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(54) **PROCESS FOR REALIZATION OF WEAR-RESISTANT PANELS AND WEAR-RESISTANT PANEL**

VERFAHREN ZUR HERSTELLUNG VERSCHLEISSFESTER PLATTEN UND VERSCHLEISSFESTE PLATTE

PROCÉDÉ DE RÉALISATION DE PANNEAUX RÉSISTANT À L'USURE ET PANNEAU RÉSISTANT À L'USURE

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**WO-A1-2011/012629** **US-B1- 6 189 280**



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## Description

**[0001]** The object of the present invention is a process for realizing wear-resistant panels usable for the formation of anti-wear and/or decorative and/or acoustic insulation surfaces.

**[0002]** Specifically, but not exclusively, it is useful for the realization of wear-resistant internal coverings in various plant and machinery, such as, for example, grinders, generally ball grinders, destined for wet and/or dry grinding in the ceramics, mineral, cement, etc., industry.

**[0003]** It may also be used for the manufacture of mineral feeder devices, tanks of operating and transport means, impact and fall tracks or zones in plants for processing stone materials, and also for the realization of flooring in zones particularly subject to wear and walkways of various types.

**[0004]** In the specific case of ball grinders, grinding occurs in one or more chambers placed in rotation in which, besides the material to be ground and possibly water, in the case of wet grinding, the grinding bodies or balls are in contact with the inside walls of the chambers, which are protected by suitable coverings. Coverings realized in various materials are known.

**[0005]** For example, coverings are known realized in hard materials, for example alumina-based, which are obtained by arranging actual bricks, adjacent to and cemented with each other so as to cover all the inside walls of the grinding chambers. These are actual building constructions which require a great deal of time for assembly and repair.

**[0006]** Coverings in wear-resistant rubber are also known, which are realized with modular elements formed of plates and blanks of various dimensions. Said types of realization require relatively low commissioning times and have the positive characteristic of allowing fairly easy replacement of worn single plates or elements. However, wear-resistant rubber coverings require the entire covering, or even only part of it, to be replaced with a certain frequency. Due to the geometrical and functioning characteristics of the grinders, parts of these coverings exist which are, in fact, more subject to wear than others. There is therefore the need, in these cases, to stop the grinder in order to proceed with replacement solely of certain worn parts of the covering and not the entire covering.

**[0007]** This all causes evident problems and diseconomies which reflect negatively on the entire production cycle.

**[0008]** These problems are more greatly accentuated in the case of continuous grinders.

**[0009]** Wear-resistant coverings are also known, for example, such as the one illustrated in Italian patent no. 1287434, which shows a wear-resistant covering for grinders comprising a rubber base, into which plates in hard material are inserted, which face with part of their external surface on the surface subject to wear of the covering itself.

**[0010]** Wear-resistant coverings such as the one just cited, which may be realised by incorporating bricks in wear-resistant material such as alumina into the rubber base, despite being able to perform their function with an advantage with respect to the previous coverings, still have defects and problems which basically originate in the realization process, which requires each portion to include wear-resistant bricks in the mass of a rubber base by means of pressing and vulcanisation operations and subsequent assembly of the various portions of covering thus realized to form the complete covering.

**[0011]** Other examples of wear-resistant panels are known from WO 2011/012629 and US 6189280.

**[0012]** The present invention, as defined by the claims, is proposed to overcome the problems and deficiencies of the prior art as described above.

**[0013]** An advantage of the invention consists in the simplicity of its embodiment.

**[0014]** Another advantage of the invention consists in the possibility of realising with great construction simplicity, on the surface subject to wear, a distribution of the inserts in hard material with a geometrical arrangement in which the distance between any two adjacent inserts may be extremely limited and substantially uniform across the entire surface.

**[0015]** Another advantage is the possibility of graduating with precision the entity of any projection of the individual inserts from the surface subject to wear, thus making it possible also to give body to geometrically pre-established zones characterised by different resistances to wear.

**[0016]** A further advantage of the invention consists in its structural capacity to be used for an extremely wide range of applications.

**[0017]** These objects and advantages and also others are all realized by the invention in question as it is defined by the appended claims.

**[0018]** Further characteristics and advantages of the present invention will become clear from the following detailed description of an embodiment of the invention in question, illustrated by way of non-limiting example in the attached figures, wherein:

Figure 1 shows a partial perspective view of a first embodiment of the wear-resistant covering according to the invention, wherein a generic cross-section executed on a perpendicular plane to the surface subject to wear is shown;

Figure 2 shows a detail of a cross-section executed according to a perpendicular plane to the work surface of the wear-resistant covering of figure 1;

Figures 3, 4 show top views of the detail of figure 2 relating to different embodiments of the cavities 4.

**[0019]** With reference to the mentioned figures, 1 denotes in its entirety a wear-resistant panel which is usable to be assembled with others to form wear-resistant surfaces.

**[0020]** Essentially, it comprises a matrix 2 having a plu-

rality of cavities 4 which are obtained on a working surface 3 of the matrix 2. The cavities 4 are dimensioned and shaped to accommodate wear-resistant inserts 5 of a matching size and stably.

**[0021]** Said inserts 5 are characterised by considerable hardness and/or by a considerable volumic mass.

**[0022]** They are frequently alumina-based.

**[0023]** Each wear-resistant panel 1 is characterised in that the wear-resistant inserts 5 are shaped and dimensioned in relation to the shape and size of the cavities 4 so that, when insertion and coupling are completed, the inserts are firmly anchored to the respective cavities.

**[0024]** According to a first embodiment, the cavities 4 are shaped and dimensioned in relation to the shape and size of the inserts 5 so that, when insertion and coupling are completed, a portion of said each insert 5 is at least partially externally projecting with respect to said work surface 3.

**[0025]** Embodiments of the invention are also envisaged in which the cavities 4 are shaped and dimensioned in relation to the shape and size of the inserts 5 so that, when insertion and coupling are completed, at least one portion of said each insert 5 is placed at the same level of the work surface 3, so that it does not project from it.

**[0026]** Embodiments are also envisaged in which the inserts 5 or part of them, when insertion and coupling are completed, are placed beneath the established level of the work surface 3.

**[0027]** For example, assembled together with other wear-resistant panels, the panel in question may be used for realization of the wear-resistant covering of the internal surface, and therefore also of the cylindrical part of the drum of a ball grinder. In particular, a ball grinder for fine grinding of the raw materials used for manufacturing ceramic articles.

**[0028]** The wear-resistant panel 1 is obtained by means of a process for realizing panels usable for the formation of anti-wear surfaces, comprising the following steps:

- forming a matrix 2 having a support function and which is provided, on a work surface 3, with a plurality of cavities 4, which are dimensioned and shaped to accommodate wear-resistant inserts 5 of matching size and are distributed over said work surface (3) according to a pre-established order and geometrical arrangement;
- spreading adhesive, if necessary;
- inserting the inserts 5 in the cavities 4;
- curing, if necessary.

**[0029]** The reciprocal coupling surfaces of the cavities 4 and the respective inserts 5 are shaped to allow accurate centring of the inserts 5 in the cavities 4 and a pre-established distribution of any adhesive in the coupling zone, clearly if adhesive is used to ensure stability of the coupling.

**[0030]** The cavities 4 are shaped and dimensioned in relation to the shape and size of the inserts 5 with an insertion mouth 40.

**[0031]** The cavities 4 have at least the concave part of the coupling surface situated in proximity to the insertion mouth 40 configured with ridges or ribs 41 suitable for achieving the centring of the respective inserts 5 and assisting pre-established distribution of the adhesive.

**[0032]** In particular, the cavities 4 have at least the concave part of the coupling surface situated in proximity to the insertion mouth 40 with an overall cylindrical shape.

**[0033]** The formation of the cavities 4 is obtainable with methods which are linked to the technological characteristics of the material of which the matrix 2 is made.

**[0034]** The latter is made of resistant materials, preferably with high elastic deformability, such as natural or synthetic rubbers and the like. In this case, formation of the cavities and with them the matrix 2 of the panel is frequently realized with pressing processes.

**[0035]** Similar production techniques are used if the matrix 2 is formed of resistant materials, with good elastic deformability, such as plastic materials and the like.

**[0036]** Other resistant materials usable may be metals and metal alloys, for which appropriate production technologies may be used for realization of the matrixes 2 and the relative cavities 4.

**[0037]** Other embodiments may also envisage the use of resistant materials formed of ceramic and glass materials and the like.

**[0038]** In any case, fixing of the inserts 5 is realised by means of gluing or simply, without a binder but by means of a forced coupling which preferably exploits the elastic deformability of at least one of the two parts generally formed of the matrix 2 in which the cavities 4 are obtained. For this purpose, ridges or ribs 41 may be used suitable both for obtaining centring of the respective inserts 5 and also for creating with them a situation of interference which implements the relative fixing.

**[0039]** In particular, "cold" gluing may be used, which does not require the heat treatments necessary, for example, for vulcanisation of rubber.

**[0040]** This also allows manufacturing with simple technologies of the wear-resistant panels 1 with the relative cavities 4, which may be realized with ridges or ribs 41 more suitable for obtaining mechanical centring of the inserts 5, which must be inserted in them, and also optimum distribution of the adhesive which fixes them.

**[0041]** It is also possible, by means of the invention, to realize highly precise geometrical arrangements of the cavities 4 on the work surface 3 and characterised by a uniform distribution which allows the distances between any adjacent inserts to be extremely limited and substantially uniform across the entire surface.

**[0042]** It is also possible to use inserts characterised by geometrical shapes deemed more efficient. Thus, for example, it is possible to use triangular, square, hexagonal, etc., inserts, in place of the overall cylindrical inserts illustrated above.

**[0043]** For example, a hexagonal shape may allow a

honeycomb distribution to be realised which allows excellent use of the work surface 3.

**[0044]** Furthermore, it is possible to graduate with precision the entity of any projection or recess of the individual inserts 5 from the surface subject to wear, thus making it possible to give body to geometrically pre-established zones characterised, for example, by different wear resistances.

**[0045]** The characteristics of the invention allow a wide range of applications.

**[0046]** These include use as acoustic insulation material, which may or may not be combined also with a decorative function. The acoustic insulation properties of the invention derive principally from the quality of the materials used, particularly those of the inserts, which are characterised by a high volumic mass.

## Claims

1. A process for realizing wear-resistant panels usable for the formation of anti-wear surfaces, comprising the following steps:

   - forming a matrix (2) having a support function and which is provided, on a work surface (3), with a plurality of cavities (4), which are dimensioned and shaped to accommodate wear-resistant inserts (5) of matching size, and are distributed over said work surface (3) according to a pre-established order and geometrical arrangement;
   - spreading adhesive, if necessary;
   - inserting the inserts (5) in the cavities (4);
   - curing, if necessary;

   the cavities (4) being shaped and dimensioned in relation to the shape and size of the inserts (5) so that, when insertion and coupling are completed, the inserts are firmly anchored to the respective cavities; each of the cavities having an insertion mouth and a coupling surface comprising a concave part, the concave part of the coupling surface situated in proximity to the insertion mouth (40) being configured with ridges or ribs (41) whose function is to achieve the centring of the respective inserts (5), as well as favouring a pre-established distribution of adhesive in the coupling zone.

2. The process according to claim 1, wherein the fixing of the inserts (5) is achieved by means of a forced coupling, without adhesive, which preferably exploits the elastic deformability of at least one of the two parts, generally consisting in the matrix (2) in which the cavities (4) are fashioned.

3. The process according to claim 2, wherein said forced coupling is effected by means of the ridges or ribs (41), whose function, in addition to that of achieving the centring of the respective inserts (5), is to create with them a situation of interference which brings about the relative fixing.

4. The process according to claim 1, wherein the cavities (4) are shaped and dimensioned in relation to the shape and size of the inserts (5) so that, when insertion and coupling are completed, at least a portion of each of said inserts (5) protrudes externally at least in part from said work surface (3).

5. The process according to claim 1 wherein the cavities (4) have an overall cylindrical shape at least in the concave part of the coupling surface situated in proximity to the insertion mouth (40).

6. The process according to one of the preceding claims, wherein said matrix (2) is formed from natural or synthetic rubbers.

7. The process according to one of the preceding claims, wherein said matrix (2) is formed from plastic materials.

8. The process according to one of the preceding claims, wherein said matrix (2) is formed from metals and metal alloys.

9. The process according to one of the preceding claims, wherein said matrix (2) is formed from ceramic materials, glass and the like.

10. A wear-resistant panel usable for forming wear-resistant surfaces, comprising a matrix (2) which features a plurality of cavities (4) fashioned in a work surface (3) of the matrix (2) and dimensioned and shaped to stably accommodate wear-resistant inserts (5) of matching size, the cavities (4) being shaped and dimensioned in relation to the shape and size of the inserts (5) so that, when insertion and coupling are completed, the inserts are firmly anchored to the respective cavities;
    each of the cavities having an insertion mouth and a coupling surface comprising a concave part, **characterised in that** the concave part of the coupling surface situated in proximity to the insertion mouth (40) is configured with ridges or ribs (41) whose function is to achieve the centring of the respective inserts (5), as well as favouring a pre-established distribution of adhesive in the coupling zone.

## Patentansprüche

1. Verfahren zur Herstellung von verschleißfesten Platten, die zur Bildung von Anti-Verschleiß-Oberflächen verwendbar sind, umfassend die folgenden

Schritte:

- Bilden einer Matrix (2) mit einer Stützfunktion, die auf einer Arbeitsfläche (3) mit einer Vielzahl von Hohlräumen (4) versehen ist, die zur Aufnahme von verschleißfesten Einsätzen (5) passender Größe dimensioniert und geformt sind und über die Arbeitsfläche (3) nach einer vorgegebenen Reihenfolge und geometrischen Anordnung verteilt sind;
- Auftragen von Klebstoff, falls erforderlich;
- Einführen der Einsätze (5) in die Hohlräume (4);
- Aushärten, falls erforderlich;

wobei die Hohlräume (4) in Bezug auf die Form und Größe der Einsätze (5) so geformt und dimensioniert sind, dass die Einsätze nach dem Einführen und Koppeln fest an den jeweiligen Hohlräumen verankert sind; wobei jeder der Hohlräume einen Einführungsmund und eine Kupplungsfläche umfassend einen konkaven Teil aufweist, wobei der konkave Teil der Kupplungsfläche in der Nähe des Einführungsmundes (40) mit Kanten oder Rippen (41) konfiguriert ist, deren Funktion darin besteht, die Zentrierung der jeweiligen Einsätze (5) zu erzielen, sowie eine vorher festgelegte Klebstoffverteilung in der Kupplungszone zu fördern.

**2.** Verfahren nach Anspruch 1, wobei die Befestigung der Einsätze (5) mittels einer Zwangskopplung ohne Klebstoff erzielt wird, die vorzugsweise die elastische Verformbarkeit mindestens eines der zwei Teile ausnutzt, im allgemeinen bestehend aus der Matrix (2), in der die Hohlräume (4) ausgebildet sind.

**3.** Verfahren nach Anspruch 2, wobei die Zwangskopplung mittels der Kanten und Rippen (41) erfolgt, deren Funktion neben der Erzielung der Zentrierung der jeweiligen Einsätze (5) darin besteht, mit ihnen eine Störsituation zu erzeugen, die die relative Befestigung bewirkt.

**4.** Verfahren nach Anspruch 1, wobei die Hohlräume (4) in Bezug auf die Form und Größe der Einsätze (5) so geformt und dimensioniert sind, dass nach dem Einführen und Koppeln mindestens ein Abschnitt von jedem der Einsätze (5) mindestens teilweise aus der Arbeitsfläche (3) nach außen hervorsteht.

**5.** Verfahren nach Anspruch 1, wobei die Hohlräume (4) mindestens im konkaven Teil der Kupplungsfläche in der Nähe des Einführungsmundes (40) eine zylindrische Gesamtform aufweisen.

**6.** Verfahren nach einem der vorhergehenden Ansprüche, wobei die Matrix (2) aus Natur- oder Synthesekautschuken gebildet wird.

**7.** Verfahren nach einem der vorhergehenden Ansprüche, wobei die Matrix (2) aus Kunststoffen gebildet wird.

**8.** Verfahren nach einem der vorhergehenden Ansprüche, wobei die Matrix (2) aus Metallen und Metalllegierungen gebildet wird.

**9.** Verfahren nach einem der vorhergehenden Ansprüche, wobei die Matrix (2) aus keramischen Materialien, Glas und dergleichen gebildet wird.

**10.** Verschleißfeste Platte, die zur Bildung verschleißfester Oberflächen verwendbar ist, die eine Matrix (2) umfasst, die eine Vielzahl von Hohlräumen (4) aufweist, die in einer Arbeitsfläche (3) der Matrix (2) ausgebildet und so dimensioniert und geformt sind, dass sie verschleißfeste Einsätze (5) passender Größe standfest aufnehmen, wobei die Hohlräume (4) in Bezug auf die Form und Größe der Einsätze (5) so geformt und dimensioniert sind, dass die Einsätze nach dem Einführen und Koppeln fest mit den jeweiligen Hohlräumen verankert sind;
wobei jeder der Hohlräume einen Einführungsmund und eine Kupplungsfläche umfassend einen konkaven Teil aufweist, **dadurch gekennzeichnet, dass** der konkave Teil der Kupplungsfläche in der Nähe des Einführungsmundes (40) mit Kanten und Rippen (41) konfiguriert ist, deren Funktion darin besteht, die Zentrierung der jeweiligen Einsätze (5) zu erzielen, sowie eine vorher festgelegte Klebstoffverteilung in der Kupplungszone zu fördern.

**Revendications**

**1.** Procédé de réalisation de panneaux résistants à l'usure utilisables pour la formation de surfaces antiusure, comprenant les étapes suivantes :

- former une matrice (2) comportant une fonction de support et présentant, sur une surface de travail (3), une pluralité de cavités (4), qui sont dimensionnées et configurées pour loger des inserts résistants à l'usure (5) de taille correspondante, et sont réparties sur ladite surface de travail (3) selon un ordre prédéfini et une disposition géométrique ;
- étaler un adhésif, le cas échéant ;
- insérer les inserts (5) dans les cavités (4) ;
- faire durcir, le cas échéant ;

les cavités (4) étant configurées et dimensionnées en fonction de la forme et de la taille des inserts (5) de sorte que, après l'insertion et l'accouplement, les inserts sont solidement ancrés dans les cavités

respectives ;
chacune des cavités comportant une bouche d'insertion et une surface d'accouplement comprenant une partie concave, la partie concave de la surface d'accouplement située à proximité de la bouche d'insertion (40) étant configurée avec des stries ou des nervures (41), dont la fonction est d'obtenir le centrage des inserts respectifs (5) et de favoriser une répartition prédéfinie de l'adhésif sur la zone d'accouplement.

**2.** Procédé selon la revendication 1, dans lequel la fixation des inserts (5) se fait par un accouplement forcé, sans adhésif, qui exploite de préférence la déformabilité élastique d'au moins une des deux parties, généralement consistante en la matrice (2) dans laquelle sont réalisées les cavités (4).

**3.** Procédé selon la revendication 2, dans lequel ledit accouplement forcé se fait au moyen des stries ou nervures (41), dont la fonction est non seulement d'obtenir le centrage des inserts respectifs (5), mais également de créer avec eux une situation d'interférence concrétisant la fixation correspondante.

**4.** Procédé selon la revendication 1, dans lequel les cavités (4) sont configurées et dimensionnées en fonction de la forme et de la taille des inserts (5) de sorte que, après l'insertion et l'accouplement, au moins une portion de chacun desdits inserts (5) dépasse sur l'extérieur au moins en partie de ladite surface de travail (3).

**5.** Procédé selon la revendication 1, dans lequel les cavités (4) présentent une forme globalement cylindrique au moins dans la partie concave de la surface d'accouplement située à proximité de la bouche d'insertion (40).

**6.** Procédé selon l'une des revendications précédentes, dans lequel ladite matrice (2) se compose de caoutchoucs naturels ou synthétiques.

**7.** Procédé selon l'une des revendications précédentes, dans lequel ladite matrice (2) se compose de matières plastiques.

**8.** Procédé selon l'une des revendications précédentes, dans lequel ladite matrice (2) se compose de métaux et d'alliages métalliques.

**9.** Procédé selon l'une des revendications précédentes, dans lequel ladite matrice (2) se compose de matières céramiques, verres et similaires.

**10.** Panneau résistant à l'usure utilisable pour la formation de surfaces résistantes à l'usure, comprenant une matrice (2) présentant une pluralité de cavités (4) réalisées sur une surface de travail (3) de la matrice (2) et dimensionnées et configurées pour loger de manière stable des inserts résistants à l'usure (5) de taille correspondante, les cavités (4) étant configurées et dimensionnées en fonction de la forme et de la taille des inserts (5) de sorte que, après l'insertion et l'accouplement, les inserts sont solidement ancrés dans les cavités respectives ;
chacune des cavités comportant une bouche d'insertion et une surface d'accouplement comprenant une partie concave, **caractérisé en ce que** la partie concave de la surface d'accouplement située à proximité de la bouche d'insertion (40) est configurée avec des lignes ou des nervures (41), dont la fonction est d'obtenir le centrage des inserts respectifs (5) et de favoriser une répartition prédéfinie de l'adhésif sur la zone d'accouplement.

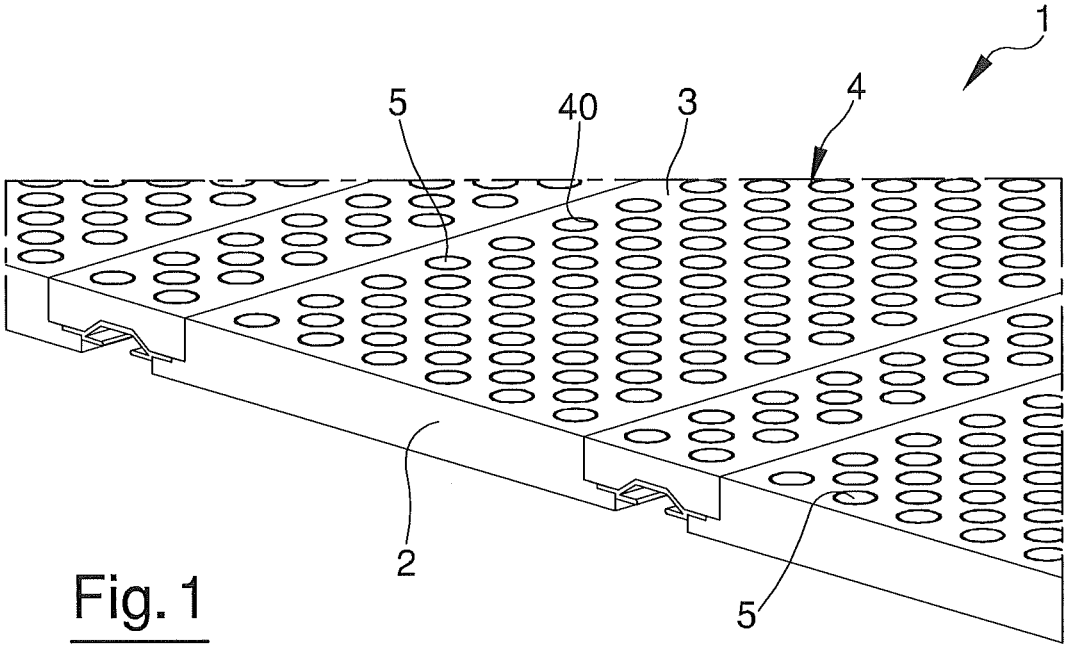



Fig. 1

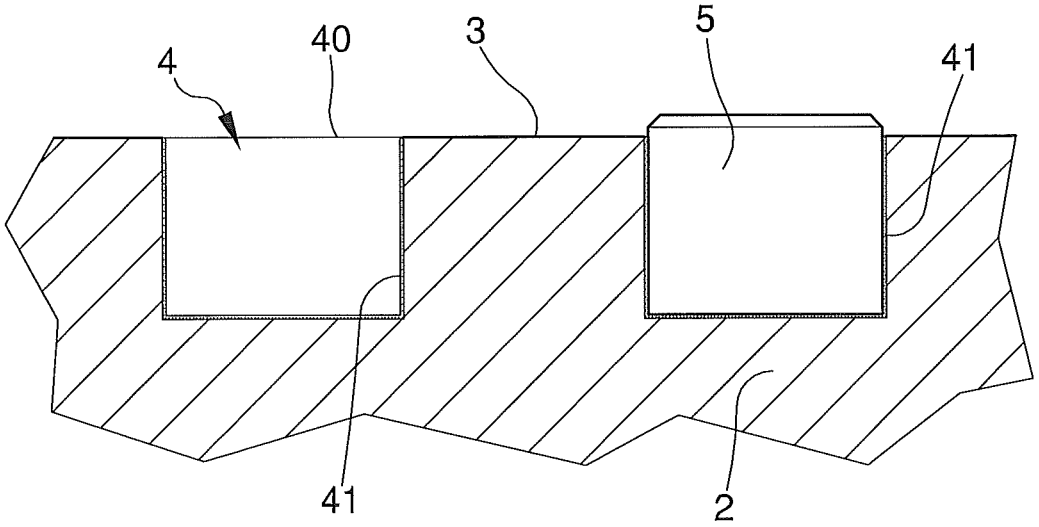



Fig. 2

Fig. 3

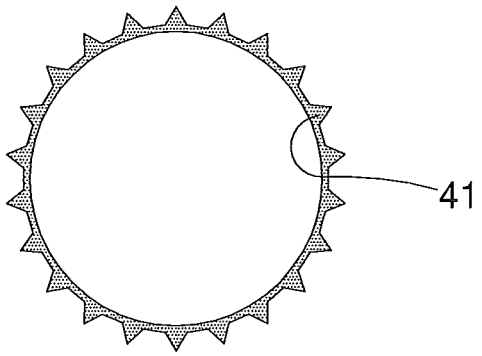



Fig. 4

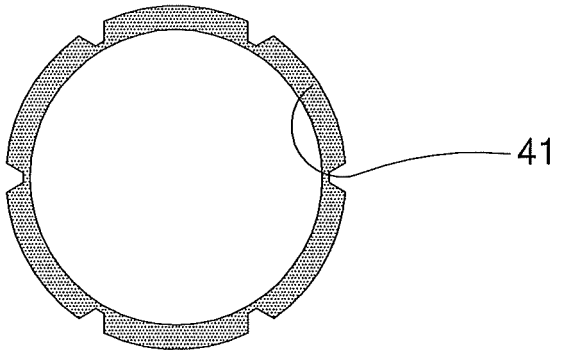
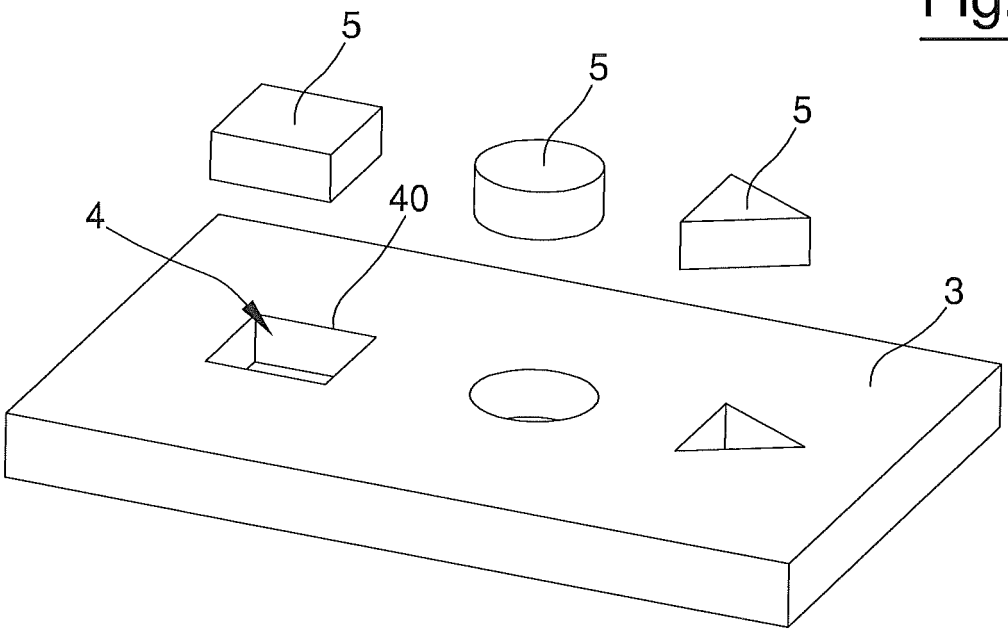



Fig. 5



## REFERENCES CITED IN THE DESCRIPTION

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