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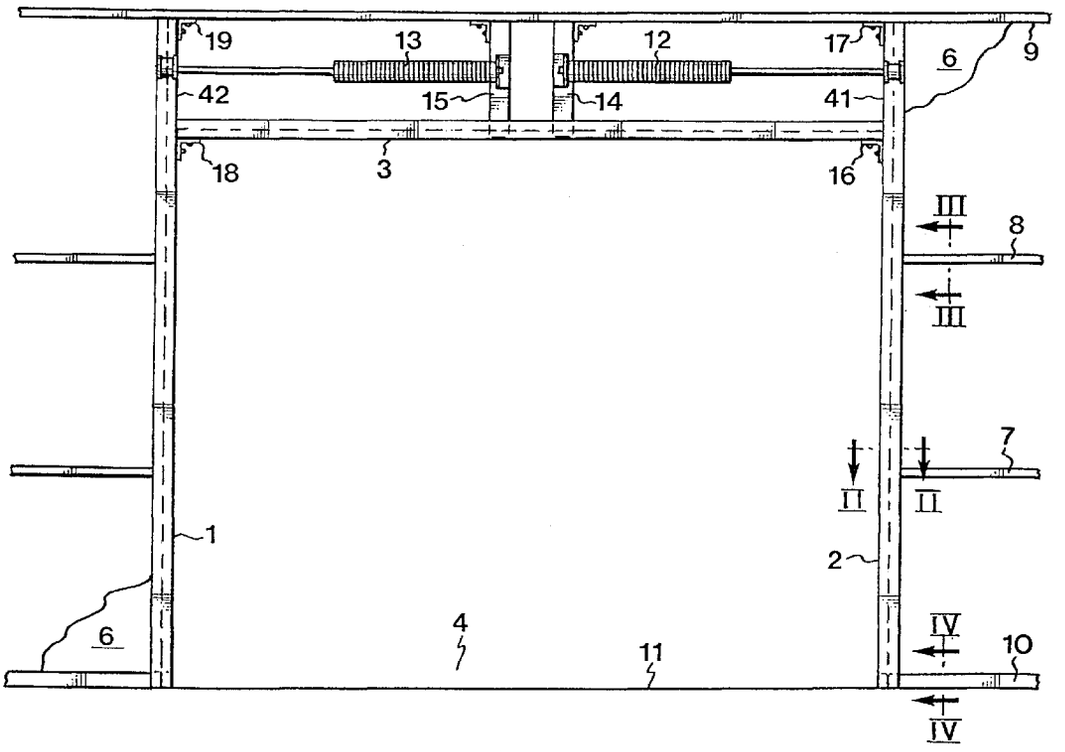
(54) Arrangement in frame structure for doors and use of light-gauge beams for doors

(57) An arrangement in a frame structure for a door comprises two vertical posts (1, 2) and a horizontal lintel (3), which at each end is connected to an adjoining post. The posts (1, 2) and the lintel (3) define a door opening (4) in a wall (6), and the wall has a number of horizontal wall studs (7-10). The vertical posts (1, 2) consist of a U beam, the U web of which faces the door opening (4) transversely of the plane thereof and the U flanges of which extend on both sides of and are connected to the horizontal wall studs (7-10).

FIG.1



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Description

Field of the Invention

The present invention relates to an arrangement in a frame structure for a door of the kind as stated in the preamble to appended claim 1. The invention is particularly, but not exclusively, applicable to frame structures for such door systems as described in Section 638:5 in the manual "Building Manual for House, Road and Water Hydraulic Engineering", Vol. 6, House Building Technology, 3rd Ed., AB Byggmästarens Förlag, Stockholm, 1964 (pp 534-537).

Background Art

The above-mentioned manual, Fig. 52d on p. 535, shows a roof sliding door of a well-known type. The movable door leaf is divided into vertical sections which at their ends are fitted with running wheels, which for the motion of the door run in running rails. In the open state, the door leaf is positioned under the roof and above the door opening. The door opening is defined by a frame structure comprising two vertical posts and a horizontal lintel which at each end is connected to the respective posts. The vertical running rails which guide the motion of the door leaf are mounted on the vertical posts on their surface facing the inside of the building.

A modern roof sliding door of fundamentally the same design is shown on p. 7 in the brochure "Building for the Future" issued by Lindab Profil AB in 1996. The frame structure for this door is essentially the same as described above.

The posts included in the frame structure for these doors stand on a special base plate which is cast integrally with the floor or fastened thereto with bolts. The posts usually consist of box beams made of heavy plate, which as a rule are at least 4 mm thick and whose outer dimensions are typically about 120 x 120 mm. The frame section supporting the above described running rails for the vertical motion of the door leaf is usually fastened with bolts to the side of the vertical posts which faces the inside of the building. The wall structure surrounding the door opening comprises wall studs, for instance in the form of Z-beams which in some cases connect with the posts.

When building a frame structure of this kind, a number of welding operations are required. First, the lower end of the post is all around welded to the base plate. Second, the two outer ends of the lintel are welded to the posts by means of a circumferential weld. Third, special flat steel pieces extending in the direction of the wall must be welded to the posts for supporting the wall studs.

These known frame structures suffer from a number of drawbacks as will be described below.

Since extensive welding operations are required, specialists must be sent for each time a door frame structure is to be built. The ordinary building fitters are in most cases not trained in welding. The welding, which per se is an expensive operation, also causes inconvenience since a welding permit must be obtained owing to the fire hazard. Usually a special fire-watcher must be present during the entire welding operation and a predetermined time after the welding has been completed (in many cases for many hours). A further construction drawback is that the posts easily warp or become twisted owing to internal stress caused by the welding.

A fire hazard arises also owing to the condition that sparking equipment is required, a so-called angle grinder, when cutting the relatively thick beams that are used for the posts.

Further disadvantages are that the relatively thick posts must be prebored before mounting of the running rails of the door and that the entire frame structure appears heavy and oversized. Another inconvenience is that the position of the base plates on which the posts stand must be determined at a relatively early stage when building the wall, which restricts the flexibility.

Summary of the Invention

One object of the present invention therefore is to provide an improved arrangement in the frame structure for a door, which obviates the drawbacks described above.

A special object of the invention is to provide a door frame structure which need not be welded and whose position in the wall can be determined at a relatively late stage.

One more object is to provide a lighter door frame structure which can be built by the ordinary building fitters.

According to the invention, these objects are now achieved by an arrangement which is of the type described by way of introduction and which in addition has the features recited in the characterising clause of appended claim 1. Preferred embodiments are stated in the appended subclaims 2-12.

The objects of the invention are also achieved by the use of light-gauge beams which is defined in appended claim 13.

The arrangement according to the invention solves the problems at issue and gives many advantages. By the vertical posts being formed by U beams, to which the horizontal wall studs can be connected without welding, the frame structure is integrated in the wall in a favourable manner. Moreover, the frame structure can easily be mounted by the ordinary building fitters. The framework that is already positioned in the wall (wall studs) is used to support the frame structure, which will be resistant to bending in all directions since it is integrated in the wall. By the horizontal wall studs being inserted into and connected to the U beams forming the posts, excellent rigidity is achieved round the door opening.

No preboring is required, but the elements included in the arrangement, which preferably consist of light-gauge beams of thin metal sheet, are interconnected by means of, for instance, self drilling and cutting screws.

Owing to the fact that the frame structure is simplified and can be made of light-gauge beams, the entire frame structure will be lighter and does not require any preboring as was previously the case. A further advantage is that no base plate is required, but the posts can stand directly on the floor and at the bottom be connected to a bottom beam. Such fixing at the bottom has been found fully sufficient in view of existing loads and stresses occurring when the door is operated.

A great advantage of the invention is that the total expenses of the frame structure, taking also the mounting work into consideration, will be approximately halved compared with prior-art structures of a comparable type.

According to a preferred embodiment, the horizontal wall studs are Z and/or C beams of thin metal sheet, for instance of the kind shown on p. 9 in the Lindab brochure mentioned by way of introduction.

Brief Description of the Drawings

The invention will now be described in more detail with reference to the accompanying schematic drawings which for an exemplifying, non-limiting purpose show a currently preferred embodiment of the invention.

Fig. 1 is a front view of an arrangement in a frame structure for a door, designed according to the preferred embodiment of the invention.

Fig. 2 is a sectional view taken along line II-II in Fig. 1.

Fig. 3 is a sectional view taken along line III-III in Fig. 1.

Fig. 4 is a sectional view taken along line IV-IV in Fig. 1.

Fig. 5 is a perspective view, seen obliquely from below, of a corner connection between a post and a lintel in the frame structure (upper left corner in Fig. 1).

Fig. 6 is an oblique perspective view of the connection between a post included in the frame structure and a horizontal wall stud essentially on a level with the sectional line II-II in Fig. 1.

Fig. 7 is an oblique perspective view of the connection between the same post and a bottom beam essentially on a level with the sectional line IV-IV in Fig. 1.

Description of Preferred Embodiments

Fig. 1 shows an arrangement in a frame structure for a door according to an embodiment of the invention. The main parts of the frame structure are two vertical columns or posts 1, 2 and a horizontal lintel 3 which at each end is connected to the respective posts 1, 2. The posts 1, 2 and the lintel 3 define a door opening 4, which is intended to be covered with a door leaf 5 which for simplifying reasons is not shown in Fig. 1, but which is indicated by a dash dot line in Fig. 2. The door leaf 5 may belong to, for example, a roof sliding door, in which the invention is particularly applicable, as will be described in more detail below.

The frame structure, which in technical language is also called door case, thus defines the door opening 4 in a wall 6, which is only indicated schematically in Fig. 1. The framework of the wall 6 comprises on both sides of the door opening 4 a number of horizontal wall studs 7-9 connecting to the posts 1, 2, and a further stud in the form of a bottom beam 10 resting on the floor 11. Fig. 1 shows but a portion of the studs 7-10.

Mechanisms for operating the door leaf 5 are also connected to the frame structure. These mechanisms comprise two spring assemblies 12, 13 which are of a type known per se and which are mounted on the posts 1, 2 and on two vertical braces 14, 15, respectively, which are positioned between the uppermost wall stud 9 and the lintel 3. With a view to reinforcing the frame structure, internal angular elements 16-19 are mounted in the corner connections between the posts 1, 2 and the lintel 3 and the upper wall stud 9, respectively.

The main parts of the frame structure, i.e. the posts 1, 2 and the lintel 3, preferably are so-called light-gauge beams like the studs 7-10. According to a preferred embodiment, these light-gauge beams are made of, for instance, about 2-mm-thick thin metal sheet, which causes the frame structure in its entirety to become considerably lighter than prior-art frame structures of an equivalent type. By using such light-gauge beams and applying a brilliant technique to connect the beams to each other, the frame structure obtains excellent strength. Since the frame structure is integrated in the wall, the posts will also be highly resistant to lateral bending.

The light-gauge beams or sections can readily be connected to each other by means of self drilling and cutting screws, riveted joints or the like, thereby completely avoiding welding.

Fig. 2 shows the connection between the one post 2 and one of the wall studs 7. The post 2 is a U beam or U section, the U web 20 of which faces the door opening 4 transversely of the plane thereof and the U flanges 21, 22 of which extend on both sides of and are connected to the wall stud 7 by means of self drilling and cutting screws 23, 24. The one U flange 22 facing the inside of the building constitutes a surface of attachment for a schematically illustrated frame 25, which preferably is screwed onto the flange 22. The frame 22 has a running rail 26 for a running wheel 27, which via a rod 28 and a fitting 29 is connected to the door leaf 5. The door frame 25 and the parts connected thereto and indicated by dash dot lines in Fig. 2 do not constitute part of the invention since the inventive arrangement is applicable to different types of door systems.

By the wall stud 7 being placed between the U flanges 21 of the post 2, a highly rigid connection is achieved, and the existing framework (wall studs) of the wall 6 are used to build the frame structure. The angular elements

16-19 can advantageously be mounted by means of self drilling and cutting screws.

The two intermediate wall studs 7, 8 are preferably so-called Z beams or Z sections of thin metal sheet, as is best shown in Fig. 3. The two flanges 30, 31 of the Z beam 7 are reliably connected to the U flanges 21, 22 of the post 2 by means of self drilling and cutting screws 32, 33. A very reliable and rigid connection is established.

It should be emphasised that the two intermediate wall studs 7, 8 can in fact be of some other type, e.g. C beams. The upper stud 9 preferably is a C section made of thin metal sheet.

As is evident from Fig. 4, the lowermost stud is a U beam 10, whose flanges 34, 35 are connected by means of self drilling and cutting screws 36, 37 to the U flanges 21, 22 of the post 2 in the same manner as the intermediate Z beams 7, 8. Also the bottom stud 10 is preferably made of thin metal sheet, and a very reliable connection between this and the post 2 is established. By the web of the bottom stud 10 resting directly on the floor 11, a base plate which is anchored in the floor 11 and is of the type appearing in prior-art frame structures for doors is not necessary.

The lintel 3 preferably is a U beam similar to the posts 1, 2, as shown in Fig. 5. Like the post 2 the lintel 3 has its U web 38 directed to the door opening 4 transversely of the plane thereof. The two U flanges 39 and 40 of the lintel 3 are thus directed upwards and form reliable points of attachment for the two vertical braces 14, 15 as shown in Fig. 1.

Fig. 6 illustrates how the Z beam 7 is inserted into the space between the two U flanges 21, 22 of the post 2, and it will be appreciated that this connection will be very rigid and reliable when the flanges 22, 30 and 23, 31, respectively, are connected to each other by means of self drilling and cutting screws.

Correspondingly, Fig. 7 shows how the bottom stud 10 is inserted into the space between the two U flanges 21, 22 of the post 2, a very reliable lower corner connection being established after fastening with screws.

The strength and rigidity of the frame structure are further promoted by the framework which forms above the lintel 3 and which is evident from Fig. 1. In fact, the two posts 1, 2 extend beyond the lintel 3 a distance vertically upwards and are connected to the upper wall stud 9 extending along the entire frame structure. The upper wall stud 9 simply constitutes a second lintel which is connected to the lintel 3 by means of, on the one hand, the two braces 14, 15, and on the other hand, the upper portions 41, 42 of the posts. Thus the lintel 3 and the upper wall brace 9 constitute together with the braces 14, 15 and the upper post portions 41, 42 a significantly reinforcing framework.

According to a variant which is not shown in more detail, the above-mentioned framework is increased by a similar superjacent framework with braces, in which case use is made of the wall studs positioned above the door.

The problems stated in the introductory part of the specification are solved by an arrangement of the type which in the form of an example has been described above. By building the frame structure from light-gauge beams, which are preferably made of thin metal sheet, no welding is required, but all connections are effected by means of simple self drilling and cutting screws. By the posts, preferably also the lintel, being U shaped in cross-section, the wall studs can easily be placed between the U flanges of the post, whereupon a reliable connection is established. The mounting operation is very quick and rational.

A particularly flexible mounting is accomplished by the frame structure not being connected to any base plates or the like which must be anchored in the floor. The position of the frame structure in the direction of the wall is not critical either since the degree at which the studs are inserted in the U shaped posts can be varied somewhat as required.

Finally, it should be pointed out that the inventive concept is in no way restricted to the embodiments described above, and several modifications are conceivable within the scope of the inventive idea as stated in the appended claims. It should be specifically emphasised that beams of other cross-sections can be used as long as fundamentally the same connecting technique without welding can be applied. Moreover, it should be emphasised that the arrangement according to the invention is not bound to a certain type of door; on the contrary it may be applied to very different door systems.

Claims

1. An arrangement in a frame structure for a door, comprising two vertical posts (1, 2) and a horizontal lintel (3) which at each end is connected to an adjoining post, the posts (1, 2) and the lintel (3) defining a door opening (4) in a wall (6), and the wall having horizontal wall studs (7-10), **characterised** in that the vertical posts (1, 2) each comprise a U beam, the U web (20) of which faces the door opening (4) transversely of the plane thereof and the U flanges (21, 22) of which extend on both sides of and are connected to the horizontal wall studs (7-10).

2. An arrangement as claimed in claim 1, wherein the lintel (3) comprises a U beam, the U web (38) of which faces the door opening (4) transversely of the plane thereof.

3. An arrangement as claimed in claim 1 or 2, wherein the posts (1, 2) are made of thin metal sheet.

4. An arrangement as claimed in any one of the pre-

ceding claims, wherein the lintel (3) is made of thin metal sheet.

5. An arrangement as claimed in any one of the preceding claims, wherein the wall studs (7-10) are made of thin metal sheet and preferably consist of Z and/or C beams.

6. An arrangement as claimed in any one of the preceding claims, wherein the U beams forming the posts (1, 2) are connected to the adjoining wall studs (7-10) by means of screwed or riveted joints (23, 24, 32, 33, 36, 37).

7. An arrangement as claimed in any one of the preceding claims, wherein the two corners in the connection between the lintel (3) and the posts (1, 2) are reinforced by means of internal angular elements (16, 18).

8. An arrangement as claimed in any one of the preceding claims, wherein the lowermost wall stud (10) on each side of the door opening is a U beam, the U web of which rests against the floor (11) and the upwardly directed U flanges (34, 35) of which are connected to the U flanges (21, 22) of the posts (1, 2).

9. An arrangement as claimed in any one of the preceding claims, wherein one U flange (22) of the posts (1, 2) constitutes a surface of attachment for a frame (25) for a displaceable door leaf (5), preferably a roof sliding door.

10. An arrangement as claimed in any one of the preceding claims, wherein the two posts (1, 2) extend beyond the lintel (3) a distance vertically upwards, the portions (41, 42), positioned above the lintel (3), of the posts (1, 2) constituting points of attachment for mechanisms (12, 13) for operating a displaceable door leaf (5) intended to cover the door opening (4).

11. An arrangement as claimed in claim 10, wherein the free ends of said upper portions (41, 42) of the vertical posts (1, 2) are connected to each other by means of a second lintel (9), which preferably is a wall stud made of thin metal sheet.

12. An arrangement as claimed in claim 11, wherein the two lintels (3, 9) in their centre are connected to each other by means of two vertical braces (14, 15), which preferably constitute points of attachment for spring assemblies (12, 13) associated with said operating mechanisms.

13. Use of light-gauge beams, which are U shaped in cross-section and which preferably are made of thin metal sheet, for building a frame structure for a door, vertical U beams being connected to adjoining horizontal wall studs on both sides of the door opening.

FIG.I

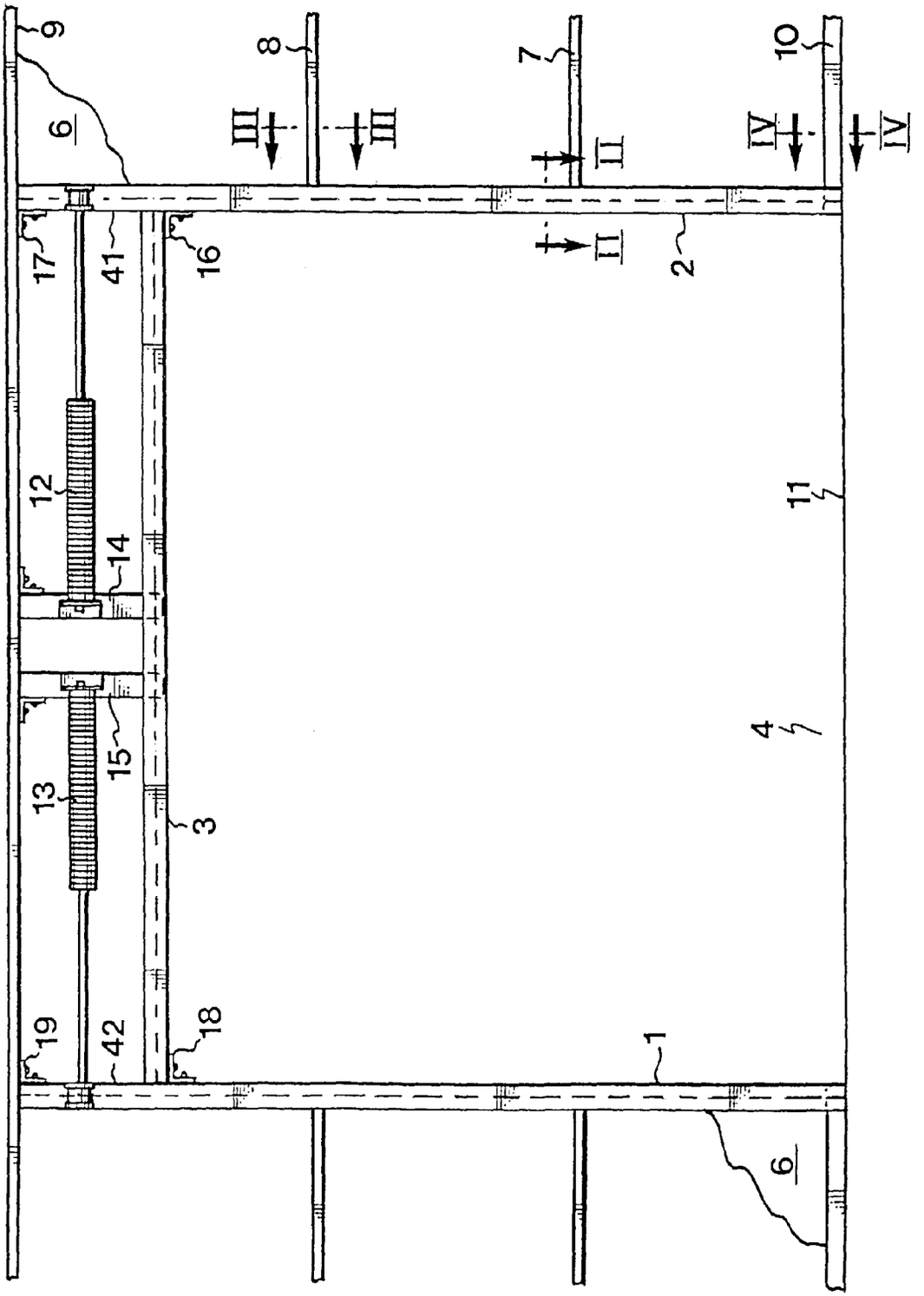


FIG.2

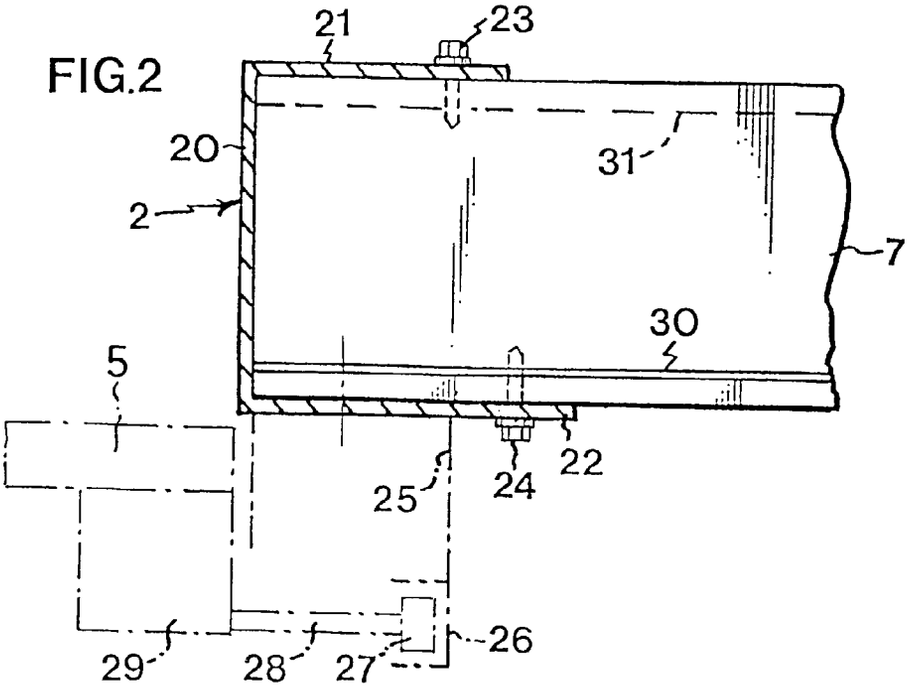


FIG.3

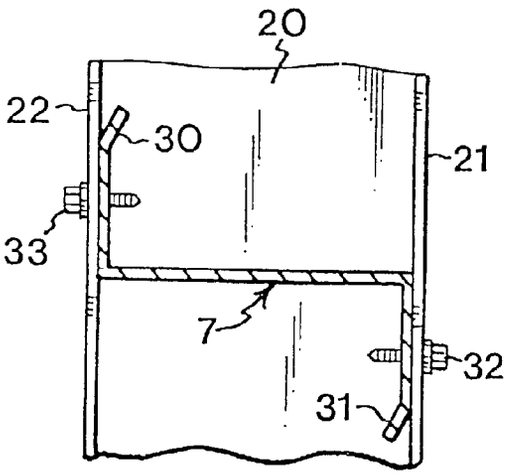


FIG.4

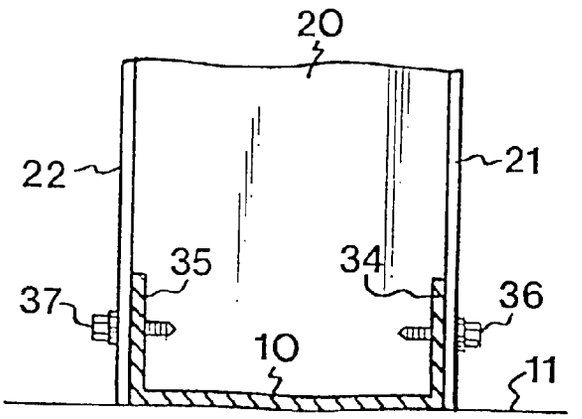


FIG.5

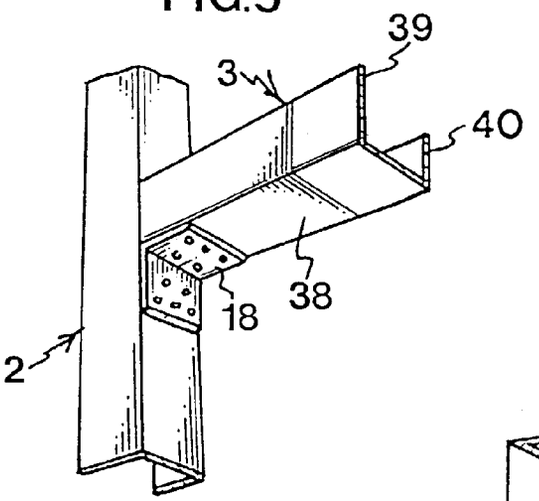


FIG.6

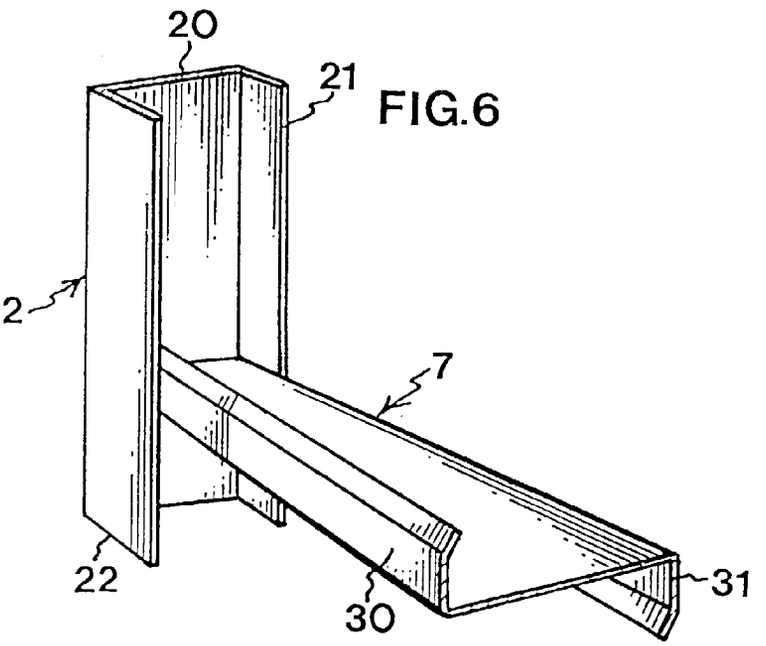
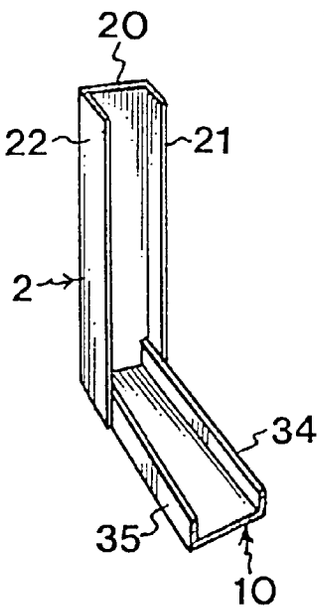


FIG.7



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EUROPEAN SEARCH REPORT

Application Number
EP 98 85 0057.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.6)
A	US 3940900 A (A.D. RUSSO), 2 March 1976 (02.03.76) * figure 2, abstract * --	1-13	E06B 1/12
A	US 4228630 A (H.U. ENGLERT ET AL), 21 October 1980 (21.10.80) * figure 1, abstract * --	1-13	
A	US 4608800 A (R. FREDETTE), 2 September 1986 (02.09.86) * figure 4 * --	1-13	
A	US 5412919 A (M.A. PELLOCK ET AL), 9 May 1995 (09.05.95) * figure 2, abstract * -----	1-13	TECHNICAL FIELDS SEARCHED (Int. Cl.6) E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	26 June 1998	WINTHER JOHAN

CATEGORY OF CITED DOCUMENTS

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