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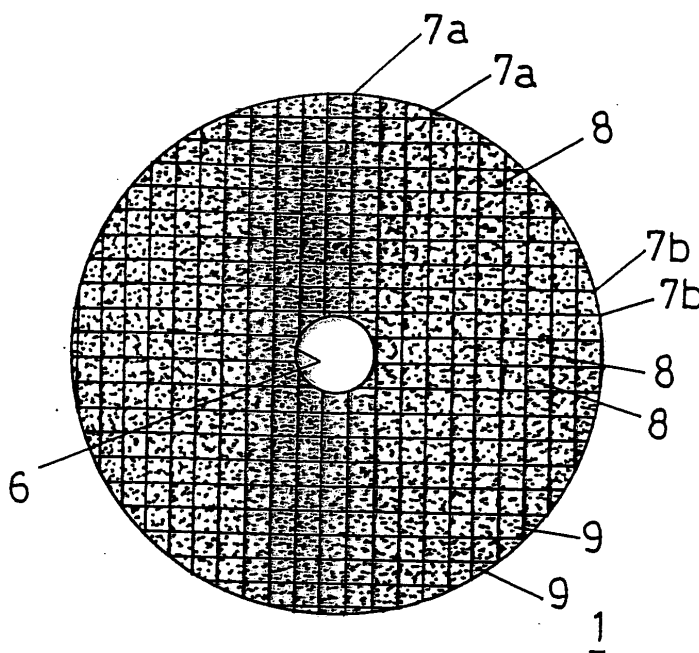
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(54) **GEINDER**

(57) A grinder (1) comprising a resilient plate (2) having one side bonded to the back side of an abrasive cloth (3) and the other side on which a fastening means (5) for attaching the grinder (1) to the rotary shaft of a rotary grinding machine is provided, **characterized in that** longitudinal grooves (7a) and lateral grooves (7b) are provided in a grid form on the surface of the abrasive cloth (3) on the side abutting against an object to be ground.

FIG. 1



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DescriptionTechnical Field

5 **[0001]** The present invention relates to a grinder or grinding disk that is designed for use in grinding or polishing metal or other worked or coated surfaces by being mounted to the rotary shaft of the rotary grinding machine.

Background

10 **[0002]** As one of the conventional grinders that may be mounted to the rotary shaft of the rotary grinding machine when they are actually used, there is proposed a grinder that includes a resilient plate having one side bonded to the back side of an abrasive cloth and the other side on which a fastening means for attaching the grinder to the rotary shaft of the rotary grinding machine is provided, whereby an object may be ground or polished by bringing the surface of the abrasive cloth into contact with the object. When this grinder is driven for rotation, its outer peripheral portion can be rotating with the greatest linear velocity, and can be used effectively for grinding the object by bringing the outer peripheral portion into contact with the surface of the object. When the grinder becomes dirty, it may easily be replaced by a new one.

15 **[0003]** Another grinder of the conventional type described above is proposed, in which the surface of the abrasive cloth that may be brought into contact with the object includes a base cloth on which fibers of the predetermined length are implanted (as disclosed in Japanese utility model registration application H4 (1992) - 92769). In this grinder, a plurality of equally spaced rows of grooves extending in a particular direction, such as in the longitudinal direction, are formed on the surface of the abrasive cloth that may be brought into contact with the object.

20 **[0004]** The grinding operation may be performed in several stages, such as the paper grinding stage that initially occurs by using a suitable compound or liquid agent and a sheet of paper such as water-repellent paper, the cloth grinding stage that then occurs by using fibers such as a wool buff, and the sponge polishing stage that finally occurs by using a sponge buff. The sponge polishing stage corresponds to the finish-polishing stage in which any traces of the buffing that may have been left on the surface of the object during the cloth grinding stage will be removed.

25 **[0005]** One possible application of the grinder described above, that is, the grinder that includes the resilient plate having one side bonded to the back side of the abrasive cloth, whereby the object may be ground or polished by bringing the surface of the abrasive cloth into contact with the object, may include the cloth grinding. The cloth grinding may be followed by the final sponge polishing in which any traces of the buffing that may remain on the surface of the object (which has been ground by the buff) will be removed.

30 **[0006]** For the grinder of the type in which the plurality of equally spaced rows of grooves extending in a particular direction, such as in the longitudinal direction, are formed, however, there are improvements yet to be made when possible effects of those grooves on the surface of the object being ground or polished are considered.

35 **[0007]** For the grinder of the type in which the cloth grinding stage is followed by the sponge polishing stage, it is not easy to completely remove the traces of the buffing left on the surface of the object during the cloth grinding stage. If it is then possible to provide a grinder that can avoid that any traces of the buffing remain on the surface of the object during the cloth grinding stage, the object can be finished completely during the subsequent sponge polishing stage.

40 SUMMARY OF THE INVENTION

45 **[0008]** The object of the present invention is to eliminate the problems associated with the conventional grinders described above, and provide a grinder of the type that includes a resilient plate having one side bonded to the back side of an abrasive cloth and the other side on which a fastening means for attaching the grinder to the rotary shaft of the rotary grinding machine is provided, whereby an object may be ground or polished by bringing the surface of the abrasive cloth into contact with the object and wherein when the grinder is used for the cloth grinding, it can avoid that the traces of the buffing remain on the surface of the object being ground during the cloth grinding stage.

50 **[0009]** For the grinder of the type in which the plurality of equally spaced rows of grooves extending in a particular direction, such as in the longitudinal direction, are formed on the surface of the grinder abutting against the object being ground or polished, spots will occur where the plurality of equally spaced rows of grooves are placed substantially at right angles with regard to the direction in which the grinder is rotating, when the grinder is used for the cloth grinding. Those spots allow the abrasive compound or liquid agent to escape in one direction only. The inventor of the present application has noticed this fact, and has found that the abrasive liquid agent or compound can always be made to escape in four directions when the grinder is rotating, if a plurality of longitudinal grooves and a plurality of lateral grooves are provided so that those longitudinal and lateral grooves can cross each other like a grid. Specifically, the traces of the buffing that may remain on the surface of the object when it is ground by the cloth or buff can be reduced, and the time required for the final polishing such as the subsequent sponge polishing can be reduced accordingly.

55 **[0010]** In its specific form, the grinder according to the present invention includes a resilient plate having one side

bonded to the back side of an abrasive cloth and the other side on which a fastening means for attaching the grinder to the rotary shaft of the rotary grinding machine is provided, wherein a plurality of longitudinal grooves and a plurality of lateral grooves are provided in a grid form on the surface of the abrasive cloth abutting against the object being ground or polished.

[0011] In accordance with the present invention, the resilient plate forming an integral part of the grinder should desirably be such that it can bring the surface of the abrasive cloth into contact with the surface of the object with the uniform pressure, by compensating for the forces of the operator being applied to the object, the operation of the machine (rotary grinding machine) and the effects of any irregularities present on the surface of the object. For this reason, the resilient plate may be made of any elastic material that is known to the art, such as sponge or rubber. Usually, the resilient plate should have the disk form since the surface of the object is polished by causing the resilient plate to rotate, although its thickness or shape may be determined appropriately.

[0012] The abrasive cloth may be any cloth that is suitable for the grinding, depending upon the degree of finishing, the purpose of grinding and the type of grinding. For example, raising materials may be employed, on the surface of which longitudinal grooves and lateral grooves may be provided like a grid.

[0013] Fibers may be implanted on each of the individual areas delimited by the longitudinal grooves and lateral grooves crossing each other. In this case, the type and length of fibers to be used, such as wool, may be selected as appropriate, depending the purpose and type of the grinding. In addition, the density of the fibers being implanted on the abrasive cloth, and the width of the longitudinal grooves and lateral grooves being spaced away from each other may be determined or changed as appropriate.

[0014] The longitudinal grooves and lateral grooves which are formed like the grid form on the surface of the abrasive cloth located on the side abutting against the object being ground are provided in such a manner that, in each part of the grinder being rotating, those grooves can be aligned with the direction (tangential direction) in which the grinder is rotating. When those grooves are provided such that they are aligned with the direction (tangential direction) in which the grinder is rotating, any of the abrasive liquid agent or compound that may remain in the grooves can flow along the grooves, and the pressure that is exerted in the grooves can be relieved so adequately that the grinding can be performed while the traces of the buffing that may remain on the surface of the object being ground can be kept to a minimum.

[0015] In accordance with the present invention, the grinder is designed so that it can be mounted to the rotary shaft of the rotary grinding machine. Then, the grinding or polishing operation may be performed by bringing the front surface side of the grinder (the front surface side of the abrasive cloth) into contact with the object being ground or polished, while the grinder is driven for rotation. Thus, the grinder must not slip out of the tip end of the rotary shaft easily during the grinding or polishing operation. Furthermore, the grinder may be exchangeable, depending upon the purpose and usage of the grinder. It would be convenient, therefore, if the grinder is designed so that it can easily be mounted to or removed from the tip end of the rotary shaft of the rotary grinding machine. In light of the above consideration, the means that is provided on the other side of the resilient plate for attaching the grinder to the rotary shaft of the rotary grinding machine may be implemented by a velvet fastener. This velvet fastener includes a pair of velvet fasteners that may be coupled with each other, one being the male fastener and the other being the female fastener. For example, the male fastener may be mounted on the other side of the resilient plate, and the female fastener may be mounted to the tip end of the rotary shaft of the rotary grinding machine.

[0016] In accordance with the present invention, the grinder may have a hollow portion in the center thereof that is depressed from the front surface side abutting against the object being ground toward the side on which the tip end of the rotary shaft of the rotary grinding machine is located.

[0017] When the grinder is rotating, the abrasive liquid agent or compound used for the grinding will tend to gather around the center of the grinder under the action of the rotation of the grinder. The hollow portion allows such abrasive liquid agent or compound to escape, thereby preventing the liquid agent or compound from becoming thick there, and can hold it in the neighborhood of the center. If such situation occurs where the liquid agent or compound gathers around the center, it may be distributed unevenly, causing the grinding to occur in different degrees in the respective neighborhoods of the center and outer peripheral portion of the grinder. As a result, the object thus ground may contain irregularities on the surface. To avoid this, the hollow portion is provided for accommodating some of the abrasive liquid agent or compound that gathers around the center of the grinder.

[0018] In accordance with the present invention, the abrasive cloth is provided on the side of the grinder that faces opposite the surface of an object being ground, and the longitudinal grooves and lateral grooves are provided in the grid form on the side of the grinder abutting against the surface of the object, or on the surface of the abrasive cloth. Thus, the liquid agent or compound can flow and escape around those longitudinal and lateral grooves when the grinder is rotating. This has the effect of prevent the traces of the buffing from being left on the object during the cloth grinding stage.

[0019] In accordance with the present invention, the fastening means for securing the grinder to the rotary grinding machine is provided in the form of the pair of velvet fasteners that facilitates the exchange of the grinders, depending upon their uses, such as the coarse grinding and fine grinding.

[0020] In accordance with the present invention, the hollow portion is provided in the center of the grinder for accom-

modating some of the liquid agent or compound that gathers there. This hollow portion can prevent the surface of the object from being ground irregularly due to the liquid agent or compound that gathers around the center.

BRIEF DESCRIPTION OF DRAWINGS

[0021]

Fig. 1 is a plan view illustrating the surface of the grinder that is located on the side abutting against the object being ground;

Fig. 2 is a front sectional view illustrating the grinder with the surface shown in Fig. 1 being placed on the upper side of the grinder;

Fig. 3 is a plan view illustrating the surface of the grinder on the side on which the grinder may be mounted to the rotary grinding machine; and

Fig. 4 is a diagram that serves to explain the relationship between the grooves on the abrasive cloth and the direction in which the grinder is rotating, in which Fig. 4 (a) is a diagram that serves to explain the relationship for the prior art grinder in which only the longitudinal grooves are provided, and Fig. 4 (b) is a diagram that serves to explain the relationship for the embodiment of the present invention shown in Fig. 1 in which the longitudinal grooves and lateral grooves are provided.

BEST MODE OF EMBODYING THE INVENTION

[0022] The best mode of the embodiment of the present invention is now described below by referring to the accompanying drawings. It is noted that Fig. 2 is a front cross sectional view of the grinder according to the present invention, which shows that the abrasive cloth 3 that is used to grind the surface of an object by bringing the abrasive cloth 3 into contact with the surface of the object is placed on the upper side of the grinder. Fig. 1 is a plan view of the grinder according to the present invention, which shows that the abrasive cloth 3 that is used to grind the surface of an object by bringing the abrasive cloth 3 into contact with the surface of the object is placed on the upper side of the grinder.

[0023] In accordance with the present invention, the grinder 1 includes a resilient plate 2 having one side (the upper side in Fig. 2) bonded to a abrasive cloth 3 and the other side (lower side in Fig. 2) bonded to a velvet fastener 5, in which the bonding may be performed by using any suitable adhesive medium for both sides.

[0024] The resilient plate 2 has the thickness of about 2 cm, and may be made of any sponge material so that it can have the disk form having the trapezoidal shape in cross section as shown in Fig. 2. It has a through hole 6 having the diameter of about 3 cm in the center.

[0025] The abrasive cloth 3 includes a base cloth 4 on which individual wool fibers 8, 8 each having the length of 4 to 6 mm are implanted. The abrasive cloth 3 has the same shape in plane as the bottom side (the upper side in Fig. 2) of the resilient plate 2 that has the trapezoidal cross section. The individual wool fibers 8, 8 that are implanted on the base cloth 4 are grouped as shown by 9, 9 for each area delimited by the longitudinal grooves 7a and lateral grooves 7b crossing each other like the grid (Fig. 1). Each of the longitudinal and lateral grooves has the width of about 1.5 mm to 3.5 mm, each adjacent longitudinal groove 7a, 7a and each adjacent lateral groove 7b, 7b being spaced by 5 mm to 8 mm from center to center, respectively.

[0026] The velvet fastener 5 on the resilient plate 2 has the same shape in plane as the upper side (the lower side in Fig. 2) of the resilient plate 2 that has the trapezoidal cross section.

[0027] The construction of the grinder 1 has been described so far.

[0028] Now, how the grinder 1 can be used is described below.

[0029] A rotary plate having one velvet fastener 5 that forms a counterpart to the other velvet fastener 5 in the pair on the grinder 1 may be coupled to the bottom end of the rotary shaft of the rotary grinding machine (not shown), and the grinder 1 may then be mounted on the rotary grinding machine by attaching the pair of velvet fasteners 5, 5 to each other.

[0030] Next, a liquid agent or compound that may be used for the grinding is attached to the abrasive cloth 3. Then, the surface of the object being ground may be ground by driving the grinder 1 for rotation.

[0031] Referring now to Fig. 4 (b), the relationships between the longitudinal grooves 7a and lateral grooves 7b on the surface of the abrasive cloth 3 and the direction in which the grinder 1 is rotating is explained by comparing with the prior art in which only the longitudinal grooves are provided as shown in Fig. 4 (a).

[0032] Fig. 4 (a) is provided for the purpose of comparison, and is used to explain the rotation of the conventional grinder 10 in which the longitudinal grooves 15 are provided but the lateral grooves are not provided. Arrows 11, 12 indicate the direction of the rotation of the grinder 10.

[0033] In the area A surrounded by an ellipse, on one hand, the longitudinal grooves 15 are substantially parallel with the arrow 11 indicating the direction of the rotation of the grinder 10. Thus, the abrasive liquid agent or compound may flow along the longitudinal grooves 15 in the moderate manner. In the area B surrounded by the ellipse, on the other

hand, the longitudinal grooves 15 are substantially at right angles to the arrow 12 indicating the direction of the rotation of the grinder 10. Thus, it may be presumed that some of the abrasive liquid agent or compound that stays in the longitudinal grooves 15 may be entrained by the edges of the longitudinal grooves 15, causing the traces of the buffing to be left slightly on the surface of the object being ground. It follows from this that for the grinder that only includes the longitudinal grooves 15, the traces of the buffing that may be left on the surface of the object being ground will be increased.

[0034] In contrast, for the grinder 1 according to the present invention, it may be seen from Fig. 4 (b) that the longitudinal grooves 7a that are substantially parallel with the arrow 13 indicating the direction of the rotation of the grinder 1 exist in the area C surrounded by the ellipse, and the lateral grooves 7b that are substantially parallel with the arrow 14 indicating the direction of the rotation of the grinder 1 also exist in the area D surrounded by the ellipse. This means that the grooves that are substantially parallel with the direction of the rotation of the grinder 1 exist over the entire surface of the abrasive cloth 3, which permits the abrasive liquid agent or compound to flow moderately along the longitudinal grooves 7a or lateral grooves 7b over the entire surface of the abrasive cloth 3.

[0035] More specifically, it means that, in the areas surrounded by the ellipse, such as the areas C and D, for example, over the entire surface of the abrasive cloth 3, the grooves that are substantially parallel with the direction of the rotation of the grinder 1 may exist, while at the same time, the grooves that are substantially at right angles to the direction of the rotation of the grinder 1 may exist. For the conventional grinder 10 shown in Fig. 4 (a), it may be presumed that the abrasive liquid agent or compound may stay in the longitudinal grooves 15 that are substantially at right angles to the direction of the rotation of the grinder 10 as described before, some of which may be entrained by the edges of the longitudinal grooves 15, causing some traces of the buffing to be left on the surface of the object being ground.

[0036] For the grinder 1 according to the present invention shown in Fig. 4 (b), however, the longitudinal grooves and lateral grooves are provided like the grid, and the abrasive liquid agent or compound that may have stayed in the grooves that are substantially at right angles to the direction of the rotation of the grinder 1 can be made to flow at once from the above grooves into the grooves that will be substantially parallel with the direction of the rotation of the grinder 1. In this way, the abrasive liquid agent or compound that may be entrained by the edges of the grooves can be reduced.

[0037] When the surfaces of the objects that have been ground by the abrasive cloth on the grinder 1 according to the present invention shown in Fig. 4 (b) are practically compared with the surfaces of the objects that have been ground by the cloth on the grinder 10 according to the prior art shown in Fig. 4 (a), it has been found that there are fewer traces of the buffing left on the surfaces when the grinding operation is performed by using the grinder 1 than when the grinding operation is performed by using the grinder 10.

[0038] Following the grinding operation performed by using the grinder 1, the finish polishing operation may be performed by using the grinder on which the fine abrasive cloth is attached or the grinder made of the sponge material. As the traces of the buffing that may be left on the surface during the grinding operation using the cloth can be reduced considerably, the time required for the finish polishing operation can be reduced accordingly. As a result, the total operation time and labor can be reduced.

[0039] In accordance with the present invention, the abrasive liquid agent or compound that gathers around the center of the grinder 1 can be held by the through hole 6 provided in the center of the grinder 1. Thus, the abrasive liquid agent or compound can be distributed uniformly over the entire surface of the grinder 1, and there is no risk that the object will be ground excessively by the liquid agent or compound that gathers around the center of the grinder 1.

[0040] Although the present invention has been described above with reference to the particular embodiments of the present invention, it should be understood that the present invention is not restricted to those embodiments, but may be changed or modified in numerous ways without departing from the spirit or scope of the invention as defined in the appended claims.

Claims

1. A grinder comprising a resilient plate having one side bonded to the back side of an abrasive cloth and the other side on which a fastening means for attaching the grinder to the rotary shaft of a rotary grinder is provided, **characterized in that** longitudinal grooves and lateral grooves are provided in a grid form on the surface of the abrasive cloth on the side abutting against an object to be ground.
2. The grinder as defined in Claim 1, **characterized in that** fibers are implanted in each of the individual areas delimited by the longitudinal grooves and lateral grooves crossing each other.
3. The grinder as defined in Claim 1 or 2, **characterized in that** the fastening means includes a pair of velvet fasteners.
4. The grinder as defined in any one of Claims 1 through 3, **characterized in that** a hollow portion is provided in the center of the grinder, said hollow portion being depressed from the side abutting against the object being ground.

toward the side being secured to the rotary shaft of the rotary grinding machine.

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FIG. 1

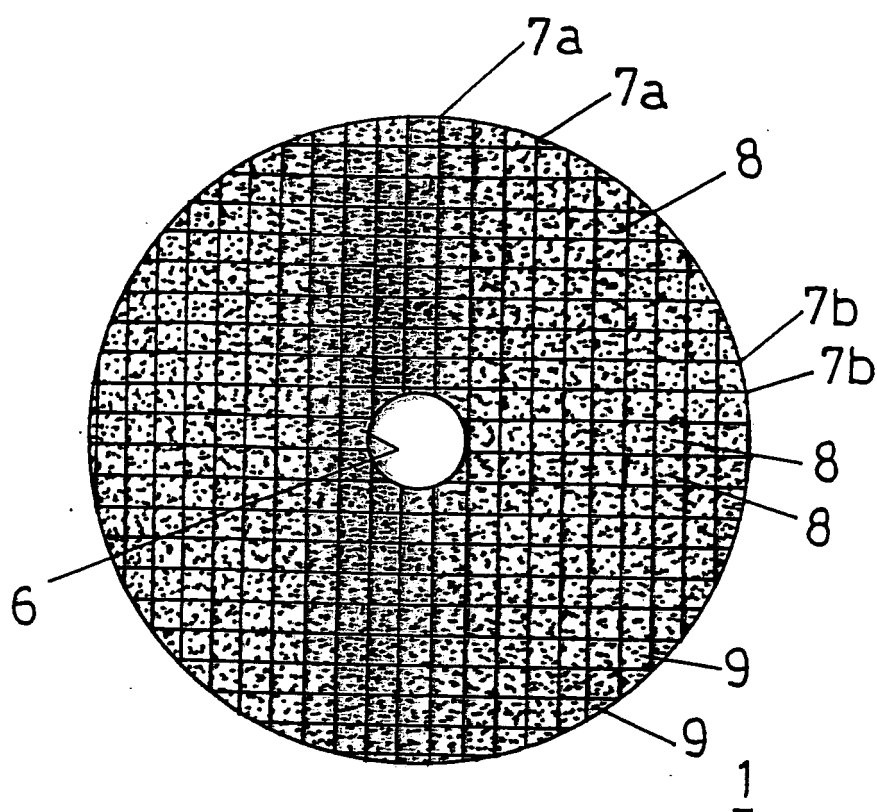


FIG. 2

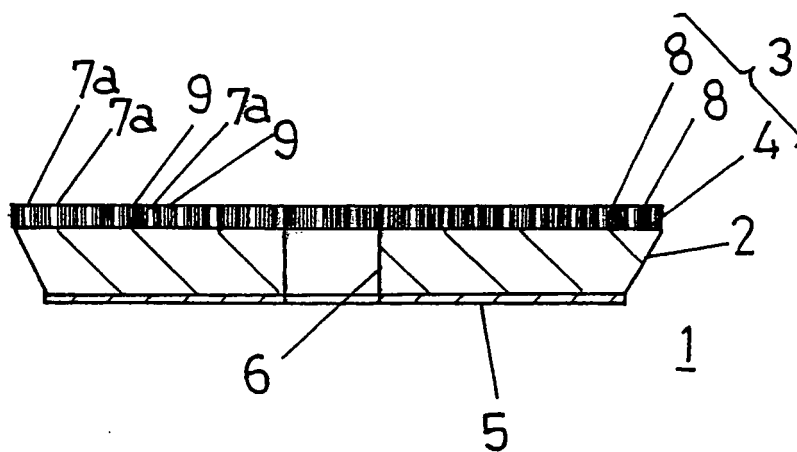


FIG. 3

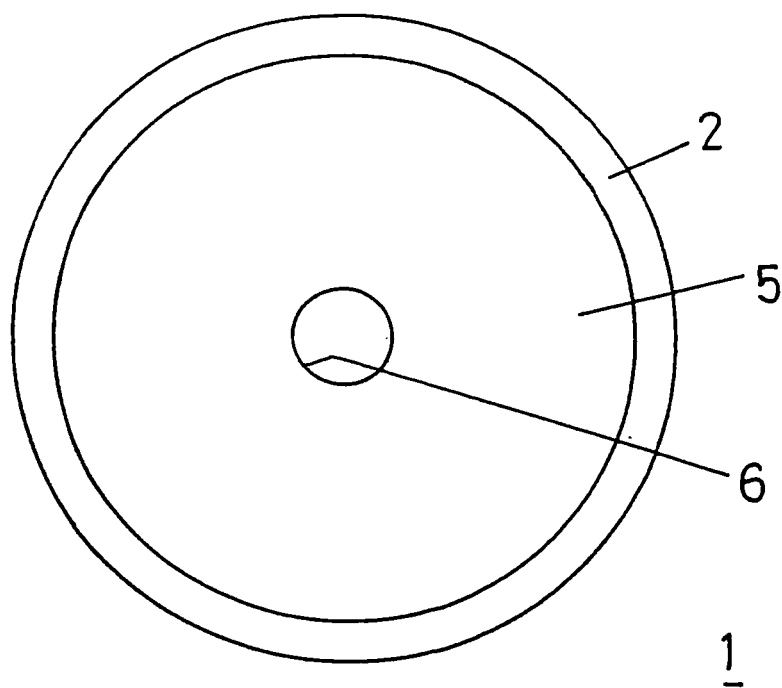


FIG. 4(a)

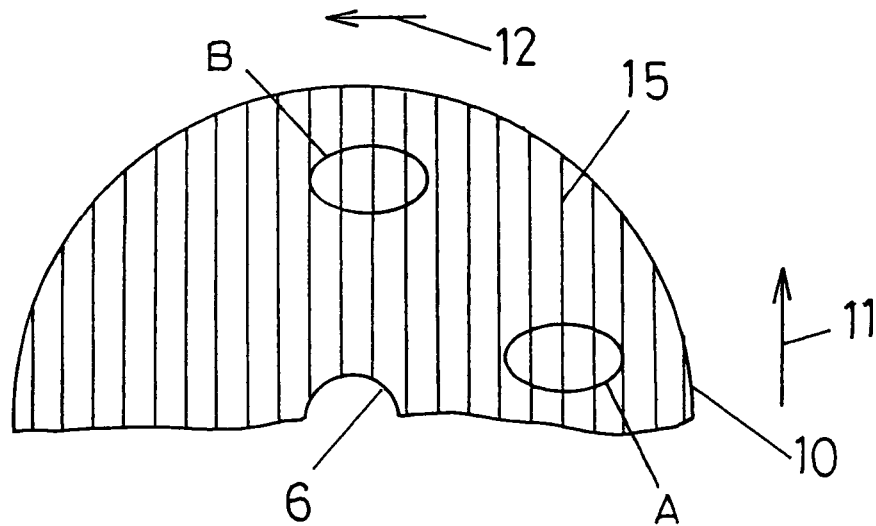
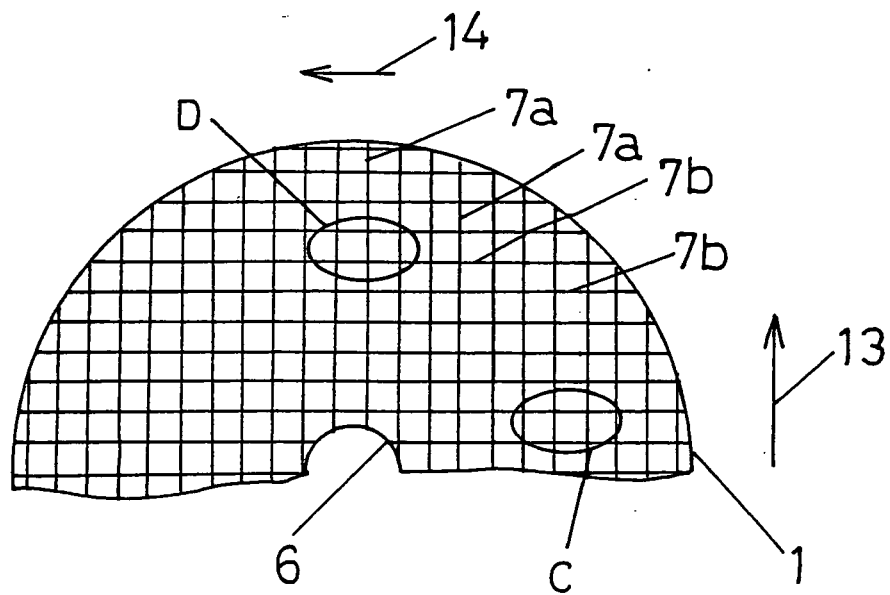


FIG. 4(b)



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/16719

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ B24D9/08		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁷ B24D9/08		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2004 Kokai Jitsuyo Shinan Koho 1971-2004 Toroku Jitsuyo Shinan Koho 1994-2004		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2002-239920 A (Kabushiki Kaisha Ujike), 28 August, 2002 (28.08.02), Claims (Family: none)	1-4
Y	JP 8-216029 A (Kabushiki Kaisha Daiki), 27 August, 1996 (27.08.96), Claims; Fig. 1 (Family: none)	1-4
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 10 March, 2004 (10.03.04)		Date of mailing of the international search report 23 March, 2004 (23.03.04)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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