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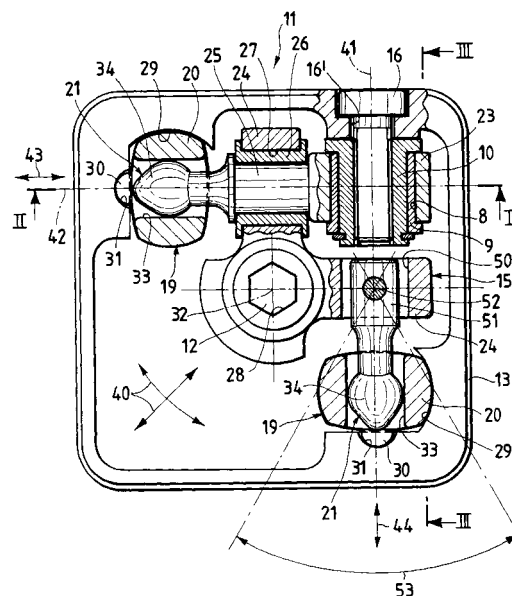
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(54) **Double-hinged lever device for independent remote drive**

(57) A double-hinged lever device for the independent remote drive, for example of rigid tie rods and/or flexible cables, consisting of a lever (12) rotatable with respect to a base box element (13), a mobile element (15) connected to the lever (12) and to the base box element (13), a pair of cables (17, 18) coupled to the mobile element (15), articulated locking elements (19) which rotatably couple ends of the cables (17, 18) to the mobile element (15), a pair of reaction sheathes (22) coupled to the base box element (13), in which the cables (17, 18) slide, wherein the mobile element (15) is hinged (in 16) on a side to the base box element (13) and comprises at least two portions (23, 24) rotatable the one with respect to the other in perpendicular plans, each one of the two portions (23, 24) being connected at a free end thereof to each of said cables (17, 18) through an elongated eye element movable within the base box element in axial direction and a knob element (21), which extend the one from the cables (17, 18) and the other from one of the portions (23, 24) of the mobile element (15), and at least one knob element (21) being movable with respect to a displacement axis of the eye element (20).

Fig.1



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Description

[0001] The present invention relates to a double-hinged lever device for independent remote drive, e.g. rigid tie rods and/or flexible cables.

[0002] In the field of remote drives, various kinds of so called "push-pull" lever devices are known for driving a pair of rigid tie rods or flexible cables. Such devices are particularly useful and are used for driving pairs of manufacturing machines hydraulic-pressure valves or the like for the drive of mechanic reduction units known as gearboxes or the like. Nowadays, known lever devices employ metallic ball joints or motion transmission systems through small connecting rods and it should be noted that both the ball joints and the transmission through connecting rods, although strong, are hardly capable of suppressing the coupling mechanical clearances. As a consequence, dedicated systems or mechanical arrangements are provided which are able to recover such clearances enhancing the operations of the drives. Another problem is correlated to the lever vibration during the operation of the manufacturing machine, to which it has been applied, what creates relevant drawbacks.

[0003] A solution to such problems can be obtained through a lever connected to a movable member which in turn bears three spherical elements which fit the one inside a fixed bushing and the other two inside further movable bushings with respect to a base element, respectively. This arrangement as well, although somehow satisfying the above indicated requirements, seems to be rather complicated as far as its assembling and setup are concerned, as well as not easy to be driven; in fact such driving mostly relies on the sensitivity of the user of such drive lever device.

[0004] Object of the present invention is that of devising a lever device for the remote drive of rigid tie rods and/or flexible cables which allows providing a solution to the above indicated technical problems. Another object of the present invention is that of realising a device that eliminates possible clearances, yet fully achieving its task of driving.

[0005] Still another object of the present invention is that of realising a device which is particularly simple to manufacture and to operate and that is safely operable without any specific skill of the operator.

[0006] Another object of the present invention is that of realising a device which aims to eliminate or reduce any lubrication and adjustment operation, further having an extremely simple assembly, with a low cost of dismantling and re-assembling for possible interventions.

[0007] These and other objects according to the present invention are achieved by realising a double hinged lever device for the independent remote drive, for example of rigid tie rods and/or flexible cables, according to claim 1.

[0008] Further features of the device will also appear from the following claims.

[0009] Through a device according to the present invention it is thus possible to achieve a rotation of the system according to an infinite number of theoretical axes, with a simplified assembly and dismantling and a correct operation all being guaranteed.

[0010] Moreover, this device is such as to be quickly adaptable to whatever kind of application wherein a differentiate remote drive is required.

[0011] The functional and structural features and the advantages of a device according to the invention will be better clear and evident from the following description of an embodiment thereof, provided as example without any limiting intent, with reference to the attached schematic drawings wherein:

- Figure 1 shows a partly sectioned plan view from above, deprived of the upper bellows, of the double-hinged lever device for the independent remote drive according to the invention in lock and rest position,
- Figure 2 shows a partially sectioned, side elevation view according to line II-II of figure 1 of the device according to the invention in the same position,
- Figure 3 shows a further partially sectioned view of the device, partially provided with an upper bellows, according to line III-III of figure 1,
- Figure 4 is a partially sectioned elevation view similar to that of figure 2 in a different operating position in which the rise of a cable has been promoted,
- Figure 5 is a plan view from above of a detail of a device of the invention in a second embodiment thereof,
- Figure 6 is a section of the detail of figure 5 seen according to line VI-VI.

[0012] With reference to the drawings, it is rather easy to note the structure of a double-hinged lever device for the independent remote drive, for example of rigid tie rods and/or flexible cables, realised according to the present invention. This is of course one possible design of such double-hinged lever device that is indicated by numeral 11 in the overall illustration thereof.

[0013] As it can also be noted from the drawings, such a device 11 consists of a lever 12 which is rotatable with respect to a base box element, 13, such as a square-sectioned sleeve box. Of course, such box element shall be adapted to be connected in a not shown way, for example through holes formed in a side area thereof, to the outer bearing structure which is part of a manufacturing machine, which is not shown as well. At the upper end of the box element 13, the device 11, as shown in figure 3, has then a closing bellows 14, which, besides preventing every accidental access, also ensures a hermetic seal against environmental agents. The lever 12 may be rotated, as same is inserted fixed in a central area of a mobile element 15 which is pivoted in 16, for example through a screw engaged in a through hole 16' in the box element 13, inserted in a threaded bush 10

supported by a second bush 9 arranged rotatable in a hole 8 of the mobile element 15. The screw 16 is applied from outside and locking means has to be foreseen for preventing an axial extraction, such as a stop ring arranged at the end of the threaded bush 10. The simple removal of the screw allows the entire group to be extracted.

[0014] Further on, it shall be noted that, according to the present invention, two cables 17 and 18 for remote transmission are coupled and extend to this mobile element 15, whereby such cables, in their operating portion outside of the base box element 13, are contained within reaction sheaths 22.

[0015] The ends of cables 17 and 18 are bound through fastening elements, indicated in their whole with 19, to the mobile element 15. In particular, the locking elements 19 consist of articulated elements which comprise a sliding eye element 20 and a knob element 21 extending and being connected to the cables 17, 18 and to the mobile component 15 respectively. In this way a curved motion is transformed into an axial motion without any clearance and friction.

[0016] It should be noted that the mobile element 15 comprises two portions 23 and 24. The first portion 23 is rotatable, as already said, in that it is pivoted in 16 into the box element 13 and extends in a knob element 21. In one of its intermediate portions it has a lowered seat 25 to receive a bushing 26 on which in 27 a perforated end of the second portion 24 of the mobile element 15 is supported free in rotation. Finally, a knob element 21 fitting in the eye element 20 is arranged fixed to the second end of this first portion 23.

[0017] Moreover, as far as the second portion 24 is concerned, it shall be noted that it has a squared shape and, at the crossing of the two arms of the square has centrally a seat 28 for the lever 12. The other end of the second portion 24 i.e. of the second arm of the square, carries a second knob element 21 bound thereto, perpendicular to the first knob element, which fits in a second eye element 20 perpendicular to the first eye element 20 as well.

[0018] Moreover, in the present invention it shall be noted that each one of the two eye elements 20 is placed slidable within the box element 13 guided on a side by shaped inner wall portions 29. On an adjacent side, a lengthwise extension 30 of the eye element 20 is foreseen, which fits into a complementary recessing 31 formed as well onto the side walls of the box element 13. In this way, the elongated eye element 20 is movable in axial direction (downwards and upwards) within the basic box element 13 according to an axis parallel to an axis 32 of the box element itself, but it is not rotatable due to the engagements onto the inner walls.

[0019] In particular, it shall be noted that, according to the invention, every knob element 21 has an attachment stem and a shaped-type end 34 which engages inside a seat or through hole 33. In the embodiment shown, such a shaped engagement end 34 is olive-

shaped; however, equally effective would be an elliptic, hexagonal, square shape or the like. The presence of an olive-shaped knob element allows the maximum amplitude of kinematic motion on all the available axis.

[0020] It has in fact been noticed that, if a round or spherical shape is foreseen, the forces that arise during the axial translation of the eye elements, react negatively and cause the spherical element to come out of the seat 34. Alternatively, it has also been noticed that a spherical knobs arrangement leads to a quicker lateral wear due to the friction in the seat or onto the walls of the box element 13.

[0021] In order to avoid friction problems, the eye element 20 was further manufactured with a plastic anti-friction material, or a layer of antifriction material has been inserted in the seat, for example in the form of a tubular or the like.

[0022] According to the invention at least one of the knob elements 21 or both of them are made such as to swing with respect to a displacement axis of the respective eye element 20. Figures 1 and 3 show how the swinging is perpendicular to a displacement axis of the respective eye element 20, which is parallel to the axis 32 of the box element 13. This is made possible in this first example through a slot 50 formed in a portion 24 of the mobile element 15 according to a perpendicular direction to the mentioned axis 32. A stem 51 of this knob element 21 is narrowed and pivoted in the slot 50 by means of a pivot 52 having an axis parallel to the axis 32. The knob element 21 may swing by an angle 53 during the correlated motion of both cables 17 and 18.

[0023] Figures 5 and 6 show that, in a second embodiment, the at least one knob element 21 may be fixed and may displace, when swinging, inside a slot 54 formed in the respective eye element 20 during the actuation of the device. The slot 54 is formed tilted with respect to the horizontal one, for example by about 30° and prevents the mobile element 15 from getting stuck. In this case as well, a slot 54 can be formed on one or both of the eye elements 20. The other parts remain unchanged and have the same reference numerals. It shall be further noted that the pivoting 16 between the mobile element 15 and the inner wall of the box element 13 is carried out through a simple screw, which can be easily removable. The screw provides the rotation axis and the fulcrum for the overall device. In this way a rapid dismantling and reassembling may be carried out of the overall group (mobile element 15, cables 17, 18 and lever) with respect to the reaction body (consisting of the box element 13) without any complex and difficult intervention.

[0024] It shall also be noted that the lower end of the eye element 20 abuts onto a washer 35 which is inserted in an area with a reduced diameter 36 of a connecting element 37 of the cable 17 or 18 to the eye element 20. On this area a spring 38 is further inserted, which abuts between the first washer 35 and a second washer 39.

[0025] Where the connecting element 37 is foreseen,

the upper end of the reaction sheath 22 forms an abutment for the second washer 39.

[0026] The presence of the spring 38 and of both washers 35 and 39 guarantees that the device takes up, in rest conditions, the position of figure 3 and be movable between the various positions with a high precision. In fact, in figure 4 it is shown the way the actuation through the lever 12 may take place, in order to command the displacement, for example, of the cable 18. By acting on the lever 12, in order to command only the rotation of the mobile element 15 about the pivoting 16, i.e. about an axis 41, according to the arrow 43, only the rise of the eye element 20 is commanded. In this case the spring 38 is compressed by the washer 39 advancing while rising. Only a drive is therefore actuated by the cable 18. It shall be noted that the second eye element 20 connected to the other cable 17 does not translate because it is placed at the final end of the second portion 24 according to the knob element 21 which stays coaxial to the pivoting 16, both being arranged according to the same axis 41.

[0027] Analogously, although not represented, it may be acted only through the lever 12, in order to rotate the second portion 24 of the mobile element 15 about the lowered seat 25 formed in the intermediate portion of the knob element 21 formed onto the first portion 23 of the mobile component 15.

[0028] In this case, the rotation takes place about an axis 42 which is perfectly perpendicular to the previously mentioned axis 41. Both axes 41 and 42 pass through the pivoting 16. In figure 1 it can be noted that both above described actions are performed with an action on the lever 12 according to the directions of a double-sided arrow 43 and a double-sided arrow 44, respectively.

[0029] Figure 1 itself shows that, through the composition of both actions according to varying directions and selected by the user according to his specific requirement, it is possible to act on the lever 12 so as to promote the motion of both cables 17 and 18 by an equal or different extent. Such capability is illustrated in general by the two double-sided arrows 40. When both cables 17 and 18 are moved at the same time, it has proved particularly advantageous and necessary the presence of the pivot 52 of the stem 51 of the knob element 21 which allows the swinging according to the angle 53 or of the slot 54 with the fixed knob element 21 movable within the same. A correct operation without parts getting stuck and worn may be thus guaranteed, with an enhanced movement without stresses. It shall be noted that it is possible to realise also the other knob element 21, locating the stem 51 and the slot 50 or the slot 54 onto the eye element so as to further improve the movements. This allows to obtain without any problem even long strokes of the cables 17 and 18.

[0030] In the portion of the box element 13 in which the cables 17 and 18 do fit, it can be noted that also position locking members are provided for the reaction

sheathes 22 or the connecting elements 37 of the cables 17 or 18.

[0031] A small lever 45 is schematically illustrated, which is movable in a seat 46 and adapted to be engaged in an undercut 47 foreseen in the connecting member 37. In this way, once the small lever 45 has been moved to an off position, the sheath can be taken out of a seat 48 formed in the box element 13.

[0032] The double-hinged lever device for independent remote drive according to the present invention allows two motions to be controlled both in a joint and separate way by only one drive lever. This particular driving does not work, as the previous ones, on properly defined mechanical axis, rather it works on pivotings of which the one is fixed and the other movable, connected to the respective cable through eye elements movable in the box element 13.

[0033] When contemporary action on both cables is required, the movement of the lever 12 always occurs about the fixed pivot 16, exploiting the capability of rotation of the second part 24 of the mobile element 15 around the first part 23 of the mobile element 15 itself. In case it is wished to operate on only one of the cables 17, 18 a rotation axis 41 or 42 is exploited from time to time. The rotation axis runs anyway through the fixed pivot 16.

[0034] It is foreseen that the parts which can possibly slide with friction are realised using particular antifriction materials with a good resistance to compression.

[0035] Summing up, a highly functional coupling is realised which advantageously has a low cost and a quite simple structure.

[0036] According to the invention there is provided a double hinge cinematic motion which is rotatably independent on eight axes, for the pull and push operation of cables and tie rods of any standard or special type for machines in general.

[0037] Therefore, it is clear in which simple and practical way a solution has been found according to the present invention to the problem of obtaining an optimal structure and operation of a double-hinged lever device for the independent remote drive of rigid tie rods and/or flexible cables.

Claims

1. A double-hinged lever device for the independent remote drive, for example of rigid tie rods and/or flexible cables, consisting of a lever (12) rotatable with respect to a base box element (13), a mobile element (15) connected to said lever (12) and to said base box element (13), a pair of cables (17, 18) coupled to said mobile element (15), articulated locking elements (19) which rotatably couple ends of said cables (17, 18) to said mobile element (15), a pair of reaction sheathes (22) coupled to said base box element (13), in which said cables (17, 18)

- slide, characterised in that said mobile element (15) is hinged (in 16) on a side to said base box element (13) and comprises at least two portions (23, 24) rotatable the one with respect to the other in perpendicular plans, each one of said two portions (23, 24) being connected at a free end thereof to each of said cables (17, 18) through an elongated eye element (20) and a knob element (21), which extend the one from said cables (17, 18) and the other from one of the portions (23, 24) of said mobile element (15), said elongated eye element (20) being movable, although not rotatable, within said base box element in axial direction according to an axis parallel to the one (32) of said box element (13), and at least one knob element (21) being movable with respect to a displacement axis of said eye element (20).
2. A device according to claim 1, characterised in that said mobile element (15) is pivoted to said base box element (13) according to a rotation axis (41) through a screw (16) applied from outside.
3. A device according to claim 2, characterised in that a bush (9) is foreseen between said screw (16) and said mobile element (15).
4. A device according to claim 3, characterised in that said screw (16) fits in a second threaded bush (10) located inside said bush (9), locking means being moreover foreseen against the axial displacement.
5. A device according to claim 1, characterised in that said mobile element (15) comprises two portions (23, 24) wherein a first portion (23) at one end is pivoted (in 16) and rotatable with respect to said box element (13) and extends at the other end in a first of said knob elements (21), furthermore in an intermediate portion thereof has formed therein a lowered seat (25) in order to receive a bush (26) on which a first perforated end (in 27) of a second portion (24) of said mobile element (15) is supported free in rotation, whereby also said mobile element bears at its opposite end a second of said knob element (21) arranged perpendicular with respect to the first one of said knob elements (21).
6. A device according to claim 5, characterised in that said second portion (24) is square shaped and at the crossing of the two arms of said square centrally has a seat (28) for said lever (12), a second end of said second portion (24) bearing, bound thereto, said second knob element (21).
7. A device according to claim 1, characterised in that each eye element (20) is arranged slidable within said box element (13) guided on at least one side by inner wall shaped portions (29).
8. A device according to claim 1, characterised in that every eye element (20) has a lengthwise extension (30) fitting in a complementary recessing (31) formed in inner walls of said box element (13).
9. A device according to claim 1, characterised in that said at least one knob element (21) may swing perpendicularly to a displacement axis of said eye element (20), the same being pivoted (in 52) within a slot (50) formed in one of the portions (23, 24) of said mobile element (15).
10. A device according to claim 1, characterised in that said at least one knob element (21) is movable within a slot (50) formed within a respective eye element (20).
11. A device according to claim 10, characterised in that said slot (50) is formed tilted with respect to the displacement direction of said eye element (20).
12. A device according to claim 1, characterised in that said at least one knob element (21) may swing according to an angle (53) with respect to said mobile element (15).
13. A device according to claim 1, characterised in that said each knob elements (21) are olive-shaped.
14. A device according to claim 1, characterised in that said each knob elements (21) have a shape with an elliptic, hexagonal, square section or the like.
15. A device according to claim 1, characterised in that every eye element (20) is provided with an engaging seat or through hole (33) for a respective knob element (21).

Fig.1

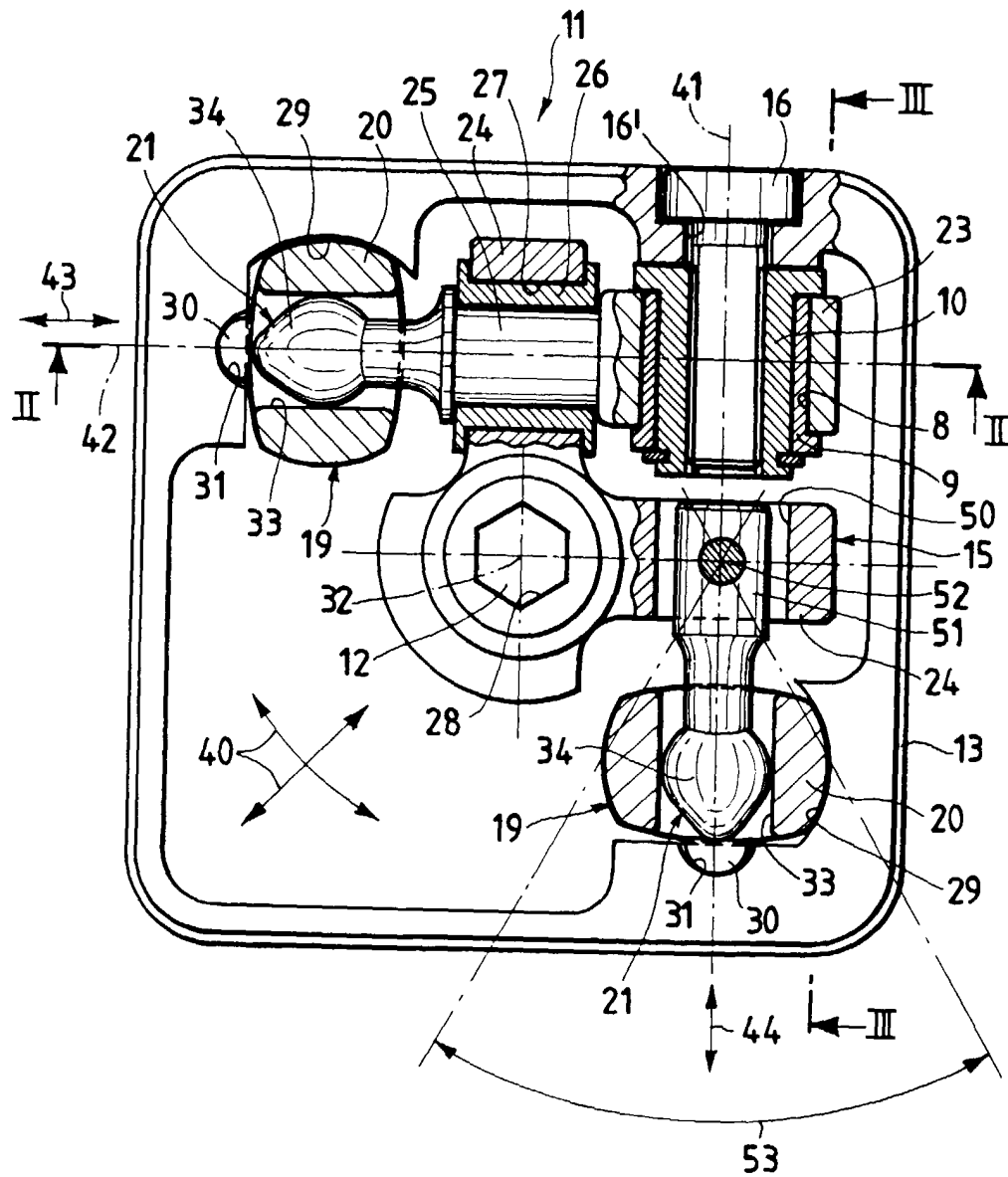


Fig.2

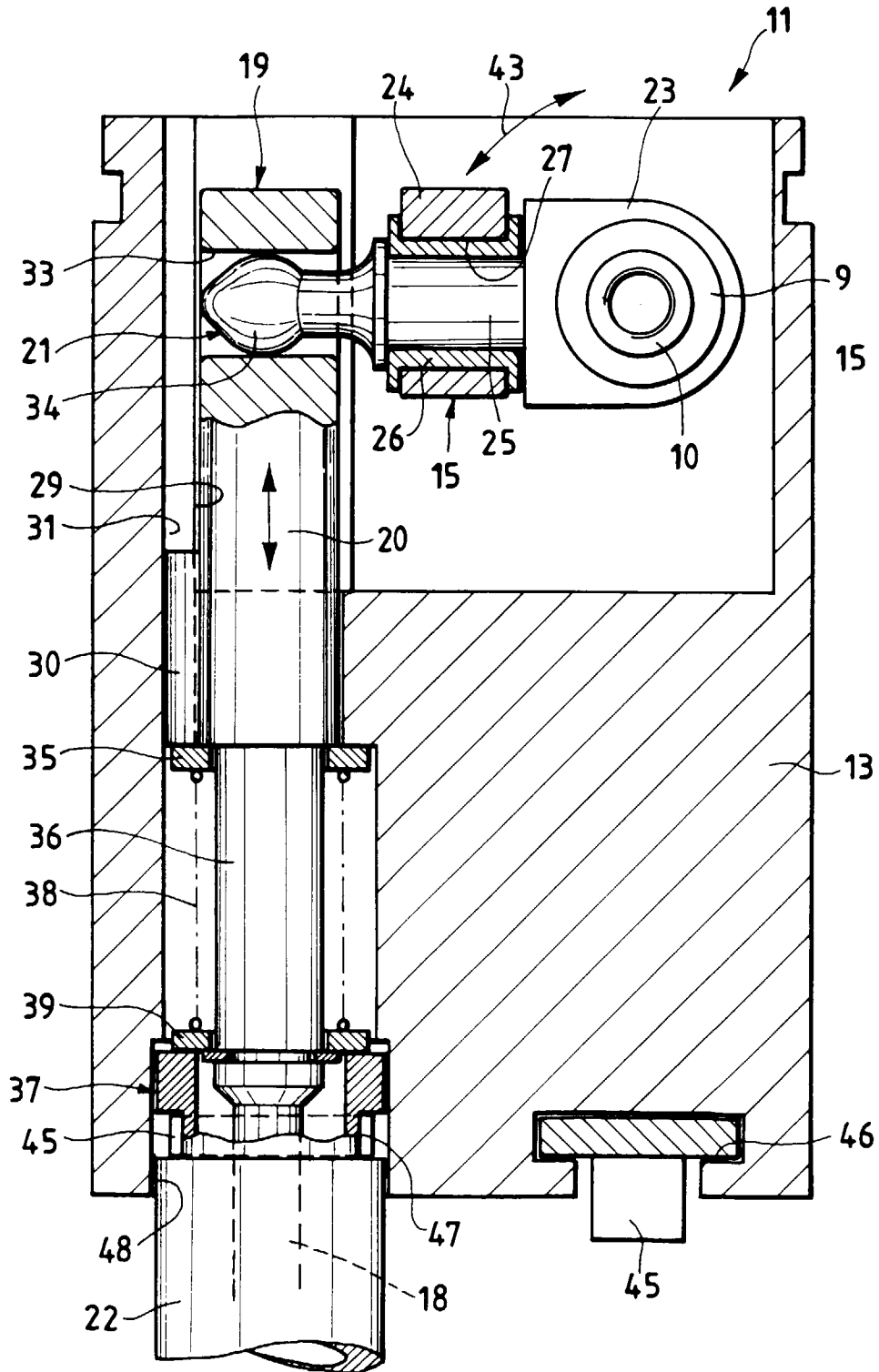


Fig.3

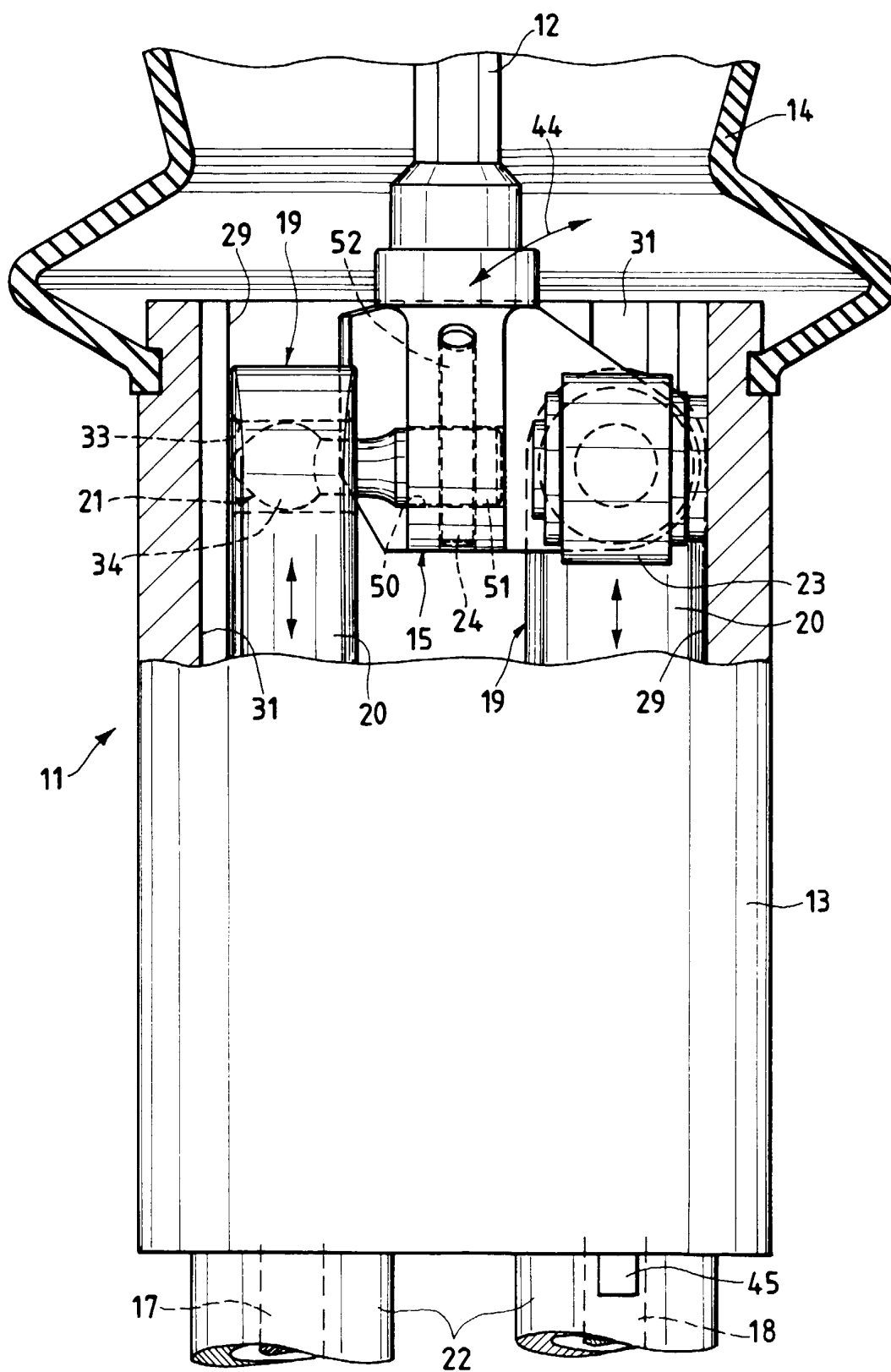
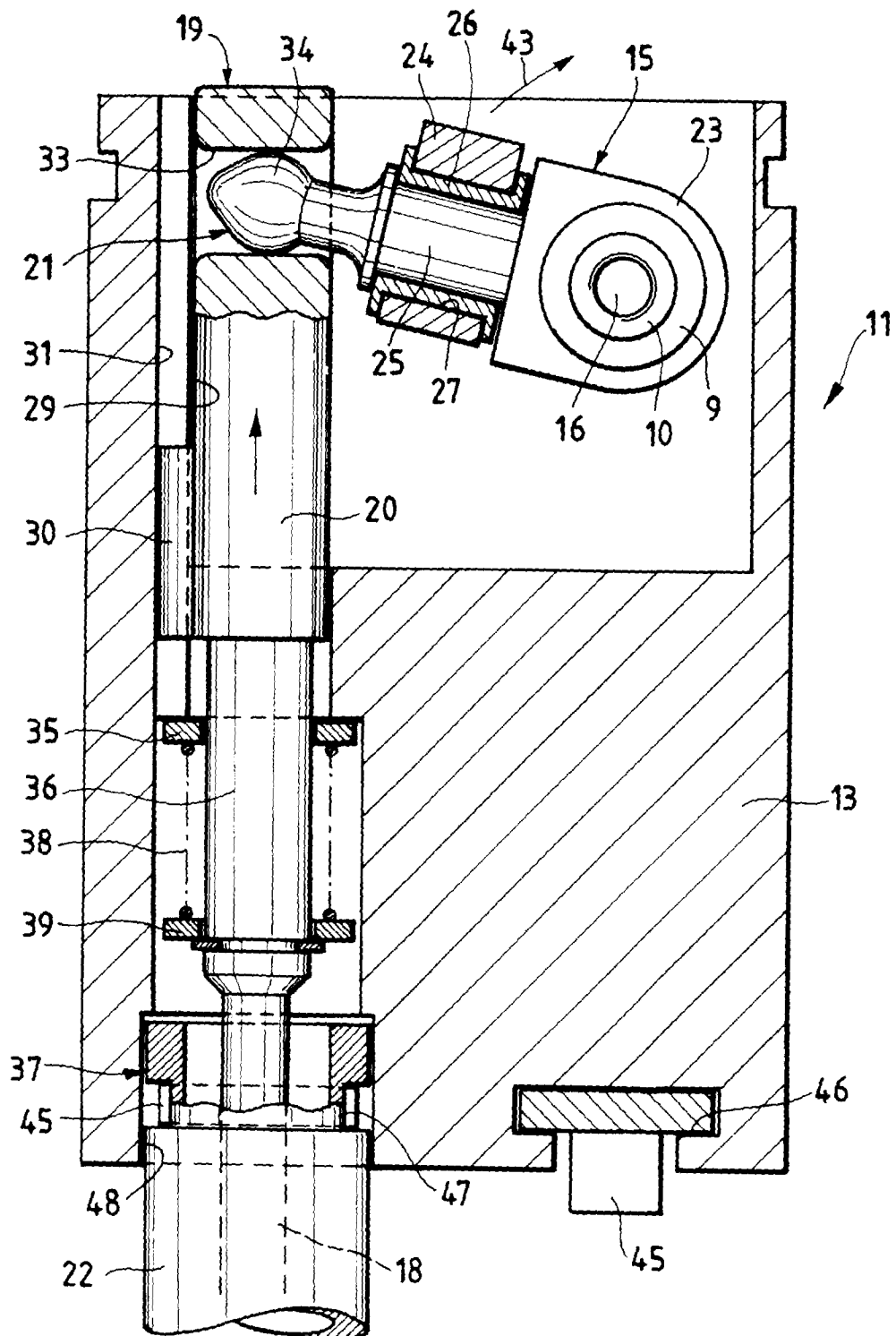


Fig.4



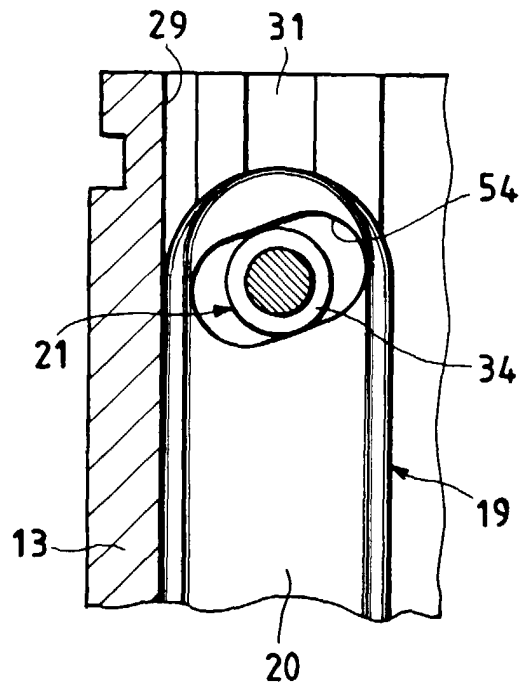


Fig.6

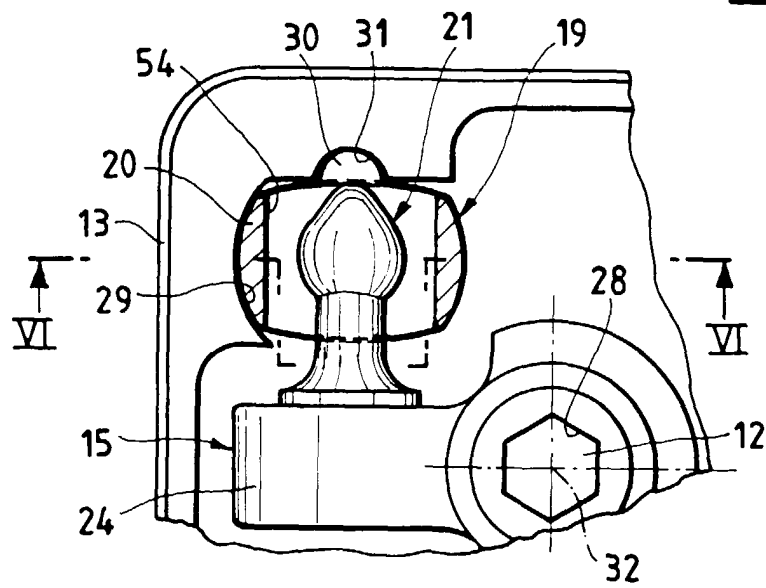


Fig.5