(19) DANMARK

(10) **DK/EP 2625093 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***B 63 B 27/24 (2006.01)*** ***F 16 L 37/36 (2006.01)*** ***F 16 L 37/367 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2015-10-05**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2015-08-05**

(86) Europæisk ansøgning nr.: **11771214.1**

(86) Europæisk indleveringsdag: **2011-10-04**

(87) Den europæiske ansøgnings publiceringsdag: **2013-08-14**

(86) International ansøgning nr.: **FR2011000539**

(87) Internationalt publikationsnr.: **WO2012045925**

(30) Prioritet: **2010-10-05 FR 1003934**

(84) Designerede stater: **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**

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(54) Benævnelse: **Indretning til styring af ventilerne i en forbindelses-/adskillelses-indretning**

(56) Fremdragne publikationer:
WO-A1-89/03002
WO-A1-03/004925
WO-A2-2009/071591

The present invention relates to installations for transferring fluid, in particular, but not exclusively, to the transport of liquefied natural gas (LNG) off-shore (open sea) between a vessel, such as a floating terminal, and a navigation vessel, such as a gas terminal.

One of the systems for transferring fluid is formed by a flexible cryogenic pipeline, carried by the floating terminal, at the end of which a LNG connector/disconnector makes it possible to connect the latter to the gas terminal.

In general, an LNG connector/disconnector (or LNG coupler/decoupler) is a device that is designed to provide a rapid disconnection between two sections of pipeline.

An LNG connector/disconnector consists in particular of a service connection/disconnection device (known as a QC/DC) which makes it possible to provide a connection between the two vessels, but also a device for emergency disconnection (known as an ERS), which makes it possible to separate the pipe into two closed sections, consisting of two isolating valves between which the pipeline can be separated without losing fluid.

This ERS function, devised previously by the companies KSB and Eurodim (patent EP 1405003), is formed in particular by two butterfly type valves, each provided with a disc mounted pivotably on the inside of the end piece about a shaft for manoeuvring between an open position of the transverse section of the flow of fluid and a closed position of the latter,

and the external devices for controlling the pivoting extend perpendicularly to the axis of the pipeline and are parallel to one another. A first butterfly valve is mounted at a first end of the first end piece and a second butterfly valve is mounted at the end of the second end piece, the faces of the two butterfly valves are turned towards one another. This device, which has the advantage of being very compact and relatively light, also makes it possible to achieve a very little loss of fluid during emergency disconnection because of the very small volume between the two butterfly valves in a closed position. It is characterised in particular by the overlap of the butterfly valves during their movement and therefore by the small distance between the two manoeuvring shafts.

This type of connector/disconnector can be used in particular in an advantageous manner for transferring through flexible floating or semi-floating pipelines, owing to its mass and reduced space requirements. However, transferring through a flexible floating pipeline, contrary to transferring through an aerial flexible pipeline, requires a hydraulic power supply for the connector/disconnector devices solely from the gas terminal, and not the flexible pipeline from the floating terminal, because of significant losses of charge caused by the length of the flexible floating pipeline and the risk of shock during the various manoeuvring operations which could affect the efficiency of the safety systems. It is also preferable to limit the equipment at the end of the flexible pipeline to thereby limit the mass and the space requirement and facilitate handling, but also to limit the risk of shock against the hull of the gas terminal during disconnection.

An approach and guiding system of the two end pieces makes it possible in particular at the end of a connection manoeuvre and at the beginning of a service disconnection manoeuvre, to ensure the coaxiality and angular ori-

entation between the two end pieces enabling the perfect positioning of one relative to the other.

The invention provides an installation for the transfer of fluid, in which the device for activating the connector/disconnector valves is activated by a hydraulic actuator supplied by a hydraulic power unit mounted on the navigation vessel without the end piece located on the side of the other vessel being made too heavy and too bulky by a large return spring or by a source of fluid pressurised sufficiently for actuation.

WO 2009/071591 describes an installation according to the preamble of claim 1.

Therefore, the main (but not only) subject matter of the invention is an installation for transferring fluid, comprising a flexible floating pipeline, the adjective 'floating' also encompassing instances where the pipeline is semi-floating, putting a navigation vessel in communication with another vessel and comprising a first end piece, on the side of the navigation vessel, and a second end piece, on the side of the other vessel, at the end of the flexible cryogenic pipeline, of a connector/disconnector mounted on a substantially vertical section of the pipeline by having the first end piece above the second end piece.

This connector/disconnector may be of the "standard" type, where the service connection/disconnection devices (commonly referred to as QC/DC) and rapid disconnection devices (commonly known as ERS) are clearly differentiated, as it may regroup these devices in a single interface, which are activated by hydraulic actuators powered by a single hydraulic power unit mounted on the navigation vessel, a single hydraulic actuator making

it possible to activate the valves, a first valve with a manoeuvring shaft, preferably of the butterfly type, being mounted at the end of the first end piece facing the second end piece and a second valve with a manoeuvring shaft, preferably of the butterfly type, being mounted at the end of the second end piece facing the first valve. The installation is characterised in that the valves are actuated by a single actuator which is common to both and a transformation mechanism is provided for a translation movement of the actuator into joint pivoting of the manoeuvring shafts of the valves, the transformation mechanism being composed of two parts, the first connected to the first end piece, the second to the second end piece, arranged such that they can connect or disconnect respectively when the connector/disconnector is connected or disconnected.

In a much preferred manner, in the case of an LNG connector/disconnector grouping the QC/DC and ERS devices into a single interface, a third valve activated by the joint actuator and manoeuvring shaft, preferably of the butterfly type, is mounted at the other end of the second end piece by having its manoeuvring shaft parallel to those of the other valves. In this way a double sealing barrier from the other vessel is provided, not only for a service disconnection which is required as a matter of safety, but also for an emergency disconnection.

Preferably, a manoeuvring part is provided which is mounted on the first end piece to be only moveable in translation, which is associated with the valves and on which the actuator applies a displacement force.

Two or preferably three butterfly valves, in the case of an LNG connector/disconnector in a single interface, are thus activated by a manoeuvring part located on the end piece on the gas terminal side comprising a transla-

tion movement produced by a hydraulic actuator powered directly by a hydraulic power unit on the gas terminal. The synchronisation of closing and opening the valves is thus effectively ensured by this manoeuvring part.

In the following it has been decided to describe only the activation of the valve of the connector at a signal interface, which is the most complex case with the control of three valves, but the invention applies to other cases in a general way.

Preferably, the manoeuvring part can be moved parallel to the axis of the fluid vein or perpendicularly.

In both cases, the first and second parts are preferably only in contact at one or two points, which makes it possible to ensure their connection and disconnection effectively. The manoeuvring part defines a first closed recess and a second recess opening to the outside, according to the axis of the fluid vein in the direction of the flexible side end piece. The mechanism for transforming the displacement of the manoeuvring part comprises a first roller mounted in a rolling manner in the first recess about a pivot axis located at one of the ends of a first connecting rod connected in rotation with the manoeuvring shaft of the first valve, a second roller mounted in a rolling manner in the second recess about a pivot axis located at one of the ends of a second connecting rod connected in rotation with the manoeuvring shaft of the second valve, two driving connecting rods, in an articulated parallelogram, of the second connecting rod to a third connecting rod and which is connected in rotation with the manoeuvring shaft of the third valve.

The line segments between the manoeuvring shaft of the first valve and the pivot axis of the roller inserted on the connecting rod joined to the first valve, on the one hand, and the manoeuvring shaft of the second valve, and the pivot axis of the roller inserted on the connecting rod connected to the second valve, on the other hand, are parallel, of the same length and, preferably, inclined in clockwise direction in relation to the axis of the pipeline, when the two valves are in a closed position, and two connecting rods, in an articulated parallelogram, of the second connecting rod to a third connecting rod which is joined in rotation of the manoeuvring shaft of the third valve.

Preferably, in this case the rolling direction of the rollers in the recesses is perpendicular to the direction of displacement of the manoeuvring part.

Preferably, a mechanical device is provided which holds the three valves in open position during the transfer, said means being in particular provided by locking the rollers which is enabled the fact that the manoeuvring part defines in each recess a cavity extending, at the level of the position of the roller, from the side opposite the corresponding manoeuvring shaft, when the valves are open.

In a first solution the manoeuvring part is movable in translation along the first end piece parallel to the axis of the fluid vein. The first, second and third connecting rods are parallel and of the same length, and a complementary connecting rod, articulated at one of its ends to the end of the first connecting rod other than the one with the first roller and comprising at its other end a movable articulation recess of the connecting rod complementary to the end of the second connecting rod other than the one with the second roller, the length of the complemtary connecting rod, counted be-

tween its articulation axes being equal to the interaxial distance of the two rollers, said complementary connecting rod enabling the transmission of the opening movement from the first to the second connecting rod, when the roller of the latter is located at the level of the recess opening from the manoeuvring part.

A stop secured to the first connecting rod between the point where the first connecting rod is joined to the manoeuvring shaft of the first valve and the one where the complementary connecting rod is articulated, allows, by means of a torsion spring positioned on the axis of rotation of the complementary connecting rod in relation to the first connecting rod, the holding of the complementary connecting rod in a fixed position, where the end pieces are separated from one another, so as to allow a reconnection of the activating kinematics for the next connection of the LNG connector/disconnector.

The recess of the manoeuvring part and the recess of the complementary connecting rod are arranged in such a way as to allow the coupling or decoupling of the mechanism respectively during a connection or disconnection of the connector/disconnector.

To allow the reclosure of the valves when they are open the first, second and third connecting rods are inclined relative to the axis of the first end piece, when the valves are open.

In a second solution, the manoeuvring part is moveable in translation perpendicular to the axis of the fluid vein, and the recess opening from the manoeuvring part does not correspond to a functional surface for manoeu-

vring the roller, a complementary connecting rod with its stop and its torsion spring is not necessary.

The second connecting rod is thus modified in relation to the first solution, in that the positioning of the connecting rods making it possible to transmit the movement to the third valve is different.

In the two solutions described it is also possible to invert the position of the rollers and the recesses to perform the same movement. In this way the first connecting rod, joined in rotation with the manoeuvring shaft of the first valve, defines a first recess and the second connecting rod, joined in rotation with the manoeuvring shaft of the second valve, defines a second recess. By applying this modification for example to the second proposed solution, the two rollers, which cooperate with these recesses, are mounted pivotably on the manoeuvring part which maintains its movement perpendicular to the axis of the fluid vein. The second connecting rod, joined to the manoeuvring shaft of the second valve, therefore has a recess which enables the connection and disconnection of the roller with which it cooperates, when the valves are in a closed position. Preferably, this second roller is released from the recess by an additional displacement of the manoeuvring part not acting on the closed position of the valves, by the fact that the recesses formed by the contact surfaces are parallel to the displacement axis of the manoeuvring part.

Regardless of the type of activation a mechanical system is provided for keeping the three valves closed when the two end pieces are separated, and in particular the two valves at the level of the second end piece, then separated from the manoeuvring part joined to the first end piece. This mechanical system for keeping the two valves of the second end piece closed com-

prises preferably a shaft positioned in pivot connection at one end in relation to the second connecting rod, which slides at its other end into the groove of a bore pivoting around a fixed axis parallel to the other axes, and positioned in such a way that the axes are aligned in this order, only several degrees (about 2 to 10) of rotation before the closed position of the valves, a spring positioned on the shaft between the shoulder of the shaft and the bore, making it possible to accommodate variations in distance between the axes during the rotation of the second connecting rod and to perform the bracing function.

The features and advantages of the present invention are described with reference to the attached figures which are given as non-restrictive examples.

The invention can thus be integrated into an installation for transferring liquefied natural gas (LNG) between a gas terminal 1 and a floating terminal 2 which can be for loading or unloading and is connected to a gas network by pipes located under the sea, said installation comprising in particular a flexible cryogenic pipeline 3 that is floating or semi-floating, supported by the floating terminal 2, as well as a connector/disconnector 4, making it possible to ensure a connection between the terminal 1 and the flexible cryogenic floating pipeline 3, which regroups the QC/DC and ERS devices into a single interface.

Figure 1 shows schematically a “floating” type installation, in which the flexible cryogenic floating pipeline 3 transferring the LNG is arranged in a floating manner on the surface of the water between the two vessels 1 and 2.

Figure 2 is a cross-section of the connector/disconnector 4. It consists of two end pieces 4.1 and 4.2, the end piece 4.1 is positioned on the gas terminal 1 in connection with the manifold whereas end piece 4.2 is fixed to the end of the flexible cryogenic floating pipeline 3. Clamping modules 7 positioned on the end piece 4.1 make it possible to couple or uncouple the two end pieces 4.1 and 4.2 at the level of their interface located in the plane radial to the axis of the pipeline passing through (YY'), so as to connect the pipelines of the terminal 1 with those of the floating terminal 2. At the end of each end piece 4.1 and 4.2 at the level of their interface a butterfly valve 5.1, 5.2 respectively is positioned, shown in closed position, each provided with a disc or butterfly mounted pivotably to the interior of the end piece about a manoeuvring shaft 6.1 and 6.2 respectively, between an opening position of the transverse section of fluid flow and a closed position of the latter, and an external device for controlling the pivoting, the manoeuvring shafts extending perpendicular to the axis (XX') of the pipeline and being parallel to one another. The faces of the two butterflies 5.1 and 5.2 are turned to face one another. A third butterfly valve 5.3 positioned at the other end of the end piece 4.2 pivoting it also about its manoeuvring shaft 6.3 parallel to the manoeuvring shafts 6.1 and 6.2, also shown as closed, makes it possible to ensure a double sealing barrier at the end of the flexible cryogenic floating pipeline 3 following the disconnection of the two end pieces 4.1 and 4.2 of the connector/disconnector 4. An approach and guiding system (not shown) of the two end pieces 4.1 and 4.2 makes it possible in particular, at the end of a connection manoeuvre and at the beginning of a disconnection manoeuvre to ensure a coaxiality and angular orientation between the two end pieces 4.1 and 4.2, allowing the perfect positioning of one relative to the other.

Figure 3 is a cross-section of the same connector/disconnector 4, but shown with the butterfly valves 5.1, 5.2 and 5.3 open, after rotation in anti-clockwise direction in relation to figure 2.

Figures 4 to 9 show schematically a first solution of the device for activating the butterfly valves, a mechanism for the transformation of the displacement of the manoeuvring actuator, parallel to the axis of the fluid vein, in a joint pivoting of the butterflies of the three valves with the possibility of coupling and uncoupling from this mechanism respectively during the connection or disconnection of the transfer system.

On the outside of the pipeline, the connecting rods 8.1, 8.2 and 8.3 are fixed respectively to the end of the manoeuvring shafts 6.1, 6.2 and 6.3 of the butterfly valves, in such a way that they are parallel to one another and slightly inclined in clockwise direction relative to the axis (XX') of the pipeline when the butterfly valves are in an open position (see figure 8). The rollers 9.1 And 9.2 are positioned respectively at the right end of the connecting rods 8.1 and 8.2 in pivot connection respectively about the axes 20.2 and 20.4, such that the distance between the axes 6.1 and 20.2 and between the axes 6.2 and 20.4 are identical. At the other end of the connecting rod 8.1 a complementary connecting rod 10 is positioned in pivot connection about the axis 20.1, the other end of which is provided with a "U"-shaped recess 21 so as to cooperate with the axis 20.3 joined to the connecting rod 8.3, such that the distance between the axes 6.1 and 20.1 and between axes 6.2 and 20.3 are identical. The connecting rods 8.1 and 8.2 are parallel, the quadrilaterals formed by the axes 6.1, 6.2, 20.3 and 20.1 on the one hand and by the axes 6.1, 6.2, 20.4 and 20.2 on the other hand form deformable parallelograms.

One connecting rod 19.2 is mounted in pivot connection at one end with the connecting rod 8.2 for example about the axis 20.4, and also in pivot connection at its other end with the connecting rod 8.3 about the axis 20.6, in such a way that the distance between the axes 6.2 and 20.4 on the one hand and between the axes 6.3 and 20.6 on the other hand is identical. A connecting rod 19.1 is mounted in pivot connection at one end with connecting rod 8.2 for example about axis 20.3, and also in pivot connection at its other end with the connecting rod 8.3 about the axis 20.5, such that the distance between the axes 6.2 and 20.3 on the one hand and between the axes 6.3 and 20.5 on the other hand is identical. The connecting rods 8.2 and 8.3 are parallel and the quadrilaterals formed by the axes 6.2, 6.3, 20.6 and 20.4 on the one hand and by the axes 6.2, 6.3, 20.5 and 20.3 on the other hand form deformable parallelograms. Preferably, the axes 20.5 and 20.6 are an equal distance from the axis 6.3, consequently the axes 20.3 and 20.4 are preferably an equal distance from the axis 6.2.

An actuator 29 (represented in cross section) enables the displacement of a manoeuvring part 11 by means of its ram 28 connected to the latter by the axis 30. The cooperation between the tabs 33 of the manoeuvring part 11 and the grooves 32 of the guide 31 joined to the end piece 4.1 gives this manoeuvring part 11 a single degree of freedom, which is a translation movement parallel to the axis (XX') of the pipeline.

Said manoeuvring part 11 is in the same plane as the rollers 9.1 and 9.2, for example in a plane above the connecting rods 8.1 and 8.2.

The roller 9.1 is positioned initially in the recess of the manoeuvring part 11 located between the contact surfaces 12 and 16.

When the end pieces 4.1 and 4.2 are not in contact (before a service connection or following a disconnection of the transfer system), the axis 20.3 joined to the end piece 4.2, therefore not being in connect with the complementary connecting rod 10, a torsion spring 22 positioned on the axis 20.1 exerts a rotational force on the complementary connecting rod 10 in anticlockwise direction about the axis 20.1 so as to hold it in position against the stop 23 fixed to the connecting rod 8.1.

The arrows shown at the level of the manoeuvring shafts 6.1, 6.2 and 6.3 symbolise the position of the corresponding butterfly valves in relation to the axis (XX') of the pipeline. The plane radial to the axis of the pipeline passing through the axis (YY') corresponds to the interface between the end pieces 4.1 and 4.2.

The actuator 28, 29 can also be positioned in reverse, such that its large section operates on opening the valves.

Figure 4 shows the device when the end pieces 4.1 and 4.2 are connected and the butterfly valves 5.1, 5.2 and 5.3 are closed. The manoeuvre of opening the butterfly valves is triggered by upwards translation of the manoeuvring part 11. The contact surface 16 of the manoeuvring part 11 drives the roller 9.1 which causes rotation in anti-clockwise direction of the connecting rod 8.1 with the manoeuvring shaft 6.1, which itself drives by means of the complementary connecting rod 10 the identical rotation of the connecting rod 8.2 with the manoeuvring shaft 6.2, which itself drives by means of the connecting rods 19.1 and 19.2 the identical rotation of the connecting rod 8.3 with the manoeuvring shaft 6.3.

Figure 5 is a cross section of Figure 4 which shows the parts of a guiding and actuation principle of the manoeuvring part 11 joined to the end piece 4.1.

Figure 6 shows the mechanism in a degree of intermediate rotation when the connecting rods 8.1, 8.2 and 8.3 are perpendicular to the axis (XX') of the pipeline.

The recess 18 allows the coupling, during a service connection, of the transformation mechanism in that the roller 9.2 comes into contact with the contact surface 13 of the manoeuvring part 11, and contrariwise allows the release during a disconnecting operation. The complementary connecting rod 10 thus allows the transmission of the opening movement of the butterfly valves to the connecting rod 8.2, then 8.3 by way of the connecting rods 19.1 and 19.2 until the roller 9.2 arrives at the level of the contact surface 17 of the manoeuvring part 11, the latter directly guiding the connecting rods 8.1 and 8.2 in rotation, this state of the kinematics being represented by Figure 7.

Figure 8 shows the mechanism in the position corresponding to the open position of the butterfly valves, after maximum translation to the top of the manoeuvring part 11. In this position, recesses in a “U” shape 14 and 15 on the contact surfaces of the manoeuvring part 11 make it possible to improve the holding in position of the rollers 9.1 and 9.2 cancelling the functional play between the rollers and recesses. As a result the butterfly valves 5.1, 5.2 and 5.3 remain perfectly open during the transfer of fluid, preventing any oscillation caused by the flow of fluid or their own weight.

The butterfly valves 5.1, 5.2 and 5.3 thus in open position, a closing manoeuvre of the valves is triggered by the inverse movement, i.e. translation downwards of the manoeuvring part 11, the contact surface 12 of which causes rotation in clockwise direction of the connecting rod 8.1 by means of the roller 9.1, and the contact surface 12 of which causes the identical rotation of the connecting rods 8.2 by means of the roller 9.2, by way of a slight initial inclination of the connecting rods 8.1 and 8.2 in relation to the axis (XX'). Thus in the case of a closing manoeuvre, the complementary connecting rod 10 does not have a mechanical function. As with the opening this movement involves the identical rotation of the connecting rod 8.3 by means of the connecting rods 19.1 and 19.2.

A single translation movement of the manoeuvring part 11 therefore involves the simultaneous rotation of the three butterfly valves 5.1, 5.2 and 5.3 in opening as in closing respectively by means of manoeuvring shafts 6.1, 6.2 and 6.3.

Figure 9 shows the mechanism when the end pieces 4.1 and 4.2 are close to completing a connection phase or at the beginning of a disconnection manoeuvre of the transfer system, the butterflies valves 5.1, 5.2 and 5.3 being of course closed when the end pieces 4.1 and 4.2 are not connected. The kinematics of the device is therefore as in Figure 4. The recess 18 of the manoeuvring part 11 thus allows the arrival or departure of the roller 9.2 respectively in connection or disconnection. Furthermore, the complementary connecting rod 10 being positioned by the torsion spring 22 which maintains it in anticlockwise rotation against the stop 23, its “U”-shaped recess 21 oriented by the axis (XX') of the pipeline, allows the arrival or departure of the axis 20.3 with the connecting rod 8.2. These two recesses thus make it possible to connect and disconnect the kinematics of the de-

vice respectively during a connection or disconnection of the end pieces 4.1 and 4.2.

Figures 10 to 14 show schematically a second solution of the device for activating the butterfly valves, a mechanism for the transformation of the displacement of the actuator perpendicular to the axis of the fluid vein into a joint pivoting of the butterflies of the threes valves, with the possibility of coupling and uncoupling from this mechanism respectively during a connection or disconnection of the transfer system.

On the exterior of the pipeline, connecting rods 34.1, 34.2 and 34.3 are fixed respectively to the end of the manoeuvring shafts 6.1, 6.2 and 6.3 of the butterfly valves. At one end of the connecting rods 34.1 and 34.2 rollers 9.1 and 9.2 are positioned respectively in pivot connection respectively about the axes 20.9 and 20.10, in such a way that the straight segments between the manoeuvring shaft 6.1 and the axis 20.9 on the one hand and the manoeuvring shaft 6.2 and the axis 20.10 on the other hand are parallel and the same length and are inclined in clockwise direction in relation to the axis (XX') of the fluid vein when the butterfly valves 5.1 and 5.2 are in a closed position.

A connecting rod 19.1 is mounted in pivot connection at one end to the triangular connecting rod 34.2 about the axis 20.7, and also in pivot connection at its other end with the connecting rod 34.3 about the axis 20.5, in such a way that the segments formed by the axes 6.2 and 20.7 on the one hand by the axes 6.3 and 20.5 on the other hand are parallel and the same length. A connecting rod 19.2 is mounted in pivot connection at one end to the connecting rod 34.2 around the axis 20.8, and also in pivot connection at its other end with the connecting rod 34.3 about the axis 20.6, in such a

way that the segments formed by the axes 6.3 and 20.6 on the other hand are parallel and the same length. Thus the quadrilaterals formed by the axes 6.2, 20.7, 20.5 and 6.3 on the one hand and by the axes 6.2, 20.8, 20.6 and 6.3 on the other hand represent deformable parallelograms. Preferably, the axes 20.7 and 20.8 are located at an equal distance from the manoeuvring shaft 6.2, consequently the axes 20.5 and 20.6 are preferably located at an equal distance from the manoeuvring shaft 6.3.

An actuator 29 (shown in cross section) allows the displacement of a manoeuvring part 42 by means of its ram 28 connected to the latter by the axis 30. The cooperation between the tabs 33 of the manoeuvring part 42 and the grooves 32 of the guide 31 joined to the end piece 4.1 gives this manoeuvring part 42 a single degree of freedom which is a translation movement perpendicular to the axis (XX') of the fluid vein.

This manoeuvring part 42 is in the same plane as the rollers 9.1 and 9.2. For space reasons the connecting rods 34.1 and 34.2 cannot be in the same plane. In relation to the axis (XX') of the fluid vein, the connecting rod 34.1 is for example located below the manoeuvring part 42, itself located below the connecting rod 34.2, itself located below the connecting rods 19.1 and 19.2.

The roller 9.1 is initially positioned in the recess of the manoeuvring part 42 located between the contact surfaces 35 and 37.

The arrows shown at the level of the manoeuvring shafts 6.1, 6.2 and 6.3 symbolise the position of the corresponding butterfly valves in relation to the axis (XX') of the fluid vein. The plane radial to the pipeline axis pass-

ing through the axis (YY') corresponds to the interface between the end pieces 4.1 and 4.2.

Figure 10 shows the device when the end pieces 4.1 and 4.2 are connected and the butterfly valves 5.1, 5.2 and 5.3 are closed. The opening manoeuvre of the butterfly valves is caused by the translation to the left of the manoeuvring part 42. The contact surface 35 of the manoeuvring part 42 guides the roller 9.1, which causes rotation in anticlockwise direction of the connecting rod 34.1 with the manoeuvring shaft 6.1 and at the same time the contact surface 36 of the manoeuvring part 42 guides the roller 9.2, which also causes rotation in anticlockwise direction of the connecting rod 34.2 with the manoeuvring shaft 6.2 and the rotation of the connecting rod 34.3 with the manoeuvring shaft 6.3 by means of the connecting rods 19.1 and 19.2.

Figure 11 shows the mechanism in an intermediate degree of rotation when the segments formed by the axes 6.1 and 20.9 on the one hand and 6.2 and 20.10 on the other hand are parallel to the axis (XX') of the fluid vein.

Figure 12 shows the mechanism in an intermediate degree of rotation, slightly before the full opening of the butterfly valves 5.1, 5.2 and 5.3.

Figure 13 shows the mechanism in the position corresponding to the open position of the butterfly valves after the maximum translation to the left of the manoeuvring part 42. In this position the recesses in a “U” shape 39 and 40 respectively on the contact surfaces 35 and 36 of the manoeuvring part 42, make it possible to improve the holding in position of rollers 9.1 and 9.2 by cancelling the functional play between the rollers and recesses. As a result the butterfly valves 5.1, 5.2 and 5.3 remain perfectly open dur-

ing the transfer of fluid, preventing any oscillation caused by the flow of fluid or by their own weight.

The butterfly valves 5.1, 5.2 and 5.3 in open position, a closing manoeuvre of the valves is triggered by the inverse movement, i.e. the translation to the right of the manoeuvring part 42, of which the contact surface 37 triggers the rotation in clockwise direction of the connecting rod 34.1 by means of the roller 9.1 and of which the contact surface 38 triggers at the same time the identical rotation of the connecting rod 34.2 by means of the roller 9.2. As when open, this movement involves the identical rotation of the connecting rod 34.3 by means of connecting rods 19.1 and 19.2.

A single translation movement of the manoeuvring part 42 therefore involves the simultaneous rotation of the three butterfly valves 5.1, 5.2 and 5.3 when opening and closing respectively by means of the manoeuvring shafts 6.1, 6.2 and 6.3.

Figure 14 shows the mechanism when the end pieces 4.1 and 4.2 are approaching a connection phase or at the beginning of a disconnection phase of the transfer system, the butterfly valves 5.1, 5.2 and 5.3 are of course closed when the end pieces 4.1 and 4.2 are not connected. The kinematics of the device is as shown in Figure 10. The recess 41 of the manoeuvring part 42 thus allows the departure or arrival of the roller 9.2 respectively during a connection or disconnection phase of the end pieces 4.1 and 4.2.

In the present case of a connector grouping the QC/DC and ERS device into a single interface, the guiding system (not shown) makes it possible to ensure coaxiality between the two end pieces 4.1 and 4.2 and therefore a perfect alignment between the roller 9.2 and the recess of the manoeuvring

part 42 located between the contact surfaces 36 and 38, whether in a connection or disconnection phase (service or emergency).

In a not shown instance of a "standard" connector clearly separating the service connection/disconnection devices and emergency disconnection, the separation between the roller 9.2 and the manoeuvring part 42 is performed only in the case of an emergency disconnection. In this case the LNG connector (for which the guiding system is only effective in service operations) and the activating system of its valves should be arranged in such a way as to perform an emergency separation without locking.

This second type of activation is preferable to the first from a mechanical point of view as the manoeuvring part acts directly on the two manoeuvring shafts 6.1 and 6.2 during the whole opening and closing, contrary to the first solution which requires in particular the use of an intermediate connecting rod.

In the two solutions described above it is also possible to invert the position of the rollers and recesses to perform the same movement. For example, by applying this modification to the second proposed solution, the rollers are inserted on the manoeuvring part, which retains its movement perpendicular to the axis of the fluid vein, whereas the recesses which cooperate with the rollers are positioned in connecting rods joined to the manoeuvring shafts of the butterfly valves.

Figures 15 to 21 show schematically a new solution for the device for activating butterfly valves, a mechanism for the transformation of the displacement of the manoeuvring actuator perpendicular to the axis of the fluid vein into a joint pivoting of the butterflies of the three valves, with the

option of coupling and decoupling respectively from this mechanism, during a connection or disconnection of the transfer system.

On the exterior of the pipeline the connecting rods 43.1, 43.2 and 43.3 are secured respectively to the end of the manoeuvring shafts 6.1, 6.2 and 6.3 of the butterfly valves. At one end of the connecting rods 43.1 and 43.2 a recess formed by the contact surfaces 45, 47, 49 and 51 and an outlet recess formed by the contact surfaces 46, 48, 50 and 52 are positioned respectively.

An actuator 29 (shown in cross section) allows the displacement of a manoeuvring part 44 by means of its ram 28 connected to the latter by the axis 30. The cooperation between the tabs 33 of the manoeuvring part 44 and the grooves of the guide 31 joined to the end piece 4.1 gives said manoeuvring part 44 a single degree of freedom which is a translation movement perpendicular to the axis (XX') of the fluid vein.

The manoeuvring part 44 comprises rollers 9.1 and 9.2 mounted in pivot connection respectively about the axes 20.11 and 20.12, such that the straight segments between the manoeuvring shaft 6.1 and the axis 20.11, on the one hand, and between the manoeuvring shaft 6.2 and the axis 20.12, on the other hand, are parallel and of the same length and preferably are inclined in clockwise direction in relation to the axis (XX') of the fluid vein, when the butterfly valves 5.1 and 5.2 are in a closed position.

The roller 9.1 is positioned initially in the recess of the connecting rod 43.1 formed by the contact surfaces 45, 47, 49 and 51. The roller 9.2 is guided to cooperate with the outlet recess of the connecting rod 43.2 formed by the contact surfaces 46, 48, 50 and 52.

A connecting rod 19.1 is mounted in pivot connection at one end with the connecting rod 43.2 about the axis 20.7 and also in pivot connection at its other end with the connecting rod 43.3 about the axis 20.5 such that the segments formed by the axes 6.2 and 20.7 on the one hand, and by the axes 6.3 and 20.5 on the other hand are parallel and the same length. A connecting rod 19.2 is mounted in pivot connection at one end with the connection rod 43.2 about the axis 20.8 and also in pivot connection at its other end with the connecting rod 43.3 about the axis 20.6, such that the segments formed by the axes 6.2 and 20.8 on the one hand and by the axes 6.3 and 20.6 on the other hand are parallel and the same length. Thus the quadrilaterals formed by the axes 6.2, 20.7, 20.5 and 6.3 on the one hand and by the axes 6.2, 20.8, 20.6 and 6.3 on the other hand represent deformable parallelograms. Preferably, the axes 20.7 and 20.8 are located an equal distance from the manoeuvring shaft 6.2, consequently the axes 20.5 and 20.6 are preferably located an equal distance from the manoeuvring shaft 6.3.

For reasons of space the connecting rods 43.1 and 43.2 cannot be in the same plane. In relation to the axis (XX') of the fluid vein the connecting rod 43.1 and the roller 9.1 are, for example, located below the manoeuvring part 44, itself located below the connecting rod 43.2 and the roller 9.2, themselves located below the connecting rods 19.1 and 19.2.

The arrows shown at the level of the manoeuvring shafts 6.1, 6.2 and 6.3 symbolise the position of the corresponding butterfly valves in relation to the axis (XX') of the fluid vein. The plane radial to the axis of the pipeline passing through the axis (YY') corresponds to the interface between the end pieces 4.1 and 4.2.

Figure 15 shows the device when the end pieces 4.1 and 4.2 are connected and the butterfly valves 5.1, 5.2 and 5.3 are closed. The contact surfaces 49 and 51 of the connecting rod 43.1 and the face 50 of the connecting rod 43.2 are, in this case, parallel to the displacement axis of the actuator 28, 29 and therefore of the manoeuvring part 44, such that after the complete closure of the valves, an additional return of the ram 28 of the actuator 29 frees the roller 9.2 completely to thus allow a separation between the end pieces 4.1 and 4.2 parallel to the axis (XX') of the fluid vein.

Figure 16 shows the device when the end pieces 4.1 and 4.2 are connected and the butterfly valves 5.1, 5.2 and 5.3 are closed but after a displacement at the output of the ram 28 of the actuator 29, until the rollers 9.1 and 9.2 come respectively into contact with the contact surface 47 and 48.

Figure 17 shows the device after an additional output of the ram 28 of the actuator 29 which enables the rollers 9.1 and 9.2 to come respectively into contact with the contact surfaces 47 and 48 and therefore to guide the rotation in the anticlockwise direction of the connecting rod 43.1 and the shaft 6.1 and, at the same time, of the connecting rod 43.2 and the manoeuvring shaft 6.2 which also at the same time causes the rotation in anticlockwise direction of the connecting rod 43.3 and the shaft 6.3 by means of the connecting rods 19.1 and 19.2.

Figure 18 shows the device in an intermediate degree of rotation, when the segments formed by the axes 6.1 and 20.11 on the one hand and 6.2 and 20.12 on the other hand are parallel to the axis (XX') of the fluid vein.

Figure 19 shows the device in a position corresponding to the open position of the butterfly valves after the maximum output of the ram 28 of the ac-

tuator 29. In this position, unlike preceding solutions, a “U”-shaped recess for ensuring the position of the valves in an open position is not necessary because the direction of contact between the rollers 9.1 and 9.2 and the respective contact surfaces 47 and 48 is radial.

The butterfly valves 5.1, 5.2 and 5.3 thus in open position, a closing movement of the valves is triggered by the inverse movement, i.e. the return of the ram 28 of the actuator 29 and therefore the translation towards the right of the manoeuvring part 44, the contact surface 45 of which triggers rotation in clockwise direction of the connecting rod 43.1 by means of the roller 9.1 and the contact surface 46 of which triggers at the same time the identical rotation of the connecting rod 43.2 by means of the roller 9.2. As when open this movement involves the identical rotation of the connecting rod 43.3 by means of the connecting rods 19.1 and 19.2.

A single translation movement of the manoeuvring part 44 therefore involves the simultaneous rotation of the three butterfly valves 5.1, 5.2 and 5.3 when open and closed respectively by means of the manoeuvring shafts 6.1, 6.2 and 6.3.

Figure 20 shows the device when the end pieces 4.1 and 4.2 are approaching a connection phase or at the start of a disconnection manoeuvre of the transfer system, the butterfly valves 5.1, 5.2 and 5.3 being of course closed while the end pieces 4.1 and 4.2 are not connected. The kinematics of the device is as shown in Figure 15. The recess of the connecting rod 43.2 located between the faces 50 and 52 thus allows the departure or the arrival of the roller 9.2 respectively during a connection or disconnection phase of the end pieces 4.1 and 4.2.

In the present case of a connector grouping the QC/DC and ERS devices into a single interface, the guiding system (not shown) makes it possible to ensure coaxiality between the two end pieces 4.1 and 4.2 and therefore a perfect alignment between the roller 9.2 and the recess of the connecting rod 43.2 located between the faces 50 and 52, either in a connection or disconnection phase (when in service or in an emergency).

In the not shown case of a "standard" connector clearly separating the connection/disconnection service and emergency disconnection devices, the separation between the roller 9.2 and the manoeuvring part 44 is performed solely in the case of an emergency disconnection. In this case the LNG connector (the guiding system of which is only effective in service) and the actuation system of its valves should be arranged so as to perform an emergency separation without locking.

This last solution for the actuation has all of the advantages of the second proposed solution. Furthermore, after completing the closure of the butterfly valves, an additional return of the ram 28 of the actuator 29 makes it possible to free the roller 9.2 in view of a disconnection of the transfer system. Owing to the fact that after the complete closure of the butterfly valves an additional translation of the manoeuvring part does not affect the position of the butterflies, it is possible to provide a system for locking the butterflies in a closed position. Also it is thus easier to provide a mechanical interlock consisting of allowing the opening of a disconnection collar (usually known as an ERC) between the two end pieces only when the valves are closed, in the manner of a "standard" type connector/disconnector.

A complementary device is thus integrated into at least one of the connecting rods with the butterfly valves 5.2 to 5.3 (their actuation being connected) in such a way that following a disconnection of the connector-disconnector 4, the butterfly valves positioned on the end piece 4.2, thus disconnected from their actuation position on the end piece 4.1, are held in a closed position to prevent any spillage of fluid into the environment. This device for holding in a closed position is shown schematically in Figures 21, 22, 23 and 24 for example at the level of the connecting rod 8.2 which allows the manoeuvring of the butterfly valve 5.2 by means of the manoeuvring shaft 6.2. The latter as well as the roller 9.2 are shown as transparent to simplify the representation given that the device for holding a closed position is located in a lower plane than the connecting rods 8.1 and 8.2 so as not to interact before the manoeuvring part 11.

A shaft 24, positioned in pivot connection at one end in relation to the connecting rod 8.2 for example about the axis 20.4, slides at its other end into the groove of a bore 25 pivoting about a fixed axis 27 parallel to axes 6.2 and 20.4 and positioned in such a way that the axes 6.2, 26 and 20.4 are aligned only several degrees of rotation before the closed position of the butterfly valve 5.2. A spring 26 positioned on the shaft 24 between the shoulder of the shaft 24 and the bore 25, makes it possible in particular to accommodate variations in distance between the axes 20.4 and 27 during the rotation of the connecting rod 8.2.

Figure 21 shows the mechanism when the position of the connecting rod 8.2 corresponds to the open position of the butterfly valve 5.2. The spring 26 is in this case decompressed.

A closing manoeuvre of the butterfly valves involves the rotation in the clockwise direction of the connecting rod 8.2, which causes on the one hand the sliding of the shaft 24 across the groove of the bore 25 at the same time as the rotation of the bore 25 in clockwise direction about its axis 27, and on the other hand the compression of the spring 26 from bringing together the axes 2.4 and 27. Figure 22 thus shows the mechanism in an intermediate degree of rotation.

Figure 23 shows the mechanism at several degrees of rotation only before the end of closure when the axes 6.2, 27 and 20.4 are aligned. The axes 20.4 and 27 are in their closest position during the movement, the spring 26 is at maximum compression.

Figure 24 shows the mechanism when the butterfly valve 5.2 is in a closed position, the connecting rod 8.2 is therefore at its maximum degree of rotation in clockwise direction. The spring 26 is now in part decompressed, the distance between the axes 27 and 20.4 being greater than in Figure 23. The axis 20.4 is therefore below the line formed by the axes 6.2 and 27, which corresponds to the locking of the kinematics by mechanical bracing, the "dead centre" in Figure 23 being exceeded.

Thus when the end piece 4.2 is detached from the end piece 4.1 on which the manoeuvring part 11 is positioned, the butterfly valves 5.2 and 5.3 of the end piece 4.2, which are no longer within the range of the manoeuvring part 11 by means of the roller 9.2 are kept closed, the butterfly valve 5.1 of the end piece 4.1 being in part kept closed by the action of the manoeuvring part on the roller 9.1. The assembly of the mechanism has a protection fairing (not shown) in order to avoid any contact with external elements which could unbrace them, only the manoeuvring part 11 is thus

able, after a reconnection of the end pieces 4.1 and 4.2, to overcome the compression of the spring 26 up to the “dead centre” of Figure 23 to reopen the butterfly valves 5.1, 5.2 and 5.3.

PATENTKRAV

1. Installation til at overføre fluid, omfattende en fleksibel flydende kryogenrørledning (3), som bringer et navigationsfartøj (1) i forbindelse med et andet fartøj (2) og omfatter et første endestykke (4.1) til siden mod navigationsfartøjet og et andet endestykke (4.2) til siden mod det andet fartøj, ved enden af den fleksible kryogene rørledning (3), en forbindelses-/adskillelses-indretning (4) monteret på en i det væsentlige vertikal sektion af rørledningen og som har det første endestykke over det andet endestykke, idet en første ventil (5.1) med en manøvreringsaksel (6.1) er montere ved enden af det første endestykke (4.1) vendende imod det andet endestykke (4.2) og en anden ventil (5.2) med en manøvreringsaksel (6.2) monteret ved enden af det andet endestykke (4.2) vendende imod den første ventil (5.1), **kendetegnet ved, at** ventilerne aktiveres af en enkelt aktuator, som er fælles for begge disse, og en mekanisme er tilvejebragt til at omdanne den translatoriske forskydning af aktuatoren (28, 29) til en fælles drejning af manøvreringsakslerne (6.1, 6.2) for ventilerne (5.1, 5.2), idet transformationsmekanismen er sammensat af to dele, den første forbundet med det første endestykke (4.1), den anden med det andet endestykke (4.2), som er anbragt på en sådan måde, at de forbindes med, hhv. adskilles fra, hinanden, når forbindelses-/adskillelses-indretningen (4) forbindes eller adskilles.

2. Installation ifølge krav 1, **kendetegnet ved, at** den første og anden del af transformationsmekanismen kun er i kontakt ved ét eller to punkter.

3. Installation ifølge krav 1 eller 2, **kendetegnet ved** en tredje ventil (5.3), som aktiveres af den fælles aktuator og med en manøvreringsaksel (6.3) monteret ved den anden ende af det andet endestykke (4.2), som har sin manøvreringsaksel (6.3) parallel med manøvreringsakslerne for de andre ventiler (5.1, 5.2).

4. Installation ifølge ethvert af kravene 1 til 3, **kendetegnet ved, at** en manøvrerings-del (11, 42, 44) er tilvejebragt, som er monteret på det første mobile endestykke (4.1) alene til translation, som er knyttet i fællesskab til ventilerne (5.1, 5.2, 5.3) og hvorpå aktuatoren (28, 29) påfører en forskydningskraft.

5. Installation ifølge krav 4, **kendetegnet ved, at**;

- den første forbindelsesstang (43.1), forbundet rotationsmæssigt med manøvreringsakslen (6.1) for den første ventil (5.1), definerer en første udsparing (45, 47, 49, 51) og
- den anden forbindelsesstang (43.2), forbundet rotationsmæssigt med manøvreringsakslen (6.2) for den anden ventil (5.2), definerer en anden udløbsudsparing (46, 48, 50, 52),
- mekanismen til at transformere forskydningen af delen (42) omfatter:
  - en første rulle (9.1) monteret rullende i den første udsparing (45, 47, 49, 51) omkring en første drejeaksel (20.11) placeret på manøvreringsdelen (44),
  - en anden rulle (9.2) monteret rullende i den anden udløbsudsparing (46, 48, 50, 52) omkring en anden drejeaksel (20.12) placeret på manøvreringsdelen (44),
  - idet linjesegmenterne imellem manøvreringsakslen (6.1) og den første drejeaksel (20.11), på den ene side, og manøvreringsakslen (6.2) og den anden drejeaksel (20.12), på den anden side, er parallelle, har samme længde og fortrinsvis er skråtstillede i en retning med uret i forhold til aksen for rørledningen (XX'), når de to ventiler (5.1, 5.2) er i en lukket position,
  - to forbindelsesstænger (19.1, 19.2), i et hængslet parallelogram, fra den anden forbindelsesstang (43.2) til en tredje forbindelsesstang (43.3), som er forbundet til rotation med manøvreringsakslen (6.3) for den tredje ventil (5.3).

6. Installation ifølge krav 4, **kendetegnet ved, at**:

- manøvreringsdelen (42) definerer en første lukket udsparing (35, 37) og, udmundende til ydersiden, en anden udsparing (36, 38, 41),
- mekanismen til at transformere forskydningen af delen (42) omfatter:
  - en første rulle (9.1) monteret rullende i den første udsparing (35, 37) omkring en første drejeaksel (20.9) placeret ved én af enderne af en første forbindelsesstang (34.1), som er forbundet rotationsmæssigt med manøvreringsakslen (6.1) for den første ventil (5.1),
  - en anden rulle (9.2) monteret rullende i den anden udsparing (36, 38, 41) omkring en anden drejeaksel (20.10) placeret ved én af enderne af en anden forbindelsesstang (34.2), som er forbundet rotationsmæssigt med manøvreringsakslen (6.2) for den anden ventil (5.2),

- idet linjesegmenterne imellem manøvreringsakslen (6.1) og den første drejeaksel (20.9), på den ene side, og manøvreringsakslen (6.2) og den anden drejeaksel (20.10), på den anden side, er parallelle, har samme længde og er skråtstillede i en retning med uret i forhold til aksen for rørledningen, når de to ventiler (5.1, 5.2) er i lukket position,
- to forbindelsesstænger (19.1, 19.2), i et hængslet parallelogram, fra den anden forbindelsesstang (34.2) til en tredje forbindelsesstang (34.3), som er forbundet rotationsmæssigt med manøvreringsakslen (6.3) for den tredje ventil (5.3).

7. Installation ifølge krav 4, **kendetegnet ved, at**
   - manøvreringsdelen (11) definerer en første lukket udsparing (12, 16) og, udmundende til ydersiden, en anden udsparing (13, 17, 18),
   - mekanismen til transformation af forskydningen af delen omfatter:
     - en første rulle (9.1) monteret rullende i den første udsparing (12, 16) omkring en drejeaksel (20.2) placeret ved én af enderne af en første forbindelsesstang (8.1), som er forbundet rotationsmæssigt med manøvreringsakslen (6.1) for den første ventil (5.1),
     - en anden rulle (9.2) monteret rullende i den anden udsparing (13, 17, 18) omkring en drejeaksel (20.4) placeret ved én af enderne af en anden forbindelsesstang (8.2), som er forbundet rotationsmæssigt med manøvreringsakslen (6.2) for den anden ventil (5.2),
     - to forbindelsesstænger (19.1, 19.2), i et hængslet parallelogram, fra den anden forbindelsesstang (8.2) til en tredje forbindelsesstang (8.3), som er forbundet rotationsmæssigt med manøvreringsakslen (6.3) for den tredje ventil (5.3), idet den første, anden og tredje forbindelsesstang (8.1, 8.2, 8.3) er parallelle og har samme længde, og
     - en komplementær forbindelsesstang (10), som er hængslet ved én af sine ender til enden af den første forbindelsesstang (8.1), som afviger fra den med den første rulle (9.1), og som ved sin anden ende omfatter en udsparing (21) for udløselig hængsling af den komplementære forbindelsesstang (10) med enden af den anden forbindelsesstang (8.2), som afviger fra den, som har den anden rulle (9.2), idet længden af den komplementære forbindelsesstang (10), imellem dennes hængslingsakser er lig med den interaksiale afstand imellem de to ruller (9.1, 9.2).

8. Installation ifølge krav 6 eller 7, **kendetegnet ved, at** rulleretningen for rullerne i udsparingerne (12, 16) og (13, 17) eller (35, 37) og (36 og 38) er vinkelret på forskydningsretningen for manøvreringsdelen (11 eller 42).

9. Installation ifølge ethvert af kravene 6 til 8, **kendetegnet ved** en mekanisk indretning, som holder de tre ventiler i en åben position under overføringen, hvilken indretning er dannet især ved det faktum, at manøvreringsdelen (11 eller 42) i hver udsparing definerer et hulrum (14, 15) eller (39, 40), som strækker sig fra den side, som er modstående den tilsvarende manøvreringsaksel (6.1 eller 6.2).

10. Installation ifølge ethvert af kravene 6 til 9, **kendetegnet ved, at** den første og anden forbindelsesstang (8.1, 8.2) er skråtstillede i forhold til forskydningsaksen for manøvreringsdelen (11, 42), når ventilerne er åbne.

11. Installation ifølge ethvert af kravene 7 til 10, **kendetegnet ved, at**:

- et endestop (23) er fastgjort til den første forbindelsesstang (8.1) imellem enden af den første forbindelsesstang (8.1), som er modsat den, hvor den første rulle (9.1) er monteret, og det punkt, hvor den første forbindelsesstang (8.1) er forbundet med manøvreringsakslen (6.1) for den første ventil og
- en fjeder (22) fastholder den komplementære forbindelsesstang (10) imod endestoppet (23), når endestykkerne er adskilt fra hinanden.

12. Installation ifølge ethvert af kravene 1 til 10, **kendetegnet ved** et mekanisk system til at holde de tre ventiler lukkede, når de to endestykker er adskilt.

13. Installation ifølge krav 12, **kendetegnet ved, at** det mekaniske system til at holde de tre ventiler lukkede omfatter en aksel (24), placeret i drejeforbindelse ved én ende i forhold til den anden forbindelsesstang (8.2), som glider ved sin anden ende ind i rillen af en boring (25), drejeligt omkring en fast akse (27), som er parallel med akslerne (6.2) og (20.4) og placeret på en sådan måde, at akslerne (6.2) og (27) og (20.4) er oprettede i denne rækkefølge alene nogle drejegrader før den lukkede position for ventilerne, en fjeder (26) placeret på akslen (24) imellem skulderen på akslen (24) og boringen (25), gør det muligt at give plads for variationer i afstand imellem akslerne (20.4) og (27) under rotationen af den anden forbindelsesstang (8.2) og udføre holdefunktionen.

14. Installation ifølge krav 5, **kendetegnet ved, at** den anden rulle (9.2) frigøres fra udsparingen, som er dannet af kontaktfladerne (46, 48), ved hjælp af en yderligere forskydning af manøvreringsdelen (44), som ikke påvirker den lukkede position for ventilerne ved det faktum, at udsparingerne, som er dannede af kontaktfladerne (49, 51) og (50), er parallelle med forskydningsaksen for manøvreringsdelen (44).

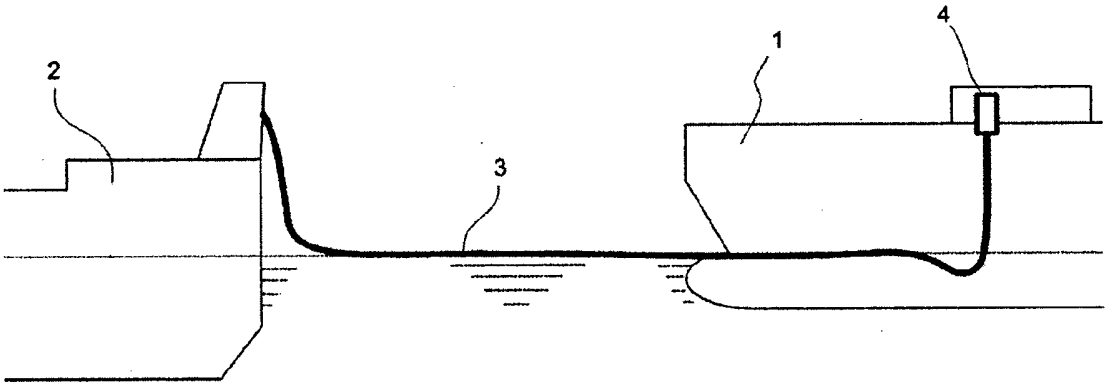

Figure 1

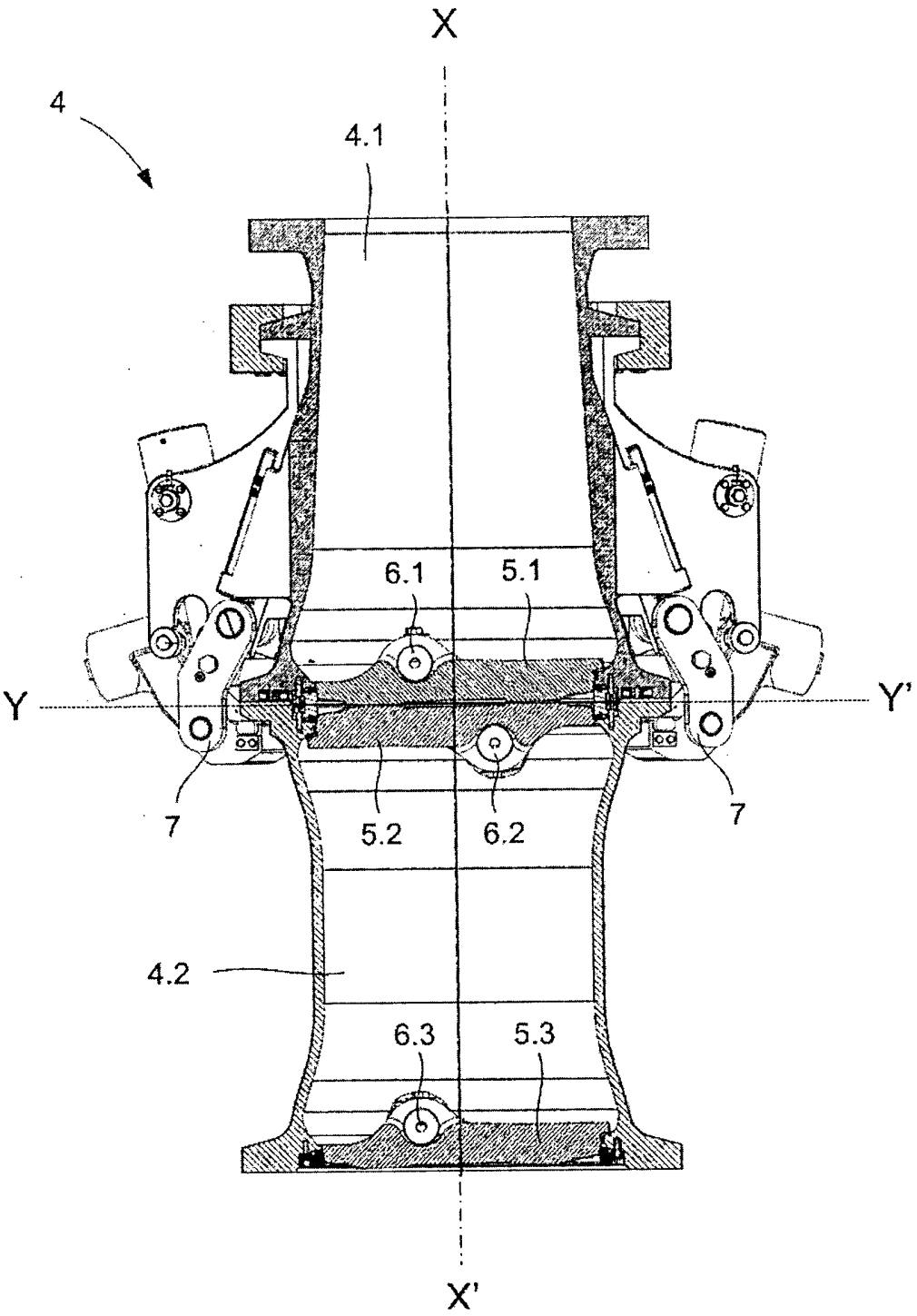

Figure 2

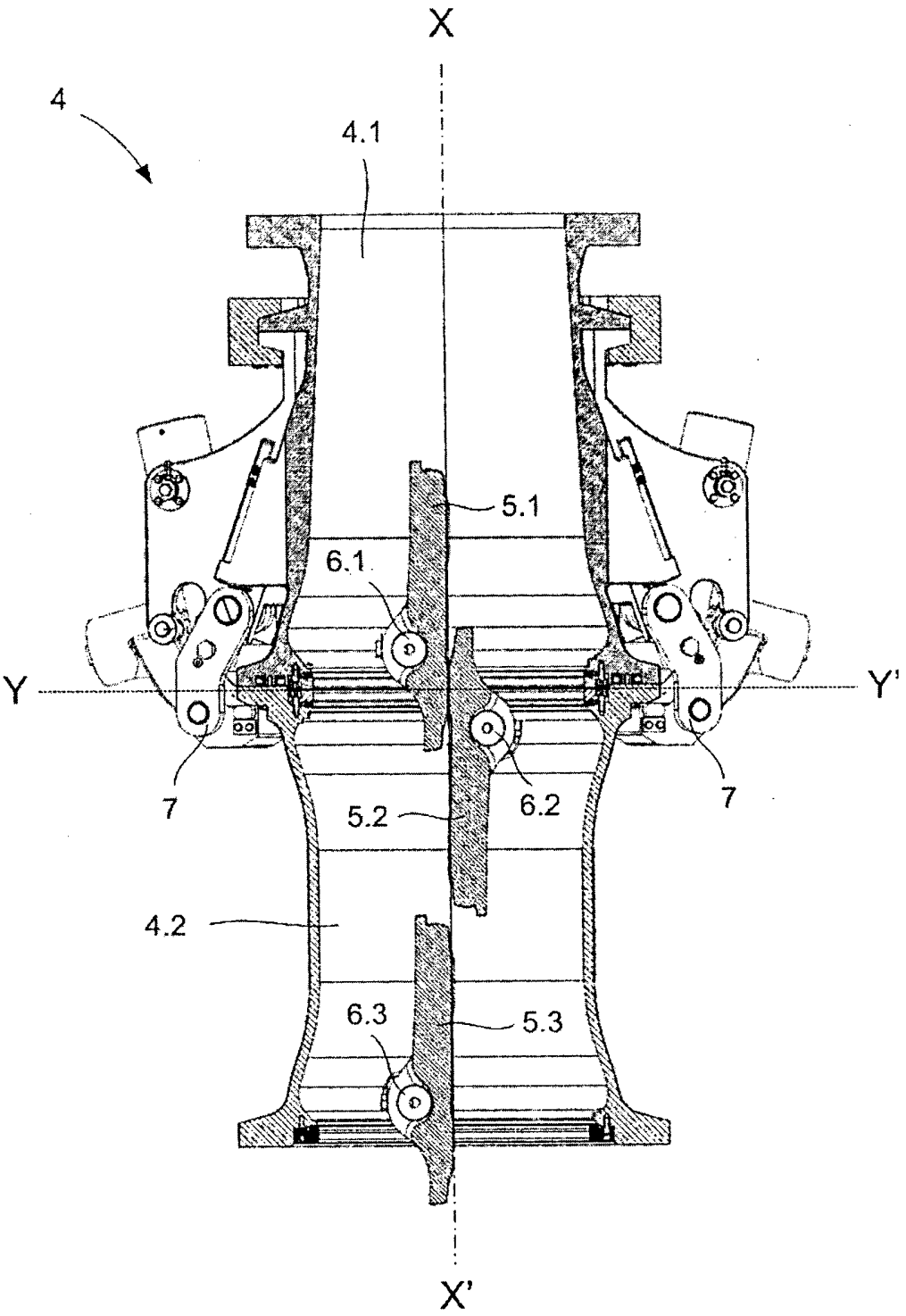

Figure 3

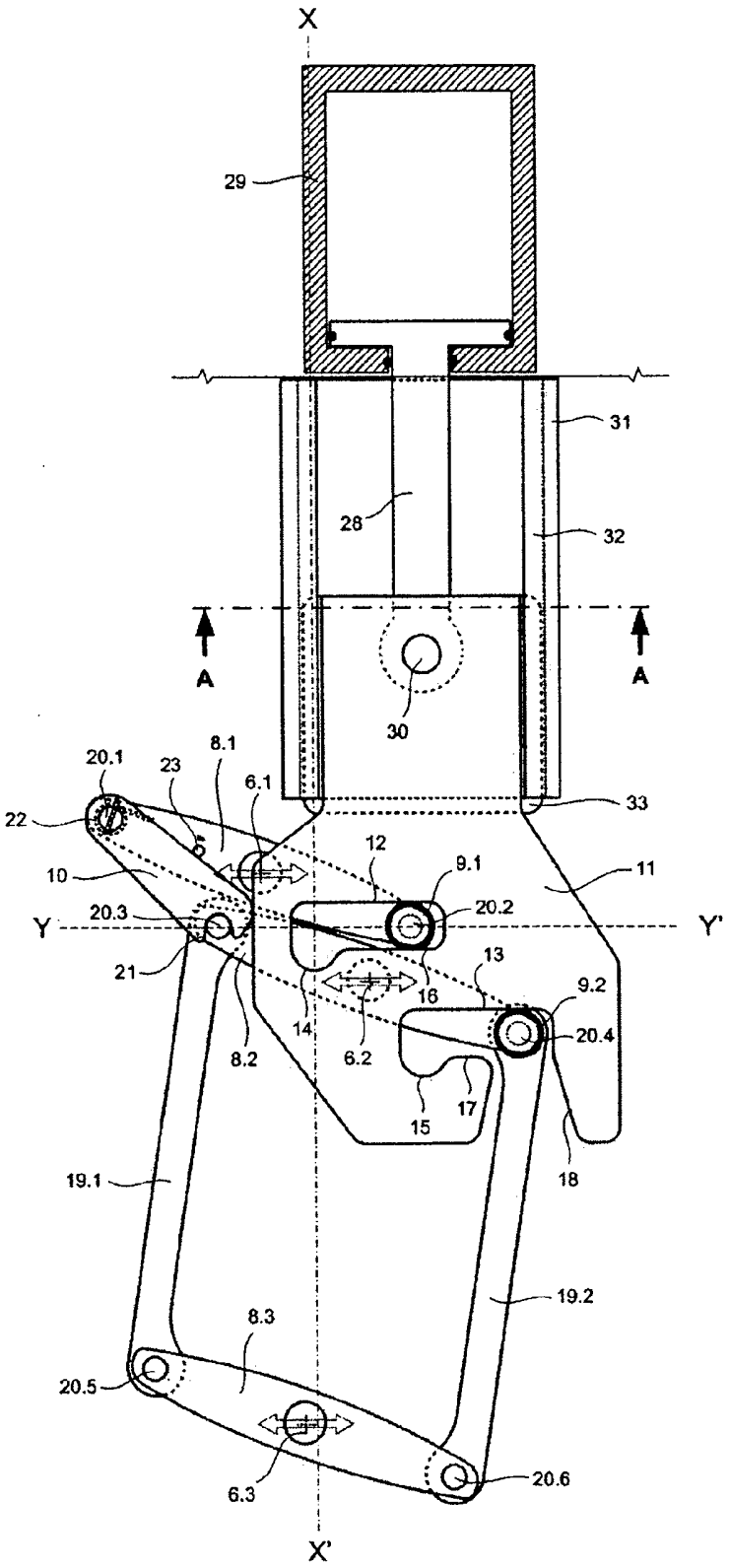
X
29
31
28
32
A
A
30
20.1
23
8.1
6.1
33
22
12
9.1
11
10
20.2
Y
20.3
Y'
21
16
13
9.2
14
6.2
20.4
8.2
15
17
18
19.1
19.2
8.3
20.5
6.3
20.6
X'

Figure 4

A - A

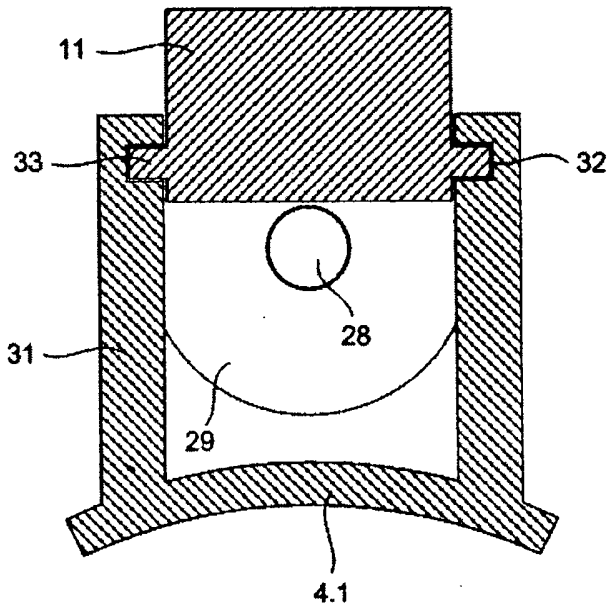

Figure 5

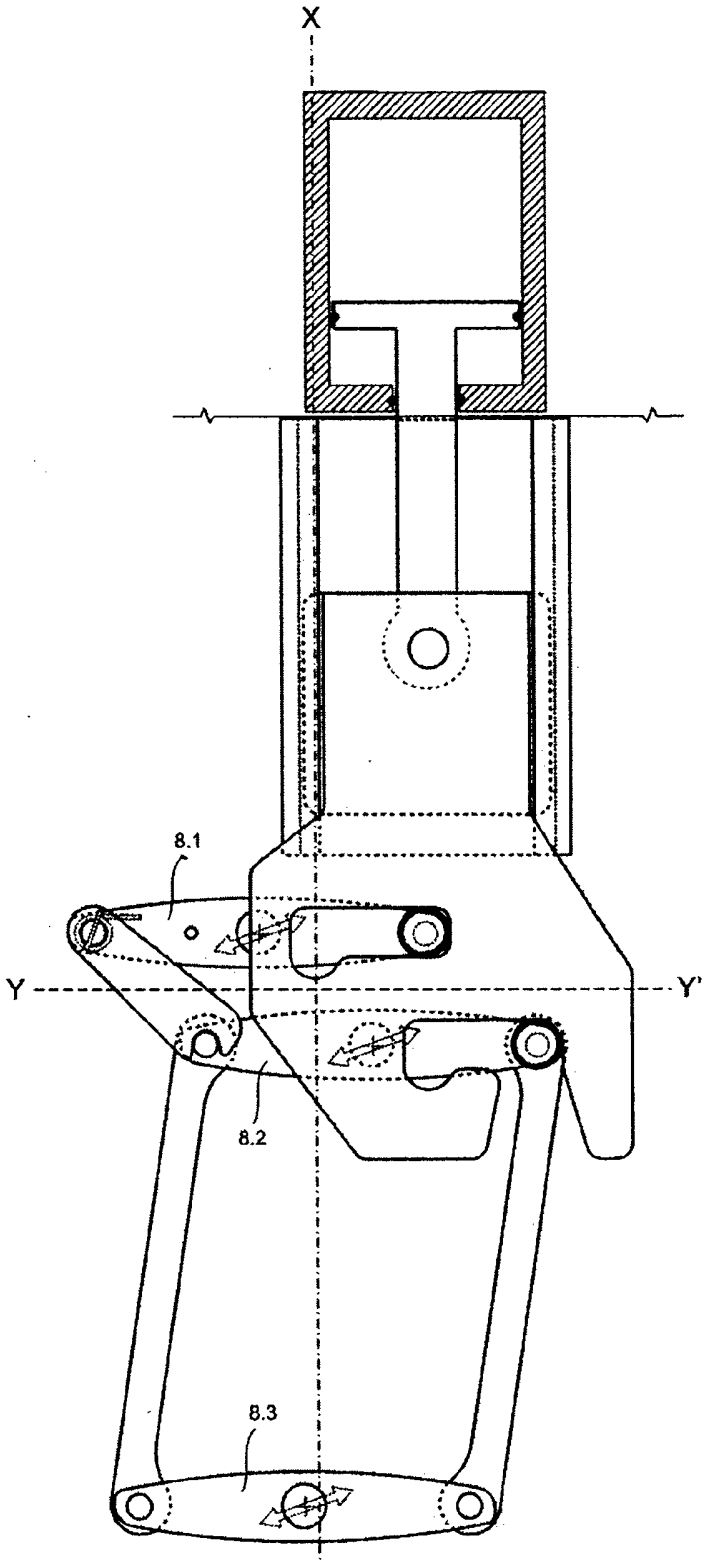

Figure 6

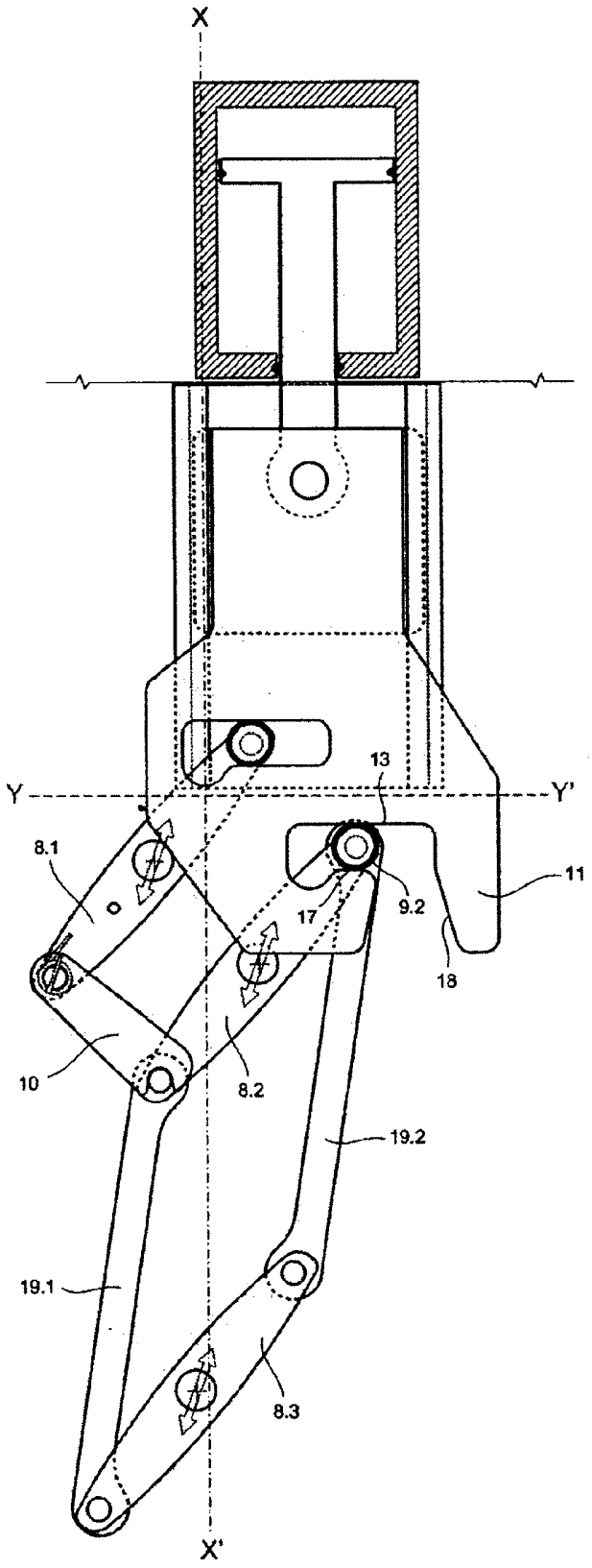

Figure 7

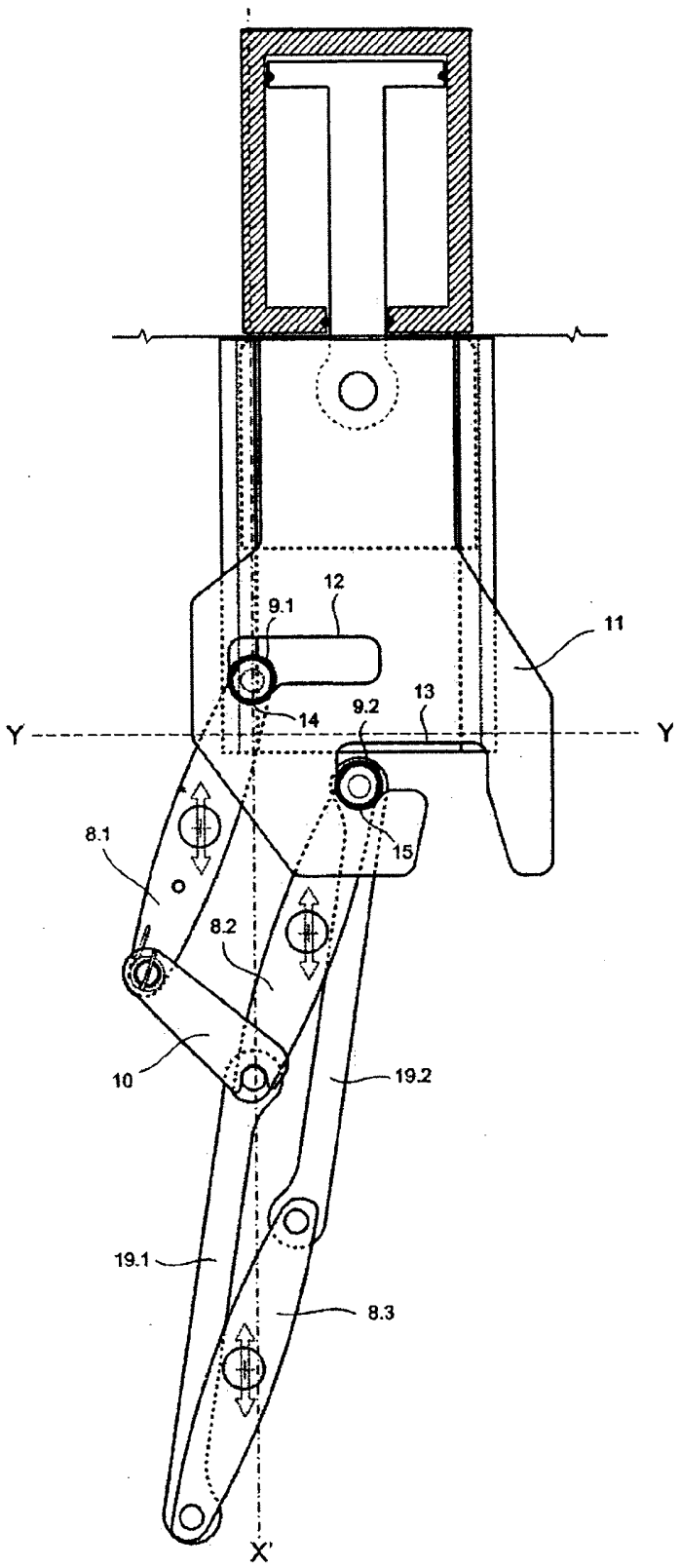

Figure 8

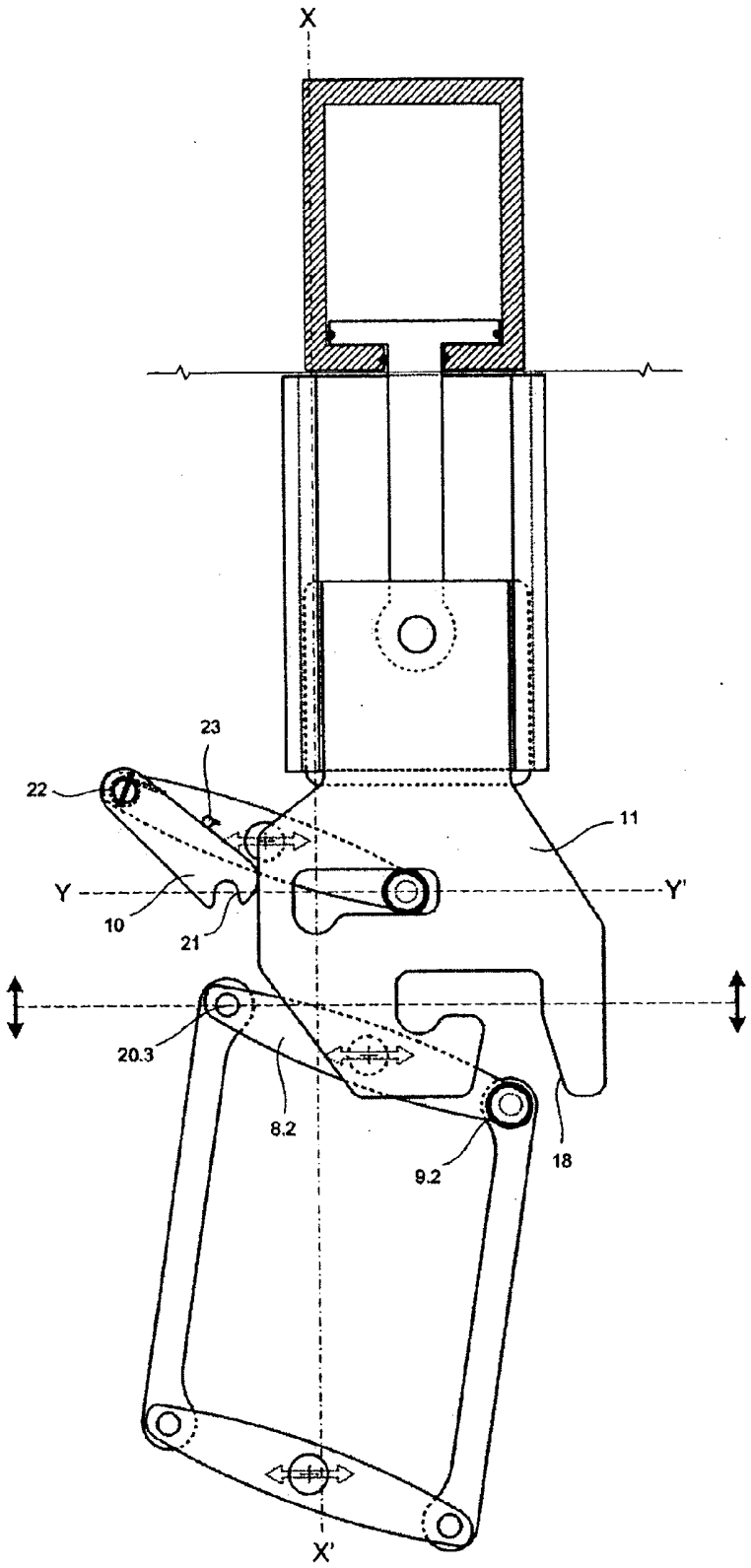

Figure 9

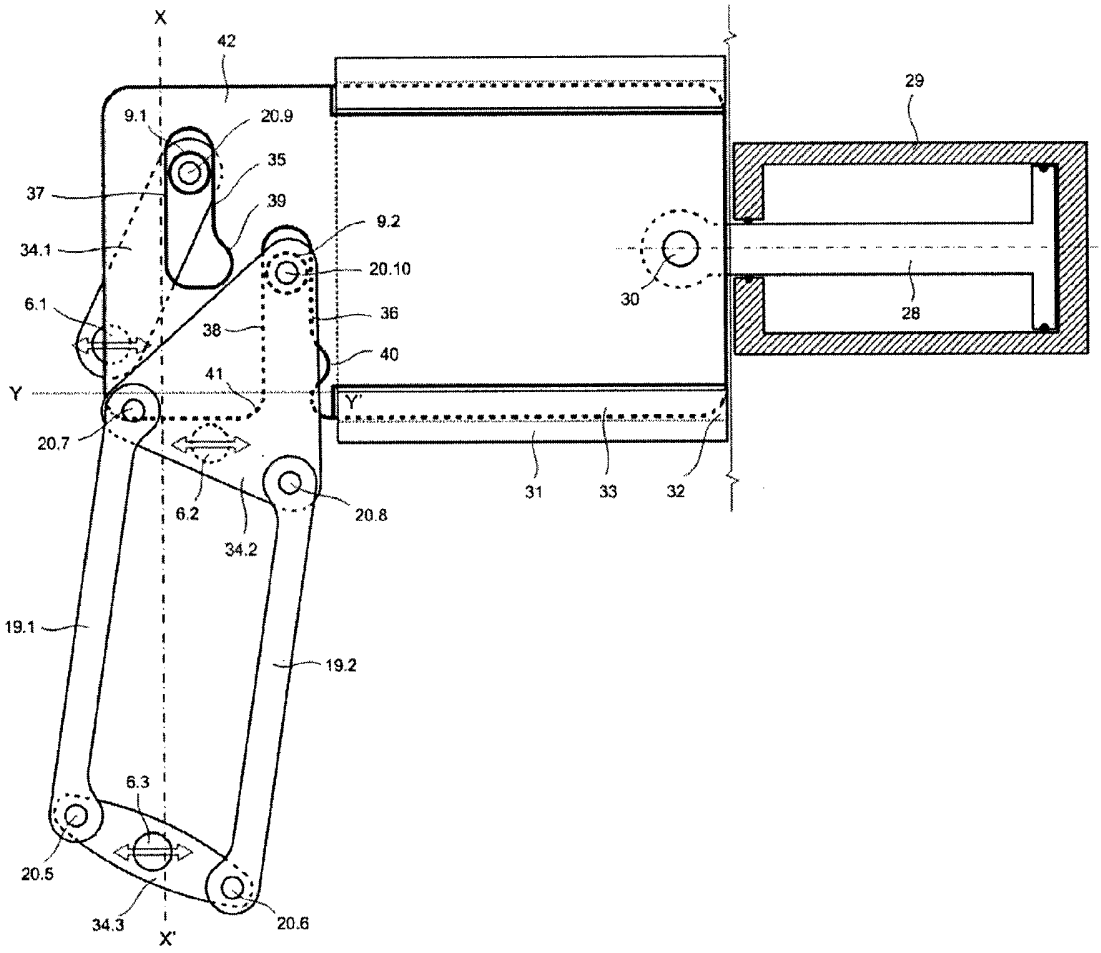
X
42
9.1
20.9
35
37
39
9.2
34.1
20.10
6.1
36
38
40
Y
41
Y'
20.7
6.2
34.2
20.8
31
33
32
29
30
28
19.1
19.2
6.3
20.5
34.3
20.6
X'

Figure 10

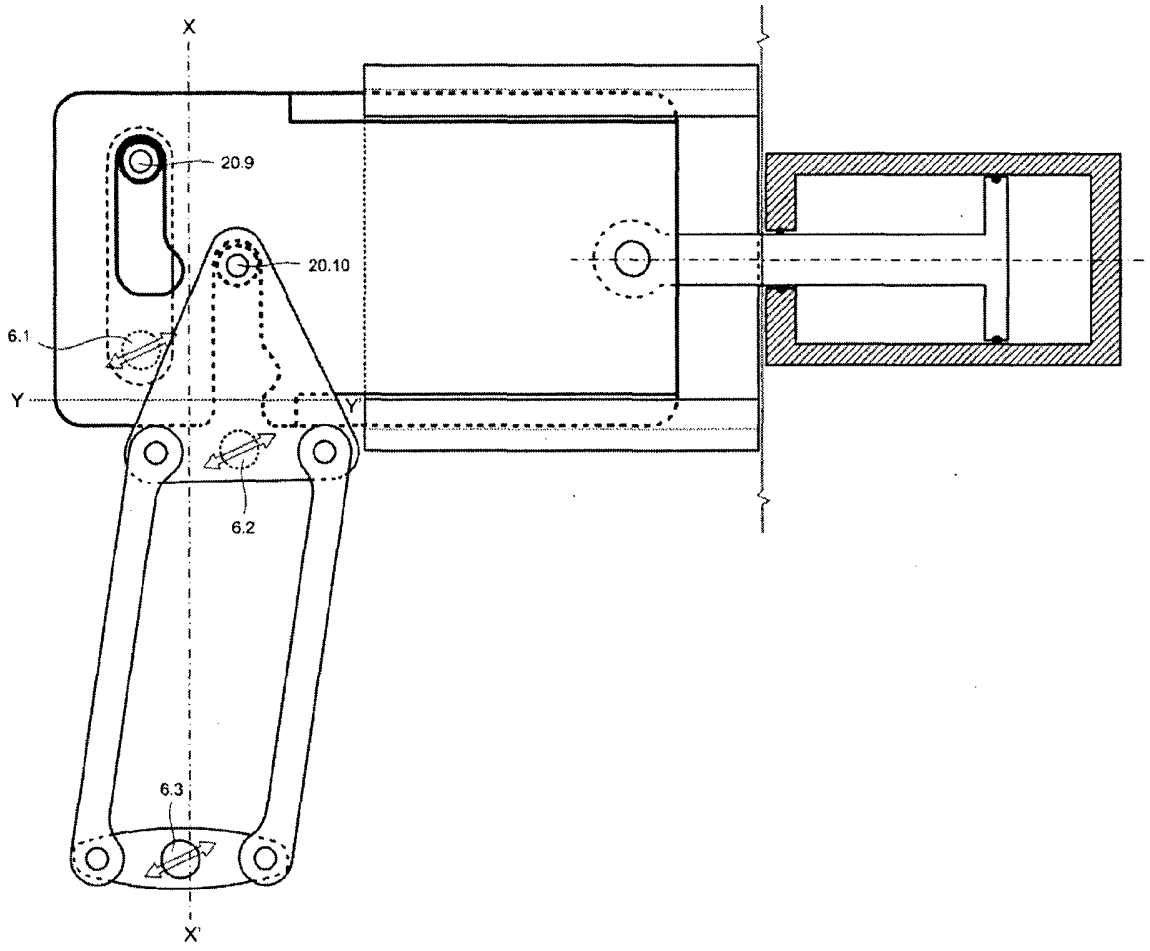

Figure 11

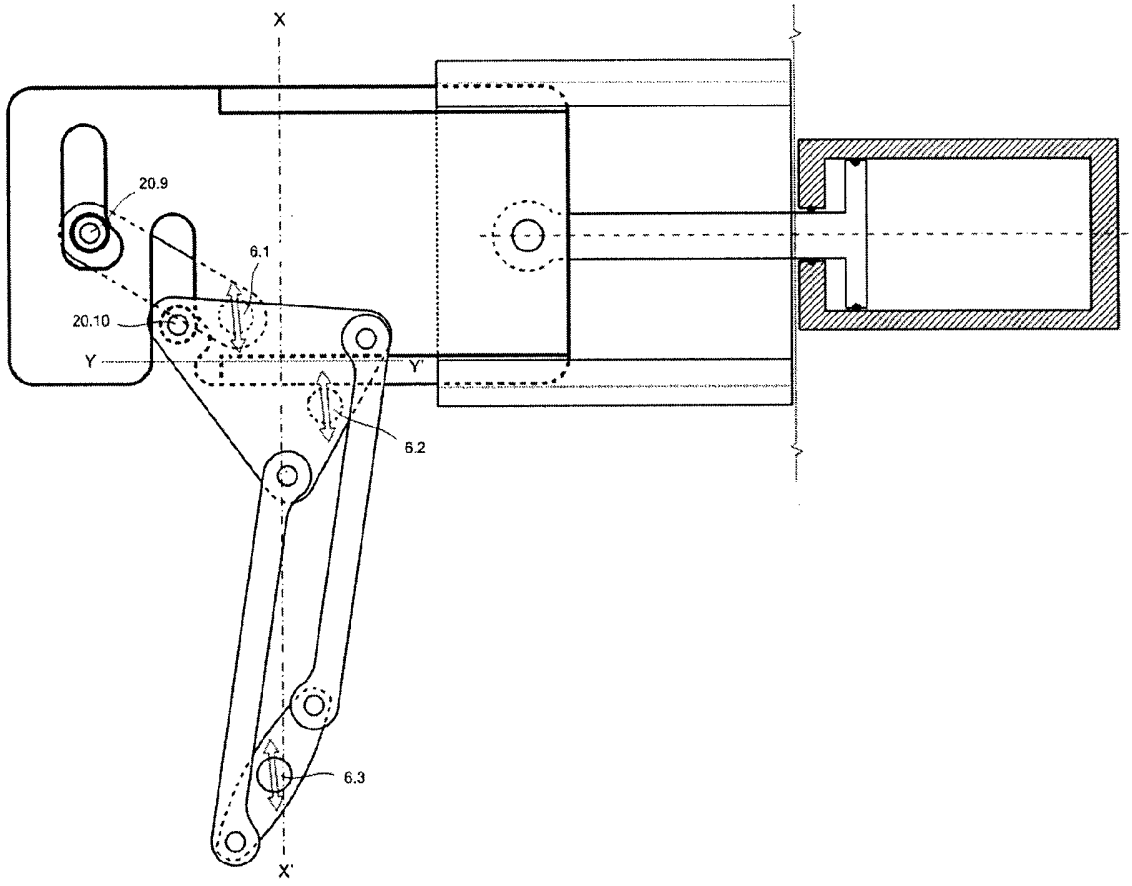

Figure 12

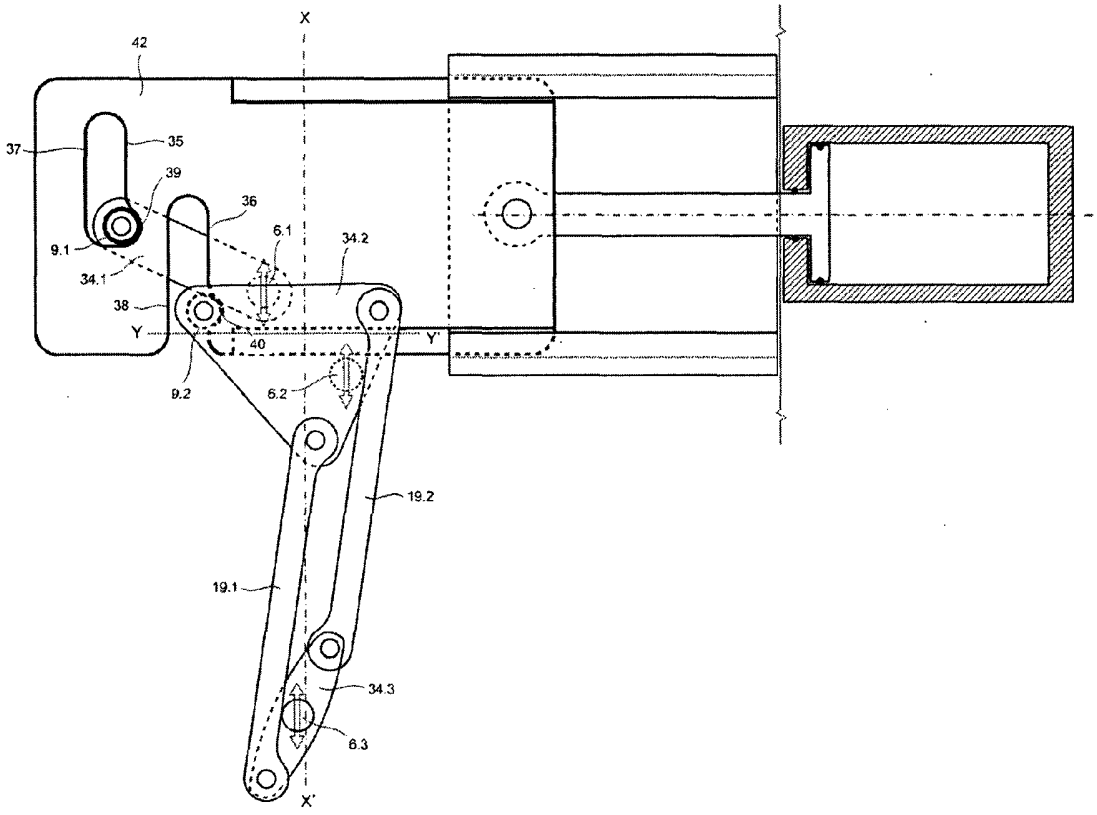

Figure 13

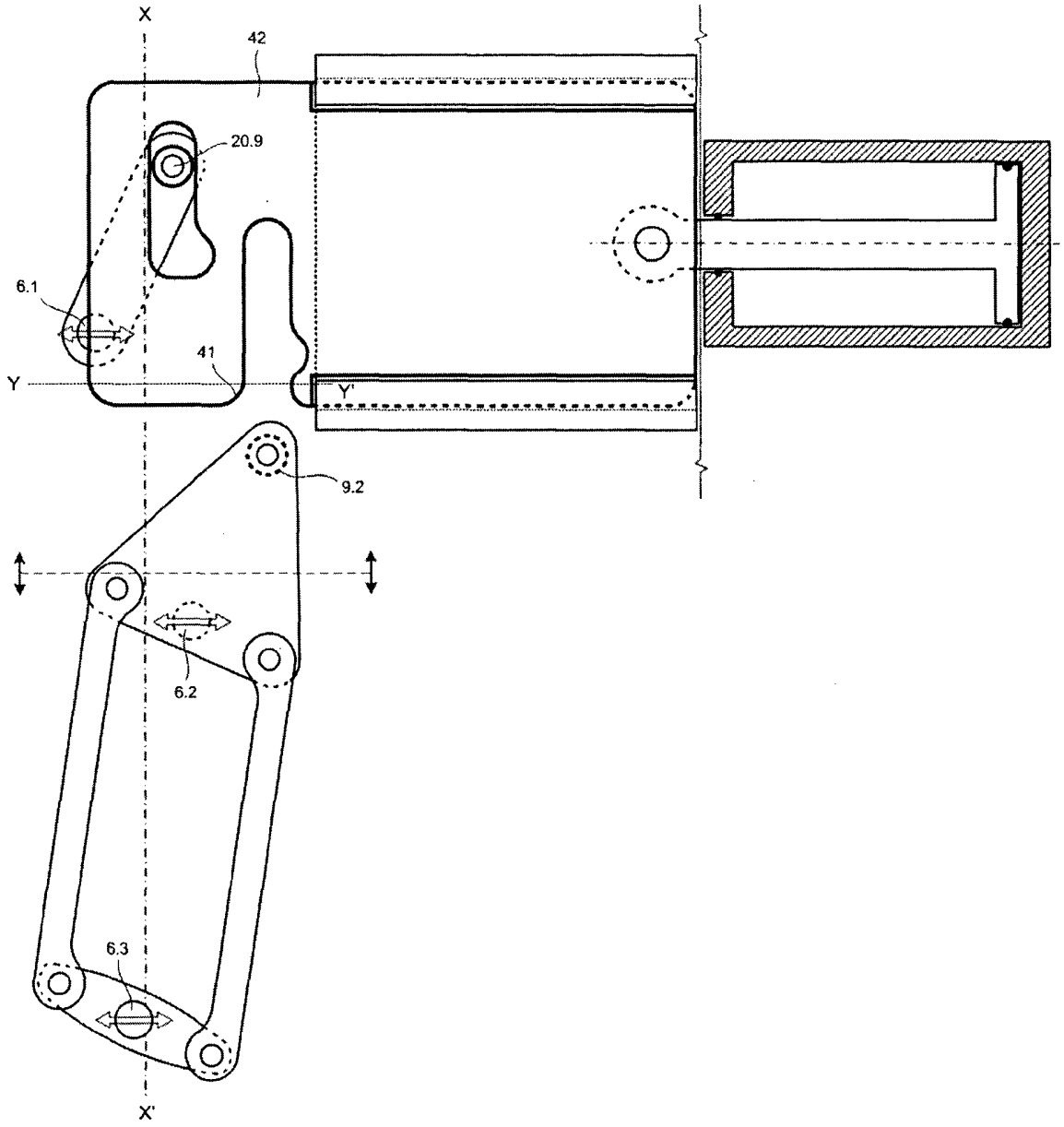

Figure 14

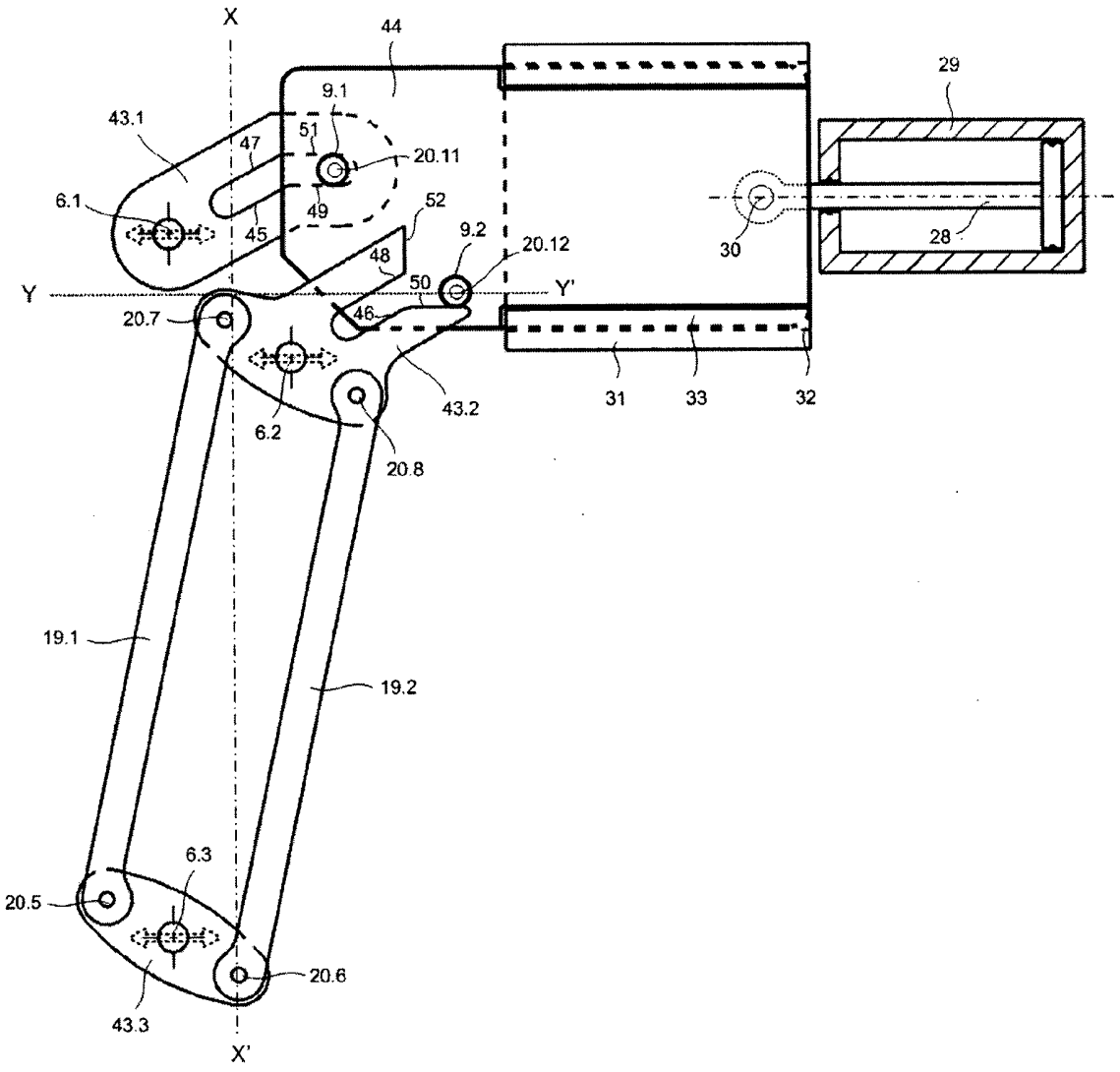
X
44
29
9.1
43.1
51
47
20.11
6.1
49
52
45
9.2
20.12
48
30
28
Y
50
Y'
20.7
46
31
33
32
43.2
6.2
20.8
19.1
19.2
6.3
20.5
20.6
43.3
X'

Figure 15

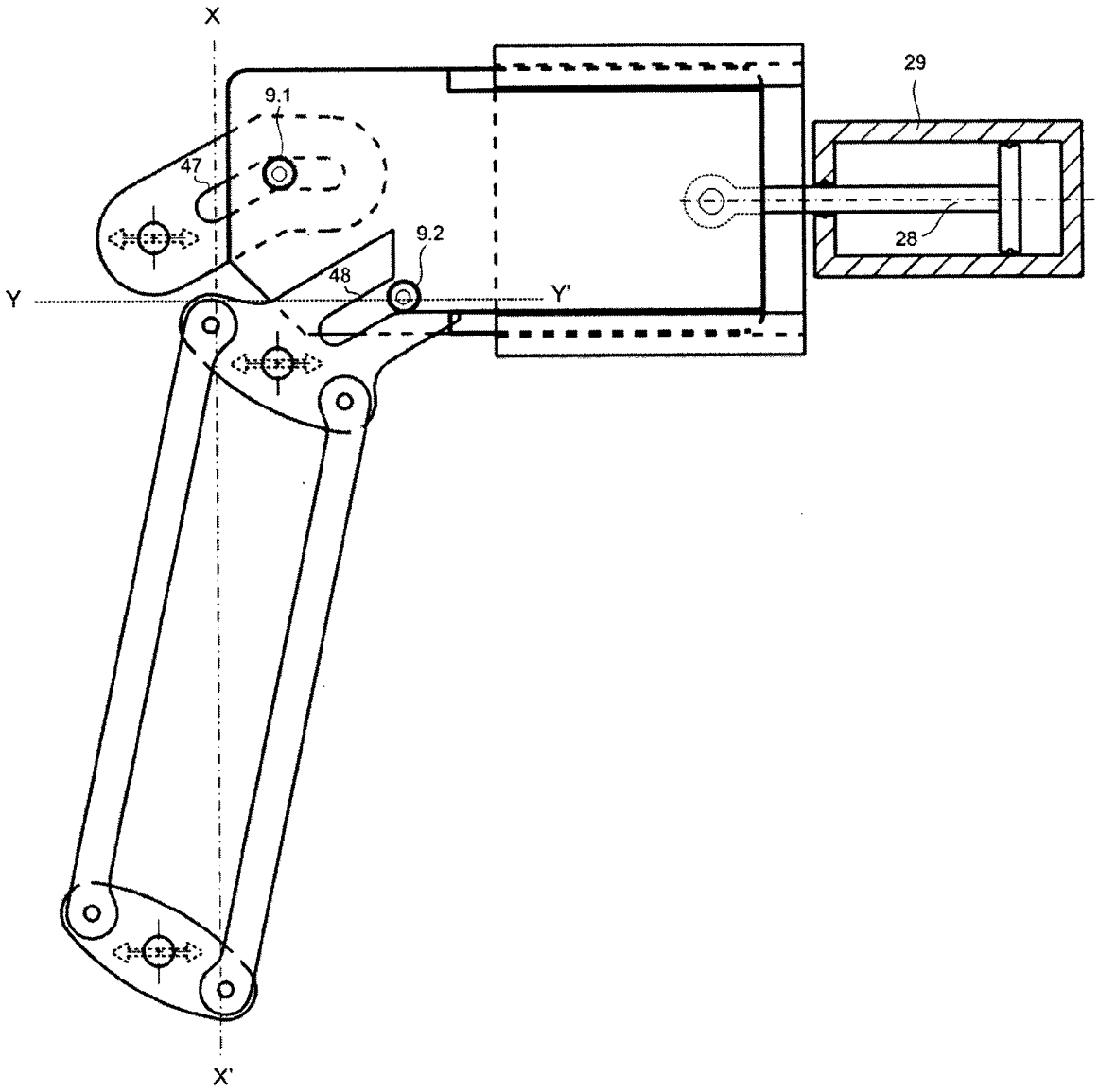

Figure 16

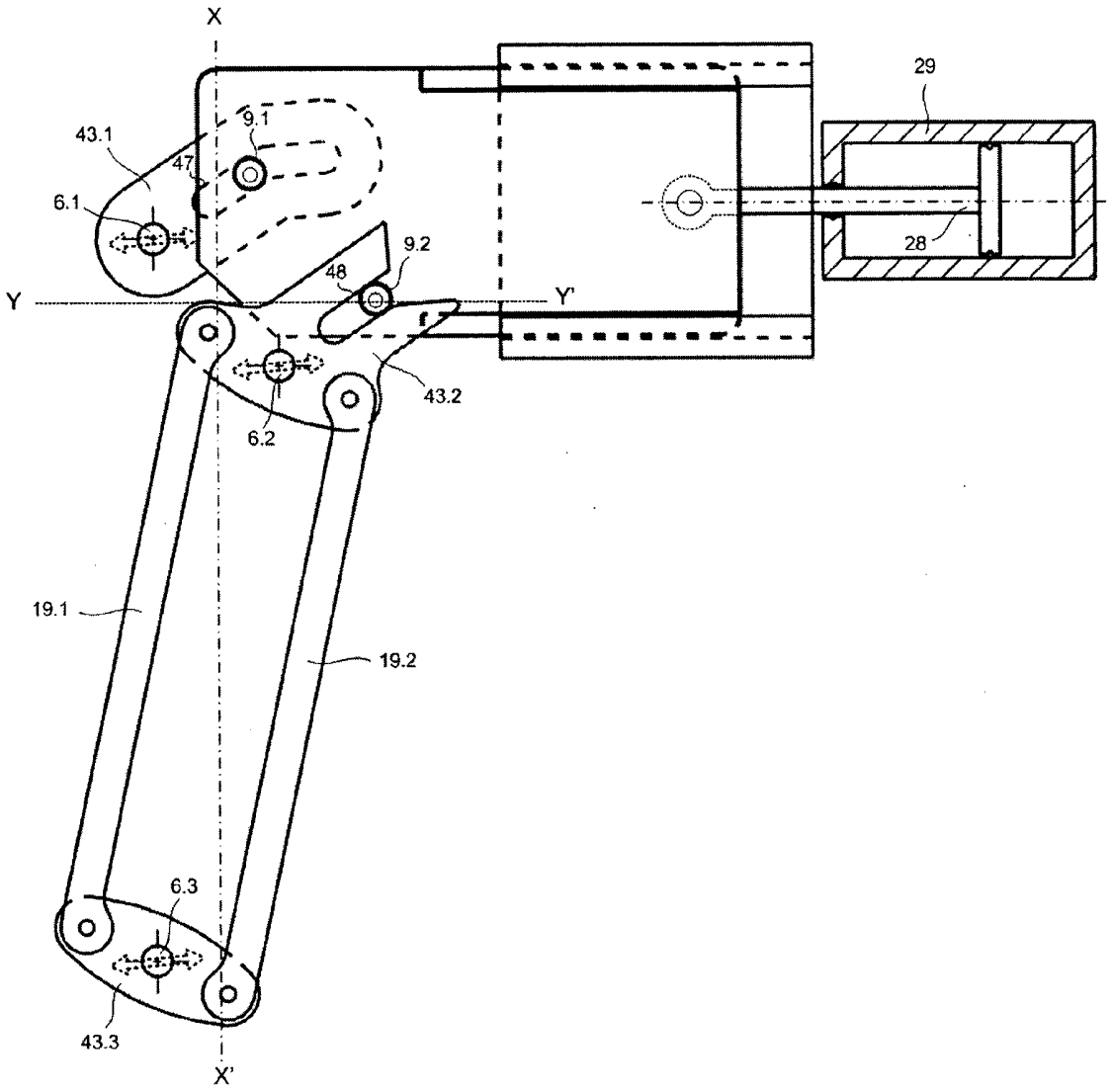

Figure 17

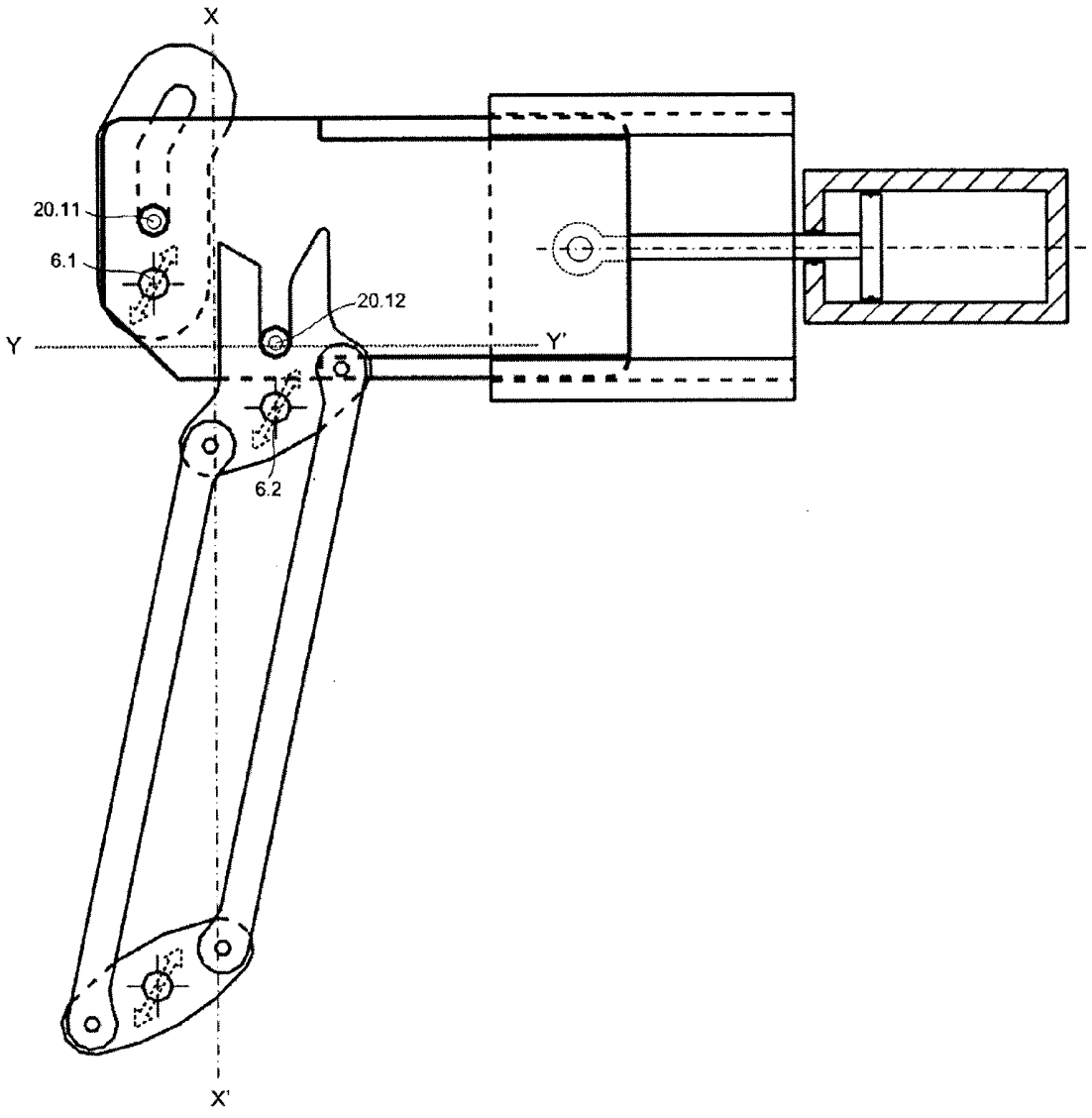

Figure 18

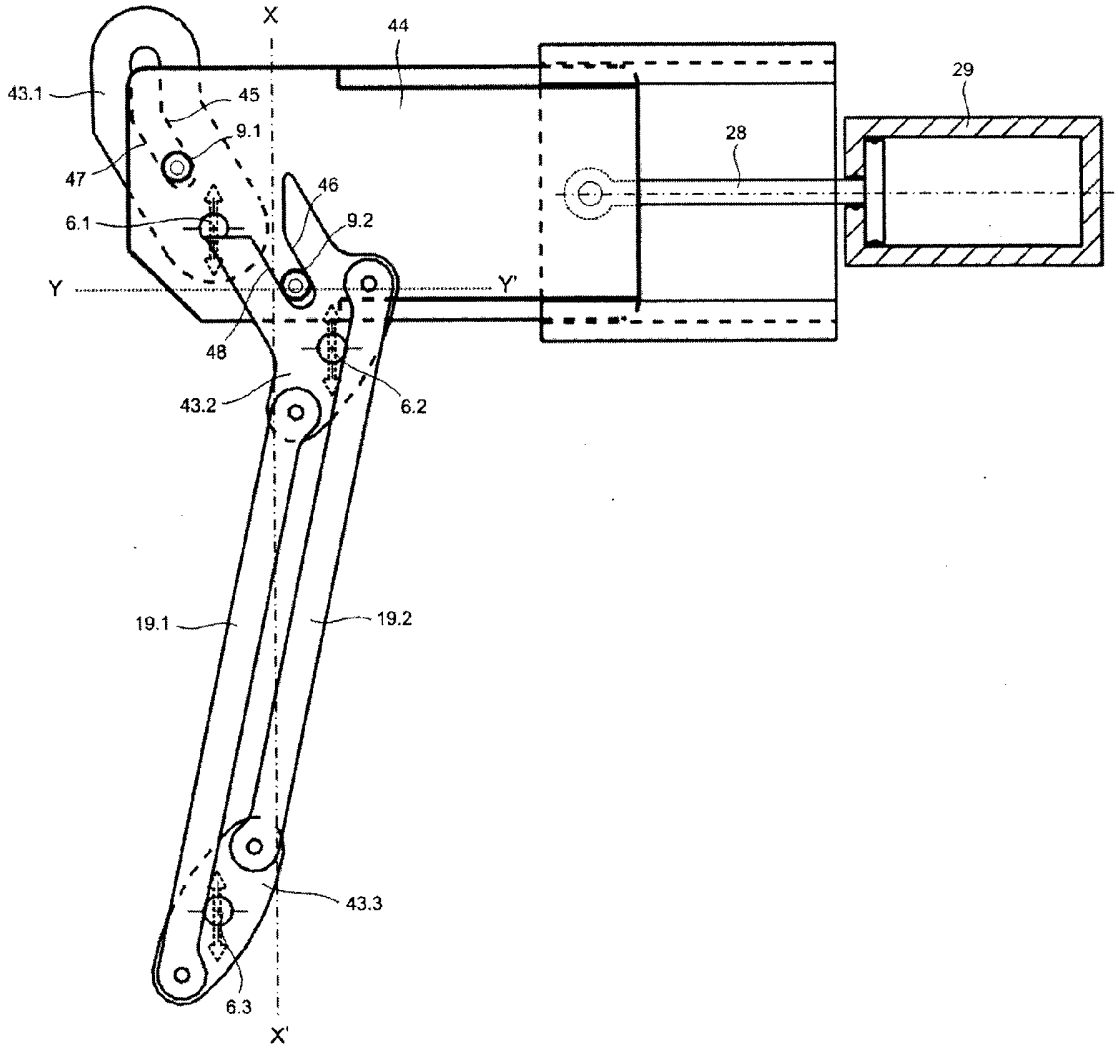

Figure 19

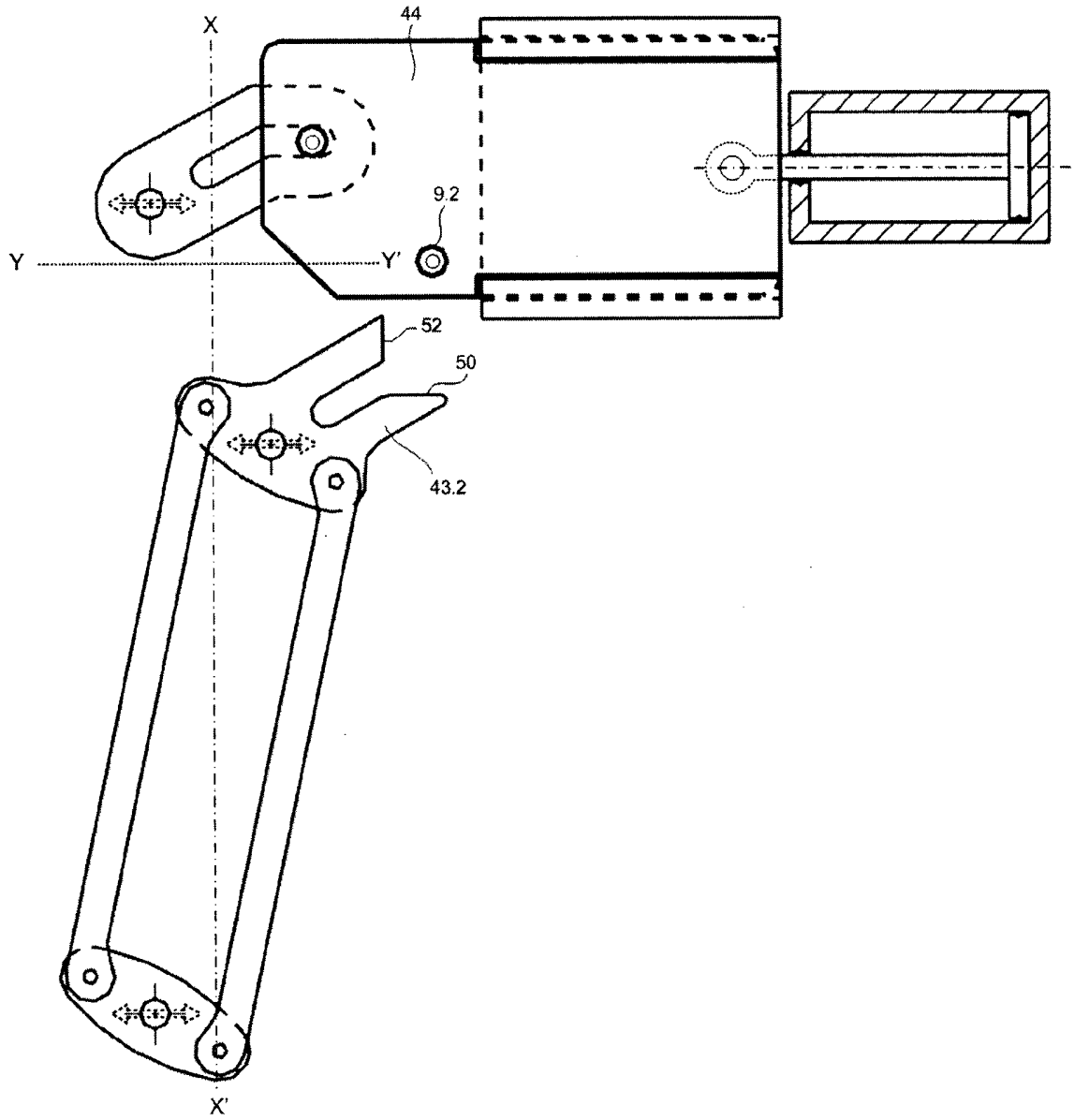

Figure 20

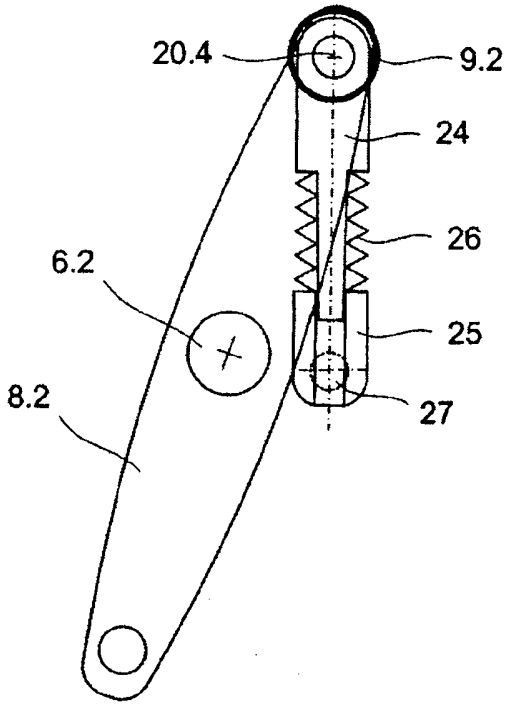

Figure 21

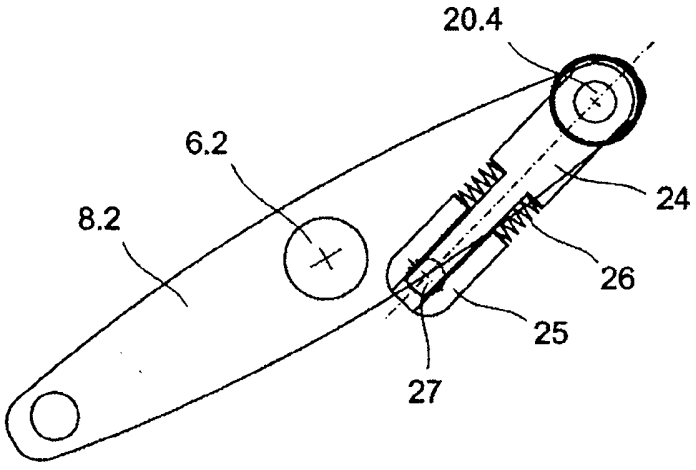

Figure 22

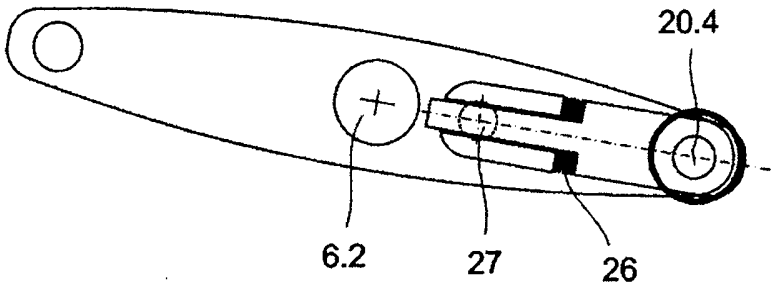

Figure 23

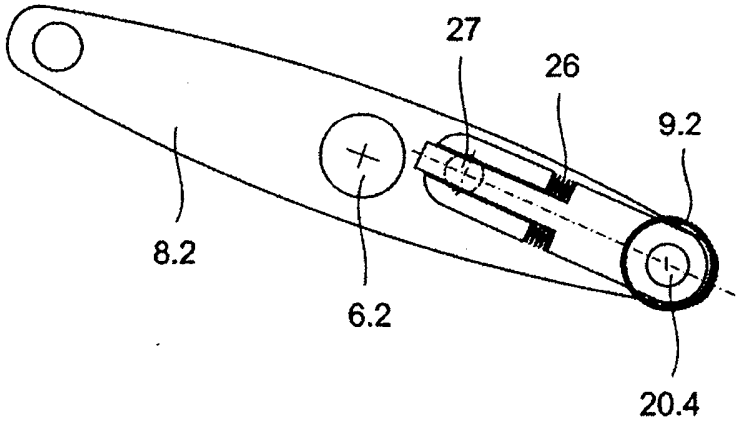

Figure 24