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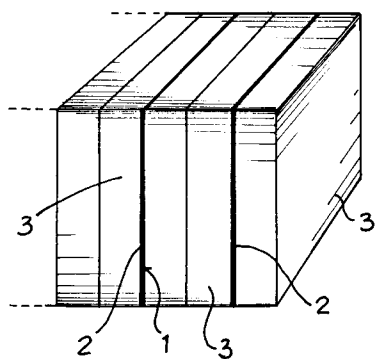
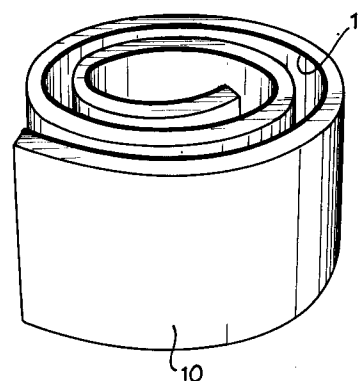
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I-25121 Brescia (IT)(54) **Composite insert for cutting tools.**

(57) The invention refers to a composite inserted part for cutting tools, composed of cutting elements (2,3,10), made of a material (3,10) having a reinforced covering. This reinforced covering (2,11) is

formed of a continuous coat made of hard material and the cutting elements (2,3) are joined together in a packet in such a way that the working parts are the heads parts.

*Fig. 1a**Fig. 5***EP 0 547 012 A2**

FIELD OF THE TECHNIC

The invention concerns the cut of fragile materials such as : glass, stone, concrete, etc., during technological operation as milling, turning, grinding, etc.

STATE OF THE ART

The manufacture of fragile materials such as glass, stone or concrete, etc., by shaving removal or by abrasion (cutting, turning, milling, grinding, etc.)at present, it is done with the use of the most modern methods: by tools composed of a support resistant to mechanical solicitations, caused by the technological operation and by an "inserted part" made of hard material, for instance tungsten carbide ; or made of material having specific abrasive characteristics (insert made of diamond), applied to the support and being in direct contact to the piece to manufacture.

The insert made of hard material and having homogeneous characteristics , for instance , small carbide plates have the following disadvantage :their available sharp edges wear out and for that reason the total insert cannot be used again. The only way is resharpening or trueing the cutting parts, but this is expensive and this is not always possible to do.

In the case of inserts made of a mixture of very hard granules, for instance diamond, incorporated inside a support, the use drives towards a progressive detaching of the above mentioned granules and then there will be a fast wear and tear of the insert.

In particular for the tooling of stones and other fragile materials , such as for instance, granite, glass , etc., the inserts are made of granules of material as hard as a diamond, boron carbide or silicium powder made of those granules is mixed with agglutinants materials and it is fixed on them as a general rule through a sintering process.

During the tooling the hard particles scratch or cut the material that has to be manufactured.

The shavings produced during the workmanship are usually removed, from the work-place, using a cooling liquid.

In usual application of this technique relates the inserts of diamond or boron nitrides applied on the drilling heads. Talking about stones and fragile materials, the inserts used at present have some defects and these are:

- poor use of granules made of hard material: as a matter of fact, during the tooling the matrix crumbles and the granules scatter;
- poor efficiency during the tooling , because the granules made of hard material lose their sharp tone in a quick way;

- high fragility of the cutting part, then poor resistance to shoves and vibrations;
- high cost of the insert because of the high cost of the starting material, and poor efficiency in using it.

There are the same above mentioned disadvantages in cutting the metals, but in a different amount.

Among the most recent inventions to improve the endurance, the efficiency and the cost of the insert , a list must be done, about the patent of invention publications:

- USSR-1397538 concerning an insert having its central part made of tungsten carbide and cobalt with external coats formed by a carbide, tungsten, cobalt and boron alloy;
- USSR-1469702 concerning an insert composed of three coats two of them external and baked clay and one of them made of a hard alloy;
- US-4861673 concerning an insert having its central part of extra-hard material of diamond, and having two external coats made of tungsten carbide or molybdenum with a 2,5 cobalt percentage. To tell exactly: the central coat holds a ferrous metal from 5 to 15% and the remaining part holds synthetical diamond granules;
- JP-63-207565 concerning an abrasive and lamellar grinder, in which an external disk drives towards the periphery some diamond granules or some boron nitre granules, a following disk is composed of a sintering of corundum carbide granules. The disks are fixed one to the other in an alternating way.

As told before, all the above mentioned recent inventions still present many defects, because the active element for the cutting is still composed of granules or fine dust inside a hard material.

The stratification is an attempt to create an insert having non-isotropical characteristics along the tool movement axes and, at the same time to improve the characteristics for its use. The problem is that the insert is very loaded along the several axes.

A tool insert used to remove shaving should have the following ideal qualities:

- high endurance on the cutting line;
- maximum hardness of the sharp part;
- maximum endurance to flexion along the sharp part;
- minimum fragility.

There is discrepancy among the above listed characteristics, because all the hard materials are fragile and have poor resistance to flexion.

It is common knowledge that, the better characteristics for anisotropy are reached with extra-fine films, having thickness of 0,1 - 10 microns or

using the same films in multi-stratum composition.

In USSR-1464349 is described a hard alloy insert and on its external surfaces is applied a hard covering made of carbide or titanium nitre, rhenium, molybdenum, hafnium or chrome, having thickness of 4 - 8 microns applied using the ionic evaporation method in absolute vacuum.

This covering improves the insert resistance against the wear. Nevertheless, because the coverings are applied on all the working sides of the insert, it cuts by the surface and not by the protruding edge, and for this reason, the cutting features of the thin coat are not used at the best.

The thin coat acts only as a separator or as a barrier between the material to tooling and the body of the insert. It's to underline that, an insert covered only by a very hard film, on its own, is not very efficient in manufacturing the stones and above all, in manufacturing the fragile materials.

THE NEWNESS AND ORIGINALITY OF THIS INVENTION

This invention is directed to improve the tooling: by the shaving removal and the abrasion of glass, stone materials, etc., and at the same time to increase the production per hour; and life of the tools, and to cut down of their cost.

These objects are reached using an insert composed of many elements, some of them covered by a thin coat of extra-hard material, later called "active elements"; and some others not covered, later called "passive elements".

The active and passive elements, are joined together inside a "packet", in a way that the edge of the hard surfaces of the covering can act as a working active element.

The active and passive elements can be in several forms such as lamellae, wires, small pipes, disks, rolled up tape, granules. The insert they make, can work in two different directions: perpendicular and inclined to the surface to manufacture.

While they are working, the passive elements wear quickly and they uncover in a progressive way the edge of the hard and sharp coat covering the active elements.

Furthermore, the superficial discontinuity between the active and the passive coats allows to get together and get rid of the shavings away from the cutting area.

The extra-hard coat can be discontinuous in some of its applications onto the active elements, to increase the cutting efficiency.

Referring to the different applications, the elements can be made of the most suited material; it can be metallic or not metallic or baked clay, and the covering or the hard film can be obtained,

depending on the different application and considering the cost, using the most suitable methods (galvanic, ceramic, ionic absolute vacuum vaporization).

The covering can have a single coat or can have multi-coats and assure three features: the increase of the transversal resistance; the starting of a self-sharpening process and the possibility of a low temperature fixing.

For the above mentioned third feature, several metals can be applied on the two sides of the element and in the heating phase during the forming of the "packet", a brazing alloy having a low fusion point is formed.

The thickness or the diameter of the passive and active elements is fixed by the requested finishing degree.

The material forming the active and passive elements is chosen on the ground of the features of the material to be machined. For instance, a passive element having tender material is more suitable to work the marble.

The right choice of the material composing the active and of course the passive elements, is done because the cutting edge can be supported avoiding its breaking off or its crumbling. If it is necessary, the active and passive elements of the same "packet" can be made of different material. The drawings attached herewith show in an indicative mood, some practical examples to realize the invention. In the mentioned drawings:

- Figure 1a shows an insert having flat lamellae form;
- Figure 1b shows an insert having flat lamellae form as in Figure 1a, after the first using phase;
- Figure 2 shows an insert having flat lamellae form, in this case setting out in inclinate mood;
- Figure 3 shows an insert having wires form;
- Figure 4 shows an insert having small pipes form;
- Figure 5 shows an insert having a wrapped up tape form;
- Figure 6a shows an insert having lamellae with discontinuous covering;
- Figure 6b shows an enlarged detail of the insert in Figure 6a;
- Figure 7 shows an insert having superimposed disks;
- Figure 8 shows an enlarged detail of an insert having granules without covering;
- Figure 8a shows again, an enlarged detail of an insert having granules with a hard covering, after some work.

Figure 1a shows the active lamellae 1 covered by a thin and extra-hard film 2 interposed with passive lamellae 3.

Figure 1b shows, for instance, the same insert, after short time of work on the upper surface.

The active element 1 has had a light consumption on the upper edge band then it can support the extra-hard coat 2.

The passive element 3 because of its less hardness is much more wear and tear, and it has had greater consumption, so then the upper edge of the extra-hard coat 2 is getting away towards the insert work direction. Just so, its consumption creates a vacuum caused by the shaving and the passing of the cooling liquid.

Figure 2 shows an insert having lamellae as the insert seen in Figure 1a, but in an inclinate position. In this case too there are active element 1, the covering 2 and the passive element. The lamellae angularity improves the shavings removal away from the cutting area.

Figure 3 shows an insert composed of a whole of thin wires having a hardening covering and set together in a jacket 5.

In this insert, the active elements 4 can be made of hard material covered by an extra-hard film, the passive elements 6 can be made of more tender material and vice versa.

In Figure 4 the insert is composed of elements having very small pipes form 7 and extra-hard covering 8, active elements while the line of active elements are separated by very thin laminae 9 not covered, passive element. This insert, having small pipes form, has the advantage to be better cooled by the liquid circulating inside it.

Figure 5 shows a metallic tape 10 covered by an extra-hard material and then wrapped up to form an insert.

Figure 6 shows an insert composed on laminae 12, covered by an extra-hard coat 13 and its surface present parallel undulations 14, as in evidence in Figure 6a, these undulations allow a good circulating of the cooling liquid.

Figure 7 shows an insert composed by superimposed disks 15, having preferably a central hole, some of them are covered by an extra-hard coat 16 - active elements - and some others are not covered. In conclusion: Figure 8 shows an insert including some not covered granules and Figure 8a shows an insert with some covered granules; and both these cases are considered after having worked. Notice that in the drawing of Figure 8 the granules have become inefficient and they can be detached as shown by 1a, while in Figure 1a, while in the embodiment in Figure 8a, the granules have always the efficiency caused by the covering 2.

PRACTICAL APPLICATIONS

For practical use, the insert has to fixed on the tool support by brazing, sticking, etc., however in a

known way.

As the manufacture is done by the edge of the hard film, it is very important that the movement trajectory of the insert is coordinated to the cutting elements position.

The insert having flat elements (Figures: 1,2,6,7) are suitable for tools in which the anisotropy is absolutely necessary (saws, drillin crowns, cutters, etc.,).

The inserts having wires form elements, small pipes form, wrapped tape form, granules form (Figures: 3,4,5,8,8a), are more suitable for grinding or polishing flat surfaces and on which the cutting features not depending on the movement trajectory of the insert are requested. The thin and extra-hard films alternate with supporting elements, remarkably increase the cutting ability, as it happens on a saw-blade.

SOME EXAMPLES OF ITS INDUSTRIAL PRODUCTION AND APPLIANCE EXAMPLE N.1

The insert is formed of flat lamellae, kept together by a bakalite glue. The passive elements are composed of brass lamellae having 0,5 mm thickness, the active elements are composed of temperate carbon steel, having 0,05mm of thickness covered by molybden nitre (HV=5,000Kg/mm²).

The elements are disposed in an orthogonal manner as regards the surface to manufacture. The insert has been tried on a machine used for milling and grooving into the stone (marble) the result was: the same production per hour, the same duration of the tool normally obtained having a diamond milling, but the tools cost was less.

EXAMPLE N.2

An insert for a grinding tool has been realized pressing a spring wrapped tape roll -see Figure 5- inside a pipe form container. The tape is in temperate carbon steel and it has 0,08 mm thickness and it is covered by a molybden nitre and diamond film. The grinding heads having these particular types of inserts, during the granite polishing and grinding, gave better results as regards those having diamond inserts.

The tools endurance was double and they had lower costs.

EXAMPLE N.3

An insert (similar to the one in Example n.2) has been realized, it has a discontinuous tipe covering and a 0,8 mm of pitch. The proof has been performed as the one in Example n2 the cutting productiveness has increased 1,5-2 times and the

tool endurance has increased 1,2-1,5 times.

Claims

1. A composite insert for cutting tools, including a plurality of cutting elements having a covering formed of hardening material coat, characterized in that the cutting elements are joined together in a "packet", in such a way that the working parts are on a head, at least. 5
10
2. Composite insert as claimed in claim 1, characterized in that the cutting elements are in the form of lamellae. 15
3. Composite insert as claimed in claim 1, characterized in that the cutting elements are in the form of wires. 20
4. Composite insert as claimed in claim 1, characterized in that the cutting elements are in the form small pipes. 25
5. Composite insert as claimed in claim 1, characterized in that the cutting elements are in the form of wrapped band. 30
6. Composite insert as claimed in claim 1, characterized in that the cutting elements are in the form of disks with central holes. 35
7. Composite insert as claimed in claim 1, characterized in that the cutting elements are in the form of granules with harden covering. 40
8. Composite insert as claimed in claims 1-7, characterized in that the cutting elements are divided by passive elements, made of vibrations absorption material. 45
9. Composite insert as claimed in claims 1-7, characterized in that the cutting elements, in the insert packet are inclined as regards its head surface and also as the movement direction. 50
10. Composite insert as claimed in claims 1-7, characterized in that the cutting elements, inside the insert packet are perpendicularly arranged as regards the head surface and inclined as regards the direction of movement. 55
11. Composite insert as claimed in claims 1-7, characterized in that the cutting elements inside the insert packet are inclined as regards the head surface and perpendicular as regards the direction of movement.
12. Composite insert as claimed in claims 1-7, characterized in that the cutting elements inside the insert packet are perpendicular as regards packet head surface and the direction of movement.
13. Composite insert as claimed in claims 1-12, characterized in that the harden covering is applied onto an irregular base.

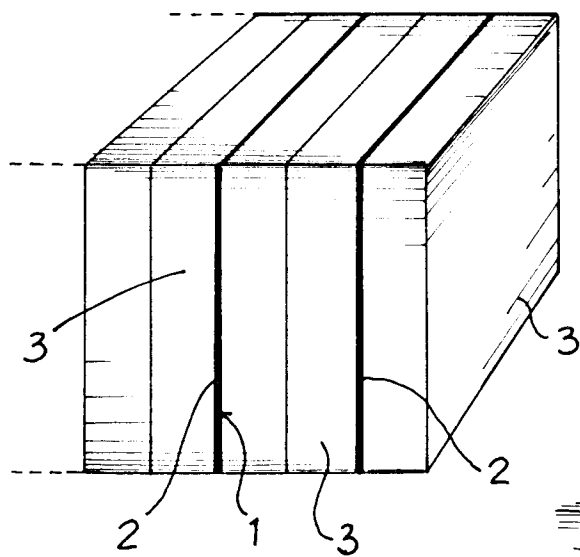


Fig. 1a

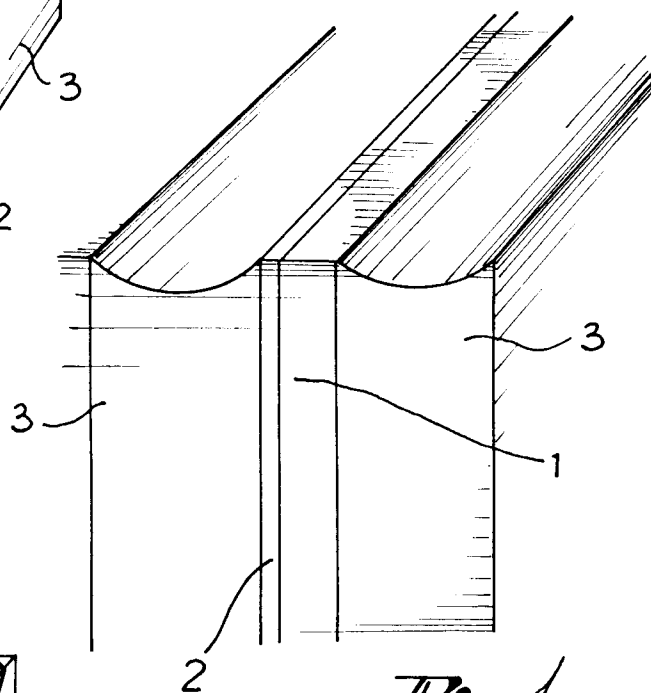


Fig. 1b

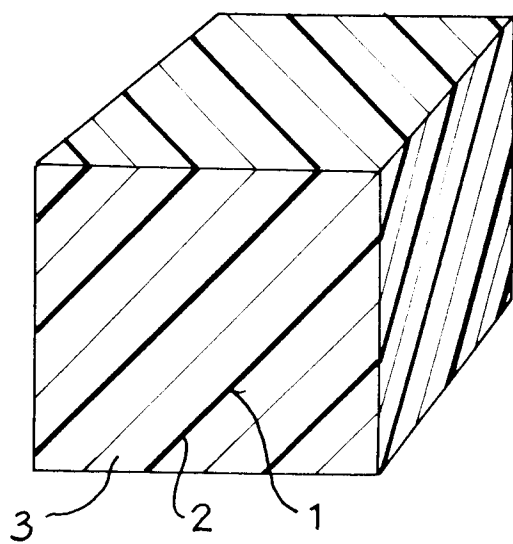


Fig. 2

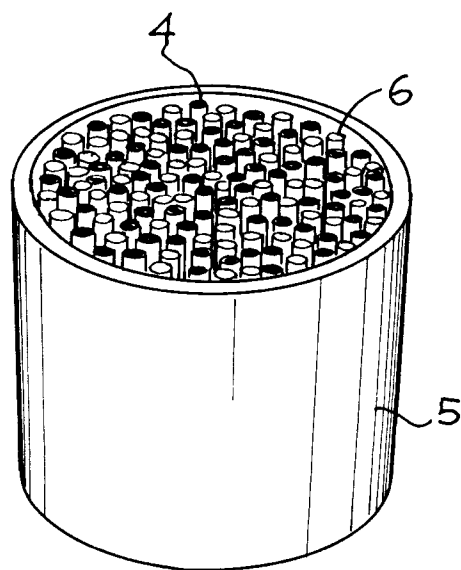


Fig. 3

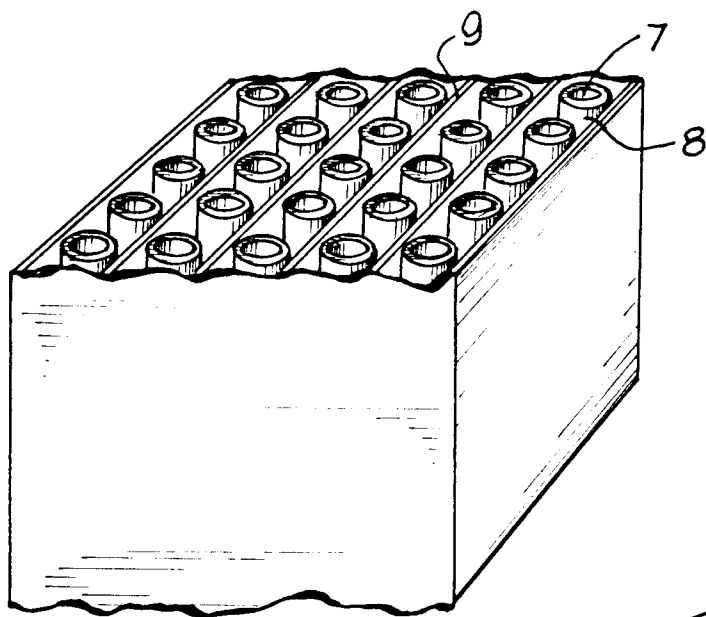


Fig. 4

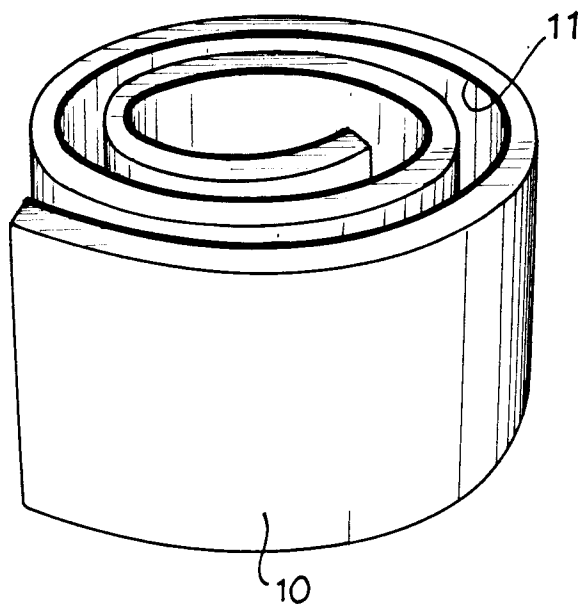


Fig. 5

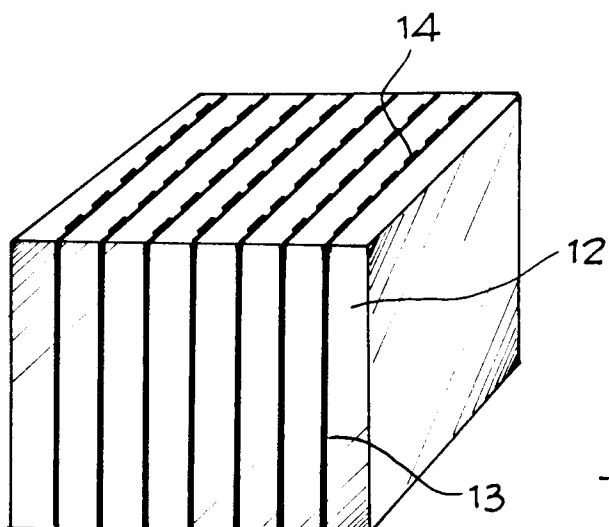


Fig. 6a

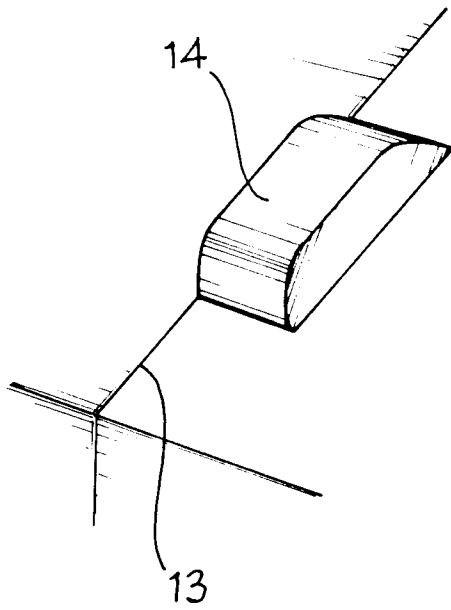


Fig. 6b

Fig. 7

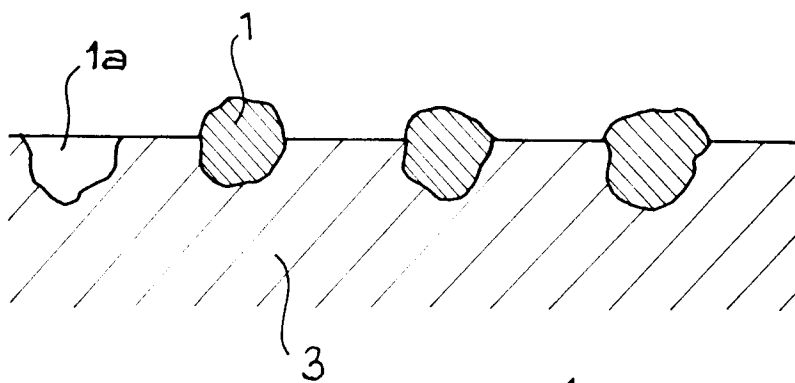
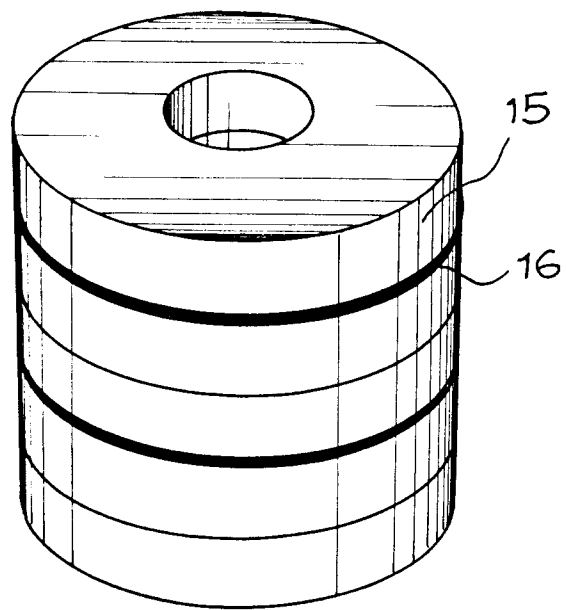


Fig. 8

Fig. 8a

