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

(11) EP 2 412 986 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.02.2012 Bulletin 2012/05

(51) Int Cl.:
F15B 15/06 *(2006.01)*

(21) Application number: **11006120.7**

(22) Date of filing: **26.07.2011**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **28.07.2010 IT PD20100240**

(71) Applicant: **STEP di Bonami Stefano**
35019 Tombolo (PD) (IT)

(72) Inventor: **Bonamin, Stefano**
35019 Tombolo (PD) (IT)

(54) Hydraulic actuator

(57) A hydraulic fifth wheel where the movement between the two flanges (4,13) joined to it takes place using a turn cylinder (8) fully contained within the fifth wheel itself.

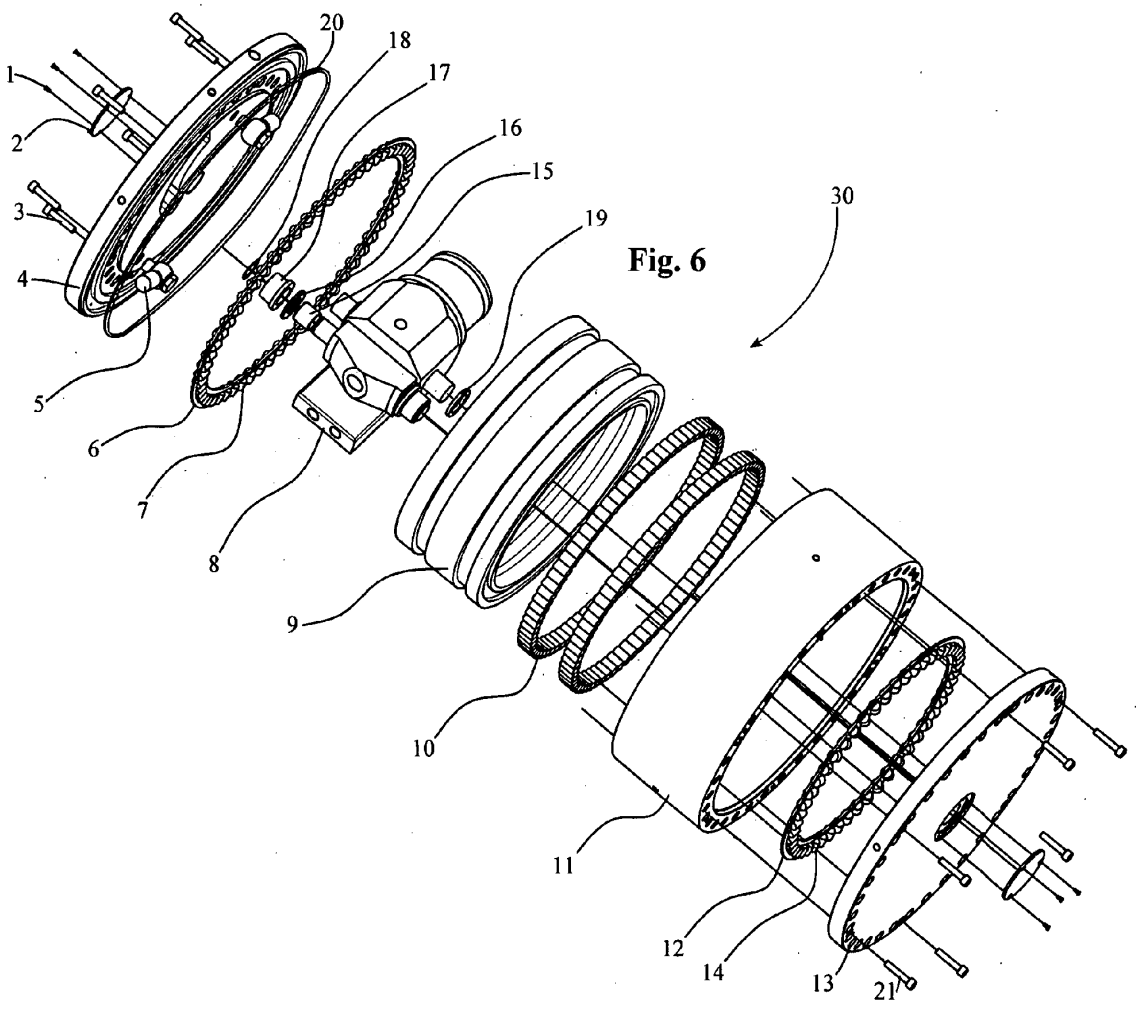


Fig. 6

EP 2 412 986 A1

Description

[0001] The object of the invention concerns a compact hydraulic fifth wheel.

[0002] As is well known the term "fifth wheel" in the mechanical field refers to a large rolling bearing designed to transmit a rotational movement from one mechanical component (fixed part, for example a structure of a crane or the fixed base of a rotary table) to another mechanical component (mobile part, for example the arm of a crane, its rubberised wheel support or the top part of a rotary table).

[0003] The fifth wheel has become a consolidated and successful mechanical device that is capable of withstanding radial, axial loads and overturning, the results of its specific applications.

[0004] The state of the art of current systems differ basically in the numerous ways the rotation movement is handled, with their various features and abundant intrinsic drawbacks.

[0005] Indeed, various construction methods have been developed for each field of application, the most common of which are the following:

a) rotation with direct cylinder (see Fig. 1)
b) rotation with "crank-piston-cylinder system" (see Fig. 2)
c) rotation with a reduction unit having a pinion on the shaft that engages teeth on the outer ring of the fifth wheel (see Fig. 3)
d) rotation with a worm screw that engages involute gear teeth on the outer ring of the fifth wheel (see Fig. 4 and Fig. 5)

[0006] The above-mentioned systems are all complicated to construct and difficult, as well as expensive, to maintain.

[0007] Moreover, they have the drawback of being extremely bulky for single applications, thereby considerably limiting the space free for manoeuvring; for example, with a direct cylinder system or a system with a crank-piston-cylinder, with a 600 mm diameter fifth wheel, to which you want to set a rotation angle of 135° degrees, you have to have a cylinder piston with a stroke that reaches 1,700 mm, with clear problems of combined stress on the rod of said piston cylinder, and therefore necessarily requiring an upscaling of its cross-section, with consequent additional weight and costs.

[0008] The main drawback of the fifth wheel system where the rotation occurs with a reduction unit with a pinion on the shaft that engages teeth on the outer ring of the fifth wheel where the reducer is position parallel to the axis of the fifth wheel and external to it, is the evident need to properly profile the mechanical component to which you want to transmit the rotational movement, with a consequent limitation of the field of use and a considerable increase in costs.

[0009] Moreover, the fifth wheel system where rotation takes place using a worm screw that engages involute gear teeth on the outer ring of the fifth wheel also has serious drawbacks, even if it is the system that takes up the least space. In fact this system is very sensitive to output torque because the inevitable play, which occurs between the outer casing where the worm screw is fixed connected to the motor and the central body where the involute teeth are located, causes dangerous and harmful stresses that initially damage the bottom of the thrust bearings of the worm screw, and when the play increases the involute profile of the screw itself is damaged; another drawback is that it has a fixing system that uses very long screws that cannot easily be found, thereby considerably increasing installation costs, and to this is added to the fact that this system is much more expensive than the previous ones.

[0010] Another disadvantage that is common to all the current systems is that the rotating parts, when they are exposed to the outdoor conditions where dampness and/or saltiness are present (for example near the sea, lakes or rivers), require continual maintenance to avoid problems of premature oxidisation and corrosion of the moving parts.

[0011] Until now the above-mentioned drawbacks have not been resolved in an acceptable manner, nor has an alternative, compact and less expensive system been found, both in terms of construction and in terms of periodic maintenance.

[0012] The purpose of the invention described below is to overcome all the drawbacks set out above, as well as others that will become evident later in the description.

[0013] In particular the purpose of this invention is to have a hydraulic fifth wheel that is more compact than those currently on the market, less complex, more easily assembled and disassembled, providing easy maintenance and which, something that is extremely important, is less expensive than present ones, both in terms of construction as well as maintenance.

[0014] It is also important that this invention can be interchangeable with existing systems.

[0015] It would also be desirable that the relative moving parts be less affected by the weather conditions.

[0016] Unsurprisingly at the moment this seems to be practically impossible for any expert in the sector.

[0017] The object of this invention is a hydraulic fifth wheel including, fixed solidly to a first flange, a tubular element (inside band) in a coaxial position with regard to a second tubular elements (outside band) fixed solidly to a second flange directly opposite, characterised by the fact that in between the two flanges and the internal band there is a turn cylinder, whose body is hinged onto the two above-mentioned flanges and whose spindle has devices at the end for joining to the two cams on the their flat internal surface, so that following the horizontal movement of the spindle of the turn cylinder you get a relative rotation between the two flanges.

[0018] Beneficially, the turn cylinder is a hydraulic piston, powered hydraulically using a pair of holes on the

head and on the sleeve of the turn cylinder for supplying the liquid, preferably oil, for the flow and return.

[0019] Opportunely, this pair of holes is connected via tubing to another pair of holes on the internal surface of one of the two flanges, using two revolving couplings.

[0020] The two above-mentioned holes hydraulically communicate radially with the outside of the fifth wheel (respectively on the tubular element or on the flange) to which are fixed two flexible hoses for the flow and return of the pressurised oil coming from a hydraulic power unit located outside and controlled by a distributor.

[0021] This above-mentioned configuration allows you to have a fifth wheel with its internal moving parts sealed shut, and which is compact and easy to construct and maintain.

[0022] The advantage of this configuration is that the fifth wheel can be moved, and in particular the hydraulic piston, without the moving parts being exposed to the outside elements, thereby reducing normal maintenance considerably, or it can even be used completely immersed in liquids since it is watertight.

[0023] In fact, the simple supply of the hydraulic liquid using external flexible hydraulic hoses drives the cylinder rod that will initiate its stroke distance; the inversion of the pouring of this liquid creates movement of the cylinder rod stroke in the opposite direction.

[0024] Opportunely, the coupling devices on the end of the rod are fork-shaped, with a flat cross-section that carries two protruding spindles opposite one another, in an axial relationship and set at 90° with respect to the operating axle of the turn cylinder.

[0025] These two spindles, by means of anti-friction devices (alveolate bushing that can be lubricated, or sliding bearings) engage inside the cams on the inner surfaces of the first and second flange.

[0026] The above-mentioned characteristics, therefore, provide low friction moving parts that need very little or even zero maintenance.

[0027] Moreover, quite surprisingly the profile of these two cams achieve homogeneous rotary movement without any vibrations (whose profile can be easily seen in diagrams 14 and 23, but which can have a different profile to get additional characteristics, for example an extension of the rotation angle that can be obtained between the two flanges joined to the fifth wheel).

[0028] The thrust exercised by the turn cylinder is transmitted to the first flange and to the second flange by spindles positioned on the head and housed in a concentric way on the two flanges and the two wheel couplings that act respectively on the two profiles of the cams on the inner part of the two flanges in question.

[0029] Advantageously, to eliminate the minimal play that can show up between the wheel couplings and the profile of the cam in the two flanges that in terms of angle can translate into some hundredths of degree it is possible to use runner wheels with runners made of an anti-friction material, and that has been specially designed to perfectly stay in the seat of the cam profile.

[0030] This linear movement of the turn cylinder imparts a rotary movement between the first flange and the second flange opposite it.

[0031] When constructing the hydraulic cylinder it is possible to use various expedients for making it as compact as possible and ensure that it can be housed inside the fifth wheel, like for example using gaskets and guiding rings for reducing the size of their housing to a minimum, or to shaping the bottom joined to the cylinder sleeve in order to further reduce the dimensions. For the same reason also the inner part of the inner band roller sliding was shaped so as to have as little space as possible between the bottom of the cylinder and the inner surface of the band.

[0032] In order to avoid the rotation of the fork around the axis of the cylinder rotation it was appropriately fixed to the head of a fork guide.

[0033] The above-mentioned advantages will be further highlighted by a preferred, and by no means restrictive, realisation where:

fig. 1 shows an example of the use of a fifth wheel with direct cylinder rotation, and fig. 2 shows an example of the use of a fifth wheel with "cylinder-piston-crank" rotation;

fig. 3 shows a fifth wheel rotated with a reduction unit having a pinion on the shaft that engages teeth on the outer ring of the fifth wheel ;

figs. 4 and 5 show a fifth wheel rotated with a worm screw that engages involute gear teeth on the outer ring of the fifth wheel;

fig. 6 shows an exploded perspective view of fifth wheel, which is the object of the invention;

fig. 7 shows the fifth wheel of fig. 6 in its closed assembled condition.

Fig. 8 shows an exploded perspective view of the turn cylinder used in the fifth wheel shown in fig. 6.

Fig. 9 shows the turn cylinder of fig. 8 in its working configuration.

Figs. 10, 11 and 12 show the inner band of the roller guide with respectively a perspective view, plane view and side view.

Figs. 13, 14 and 15 show the inner band of the roller guide with respectively a perspective view, plane view and side view.

Figs. 16, 17 and 18 show the closing disc with respectively a perspective view, plane view and side view.

Figs. 19, 20 and 21 show the inner band of the roller guide with respectively a perspective view, plane view and side view.

Figs. 22, 23 and 24 show the outer flange band with respectively a perspective view, plane view and side view.

Figs. 25, 26 and 27 show the exterior roller guide with respectively a perspective view, plane view and side view.

Figs. 28, 29 and 30 show the inner roller guide with

respectively a perspective view, plane view and side view.

Fig. 31 shows a plane view of the fifth wheel array of fig. 7 with a closed cylinder.

Figs. 32 and 33 show a plane and prospective cross-section view respectively of the fifth wheel of fig. 1 along the section line A-A shown in fig. 31.

Fig. 34 shows a plane view of the fifth wheel of fig. 31 in line with the B-B section indicated in fig. 32.

Fig. 35 shows a plane view of the fifth wheel array of fig. 7 with an open cylinder.

Figs. 36 and 37 show respectively a plane and prospective cross-section view of the fifth wheel of fig. 35 along the section line C-C shown in fig. 35.

Fig. 38 shows a plane view of the fifth wheel of fig. 35 in line with the D-D section indicated in fig. 36.

Fig. 39 shows the turn cylinder of fig. 9 from a different perspective.

Figs. 40, 41 and 42 are the side and front plane views of the turn cylinder of fig. 39.

Figs. 43 and 44 show the turn cylinder of fig. 39 sectioned along the plane E-E indicated in fig. 40, with an all closed and all open configuration.

[0034] From the above-mentioned drawings it is easy to understand how the example is constructed and how the various parts are connected to each other, and as a result it is easy to understand how the rotation of the fifth wheel works.

[0035] The hydraulic fifth wheel 30 is composed of a flange 4 is fixed solidly to an internal band 9 using screws 3; there is a second opposite flange 13 that is fixed solidly to the outer band 11 by means of screws 21.

[0036] Between the outer band 11 and the inner band 9, positioned in a concentric manner, there are two series of vertical rollers 10 placed axially to them.

[0037] These two series of vertical rollers 10 have a dual purpose; the first purpose consists of keeping radially centred and transmitting the radial load between the inner band 9 and the outer band 11, thereby providing relative rotation between them; a second purpose consists of axially locking the inner band 9 and the outer band 11 so as to prevent an opening of the fifth wheel 30 that is subjected to a negative axial load (see detail X in figs. 32 and 36).

[0038] To transmit the axial load a series of 7 rollers guided by an inner roller guide 6 between the first flange 4 and the external flange 11 inside one or more special round grooving (on the outer flat wall of the external band 11 and round grooving on flange 4) and a second series of rollers 14 guided by an outer roller guide 12 and located between the flange 13 and the inner band 9.

[0039] The relative rotation between the first flange 4, solidly joined to the internal band 9 and the opposite flange 13, solidly fixed to the inner band 9, is obtained by means of a hydraulic turn cylinder 8 having a head 35 with two projecting shafts 48 axially opposite each other and set at 90° with respect to the operating axis of the cylinder 8 itself and housed in two housings (22, 23) in the centre of the first flange 4 and in the centre of the opposite flange 13.

[0040] On the head 35 and on the cylinder sleeve 31 there are two holes (24, 25) with tapered thread for feeding it (flow/return oil). These two holes (24, 25) are connected using two High Pressure rubber hoses (not shown) with two holes (26, 27) with tapered threading on the inner surface of the first flange 4 facing the turn cylinder 8 using two revolving fastenings 5.

[0041] The two holes (26, 27) with tapered threading on the inner surface of the first flange 4 are connected respectively to two holes with tapered threading positioned radially to the flange itself to which are fixed two flexible hydraulic tubes for the flow-return of the pressurised oil coming from a hydraulic power unit located outside and controlled by a distributor.

[0042] Feeding the external flexible hydraulic tube connected to the internal flexible tube fixed to the threaded hole on the cylinder sleeve 31 of the cylinder 8, the spindle 32 of the cylinder 8 will start its stroke.

[0043] On the end of the spindle 32 has been fixed a fork arm 33, with a flat cross-section that carries two protruding shafts 49 opposite one another, in an axial relationship with one another and set at 90° with respect to the operating axle of the turn cylinder 8.

[0044] These two protruding shafts 49 opposite to each other carry two runner wheels 17 to which are joined two bushes with lubrication pockets 15 (sliding bearings) to provide rotation around their shafts with minimal friction.

[0045] Between the protruding shafts 49 of the fork 33 and the respective wheels 17 there is a shim 16 made of anti-friction material.

[0046] To fix the wheels 17 axially to the respective spindles, two Seeger elastic safety rings for shafts are applied.

[0047] The cylindrical surface of the two wheels 17 are in contact, respectively, with the surface of a first cam 28 in the first flange 4, and with the surface of a second cam 29 in the opposite flange 13.

[0048] With the profile of these two cams 28 and 29 you can get a smooth rotary movement without any vibrations.

[0049] The thrust exercised by the turn cylinder 8 is transmitted to the first flange 4 and to the second flange 13 by spindles 48 positioned on the head 35 and housed in a concentric way in the two flanges 4 and 13 and the two wheels 17 that act respectively on the two profiles of the cams 28 and 29 on the inner part of the two flanges 4 and 13 in question.

[0050] Advantageously, to eliminate the minimal play that can show up between the wheels 17 and the profile of the cam 28 and 29 in the two flanges 4 and 13, which in terms of angle can translate into some hundredths of degree it is possible to use the wheels 17 with runners made of an anti-friction material and that has been specially designed to perfectly fit in the housing of the cam profile 28 and 29.

[0051] This linear movement of the turn cylinder 8 imparts a rotary movement between the first flange 4 and the second flange 13 opposite it.

[0052] By feeding the flow/return turn cylinder 8 the inversion of the relative motion between the two flanges 4, 13 takes place.

[0053] When constructing the hydraulic cylinder some expedients were used for making it as compact as possible and ensure that it can be housed inside the fifth wheel 30 in question, in particular gaskets and specific guiding rings 37-38-39-40 -41-42-43 -44 were used for reducing the size of their housing to a minimum, and the base plate joined to the cylinder sleeve 31 was shaped in order to further reduce the dimensions. For the same reason also the inner part of the inner band 9 was shaped so as to have as little space as possible between the base of the cylinder and the inner surface of the fascia.

[0054] In order to prevent the rotation of the fork 33 around the axis of the turn cylinder 8 a fork guide 36 was fixed to the head 35 using two cap screws 46 and three dowel pins 45 made of tempered and ground carbon steel.

[0055] Also the outer shape of the fork 33 was specially designed to reduce the size to a minimum, for this reason an alloy steel is used in order to make up for the reduction of the resistant section and to have sufficient resistance to the mechanical stress to which it is subjected.

[0056] To better identify the various parts with their correct name, below is a list for the exploded view of the hydraulic fifth wheel of fig. 6: Closing disk assembly screws 1, closing disk 2, inner band flange assembly screws 3; inner band flange 4; revolving couplings 5; inner roller guide 6; rollers 7; turn cylinder 8; inner band roller guide 9; vertical rollers 10; outer band 11; outer rollers guide 12; outer band flange 13; rollers 14; lubrication pocket 15; shim 16; wheel 17; Seeger elastic safety ring 18; shim 19; gasket 20; flange 21 assembly screws.

[0057] And the list for the exploded view of the hydraulic cylinder 8: cylinder sleeve 31; cylinder rod 32; fork 33; piston 34; head 35; fork guide 36; O-ring 37; guide ring 38; O- ring 39; anti-extrusion ring 40; guide ring 41; rod wiper 42; Balsele 43; Balmaster 44; dowel pins 45; fork guide 46 assembly screws; fork fastening screws 47; spindles positioned on the head 48; offset spindles on the fork 49.

[0058] The advantages resulting from this invention, in addition to those described above, are:

a) ease and simplicity of assembling, and dismantling, on the machine where it has to be put since there is no need for particular points for housing the spindles for fixing the cylinders or piston rods or housings with particular spot face surfaces for allowing them to be restrained

b) considerable reduction of normal maintenance work (the outer surface has no particular points that could get rusty because it is perfectly cylindrical, and because it is watertight the lubrication operations can be scheduled far apart from each other)

c) ease of dismantling and replacing of any damaged parts

d) ease of assembling the individual components that it is made up of

e) reduction to a minimum and simplification of the parts that it is made of

f) ease of construction using normal mechanical operations obtained by stock removal without having to use moulds for casting casing or moulding the rings that make it up with a considerable reduction in production costs, movement of the pieces and savings in terms of time for getting the raw materials since these can easily be found on sale and normally in the condition required

g) solid and compact form that is adaptable for any use

h) interchangeability with existing ones, because they can be easily adapted to any housing and any type of hydraulic equipment

i) the possibility of working immersed in liquid because it is watertight (maritime applications for example)

j) in the event that any internal components break it does not cause any leaks of pressurised oil or loss of lubricants that could contaminate the surrounding area, nor could any parts of it be flung out, so the operator is protected from any harm.

k) the total elimination of the possibility (in the event of accidental bumps) of the risk that the two flanges could separate and therefore of the two mechanical components to which the flanges are fixed (for example the base of a crane or the arm of a crane)

l) all the components are housed inside it and are therefore protected from any outside corrosive elements

m) the stroke of the cylinder is reduced by over twenty times compared to a standard rotation with a direct cylinder or with cylinder-piston-crank rotation

n) a reduction in the volume, the flow and the pressure of the oil needed for rotating it since it has a cylinder with decreased bore and stroke, and all this leads to a sizeable economic benefit because in the phase when the hydraulic equipment is being designed it is possible to select components with much lower flow and pressure characteristics

o) the elimination of external encumbrances

p) ease of transportation, storage and a considerable reduction in the requirements for protection and packing, fully respecting the environment and with a considerable reduction of costs

q) ease of disposal when decommissioned, because the different types of materials use have been reduced to a minimum.

[0059] From the detailed description above the revolutionary invention of creating a hydraulic fifth wheel

where the movement between the two flanges joined to it takes place using a turn cylinder that is completely inside its overall dimensions.

Claims

1. Compact hydraulic fifth wheel including, fixed solidly to a first flange (4), a tubular element (inside band) (9) with a coaxial position with regard to a second tubular elements (outside band) (11) fixed solidly to a second flange (13) directly opposite, **characterised by** the fact in-between the two flanges (4, 13) and the internal band (9) there is a turn cylinder (8), whose body is hinged onto the two above-mentioned flanges (4, 13) and whose spindle (32) has devices (33) at the end for joining to the two cams (28, 29) on the their flat internal surface, so that following the horizontal movement of the spindle (32) of the turn cylinder (8) you get a relative rotation between the two flanges (4, 13).

2. Compact hydraulic fifth wheel according to claim 1 **characterised by** the fact that the rotation between the first flange (4), solidly joined to the internal band (9) and the opposite flange (13), solidly fixed to the external band (11), is obtained by means of a hydraulic turn cylinder (8) having a head (35) with two protruding shafts (48) opposite each other on the same axis and set at 90° with respect to the operating axis of the cylinder (8) itself, and retained in two housings (22, 23) in the centre of the first flange (4) and in the centre of the opposite flange (13).

3. Compact hydraulic fifth wheel according to claim 1 **characterised by** the fact that the feeding of said turn cylinder occurs through a flange (4, 13) maintaining the hydraulic seal of the fifth wheel (30).

4. Compact hydraulic fifth wheel according to claim 1 **characterised by** the fact that said devices (33) suitable for coupling to at least one cam (28, 29) are fork-shaped (33), with a flat cross section that carries two protruding shafts (4) opposite one another, on the same axis and set at 90° with respect to the operating axle of the turn cylinder (8).

5. Compact hydraulic fifth wheel according to claim 1 **characterised by** the fact that said two protruding shafts (49) opposite to each other carry two wheels (17) to which are joined two bushes with lubrication pockets (15) (sliding bearings) to provide rotation around their shafts with minimal friction.

6. Compact hydraulic fifth wheel according to claim 5 **characterised by** the fact that between the protruding shafts (49) of the fork arm (33) and the respective wheels (17) there is a shim (16) made of anti-friction material.

7. Compact hydraulic fifth wheel according to one or more of the previous claims **characterised by** the fact that the profile of these two cams (28, 29) can obtain an even rotational movement without any vibrations.

8. Compact hydraulic fifth wheel according to one or more of the previous claims **characterised by** the fact that said wheels (17) can be replaced by runners made of an anti-friction material and specially designed to perfectly house the cams (28, 29) in the housing of the profile.

9. Compact hydraulic fifth wheel according to one or more of the previous claims **characterised by** the fact that in order to prevent the rotation of the fork arm (33) around the axis of the turn cylinder (8), a fork guide (36) was fixed to the head (35).

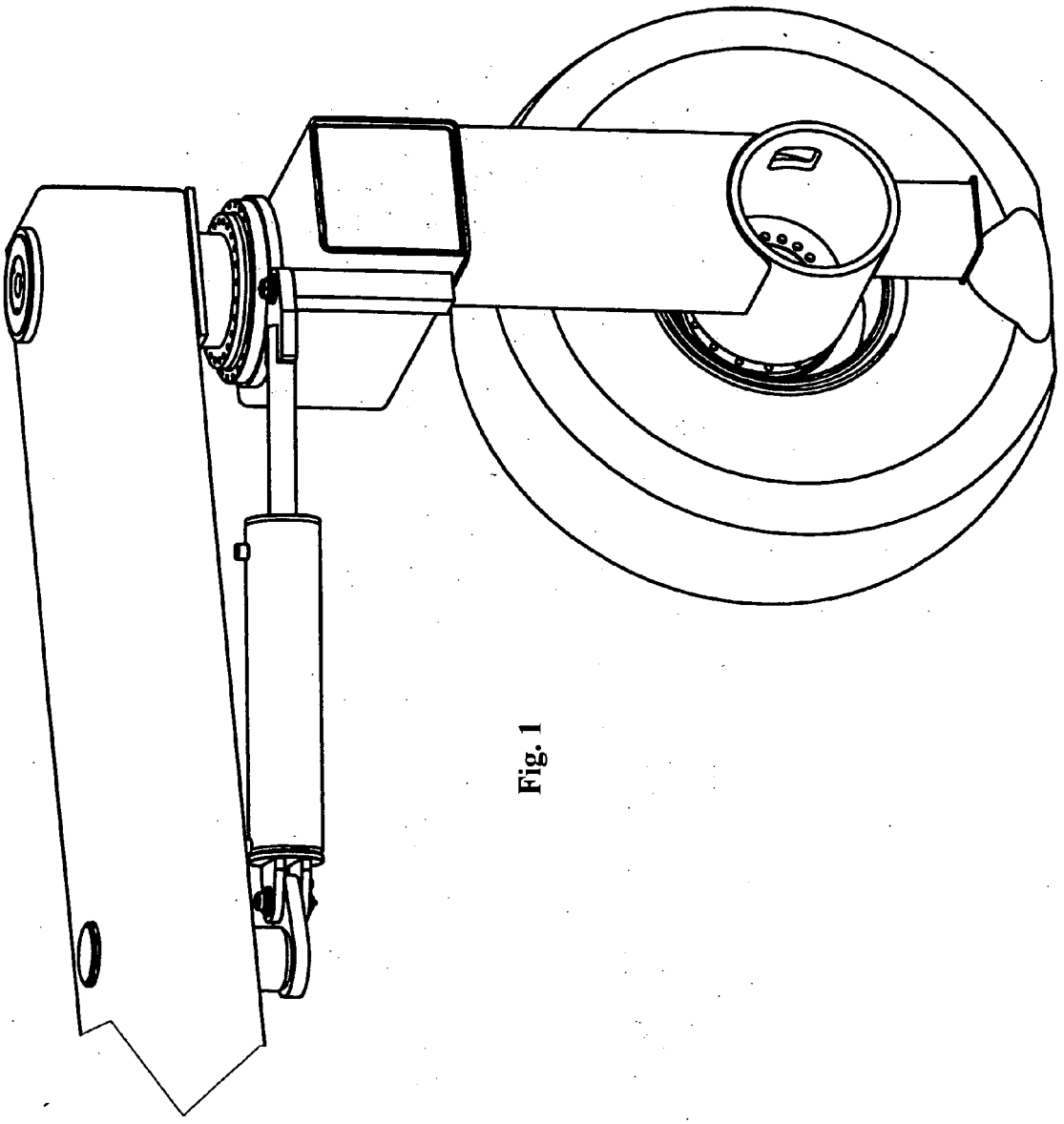


Fig. 1

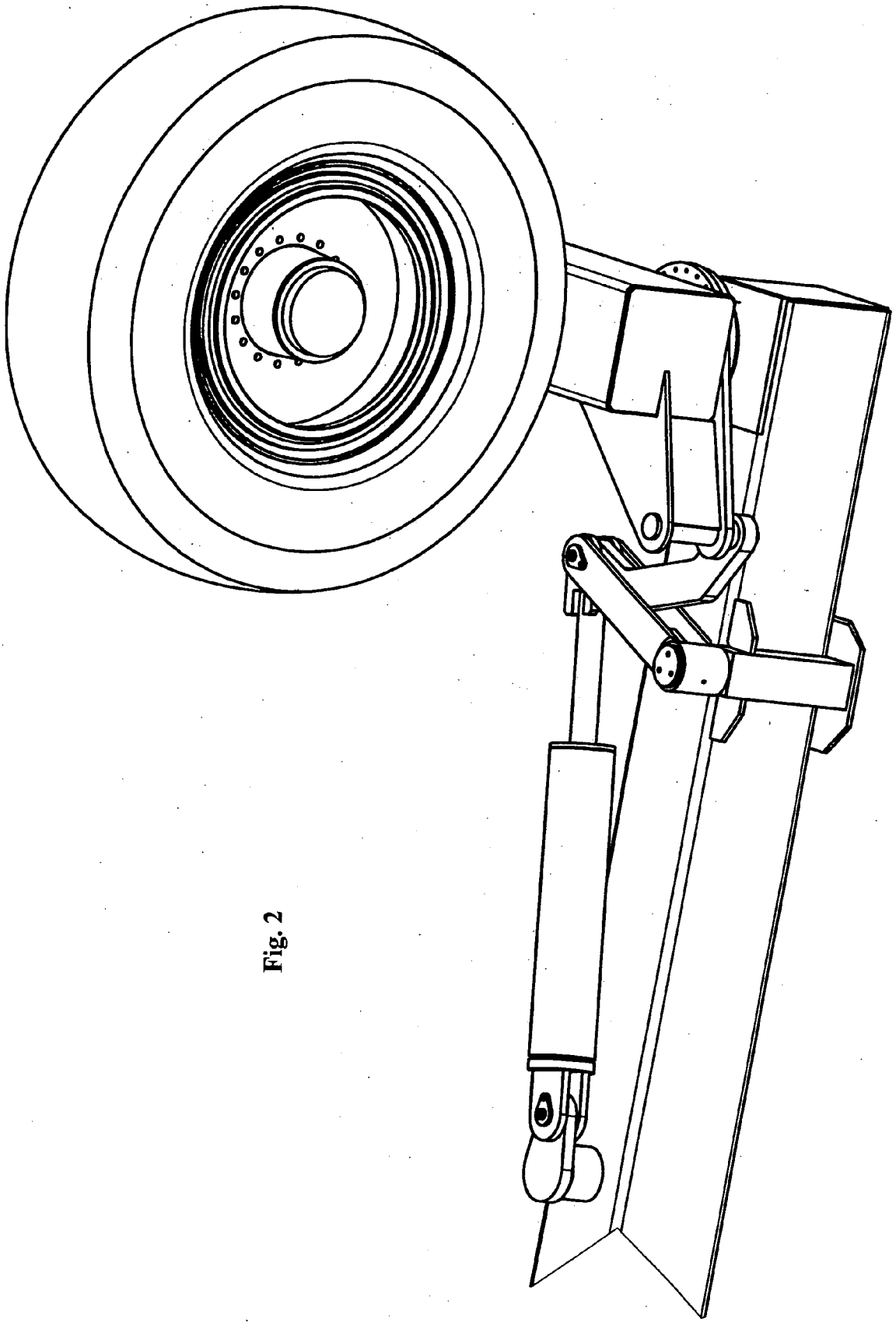
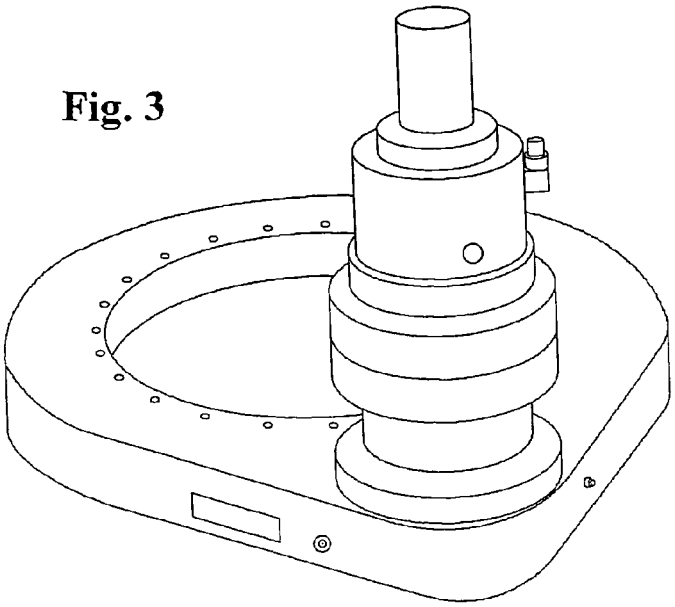
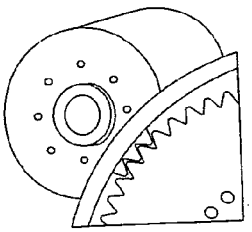
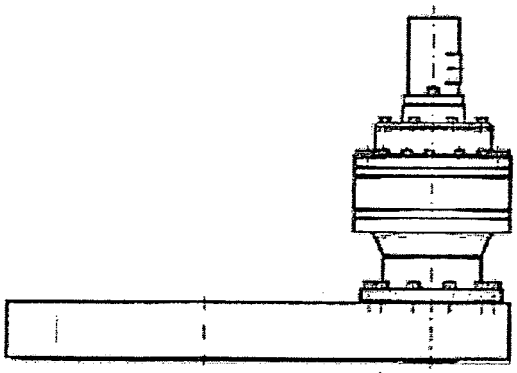


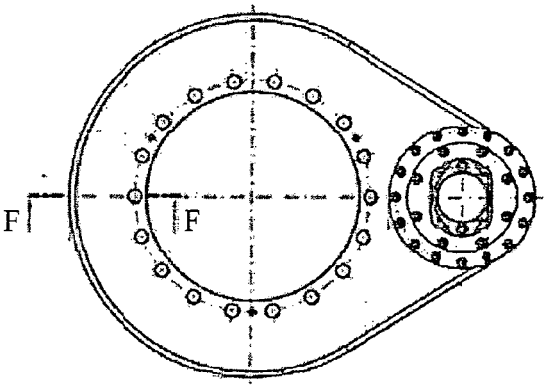
Fig. 2

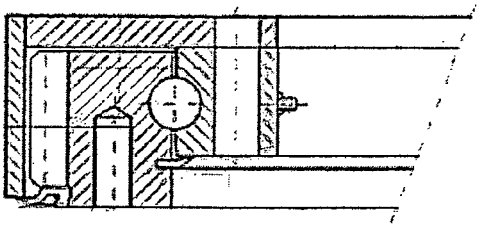
Fig. 3





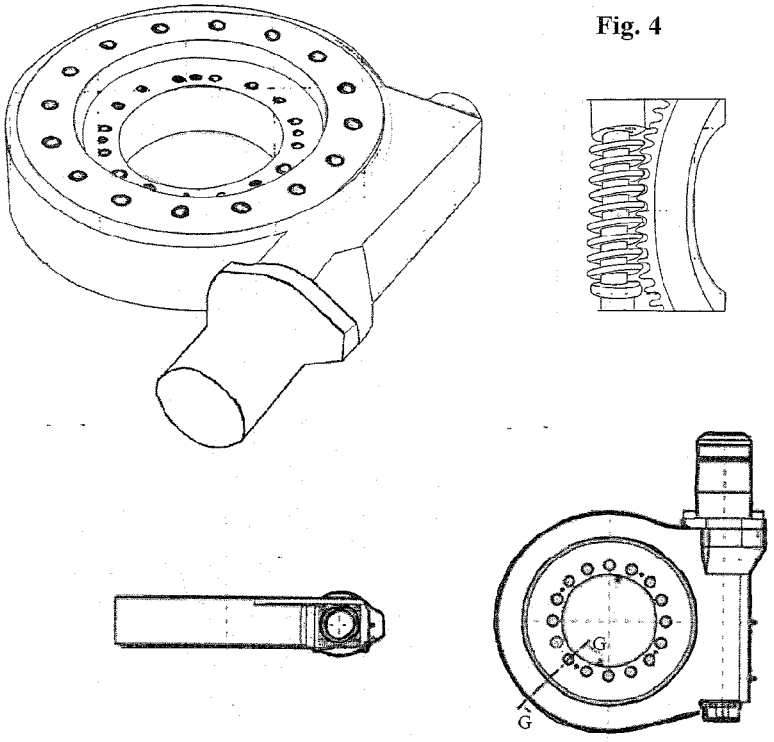






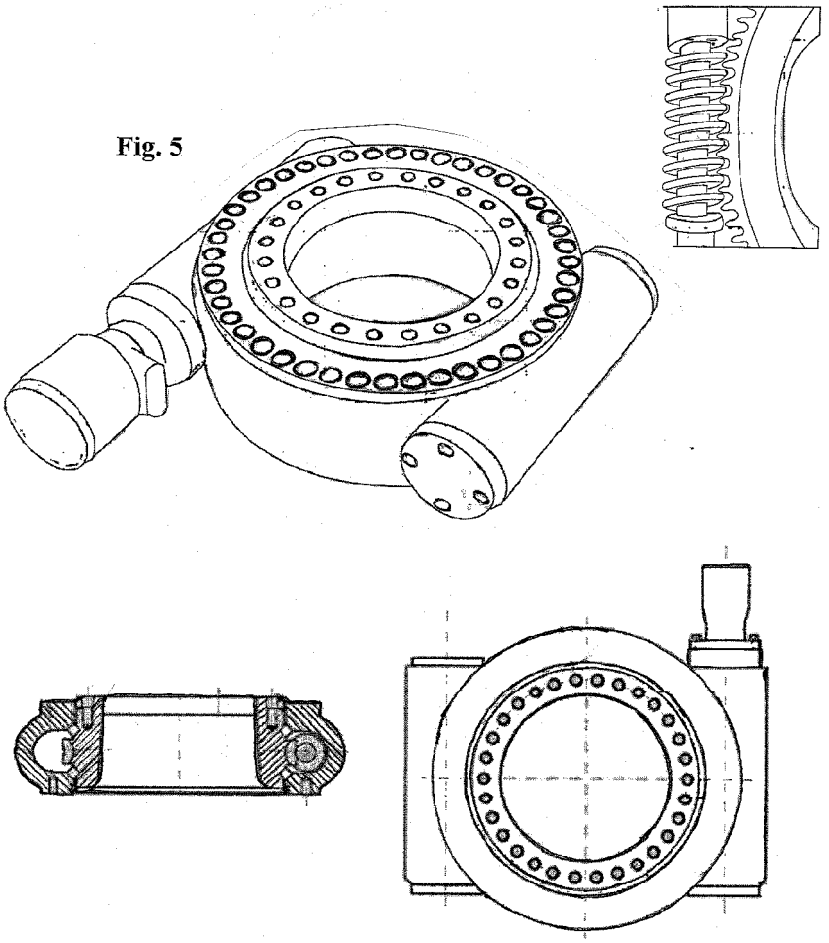
Sez. F-F

Fig. 4



Sez. G-G

Fig. 5



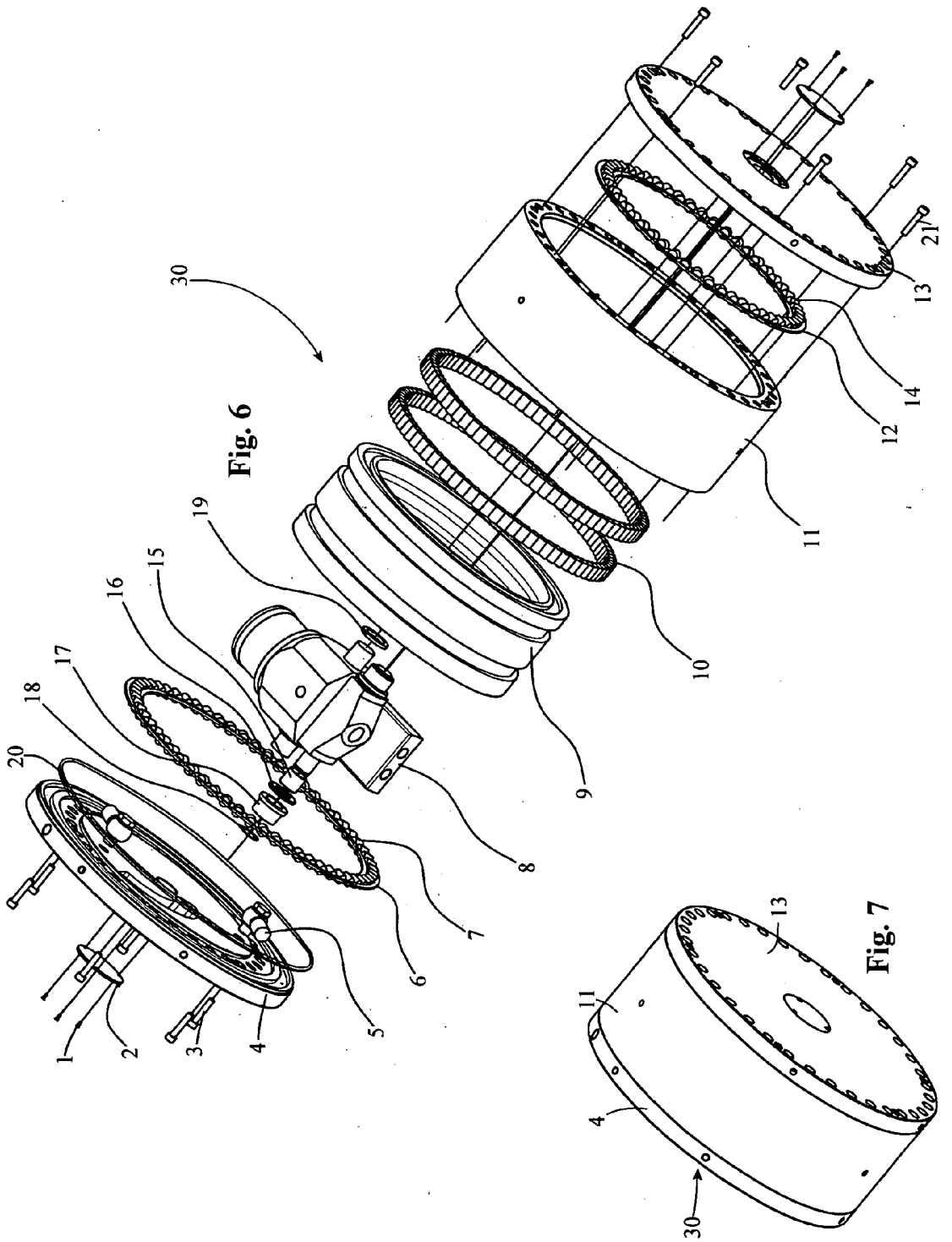


Fig. 6

Fig. 7

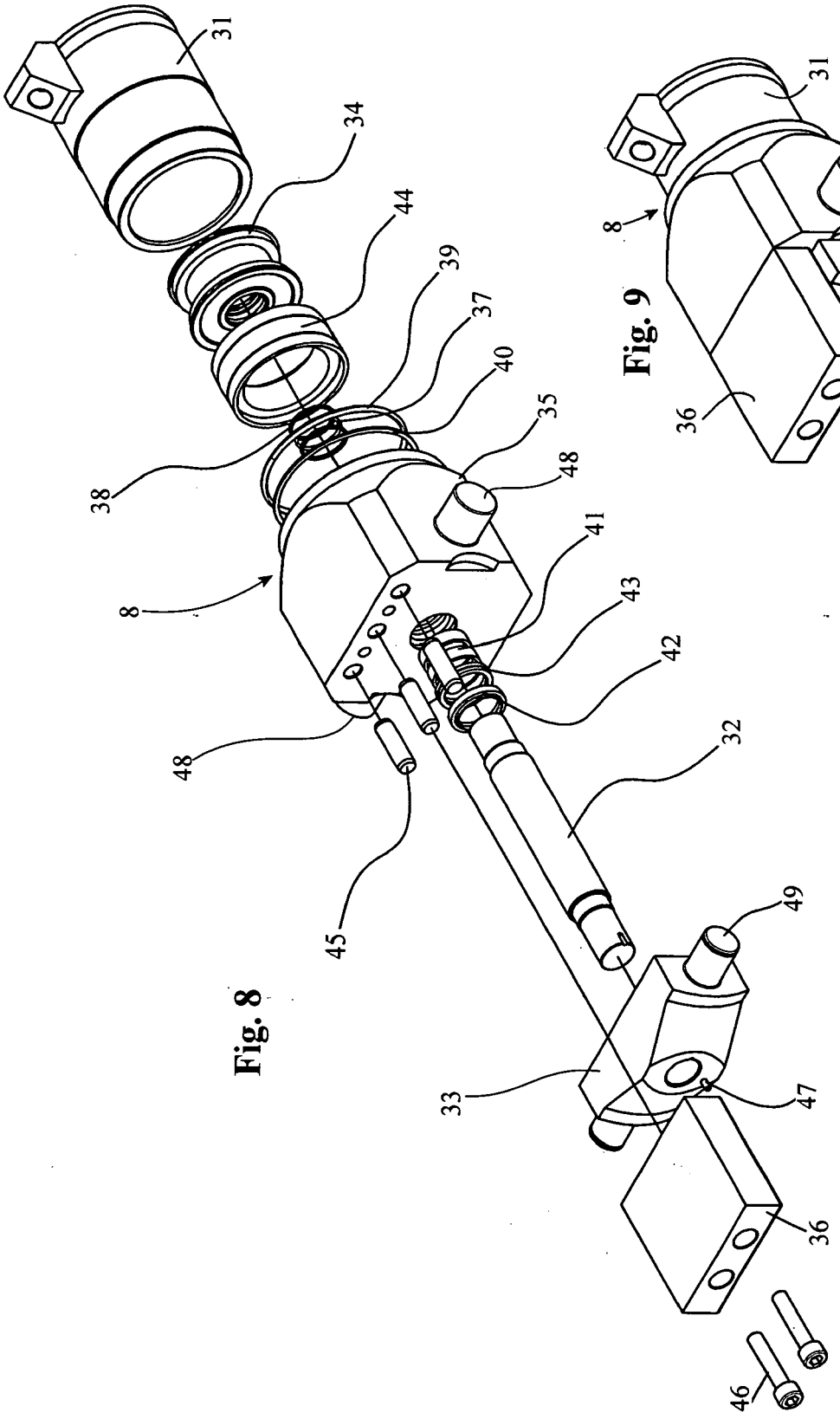

31
34
44
39
37
40
35
48
38
41
8
43
42
48
32
45
49
33
47
36
46

Fig. 8

31
48
49
8
36

Fig. 9



Fig. 15

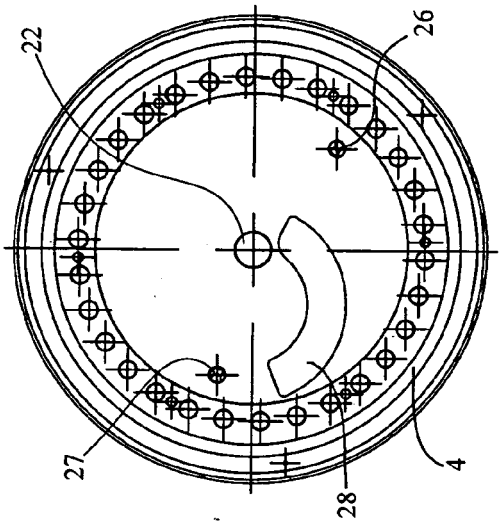


Fig. 14

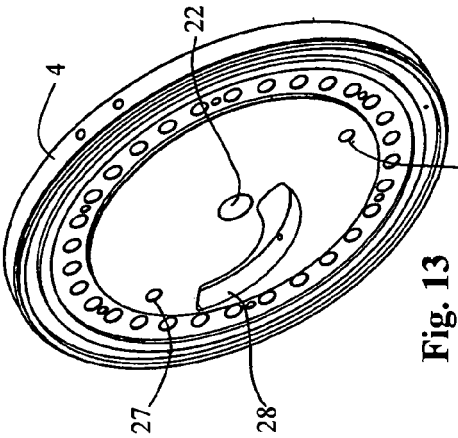


Fig. 13

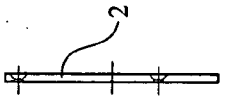


Fig. 18

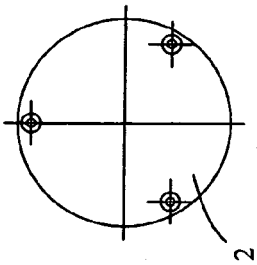


Fig. 17

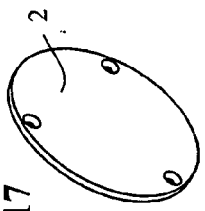


Fig. 16

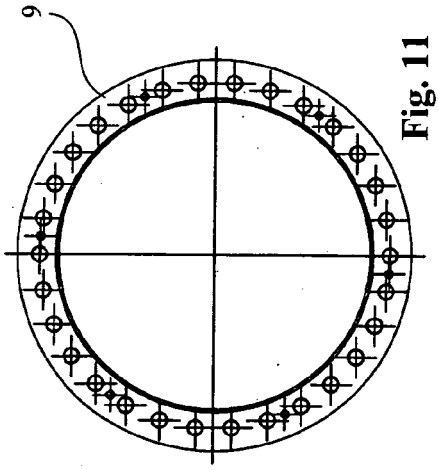


Fig. 11

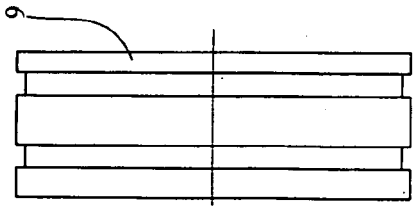


Fig. 12

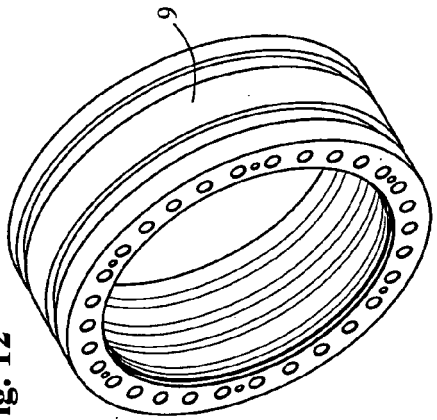


Fig. 10

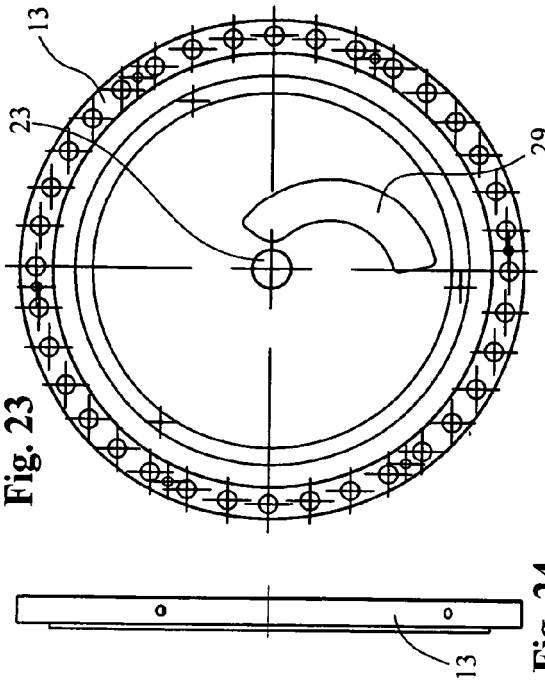


Fig. 23

Fig. 24

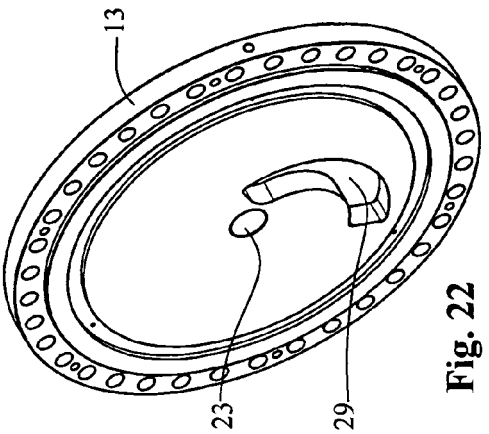


Fig. 22

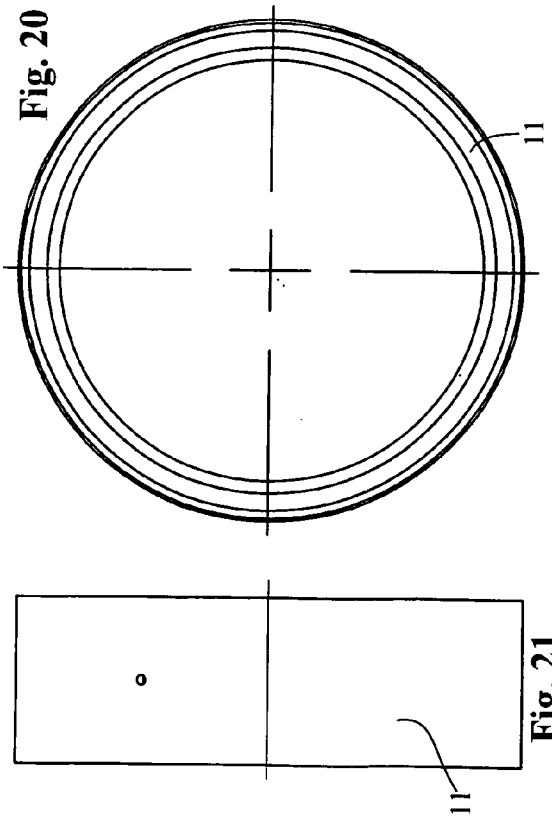


Fig. 20

Fig. 21

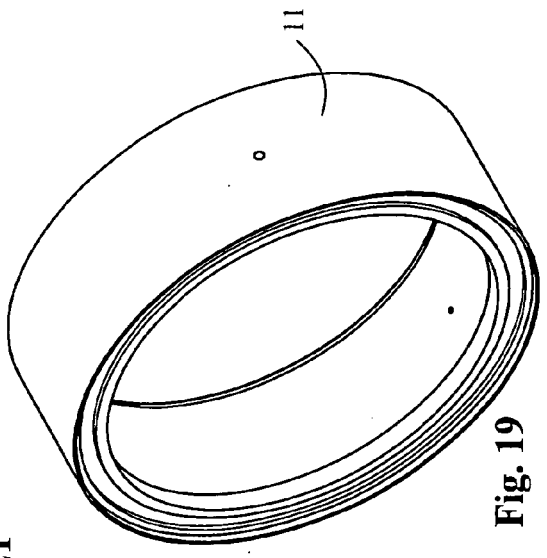


Fig. 19

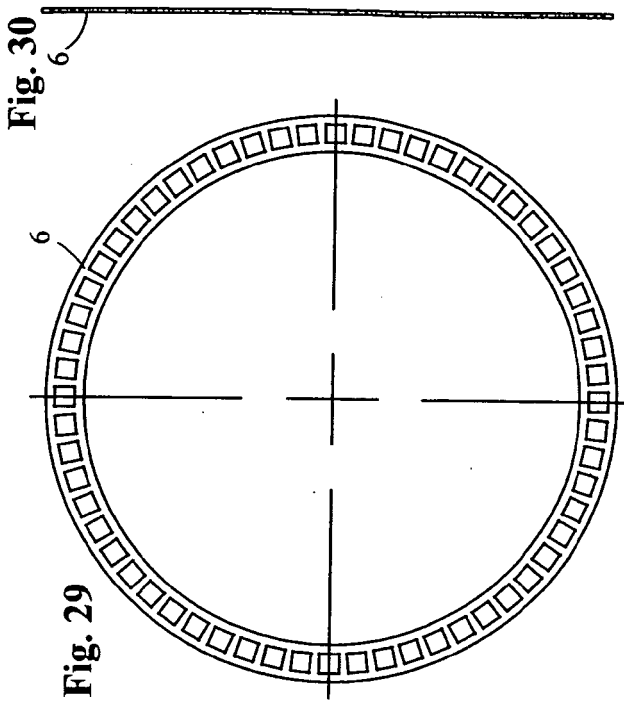


Fig. 30

Fig. 29

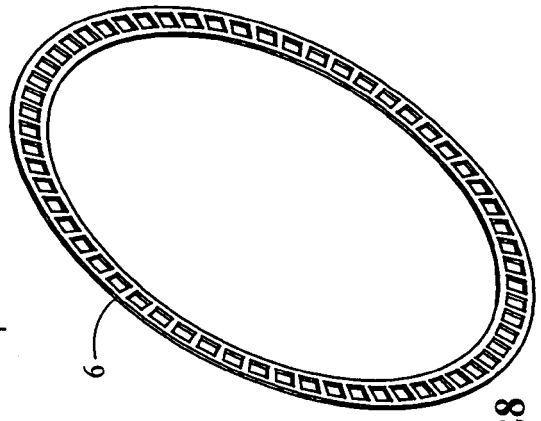


Fig. 28

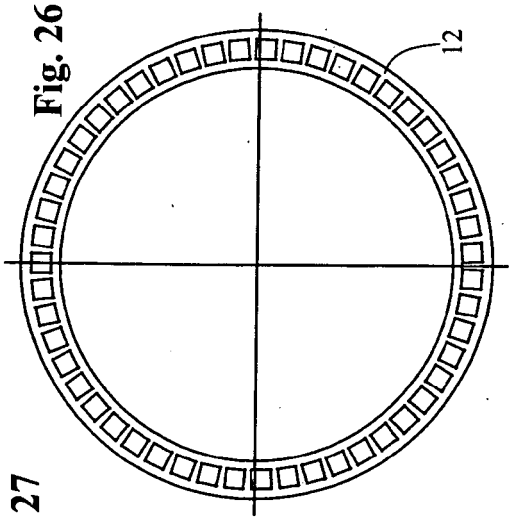


Fig. 26



Fig. 27

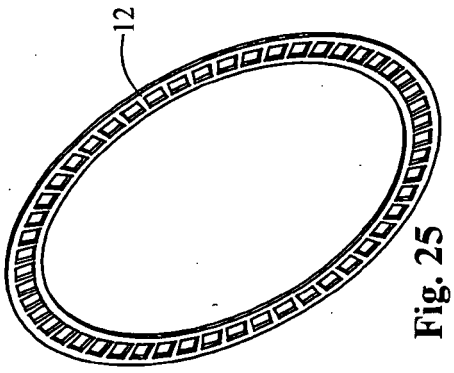
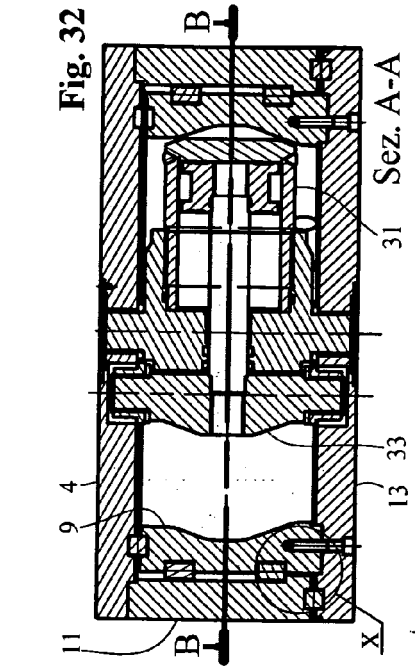
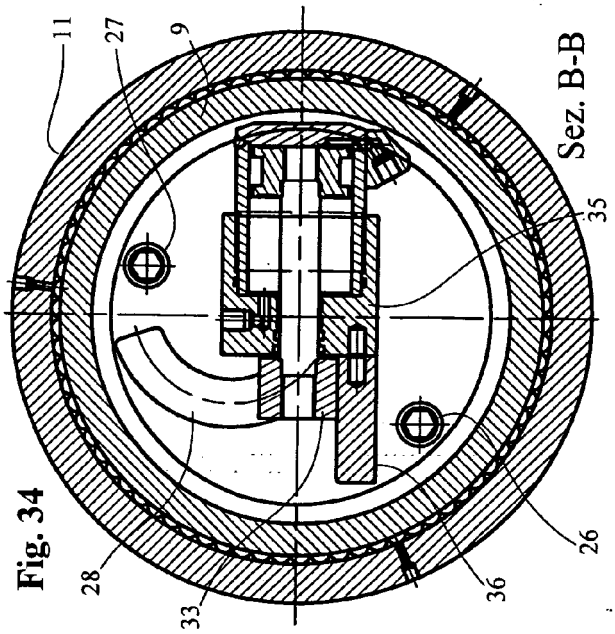
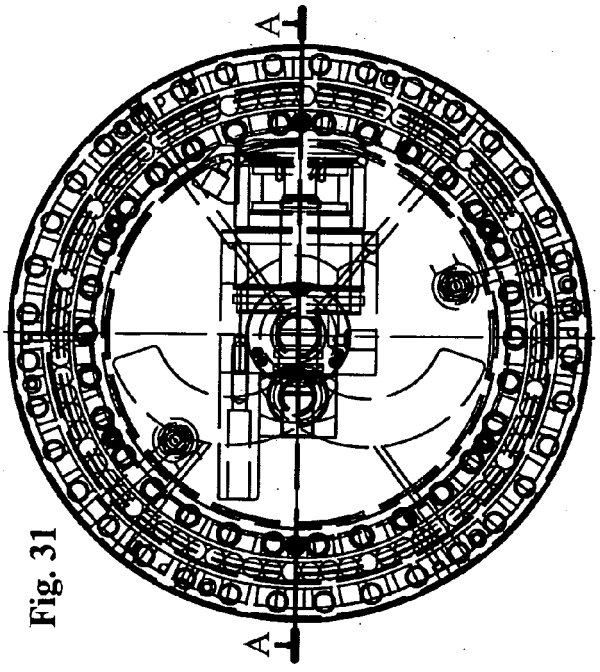
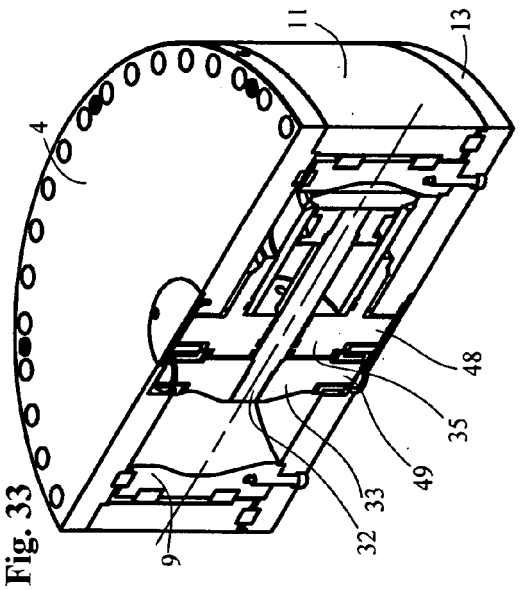


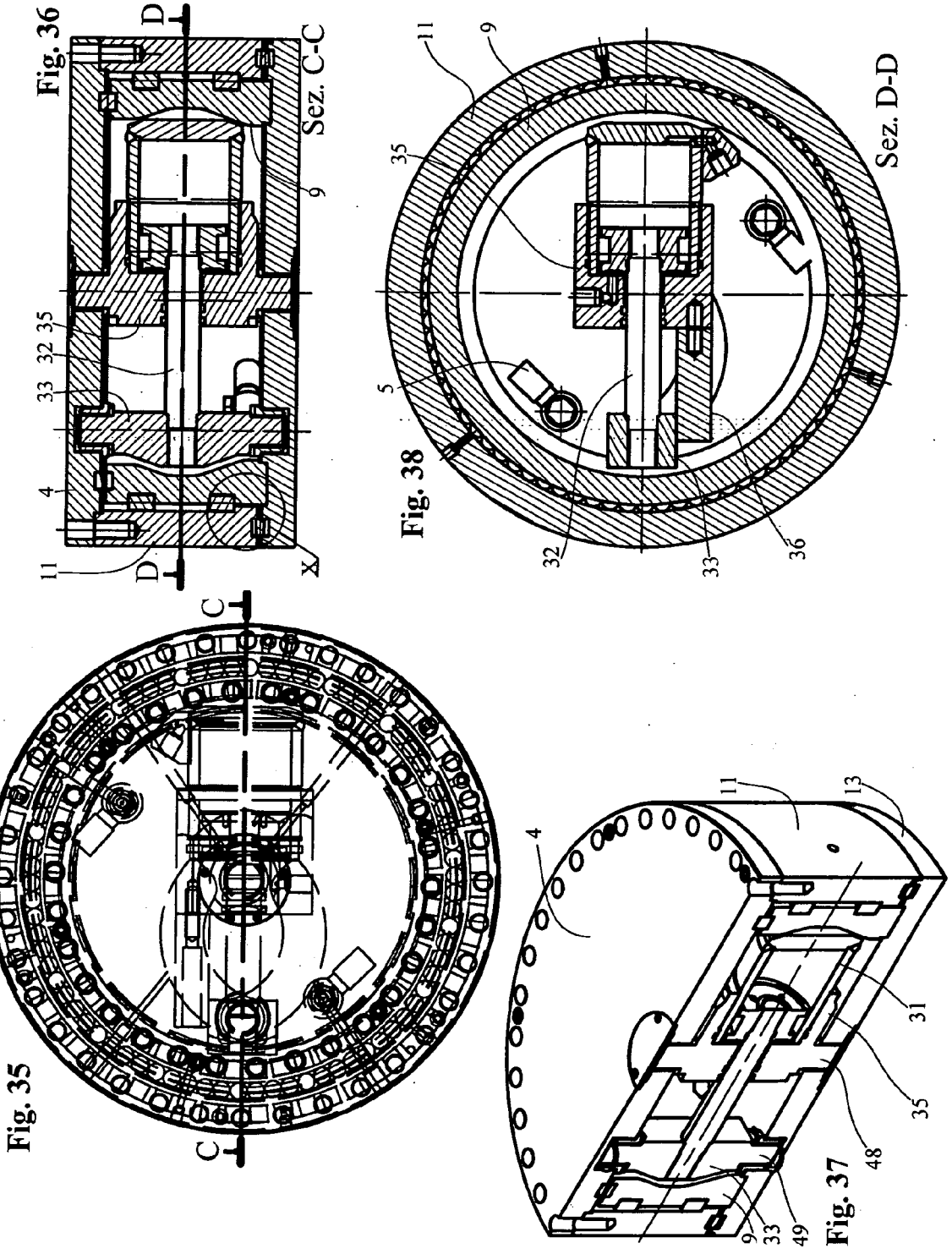
Fig. 25

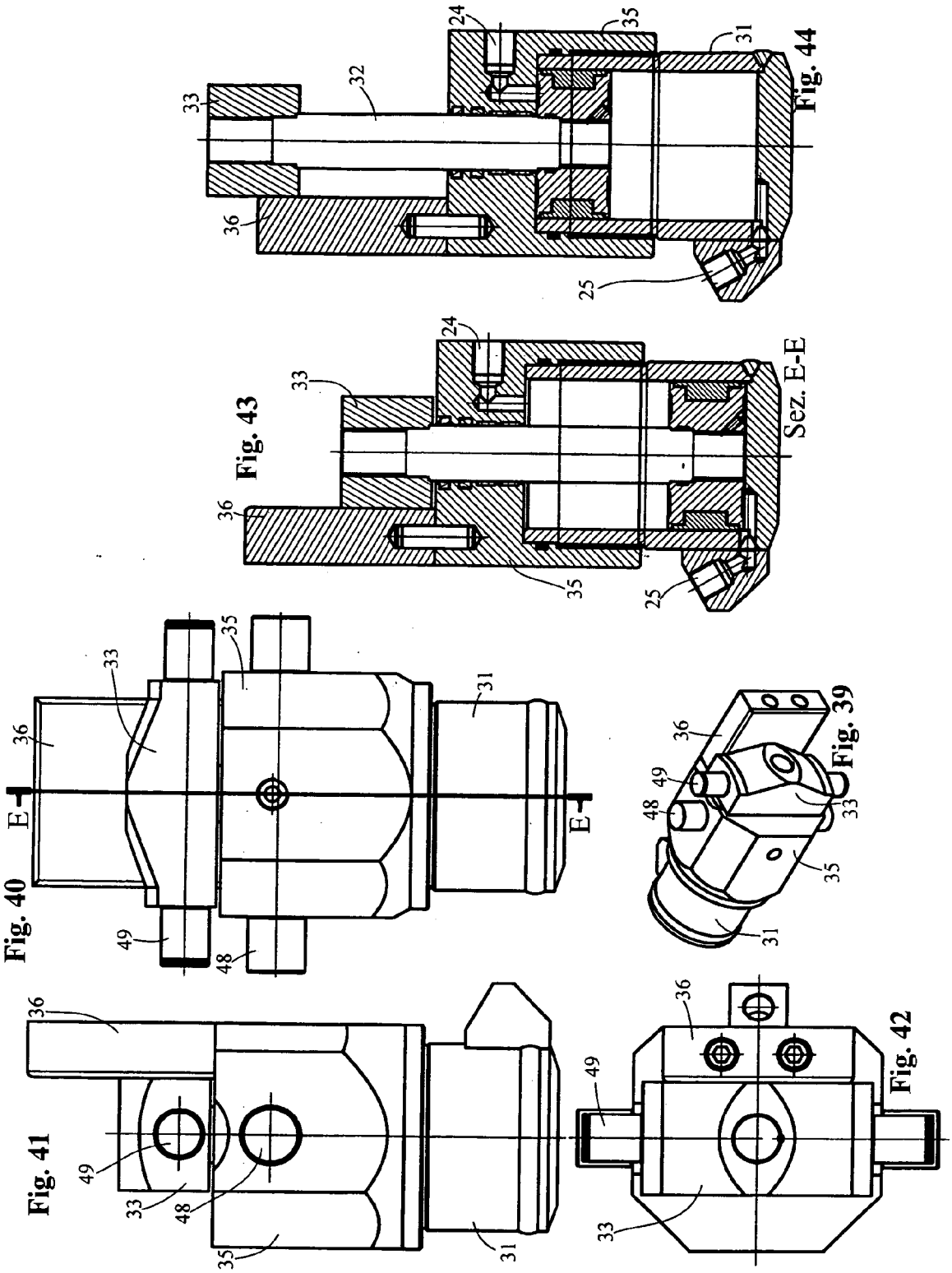

Fig. 32
B
Sez. A-A
31
33
13
4
9
11
B
X


Fig. 34
11
27
9
Sez. B-B
35
28
33
36
26


Fig. 31
A
A


Fig. 33
11
13
4
48
35
49
33
32
9


Fig. 36
Sez. C-C
D
D
C
C
11
4
33
32
35
9
X
Fig. 38
Sez. D-D
11
9
35
5
32
33
36
Fig. 35
Fig. 37
4
11
13
31
35
48
9
33
49


Fig. 44
Fig. 43
Sez. E-E
Fig. 40
Fig. 39
Fig. 41
Fig. 42

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 00 6120

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 41 34 220 A1 (VOLKSWAGEN AG [DE]) 30 April 1992 (1992-04-30) * column 2, line 62 - column 4, line 23; figures 1-2 *	1-9	INV. F15B15/06
A	FR 1 229 437 A (MAHDRESCHERWERK WEIMAR VEB) 7 September 1960 (1960-09-07) * the whole document *	1-9	
A	US 5 106 052 A (DATTA DIPTI [CA] ET AL) 21 April 1992 (1992-04-21) * the whole document *	1-9	

TECHNICAL FIELDS SEARCHED (IPC)

F15B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 November 2011	Bindreiff, Romain

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 00 6120

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-11-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4134220 A1	30-04-1992	NONE	
FR 1229437 A	07-09-1960	NONE	
US 5106052 A	21-04-1992	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82