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(54) **Box of intermediate plates having an elastic plate of adjustable elasticity**

(57) Box of intermediate plates having an elastic plate of adjustable elasticity, composed of an intermediate cap plate or cover (2), an intermediate protection plate or base (3), and an adjustable intermediate elastic plate (4), placed between them with a breathing zone (9) in its perimeter to allow an expansion. The cover (2) is provided with flanges (5) to be fitted into some accommodations (6) disposed on the base (3), and lugs (7) for the preassembly of the base plate. The cover (2) and the base (3) have accommodations (8) and (11) to fix the elastic plate (4) with lugs (12). The intermediate elastic plate (4) has hollows (13), wave shapes consisting of ridges (14) and valleys (15), its perimeter zone (16) can be smooth or nonexistent, and its lower face is provided with lightening cavities (17) in the shape of mounting holes.

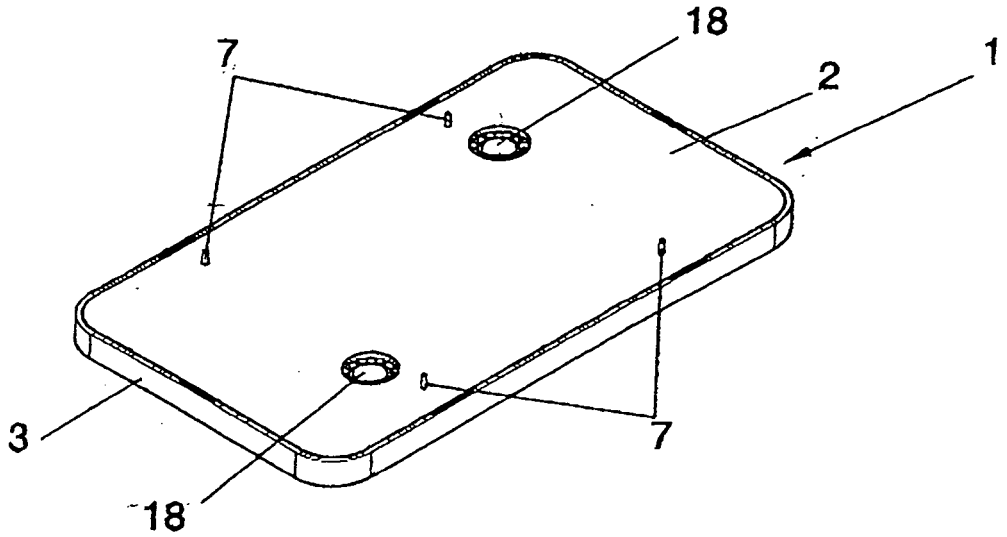

FIG. 1A

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Description

OBJECT OF THE INVENTION

[0001] The invention refers to, as expressed on the wording of this descriptive report, a box of intermediate plates with an elastic plate of adjustable elasticity, which provides to the function it is assigned to, a number of advantages and characteristics, apart from those inherent to its organization and constitution, to be detailed afterwards, which imply an innovative improvement in this field.

[0002] Specifically, the object of the invention consists of a compact structure of plates which constitute a box, assigned to be located under the base plate of any indirect rail fastening system, its aim being to give elasticity to such system. The structure mainly comprises an intermediate elastic plate located inside a box, which is composed of an intermediate cap plate, acting as a cover, and an intermediate protection plate, acting as a base.

[0003] Each of the elements of the structure composing the box mentioned before, along with its properties, is known as "intermediate plate", as opposed to the under rail plate located on the base plate of an indirect rail fastening system.

FIELD OF THE INVENTION

[0004] This invention has its field of application in the industry dedicated to the manufacturing of equipment for railroad transportation systems, and especially to slab track systems.

BACKGROUND OF THE INVENTION

[0005] As is widely known, a slab track or track on a concrete slab is an infrastructure system whose aim is to improve rail quality and reduce excessive railroad maintenance costs. Its main characteristic is that it is manufactured without ballast. It consists of a concrete slab which transmits a uniform stress distribution to the platform, but of a lower value, and has the advantages of supporting higher loads per axle, decreasing pressure transmitted to the platform, and having remarkably lower maintenance costs.

[0006] Parts of slab track are:

- A concrete slab.
- An intermediate plate which gives elasticity to the track.
- A base plate, much more rigid, which supports and transmits the loads to the slab. It has a double fastening system: from the base plate to the slab anchorage, and from the rail to the base plate.
- An under rail plate, which can also give elasticity to the track and support directly the load of the rail.
- And a rail, anchored to the base plate by means of an elastic fastening system.

[0007] Nowadays, and as a reference to the status of technique, it has to be mentioned that the applicant is not aware of the existence, for the purpose herein concerned, of any other invention with technical, structural and constitutive characteristics similar to the ones of the box of intermediate plates having an elastic plate of adjustable elasticity supported by this invention, whose main objective is to give elasticity to the indirect rail fastening systems.

EXPLANATION OF THE INVENTION

[0008] In this way, the device supported by the invention, as stated, represents an important novelty in its field of invention, its characterizing features being suitably compiled in the claims of this descriptive report.

[0009] Specifically, the structure which constitutes the box supported by this invention, as previously mentioned composed of an intermediate elastic plate located inside a box which comprises respectively an intermediate cap plate acting as a cover and an intermediate protection plate acting as a base, has two main properties: elasticity and compactness.

[0010] The elasticity is given by the intermediate element of the structure, known as intermediate elastic plate, having adjustable elasticity.

[0011] The compactness is obtained by protecting such intermediate elastic plate through a closed box, which is composed of a cover known as intermediate cap plate and a base known as intermediate protection plate, both of them made of a comparatively much more rigid material than the intermediate elastic plate.

[0012] All these things considered, we now proceed to specify the characteristics and functions of each of the said intermediate plates composing the box object of the invention.

[0013] The intermediate cap plate or cover is located in the upper part of the box structure, in direct contact with the base plate of the indirect rail fastening system under which the structure is situated. Such cover is used to close the box and thus protect the intermediate elastic plate which is placed inside. The cover allows a vertical movement by means of a flange system, but not to move upward beyond a limit.

[0014] The said flanges are part of the pre-assembly system, since they must be able to support the weight of the box structure. They will allow two possible pre-assemblies: of the box structure during its transportation and of the box structure with a base plate having a compatible assembly. For that purpose, a lug system is disposed on the upper face of the cover or intermediate cap plate, that is, on the face in contact with the base plate, for a possible assembly under such base plate.

[0015] On the other hand, some accommodations are disposed on the inner face of the cover to position the elastic plate and prevent its movement during the handling and transportation of the box structure. The rest of the surfaces of the cover is completely smooth to allow

an appropriate deformation of the intermediate elastic plate.

[0016] The cover is of a much more rigid material than the elastic plate and must distribute and transmit the loads from the rail through the base plate of the indirect rail fastening system.

[0017] In contrast with this, the intermediate protection plate or base constitutes the base of the box and is complementary to the previously described cover in the protection of the intermediate elastic plate. The base has, jointly with the cover, a slightly bigger perimeter than the one of the intermediate elastic plate, forming a breathing zone which allows the expansion of the intermediate elastic plate under compression load. Both the base and the cover have in common their rectangular shape and the corners, which are widely rounded.

[0018] The base gives lateral and lower protection to the structure during the building of the slab on which it will lean on in the end, and during all its useful life.

[0019] It is important to remark that plural accommodations are disposed along the inner perimeter of the lateral wall of the base, suitable to receive the aforementioned flanges of the cover, and aimed at allowing them to perform a vertical movement but not to exceed a limit, which is why they are positioned to be coincident with the flanges and also have slightly bigger dimensions.

[0020] Innerly, the base allows the intermediate elastic plate that is received to have a stable and homogeneous support. Besides, it has plural accommodations, just like the cover or cap plate, to position the elastic plate and prevent its movement during the handling and transportation of the structure.

[0021] It must be stated that although, contrary to the cover, a specific resistance is not necessary for the load distribution, the fact that the base is built with the same material as the cover will allow it to have a lower thickness, which will make possible to optimise the total thickness of the box, and thus get the intermediate elastic plate to have a maximum thickness. Consequently, its resistant function will be analogous to the one of the cover.

[0022] Finally, the intermediate elastic plate is settled inside the box, composed, as mentioned before, of an intermediate cap plate or cover and an intermediate protection plate or base. The elastic plate is adjustable to the cover and the base of the box, between which it is positioned by means of small lugs, disposed on the corners and coupled in the corresponding accommodations assigned for that purpose in the inner faces of the cover and the base. This is useful to prevent any kind of movement inside the structure, previously mounted, during its handling and transportation.

[0023] In a plan view, the sides of the said intermediate elastic plate are provided with hollows to allow a better expansion under compression load. As mentioned before, the box containing it has a breathing zone in its perimeter to prevent the sides of the elastic plate from bumping into the inner walls of the box in cases of extreme loads.

[0024] It is also important to remark that the upper face of the elastic plate has wave shapes consisting of ridges and valleys, constituted by spherical caps. The perimeter zone can be smooth or nonexistent. In addition, the inner face is provided with lightening mounting holes.

[0025] With regard to its functionality, as previously mentioned, the elastic plate gives elasticity to the structure. The ridges and the valleys, the smooth perimeter surface and the mounting holes, which are part of the plate geometry, make possible to adjust its elasticity.

[0026] So, the valleys can be emptied or filled; the perimeter zone can be smooth, with a variable thickness and height or nonexistent; and the lightening mounting holes of the inner face also allow to adjust elasticity by means of lightening combinations.

[0027] The intrinsic properties of the elastomeric material of the intermediate elastic plate constitute the other factor to give elasticity.

[0028] Therefore, the box structure of intermediate plates having an elastic plate of adjustable elasticity supported by the invention can be adapted to any kind of base plate of an indirect rail fastening system. This implies the advantage of being adaptable to different combinations, locations and shapes of the through bores used for the insertion of fixing screws.

[0029] Finally, it is important to remark that according to the final location of the indirect rail fastening system and the level of protection which is given to the intermediate elastic plate, it will be possible to seal the box with an elastic joint adapted system.

[0030] Consequently, the box of intermediate plates having an elastic plate of adjustable elasticity supported by this invention represents an innovative structure with structural and constitutive characteristics not known so far for such purpose, reasons which, together with its practical usefulness, grant enough basis to obtain the exclusiveness privilege applied for.

DESCRIPTION OF THE DRAWINGS

[0031] In order to complete this description and to ease a better understanding of the invention, we attach to this descriptive report, making part of the same, a set of layouts where, with an illustrative non limitative character, the following has been represented:

Figures number 1-A to 1-E show plural views of the box of intermediate plates having an elastic plate of adjustable elasticity object of the invention, already mounted, where the main parts and elements, along with their configuration and disposition can be seen. Specifically, Figure 1-A is a perspective view, Figure 1-B is a plan view, Figure 1-C is a cross-sectional view, and Figures 1-D and 1-D show some enlarged details of a section of Figure 1-C.

Figures 2-A, 2-B, 2-C and 2-D show, respectively, a down plan view, a top plan view, an elevation view

and detail of the intermediate cap plate or cover of the box according to the invention, displaying its general configuration and its different constitutive parts and elements.

Figures 3-A, 3-B, 3-C and 3-D show, respectively, a down plan view, a top plan view, a cross-sectional view and detail of the intermediate protection plate or base of the box.

Figures 4-A, 4-B, 4-C, 4-D and 4-E show, respectively, a perspective view, a down plan view, a top plan view, a cross-sectional view and detail of the intermediate elastic plate.

PREFERENTIAL EXECUTION OF THE INVENTION

[0032] In the light of the said figures, and according to their numbering, it may be seen different prefered embodiments of the device in question formed by the parts and elements described in detail hereinafter.

Therefore, as the Figures show, the said box (1) aimed, as previously mentioned, at being placed under the base plate of any indirect rail fastening system so as to give elasticity, is basically constituted through a set of intermediate plates, which comprises an intermediate cap plate acting as a cover (2) of the box, an intermediate protection plate acting as a base (3) of the box, and an intermediate elastic plate (4) of adjustable elasticity located inside the box (1) between them.

As can be seen in Figure 1-B, the cover (2) and the base (3) have a slightly bigger perimeter than the intermediate elastic plate (4), forming a breathing zone (9) aimed at allowing the expansion of the intermediate elastic plate (4) under compression load.

Likewise, it must be stated that both the cover (2) and the base (3) have a rectangular shape with widely rounded corners.

According to Figures 2-A to 2-D, the cover (2) or intermediate cap plate, located in the upper part of the box structure (1), in direct contact with the base plate of the indirect rail fastening system to which it is applied, is used to close the box (1) and protect the intermediate elastic plate (4) which is placed inside.

Such cover (2), which is made of a much more rigid material than the intermediate elastic plate (4) due to its supporting function, is provided with a flange system (5) in its perimeter, adapted to fit into some accommodations (6) disposed on the base (3), allowing their vertical movement, but not to move upward beyond a limit.

Besides, the upper face of the cover (2), that is, the face in contact with the base plate of the fastening system, is provided with lugs (7) for its possible pre-assembly under the said base plate.

In contrast with this, some accommodations (8) are disposed on the inner face of the cover (2) to position the intermediate elastic plate (4) and prevent its movement during the handling and transportation of the box structure (1), the rest of the surfaces of the cover (2) being completely smooth to allow an appropriate deformation of the intermediate elastic plate (4).

[0033] As can be observed in Figures 3-A to 3-D, the base (3) or intermediate protection plate constitutes the base of the box (1) and complements the already described cover (2) in the protection of the intermediate elastic plate (4).

[0034] The base (3), which gives lateral and lower protection to the structure, is provided with the aforementioned accommodations (6) along the inner perimeter of its lateral wall (10), aimed at receiving the flanges (5) of the cover (2). Such accommodations (6) are respective to the said flanges (5) and have slightly bigger dimensions.

[0035] Innerly, similar to the cover (2), it has plural accommodations (11) to position the elastic plate and prevent its movement during the handling and transportation of the structure.

[0036] The base (3) is built with the same material as the cover (2), so that it may have a lower thickness which makes possible to optimise the total thickness of the box (1), and get the intermediate elastic plate (4) to have a maximum thickness.

[0037] On the other side, the intermediate elastic plate (4), made of an elastomeric material and placed inside the box (1), as can be seen in Figures 4-A to 4-E, is positioned between the cover (2) and the base (3) which constitute such box (1) by means of small lugs (12), disposed on the corners and fitted into the corresponding accommodations (8) and (11), assigned for that purpose in the inner faces of the cover (2) and the base (3).

[0038] It is also important to remark that the sides of the intermediate elastic plate (4) are provided with hollows (13) whose purpose it to allow a better expansion of the plate under compression load, the previously mentioned breathing zone (9) being disposed to prevent the said sides of the intermediate elastic plate (4) from bumping into the inner walls of the box in cases of extreme loads.

[0039] Besides, the upper face of the intermediate elastic plate (4) has wave shapes consisting of ridges (14) and valleys (15), constituted by spherical caps, the perimeter zone (16) can be smooth or nonexistent, and the inner face is provided with lightening cavities (17) in the shape of mounting holes aimed at allowing to adjust its elasticity.

[0040] As previously mentioned, the box structure may be adapted to any kind of base plate of an indirect rail fastening system, for which the cover (2), the base (3) and the intermediate elastic plate (4) have through bores (18), suitable for the insertion of fixing screws, which may have different combinations, locations and shapes.

[0041] It will be possible to seal the box (1) with an elastic joint adapted system, according to the final location of the indirect rail fastening system and the level of protection which is given to the intermediate elastic plate (4).

[0042] Being already described the nature of this invention, as well as the way to put it into practice, it is not

considered necessary to make an extensive description for an expert in the field understands it reach and the derived advantages, stating that, within its essentiality, it might be put in practice in other ways differing in detail from such indicated in the title of the example, to which the protection requested will also reach, provided its main principle is not altered, changed or modified.

Claims

1. Box of intermediate plates having an elastic plate of adjustable elasticity, suitable for being settled under the base plate of any indirect rail fastening system, giving elasticity to such system, **characterized by** the fact that it comprises an intermediate cap plate which acts as a cover (2) of the box, an intermediate protection plate which acts as a base (3) of the box, and an intermediate elastic plate (4) of adjustable elasticity, placed inside the box (1) between them; wherein the cover (2) and the base (3) are made of a much more rigid material than the intermediate elastic plate (4) and have a slightly bigger perimeter, forming a breathing zone (9), aimed at allowing the expansion of the intermediate elastic plate (4) under compression load.

2. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claim 1, **characterized by** the fact that both the cover (2) and the base (3) have a rectangular shape with widely rounded corners.

3. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 and 2, **characterized by** the fact that the cover (2) or intermediate cap plate is located in the upper part of the box structure (1), in direct contact with the base plate of the indirect rail fastening system to which it is applied, being useful to close the box (1) and protect the intermediate elastic plate (4) which is placed inside.

4. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 3, **characterized by** the fact that the cover (2) is provided with a flange system (5) along its perimeter, adapted to fit into some accommodations (6) disposed on the base (3), which allow their vertical movement, but not to move upward beyond a limit.

5. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 4, **characterized by** the fact that lugs (7) have been disposed on the upper face of the cover (2), the one in contact with the base plate of the fastening system, so that it can be pre-assembled under the said base plate.

6. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 5, **characterized by** the fact that plural accommodations (8) can be seen in the lower face of the cover (2), aimed at positioning the intermediate elastic plate (4) and preventing its movement during the handling and transportation of the box structure (1); and by the fact that the rest of the surfaces of the cover (2) are completely smooth to allow an appropriate deformation of the intermediate elastic plate (4).

7. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 6, **characterized by** the fact that the base (3) or intermediate protection plate constitutes the base of the box (1) and is complementary to the cover (2) in the protection of the intermediate elastic plate (4); and by the fact that there are plural accommodations (6) along the inner perimeter of its lateral wall (10) aimed at receiving the flanges (5) of the cover (2), which have a coincident position with respect to the flanges and slightly bigger dimensions.

8. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 7, **characterized by** the fact that the base (3) is innerly provided with some accommodations (11) to position the intermediate elastic plate (4) and prevent its movement during the handling and transportation of the structure.

9. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 8, **characterized by** the fact that the intermediate elastic plate (4) is made of an elastomeric material; and by the fact that it is positioned between the cover (2) and the base (3) which constitute such box (1) by means of small lugs (12), disposed on the corners and fitted into the corresponding accommodations (8) and (11) made for that purpose in the inner faces of the cover (2) and the base (3).

10. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 9, **characterized by** the fact that the sides of the intermediate elastic plate (4) are provided with hollows (13) aimed at allowing a better expansion of the plate under compression load.

11. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 10, **characterized by** the fact that, so as to make possible to adjust its elasticity, the intermediate elastic plate (4) has wave shapes in its upper face consisting of ridges (14) and valleys (15) constituted by spherical caps, its perimeter zone (16) can be smooth or non-existent, and its lower face has plural lightening cavities (17) in the shape of mounting holes.

12. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 11, **characterized by** the fact that the cover (2), the base (3) and the intermediate elastic plate (4) are provided with through bores (18) for the insertion of fixing screws, which may have different combinations, locations and shapes, according to what is necessary in each case.

13. Box of intermediate plates having an elastic plate of adjustable elasticity, as per claims 1 to 12, **characterized by** the fact that it can be sealed with an elastic joint adapted system, according to the final situation of the indirect rail fastening system and the level of protection given to the intermediate elastic plate (4).

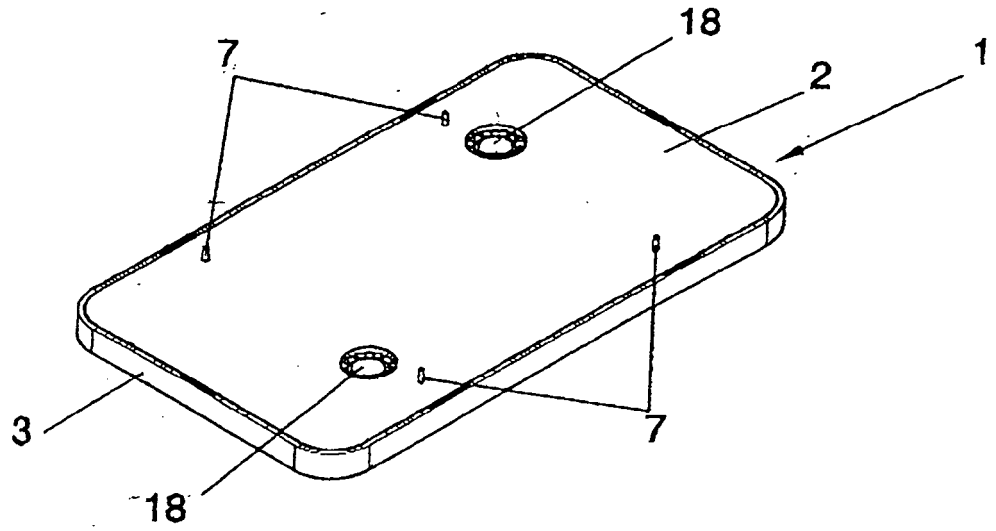


FIG. 1A

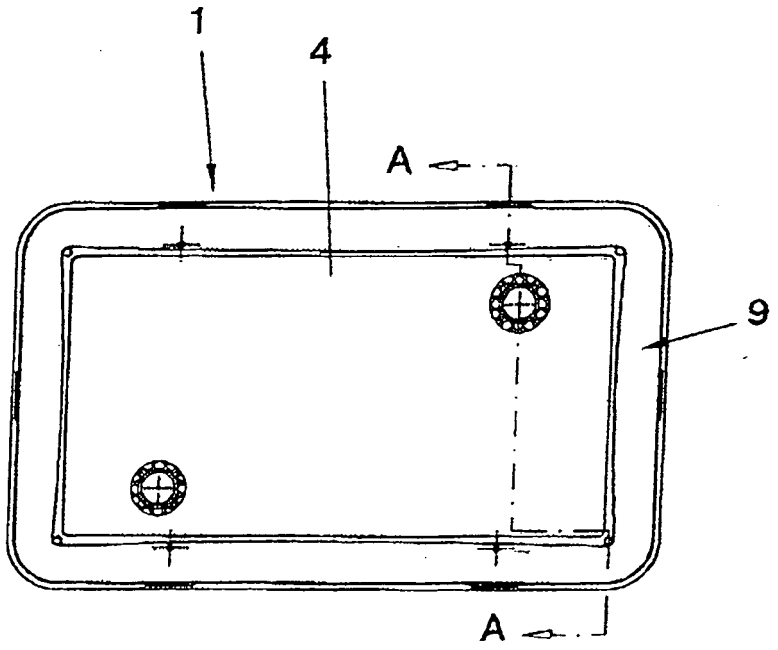
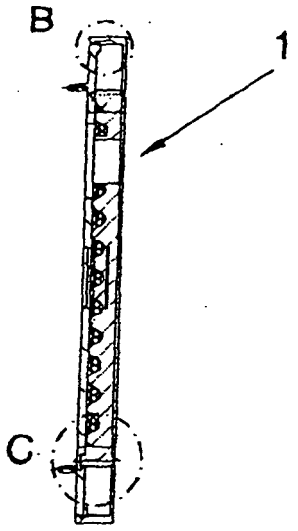


FIG. 1B



A-A

FIG. 1C

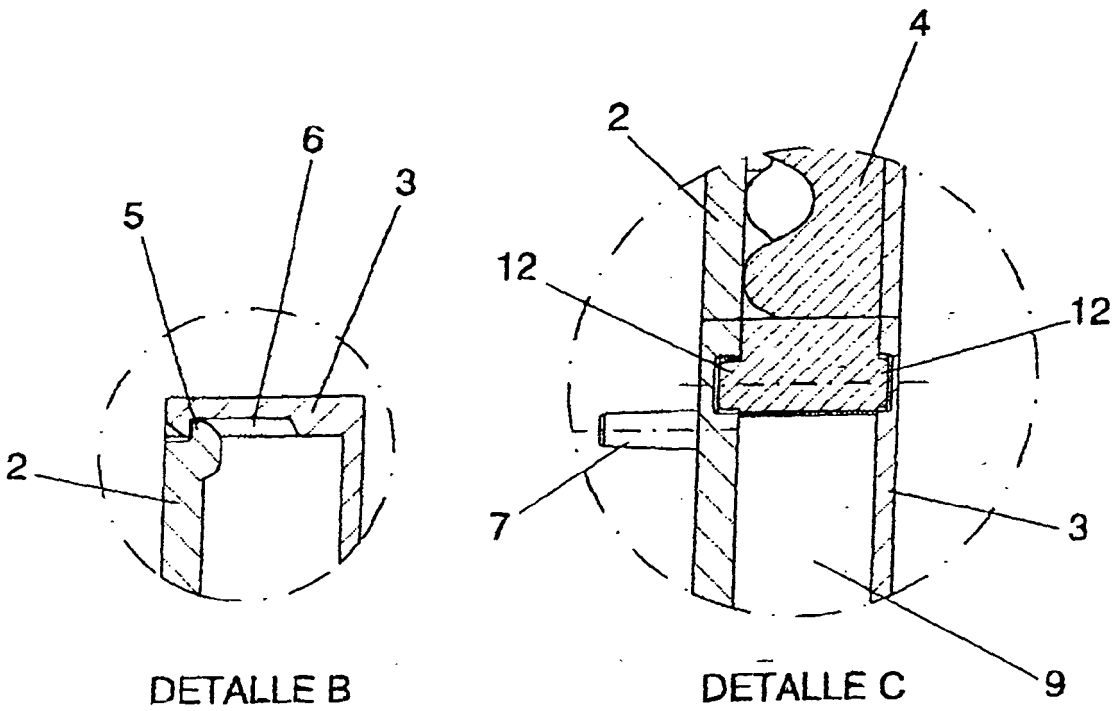


FIG. 1D

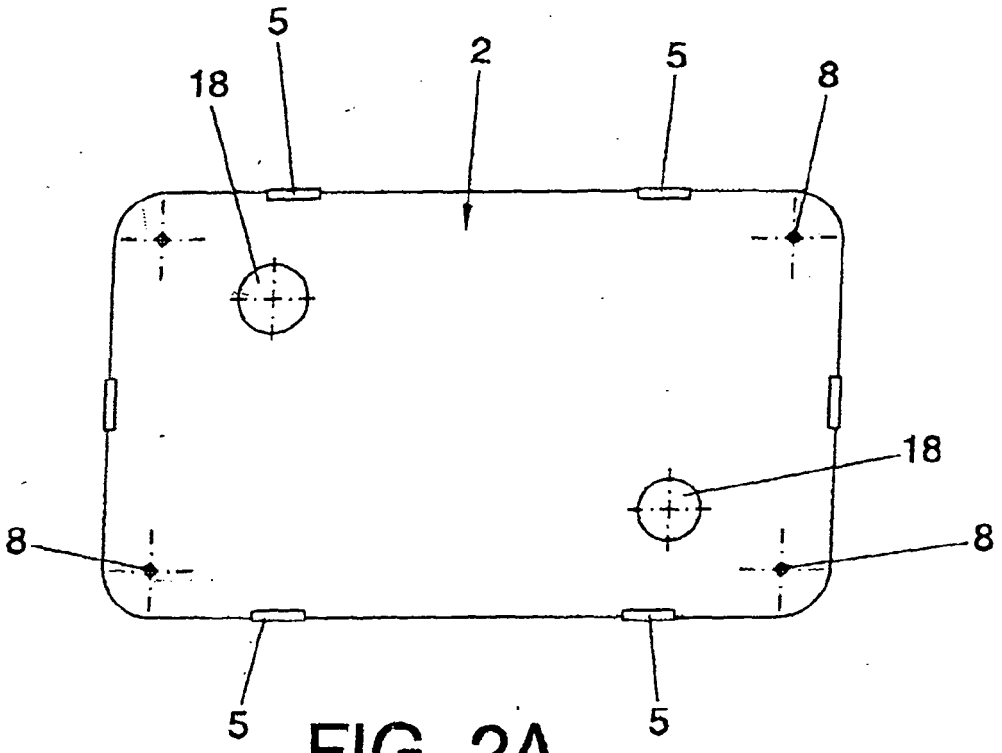


FIG. 2A

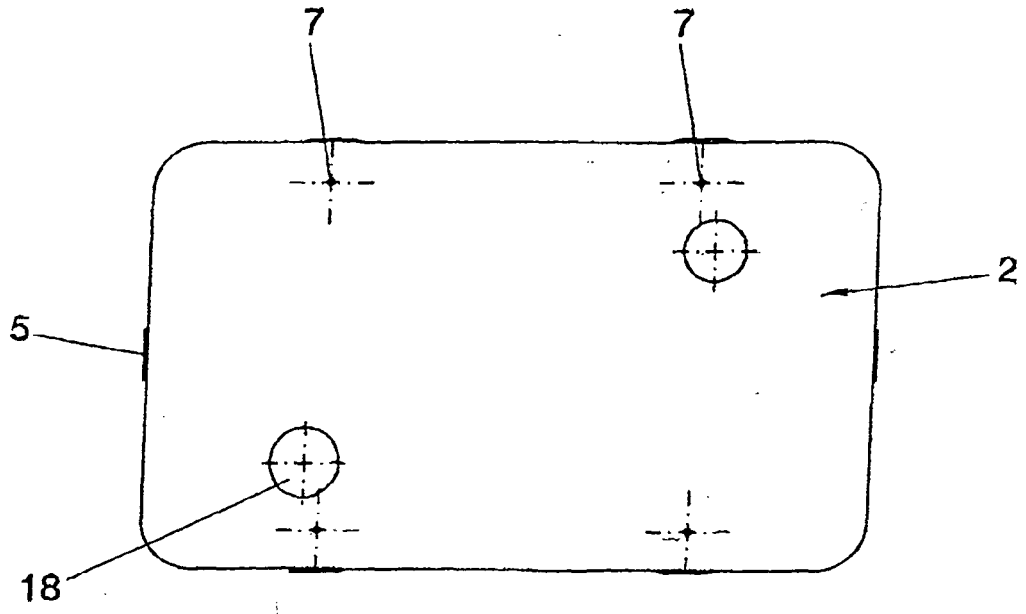


FIG. 2B

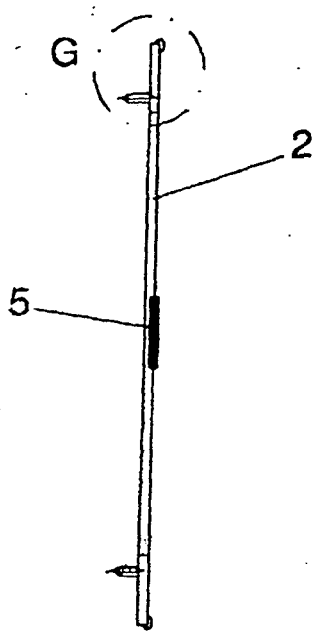
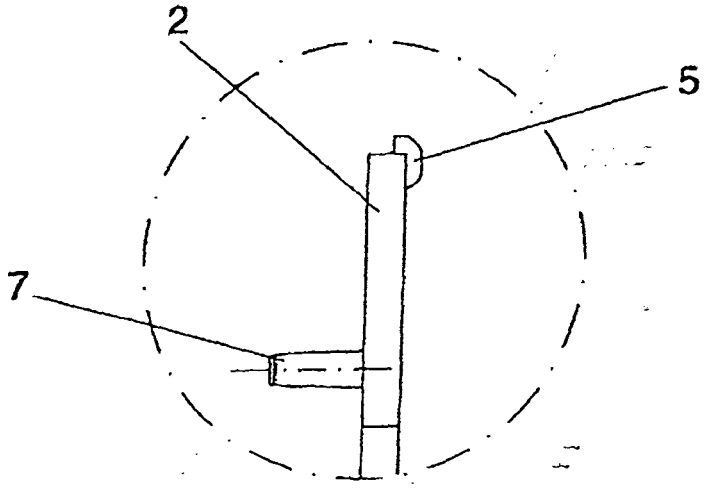


FIG. 2C



DETALLE G

FIG. 2D

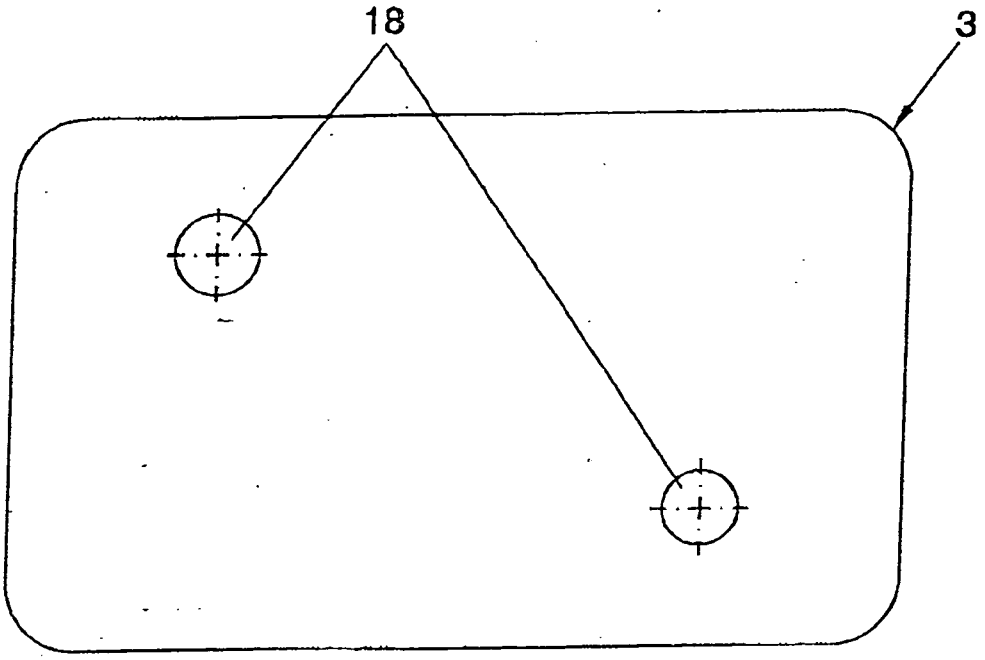


FIG. 3A

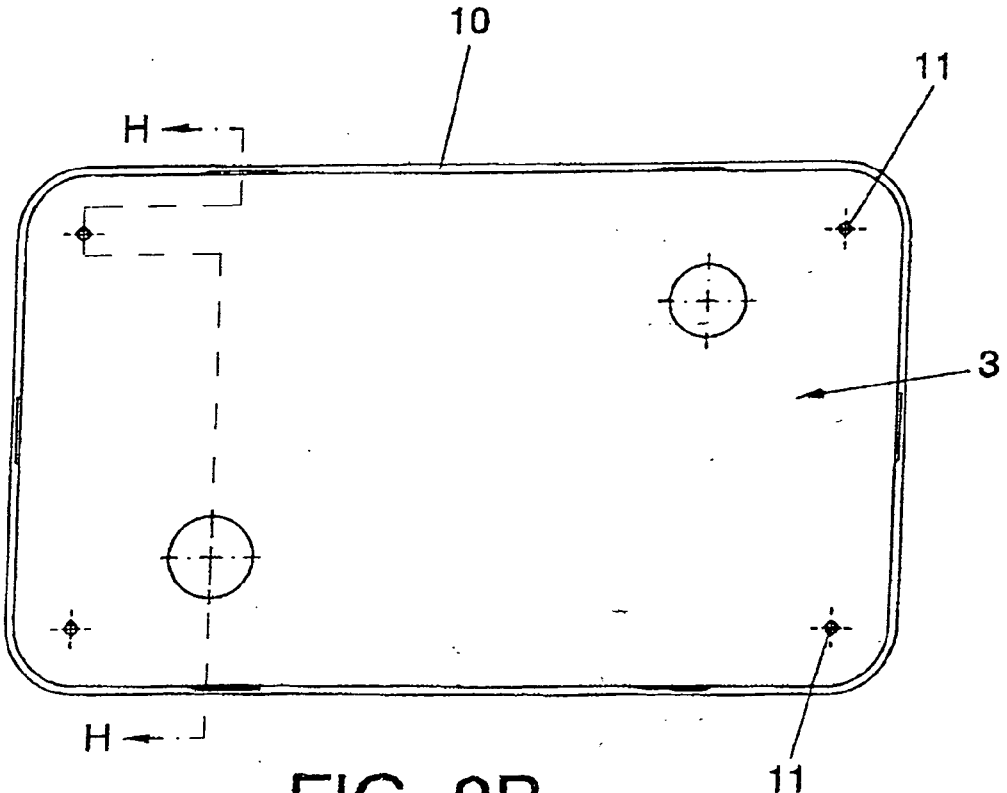
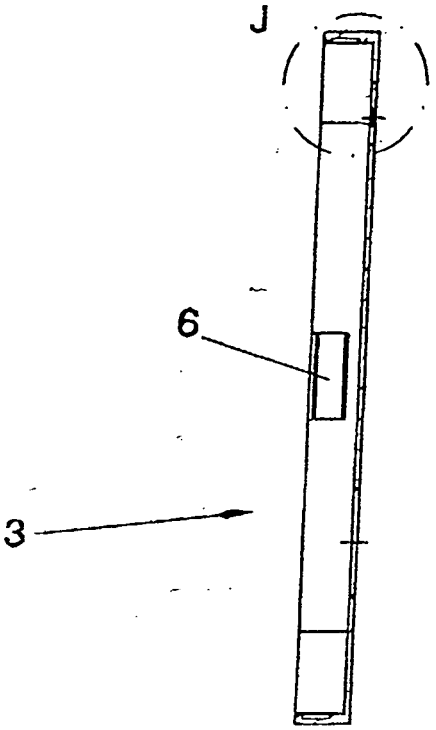
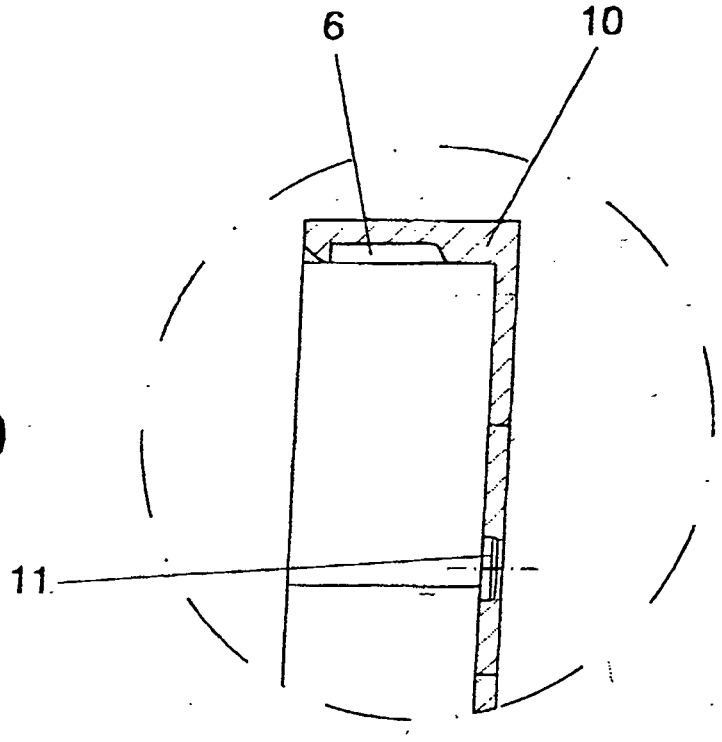


FIG. 3B



H-H

FIG. 3C



DETALLE J

FIG. 3D

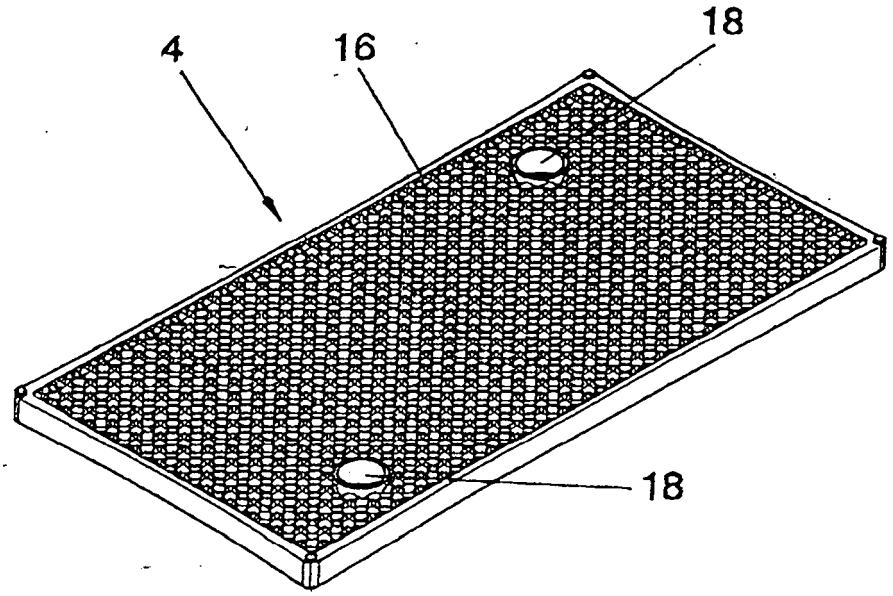


FIG. 4A

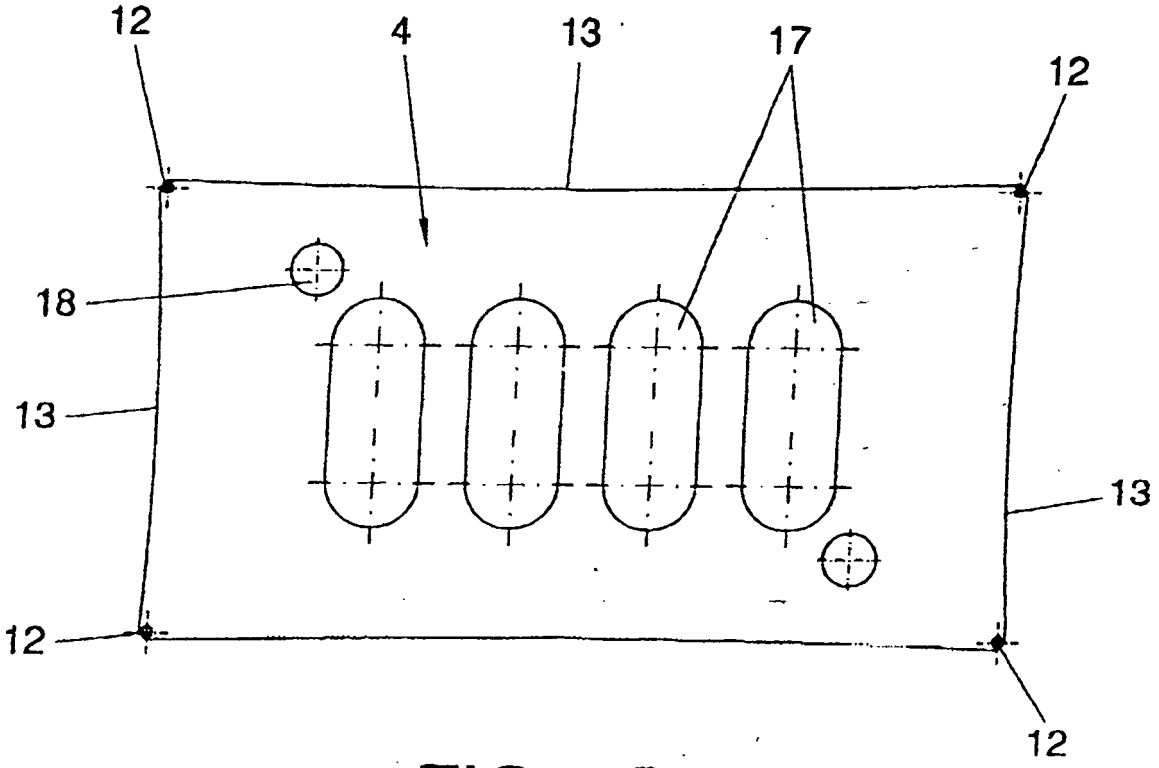


FIG. 4B

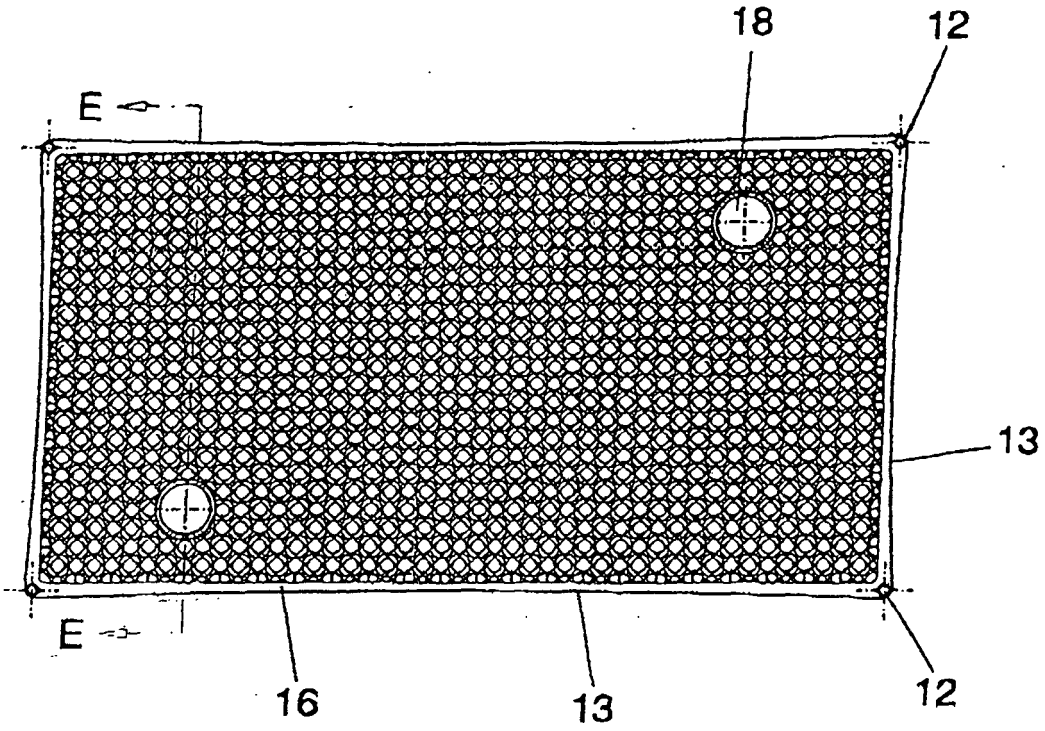
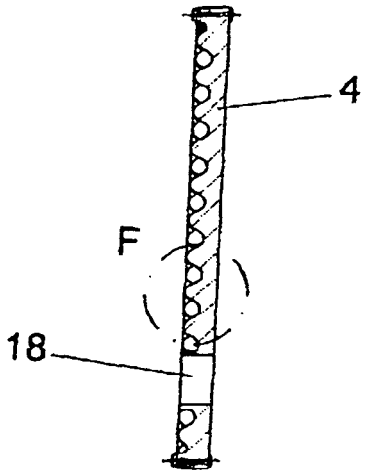
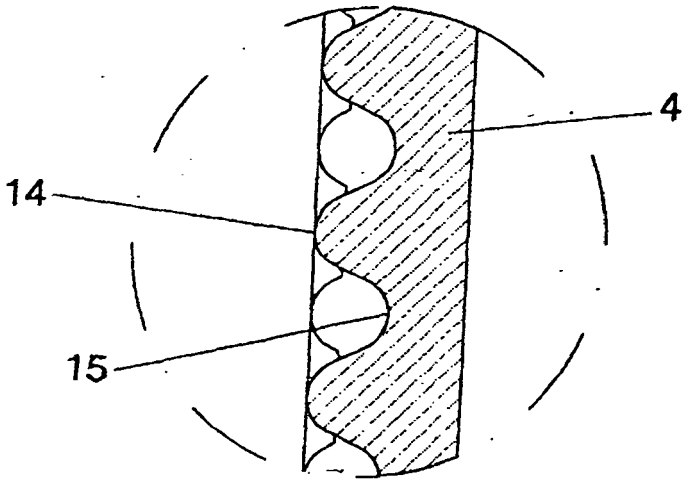


FIG. 4C



E-E

FIG. 4D



DETALLE F

FIG. 4D