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(54) Electrical conductors connector

(57) The invention relates to a switch connector for electrical conductors which allows at least two electrical conductors, at least one of which may be live, to be electrically and mechanically connected. The connector includes biasing means which cause the switch to move to the electrical connection position. A safety device is provided which retains the biasing means in a biased condition and the switch in an open position until user actuation at the desired time such that movement of the safety device allows the release of the biasing means and the movement of the switch to the closed contact position at a speed to allow safe electrical connection.

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Description

[0001] The invention to which this application relates is to the provision of a connector of the type which can be used to connect, electrically and mechanically, at least two electrical conductors so as to allow an electrical connection to be achieved between the respective conductors.

[0002] The provision of connectors for electrical conductors is well known and the particular type of connector which is used can be determined by the voltage level which is required to pass through the conductors and/or whether the connection is to be made while the conductors are live or when they are themselves unconnected from the electricity supply.

[0003] In this invention, the connector is for use in the connection of electrical conductors which are live throughout the connection process and it will therefore be appreciated that there is a need for good safety provisions for the personnel who will be performing the connection.

[0004] It is envisaged that the connector as herein described is of particular use for the connection of electrical conductors carrying less than 1,000 volts, said conductors typically used to connect branch conduction lines from a network electricity supply, although it should be appreciated that this is not the only use.

[0005] The connection of electrical conductors while live, can be achieved already using conventional connectors and connection processes. However, despite the use of safety clothing and specific methods, it is still frequently the case that arcing and/or the provision of sparks, and generally dangerous conditions can be created if the connection does not take place strictly in accordance with the suggested method. This causes danger to the personnel performing the connection and/or the adjacent personnel and premises. A further problem which is often experienced is that the electricity supply may often carry a load prior to, or as soon as the connection is made. The load can be created by one or numerous pieces of electrical apparatus which are in various premises connected to the network and which are switched on. The personnel conducting the live connection have no practical way of identifying what the particular load will be at the time of connection and therefore, as the occurrence of load can make the live connection more dangerous, there is a need to take into account the possibility of a load being present.

[0006] The applicant in their co-pending application No. EP0952627, provides a connector which has a switch incorporated therein, the operation of which occurs after mechanical connection of the said electrical conductors has been achieved in the connector. Once the mechanical connection has been achieved, the switch can be operated to cause a fast, snap action electrical connection. It is found that the provision of a snap action electrical connection reduces the chances of arcing and sparking occurring and also ensures a uniform achievement of electrical connection by each conductor of this arrangement.

[0007] The aim of the present invention is to provide an improved form of electrical conductor which renders the same more effective and more practically easy to use.

[0008] In a first aspect of the invention, there is provided a connector for the electrical connection of at least two electrical conductors, said connector including first means for mechanical location of an electrical conductor and a second means for mechanical location of a second electrical conductor, and a switch which, when actuated, causes electrical connection between said conductors, characterised in that said switch has a connector portion actuated by a biasing means, said biasing means moving between a switch open position and a switch closed position in response to movement of a user actuated component.

[0009] In one embodiment the movement of the switch occurs under the influence of an applied force which is released to act on the switch.

[0010] In one embodiment, at least one of the conductors is live throughout the connection process. Typically the outer housing and preferably all parts of the connector which could possibly be contacted by the user in use are formed of an insulated material.

[0011] Preferably, the connector includes mechanical means in the form of first and second pairs of contact jaws, said jaws typically provided with piercing means so as to allow the same to pierce through insulating material on the electrical conductors to contact the conductive metal cores thereof, said pairs of jaws selectively movable to a closed position so as to allow electrical connection between the conductor cores.

[0012] In one embodiment, clamping means are provided for the said pairs of jaws, said clamping means comprising respective first and second shear bolts mounted to be tightened into threaded apertures in a body of the connector.

[0013] In one embodiment, a clamping component for the switch is provided in the form of a further shear bolt which can be tightened into a threaded aperture and in turn apply force to resilient means acting on the switch.

[0014] In one embodiment, the resilient means is a leaf spring, said leaf spring mounted and/or of a form such that a predetermined force has to be applied to the same by the clamping component before the switch will be moved to a closed, electrically connecting position.

[0015] In an alternative preferred embodiment the resilient means is a coil spring which acts on the switch and which is held against the bins such that, when released, the spring accelerates the movement of the switch to a closed position to provide electrical connection.

[0016] In one embodiment, the connector includes a safety device which ensures that the switch cannot be actuated before the conductors are mechanically clamped in position with jaws having made contact with the cores of the respective conductors.

[0017] In one embodiment, the safety device is provided on the clamping component for the switch and in one embodiment in the form of a protrusion which means that the same cannot be tightened beyond a predetermined limit to apply force on the switch.

[0018] In one embodiment the safety device is a plate which locates on the first and/or second clamping means and cannot move further until those clamping means for the connector have first been tightened into position to make mechanical connection with the conductors.

[0019] In an alternative embodiment the safety device is a pin mounted on the clamping component for the switch and which, when in position, prevents the clamping component from actuating the switch to the closed position. Typically the pin has a portion to be gripped.

[0020] In a further embodiment of the invention, the connector includes a switch retainer, said retainer selectively releasable from a position with the switch and, when in position, said retainer acts to maintain the switch in an open position.

[0021] In one embodiment, the retainer is of an insulating material, having a tab which lies to maintain the switch in an open position within the connector and a tag protruding from the connector, said tag being selectively manipulated by the user to remove the retaining means from the connector and hence free the switch so that the same can subsequently be moved to a closed position.

[0022] It should be appreciated that the retaining means does not specifically act against the biasing means in normal condition but rather if the switch was to be moved from the open position, the retaining means prevents the same from being moved. This is an important feature as, for safety reasons, it is important that the switch is open when the initial mechanical connection of the electrical conduction is taking place with the connector.

[0023] Specific embodiments of the invention will now be described with reference to the accompanying drawings, wherein:-

Figures 1a - b illustrate elevation and sectional end elevation along line AA of a first embodiment of an electrical connector;

Figure 2 illustrates a perspective view of the connector of Figure 1 with certain components removed for ease of reference; and

Figures 3a and b illustrate a further embodiment of the invention.

[0024] Referring now to the drawings, in both embodiments, the electrical connector comprises a body 2 formed of first and second parts 4, 6. Each of the parts has a pair of jaw members, 8, 10, said jaw members having teeth 12 formed therein. First and second clamping means 16, 18 are provided, said clamping means provided in the form of shear bolts which can be screwed into threaded apertures 20, 22 in the body 2 to bring the first and second parts 4, 6 together and the jaws into contact with electrical conductors which are placed along channels 26, 28. The teeth of the jaws protrude through any insulation material of the conductors and into contact with the electrically conductive core of the conductors.

[0025] A further clamping component 30 is provided which, in this case, lies between the first and second clamping means. The clamping component is provided to be selectively screwed into the body of the connector to apply force to a switch 34.

[0026] In Figures 1 a-b and 2 the force on the switch is applied via a resilient leaf spring 36. The clamping component 30 is provided with a safety device 40 which prevents the clamping component from being screwed into the body 2, until the clamping means 26, 28 are first screwed into the body as the safety device is in the form of a protrusion or protruding ring which depends outwardly to a sufficient distance such that the same cannot be moved past the heads or bodies 32 of the clamping means 26, 28.

[0027] This therefore ensures that the switch cannot be closed until the electrical conductors are mechanically connected in the connector. When possible, the clamping component is screwed into the body but, before doing so, a retaining means 42 has to be removed by gripping the tag 44 and hence removing the tab 46 from a position lying intermediate the switch and an electrically connecting plate 48 of the body connected electrically to the jaws 8, 10 and hence the electrical conductors. The retaining means is provided to maintain the switch in an open position during transit and initial fixing so as to prevent the switch from moving to a closed position before the user of the connector is ready for it to do so.

[0028] With the retaining means removed, the clamping component can then be screwed down and as it does so, it starts to apply a force on the leaf spring. However, it is only when the clamping force applied reaches a particular level that the leaf spring will actuate the switch. When this level is reached, the switch is moved to a closed position in a snap action manner under the influence of the leaf spring, thereby ensuring that the connection which is achieved is quick and efficient as required for safe operation.

[0029] Referring now to Figures 3a and b there is shown an alternative, preferred embodiment of a switch actuation means in accordance with the invention. In this case the connector is provided with a safety device in the form of a pin 50 which passes into the clamping component 30 and contacts with a protrusion 52 formed on the part 4. With the pin in position the clamping component is prevented from being moved further in the direction of arrow 54 shown in Figure 3b.

[0030] Furthermore the switch 34 which is attached to the end of the clamping component 30 via screw 56 is prevented from being moved under the influence of the biasing coiled spring 58. Thus, the switch is retained in an open position while the pin is in the position shown.

The coil spring 58 is biased at this time and is held in the biased position by the positioning of the pin.

[0031] In order to allow the electrical connection to be achieved, once the mechanical connection of the conductors 60, 62 shown in Figure 3b, in the teeth 12 of jaws 6, 8 has been achieved, the pin 50 needs to be released.

[0032] When the pin 50 is removed by the user, typically by gripping portion 60 and moving the pin in the direction of arrow 62, the switch 56 is free to move and is forced in the direction 54 under the influence of the biasing spring 58, to the closed position with the connector portion 59 in contact with the electrical contact surface 64 and hence achieve the electrical connection which is required between the conductors 60, 62. In this embodiment the retaining means 42 need not necessarily be provided.

[0033] The release of the biased coil spring 50 causes a quick electrical connection to be achieved. The clamping means 30 can initially be moved in the opposite direction to 54 in order to increase the bias on the spring 50 to an extent required and the pin inserted to retain the same in that position such that, when the pin is released, a fast movement action on the switch is achieved in direction 54.

[0034] It should be appreciated that this method and use of the apparatus will be performed to achieve a live connection between electrical conductors.

[0035] Typically, the clamping forces applied on the electrical conductors in the body and also the clamping force required to be applied to the leaf spring to cause operation of the switch, will be selected in accordance with particular operating requirements and it should be appreciated that the clamping force applied by the clamping means on the conductors need not be the same as the clamping force applied to the leaf spring to operate the switch.

Claims

1. A connector for the electrical connection of at least two electrical conductors, said connector including a first means for mechanical location of an electrical conductor and a second means for mechanical location of a second electrical conductor, and a switch, which, when actuated, causes electrical connection between said conductors, **characterised in that** said switch has a connector portion actuated by a biasing means, said biasing means movable between a switch open position and a switch closed position in response to movement of a user actuated component.

2. A connector according to claim 1 wherein the movement of the switch occurs once a force is released by user actuation and is then applied by the said component onto the switch.

3. A connector according to claim 1 wherein at least one of the conductors can be live through the connection process.

4. A connector according to claim 1 wherein an outer housing of the connector is formed of an insulating material.

5. A connector according to claim 1 wherein the connector includes mechanical means in the form of first and second pairs of contact jaws, said jaws provided with piercing means to pierce through the insulating material on the electrical conductors to contact the conductive metal cores thereof.

6. A connector according to claim 5 wherein said pairs of jaws are selectively movable to a closed position so as to allow the mechanical connection between the conductor cores.

7. A connector according to claim 5 wherein clamping means are provided with said pairs of jaws, said clamping means comprising respective first and second shear bolts mounted to be tightened into threaded apertures in the body of the connector.

8. Apparatus according to claim 1 wherein a clamping component for the switch is provided which can be initially moved to create a force on a resilient means provided to act on the switch.

9. A connector according to claim 8 wherein the resilient means is a leaf spring.

10. A connector according to claim 8 wherein the resilient means is a coil spring.

11. A connector according to claim 1 wherein the connector includes a safety device to ensure that the switch cannot be actuated while the said device is in position.

12. A connector according to claim 11 wherein the safety device is provided on the clamping component with the switch.

13. A connector according to claim 12 wherein the safety device is provided in the form of a member to prevent the clamping component and a biasing means being beyond a predetermined limit to apply force on the switch.

14. A connector according to 13 wherein the safety device is a plate which locates in the first and/or second clamping means and cannot move beyond a predetermined limit until those clamping means for a connector have first been tightened into position to make the mechanical connection with the conductors.

15. A connector according to claim 13 wherein the safety device is a pin mounted on the clamping component for the switch and which, when in position, prevents the clamping component from actuating the switch to the closed position.

16. A connector according to claim 15 wherein the pin has a portion to be gripped by the user.

17. A connector according to claim 1 wherein the connector includes a selectively releasable switch retainer.

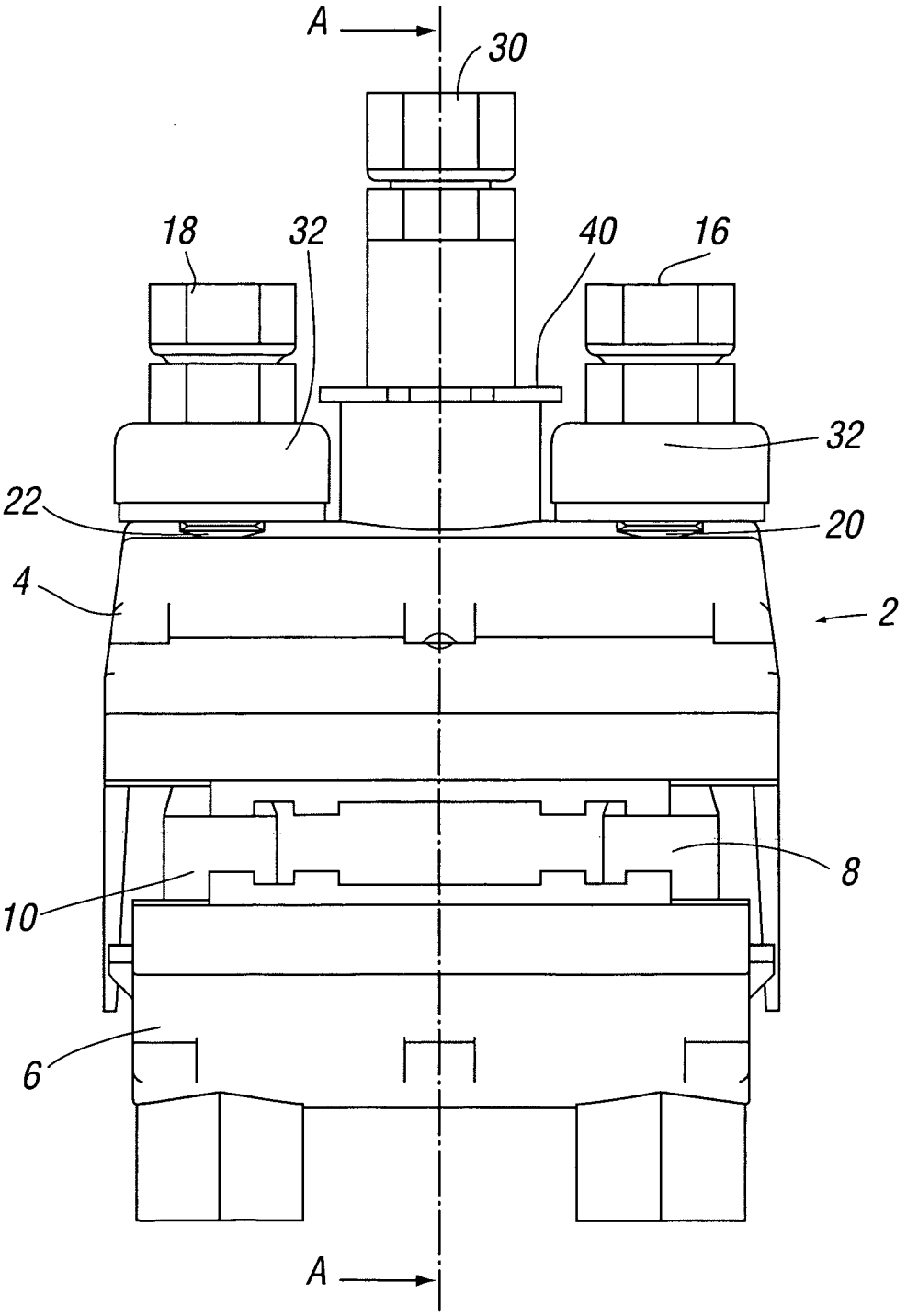

FIG. 1a

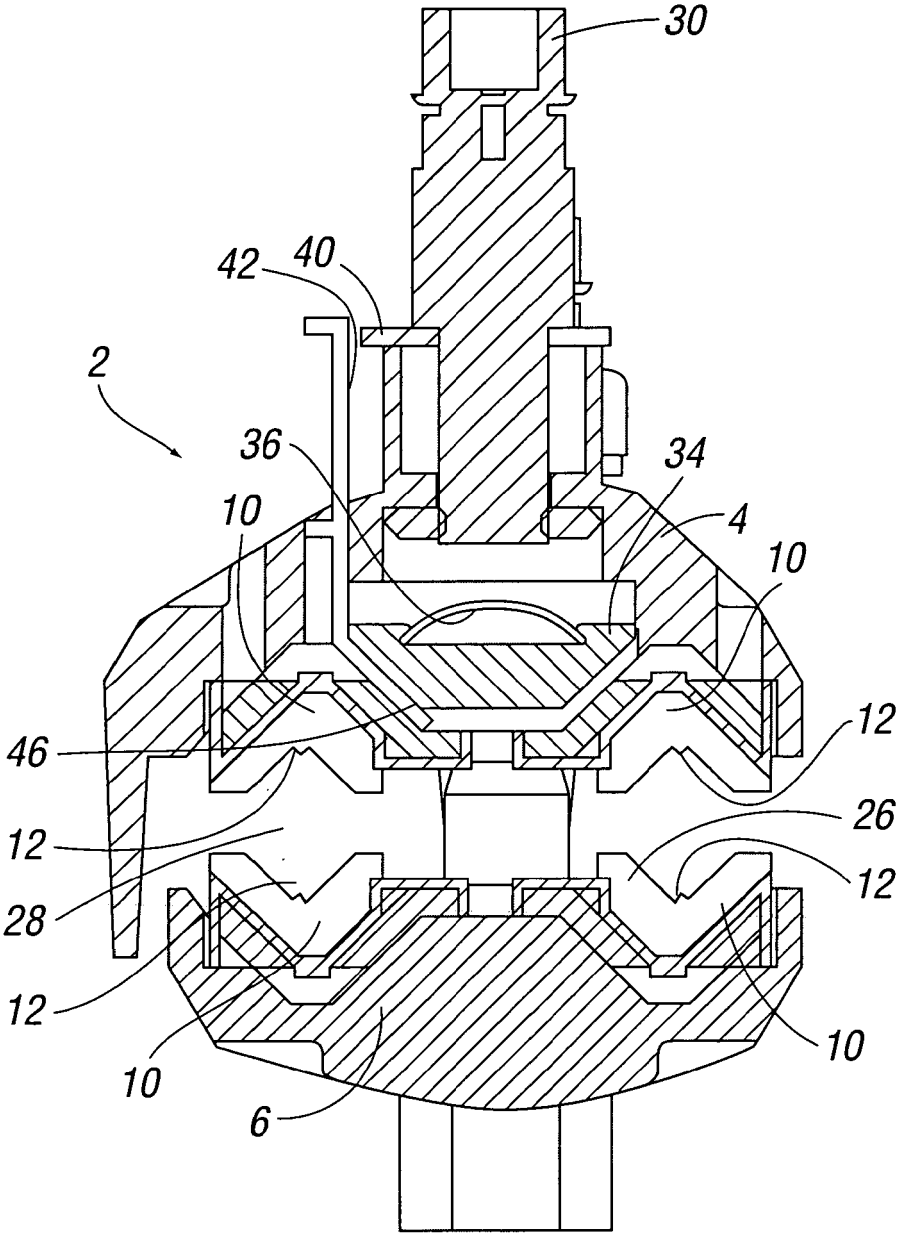

FIG. 1b

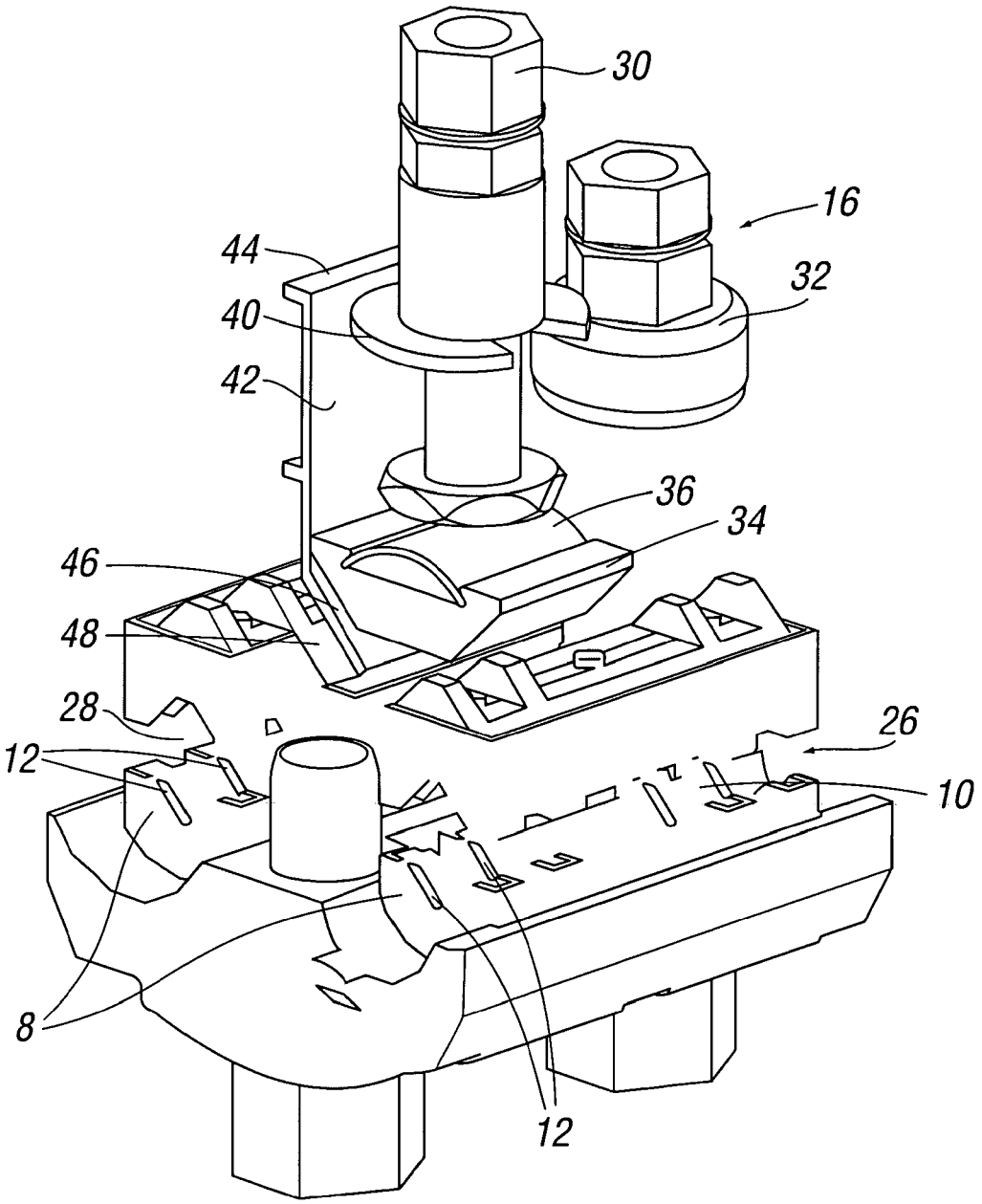

FIG. 2

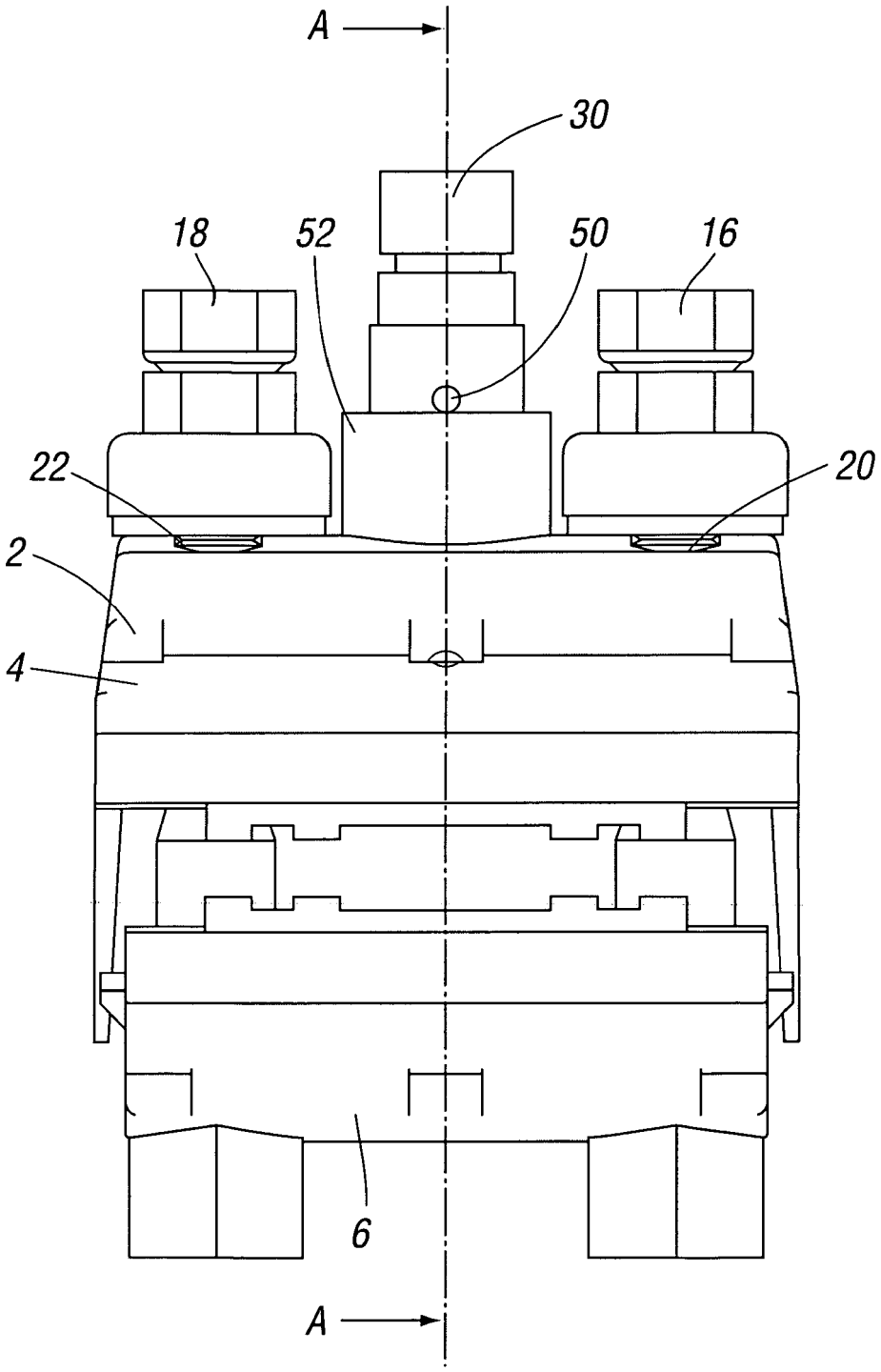

FIG. 3a

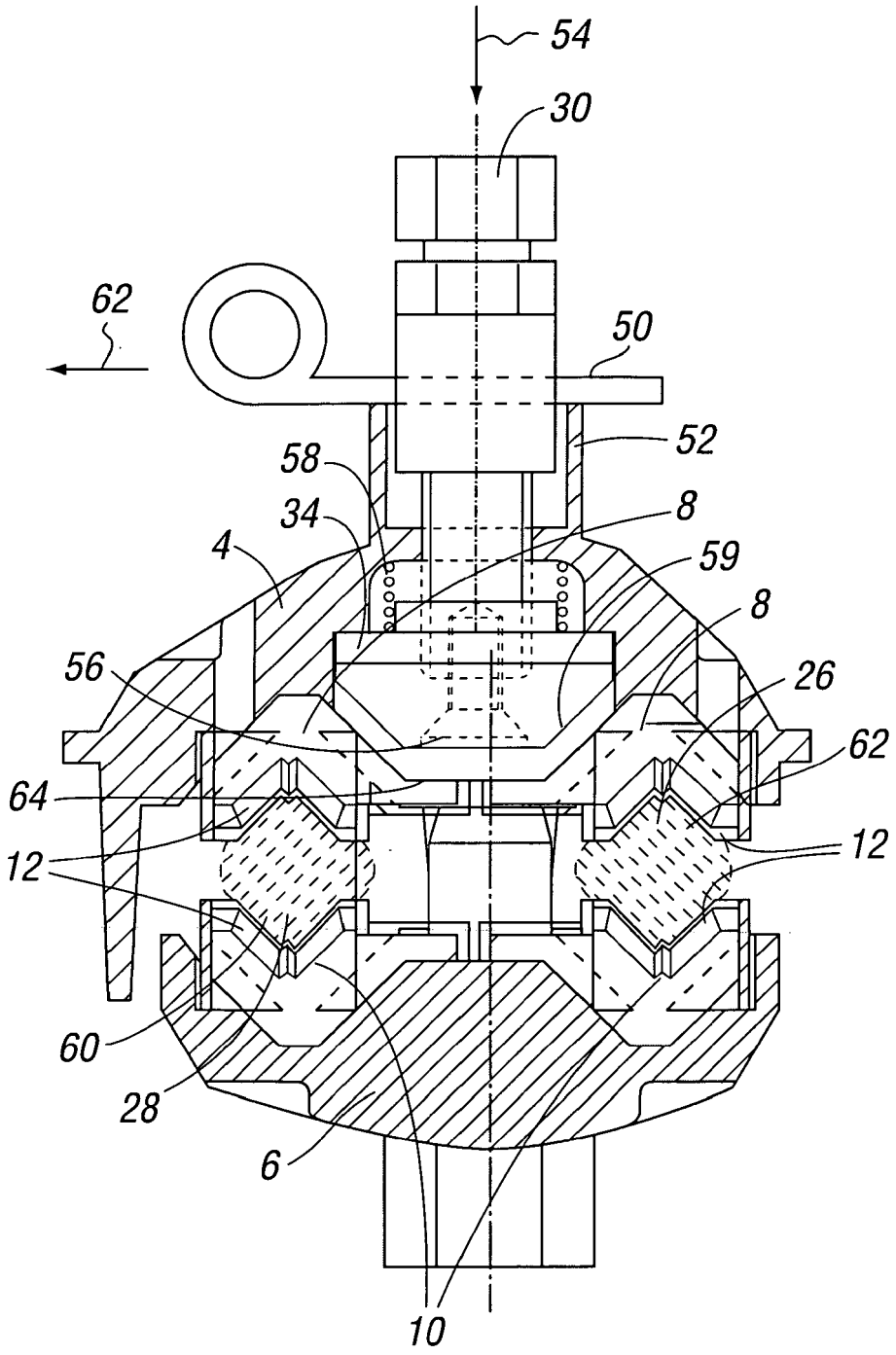

FIG. 3b

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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