(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 908 271 A2

(12) EUROPEAN PATENT APPLICATION

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

(51) Int Cl.[6]: **B24B 41/047**, B24B 47/12

(21) Application number: **98830162.8**

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

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **09.10.1997 IT FI970223**

(71) Applicant: **CO.ME.S. S.r.l.**
56012 Fornacette (Pisa) (IT)

(72) Inventors:
- **The inventor has agreed to waive his entitlement to designation.**

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

(54) Lapping head with oscillating toolholders

(57) Lapping head with oscillating toolholders, with a driving shaft (1), and a plurality of toolholders (6) which are connected to the driving motor (1) by means of first and second drive means for the transmission of motion; wherein the first drive means (3, 5) comprise a first body (5) for supporting the toolholders (6) which is integral with the driving shaft (1) and the second drive means cause the toolholders (6) to oscillate about their axes (7), wherein the second drive means 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 motor (1) and 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 wherein the said toolholders (6) are pivoted on 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 (Fig. 1).

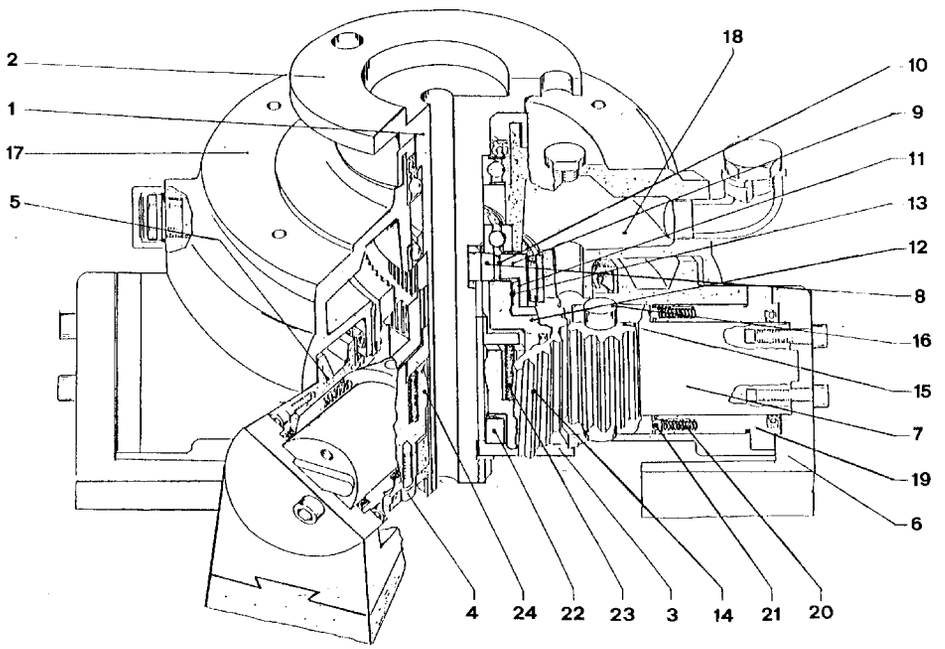

Fig. 1

EP 0 908 271 A2

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 (tubolar, 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 toolholhers 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 techinque. In other words, the present lapping head allows a more efficent 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.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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.

[0014] 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).

[0015] 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.

[0016] 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).

[0017] In the illustrated example, the special toothing (14) is formed on the crown gear (12).

[0018] As best shown in Fig. 3, the special toothing (14) alternates straigth 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).

[0019] 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).

[0020] 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 adtantageous 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 motor (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 motor (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 geras located downstrean thereof, by modifying the rotary motion of siad 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).

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.

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).

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.

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).

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).

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).

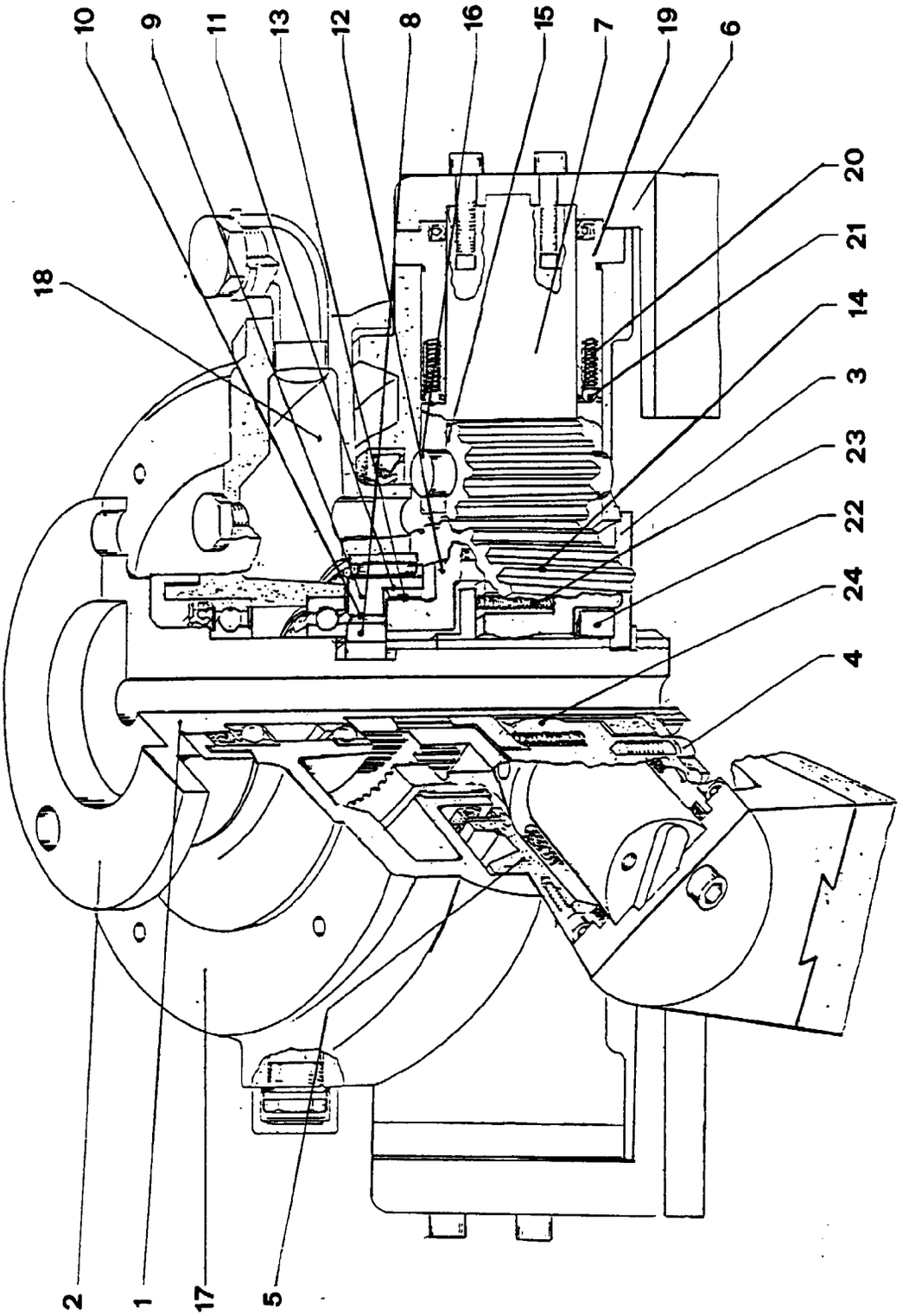

Fig. 1

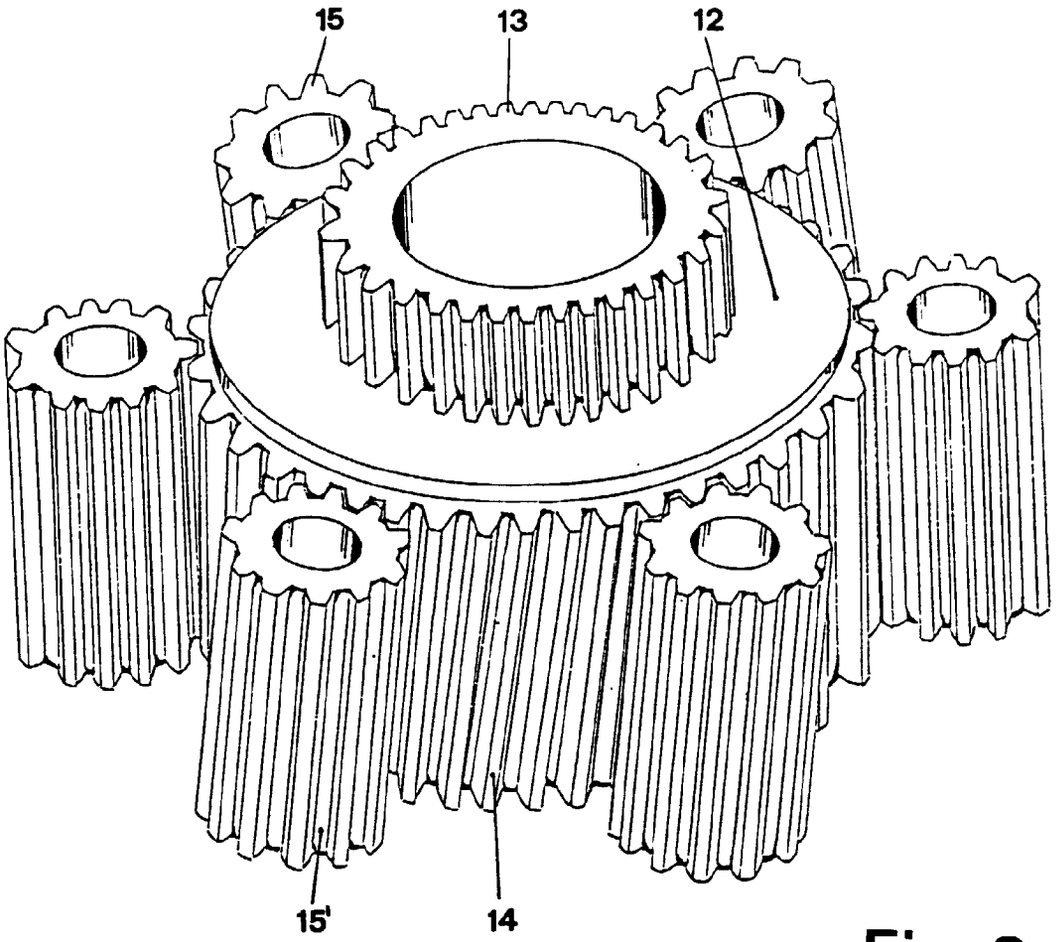

Fig. 2

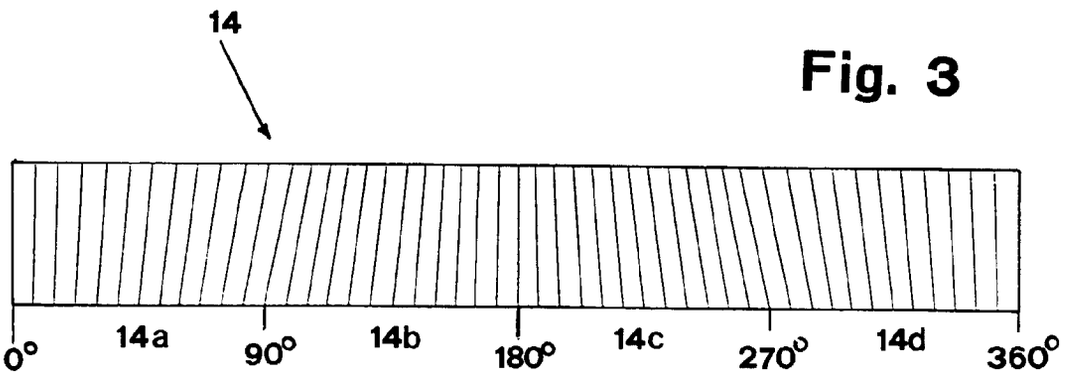

Fig. 3