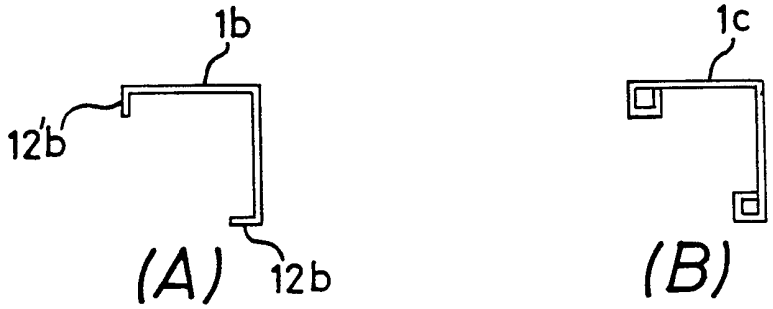


FIG.3



(A) (B) (C)

FIG. 4



(A) (B)

FIG.5

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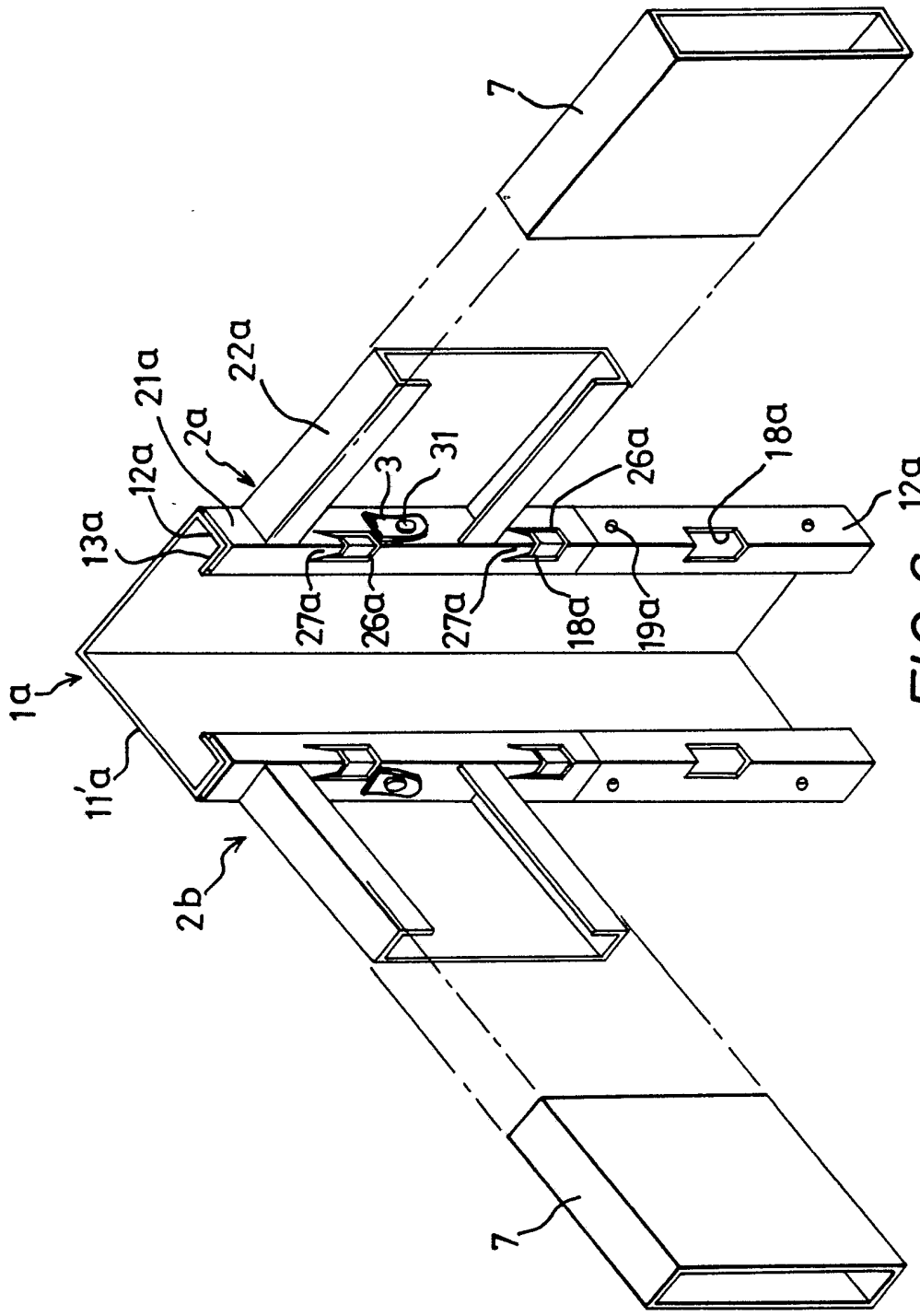

FIG. 6

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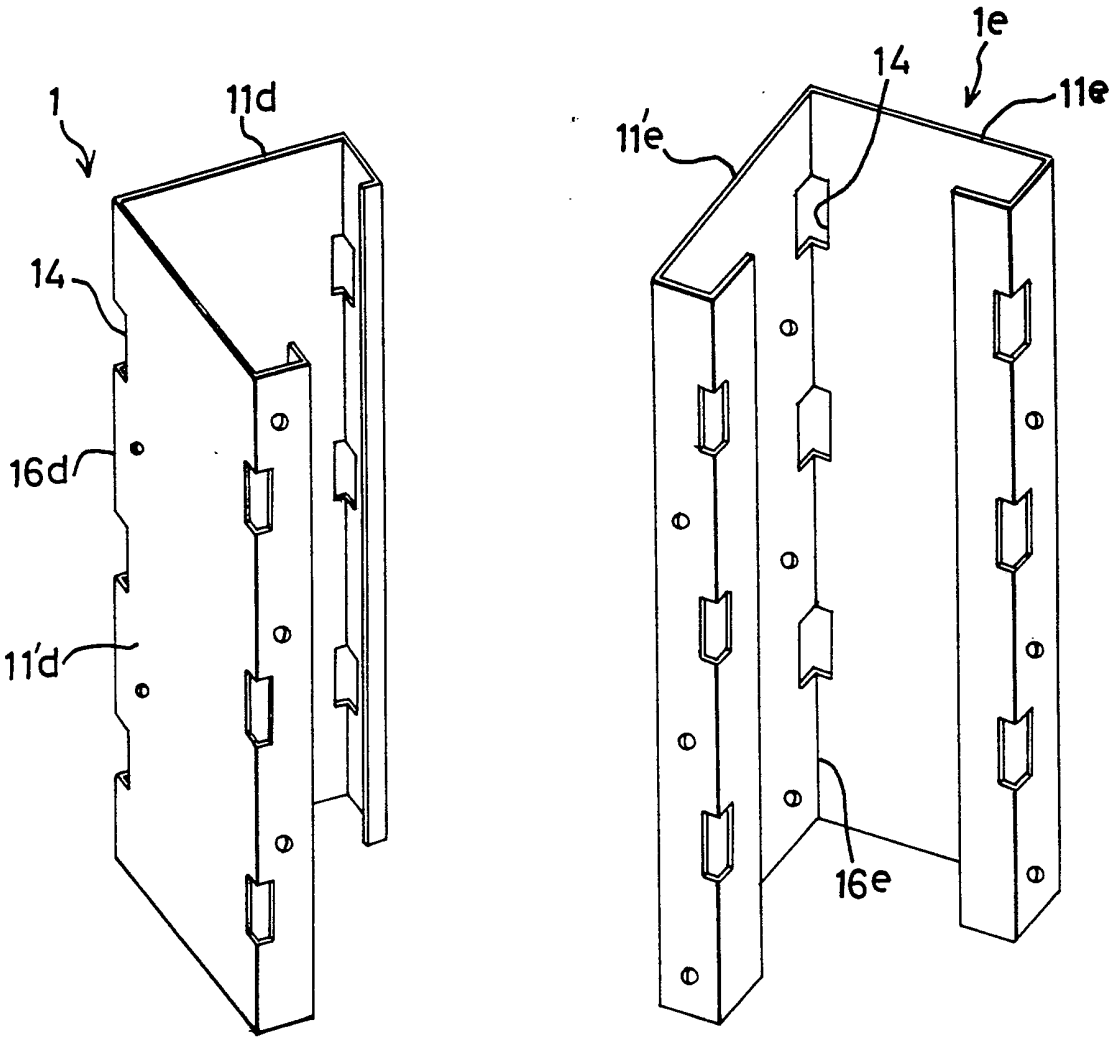

(A) (B)

FIG. 7

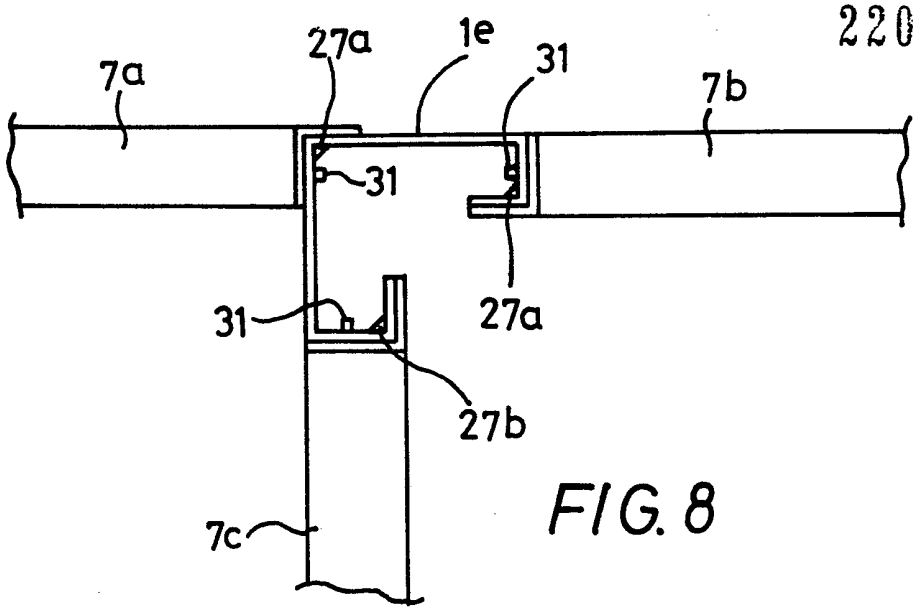
7a
27a
1e
31
7b
31
31
27a
27b
7c

FIG. 8

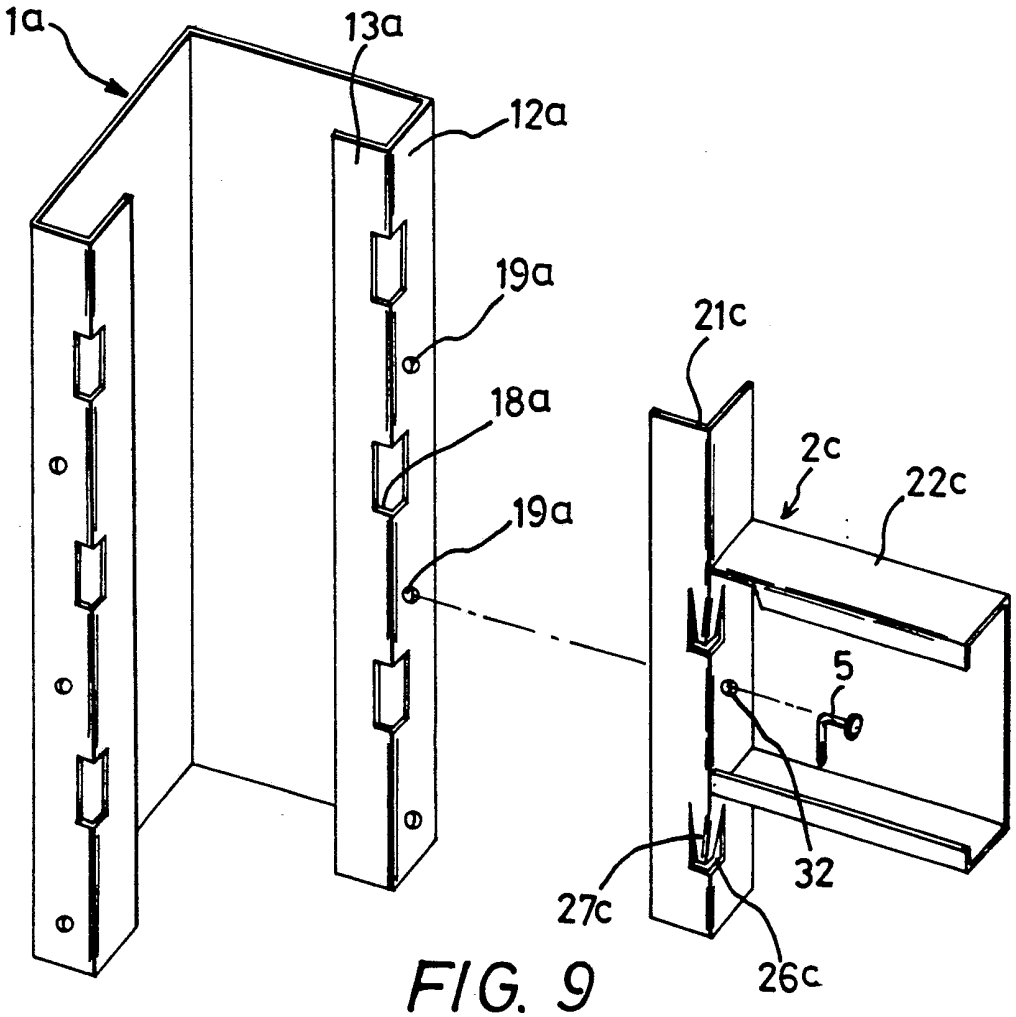
1a
13a
12a
19a
21c
18a
2c
22c
19a
5
32
27c
26c

FIG. 9

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STRUCTURAL FRAME COMPONENTS

The present invention relates to structural frame components and more particularly, to vertical angle irons and connectors which can be easily assembled into a frame in a quick manner by merely engaging the pre-formed wedge-in engaging holes of the former and the wedge-in pins of the latter mutually, the fastening and connecting thereby being completely free from using of any screws or bolts, and in which one vertical angle iron can be connected with one to three connectors thereby enabling assembly of transverse horizontal beams in multidirection to form a large, open frame.

BACKGROUND OF THE INVENTION

Conventionally, in the assembly of a rack, a cabinet or a structural frame, fasteners, for instances, screws or bolts, are generally used for fastening and retaining the structural components of each product in position. Representative of such prior proposals are the Presnick's U.S. Pat. No. 4,078,847, Olashaw's U.S. Pat. No. 4,347,015, Crowe's U.S. Pat. No. 4,196,952, and the author's co-owned U.S. Pat. No. 4,545,490. However, utilizing screws or bolts in retaining and locating the connecting components in framework assemblies with angle irons not only brings troubles into the assembling work, but also makes it a need for an assembler to use tools, such as a wrench, to tighten the screws or bolts, rendering the assembling work even more complicated and inefficient. Furthermore, these screws or bolts are

likely to loosen up after the structural frame or rack has been used for a time, and this will bring the frame or rack to be less stable and will consequently reduce the load-supporting capacity in the structural frame or rack.

Such types of angle irons are probably not suitable for use in conjunction with a generally oval, rounded, rectangular or square pipe being utilized as a transverse beam, and are generally deficient in esthetic appearance and lack of variablities in practical uses. Especially, since the connecting portions of the structural frame or rack have no safety devices, accidents are likely to happen if the fastening screws are getting loose during transportation. Furthermore, as the reinforcement and the connector structures are unsatisfactory, the load-supporting capacity of the frame or rack is low. The requirement of separate management and use for the screws, connector parts etc. will further bring troubles into the maintenance of the components and the parts may also get scattered or lost easily.

Some types of framing structures require no fasteners like screws or bolts for their assemblies. Various constructions have been proposed for such an assembly of structural frames, among which Nelson-Hawkins in U.S. Pat. No. 3,339,750 utilizes a kind of h-shaped or H-shaped connector key for interconnecting

angle irons. In a further instance, a corner construction is disclosed in U.S. Pat. No. 3,914,062 to Heininger, in which intersecting channels formed by spaced portions thereof receive the flanges of angle irons. Most recently, this author in U.S. Pat. Appln. Ser. No. 889,396 proposes a multibranch structural connector which is made of plastics or of aluminum alloy for assembling purposes.

SUMMARY OF THE INVENTION

With a view to eliminate these disadvantages, there is provided in accordance with the present invention an assembly frame whose structural components are more simplified and construction is improved thereby improving its efficiency and making it the more convenient, safe, mobile and esthetically attractive for uses.

It is one object of this invention to provide a corner connection means for a structural frame, which permits the frame components to be easily put together with a minimum of operations and which produces a strong, rigid, and tight joint between the frame components.

It is another object of the invention to provide an improved connecting means for obtaining a rigid corner joint between the components of structural frame without the use of screws, bolts or like fastening elements.

It is a further object of the invention to provide

a quick assembly type structural components as described above, which may utilize, by necessity, transverse oval, rounded, or square transverse beams and form a rack or frame having variability and superiority and esthetic appealing in the outer appearance.

It is yet another object of the invention to provide a joint member or connector for use in the quick assembly type structural frame, whose base part joins with an insert arm, wedge-in pins and elastic cotter and together to form into a single body so that the member is simple in construction without having to handle the wedge-in pins and cotter separately and in which during use, there will not be concerned about the parts getting scattered or lost, and there is the safety cotter to prevent looseness in the member and further fitting and joining of the parts may be effected merely by a wedge-in engagement so that it is very convenient and safe in use.

It is yet an additional object of the invention to provide a novel vertical angle iron which can be connected with multi-directional connectors or joint members, thereby permitting the assembly of a large structural frame with vertical angle irons in number as many as over four.

These and other objects, features and advantages of the invention will be apparent from the following

description by reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a first embodiment of an angle iron and a connector of the present invention;

FIG. 2 is a perspective view of another embodiment of the angle and connector of the present invention;

FIG. 3 is a cross-sectional view of the connector taken along the line A-A as shown in FIG. 1;

FIGS. 4(A) through 4(C) are side views showing different variations of the connector of the invention;

FIGS. 5(A) and (B) are end views showing another embodiments of the angle iron of the invention;

FIG. 6 illustrates a joining portion in one example of application when a vertical angle iron and two connectors are fitted together to form a frame in accordance with the invention;

FIGS. 7(A) and (B) are perspective views of other embodiments of the angle iron of the invention;

FIG. 8 is an end view of the angle iron illustrated in FIG. 7(B), showing the angle iron being connected with three connectors and transverse beams in three directions; and

FIG. 9 is a perspective view of still another embodiment of the connector and angle iron of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, there is illustrated a vertical angle iron and a connector, the structural components according to the present invention. This angle iron 1 is generally L-shaped in cross-section and fabricated by rolling depression molding form metal sheet, for instance, the steel sheet, or by extrusion of light alloy or plastics. In order to prevent hand or clothes from being cut by any sharp edges, the angle has its two side edges each bent inward perpendicularly twice to form a channel bent flange with a first plate 12(12') and a second plate 13(13'), as disclosed in U.S. Patent No. 4,545,490 and the author's pending U.S. Pat. Appln. Ser. No. 889,396. However, in the angle iron 1 of the present invention, there are two rows of spaced wedge-in engaging holes 18 formed along the two right angle corner portions 15, 15' between the flat sheet 11 and the first plate 12, and between the flat sheet 11' and the first plate 12' resepctively. The distances between any two neighboring wedge-in holes 18 in a row is the same, and each hole 18 has the shape of a rectangle but bent at the middle portion thereof along its longitudinal direction. In another aspect, there is a row of small cotter apertures 19 distributed at each of the first plates 12 and 12' along the longitudinal direction of such plates. Each cotter aperture 19 is

at the position near the midpoint of two neighboring wedge-in engaging holes 18.

FIG. 1 also illustrates a connector or joint member 2 according to the invention. The connector 2 used for connecting with the aforesaid angle iron 1 comprises a base 21 of an L-shaped section having an outwardly protruding insert arm 22 formed integrally on a side 23 of the base 21. Along the perpendicular corner portion 25 of the L-section base 21, there are two holes 26 formed by pressing, the distance therebetween being equal to the distance between any two neighboring wedge-in engaging holes 18 described above. Each hole 26 is of a wedge-in pin 27 in shape, the wedge-in pin 27 with its upper tail end integrally extending from the corner portion 25 and its lower front end obliquely extending towards the interior of the base 21. On the surface of side 23 having said arm 22 is mounted a spring leaf 3 (also refer to FIGS. 2, 3). This spring leaf 3 is secured in place at its upper end by a rivet or the like while the lower end thereof is provided with a cotter bolt 31. This cotter bolt 31 passes at one end through an aperture 32 defined on the near middle portion of side 23 and projects out at the back of side 23. The lower end of the spring leaf 3 is slightly upturned so as to facilitate the pulling up by hand of the spring leaf 3 during the disassembling of the connector 2.

FIG. 2 illustrates another embodiment of the angle

iron 1a and connector 2a in accordance with the invention. The difference between angle iron 1a and the aforesaid angle iron 1 is that the spaced wedge-in engaging holes 18a of the angle iron 1a are instead disposed along corner portions 15a and 15a' of the bent flanges of the angle iron, that is to say, formed on the right angle corner portions 15a, 15a'formed respectively between the first plate 12a(12a') and second plate 13a(13a'). The difference between connector 2a and the aforesaid connector 2 is that the insert arm 22a and spring leaf 3 of connector 2a are instead formed on the side 24a of its base 21a. The same as the above-mentioned angle iron 1 shown in FIG. 1, there are also two rows of equal-distanced cotter apertures 19a distributed on the first plate 12a and 12a' respectively to allow the cotter bolt 31 to pass through when the structural frame is assembled.

Although the cross-sections of said insert arms 22, 22a shown in FIGS. 1 and 2 are fit for being inserted into horizontal, transverse beams with rectangular cross-section, the cross-sections of these arms may also be rounded, square, or oval as shown in FIGS. 4(A) through 4(C) to receive the horizontal, transverse beams with the similar cross-section.

FIGS. 5(A) and 5(B) illustrate other embodiments of

the angle irons described above, in which FIG. 5(A) shows angle 1b with its L-shaped bent edges formed by bending perpendicularly the longitudinal edges thereof once only to form first plates 12b and 12b' and the wedge-in engaging holes formed at the same positions as those formed in the angle iron 1 shown in FIG. 1,and in which FIG. 5(B) shows angle iron 1c with its bent flanges formed by perpendicularly bending the longitudinal edges thereof three times and the wedge-in engaging holes formed at the same positions as those formed in the angle iron 1a shown in FIG. 2.

It will be appreciated that by using the aforesaid angles and connectors in accordance with the present invention, various structural frames or assembly racks can be conveniently assembled. FIG. 6 illustrates the main joining part of a structural frame composed of angle iron 1a and connector 2a and 2b according to the embodiments of the invention. During the assembly of the joining part,the connector 2a (2b will not be mentioned) is placed near one L-shaped bent flange of the angle iron 1a first and then, by aligning the two wedge-in pins 27a in the two holes 26a of connector 2a against the two wedge-in engaging holes 18a distributed on the L-shaped bent flange of the vertical angle iron 1a and next leading the two pins 27a into the respective wedge-

in engaging holes 18a, the connector 2a may be combined with the vertical angle iron 1a in a loose manner. After the loose combination status has been reached, the assembler can then press the insert arm 22a of the connector 2a downwardly to cause the two wedge-in pins 27a to wedge into the two engaging holes 18a tightly and firmly. When these wedge-in pins 27a have not been deeply inserted in said engaging holes 18a, the cotter bolt 31 is not within the location of a cotter operture 19a on the first plate 12a of angle iron 1a but is pressing against the surface of the first plate 12a, the spring leaf 3 will thereby be forced to act about its rivet joint as center, and open up towards the outside. After these wedge-in pins 27a have been pressed deeply into said wedge-in engaging holes 18a,the cotter bolt 31 is also lowered down to a position just aligning with one cotter aperture 19a distributed on the first plate 12a of angle iron 1a. Since there is no more resistance now, the spring leaf 3 by the recovery force of its elasticity will urge cotter bolt 31 to move into the cotter aperture 19a, whereby connector 2a and angle iron 1a will join together to form a single body. In FIG. 6, the base 21a of connector 2a is now abutting closely against the outside wall of the L-shaped bent flange composed of first plate 12a and second plate 13a while the end portions of wedge-in pins 27a and the end

portion of cotter bolt 31 of the connector 2a are projecting inside the interior of that bent flange. The outside of insert arm 22a can be inserted into the inside of a transverse beam 7 to support the latter.

FIG. 7(A), 7(B) illustrate other embodiments of the angle iron according to the invention. These angle irons 1d, 1e each has three rows of spaced wedge-in engaging holes formed on its right angle corner portions, that is to say, there is a row of wedge-in engaging holes 14 formed on the corner portion 16d or 16e between the two flat sheets 11d, and 11d' or the two flat sheets 11e, 11e' to provide additionally a new connecting placement for attachment another connector or joint member in another direction. In this way, each angle iron 1e(1d) is able to connect with three connectors or joint members in different directions (FIG. 8) to be inserted into transverse beams 7a, 7b, 7c in three directions. It is possible therefore to dispose a third reinforcement angle iron 1e between two vertical angle irons (not shown) by combining transverse beams 7a, 7b among them, and the third reinforcement angle iron 1e is also able to connect with another connector which has been inserted into another transverse beam 7c to form a T-shaped corner construction, so that the base area of a structural frame can be enlarged with attendant improvements in the strength and rigidity of the

frame. Next, the spring leaf 3 may be excluded from the assembly and in this condition, the cotter bolt 31 described above will be substituted by an L-shaped pin 5 showed in FIG. 9. When the aperture 32 of the connector 2c is aligned with one corresponding cotter aperture 19a of angle iron 1a by above-mentioned wedge-in engaging action, the L-shaped pin 5 then can be passed through the aperture 32 and cotter aperture 19a as a locking element like the aforesaid cotter bolt 31.

It should be noted that the various connectors described above can be selectively adapted for use in assembling with different kinds of angle irons and since this is of a general knowledge art, its many variable examples will not be dealt with in detail here.

In the assembly of the frame constructed in accordance with the invention, it is necessary only to select the required connectors to interconnect the angle irons by means of the wedge-in pins formed therein being engaged respectively in the wedge-in engaging holes defined in the angle irons. The cotter bolt by its recovery force of elasticity will be guided into the cotter aperture and owing to the wedge-in engaging effect between the wedge-in pins and the wedge-in engaging holes, the connectors will thus be firmly secured to the angle irons and together with the latter they form a single body. In the assembling, fastening

by means of bolts or nuts is not at all required, nor is any tool needed for the job. Hence, by fitting and assembling of a frame in accordance with the principle of the invention, it is much faster and with convenience. Next, when the frame is to be disassembled, all that is required is to pull out, by means of the spring leaf, the cotter bolt or L-shaped pin from the cotter aperture and thereafter to knock the connector upwardly by hand or with a hammer. When the wedge-in pins are moved into the middle portion of the wedge-in engaging holes, the connector can then be removed towards the outer side. Like in the assembling, it is also convenient with the disassembling of the frame. Moreover, the angle irons and connectors so removed can be used again and again. Since the connectors are firmly secured in the angles through the wedge-in engaging action and also depending on necessity, are capable of working in conjunction with different square or oval tubes, or angle irons as transverse beams, it is very safe and of variability in uses with the assembly frame of the invention and meets substantially all the needs of the manufactures and users. Other advantages of the present invention includes verticle adjustment being simple, easy manufacture of the connectors and inexpensive cost. Moreover, for only by one single angle iron can this iron be connected with one to three corresponding connectors in

different directions, it will be appreciated that by the instant invention the assembling variability is increased and an even larger structural frame can be easily assembled.

It is to be understood that the forms of the invention herein shown and described are to be taken as merely preferred examples of the same, and that the invention may be otherwise various embodied or practiced, for example, substitute of the above-mentioned angle members with square steel pipes having wedge-in engaging holes on its all corner portions, adding reinforcement bars or bent edges to the bases of connectors, provision of insertion portions on the sides of the bases to form cross-shaped connectors, or substitute of the oblique wedge-in pins with ladder-shaped pins, within the spirit and scope of the invention, which is defined only by the following claims.

CLAIMS:

1. A component for assembling structural frame comprising angle irons and connectors; each said angle iron including a pair right angle flat sheets each bent perpendicularly at its outer side edge once or twice to form an inwardly bent flange with a first plate or a first plate and a second plate, at least two rows of spaced wedge-in engaging holes formed on the right angle corner portions between said two flat sheets, said first plates and flat sheets or said first plates and second plates respectively along the longitudinal direction thereof, and at least two rows of cotter apertures formed near said wedge-in engaging holes, each wedge-in engaging hole being of a rectangular or square shape but perpendicularly bent at middle portion thereof along its longitudinal direction; each connector including a vertical, L-shaped base with a pair of right angle flat sheets and an insert arm integrally formed on the surface of one side sheet and projecting out perpendicularly of said sheet, and at least one hole formed on the right angle corner portion of said L-shaped base each provided with a wedge-in pin extending in the interior thereof, and at least one aperture for locking being formed on said L-shaped base.

2. The component for assembling structural frame defined in claim 1, wherein said connectors each further has a spring leaf with its one end secured on the surface

of said base and the other end thereof being of a cotter bolt passing through said locking aperture of said constantly, said cotter bolt capable of moving within said locking aperture by the elasticity of the spring leaf; and when said connector is abutted against one corner portion of said angel iron and the wedge-in pins of the connector are inserted into said wedge-in engaging holes at said angle iron deeply, said cotter bolt can further move into said cotter aperture to prevent the separation of said connected angle iron and connector.

3. The component for assembling structural frame defined in claim 1, wherein said wedge-in pin formed on corner portion of said L-shaped base has its upper tail end integrally extending out from said corner portion and its lower front end obliquely extending toward the interior of said L-shaped base, or has its upper tail end integrally extending out from said corner portion and of a ladder-shaped body, or with the shape which can be firmly inserted into said wedge-in engaging hole to connect said angle iron and connector.

4. The component for assembling structural frame defined in claim 1, wherein the connector having its insert arm formed into a rectangular, square, rounded, hexagonal, triangular, long circular or oval tubular body is provided with a notch and integrally connected to the middle position on one side sheet of said L-shaped base of connector.

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