

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 0 908 271 B1**

(12)

## EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention  
of the grant of the patent:  
**23.10.2002 Bulletin 2002/43**

(51) Int Cl.7: **B24B 41/047**, B24B 47/12

(21) Application number: **98830162.8**

(22) Date of filing: **20.03.1998**

(54) **Lapping head with oscillating toolholders**

Schleifkopf mit oszillierenden Werkzeugträgern

Tête de polissage avec supports d'outils oscillants

(84) Designated Contracting States:  
**DE ES FR IT PT**

(30) Priority: **09.10.1997 IT F1970223**

(43) Date of publication of application:  
**14.04.1999 Bulletin 1999/15**

(73) Proprietor: **CO.ME.S. S.r.l.**  
**56012 Fornacette (Pisa) (IT)**

(72) Inventor: **Signorini, Roberto**  
**56012 Fornacette (Pisa) (IT)**

(74) Representative: **Martini, Lazzaro**  
**Studio Brevetti Ing. Dr. Lazzaro Martini s.r.l.**  
**Via dei Rustici 5**  
**50122 Firenze (IT)**

(56) References cited:  
**EP-A- 0 571 340** **EP-A- 0 667 210**  
**EP-A- 0 737 548**

**EP 0 908 271 B1**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

## Description

**[0001]** The present invention refers to a lapping head with oscillating toolholders for use, in particular, in lapping and/or polishing machines for working stone materials such as marble, granite, grès, etc.

**[0002]** Known to those skilled in the art are heads with oscillating toolholders for the polishing and lapping of stone materials, said heads having a vertical shaft connected, on one side, to a corresponding driving shaft and, on the other, to a case to drive the latter into rotation at a predetermined speed. Disposed between the case and the member from which the motor receives the motion is a fixed reaction flange supported by the case by means of bearings having their axis parallel to the axis of the shaft. The case bears a plurality of toolholder elements to which corresponding abrasive tools may be attached and which are driven into oscillatory motion about their respective axis via a mechanical transmission connected to said driving motor, so that each abrasive tool will be driven into an oscillatory motion about the axis of its toolholder and, at the same time, into rotary motion about the axis of the driving motor. According to a further operating technique, use is also made of machines having cylindrical grinding wheels. Heads for lapping machines of this type are described, for example, in the patents EP-571.340, IT-1.198.798 and IT-FI-96-U-00062.

**[0003]** The kinematic link allowing for the transmission of the motion from the main shaft to the various toolholders may be carried out in several ways. For example, use can be made of cams of suitable shape (tubular, for instance), or of eccentrics; practical solutions are also known which adopt special connecting rods, or levers, or rockers provided with rollers which interact with relevant cam means.

**[0004]** The utilization of components of the type above mentioned may cause non uniform oscillations of the toolholders due to the same configuration of the drive means which, upon the transformation of the uniform rotary motion of the driving shaft into the reciprocating motion of the various driven shafts, may be a cause of dead times or accelerations. The occurrence of such phenomena is detrimental to the lapping process. Moreover, with the components of the above said type, the use of relatively high cutting speed may give rise to problems especially when considering the increasingly higher use of diamond tools.

**[0005]** The main object of the present invention is to provide a lapping head in which the driving shaft moves the toolholders into an oscillatory motion thanks to means for the transmission of motion which comprise a plurality of gears (pivoted on corresponding toolholders) and a crown gear connected to the driving shaft and to be driven by the latter, the same crown gear being connected to the said gears through the association of two toothings one of which exhibits at least a variation of inclination along its development; the toolholders are

pivoted to said support body so as to oscillate when said toothings mesh with each other in correspondence of a portion thereof exhibiting said variation of inclination.

**[0006]** The present solution makes it possible to use a higher working speed, with an extremely uniform oscillation of the tool and without the dead times and accelerations which characterize the prior technique. In other words, the present lapping head allows a more efficient production and a better quality of the finished product.

**[0007]** This result has been achieved, according to the invention, by providing a lapping head with oscillating toolholders having the characteristics disclosed in claim 1. Further characteristics being set forth in the dependent claims.

**[0008]** These and other advantages and characteristics of the invention will be best understood by anyone skilled in the art from a reading of the following description in conjunction with the attached drawings given as a practical exemplification of the invention, but not to be considered in a limitative sense, wherein:

- Fig. 1 is a top perspective view, with cutaway parts to highlight others, showing an exemplary embodiment of a lapping head according to the invention;
- Fig. 2 is a top perspective view showing some details of the embodiment of Fig. 1;
- Fig. 3 shows schematically a development of a toothing of a crown gear according to the present invention.

**[0009]** A lapping head with oscillating toolholders constructed according to the present invention comprises a driving shaft (1) carrying on top a flange (2) which defines the means (2) associated to relevant driving means.

In practice, the flange (2) allows for the attachment of the lapping head to the spindle of a machine, the latter being not shown in the drawings as it does not make part of the present invention.

**[0010]** The lapping head further comprises a plurality of toolholders, (6) connected to the driving shaft (1) by means of first and second drive means, to be described herebelow.

**[0011]** The first drive means comprise a first body (5) supporting the toolholders (6) and which is secured by screws (4) to a flange (3) provided in the lower portion of the driving shaft (1) so as to result integral thereto upon the rotary motion of the same shaft.

**[0012]** The second drive means are intended to cause, in correspondence of the rotation of the driving shaft (1), an oscillation of the toolholders (6) about their axes (7) disposed at an angle to the driving shaft (1); in particular, the shaft (7) of the toolholders (6) may be disposed radially and substantially perpendicular to the driving shaft (1) - as shown in the non limitative example in which they are in an unbinding number of six.

**[0013]** The second means for the transmission of the

motion comprise, in general, at least a plurality of first gears (15), pivoted on the toolholders (6) and a crown gear (12) connected to the driving shaft (1) and to be driven by the latter. A gear train (8, 9) may be provided between the crown gear (12) and the driving shaft (1) as illustrated in the example.

Mounted on the driving shaft (1), as shown in the figures, is a second gear (8) which drives into motion a third gear (9) pivoted idly on a second support body (17) located on top with respect of the first support body (5).

**[0014]** The third gear (9) has two inner toothings (10, 11) for meshing respectively with said second gear (8) and a first toothing (13) borne by the crown gear (12). In this way, it is possible to drive the crown gear (12) and the gears disposed downstream thereof by modifying the rotary motion derived from the driving shaft (1) according to a predetermined gear ratio.

The crown gear (12) is made to mesh with the first gears (15) through the association of two toothings (14, 15') one of which exhibits at least one variation of inclination along its development; the toolholders (6), moreover, by pivoting with respect to the support body (5), are caused to oscillate when the meshing of said toothings takes place in correspondence of a portion thereof exhibiting said variation of inclination.

**[0015]** The toothing exhibiting at least one variation of inclination along its development (also referred to as special toothing hereinbelow) may be provided either on the crown gear (12) or on the first gears (15).

In the illustrated example, the special toothing (14) is formed on the crown gear (12).

**[0016]** As best shown in Fig. 3, the special toothing (14) alternates straight and inclined portions.

In particular, considering a development over 360°, two straight teeth or spaces may be provided in correspondence of the origin (0° is coincident with 360°) and the mid point. In the 0° to 90° portion (designated with 14a) the teeth become oblique, with the maximum inclination being at 90°. From this point on, in the portion 14b, the inclination decreases [gradually] to become zero at 180°. From 180° to 270° (portion 14c) the teeth are again oblique but with an inclination opposite to that of the portions 14a and 14b. In correspondence of 270° the inclination is the highest, then decreases from 270° to 360° (or 0°), in the portion 14d, until it cancels out.

The oscillation of the toolholders (6) is therefore obtained by the variation of inclination of the special toothing (14) which, by meshing with the first gears (15) (which are straight), cause the same toolholders (6) to incline differently according to a complete movement upon every revolution of the crown gear (12).

**[0017]** In practice, the speed of oscillation of the toolholders (6) is determined by the number of sectors or portions into which the special toothing (14) is divided, as well as by the transmission ratio of the gearing defined by the second gear (8), by the third gear (9) with its two toothings (10) and (11), and by the crown gear (12) with its toothing (13).

Again with reference to the figures, the first gears (15) may be supported by corresponding pins (16) provided on the toolholders (6) and be disposed substantially perpendicular to the shafts (7).

**[0018]** Advantageously, the present lapping head makes it possible to obtain an alternate and continuous radial motion. Such motion is obtained by making the special toothing (14) eccentric with respect to the driving shaft (1), or by making the gears (15) eccentric with respect to the relevant pins (16). The radial motion described above will result proportional to the diametral variation or to the degree of eccentricity of the special toothing (14) (or of the gears (15)).

The radial motion will result extremely advantageous in case of the so-called dressing of diamond tools.

The shafts (7) may result engaged to the first support body (5) through a bush (19) associated to the same shafts (7) by a connection comprising a clearance-recovery device, for example, with springs (20) and balls (21), as shown in the drawings.

Moreover, to reduce the vibrations and provide polished and shadeless surfaces, the support body (5) may be made to oscillate with respect to the driving shaft (1) by spring elements (22) and (23). On the first support body (5), in correspondence of the portions intended to face the toolholders (6), corresponding swells (24) may be provided coincident with the relevant axes of the shafts (7).

Moreover, on the second support body (17), an inner cavity (18) may be provided which defines a chamber for storing a lubricating fluid.

## Claims

1. Lapping head with oscillating toolholders, of the type comprising means (2) for association with relevant driving means, a driving shaft (1) connected to said association means (2), and a plurality of toolholders (6) which are connected to the driving shaft (1) by means of first and second drive means for the transmission of motion; said first drive means (3, 5) comprise a first body (5) for supporting the toolholders (6) which is integral with the driving shaft (1) upon the rotary motion of the latter, said second drive means being able to determine, in correspondence of the rotation of said driving shaft (1), an oscillation of the same toolholders (6) about their axes (7) disposed at an angle to said driving shaft (1); lapping head **characterized in that** said second drive means for the transmission of motion comprise at least a plurality of first gears (15) pivoted on said plurality of toolholders (6), and a crown gear (12) connected to the driving shaft (1) and to be driven by the latter, the said crown meshing with said plurality of first gears (15) through two toothings (14, 15') one of which exhibits at least a variation of inclination along its development, and where-

in the said toolholders (6) are pivoted to said support body so as to oscillate when the meshing of said toothings takes place in correspondence of a portion thereof exhibiting said variation of inclination.

2. Lapping head according to claim 1, **characterized in that** said toothing having at least one variation of inclination along its development is a toothing (14) formed on said crown gear (12).
3. Lapping head according to claim 1, **characterized in that** said toothing having at least one variation of inclination along its development is a toothing (15') formed on said plurality of gears (15).
4. Lapping head according to claim 1, **characterized in that** said toothing having at least one variation of inclination exhibits at least a portion substantially straight alternating an oblique portion.
5. Lapping head according to claim 4, **characterized in that** said toothing having at least one variation of inclination exhibits portions substantially straight alternating oblique portions.
6. Lapping head according to claim 4, **characterized in that** said toothing (14) exhibits an inclination which varies in inclination and direction.
7. Lapping head according to claim 1, **characterized in that** said crown gear (12) exhibits a first toothing (13) and a second toothing (14), a gear train (8, 9) being provided between said driving shaft (1) and said first toothing (13) of said crown gear (12) so as to drive said crown gear, as well as the gears located downstream thereof, by modifying the rotary motion of said driving shaft (1) according to a predetermined gear ratio.
8. Lapping head according to claim 7, **characterized in that** said gear train comprises a second gear (8) keyed on said driving shaft (1) and a third gear (9), idly disposed on a second support body (17) solid to said first support body (5) and exhibiting two inner toothings (10, 11) able to mesh, respectively, with said second gear (8) and said first toothing (13) of said crown gear (12).
9. Lapping head according to claim 1, **characterized in that** said plurality of first gears (15) is supported by relevant pins (16) provided on said toolholders (6) and disposed substantially perpendicular to said shafts (7), said shafts (7) being engaged to said first support body through a bush (19) associated to the same shafts (7) by a connection comprising a clearance-recovery device.

10. Lapping head according to claim 9, **characterized in that** said clearance-recovery device comprises springs (20) and balls (21).

- 5 11. Lapping head according to claim 1, **characterized in that** between said driving shaft (1) and said first support body (5) there are provided spring elements (22, 23) able to reduce the vibrations.
- 10 12. Lapping head according to claim 1, **characterized in that** said first support body (5) is provided, in correspondence of its portions intended to face said toolholders (6), a swell (24) coincident with the relevant axes of said shafts (7).
- 15 13. Lapping head according to claim 1, **characterized in that** it comprises a second support body (17), disposed above said first support body (5) and exhibiting an inner cavity (18) defining a chamber for containing a lubricating fluid.
- 20 14. Lapping head according to claim 1, **characterized in that** said shafts (7) of said toolholders (6) are disposed radially and substantially perpendicular to said driving shaft (1).
- 25 15. Lapping head according to claim 1, **characterized in that** said crown gear (12) has a toothing (14) eccentric with respect to said driving shaft (1).
- 30 16. Lapping head according to claim 1, **characterized in that** said first gears (15) have a toothing (15') eccentric with respect to the relevant pins (16) which support the same gears (16).
- 35

#### Patentansprüche

- 40 1. Läppkopf mit oszillierenden Werkzeughaltern des Typs, der Einrichtungen (2) zum Verbinden mit entsprechenden Antriebseinrichtungen, eine Antriebswelle (1), die mit diesen Verbindungseinrichtungen (2) verbunden ist, und eine Vielzahl von Werkzeughaltern (6) umfaßt, die mit der Antriebswelle (1) durch erste und zweite Antriebseinrichtungen für die Übertragung von Bewegung verbunden sind, wobei die ersten Antriebseinrichtungen (3, 5) einen ersten Körper (5) zum Tragen der Werkzeughalter (6) umfassen, der mit der Antriebswelle (1) drehfest verbunden ist, wobei die zweite Antriebseinrichtung entsprechend der Drehung der Antriebswelle (1) in der Lage ist, eine Oszillation der Werkzeughalter (6) um ihre Wellen (7) zu bewirken, die unter einem Winkel bezüglich der Antriebswelle (1) angeordnet sind, **dadurch gekennzeichnet, daß** die zweite Antriebseinrichtung für die Übertragung von Bewegung zumindest eine Vielzahl von ersten Zahnradern (15) umfaßt, die an der Vielzahl von Werk-
- 45
- 50
- 55

zeughaltern (6) angelenkt sind und ein Kronenzahnrad (12), das mit der Antriebswelle (1) verbunden ist und von dieser angetrieben wird, wobei das Kronenzahnrad mit der Vielzahl von ersten Zahnradern (15) mittels zweier Zahnungen (14, 15) 5 kämmt, von denen die eine wenigstens eine Veränderung der Neigung längs ihrer Abwicklung aufweist, und wobei die Werkzeughalter (6) an dem Tragkörper so angelenkt sind, daß sie oszillieren, wenn das Kämmen der Zahnungen entsprechend 10 einem Bereich hiervon stattfindet, der die Veränderung der Neigung aufweist.

2. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** die Zahnung, die wenigstens eine Änderung der Neigung längs ihrer Abwicklung aufweist, eine an dem Kronenzahnrad (12) ausgebildete Zahnung (14) ist. 15
3. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** die Zahnung, die wenigstens eine Änderung der Neigung längs ihrer Abwicklung aufweist, eine Zahnung (15') ist, die an der Vielzahl von Zahnradern (15) ausgebildet ist. 20
4. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** die Zahnung, die wenigstens eine Änderung der Neigung aufweist, zumindest einen im wesentlichen geraden Teil besitzt, der mit einem schräg verlaufenden Teil alterniert. 25 30
5. Läppkopf nach Anspruch 4, **dadurch gekennzeichnet, daß** die Zahnung, die zumindest eine Änderung der Neigung aufweist, im wesentlichen gerade Teile besitzt, die mit schräg verlaufenden Teilen alternieren. 35
6. Läppkopf nach Anspruch 4 **dadurch gekennzeichnet, daß** die Zahnung (14) eine Neigung aufweist, die hinsichtlich der Neigung und Richtung variiert. 40
7. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** das Kronenzahnrad (12) eine erste Zahnung (13) und eine zweite Zahnung (14) aufweist, daß eine Getriebeanordnung (8, 9) zwischen 45 der Antriebswelle und der ersten Zahnung (13) des Kronenzahnrades (12) vorgesehen ist, um sowohl das Kronenzahnrad als auch die ihm nachgeordneten Zahnradern durch eine Modifizierung der Drehbewegung der Antriebswelle (1) gemäß einem vorbestimmten Getriebeverhältnis anzutreiben. 50
8. Läppkopf nach Anspruch 7, **dadurch gekennzeichnet, daß** die Getriebeanordnung ein zweites Zahnrad (8), das auf die Antriebswelle (1) aufgekeilt ist, und ein drittes Zahnrad (9) umfaßt, das frei laufend auf einem zweiten Tragkörper (17) gelagert ist, der fest mit dem ersten Tragkörper (5) verbunden 55

ist, und das zwei innere Zahnungen (10, 11) besitzt, die in der Lage sind, mit dem zweiten Zahnrad (8) bzw. der ersten Zahnung (13) des Kronenzahnrades (12) zu kämmen.

9. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** die Vielzahl von ersten Zahnradern (15) durch entsprechende Zapfen (16) getragen wird, die an den Werkzeughaltern (6) vorgesehen und im wesentlichen senkrecht zu den Wellen (7) angeordnet sind, wobei die Wellen (7) mit dem ersten Tragkörper über eine Buchse (19) in Eingriff stehen, die diesen Wellen (7) über eine Verbindung zugeordnet ist, die eine Spiel- Ausgleichsvorrichtung umfaßt.
10. Läppkopf nach Anspruch 9, **dadurch gekennzeichnet, daß** die Spiel- Ausgleichsvorrichtung Federn (20) und Kugeln (21) umfaßt.
11. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** zwischen der Antriebswelle (1) und dem ersten Tragkörper (5) Federelemente (22, 23) vorgesehen sind, die in der Lage sind, die Vibrationen zu vermindern.
12. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** der erste Tragkörper (5) im Bereich seiner Teile, die dazu dienen, den Werkzeughaltern (6) gegenüber zu liegen, mit einer Schwellung (24) versehen ist, die mit den entsprechenden Achsen der Wellen (7) zusammenfällt.
13. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** er einen zweiten Tragkörper (17) umfaßt, der oberhalb des ersten Tragkörpers (5) angeordnet ist und einen inneren Hohlraum (18) aufweist, der eine Kammer für die Aufnahme eines Schmierfluids umgrenzt.
14. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** die Wellen (7) der Werkzeughalter (6) radial und im wesentlichen senkrecht zur Antriebswelle (1) angeordnet sind.
15. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** das Kronenzahnrad (12) eine Zahnung (14) aufweist, die bezüglich der Antriebswelle (1) exzentrisch ist.
16. Läppkopf nach Anspruch 1, **dadurch gekennzeichnet, daß** die ersten Zahnradern (15) eine Zahnung (15') aufweisen, die bezüglich der betreffenden Zapfen (16) exzentrisch ist, die diese Zahnradern (15) tragen.

## Revendications

1. Tête de douçissage. comportant des porte-outils oscillants du type comprenant des moyens (2) d'association à des moyens d'entraînement appropriés, un arbre d'entraînement (1) relié auxdits moyens d'association (2), et une pluralité de porte-outils (6) qui sont reliés à l'arbre d'entraînement (1) au moyen de premiers et de seconds moyens d'entraînement pour la transmission de mouvement ; lesdits moyens d'entraînement (3, 5) comprennent un premier corps (5) destiné à supporter les porte-outils (6) qui sont solidaires de l'arbre d'entraînement (1) lors du mouvement de rotation de ce dernier, lesdits seconds moyens d'entraînement étant aptes à déterminer, conformément à la rotation dudit arbre d'entraînement (1), une oscillation des mêmes porte-outils (6) autour de leur axe (7) disposé chacun angulairement par rapport audit arbre d'entraînement (1) ; la tête de douçissage étant **caractérisée en ce que** lesdits seconds moyens d'entraînement pour la transmission de mouvement comprennent au moins une pluralité de premiers engrenages (15) montés à rotation sur ladite pluralité de porte-outils (6) et une roue plate (12) reliée à l'arbre d'entraînement (1) qui l'entraîne, ladite roue plate s'engrenant avec ladite pluralité de premiers engrenages (15) via deux dentures (14, 15') dont une présente au moins une variation d'inclinaison le long de son développement, lesdits porte-outils (6) étant montés à rotation sur ledit corps de support de manière à osciller lorsque l'engrènement desdites dentures se fait conformément à sa portion présentant ladite variation d'inclinaison.
2. Tête de douçissage selon la revendication 1, **caractérisée en ce que** ladite denture présentant au moins une variation d'inclinaison le long de son développement est une denture (14) formée sur ladite roue plate (12).
3. Tête de douçissage selon la revendication 1, **caractérisée en ce que** ladite denture présentant au moins une variation d'inclinaison le long de son développement est une denture (15') formée sur ladite pluralité d'engrenages (15).
4. Tête de douçissage selon la revendication 1, **caractérisée en ce que** ladite denture présentant au moins une variation d'inclinaison présente au moins une portion sensiblement droite alternant avec une portion oblique.
5. Tête de douçissage selon la revendication 4, **caractérisée en ce que** ladite denture présentant au moins une variation d'inclinaison présente des portions sensiblement droites alternant avec des portions obliques.
6. Tête de douçissage selon la revendication 4, **caractérisée en ce que** ladite denture (14) présente une inclinaison qui-varie en inclinaison et en direction.
7. Tête de douçissage selon la revendication 1, **caractérisée en ce que** ladite roue plate (12) présente une première denture (13) et une seconde denture (14), un train d'engrenages (8, 9) étant prévu entre ledit arbre d'entraînement (1) et ladite première denture (13) de ladite roue plate (12) de manière à entraîner ladite roue plate, ainsi que les engrenages placés en aval de celle-ci, en modifiant le mouvement de rotation dudit arbre d'entraînement (1) dans un rapport d'engrenage prédéterminé.
8. Tête de douçissage selon la revendication 7, **caractérisée en ce que** ledit train d'engrenages comprend un deuxième engrenage (8) claveté sur ledit arbre d'entraînement (1) et un troisième engrenage (9), disposé à mouvement libre sur un second corps de support (17) solidaire dudit premier corps de support (5) et présentant deux dentures intérieures (10, 11) apte à s'engrener, respectivement, avec ledit deuxième engrenage (8) et ladite première denture (13) de ladite roue plate (12).
9. Tête de douçissage selon la revendication 1, **caractérisée en ce que** ladite pluralité de premiers engrenages (15) est supportée par des axes appropriés (16) prévus sur lesdits porte-outils (6) et disposés sensiblement perpendiculairement auxdits arbres (7), lesdits arbres (7) étant engagés avec ledit premier corps de support via une douille (19) associée aux mêmes arbres (7) par une liaison comprenant un dispositif de rattrapage de jeu.
10. Tête de douçissage selon la revendication 9, **caractérisée en ce que** ledit dispositif de rattrapage de jeu comprend des ressorts (20) et des billes (21).
11. Tête de douçissage selon la revendication 1, **caractérisée en ce que**, entre ledit arbre d'entraînement (1) et ledit premier corps de support (5), il est prévu des éléments élastiques (22, 23) aptes à réduire les vibrations.
12. Tête de douçissage selon la revendication 1, **caractérisée en ce que** ledit premier corps de support (5) est prévu, en correspondance de ses portions prévues pour être dirigées vers lesdits porte-outils (6), un renflement (24) coïncidant avec les axes appropriés desdites arbres (7).
13. Tête de douçissage selon la revendication 1, **caractérisée en ce qu'elle** comprend un second corps de support (17), disposé au-dessus dudit premier corps de support (5) et présentant une cavité intérieure (18) définissant une chambre destinée à con-

tenir un fluide lubrifiant.

14. Tête de doucissage selon la revendication 1, **caractérisée en ce que** lesdits arbres (7) desdits porte-outils (6) sont disposés radialement et sensiblement perpendiculairement audit arbre d'entraînement (1). 5
15. Tête de doucissage selon la revendication 1, **caractérisée en ce que** ladite roue plate (12) comporte une denture (14) excentrique par rapport audit arbre d'entraînement (1). 10
16. Tête de doucissage selon la revendication 1, **caractérisée en ce que** lesdits premiers engrenages (15) comportent une denture (15') excentrique par rapport aux axes appropriés (16) qui supportent les mêmes engrenages (15). 15

20

25

30

35

40

45

50

55

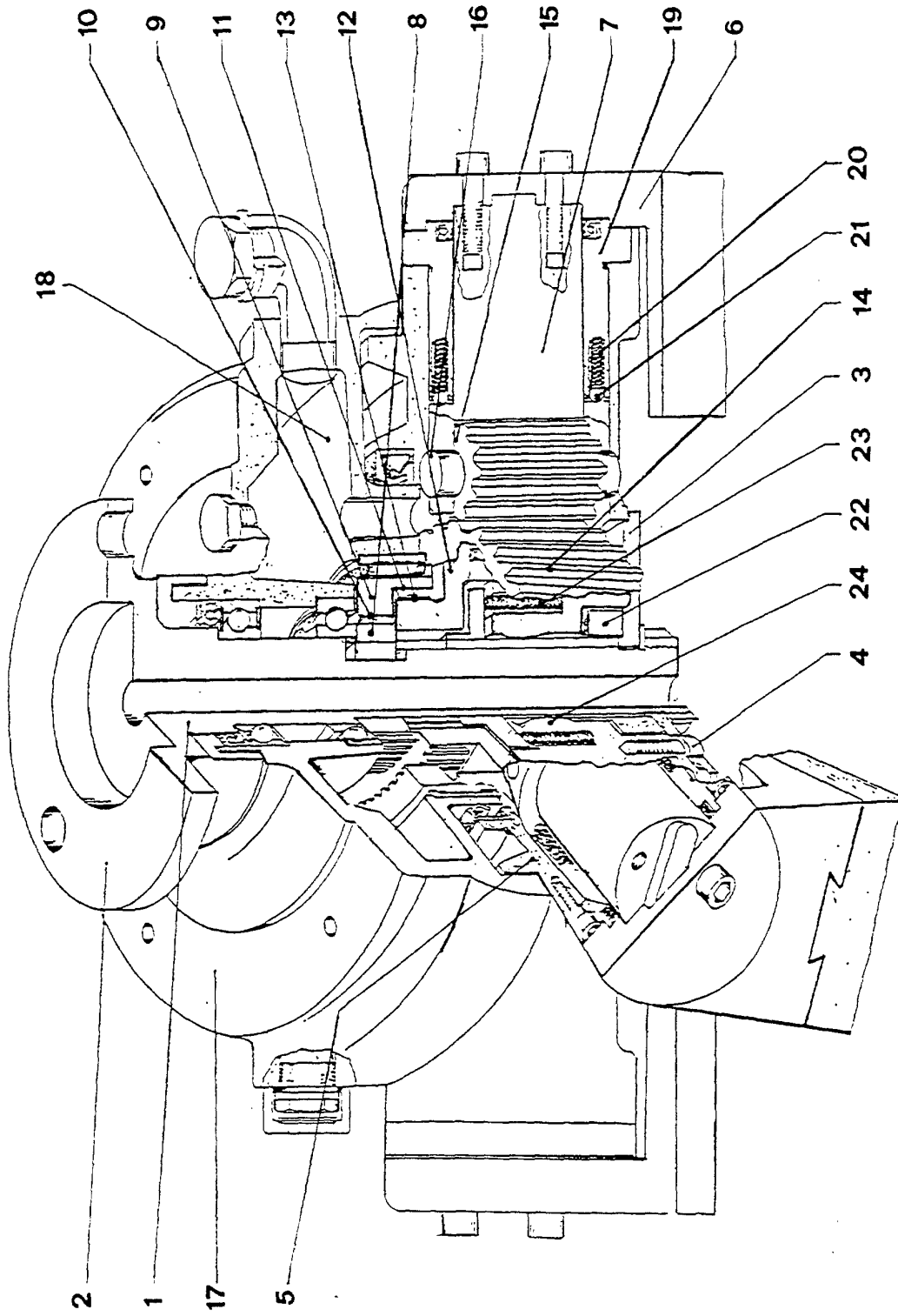
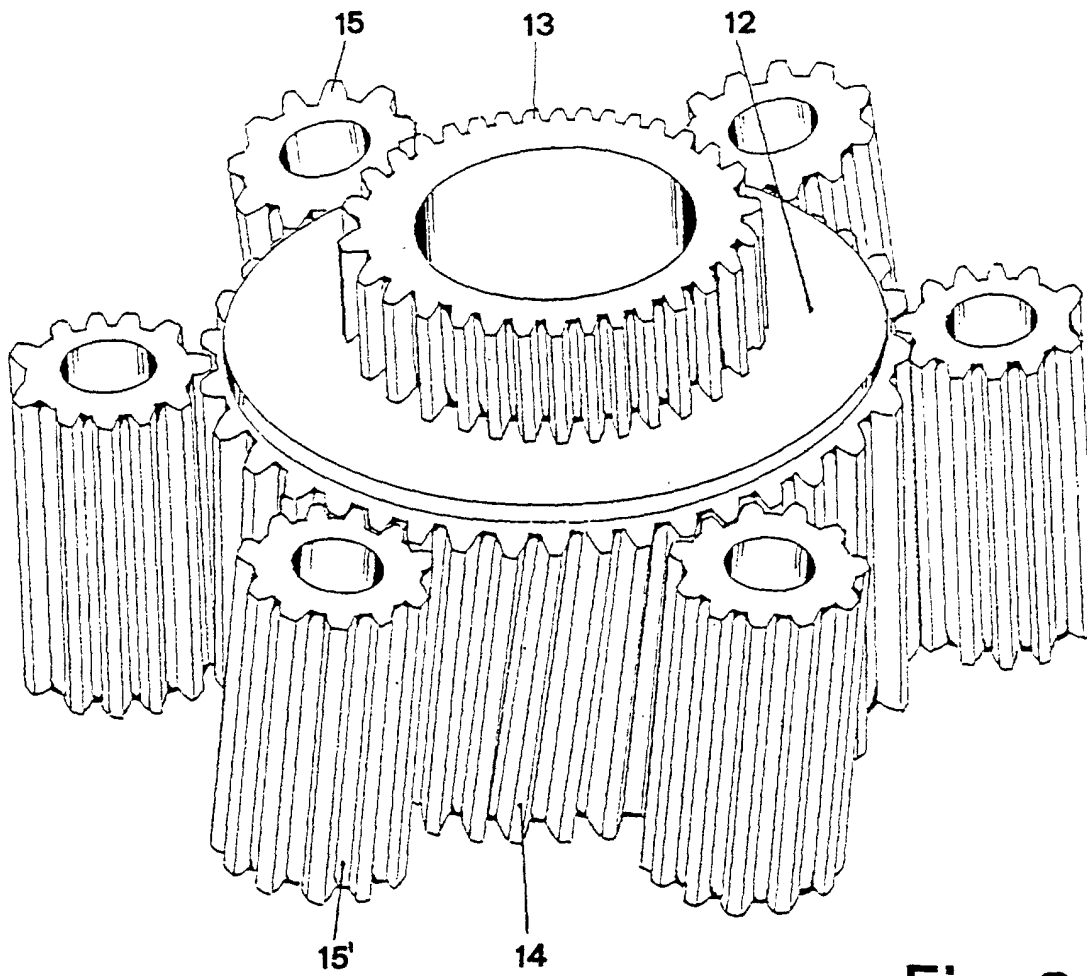
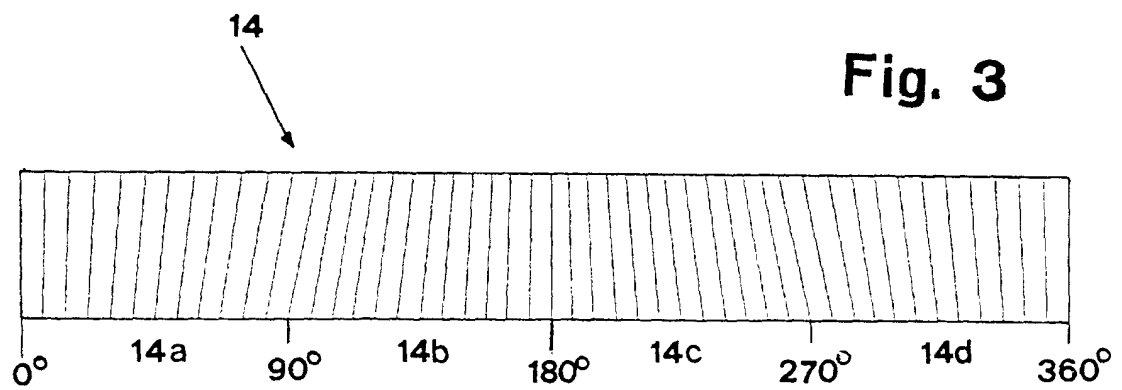


Fig. 1





**Fig. 2**



**Fig. 3**