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CA 2789202 A1 2011/08/11

(21) 2 789 202

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2011/01/18
(87) Date publication PCT/PCT Publication Date: 2011/08/11
(85) Entrée phase nationale/National Entry: 2012/08/07
(86) N° demande PCT/PCT Application No.: EP 2011/050610
(87) N° publication PCT/PCT Publication No.: 2011/095391
(30) Priorité/Priority: 2010/02/08 (EP10001256.6)

(51) Cl.Int./Int.Cl. *H01F 27/02* (2006.01), *B65D 85/66* (2006.01), *B65D 85/672* (2006.01), *B65D 85/676* (2006.01)

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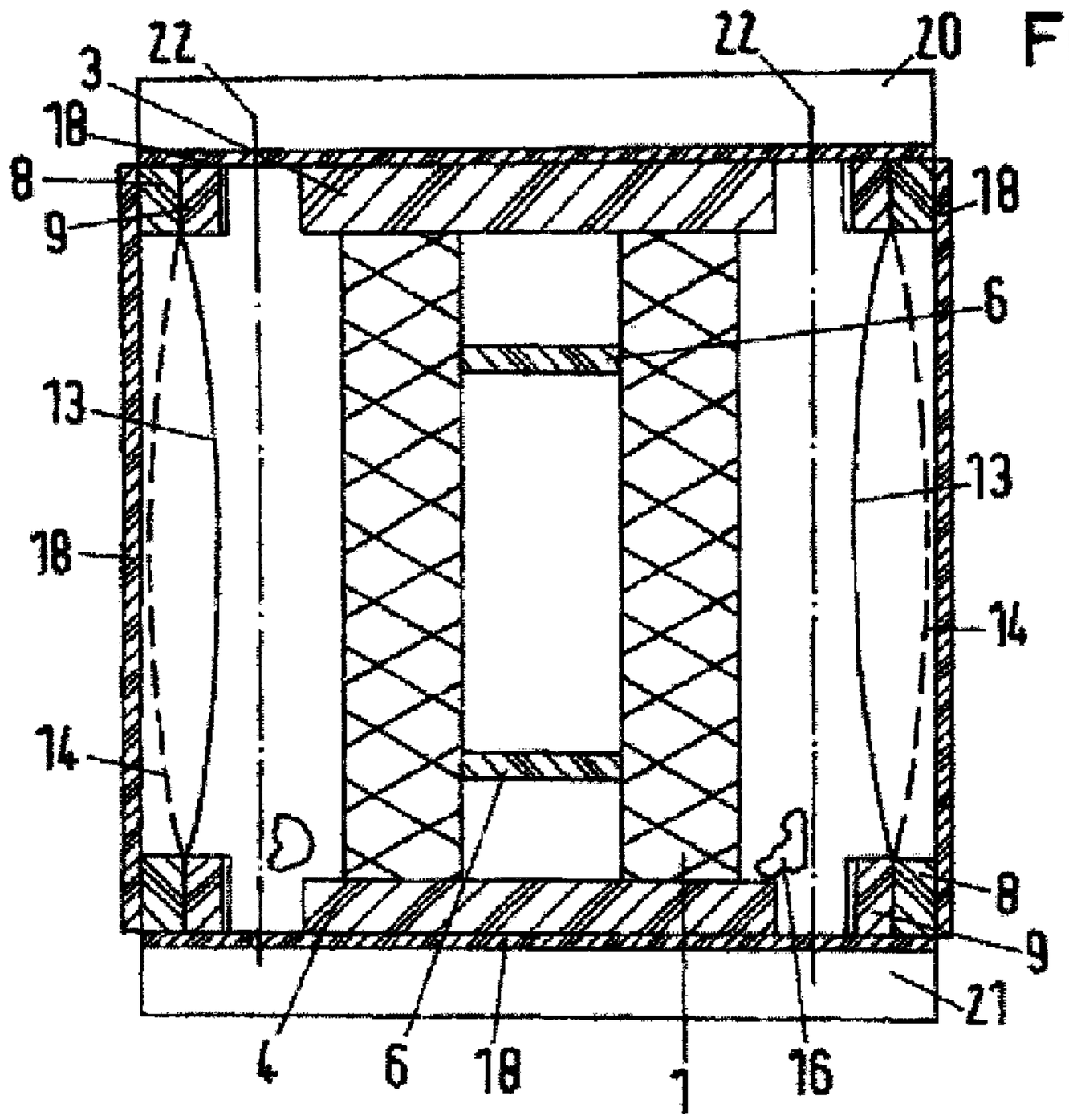
(54) Titre : BOITIER DE TRANSPORT POUR UN ENROULEMENT OU UN BLOC D'ENROULEMENT
(54) Title: TRANSPORT HOUSING FOR A COIL OR A COIL BLOCK

Fig.1



(57) Abrégé/Abstract:
The invention relates to a transport housing for a coil or a coil block, having an upper (20) and a lower pressing plate (21), wherein the coil (1) or the coil block is arranged between the two pressing plates (20, 21) and the latter can be braced against each other by

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(57) Abrégé(suite)/Abstract(continued):
means of a plurality of tension rods (22) in the manner of an axial tension configuration, having a frame (8/9) enclosing the coil (1) or the coil block to which a membrane (13/14), movable both toward the inner chamber of the transport housing and toward the outside, is fastened and having an outer housing (18) which provides mechanical protection for the membrane (13/14) and enables unhindered movement of the membrane (13/14) to the outside.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
11. August 2011 (11.08.2011)

PCT

(10) Internationale Veröffentlichungsnummer
WO 2011/095391 A1

(51) Internationale Patentklassifikation:
H01F 27/02 (2006.01) *B65D 85/672* (2006.01)
B65D 85/66 (2006.01) *B65D 85/676* (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2011/050610

(22) Internationales Anmeldedatum:
18. Januar 2011 (18.01.2011)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10001256.6 8. Februar 2010 (08.02.2010) EP

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Erklärungen gemäß Regel 4.17:

— *Erfindererklärung (Regel 4.17 Ziffer iv)*

Veröffentlicht:

— *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

(54) **Title**: TRANSPORT HOUSING FOR A COIL OR A COIL BLOCK

(54) **Bezeichnung** : TRANSPORTGEHÄUSE FÜR EINE WICKLUNG ODER EINEN WICKLUNGSBLOCK

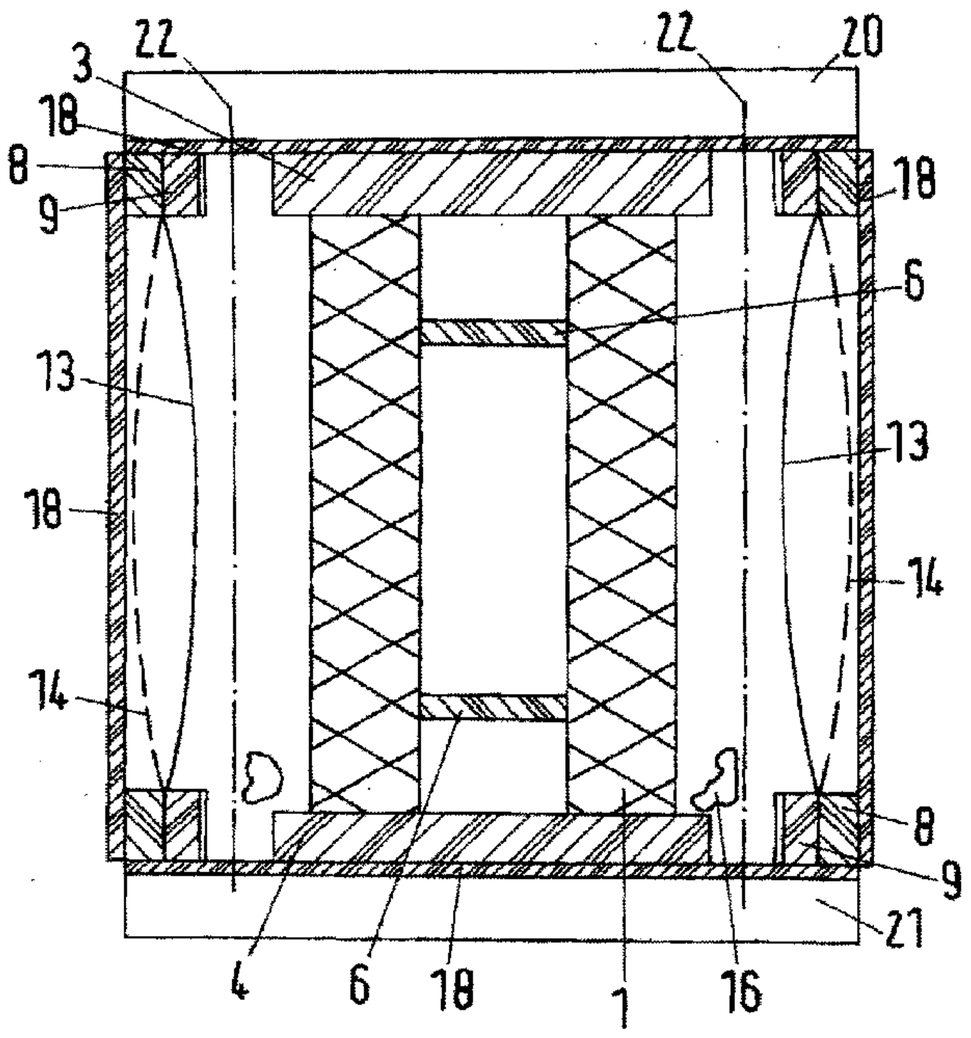

Fig.1

(57) Abstract: The invention relates to a transport housing for a coil or a coil block, having an upper (20) and a lower pressing plate (21), wherein the coil (1) or the coil block is arranged between the two pressing plates (20, 21) and the latter can be braced against each other by means of a plurality of tension rods (22) in the manner of an axial tension configuration, having a frame (8/9) enclosing the coil (1) or the coil block to which a membrane (13/14), movable both toward the inner chamber of the transport housing and toward the outside, is fastened and having an outer housing (18) which provides mechanical protection for the membrane (13/14) and enables unhindered movement of the membrane (13/14) to the outside.

(57) Zusammenfassung: Es wird ein Transportgehäuse für eine Wicklung oder einen Wicklungsblock vorgeschlagen, mit einer oberen (20) und einer unteren Pressplatte (21), wobei die Wicklung (1) oder der Wicklungsblock zwischen beiden Pressplatten (20, 21) angeordnet ist und letztere mittels mehrerer Zugstangen (22) gegeneinander im Sinne einer axialen Spannkonfiguration verspannbar sind, mit einem die Wicklung (1) oder den Wicklungsblock umschließenden Rahmen (8/9), an welchem eine sowohl zum Innenraum des Transportgehäuses als auch nach außen hin bewegliche Membran (13/14) befestigt ist und, mit einem Außengehäuse (18), welches einerseits einen mechanischen Schutz für die Membran (13/14) bietet und andererseits eine ungehinderte Beweglichkeit der Membran (13/14) nach außen hin ermöglicht.

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Transport housing for a coil or a coil block

Description

The invention relates to a housing for a coil or a coil block.

As result of the increasing number of on-site repairs to transformers and also due to bottlenecks in coil manufacture in individual manufacturing locations of a transformer plant while there is simultaneously free winding capacity at other locations, the transportation of coils for oil-filled transformers >1000 kVA and pre-assembled coil blocks without the associated transformer tank and without associated cores is acquiring ever greater importance.

Coils for oil-filled transformers must be transported

A) completely dry,

B) vertically and axially clamped with a defined force,

C) radially supported,

D) and complying with specified width and height dimensions.

The requirement according to A) results from the fact that, in the case of on-site repairs, technical equipment for drying the coils is not usually available and neither can it be provided at reasonable expense. On the other hand, when coils are transferred between different manufacturing locations without dry transportation, the coils must first be dried before installation, which often results in time and capacity problems.

The requirement according to B) results from the fact that coils have to be fitted in a short-circuit-proof manner, axially clamped under a defined force and thereby set up under pressure to a defined installation

length. However, the technical prerequisites for pressing coils and coil blocks are not usually available on site. On the other hand, when coils are transferred between different manufacturing locations, the same time and capacity problems can occur as with drying. It is not technically possible to transport coils without any axial clamping.

The necessity for radial support when transporting coils as a requirement according to C) results from the fact that coils and coil blocks mounted on the active part are supported by the solid core legs. Their construction with correspondingly thin supporting cylinders is not designed for unsupported transportation. It is not possible to transport coils without radial fixing or support.

The requirements according to D) result from width dimensions which, in the case of land transport, arise from the width of the roadways to be used and the building regulations for trucks derived therefrom, and from height dimensions which are derived from necessary bridge clearances and similar. The same also applies to rail transport. In the case of sea transport, in addition to the above-mentioned requirements, container dimensions and the requirements relating to stackability must also be taken into account.

According to the prior art, when transporting coils or coil blocks, the requirements according to B) and C) are usually implemented by fitting said coils or coil blocks into a press frame consisting of lower and upper pressing plate and tie rods for fixing under pressure.

According to the prior art, the requirement according to A) is usually fulfilled by transporting the coils in pressure-tight transport tanks which are specially designed for this means of transport and are therefore

expensive, wherein the use of a transport tank is restricted to one or sometimes a few means of transport. The press frame with the coils is placed and fixed in this transport tank and then screwed pressure-tight by means of a cover. In order to provide protection against moisture during transportation, this configuration is then either filled with dry air, wherein a positive pressure must be maintained in the tank by means of an attached system with pressure cylinder for the whole of the transportation period, or the transport tank is filled with dried transformer oil and an oil-free space between the top of the coil and the bottom of the tank which is connected to the external atmosphere via an air dryer is used to balance the temperature. At the same time, the requirements according to D) with regard to the external dimensions must be complied with.

The previous implementation of the requirement according to A) for dry transportation by means of transport tanks has the following disadvantages

- Due to their construction and due to their manufacture, pressure-tight transport tanks are very expensive, i.e. the price of a transport tank is up to 40% of the cost of the leg coils to be transported.
- When transporting with dry air, the maintenance of the positive pressure must be monitored at regular intervals during transportation.
- The additional dimensions for transport tank, cover, compressed air system or dry air storage for oil transportation with air cushions significantly reduce the space remaining for the coil block itself in the given transport volume.
- Above a certain coil size, cost-intensive special transport means, including night travel, single lane closures, police escort etc., are required

depending on the dimensions of the pressed coil block.

- In the case of on-site repairs, these disadvantages including the associated additional costs must be taken into account in the absence of other alternatives.
- Up to now, the high transport costs have almost entirely prevented coils being transferred between different manufacturing locations to make use of free winding capacity for want of appropriate cost effectiveness.

The invention is based on the object of specifying a cost-effective transport housing for a coil or a coil block which fulfils the above-mentioned requirements.

According to the invention, this object is achieved by a transport housing for a coil or a coil block

- having an upper and lower pressing plate, wherein the coil or the coil block is arranged between the two pressing plates and the latter can be clamped against one another by means of a plurality of tie rods in the manner of an axial clamping configuration,
- having a frame enclosing the coil or the coil block to which a membrane, movable both towards the interior of the transport housing and towards the outside, is fixed, and
- having an outer housing which, on the one hand, provides mechanical protection for the membrane and, on the other, enables unhindered movement of the membrane to the outside.

The advantages which can be achieved with the invention consist particularly in that the coils or pre-assembled coil blocks withstand the loads of transportation, e.g. non-containerized sea transport in the form of individually packaged goods, without damage and without absorbing moisture. In comparison with the known prior

art, this results in a considerable reduction in transport costs. Advantageously, the structural components of the transport housing can be reused many times after completion of transportation and dismantling.

Expedient embodiments of the invention are characterized in the dependent claims.

The invention is explained below with reference to the exemplary embodiments shown in the drawing. In the drawing:

Fig. 1 shows a lateral section through a transport housing, wherein the functional principle of a membrane used in the transport housing is additionally outlined,

Fig. 2 shows a perspective view on a transport housing,

Fig. 3 shows a side view of a transport housing,

Fig. 4 shows a view on a transport housing with the housing cover removed,

Fig. 5 shows a lateral section through a transport housing,

Fig. 6 shows a detailed view relating to the housing structure.

A lateral section through a transport housing is shown in Fig. 1, wherein the functional principle of a membrane used in the transport housing is additionally outlined. A coil 1, the upper face of which makes contact with a preferably wooden upper block support 3 and the lower face of which makes contact with a likewise preferably wooden lower block support 4, can

be seen. A plurality of preferably wooden radial supports 6 serves to support the hollow cylindrical shaped interior of the coil 1. The transport housing has a supporting frame 8/9 which is likewise preferably made of wood and is formed from an outer part frame 8 and an inner part frame 9 forming a cuboid.

In particular, this frame 8/9 is also used to secure an outer housing 18, preferably made of wood, consisting of floor, cover and four side walls (plywood sheeting). At the same time, the upper block support 3 makes contact with the cover of the outer housing 18; likewise the lower block support 4 makes contact with the floor of the outer housing 18. For the axial clamping of the coil 1, an upper pressing plate 20 (pressing cover) is arranged on the outer surface of the cover and a lower pressing plate 21 (pressing floor) is arranged on the outer surface of the floor. These pressing plates 20, 21, which are at least partially made of metal, have a plurality of holes for the penetration of a plurality of tie rods 22 which run in a symmetrical manner in the interior of the transport housing. At the end, on at least one side, these tie rods 22 are provided with threaded holes so that the transport housing with the coil 1 inserted can be clamped between the upper pressing plate 20 and the lower pressing plate 21 using nuts placed on the tie rods 22 (fixing under pressure, axial clamping configuration).

A very important structural component of the transport housing is a membrane 13/14 which is preferably made of a plastic film, in particular polyethylene, and which by way of example consists of a total of four membrane sections (film sections) which are each clamped between outer part frame 8 and inner part frame 9 parallel to the side walls of the outer housing 18, designated

- membrane 13 the membrane position which occurs in the case of positive external pressure (in comparison with the pressure prevailing in the interior of the transport housing),
- membrane 14 the membrane position which occurs in the case of negative external pressure (in comparison with the pressure prevailing in the interior of the transport housing).

A desiccant 16, preferably in the form of a silica gel bag, is provided in the interior of the transport housing to thus absorb the residual moisture in the air in the interior of the transport housing.

A perspective view on a transport housing is shown in Fig. 2. The cuboid-shaped structure and the frame construction of the transport housing which encloses the cylindrical coil 1 can be clearly seen here. For clarity, all four side walls of the outer housing 18 have been removed and only the cover and floor of the outer housing 18 are shown. The upper pressing plate 20 is in the form of a cross formed from two beams, and the ends of each of a total of five tie rods 22 which are fixed to the upper pressing plate are also shown. The lower block support 4 and the frame 8/9 consisting of the outer part frame 8 and the inner part frame 9 can likewise be seen, wherein, in the case of the four side walls of the outer housing 18, a preferably wooden intermediate frame 11 is additionally arranged centrally between the outer edges in each case to thus achieve an additional stiffening in the case of relatively large side walls and to achieve an additional central fixing facility when each side wall is formed from two side wall halves (two-part construction of the side walls).

Additional, preferably wooden, stiffening sections 10 are provided in the corner regions of the frame 8/9 to

achieve an overall stiffening of the cuboid-shaped frame structure.

A side view of a transport housing is shown in Fig. 3. The upper pressing plate 20, the lower pressing plate 21 and a side wall of the outer housing 18 can be seen, wherein the side wall shown is made up of two side wall halves.

A view on a transport housing with the housing cover removed is shown in Fig. 4. In particular, the cross-shaped upper pressing plate 20 and the positions of the total of five tie rods 22 anchored therein can be seen. One tie rod 22 is arranged centrally; the further four tie rods 22 are arranged close to the four corners of the transport housing formed by the supporting frame 8/9 and the outer housing 18. The position of the upper block support 3 in relation to the coil 1 and to the side walls of the transport housing is shown dashed.

A lateral section through a transport housing is shown in Fig. 5, from which can be seen the axial clamping of the coil 1 between upper pressing plate 20 with upper block support 3 and lower pressing plate 21 with lower block support 4 using the tie rods 22. Further, the radial support 6, which by way of example is formed from three separate structural components, and the supporting frame 8/9 with protective outer housing 18 can be seen.

A detailed view relating to the housing structure can be seen in Fig. 6 which shows the structure in the edge region of the transport housing with outer part frame 8, inner part frame 9, edge stiffening section 10, intermediate frame 11, floor of the outer housing 18 and lower pressing plate 21. The membrane 13/14 fixed between outer part frame 8 and inner part frame 9 is of crucial importance for the transport housing. Here, the

edges of outer part frame 8 and inner part frame 9 are covered with an elastic structural component, preferably an L-section made of rubber (rubber strip) in order, on the one hand, to thus achieve a seal between the interior of the transport housing and the outer atmosphere and, on the other, to prevent sharp edges loading or acting upon the membrane 13/14.

It can already be seen from the above explanation of the transport housing according to the invention that the disadvantages listed in the introduction which occur with the prior art are avoided in that a tankless concept based on different physical principles compared with the known prior art is implemented in order to prevent the coil 1 absorbing moisture during transportation. This concept is based on the following assumptions:

The coil 1 is kept dry when being transported in the air-filled transport housing in that it is transported in an atmosphere consisting of dry air. A positive pressure is not necessary to maintain such a dry-air atmosphere or internal air which encompasses the coil. It must only be guaranteed that the pressure in the space surrounding the coil or in the interior can be matched to the pressure outside without an exchange of air taking place between the dry internal air and the external air or the possibly moist external air. When this balance has been established, no further exchange of air takes place, that is to say the dry air remains inside and the moist air remains outside.

This applies physically for the macroscopic range and can be maintained over a limited period until molecular mixing processes begin. It must be assumed that this limited period is of the order of magnitude of six to eight weeks and that in practice an exchange of air does not take place in this period when the pressure

balance or the equality of the internal/external pressure is guaranteed, even when there are small gaps between the interior of the transport housing and the external atmosphere. Here, the pressure balance is achieved with comparatively simple means by the membrane principle using the membrane 13/14.

The outer part frame 8 not only serves to clamp the membrane, but also as a spacer relative to the outer housing 18 - which constitutes a protective layer to prevent mechanical damage to the membrane 13/14 - and creates the space necessary for the possible expansion of the membrane 13/14 when the pressure in the interior of the transport housing increases, for example due to higher internal temperature compared with the external temperature. The pressure is balanced due to the expansion or bulging out of the membrane 13/14 with the resulting increase in the internal volume. When the external temperature is higher in comparison with the internal temperature, the process acts in the opposite direction; the membrane 13/14 bulges inwards and reduces the internal volume for the necessary pressure balance.

At the same time, the external free space between membrane 13/14 and outer housing 18 advantageously effects an additional thermal insulation which reduces the effects of internal/external temperature differences and slows down the necessary pressure balancing processes. For sea transportation and for extreme climatic conditions to be expected during transportation, the outer housing 18 is preferably sealed with acrylic and subsequently coated with paint and thereby made weatherproof.

In all cases, the above description refers to the coil 1. This can, of course also be a coil block.

With regard to clamping the pressing plate structure, a variant with five tie rods (including central rod) has been considered in the exemplary embodiment explained above. As an example, clamping forces up to approx. 600 kN are possible with this variant. As an alternative, a simpler variant with only four tie rods (central rod omitted) can also be implemented, wherein clamping forces up to approx. 400 kN are possible with such an embodiment. Variants with up to sixteen tie rods (and more) can be realized for large coil blocks where high clamping forces up to 2000 kN (and more) are required. With all embodiments, radial clamping is preferably carried out in each case by means of steel cylinders welded to the pressing plates.

List of references

1 Coil or coil block
2 ---
3 Upper block support (wood)
4 Lower block support (wood)
5 ---
6 Radial support (wood)
7 ---
8 Outer part frame (wood) of the frame 8/9
9 Inner part frame (wood) of the frame 8/9
10 Stiffening section (wood)
11 Intermediate frame (wood)
12 ---
13 Membrane position of the membrane 13/14 (polyethylene) for positive external pressure
14 Membrane position of the membrane 13/14 for negative external pressure
15 ---
16 Desiccant (silica gel bag)
17 ---
18 Outer housing with floor, cover, side walls (wood) of the transport housing for a coil or a coil block
19 ---
20 Upper pressing plate (made at least partially of metal)
21 Lower pressing plate (made at least partially of metal)
22 Tie rods (metal)

Patent claims

1. Transport housing for a coil or a coil block,

- having an upper (20) and lower pressing plate (21), wherein the coil (1) or the coil block is arranged between the two pressing plates (20, 21) and the latter can be clamped against one another by means of a plurality of tie rods (22) in the manner of an axial clamping configuration,
- having a frame (8/9) enclosing the coil (1) or the coil block to which a membrane (13/14), movable both towards the interior of the transport housing and towards the outside, is fixed, and
- having an outer housing (18) which, on the one hand, provides mechanical protection for the membrane (13/14) and, on the other, enables unhindered movement of the membrane (13/14) to the outside.

2. The transport housing as claimed in claim 1, characterized in that the frame (8/9) is made up of an outer part frame (8) and an inner part frame (9), wherein the membrane (13/14) is clamped between the two part frames (8, 9).

3. The transport housing as claimed in claim 2, characterized in that the edges of outer part frame (8) and inner part frame (9) are covered with an elastic structural component, preferably an L-section made of rubber.

4. The transport housing as claimed in one of the preceding claims, characterized in that the outer housing (18) is fixed to the frame (8/9).

5. The transport housing as claimed in one of the preceding claims, characterized in that the coil (1) or coil block is in contact with the axial clamping

configuration by means of an upper (3) and a lower block support (4).

6. The transport housing as claimed in one of the preceding claims, characterized by a radial support (6) in the interior of the coil (1) or the coil block.

7. The transport housing as claimed in one of the preceding claims, characterized in that a desiccant (16) is arranged in the interior of the transport housing.

Fig.1

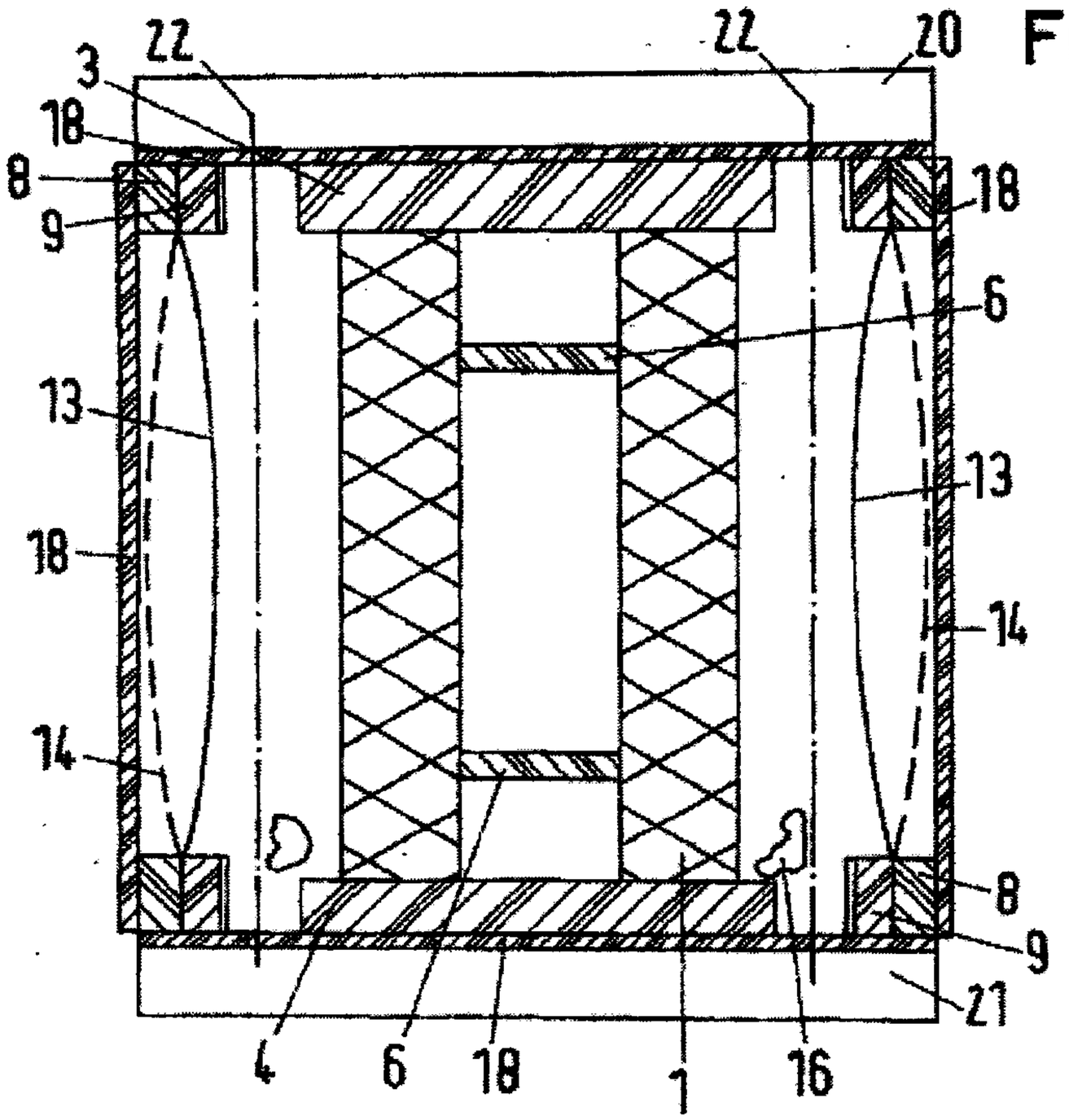
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Fig.2

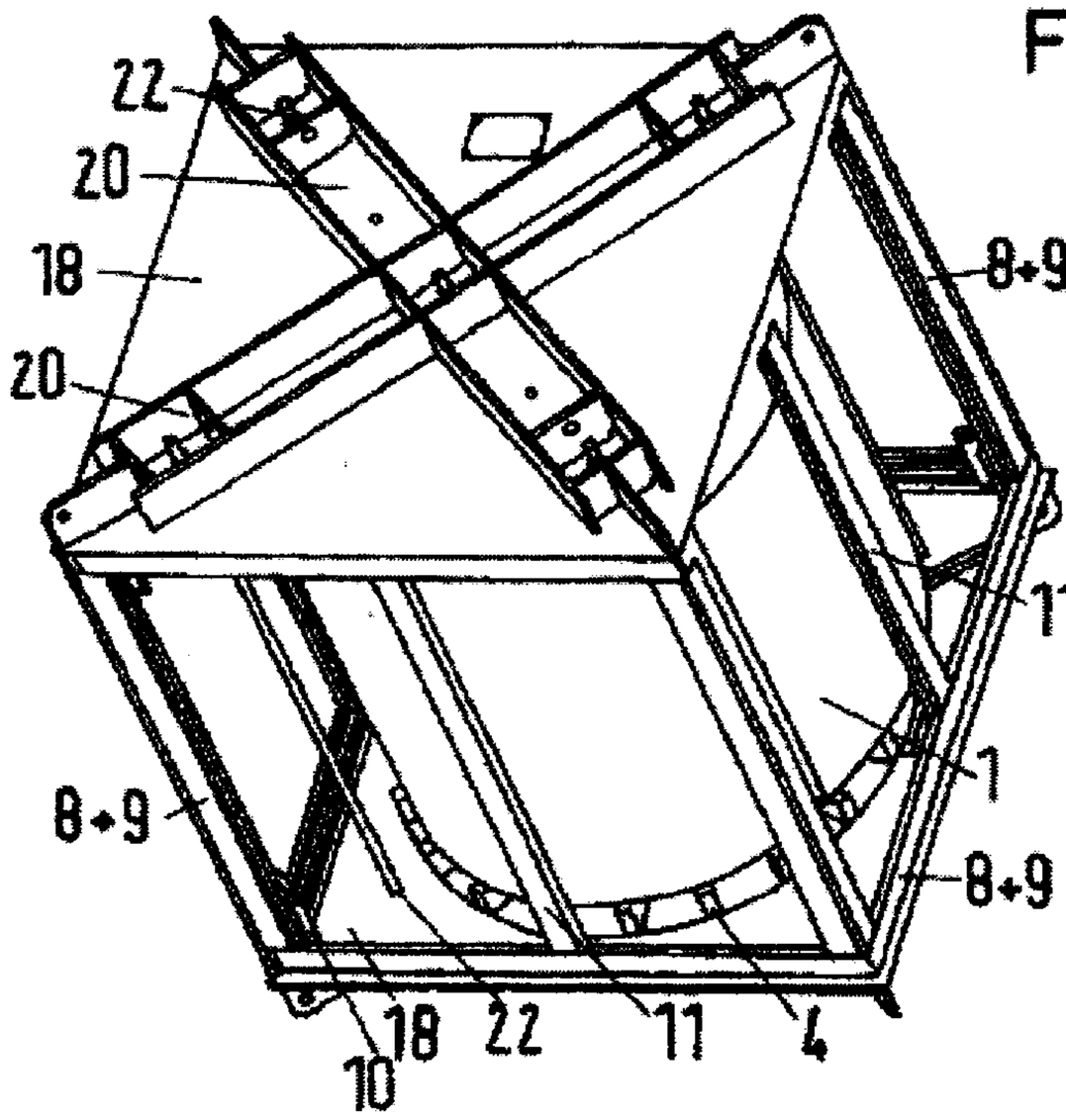
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Fig.3

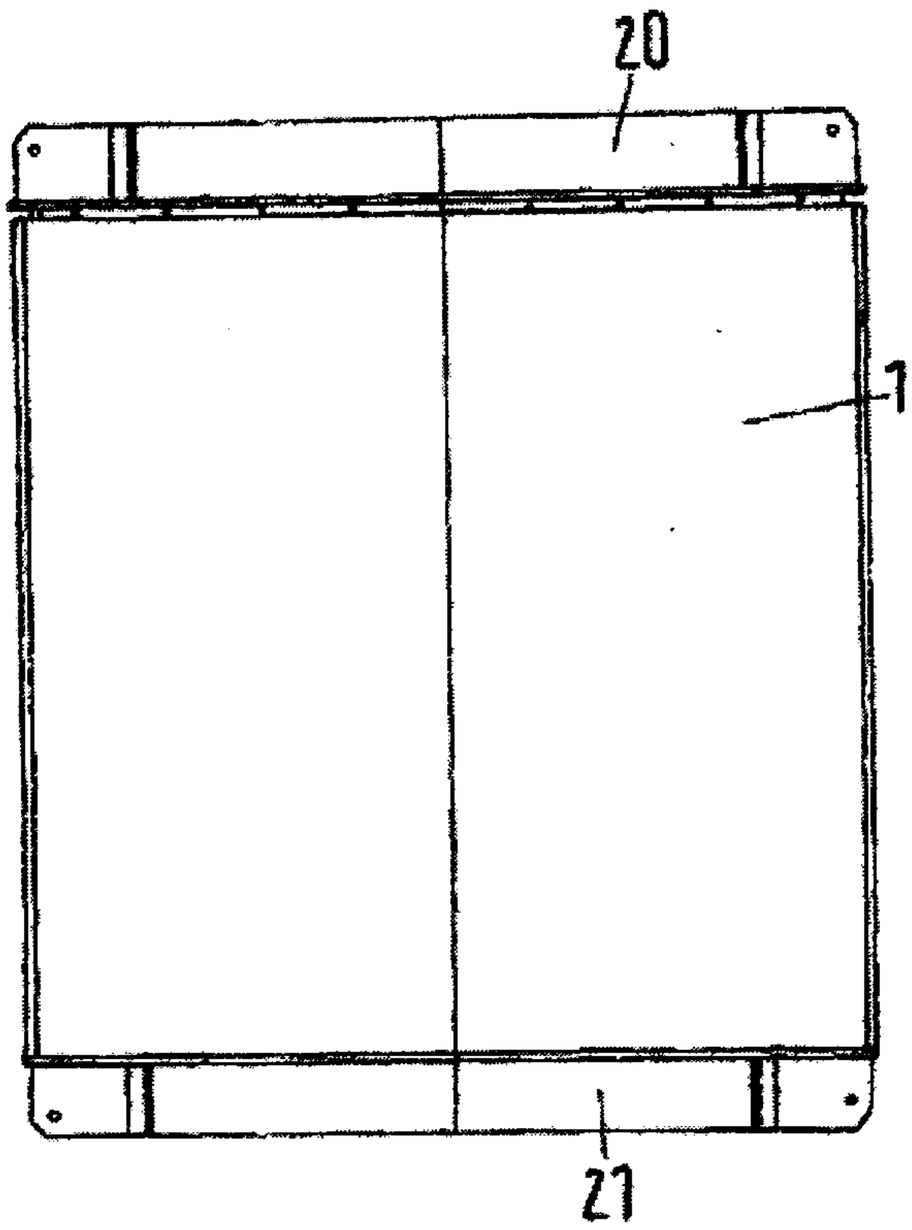

Fig.4

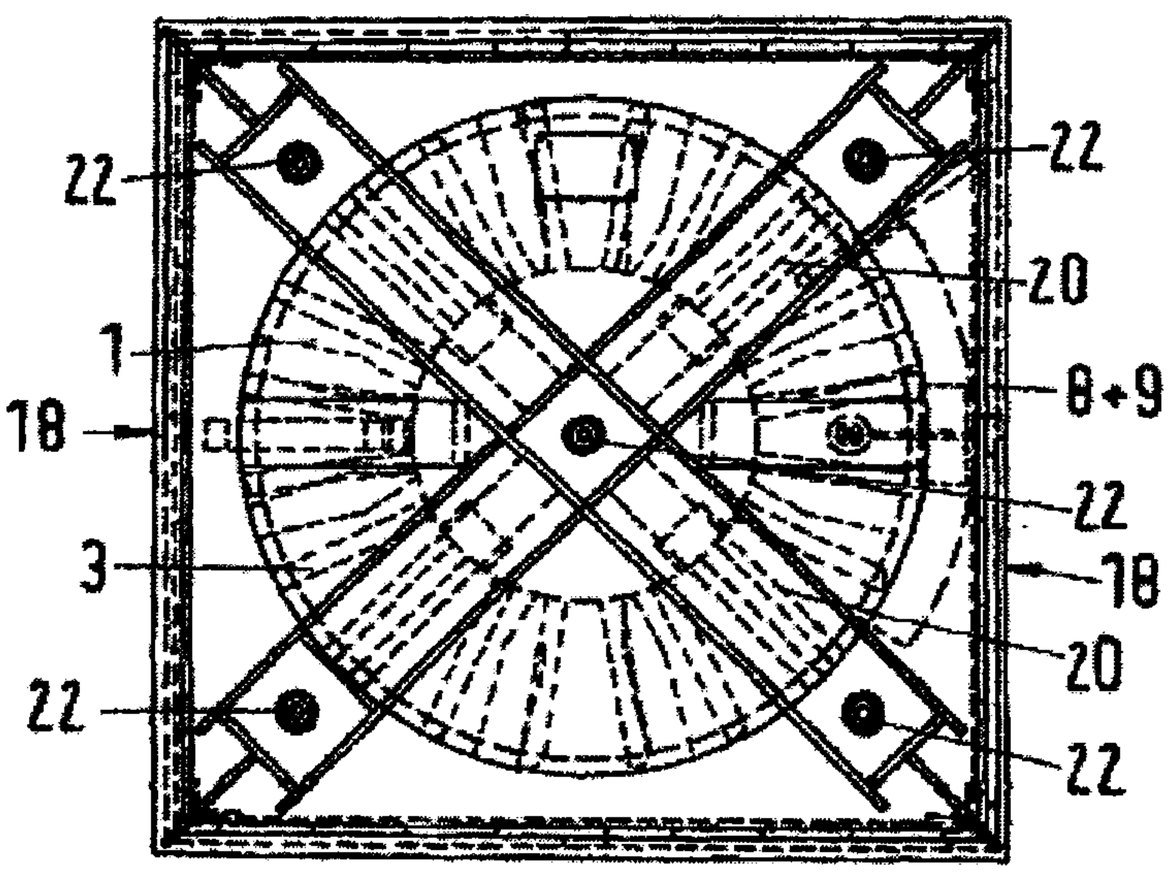

Fig.5

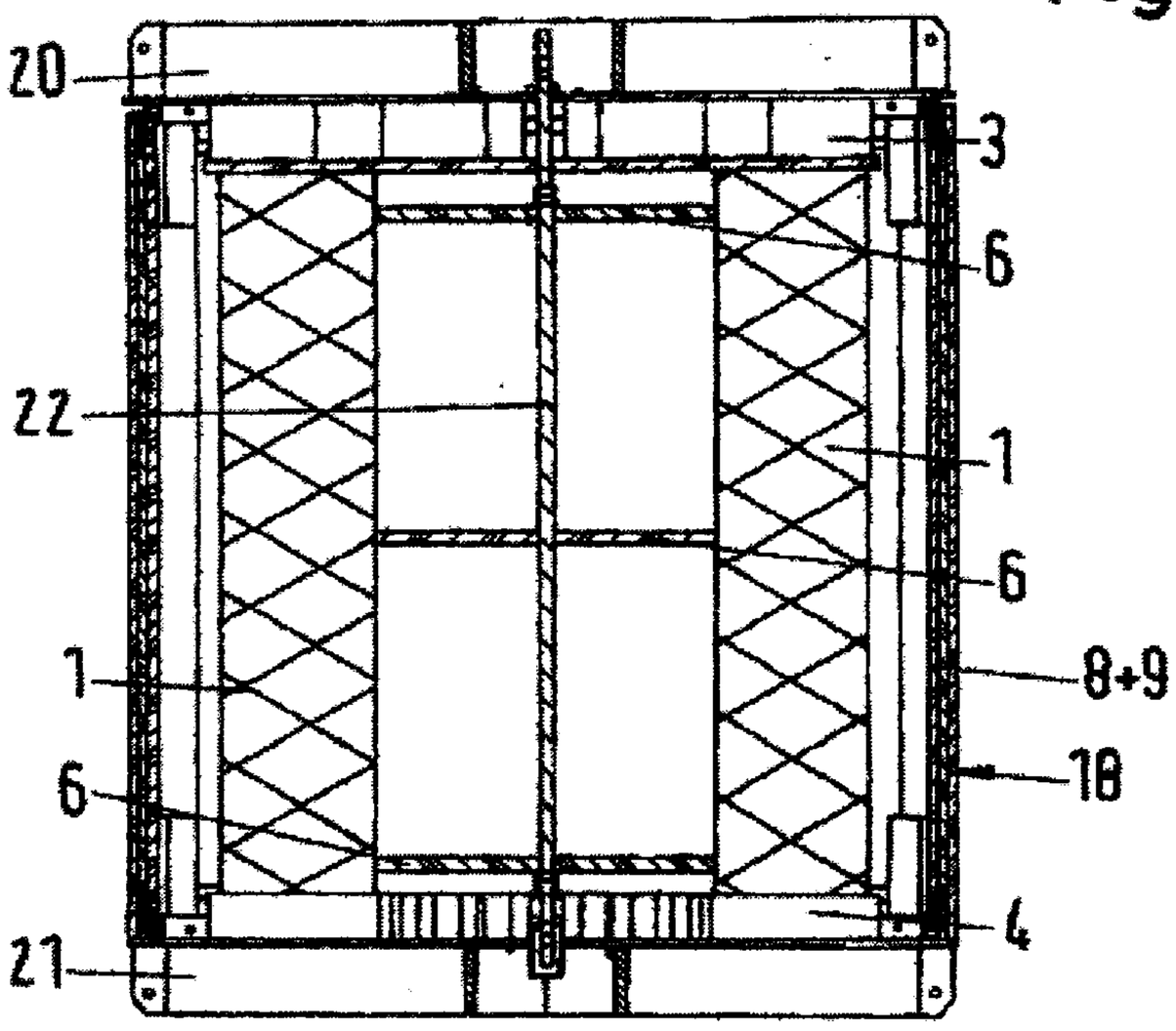

Fig.6

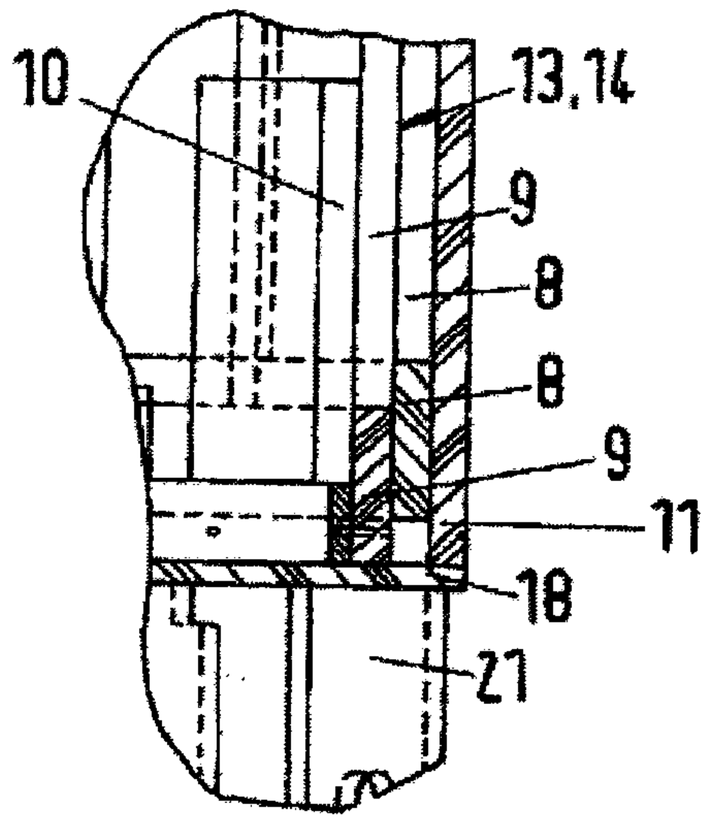

Fig.1