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(54) **Profile for concrete structure and use of said profile**

(57) A profile (1) for embedding in a concrete structure during moulding, the profile having a cross section which is generally U shaped or C-shaped with a base (2) and a first (3) and a second (4) part extending laterally from opposite edges (5,6) of the base to form the legs (7,8) of the U shaped or C-shaped cross section, wherein the first part has a row of segments (9) resembling a teeth-like structure along the edge (6) of the base and the second part (4) extends into a third part (10) that is bend at an angle (11) relatively to the second part.

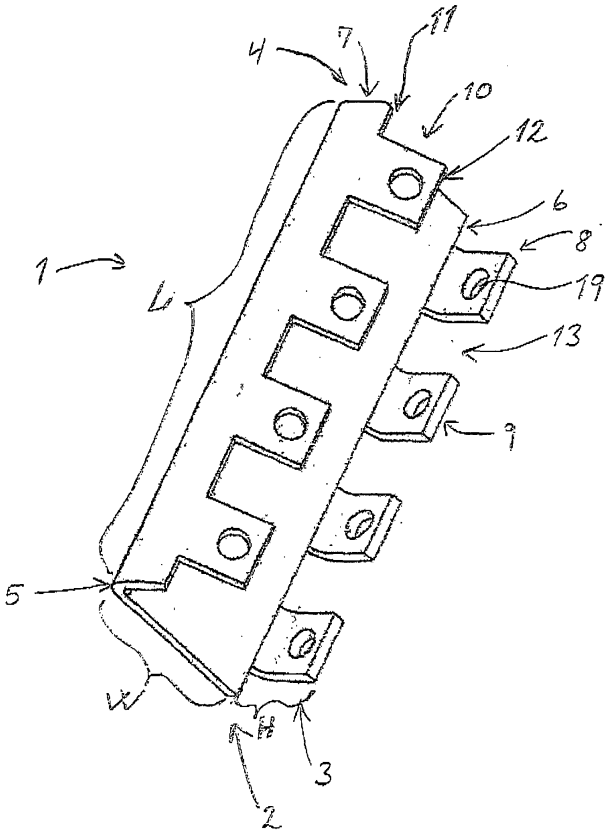

FIG.1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a profile, preferably a steel profile, for embedding in a concrete structure to a production method of such a profile and use of such a profile.

BACKGROUND OF THE INVENTION

[0002] When a structure is made of precast concrete panels, a normal joining procedure is welding. At the connection line of each of the concrete panels, a steel part is moulded into each concrete panel, positioned so that welding is possible, thus creating a rigid connection between the concrete panels.

[0003] These steel parts are not following a standard, but manufactured from application to application. Often, the steel parts are produced locally at the concrete panel manufacturer, who is normally handling the steel reinforcements used in concrete panels. The result is generally improvised solutions, costly and inappropriate steel parts. The most commonly seen device is a flat, massive steel plate with some tubular steel reinforcements welded to the rear side, in order to create tearing strength.

[0004] The geometrical dimensions of the steel part are chosen in order to create sufficient mechanical strength between the concrete panels in the structure, matching the necessary cross section area of the fillet weld. The steel part should also be designed to withstand deformations emerging from the stresses created from the weld heat, and also the concrete can be damaged if the steel part temperature exceeds a concrete type dependent level. These boundaries often lead to choosing steel part thicknesses well above the actually required minimum, and often, the thickness is not subject to analytical calculations in a design phase.

[0005] The steel part should have an application dependent minimum tearing strength, which can be determined analytically. Not often are calculations used to design the tearing properties of a steel part, but occasionally, a practical tension test is performed to prove this. Mostly, bended steel reinforcements are welded onto the rear side of the steel part to increase the tearing strength, but most commonly done intuitively, using the steel reinforcements available.

[0006] When a structure is made of precast concrete panels, a normal procedure for attaching doors and other lightweight components is by using bolts or other threaded components.

[0007] Lightweight components are defined as components that do not load its supporting structure [the concrete panel] with substantial forces. The magnitude of these forces may vary from application to application and should be defined more specifically in each case.

[0008] In most designs the support of lightweight components includes threaded inserts to be placed correctly on the concrete panel mould, or similar steel part devices especially prepared for each application.

[0009] Also, these steel parts are not following a standard, but manufactured from application to application and produced locally at the concrete panel manufacturer. The most commonly seen device is a flat, massive steel plate with threads added to the side placed against the concrete panel mould. The mechanical strength of designs like these is often way above needs, often meaning parts are more expensive than required.

[0010] Using standardized thread inserts, which can be positioned against a concrete panel mould, tends to lower costs to what might be an acceptable level. However, there might be a high effort involved in the positioning of these standardized thread inserts, since these most commonly has tubular shape. Attaching the standardized thread inserts to the concrete panel mould could prove time consuming, with relatively high tolerances involved. Also, there is the possibility of the standardized thread insert to tilt when the liquid concrete is distributed in the concrete panel mould.

[0011] Often the lightweight components require more than one connection point to the supporting structure, meaning that position tolerances between two connection points becomes critical. In the example of attaching a sheet metal door to a concrete panel structure, the upper and lower hinge of the door should be attached in a way securing the door to open and close correctly. If the interrelated distances between the two hinges are not having narrow tolerances, the door would never work properly.

[0012] When producing precast concrete panels, the entire handling of the concrete panel during the production speaks against narrow tolerances. Forces from the vibration of the concrete are significantly, spoiling any accurate positioning of any devices, as does the forces emerging from the distribution of the liquid concrete when being held into the mould.

[0013] The only way that narrow tolerances between more than one connection point in the concrete panel is possible is by using one insert with the tolerances build in. This could be steel part with pre-manufactured threaded holes or similar. This steel part should have sufficient tearing strength to withstand the pullout forces when mounting e.g. a sheet metal door, and should be manufactured in a way allowing narrow tolerances. Costs are certainly a concern as well.

DESCRIPTION / SUMMARY OF THE INVENTION

[0014] It is therefore the object of the invention to provide a profile for concrete structures not having the aforementioned disadvantages. In particular, it is the purpose of the invention to provide a profile to be embedded in the concrete during manufacturing of the concrete structure, where the profile is easy to manufacture at low cost, implies a high degree of flexibility to the concrete panel

designer and can withstand a high tearing strength when embedded in the concrete structure.

[0015] This purpose is achieved with a profile for embedding in a concrete structure during moulding, the profile having a cross section which is generally U shaped or C-shaped with a base and a first and a second part extending laterally from opposite edges of the base to form the legs of the U shaped or C-shaped cross section, wherein the first part has a row of segments resembling a teeth-like structure along the edge of the base and the second part extends into a third part that is bend at an angle relatively to the second part.

[0016] Experiments have revealed that the profile is easy to manufacture at low cost, implies a high degree of flexibility to the concrete panel designer and can withstand a high tearing strength when embedded in the concrete structure. For example, it is suited as welding plates in order to fasten concrete panels to foundation plates of compact secondary substation, such as transformer houses. Other applications are as door frames moulded into concrete panels, for example as used in compact secondary substation, such as transformer houses.

[0017] The design of the profile allows usage on edges of concrete panels as well as anywhere on the concrete panel sides. This universal usage is important, since it offers maximum flexibility to the concrete panel designer without compromising an industrialized solution with respect to production.

[0018] In a further embodiment, the base is flat and the first and the second part extend laterally at a right angle from the base. In an even further embodiment, the end parts of the segments are bent at an angle. Each of the segments may have at least one hole.

[0019] In order for the profiles to be combined with reinforcement material in concrete structures, the gaps between the segments may be adapted in accordance with a net mask size of a metal net used for reinforcement of the concrete structure.

[0020] In order for the third part to have a high tearing strength when embedded in the concrete, the third part may have a row of holes along the base in order to accommodate concrete inside these holes.

[0021] In a further embodiment, the third part has other segments in a teeth-like structure. For example, the gaps between the other segments are adapted in accordance with a net mask size of a metal net used for reinforcement of the concrete structure. Each of the segments may, for instance, have one of the other segments as a counterpart with equal distances from one end of the profile. In addition, the third part may be bent at an angle of between 25 and 65 degrees, preferably between 25 and 55 degrees, for example bent at an angle of around 45 degrees.

[0022] In a preferred embodiment, the base is more than two times and less than 5 times, for example around 3 times, wider than the height of the legs of the U-shaped or C-shaped cross section. In addition, the length of the base may be at least 2 times larger than its width, for example around 3 times its width.

[0023] Such a profile may be made of a bent sheet of metal.

[0024] A profile according to the invention may be used in combination with a compact secondary substation (CCS) for an electrical apparatus, such as a transformer, comprising a foundation plate, two concrete panels provided as walls on opposites sides of the foundation plate and fastened to the foundation plate, a roof covering the space between the two concrete panels and connected to the panels, a gable at each end of the substation, wherein at least one of the gables is made of sheet metal parts and comprise a door entrance, wherein the profile is moulded into at least one of the concrete panels.

[0025] Pre-cast concrete panels according to the invention are easy to manufacture, for example as flat walls. They can be made without the necessity of a premanufactured mould, using only a flat bedplate as moulding surface. Chipboard sides may be erected on the bedplate, creating a one-off mould that eventually is torn apart when the concrete panel is de-moulded. Reinforcements, inserts and other parts to be moulded into the concrete panel are placed with coarse tolerances before the mould is filled with concrete.

[0026] Using this flexible manufacturing method, a Concrete CSS can be erected. Moulded into the different concrete panels creating the overall structure a number of welding plates allows the concrete panels to be welded together. By adding a flexible door panel profile made of machined and bended sheet metal, lightweight doors can be attached in a precise way. As a frame for the doors, profiles according to the invention may successfully be used.

[0027] For example, the substation is a transformer house with at least a first and a second room, wherein the first room contains the high voltage part of the electricity and the second room contains the low voltage part of the electricity. In addition, the substation may also contain a third room for the transformer. Consisting of a minimum of three different rooms - the low voltage room, the high voltage room and the transformer room - the overall layout of a CSS can be made simple. Each of the gable ends of the housing may be made entirely of sheet metal parts, allowing full access to the electrical equipment in the low voltage and the high voltage rooms. In the middle of the CSS the transformer may be placed, with access through ventilation doors integrated in the concrete panels. When installing the transformer, the roof can be lifted off the structure as the roof of the substations is mounted detachable.

[0028] It should be noted that the above described substation with concrete panels as walls is of a general nature and may be constructed without the profile of the invention.

SHORT DESCRIPTION OF THE DRAWINGS

[0029] The invention will be explained in more detail with reference to the drawing, where

FIG. 1 is an image of a first embodiment of the invention suited as a welding plate,
FIG. 2 shows the embodiment of FIG. 1 in an end view,
FIG. 3 shows the embodiment of FIG. 1 implemented in a concrete panel,
FIG. 4 illustrates the moulding of the embodiment of FIG. 1 in a concrete panel,
FIG. 5 shows the embodiment of FIG. 1 implemented together with reinforcement material between the segments,
FIG. 6 is an image of a second embodiment of the invention suited as a door panel,
FIG. 7 shows the embodiment of FIG. 6 in a different perspective view,
FIG. 8 shows the embodiment of FIG. 6 in an end view,
FIG. 9 shows the embodiment of FIG. 6 in an end view with a polymer slab inserted,
FIG. 10 illustrates an application of the embodiment of FIG. 6 as an edge protector,
FIG. 11 illustrates an application in a compact secondary substations for an electrical apparatus transformer,
FIG. 12 illustrates the transformer station with gable doors and ventilation doors,
FIG. 13 shows the transformer station in perspective with transparent roof,
FIG. 14 shows the transformer station in perspective with transparent roof in a different perspective,
FIG. 15 shows the transformer station in perspective with transparent roof in a further different perspective.

DETAILED DESCRIPTION / PREFERRED EMBODIMENT

[0030] FIG. 1 is an image of a profile/welding plate 1 according to the invention in a first embodiment suited as a welding plate, which is generally U shaped with a straight base 2 and a first 3 and a second part 4 extending laterally from opposite edges 5, 6 of the base 2 to form the legs 7, 8 of the U shaped or cross section, which is illustrated by the end section in FIG. 2. The profile 1 has a length L, a width W and a height H.

[0031] The first part 3 has a row of segments 9 resembling a teeth-like structure along the edge 6 of the base 2 with gaps 13 between the segments. The second part 4 extends into a third part 10 that is bent at an angle 11 relatively to the second part 4. In the figure, the third part 10 is angled at 45 degrees relatively to the second part 4. The third part 10 comprises other segments 12 matching the row of segments 9 from the first part 3 of the U-shape. This row of other segments 12 is angled 45 degrees inwards in the cross section, in order to minimize the circumscribed circle. The length L of the profile is approximately three times the width W of the profile.

[0032] Taking an approach from a sheet steel manufacturing point of view, the design of a welding plate is done by machining and bending of a piece of sheet steel.

[0033] As illustrated in FIG. 1, all of the segments 9 have through-going holes 19 for tearing strength purposes. The base 2 of the U-shape has a width W which is approximately three times wider than the height H of the U-shape side. However, accurate dimensions of the profile can vary from application to application, as can the ratios mentioned.

[0034] By letting the second part 4 of the welding plate 1 be rigid and without holes, the steel part 4 is suited for use around a corner 14 of a concrete panel 15, as illustrated in FIG. 3, which can be useful in some applications.

[0035] The height H of this second part 4 of the welding plate 1 and the gaps 13 between the other segments 12 is chosen with respect to the environmental class of the overall concrete structure. As illustrated in FIG. 4, the height may be chosen to allow the normally used reinforcement net 16 to be placed on top of the welding plate with the net extending through the gaps 13. The gaps 13 between the teeth-like segments in the welding plate are chosen in accordance with the net mask size.

[0036] A further application is illustrated in FIG 5. The tearing strength of the welding plate 1 according to the invention can be improved by through-going reinforcement steels 17 using the holes 19 placed in the segments in the welding plate 1. Size and exact position of these holes can vary from application to application. If no through-going reinforcement steels are used, the holes 19 add to increased tearing strength allowing the liquid concrete to fill the void.

[0037] The thickness of the welding plate 1 is chosen in accordance with the chosen manufacturing method, which is foreseen to be sheet steel bending machine based. With this commonly used production method, a cheaper device can be manufactured, and a more accurate production is possible, compared to welding methods. This increases the quality of the assembly method, since some device uncertainties are removed.

[0038] FIG. 6 illustrates a second embodiment of a profile 1' according to the invention, namely a door frame profile. Taking an approach from a sheet metal manufacturing point of view, the design of a door frame profile is done by machining and bending of a piece of sheet metal.

[0039] A C-shaped cross section is used as basis for the device, best seen on FIG. 8. With reference to FIG. 6, a first part 3 of the C-shaped profile 1' comprises segments 9 as a row of teeth which have end parts 18 that are bent at an angle relative to the first part 3. The teeth-like segments 9 are included in the geometry for tearing strength purposes, allowing the liquid concrete to fill the void under the bent end part of the sheet metal flange 3. The base 2 of the C-shape is made several times wider than the height of the first 3 and second part 4 of the C-shape.

[0040] As illustrated in FIG. 7, in this base flange 2, a

pattern of holes, threads or similar can be pre-manufactured in the base for later mounting purposes. The second part of the C-shape is higher, topped by an inward bended third part 11 with large holes 21. This third part is incorporated as a flange in the geometry for tearing strength purposes, allowing the liquid concrete to anchor the door frame profile 1' during the distribution in the concrete panel 15 mould.

[0041] Accurate dimensions of the door frame profile would vary from application to application.

[0042] By using cellular foam 22 of EPDM, for example self-adhesive, or similar as shown in the cross sectional view of FIG. 9, the pre-manufactured pattern on the inner side 23 is kept free of concrete. Only the teeth-like segment section 24 as well as the inward bended third part 10 is in contact with the concrete, serving as load bearing parts of the profile 1. By choosing a soft cellular profile 22, penetration is possible for screws, rivets or similar.

[0043] The design of the door frame profile 1' allows usage on edges of concrete panels 15 as illustrated in more detail in FIG. 10 as well as anywhere on the concrete panel sides. This universal usage is important, since it offers maximum flexibility to the concrete panel designer. Most commonly a door frame profile 1' would be used along one of the concrete panel 15 edges 14, hence making positioning easy since the base part 2 can be placed up against a mould side.

[0044] The combination of a sheet metal profile, pre-manufactured by computer numerical machinery, and an accurate positioning of the door frame profile 1' is resulting in very high quality assembly results. The usage in e.g. mounting of doors has proven very well, with low effort in manufacturing the concrete panel 15 and a cost-effective door frame profile 1'.

[0045] An application of the welding plate is illustrated in FIG. 11 showing a compact secondary substation 30 for an electrical apparatus, such as a transformer, comprising a foundation plate 31, two concrete panels 32, 33 provided as walls on opposites sides of the foundation plate 31 and fastened to the foundation plate, a roof 34 covering the space 35 between the two concrete panels 32, 33 and fastened to the panels by welding plates 1.

[0046] The concrete panels 32, 33 are provided with openings 36, 37 into which ventilation doors 38, 39 as shown in FIG.12 and FIG. 15 can be mounted. As best seen in FIG. 11 in combination with FIG. 12, a gable 40, 41 at each end of the substation 30 is made of sheet metal parts and comprises a door 42 entrance. As best seen in FIG. 13 in combination with FIG. 14 and FIG. 15 the substation 30 in form of a transformer house is provided with at least a first room 44 and a second room 45. The first room 44 contains the high voltage part of the electricity and the second room 45 contains the low voltage part of the electricity. In addition, the substation also contains a third room 46 for a transformer 43. Consisting of a minimum of three different rooms - the high voltage room 44, the low voltage room 45 and the transformer room 46 - the overall layout of a CSS can be made simple. The transformer 43 is shown in greater detail in FIG. 14 illustrating high voltage connections 47 and low voltage connections 48.

Claims

1. A profile for embedding in a concrete structure during moulding, the profile having a cross section which is generally U shaped or C-shaped with a base and a first and a second part extending laterally from opposite edges of the base to form the legs of the U shaped or C-shaped cross section, wherein the first part has a row of segments resembling a teeth-like structure along the edge of the base and the second part extends into a third part that is bend at an angle relatively to the second part.

2. A profile according to claim 1, wherein the base is flat and the first and the second part extend laterally at a right angle from the base.

3. A profile according to claim 1 or 2, wherein an end part of the segments are bend at an angle.

4. A profile according to any preceding claim, wherein the each of the segments have at least one hole.

5. A profile according to any preceding claim, wherein the gaps between the segments are adapted in accordance with a net mask size of a metal net used for reinforcement of the concrete structure.

6. A profile according to any preceding claim, wherein the third part has a row of holes along the base.

7. A profile according to any preceding claim, wherein the third part has other segments in a teeth-like structure.

8. A profile according to claim 7, wherein the gaps between the other segments are adapted in accordance with a net mask size of a metal net used for reinforcement of the concrete structure.

9. A profile according to claim 7 or 8, wherein each of the segments has one of the other segments as a counterpart with equal distances from one end of the profile.

10. A profile according to any preceding claim, wherein the third part is bent at an angle of between 25 and 65 degrees.

11. A profile according to claim 10, wherein the third part is bent at an angle of around 45 degrees.

12. A profile according to any preceding claim, wherein

the base is more than two times wider and less than 5 times wider than the height of the legs of the U-shaped or C-shaped cross section.

13. A profile according to claim 12, wherein the base is around three times wider than the height of the legs of the U-shaped or C-shaped cross section.

14. A profile according to any preceding claim, wherein length of the base is at least 2 times larger than its width.

15. A profile according to any preceding claim, wherein the length of base is around 3 times its width.

16. A profile according to any preceding claim made of a bent sheet of metal.

17. A profile according to anyone of the claims 1-16 in combination with a compact secondary substation for an electrical apparatus, such as a transformer, comprising a foundation plate, two concrete panels provided as walls on opposites sides of the foundation plate and fastened to the foundation plate, a roof covering the space between the two concrete panels and fastened to the panels, a gable at each end of the substation, wherein at least one of the gables is made of sheet metal parts and comprise a door entrance, wherein the profile is moulded into at least one of the concrete panels.

18. Use of a profile according to anyone of the claims 1-16 as a welding plate in a Compact secondary substation, such as a transformer station, for fastening moulded concrete panels to a foundation plate.

19. Use of a profile according to anyone of the claims 1-16 as a door frame profile moulded into a concrete panel.

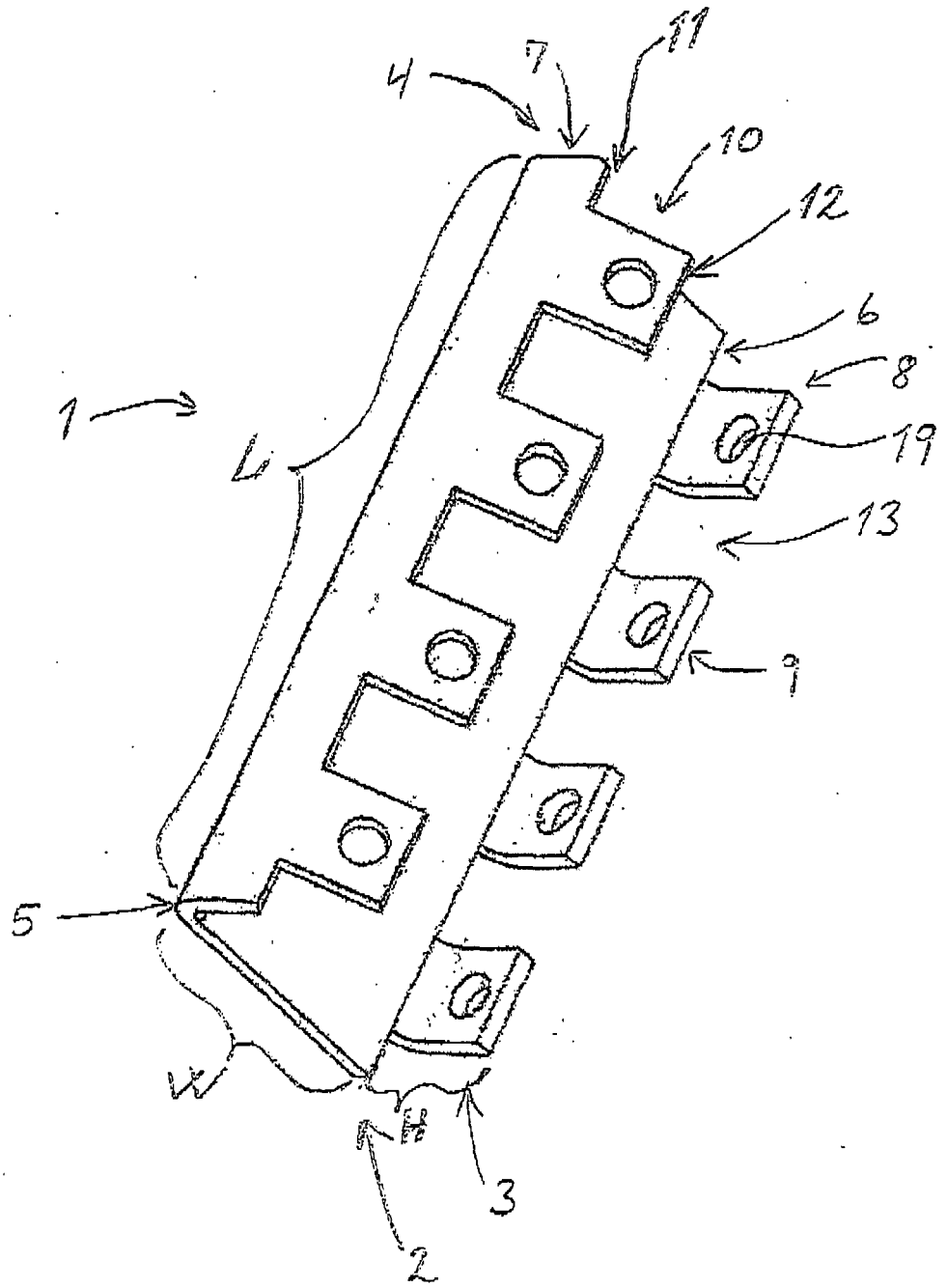

FIG.1

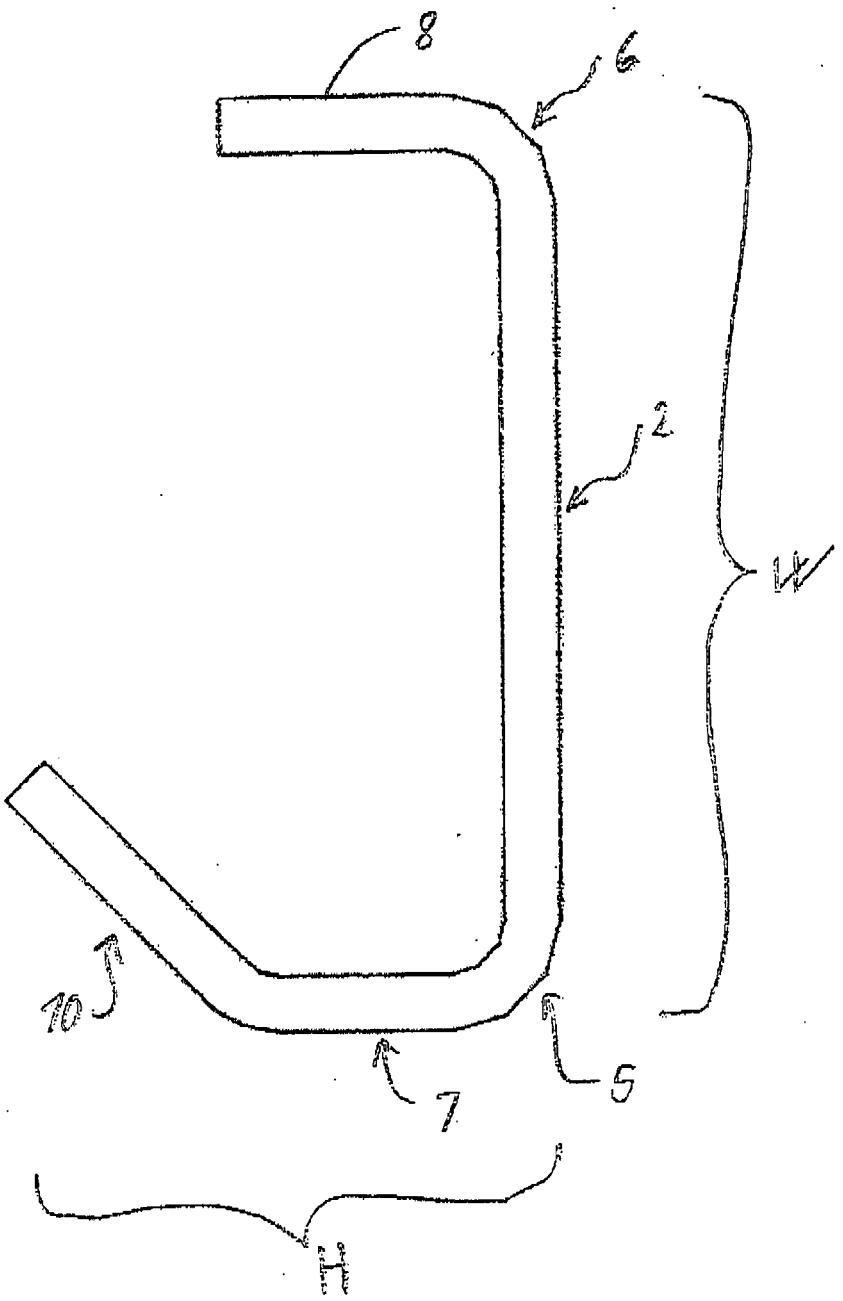

FIG. 2

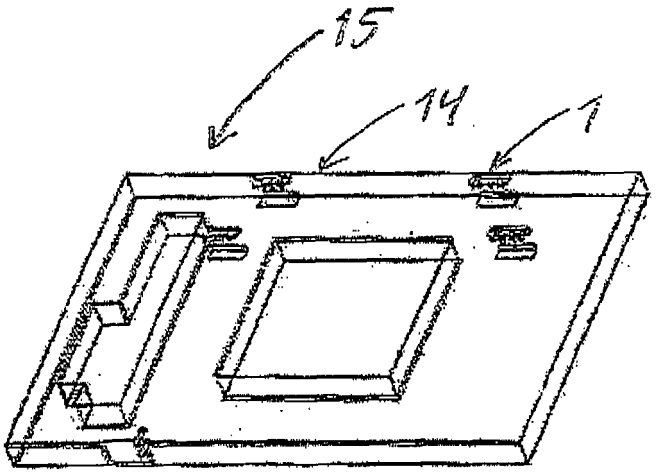

FIG.3

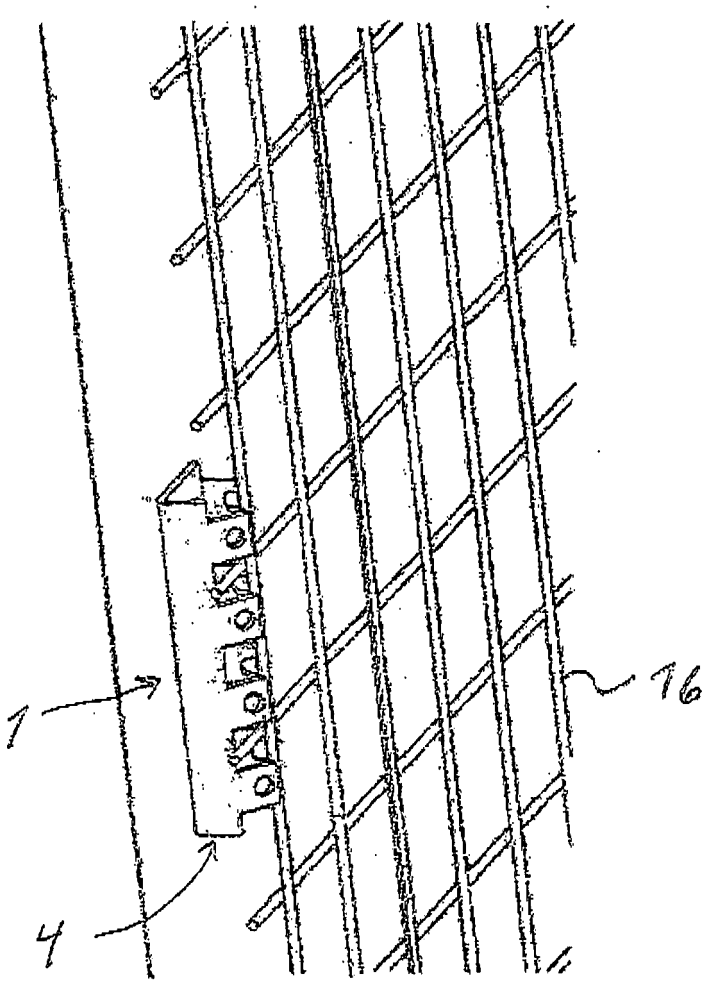

FIG.4

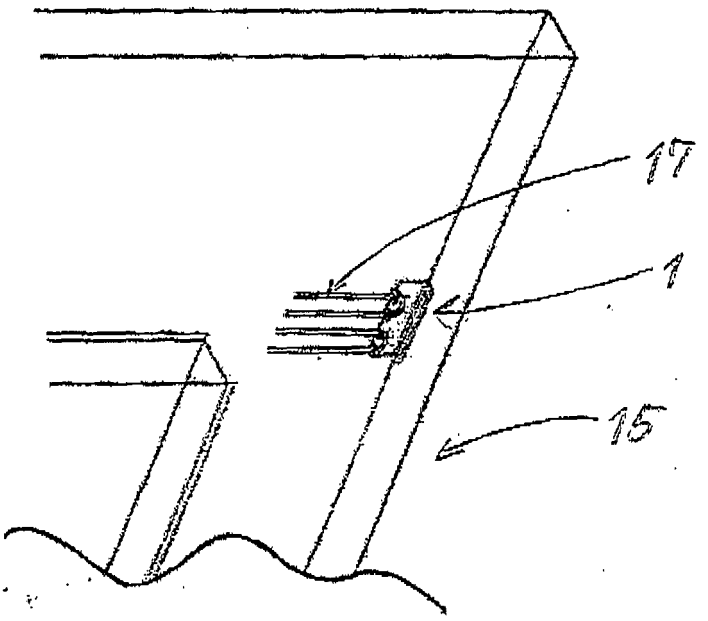

FIG. 5

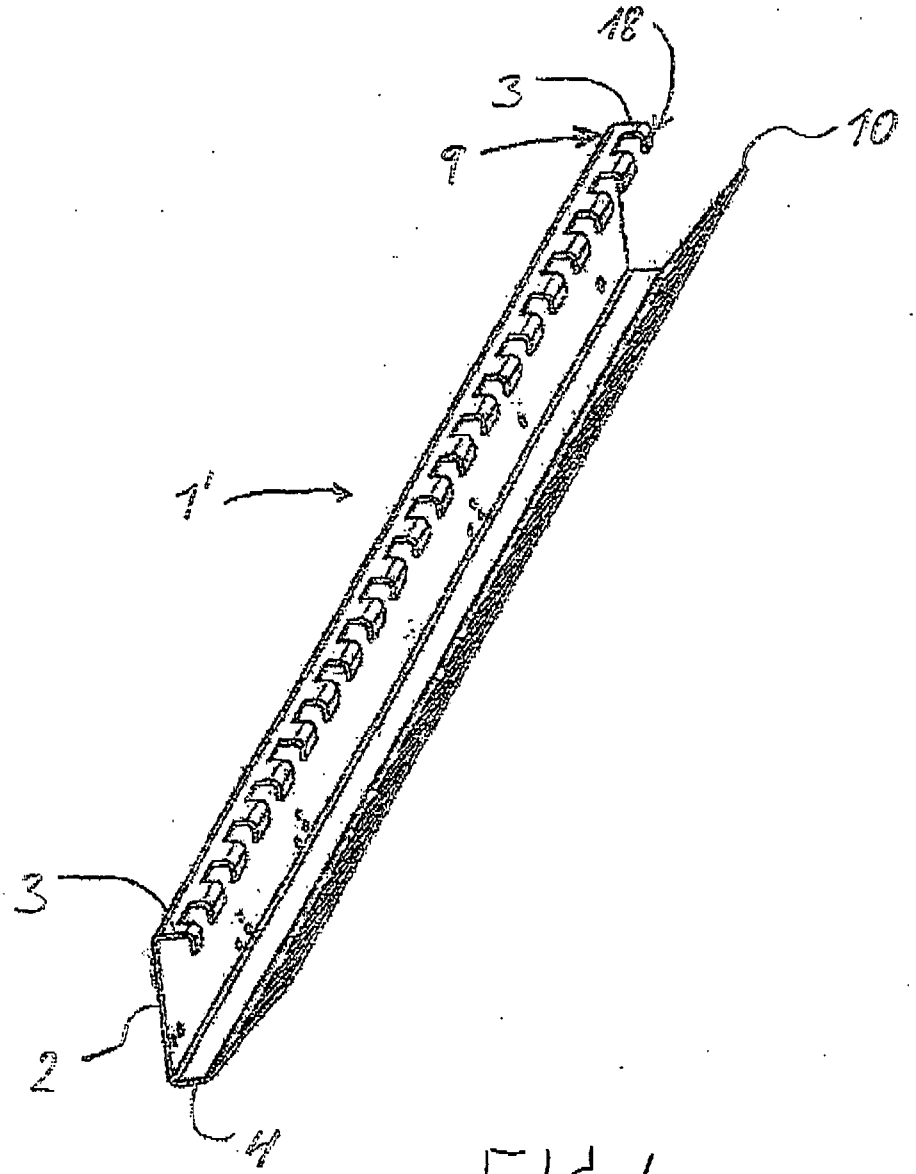

FIG. 6

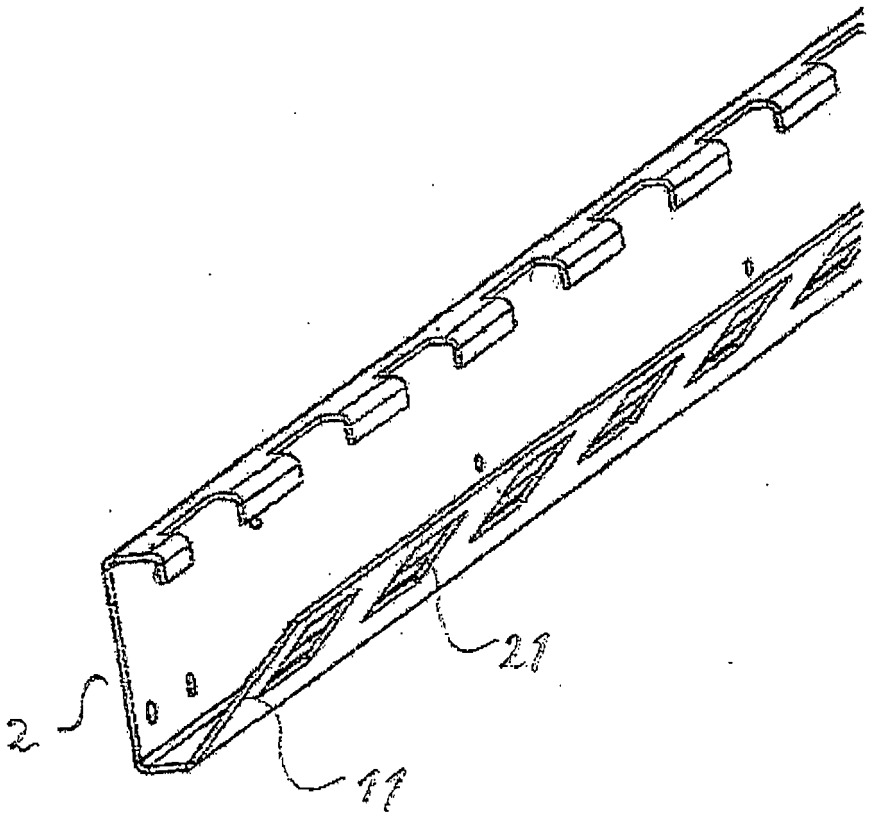

FIG.7

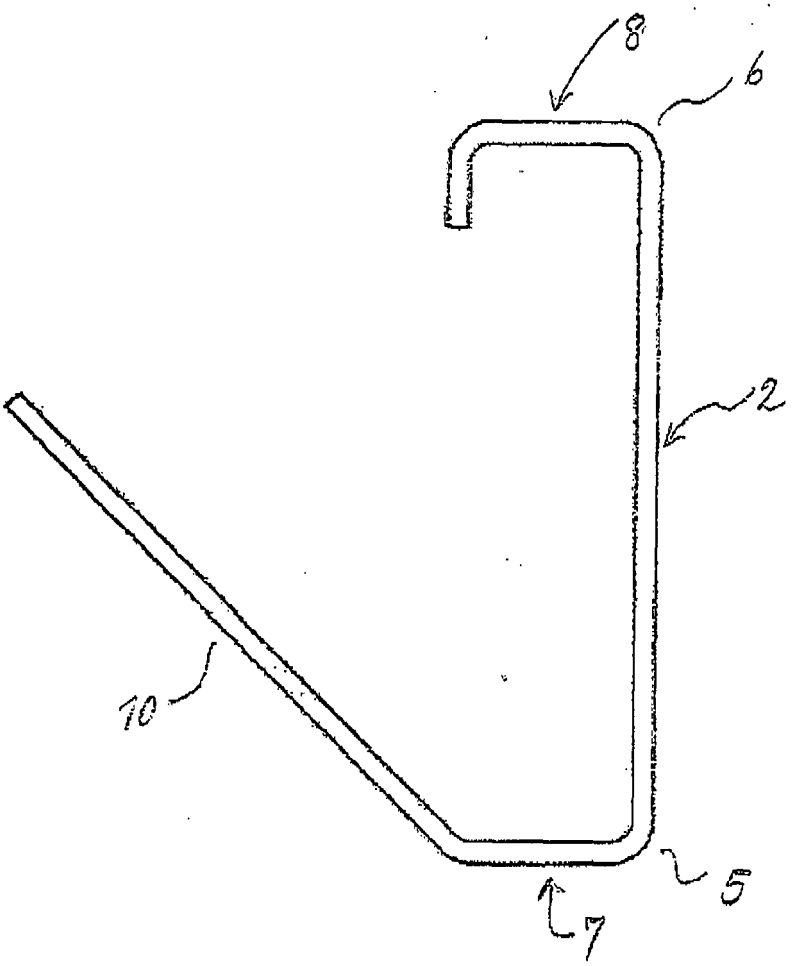

FIG.8

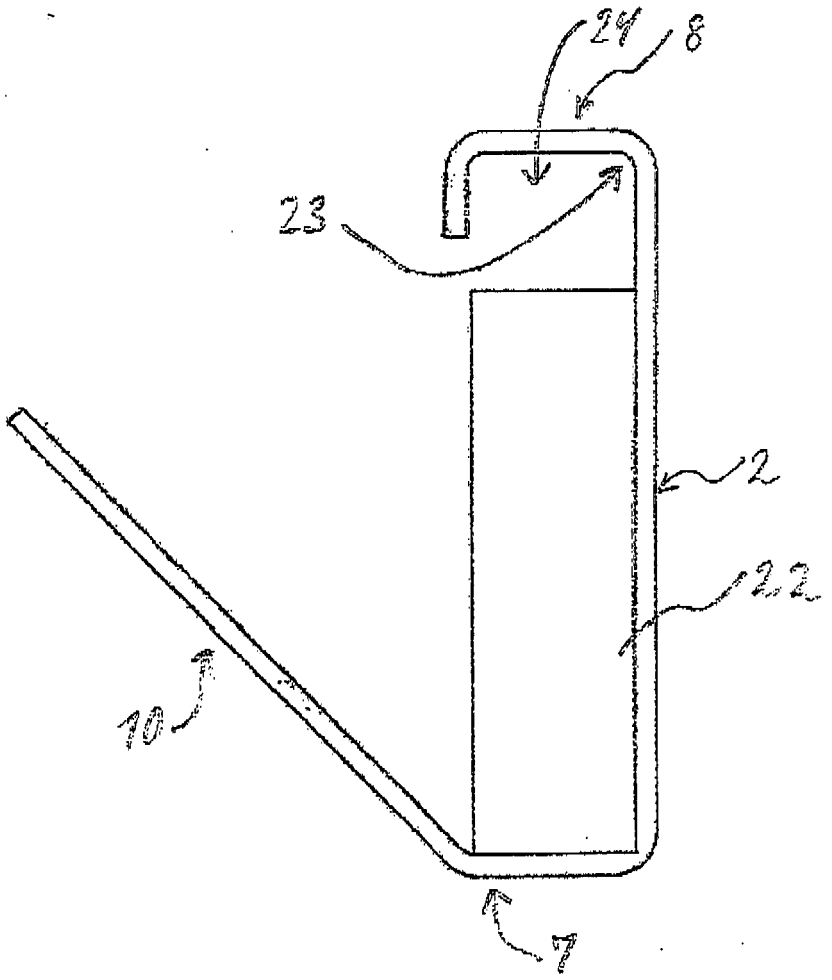

FIG. 9

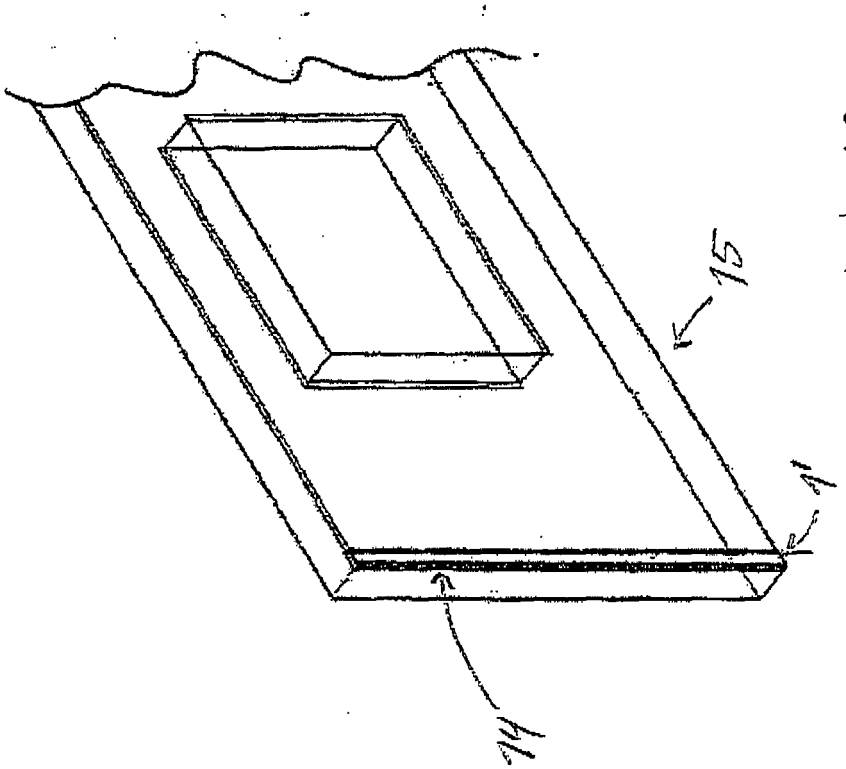

FIG. 10

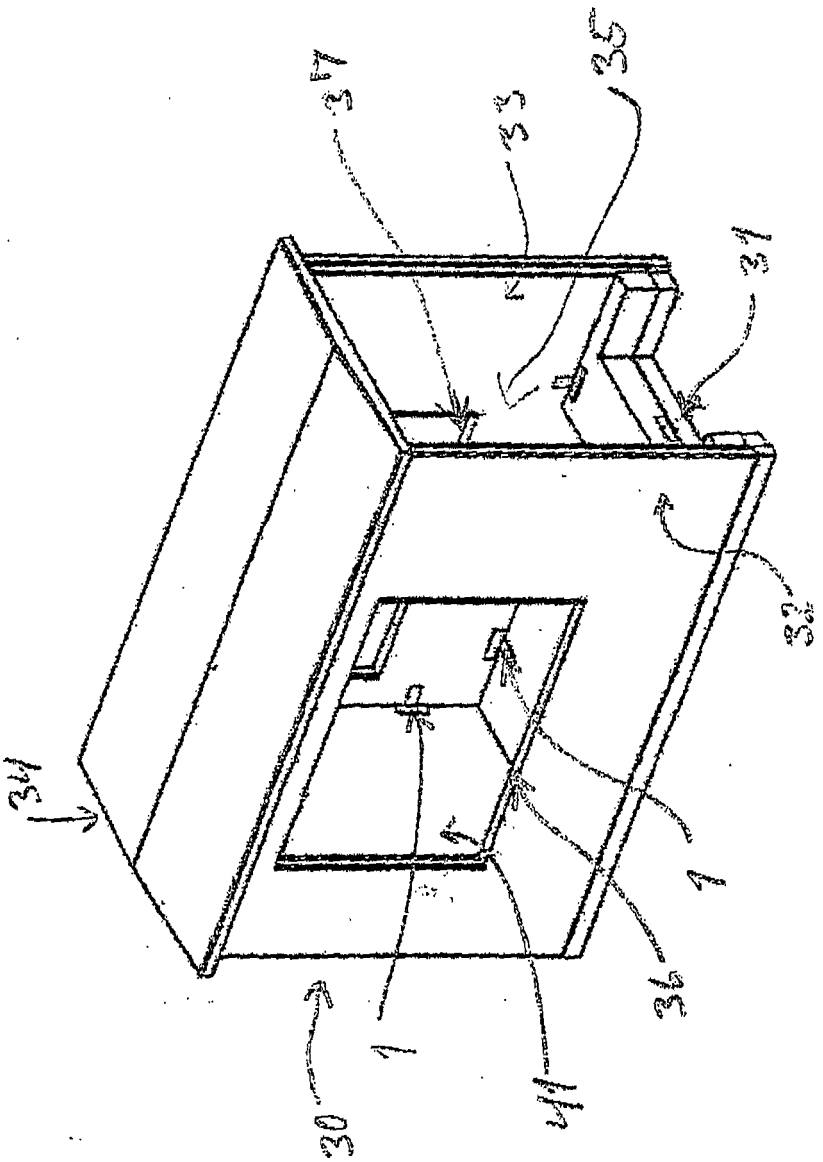

FIG.11

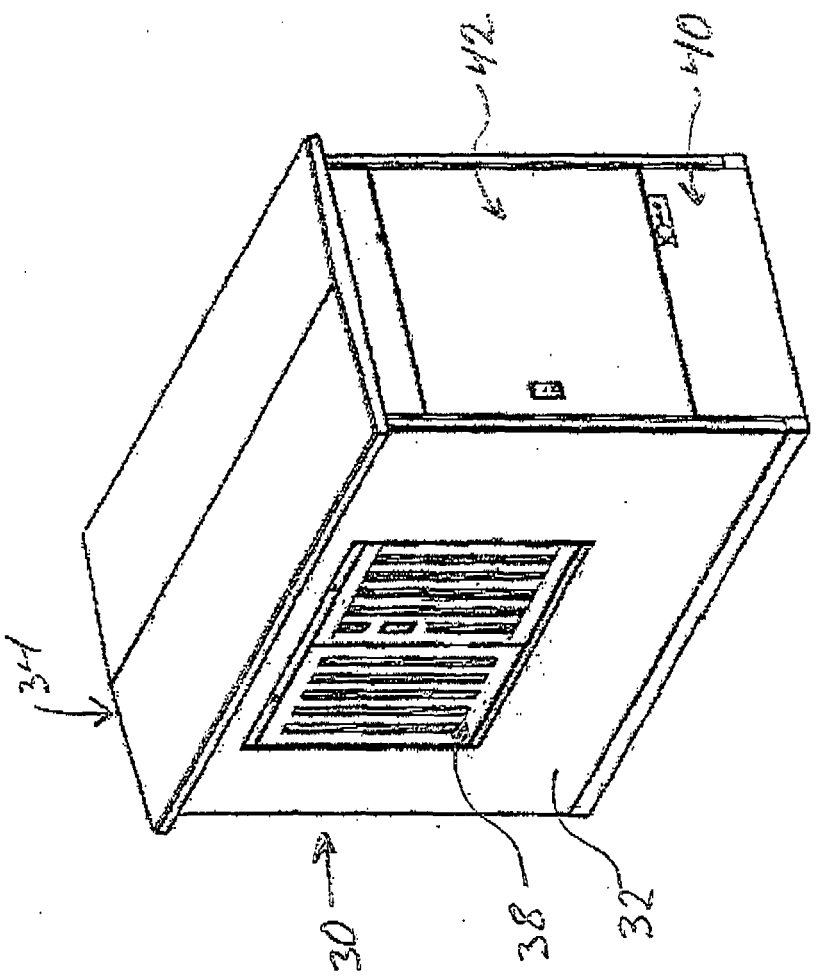

FIG. 12

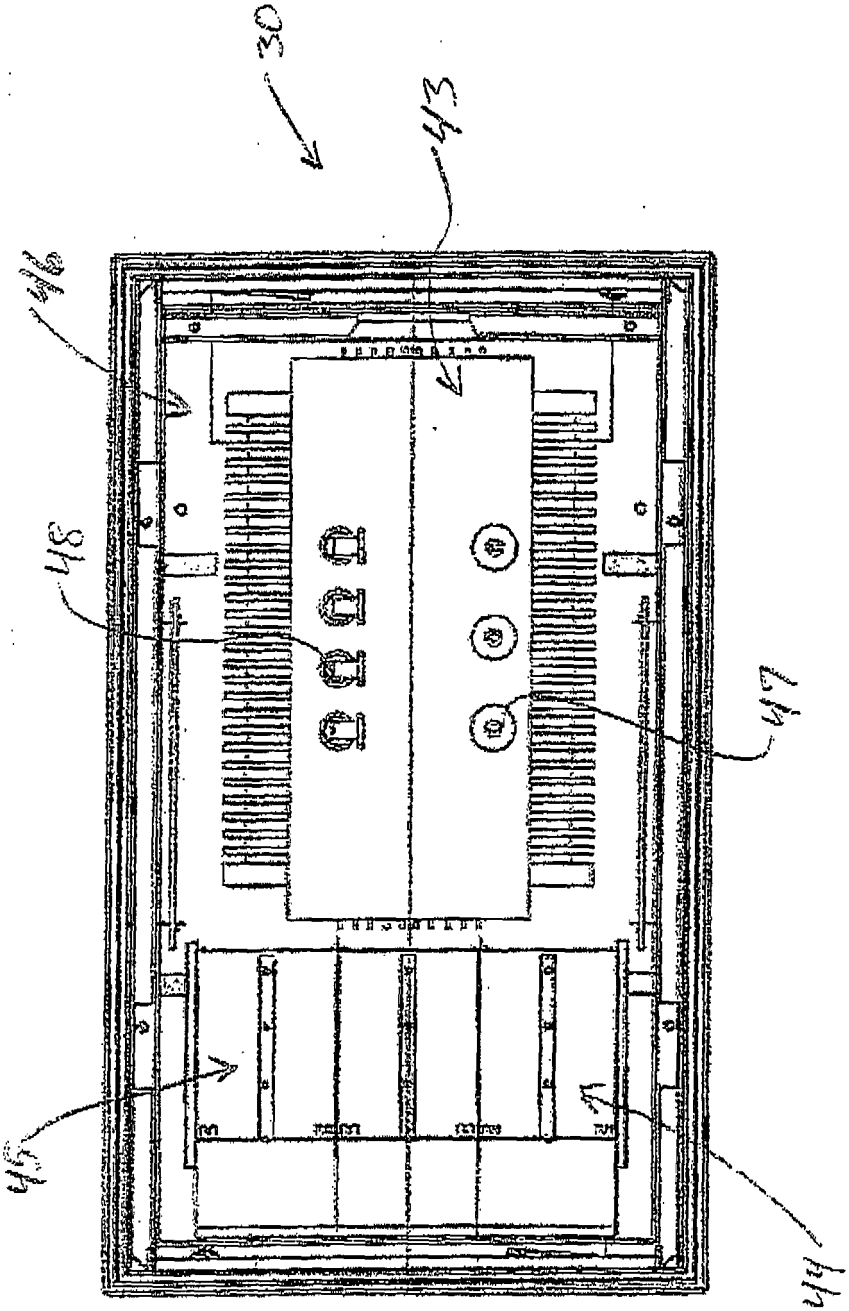

FIG. 13

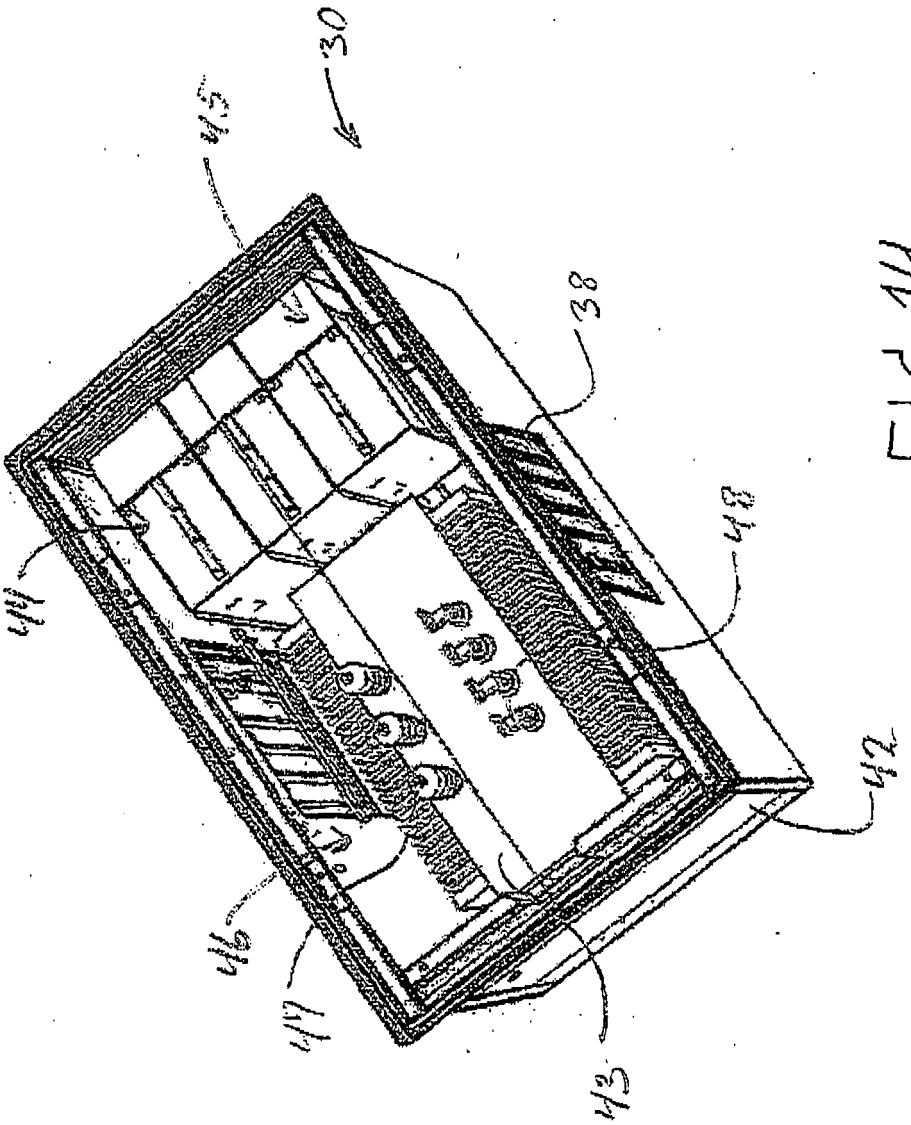

FIG. 14

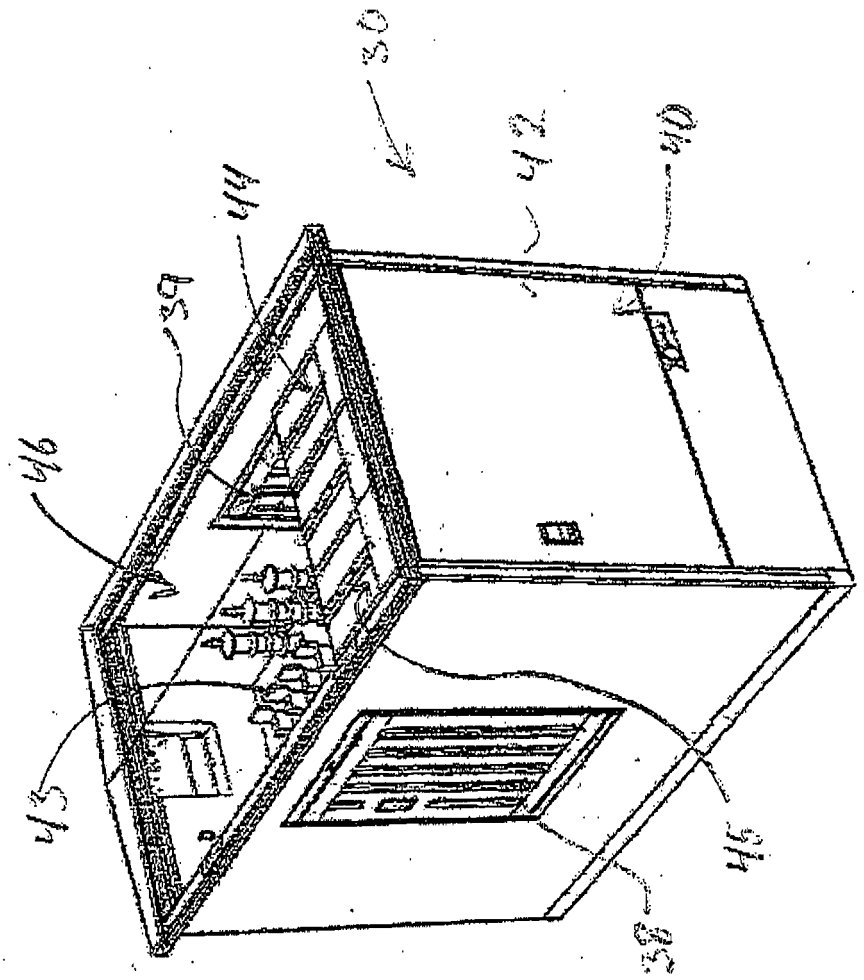

FIG. 15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 02 8689

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 1 562 784 A (OLSEN RUDOLPH K) 24 November 1925 (1925-11-24) * figure 4 *	1-19	E04B1/41
A	US 4 905 444 A (SEMAAN ET AL) 6 March 1990 (1990-03-06) * figure 5 *	5	
A	DE 100 01 621 A1 (BETON- ELEMENTE- UND BAUSTOFFWERK HEINRICH GRAEPER GMBH & CO KG; BETON) 31 October 2001 (2001-10-31) * claim 1; figures 6,14 *	17	
A	US 3 574 984 A (IGNATIUS A. CHAP) 13 April 1971 (1971-04-13) * figures 1-4 *	1-18	

TECHNICAL FIELDS SEARCHED (IPC)

E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 February 2006	Rosborough, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 02 8689

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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06-02-2006

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