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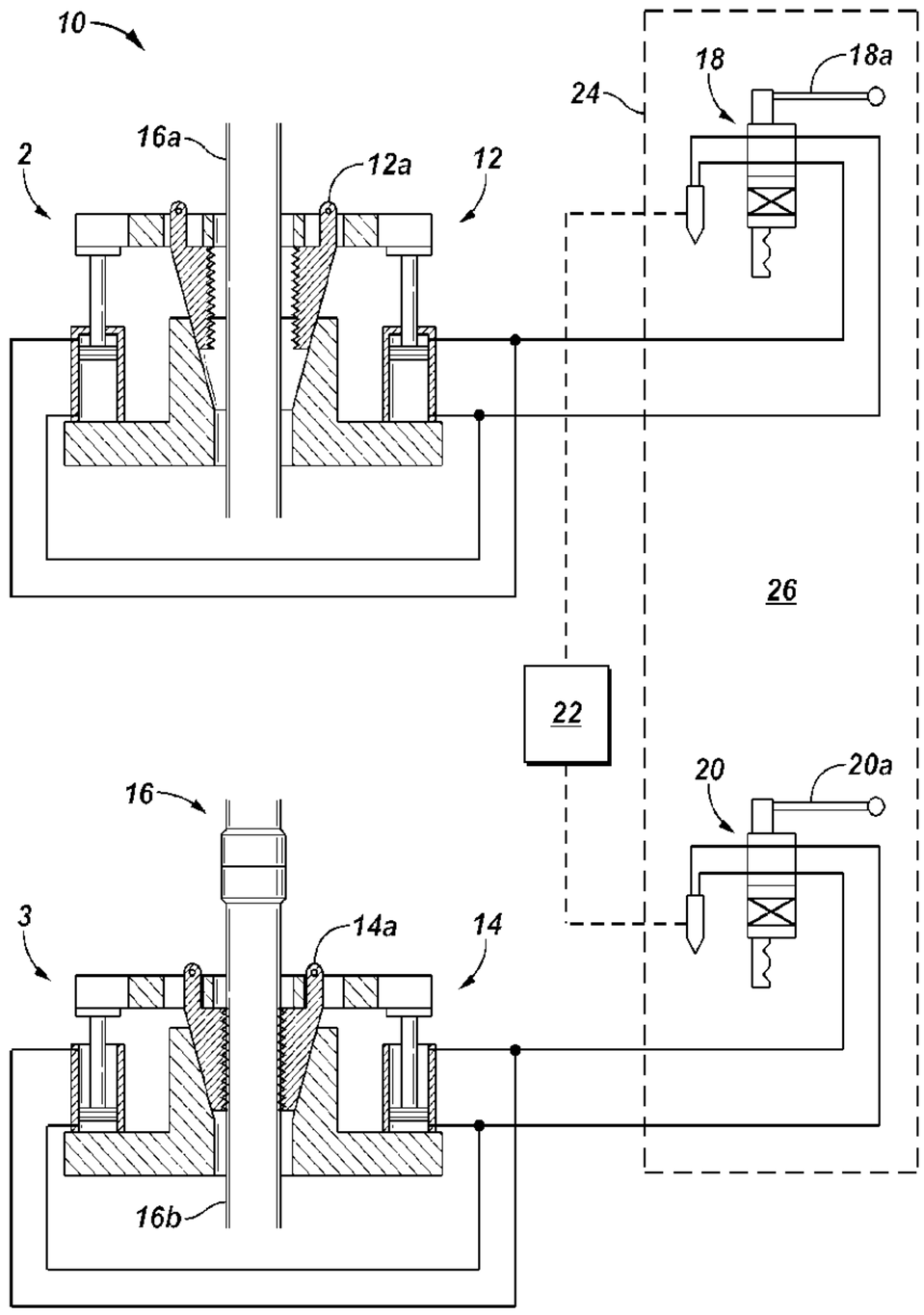
(54) Titre : SYSTEME DE VERROUILLAGE DE PREHENSION TUBULAIRE
(54) Title: TUBULAR GRIP INTERLOCK SYSTEM

FIG. 1



(57) Abrégé/Abstract:
A tubular grip interlock system for ensuring that a tubular string is gripped by at least one of a first tubular gripping device and a second tubular gripping device includes a console having a panel forming a track having a first leg and a second leg; a first actuator

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(57) Abrégé(suite)/Abstract(continued):
operating the first tubular gripping device between an open and a closed position; a second actuator operating the second tubular gripping device between an open and a closed position; and a single control device movable along the track, the single control device operationally connected to the first actuator and operationally disconnected from the second actuator when the single control device is disposed along the first leg and wherein the single control device is operationally disconnected from the first actuator and operationally connected to the second actuator when the single control device is disposed in the second leg.

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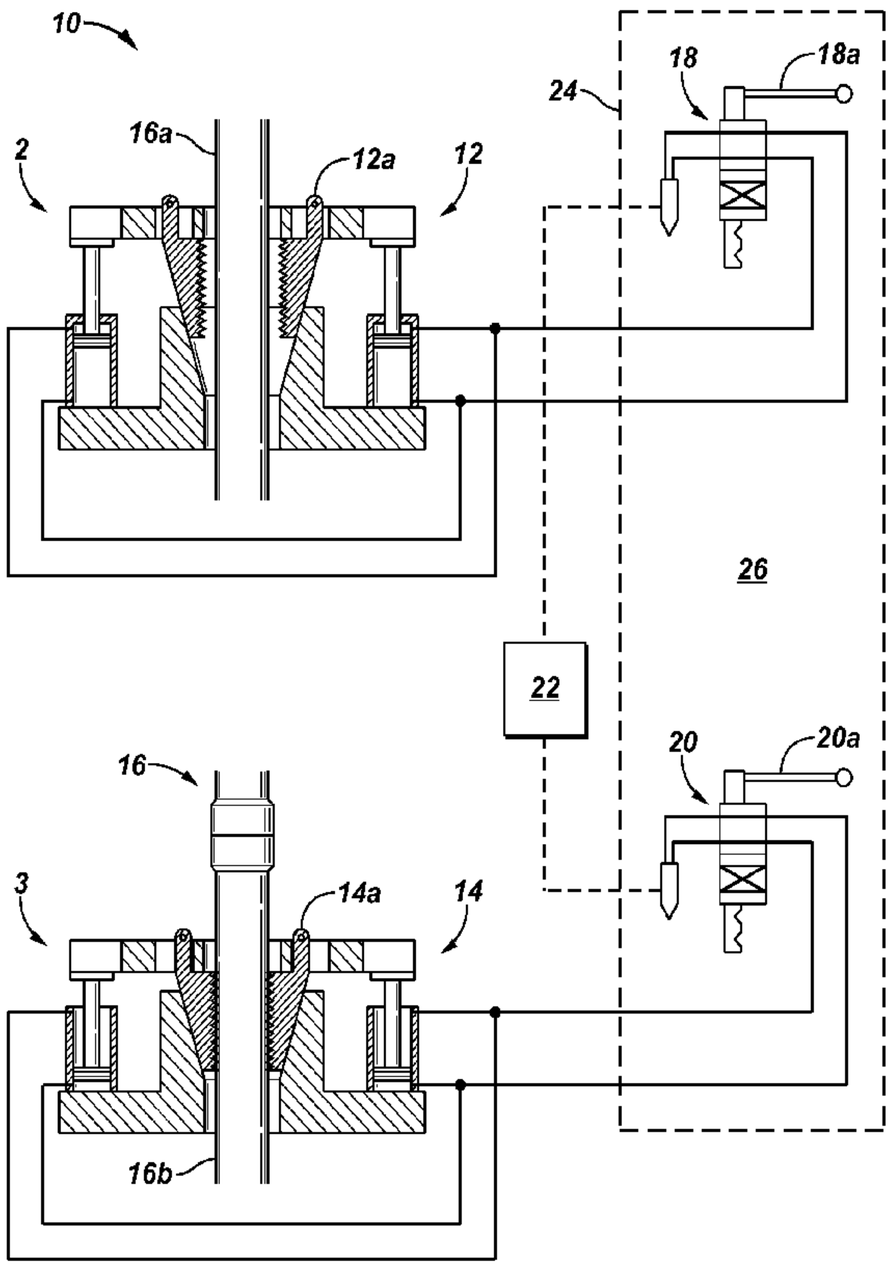
[Continued on next page]

(54) Title: TUBULAR GRIP INTERLOCK SYSTEM

(57) Abstract: A tubular grip interlock system for ensuring that a tubular string is gripped by at least one of a first tubular gripping device and a second tubular gripping device includes a console having a panel forming a track having a first leg and a second leg; a first actuator operating the first tubular gripping device between an open and a closed position; a second actuator operating the second tubular gripping device between an open and a closed position; and a single control device movable along the track, the single control device operationally connected to the first actuator and operationally disconnected from the second actuator when the single control device is disposed along the first leg and wherein the single control device is operationally disconnected from the first actuator and operationally connected to the second actuator when the single control device is disposed in the second leg.

FIG. 1



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TUBULAR GRIP INTERLOCK SYSTEM

TECHNICAL FIELD

[0001] The invention relates in general to running tubulars into and pulling tubulars out of a wellbore and more particularly to an interlock for assembling and disassembling tubular strings.

BACKGROUND

[0002] Strings of interconnected tubulars are inserted into and pulled from wellbores at various times and for various purposes. For example, tubulars strings are assembled and run into the well for drilling the wellbore, running casing to line the wellbore, and to position tools in the wellbore. Tubulars include all tubular members which are referred to under different terms, such as and without limitation, casing, liner, drill pipe, and tubing, based on the intended use and/or diameter of the tubular.

[0003] A drilling rig is employed to assemble the tubular string for insertion into the wellbore and to dissemble the tubular string as it is pulled from the wellbore. The drilling rig employs a pair of cooperative tubular gripping devices to support the tubular string and to assemble and disassemble the tubular string. One tubular gripping device can travel longitudinally relative to the rig floor and is commonly referred to as an elevator or casing running tool. The other tubular gripping device is commonly referred to as a spider and can be maintained in a substantially stationary position at the rig floor.

[0004] Generally, the spider grips and supports the portion of the tubular string that extends into the wellbore. The elevator, during assembly, engages an add-on tubular joint and aligns it over the tubular (e.g., tubular string) that is held by the spider. The add-on tubular is then connected

to the suspended tubular string. The tubulars may be made-up by various tools including power tongs, spinners, and top drives. The elevator may be utilized in some applications for rotating the tubular for assembly and disassembly. Once the tubulars are interconnected to assemble a tubular string, the spider disengages the tubular string and the elevator lowers the tubular string through the spider to a desired position. The spider then re-engages the tubular string and the elevator disengages the string. The sequence may be reversed when pulling the tubular string from the wellbore and disassembling the tubular string.

[0005] Often the elevator and the spider are operated by remote control from a common location by an operator. A lever-operated valve actuates the spider between the engaged or closed position and the disengaged or open position. A second lever-operated valve actuates the elevator between the engaged and disengaged position. The elevator and spider work in tandem to maintain a constant grip on the tubular string by at least one of the tubular gripping devices. The failure to maintain a grip on the tubular string by one of the tubular gripping devices may result in the release of the string into the wellbore. The failure to maintain engagement with the tubular string can occur in many different ways. One example of a failure occurs when a tubular gripping device does not obtain a sufficient grip on the tubular string. Another common failure simply occurs when both tubular gripping devices are inadvertently disengaged at the same time. This can happen for various reasons such as when an operator actuates one tubular gripping device to open (e.g., disengage) before the fluidic (e.g., hydraulic, pneumatic) system has had sufficient time to actuate the other tubular gripping device to the closed (e.g., engaged) position. This can also occur due to the mistiming of actuation steps, wherein an operator begins operating

one valve from the closed to the open position while still operating the other valve from the open to the closed position resulting in both valves being in the open position.

[0006] Interlock systems such as the grip assurance systems disclosed in U.S. Patents 5,791,410 and 4,676,312 have been provided to ensure that one tubular gripping device is engaged with the tubular string before the other tubular gripping device is disengaged from the tubular string and or that a sufficient grip is obtained by the engaging device. However, there continues to be a need for interlock systems that can be utilized singularly or in combination with other tubular grip assurance systems.

SUMMARY

[0007] One embodiment of a tubular grip interlock system includes a first tubular gripping device operable between an open and a closed position; a second tubular gripping device operable between an open and a closed position; and an interlock gate preventing manual operation of the first tubular gripping device and the second tubular gripping device simultaneously.

[0008] The interlock gate may include a track defining a first leg and a second leg, and a single interlock device operationally connected to the first tubular gripping device and the second tubular gripping device. The single interlock device may be moveable along the track; wherein movement of the single interlock device along the first leg operates the first tubular gripping device between its open and closed position and wherein movement of the single interlock device along the second leg operates the second tubular gripping device between its open and closed position. The track may include a cross-over leg separating the first and the second leg, wherein when the single interlock device is disposed at the cross-over leg the first tubular gripping device and the second tubular gripping device are in the closed position.

[0009] The system may include a first valve operating the first tubular gripping device; a second valve operating the second tubular gripping device; a first actuator operationally connected to the first valve, the first actuator moveable along an operational path between the open position and the closed position of the first tubular gripping device; and a second actuator operationally connected to the second valve, the second actuator moveable along an operational path between the open and the closed position of the second tubular gripping device. The system may include

a single interlock device that is selectively connectable to the first actuator and the second actuator.

[0010] The interlock system may include a first valve operating the first tubular gripping device; a second valve operating the second tubular gripping device; a track having a first leg and a second leg; and a single interlock device moveable along the track, wherein the interlock device is operationally connected to the first valve and operationally disconnected from the second valve when the single interlock device is in the first leg and the interlock device is operationally disconnected from the first valve and operationally connected to the second valve when the interlock device is in the second leg. The track may include a cross-over leg, wherein the first tubular gripping device and the second tubular gripping device are actuated to their respective closed positions when the interlock control device is disposed along the cross-over leg. The interlock gate may include a member selectively positioned to block movement of the interlock device along the track. The member may be actuated to a position in the track in response to a tubular grip assurance signal.

[0011] It is noted that the actuation of a tubular gripping device to a position may not occur simultaneous with the operation of the respective valve or actuator to such position. For example, a first valve may operate a first tubular gripping device. A time lag may exist between operation of the first valve from the open to the closed position and the actuation of the first tubular gripping device from the open to the closed position. Therefore an operational position of a valve or actuator may not correspond to the actual position of the associated tubular gripping device and the tubular string.

[0012] One embodiment of a tubular grip interlock system for ensuring that a tubular string is gripped by at least one of a first tubular gripping device and a second tubular gripping device includes a console having a panel forming a track having a first leg and a second leg; a first actuator operating the first tubular gripping device between an open and a closed position; a second actuator operating the second tubular gripping device between an open and a closed position; and a single control device movable along the track, the single control device operationally connected to the first actuator and operationally disconnected from the second actuator when the single control device is disposed along the first leg and wherein the single control device is operationally disconnected from the first actuator and operationally connected to the second actuator when the single control device is disposed in the second leg.

[0013] The first actuator may be, for example and without limitation, a lever, button or switch, e.g., electric or fluidic. Similarly, the second actuator may be, for example and without limitation, a lever, button or switch, e.g., electric or fluidic. A first control valve may operationally connect the first actuator to the first tubular gripping device. A second control valve may operationally connect the second control valve to the second tubular gripping device.

[0014] One embodiment of a method for running tubular strings includes the steps of providing a first tubular gripping device operable between an open and a closed position and a second tubular gripping device operable between an open and a closed position; providing a single control device to actuate the first and the second tubular gripping devices from a control console, the single control device moveable along a track having a first leg and a second leg; moving the single control device along the first leg to actuate the first tubular gripping device between the open and the closed position when the second tubular gripping device is in the closed position;

and moving the single control device along the second leg to actuate the second tubular gripping device between the open and the closed position when the first tubular gripping device is in the closed position. In one embodiment, the single control device is operationally connected to the first tubular gripping device and operationally disconnected from the second tubular gripping device when the single control device is disposed in the first leg. In some embodiments the first tubular gripping device is in the closed position when the second tubular gripping device is in the open position and similarly, the second tubular gripping device is in the closed position when the first tubular gripping device is in the open position. The first and the second tubular gripping devices may be in the closed position simultaneously. The method may include the step of blocking movement of the single control device to operate the first tubular gripping device to the open position in response to the second tubular being in the open position.

[0015] An embodiment of a method for maintaining a grip on a tubular string in a wellbore tubular running operations with at least one of a first or a second tubular gripping device includes the steps of providing a first valve operating the first tubular gripping device between an open and a closed position and a second valve operating the second tubular gripping device between an open and a closed position; actuating the first valve and the second valve with a single interlock device; and preventing simultaneous operational connection of the single interlock device to the first valve and the second valve.

[0016] The method may include the step of requiring actuation of the first valve to the closed position before disconnecting the single interlock device from the first valve. The method may include the step of limiting movement of the single interlock device in response to one of the first tubular gripping member or the second tubular gripping member being in the open position.

[0017] The foregoing has outlined some of the features and technical advantages of the invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The foregoing and other features and aspects of the invention will be best understood with reference to the following detailed description of a specific embodiment of the invention, when read in conjunction with the accompanying drawings, wherein:

[0019] Figure 1 is a conceptual illustration of an embodiment of an interlock control system of the invention;

[0020] Figure 2 is a perspective view from above a control console illustrating an interlock gate system in accordance with an embodiment of the invention;

[0021] Figure 3 is a perspective view from below the panel of the console of Figure 2;

[0022] Figure 4 is a perspective, top view of another embodiment of an interlock gate system;

[0023] Figure 5 is an exploded view of an embodiment of an operational connecting system of the interlock gate system illustrated in Figure 4;

[0024] Figure 6 is a top view of control panel illustrating another embodiment of an interlock gate system of the invention;

[0025] Figures 7A-7J illustrate another embodiment of interlock gate system in various operational positions; and

[0026] Figure 8 is a top view of control panel illustrating another embodiment of an interlock gate system of the invention.

DETAILED DESCRIPTION

[0027] Refer now to the drawings wherein depicted elements are not necessarily shown to scale and wherein like or similar elements are designated by the same reference numeral through the several views.

[0028] Refer now to Figure 1 wherein a conceptual illustration of an embodiment of an interlock control system, generally denoted by the numeral 10, is provided. System 10 includes a pair of tubular gripping device 12 and 14. Tubular gripping devices 12 and 14 can be utilized in conjunction during the assembly and disassembly of a tubular string 16. Tubular gripping device 12 is shown in the open position, wherein slips 12a are disengaged from gripping add-on tubular 16a which is threadedly connected to tubular joint 16b to form a tubular string 16. Tubular gripping device 14 is shown in the closed or engaged position, wherein slips 14a are engaged and gripping tubular 16. "Tubular" may be referred to from time to time herein as casing for the purposes of description, however it is recognized that other tubular elements such as, drill pipe, tubing, liners may be utilized and are incorporated into the meaning of casing.

[0029] Figure 1 is provided for purposes of describing an embodiment of a system of the invention and is not meant to be limiting. For example, tubular gripping devices 12 and 14 are both shown as external tubular gripping devices, wherein the gripping elements contact and grip the exterior of the tubular. However, the tubular gripping device may be any tubular gripping and/or tubular running tool including an internal tubular gripping device, such as without limitation a gripping head adapted to be positioned inside of the tubular and engaging the tubular along its inside diameter.

[0030] As used herein, "elevator" or "elevator slips" means an apparatus or mechanism that is arranged to grip and hold a tubular for the purpose of raising or lowering the tubular. Examples of elevators include external slip devices, such as illustrated in Figure 1, as well as internal tubular gripping devices, such as gripping heads that are often used with top drive systems. The elevator may further be adapted for applying torque or rotation for example to connect or disconnect tubular joints and for the purpose of drilling. "Spider" or "spider slips" refer to a device for gripping a tubular while the tubular gripping device remains substantially stationary. Often the spider is supported by the rig floor or deck.

[0031] Elevator 12 and spider 14 are controlled between their open and closed position via pressurized fluid (e.g., gas, liquid). For purposes of description "open" is used herein to mean that the tubular gripping device is actuated to a position disengaged from and not gripping the tubular. "Closed" is used herein to mean that the tubular gripping device is operated so as to be engaging and gripping the tubular. These terms apply to both external and internal tubular gripping devices.

[0032] The flow of pressurized fluid to elevator 12 may be controlled by an elevator control valve 18. Similarly, spider 14 may be operated between the open and closed position by a spider control valve 20. Control valves 18 and 20 may be referred to herein from time-to-time as a directional control valve. For example, in Figure 1, control valves 18, 20 are illustrated as four-way directional valves. Control valve 18 may be one of various types of valves, such as without limitation a pneumatic solenoid, hydraulic solenoid, or electric solenoid.

[0033] A grip assurance interlock type system, generally denoted by 22, may be interconnected between the elevator operating system 2 and the spider operating system 3. Grip assurance interlock system 22 may be one of various types of interlock systems such as, and without limitation, the grip assurance interlock systems disclosed in U.S. Patents 5,791,410 and 4,676,312, which are incorporated herein by reference. Grip assurance interlock system 22 may be utilized in combination with, or independent of, the interlock gate system disclosed herein.

[0034] Depicted elevator control valve 18 and spider control valve 20 are manually operated and positioned at a common location 24, generally referred to herein as a control console, identified by the dashed lines. An interlock gate system 26 can be operationally connected to the elevator system 2 and the spider system 3 to avoid the inadvertent release of the tubular string. Examples of interlock gate system 26 are described further with reference to Figures 2-6.

[0035] Refer now to Figure 2 wherein an embodiment of an interlock gate system 26 is illustrated. Interlock gate system 26 includes elevator control valve 18, spider control valve 20, a single interlock control device 28 (e.g., knob, lever, etc.), and a track 30 (e.g., gate, indexed path). Track 30 is a path of travel between operational positions of interlock control device 28 and may be a feature formed by a deck, or panel 32 which is shown as transparent in Figure 2 for purposes of describing and illustration various features of interlock gate system 26. Positioned behind panel 32, relative to the operator, are control valves 18 and 20. Each control valve 18, 20, may have a valve actuation device 18a, 20a respectively for manually operating the respective valves between the open and closed position. The range and/or direction of movement of the respective actuation device may be referred to as the operational path of the actuation device. In the embodiments of Figures 2-6, valve actuation devices 18a, 20a are

illustrated and described as levers, but may include without limitation levers, buttons, and electric switches including contact switches. In Figures 7A-7J, valve actuation devices 18a, 20a are illustrated as buttons or push rods. In Figure 8, Figure 8 actuation devices 18a, 20a are illustrated as levers or rods and are also described with reference to electric solenoids for example that may include switches positioned for example at positions 36a, 38a and 37. Further as understood, the functions of the two control valves may be provided in some embodiments by a single valve.

[0036] Valve actuation devices 18a and 20a may be positioned above, on, or below panel 32. In some embodiments, a view way, or slot, 34 may be formed by panel 32 adjacent to each valve actuation device 18a, 20a. View way 34 may be an open slot formed through panel 32 or may be an elongated window, having a transparent material for example, so that the respective actuation device may be visually seen. View way 34 may extend proximate the length of travel of the associated actuation device 18a, 20a between the open and closed positions (e.g., operational path). In some embodiments the end of the actuation device may terminate in view way 34 (e.g., a slot) to limit the range of travel of the actuation device to the slot dimensions. In other embodiments view way 34 may be provided to visually confirm the position of the valve actuation device. View ways 34 may be particularly suited for embodiments of interlock gate system 26 that are employed to retrofit a conventional two-valve control console.

[0037] In some embodiments, track 30 is formed through panel 32 and interlock control device 28 is disposed through the track. In some embodiments, track 30 may be positioned between spaced apart control valves 18 and 20 as illustrated in the embodiments of Figures 2-7J. Control track 30 may include a first operational leg 36, a second operational leg 38, and a cross-over leg

40. Operational legs 36, 38 are functionally spaced apart by cross-over leg 40. In the illustrated embodiments of Figures 2-7J, operationally legs 36, 38 are laterally spaced apart. In the embodiment of Figures 2 and 3, track 30 resembles a block letter type U-shaped path. However, it is understood that track 30 (e.g., gate) may be formed in various patterns. For example, and without limitation, a U-shaped gate (Figure 2 and Figure 8), an H-shaped gate, an L-shaped gate and some embodiments may include additional legs forming for example an E-shaped gate, W-shaped gate, Y-shaped gate, a straight line gate and the like. Track 30 may be substantially linear in some embodiments, for example, the linear track having a first operational leg separated from the second operational leg by the intervening cross-over leg. The cross-over leg may be an elongated section or a point. In the illustrated embodiments of Figures 2-7J, operational legs 36, 38 are depicted substantially as having the same length and positioned substantially parallel to and aligned with one another. In the embodiment illustrated in Figures 2 to 4, operational legs 36 and 38 are positioned inside of opposing view ways 34 or the respective actuation devices 18a, 20a. In the embodiment of Figure 8, operational leg 36 and operational leg 38 are operationally separated by closed position 37.

[0038] In some embodiments, operational legs 36, 38 are lateral spaced apart from one another by cross-over leg 40, however, it is noted that operational legs 36, 38 may be or may not be oriented parallel to one another. It is noted that parallel and similar terms are utilized herein for purposes of description of the general alignment of various features and include positions that may be similar to the utilized term. For example, unless otherwise physically required, parallel may include an alignment of the features such that the projected paths of the features may intersect at some distance.

[0039] Interlock control device 28 is expressly illustrated as a lever extending through a slot type control track 30 in Figures 2-7J and as a knob in Figure 8. Interlock control device 28 is operationally connected to the first and second tubular gripping devices 12, 14 such that only one tubular gripping device 12, 14 may be actuated to the open position at the same time.

[0040] In some embodiments, interlock control device 28 is operationally connectable to control valves 18 and 20 in a manner such that when one valve is operable from the closed to the open position by interlock control device 28 the other control valve is operationally disconnected from interlock control device 28. The operational and functional connection of interlock control device 28 with control valves 18 and 20 is described further below.

[0041] Each operational leg 36, 38 is associated with one of the tubular gripping devices and defines a path between an open and closed position of the respective tubular gripping device. For example, in Figure 2, operational leg 36 is associated with control valve 20 and tubular gripping device 14 and operation leg 38 is associated with control valve 18 and tubular gripping device 12. The first ends 36a, 38a represent one operational position of control valves 18, 20 and the second ends 36b, 38b represent the other operational position of control valves 18, 20. In this embodiment, first ends 36a, 38a are associated with the respective closed position of control valves 18, 20 and the respective tubular gripping devices 12, 14 and the second end 36b, 38b are associated with the respective open position of control valves 18, 20 and the respective tubular gripping device 12, 14. In the illustrated embodiments, cross-over leg 40 interconnects the closed positions or points 36a and 38a or the respective tubular gripping devices 12, 14. Thus, a first control valve must be operated to the closed position before interlock control device 28 can operate the other control valve from the closed position to the open position.

[0042] Refer now to Figure 3 wherein interlock gate system 26 of Figure 2 is illustrated from below panel 32. Interlock control device 28 is functionally positioned so as to be moveable along the length of track 30 and to selectively connect with actuation devices 18a and 20a. Interlock control device 28 is functionally supported by a bracket 44 connected to console 24. Interlock control device 28 is moveably connected to bracket 44 by a linkage 46 and U-Joint 48. U-Joint 48 facilitates movement of interlock control device 28 along track 30 but may not allow interlock control device 28 to rotate. Single interlock control device 28 and panel 32 with track 30 may be operationally connected at console 24 with control valves 18 and 20 to replace a two-lever tubular gripping system control.

[0043] Interlock control device 28 is selectively connectable to control valve 18, via valve actuation device 18a, and to control valve 20, via actuation device 20a, through an operational connector 42 in the embodiments illustrated in Figures 2-5. In the embodiment of Figures 2,3 and 5, connector 42 is illustrated having opposing open ended slots 50a, 50b each adapted to engage a respective control valve actuation device 18a or 20a. In Figure 3, control valve actuation device 20a is shown frictionally held in slot 50b, operationally connecting interlock control device 28 and control valve 20.

[0044] Operation of interlock system 10 is now briefly described with reference to the embodiments illustrated in Figures 1-3. For operation of spider 14, the single interlock control device 28 is operationally connected to valve actuation device 20a of control valve 20. In this embodiment, interlock control device 28 and valve actuation device 20a are interconnected via operational connector 42. Interlock control valve 28 may then be positioned at first end 36a of operational leg 36 of track 30 wherein control valve 20 actuates spider 14 to the closed position.

Interlock control device 28 may then be moved along operational leg 36 to the open position at end 36b actuating spider 14 to the open position via control valve 20. When it is desired to operate elevator 12 to the open position, the operator first moves interlock control device 28, which is currently operationally connected to spider 14, to the closed position (point 36a) for spider 14. Once positioned at closed point 36a, interlock control device 28 may be moved laterally across cross-over 40 to first end 38a of leg 38, which is the operational closed position of elevator 12 in this embodiment. When interlock control device 28 is positioned at closed position 36a, control valve actuation device 20a is restricted from moving perpendicular to operational leg 36. In other words, actuation device 20a cannot be moved with interlock control device 28 along cross-over 40. Thus, when interlock control device 28 is moved from position 36a to position 38a, along cross-over 40 in this embodiment, it is disconnected from valve actuation device 20a before connecting with the valve actuation device 18a proximate to end 38a. Elevator 12 may be operated as described with reference to spider 14. It is noted that although actuation devices 18a, 20a are illustrated as levers in Figures 1-3, other actuation devices may be utilized, such as and without limitation to push rods and button and the like.

[0045] Refer now to Figure 4 wherein another embodiment of an interlock gate system 26 is provided. An additional position is provided in this embodiment of interlock gate system 26 relative to the embodiment illustrated in Figures 2 and 3. Control track 30 includes a neutral leg 52, forming a substantially block letter, Y-shaped gate for interlock control device 28. Neutral leg 52 is shown extending from cross-over 40 in the opposite direction taken by operational legs 36 and 38. When interlock control device 28 is positioned in neutral leg 52 it is not physically connected to either valve actuation device 18a or valve actuation device 20a. Interlock control

device 28 may be held or locked in a neutral or safety position 54 in some embodiments as described further with reference to Figure 5. In some embodiments, neutral leg 52 may extend from cross-over 40 in the same direction as legs 36 and 38, such as in an E-shaped or W-shaped configuration. Neutral leg 52 may be provided for example as a position to pre-power one or both of the fluid systems for tubular gripping systems 2, 3.

[0046] Figure 5 is a perspective, cut-away view of an embodiment of console 24 illustrating interlock gate system 26 secured in safety position 54 of Figure 4. In this embodiment, safety locking system 56 includes operational connector 42 and hold 58. Connector 42 may be constructed similar to connector 42 as utilized in the previously described embodiments further include a tab 60. Tab 60 extends outward from the main body of connector 42. Hold 58 may comprise various devices adapted to grip tab 60. In this embodiment, hold 58 comprises a threaded member threadedly connected through a bracket 62 that is connected to console 24.

[0047] Refer now to Figure 6 wherein another embodiment of interlock system 10 is provided and described with reference to Figure 1. In this embodiment, interlock gate system 26 further includes a cross-over block system generally denoted by the numeral 64. Cross-over block system 64, and therefore interlock gate system 26, can be functionally connected to supplemental grip assurance interlock system 22 (Figure 1). Grip assurance interlock system 22 may assure that an operated tubular gripping device 12, 14 has completed movement to or from the closed or open position, or that a sufficient grip on tubular string 16 has been obtained before the other tubular gripping device may be actuated to the open position. Signals from a sensor or other element of grip assurance interlock system 22 may be communicated to cross-over block system 64 such that block system 64 permits or hinders movement of interlock control device 28 across

cross-over 40 and thus prevents actuation of one of the tubular gripping devices before the other tubular gripping device has actuated to the closed position. It is noted that signals may be communicated in various manners including without limitation by fluid pressure (e.g., hydraulic, pneumatic) and electric signals.

[0048] Cross-over block system 64 may include one or more blocking devices 66. In the illustrated embodiment of Figure 6, system 64 includes two blocking devices denoted as spider block 66a and elevator block 66b. Each block device 66 includes an actuator 68 (e.g., driving device) operationally connected to a stop 70 for positioning stop 70 in a blocking position relative to interlock control device 28 from actuating either of the tubular gripping devices from the closed to the open position. In the illustrated embodiments, blocking device 66 prevents the movement of interlock control device 28 from moving across cross-over leg 40. In some embodiments block device 66 may prevent movement of interlock control device 28 between a closed position 36a, 38a, and the respective open position 36b, 38b, for example by blocking a respective leg 36, 38 or otherwise limiting movement of interlock control device 28.

[0049] As previously noted, spider block 66a is in operational connection with grip assurance interlock 22 (Figure 1) and spider 14 such that if spider 14 is not closed, then stop 70 is actuated to a blocking position, illustrated in cross-over leg 40 in Figure 6. When spider 14 is indicated as being closed by grip assurance interlock system 26, block device 66 is actuated to withdraw stop 70 from the blocking position. This same process is performed in regard to the operation of elevator 12 and block device 66b. Although not illustrated, one block device 66 may be utilized and be operationally connected to one or both of tubular gripping devices 12, 14 and/or one or both of the interlock systems 2, 3 (Figure 1). It is further noted that indicators 72 (e.g., visual

and/or audio) may be connected to signal when the spider 14 and/or the elevator 12 is closed and/or open. For example, indicators 72 may include without limitation lights, pressure indicators (e.g., re/green visual signal), horns, whistles and light emitting diodes (LEDs).

[0050] Refer now to Figures 7A-7J wherein another embodiment of interlock gate system 26 is illustrated. Interlock gate system 26 depicted in Figure 6 may include a cross-over block system 64. Interlock gate system 26 is shown in various operational positions in Figures 7A-7J for purposes of illustrating an embodiment of operation of the system. Figures 7A and 7B provide different views of interlock gate system 26 in the same operational position. Similarly, each of the groupings of Figures 7C and 7D, 7G and 7H, and 7I and 7J, illustrate different views of interlock gate system 26 in the same operational position. In the embodiments illustrated in Figures 7A-7J, track 30 is a U-shaped track and for purposes of description leg 36 is associated with operation of a tubular gripping device referred to as a spider, and leg 38 is associated with operation of a tubular gripping device referred to as an elevator. Also, for purposes of description position 36b is the spider open position; position 36a is the spider closed position; position 38a is the elevator closed position; and position 38b is the elevator open position. This orientation of the positions corresponds to a typical control console orientation, wherein the "open" positions are oriented "up" relative to the operator and the "closed" position is oriented "down." Interlock gate system 26 facilitates that position 36a and 38a corresponds to both of the tubular gripping devices being closed and that interlock control device 28 cannot actuate either of the tubular gripping devices to an open position when the other tubular gripping device is open.

[0051] Elevator control valve 18 includes an actuation device 18a and spider control valve 20 includes an actuation device 20a. Interlock control device 28 is operationally positioned on a rod 74 so as to be selectively moveable between control valves 18 and 20 in the embodiment of Figures 7A-7J. Rod 74 may be oriented substantially parallel to and aligned with leg 40 of track 30. Block device 64 includes an actuator 68 (e.g., driving device), described herein as fluidic (e.g., hydraulic, pneumatic) cylinders, and a stop member 70. Member 70 may be positioned in the path of interlock control device 28 to selectively prevent the movement of interlock control device 28 between actuation devices 18a and 20a. As described with reference to Figure 6, blocking device 64 may be in operational connection with supplemental grip assurance interlock system 22 (Figure 1) or another sensor or system to signal position of the tubular gripping devices.

[0052] In Figures 7A and 7B, interlock control device 28 is illustrated in selective connection with elevator control valve 18 via actuation device 18a. Interlock control device 28 is located at position or station 38b and has thus actuated valve 18 to open its associated tubular gripping device. Note that in Figure 7A that stop 70 is illustrated positioned in the path of interlock control device 28 between valve actuation device 18a and valve actuation device 20a. Stop 70 may be positioned in a blocking position in response to one of the tubular gripping devices being in an open position as also described with reference to Figure 6 above.

[0053] In Figures 7C and 7D, interlock control device 28 is shown at position 38a and in selective connection with actuation device 18a. At position 38a, the associated tubular gripping device has been actuated to the closed position. Stop 70 is illustrated in the blocking position

indicating that grip assurance interlock system 22 has not signaled that the tubular gripping device associated to actuation device 18a has completed closing movement.

[0054] Figure 7E illustrates interlock control device 28 disconnected from actuation device 18a and device 20a and stop 70 in the blocking position. Figure 7F illustrates stop 70 retracted out of the blocking position permitting movement of interlock control device 28 between control valves 18 and 20.

[0055] In Figures 7G and 7H, interlock control device 28 is shown at position 36a and in selective connection with actuation device 20a. At position 36a, interlock control device 28 is positioned to operate the tubular gripping device associated with valve 20 to the open position. In position 36a, both of the tubular gripping devices are in the closed position. Stop 70 is illustrated in the blocking position indicating that grip assurance interlock system 22 detects that at least one of the tubular gripping devices is either open, not gripping the tubular string, in the process of opening or closing, or that another selected event has not been satisfied.

[0056] In Figures 7I and 7J, interlock control device 28 is illustrated in selective connection with elevator control valve 20 via actuation device 20a. Interlock control device 28 is located at position or station 36b and has thus actuated valve 20 to open its associated tubular gripping device.

[0057] Refer now to Figure 8 illustrating another embodiment of interlock system 26 which is described with reference to Figure 1 in particular. In this embodiment, interlock control device 28 is connected about a pivot 76 and pivots along track 30 (e.g., path) between first tubular gripping device open position 36a, a second tubular gripping device open position 38a, and a

first and second tubular gripping device closed position 37. In this embodiment, first tubular gripping device open position 36a is associated with tubular gripping device 14 (e.g., spider) and second tubular gripping device open position 38a is associated with tubular gripping device 12 (e.g., elevator). In this embodiment, track 30 may be defined as having a first operation leg 36 extending between open position 36a and closed position 37 associated with tubular gripping device 14 and a second operational leg 38 extending between open position 38a and closed position 37 associated with tubular gripping device 12.

[0058] Track 30 represents the path of travel of interlock control device 28 between the operational positions as illustrated by the dashed line on panel 32. Track 30 may be formed through panel 32, for example as a slot, or on or by panel 32 such as a detent, index or the like, or it may not be a physical feature but only the route of movement of a portion of interlock control device between operational positions. Track 30 may also be defined, in this embodiment for example, as the outer surface 78 of a cam 80 portion of interlock control member 28. Closed position 37 may be defined as a cross-over leg portion wherein both of the tubular gripping devices are in the closed position. Track 30 is illustrated as a slot through which a portion of interlock control device 28 (e.g., a lever or knob) is disposed.

[0059] In the embodiment of Figure 8, interlock control device 28 is operationally connected to tubular gripping device 12 via control valve 18 and to tubular gripping device 14 via control valve 20. As noted previously, the functions of control devices 18 and 20 may be replaced by a single control valve, for example a three-position directional valve. In the illustrated embodiment, the one or more control valves include actuation devices 18a and 20a. Actuation devices 18a, 20a are illustrated in this embodiment as levers (such as depicted in Figures 2-5) or

as rods (such as depicted in Figures 7A-7J). Interlock control device 28 may be in operational contact with actuation devices 18a, 20a, via cam 80 for example, to operate tubular gripping devices 12, 14 (Figure 1) between their operational positions. In some embodiments, actuation devices 18a, 20a may include or be replaced by electrical switches, such as contacts, positioned at the operational positions indicated on track 30 to be activated by contact with a portion (e.g., a knob) of interlock control device 28.

[0060] Interlock gate system 26 may include a blocking mechanism 66, for example as described with reference to Figures 6 and 7A-7J. Actuator 68 may be operationally connected to an interlock grip assurance system 22 and tubular gripping device 12 and/or tubular gripping device 14. Blocking mechanism 66 may actuate stop 70 into a blocking position for example when one or the other of tubular gripping device 12 or 14 is not in the gripping (e.g., closed) position. In the illustrated embodiment, the blocking position is shown as stop 70 engaging interlock control device 28. In this example, stop 70 is disposed in a detent 82 of cam 80.

[0061] Although specific embodiments of the invention have been disclosed herein in some detail, this has been done solely for the purposes of describing various features and aspects of the invention, and is not intended to be limiting with respect to the scope of the invention. It is contemplated that various substitutions, alterations, and/or modifications, including but not limited to those implementation variations which may have been suggested herein, may be made to the disclosed embodiments without departing from the spirit and scope of the invention as defined by the appended claims which follow.

WHAT IS CLAIMED IS:

1. A tubular grip interlock system, the system comprising:

a first tubular gripping device operable between an open and a closed position;

a second tubular gripping device operable between an open and a closed position; and

an interlock gate preventing manual operation of the first tubular gripping device and the second tubular gripping device simultaneously.

2. The system of claim 1, wherein the interlock gate comprises:

a track defining a first leg and a second leg; and

a single interlock device operationally connected to the first tubular gripping device and the second tubular gripping device, the single interlock device moveable along the track; wherein movement of the single interlock device along the first leg operates the first tubular gripping device between its open and closed position and wherein movement of the single interlock device along the second leg operates the second tubular gripping device between its open and closed position.

3. The system of claim 2, wherein the track comprises a cross-over leg separating the first and the second leg, wherein when the single interlock device is disposed at the cross-over leg the first tubular gripping device and the second tubular gripping device are in the closed position.

4. The system of claim 1, comprising:

a first valve operating the first tubular gripping device;

a second valve operating the second tubular gripping device;

a first actuator operationally connected to the first valve, the first actuator moveable along an operational path between the open position and the closed position of the first tubular gripping device; and

a second actuator operationally connected to the second valve, the second actuator moveable along an operational path between the open and the closed position of the second tubular gripping device.

5. The system of claim 4, wherein the interlock gate comprises a single interlock device that is selectively connectable to the first actuator and the second actuator.

6. The system of claim 1, wherein the system comprises:

a first valve operating the first tubular gripping device;

a second valve operating the second tubular gripping device;

a track having a first leg and a second leg; and

a single interlock device moveable along the track, wherein the interlock device is operationally connected to the first valve and operationally disconnected from the second valve when the single interlock device is in the first leg and the interlock device is operationally disconnected from the first valve and operationally connected to the second valve when the interlock device is in the second leg.

7. The system of claim 6, wherein the track further comprises a cross-over leg, wherein the first tubular gripping device and the second tubular gripping device are actuated to their respective closed positions when the interlock control device is disposed along the cross-over leg.

8. The system of claim 6, wherein the interlock gate further comprises a member selectively positioned to block movement of the interlock device along the track.

9. The system of claim 8, wherein the member is actuated to a position in the track in response to a tubular grip assurance signal.

10. The system of claim 6, further comprising:

a first actuator operationally connected to the first valve, the first actuator moveable along an operational path between the open position and the closed position of the first tubular gripping device; and

a second actuator operationally connected to the second valve, the second actuator moveable along an operational path between the open and the closed position of the second tubular gripping device.

11. The system of claim 10, wherein the first leg and the second leg are positioned inside of the operational paths of the respective first actuator and the second actuator; and

the single interlock device is operationally connected to the first valve via the first actuator and the single interlock device is operationally connected to the second valve via the second actuator.

12. The system of claim 10, wherein the interlock gate further comprises a member selectively positioned to block movement of the interlock device between a closed position and an open position.

13. A tubular grip interlock system for ensuring that a tubular string is gripped by at least one of a first tubular gripping device and a second tubular gripping device, the system comprising:

a console having a panel providing a track having a first leg and a second leg;

a first actuator operating the first tubular gripping device between an open and a closed position;

a second actuator operating the second tubular gripping device between an open and a closed position; and

a single control device movable along the track, the single control device operationally connected to the first actuator and operationally disconnected from the second actuator when the single control device is disposed along the first leg and wherein the single control device is operationally disconnected from the first actuator and operationally connected to the second actuator when the single control device is disposed in the second leg.

14. The system of claim 13, wherein the first actuator comprises one selected from a lever, a button, or an electric switch; and

the second actuator comprises one selected from a lever, a button, or an electric switch.

15. The system of claim 13, further comprising:

a first control valve operationally connecting the first actuator to the first tubular gripping device; and

a second control valve operationally connecting the second actuator to the second tubular gripping device.

16. The system of claim 15, wherein the first actuator comprises one selected from a lever, a button, or an electric switch; and

the second actuator comprises one selected from a lever, a button, or an electric switch.

17. The system of claim 13, further comprising a member selectively actuated to a blocking position relative to the track, wherein the single control device is blocked from passing the member in the blocking position.

18. The system of claim 17, wherein the member is operationally connected to a tubular grip assurance system, the member removed from the blocking position in response to a signal from the tubular grip assurance system.

19. The system of claim 13, wherein the track includes cross-over leg, wherein the first tubular gripping device and the second tubular gripping device are in the closed positioned when the single control device disposed in the cross-over leg.

20. A method for running tubular strings, the method comprising the steps of:

providing a first tubular gripping device operable between an open and a closed position and a second tubular gripping device operable between an open and a closed position;

providing a single control device to actuate the first and the second tubular gripping devices from a control console, the single control device moveable along a track comprising a first leg and a second leg;

moving the single control device along the first leg to actuate the first tubular gripping device between the open and the closed position when the second tubular gripping device is in the closed position; and

moving the single control device along the second leg to actuate the second tubular gripping device between the open and closed position when the first tubular gripping device is in the closed position.

21. The method of claim 20, wherein the single control device is operationally connected to the first tubular gripping device and operationally disconnected from the second tubular gripping device when the single control device is in the first leg.

22. The method of claim 20, further comprising the step of blocking movement of the single control device to operate the first tubular gripping device to the open position in response to the second tubular gripping device being in the closed position.

23. A method for maintaining a grip on a tubular string in wellbore tubular running operations with at least one of a first or a second tubular gripping device, the method comprising the steps of:

providing a first valve operating the first tubular gripping device between an open and a closed position and a second valve operating the second tubular gripping device between an open and a closed position;

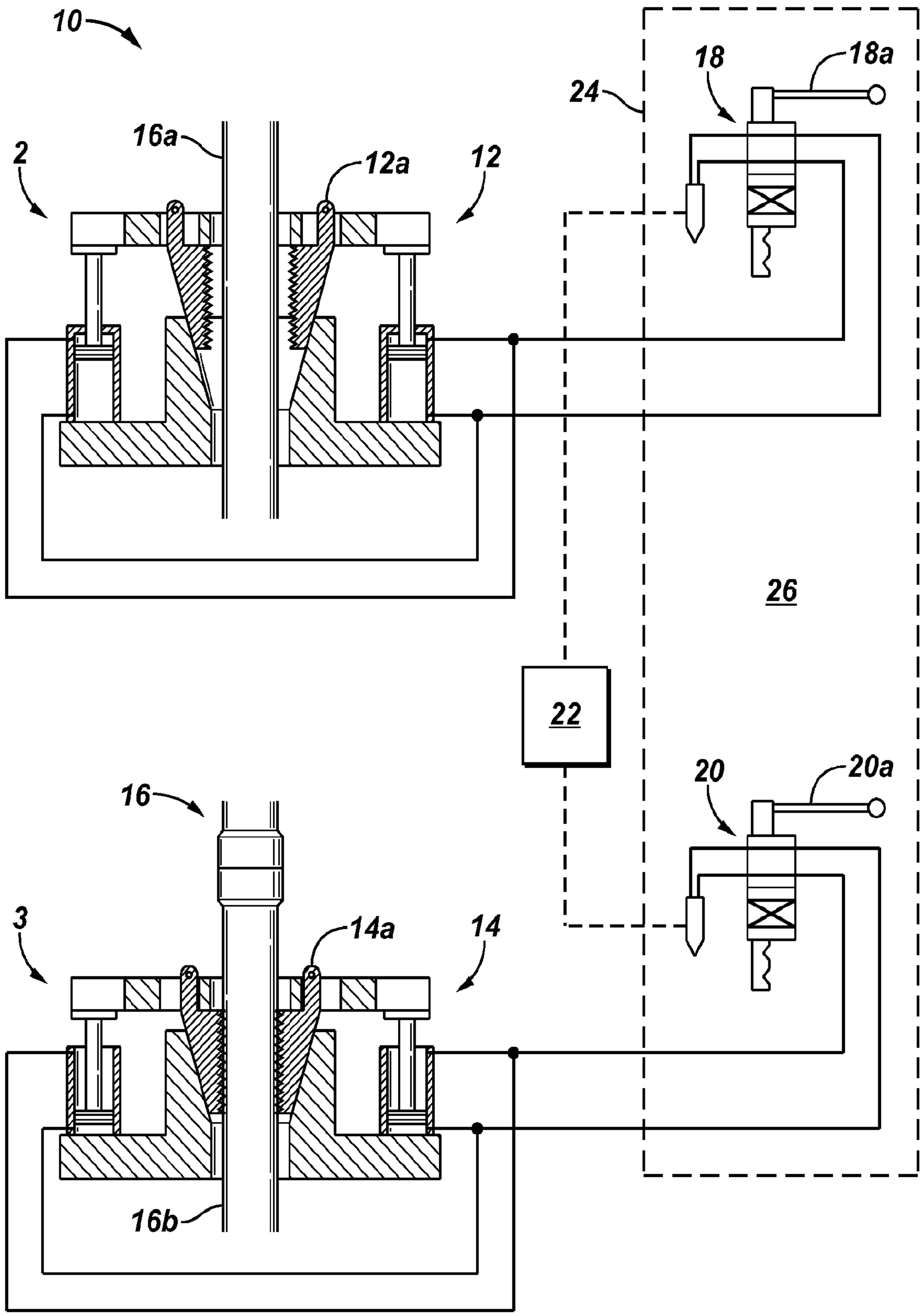
actuating the first valve and the second valve with a single interlock device; and

preventing simultaneous operational connection of the single interlock device to the first valve and the second valve.

24. The method of claim 23, further comprising the step of requiring actuation of the first valve to the closed position before disconnecting the single interlock device from the first valve.

25. The method of claim 24, further comprising the step of limiting movement of the single interlock device in response to one of the first tubular gripping member or the second tubular gripping member being in the open position.

FIG. 1



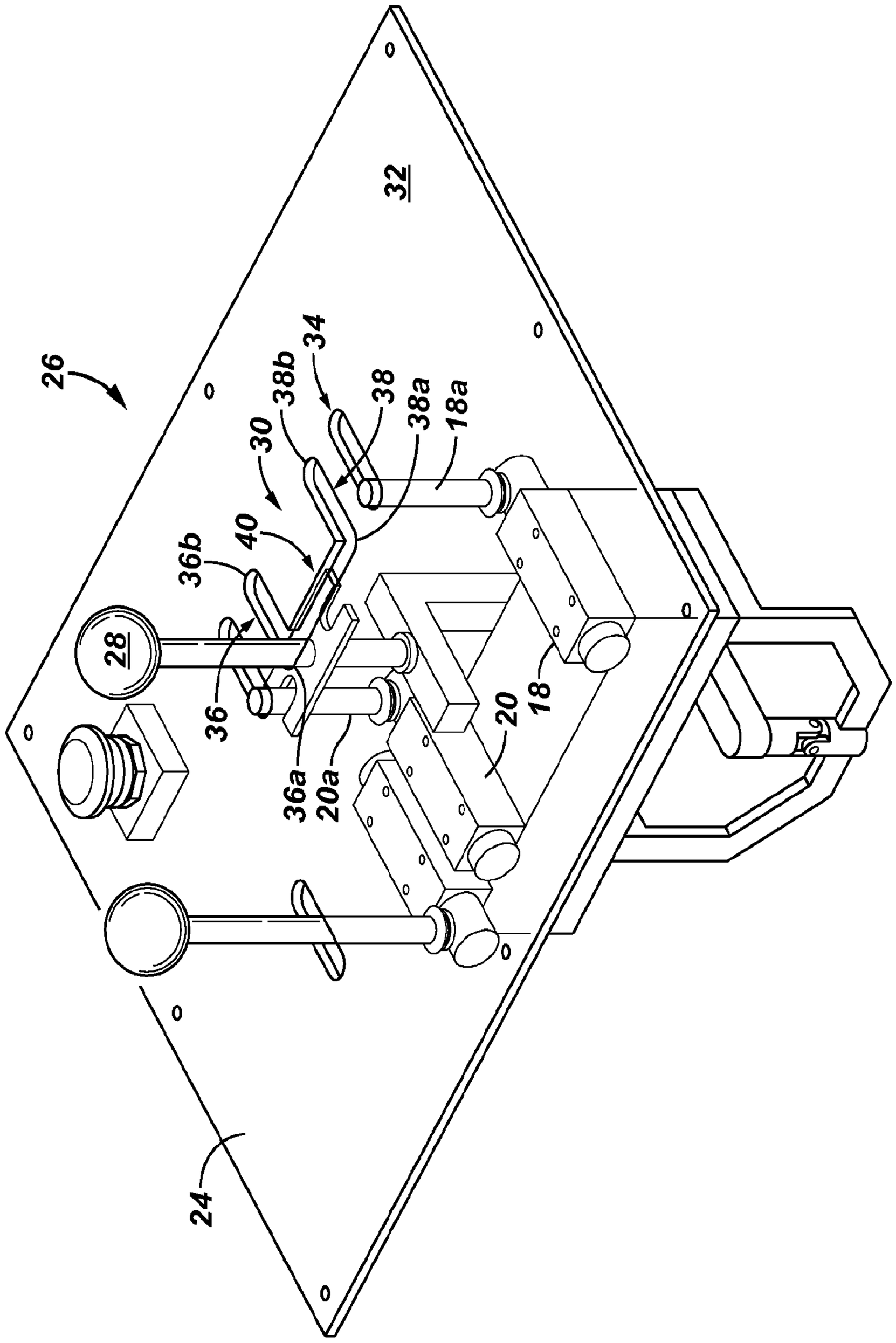


FIG. 2

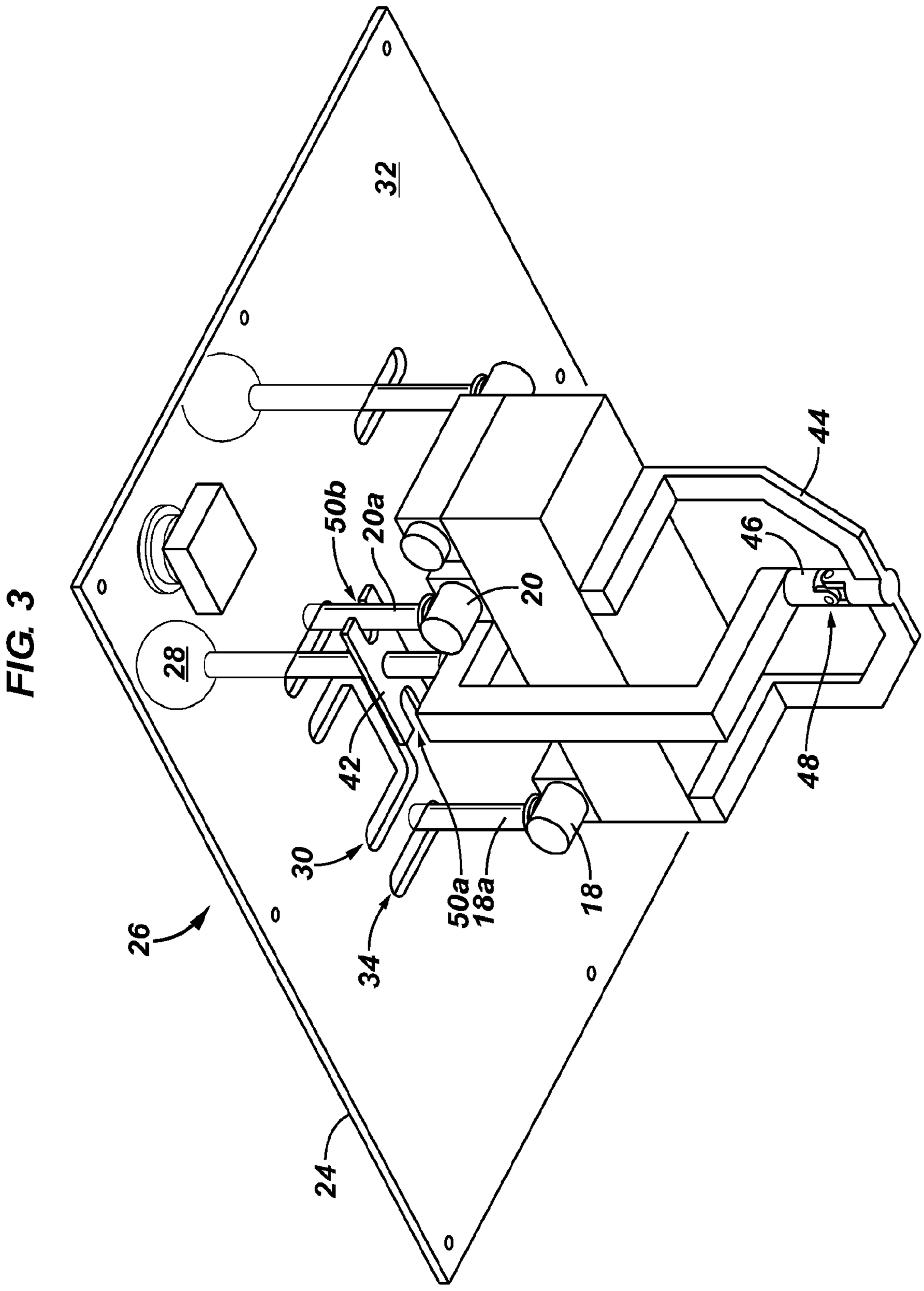


FIG. 3
0
32
28
26
24
30
34
42
50b
20a
20
50a
18a
18
44
46
48

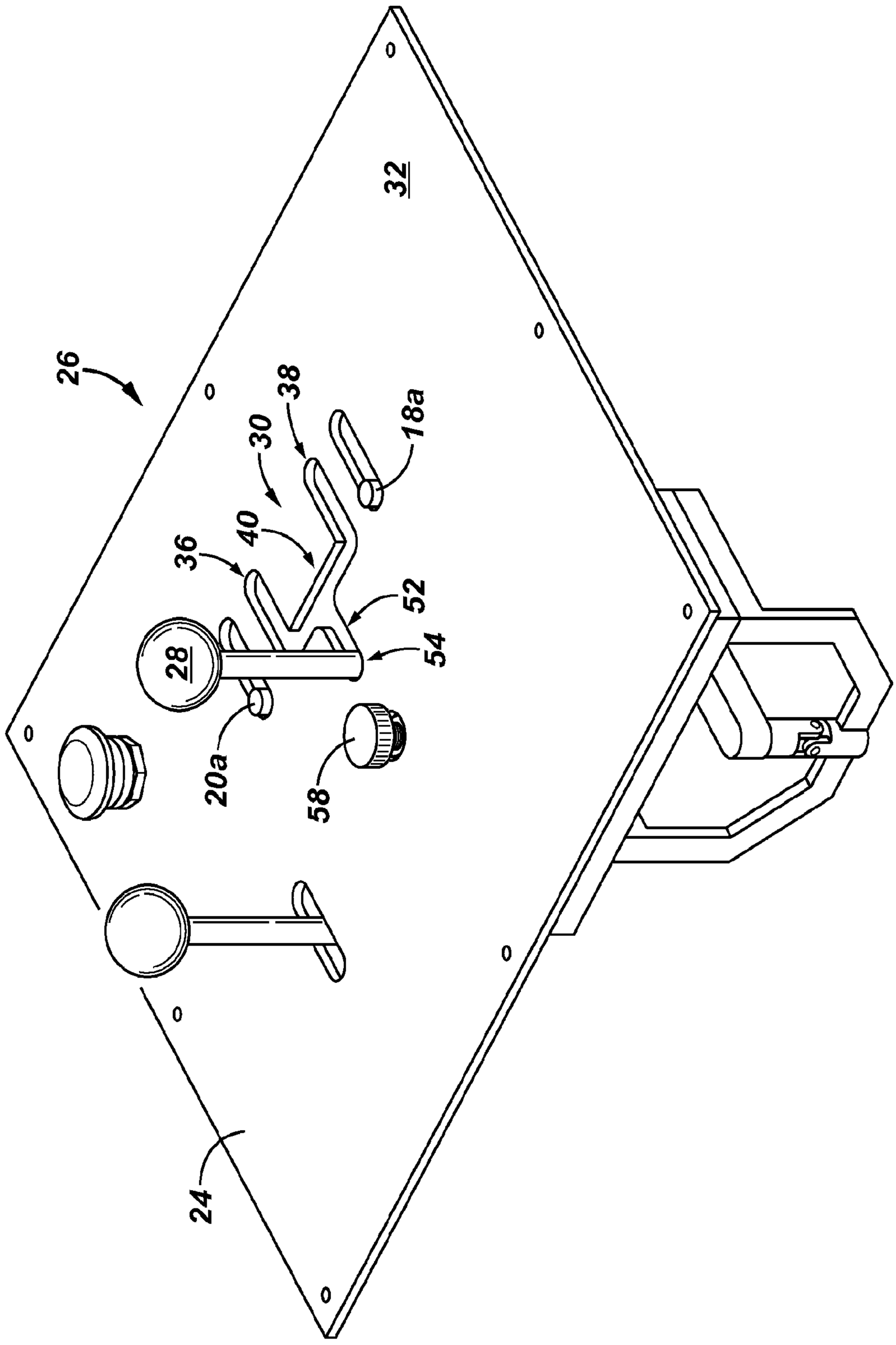


FIG. 4

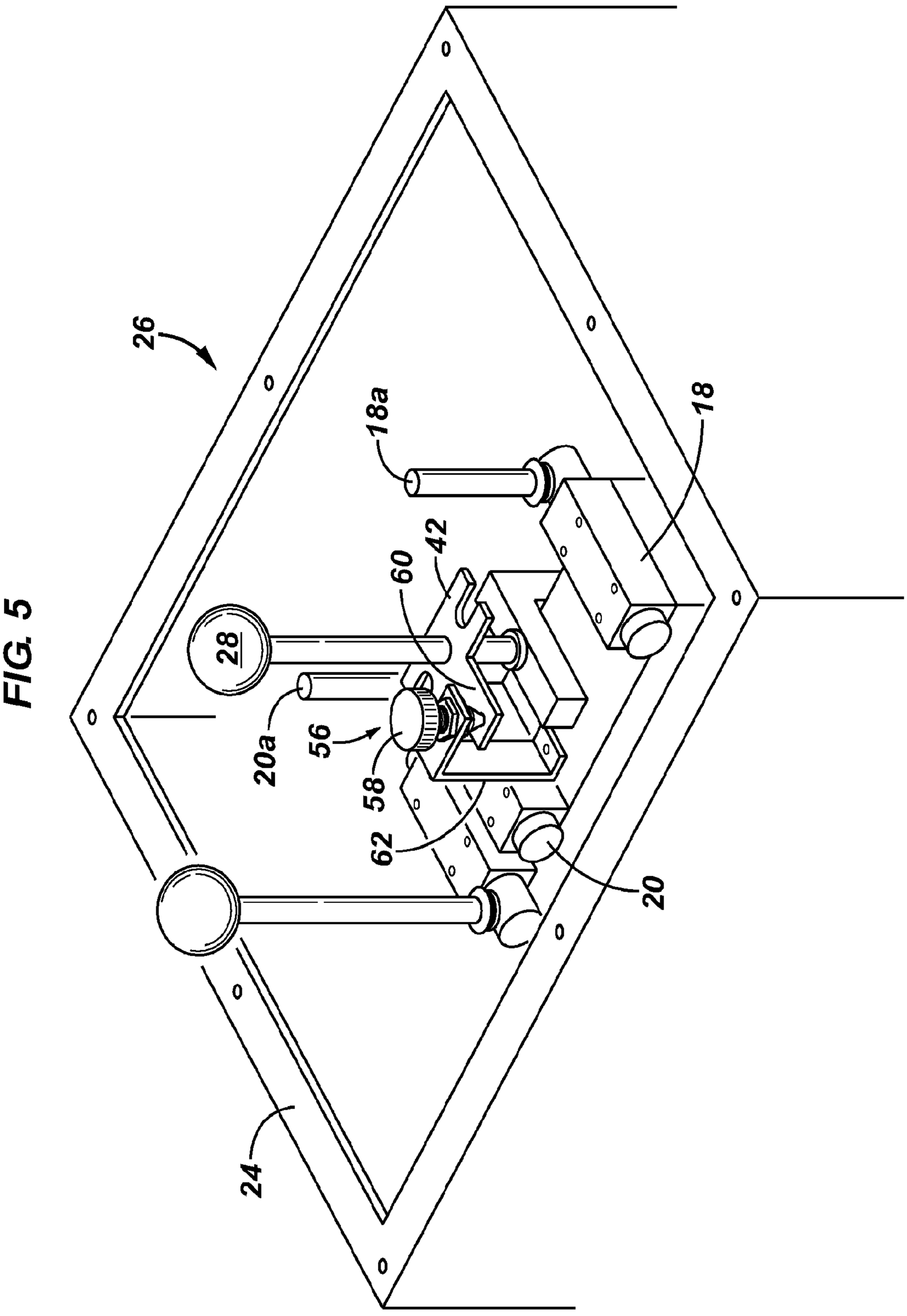


FIG. 5

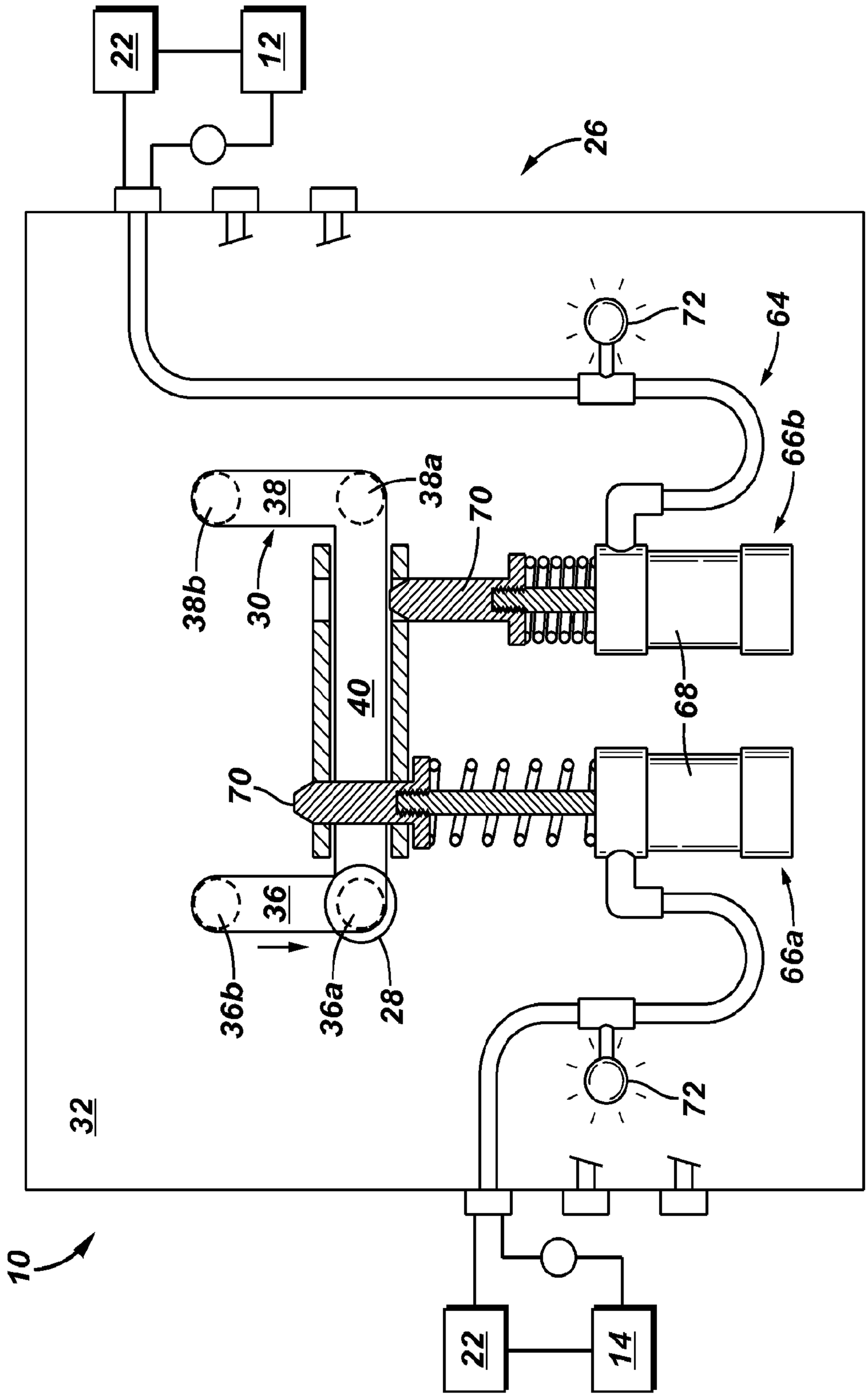

22
12
26
72
64
66b
38a
38
70
38b
30
40
68
70
36
36b
36a
28
66a
72
32
10
22
14

FIG. 6

FIG. 7A

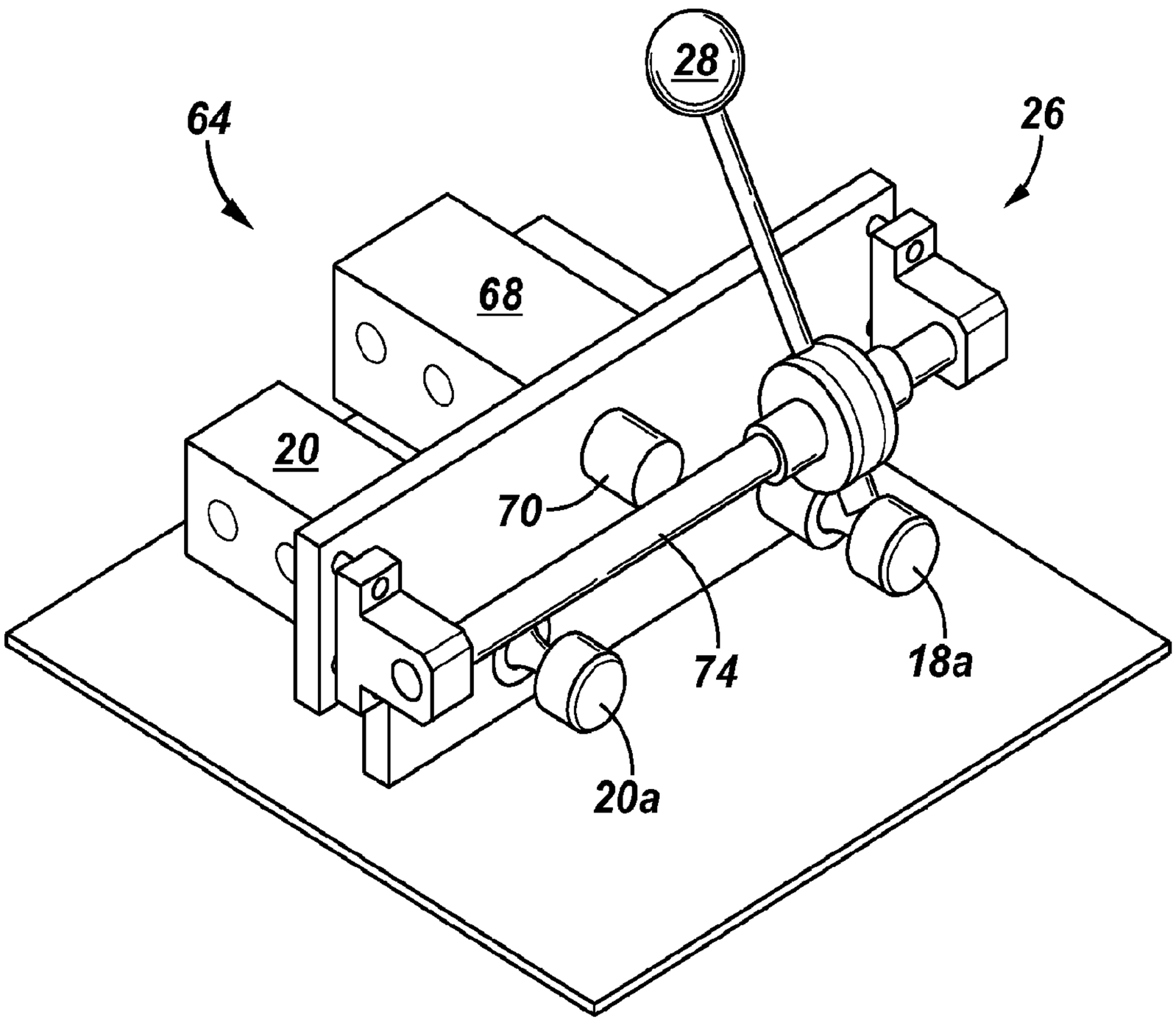


FIG. 7B

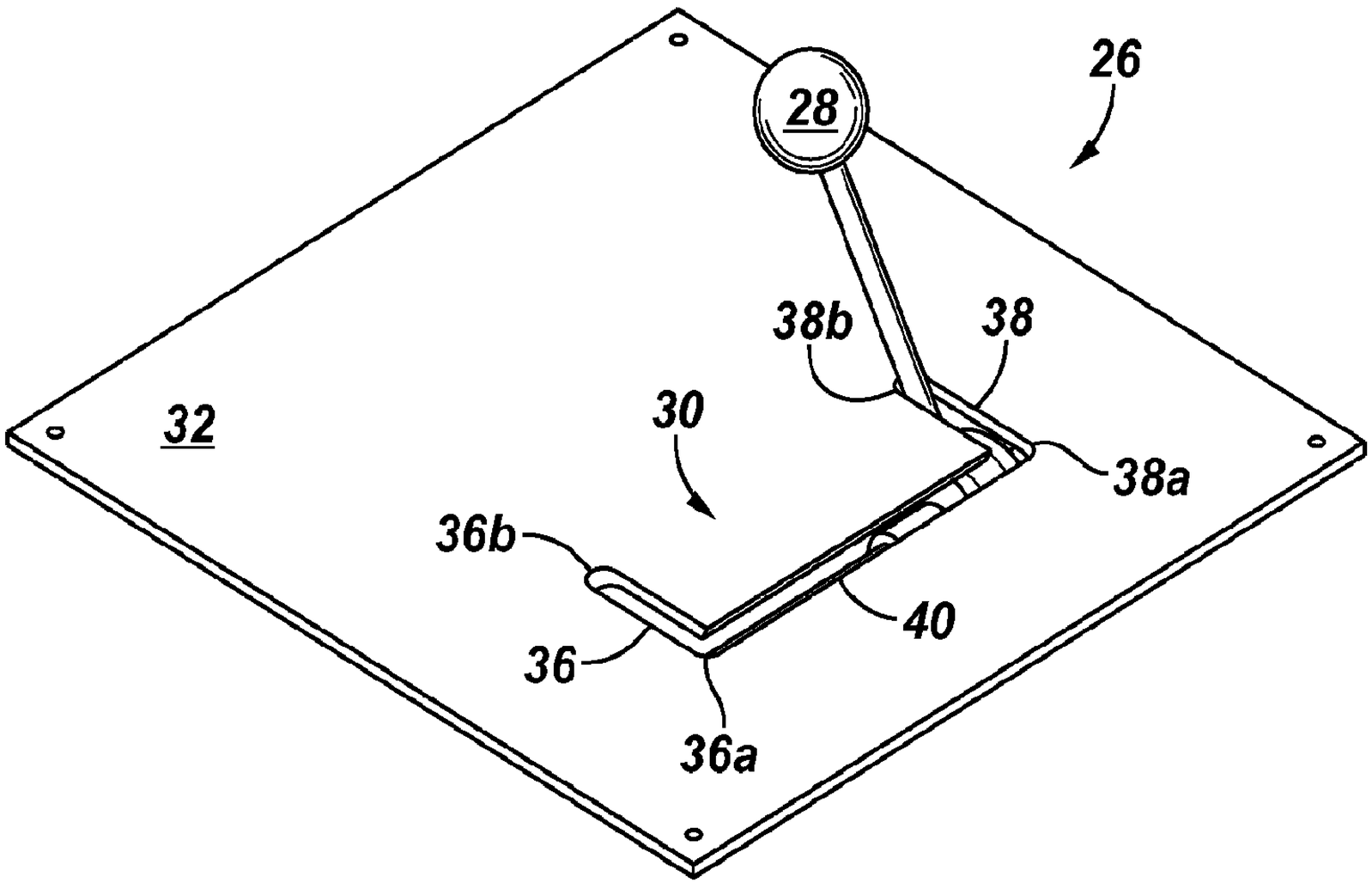


FIG. 7C

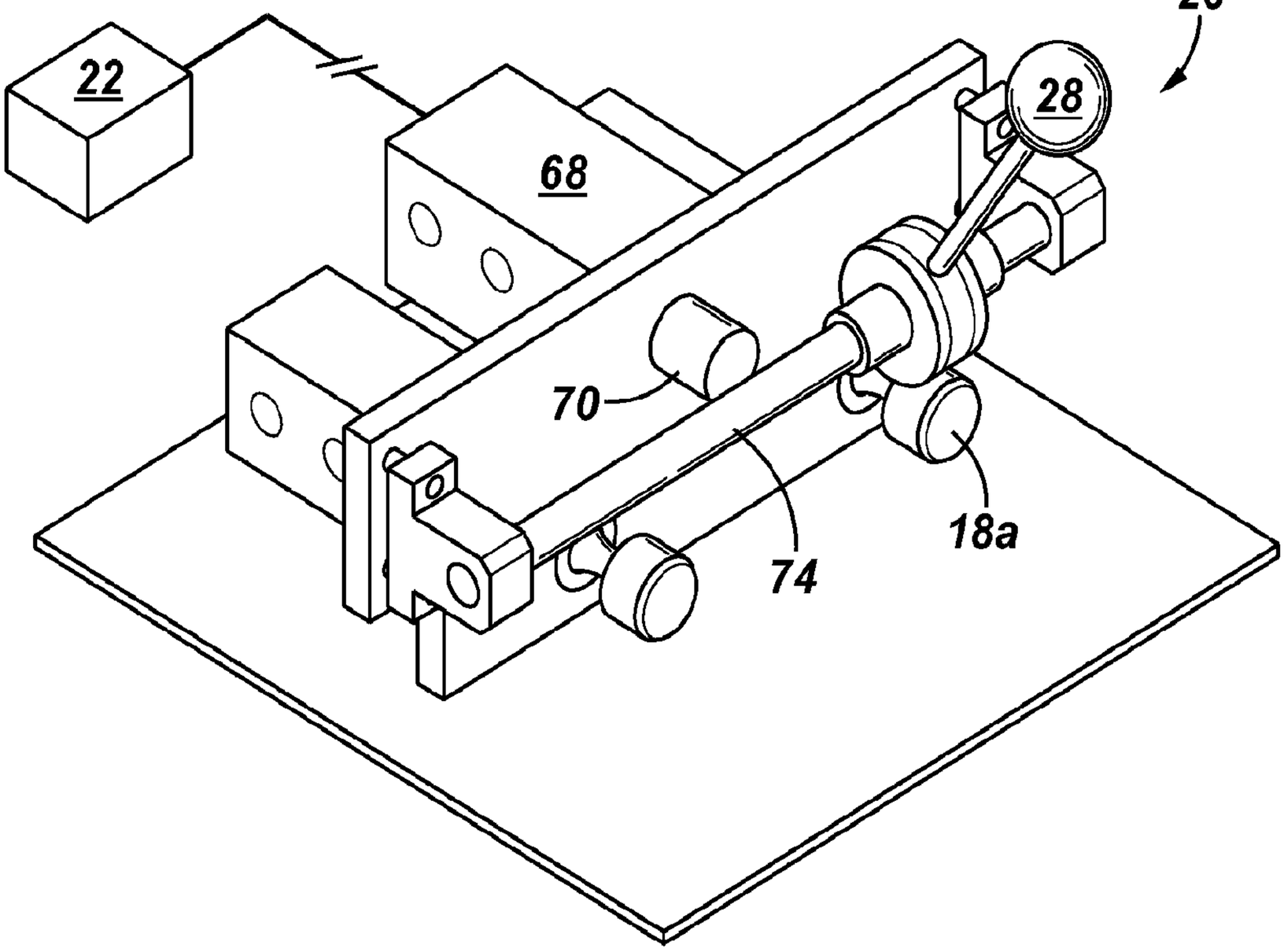


FIG. 7D

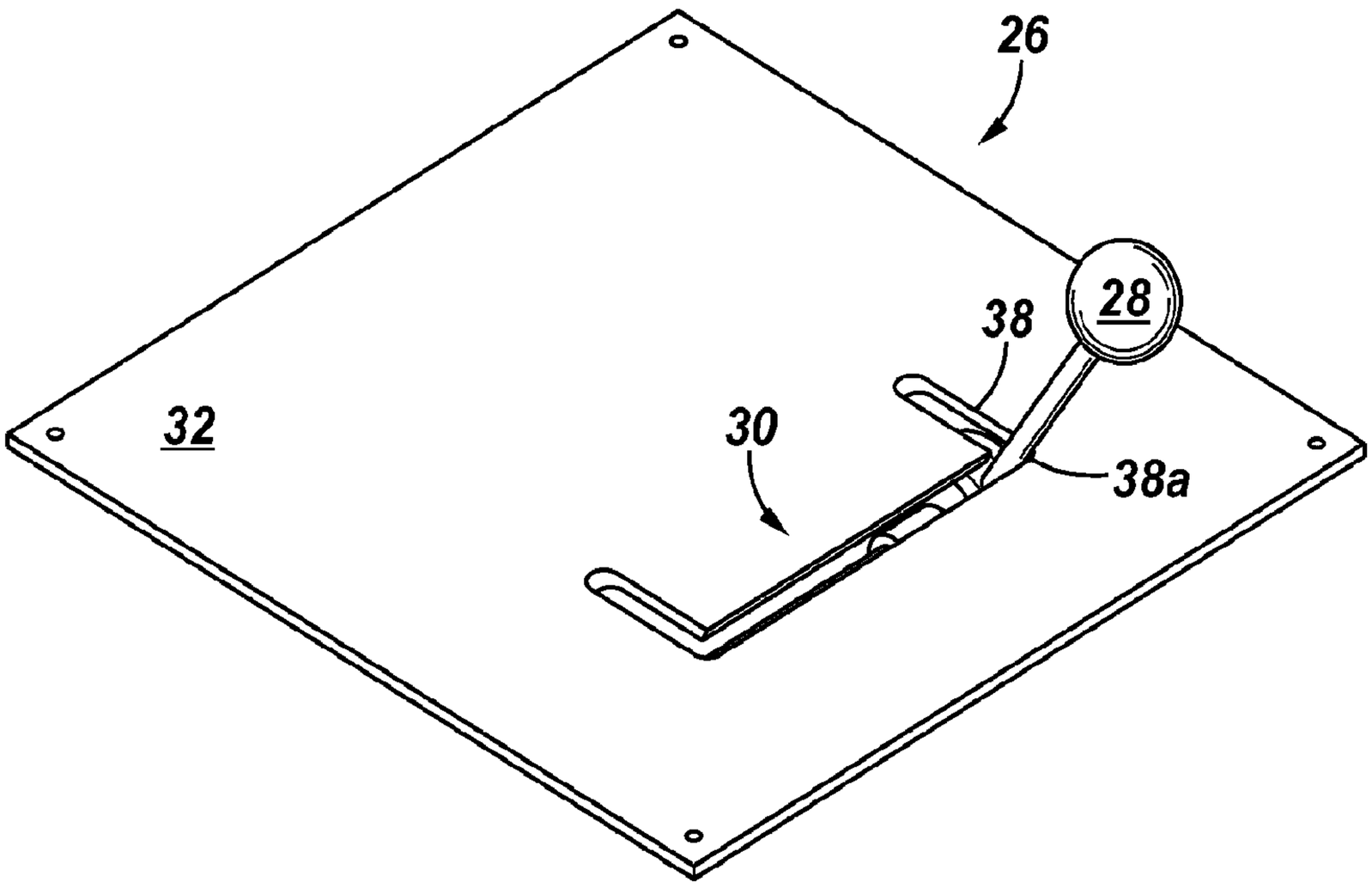


FIG. 7E

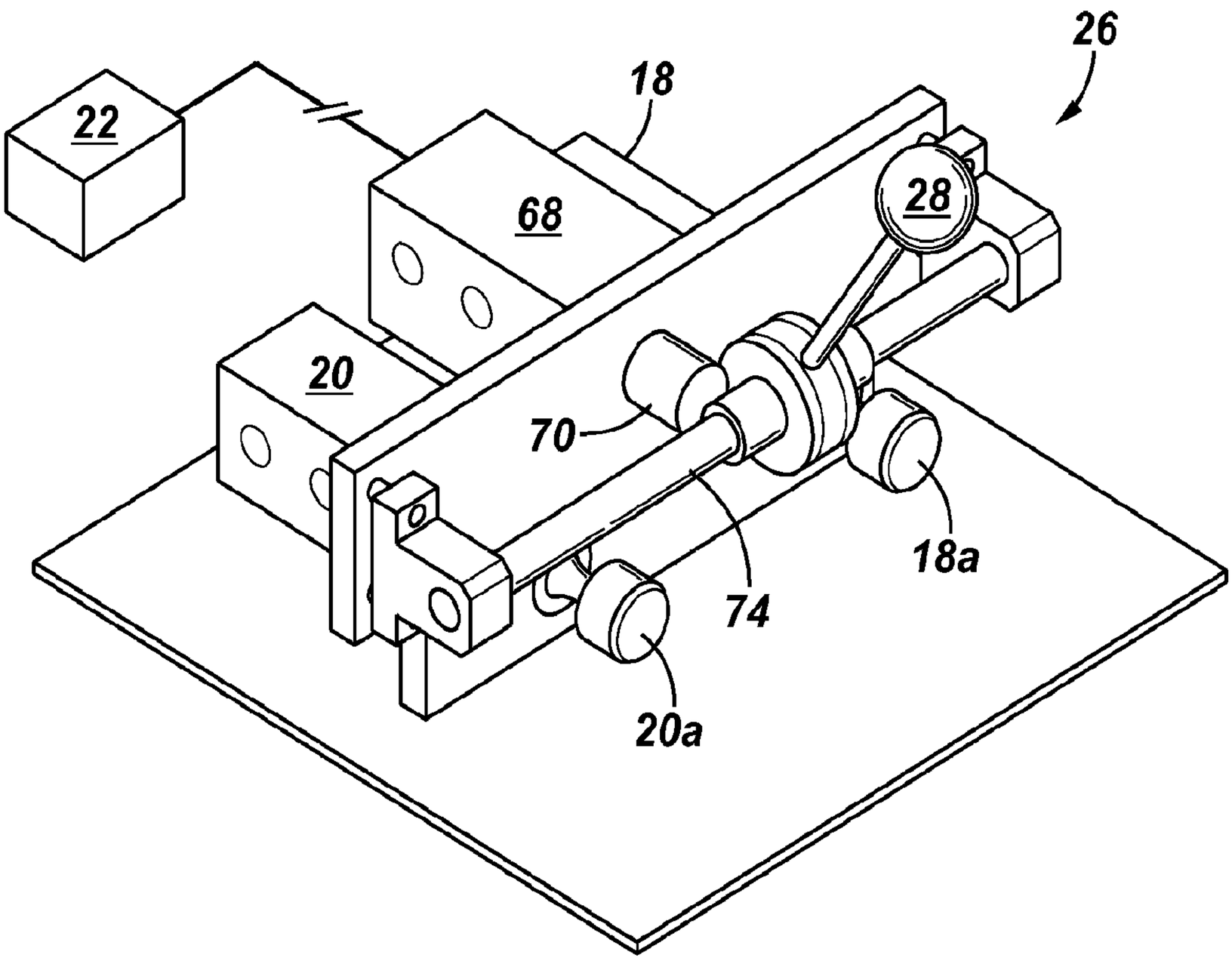


FIG. 7F

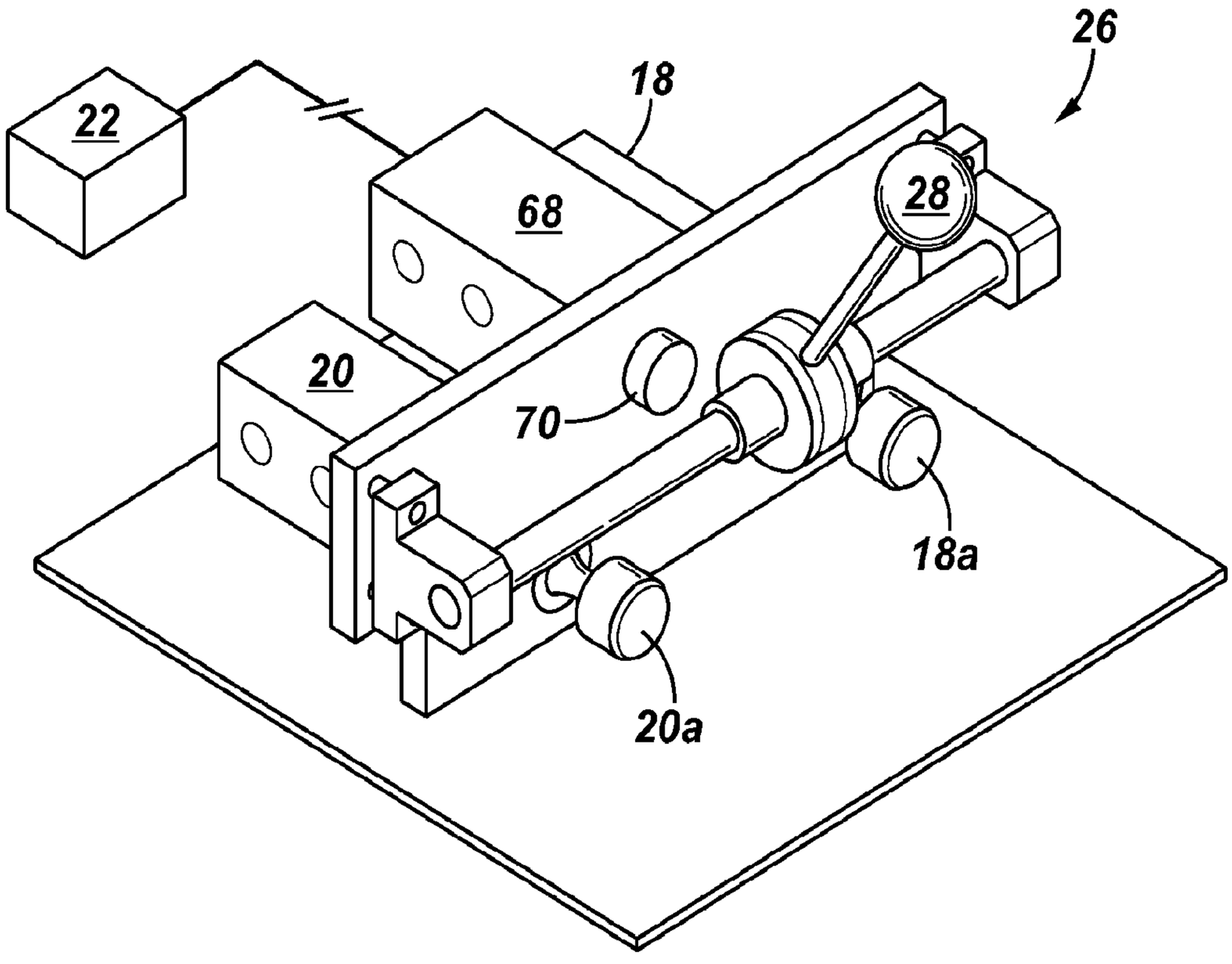


FIG. 7G

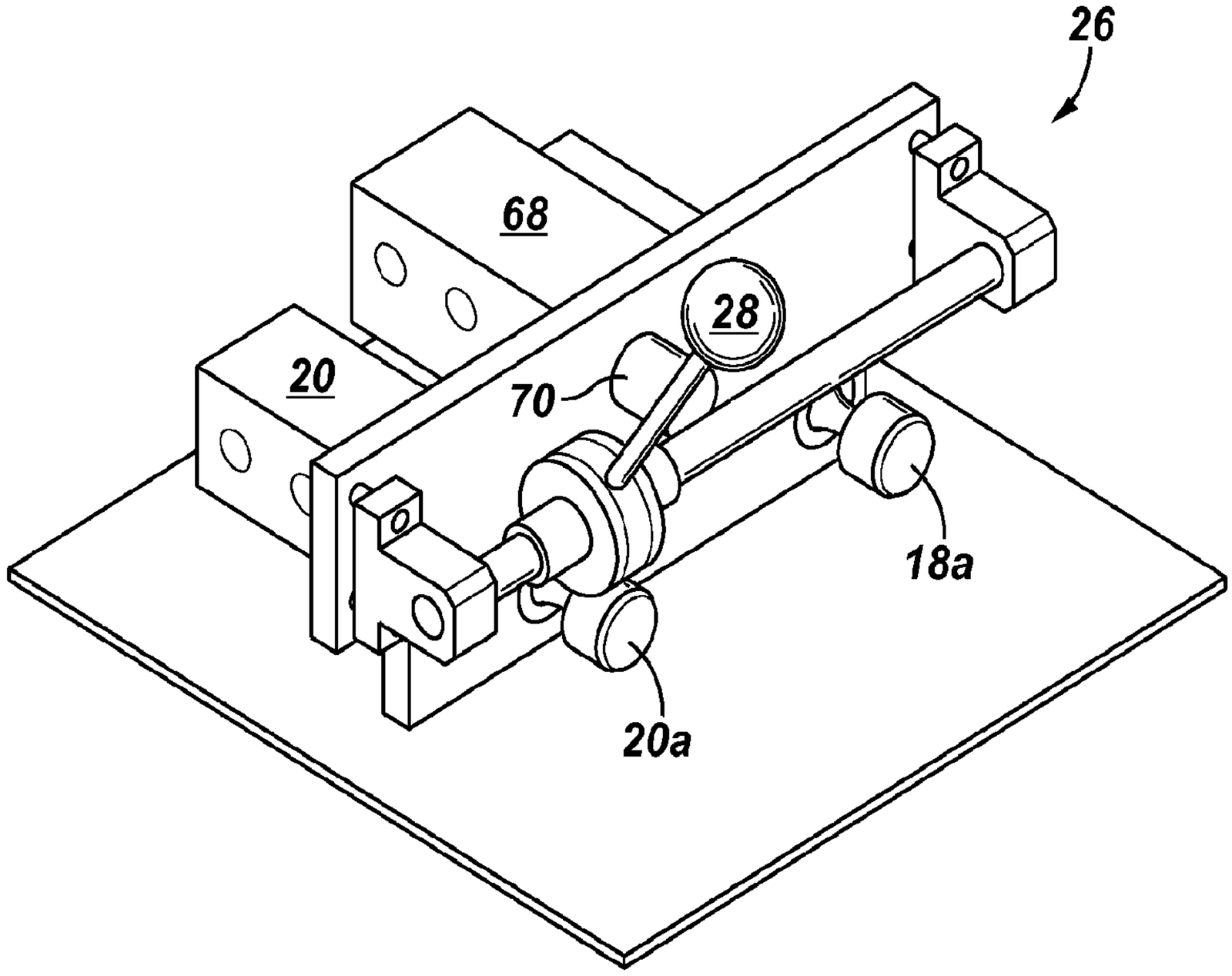


FIG. 7H

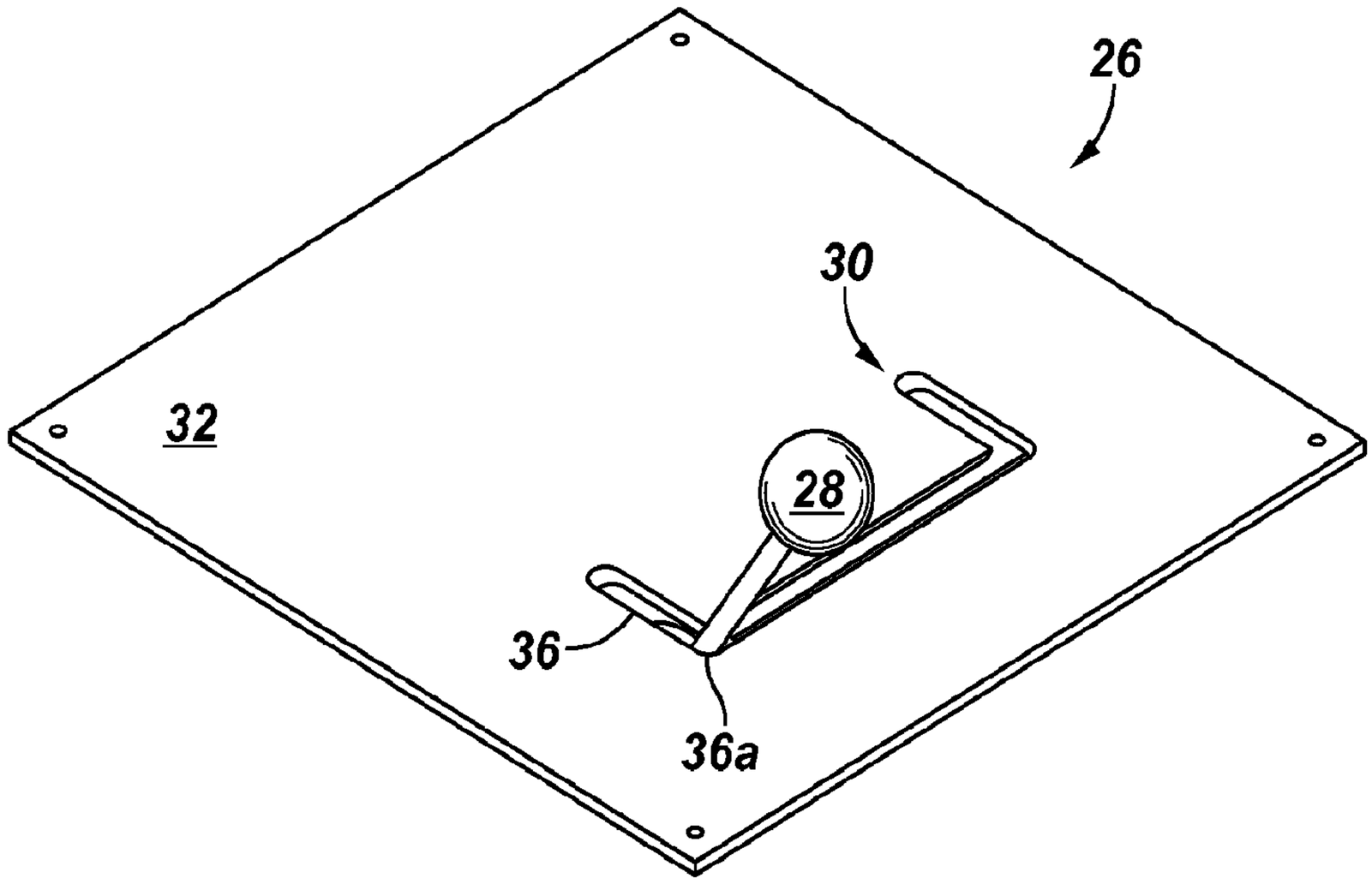


FIG. 7I

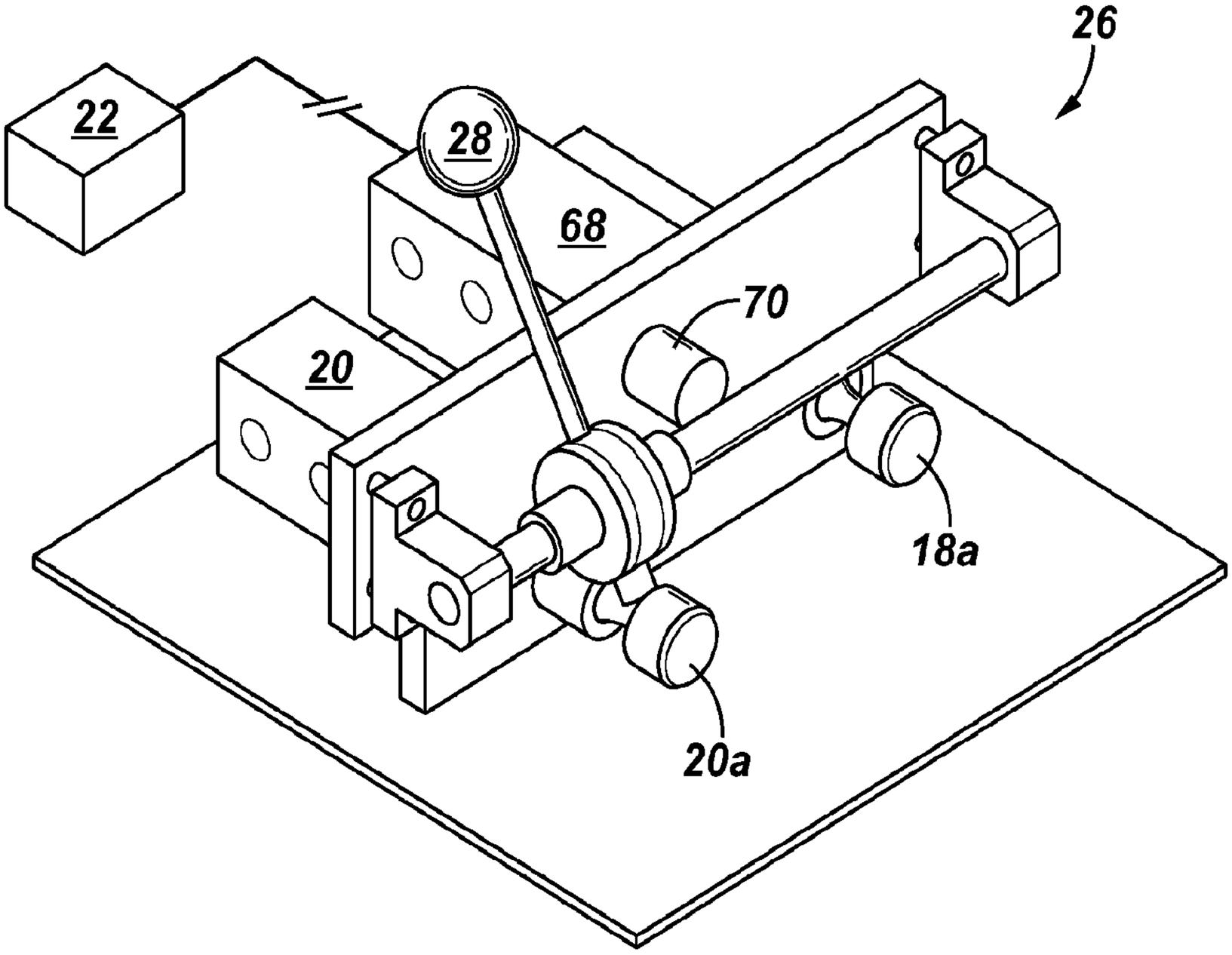


FIG. 7J

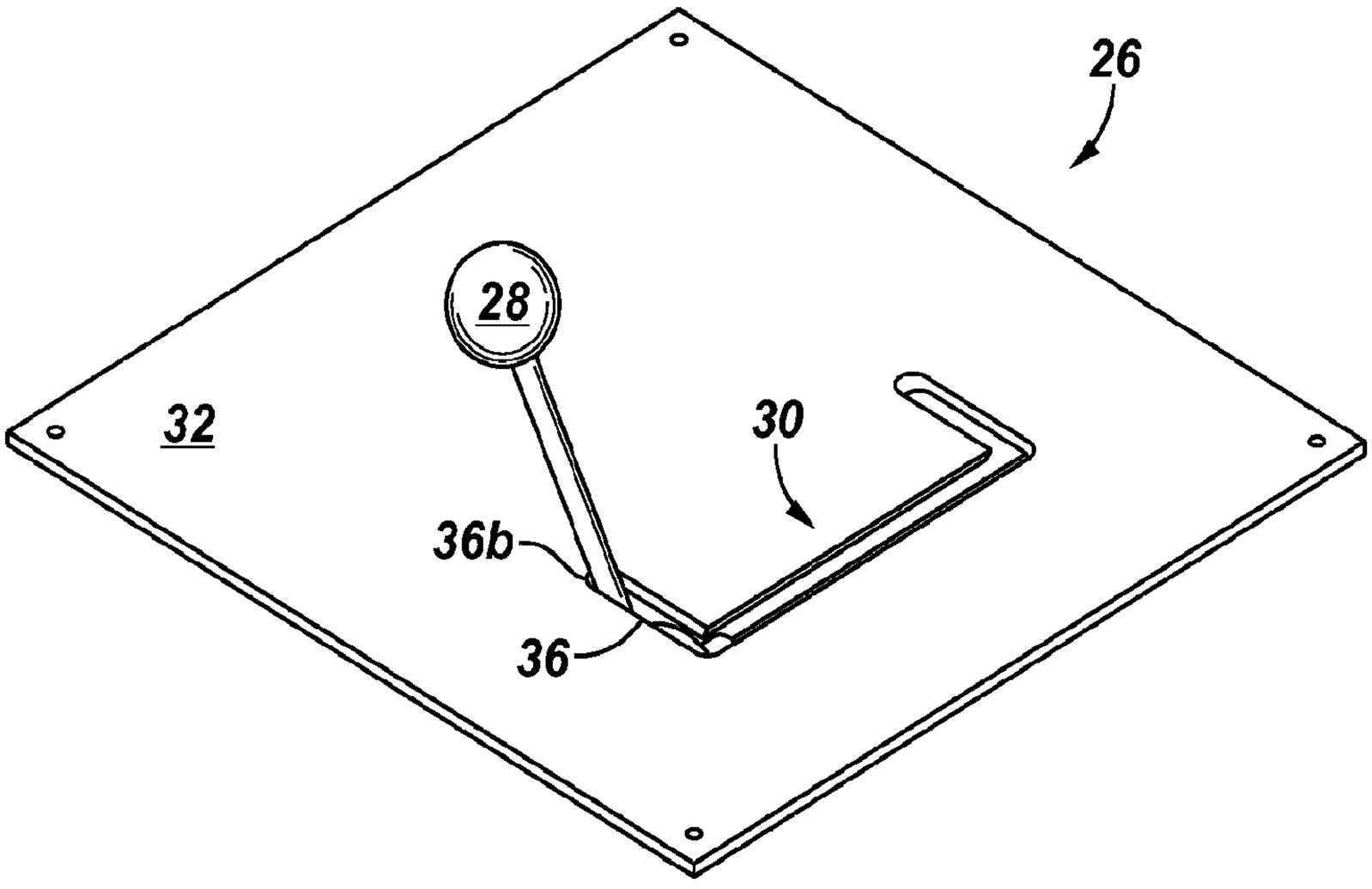
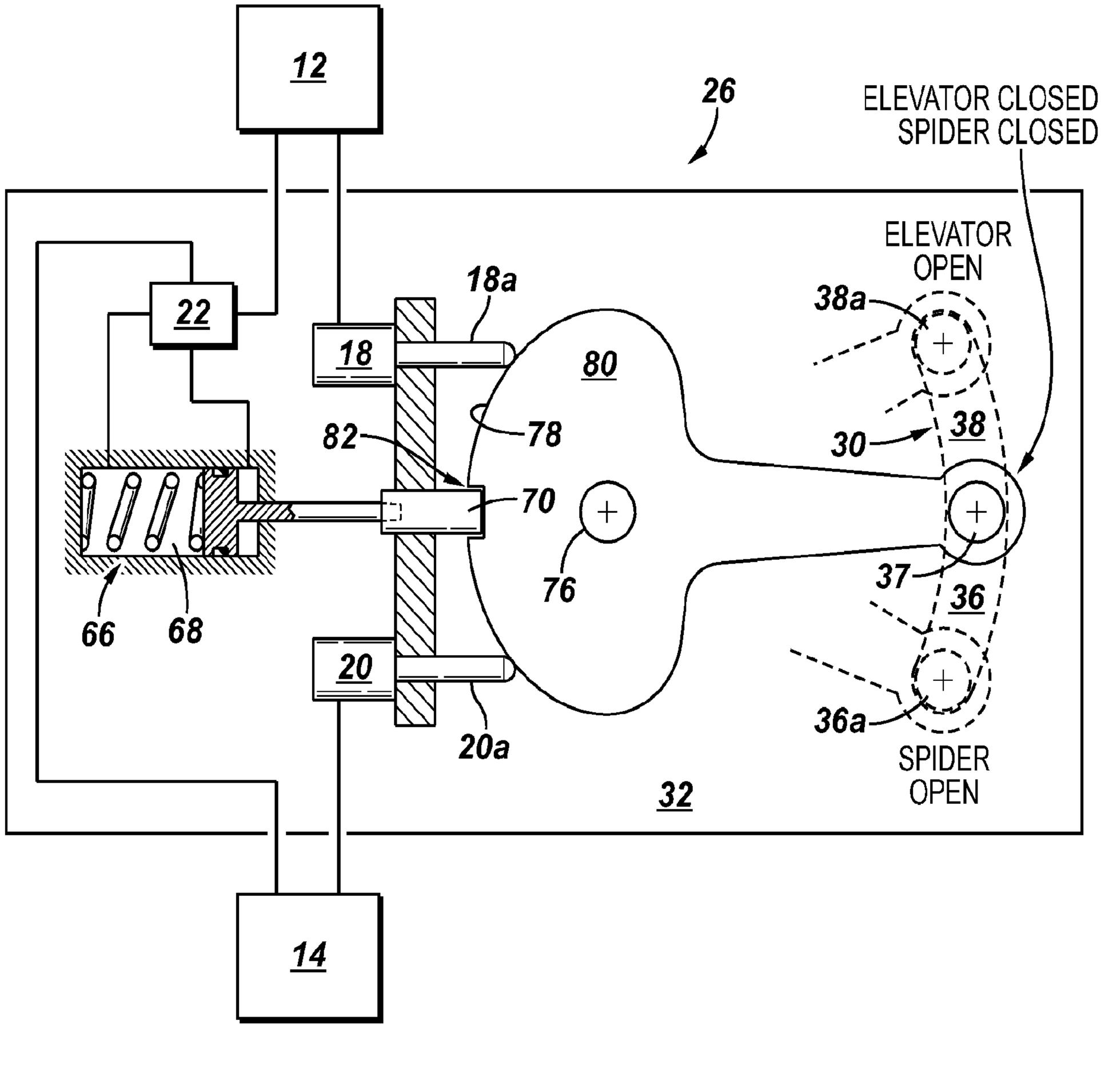


FIG. 8


12
26
ELEVATOR CLOSED
SPIDER CLOSED
ELEVATOR
OPEN
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70
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37
36
66
68
20
36a
20a
SPIDER
OPEN
32
14

FIG. 1