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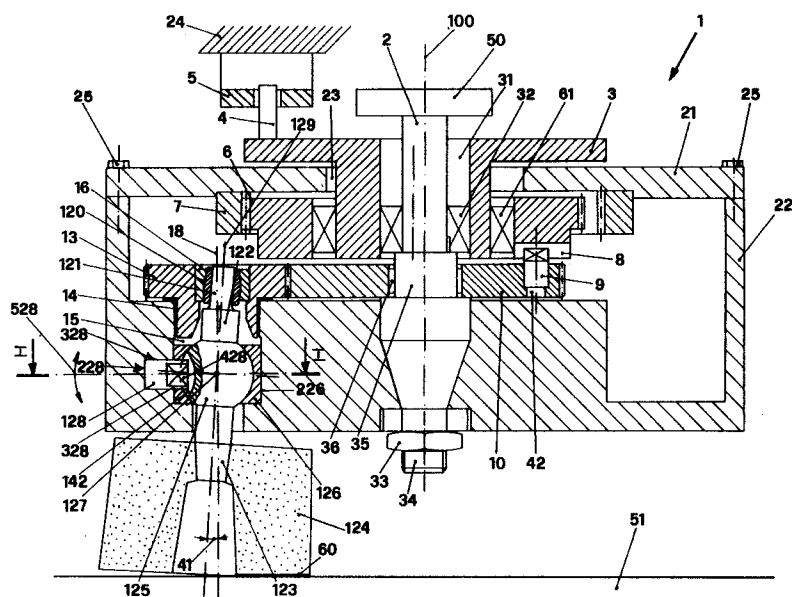
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I-36100 Vicenza (IT)(54) **Improved lapping head for rocky materials, particularly for granite slabs.**

(57) The invention discloses a lapping head comprising a casing (22), supporting a plurality of lapping wheels (124; 224), supported by a central shaft (2) connected with a driving element (50) and containing bevel pinions (13) caused to rotate by kinematic elements. Each of said lapping wheels (124) is attached to the end (123) of a pivot (122), eccentrically connected in the hole (16) of one of said bevel pinions (13), provided with a spheric body (125)

suited to allow, during the rotating motion the rotation of said lapping head, a conic motion of revolution of the longitudinal axis (129) of said pivot (122) and of the lapping wheel attached to it in relation to the longitudinal axis of the corresponding bevel pinion (13), and a simultaneous motion of revolution of said lapping wheel in relation to the axis of rotation (100) of the lapping head itself.

**FIG.1****EP 0 657 248 A1**

The invention concerns the realization of an improved lapping head for slabs of rocky material.

It is a known fact that the lapping of marble, granite slabs and rocky materials in general, is performed by means of lapping heads presenting oscillating abrasive sectors.

Said lapping heads consist of a body having a cylindrical or polyhedral shape which supports on the outer surface a plurality of lapping wheels.

The head is caused to rotate around its vertical axis so as to set into rotation the lapping wheels arranged around its periphery which, simultaneously, are also caused to oscillate each around a horizontal axis.

The lapping of the plate is therefore obtained by the abrasive action of the lapping wheels which combine the rotating motion around a vertical axis with the oscillating motion of each one on a vertical flat surface.

In some types of lapping heads belonging to the known technique, the rotational movement of the head and the oscillation of the lapping wheels are obtained through a kinematism consisting of a pinion which simultaneously engages with two toothed wheels co-axial with one another, one of which is attached to the body of the head while the other one is attached to a cam.

Whenever the pinion rotates both the toothed wheels are caused to rotate, thus causing both the rotating motion of central body of the head and the rotating motion of the cam.

This one, when rotating, contrasts against the levers connected to the shafts supporting the lapping wheels and causes, therefore, the oscillating motion of the lapping wheels themselves.

Since the two toothed wheels present a number of teeth slightly different from one another, the cam rotates with a slightly different speed in relation to the body of the lapping head and then the oscillating motions per minute performed by the lapping wheels around their own axis are considerably lower in relation to the number of revolutions per minute performed by the body of the head.

Besides, the lower the number of oscillating motions the lower the relative speed between the two toothed wheels and therefore, in conclusion, the number of their teeth differs.

One of the inconveniences that the lapping heads of such a type present is given by the high maintenance that they require.

In fact, since the pinion rotates at a high speed, it constantly needs a perfect lubrication.

If this is neglected even for a short time, because of the particular environment presenting a high content of abrasive powders wherein the machine operates, the pinion, the toothed wheels and the bearings will deteriorate rapidly.

Such an inconvenience is obviated by the realization of the patent which is the object of the patent application No. 85561/A/89 in the name of the same inventor in which, by obtaining the lapping head, the pinion which rotates at a high speed is eliminated, therefore, the rotating gear of the head and the oscillating gear of the lapping wheels are limited only to two toothed wheels.

Even the lapping head obtained according to the dictates of the mentioned patent application, as well as the other lapping heads belonging to the known technique, present other inconveniences, the main of which consisting in that the cam which causes the oscillating motions of the arms supporting the lapping wheels involves considerable manufacturing costs because of the complexity and the difficulty involved in the realization of its configuration.

In fact, if the configuration of its profile is not state-of-the art, different oscillating motions among the various lapping wheels will result and, therefore, a different working performance of one lapping wheel in relation to the other.

Another inconvenience consists in that the cam realizes with the oscillating levers of the shafts supporting the lapping wheels an almost point-shaped contact, and, at any rate a contact which is restricted to a segment of a very reduced length.

This fact causes during the working process high wearing in the points of contact because of the high specific loads and it also entails a low capacity to absorb shocks and dynamic loads.

Another inconvenience consists in that the presence of the control oscillating levers of the shafts supporting the lapping wheels which develop their dimensions following a tangential direction, restrict the number of lapping wheels which can be assembled on each lapping head depending on the respective diameter.

Not the least inconvenience is that the lapping heads belonging to the known technique require an accurate adjustment during the assembly, above all with regard to the positioning of the oscillating mechanisms of the lapping wheels in relation to the profile of the cam.

However precise the profile of the cam and accurate the assembly may be, a small clearance which cannot be eliminated persists, this, in the course of the time, shows a tendency to become bigger.

With the purpose of eliminating all the mentioned inconveniences, a lapping head with oscillating lapping wheels, object of the Italian registered No. 85504/A/90 in the name of the same inventor has been realized which, as compared with the lapping heads belonging the known technique, is of simpler construction, its inner elements are less subject to wearing, it absorbs without damage

shocks and accidental dynamic stresses, it does not require difficult matchings or adjustments when assembled, it works more reliably and needs less maintenance.

Even said lapping head, however, presents some inconveniences, the main one of which consists in that during the operation process each lapping wheel acts on the same surfaces on which the preceding lapping wheel has worked.

Another inconvenience consists also in that the structure of the lapping head is such that, even reducing as much as possible the dimensions of the kinematics and of the mechanical mechanisms which compose it, it is unavoidable for the lapping wheels to be separated from each other by a certain distance.

This fact entails some inconveniences when surfaces consisting of paving tiles of small size are smoothed, in that case the lapping wheels act in correspondence with the corners of each paving tile and generates some flexures which can also cause the paving tile to break.

The purpose of the invention is to eliminate these inconveniences too.

In particular, the main purpose of the invention is to obtain an improved lapping head in which the lapping wheels which it supports present points of contact with the working surface which are constantly variable and such that each lapping wheel operates on surfaces differing from the surfaces treated by the preceding lapping wheel.

It is another purpose to allow the lapping wheels to be so close to each other, as to obtain that even when in the presence of surfaces consisting of paving tiles of small sizes, the lapping wheels essentially operate on the entire surface of each paving tile, rather than affecting only a central and very reduced section of the same.

The described purposes are achieved by a lapping head which, in accordance with the main claim comprises a casing supporting a plurality of lapping wheels closed by means of a lid and supported by a central shaft connected with a driving element, said casing containing first kinematic elements co-operating with one another and co-operating through second kinematic elements with an internal gear innerly attached to said lid, and it is characterized in that each of said lapping wheels is attached to the end of a pivot which presents the opposite end connected inside a hole drilled in one of said first kinematic elements and is provided, in an essentially central position, with a spheric body united to the casing through connecting mechanisms suited to allow, during the rotating motion of said lapping head, a conic motion of revolution of the longitudinal axis of said pivot supporting the lapping wheels in relation to the longitudinal axis of the corresponding element of said first kinematic

elements, and with a centre of revolution coinciding with the geometric centre of said spheric body, as well as a simultaneous motion of revolution performed by said spheric body in relation to the axis of rotation of the lapping head itself.

According to a preferred embodiment, the head according to the invention presents said first kinematic elements consisting of bevel pinions coupled within lodgings obtained in the body of said casing, and engaging with a sun wheel externally co-axial with the central shaft.

In a different embodiment said lapping head presents said first kinematic elements consisting of a guiding disk inside which a pilot disk is coupled, the latter, in turn, being eccentrically attached outside the central shaft.

According to a preferred embodiment said lapping head is equipped with four peripheral lapping wheels, essentially positioned in correspondence with the vertexes of a square and with their longitudinal axis arranged in a slanted position in relation to the longitudinal axis of the shaft located at the center of the lapping head itself.

During the rotating motion performed by the head around its axis of rotation, a motion of revolution also occurs, performed by the lapping wheels in relation to the axis of rotation of the head itself.

Simultaneously, the longitudinal axis of each of said lapping wheels rotates with a conic motion of revolution around the longitudinal axis of the bevel pinion to which the shaft which supports said lapping wheel is connected, said shaft having a centre of revolution which coincides with the centre of a spheric body belonging to said pivot which supports said lapping wheel.

In such a way on the surfaces being worked the contact of the lapping wheel is constantly variable in width and describes in correspondence with the working surface itself, circular crowns which are constantly variable in width.

The envelopment of the different instantaneous situations when the various lapping wheels touch the working surface during the rotating motion of the head itself, generates two closed curves the axes of which intersect one another.

Advantageously, the improved lapping head according to the invention allows a higher finishing quality of the surfaces being treated, while also allowing a constant and more uniform wear of the lapping wheels in correspondence with the area which is in contact with the surface being treated.

Moreover, this fact advantageously allows a better distribution of the loads with a consequent decreased stress of the mechanical mechanisms which compose the lapping head, and a better distributed stress on the plates or the paving tiles being treated.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter.

However, it should be understood that the detailed description and specific example, while indicating a preferred embodiment of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description and from the drawings, wherein:

- Fig. 1 shows a cross-section of the lapping head according to the invention;
- Fig. 2 shows the detail of the spheric body of the shaft supporting the lapping wheel taken following cross-section I°-I° of Fig. 1;
- Fig. 3 shows the lapping head according to the invention, in a plan view from the side of the lapping wheels, wherein the same Figure shows the cross-section II°-II° taken following the cross-section represented in Fig. 1;
- the Figs. from 4 to 11 show different situations when the lapping wheels touch the working surface corresponding to different positions acquired by each lapping wheel during its conic motion of revolution around the centre of the spheric body belonging to the shaft to which it is attached;
- Fig. 12 shows a different embodiment of the lapping head according to the invention.

With reference to the Figs. 1 and 3, it can be observed that the lapping head according to the invention, indicated as a whole with 1, comprises a casing 22 on top of which a lid 21 provided with an axial hole 23, is attached through proper connecting means, such as screws 25, for instance.

Inside the hole 23 of the lid 21 a flange 3 presenting an eccentric axial hole 31 is assembled, said flange not being able to rotate because is attached by means of a pivot 4 to a fork 5, secured to the machine bed 24 of the lapping machine to which the lapping head belongs.

In the inner part of the lid 21 is attached an internal gear 7 which, therefore, is also attached to the casing 22. Outside the flange 3 is coupled, by means of bearings 61, the toothed central wheel 6 which constitutes second kinematic elements and engages with the internal gear 7, while inside the eccentric hole 31 of the same flange 3 is coupled, by means of bearings 32, a central shaft 2.

Said central shaft 2 is attached to the casing 22 through mechanical connecting means, for instance through a nut 33 which couples with its threaded extremity 34.

It is, therefore, understood that when the central shaft 2 is caused to rotate by connecting its extremity 50 with a driving element belonging to the lapping machine, the whole casing 22 is caus-

ed to rotate and, therefore, the gear 7 sets into rotation the toothed central wheel 6 with which it engages.

In particular, it can be observed that the central wheel 6 is entirely contained in the inner diameter of the gear 7 and therefore presents a lower number of teeth than the gear.

As a result, when the casing 22 and, therefore, also the gear 7 rotate, the central wheel 6 rotates at a slightly higher speed in relation to the casing 22, the difference in speed depending on the ratio between the number of teeth of the gear 7 and of the central wheel 6.

It can also be observed that on the central wheel 6 there is a radial slot 8 within which a pivot 9 which is secured inside a seat 42 obtained in a first kinematic element is bound, said first kinematic element consists of a sun wheel 10 which is slidingly keyed on the intermediate diameter 35 of the central shaft 2 by means of the interposition of a bearing 36.

Therefore, said pivot 9, said seat 42 and said slot 8 constitute the connecting means which make said central wheel 6 and said sun wheel 10 mechanically and stably connected with one another.

The pivot 9 allows the central wheel 6 to set into rotation also the sun wheel 10 which performs a rotating motion around the longitudinal axis 100 of the shaft 2 which coincides with the axis of rotation of the entire head 1.

The sun wheel 10, as can be observed also in Fig. 3, engages with other four first kinematic elements consisting of bevel pinions 13 which are arranged in an orthogonal position in relation to each other, each of them, as can be observed in Fig. 1, is coupled in a housing 15 obtained in the casing 22, eventually by means of the interposition of a bearing 14.

Each bevel pinion 13 is provided with a hole 16 which, as can be observed in Fig. 3, is eccentrically drilled with eccentricity 17 in relation to the axis 18 of the bevel pinion 13 itself.

Inside each of said eccentric holes 16 is lodged a joint 120 within which the extremity 121 of a shaft 122 is inserted, the opposite extremity 123 of said shaft supporting a cup-shaped lapping wheel 124.

In an essentially central position, said pivot 122 presents a spheric body 125 which is lodged in a seat 126, assembled in a housing 226 obtained in the casing 22 and within which it is bound by a pin 128 the extremity of which co-operates in a housing 142 obtained in the spheric body 125 itself.

In particular, in the Figs. 1 and 2 it can be observed that said pin 128 presents one extremity 228 coupled with a corresponding seat 328 obtained in the casing 22 within which it can rotate on itself following the arrow 528, and the opposite

extremity has a prismatic profile 428, bound in a corresponding prismatic housing 142 obtained in the spheric body 125.

In such a way, the coupling between the prismatic profiles 428 of the pin 128 and 142 of the spheric body 125, allows the latter to perform any movement around its geometric centre 127 except the rotating motion around the longitudinal axis 129 of the shaft 122 supporting the lapping wheels, and passing through said geometric centre 127.

It can also be observed that the geometric centre 127 of the spheric body 125 coincides with the point defined by the intersection between the longitudinal axis 18 of each bevel pinion 13 and the longitudinal axis 129 of the shaft 122 supporting the lapping wheels, which is arranged in a slanted position and which passes through the centre 40, visible in Fig. 3, of the eccentric hole 16 drilled in each of said bevel pinions 13.

The lapping wheel 124 presents, as can be observed in Fig. 1, its axis of rotation which coincides with the axis 129 of the pivot 122 supporting the lapping wheels, which is slanted by the angle 41 in relation to the longitudinal axis 18 of each bevel pinion 13.

Whenever the central shaft 2 is set into rotation, it also causes to rotate, following the same direction, the casing 22 and, by means of the internal gear 7 attached to the lid 21, it causes the rotation of the kinematic elements consisting of the central wheel 6, of the sun wheel 10 and of the bevel pinions 13 engaging with said sun wheel 10.

Each bevel pinion 13 by rotating around its vertical axis 18, forces the extremity 121 of the shaft 122 supporting the lapping wheels, to perform a motion of revolution around the axis 18 of the bevel pinion 13 itself, so that the longitudinal axis 129 of the shaft 122 supporting the lapping wheels, rotates with a conic motion of revolution around the longitudinal axis 18, with a revolution centre 127.

The contact line 60 of the lapping wheel 124 with the surface to be lapped 51 visible in Fig. 1, is then constantly variable, as can be observed in the Figs. from 4 to 11.

With regard to the contact line 60 of each lapping wheel with the surface to be lapped 51, in Fig. 3 it can be observed that the four bevel pinions 13 are assembled on the casing 22 such that the eccentricities 17 of two bevel pinions 13 horizontally opposite to one another, as represented in the drawing of Fig. 3, are turned toward the centre of the lapping head, while the same eccentricities of the vertical bevel pinions, as represented in the same drawing and again opposite to one another, are turned instead toward the exterior of the lapping head itself.

This fact entails, as can be observed in Fig. 4, that the contact lines 60 of the lapping wheels 124

belonging to the bevel pinions horizontally arranged in the drawing represented in Fig. 4, are arranged in a position which is nearer to the axis of rotation 100 of the lapping head, while the contact lines 160 of the lapping wheels 224 vertically arranged in the drawing, are turned further removed from the axis of rotation 100 of the lapping head itself.

These different positions of the contact lines 60 and 160 can be further differentiated from one another by positioning the bevel pinions 13 according to positions which differ from what has been described by simply varying the orientations of the eccentricity 17.

This fact permits to obtain different ways of operating according to the requirements of the user and, above all, according to the number of the lapping wheels.

If one considers the beginning of the lapping operation and, therefore, the setting into rotation of the lapping head beginning from the initial situation represented in Fig. 4, while the lapping head rotates following the direction indicated by the arrow 70, each bevel pinion 13 and the lapping wheel joined to it rotate following the opposite direction indicated by the arrow 71, so that the contact line 60 of the horizontal lapping wheels 124 with the working surface 51 describe the crown 61, while the contact lines 160 of the vertical lapping wheels 224 describe the crown 161, wherein each of said crowns corresponds to a lapping area on the working surface 51.

By representing various instantaneous situations, which are defined whenever for each revolution of the lapping head following direction 70 each bevel pinion 13 positions itself as represented in Fig. 4, the contact line of each lapping wheel with the working surface 51 is moved by a certain angular quantity because of the rotation following direction 71 of each lapping wheel simultaneously with the rotation following direction 70 of the head to which said lapping wheel belongs.

Obviously, the different positions depend on the transmission ratios of the kinematic elements.

As a consequence, during an instant following the instant which the configuration of Fig. 4 represents, the contact lines 60 and 160 of the lapping wheels 124 and 224 respectively, position themselves as represented in the situation of Fig. 5, wherein the working area of the contact lines 60 corresponds with the crown 62, while the working area of the contact lines 160 corresponds with the crown 162.

In a similar way, during a another following instant, the configuration represented in Fig. 6 is reached, wherein the contact lines 60 operate on the area represented by the crown 63, while the contact lines 160 operate on the area represented

by the crown 163, said crowns having equal diameters and equal width, thus coinciding.

Then, the configuration represented in Fig. 7 occurs, wherein the contact lines 60 and 160 operate on the crowns 64 and 164 respectively, thus achieving, therefore, the configuration represented in Fig. 8 wherein the contact lines 60 and 160 operate on the crowns 65 and 66 respectively, thus reproducing the configuration essentially opposite in relation to the initial configuration represented in Fig. 4.

It is to be observed that during the rotating motion of the lapping wheels, the lapping head moves on the working surface 51 following any horizontal direction represented by the arrows 73 and, consequently, the working areas which are crown-shaped, intersect with one another so that the contact line of one lapping wheel does not interfere with the working area of the preceding lapping wheel or, however, such an intersection is extremely limited.

While continuing the rotating motion of the head and of the lapping wheels, the contact lines 60 and 160 operate, therefore, on the circular crowns 66 and 166 represented in Fig. 9 and then reach the situation represented in Fig. 10 which is completely similar to the working situation represented in Fig. 6 wherein, in this case too, both the contact lines 60 and 160 work on the circular crowns 67 and 167 respectively, which are coincident with one another.

While continuing in the rotating motion, the situation represented in Fig. 11 is reached. This repeats in an opposite way the configuration of Fig. 7.

A different embodiment based on the same idea of solution is represented in Fig. 12 wherein it can be observed that in the lapping head according to the invention, indicated as a whole with 601, said first kinematic elements, which in the solution previously described consist of a sun toothed wheel 10 and of the bevel pinions 13, in this case consist of a pilot disk 510, externally coupled with eccentricity 511 to the central shaft 502 and of a guiding disk 513 which internally receives the coupling of the pilot disk 510.

On the periphery of said guiding disk 513 holes 516 are drilled. These correspond in number to the lapping wheels 624 to be set into rotation and inside each of them a joint 620 is coupled.

In each of said joints 620 the extremity 621 of a shaft 622 is coupled, said shaft, as for the embodiment solution previously described, presents in an intermediate position a spheric body 625 and on the opposite extremity 523 supports a cup-shaped lapping wheel 624.

Therefore, whenever the central shaft 502 is set into rotation, the entire body 522 of the lapping

head is set into rotation too, and the central wheel 506 which engages with the gear 507 is also caused to rotate.

Even such a different solution foresees that in said second kinematic elements, which in this case consist of a central toothed wheel 506, a radial slot 508 is obtained, inside it is bound a pivot 509 attached in a seat 524 of the pilot disk 510, so that said central wheel and said pilot disk 510 are joined together.

The rotating motion of the pilot disk 510 causes, therefore, the guiding disk 513 to perform a motion of revolution since said guiding disk 513 is bound to the body 522 of the head of the cylindrical bush 630 which engages in the hole 631 drilled in body 522 itself.

This motion of revolution around the vertical axis 632 of the head, generates a conic rotating motion of the shaft 622 and of the corresponding lapping wheel 624.

Even in such a different solution the lapping wheel 624 moves, therefore, with a conic rotating motion around the axis 518 with a centre of rotation 527 which is coincident with the centre of the spheric body 625.

It is understood that, according to what has been described, the lapping head object of the invention achieves the proposed purposes.

The first purpose which has been achieved is the realization of a head in which the point of contact of the lapping wheels with the surface being treated is constantly variable, so that each lapping wheel operates on a surface which is independent in relation to the surface on which the preceding lapping wheel has operated.

Moreover, the conic motion of the lapping wheel entails a constant variation of the point of contact also for the lapping wheel itself which permits a constant renewal of the lines of contact themselves.

The purpose of approaching the lapping wheels toward one another so as to be able to treat also surfaces which are composed by paving tiles of a small size, thus increasing the distribution of the lines of contact of all the lapping wheels with said paving tile so as to reduce the specific loads has also been achieved.

Besides, the head according to the invention realized according to the described variation, permits also to reduce the manufacturing costs.

During the construction phase the lapping head according to the invention may undergo some modifications entailing a different embodiment with regard to the number of lapping wheels which may vary indefinitely and in any case may differ from four.

Even the dimension of said heads and of said lapping wheels may vary indefinitely. However, it is

to be understood that any possible different construction which is deemed necessary during the manufacturing phase, will fall within the spirit and scope of the present invention.

Claims

1. A lapping head comprising a casing (22; 522) supporting a plurality of lapping wheels (124; 224; 624), closed by means of a lid (21) and supported by a central shaft (2; 502) connected with a driving element (50), said casing (22; 522) containing first kinematic elements (13, 10; 513, 510) co-operating with one another and co-operating through second kinematic elements (6; 506) with an internal gear (7; 507) innerly attached to said lid (21), **characterized in that** each of said lapping wheels is attached to the end (123; 523) of a pivot (122; 622) which presents its opposite end (121; 621) connected in at least one hole (16; 516) drilled in one (13, 513) of said first kinematic elements and is provided, in an essentially central position, with a spheric body (125; 625) united to the casing (22; 522) through connecting mechanisms (126, 128) suited to allow, during the rotating motion of said lapping head, a conic motion of revolution of the longitudinal axis (129) of said pivot (122; 622) supporting the lapping wheels, in relation to the longitudinal axis of the corresponding element of said first kinematic elements and with a centre of revolution (127; 527) coinciding with the geometric centre of said spheric body (125; 625), and a simultaneous motion of revolution performed by said spheric body in relation to the axis of rotation (100) of the lapping head itself.
2. A lapping head according to claim 1, **characterized in that** said first kinematic elements consist of bevel pinions (13) coupled inside lodgings (15) obtained in the body of said casing (22) and engaging with a sun wheel (20) externally co-axial with the central shaft (22).
3. A lapping head according to claim 1, **characterized in that** said first kinematic elements consist of a guiding disk (513) inside which a pilot disk (510) is coupled, the latter, in turn, being attached with eccentricity (511) outside the central shaft (502).
4. A lapping head according to claim 1, **characterized in that** said second kinematic elements which allow the co-operation of said bevel pinions (13) with said internal gear (7) consist of a toothed central wheel (6), externally coupled with a flange (3) arranged through a central hole (23) drilled in the lid (21) and engaging with an internal gear (7), said toothed central wheel (6) being connected with at least one element (10) of said first kinematic elements (13, 10), said at least one element (10) being coupled with the central shaft (2) by means of bearings (36) and being stably connected to said toothed central wheel (6) through mechanical joining means (8, 9, 42).
5. A lapping head according to claim 4, **characterized in that** said joining means are a pivot (9), one end of which couples with a radial slot (8) obtained in said toothed central wheel (6) and its opposite end couples with a seat (42) obtained in said element (10) of said first kinematic elements.
6. A lapping head according to claim 4 or claim 5, **characterized in that** said element of said first kinematic elements is a toothed sun wheel (10).
7. A lapping head according to claim 1, **characterized in that** said element of said first kinematic elements is a pilot disk (510).
8. A lapping head according to claim 1, **characterized in that** the geometric centre (127) of said spheric body (125) coincides with the point of intersection of the longitudinal axis (129) of said pivot (122) supporting the lapping wheels with the longitudinal axis (18) of the kinematic element (13) corresponding with it and belonging to said first kinematic elements.
9. A lapping head according to claim 1, **characterized in that** said spheric body (125) is united to the casing (22) through a seat (126) attached within a lodging (226) obtained in the body of the casing (22) itself, being bound within said seat by a pin (128) attached to the casing (22) and co-operating in a lodging (142) obtained in the spheric body (125) itself.
10. A lapping head according to claim 9, **characterized in that** said pin (128) is a cylindrical pin which presents one end (228) having a circular section, coupled with a corresponding seat (328) obtained in the casing (22) and its opposite end (328) having a prismatic profile (428), bound in a corresponding prismatic lodging (142) obtained in the spheric body (125).

11. A lapping head according to claim 1, **characterized in that** one the ends (121; 621) of said pivot (122; 622) supporting the lapping wheels, lodges in the hole (16; 516) of the corresponding element (13; 513) of said first kinematic elements through the interposition of a spheric joint (120; 620). 5
12. A lapping head according to claim 1, **characterized in that** each of said lapping wheels (124, 224; 624) presents the axis of rotation coinciding with the longitudinal axis (129) of said pivot (123; 623) supporting the lapping wheels, and passing through the centre (40) of the hole (16; 516) of each corresponding element (13; 513) of said first kinematic elements, to which said pivot is connected, said centre (40) being realized eccentric with eccentricity (17) in relation to the longitudinal axis (18; 518) of the element (13; 513) itself. 10
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13. A lapping head according to claim 12, **characterized in that** the longitudinal axis (129) of each of said pivots (122; 522) supporting the lapping wheels, presents an inclination (41) in relation to the longitudinal axis (18; 518) of the corresponding element (13; 513) of said first kinematic elements with which it is coupled. 25
14. A lapping head according to claim 1, **characterized in that** it is provided with four lapping wheels (124, 224; 624) arranged on the vertexes of a square and opposite to one another two by two, each of said lapping wheels presenting the longitudinal axis of rotation which is in a slanted position in relation to the axis (100) of rotation of the head. 30
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15. A lapping head according to claim 11, 12 or 13, **characterized in that** said corresponding element of said first kinematic elements consists of a bevel pinion (13). 40
16. A lapping head according to claim 11, 12 or 13 **characterized in that** said corresponding element of said first kinematic elements consists of a guiding disk (513). 45

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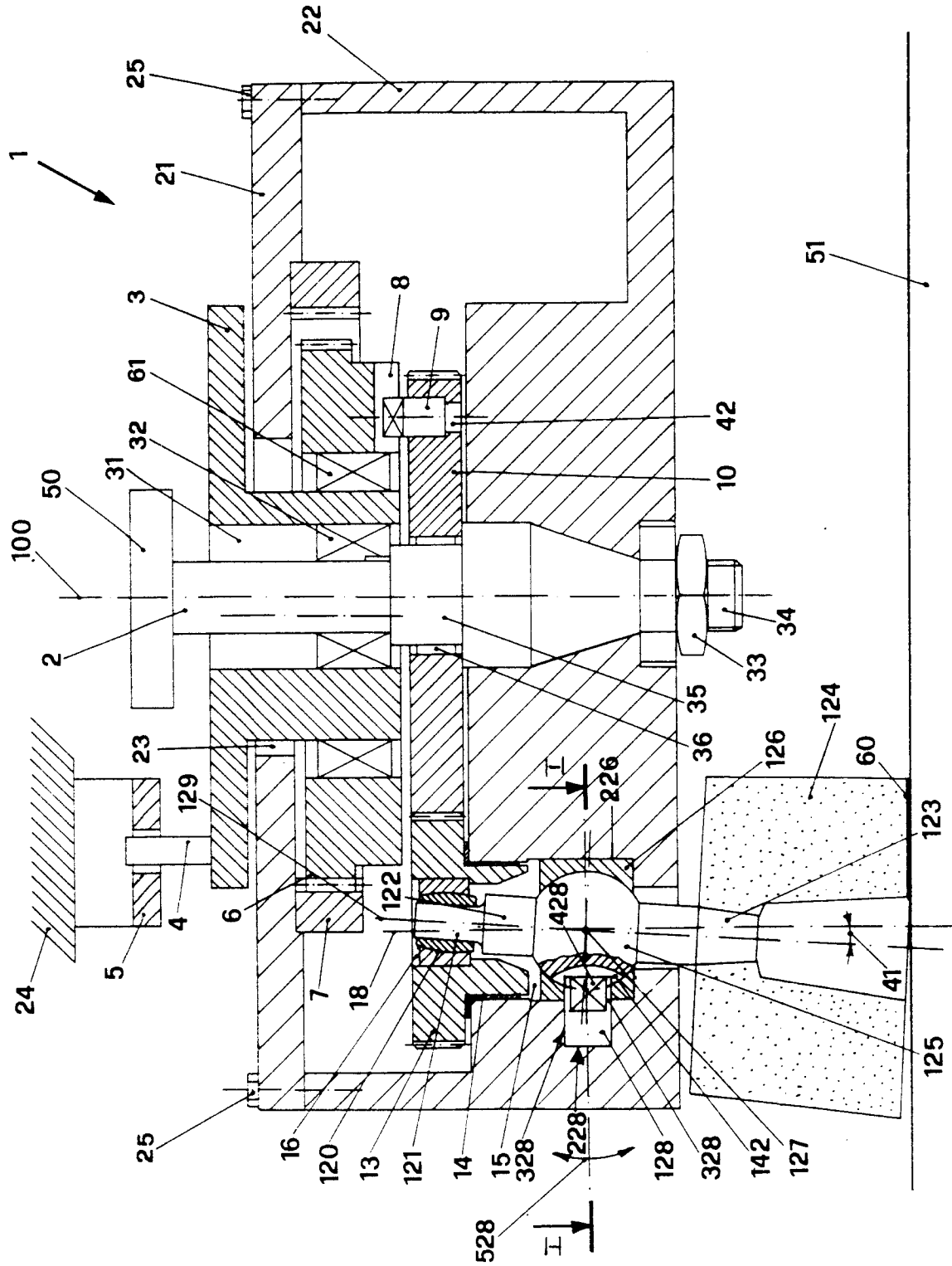
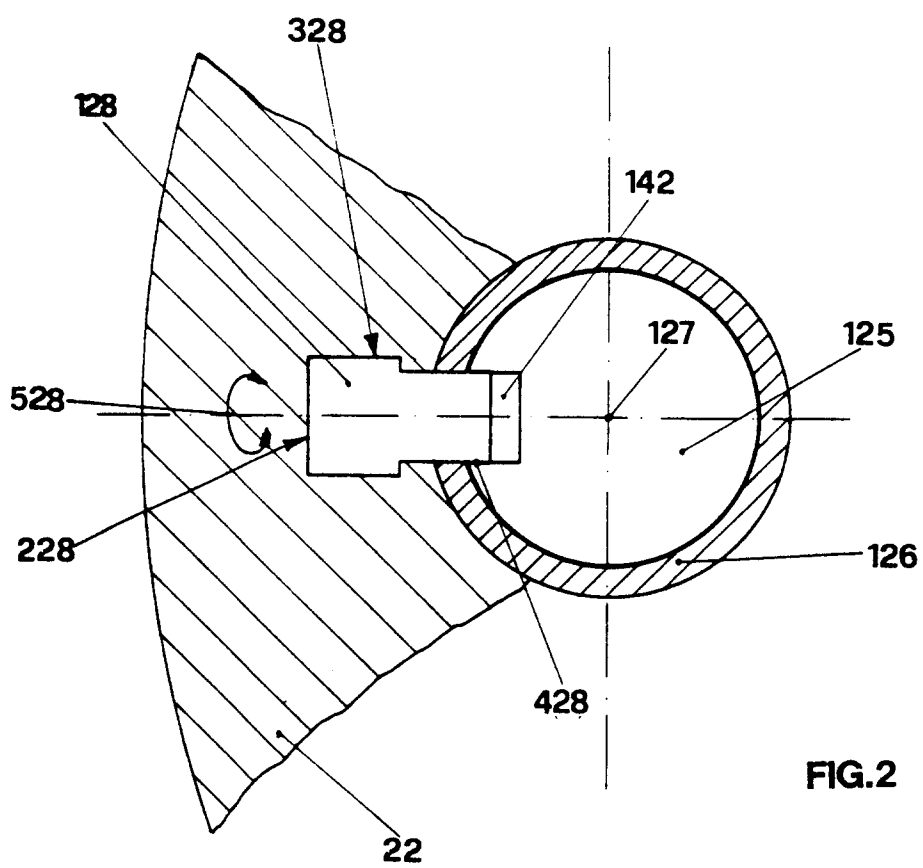


FIG. 1



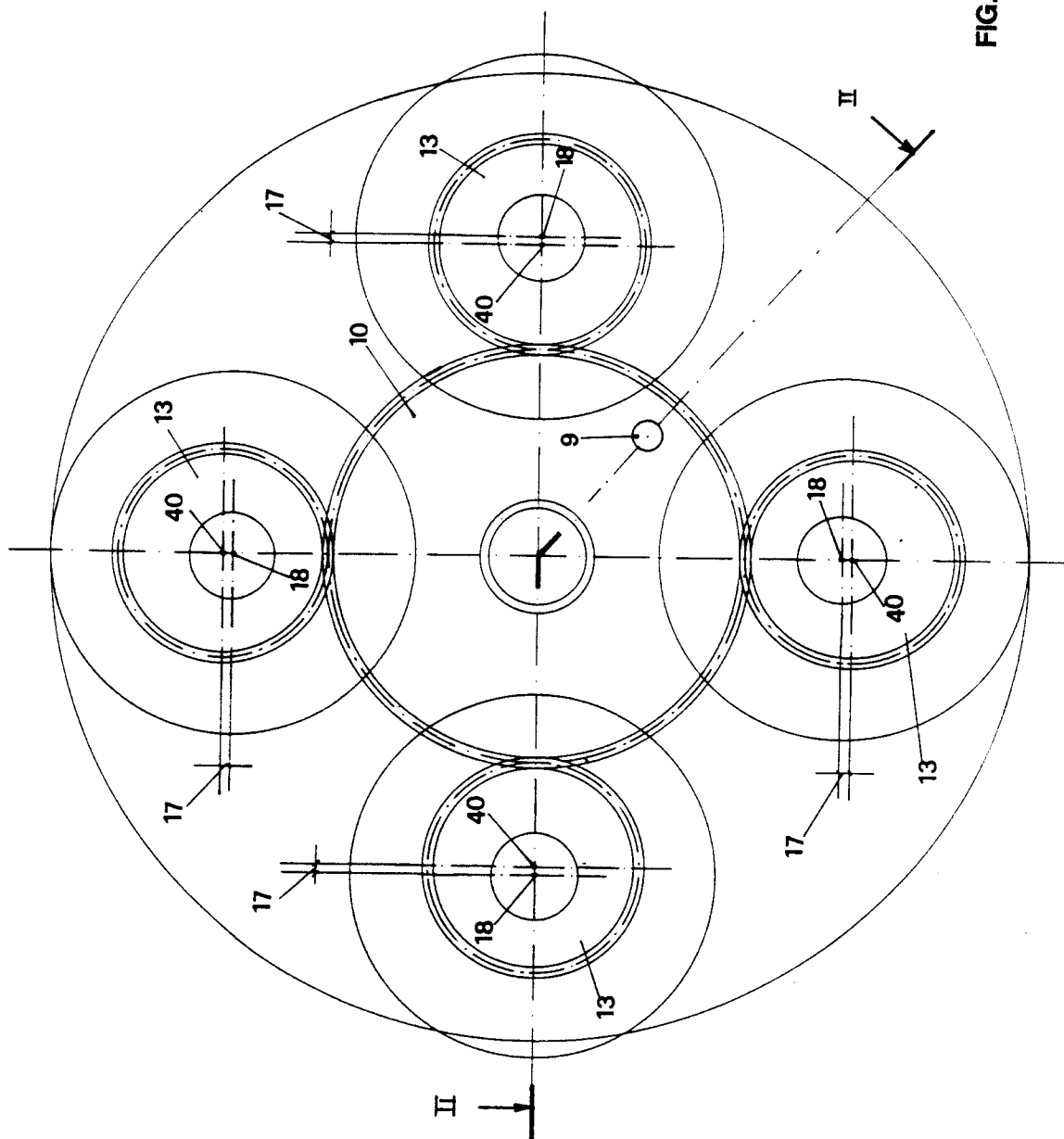


FIG. 3

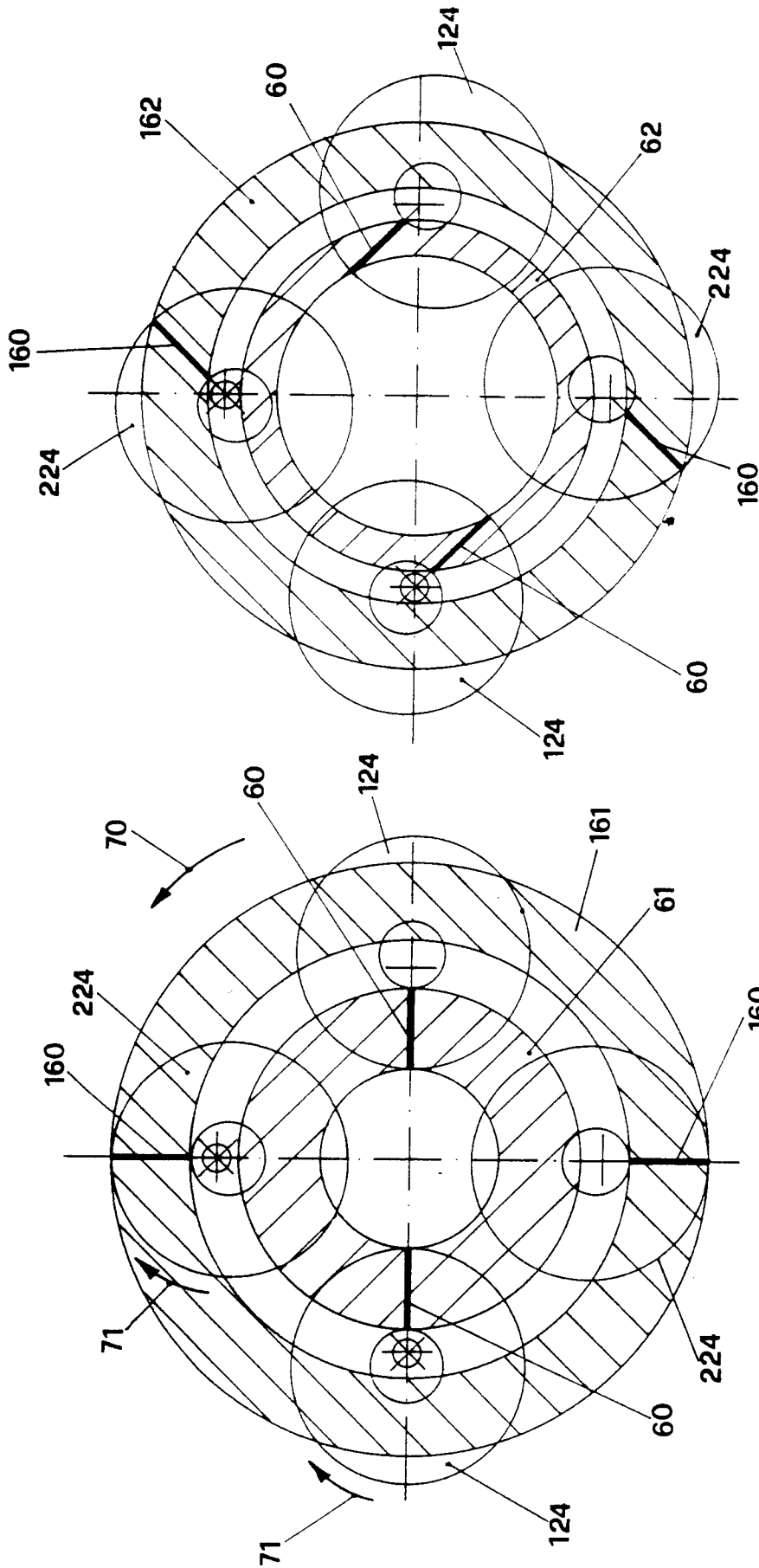


FIG.5

FIG.4

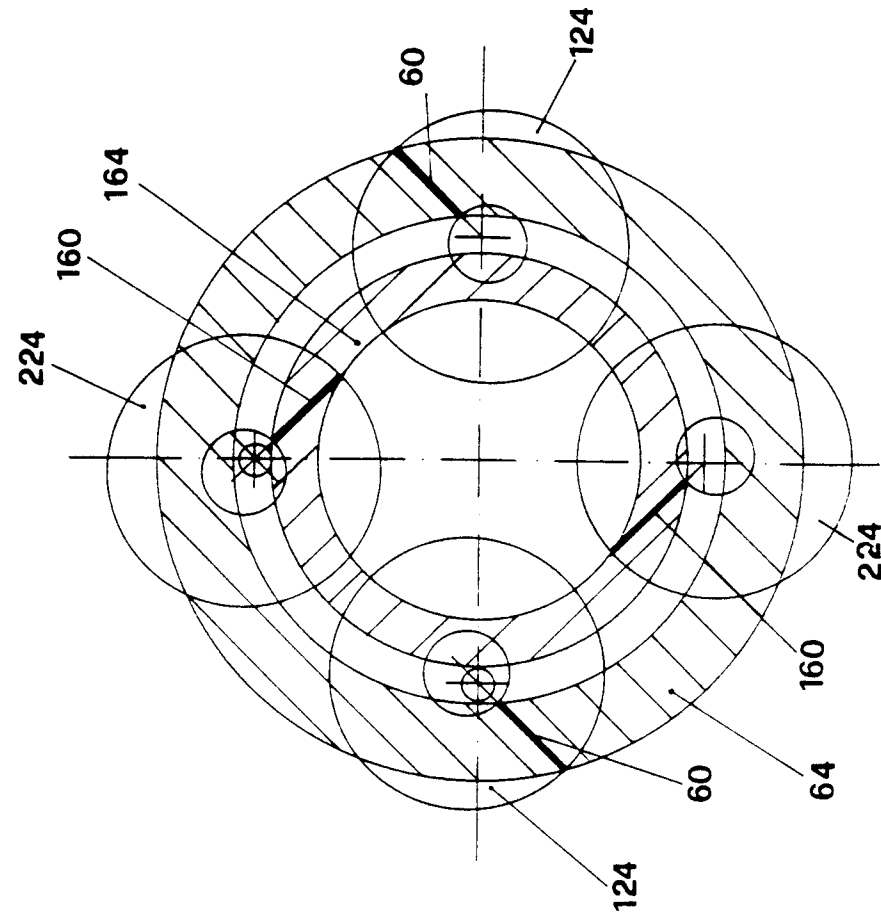


FIG. 6

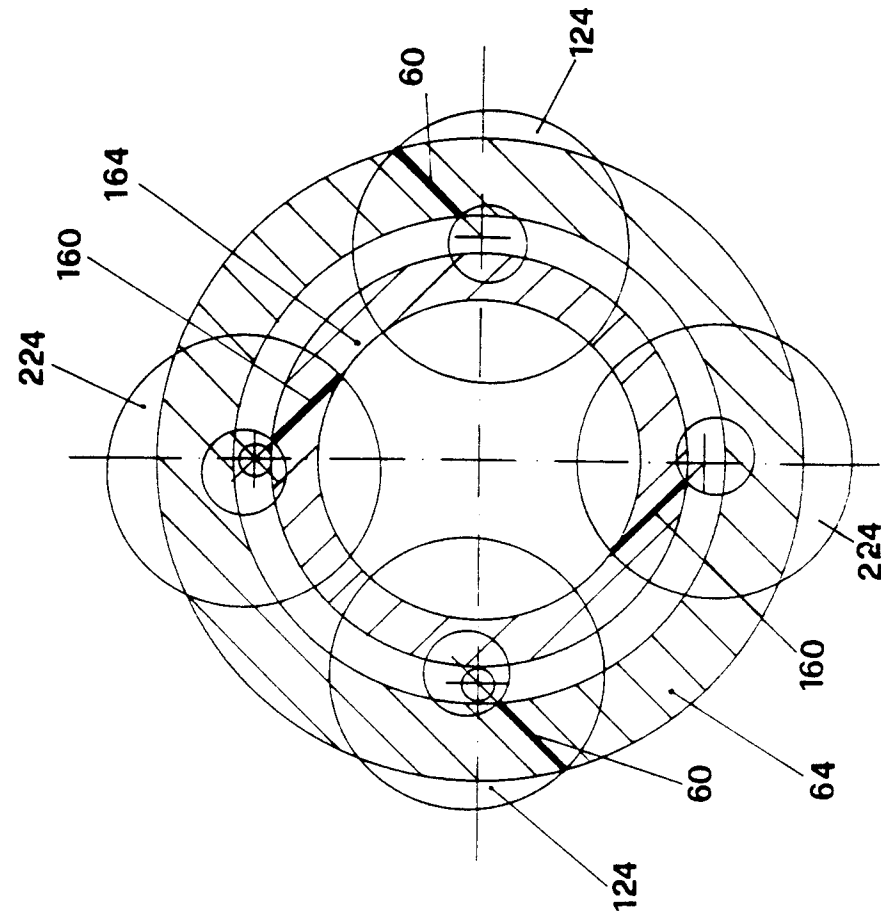


FIG. 7

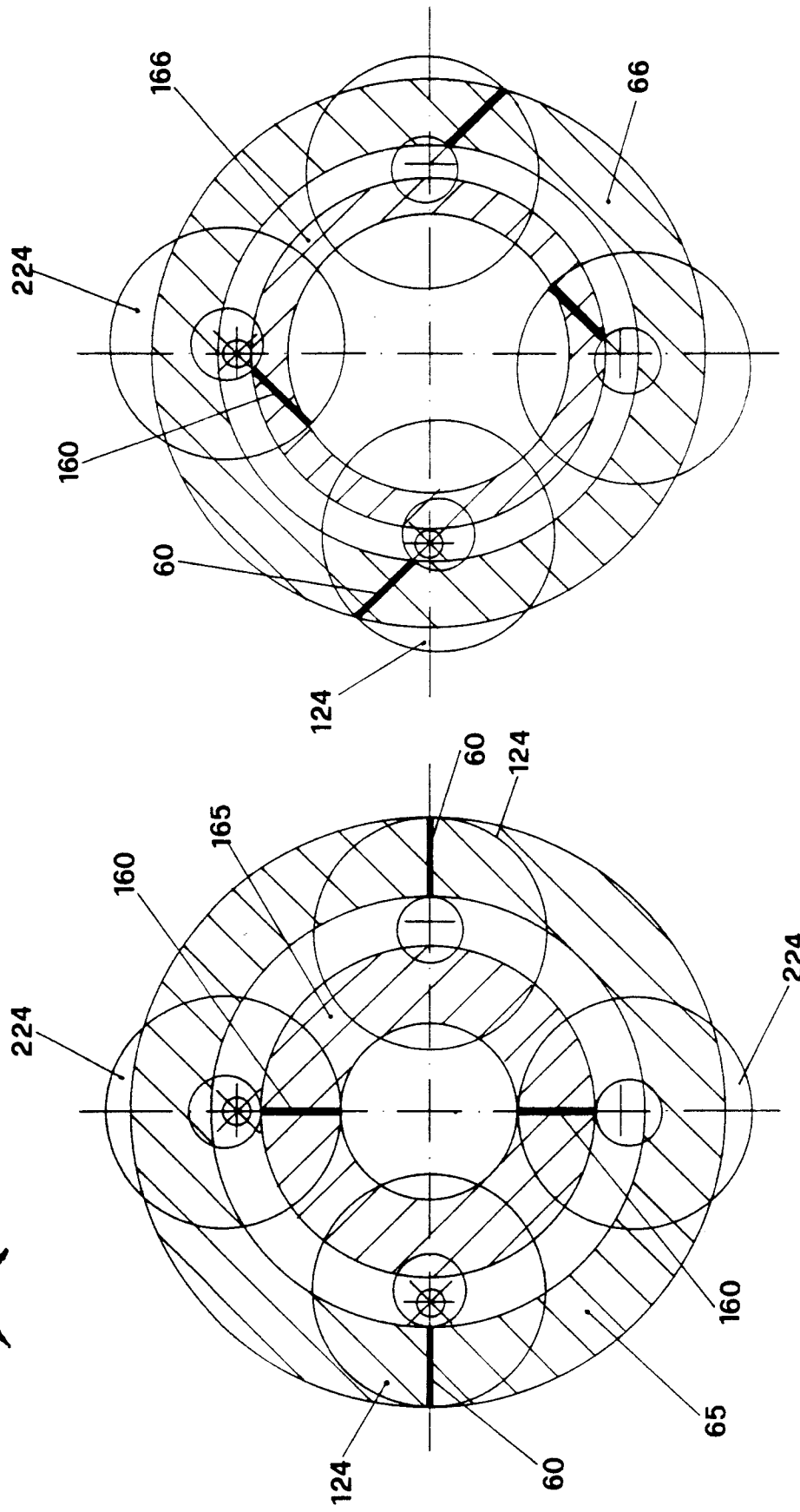
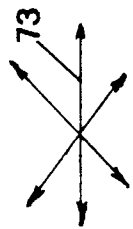


FIG.9

FIG.8

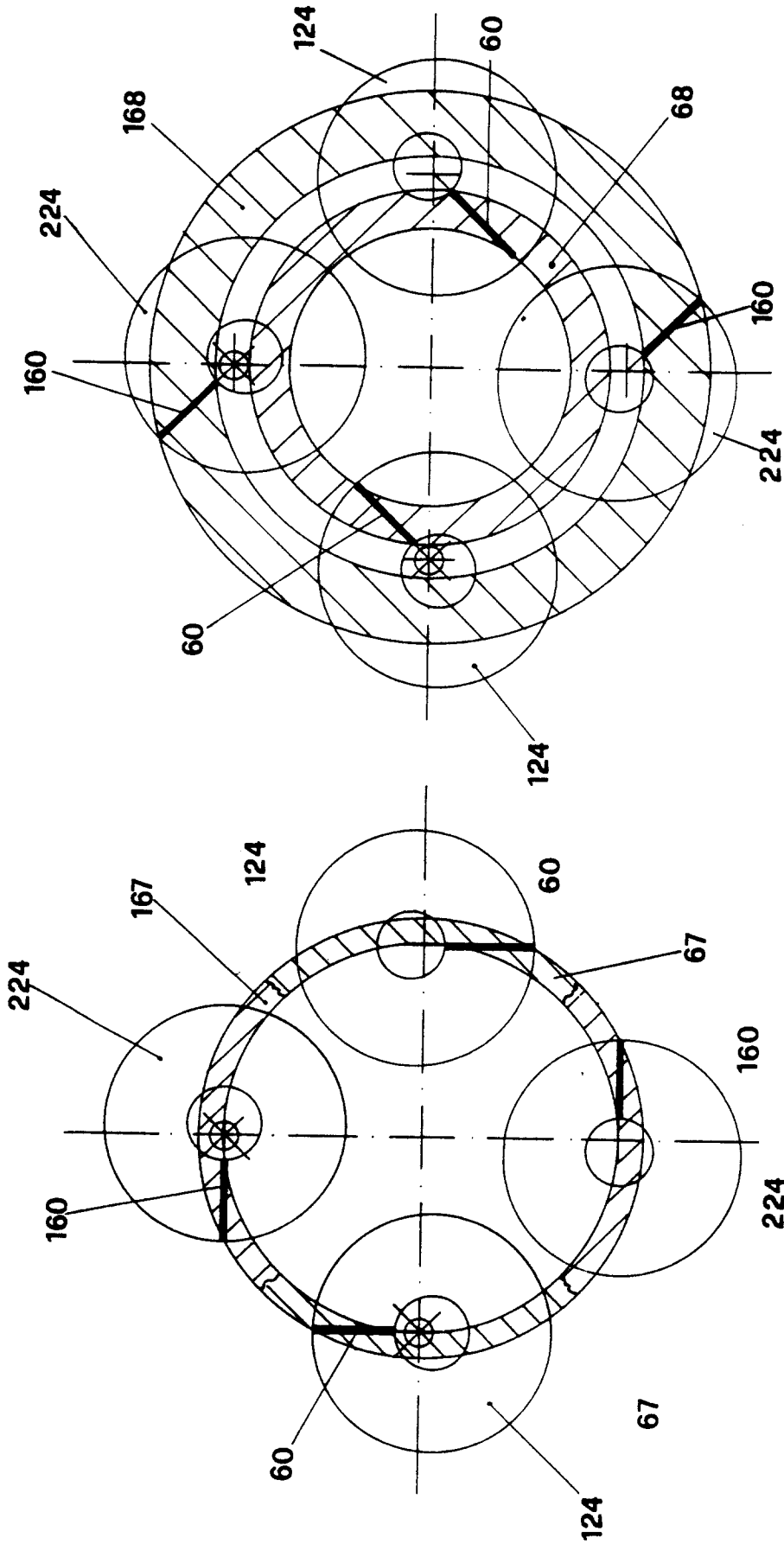


FIG.11

FIG.10

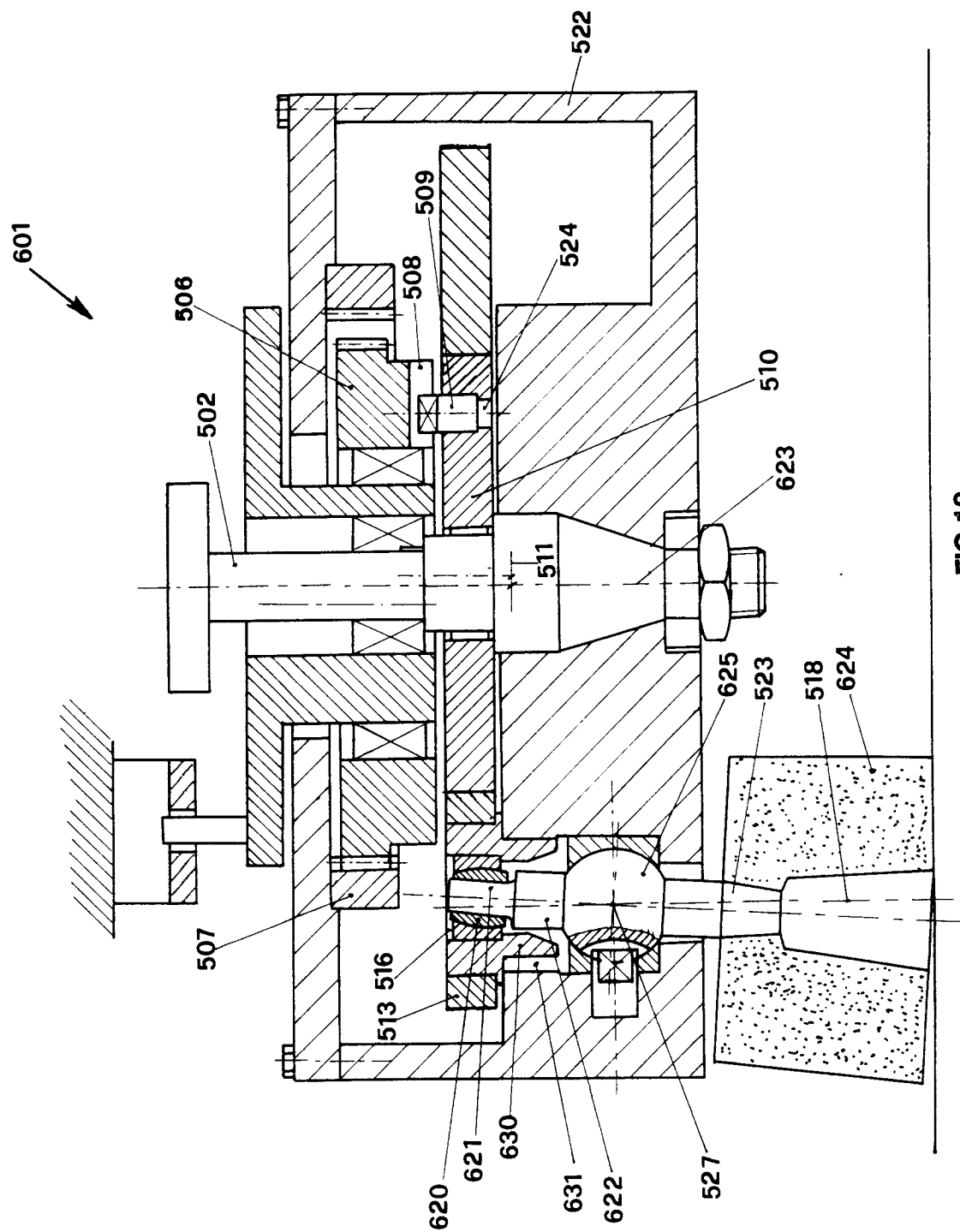


FIG.12



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 11 9192

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 437 831 (BREMA SRL) * column 4, line 48 - column 9, line 7; figures 1,2 *	1	B24B41/047
A	DE-C-680 641 (SOCIÉTÉ MARBRIÈRE DE PARIS S. A.) * figures 1-3 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B24B
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 8 February 1995	Examiner Wunderlich, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			