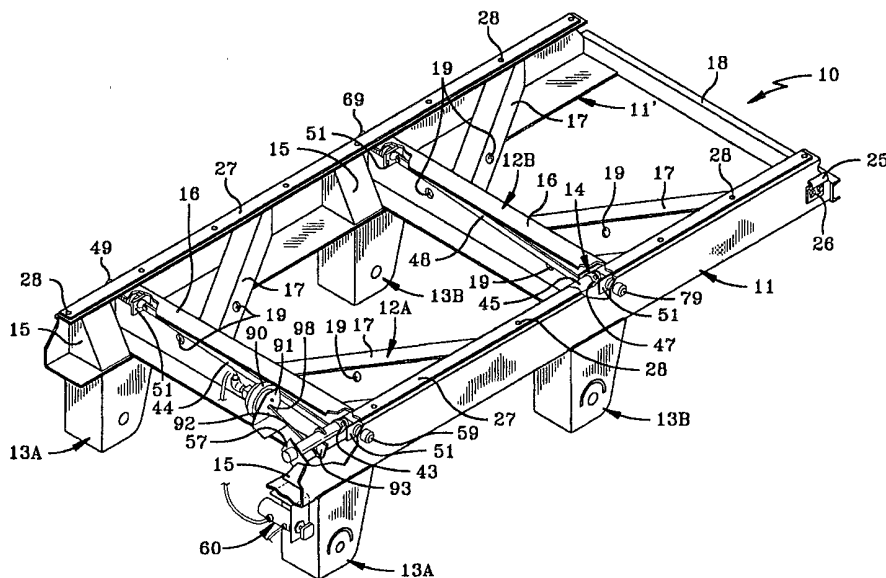




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(54) Title: RESET VALVE FOR SEMI-TRAILER SUBFRAME LOCKING MECHANISM



(57) Abstract

An air-piloted valve (60) for pneumatically actuating a set of pin mechanism (59) for locking a movable subframe (10) in a selected position relative to the semi-trailer. When the semi-trailer is at rest and the parking brake is engaged, pressurized air is exhausted from the parking brake system and the valve. The lack of air in the valve enables an operator of the semi-trailer to manually open the valve, thereby enabling air from a dedicated source to pass through the valve and unlock the pins. After repositioning the slider beneath the semi-trailer body, the operator manually closes the valve, thereby exhausting air from the locking mechanism via the valve and enabling the pins to automatically lock.

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RESET VALVE FOR SEMI-TRAILER SUBFRAME LOCKING MECHANISM**BACKGROUND OF THE INVENTION**

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FIELD OF THE INVENTION

The invention relates to semi-trailer subframes, and in particular to movable subframes for semi-trailers. More particularly, the invention is directed to a movable subframe for semi-trailers which includes a retractable pin mechanism for locking the movable subframe in a selected position relative to the semi-trailer body, wherein the retractable pin mechanism is pneumatically actuated via an air-piloted reset valve which controls air supply to the mechanism, and further wherein the valve is integrated with the parking brake system of the vehicle to prevent or limit, when the pin mechanism is in an unlocked position, movement of the semi-trailer from a parked position.

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15**BACKGROUND ART**

Movable subframes, typically referred to as sliders, have been utilized on semi-trailers or tractor-trailers for many years. One or more axle/suspension systems usually are suspended from a single slider structure. The slider in turn is mounted on the underside of the trailer body, and is movable longitudinally therealong to provide a means of variable load distribution. More specifically, the amount of cargo that a trailer may carry is governed by local, state and/or national road and bridge laws, and is dependent on proper load distribution. The basic principle behind most road and bridge laws is to limit the maximum load that a vehicle may carry, as well as to limit the maximum load that can be supported by individual axles. A trailer having a slider gains an advantage with respect to laws governing maximum axle loads. More particularly, proper placement of the slider varies individual axle loads or redistributes the trailer load so that it is within legal limits.

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Once properly positioned, the slider is locked in place on the underside of the trailer by a retractable pin mechanism. The retractable pin mechanism generally includes two or more, and typically four, retractable pins which may be interconnected by a usually manually or pneumatically actuated crank mechanism. When the pins are in their extended or outboardmost position, they each extend through a respective opening formed in the slider and a selected aligned one of a plurality of openings formed in the trailer body. The pins thereby lock the slider in a selected position relative to the trailer body.

However, these pins can become jammed. The mechanical advantage enjoyed by a manual operator of the pin mechanism is designed to overcome spring forces which bias the pins to the locked position, for retracting the pins when it becomes necessary to reposition the slider. The mechanical advantage is not designed to free or retract jammed pins from their locked position. Since the mechanical advantage sometimes is inadequate, prior art slider pin mechanisms rely on either the brute force of the semi-trailer operator or add-on devices such as pneumatically actuated systems designed to release jammed pins.

In assessing the reason for jammed pins, it has been discovered that shear forces are imposed on the individual pins. The shear forces operate in a direction perpendicular to the longitudinal axis of each cylindrical pin. More specifically, slight movement of the slider relative to the trailer body during operation of the semi-trailer can cause slight misalignment between the respective slider and trailer body openings through which each pin extends when in the locked position. This misalignment can in turn cause contact pressure points between each pin and its respective trailer body opening, aligned slider opening, and mounting bracket opening adjacent to the inboard end of the pin. The contact pressure points in turn cause the above-mentioned shear forces on the pins. Such whipsaw-like or jamming

forces can become greater than the force that a semi-trailer operator can manually apply through the crank mechanism to free the pins.

Thus, when prior art locking pin mechanisms become jammed, the operator of the semi-trailer risks personal injury due to overexertion in attempting to manually free jammed pins, and further risks damaging the retractable pin mechanism. Specifically, a typical method of attempting to release prior art jammed pin mechanisms is for the semi-trailer operator to rock the trailer fore-and-aft, while an assistant manually operates the retractable pin mechanism. The rocking motion briefly realigns the misaligned openings, so that the assistant can retract the pins during the period of realignment. The process has been simplified by various prior art quick-release devices, such as pneumatically operated quick-release devices, which generally allow the vehicle operator to maneuver the trailer while the quick release device automatically frees the jammed pins, thus effectively obviating the need for another person to manually operate the crank mechanism.

However, one problem with many prior art pneumatic quick-release devices of this type, is that a risk exists that the pins of the locking mechanism will retract during operation of the semi-trailer, or, alternatively, after the operator repositions the slider beneath the semi-trailer but forgets to lock the pin mechanism, the operator is at risk of driving away with the pins in an unlocked position. In both cases, the trailer of the semi-trailer likely will separate from the movable subframe and will hit the ground, with the obvious result that operation of the semi-trailer will be impossible and the trailer will be damaged. In addition, and of a more serious nature, in the former case separation of the movable subframe from the trailer of the semi-trailer during over-the-road operation of the vehicle could result in serious property damage and/or bodily injury or death to the operator of the semi-trailer or to others operating vehicles in the vicinity of the semi-trailer.

The present invention significantly reduces or eliminates the risk of accidental separation of the movable subframe from the semi-trailer by incorporating a three-way two-position air-piloted reset valve in the locking mechanism arrangement of parts, and by integrating that valve with the emergency or parking brake system of the semi-trailer. More specifically, when an operator of the semi-trailer desires to reposition the movable subframe beneath the semi-trailer, the operator engages the parking brake in the semi-trailer tractor cab, which in most conventional parking brake systems causes air to be exhausted from the parking brake air conduits. The parking brake conduit system pneumatically communicates with the locking pin mechanism via the valve, and with the parking brake conduits being free of air and the parking brake set, the operator then can alight from the tractor cab and manually pull the knob of the valve to its outboardmost or open position. This enables air to travel from a dedicated pressurized air supply, through the valve, and to the locking pin mechanism to enable the mechanism to overcome the force of the springs biasing the pins to a locked position and to retract the pins to an unlocked position. The valve is designed so that when air pressure is present in the parking brake system conduits and enters the valve, such air pressure prevents or makes it very unlikely that the valve knob could be pulled, either intentionally or by accident, to its outboardmost position to unlock the pins. Such an arrangement of parts greatly reduces or eliminates the risk of the slider separating from the semi-trailer during over-the-road operation, because during such operation, the parking brakes obviously are disengaged and pressurized air is present in the parking brake system conduits. After repositioning of the slider, the operator then can push the valve into a closed position to block the supply of pressurized air to and to exhaust any air present in, the locking pin mechanism, to enable the spring bias of each of the pins to move its respective pin in the outboard direction to a locked position. A second significant advantage to this arrangement of parts

exists in that if the operator forgets to close or to push the valve back in after repositioning the slider, releases the parking brake and attempts to drive away, the influx of pressurized air into the valve caused by releasing the parking brake automatically forces the knob to move to its inboardmost or closed position. The pressurized air present in the locking pin mechanism then is released to enable the spring bias of the pins to immediately move the pins to the locked position. Thus, it is unlikely that the operator of the semi-trailer could drive away with the pin mechanism unlocked and causing separation of the slider from the semi-trailer. Thus, it can be appreciated that the air-piloted reset valve locking pin mechanism of the present invention greatly reduces if not completely eliminates the risk of accidental separation of the semi-trailer from its movable subframe.

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SUMMARY OF INVENTION

Objectives of the present invention include providing an air-piloted reset valve locking mechanism for semi-trailer subframes, which prevents or greatly reduces the risk of disengagement of the subframe from the semi-trailer during operation of the semi-trailer over-the-road, as well as at the initiation of operation of the semi-trailer when the operator fails to lock the pin mechanism after repositioning the subframe.

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Another objective of the present invention is to provide such an air-piloted reset valve locking mechanism for semi-trailer subframes, which is economical, durable in use, and easy to install, maintain, and use.

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These objectives and advantages are obtained by the air-piloted reset valve locking mechanism for semi-trailer subframes, the general nature of which may be stated as including a retractable locking pin mechanism of a subframe structure for a vehicle trailer, the subframe structure being movably mountable on spaced-apart, parallel elongated rails mounted on the bottom of the trailer, the trailer rails each being formed with a plurality of openings, the subframe structure

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including a pair of spaced-apart, parallel elongated main members, the main members each including means for movably engaging a respective one of the trailer rails, at least one of the main members further being formed with at least one locking pin opening, the main member opening
5 being selectively alignable with its respective trailer rail openings, for passage of a generally complementary-sized and shaped locking pin through the respective aligned openings for locking the subframe structure in a selected position relative to the vehicle trailer, the retractable locking pin mechanism including means for extending the pin to a
10 locked position and a fluid actuated retraction mechanism for retracting the locking pin mechanism to an unlocked position, wherein the improvement comprises means for controlling the fluid actuated retraction mechanism, including, a valve disposed adjacent to the vehicle trailer, the valve being in communication with a parking brake system of the
15 vehicle trailer, the valve further being in fluid communication with a source of pressurized fluid, the valve further being in fluid communication with the fluid actuated retraction mechanism, the valve being formed with an exhaust port, so that when a parking brake of the parking brake system is engaged, fluid is absent from the parking
20 brake system enabling opening of the valve causing fluid to flow from the source of fluid, through the valve, and to the fluid actuated retraction mechanism for retracting the pin to an unlocked position for selective positioning of the subframe structure relative to the vehicle trailer, after which when the valve is closed, fluid is prevented from
25 travelling from the source of fluid to the fluid actuated retraction mechanism, and in turn fluid is exhausted from the retraction mechanism via the valve exhaust port, whereby the means for extending the pin to a locked position automatically operates, and alternatively if an operator fails to close the valve, upon disengagement of the parking
30 brake by the operator, fluid is introduced into the parking brake system and causes the valve to close and enables the pin to automatically lock, and maintains the valve in a closed state.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiment of the invention, illustrative of the best mode in which applicants have contemplated applying the principles, is set forth in the following description and is shown in the drawings and is particularly and distinctly pointed out and set forth in the appended claims.

FIG. 1 is a fragmentary perspective view, with portions broken away and shown in broken lines, of a slider for semi-trailers, showing the air-piloted reset valve locking pin mechanism of the present invention installed on the semi-trailer slider;

FIG. 2 is a fragmentary elevational view of the semi-trailer slider incorporating the air-piloted reset valve locking pin mechanism of the present invention, with portions broken away, and showing only one of two axle/suspension systems which depend from the slider, with a wheel, portions of the suspension system, and a trailer rail depending from a trailer body on which the slider is movably mounted, shown in broken lines;

FIG. 3 is a fragmentary top plan view, with portions broken away and shown in broken lines, of the slider incorporating the air-piloted reset valve locking pin mechanism of the present invention shown in FIG. 2;

FIG. 4 is a perspective view of the three-way two-position reset valve useful in the present invention, and showing a bracket incorporated on the valve for mounting the valve on a slider;

FIG. 5 is a sectional view taken along lines 5-5 of FIG. 4, with portions broken away and shown in broken lines, and showing the valve with fittings mounted in the valve ports for fluid communication between the valve ports and conduits attached to the fittings, and diagrammatically showing fluid communication between the valve and a source of pressurized air, and further showing the valve in a closed or inboardmost position in which the flow of pressurized air to the locking

mechanism is blocked to enable the pins to be biased to an outboard-most or locked position;

FIG. 6 is a sectional view similar to FIG. 5, but showing the valve in an open or outboardmost position, wherein pressurized air is free to flow to the locking mechanism to overcome the outboard bias of the pins to retract or unlock the pins;

FIG. 7A is an enlarged fragmentary front view, with portions broken away, of the reset valve and associated parts of the retractable locking pin mechanism of the present invention, showing the knob of the valve pushed to its inboardmost or closed position and the pins in an extended locked position;

FIG. 7B is a fragmentary top plan view, with portions broken away and shown in broken lines, of the arrangement of parts shown in FIG. 7A;

FIG. 8A is a view similar to FIG. 7A, but showing the knob of the valve pulled to its outboardmost or open position, causing pneumatic actuation of the locking mechanism and retraction of the pins to an unlocked position; and

FIG. 8B is a fragmentary top plan view, with portions broken away and shown in broken lines, of the arrangement of parts shown in FIG. 8A.

Similar numerals refer to similar parts throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A slider of a semi-trailer incorporating the improved air-piloted reset valve retractable locking pin mechanism of the present invention, is indicated generally at 10 and is shown in FIG. 1. Slider 10 includes a pair of main members 11, 11', front and rear generally K-shaped cross member structures 12A and 12B, respectively, front and rear pairs of hangers 13A and 13B, respectively, for suspending axle/suspension

systems, and the improved air-piloted reset valve retractable locking pin mechanism of the present invention 14.

Specifically, each main member 11, 11' is an elongated, generally C-shaped beam made of a metal such as steel or other suitable material. The open portion of each main member 11, 11' is opposed to the open portion of the other main member and faces inboard relative to slider 10. Main members 11, 11' are connected to each other in spaced-apart parallel relationship by K-shaped cross member structures 12A, B. Each K-shaped cross member structure 12 includes a base member 16 which extends between and is perpendicular to main members 11, 11' (FIGS. 1 and 3). The open portion of each base member 16 faces in a frontward direction. Each end of base member 16 nests in the open portion of a respective one of main members 11, 11', and is secured therein by any suitable means such as welding or mechanical fastening. Each base member 16 is a generally C-shaped beam made of a metal such as steel or other suitable material. Each front hanger 13A is attached by welding or other suitable means, to the lowermost surface of a respective one of main members 11, 11' at a location directly beneath base member 16 of front K-shaped cross member structure 12A. Each rear hanger 13B similarly is attached at a location directly beneath base member 16 of rear K-shaped cross member structure 12B. Each K-shaped cross member structure 12 further includes a pair of inclined members 17, each of which is a generally C-shaped beam also made of a metal such as steel or other suitable material. The open portion of each inclined member 17 faces in an outboard-frontward direction, and each of the inclined members extends between generally the middle portion of base member 16 and a respective one of main members 11, 11'. The front end of each inclined member 17 is attached at an angle to the rearwardmost surface of base member 16 by any suitable means such as welding or mechanical fastening, and a rear end of each of the inclined members is nested at an angle in the open portion of a respective one of main members 11, 11', and also is at-

tached thereto in any suitable manner such as by welding or mechanical fastening. An optional reinforcement bar 18 which extends between the rearwardmost ends of main members 11, 11', adds additional strength to the structure, and is attached thereto by any suitable means such as welding or mechanical fasteners. Thus, it can be seen that base member 16 and inclined members 17 form an integral K-shaped cross member structure 12 which interconnects and maintains main members 11, 11' in a spaced-apart parallel relationship.

One or more openings 19 (FIG. 1) are formed in the vertically extending surface of each base member 16 and each inclined member 17, and each of the openings is aligned with the corresponding openings formed in the other members to provide for passage of air and/or fluid conduits, electrical lines, and the like, used in the operation of the semi-trailer (not shown).

Each main member 11, 11' has a pair of rail guides 25 mounted on its outboard surface by bolts 26 (FIGS. 1 to 3). Each rail guide 25 is mounted adjacent to a respective one of the ends of main members 11, 11'. A low friction strip 27 is attached to the uppermost surface of each main member 11, 11' by recessed fasteners 28, and extends generally the entire length of the main member. Strip 27 is formed of any suitable low-friction material, such as ultra-high molecular weight polyethylene.

As mentioned hereinabove, and as best shown in FIGS. 2 and 3, slider 10 incorporating improved air-piloted reset valve retractable locking pin mechanism 14 of the present invention, supports front and rear axle/suspension systems. However, only front axle/suspension system 30 is shown in the drawings and described herein since the front and rear systems are identical in structure and operation. Moreover, inasmuch as axle/suspension system 30 is suspended from slider 10, but does not form an integral part thereof, only the major components of system 30 will be cited for aiding in the description of the environment in which the slider incorporating the improved air-piloted re-

set valve retractable locking pin mechanism 14 of the present invention operates. Axle/suspension system 30 includes generally identical suspension assemblies 31 suspended from each hanger 13A of the pair of front hangers. A reinforcement box 15 is mounted by any suitable means in the open portion of each main member 11, 11' frontward of and adjacent to each end of each of base members 16, to provide additional strength to slider 10 for supporting hangers 13A, B, and their associated suspension assemblies 31. Each suspension assembly 31 includes a suspension beam 32 which is pivotally mounted on hanger 13A in a usual manner. An air spring 33 is suitably mounted on and extends between the upper surface of the rearwardmost end of suspension beam 32 and main member 11, 11', at a location directly beneath the outboard end of a respective one of inclined members 17 of K-shaped cross-member structure 12A. A shock absorber 34 extends between and is mounted on suspension beam 32 and the respective inclined member 17. Another component of suspension assembly 31, mentioned herein only for the sake of relative completeness, is an air brake 35. An axle 36 extends between and is captured in the pair of suspension beams 32 of axle/suspension system 30. One or more wheels 38 are mounted on each end of axle 36.

Slider 10 is movably mounted on trailer body 40 by slidable engagement of rail guides 25 with spaced-apart, parallel and generally Z-shaped rails 41 (FIG. 2), which are mounted on and depend from the underside of the trailer body. Each low friction strip 27 abuts the bottom surface of the uppermost portion of a respective one of rails 41 to provide a smooth, generally friction-free contact surface for slidable movement of slider 10 on trailer body 40.

In accordance with one of the main features of the present invention, slider 10 can be selectively positioned relative to trailer body 40 for optimum load distribution by improved air-piloted reset valve retractable locking pin mechanism 14 of the present invention. As best shown in FIGS. 1 and 3, pin mechanism 14 includes an elongated pivot

rod 45 which passes rearwardly through an aligned pair of openings (not shown) formed in base member 16 and a predetermined one of inclined members 17 of front K-shaped cross member 12A adjacent to main member 11. A pivot rod support 57 is securely mounted, such as
5 by welding, on frontwardmost reinforcement box 15 of main member 11, and extends inboardly adjacent to pivot rod 45. Pivot rod support 57 maintains the position of pivot rod 45 relative to the other parts of locking pin mechanism 14, by preventing excessive outboard, inboard or vertical movement of the pivot rod, which otherwise could prevent
10 smooth operation of the mechanism. A lever 43 is attached (FIGS. 1, 7A and 7B), by welding or other suitable means, to pivot rod 45 adjacent to the front end of the rod and frontwardly adjacent to base member 16 of front K-shaped cross member 12A. A first end of an elongated arm 44 is pivotally attached by any suitable means to a lower end
15 of lever 43. A second end of arm 44 is pivotally attached by any suitable means to the inboard end of a pin 49 disposed adjacent to opposite main member 11'. An upper end of lever 43 is pivotally attached by any suitable means to the inboard end of a pin 59 disposed adjacent to main member 11. A lever 47 similarly is attached to pivot rod 45 adjacent
20 to the rear end of the rod and frontwardly adjacent to base member 16 of rear K-shaped cross member 12B. A first end of an elongated arm 48 is pivotally attached to a lower end of lever 47. A second end of arm 48 is pivotally attached to the inboard end of a pin 69 disposed adjacent to opposite main member 11'. An upper end of lever 47 is
25 pivotally attached to the inboard end of a pin 79 disposed adjacent to main member 11.

The inboard end of each pin 49, 59, 69, 79 is slidably mounted (FIGS. 1, 3, 7A and 7B) in an opening (not shown) formed in a bracket 51 which is attached by suitable means such as welding to a
30 respective one of base members 16. An enlarged outboard end of each pin 49, 59, 69, 79 passes through an opening 52 (see also FIG. 2) formed in a respective one of main members 11, 11'.

In accordance with a key feature of the present invention, the above-described arrangement of parts including levers 43, 47, elongated arms 44, 48, pivot rod 45, and pins 49, 59, 69, 79, can be pneumatically actuated via a three-way, two-position air-piloted reset valve 60 (FIGS. 4 and 5) of a type which is well known in the valve art. One type of three-way, two-position valve of a similar type is manufactured by Haldex Brake Systems of Kansas City, Missouri, and is identified by part number 352 042 001. However, the valve identified by this part number operates slightly differently than valve 60 preferred for use in the present invention, namely, it is a push-to-open pull-to-close valve, while the present invention contemplates a push-to-close pull-to-open operation, as will be described in detail hereinbelow. Valve 60 includes a cylinder 61 formed with a chamber 62 and ports 63, 64, 65, and 66. A piston or spool 67 is seated in chamber 62 and sealed by a pair of spaced-apart O-rings 68. Piston 67 is movable from a closed or inboardmost position shown in FIG. 5 to an open or outboardmost position shown in FIG. 6 by a rod 58 which is attached by any suitable means, such as threadable engagement, to piston 67. Rod 58 extends outwardly from chamber 62 and through an outboard end of cylinder 61 via an opening 70 formed in and passing completely through the cylinder end. The outboard end of rod 58 includes a knob 71 mounted thereon by any suitable means, such as threadable engagement, to facilitate manual actuation of valve 60, as will be described in greater detail below in the description of the operation of air-piloted reset valve retractable locking pin mechanism 14. Rod opening 70 is sealed by an O-ring 72. An L-shaped bracket 73 is captured by lock nut 85 on valve cylinder 61, and the L-shaped bracket in turn is mounted by any suitable means on the lowermost surface of main member 11 adjacent to and frontward of hanger 13A (FIG. 7A). More specifically, valve 60 is oriented on main member 11 so that knob 71 is disposed in an outboard direction to enable easy grasping of the knob for operating retractable pin mechanism 14 of the present invention.

A first end of a conduit 75 (FIGS. 5, 7A and 7B) is attached to and communicates with port 63 and an outboard portion of chamber 62 via a fitting 76. Conduit 75 also is attached at its second opposite end and communicates with the emergency or parking brake air supply of the semi-trailer. An exhaust tube 77 is attached to and communicates with port 64 and in inboard portion of chamber 62 via a fitting 78. A first end of conduit 74 is attached to and communicates with port 65 and a central portion of chamber 62 via a fitting 80. Conduit 74 also is attached at its second opposite end and communicates with a tank 81 containing a pressurized air supply. A usual two-way pressure protection valve 84 is interposed between valve 60 and tank 81 in conduit 74 to ensure that adequate pressure is maintained in the tank. A first end of a conduit 82 is attached to and communicates with port 66 and a central portion of chamber 62 via a fitting 83. Conduit 82 also is attached at its second opposite end and communicates with an air actuator 90 of a type which is well known to the art and to the literature.

Air actuator 90 is securely mounted on a bracket 91 (FIGS. 1, 3, 7A, and 7B) by any suitable means such as nuts 97, and the bracket in turn is mounted on the front surface of base member 16 of front K-shaped cross member 12A by any suitable means such as welding. A piston rod 92 of air actuator 90 extends outboardly toward pivot rod 45 from the air actuator through an opening 98 formed in bracket 91. The outboard end of piston rod 92 is pivotally attached by suitable means to a bracket 93 which in turn is immovably mounted, such as by welds, frontwardly adjacent to lever 43 on pivot rod 45.

Improved air-piloted reset valve retractable locking pin mechanism 14 of the present invention useful in slider 10 of a semi-trailer is operated in the following manner. When it is desired to lock slider 10 in a selected position relative to trailer body 40, main member openings 52 are aligned, in a manner well-known in the semi-trailer art, with selected ones of a plurality of correspondingly-sized openings 55 formed

in rails 41 of trailer body 40 (FIG. 2). Each pin 49, 59, 69, 79 automatically extends through the selected aligned openings 52, 55, since the pin is biased in an outboard direction by a coil spring 56 captured between bracket 51 and the enlarged outboard end of the pin. During
5 such automatic extension of pins 49, 59, 69, 79, to the locked position, valve 60 is in the position shown in FIG. 5, in which the pressurized air supply to air actuator 90 is exhausted through conduit 82, port 66, chamber 62, and out of port 64 through exhaust tube 77. Thus, the outboard bias of each coil spring 56 is free to operate without being
10 overcome by any air pressure forces (FIGS. 1, 3, 7A and 7B). When it is again desired by the operator of the semi-trailer to move slider 10 beneath trailer body 40, by retracting pins 49, 59, 69, 79, using the pneumatic pressure of locking mechanism 14 of the present invention, the parking brake of the trailer is engaged and air is exhausted from
15 parking brake conduit 75. This exhausting of air enables knob 71 to be manually pulled outboardly by the semi-trailer operator, since there is no air pressure in the parking brake conduit (not shown), or in conduit 75, port 63, or the outboard portion of chamber 62, to prevent such pulling of the knob and attached rod 58 and piston 67. Knob 71, rod 58 and
20 piston 67, all are retained in this outboardmost position by a detent 99 which is spring-loaded and engages a groove 96 formed in rod 58. Manually moving piston 67 to its outboardmost position shown in FIG. 6 enables pressurized air from dedicated air supply tank 81 to travel through conduit 74 and pressure protection valve 84, and into inlet port
25 65, through chamber 62, out of outlet port 66, through conduit 82, and into air actuator 90. This supply of air to air actuator 90 in turn causes movement of piston rod 92 in an outboard direction to rotate bracket 93 and pivot rod 45 in a counterclockwise direction, when viewed from the front of slider 10 (compare FIGS. 7A and 8A), to overcome the bias
30 of coil springs 56 and permit retraction of pins 49, 59, 69, 79 out of aligned openings 55, 52 (FIGS. 8A and 8B). Thus, slider 10 can be selectively adjusted by moving the slider longitudinally along rails 41 be-

neath trailer body 40, until main member openings 52 align with selected rail openings 55 and pins 49, 59, 69, 79 engage therewith as described hereinabove for maximizing load distribution. Knob 71 then can be manually pushed to its inboardmost position by the semi-trailer operator to in turn push rod 58 and piston 67 to their inboardmost position shown in FIG. 5, thereby blocking the supply of air to actuator 90 and exhausting air from the actuator and out of exhaust tube 77, to enable the bias of coil springs 56 to urge pins 49, 59, 69, and 79 to their extended locked position. Knob 71, rod 58, and piston 67 all are retained in this inboardmost position by the engagement of detent 99 with a second groove 95 formed in rod 58.

In accordance with one of the main features and advantages of the present invention, if the operator of the semi-trailer forgets to return knob 71 to its inboardmost position shown in FIG. 5 after repositioning slider 10 beneath trailer body 40, the pins will nonetheless automatically be enabled to lock upon release of the parking brake by the operator just prior to initiating movement of the semi-trailer. More particularly, upon release of the parking brake, the parking brake conduit fills with pressurized air, and in turn, pressurized air is introduced into conduit 75, port 63, and the outboard portion of chamber 62 to overcome the bias of detent 99 and automatically force piston 67 to reset to its inboardmost position shown in FIG. 5. The pressurized air present in actuator 90 then is released from exhaust tube 77 to enable the bias of coil springs 56 to force the pins to the extended or locked position. Another of the features and advantages of the above-described arrangement of parts of the present invention is that the risk of movement of piston 67 from its inboardmost position shown in FIG. 5 to its outboardmost position shown in FIG. 6 during over-the-road operation of the semi-trailer, whereby pressurized air is supplied to actuator 90 to retract or unlock the pins, is unlikely. More specifically, during over-the-road operation of the semi-trailer, the parking brake is in a released state and air is present in the parking brake system, as well as being

present in conduit 75, port 63, and the outboard portion of cylinder chamber 62. This pressurized air, together with detent 99 engaged with groove 95, which provides minor resistance, effectively prevents or reduces the risk of movement of piston 67 in an outboard direction which would result in accidental unlocking of the pins. It is understood that the operation of valve piston 67 could be reversed without affecting the overall concept of the present invention, namely, the pins could be locked when piston 67 is in the outboardmost position and unlocked when the piston is pushed to its inboardmost position, but it is believed that the arrangement of parts shown and described herein provides a higher degree of actual and psychological safety, inasmuch as it is conceivable that an extremely hard blow applied to knob 71 during the operation of the semi-trailer, if the pins are locked when knob 71 is pulled out, could cause knob 71 to depress and unlock the pins.

It is further understood that the present invention contemplates the following modified arrangement of parts and operation to achieve the objectives enumerated above. When it is desired by the operator of the semi-trailer to reposition slider 10 beneath trailer body 40, the operator applies the vehicle parking brake which in turn causes evacuation of air from the parking brake system. The operator then manually moves a switch, preferably located in the tractor-trailer cab, to the on position to remotely energize a solenoid valve causing the valve to open and allowing air to flow to actuator 90 and retracting the pins. After repositioning of the slider, the operator then manually moves the switch to the off position to deenergize the solenoid valve. The piston of the valve is spring-biased to the closed position, so that upon such deenergization the valve automatically closes, enabling the pins to automatically extend to the locked position. However, even if the operator fails to move the switch to the off position, upon release of the parking brake, an air pressure switch, which is in communication with the parking brake system, senses the return of air to the system and deenergizes the solenoid valve enabling the pins to lock. Moreover,

even if the operator fails to turn off the switch and the air pressure switch also fails for some reason, the air pressure present in the parking brake system will overcome the solenoid energization force which moves the valve to the open position, and will cause the valve to close enabling the pins to lock. It is also understood that other types of valves which accomplish actuation of the locking pin mechanism as described above, also can be utilized. Hydraulic operation of the locking pin mechanism of the present invention also is contemplated. Moreover, the present invention is not limited to the exact locking pin mechanism arrangement of parts or slider structure shown and described herein.

Thus, it can be seen that the improved air-piloted reset valve retractable locking pin mechanism 14 of the present invention overcomes disadvantages of various prior art pneumatic locking pin mechanisms which bear a higher risk of being accidentally actuated to cause separation of the slider from the semi-trailer during over-the-road operation of the semi-trailer, as well as separation of the slider from the semi-trailer when the operator of the semi-trailer initially drives off after releasing the parking brake, but having forgotten to reengage the locking pins.

Accordingly, the improved air-piloted reset valve locking mechanism for semi-trailer sliders is simplified, provides an effective, safe, inexpensive, and efficient system which achieves all the enumerated objectives, provides for eliminating difficulties encountered with prior semi-trailer slider locking mechanisms, and solves problems and obtains new results in the art.

In the foregoing description, certain terms have been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such terms are used for descriptive purposes and are intended to be broadly construed.

Moreover, the description and illustration of the invention is by way of example, and the scope of the invention is not limited to the exact details shown or described.

5 Having now described the features, discoveries and principles of the invention, the manner in which the improved air-piloted re-
set valve locking mechanism for semi-trailer sliders is constructed, ar-
ranged and used, the characteristics of the construction and arrange-
ment, and the advantageous, new and useful results obtained; the
new and useful structures, devices, elements, arrangements, parts
10 and combinations are set forth in the appended claims.

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WHAT IS CLAIMED IS:

1. A retractable locking pin mechanism of a subframe structure for a vehicle trailer, said subframe structure being movably mountable on spaced-apart, parallel elongated rails mounted on the bottom of said trailer, said trailer rails each being formed with a plurality of openings, said subframe structure including a pair of spaced-apart, parallel elongated main members, said main members each including means for movably engaging a respective one of said trailer rails, at least one of said main members further being formed with at least one locking pin opening, said main member opening being selectively alignable with its respective trailer rail openings, for passage of a generally complementary-sized and shaped locking pin through the respective aligned openings for locking the subframe structure in a selected position relative to the vehicle trailer, said retractable locking pin mechanism including means for extending said pin to a locked position and a fluid actuated retraction mechanism for retracting the locking pin mechanism to an unlocked position, wherein the improvement comprises means for controlling said fluid actuated retraction mechanism, including:

a) a valve disposed adjacent to said vehicle trailer, said valve being in communication with a parking brake system of the vehicle trailer, the valve further being in fluid communication with a source of pressurized fluid, said valve further being in fluid communication with said fluid actuated retraction mechanism, the valve being formed with an exhaust port, so that when a parking brake of said parking brake system is engaged, fluid is absent from the parking brake system enabling opening of said valve causing fluid to flow from said source of fluid, through the valve, and to said fluid actuated retraction mechanism for retracting said pin to an unlocked position for selective positioning of the subframe structure relative to said vehicle trailer, after which when said valve is closed, fluid is prevented from travelling from the source of fluid to the fluid actuated retraction

mechanism, and in turn fluid is exhausted from said retraction mechanism via said valve exhaust port, whereby said means for extending said pin to a locked position automatically operates, and alternatively if an operator fails to close the valve, upon disengagement of said parking brake by said operator, fluid is introduced into said parking brake system and causes the valve to close and enables the pin to automatically lock, and maintains said valve in a closed state.

2. The improved controlling means of Claim 1, in which said fluid is air.

3. The improved controlling means of Claim 1, in which said valve includes a cylinder formed with a bore and three ports in addition to said exhaust port communicating with said bore; in which a piston is mounted in said bore; in which a rod is attached to said piston and passes through an opening formed in said cylinder and outwardly from said bore; and in which said rod can be manually grasped to move the piston between open and closed positions.

4. The improved controlling means of Claim 3, in which said rod is manually pulled to its outwardmost position to open said valve and pushed to its inwardmost position to close said valve.

5. The improved controlling means of Claim 4, in which a knob for manually grasping said rod is attached to the outwardmost end of the rod.

6. The improved controlling means of Claim 4, in which said rod is formed with a pair of spaced apart outer and inner grooves; in which a spring-loaded detent is disposed in said cylinder adjacent to said cylinder rod opening, so that upon movement of said rod to open

said valve said detent engages said inner groove and upon movement of said rod to close said valve said detent engages said outer groove.

5 7. The improved controlling means of Claim 3, in which a first O-ring forms a seal between said rod and said cylinder rod opening; and in which a pair of O-rings forms a seal between said piston and an internal bore surface of said cylinder.

10 8. The improved controlling means of Claim 1, in which a first end of a bracket is mounted on said cylinder; and in which a second end of said bracket is mounted on said subframe structure.

15 9. The improved controlling means of Claim 2, in which a downwardly extending tube is mounted on said exhaust port; in which said source of pressurized air is an air tank; and in which a two-way pressure protection valve is interposed in and is in fluid communication with said second conduit.

20 10. The improved controlling means of Claim 2, in which the means for extending said pin to a locked position is a coil spring disposed about the pin; in which said coil spring biases said pin to the extended locked position and said retraction mechanism must overcome said bias to retract the pin to a unlocked position; and in which said pneumatically actuated retraction mechanism is an air chamber.

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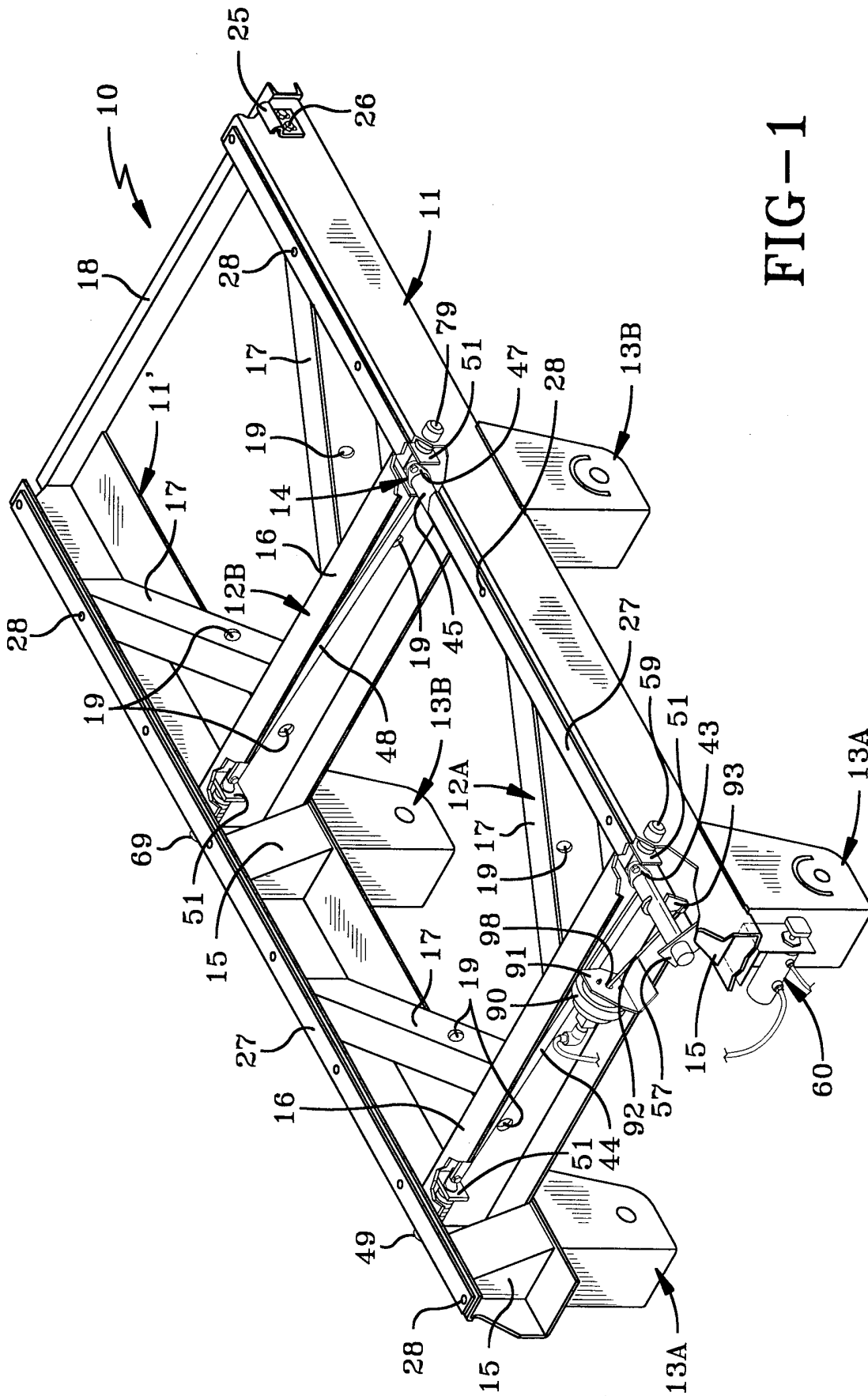


FIG-1

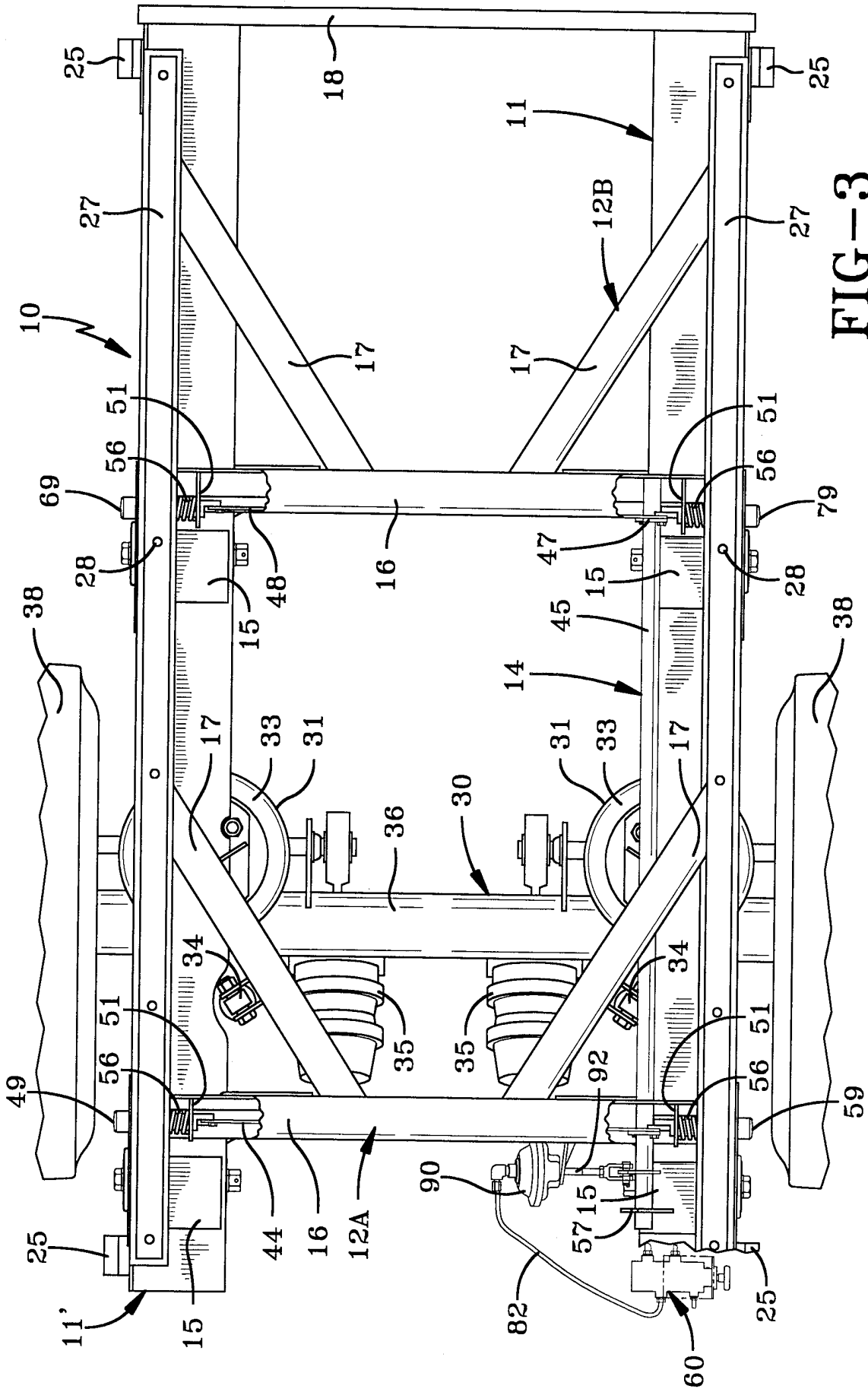


FIG-3

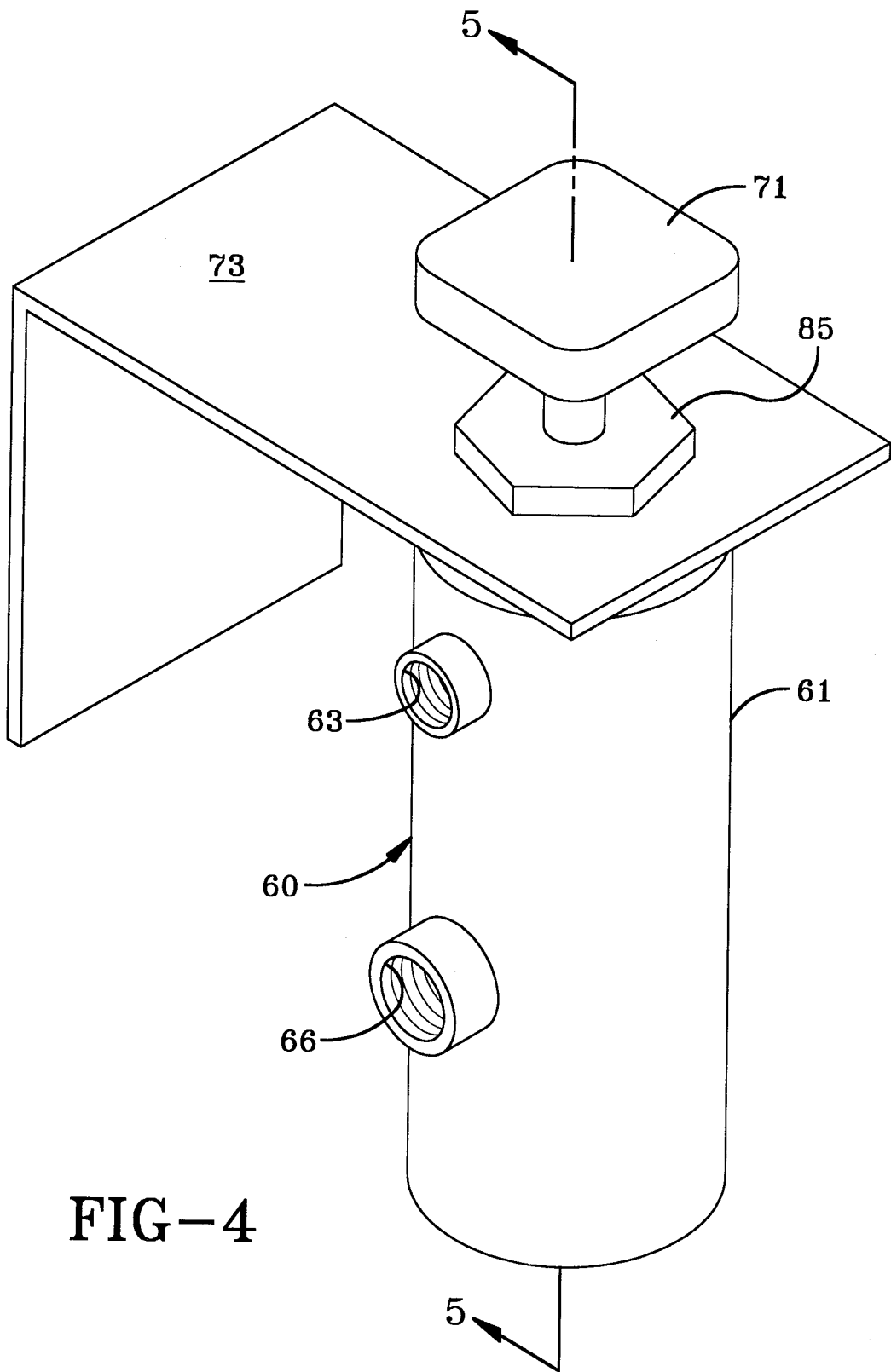


FIG-4

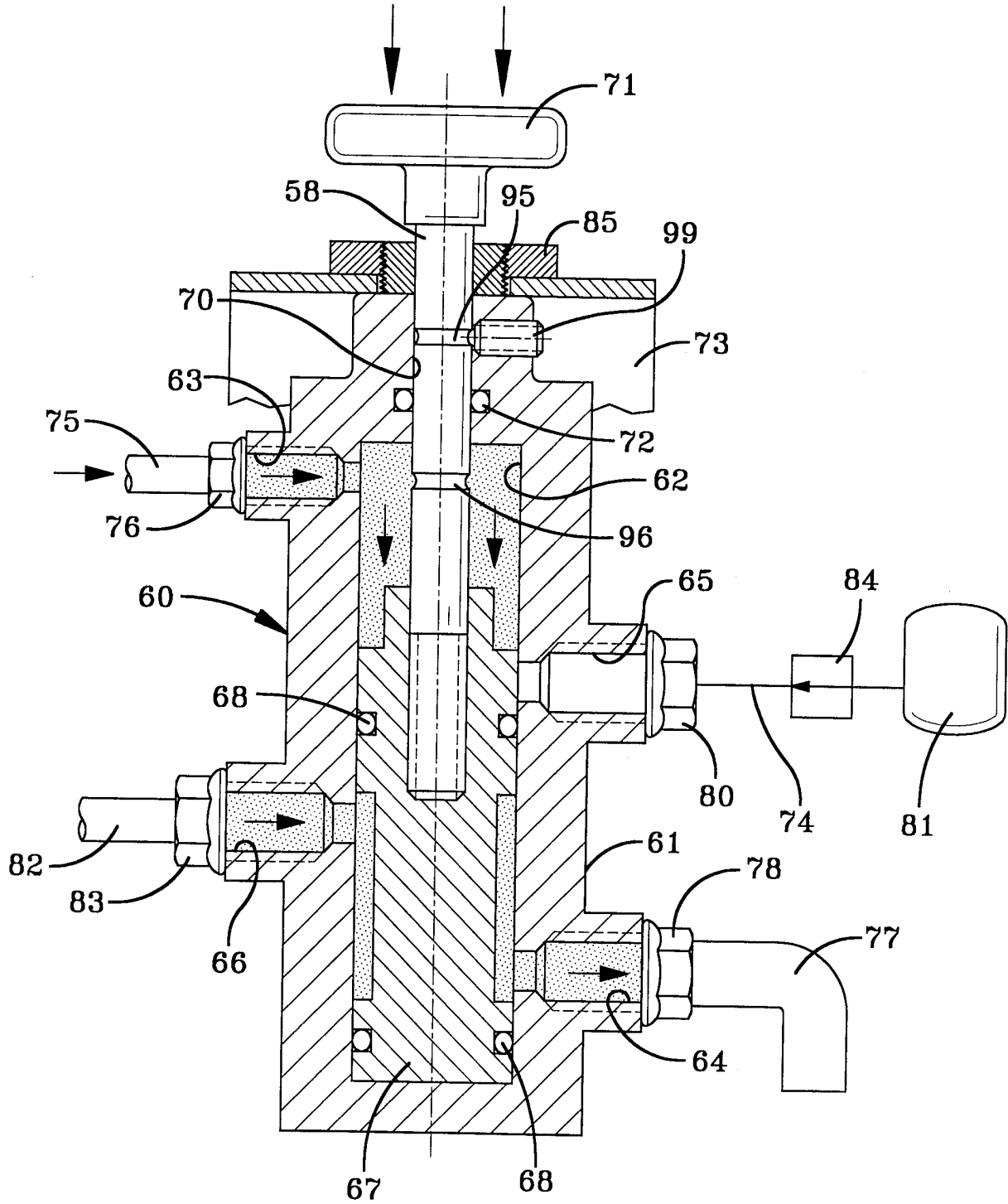


FIG-5

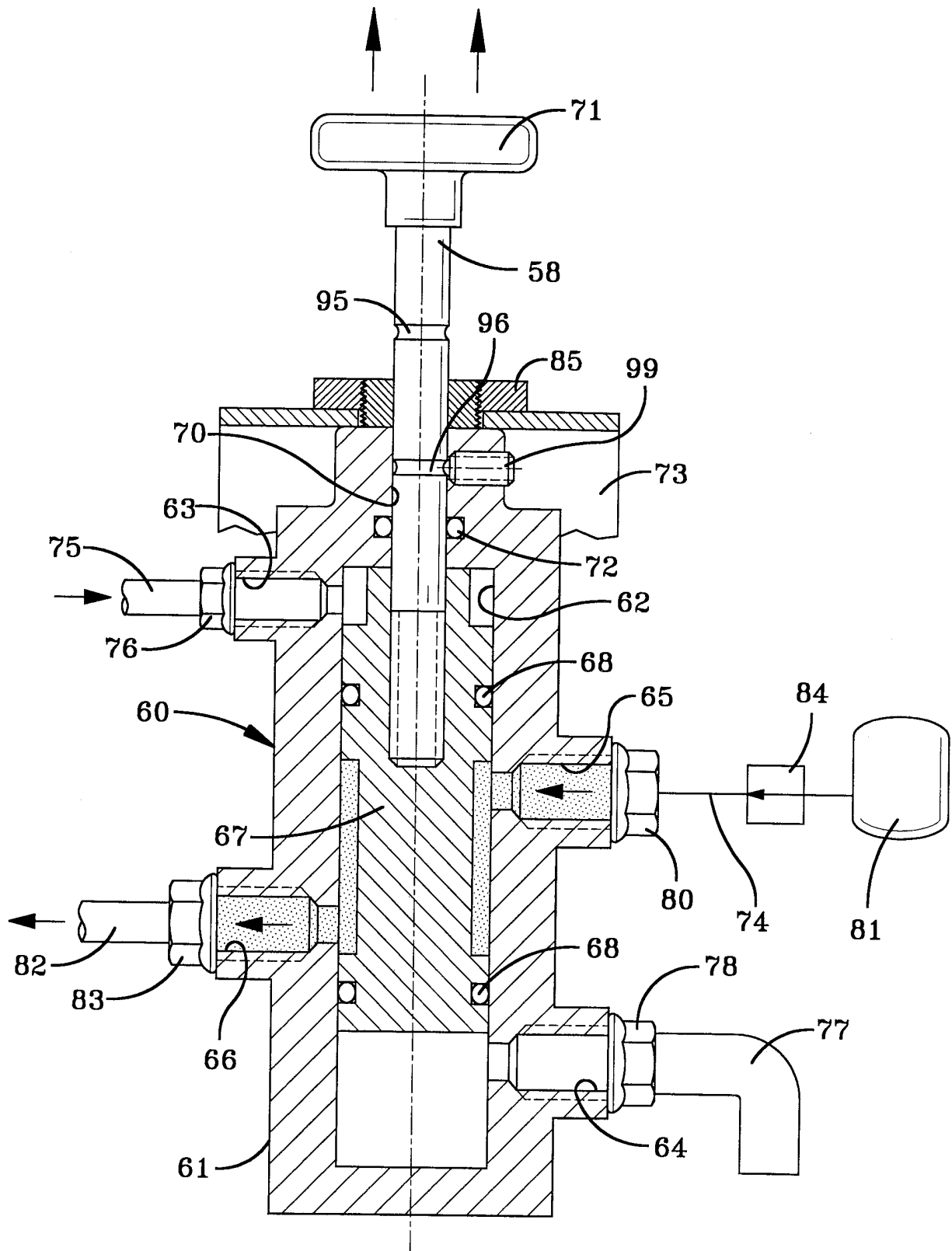
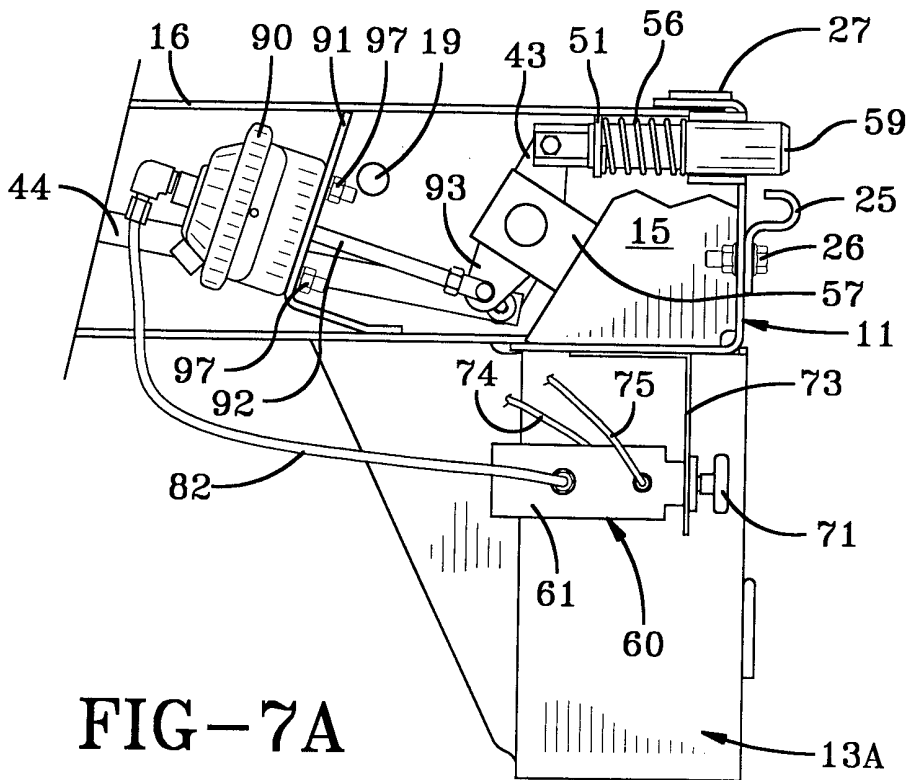
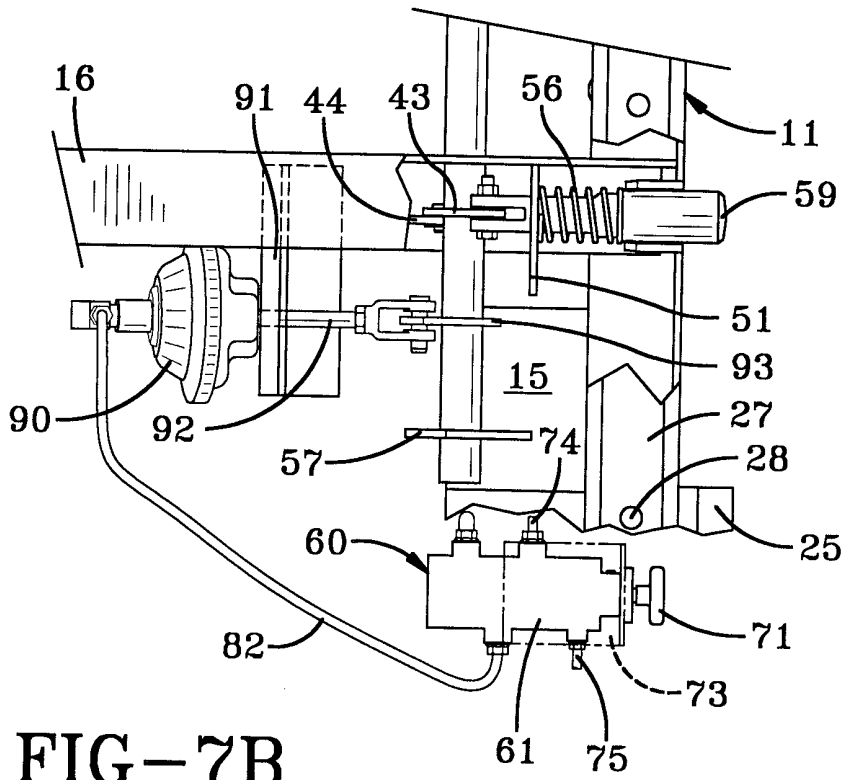


FIG-6



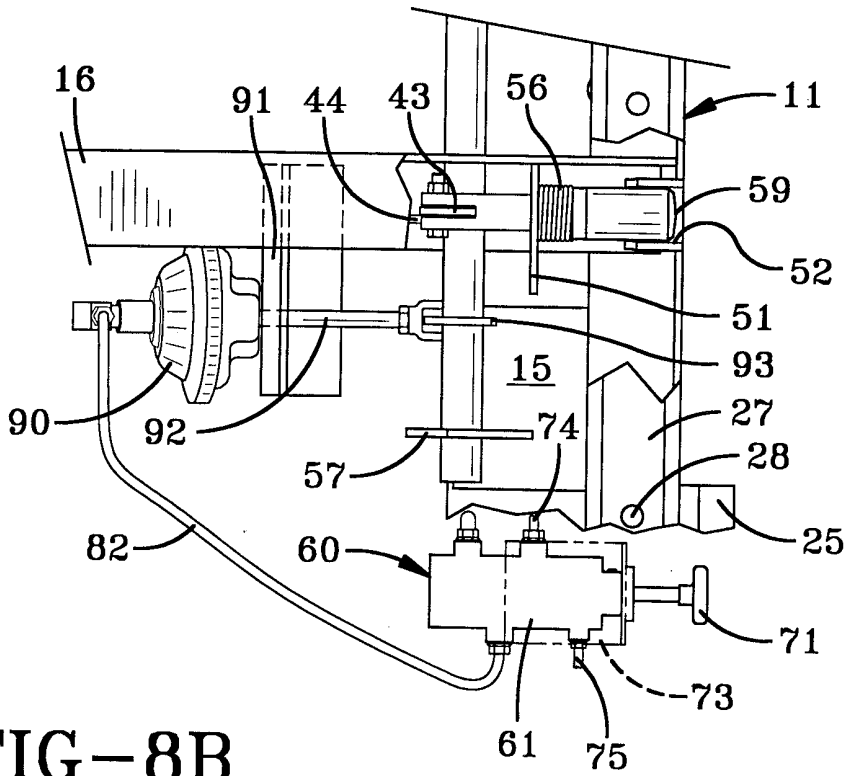


FIG-8B

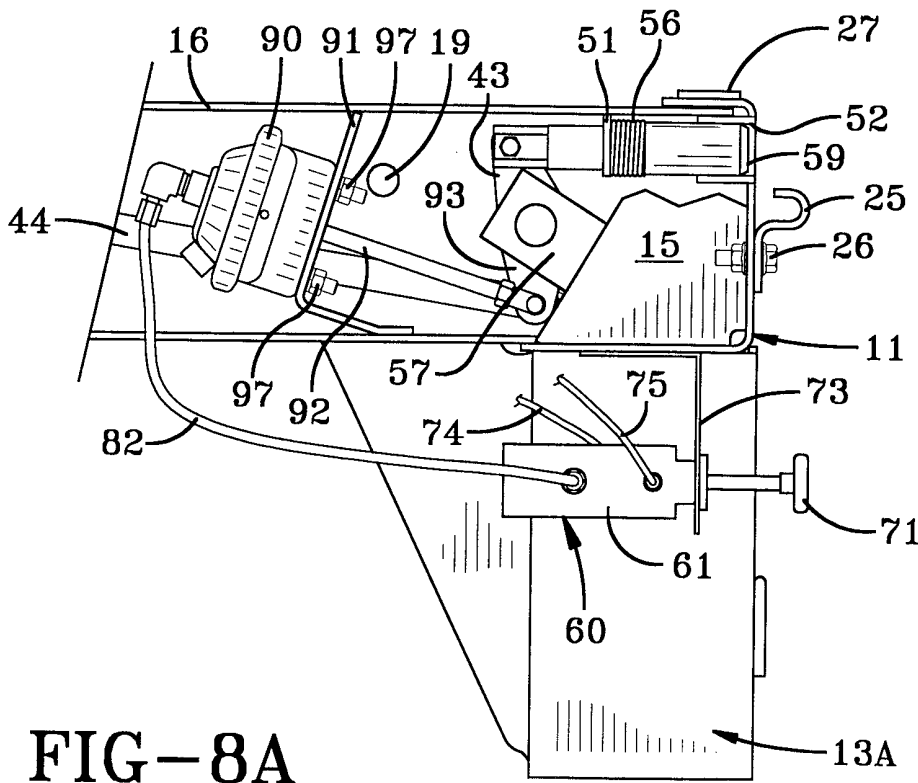


FIG-8A

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/00341

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(7) :B62D 53/06
 US CL :280/149.2, 405.1, 407.1
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 U.S. : 280/149.2, 405.1, 407.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 BRS
 search terms: pneumatic, manual reset valve

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,620,195 A (Wessels) 15 April 1997, figures 5 and 6	1-4, 9, 10 ----- 5-8

Further documents are listed in the continuation of Box C. See patent family annex.

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| <p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> | <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p> |
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Date of the actual completion of the international search 21 APRIL 2000	Date of mailing of the international search report <div style="text-align: center; font-size: 1.2em; font-weight: bold;">16 MAY 2000</div>
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Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer <div style="text-align: center;"> JUDY SWANN <i>Diane Smith f</i> </div> Telephone No. (703) 308-1113
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