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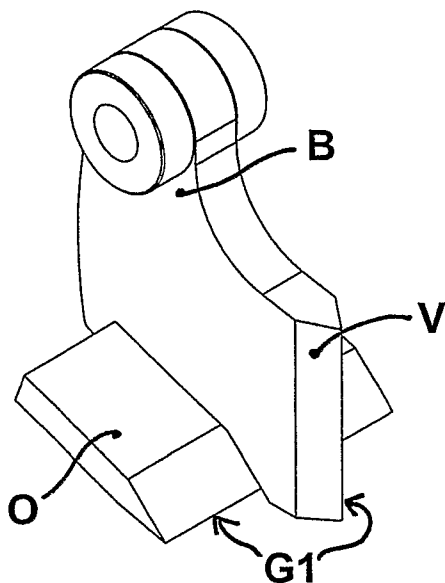
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(54) Title: CRUSHING ELEMENT FOR AGRICULTURAL, INDUSTRIAL AND OTHER TYPES OF MACHINES



(57) Abstract: The invention is a new crushing hammer for brush cutters, bioshredders, choppers and shredders for grass, twigs and pruning residues in general, organic waste, packages etc. with a fixing support (B) and at least two cutting edges integral with said fixing support (B), and wherein said cutting edges (V, O) lie on intersecting planes.

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TITLE

**CRUSHING ELEMENT FOR AGRICULTURAL, INDUSTRIAL AND
OTHER TYPES OF MACHINES**

DESCRIPTION

5 The present patent concerns the cutting tools of brush cutters, of bioshredders, of
choppers and shredders for grass, twigs and pruning residues of all sorts, such as
leaves, corn stalks and cobs, and of all machines capable of crushing products,
even in fields other than the agricultural one. In particular the patent concerns a
new cutting tool, hereinafter referred to as crushing hammer, with multi-
10 directional cutting edges and with the cutting blade on one side only or on the
back and front sides of the cutting edge (Figures 1-8, 11a-c). The cutting blade
can have a linear (Figures 1-8, 9a), toothed or irregular profile (Figures 9b, 9c, 9d,
10, 11a-d).

The new crushing hammer with multi-directional cutting edges and blade on both
15 sides, front and back, is reversible. This characteristic allows the crushing hammer
to be used twice before having to replace it, with a considerable profit for the user.
In fact first one operates with the front blades of the crushing hammer until these
are worn out, then the crushing hammer is removed from the fixing arm or plate, it
is turned round so that the unused cutting edges are brought into the operational
20 position and can be used until they are worn out. When the crushing hammer is
turned round to employ the unused rear blades, the same position of the crushing
hammer on the rotor shaft must be maintained, because in this way the balance of
the rotor shaft is maintained.

Chopping machines are known, commonly used in the farming sector to cut and
25 remove from the soil the plant residues of previous crops and general pruning
residues.

Shredding machines are also known, used for crushing and shredding pruning residues, branches, leaves, twigs, etc. Even the known bioshredders, like the chopping machines, are equipped with rotor shafts and cutting tools.

5 The known shredders essentially consist of a metal chassis, supporting one or more rotor shafts placed horizontally, vertically or diagonally with respect to the soil and orthogonal to the advancing direction of the machine. Said rotor shafts can be applied on towed or self-propelled machines, for example even trailers.

With the aid of supports, the cutting tools are fitted to the rotor shafts, which set the cutting tools rotating.

10 To improve and reduce the number of working cycles, a new type of crushing hammer with multi-directional and reversible cutting edges on both sides has been designed and implemented. The main purpose of the present artefact is to crush efficiently and quickly the material introduced in the machine; it also carries out minute crushing, does not cause machine jamming and reduces the working times.

15 The new crushing hammer can be applied to:

- brush cutters, bioshredders, choppers and shredders for grass, twigs and pruning residues of all sorts, organic and vegetable waste;
- machines that chop and shred grass, branches, corn stalks and cobs, wood of all sorts;
- 20 - machines that shred gardening residues;
- self-propelled machines, machines with 3-point hitch, towed machines and machines fitted with any sort of engine (hydraulic, internal combustion, diesel engines);
- any other type of machine capable of crushing products, even in fields other
25 than the agricultural one;
- bioshredders for disintegrating organic waste to produce high quality

- “humus”, since the new crushing hammer can shred the product very finely;
- in the industrial field on machines for shredding various types of materials, such as garbage, furniture, packages, assorted refuse and cardboard.

These and other direct and complementary purposes are achieved through the implementation of the new crushing hammer with reversible and multi-directional cutting edges on both sides.

The present artefact is composed in its main components of one or more supports for fixing to said rotor shafts of the machine and of one or more cutting edges, integral with said fixing support and arranged with the cutting blades parallel and/or perpendicular to one another and/or lying on planes that intersect each other, forming corners that can even be different from 90°.

Said artefact comprises:

- a single body obtained by casting and/or pressing;
- vertical and/or horizontal and/or inclined cutting edges welded together or coupled together with fixing elements, such as screws or rivets.

As shown in Figures 1, 2a, 2b, 3, 4, 5, 6, 7, 8, 11a-d, one or more of said vertical cutting edges (V1, V2, ..., Vn) and/or one or more of said horizontal cutting edges (O1, O2, ..., On) and/or one or more of said inclined cutting edges (T1, T2, ..., Tn) of the various types of crushing hammers previously described may comprise a front cutting blade (G1) and/or a rear cutting blade (G2), with respect to the rotation direction of the hammer.

Said front (G1) and rear (G2) cutting blades can be:

- with linear profile (G1L, G2L), as shown in Figure 9a;
- with toothed profile (G1D, G2D), as shown in Figure 9b;
- with serrated profile, as shown in Figure 9c, with small teeth (G1S, G2S), and/or as shown in Figure 9d, with for example triangular teeth (G1T, G2T);

- with irregular profile or profile in various shapes.

The following Figures 10, 11a-d, represent, as examples, five of the possible manufacturing solutions for new crushing hammers with one or more of said toothed cutting blades (G1D, G2D) and/or serrated cutting blades (G1S, G2S).

5 The present artefact must be manufactured from material capable of resisting the required working processes and suitable for welding.

The fixing arm or plate of the new crushing hammer can be:

- articulated with pivot: it allows the new crushing hammer to swing around the arm pivot or the fixing plate when the rotor shaft turns (Figure 13). As shown
10 in Figure 13, said fixing arm or plate (B) is articulated, having at least one pivot (P) for connection to said rotor shaft (R);
- fixed and/or welded onto the rotor shaft: the new crushing hammer is integral with the rotor and does not swing during the rotation of the rotor shaft (Figure 12). As shown in Figure 12, said fixing arm or plate (B) is fastened and/or
15 welded to said rotor shaft (R).

The following part describes the preferred embodiments of said new crushing hammer with reversible and multi-directional cutting edges on two sides. Note that the Figures from 1 to 3 attached herewith show three-dimensional views of various possible technical solutions of the new crushing hammer. Said figures are
20 to be considered exclusively indicative and are given purely as an example without limitation.

EMBODIMENT 1: reference figure 1;

Said new crushing hammer has two cutting edges arranged orthogonally to each other, preferably in a T or a cross. One of said cutting edges (V) is arranged
25 vertically, i.e. radial to said rotor shaft, whereas the other cutting edge (O) is arranged horizontally, i.e. parallel to said rotor shaft.

EMBODIMENTS 2-3: reference figures 2a and 2b, 3, 8;

According to a further embodiment of the invention, the new crushing hammer has a central vertical cutting edge (V), arranged radial to the rotor shafts, and two or more horizontal cutting edges (O1, O2, ..., On, where n is a number higher than or equal to 1), where the cutting edges have the same or different lengths.

Applied to the lower edge/s of said vertical cutting edge (V) there is a tooth (D) for the expulsion of foreign bodies (Figure 2b – part D).

As shown in Figures 1, 2 and 3, the new crushing hammer comprises at least one arm or vertical plate (B) for fixing to the rotor shaft of the machine, a central vertical cutting edge, substantially coplanar with said fixing arm or plate (B), and one or more horizontal cutting edges (O1, O2, ..., On, where n is a number higher than or equal to 1), i.e. arranged orthogonally to said fixing arm or plate (B), and where said vertical cutting edges (V) and horizontal cutting edges (O1, O2, ..., On) are integral with said fixing arm or plate (B).

The vertical cutting edges (V) and the horizontal cutting edges (O1, O2, ..., On) are equipped with one or more cutting blades (G1, G2), a front one (G1) and a back one (G2).

In particular, said central vertical cutting edge (V) is machined on the front and/or rear side of said fixing arm or plate (B).

EMBODIMENT 4: reference figure 4;

According to a further alternative solution, the new crushing hammer is equipped with a horizontal cutting edge (O), i.e. placed parallel to the axis of rotation, and two or more vertical cutting edges (V1, V2, ..., Vn), orthogonal to said horizontal cutting edge (O) and placed symmetrically to said fixing arm or plate (B). The cutting edges can have the same length or different lengths. The cutting edges have one or more cutting blades (G1, G2), a front one (G1) and a back one (G2).

EMBODIMENT 5: reference figures 5 and 6;

According to a further alternative solution, the new crushing hammer is equipped with one or more horizontal cutting edges (O1, O2, ..., On), i.e. parallel to the axis of rotation, and two or more vertical cutting edges (V1, V2, ..., Vn), orthogonal or inclined with respect to said horizontal cutting edges (O1, O2, ..., On) and placed symmetrically with respect to said fixing arm or plate (B), so that said horizontal and vertical cutting edges form one or more quadrangular meshes.

In the solution shown in Figure 6, the new crushing hammer comprises two or more fixing arms or plates (B), two or more horizontal cutting edges (O1, O2, ..., On) and two or more vertical cutting edges (V1, V2, ..., Vn), where each one of said vertical cutting edges (V1, V2, ..., Vn) is machined on the front and/or rear advanced side of each of said fixing arms or plates (B). The cutting edges can have the same length or different lengths. The cutting edges have one or two cutting blades, a front one (G1) and a back one (G2).

EMBODIMENT 6: reference figures 7 and 7a

According to a further solution, the new crushing hammer comprises a central vertical cutting edge (V), substantially coplanar with said fixing arm or plate (B), and one or more cutting edges (T1, T2, ..., Tn) placed transversely to said vertical cutting edge (V) and forming an angle different from 90° with this. In particular, said cutting edges (T1, T2, ..., Tn) are arranged as an upturned V and each one of the two pitches that form such cutting edges (T1, T2, ..., Tn) form a non-orthogonal angle with the plane on which said vertical cutting edge (V) lies. Even said inclined cutting edges (T1, T2, ..., Tn) have the cutting blade (G1, G2) on one or two sides. The cutting edges can have the same length or different lengths.

EMBODIMENT 7: reference figure 10;

According to a further manufacturing solution, as exemplified in Figure 10, said

horizontal cutting edge/s (O), (O1, O2, ..., On) and/or said inclined cutting edges (T1, T2, ..., Tn) have an oblique cutting blade (G1) and/or (G2), set back with respect to said vertical cutting edge (V).

5 In this way, during the rotation of the hammer the cutting and crushing action of the cutting blade (G1) and/or (G2) is exploited to the maximum, in particular in the case of the toothed cutting blade (G1D) and/or (G2D), of the serrated cutting blade (G1S, G2S) and of other types of irregular or variously shaped cutting blades.

10 The vertical cutting edge/s (V) of the new crushing hammer, in the operating phase remove any stones that may be in the soil and, owing to the fact that it projects with respect to the horizontal and/or inclined cutting edges (O and/or T), protects the horizontal and/or inclined cutting edges (O and/or T) from wear.

15 The present artefact has cutting edges arranged in at least two or more directions, in such a way as to be able to cut and crush all products, whatever position these happen to be in once they have been introduced in the machine. The solutions described above have been studied to avoid jamming caused by the product or by non-crushed product residues that could prevent the correct rotation of the rotor shaft.

20 In substance, the new crushing hammer described herein makes it possible to achieve optimal results, never obtained before by means of known hammers, as it produces less consistent residues, in less time and with less power costs.

Furthermore, during trials on the field with the new crushing hammer, it has been noticed that the material is crushed into smaller parts and in less time than when using the known cutting tools, with consequent considerable time saving.

25 In this way the power consumption and the wear of the cutting tools or crushing hammers are limited and therefore they can be used for longer periods of time.

Consequently, with reference to the above description and to the attached drawings, the following claims are made.

5

CLAIMS

1. New crushing hammer for brush cutters, bioshredders, choppers and shredders for grass, twigs and pruning residues in general, organic and non-organic waste, packaging, furniture, cardboard, with one or more supports for
5 fixing to one or more rotor shafts of said machines, characterised in that it comprises cutting edges (V, O) integral with said fixing arm or plate (B), and wherein said cutting edges (V, O) lie on different intersecting planes.

2. New crushing hammer according to claim 1, characterised in that one or more of said cutting edges (V) are arranged vertically, i.e. orthogonally to the axis
10 of rotation of said hammer, and one or more further cutting edges (O) are arranged horizontally, i.e. parallel to the axis of rotation of said hammer, and wherein said cutting edges (V) and (O) are arranged in a T o crossed over.

3. New crushing hammer according to claims 1, 2, characterised in that it comprises a vertical cutting edge (V) in a substantially central position and
15 coplanar with said fixing arm or plate (B), and one or more horizontal cutting edges (O1, O2, ..., On), and wherein said cutting edges can have the same or different dimensions.

4. New crushing hammer according to claims 1, 2, 3, characterised in that it comprises a horizontal cutting edge (O) and two or more vertical cutting edges
20 (V1, V2, ..., Vn).

5. New crushing hammer according to claims 1, 2, 3, characterised in that it comprises at least two or more horizontal cutting edges (O1, O2, ..., On) and at least two or more vertical cutting edges (V1, V2, ..., Vn).

6. New crushing hammer according to one or more of the previous claims,
25 characterised in that said vertical cutting edges (V1, V2, ..., Vn) are placed symmetrically with respect to one or more of said fixing arm/s or plate/s (B).

7. New crushing hammer according to claim 1, characterised in that it comprises a vertical cutting edge (V) in a substantially central position, coplanar with said fixing arm or plate (B), and one or more cutting edges (T1, T2, ..., Tn) lying on one or more planes that intersect the plane on which said vertical cutting edge (V) lies and are not orthogonal to this.

8. New crushing hammer according to one or more of the previous claims, characterised in that one or more of said vertical cutting edges (V), (V1, V2, ..., Vn) and/or one or more of said horizontal cutting edges (O), (O1, O2, ..., On) and/or one or more of said inclined cutting edges (T1, T2, ..., Tn) comprise one or two cutting blades, of which one (G1) is on the front side and/or one (G2) is on the rear side with respect to the rotation direction of said crushing hammer.

9. New crushing hammer according to the previous claims, characterised in that in correspondence with the front and/or rear lower end of one or more of said vertical cutting edges (V), (V1, V2, ..., Vn) a tooth (D) for the expulsion of foreign bodies is machined.

10. New crushing hammer according to one or more of the previous claims, characterised in that said cutting blade/s has/have a linear profile (G1L, G2L).

11. New crushing hammer according to one or more of the previous claims, characterised in that said cutting blade/s (G1) and/or (G2) has/have a toothed profile (G1D, G2D) and/or a serrated profile (G1S, G2S), (G1T, G2T) and/or an irregular profile and/or a variously shaped profile.

12. New crushing hammer according to one or more of the previous claims, characterised in that said cutting blade/s (G1) and/or (G2) of one or more of said horizontal cutting edges (O), (O1, O2, ..., On) and/or of one or more of said inclined cutting edges (T1, T2, ..., Tn) is/are oblique and set back with respect to said vertical cutting edge (V).

13. New crushing hammer according to one or more of the previous claims, characterised in that one or more of said vertical cutting edges (V), (V1, V2, ..., Vn) is machined onto the advanced front and/or rear side of said fixing arm/s or plate/s (B).

5 14. New crushing hammer according to one or more of the previous claims, characterised in that said fixing arm/s or plate/s (B) is/are articulated and comprises/comprise at least one pin (P) for the swinging of said crushing hammer.

10 15. New crushing hammer according to one or more of the previous claims, characterised in that said fixing arm/s or plate/s (B) is/are integral with the corresponding rotor shaft (R) and welded to it.

16. New crushing hammer according to the previous claims, characterised in that it is a single body obtained by casting and/or pressing and/or welding of one or more components.

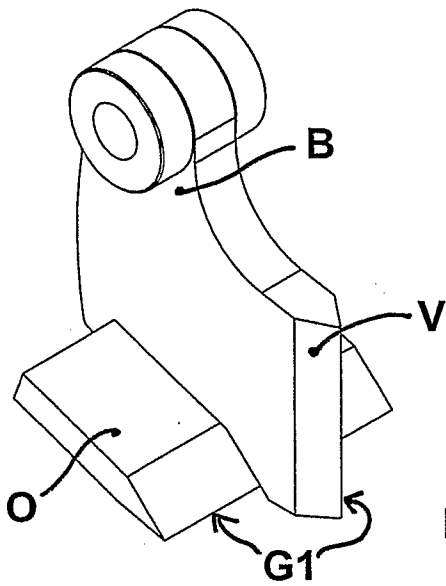


Fig. 1

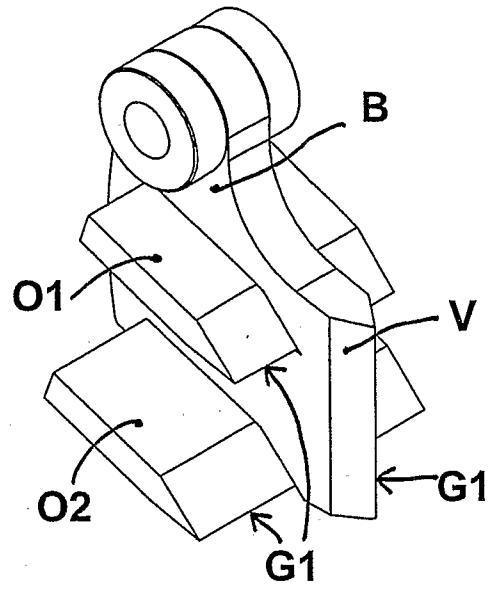


Fig. 2a

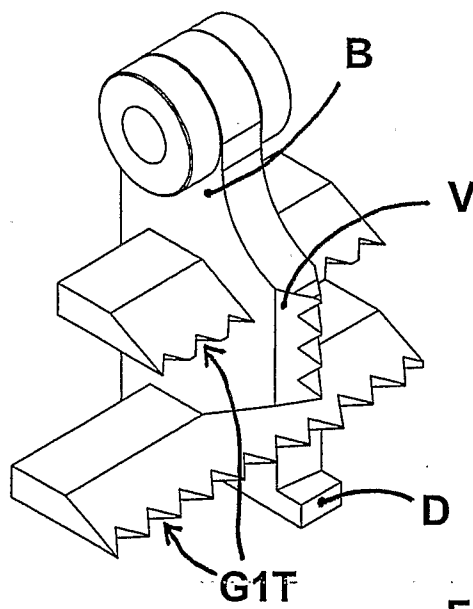


Fig. 2b

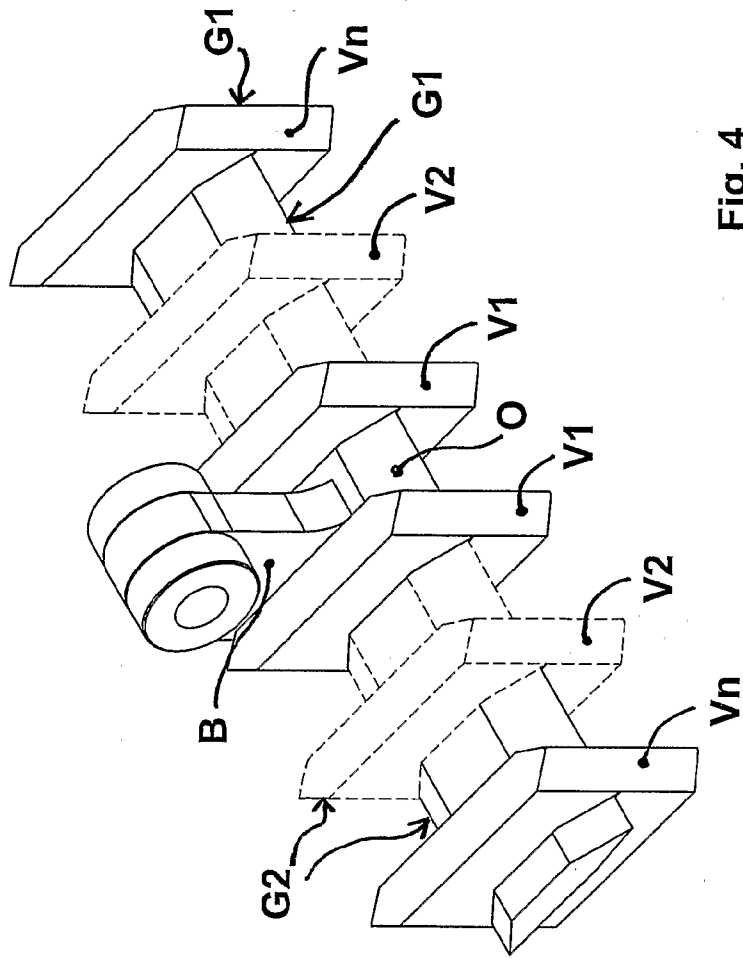


Fig. 4

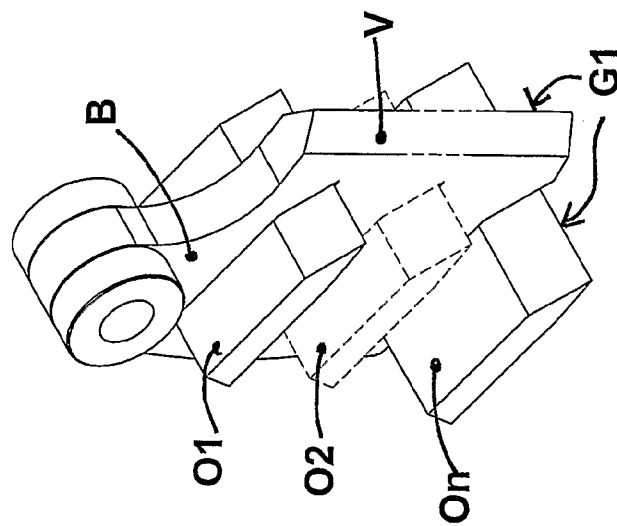


Fig. 3

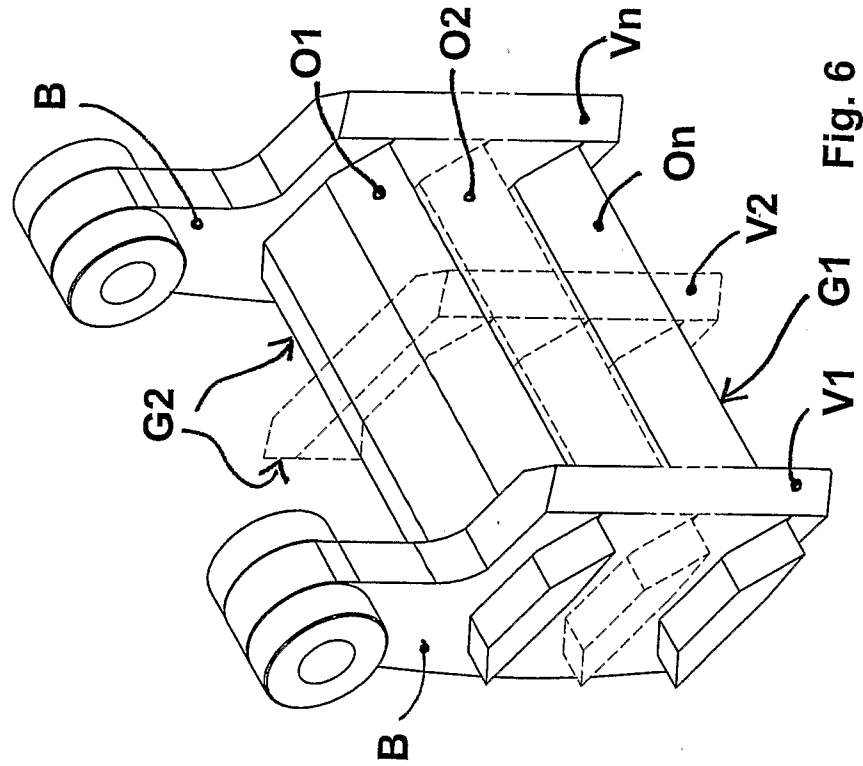


Fig. 6

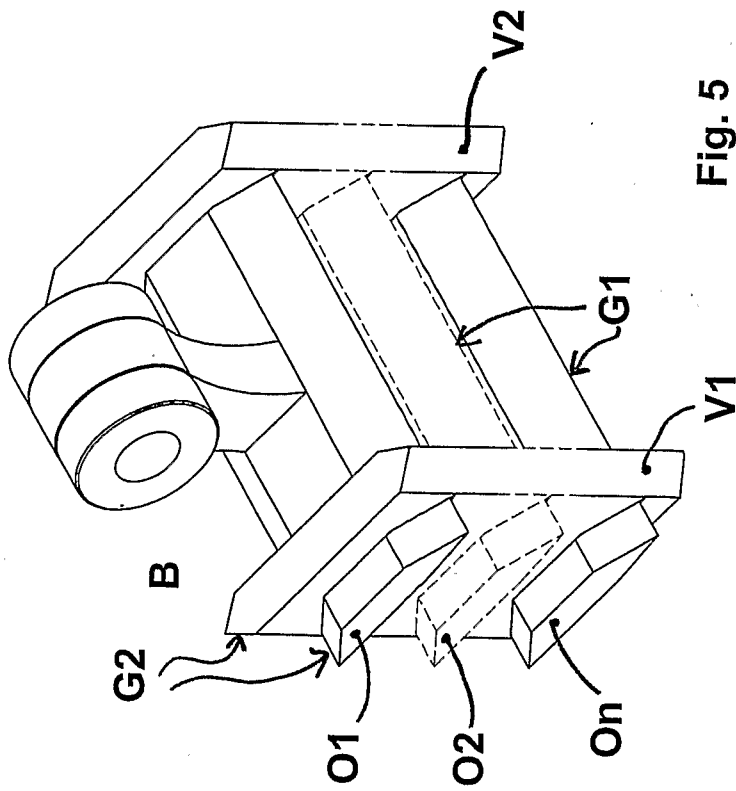


Fig. 5

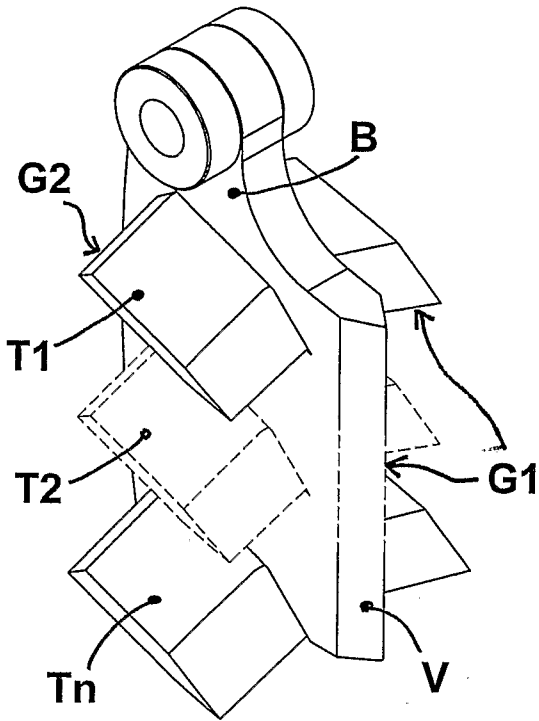


Fig. 7

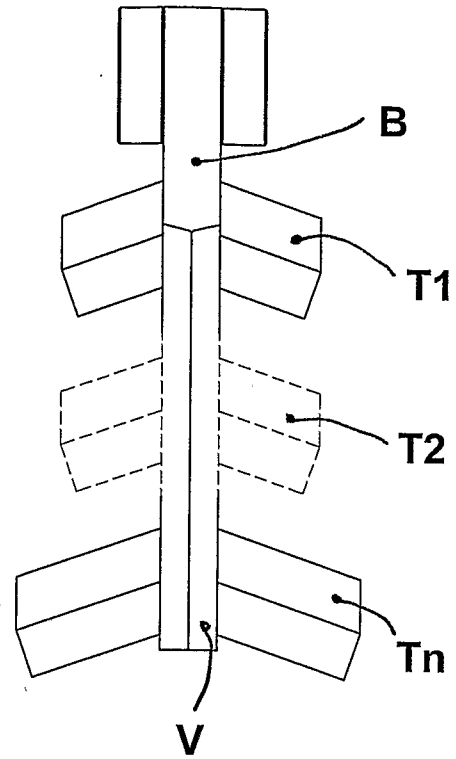


Fig. 7a

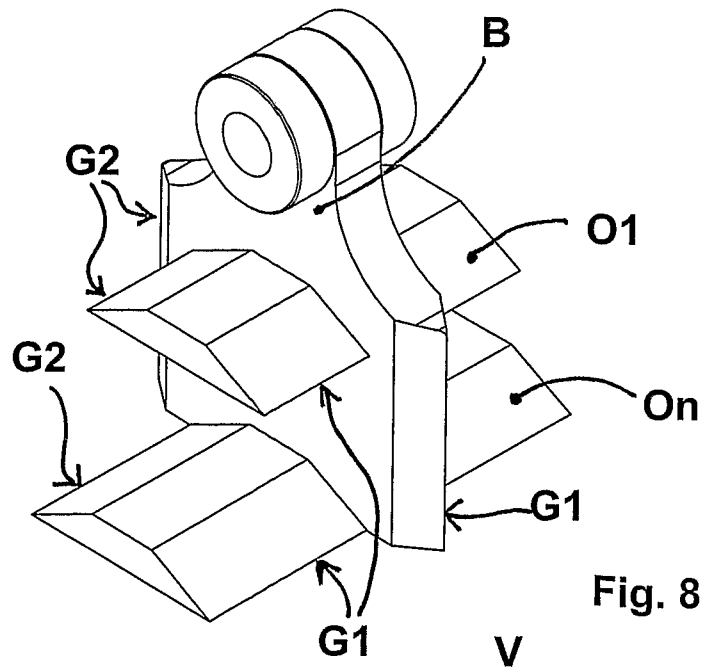


Fig. 8

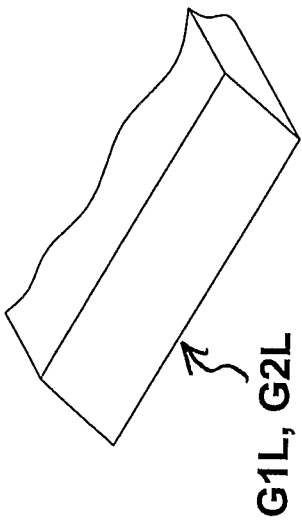


Fig. 9a

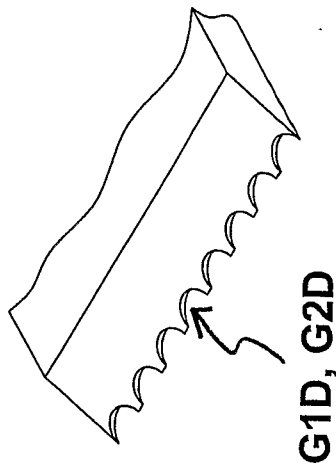


Fig. 9b

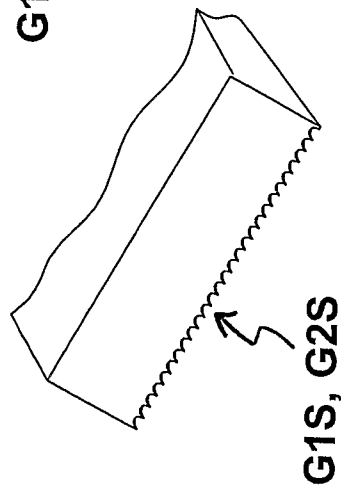


Fig. 9c

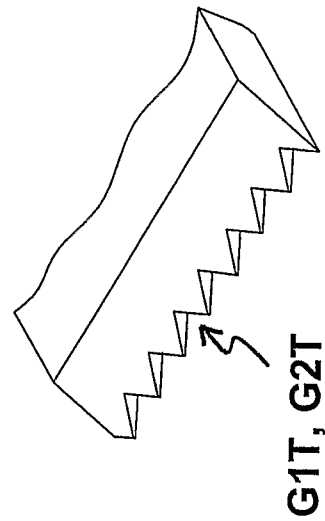


Fig. 9d

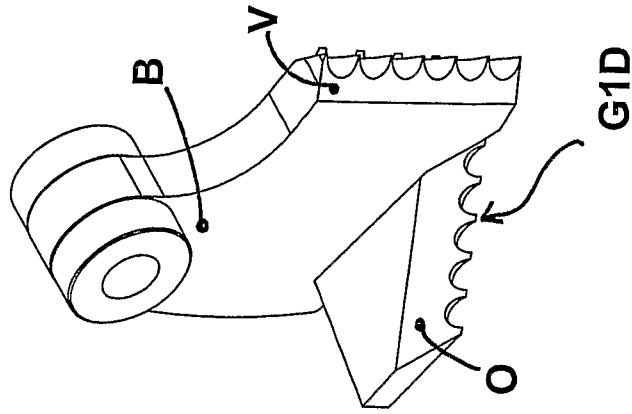


Fig. 10

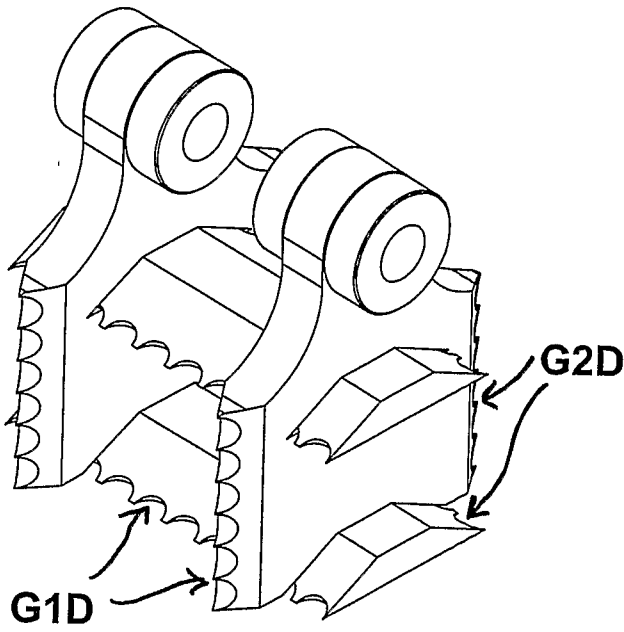


Fig. 11a

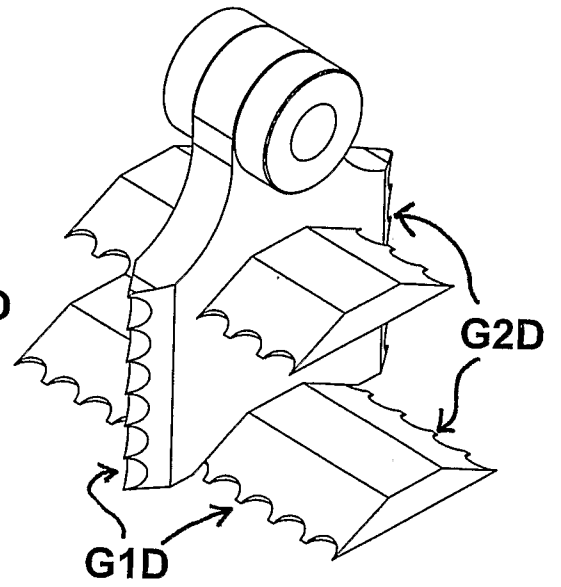


Fig. 11b

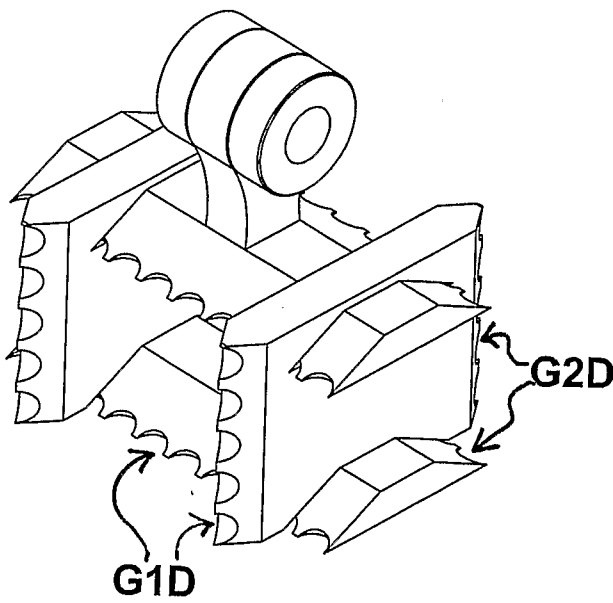


Fig. 11c

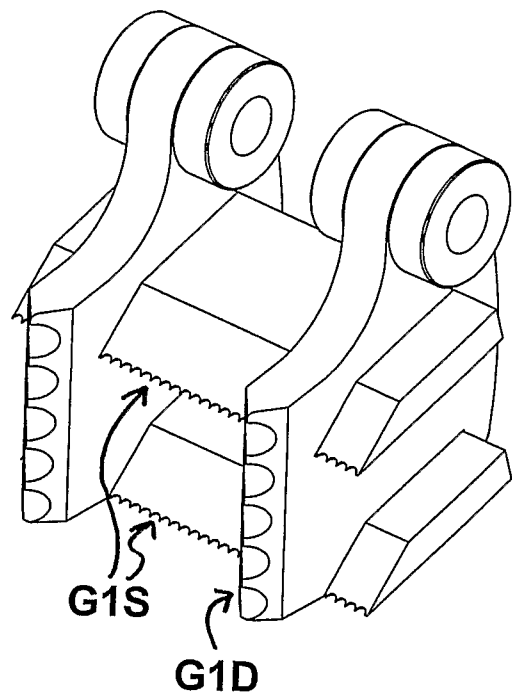


Fig. 11d

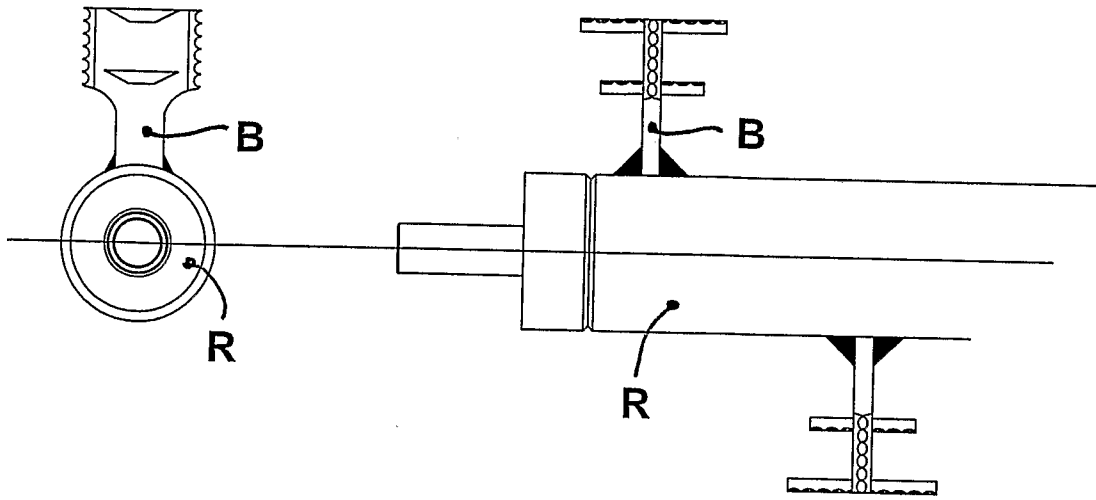


Fig. 12

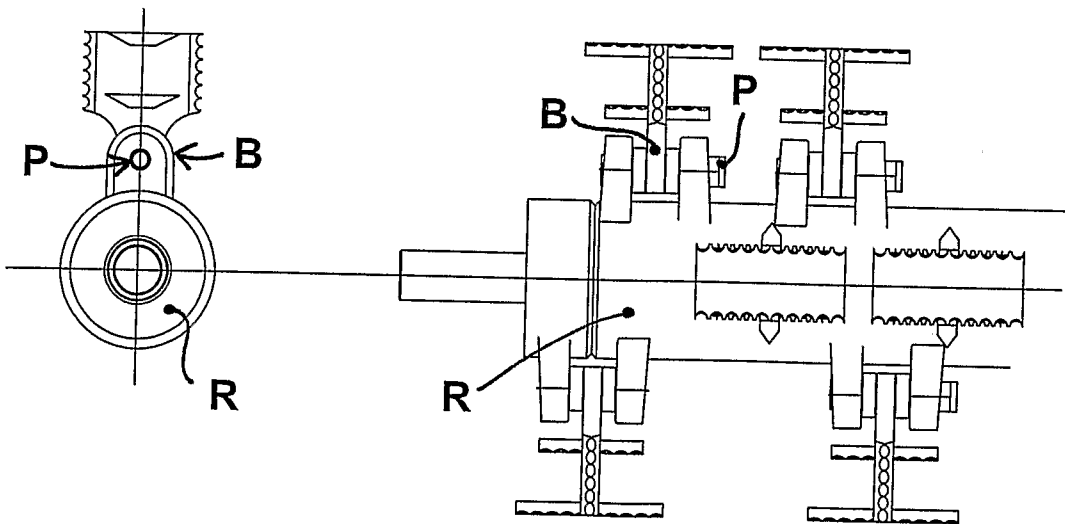


Fig. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2006/000148

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01G3/00 B02C18/00

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)
A01G B02C A01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 85 02 956 U1 (WILLIBALD, JOSEF, 7771 FRICKINGEN, DE) 9 May 1985 (1985-05-09) page 7, line 8 - page 9; claims 1-3; figures	1
A	US 5 819 825 A (LYMAN MARK GERLINGER [US] ET AL) 13 October 1998 (1998-10-13) column 4, line 23 - line 59	1
A	EP 0 228 002 A2 (DOPPSTADT WERNER) 8 July 1987 (1987-07-08) column 2, line 3 - line 60; claim 1; figures	1
A	SU 965 395 A1 (ROSTOVSKIJ NA DONU I SELSKO [SU]) 15 October 1982 (1982-10-15) abstract; figures	1
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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

15 November 2006

Date of mailing of the international search report

23/11/2006

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2006/000148

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 5 657 933 A (WILLIAMS ROBERT M [US]) 19 August 1997 (1997-08-19) column 1, line 65 - column 2, line 56; figures</p> <p style="text-align: center;">-----</p>	1

INTERNATIONAL SEARCH REPORT

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