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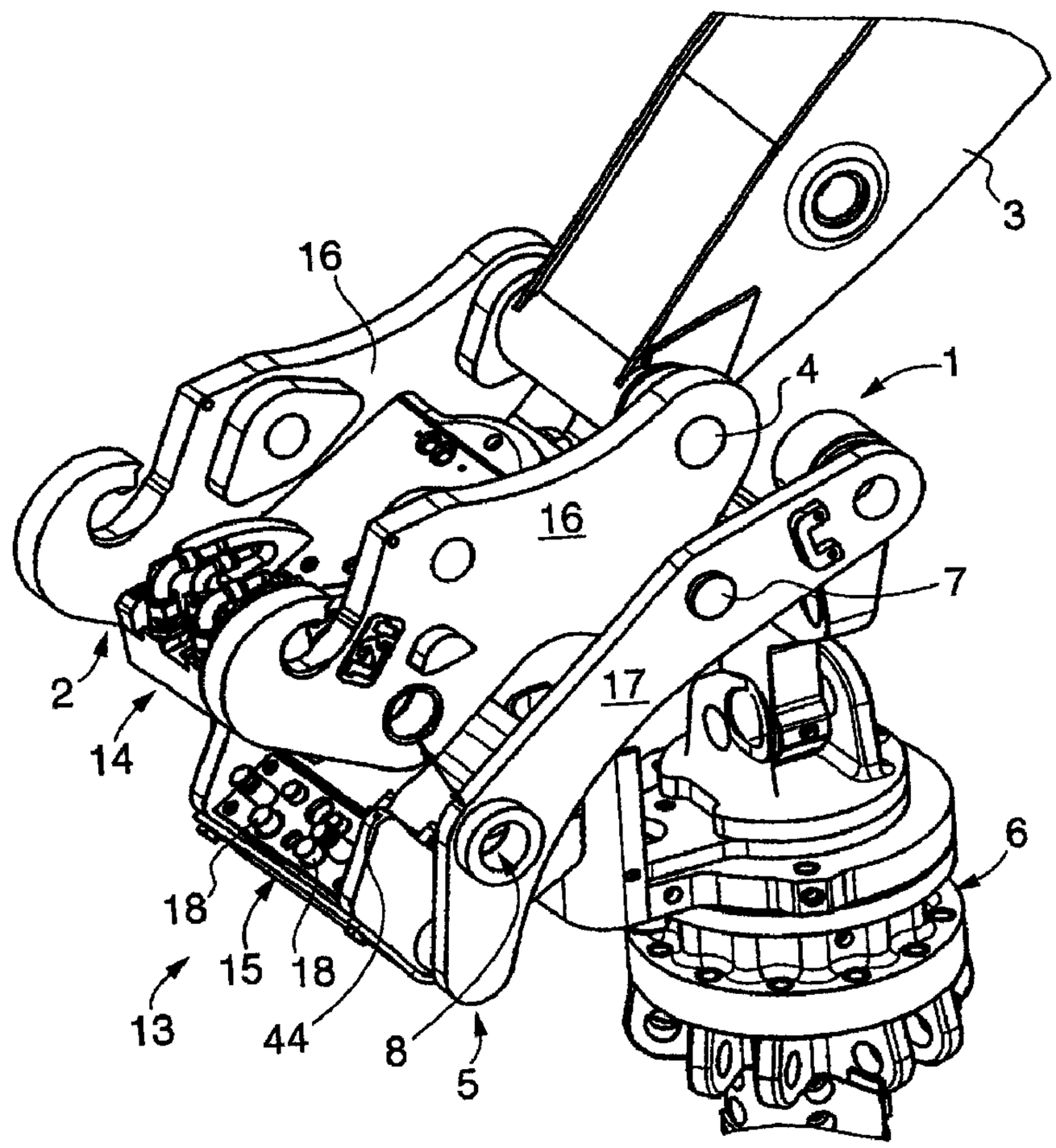

(57) Abrégé/Abstract:
A quick coupling for coupling a tool to the boom of a hydraulic excavator and the like with a quick coupling part on the boom and a quick coupling part on the tool which can be latched together by means of two spaced latching axles and with a power coupling, for

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(57) Abrégé(suite)/Abstract(continued):
example a hydraulic coupling, for the automatic coupling of a power circuit on the tool to a power circuit on the boom. The power circuit coupling has a power coupling part on the boom and a power coupling part the tool which are arranged such that they automatically couple as soon as the two quick coupling parts are pivoted together into their latching position about a first of the two latching axles. A linear guide means is associated with the power coupling which guides the two power coupling parts in a linear manner with respect to one another during coupling despite the pivot movement of the two coupling parts.

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ABSTRACT

A quick coupling for coupling a tool to the boom of a hydraulic excavator and the like with a quick coupling part on the boom and a quick coupling part on the tool which can be latched together by means of two spaced latching axles and with a power coupling, for example a hydraulic coupling, for the automatic coupling of a power circuit on the tool to a power circuit on the boom. The power circuit coupling has a power coupling part on the boom and a power coupling part the tool which are arranged such that they automatically couple as soon as the two quick coupling parts are pivoted together into their latching position about a first of the two latching axles. A linear guide means is associated with the power coupling which guides the two power coupling parts in a linear manner with respect to one another during coupling despite the pivot movement of the two coupling parts.

A QUICK COUPLING

This invention relates to a quick coupling for coupling a tool to the boom of a hydraulic excavator and the like. The coupling has a quick coupling part on the boom and a quick coupling part on the tool, which can be latched to one another via a pair of spaced latching axles, together with a power circuit coupling, in particular a hydraulic coupling, for coupling a power connection on the tool to a power connection on the boom. The power circuit coupling has a power coupling part on the boom and a power coupling part on the tool, which are arranged such that they automatically couple with one another as soon as the two quick coupling parts are pivoted together about a first of the two latching axles into their latching position.

Quick couplings of the pivot type are commonly used in hydraulic excavators since they allow simple and fast changing of different tools such as hydraulic grabs, ditch cleaning shovels, grab tongs and the like. Initially, only one of the two latching axles needs to be positioned and brought into engagement for coupling. This can advantageously be a transverse bolt which is hung into a hook-like eyelet on the opposite coupling part. Then the coupling part on the boom can be pivoted relative to the tool about the latching axle already brought into engagement to locate the latching position in which the second latching axle can be latched. The latter is as a rule formed by a pair of latching bolts which can move apart and into corresponding latching bores on the opposite quick coupling part.

Such a fast coupling of the pivot type is known from WO 91/01414 in which an automatic hydraulic coupling is provided

which automatically couples a power circuit on the boom to a power circuit on the tool when the two quick coupling parts are pivoted together. There are two power coupling parts provided of which one is secured to the quick coupling part on the boom and the other to the quick coupling part on the tool, such that the two power coupling parts are moved towards one another and brought into engagement when the two quick coupling parts are pivoted together about the already latched latching axle. One of the two power coupling parts is movably mounted on the corresponding quick coupling part to compensate the circular movement of the quick coupling parts during the pivoting together.

This known quick coupling has a number of disadvantages. The power coupling parts do not couple cleanly when the quick coupling parts are moved together so that oil leakage and contamination of the soil can occur. Due to tilting of the power coupling parts, these are subject to great wear and can even be damaged.

This invention seeks to provide an improved quick coupling of this type which avoids the disadvantages of the prior art. In particular, an improved arrangement of the power coupling should be provided which allows a leak-free and defect-free coupling of the power circuits on the boom and on the tool.

Thus in a broad embodiment this invention seeks to provide a quick coupling for coupling a tool to the boom of a hydraulic excavator or the like with a first quick coupling part on the boom and a second quick coupling part on the tool which can be latched together by means of two spaced apart latching axles and

with a power circuit coupling, such as a hydraulic coupling, for the automatic coupling of a power connector at the tool to a power connector at the boom, wherein the power circuit coupling has a first power coupling part on the boom and a second power coupling part on the tool which are arranged on the fist quick coupling part on the boom or at the second quick coupling part on the tool such that they automatically couple as soon as the first and second quick coupling parts are pivoted together into their latching position about a first of the two latching axles, wherein a linear guide is associated with the power coupling which guides the first and second power coupling parts in a linear manner with respect to one another during coupling.

In accordance with the invention, the first and second power coupling parts are moved towards one another in an exactly linear manner. A linear guide is provided for the power coupling parts which forces the power coupling parts into a relative movement with respect to one another along a straight line against the circular pivot movement. To provide compensation for the pivot movement, at least one of the two power coupling parts is mounted on the corresponding quick coupling part movably relative thereto. It is, however, provided in a further development of the prior art that the movably mounted power coupling part compensates the pivot movement during the moving together of the quick coupling parts and moves precisely such that an exact linear movement takes place between the two power coupling parts.

In a further embodiment of the invention, the linear guide has at least one guide element on the boom and at least one guide element on the tool which enter into engagement with one another on the closing of the power circuit coupling before the two power

circuit coupling parts, in particular their connection connectors, enter into engagement with one another. The linear guide therefore enters into and out of engagement on the pivot movement of the two quick coupling parts about the already latched first latching axle of the quick coupling parts. The engagement of the guide elements of the linear guide takes place, however, before the engagement of the connection connectors of the power coupling parts such that the linear guide of the power coupling parts is ensured from the start. No tilting can take place and a precise linear movement is ensured over the whole coupling path of the first and second power coupling parts. The guide elements of the linear guide are therefore in particular components formed separately from the actual power coupling elements, i.e. the connector members. They are, however, preferably fixedly arranged on the power coupling parts or can be moulded with them.

The linear guide can be made in several ways. A cam track can be provided for the movably mounted power coupling part or for the movably mounted power coupling parts. A cam-like control of the movement of the movable power coupling part or parts can also be provided. In a further embodiment of the invention, there are provided as guide elements at least one guide bolt on one of the power coupling parts and at least one guide bore on the other power coupling part. The guide bolt is pushed into an exact fit into the complementary guide bore when the power coupling parts are moved together, whereby a linear movement is ensured. Preferably, a pair of guide bolts spaced from one another and associated guide bores are provided, with the connection connectors being able to be arranged between the guide bolts or guide bores respectively. The guide bolts extend with

their longitudinal axes parallel to the direction in which the connector connections can be pushed onto one another. As connection connectors, the power coupling parts can have female and male connector members known per se which can be pushed into one another.

The guide bolt(s) of the linear guide preferably have a special shape which prevents tilting during insertion into the complementary guide bore. In particular, each of the guide bolts can have a rounded head, a cylindrical guide section and a constriction which is provided between the head and the cylindrical guide section. In the region of the constriction, the guide bolt has a diameter reduced with respect to the head or with respect to the guide section. The rounded head can also be inserted into the guide bore with a slight angular offset. An alignment or a compensation of the angular offset takes place when the cylindrical guide surface axially spaced from the bolt head comes into engagement with the guide bore.

Preferably, at least one of the two power coupling parts is movably mounted relative to the associated quick coupling part. More preferably, only one of the two power coupling parts is movably mounted while the other is rigidly secured to the other quick coupling part. In this way, a simple arrangement is achieved which nevertheless allows the required compensation of the pivot movement.

The movability of the mounting of the moveable power coupling part is preferably formed in a multi-axial manner. In particular, the mounting of the moveable power coupling part can allow at least one tilting movement about an axis parallel to the

first latching axle and a movement in a direction perpendicular to the first latching axle. The mounting preferably also permits a pushing movement parallel to the first latching axle and/or a tilting movement about a tilting axis perpendicular to the first latching axle. With such a comprehensive movable mounting, lateral offset, for example as a result of imprecisions in the assembly, can also be compensated. In addition, the arrangement of the power coupling parts can also be produced more easily since coarser manufacturing tolerances can be used.

In a further embodiment of the invention, one of the two power coupling parts is mounted on a spring device, in particular on a pair of compression springs. The compression springs can be rigidly secured to the corresponding quick coupling part and jointly bear the corresponding power coupling part. The compensation of the pivot movement with respect to the corresponding quick coupling part takes place by deformation of the spring device. To ensure coordination of the movement of the power coupling parts, a limitation of the spring path in the direction of the coupling movement can be provided.

In a further embodiment of the invention, a pressure ram can be provided on which the movable power coupling part sits in a tiltable and/or a displaceable manner. The pressure ram preferably has a rounded head which can engage approximately centrally between the spring elements of the spring device on the power coupling part. The pressure ram presses the two power coupling parts reliably and securely onto one another in the final stage of the coupling movement. The pressure ram can advantageously be of changeable length. The pressure ram can in particular be made resiliently to avoid damage and to allow a

compensation of tolerances, with the spring constant of the pressure ram being able to be substantially higher than that of the resilient mounting of the power coupling part. In a further embodiment of the invention, the pressure ram can be made as a hydraulic ram, i.e. it can be moved out or biased into its moved out position by a fluid medium. In this way, greater pressure can be applied to the movably mounted power coupling part, preferably towards the end of the coupling movement or after the power coupling parts have been fully moved together, so that the power coupling parts can be reliably held in their moved together position.

The hydraulic pressure with which the pressure ram holds the two power coupling parts together is adapted to the operating conditions in a particularly advantageous manner. The force holding together the power coupling parts is always selected to be so high that the parts are completely held together without play at any time. On the other hand, movement is not constantly with a maximum force which would be sufficient to hold the parts together under all operating conditions. If the pressure ram should hold the power coupling parts together solely by spring force, the spring must be dimensioned to be so large that it holds the power coupling parts together under all conditions so that forces would act over wide paths which would be much too large. The pressure force can advantageously be varied with a hydraulic ram.

The pressure ram can in particular be fed with a pressure medium from one of the pressure medium circuits to be fed, i.e. the pressure ram is subjected to the action of the pressure fluid which is forwarded to the tool coupled via the power coupling.

In this way, the holding together force also depends on the operating pressure of the tool. In an advantageous further embodiment of the invention, the area ratio between the effective working cylinder area of the pressure ram which is acted on by the pressure medium and the effective connector area, i.e. the effective flow cross-section through the coupling which is exposed to pressure medium perpendicular to the coupling direction in the region of the connectors, is selected to be larger than 1. An advantageous design can consist of the area ratio being approximately 5/4. The holding together force applied by the pressure ram is always higher due to this area ratio than the maximum occurring force which attempts to press the power coupling apart. If the operating pressure in the pressure medium lines to be coupled increases, the force acting on the pressure ram and thus the holding together force also increases. Usually a plurality of pressure medium connectors are provided. Likewise, a plurality of pressure rams can be provided. In this case, the ratio of the sum of the effective working cylinder areas and the sum of the connector areas is selected in the previously described manner.

In a further embodiment of the invention, the cylinder of the pressure ram or the cylinders of the pressure rams can be put into flow connection with a plurality, in particular all, of the pressure medium lines of the pressure medium circuit to be coupled. A valve arrangement is preferably interposed between the pressure medium lines and the cylinder(s) which ensures always that one of the pressure medium lines which has the highest pressure is in connection with the pressure ram, so that the pressure ram is always acted on with the sufficiently large pressure. As the valve arrangement, the pressure medium lines

can be switched together in pairs via shuttle valves so that it is always the higher pressure that is used.

The pressure ram can be fed from different sections of the pressure medium circuit. It is possible to connect the pressure medium circuit on the boom to the pressure ram. The fluid connectors are usually provided with leak securing means so that the pressure ram can be actuated when the connectors are not yet connected, with the connectors being connected by the moving out of the ram. In a preferred aspect of the invention, however, the cylinder(s) are fed from the pressure medium circuit on the tool so that they are only acted on by pressure when the power circuit coupling, and in particular its fluid connectors, are moved together and the connectors have coupled.

In a further embodiment of the invention, it can also be provided to move the power circuit coupling parts together with a time delay with respect to the pivoting together movement of the quick coupling. This can be simply achieved by ensuring that the hydraulic pressure acting on the pressure ram is effected with a time lag.

A separate hydraulic circuit can be provided to actuate the pressure ram.

The movably mounted power coupling part and thus the pressure ram can generally be arranged on the boom. In a further embodiment of this invention, however, they are provided on the tool.

It must be ensured that relative movements can take place between the pressure ram and the power coupling part acted upon by it so that both tilt movements and displacement movements perpendicular to the longitudinal axis of the pressure ram are possible. On the one hand, the movably mounted power coupling half compensates the pivot movement of the quick coupling halves to the extent that the circular movement is converted to a linear movement. Furthermore, relative movements occur as a consequence of play and the like. To permit this offset, the pressure ram and the power coupling half acted upon by it are movable relative to one another. To enable large forces to be transmitted, the pressure ram can be provided at the end face with a pressure cap which has a planar end surface such that it can sit closely on, and have the same area as, the essentially planar power coupling part. To permit tilting movements, it is preferably provided that the pressure cap and the pressure ram have areas arched in complement to one another with which they sit on top of one another such that the pressure cap can tilt on the ram itself and nevertheless an essentially flat connection is provided.

To hold the two power coupling parts securely together even in rough operation, a form-locking latching of the two power coupling parts can be provided alternatively or additionally to the hydraulic pressure ram. In a further embodiment of the invention, it can be provided that the guide bolt of the linear guide is locked when this is moved into the complementary guide bore. In particular, a movable transverse bolt can be provided which is mounted in the power coupling part which includes the guide bore. The latching transverse bolt can preferably be operated hydraulically. The transverse bolt can advantageously interact with the constriction of the guide bolt, i.e. when the

guide bolt is fully moved into the guide bore, the latching transverse bolt is moved in tangentially to the guide bore such that it projects into the guide bore, in the region in which the constriction of the guide bolt is located.

In a further advantageous embodiment of the invention, a separate bar can be provided for the form-locking latching of the two power coupling parts in their coupled position. A bar flap is preferably provided. A setting cylinder which is preferably hydraulically operated can be provided for actuating the bar. The bar can be acted on by a spring such that it is biased to its latching position. In this way, the actuating means only needs to be actuated for unlatching.

In a further embodiment of the invention, a pre-centring means is provided in addition to the linear guide for the first and second power coupling parts on the pivoting together of the first and second quick coupling parts. The pre-centring means aligns the two power coupling parts towards one another before the engagement of the linear guide that the corresponding guide elements of the linear guide can engage into one another in accordance with their purpose. This in particular has advantages if, in non-attentive operation, the first latching axle is not accurately adjusted or fully moved in on the pivoting together of the two quick coupling parts. In this case, alignment errors of the power coupling parts can occur which could effect damage to the power circuit coupling when they are moved together. The pre-centering likewise corrects excessive alignment errors of the power coupling parts relative to the corresponding quick coupling part which can occur, for example, due to the movable mounting of at least one of the power coupling parts.

The pre-centering means can be made in several ways. It preferably has a pair of centering surfaces which slide off one another on the pivoting together of the first and second quick coupling parts and of which one is provided at the movably mounted power coupling part. The other of the interacting centering surfaces can be provided on the other power coupling part. In a further embodiment of this invention, it can be arranged on the opposite quick coupling part. The interacting centering surfaces are in particular arranged such that they enter into engagement before the linear guide.

In a further embodiment of this invention, in addition to the pre-centering means, a pivot guide can be provided which ensures that the first and second quick coupling parts can only be pivoted together in their desired alignment to one another, i.e. when the first latching axle is properly aligned. The pivot guide prevents damage to the power coupling by moving together the quick coupling parts with an offset. In the latter case, the connection members, or the guide bolts, of the power coupling parts would likewise move towards one another with an offset and cause damage. The pivot guide has guide surfaces preferably provided at the solid pivot coupling parts themselves, which guide surfaces slide past one another or also slide off on one another on a proper alignment of the quick coupling parts on pivoting together about the first latching axle. They can be made to provide centering such that on pivoting together, the two quick coupling parts press into their desired alignment to one another in which the first latching axle is properly aligned. The guide surfaces advantageously prevent an offset of the two quick coupling halves with respect to one another before the

second latching axle is latched, in particular when the power coupling parts have already come into engagement with one another. Such an offset would necessarily have the consequence of damage to the power coupling. The guide surfaces can in particular be made such that they interact with the first latching axle, which is formed in hook-like fashion, as soon as they are pushed over one another, so that an offset or a slipping of the quick coupling halves with respect to one another is prevented.

In accordance with a particularly advantageous embodiment of the invention, the power circuit coupling is a mounting unit which can be subsequently mounted to the two quick coupling parts. It is not an integral component of the quick changer. The power circuit coupling is preferably made such that known quick changers can be retrofitted.

To ensure good accessibility to the power circuit coupling, in a further embodiment of the invention, the power circuit coupling can be arranged outside the latching axles of the two quick coupling parts. The power circuit coupling in this case does not lie with difficult accessibility between the two latching axles, but can, for example, be easily reached for cleaning. In addition, it is not disposed in the intermediate space between the two latching axles which is prone to the collection of contamination and dirt.

In a further embodiment of the invention, the power circuit coupling is arranged within abutting areas of the quick coupling part on the tool and/or of the quick coupling part on the boom, in particular such that when the two coupling parts are separated

from one another, the power circuit coupling parts do not abut the ground when the corresponding quick coupling part is placed on the ground. The two quick coupling parts can preferably each have two spaced carrier members substantially perpendicular to the latching axles and the power coupling parts can each be arranged transversely thereto between two carrier members which belong together. They are disposed in the protected region between the perpendicular carrier members of the quick coupling parts. The carrier members of the quick coupling parts are pushed into one another or over one another in the region of the latching axles. Unlike the prior art, the quick coupling part on the boom does not include a base plate which extends parallel to the latching axles and on which the power coupling part would be arranged. It is hereby avoided that when the coupling part on the boom is placed on the ground with its base plate, the power coupling part arranged thereon is not pressed into the ground.

In a further embodiment of the invention, the two power coupling parts are each made in essentially plate-like form. The already mentioned male or female connector members, which form the first and second power connectors, are arranged on the plate-like carrier of the power coupling parts. The guide bolts or guide bores can be rigidly secured or worked in on a spacing therefrom.

The invention therefore seeks to provide a quick coupling for coupling a tool to a boom, comprising:

(a) a boom side coupling part having a power connector; and a tool side coupling part having a power connector;

(b) a pair of spaced apart latching axles comprising a first latching axle and a second latching axle, the boom side

coupling part and the tool side coupling part being engageable with the first latching axle, and thereafter rotatable towards each other about the first latching axle;

(c) a power circuit coupling constructed and arranged to couple the boom side power connector to the tool side power connector and comprising a boom side power coupling part and a tool side power coupling part, at least one of the boom side power coupling part and the tool side power coupling part being pivotably mounted about an axis parallel to the first latching axle and movable in a direction perpendicular to the first latching axle, wherein when the boom side coupling part and the tool side coupling part are rotated towards each other about the first latching axle, the boom side power coupling part and the tool side power coupling part are brought together in a circular path about the first latching axle and automatically coupled to each other; and

(d) a linear guide associated with the power circuit coupling and constructed and arranged to guide the boom side power coupling part and tool side power coupling part in a linear movement relative to each other when coupling.

The invention will now be described with reference to attached drawings, in which:

Fig. 1 shows a perspective view of a quick coupling in accordance with a preferred embodiment of the invention which has a pair of mechanical quick coupling parts and a power coupling, with the mechanical quick coupling parts only being in engagement with one of two latching axles and the power coupling not yet being coupled;

Fig. 2 shows a perspective view of the quick coupling of Fig. 1, with the quick coupling parts being shown in the pivoted together state with a coupled power coupling;

Fig. 3 shows view of the quick coupling Fig. 1, with the quick coupling parts in engagement with only one of two latching axles;

Fig. 4 shows an enlarged partly sectional view of the quick coupling which shows the power coupling shortly before its two power coupling parts enter into engagement with one another;

Fig. 5 shows a partly sectional view similar to Fig. 4, with the power coupling being shown in another sectional plane in which the female and male connector pieces of the coupling can be seen;

Fig. 6 shows an enlarged sectional view of the power coupling which shows the engagement of the linear guide of the power coupling shortly before the power coupling is completely coupled;

Fig. 7 shows a frontal view of the power coupling in a sectional representation which shows the power coupling in the completely coupled state;

Fig. 8 shows a quick coupling in accordance with another preferred embodiment of the invention, in which both power coupling parts of the power coupling are movably mounted;

Fig. 9 shows a detailed view of a power coupling part pivotally mounted on a pivotal flap in accordance with another preferred embodiment of the invention;

Fig. 10 shows a view of a quick coupling in accordance with a further embodiment of the invention, in which a pre-centering means of the movably mounted power coupling part is provided by a cam-like pre-centering surface on the pivoting together of the quick coupling parts;

Fig. 11 shows an enlarged partly sectional view of a quick coupling similar to Figure 4 which shows the power coupling shortly before its two power coupling parts enter into engagement with one another;

Fig. 12 shows a sectioned frontal view of a power coupling in sectional representation similar to Figure 7 which shows the power coupling in a completely coupled state, with the guide bolt of one power coupling part secured by a transverse bolt in the other power coupling part;

Fig. 13 shows a section-wise sectional view along the line A-A in Figure 12;

Fig. 14 shows a perspective view of the power coupling in the coupled state, with the two power coupling parts coupled in form-locking manner by means of a pivotally mounted bar;

Fig. 15 shows a partly sectional view similar to Figure 4 of a further embodiment of the quick coupling which shows the power coupling with a hydraulically actuated pressure ram shortly before the coupling couples;

Fig. 16 shows a partly sectional view similar to Figure 15, with the power coupling being shown in the completely moved together state;

Fig. 17 shows an enlarged partly sectional view of the hydraulic pressure ram of Figures 15 and 16;

Fig. 18 shows a schematic representation of the hydraulic circuit for actuating two hydraulic pressure rams in accordance with Figures 15, 16 and 17;

Fig. 19 shows a perspective view of the lower, movably mounted part of the power coupling from the preceding Figures; and

Fig. 20 shows a half-section through a guide bolt for the power coupling which forces a linear engagement of the two power coupling parts.

The quick coupling 1 shown in the Figures has a first quick coupling part 2 on the boom which is pivotally secured to the shaft 3 of a boom of a hydraulic excavator and which can be pivoted via a pivot flap not shown in any more detail in a manner known per se about the pivot axis 4 perpendicular to the longitudinal axis of the shaft 3. The quick coupling 1 further has a second quick coupling part 5 on the tool which is connected to a hydraulic excavator tool. The tool, for example, can be a grabbing tool with a rotating mechanism 6 which is hydraulically actuated. The first and second parts 2 and 5 of the quick coupling 1 can be latched to one another by two parallel latching axles 7 and 8 which are spaced from one another and which can be latched together. The latching axles 7 and 8 extend, as Figure 1 shows, parallel to the pivot axis 4 about which the quick coupling 1 can be pivoted relative to the shaft 3.

As can be seen from Figure 3, the first of the two latching axles 7 is formed by a transverse bolt 9 provided at the second quick coupling part 5 on the tool and by a pair of latching hooks 10 provided on the first quick coupling part 2 on the boom. The latching hooks 10 can be hooked in at the transverse bolt 9 so that this is engaged by the latching hooks 10 and the quick coupling part 5 on the tool can be raised. As Figure 3 shows, the latching hooks 10 are hook-like recesses open on one side which surround the transverse bolt 9 in the form of a half-shell. The hook recesses are in this connection open to the side of the

first quick coupling part 2 which is remote from the second latching axle 8.

The second latching axle 8 includes a latching bolt pair 11, which can be moved apart, and by an associated pair of latching bores 12. As Figure 3 shows, the latching bolt pair 11 is arranged on the first quick coupling part 2 on the boom and can be moved in and out, preferably hydraulically; suitable mechanisms for this are well known. The latching bores 12 are formed in the second quick coupling part 5 on the tool. As can be seen from Figure 1, both the first quick coupling part 2 on the boom and the second quick coupling part 5 on the tool have substantially vertical carrier members which are spaced apart from one another and indeed differently spaced apart from one another, so that the carrier plates of the quick coupling part 2 on the boom can be moved in between the carrier plates of the second quick coupling part 5 on the tool.

To couple the first and second quick coupling parts 2 and 5, the first quick coupling part 2 on the boom is initially moved into the second quick coupling part 5 on the tool and the transverse bolt of the opposite quick coupling part is engaged by the hook-like latching recesses 10 (see Figure 3). By a slight raising of the first quick coupling part 2 on the boom, it can be ensured that the second quick coupling part 5 on the tool securely falls into the hook-like latching recess 10. To latch the second latching axle 8, then the quick first coupling part 2 on the boom is pivoted about the pivot axis 4 so that the first and second quick coupling parts 2 and 5 are pivoted together about the first latching axle 7. The two quick coupling parts 2 and 5 are pivoted together so far that the latching bolt pair 11

and the associated latching bores 12 coincide with one another. Then the latching bolts 11 are preferably moved apart by hydraulic action so that they move into the latching bores 12. The first and second quick coupling parts 2 and 5 are fixedly latched together by the two latching axles 7 and 8.

Referring also to Figure 11, to prevent an offset of the two quick coupling halves and thus damage to the sensitive power coupling, during the pivoting of the first and second quick coupling parts 2 and 5 about the first latching axle 7, the two quick coupling parts 2 and 5 can be provided with a pivot guide 44. The two solid quick coupling parts 2 and 5 each have a guide surface 46 and 47, which can only be pushed over one another or past one another when the first latching axle 7 (see Figure 1) coincides properly. If, for example, an excavator driver does not drive the hook-like recess 10 (shown in Figure 3)in properly, the pivot guide prevents pivoting together with offset. The guide surfaces 46 and 47 can be made such that they have a centring effect, i.e. the two quick coupling parts 2 and 5 press into the properly aligned position when they are pivoted together.

Further referring to Figure 1, to supply driving elements on the tool with power, a power coupling 13, which connects a hydraulic circuit on the boom to a hydraulic circuit on the tool, is associated with the quick coupling 1. For example, the rotating mechanism 1 in accordance with Figure 1 can be hydraulically operated. Further driving elements and accordingly a plurality of hydraulic circuits can be provided and coupled.

The power coupling 13 comprises first and second power coupling parts 14 and 15 which are mounted to the first quick

coupling part 2 on the boom and to the second quick coupling part 5 on the tool respectively. They are arranged on the side of the quick coupling parts 2 and 5 opposite the first latching axle 7 and 8, and indeed each at the same spacing from the first latching axle 7 so that they move on to one another on the pivoting together of the two quick coupling parts 2 and 5. The first and second power coupling parts 14 and 15 could generally also be arranged between the two latching axles 7 and 8. However, they preferably lie out the region bounded by the two latching axles 7 and 8 since experience has shown that the latter location is prone to contamination and is difficult to access. Due to the arrangement of the first and second power coupling parts 14 and 15 outside the latching axles 7 and 8, these are less prone to faults and easier to maintain. As Figures 1 and 7 show, the first and second power coupling parts 14 and 15 are each arranged between the perpendicular carrier members 16 of the first quick coupling part 2 on the boom or between the perpendicular carrier members 17 of the second quick coupling part 5 on the tool. They thus lie in a protected manner, and in particular do not protrude over the first and second quick coupling parts 2 or 5 such that the first and second power coupling parts 14 or 15 would be pressed into the ground when the corresponding quick coupling parts 2 and 5 are placed on the ground.

Both the first and second power coupling parts 14 and 15 encompass a plurality of power line couplings. They are each formed as a connector block in which a plurality of connector members 18 are arranged together. As Figure 4 shows, each of the two power coupling parts 14 and 15 has a plate-shaped carrier member 19 or 20 which in each case extends transversely to the

corresponding quick coupling part 2 or 5. The connector members 18 (shown in Figure 5), which can be pushed together and which effect the hydraulic fluid connection, are positioned perpendicular to the carrier members 19 and 20. The connector members 18 can be either male or female connectors.

In accordance with the embodiment shown in Figures 1 to 7, the first power coupling part 14 arranged at the first quick coupling part 2 on the boom is rigidly mounted relative to the first quick coupling part 2. The second power coupling part 15 secured to the second quick coupling part 5 on the tool is movably mounted. As Figure 4 and Figure 7 show, the whole power coupling part 15 is seated on a spring arrangement 21 which in the embodiment shown consists of four compression springs 22 arranged in an oblong. The compression springs 22 are secured at one end to bracket plates which are arranged on the perpendicular carrier members 17 of the second quick coupling part 5 on the tool(compare Figure 7). At the other end, the compression springs 22 are connected, preferably screwed, to the carrier member 20 of the second power coupling part 15. The compression springs 22 have a sufficient height and elasticity so that the second power coupling part 15 can be displaced or tilted in a multi-axial fashion. The spring arrangement 21 forms a multi-axially movable mounting for the power coupling part 15 so that this can compensate an offset to the opposite power coupling part 14, in particular due to the pivot movement of the quick coupling parts 2 and 5.

As can be seen from Figures 3 and 6, the two power coupling parts 14 and 15 automatically move synchronously through the pivot together with the movement of the quick coupling parts 2

that the cylindrical guide section 27 has a conical incline which can be in the range from 5 to 15 degrees, preferably approximately 10 degrees. The specific shape of the guide bolt, in particular the spherical form of the head, allows a tilt-free insertion of the guide bolts into the opposite guide bores. In the region of their opening cross-section, the guide bores 25 can have a cross-section widening in the form of a chamfer, a rounding or the like to facilitate insertion of the guide bolts(compare Figure 4). The guide bolts 25 or the guides bores 28 are preferably formed from a suitable material and are inserted into the power coupling part 14 (shown in Figures 5 and 6) on the boom.

Referring now to Figures 1 to 4, and Figure 10, to prevent the guide bolts 24 from not fitting into the guide bores 24 due to excessive offset when the quick coupling parts 2 and 5 are moved together, a pre-centering means 29 can be provided for the pre-centering of the two power coupling parts 14 and 15 relative to one another. Figure 10 shows an example of such a pre-centering means 29. At one end, the movably mounted power coupling part 15 (see Figure 1) can have a centering surface 30. At the other end, a cam-shaped centering surface 31 can be provided at the quick coupling part 14 (see Figure 1) on which the centering surface 30 of the power coupling part 15 (see Figure 1) slides when the two quick coupling parts 2 and 5 (see Figure 1) are moved together. The pre-centering means has the effect that the two power coupling parts 14 and 15 are in a position at least roughly aligned to one another when they are moved apart.

Referring now to Figures 1, 6 and 7, to achieve a reliable and complete moving together of the connector members 18 (shown in Figure 7), a member is preferably provided which becomes active on the last part of the path of the pivot movement of the quick coupling parts 2 and 5 (shown in Figure 1) and presses the two power coupling parts 14 and 15 (see Figure 1) completely onto one another. A pressure ram 32 can in particular be provided on which the spring-mounted power coupling part 15 is seated (see Figure 6). Since the springs must be sufficiently elastic to compensate the pivot movement or offset, they could yield and be pressed together so that no complete coupling of the hydraulic coupling takes place. The pressure ram 32 acts as a limiter for the spring path of the spring mounting. As Figure 6 shows, the head of the pressure ram 32 is preferably slightly rounded so that even with a slightly inclined position of the movably mounted power coupling part 15 the pressure ram 32 sits as centrally as possible. The pressure ram 32 can likewise be mounted in a resilient manner. As Figure 6 shows, the pressure ram 32 can be a bolt mounted in a longitudinally displaceable manner which is biased by means of a compression spring 43 which can be made in the form of a spring washer set. The spring hardness of the pressure ram 32 is expediently substantially larger than that of the spring arrangement 21 (see Figure 7) for the movable mounting of the second power coupling part 15. As Figure 6 shows, the power coupling part 15 is seated on the pressure ram 32 towards the end of the moving together movement the pressure ram then presses the movably mounted second power coupling part 15 completely onto the first power coupling part 14 during the remaining pivoting together of the quick coupling parts 2 and 5 (see Figure 1). In this way it is ensured that a complete coupling of the power coupling is achieved. In

accordance with an alternative embodiment of the invention, the pressure ram 32 can be a hydraulically actuable ram. For this purpose, the arrangement can be turned around, i.e. the movably mounted power coupling part is preferably arranged at the first quick coupling part 2 (see Figure 1) at the boom so that the pressure ram can be supplied from the hydraulic system on the boom. With the pressure ram which can be moved out hydraulically, an increased force can be applied in particular towards the end of the coupling movement.

Figures 15 to 18 show an advantageous embodiment of the power coupling with a hydraulically actuated pressure ram. The power coupling parts are generally mounted movably or resiliently in the previously described manner so that reference is made to the preceding description. As Figure 15 shows, the pressure ram is moved into its starting position so far that there is air between the plate-like carrier member 19 and the end face of the pressure ram 32. The power coupling therefore initially threads in with the aid of the springs 32 or of the force applied thereby, with the linear guide ensuring that the two power coupling parts move perpendicularly on to one another. In this connection, an elastic deformation of the mounting springs is created, as Figure 16 shows.

In order to hold the two power coupling parts together reliably in operation even with large forces, the hydraulic pressure ram 32 is provided which presses centrally against the carrier member 19 so that this is pressed tightly against the carrier member 20 (shown in Figure 4)on the boom. Two or more hydraulic pressure members 32 can be provided. As Figure 17 shows, the pressure ram 32 comprises a piston-in-cylinder unit

which consists of a plunger piston 60 and a cylinder liner 61 displaceably guiding the plunger piston 60. The cylinder liner 61 is screwed into the carrier member 62 of the power coupling fixed to the tool in a manner impermeable to fluid. As Figure 17 shows, the plunger piston 60 is biased by a spring unit 63, and in its moved out position it moves towards a shoulder 64. Disc springs of suitable thickness can be provided as the spring unit 63. The disc springs are dimensioned such that they can yield when the power coupling parts are moved together. The play-free, fixed holding together under all operating conditions is achieved by the hydraulic action on the plunger piston 60. For this purpose, the plunger piston 60 or a pressure chamber 66 is connected to the hydraulic lines of the tool via a pressure fluid bore 65. As Figure 18 shows, four pressure medium lines 67, 68, 69, 70 are guided in the embodiment drawn by means of connectors 71 of the power coupling from the boom to the tool of the quick coupler. The pressure medium lines 67 to 70 at the tool are all connected to the pressure chamber 66 of the pressure ram 32. In this connection, the pressure medium lines 67 to 70 are each collected together in pairs via shuttle valves 72, 73 and 74. The shuttle valves in the form of double check valves ensure that always that pressure medium line is selected from the pressure medium lines 67 to 70 which has the highest pressure. Therefore, always that pressure is applied in the pressure chamber 66 of the pressure ram 32 which is the largest of the pressures prevailing in the pressure medium lines 67 to 70.

The effective area of the plunger piston which effects its adjusting force is in this connection larger than the sum of the cross-section areas of the connectors 71. It is ensured in this way, in conjunction with the circuit which always gives the

greatest pressure to the plunger pistons, that the holding together force is always greater than the forces effected by the pressures in the connectors which want to press the power coupling apart.

As Figure 17 shows, a pressure cap 75 sits on the plunger piston 60 at the end face which has an essentially planar end face. It is ensured in this way that it always contacts the carrier member plate 19 (shown in Figure 16) over its full area, so that excessive localised pressure such as would occur with a spot-like contact are avoided. To allow a tilt movement, the connection surfaces 76 at which the end face of the plunger piston 60 and the pressure cap 75 contact one another are rotationally symmetrically rounded surfaces so that a tilt movement is possible between the pressure cap and the plunger piston 60. Nevertheless, the contact between the plunger piston 60 and the pressure cap 75 is also over its full area.

In operation, as already mentioned, large forces can occur in part which could press the power coupling parts apart. To provide a remedy here, optionally a form-locked latching of the power coupling parts 14 and 15 (see Figure 1) can also be provided.

As Figures 12 and 13 show, a displaceably mounted transverse bolt 48 can be provided in the first power coupling part 14. The transverse bolt 48 is arranged such that it can move tangentially into the guide bore 25, in the region of the bore in which the constriction 28 of the guide bolt 24 comes to rest when the guide bolt is completely pushed in. As Figure 13 shows, the transverse bolt 48 can have sections of different diameter. If the bolt is

inserted into the guide bore 25 with a section of large diameter, the guide bolt 24 is latched. If the transverse bolt 48 is pushed into the guide bore 25 with a section of narrowed diameter, the guide bolt 24 can be pushed in and out. The transverse bolt 48 is preferably hydraulically actuated. Optionally, it can be biased in its latching position by means of a spring (not shown) so that a hydraulic actuation is only needed for unlatching.

Furthermore, referring to Figure 14, a bar 49 can be provided which latches the power coupling parts 14 and 15 together in a form-locking manner. In a further embodiment of the invention, the bar 49 can be formed as a rocker which is pivotally mounted about a pivot axis 51 on the first power coupling part 14. The bar 49 has a cranked hook at its one end with which it can engage behind a latching projection 52 on the second power coupling part 15. The bar 49 is preferably biased into its latching position by means of a spring 50. In addition, a hydraulic cylinder 53 is hinged to the bar 49 to pivot it into its unlocking position. The hydraulic cylinder 53 is preferably arranged on the boom to be permanently connected to the hydraulic system there.

Figure 8 shows an alternative mounting of the first and second power coupling parts 14 and 15 (shown in Figure 1). Here, both power coupling parts are movably mounted. The first power coupling part 14 secured to the quick coupling part 2 (see Figure 1) on the boom is pivotally seated about a transverse axis 33 on a pivot flap 34. The pivot flap is in turn pivotally mounted to the quick coupling part about a pivot axis 35 parallel to and spaced from the transverse axis 33. Optionally, a neutral

position of the power coupling part 14 can be ensured by means of a spring device.

The second power coupling part 15, which is secured to the second quick coupling part 5 (see Figure 1) on the tool is likewise movably mounted. In the embodiment shown, it is mounted in a longitudinally displaceable manner, in a plane which is parallel to the first latching axle 7 (see Figure 1) of the quick coupler 1. In accordance with the embodiment shown in Figure 8, the second power coupling part 15 is movable from left to right. It is held in its neutral position by the springs 35.

Figure 9 shows an alternative movable mounting of the second power coupling part 15 on the tool. It is seated on a pivot flap 36 which can be pivoted about a transverse axis 37 towards and away from the first latching axle 7. The power coupling part 15 is itself seated on the pivot flap 36 likewise pivotal about the tilt axis 38. The tilt axis 38 extends parallel to the axis 36, as Figure 9 shows. The second power coupling part 15 is held in its neutral position on the pivot flap 36 by means of springs 39.

Figure 10 shows a further alternative mounting of the first power coupling part 14 which is secured to the first quick coupling part 2 on the boom. The first coupling part 14 is seated in tiltable fashion on a transverse bolt 40 which extends parallel to the first latching axle 7. In addition, the power coupling part 14 is mounted displaceably on the bolt 40. It has an elongate hole 41 so that it is displaceable transversely to the bolt 40. The first power coupling part 14 is held in its neutral position by means of a spring 42. In addition, the pre-centering means 29 is provided which pre-centers the first power

coupling part 14 when this is moved onto the second power coupling part 15 when the two quick coupling parts 2 and 5 are pivoted together.

The upwardly projecting tine at the lower quick coupling part at which the pre-centring cam surface 31 is provided has a double function. It simultaneously forms the pivot guide 44 which forces the first and second quick coupling parts towards one another and into their properly aligned position; the reference numerals 46 and 47 designate the corresponding guide surfaces.

Further mounting types for the movable power coupling part(s) are possible without these being represented separately. For instance, a resilient mount can be obtained, for example, when the springs of the spring arrangement 21 shown in Figures 1 to 7 are replaced by elastic elements, e.g. rubber elements. Furthermore, it would be possible, instead of a self-adjusting mounting, to provide a compulsory mounting for at least one of the power coupling parts so that this compensates the pivot movement of the quick coupling parts 2 and 5 and an exactly linear movement is achieved between the two power coupling parts.

Considerable advantages can be achieved with the quick coupling of this invention. The latching of the power coupling is in particular also ensured simultaneously with the quick changer latching. In addition, the power coupling 13 can also be retrofitted to existing quick changers, in particular due to its shown arrangement and positioning, as it is not integrated, but attached. The positioning of the power coupling 13 allows good accessibility for maintenance and repair. In addition, due to

the adaptation of the power couplings to the quick coupler, their size is variable and adaptable to the circumstances. A plurality of hydraulic lines can be collected together in a single power coupling block.

To prevent the resilient mounting of a power coupling part from being excessively pulled apart on the moving apart of the quick coupling, a stop 80 can be provided. As Figure 19 shows, the stop 80 can be formed by two projections towards which the elastically mounted carrier member plate 19 moves during separation. The stops 80 are preferably arranged centrally, i.e. the line defined by them goes centrally through the guide bolts 24 of the power coupling.

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What is claimed is:

1. A quick coupling for coupling a tool to a boom, comprising:

(a) a boom side coupling part having a power connector; and a tool side coupling part having a power connector;

(b) a pair of spaced apart latching axles comprising a first latching axle and a second latching axle, the boom side coupling part and the tool side coupling part being engageable with the first latching axle, and thereafter rotatable towards each other about the first latching axle;

(c) a power circuit coupling constructed and arranged to couple the boom side power connector to the tool side power connector and comprising a boom side power coupling part and a tool side power coupling part, at least one of the boom side power coupling part and the tool side power coupling part being pivotably mounted about an axis parallel to the first latching axle and movable in a direction perpendicular to the first latching axle, wherein when the boom side coupling part and the tool side coupling part are rotated towards each other about the first latching axle, the boom side power coupling part and the tool side power coupling part are brought together in a circular path about the first latching axle and automatically coupled to each other; and

(d) a linear guide associated with the power circuit coupling and constructed and arranged to guide the boom side power coupling part and tool side power coupling part in a linear movement relative to each other when coupling.

2. A quick coupling according to Claim 1, wherein the linear guide comprises at least one guide element at the boom side and at least one guide element at the tool side which enter into engagement with one another on closing of the power circuit coupling.

3. A quick coupling according to Claim 2, wherein the at least one guide element on the boom and the at least one guide element on the tool enter into engagement before the boom side power coupling part and the tool side power coupling part come into engagement with one another.

4. A quick coupling according to Claim 2 or Claim 3, wherein the guide elements comprise at least one guide bolt at one of the power coupling parts and at least one guide bore at the other power coupling part for receiving the guide bolt.

5. A quick coupling according to Claim 4, wherein the at least one guide bolt has a rounded head, a cylindrical guide section and a constriction between the head and the guide section.

6. A quick coupling according to Claim 5, wherein the power coupling part having the guide bore comprises a movable transverse bolt constructed and arranged to secure the guide bolt in its position and push it into the guide bore.

7. A quick coupling according to Claim 6, wherein the transverse bolt is hydraulically actuatable.

8. A quick coupling according to Claim 1, wherein only one of the boom side coupling part and the tool side coupling part is movably mounted by a mounting means relative to its corresponding quick coupling part.

9. A quick coupling according to Claim 1, wherein each of the boom side coupling part and the tool side coupling part is movably mounted by a mounting means relative to its corresponding quick coupling part.

10. A quick coupling according to Claim 8 or Claim 9, wherein the mounting means comprises a spring device.

11. A quick coupling according to Claim 10, wherein the spring device comprises a plurality of compression springs.

12. A quick coupling according to any one of Claims 1 to 10, further comprising a pressure ram wherein one of the boom side power coupling part and the tool side power coupling part is at least one of tiltably and displaceably seated.

13. A quick coupling according to Claim 12, wherein the pressure ram comprises a bolt mounted in a longitudinally displaceable manner and biased by means of a spring.

14. A quick coupling according to Claim 13, wherein the pressure ram comprises a displaceably mounted piston which can be acted on by a pressure medium.

15. A quick coupling according to Claim 14, wherein the piston is acted on by the pressure medium from a pressure medium circuit to be coupled, and a ratio of area of effective working pressure ram acted on by the pressure medium to area of effective connector surface acted on in a region of connectors by the pressure medium perpendicular to the coupling direction is greater than 1:1.

16. A quick coupling according to Claim 14, wherein the piston is in flow connection with a plurality of pressure medium lines of a pressure medium circuit to be coupled.

17. A quick coupling according to Claim 14, wherein the piston is in flow connection with each of the pressure medium lines of a pressure medium circuit to be coupled.

18. A quick coupling according to Claim 14, wherein the piston is constructed and arranged to be operably in flow connection with all pressure medium lines of a pressure medium circuit to be coupled, and a valve arrangement is provided between the pressure medium lines and the piston to connect the piston to the pressure medium line standing under the highest pressure.

19. A quick coupling according to Claim 14, wherein the piston is fed from a pressure medium circuit on the tool side.

20. A quick coupling according to Claim 14, wherein the piston is fed by a pressure medium circuit separate from the pressure medium circuit to be coupled.

21. A quick coupling according to any one of Claims 1 to 10, wherein the boom side power coupling part and the tool side power coupling part are moved together with a time delay relative

to the pivoting together movement of the boom side coupling part and the tool side coupling part by means of a pressure ram.

22. A quick coupling according to Claim 21, comprising a pressure cap with a tiltable connection to an end face of the pressure ram.

23. A quick coupling according to Claim 22, wherein said tiltable connection comprises surfaces rounded in complementary fashion with respect to one another.

24. A quick coupling according to Claim 1, wherein at least one of the boom side power coupling part and the tool side power coupling part is at least one of tiltable about an axis parallel to the first latching axle and movably mounted in a direction substantially perpendicular to the first latching axle.

25. A quick coupling according to Claim 1, further comprising a pre-centering means for pre-centering the boom side power coupling part and the tool side power coupling part on the pivoting together of the boom side coupling part and tool side coupling part.

26. A quick coupling according to Claim 25, wherein the pre-centering means comprises a pair of centering surfaces which slide off one another on pivoting together, one centering surface being arranged at the tool side power coupling part and the other centering surface being arranged at one of the boom side power coupling part and the boom side coupling part.

27. A quick coupling according to Claim 1, wherein a pivot guide is provided for the boom side coupling part and the tool side coupling part, the pivot guide having a guiding operation selected from at least one of forcing the boom side coupling part and the tool side coupling part towards one another on the pivoting together into their desired alignment, and preventing a pivoting where the boom side coupling part and the tool side coupling part are misaligned.

28. A quick coupling according to Claim 27, wherein the pivot guide has guide surfaces spaced from the first latching axle which are provided at one of the boom side coupling part and the tool side coupling part and which are slideable over or past one another only on aligned

pivoting together of the boom side coupling part and the tool side coupling part about the first latching axle.

29. A quick coupling according to Claim 1, wherein the boom side power coupling part and the tool side power coupling part are each mountable as an assembly unit on the boom side coupling part and the tool side coupling part, respectively.

30. A quick coupling according to Claim 1, wherein the power circuit coupling is arranged outside the two latching axles.

31. A quick coupling according to Claim 1, wherein the boom side coupling part and the tool side coupling part each have two spaced carrier members substantially perpendicular to the latching axles and the boom side power coupling part and the tool side power coupling part are each arranged transversely between two of the associated carrier members.

32. A quick coupling according to Claim 1, wherein each of the boom side power coupling part and the tool side power coupling part has a substantially plate-like carrier member and one of male and female connector members arranged perpendicular to the plate-like carrier member.

33. A quick coupling according to Claim 32, further comprising guide bolts and guide bores for the linear guidance of the boom side power coupling part and the tool side power coupling part, the guide bolts and the guide bores being one of rigidly connected to the carrier members and formed in the carrier members.

34. A quick coupling according to Claim 1, wherein each of the boom side power coupling part and the tool side power coupling part is designed as a connector block having a plurality of connector members for a plurality of power lines.

35. A quick coupling according to Claim 1, wherein a bar is provided for form-locking latching of the boom side power coupling part and the tool side power coupling part when in a coupled position.

36. A quick coupling according to Claim 1, wherein the bar is biased in its latching position by at least one of a spring and a hydraulic actuation means.

37. A quick coupling according to any one of Claims 1 to 36, wherein the boom forms part of a hydraulic excavator and the power circuit coupling is a hydraulic coupling.

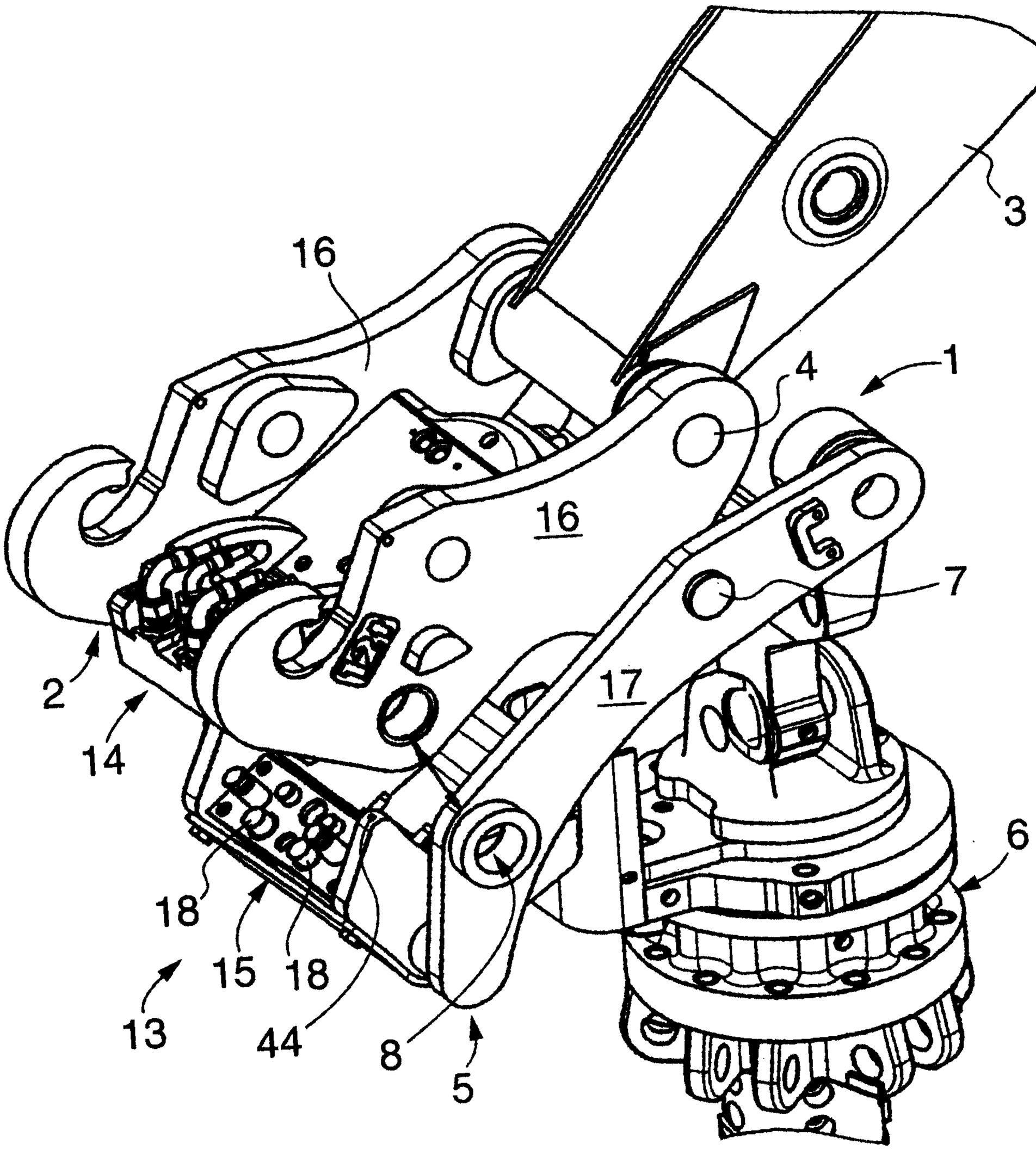


FIG. 1

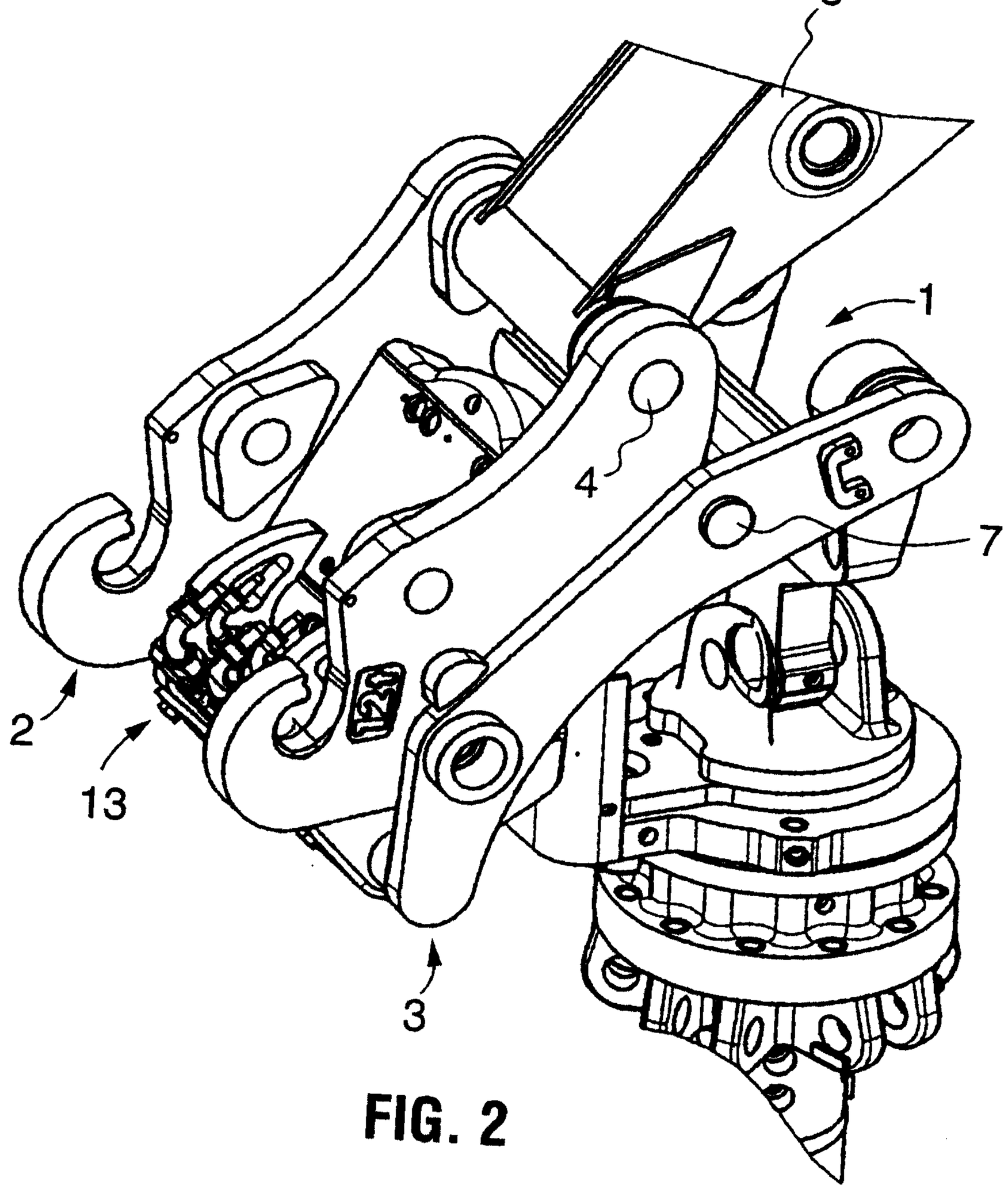


FIG. 2

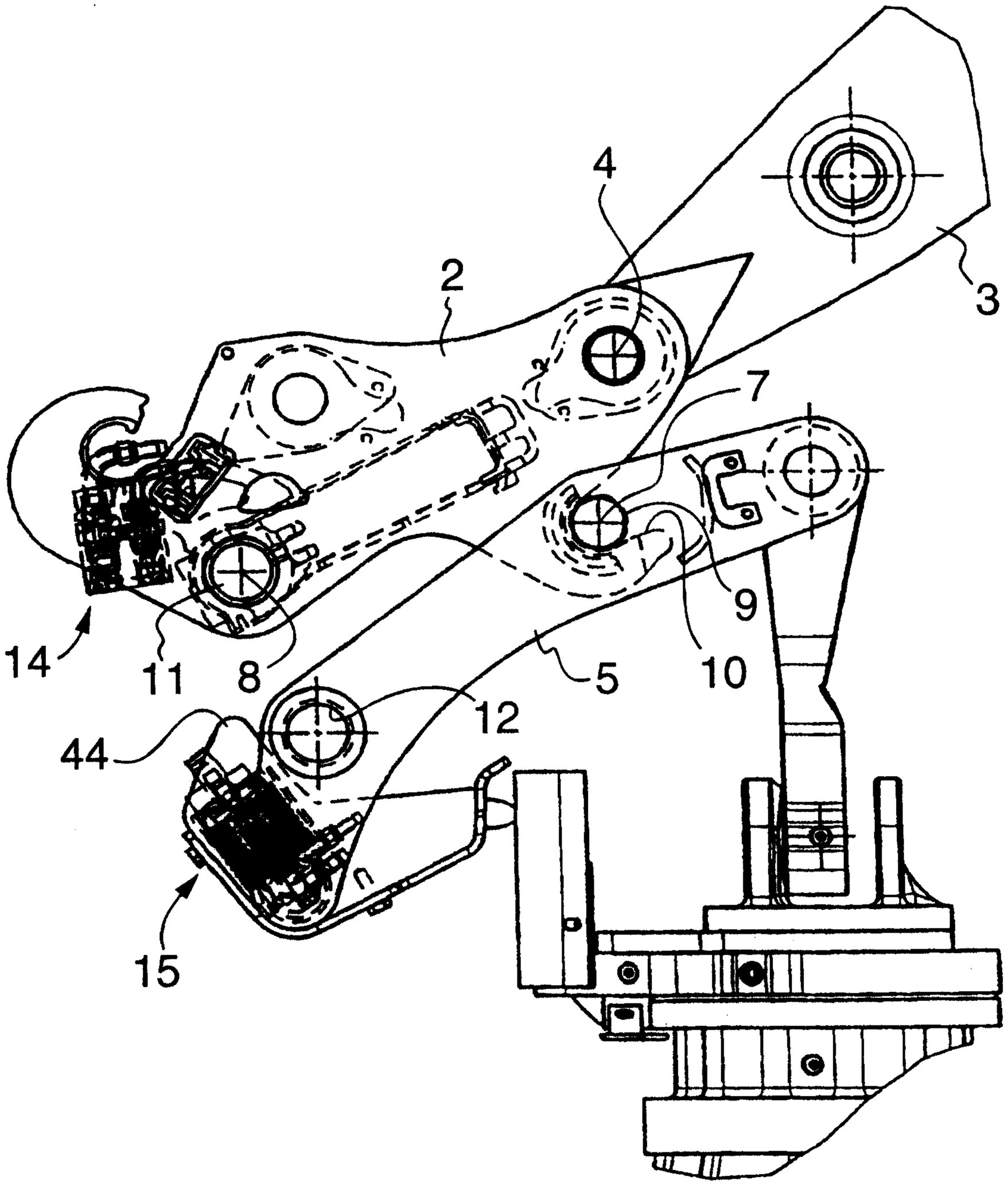


FIG. 3

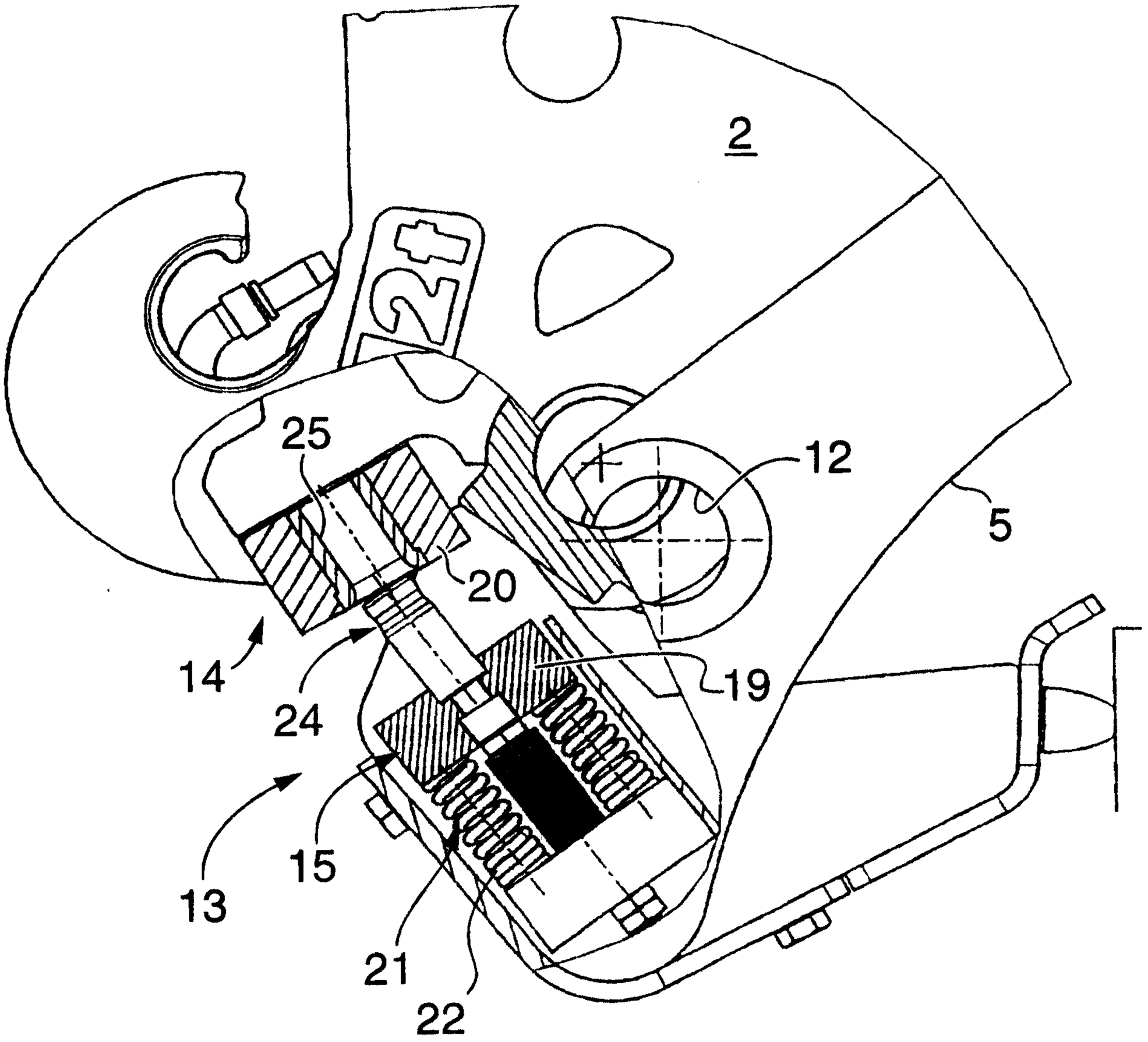


FIG. 4

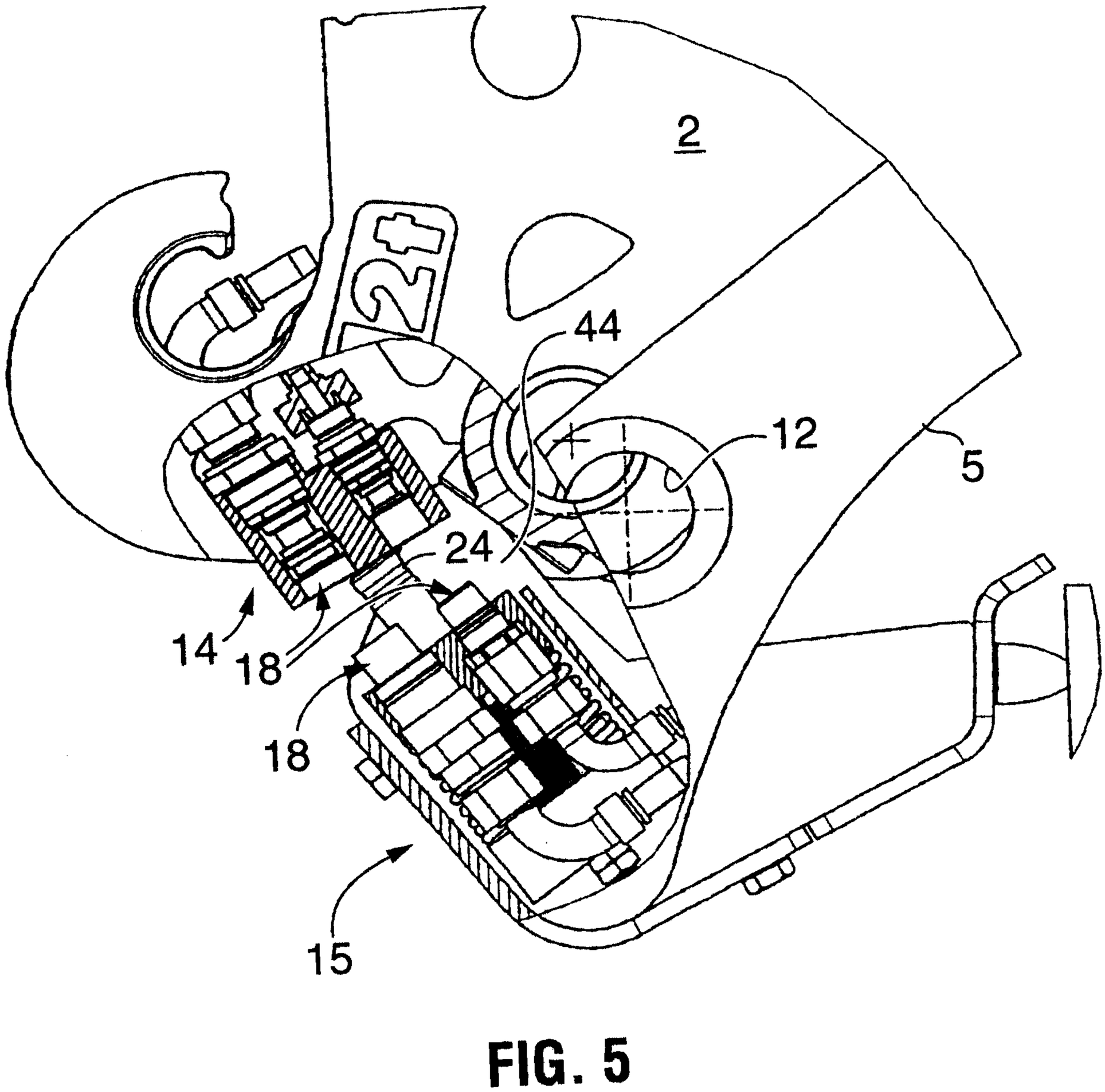


FIG. 5

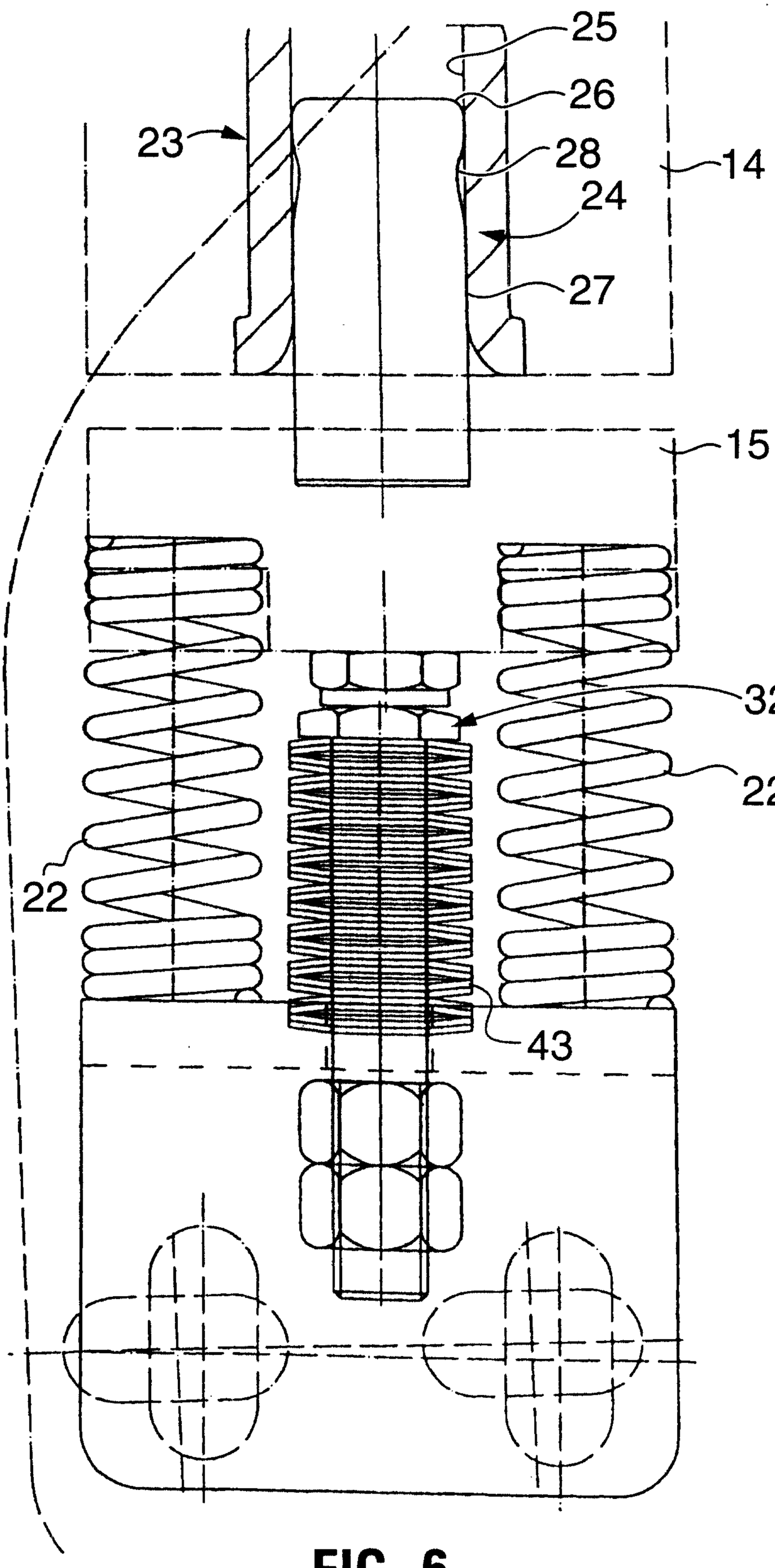


FIG. 6

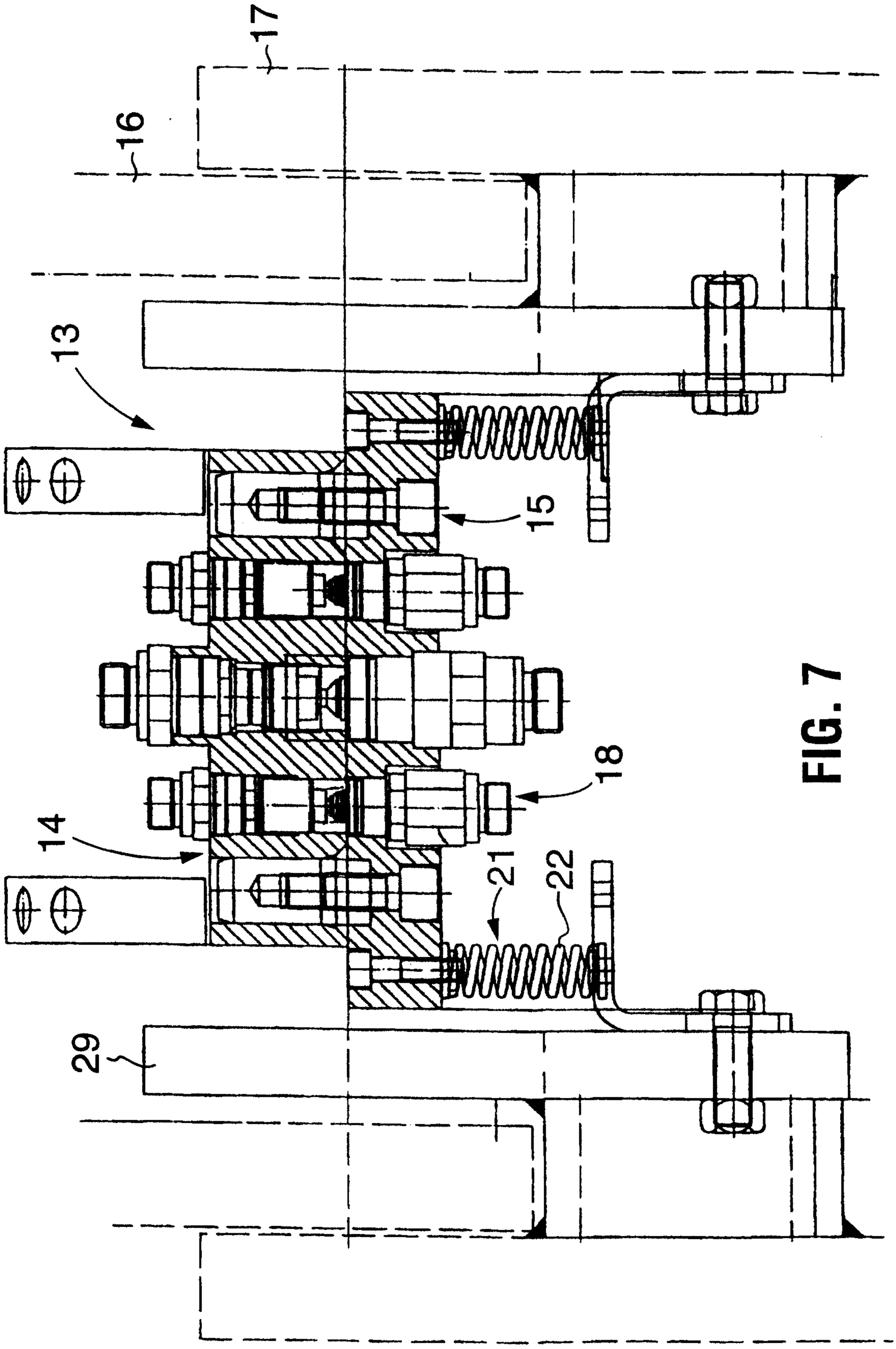


FIG. 7

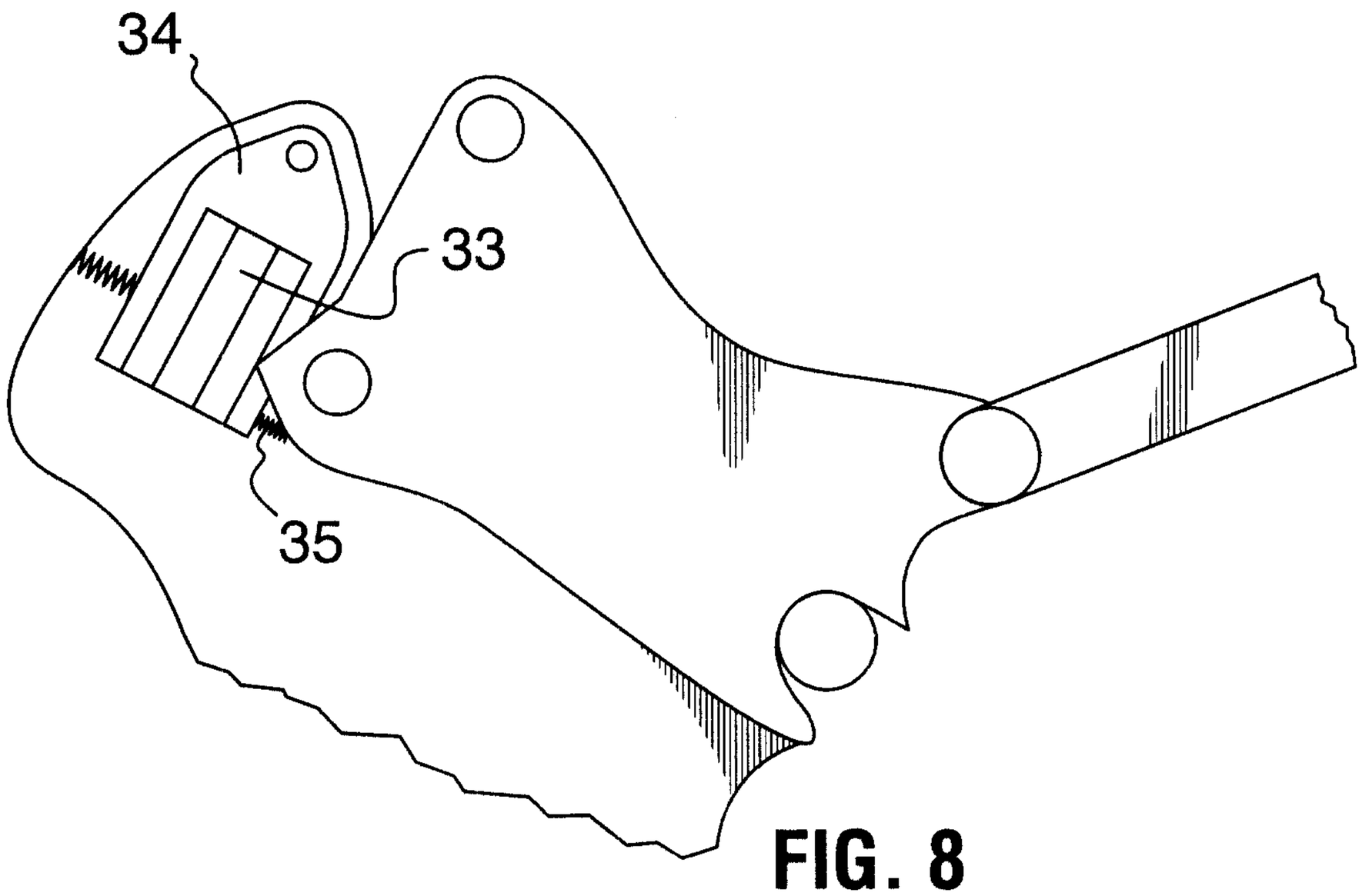


FIG. 8

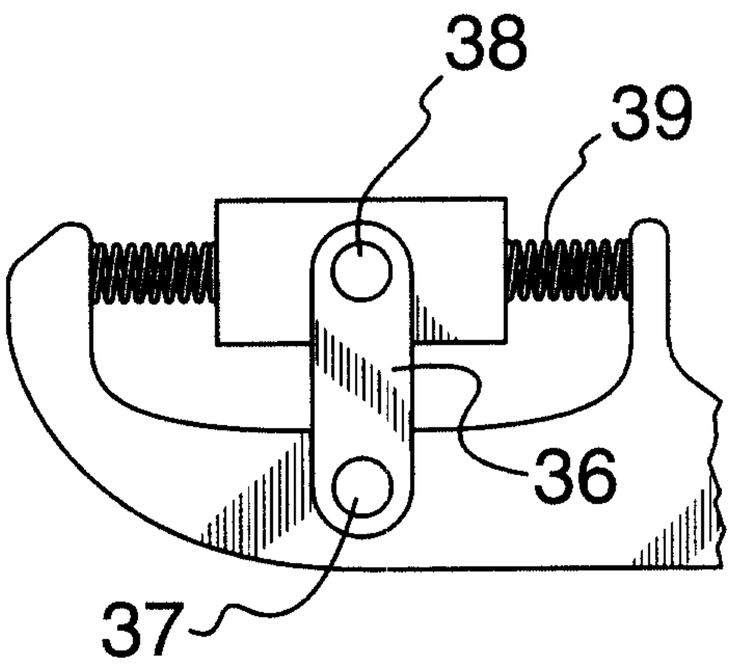


FIG. 9

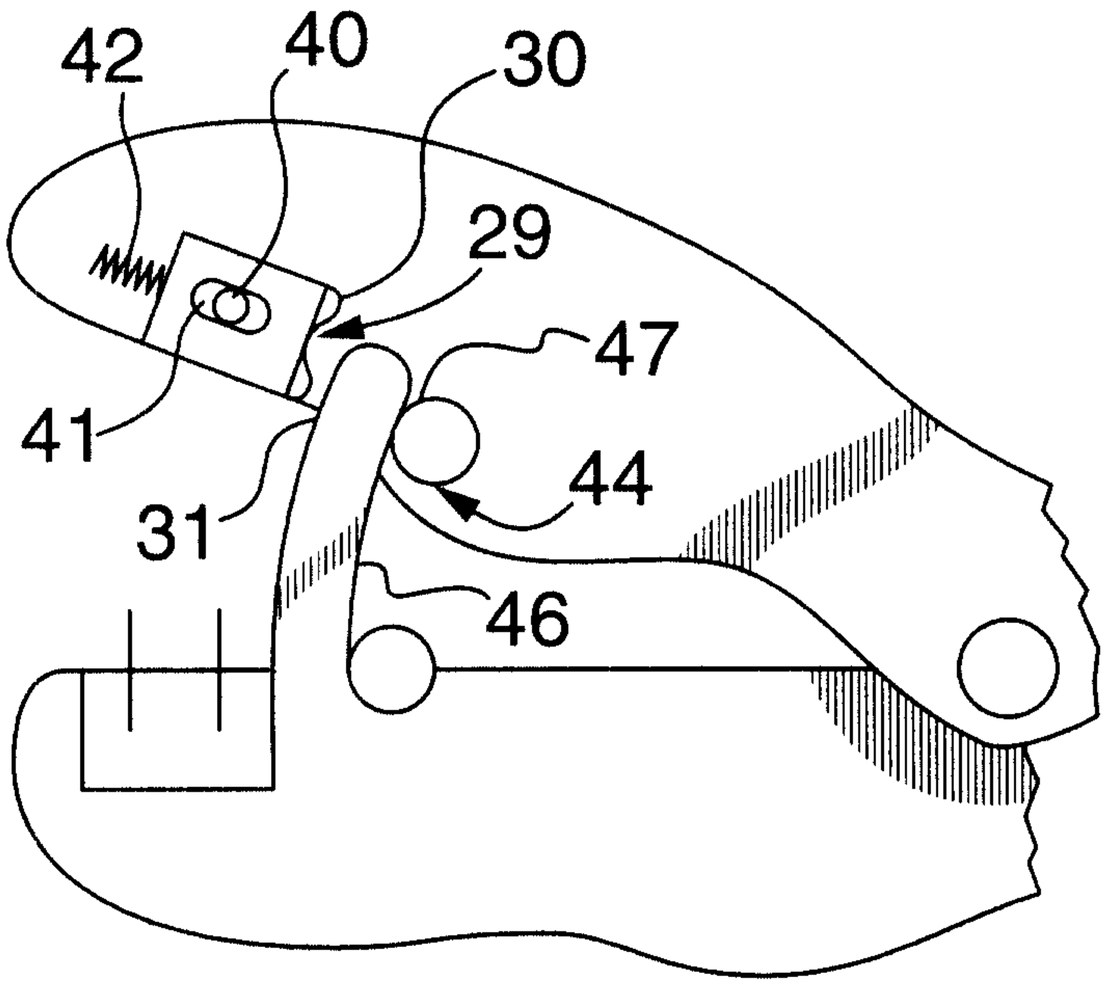


FIG. 10

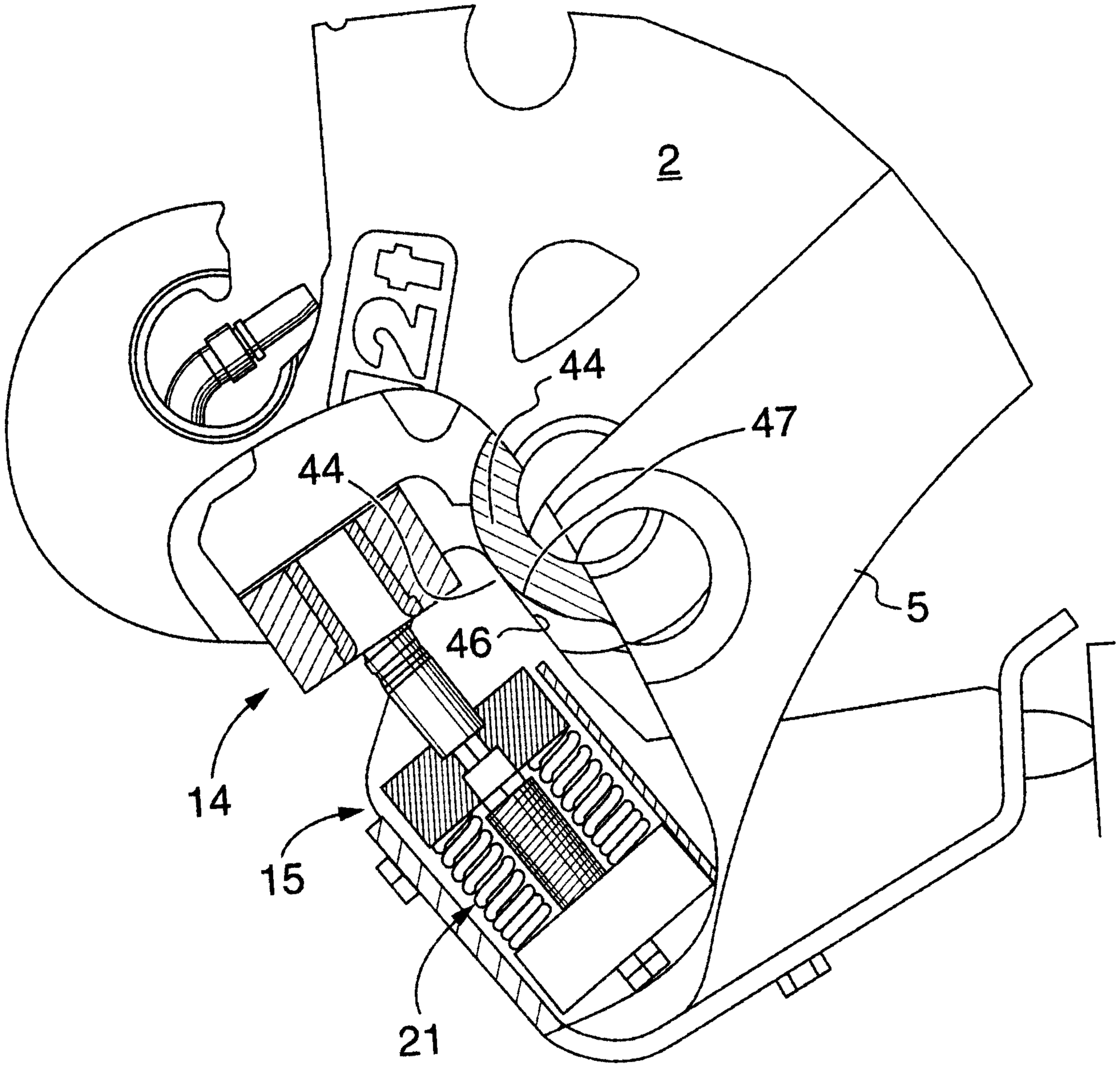


FIG. 11

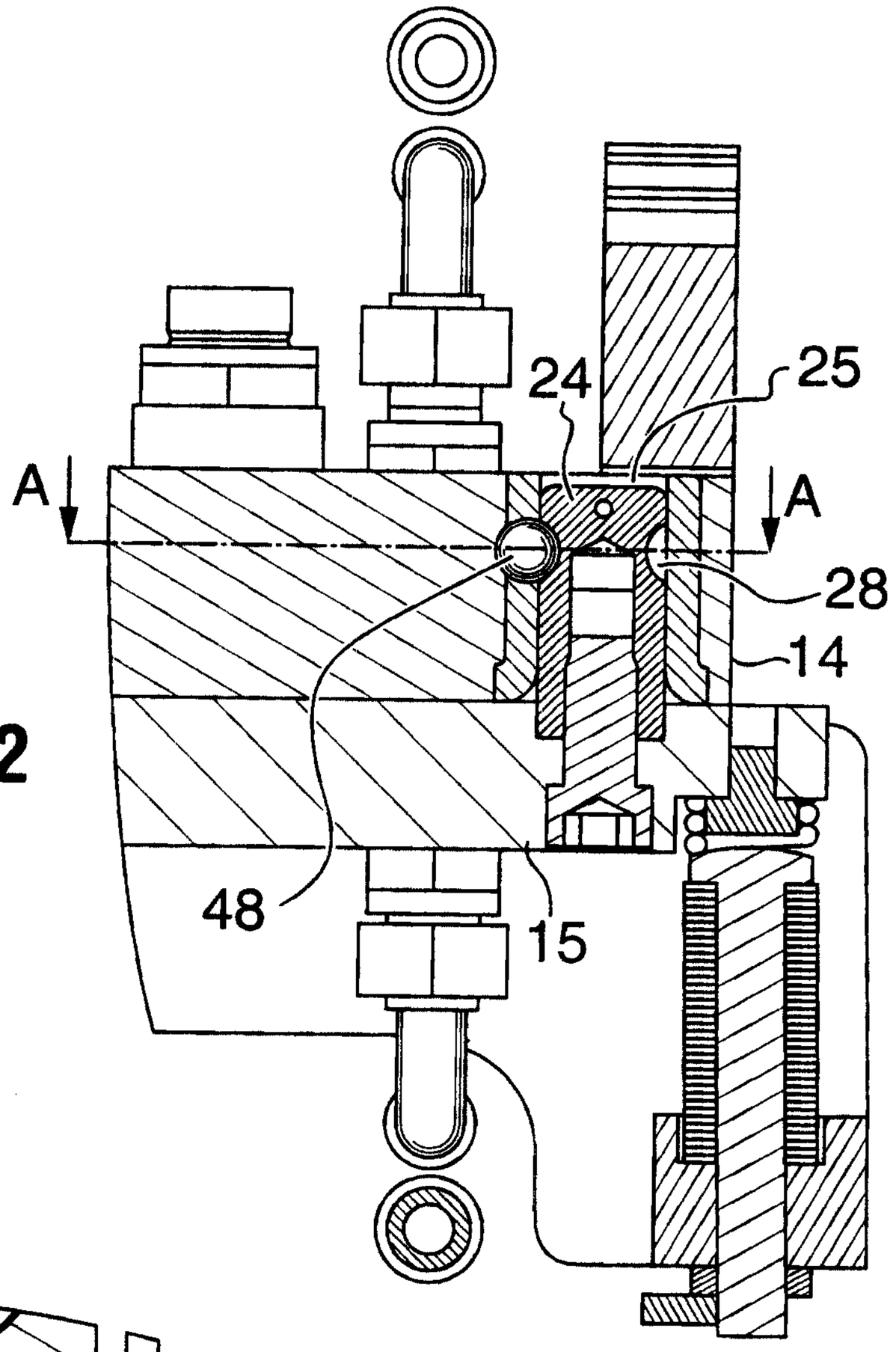


FIG. 12

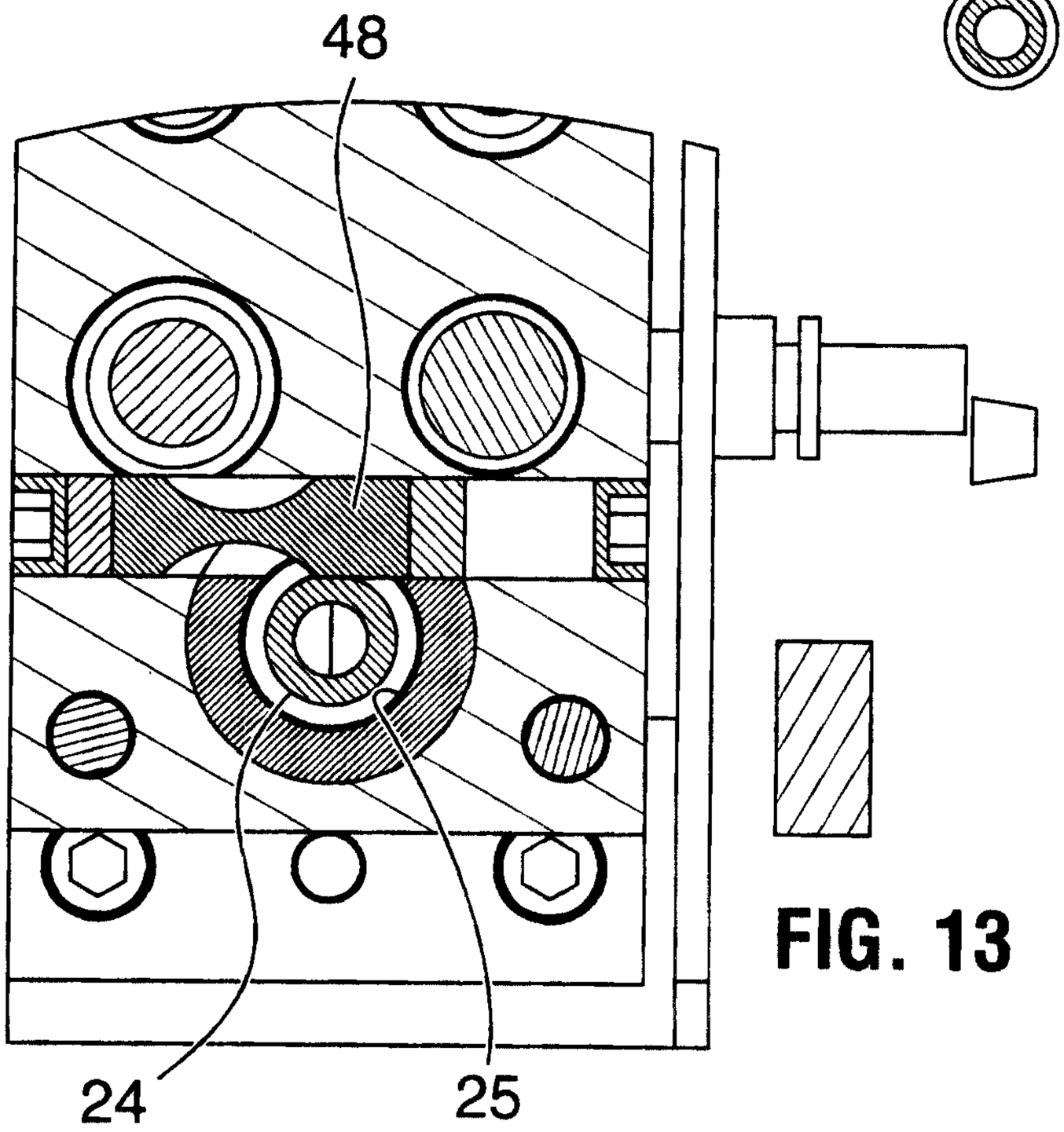


FIG. 13

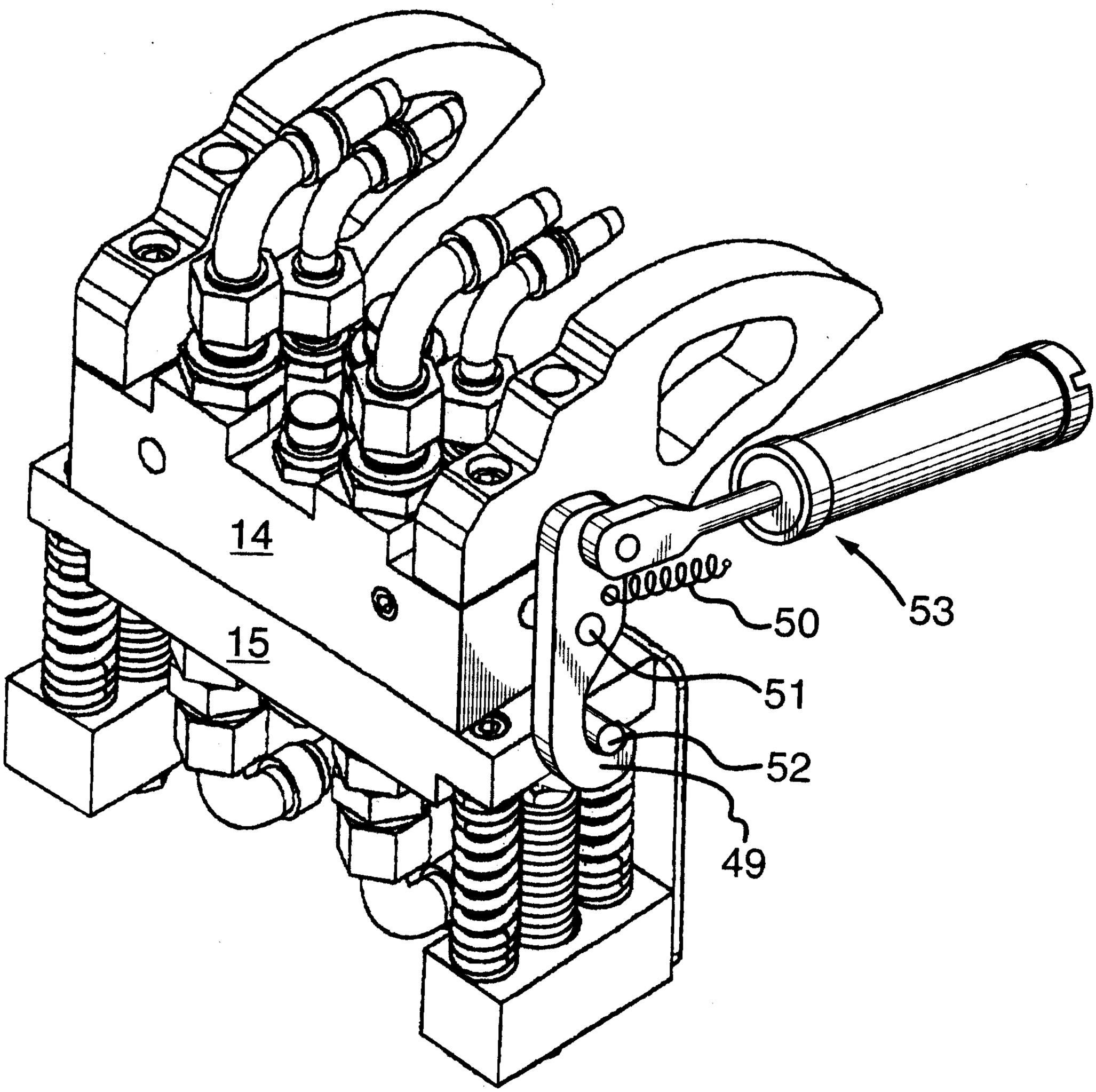


FIG. 14

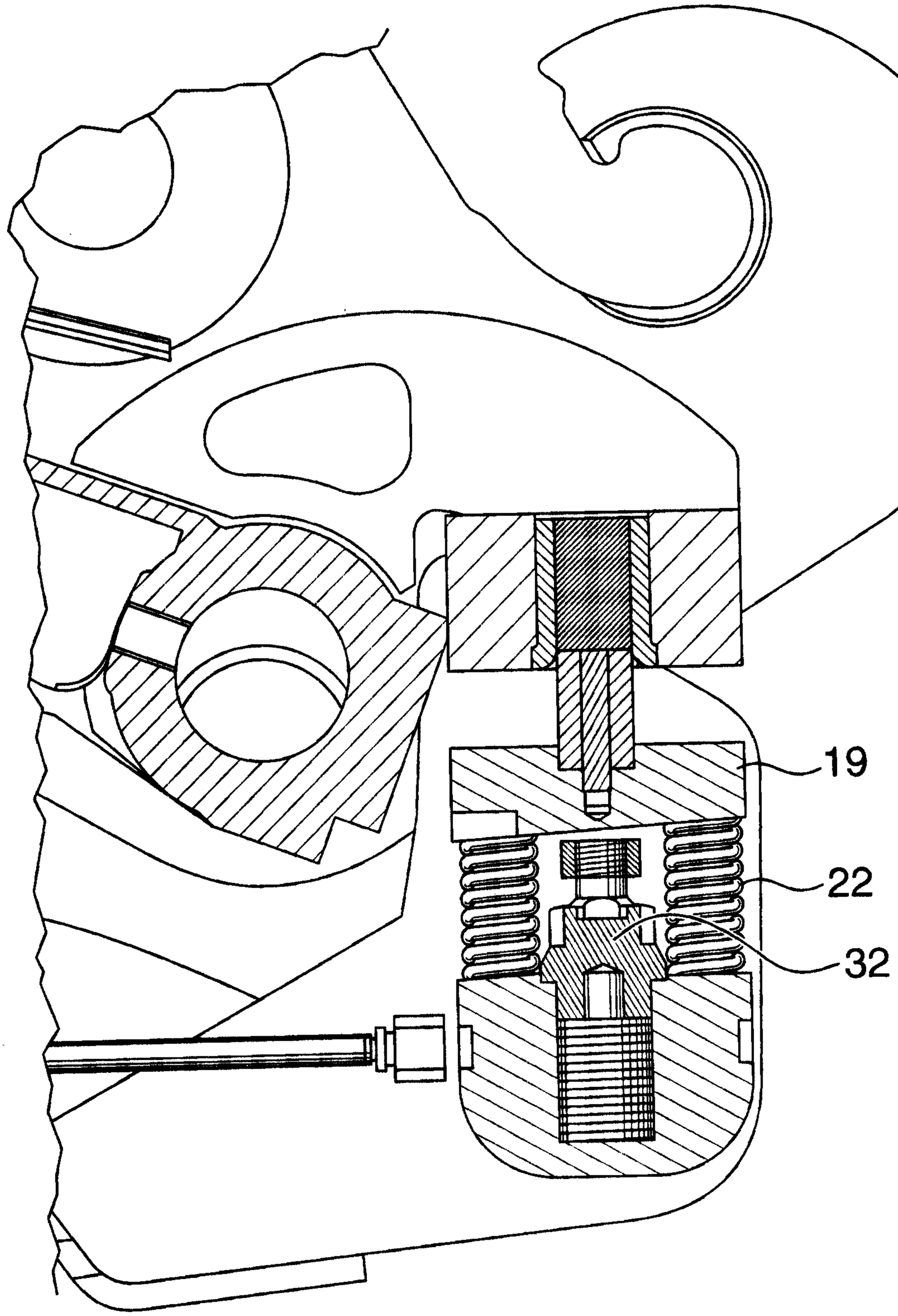


FIG. 15

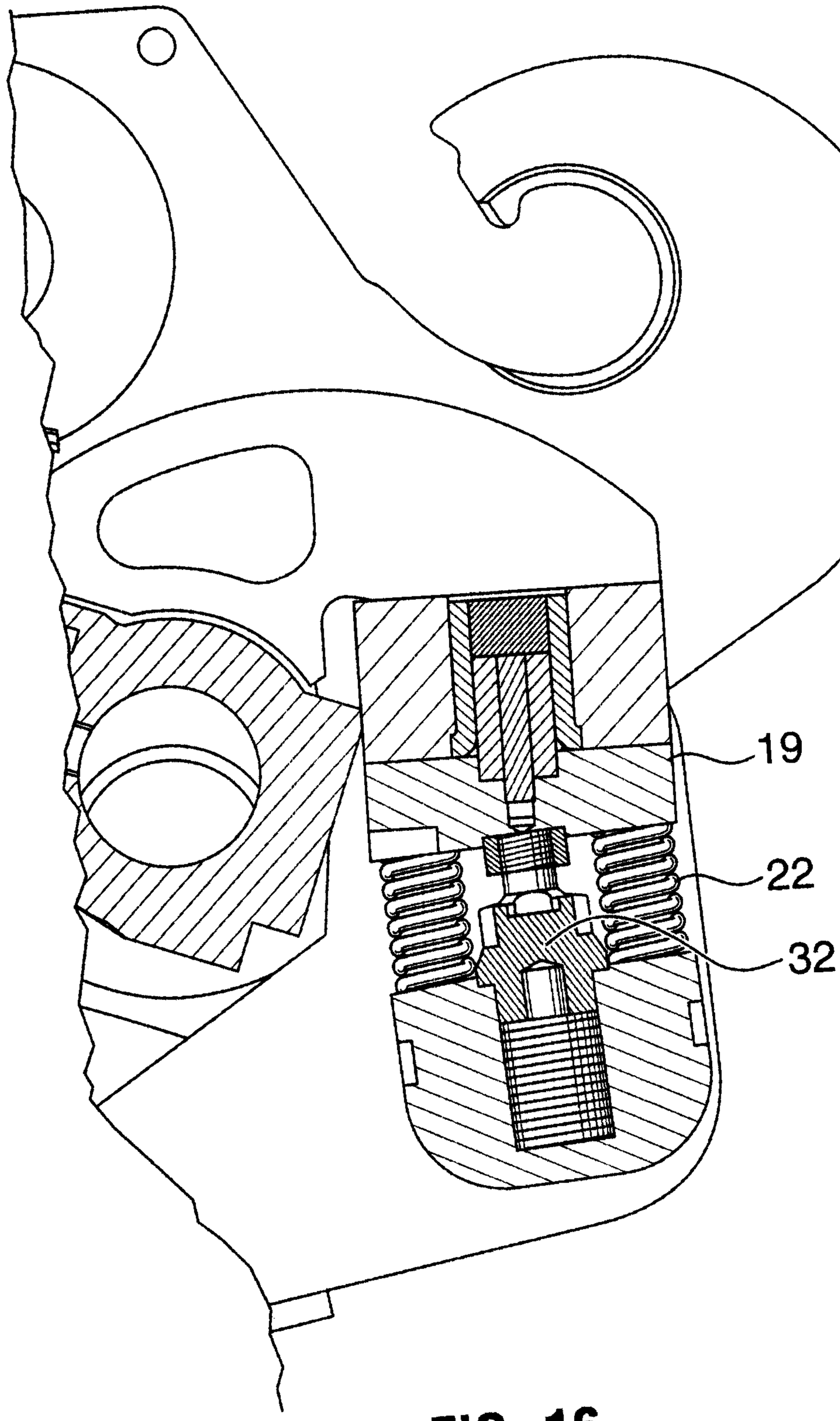


FIG. 16

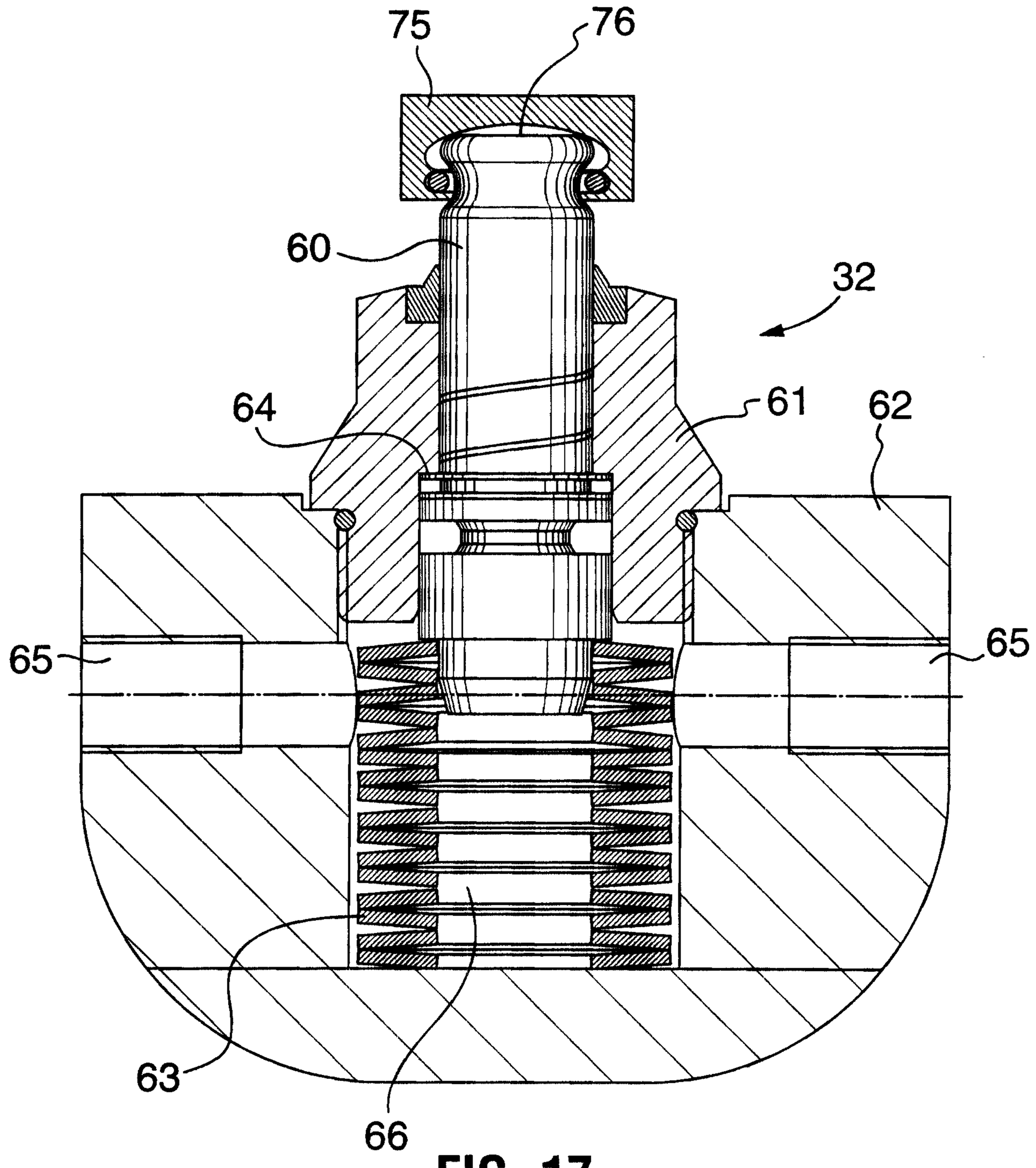


FIG. 17

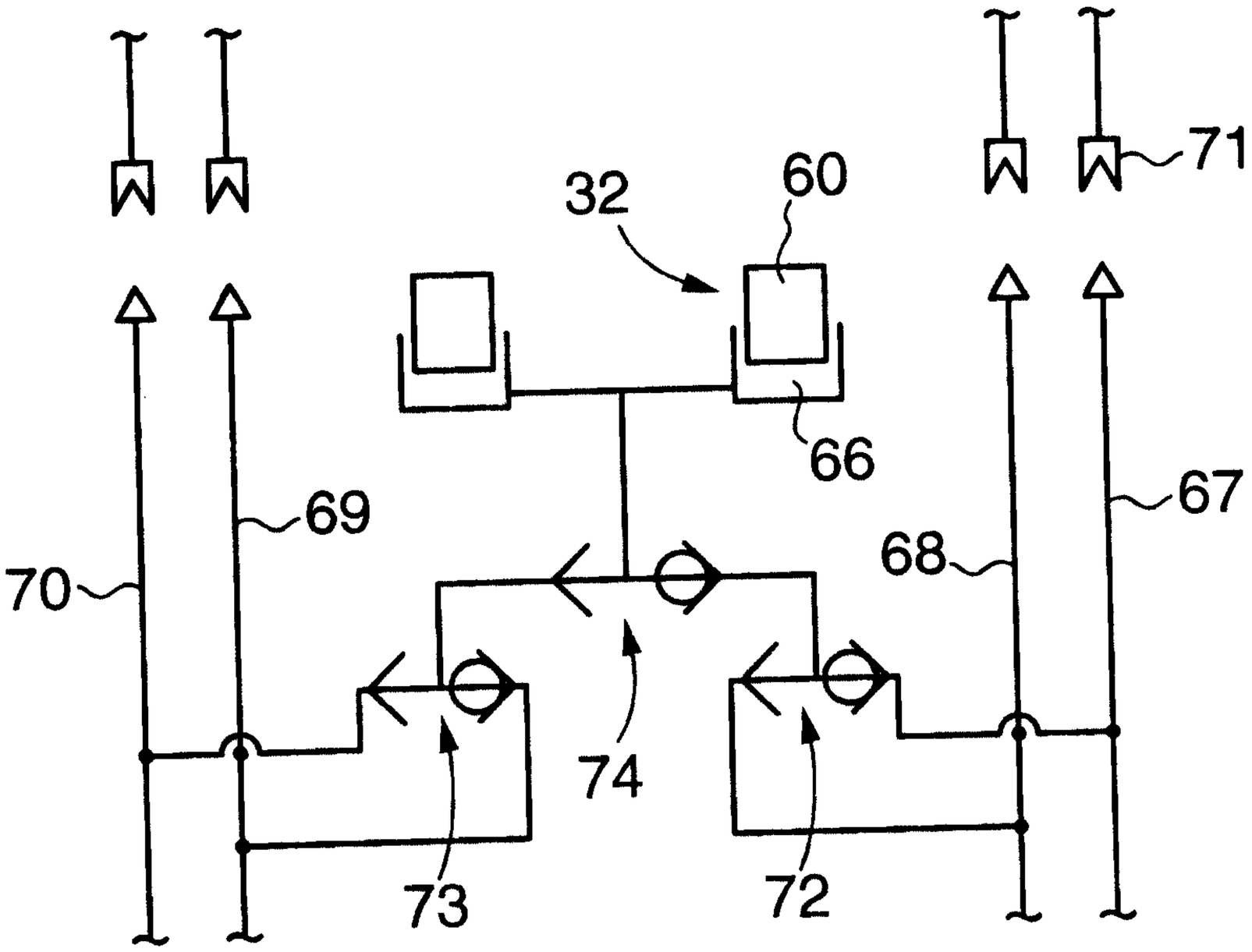


FIG. 18

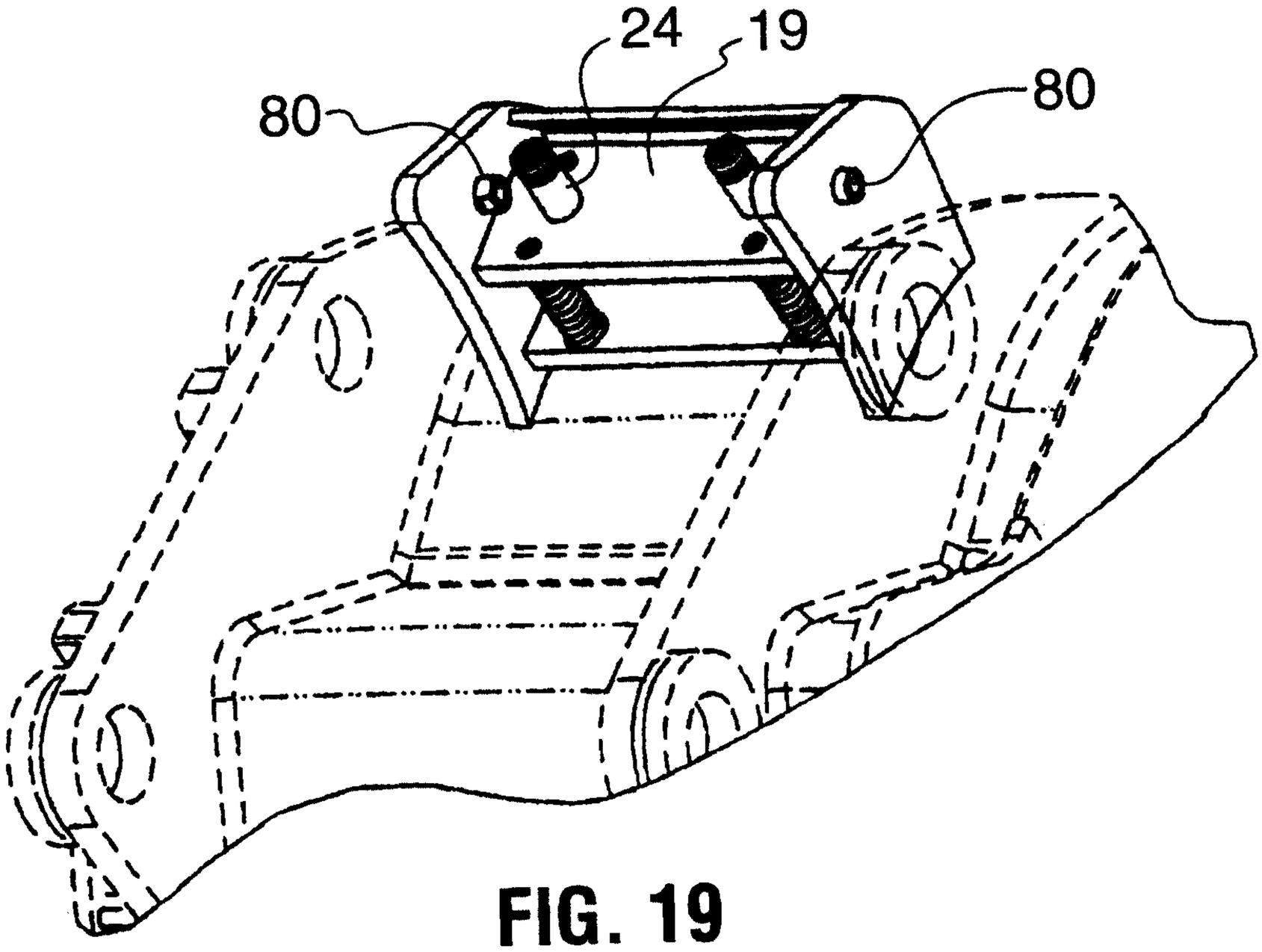


FIG. 19

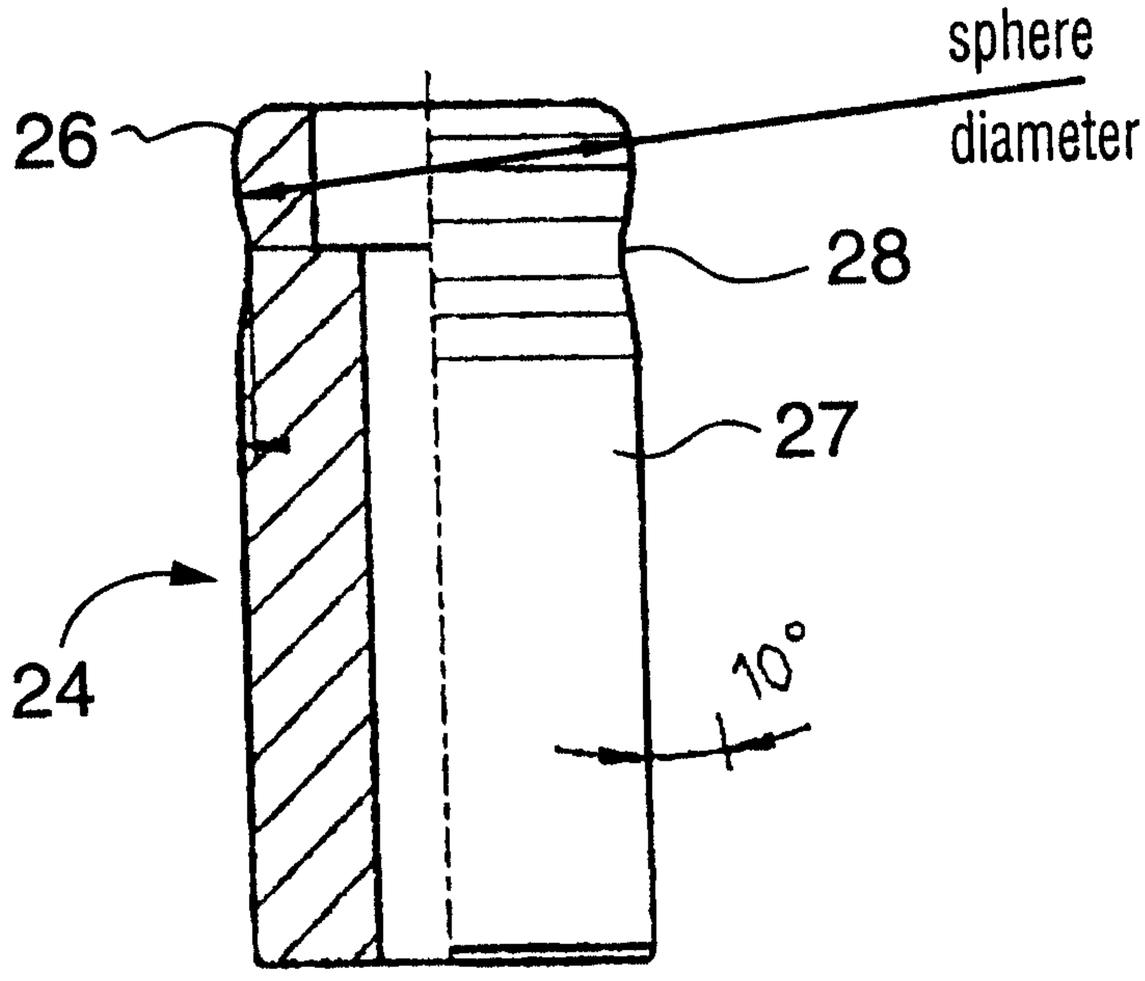
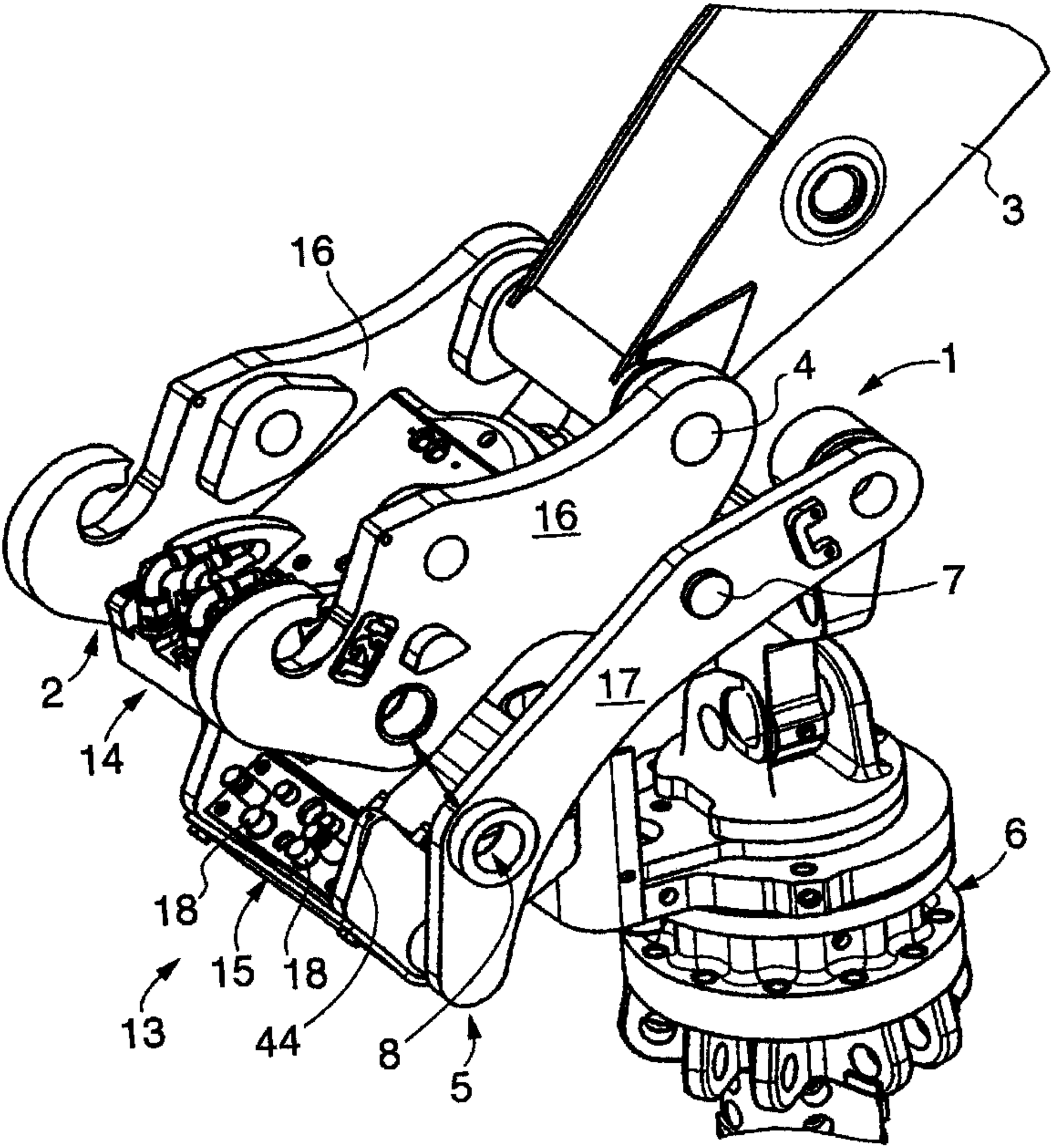


FIG. 20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