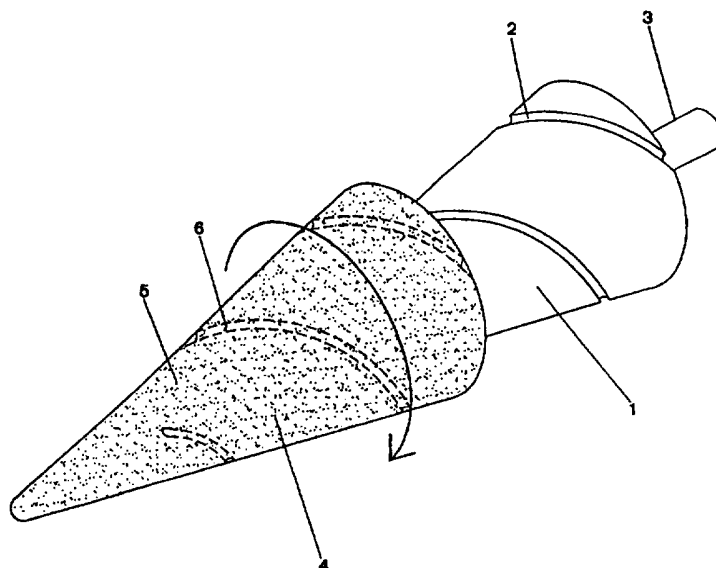




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: TOOL FOR GRINDING AND POLISHING OBJECTS AS WELL AS GRINDING MEMBER AND METHOD FOR PRODUCING GRINDING MEMBERS FOR SUCH A TOOL

**(57) Abstract**

A tool for grinding and polishing objects of varying geometric shape comprises a carrier (1) having a member (3) for connection to a driving unit imparting a movement thereto and a grinding member (4) provided with a grinding surface (5) adapted to be interchangeably connected to the carrier (5) through connection means (2, 6) at least partially outside thereof for changing between different grinding members. The connection means is adapted to establish a connection between the carrier (1) and the grinding member (4) along more than the half of the length of the carrier.

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5 **Tool for grinding and polishing objects as well as grinding member and method for producing grinding members for such a tool**

10 FIELD OF THE INVENTION AND PRIOR ART

15 The present invention relates to a tool for grinding and polishing objects of varying geometric shape, which comprises a carrier having a member for connection to a driving unit imparting a movement thereto and a grinding member provided with a grinding surface and adapted to be interchangeably connected to the carrier through connection means at least partially outside thereof for changing between different grinding members. The invention also relates to grinding members for this type of tools as well as a method for producing such grinding members according to the preambles of the claims directed thereto.

25 Tools of this type are primarily useful for workmen and others working with works of art and designs having irregular surfaces, where it is difficult to reach and polish in all spaces and on all surfaces by conventional tools and accessories. A desired result is not obtained by the most common tool accessories in the form of rasps, cutting edges of high-speed steel, grinding pins having ceramic surfaces, etc, should the object be to achieve fine-polished surfaces, since the grinding members of these tool accessories are too hard. Another disadvantage of such conventional tools is that they are difficult to control depending upon the fact that the hard grinding members may "throw" the tool, thus resulting in extensive damage of the tool exerted to polishing.

However, a tool defined in the introduction is to a large extent able to reduce these disadvantages, and such a tool is already known through US patent 3 928 948, in which a cone-shaped carrier is intended to be screwed into a sleeve provided with an internal thread corresponding to a thread arranged on the carrier, said sleeve being secured to the base end of a grinding member being also cone-shaped and into which the carrier is intended to be inserted. Thus, the connection means has a connection action between the carrier and the grinding member only at the extremity of the latter, which means that the grinding member has a tendency to not perfectly follow the carrying member along the length thereof in all grinding and polishing situations, which may both influence the result obtained negatively and cause a premature destruction of the grinding surface of the grinding member.

SUMMARY OF THE INVENTION

The main object of the present invention is to provide a tool of the type defined in the introduction, which finds remedy for the inconveniences mentioned above of the American patent referred to above.

This object is according to the invention obtained by providing a tool according to the appended claim 1, i.e. in which said connection means is adapted to establish a connection between the carrier and the grinding member along more than half the length of the carrier.

Thanks to the provision of the tool with such a connection means the carrier and the grinding member arranged thereon will act as if they were one single continuous body, which will especially in grinding and polishing surfaces against which the grinding member is pressed by a certain force lead to a maintained good machining result without any risk for harmful loads directed obliquely on the grinding member or premature destruction of the grinding surface of the grinding member as a consequence of folding or the like, which was a risk for the tool according to the American patent mentioned above.

According to a preferred embodiment of the invention said connection means is adapted to establish a connection between the carrier and the grinding member along more than 65% of the length of the carrier. Such a long connection of the carrier and the grinding member in the longitudinal direction of the carrier confers an excellent rigidity on the grinding and polishing tool in the use thereof.

According to another preferred embodiment of the invention the connection means is adapted to establish a connection by threads, the thread runs externally of the carrier and has a pitch between two consecutive turns of the thread exceeding 0.7 times the radius of the carrier. Thanks to the utilization of the connection by threads with such a large pitch it is possible to obtain a quick connection for quickly and comfortably changing grinding members should a grinding member have been worn out or should there be a desire to change to a grinding member having another outer shape, at the same time as the good stability of the tool may be ensured thanks to the long connection between the carrier and the grinding member in the longitudinal direction of the carrier, since most often only a few turns of the thread are needed so as to obtain the connection required.

According to a further preferred embodiment of the invention said pitch exceeds the radius of the carrier, which has turned out to be very advantageous from the quick-changing point of view.

According to another preferred embodiment of the invention the carrier is substantially cone-shaped, and the grinding member has a recess being correspondingly cone-shaped and adapted to receive the carrier upon establishing a connection therebetween. Such a shape of the carrier and the recess of the grinding member for the carrier enables an easy establishing of a good connection therebetween and a steady supporting of the grinding member by the carrier.

According to another preferred embodiment of the invention the grinding member has a cone-shaped outer shape provided with the grinding surface. Such a cone-shaped grinding surface makes it possible to efficiently reach into spaces which are difficult to machine by conventional tools and it may advantageous also be used for grinding and polishing flat surfaces.

Another object of the present invention is to provide a grinding member being particularly well suited to reach and obtain grinding and polishing of surfaces being difficult to reach in any particular shape of an object to be ground.

This object is according to the invention obtained by providing such a grinding member with a ball-shaped outer shape provided with the grinding surface. A grinding member so designed makes it possible to get access inside all types of round, i.e. concave surfaces, such as for example when grinding and polishing a bowl.

The object is also obtained by providing such a grinding member with a cylindrical outer shape provided with the grinding surface. Such a cylindrical grinding member is well suited for grinding and polishing inside cavities having substantially straight walls in different types of objects.

According to a preferred embodiment of the grinding member last mentioned this is made of a compressible material for making a contact by the grinding surface thereof to convex surfaces to be ground upon pressing the outer surface of the grinding member thereagainst. The possibility to an efficient grinding and polishing of different curved surfaces, such as for example the outer surface of a conventional bowl, is obtained by this.

A third object of the present invention is to provide a method for producing a grinding member for a tool for grinding and polishing,

which is simple and results in a high quality product being fine-grained to an optional extent.

5 This object is according to the invention obtained by providing a method, in which a body having an external surface of plastic material is coated by a glue and alumina being fine-grained to a desired extent. A grinding member may in this way be obtained by the direct coating of a body by a glue, in which fine-grainedness of the grinding surface so obtained may be chosen by choosing the fine-grainedness of the
10 alumina.

Further advantages as well as advantageous features of the invention will appear from the following description and the other dependent
15 claims.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, below follows a description of preferred embodiments of the invention cited as examples.
20

In the drawings:

Fig. 1 is a perspective view of a carrier of a tool according to the invention,
25

Fig. 2 is a perspective view of a grinding member of a tool according to the invention,

Fig. 3 illustrates in perspective how the grinding member according to Fig. 2 is intended to be applied on the carrier according to Fig. 1,
30

Fig. 4 illustrates a tool provided with a grinding member according to a second preferred embodiment of the invention in function,

5 Fig. 5 illustrates a tool provided with a grinding member according to a third preferred embodiment of the invention in function, and

10 Fig. 6 illustrates a tool provided with a grinding member according to a fourth preferred embodiment of the invention in function.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

15 Fig. 1 shows in perspective a carrier 1 in the form of a substantially cone-shaped body, which is intended to carry a grinding member outside thereof, said member being illustrated further below. Preferably, at least the outer walls of the carrier are made of a compressible material, such as rubber. In the present case the whole carrier is
20 made of rubber. The carrier 1 has a thread groove 2 running therearound and having a large pitch, and a large pitch means that the distance between two consecutive turns of the thread exceeds 0.7 times the radius of the carrier, in which the radius of the carrier at the base end thereof, i.e. that end at which the groove starts, is intended.
25 In the case shown in Fig. 1 said pitch exceeds the radius of the carrier at said base end. The groove 2 extends over about two thirds of the length of the carrier, in which the length of the carrier is defined as the distance between the two ends thereof seen in the direction of the thread pitch. Thanks to the large pitch only a few turns of the thread
30 are needed for making the thread extend over a substantial part of the length of the carrier, so that it will in this way be possible to combine the possibility to a quick change of a grinding member received on the carrier and a good stability and fixing of a grinding member received on the carrier. The carrier is also provided with a member, in the form

of a pin 3, for connection to a driving unit imparting a movement thereto, such as securing in for example a chuck of a drilling machine, for carrying out a grinding or polishing by means of the tool. The pin 3 may of course also be secured to other driving units.

5

A grinding member 4 with the shape of a hollow cone is illustrated in Fig. 2, the cavity of which cone having a shape corresponding to the carrier 1 for receiving the carrier therein. The grinding member 4 is provided with an external grinding surface 5, in which this may be
10 formed by gluing a conventional grinding fabric on the very cone, which preferably is made of plastic material and most preferred of urethane plastic. According to a method according to the invention for producing such a grinding member a grinding member body having an external surface of plastic material, preferably of urethane plastic, has
15 however been coated by a glue and alumina being fine-grained to a desired extent. The glue is then first applied, preferably by painting or spraying, onto the external surface and the alumina is then applied, preferably by blowing or rolling it thereon. The cone-shaped grinding member 4 has an internal thread 6 in the form of a ridge running
20 therearound, which is adapted to enter into engagement with the thread groove 2 of the carrier in screwing the grinding member 4 onto the carrier 1. By the relative turning of the carrier 1 and the grinding member 4 illustrated in Fig. 3 a change of grinding member 4 on the carrier 1 may be carried out in a quick and efficient way, in which this
25 change may be carried out so as to exchange a grinding member worn out by a new one or a grinding member by another grinding member being fine-grained to another extent or having an outer shape adapted for grinding of other surfaces.

30 When grinding or polishing is carried out the carrier 1 is preferably rotated in such a direction that the reaction forces received by the grinding member from the surface being ground tend to tighten this harder to the carrier.

The operator may in grinding have a set of different grinding members and by a workshop wrinkle quickly change them for another. The cone-shaped design of the grinding member shown in Fig. 2 and 3 means that an efficient grinding may be carried out on flat surfaces and in spaces where conventional grinding tools have difficulties to obtain a good result and other shapes of the grinding member advantageous for particular applications will hereinafter be discussed with reference to Fig. 4 to 6. All of these grinding members may be used on one and the same carrier.

It is illustrated in Fig. 4 a grinding member 7 having the same inner cone shape as the grinding member according to Fig. 2 and 3, but with a ball shape 9 at one end thereof and provided with a grinding surface 8. This ball shape makes the grinding member suited for grinding of for instance the internal side of a bowl 10.

A grinding member according to a third preferred embodiment of the invention is illustrated in Fig. 5, in which this grinding member 11 internally corresponds to the two other grinding members described above, but it has an outer cylindrical shape provided with the grinding surface 12. Such a grinding member is well suited for grinding an object having straight walls, such as the inner side of a straight bowl 13, such as shown in Fig. 5. The grinding member may for such a use be formed by a comparatively rigid material, preferably a rigid plastic material.

A grinding member 14 according to a fourth preferred embodiment of the invention is illustrated in Fig. 6, which corresponds to the grinding member according to Fig. 5 except for the fact that it is manufactured by a compressible material for contacting the grinding surface 15 thereof to convex or curved surfaces 16 to be ground when pressing the outer surface of the grinding member thereagainst. For example, the outer side of the bowl 17 may in this way be efficiently ground.

Grinding has mainly been discussed above, but the tool according to the invention may just as well be used for polishing, and the definition of "grinding member" is to be interpreted as a member being used for grinding or polishing.

5

The present invention is of course not in any way restricted to the preferred embodiments described above, but many possibilities to modifications thereof would be apparent to a man skilled in the art without departing from the basic idea of the invention.

10

Completely different outer shapes of grinding members for grinding or polishing of very particularly shaped objects would for example be possible.

Claims

1. A tool for grinding and polishing objects of varying geometric shape, which comprises a carrier (1) having a member (3) for connection to a driving unit imparting a movement thereto and a grinding member (4, 7, 11, 14) provided with a grinding surface (5, 8, 12, 15) and adapted to be interchangeably connected to the carrier through connection means (2, 6) at least partially outside thereof for changing between different grinding members, characterized in that said connection means is adapted to establish a connection between the carrier and the grinding member along more than half the length of the carrier.
2. A tool according to claim 1, characterized in that said connection means (2, 6) is adapted to establish a connection between the carrier (1) and the grinding member (4, 7, 11, 14) along more than 65% of the length of the carrier.
3. A tool according to claim 1 or 2, characterized in that said connection means (2, 6) is of the quick-connection type, i.e. a connection means allowing a quick establishment and release of the connection for quickly changing grinding members on the carrier.
4. A tool according to any of claims 1-3, characterized in that said connection means (2, 6) is adapted to establish a connection by threads.
5. A tool according to claim 4, characterized in that the thread (2) runs externally of the carrier (1) and has a pitch between two consecutive turns of the thread exceeding 0.7 times the radius of the carrier.
6. A tool according to claim 5, characterized in that said pitch exceeds the radius of the carrier.

7. A tool according to any of claims 4-6, characterized in that the connection by threads is formed by a groove (2) made in the carrier and running therearound as well as a ridge (6) on an internal surface of the grinding member running around therein.

5

8. A tool according to any of claims 1-7, characterized in that at least the outer walls of the carrier (1) are made of a compressible material.

10

9. A tool according to claim 8, characterized in that the carrier (1) is made of rubber or a similar material.

15

10. A tool according to any of claims 1-9, characterized in that the carrier (1) is substantially cone-shaped, and that said grinding member (4, 7, 11, 14) has a correspondingly cone-shaped recess adapted to receive the carrier upon establishing a connection therebetween.

20

11. A tool according to any of claims 1-10, characterized in that the grinding member (4) has a cone-shaped outer shape provided with a grinding surface (5).

25

12. A grinding member for a tool for grinding and polishing objects of varying geometric shape, which has a grinding surface and is adapted to be connected to a carrier (1) having means (3) for connection thereof to a driving unit imparting a movement thereto, characterized in that it has a ball-shaped outer shape (9) provided with the grinding surface (8).

30

13. A grinding member for a tool for grinding and polishing objects of varying geometric shape, which has a grinding surface and is adapted to be connected to a carrier (1) having means (3) for connection thereof to a driving unit imparting a movement thereto, characterized in that it has a cylindrical outer shape provided with the grinding surface (12).

14. A grinding member according to claim 13, characterized in that it is made of a compressible material for making a contact by the grinding surface (15) thereof to convex surfaces to be ground upon pressing the outer surface of the grinding member (14) thereagainst.

5

15. A method for producing a grinding member for a tool for grinding and polishing, characterized in that a body having an external surface of plastic material is coated by a glue and alumina being fine-grained to a desired extent.

10

16. A method according to claim 15, characterized in that the external surface of the body is first coated by glue and the alumina is after that applied thereon.

15

17. A method according to claim 15 or 16, characterized in that it is urethane plastic that is coated by glue and alumina.

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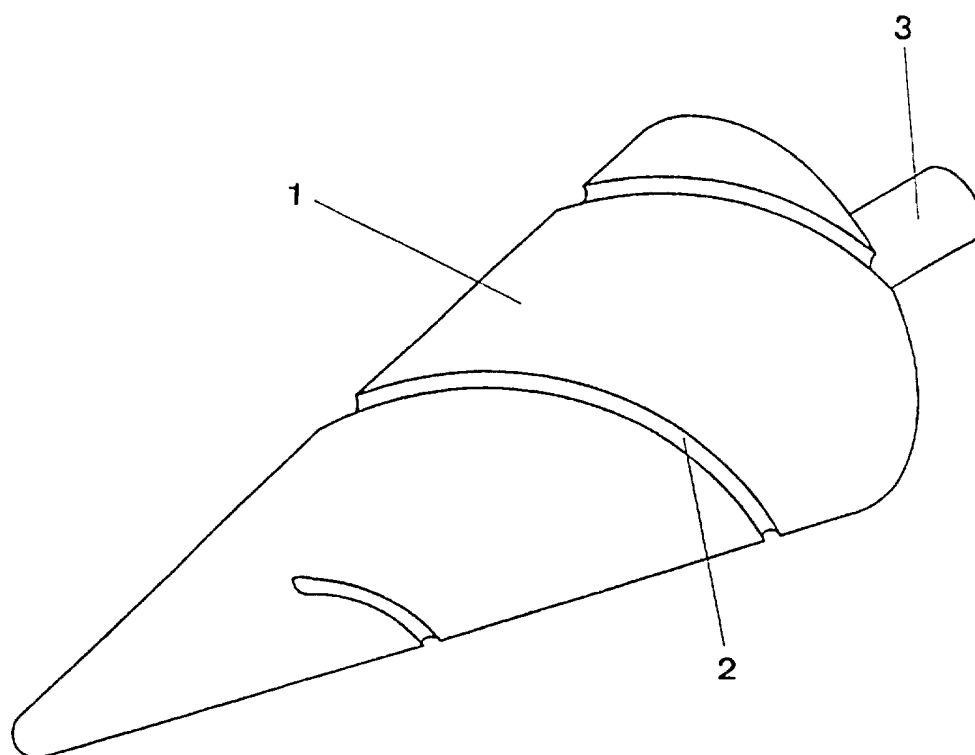


Fig 1

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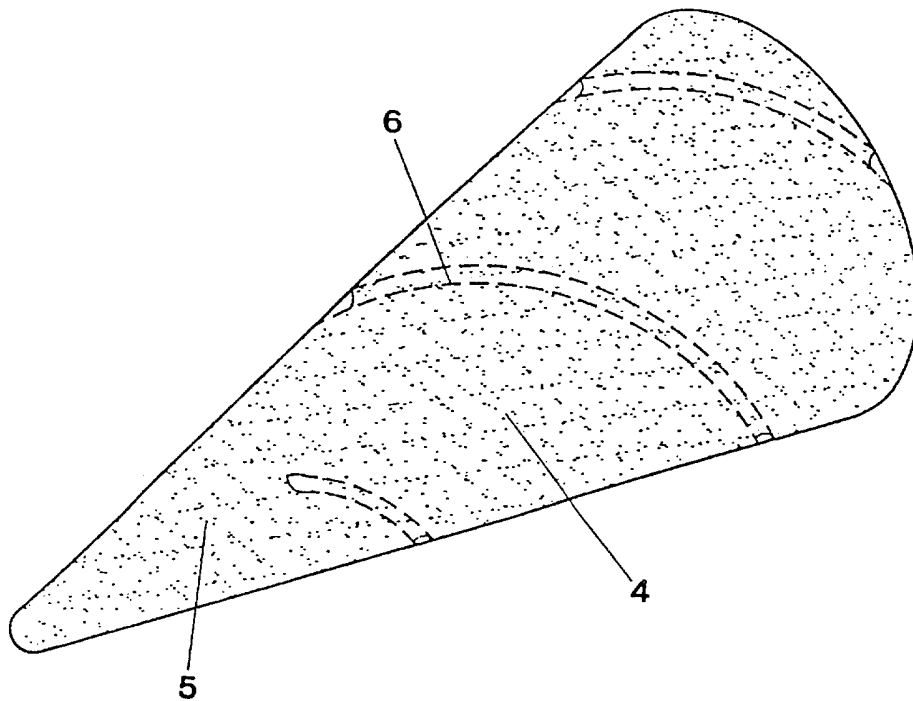


Fig 2

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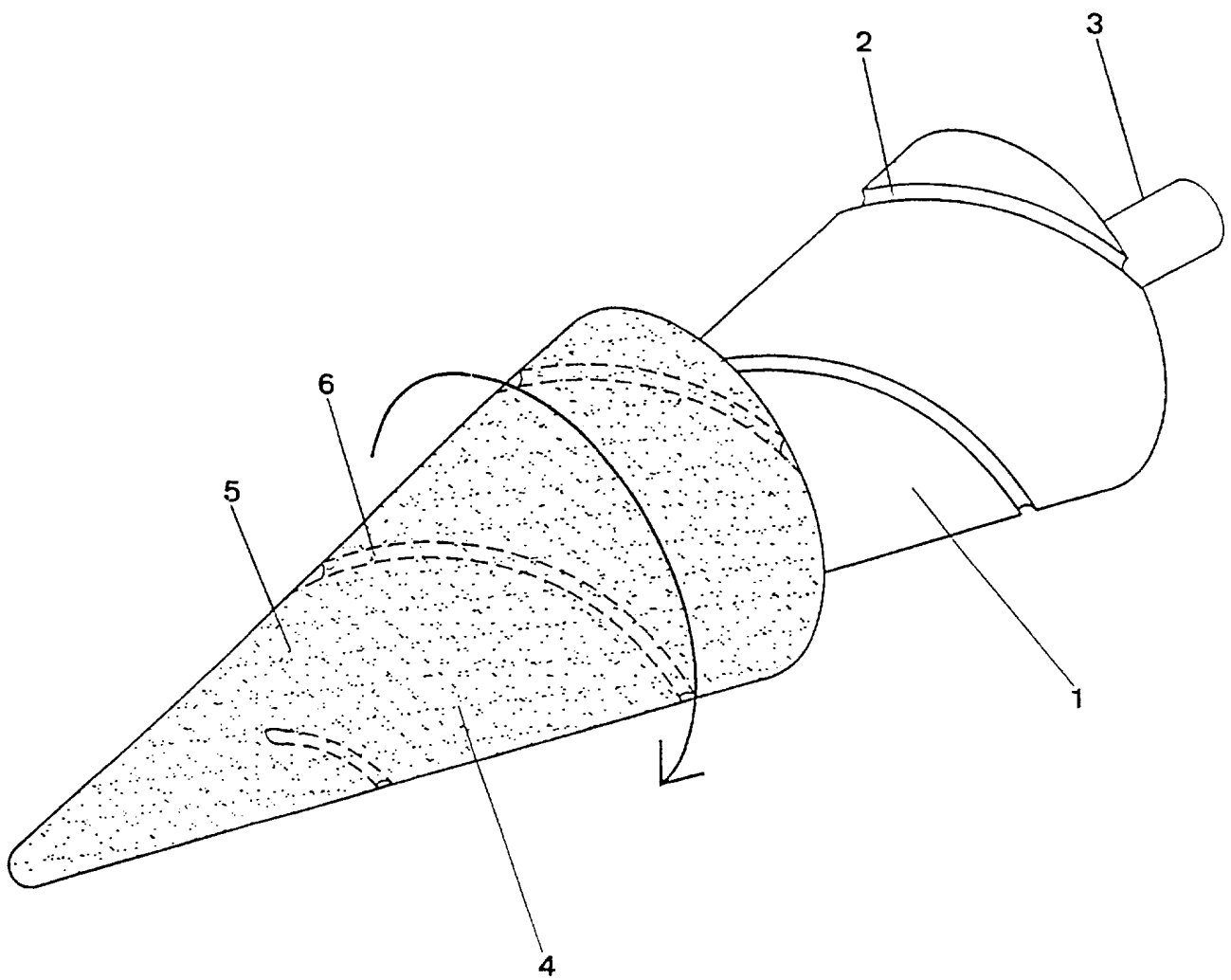


Fig 3

4/6

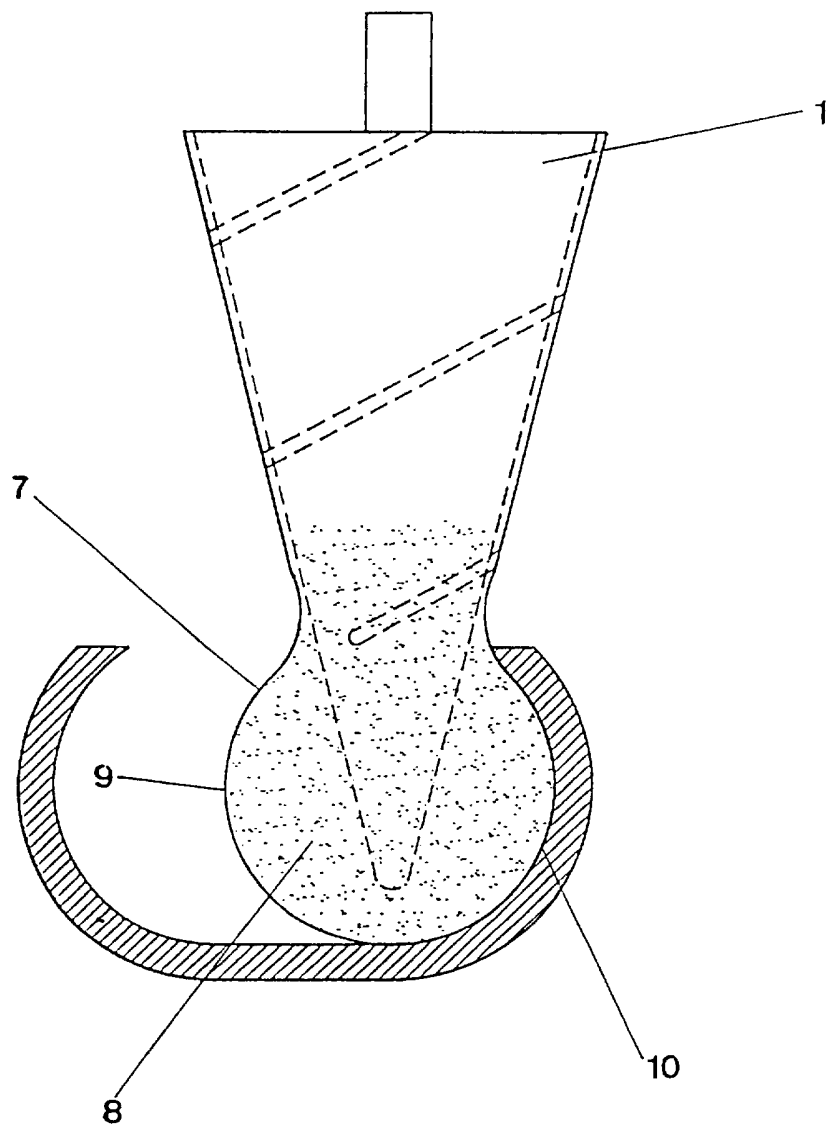


Fig 4

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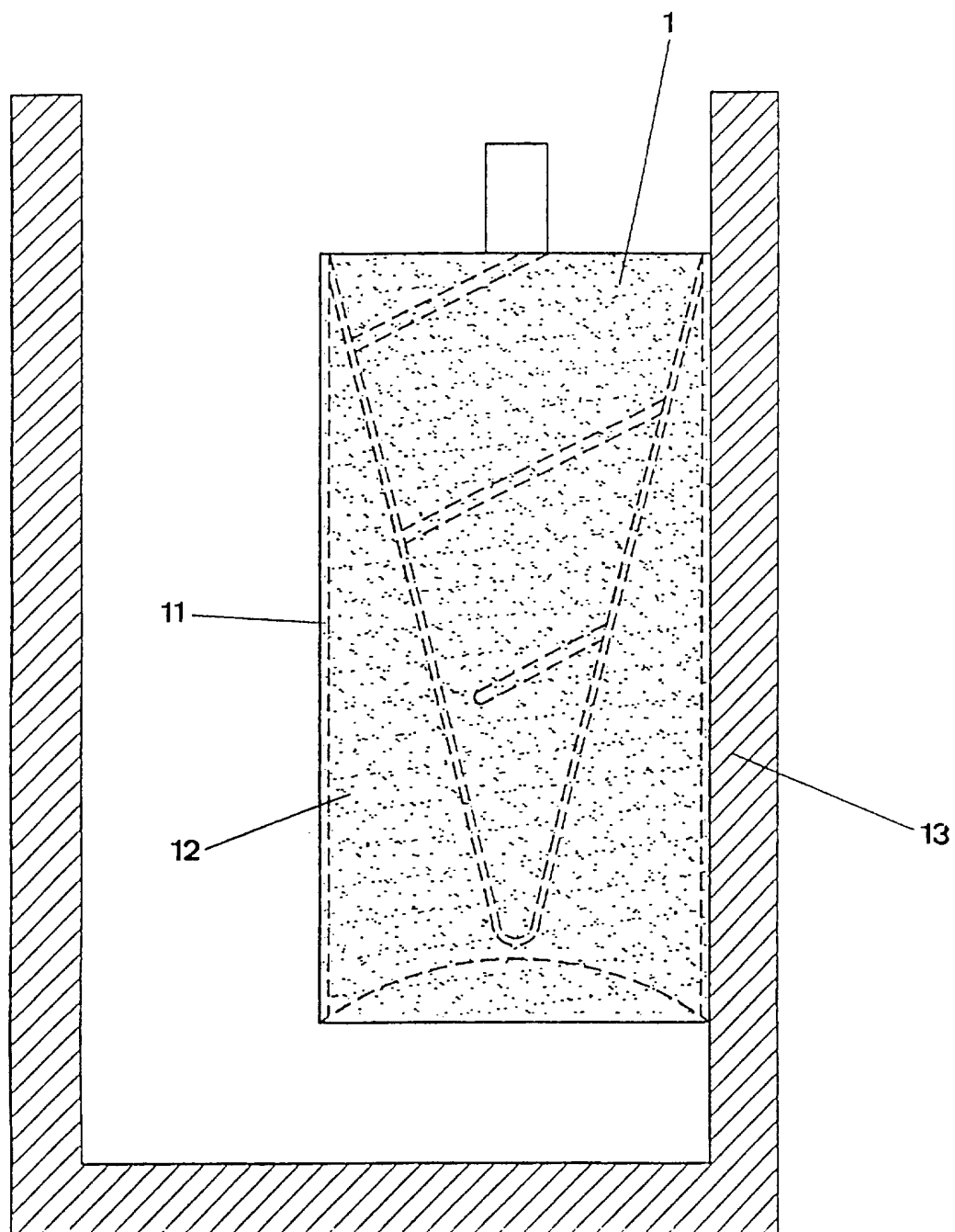


Fig 5

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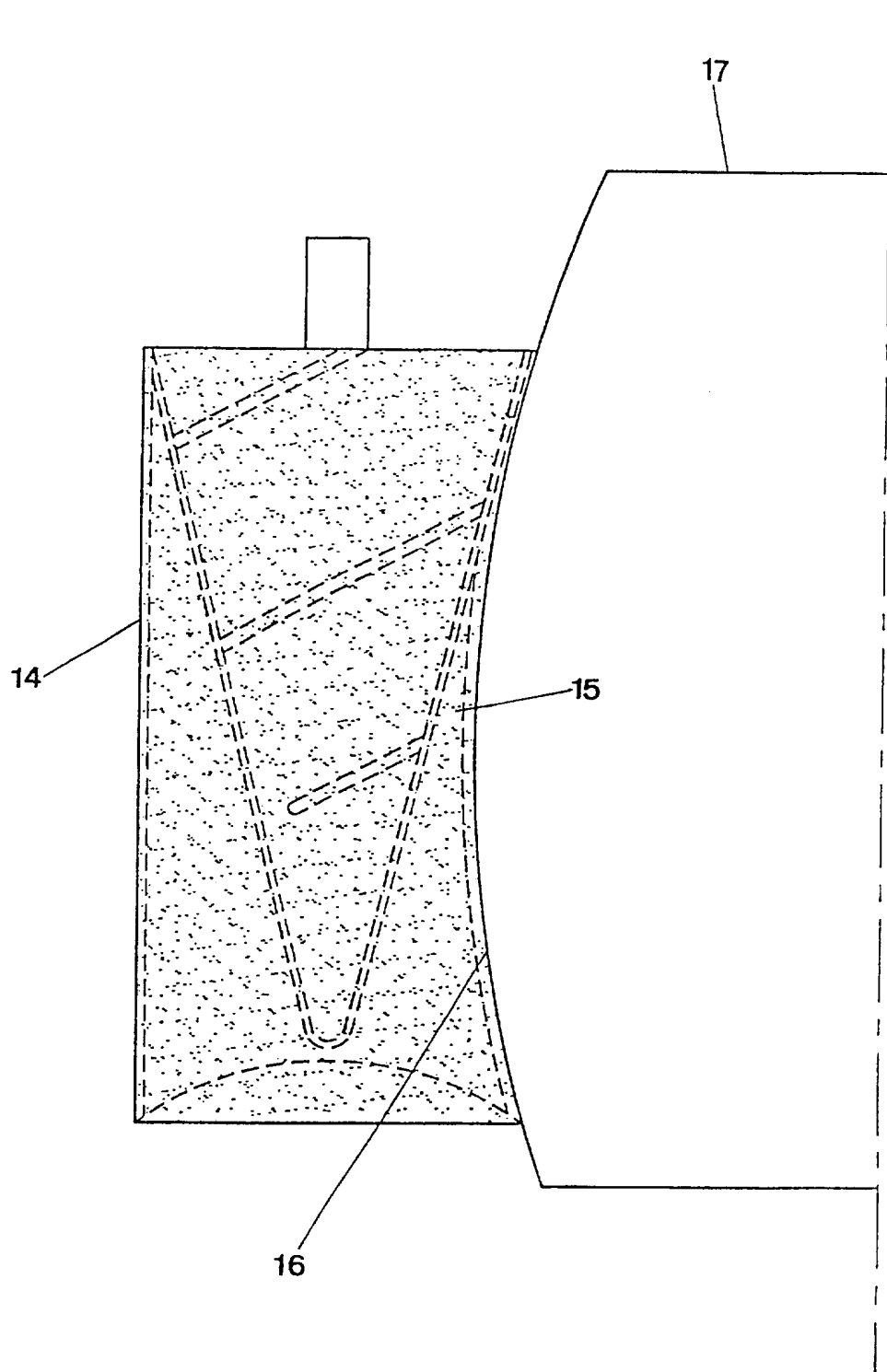


Fig 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 96/01504

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B24B 45/00, B24B 11/00, B24B 19/22, B24B 23/02, B24D 9/00, B24D 11/00
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DIALOG: WPI, CLAIMS, JAPIO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4167083 A (SÖDERBERG), 11 Sept 1979 (11.09.79), figures 2-4	1-6
Y		8-11
A		7
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X	US 739028 A (J.O. ROLLINS), 15 Sept 1903 (15.09.03), page 1, line 55 - line 58; page 1, line 64 - line 77, figure 3	1,2,4,7,10, 13
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Y	US 3928948 A (DENUNZIO ET AL), 30 December 1975 (30.12.75)	8-11
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

12 February 1997

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PCT/SE 96/01504

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

28/10/96

International application No.

PCT/SE 96/01504

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