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(54) MULTIPLE TERMINALS BUSHING ASSEMBLY

BUCHSENANORDNUNG FÜR MEHRERE ANSCHLÜSSE

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Description

Field of the Invention

[0001] The present invention relates to a multiple terminals bushing assembly for electrical transformer.

Background of the Invention

[0002] Electrical transformers are used to distribute electricity from the point of generation or substations for domestic home or business and thereby stepping down the voltage. Transformers require insulative conductors on both the high and low voltage sides. The transformer case or tank is usually metal and must be safely insulated. A bushing is a hollow isolator, carrying high and low voltage leads through a wall portion of the tank.

[0003] Low voltage bushings of tank-type transformers are generally made up of molded epoxy bushing or multi-piece assemblies with porcelain isolators. Mounting space of a bushing assembly is restricted by outer dimensions, creepage distance and clearance distance between the terminals.

[0004] Traditionally, the bushing compartment of electrical transformers, especially distribution transformers, is arranged on the top portion of the transformer tank. The tank is hermetically sealed by placing a sealing gasket between the top portion, usually a flat cover, and a pot-shaped casing portion. The bushing compartment comprises electrically insulated conductors extending through an opening of the tank and having substantial vertical oriented outer terminals. Electrical connection of the terminals is easily possible with the bushing compartment arranged on the top of the tank.

[0005] However, in applications where additional high current connection is required the available space on the top portion of the tank is limiting factor. The required space for multiple bushings per phase will increase the outer dimensions of the transformer. It is common practice to place the bushings on the cover of the transformer in single or multiple rows making the connection to the control unit grid difficult. A further disadvantage is, that such an low voltage bushing arrangement is not easy to adapt on various modifications for specific applications.

[0006] Thus, it would be desirable to provide a multiple terminals bushing assembly which requires less mounting space and which is easy to adept on specific applications.

[0007] Document EP 0 037 367 A1 discloses a multiple terminals bushing according to the preamble of claim 1.

Summary of the Invention

[0008] Against the foregoing background, it is an object of the present invention to provide a multi terminals bushing assembly with small overall installed size.

[0009] In accordance with the present invention there is provided a multiple terminals bushing assembly for an

electrical transformer according to claim 1.

[0010] In other words, the bushing assembly according to the invention has two press plates which serve as an insulation support for the connector elements. In comparison to epoxy molded bushings the space required for large amount of bushings is reduced. Susceptibility to variations and modifications for specific applications e.g. simple implementation of additional connector elements and easy rearrangement for specific applications, various connector elements having different cross-sections and shapes implemented in one bushing assembly. Low cost is achieved by the unsophisticated machining and assembly technology and by the availability of the raw materials on the market.

[0011] Preferably the ring-shaped gasket is arranged in a ring-shaped recess provided in at least one of the press plates and serve as a seal to prevent fluid leakage around the connector elements.

[0012] The clamping arrangement comprises a first set of bolts to hold together the press plates during the pre-assembly of the transformer's active part.

[0013] The first set of bolts are arranged in counter-bored holes provided in the upper press plate averted from the transformer casing to leave clearance between the bolt head and clamping frame and screwed in threaded blind holes in the lower press plate to prevent the fluid flow through the hole.

[0014] In order to distribute the clamping force uniformly the clamping arrangement further comprises a clamping frame and second set of bolts, whereby the pair of press plates is sandwiched between the clamping frame and the transformer casing.

[0015] For leakage-free mounting, a sealing plate is arranged between the transformer casing and the opposing press plate.

[0016] For the assembling process it is desirable that the second set of bolts to be introduced from the exterior of the transformer casing in order to pull the clamping frame towards the tank and squeeze the sealing gaskets around the connector elements.

[0017] In a preferred embodiment the second bolts are flange-type bolts and sealing between the tank wall and the bolt is accomplished by a gasket, whereby a washer limits the squeezing of the gasket.

[0018] Preferably the curved surface area of each of the connector elements is coated with a sealant compound.

Brief Description of the Drawings

[0019] In the accompanying drawing,

Fig. 1a is a front view of a terminal assembly of an electrical transformer having multiple low voltage bushings per phase;

Fig. 1b is a top view of Fig 1a;

- Fig. 2 is an enlarged view of two different type of connector elements;
- Fig. 3 is an in enlarged view according to section "A-A and "B-B" in Fig. 1b;
- Fig. 4 is a top view of a steel clamping frame;
- Fig. 5 is a top view of a sealing plate;
- Fig. 6 is an enlarged front view of "Detail X" in Fig 1a;
- Fig. 7 is a partial sectional drawing of a front view of an application of the invention, whereby the low voltage bushing assembly is mounted on a bushing compartment which is attached on the side wall of a transformer tank;
- Fig. 8 is a side view of Fig 7.

Detailed Description of Preferred Embodiments

[0020] Fig. 1a shows a front view of bushing assembly 1 of a tank-type electrical transformer having multiple low voltage bushings per phase. The transformer tank 6 has an opening 15. The bushing assembly 1 is arranged in this opening 15.

[0021] The bushing assembly 1 comprises multiple connector elements 2, 21 made of conductive material. The connector elements 2,21 are adapted for connection of electrical conductors.

[0022] The bushing assembly 1 further comprises one upper and one lower machined press plates 3, 4. Both press plates 3, 4 are closely spaced and made of an insulation material. Each press plate 3, 4 show through holes 12 (Fig. 3) for guiding the connector elements 2, 21 between the exterior 18 and the interior 19 of the transformer tank 6.

[0023] The press plates 3, 4 are sandwiched between a clamping frame 5 (Fig. 4) and the transformer tank 6. A sealing plate 8 (Fig. 5) is located between the lower press plate 4 and the tank 6. The clamping frame 5 and the sealing plate 8 have openings 22, 23.

[0024] Fig. 1b shows a top view of the bushing assembly 1. Each phase comprises six connector elements 2 and one connector element 21. The connector elements 2,21 of each phase arranged in the openings 22, 23 of the clamping frame 5 and sealing plate 8(three rows, with two connector elements in each row).

[0025] Fig. 2b shows two connector element types made of conductive material used for different ampacities. The electrical conductor is inserted into the ending of the tubular part of the connector element and electrically connected using crimp connection.

[0026] The clamping arrangement may be more clearly understood with reference to Figure 3. Figure 3 shows partially in section the area around the through holes in the upper press plate and countersunk holes in the lower

press plate 12 according to lines A-A and B-B in Figure 2. The clamping arrangement comprises first bolts 17 to pull together plates 3 and 4. The upper press plate has counterbored holes 10 for the head of bolt 17. The lower press plate 4 has threaded blind holes 11. With the bolts 17 the press plates 3, 4 are compressed and held in a closely spaced position. Fluid leakage is prevented by the sealing gaskets 7, which are provided in countersunk holes 16 in the lower plate 4, squeezed by pulling the plates 3, 4 together and by a sealing plate 8 between the transformer tank 6 and the lower plate 4. Furthermore, the curved surface area of each of the connector elements 2, 21 is coated with a sealant compound. Retaining rings 20 are inserted in the groove on connector element 2 to prevent the slip out from the press plates.

[0027] The final clamping is furnished by compressing the sealing gaskets 7 between the press plates 3, 4 around the connector elements with the steel clamping frame 5. The clamping bolts 13 are introduced from the outer side (exterior 18). This facilitates the assembly process. To prevent fluid leakage through the clamping bolts 13, an o-ring 9 (Fig. 6) is placed between the flanged clamping bolt and the washer 14 (Fig. 6).

[0028] Fig. 7 and Fig. 8 show the bushing assembly 1 according to the invention located on the bottom part of a bushing compartment 24. The bushing compartment 24 is attached to a side wall 25 of a transformer tank. This design allows the arrangement of bushings in two levels: the high voltage side on the top of the transformer, the low voltage multiple terminals on the bottom portion 26 of a separate bushing compartment 24.

[0029] The two-level construction of a bushing assembly opens the possibility for arrangement of further connection means required in high current applications. Electrical terminals 2, 21 facing downwardly from the bottom portion 26 of the bushing compartment 24 are protected in a niche.

[0030] The invention provides sufficient space for electrical connection required in additional high current applications.

[0031] The foregoing merely illustrates the principal of the invention. Those skilled in the art will be able to diverse numerous arrangements which, although not explicitly described or shown herein, embody those principles and are within the scope of the invention.

List of used reference signs

[0032]

- 1 bushing assembly
- 2 connector element
- 3 upper press plate
- 4 lower press plate
- 5 clamping frame
- 6 transformer tank
- 7 sealing gasket
- 8 sealing plate

- 9 O-Ring
- 10 counterbored hole
- 11 threaded blind hole
- 12 through hole
- 13 flanged clamping bolt
- 14 washer
- 15 opening in 6
- 16 countersunk holes
- 17 bolt
- 18 exterior
- 19 interior
- 20 retaining rings
- 21 connector element
- 22 opening in 5
- 23 opening in 8
- 24 bushing compartment
- 25 side wall of transformer tank
- 26 bottom portion of 24

Claims

1. Multiple terminals bushing assembly for an electrical transformer, comprising:

an insulating support, comprising:

a pair of closely spaced press plates (3,4) made of an insulating material and arranged in an opening (15) of the transformer casing (6), whereby each of the press plates (3,4) having corresponding openings which are adapted for connector elements (2,21) passing through the openings (12); a ring-shaped gasket (7) arranged in each opening and in contact with each of the press plates and the curved surface area of a corresponding connector element;

a clamping arrangement for squeezing the gasket, wherein the clamping arrangement comprises first bolts (17) to compress the press plates (3,4), wherein the first bolts (17) are arranged in counter bored holes (10) provided in the press plate (3) **characterised in that** averted form the transformer casing (6), the clamping arrangement further comprises a clamping frame (5) and second bolts (13), whereby the pair of press plates (3,4) is sandwiched between the clamping frame (5) and the transformer casing (6), wherein a sealing plate (8) is arranged between the transformer casing (6) and the opposing press plate (5), and wherein the second bolts (13) are introduced from the exterior (18) of the transformer casing (6).

2. Bushing assembly as claimed in Claim 1, wherein

the ring-shaped gasket is arranged in a ring-shaped recess, which is provided in at least one of the press plates.

- 5 3. Bushing assembly as claimed in Claim 1, wherein the second bolts (13) are flange-type bolts and sealing is accomplished by a gasket (9), whereby a washer (14) limits the squeezing of the gasket (9).
- 10 4. Bushing assembly as claimed in Claim 1, wherein the curved surface area of each of the connector elements (2, 21) is coated with a sealant compound.
- 15 5. Bushing assembly as claimed in Claim 1, wherein the clamping frame is made of steel.
- 6. Bushing assembly according to Claim 1, used as low voltage multiple terminals bushing assembly.
- 20 7. Electrical Transformer, comprising:

a tank having a side wall;
a bushing compartment attached to the side wall, whereby the bushing compartment having a bottom portion with an opening;
a bushing assembly according to one of the Claims 1 to 6 leak-proof mounted in the opening.

Patentansprüche

1. Durchführungsanordnung für mehrere Anschlüsse für einen elektrischen Transformator, welche umfasst:

einen isolierenden Träger, welcher umfasst:

ein Paar dicht nebeneinander angeordneter Druckplatten (3, 4), die aus einem Isolationsmaterial hergestellt sind und in einer Öffnung (15) des Transformatorgehäuses (6) angeordnet sind, wobei jede der Druckplatten (3, 4) entsprechende Öffnungen aufweist, welche für Verbinderelemente (2, 21) ausgelegt sind, die durch die Öffnungen (12) hindurchführen;
in jeder Öffnung eine darin angeordnete ringförmige Dichtung (7), die sich in Kontakt mit jeder der Druckplatten und dem gekrümmten Oberflächenbereich eines entsprechenden Verbinderelements befindet;

eine Klemmanordnung zum Zusammendrücken der Dichtung, wobei die Klemmanordnung erste Bolzen (17) umfasst, um die Druckplatten (3, 4) aneinanderzudrücken,

wobei die ersten Bolzen (17) in angesenkten Lö-

chern (10) angeordnet sind, die in der Druckplatte (3) vorgesehen sind, die vom Transformatorgehäuse (6) abgewandt ist, **dadurch gekennzeichnet, dass** die Klemmanordnung ferner einen Klemmrahmen (5) und zweite Bolzen (13) umfasst, wobei das Paar von Druckplatten (3, 4) zwischen dem Klemmrahmen (5) und dem Transformatorgehäuse (6) angeordnet ist, wobei eine Dichtplatte (8) zwischen dem Transformatorgehäuse (6) und der gegenüberliegenden Druckplatte (5) angeordnet ist, und wobei die zweiten Bolzen (13) von der Außenseite (18) des Transformatorgehäuses (6) eingeführt sind.

2. Durchführungsanordnung nach Anspruch 1, wobei die ringförmige Dichtung in einer ringförmigen Vertiefung angeordnet ist, welche in wenigstens einer der Druckplatten vorgesehen ist.
3. Durchführungsanordnung nach Anspruch 1, wobei die zweiten Bolzen (13) Flanschbolzen sind und das Abdichten durch eine Dichtung (9) bewerkstelligt wird, wobei eine Unterlegscheibe (14) das Zusammendrücken der Dichtung (9) begrenzt.
4. Durchführungsanordnung nach Anspruch 1, wobei der gekrümmte Oberflächenbereich jedes der Verbindungselemente (2, 21) mit einer Dichtmasse beschichtet ist.
5. Durchführungsanordnung nach Anspruch 1, wobei der Klemmrahmen aus Stahl hergestellt ist.
6. Durchführungsanordnung nach Anspruch 1, welche als Niederspannungsdurchführungs-Anordnung für mehrere Anschlüsse verwendet wird.
7. Elektrischer Transformator, welcher umfasst:
 - einen Kessel mit einer Seitenwand;
 - eine Durchführungskammer, die an der Seitenwand befestigt ist, wobei die Durchführungskammer einen Bodenabschnitt mit einer Öffnung aufweist;
 - eine Durchführungsanordnung nach einem der Ansprüche 1 bis 6, die leckdicht in der Öffnung angebracht ist.

Revendications

1. Ensemble traversée à plusieurs bornes, destiné à un transformateur électrique, comprenant :
 - un support isolant comprenant :
 - une paire de plaques de pression faiblement espacées (3, 4), constituées d'un matériau isolant et disposées dans une ouver-

ture (15) du boîtier de transformateur (6), de sorte que chacune des plaques de pression (3, 4) présente des ouvertures correspondantes qui sont adaptées à des éléments connecteurs (2, 21) passant à travers les ouvertures (12) ;
 un joint annulaire (7) disposé dans chaque ouverture et au contact de chacune des plaques de pression et la surface incurvée d'un élément connecteur correspondant ;
 un agencement de serrage destiné à presser le joint, dans lequel l'agencement de serrage comprend des premiers boulons (17) destinés à comprimer les plaques de pression (3, 4), dans lequel les premiers boulons (17) sont disposés dans des trous chambrés (10) ménagés dans la plaque de pression (3) écartée du boîtier de transformateur (6),
caractérisé en ce que l'agencement de serrage comprend en outre un cadre de serrage (5) et des seconds boulons (13), de sorte que la paire de plaques de pression (3, 4) est prise en sandwich entre le cadre de serrage (5) et le boîtier de transformateur (6), dans lequel une plaque d'étanchéité (8) est disposée entre le boîtier de transformateur (6) et la plaque de pression opposée (5), et dans lequel les seconds boulons (13) sont introduits depuis l'extérieur (18) du boîtier de transformateur (6).

2. Ensemble traversée selon la revendication 1, dans lequel le joint annulaire est disposé dans un évidement annulaire qui est ménagé dans au moins l'une des plaques de pression.
3. Ensemble traversée selon la revendication 1, dans lequel les seconds boulons (13) sont des boulons à collerette et l'étanchéité est réalisée par un joint (9), de sorte qu'une rondelle (14) limite la compression du joint (9).
4. Ensemble traversée selon la revendication 1, dans lequel la surface incurvée de chacun des éléments connecteurs (2, 21) est revêtue d'un produit d'étanchéité.
5. Ensemble traversée selon la revendication 1, dans lequel le cadre de serrage est constitué d'acier.
6. Ensemble traversée selon la revendication 1, utilisé en tant qu'ensemble traversée à plusieurs bornes à basse tension.
7. Transformateur électrique comprenant :
 - une cuve présentant une paroi latérale ;

un compartiment de traversée fixé à la paroi latérale, de sorte que le compartiment de traversée présente une partie inférieure pourvue d'une ouverture ;

un ensemble traversée selon l'une des revendications 1 à 6, monté étanche dans l'ouverture.

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FIG 1A

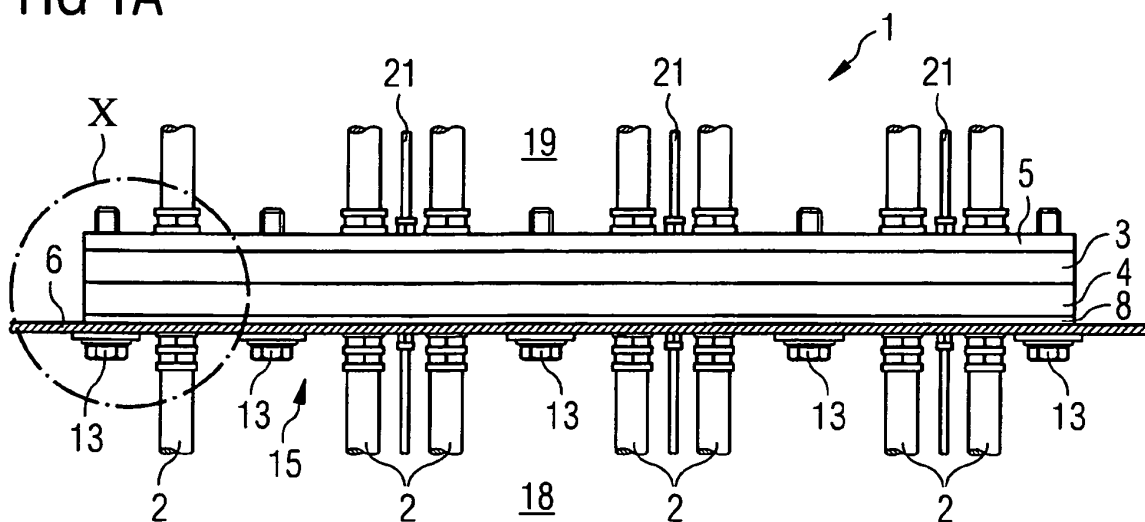


FIG 1B

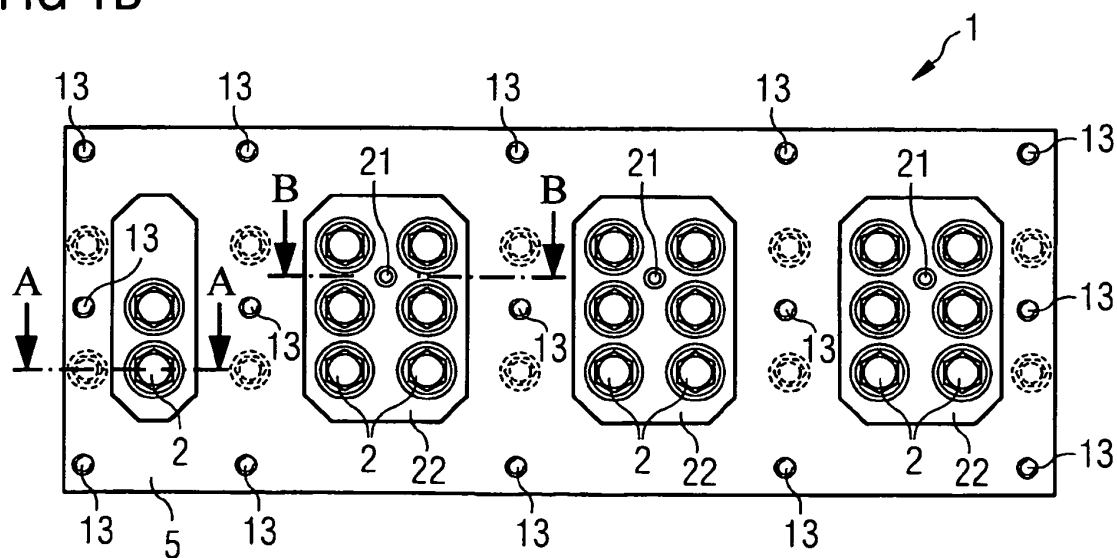


FIG 2

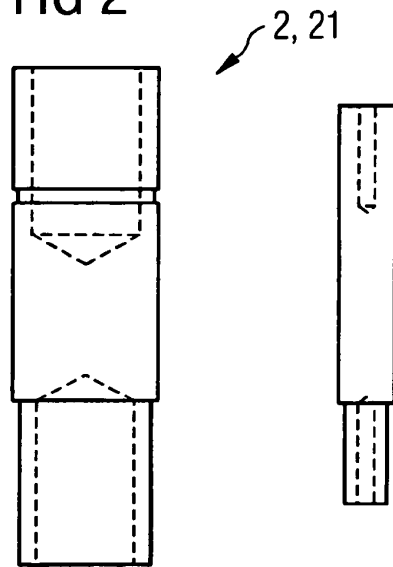


FIG 3

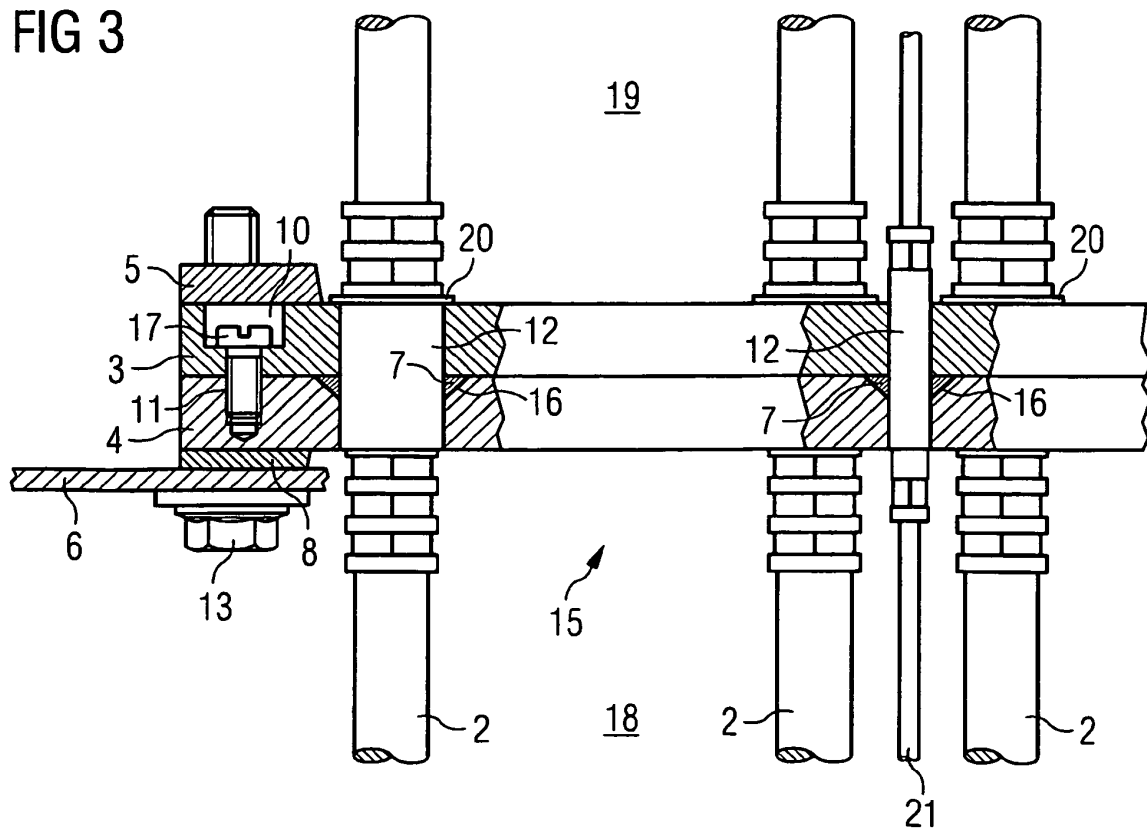


FIG 4

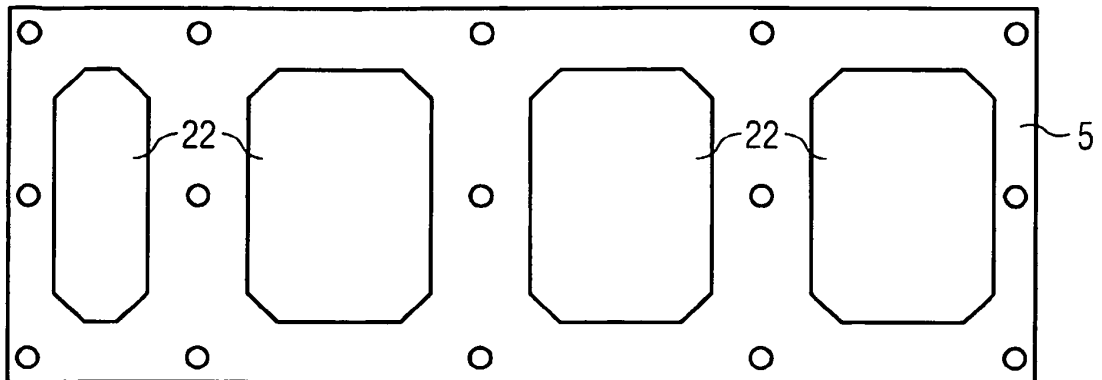


FIG 5

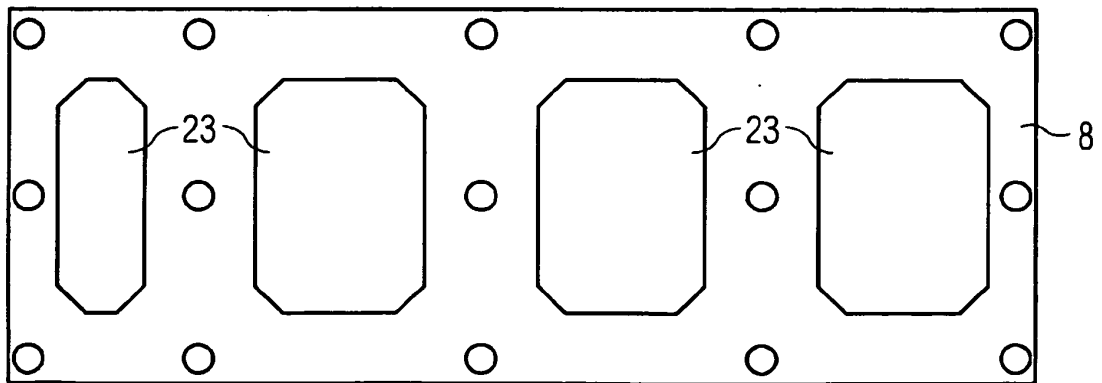


FIG 6 Detail X

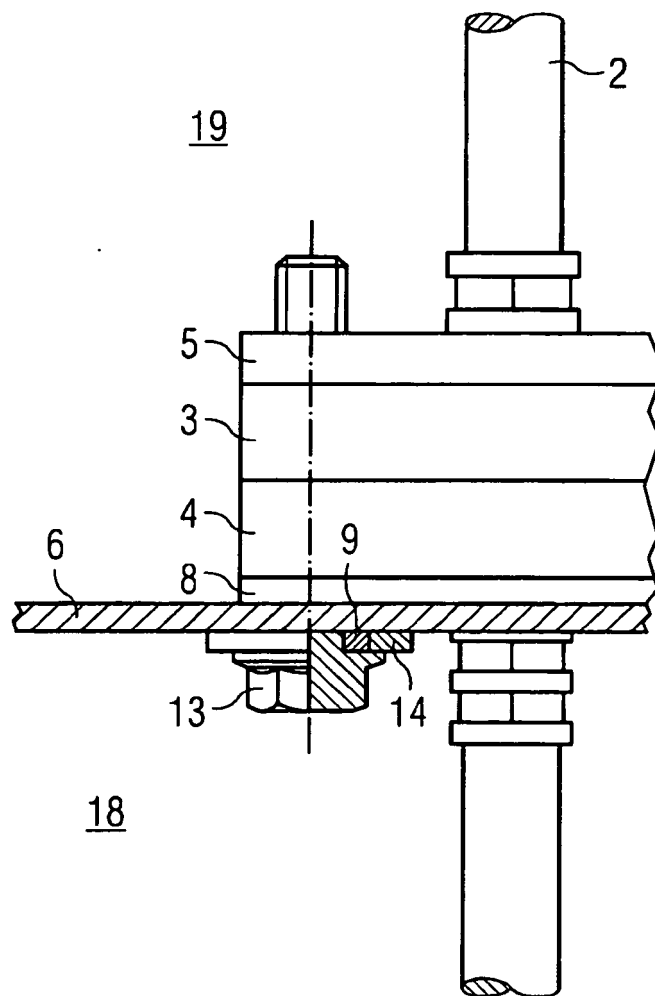


FIG 8

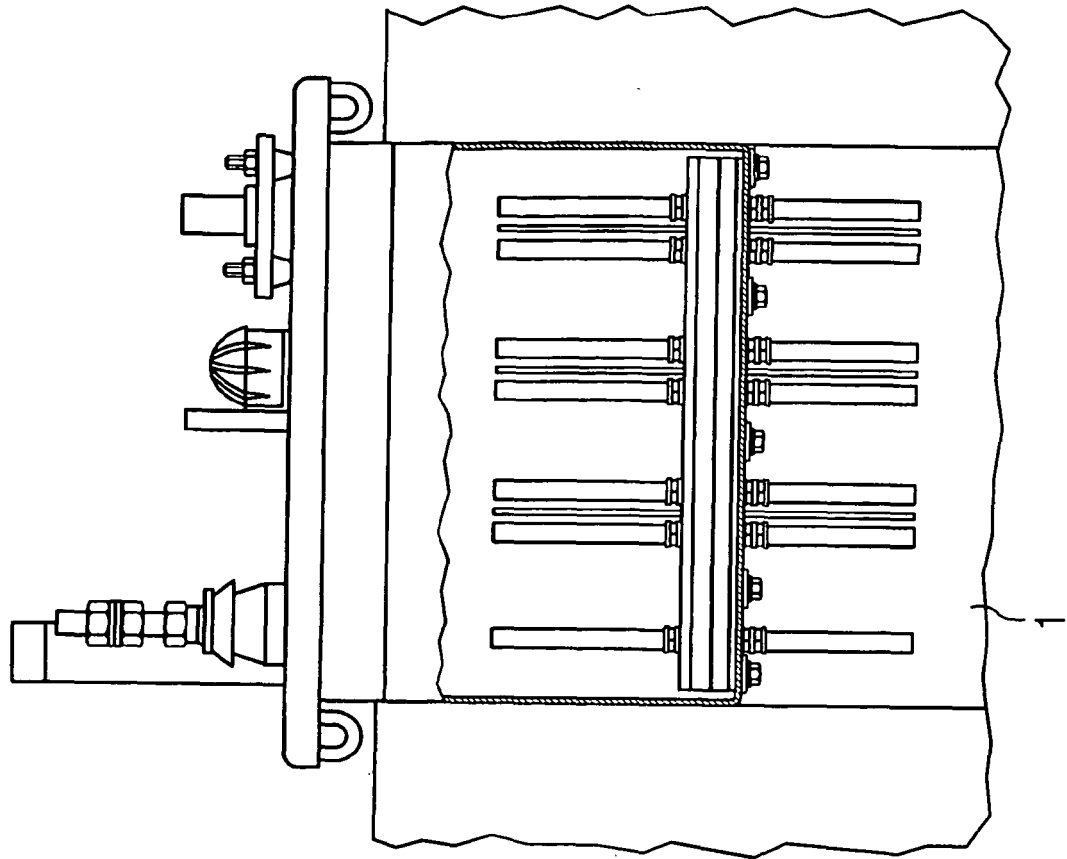
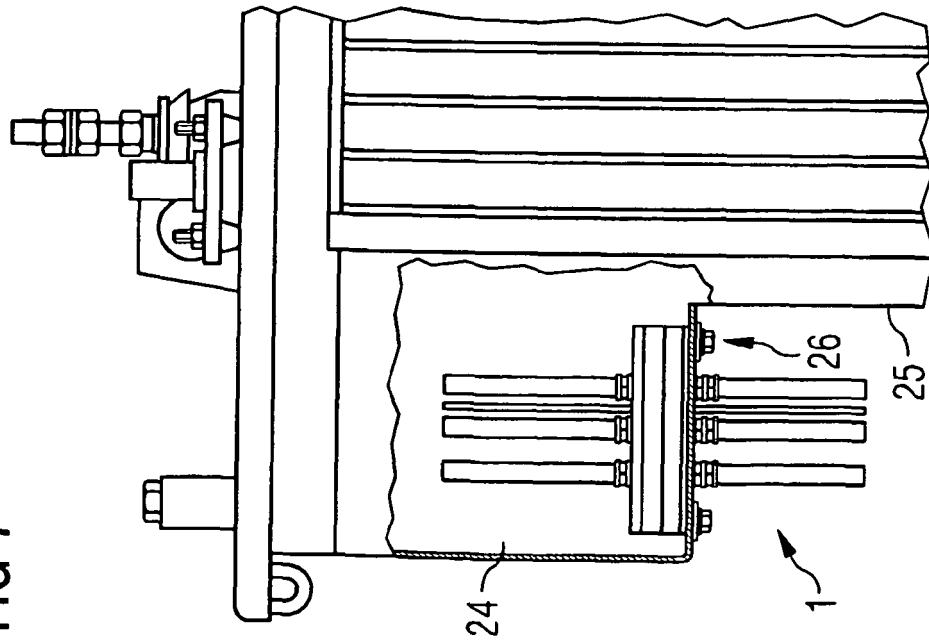


FIG 7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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