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(54) **A dry setting equipment**

Trockenhärtungseinrichtung

Équipement de réglage à sec

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Description

[0001] The object of the instant application is the (temporary) isolation of harbor and inland marine infrastructure by dry setting equipment in order to provide safe and dry working space for underwater works and thus to make the infrastructure accessible to workers who have to work on the infrastructure. The dry setting equipment of interest here may be designated as a cofferdam. Examples of infrastructure also of interest are sheet or tubular piles, quay walls, bridge columns, lock doors, jetties, river embankments, etc.

[0002] Generally, a cofferdam is provided with horizontal and vertical tubular sealing means. But also generally, the infrastructure to be isolated is corrugated with ribs and grooves called out-pounds and in-pounds, respectively. The in-pounds, facing the dock side, are filled up with water.

[0003] The problem at the origin of the invention of the instant case relates to the sealing between the cofferdam and the in-pounds, the cofferdams, to this end, being provided with sealing shoes. These are two issues of concern. The first one is the action of the water pressure onto the sealing shoes which could be pushed away from the infrastructure. The second issue of concern is the fact that the surface of the infrastructure to be sealed by the cofferdam, and more particularly the bottom surface of the in-pounds, is usually not quite flat. It could be irregular, it could be also provided with "obstacles", such as tie rods for pulling the infrastructure back to the land side, for keeping it in place.

[0004] Thus, the invention of the instant case is proposed for, first, taking care of the irregular nature of the surfaces to be sealed, those of the horizontal and vertical sealing tubes as well as those of the sealing shoes.

[0005] To this end, the invention relates to a dry setting equipment for isolating an infrastructure at least partly under water and providing a dry working space to the infrastructure, the equipment comprising sealing means, secured to the equipment by a securing side, and to be applied against surfaces of the infrastructure to be sealed by a sealing side, characterized in that the stiffness of the side opposite the sealing side of the sealing means is greater than the stiffness of the sealing side of the sealing means.

[0006] In other words, the stiffness of the sealing means is decreasing towards their sealing side. Thanks to the invention and to the relative flexibility of the sealing side of the sealing means, this sealing side could more or less correspond in shape to the surface of the infrastructure to be sealed, while the opposite side of the sealing means, with a greater stiffness, exerts a certain pressure onto the sealing side, with the result that the sealing side does indeed more or less correspond in shape to the surface of the infrastructure to be sealed, without the risk of some water getting into the space between the surface of the infrastructure and the sealing means.

[0007] Advantageously, the decrease in stiffness of the sealing means is incremental and it comprises preferably at least two different compounds of different stiffnesses, respectively.

[0008] In the latter case, the different compounds of the sealing means may be wrapped by a flexible sheet preventing water and air to penetrate between the compounds.

[0009] The sealing means may comprise horizontal and or vertical sealing tubes of which the securing side is secured to a supporting plate of the equipment.

[0010] The sealing means may also comprise sealing shoes arranged for sealing in-pounds of the infrastructure, said sealing shoes having a hard core on the side opposite the sealing side of the sealing shoes, with a shape like a rib, adapted to the shape of the in-pounds to be sealed, for the sealing shoes to resist to the water pressure and not to be pushed away from the infrastructure.

[0011] In the preferred embodiment of the dry setting equipment of the instant case, the hard core is surrounded by two superposed layers of different stiffnesses, except in a rear part of it secured to the dry setting equipment, preferably by means of a supporting shaped piece itself secured to the dry setting equipment.

[0012] It should be noted that the sealing shoes of the instant case are not as complicated as those of EP0533649, which have been designed to also be adapted to irregular profiles of sheet piles. These prior art shoes include a through air chamber, a hard core, adjacent the air chamber and a deformable sealing element. The air chamber exerts a pressure onto the core which transmits that pressure to the sealing element. These three compounds are slidingly mounted between two guiding plates.

[0013] The shoes of the dry fitting equipment of the instant case are clearly more easily manufactured and installed on the equipment.

[0014] Still preferably, the compounds of the sealing shoes are wrapped by a flexible sheet preventing water and air to penetrate between the compounds.

[0015] Advantageously, a flexible and protruding skirt is placed underneath the sealing shoes and arranged for being bent against the surface of the infrastructure to be sealed and acting as a back up sealing means.

[0016] The invention shall be better understood upon reading the following description with reference to the following drawings, at different scales, of which

- the figure 1 is a top view, partly in cross-section, of the dry setting cofferdam of the invention;
- the figure 2 is a cross-sectional view of the means supporting a sealing shoe of the cofferdam of figure 1;
- the figure 3 is a perspective and cross-sectional view of a sealing shoe of the cofferdam of figure 1, from the bottom side;
- the figure 4 is a perspective view of a sealing shoe of the cofferdam of figure 1, from above;

- the figure 5 is a cross-sectional view of the shoe of the cofferdam of figure 1;
- the figure 6 is a top cross-sectional view of a sealing shoe pushed into an in-pound of a sheet pile to be isolated;
- the figure 7 is a side view of a sealing shoe while being introduced into an in-pound of a sheet pile and
- the figure 8 is a cross-sectional view of a peripheral sealing of the dry setting cofferdam of figure 1.

[0017] With reference to figure 1, the infrastructure to be isolated is here a sheet pile 1, here partly under water, which is corrugated with out-pounds 2 and in-pounds 3. The in-pounds 3 are facing the dock side and, prior to be isolated, filled up with water.

[0018] The pile 1 is isolated by a dry setting cofferdam 4. The cofferdam 4, in the instant case, comprises two upright side walls 5, 6 and an upright back and dockside wall 7. There is a floor at the bottom of the three walls. A continuous horizontal and vertical tubular sealing 8, to be seen on figure 1, is secured over the entire length and the entire height of the cofferdam to the edges 9, 10 of its side walls 5, 6 and bottom. This peripheral sealing 8 shall be described in more details herein below.

[0019] For the sealing between the cofferdam 4 and the in-pounds 3, the cofferdam is provided with sealing shoes 11. The sealing shoes shall also be described in more details herein below.

[0020] The shoes 11 are here secured to the dockside wall 7 of the cofferdam 4 by means of

- a UPN 12 fixed to the inner side of the dockside wall 7,
- two L shaped beams 13, 14, the first one being welded to the UPN 12 and
- a supporting plate 15 welded to the second L shaped beam 14.

[0021] The shoes 11 having to be applied against the bottom surface 16 of the in-pounds, their structure is remarkable.

[0022] Each shoe has a general shape of a truncated pyramid, best seen on figure 4, adapted to fit within an in-pound 3, with a small base 17, to be in abutment against the bottom surface 16 of the in-pounds and a large base 18 facing the dock side. The small base 17 corresponds to the sealing side of the shoe. The top surface 19 of the shoe, between the small and large bases, corresponds to its securing side as will be explained herein below.

[0023] The stiffness of the shoe is decreasing from the large base 18, opposite the small and sealing base 17, to the small and sealing base 17 of the shoe.

[0024] In other words, the stiffness of the sealing shoe, adjacent the large base 18, is greater than the stiffness of the sealing side 17 of the sealing shoes. More precisely, in the instant case as described here, the shoe 11 comprises three different compounds of different stiffnesses, respectively.

[0025] From the large base 18 of the shoe extends a hard core 20, which is surrounded by two superposed layers 21, 22 except in the rear part of the shoe, corresponding to the large base 18 (figure 5), with the intermediate layer 21 having a stiffness smaller than the one of the hard core 20 but greater than the one of the "outer" and sealing layer 22.

[0026] In the instant embodiment of the shoe 11 as described above, the three compounds are wrapped by a flexible sheet 23 preventing water and air to penetrate between the compounds.

[0027] In the instant case again, a flexible skirt 24 is secured underneath the sealing shoe 11. It has a trapezoidal shape and is protruding over the lateral sides 25, 26 and the large base 17 of the shoe, which are perpendicular to the top surface 19. The skirt 24 is secured against the bottom surface 25 of the shoe, opposite and parallel to the top surface 19.

[0028] Two securing metallic plates 26, 27 are fixed onto the top surface 19 and the flexible skirt 24 for, first firmly holding the different compounds of the shoe and maintaining its overall stiffness and, second, for securing the shoe to the supporting plate 15.

[0029] The hard core 20 of the shoe 11 may be made of wood. The surrounding layers 21, 22 may be made of plastic foam.

[0030] The wrapping sheet 23 may be made of a polymer of the registered trademark linatex, which is a very powerful material standing sever conditions.

[0031] Once a shoe 11 has been introduced into an in-pound 3 and pushed against its bottom surface 16, the relative flexibility of extreme layer 22 can absorb the irregularities or obstacles 27 of this bottom surface, while being pushed towards the bottom surface 16 by the intermediate layer 21 and the hard core 20, of greater stiffnesses.

[0032] Thanks to that, the risk of some water remaining inside the in-pound, in the space 28, between the surface of the in-pound and the shoe, is reduced (figure 6).

[0033] On figure 7 is shown a sealing shoe 11 during its introduction into an in-pound 3 of a sheet pile 1, to illustrate the back up function of the flexible skirt 24 bent against the bottom surface 16 of the in-pound 3, prior to the small sealing base 17 of the shoe 11 being pushed into abutment against the bottom surface 16.

[0034] The tubular structure of the peripheral sealing 8 is represented on figure 8. It is very similar to that of the sealing shoes 11, however, without a hard core. Two circular layers 29, 30 of different stiffnesses are mounted on a metallic supporting plate 31, the stiffness of the central layer 29 being greater than that of the peripheral layer 30. Like with the sealing shoes 11, the two layers 29, 30 are wrapped by a flexible sheet 32 also preventing water and air to penetrate between the two compounds 29, 30. The peripheral 8 is arranged to be applied against the surface 33 of the out-pound 2 of the sheet pile 1, via the peripheral sealing layer 30 (through the flexible sheet 32).

Claims

1. Dry setting equipment (4) for isolating an infrastructure (1) at least partly under water and providing a dry working space to the infrastructure (1), the equipment (4) comprising sealing means (11;8) secured to the equipment (4) by a securing side (19;29) and to be applied against surfaces (16;33) of the infrastructure (1) to be sealed, by a sealing side (17,22;30), **characterized in that** the stiffness of the side (20;29) opposite the sealing side (17,22;30) of the sealing means (11;8) is greater than the stiffness of the sealing side (17,22;30) of the sealing means (11;8).

2. Dry setting equipment according to claim 1, wherein the decrease in stiffness of the sealing means (11;8) is incremental.

3. Dry setting equipment according to claim 2, wherein the sealing means (11; 8) comprises at least two different compounds (20-22; 29, 30) of different stiffnesses, respectively.

4. Dry setting equipment according to claim 3, wherein the different compounds (20-22; 29, 30) are wrapped by a flexible sheet (23; 32).

5. Dry setting equipment according to one of claims 1 to 4, wherein the sealing means (11; 8) comprise horizontal and/or vertical sealing tubes (8) of which the securing side (29) is secured to a supporting plate (31) of the equipment (4).

6. Dry setting equipment according to one of claims 1 to 5, wherein the sealing means (11; 8) comprise sealing shoes (11) arranged for sealing in-pounds (3) of the infrastructure (1), said sealing shoes (11) having a hard core (20) on the side opposite the sealing side (17) of the sealing shoes (11), with a shape like a rib, adapted to the shape of the in-pounds (3) to be sealed.

7. Dry setting equipment according to claim 6, wherein the hard core (20) is surrounded by two superposed layers (21, 22) of different stiffnesses, except in a rear part of it secured to the dry setting equipment, preferably by means of a supporting shaped piece itself secured to the dry setting equipment.

8. Dry setting equipment according to one of claims 3 to 7, wherein the compounds of the sealing shoes (11) are wrapped by a flexible sheet (24;32).

9. Dry setting equipment according to one of claims 6 to 8, wherein a flexible and protruding skirt (24) is secured, underneath the sealing shoes (11) and arranged for being bent against the surface of the infrastructure to be sealed and acting as a back up sealing means.

Patentansprüche

1. Trockensetzungsausrüstung (4) zum Isolieren einer Infrastruktur (1) zumindest teilweise unter Wasser und Bereitstellung eines trockenen Arbeitsraums an der Infrastruktur (1), wobei die Ausrüstung (4) Abdichtmittel (11; 8) umfasst, die an der Ausrüstung (4) durch eine Befestigungsseite (19; 29) befestigt werden und gegen Oberflächen (16; 33) der abzudichtenden Infrastruktur (1) mit einer Abdichtseite (17, 22; 30) aufgebracht werden, **dadurch gekennzeichnet, dass** die Steifigkeit der der Abdichtseite (17, 22; 30) des Abdichtmittels (11; 8) entgegengesetzten Seite (20; 29) größer ist als die Steifigkeit der Abdichtseite (17, 22; 30) des Abdichtmittels (11; 8).

2. Trockensetzungsausrüstung nach Anspruch 1, wobei die Abnahme der Steifigkeit des Abdichtmittels (11; 8) inkrementell ist.

3. Trockensetzungsausrüstung nach Anspruch 2, wobei das Abdichtmittel (11; 8) mindestens zwei verschiedene Verbindungen (20-22; 29; 30) jeweils verschiedener Steifigkeiten umfasst.

4. Trockensetzungsausrüstung nach Anspruch 3, wobei die verschiedenen Verbindungen (20-22; 29; 30) von einer flexiblen Folie (23; 32) ummantelt sind.

5. Trockensetzungsausrüstung nach einem der Ansprüche 1 bis 4, wobei die Abdichtmittel (11; 8) horizontale und/oder vertikale Abdichtrohre (8) umfassen, deren Befestigungsseite (29) mit einer Trägerplatte (31) der Ausrüstung (4) befestigt wird.

6. Trockensetzungsausrüstung nach einem der Ansprüche 1 bis 5, wobei die Abdichtmittel (11; 8) Abdichtschuhe (11) umfassen, die zum Abdichten in den Vertiefungen (3) der Infrastruktur (1) angeordnet sind, wobei die Abdichtschuhe (11) (20) auf der der Abdichtseite (17) entgegengesetzten Seite der Abdichtschuhe (11) einen harten Kern aufweisen, mit einer Form wie eine Rippe, die der Form der abzudichtenden Vertiefungen (3) angepasst ist.

7. Trockensetzungsausrüstung nach Anspruch 6, wobei der harte Kern (20) von zwei übereinander liegenden Schichten (21, 22) verschiedener Steifigkeiten umgeben ist, außer in einem hinteren Teil davon, der an der Trockensetzungsausrüstung befestigt ist, vorzugsweise mittels eines tragenden geformten Teils, das selbst an der Trockensetzungsausrüstung befestigt ist.

8. Trockensetzungsausrüstung nach einem der Ansprüche 3 bis 7, wobei die Verbindungen der Abdichtschuhe (11) von einer flexiblen Folie (24; 32) ummantelt sind.

9. Trockensetzungsausrüstung nach einem der Ansprüche 6 bis 8, wobei eine flexible und vorstehende Schürze (24) unter den Abdichtschuhen (11) befestigt ist und dazu angeordnet ist, gegen die Oberfläche der abzudichtenden Infrastruktur gebogen zu werden, und als zusätzlich sicherndes Abdichtmittel wirkt.

Revendications

1. Équipement de mise au sec (4) pour isoler une infrastructure (1) située au moins en partie sous l'eau et fournir un espace de travail au sec à l'infrastructure (1), l'équipement (4) comprenant des moyens de scellement (11 ; 8) fixés à l'équipement (4) par une face de saisie (19 ; 29) et à appliquer contre des surfaces (16 ; 33) de l'infrastructure (1) à sceller par une face de scellement (17 ; 22 ; 30), **caractérisé en ce que** la rigidité de la face (20 ; 29) opposée à la face de scellement (17 ; 22 ; 30) des moyens de scellement (11 ; 8) est supérieure à la face de scellement (17 ; 22 ; 30) des moyens de scellement (11 ; 8).

2. Équipement de mise au sec selon la revendication 1, dans lequel la diminution de rigidité des moyens de scellement (11 ; 8) est progressive.

3. Équipement de mise au sec selon la revendication 2, dans lequel les moyens de scellement (11 ; 8) comprennent au moins deux matériaux différents (20-22 ; 29 ; 30) de rigidités différentes, respectivement.

4. Équipement de mise au sec selon la revendication 3, où les différentes matériaux (20-22 ; 29 ; 30) sont emballés dans une feuille souple (23 ; 32).

5. Équipement de mise au sec selon l'une quelconque des revendications 1 à 4, dans lequel les moyens de scellement (11 ; 8) comprennent des tubes de scellement (8) horizontaux et/ou verticaux dont la face de saisie (29) est fixée à une plaque support (31) de l'équipement (4).

6. Équipement de mise au sec selon l'une quelconque des revendications 1 à 5, dans lequel les moyens de scellement (11 ; 8) comprennent des patins d'étanchéité (11) conçus pour sceller des biefs entrants (3) de l'infrastructure (1), lesdits patins d'étanchéité (11) ayant un noyau dur (20) du côté opposé à la face de scellement (17) des patins d'étanchéité (11), avec une forme de nervure, adaptée à la fore des biefs entrants (3) à sceller.

7. Équipement de mise au sec selon la revendication 6, dans lequel le noyau dur (20) est entouré de deux couches superposées (21 ; 22) de rigidités différentes, excepté dans sa partie arrière fixée à l'équipement de mise au sec, de préférence au moyen d'une pièce support mise en forme, elle-même fixée à l'équipement de mise au sec.

8. Équipement de mise au sec selon l'une quelconque des revendications 3 à 8, dans lequel les matériaux des patins d'étanchéité (11) sont emballés dans une feuille souple (24 ; 32).

9. Équipement de mise au sec selon l'une quelconque des revendications 6 à 8, dans lequel est fixée une bordure (24) flexible et saillante sous les patins d'étanchéité (11) et conçue pour être courbée contre la surface de l'infrastructure à sceller et agissant comme des moyens de scellement de secours.

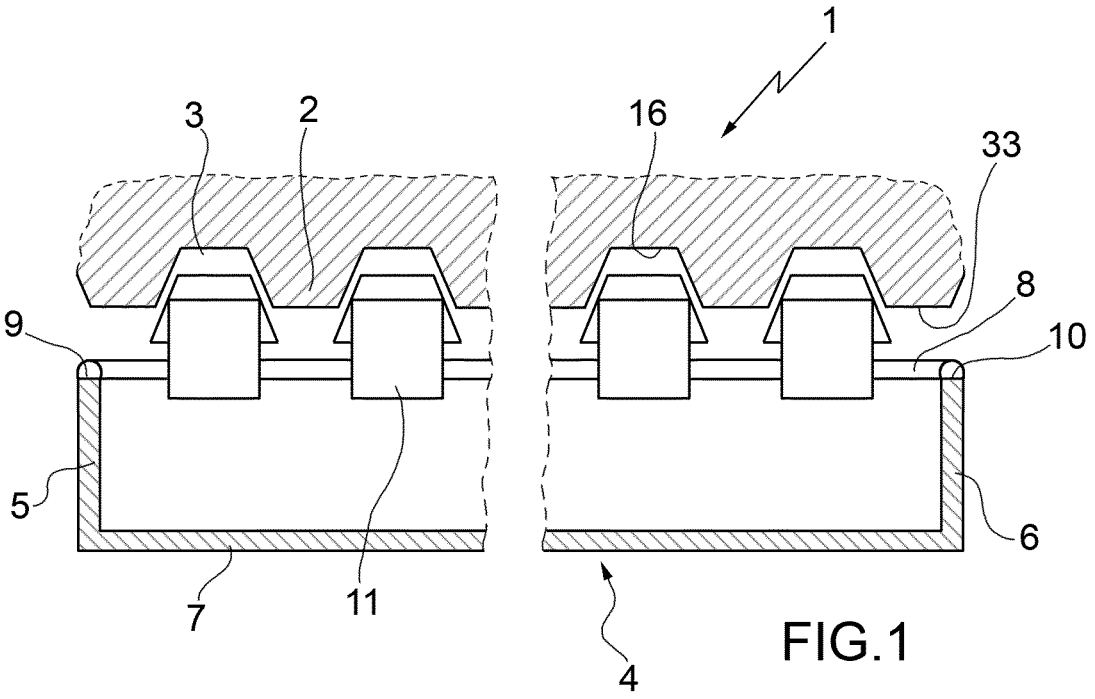


FIG.1

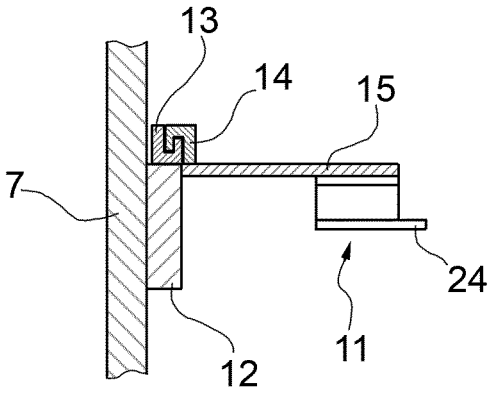


FIG.2

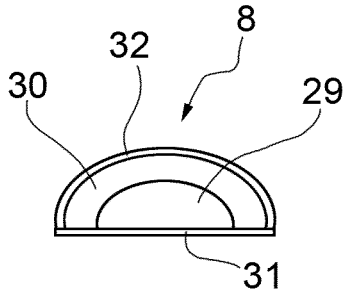


FIG.8

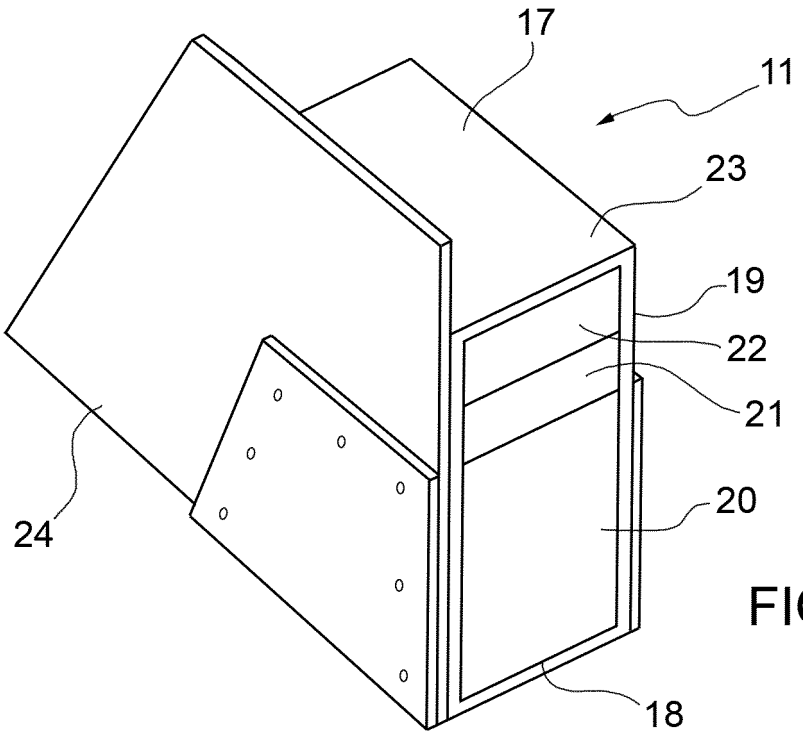


FIG.3

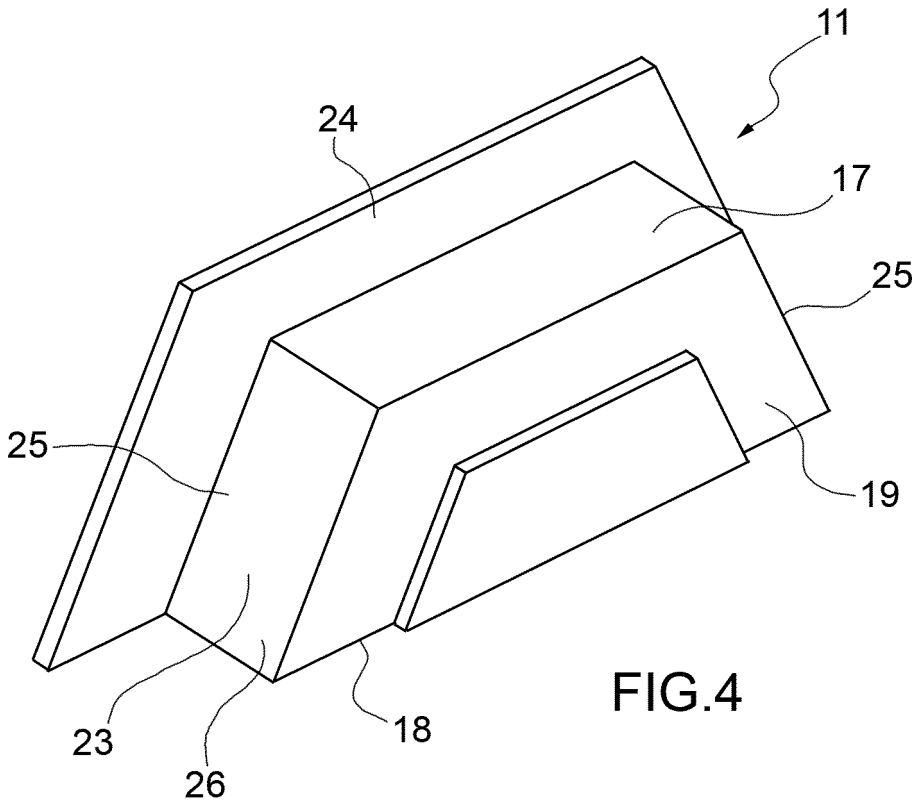


FIG.4

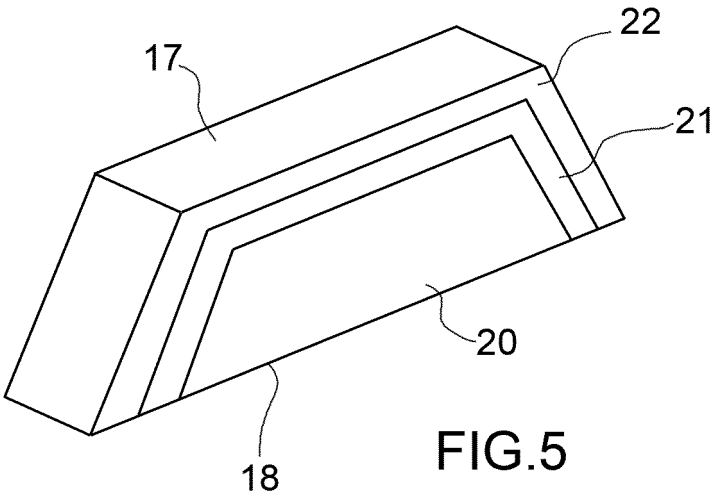


FIG.5

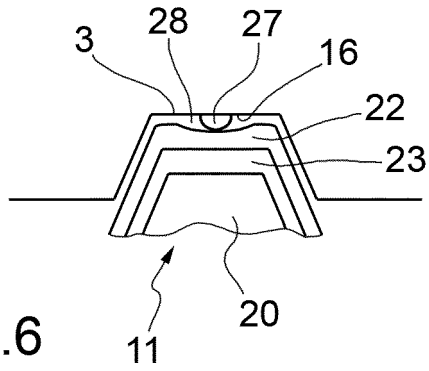


FIG.6

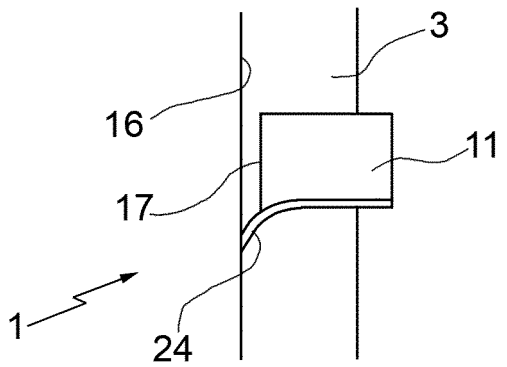


FIG.7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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