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EUROPEAN PATENT SPECIFICATION

- ④⑤ Date of publication of patent specification: **30.09.87** ⑤① Int. Cl.⁴: **B 27 L 11/00**
②① Application number: **84900619.2**
②② Date of filing: **23.01.84**
②③ International application number:
PCT/FI84/00008
②⑦ International publication number:
WO 84/02871 02.08.84 Gazette 84/18

⑤④ **CHIPPER.**

③⑨ Priority: **21.01.83 FI 830202**

④③ Date of publication of application:
03.04.85 Bulletin 85/14

④⑤ Publication of the grant of the patent:
30.09.87 Bulletin 87/40

②④ Designated Contracting States:
AT DE SE

⑤⑥ References cited:
EP-A-0 019 092
DE-B-1 207 205
DE-C-3 027 044
GB-B-1 361 953
SE-B- 339 389
US-A-2 889 859
US-A-4 053 004
US-A-4 301 846

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Description

The present invention is concerned with a chipper for the chipping of wood. In particular, the chipper in accordance with the invention is suitable for chipping of slender trees. Such slender trees are harvested in connection of thinning and cleaning of forests, and such wood is usually of small dimensions to be used for any other purpose except for firewood. This is why it is preferable that the wood material is recovered as completely as possible, i.e. including the twigs, leaves, and needles.

For the chipping of the wood material mentioned above, different types of chippers have been used and developed, the oldest ones of them being direct applications of lath chippers used at sawmills. Lath chippers are, however, not very well suitable for the said purpose, for the construction of their chipping member usually requires forced feeding of the lumber to be chipped. Separate forced-feeding devices make the chipper unnecessarily heavy for cross-country conditions, e.g., for operation by means of an ordinary agricultural tractor. On the other hand, the chipping member of these chippers has been planned for chipping of raw-material suitable for pulp mills, i.e. of chips of relatively little dimensions. The chips of the said sort are not very well suitable, e.g., for grate boilers, because the small-size chips are packed on the grate as a dense heap, through which the combustion air cannot penetrate to a sufficient extent.

By means of more recent chipper developments, it has been possible essentially to eliminate these deficiencies, in which developments the chipping member itself is of such a construction that it produces efficient feeding of the lumber. By means of these chippers, it is also possible to chip the wood to chips of larger size, of about 5 cm dimension, which might also be termed as small firewood chunks. The production of chips of larger size has been permitted thereby that the chips chopped off are not removed through blade openings in the chipper disc, but the chips chopped off remain in connection with the blade members and are removed through relatively spacious passage openings independent from the chipping member.

A chipper of this kind is described in EP—A—0019092. In this prior-art chipper construction, the chipper member consists of a cutter blade as screw-shaped surrounding the shaft that receives the operating power, the perpendicular distance of the said blade from the shaft increasing in the direction of feed of the wood. Under these circumstances, the cutter blade forms a spiral cone expanding in the direction of feed of the wood, the sharpened outer edge of the said spiral cutting through the wood by pressing it against a guide formed into the feed trough. By means of the spiral construction of the cutter blade, a good feed of the wood has been achieved, and no separate members are required for this purpose.

However, it can be considered an essential drawback of a spiral chipper of this type that therein the cutting blade runs in the same cutting track from the beginning of the cutting process right to the end, penetrating deeper into the wood as the diameter of the cutting spiral increases, i.e. the cutting movement of the cutter blade becomes substantially perpendicular to the longitudinal axis of the wood. Thereby, as the cutting makes progress, the blade is wedged ever more tightly into the cutting groove and causes a very steep increase in the requirement of power. The wedging situation goes on until the wedge effect of the blade produces a sufficiently great longitudinal power component in the wood, which component cleaves a piece of chips apart. Thereupon the cutting goes on at the said cutting point until the next cleavage process. In EP—A—0019092, attempts have been made to reduce the wedging of the blade into the wood and, correspondingly, a sudden increase in the power requirement, so that the inclination of the cutting edge of the blade spiral relative the cutting direction perpendicular to the longitudinal axis of the wood has been made such that it increases in the direction of feed of the wood, i.e. in the direction of progress of the cutting. By means of this constructional solution, a prying effect has been produced for the blade in the cutting groove in the longitudinal direction of the wood as the blade penetrates deeper into the wood as the cutting makes progress, which prying effect causes a cleavage apart of a chip earlier than what would be the case with a wedge effect of the blade alone.

In the said constructional solution, when the blade pries the chip piece apart, the rear portion of the blade is supported against the corresponding wall of the cutting groove, whereby it produces a strong rubbing resistance and, at the same time, overrules the power component of the blade tip in the longitudinal direction of the wood, which component cleaves the chip apart and feeds the wood forwards. In practice, it has also been noticed that, when slender trees are chipped by means of the said prior-art chipper type, the trees tend to jump around extensively in the feed funnel, which causes a safety risk for the operator of the machine. The strong transverse and rotating effects caused on the trees to be chipped are obviously attributable to the basic construction of the device, according to which construction, during cutting, the blade is a tangent to the tree in accordance with the curve radius of the spiral edge at each particular time, i.e., in a way, scrapes the tree constantly at a very steep angle. It should be noticed further that the curve form of this scraping track, i.e. bottom of the cutting groove, increases throughout the entire cutting operation, whereat the maximum cutting load is directed at the initial and final ends of the cutting groove, which may have its effect on the instability of the cutting operation.

By means of the chipper construction in accordance with the present invention, a chipper has

been provided which is particularly well suitable for the chipping of slender trees, in which the automatic feed of the wood is highly efficient, in which the trees have a steady behaviour throughout the entire cutting process, and by means of which the chipping can be achieved with a lower power requirement as compared with the prior-art chippers. The chipper in accordance with the invention, comprises feeding members, such as a trough for feeding the wood to be chipped, a chipping member supported and rotated by a shaft receiving the operating power, as well as, preferably, members for the removal of the chips, such as a blower supported and driven by the said shaft, as well as an exhaust tube, and in which chipper the chipping member consists of a chipping blade or blades, is characterized in that a blade disc is mounted perpendicularly and centrally on the shaft, and in that the chipping blade consists of at least one continuous blade projecting substantially perpendicularly from the plane of the blade disc in the direction of the shaft, that the blade approaches the centre of the disc from the circumference of the disc as spiral-shaped in the direction opposite to the rotation direction in use of the disc, and that the perpendicular distance of the edge of the blade from the plane of the disc increases as the blade approaches the central area of the disc, whereby the edge forms a cutting edge.

The invention will be described with the aid of the attached drawing, wherein

Figure 1 shows a chipper in accordance with the invention as viewed from above, partly in section,

Figure 2 shows the chipping member of the chipper as mounted on the drive shaft,

Figure 3 shows the chipping member as viewed out of the direction of introduction of the drive power for the shaft,

Figure 4 shows a detail of the relative fitting between the final cutting edge of the blade and the counter-blade formed into the feed tube, as seen perpendicularly to the direction of the drive shaft, and

Figure 5 shows a detail of the portion in the side wall of the feed tube at which the counter-blade of the final cutting edge of the cutting blade has been formed.

In respect of its basic construction, the chipper shown in Figure 1 is in itself known, i.e. it comprises a tube-shaped or trough-shaped feeding member 1 for feeding the wood to be chipped, a chipping chamber, in which the chipping member 3 supported by the driven shaft 2 performs the chipping of the wood fed in as well as feeds the wood further to the chip-removing members. The removing members preferably consist of a blower unit 4 supported and driven by the same shaft 2 as well as of an exhaust tube 5 guiding the out-coming chip flow.

The chipping member 3 consists of a blade disc 6, which is mounted on the drive shaft 2 centrally and perpendicularly to the shaft. The blade 7 that performs the cutting is formed as a spiral mounted on the blade disc, at which spiral the

edge projecting from the blade disc is sharpened as a cutting edge 7'. The blade spiral projects as substantially perpendicular from the face of the blade disc, i.e. as substantially parallel to the drive shaft 2. The blade spiral 7 starts from the circumference of the blade disc and approaches the centre of the blade disc as spiral-shaped, preferably to a distance that is about 1/4 of the diameter of the blade disc. At the same time, the cutting edge of the blade spiral becomes more distant from the face of the blade disc as screw-shaped to a distance corresponding to a full cutting stroke, i.e. to a distance at which the cutting edge meets the wall plane of the feed trough.

The length of the blade spiral and, at the same time, also the thread-shaped pitch of its cutting edge have been selected so that the blade performs a full cutting stroke during about $1\frac{1}{2}$ revolutions of the blade disc. Thereby, the blade starts a new cutting operation before the preceding cutting operation has been completed, which stabilizes the cutting process and ensures continuous and undisturbed feed of the wood. By means of the said blade length, the masses of the blade have also become dynamically substantially balanced.

In view of aspects of strength and of smooth starting of the cutting operation, it is advantageous that a starting edge 7'' of steeper pitch is formed at the beginning of the steel spiral, which starting edge begins the cutting of the log by striking a starting cut into it, into which said starting cut the blade edge 7' proper then cuts in. In the dimensioning of the blade, the dynamic balance of the blade device must, of course, also be taken into account, for the machine will revolve at quite a high speed of revolution, which, as attached directly to the power takeoff of a tractor, will be about 540 rpm.

In view of smooth finishing of the cutting operation and in view of complete cutting of twigs and other thin parts of trees, it is advantageous to provide the feed trough with a curved counter-blade groove 8, in which the final edge of the cutting blade 7 runs to produce a shear-like finishing cutting for each cutting cycle. The said counter-blade groove preferably extends across the entire feed trough, as is shown in Figure 5.

Figure 5 also shows the grooves 9 formed in the feeding direction in the side wall of the end portion 1' of the trough 1 at the side of the final cutting counter-blade 8, the objective of the said grooves being to guide the trees to be chipped so that they should not be turning at the final stage of the chipping. The said grooves may, of course, be replaced by corresponding ribs.

It has been noticed in practice that the chipper in accordance with the invention operates very smoothly, i.e. the feeding of the wood into the chipper takes place at a uniform speed and efficiently, without any tendency of the trees to toss around at any stage of chipping. Moreover, it has been noticed that the power requirement with a chipper in accordance with the invention, when chipping a tree of equal thickness, is lower than

when prior-art chippers are used. It can be considered that the favourable effects mentioned above are derived from the favourable cutting operation of the chipping member used in the chipper in accordance with the invention. The low consumption of power and the efficient feed are obviously mainly caused by the form of the blade. When the chipping member bites, in accordance with the pitch of the screw line of the cutting edge, transversely into the wood, the blade becomes more progressively steeply curved, as the spiral becomes narrower in the longitudinal direction of the wood, whereby the blade presses the chip piece being cut apart in the transverse direction by means of the steepening inner portion of the blade in the feeding direction of the wood, which results in an increasing force component in the longitudinal direction of the wood in the direction cleaving the chip particle apart. The said longitudinal power component essentially contributes to the detaching of the chip particle, whereby the distance of cutting of the blade edge into the wood at each particular time remains short, as a result of which there is also a low rubbing-friction effect. Moreover, this power components acts in the feeding direction of the wood and aids in the feeding of the wood, without any counter-component opposing this power component occurring in the cutting process, since the outer edge of the blade becomes constantly more distant from the corresponding edge of the cutting groove and consequently does not cause a rubbing resistance against this edge.

Another essential factor that contributes to the steady behaviour of the wood in the chipper is the fact that the cutting blade is a tangent to the log at a small angle, which corresponds to the pitch angle of the screw line of the cutting edge, and not to the curve radius of the screw, as is the case in a prior-art spiral chipper.

It is another significant advantage of the chipper in accordance with the present invention as compared with a prior-art chipper that the construction of the chipper member is essentially more advantageous in respect of the strength and the manufacture of the chipping member.

As an alternative for the embodiment shown in the figures, two blades may be mounted on the blade disc, angularly displaced the one from the other. This gives better possibilities for making the choice between the desired chip size and the diameter of the blade disc of the chipper.

Claims

1. Chipper, suitable for chipping slender trees, which comprises feeding members, such as a trough (1) for feeding the wood to be chipped, a chipping member (3) supported and rotated by a shaft (2) receiving the operating power, as well as, preferably, members for the removal of the chips, such as a blower (4) supported and driven by the said shaft (2), as well as an exhaust tube (5), and in which chipper the chipping member (3) consists of a chipping blade or blades, characterized in that a

blade disc (6) is mounted perpendicularly and centrally on the shaft (2), and in that the chipping blade consists of at least one continuous blade (7) projecting substantially perpendicularly from the plane of the blade disc (6) in the direction of the shaft (2), that the blade approaches the centre of the disc from the circumference of the disc as spiral-shaped in the direction opposite to the rotation direction in use of the disc, and that the perpendicular distance of the edge (7') of the blade from the plane of the disc increases as the blade approaches the central area of the disc whereby the edge (7') forms a cutting edge (7').

2. Chipper as claimed in claim 1, characterized in that the blade (7) extends over about one and a half revolutions around the centre of the blade disc (6).

3. Chipper as claimed in claim 1 or 2, characterized in that the radially outer end (7'') of the blade (7) is inclined at a greater angle to the disc than is the remainder of the blade edge (7').

4. Chipper as claimed in any of the preceding claims 1 to 3, characterized in that the radially inner end of the blade (7) is provided with a cut-off edge (7''') for engagement with a groove (8) in the trough (1).

5. Chipper as claimed in any of the preceding claims 1 to 4, characterized in that two blades (7) are mounted on the blade disc (6) angularly displaced the one from the other.

Patentansprüche

1. Zerkleinerer, insbesondere zum Zerkleinern von Dünnschholz, bestehend aus einer Zuführeinrichtung, wie einem Einführschacht (1) für das zu zerkleinernde Holz, einem auf einer antreibbaren Welle (2) angeordneten Zerkleinerungswerkzeug (3) sowie vorzugsweise aus einer Austragseinrichtung für die Holzschnitzel, wie einem auf der Welle (2) angeordneten und von ihr angetriebenen Gebläse (4) und einem Austragsrohr (5), wobei das Zerkleinerungswerkzeug (3) ein oder mehrere Messer aufweist, dadurch gekennzeichnet, daß auf der Welle (2) eine dazu senkrechte Messerscheibe (6) mittig befestigt ist, daß das wenigstens eine Messer aus einer im wesentlichen senkrecht von der Ebene der Messerscheibe (6) in Richtung der Welle (2) abstehenden, durchgehenden Klinge (7) besteht, daß sich die Klinge (7) der Scheibenmitte vom Umfang der Scheibe (6) in Form einer zur Arbeitsdrehrichtung der Scheibe (6) gegensinnigen Spirale nähert und daß der senkrechte Abstand des eine Schneidkante bildenden Klingengrandes (7') von der Scheibenebene mit der Annäherung der Klinge (7) an den Mittenbereich der Scheibe (6) anwächst.

2. Zerkleinerer nach Anspruch 1, dadurch gekennzeichnet, daß sich die Klinge (7) über etwa eineinhalb Windungen um die Mitte der Messerscheibe (6) erstreckt.

3. Zerkleinerer nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das radial äußere Ende (7'') der Klinge (7) gegenüber der Scheibe (6) unter einem größeren Winkel als der übrige Klingengrand (7') geneigt ist.

4. Zerkleinerer nach einem der vorhergehenden Ansprüche 1 bis 3, dadurch gekennzeichnet, daß das radial innere Ende der Klinge (7) mit einer mit einer Nut (8) im Einführschacht (1) zusammenwirkenden Abschneidkante (7''') versehen ist.

5. Zerkleinerer nach einem der vorhergehenden Ansprüche 1 bis 4, dadurch gekennzeichnet, daß zwei Klingen (7) gegeneinander winkelfersetzt auf der Messerscheibe (6) befestigt sind.

Revendications

1. Déchiqueteuse, convenant pour déchiqueter des arbres minces, qui comprend des organes d'amenée tels qu'une auge (1) pour amener le bois à déchiqueter, un organe déchiqueteur (3) supporté et mis en rotation par un arbre (2) recevant l'énergie de fonctionnement, ainsi que, de préférence, des organes pour le retrait des copeaux, tels qu'un ventilateur (4) supporté et entraîné par l'arbre (2), ainsi qu'un tube d'échappement (5), déchiqueteuse dans laquelle l'organe déchiqueteur (3) est formé d'une lame ou de lames déchiqueteuses, caractérisée par le fait qu'un disque de lame (6) est monté perpendiculairement et centralement sur l'arbre (2) et par le fait que la lame déchiqueteuse est formée d'au moins une lame continue (7) faisant saillie pratiquement perpendiculairement en partant du plan

du disque de lame (6) dans la direction de l'arbre (2), que la lame approche du centre du disque en partant de la périphérie du disque avec une forme en spirale dans le sens opposé au sens de rotation du disque en service, et que la distance perpendiculaire du bord (7') de la lame au plan du disque augmente à mesure que la lame approche de la région centrale du disque, de sorte que le bord (7') forme un tranchant (7').

2. Déchiqueteuse selon la revendication 1, caractérisée par le fait que la lame s'étend sur environ un tour et demi autour du centre du disque de lame (6).

3. Déchiqueteuse selon la revendication 1 ou 2, caractérisée par le fait que l'extrémité extérieure (7'') radialement de la lame (7) est inclinée sous un plus grand angle par rapport au disque que le reste du bord de la lame (7').

4. Déchiqueteuse selon l'une quelconque des revendications précédentes 1 à 3, caractérisée par le fait que l'extrémité intérieure radialement de la lame (7) est munie d'un bord coupé (7''') pour la coopération avec une gorge (8) de l'auge (1).

5. Déchiqueteuse selon l'une quelconque des revendications précédentes 1 à 4, caractérisée par le fait que les deux lames (7) sont montées sur le disque de lame (6) en étant déplacée angulairement l'une par rapport à l'autre.

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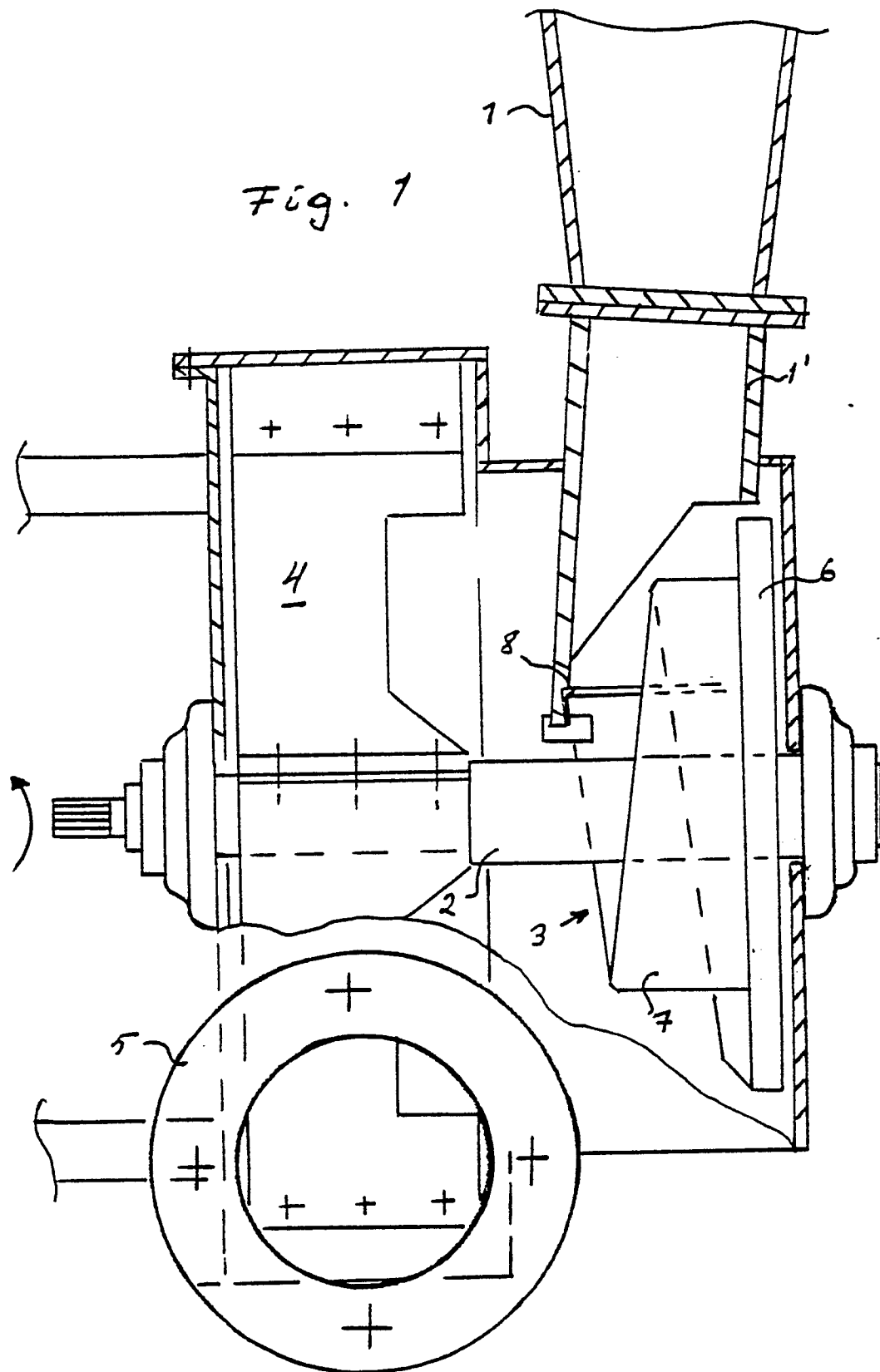
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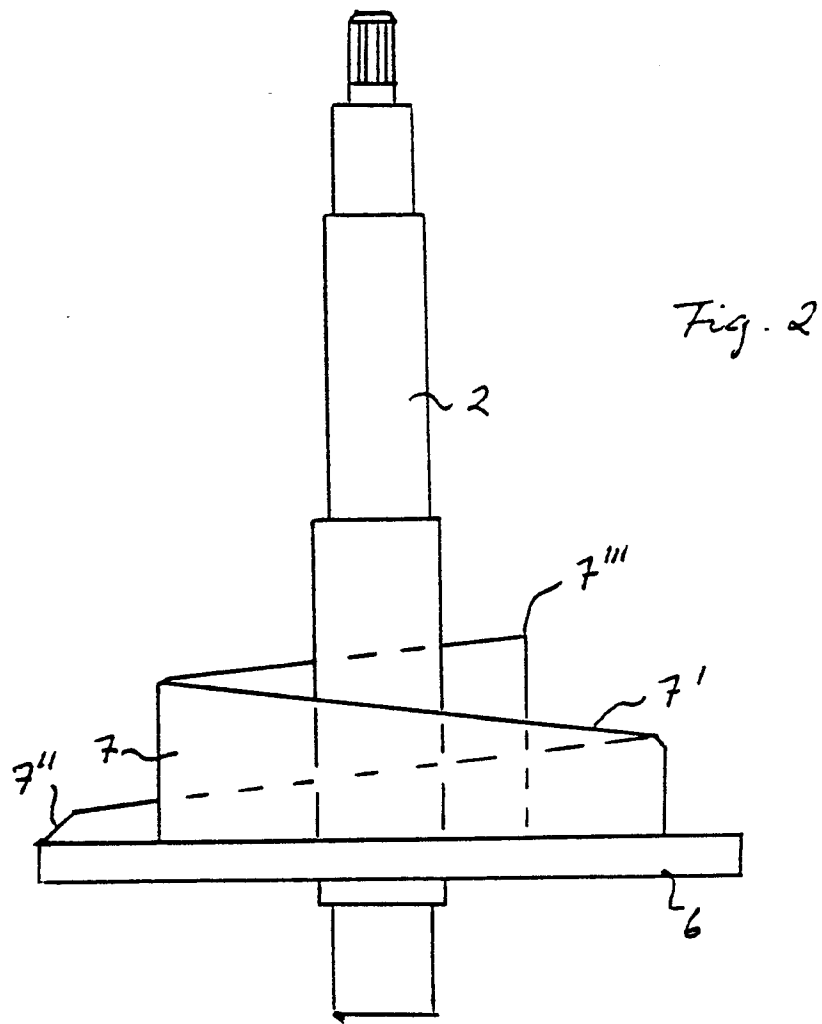
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Fig. 1





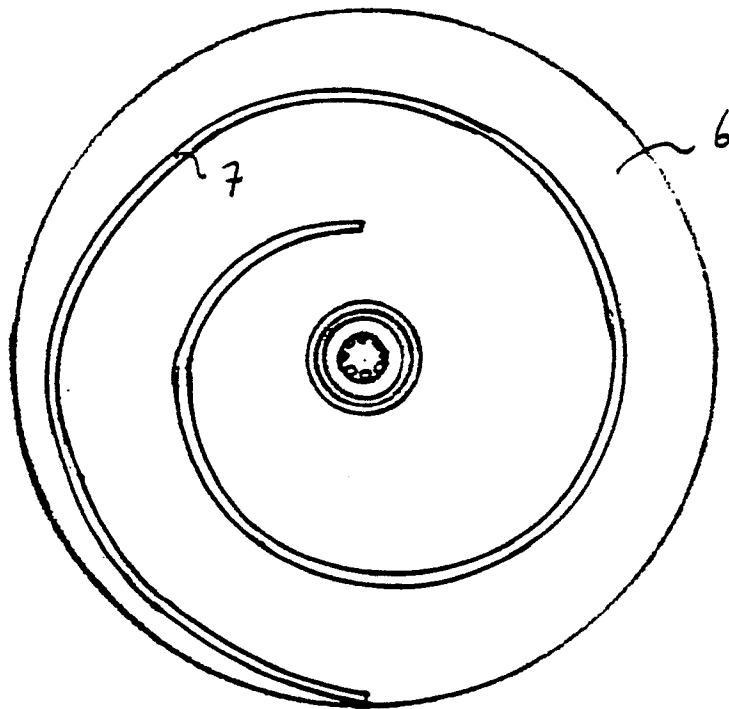


Fig. 3

