

(19)



(11)

EP 1 808 872 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

18.07.2007 Bulletin 2007/29

(51) Int Cl.:

H01F 27/26 ^(2006.01)

H01F 27/245 ^(2006.01)

H01F 27/30 ^(2006.01)

H01F 30/12 ^(2006.01)

(21) Application number: **06025010.7**

(22) Date of filing: **04.12.2006**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**

Designated Extension States:

AL BA HR MK YU

(30) Priority: **17.01.2006 IT VI20060018**

(71) Applicant: **GBE S.R.L.**

35040 Orgiano VI (IT)

(72) Inventors:

- **Tapparelli, Renato**
36075 Montecchio Maggiore
(Vicenza) (IT)
- **Muzzolon, Francesco**
36045 Lonigo
(Vicenza) (IT)
- **Sanson, Giuliano**
36045 Montecchio Maggiore
(Vicenza) (IT)

(74) Representative: **Bettello, Pietro**

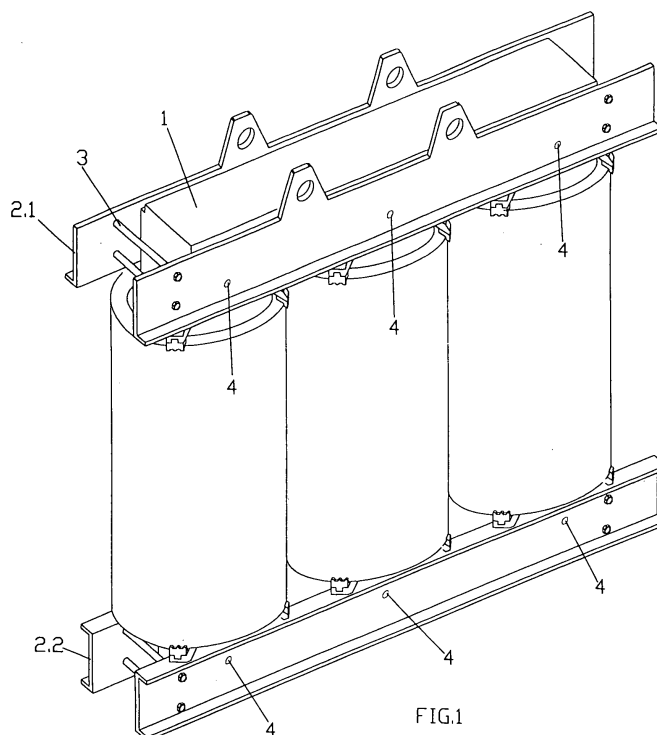
Via Col d'Echele, 25

36100 Vicenza (IT)

(54) Clamping, compacting and lifting system for electric transformers and reactors

(57) The invention relates to a clamping, compacting and lifting system for electric transformers and reactors, of the type wherein the magnetic core (1) is equipped with lamination stack clamps (2) maintained in position through tie rods (3). Said system is characterised in that

the transformer is lifted by means of constraints between the lamination stack clamps (2.1, 2.2) and the magnetic core (1), such constraints being comprised of pins (4) protruding from the internal part of the lamination stack clamp sections which are inserted into corresponding housings (5) drilled in the magnetic core.



EP 1 808 872 A2

Description

[0001] The present finding relates to a clamping, compacting and lifting system for electric transformers and reactors as described in the general definition in claim 1.

[0002] It is a familiar fact that the magnetic laminations in electric transformers and reactors which constitute the magnetic core are maintained mutually stacked together by the compressing action performed by so-called "lamination stack clamps", applied where the two horizontal yokes are located connecting the vertical columns on which the coils are positioned concentrically.

[0003] Normally the lamination stack clamps are composed of sections with a basic "C" or "L" shape arranged in pairs on the two sides of the lamination stack and held together mutually by means of transversal tie rods.

[0004] In current state of the art, in order to let the transformers be lifted, the two lamination stack clamps, the upper or "head" clamp and the lower or "base" clamp, are mutually connected by vertical bars composed of longitudinal metal trays, equipped with protruding pins at each end, which are fitted into the body of the sections that act as lamination stack clamps.

[0005] The drawback that exists with this blocking system not only involves the complexity of the operation required to create trays equipped with welded pins, but also the fact that when operating, the trays rise higher than the lamination stack clamps from the inside, and therefore create gaps between the stack clamp and the core. These gaps then need to be filled with additional thickening members to ensure uniform and efficient packing pressure on the magnetic laminations; obviously a very laborious process.

[0006] Lamination stack clamp fixing systems are described in the European patent EP 0 477 423 B1 and the Italian patent MI2001U000077, where the lamination stack clamp and the metal connecting trays are aligned mutually to permit the stack clamp sections to make direct contact with the magnetic core.

[0007] Although this method eliminates the need for additional thickening elements, it does impose the need for metal connecting trays, and since these have to be limited in length according to the height of the magnetic core, this involves extra work for the transformer constructor, in that he must produce and stock a considerable variety and number of said trays to satisfy different customer requirements.

[0008] Furthermore, there is the added disadvantage that when the metal connecting trays are positioned against the magnetic core column, this increases the winding section of the core itself.

[0009] Lastly, a further disadvantage with said construction system, lies in the fact that the hooking up operation between the lamination stack clamp bodies and the connecting trays is rather difficult.

[0010] An alternative method for lifting electric transformers and reactors, but without connecting trays, provides for the use of the core columns as the connecting

element between the lamination stack clamps with suitably insulated yoke tie rods which pass through the core.

[0011] However, this second method can be applied only to small-sized machines, because the weight of the magnetic core in medium and large-sized machines is supported by the tie rods, with the risk of damaging the layer of insulation on the rods, leading to the forming of a "closed turn" that would compromise correct equipment function.

[0012] The aim of the present invention is to provide a clamping, compacting and lifting system for electric transformers and reactors that do not involve any of the problems present in prior art on similar products.

[0013] Specifically, the aim of the present invention is to provide a clamping, compacting and lifting system for electric transformers and reactors that is easier to build and less costly than the systems produced by prior art.

[0014] Even more specifically, the aim of the present invention is to provide a clamping, compacting and lifting system for electric transformers and reactors that can be used for a wide range of different widths on various magnetic cores.

[0015] More specifically again, the aim of the present invention is to provide a clamping, compacting and lifting system for electric transformers and reactors that is not limited in any way by the height of the magnetic core.

[0016] More specifically again, the aim of the present invention is to provide a clamping, compacting and lifting system for electric transformers and reactors that increases the exposed surface of the core, thus making heat release much easier.

[0017] These aims are achieved by creating a clamping, compacting and lifting system for electric transformers and reactors that has no connecting rods between the two lamination stack clamps and characterised by the fact that the transformer is lifted by means of constraints between the lamination stack clamps and the magnetic core provided by short pins that are not through-pins, protruding from the internal part of the lamination stack clamp sections for fitting into respective housings bored in the magnetic core.

[0018] The finding will be better defined in the description of certain possible embodiments, provided as examples, but by no means limiting, and the appended drawings wherein:

- Figure 1 shows a view in perspective of a transformer according to the invention;
- Figures 2 and 3 show a front and side elevation of a magnetic core equipped with the lamination stack clamps according to the invention;
- Figures 4 and 5 show respectively an overview, and a view of the pin in a first embodiment of the lamination stack clamp/magnetic core constraint according to the invention;

- Figures 6 and 7 show respectively an overview, and a view of the pin in a second embodiment of the lamination stack clamp/ magnetic core constraint according to the invention;
- Figures 8 and 9 show respectively an overview, and a view of the pin in a third embodiment of the lamination stack clamp/ magnetic core constraint according to the invention;
- Figures 10 and 11 show respectively an overview, and a view of the pin in a fourth embodiment of the lamination stack clamp/ magnetic core constraint according to the invention;
- Figures 12 and 13 show respectively an overview, and a view of the pin in a fifth embodiment of the lamination stack clamp/ magnetic core constraint according to the invention;
- Figures 14 and 15 show respectively a front and side view, of a sixth embodiment of the lamination stack clamp/magnetic core constraint according to the invention;

[0019] As can be seen in figures 1-3, the electric transformer comprises a magnetic core 1, equipped with lamination stack clamps 2, maintained in position by tie rods 3, all of which according to a per se known construction method.

[0020] Figures 2 and 3 show the lamination stack clamps- i.e. the upper clamp 2.1 and the lower clamp 2.2, are fixedly connected to the magnetic core 1 by means of pins 4, protruding from the internal part of said lamination stack clamps and inserted in respective housings 5 bored in said magnetic core, and more precisely, on yoke 1.1 and aligned with columns 1.2, so that the most external portion of column 1.2, and in particular the last laminations or the last step act as a connection system between the two lamination stack clamps, replacing the tie-rod type connection usual in prior art.

[0021] The pins 4, that penetrate the magnetic core for a short distance, can be attached to the section 10 of the lamination stack clamp through welding, or can be removable and therefore maintained in position by means of a mobile connection means such as a bolt or a fixed end.

[0022] Figures 4 and 5 show a first embodiment, where pin 4.1 is inserted into housing 5 and fixedly attached to section 10 of the lamination stack clamp through welding on the head flange 4.1.1. of said pin.

[0023] Figures 6 and 7 show a second embodiment where pin 4.2 is composed of two portions having different diameters, where portion 4.2.1. with a larger diameter is inserted into housing 5, while portion 4.2.2. with a lesser diameter is fitted into a corresponding hole drilled in section 10, so that when the lamination stack clamp is closed, this creates an abutment that prevents the pin

from slipping out of housing 5.

[0024] Figures 8 and 9 show a third embodiment where pin 4.3 is mounted with an intermediate collar 4.3.1, which, when the lamination stack clamp is closed, remains blocked between the section 10 and the magnetic core 1, thus preventing the pin from slipping out of housing 5.

[0025] Figures 10 and 11 show a fourth embodiment where pin 4.4 is equipped with a threaded terminal portion 4.4.1, with a narrower diameter, which, when the lamination stack clamp is closed, will receive a blocking nut 4.4.2 screwed onto the thread with the addition of the washer 4.4.3.

[0026] Figures 12 and 13 show a fifth embodiment where the insulated tie-rod T is inserted into the through-pass hole in the magnetic core 1, complete with a metal bush and collar 4.5, tightened by means of insulating washers 3.1 and nut 3.2.

[0027] In cases where specific construction conditions, such as particularly small sized section 10, do not permit the application of pin 4 on the rib of the said section, the invention provides for the application of the pin 4 on a terminal 20, positioned externally, attached to and aligned with said section.

[0028] Said terminal 20 can be configured in a bent wing portion of section 10, or a plate welded under the section and aligned with said section.

[0029] Lastly, as shown in figure 2, the invention provides for a plurality of holes 30 drilled in the lamination stack clamp sections 10 for the insertion of the pins 4, in order to obtain through their combination, various interaxial sizes, therefore providing the possibility of using the same lamination stack clamps for magnetic cores of different interaxial sizes and lengths.

[0030] Naturally other embodiments different from those described are also possible according to the size of the magnetic core or the configuration of the lamination stack clamps, while remaining within the scope of the following claims.

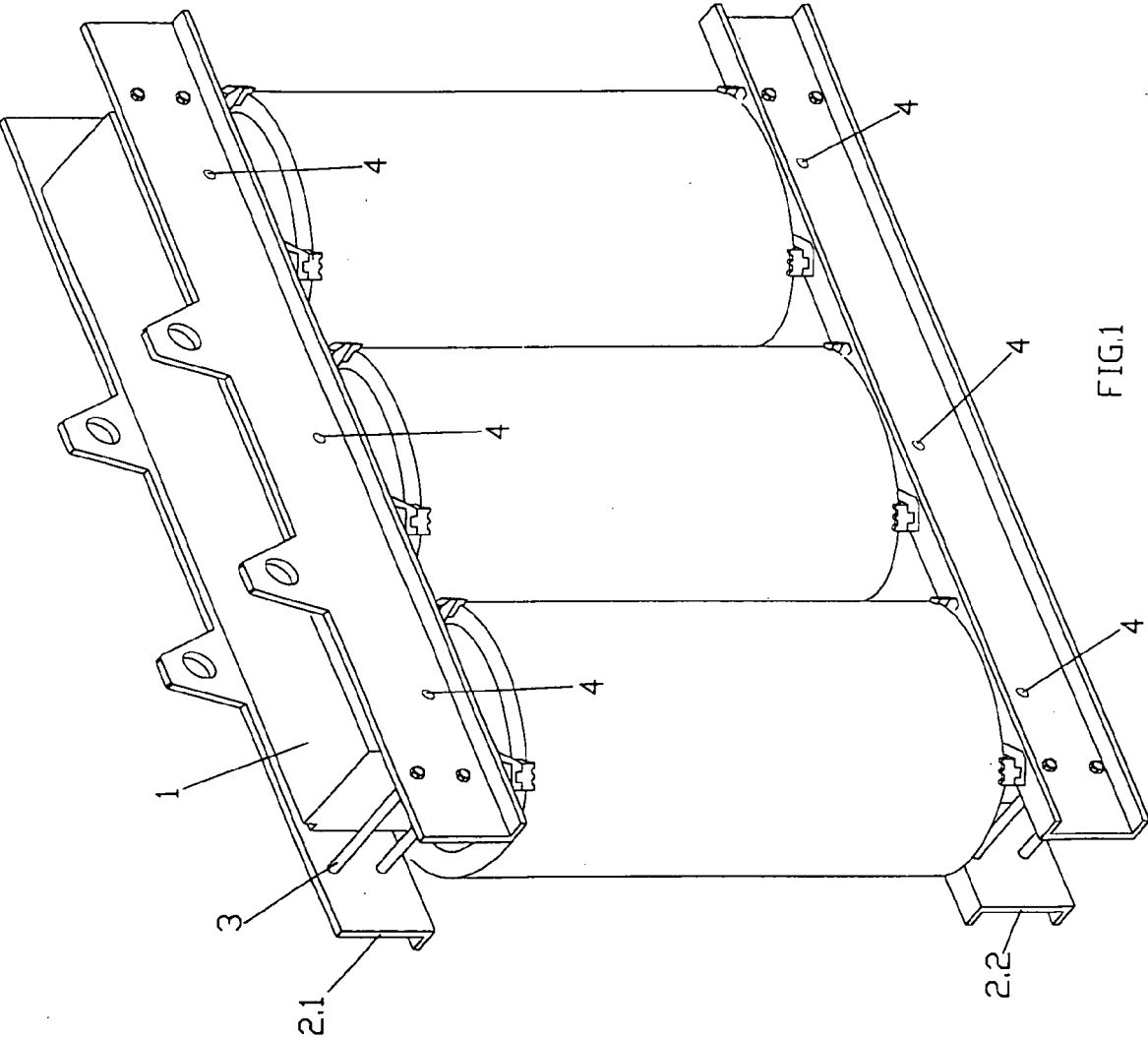
Claims

1. CLAMPING COMPACTING AND LIFTING SYSTEM FOR ELECTRIC TRANSFORMERS AND RECTORS of a type wherein the magnetic core (1) is equipped with lamination stack clamps (2) maintained in position by means of tie-rods (3), said system being **characterised in that** the lifting action of the transformer is performed by means of constraints between the lamination stack clamps (2.1, 2.2) and the magnetic core (1) comprised of pins (4) that protrude from the interior of the sections (10) of the lamination stack clamps and are inserted into corresponding housings (5) bored in the magnetic core.

2. SYSTEM according to claim 1 **characterised in that**

the pins (4) penetrate the magnetic core (1) inside the housing (5) for a short distance,

3. SYSTEM according to claim 1 **characterised in that** the pins (4) act on the yoke (1.1) on the columns (1.2) which also act as a means of connection between the two lamination stack clamps (2.1, 2.2).
4. SYSTEM according to one or more of the previous claims **characterised in that** the pins (4) are integral with the lamination stack clamps (2).
5. SYSTEM according to one or more of the previous claims **characterised in that** the pins (4) are removable from the lamination stack clamps (2).
6. SYSTEM according to one or more of the previous claims **characterised in that** the pin (4.1) which is inserted in the housing (5) is made integral with the section (10) of the stack clamp through welding to the head flange (4.1.1.) of said pin.
7. SYSTEM according to one or more of the previous claims, **characterised in that** the pin (4.2) is composed of two portions having different diameters, where the portion (4.2.1.) having a larger diameter is inserted in the housing (5), while the portion (4.2.2) having the lesser diameter, is inserted in the corresponding hole drilled in the section (10), so that when the stack clamp is closed, it creates an abutment that prevents the pin from slipping out of the housing.
8. SYSTEM according to one or more of the previous claims, **characterised in that** the pin (4.3) is mounted with an intermediate collar (4.3.1.) so that when the stack clamp is closed, it remains blocked between the section (10) and the magnetic core (1) to prevent the pin from slipping out of the housing (5).
9. SYSTEM according to one or more of the previous claims, **characterised in that** the pin (4.4) has a threaded terminal portion (4.4.1) having a lesser diameter so that when the stack clamp is closed, permits a block nut (4.4.2) to be screwed onto the thread, upon insertion of the washer (4.4.3).
10. SYSTEM according to one or more of the previous claims, **characterised in that** the insulated tie rod (T) is inserted into a pass-through hole in the magnetic core (1) complete with a metal bush with a collar (4.5) and that the clamping action is obtained by means of insulating washers (3.1) and nut (3.2).
11. SYSTEM according to one or more of the previous claims, **characterised in that** the pin (4) acts on a terminal (20), on the exterior, attached to and aligned with the section (10) of the stack clamps (2.1, 2.2).
12. SYSTEM according to claim 11, **characterised in that** the terminal (20) is configured from a bent wing portion of the section (10).
13. SYSTEM according to claim 11, **characterised in that** the terminal (20) is composed of a plate welded under the section (10).
14. SYSTEM according to one or more of the previous claims, **characterised in that** the sections (10) of the stack clamps are drilled with a plurality of holes (30) for insertion of the pins (4) in order to obtain different interaxial sizes through their combination.



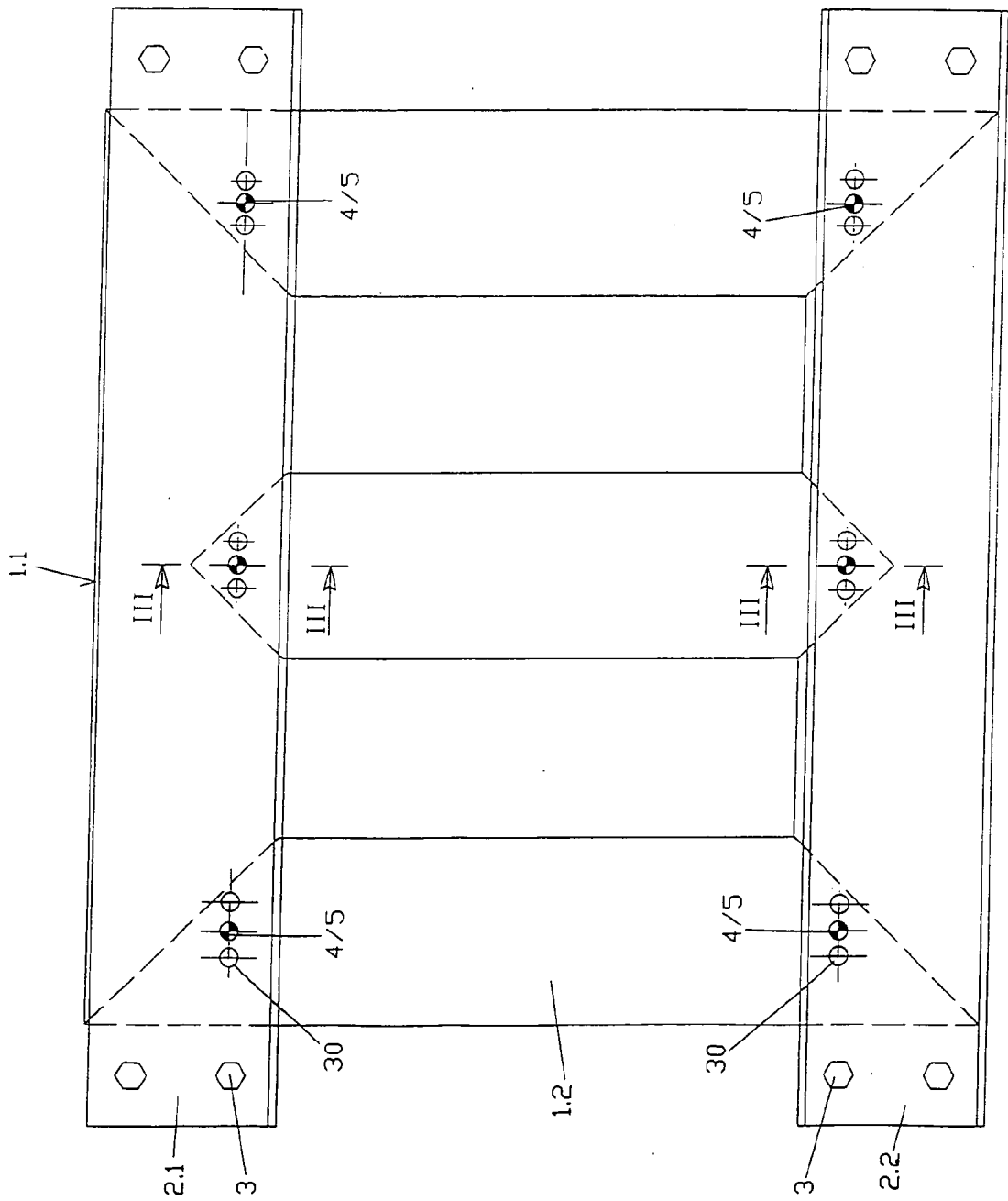


FIG. 2

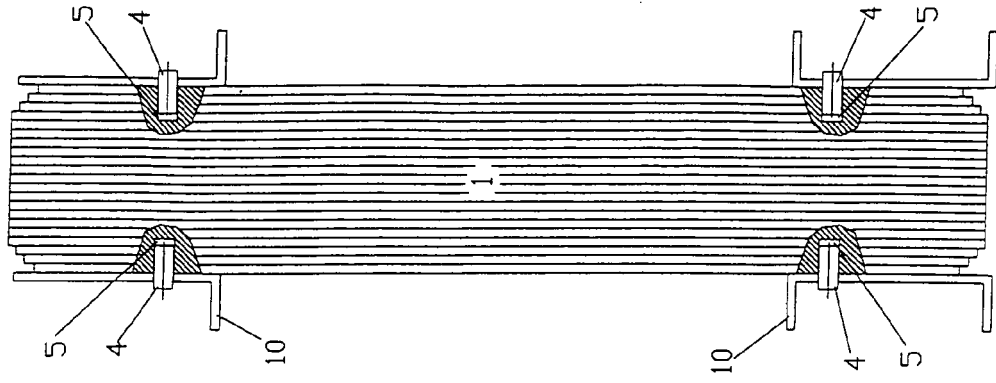
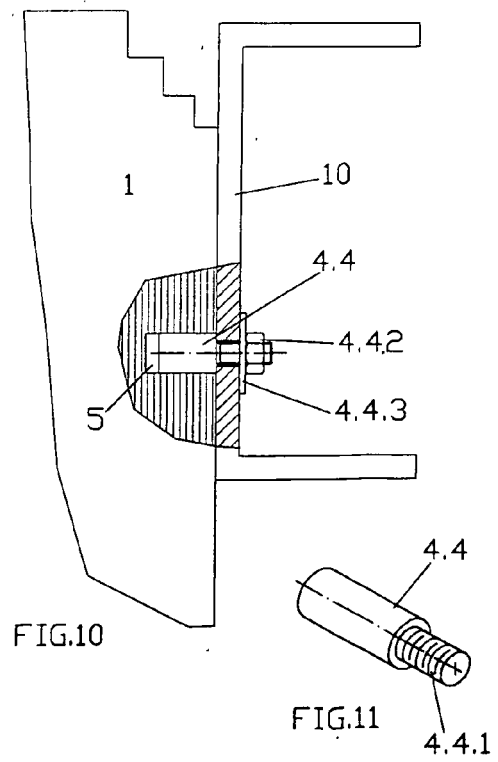
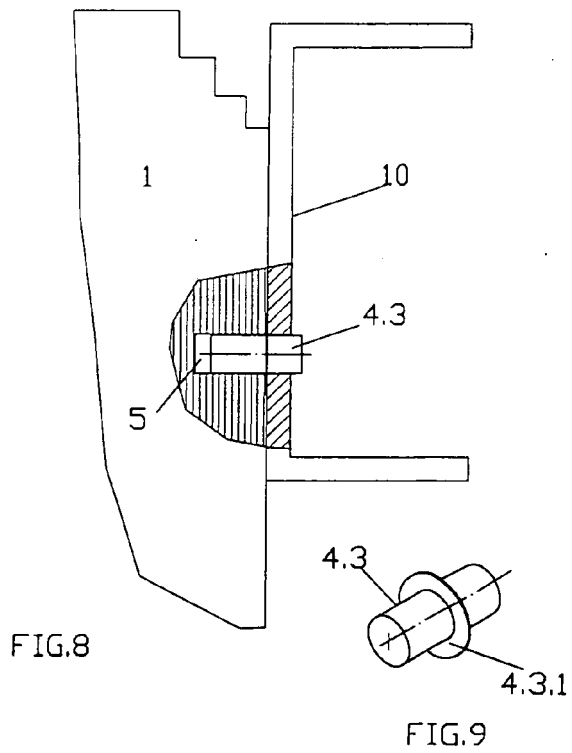
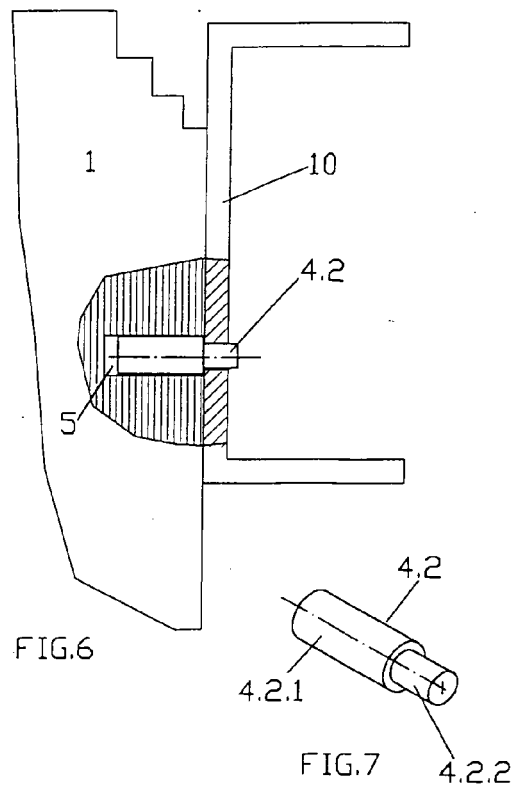
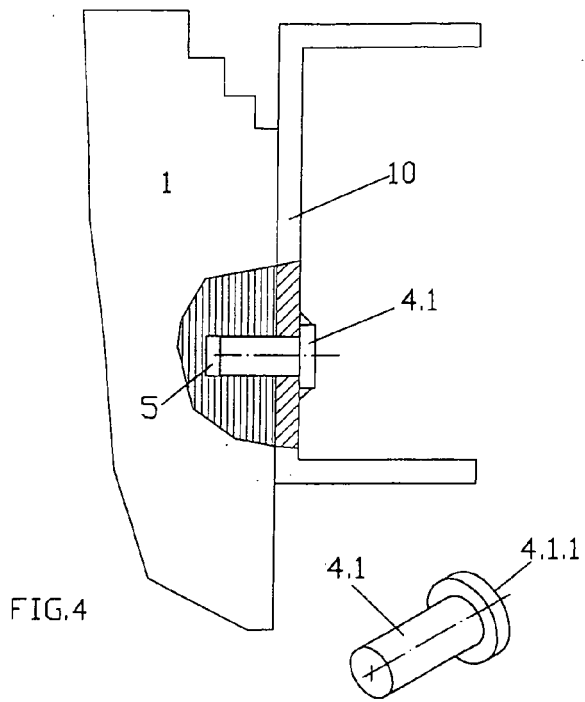


FIG. 3



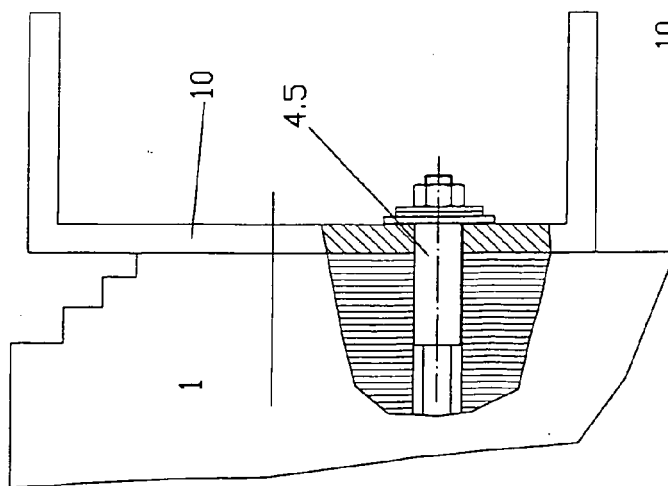


FIG.12

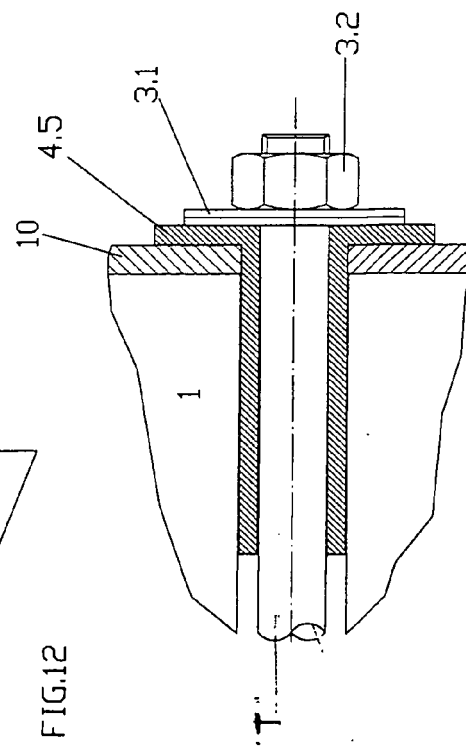


FIG.13

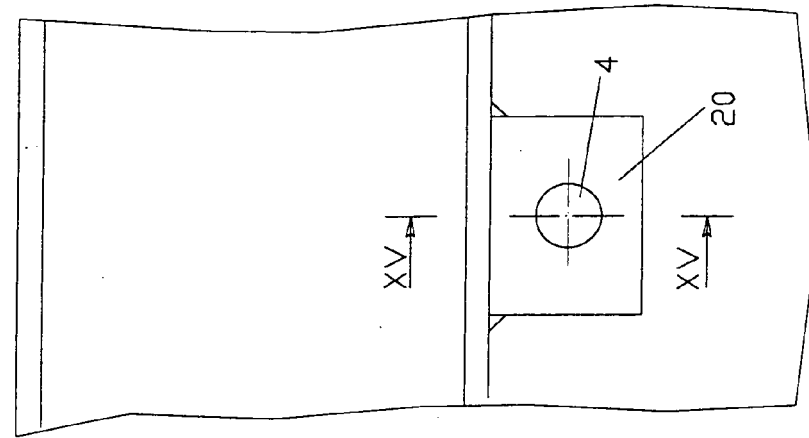


FIG.14

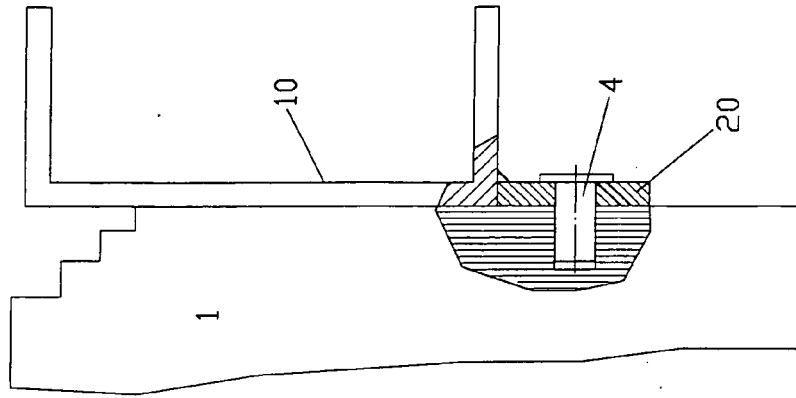


FIG.15

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0477423 B1 [0006]
- IT MI2001 U [0006]
- IT 000077 U [0006]