

Nov. 10, 1970

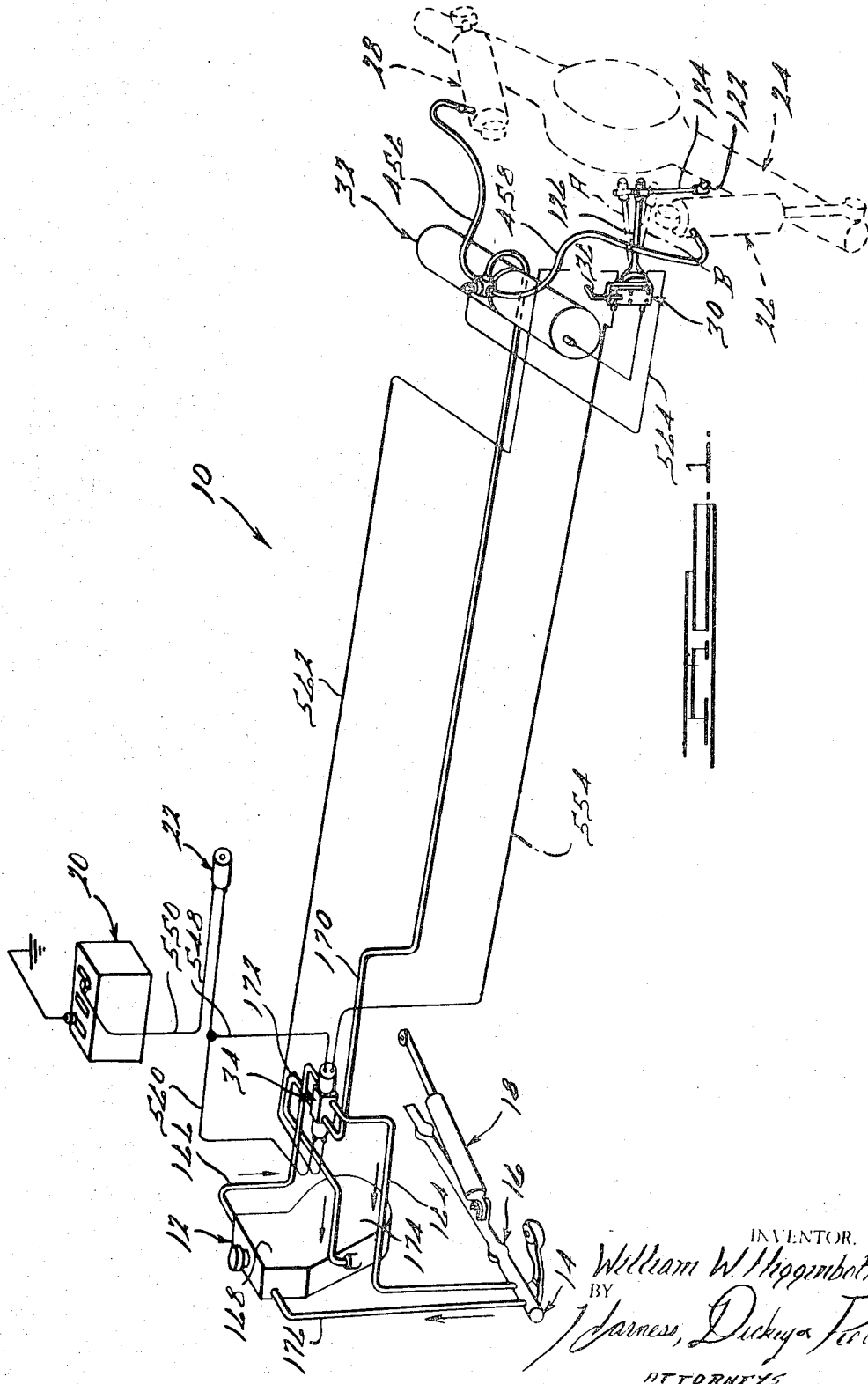
W. W. HIGGINBOTHAM

3,539,744

COMBINATION ELECTRICAL SWITCH AND FLUID ACCUMULATOR CHAMBER

Original Filed March 24, 1966

2 Sheets-Sheet 1



Nov. 10, 1970

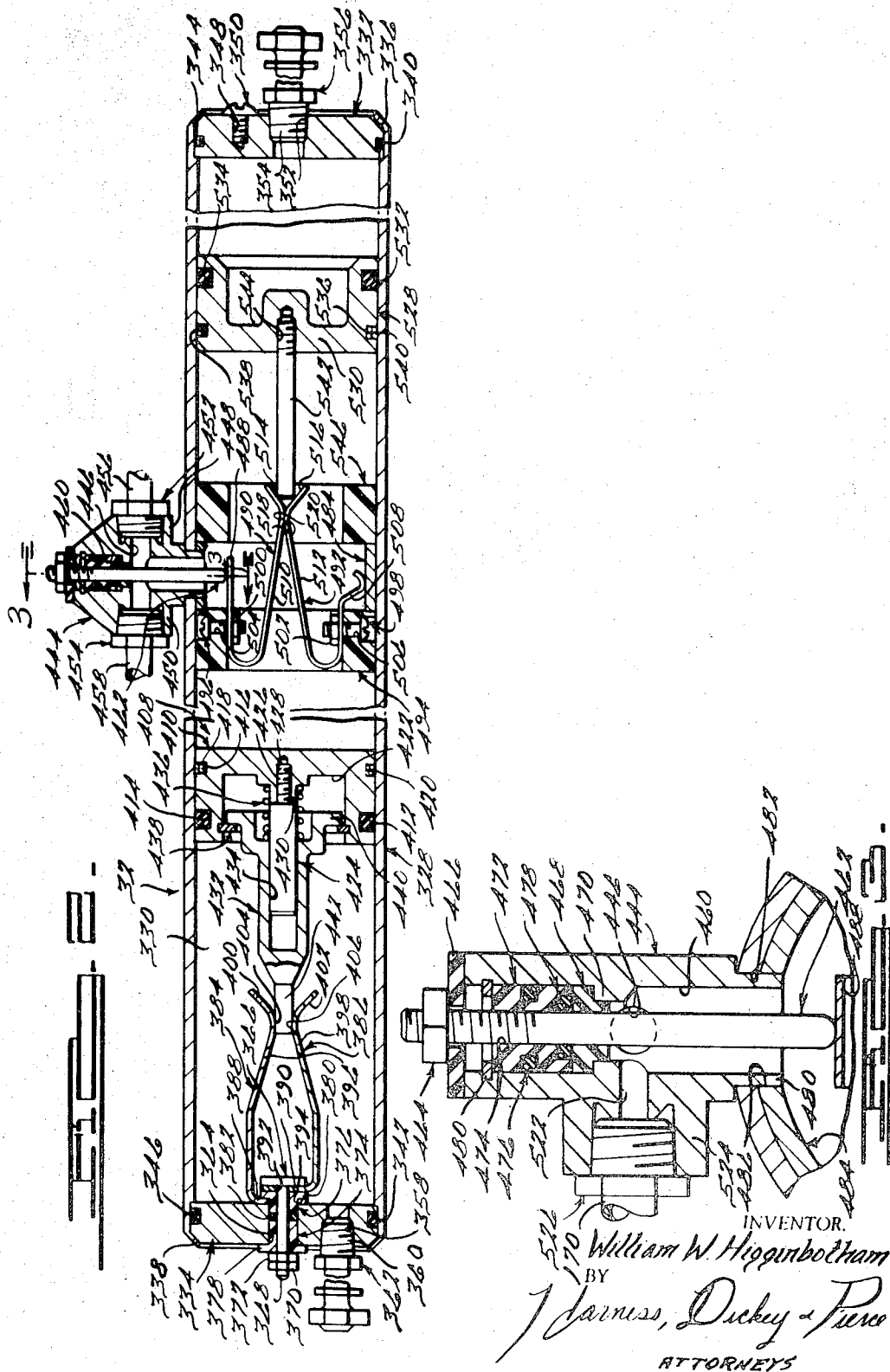
W. W. HIGGINBOTHAM

3,539,744

COMBINATION ELECTRICAL SWITCH AND FLUID ACCUMULATOR CHAMBER

Original Filed March 24, 1966

2 Sheets-Sheet 2



1

3,539,744

COMBINATION ELECTRICAL SWITCH AND FLUID ACCUMULATOR CHAMBER

William W. Higginbotham, Monroe, Mich., assignor to Monroe Auto Equipment Co., Monroe, Mich., a corporation of Michigan

Original application Mar. 24, 1966, Ser. No. 537,056, now Patent No. 3,409,307, dated Nov. 5, 1968. Divided and this application Jan. 8, 1968, Ser. No. 722,506

Int. Cl. H01h 35/38

U.S. Cl. 200—82

9 Claims

ABSTRACT OF THE DISCLOSURE

In combination with a vehicle leveling system having a fluid actuatable elevating mechanism and an electrically energized fluid pumping means, a combination electrical switch and fluid accumulator assembly, the assembly comprising an elongated cylindrical housing, piston means slidably disposed within the housing and dividing the interior thereof into first and second fluid chambers, one of the chambers being communicable with a source of pressurized fluid and the other of the chambers containing actuating fluid for the elevating mechanism and being communicable therewith, with the piston means being movable longitudinally of the housing in response to preselected differential pressure conditions between the chambers, first and second terminal means on the housing, first and second contact means disposed within one of the chambers, the contact means having portions connected to each terminal means and second portions normally engaged with each other, whereby to complete a circuit between the first and second terminal means, and means on the piston means movable to and from a position separating the engaged portions of the contact means to open and close an electrical circuit associated with the pumping means.

REFERENCE TO RELATED PATENTS

This is a divisional application of Ser. No. 537,056, now Pat. No. 3,409,307.

SUMMARY OF THE INVENTION

This invention relates generally to vehicle leveling systems and, more particularly, to a new and improved combination electrical switch and fluid accumulator assembly for use in vehicle leveling systems.

It is accordingly a general object of the present invention to provide a new and improved combination electrical switch and fluid accumulator assembly.

It is a more particular object of the present invention to provide an assembly of the above character which is of a relatively simple design, is economical to manufacture and will find universality of application in various types of vehicle leveling systems.

It is a related object of the present invention to provide a new and improved combination electrical switch and fluid accumulator assembly which is extremely compact in size and which may be adapted for various types of electrical circuit opening and closing applications.

Other objects, features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a schematic illustration of an exemplary embodiment of a vehicular leveling system having the combination electrical switch and fluid accumulator of the present invention in operative association therewith;

FIG. 2 is a longitudinal cross-sectional view of the switch assembly of the present invention, and

FIG. 3 is an enlarged fragmentary cross-sectional view

2

of a portion of the structure illustrated in FIG. 2, as taken substantially along the line 3—3.

Referring now in detail to the drawings, a vehicle leveling system 10, in which the present invention may be incorporated, is shown in operative association with various component members of a conventional automotive vehicle. More particularly and as best seen in FIG. 1 of the drawings, the leveling system 10 is shown in operative association with an automobile power steering system comprising a power steering unit 12 and a power steering valve mechanism 14 which is attached to one end of the vehicle's steering linkage 16 adjacent a power steering cylinder 18. The leveling system 10 is also shown in association with an automobile battery 20, ignition switch 22, and rear axle suspension system comprising an axle assembly 24 and a pair of conventional hydraulically expandable shock absorbers 26 and 28.

Generally speaking, the leveling system 10 comprises three separate but cooperative assemblies which function to pump the power steering fluid of the aforesaid power steering system to and from the shock absorbers 26 and 28 to effect raising and lowering of the vehicle chassis or body with respect to the axle assembly 24 in response to various load conditions imposed upon the vehicle, whereby the vehicle body is continuously maintained at a substantially level attitude. The aforesaid assemblies comprise a leveling switch assembly 30 that functions to sense the differential attitude between the axle assembly 24 and the vehicle body, a combination electrical switch and fluid accumulator assembly 32 according to the present invention which functions to selectively communicate power steering fluid to the aforesaid shock absorbers 26, 28 in response to actuation of the leveling switch assembly 30, and a distribution valve assembly 34 which functions to selectively control the rate and quantity of power steering fluid transmitted between the power steering system and the fluid accumulator assembly 32. The valve assembly 34 comprises a pair of solenoid valve members which are adapted to be electrically energized by power supplied from the vehicle's electrical system, i.e., battery 20, generator, etc., at such time as certain electrical circuits within the system 10 are closed, at which time the power steering fluid is pumped to and allowed to flow from the fluid accumulator assembly 32 and shock absorbers 26, 28.

Referring now in detail to the construction of the combination electrical switch and fluid accumulator assembly 32 of the present invention, as best seen in FIGS. 2 and 3, the assembly 32 comprises an elongated cylindrical housing 328 which defines a central accumulator chamber 330. The opposite ends of the housing 328 are closed by end header members 332 and 334 that have beveled outer edges 336 and 338, respectively, which enable the ends of the housing 328. The end header 332 is formed with a radially inwardly over the outer edges thereof to fixedly secure the members 332, 334 to the housing 328. Suitable sealing members 340 and 342 are disposed within annular recesses 344 and 346 formed around the outer peripheries of the header members 332 and 334, respectively, for providing fluid-tight seals at the opposite ends of the housing 328. The end header 332 is formed with a threaded bore 348 adapted to have a screw, bolt or the like 350 threadably mounted therewithin for attaching a ground conductor (not shown) to the member 332, whereby to ground the accumulator assembly 32 to the vehicle body. The header member 332 is also formed with a central internally threaded bore 352 adapted to threadably receive a mounting section 354 of a gas valve assembly 356, which assembly 356 is adapted to be used for communicating a gaseous substance into the interior of the chamber 330, as will later be described. The header member 334 is also formed with an internally threaded

bore 358 adapted to threadably receive a mounting section 360 of a gas valve assembly 362 which is substantially identical in construction to the aforementioned assembly 356 and is also adapted to communicate a gaseous substance into the interior of the chamber 330. The member 334 is also formed with a central bore 364 to have a terminal screw, bolt or the like 366 inserted therethrough. More particularly, the terminal bolt 366 is formed with a threaded outer (left) end section 368 adapted to have a pair of nuts 370, 372 threaded thereon for securing thereto one of the electrical conductors later to be described. The bolt 366 is mounted within a pair of dielectric insulating members 374 and 376 which are interposed between the outer periphery of the bolt 366 and the inner periphery of the bore 364, as illustrated in FIG. 2. The members 374, 376 are formed with radially outwardly extending flange sections 378 and 380, respectively, which are located adjacent the inner and outer sides of the header member 334 to prevent any axial movement of the members 374, 376 relative thereto. A suitable O-ring sealing member 382 is interposed between the adjacent ends of the members 374 and 376 for providing a gas-tight seal within the bore 364.

The bolt 366 is adapted to support a pair of terminal clip members 384 and 386 within the left end of the housing 328. The members 384, 386 are preferably constructed of a resilient current conductive material, and are formed with transversely extending mounting sections 388 and 390 at the left ends thereof. The section 390 of the clip member 386 is formed with a central bore 392 adapted to have the terminal bolt member 366 inserted therethrough, and the section 388 of the clip member 384 is formed with a central bore 394 adapted to have the insulating member 376 inserted therethrough, as illustrated in FIG. 2. It will be noted that the clip members 384 and 386 are insulated from one another at their left ends by the flange section 380 of the member 376. However, the members 384 and 386 have converging sections 396 and 398, and diverging sections 400 and 402 which define normally engaged face portions 404 and 406, respectively. It will be seen that the mounting section 388 of the clip member 384 abuts against the inner side of the header member 334 which is grounded to the vehicle chassis through the housing 328, header member 332 and the ground wire connected thereto by the screw 350. Accordingly, the clip members 384 and 386 normally complete an electrical circuit between the terminal bolt member 366 and the vehicle chassis, which circuit will be broken at such time as the clip members 384, 386 are separated or biased apart in the manner hereinafter to be described.

As illustrated in FIG. 2, a piston assembly, generally designated 408, is slidably or reciprocally mounted within the left end of the housing 328. The assembly 408 comprises a generally cup-shaped piston member 410, the outer periphery of which is provided with an O-ring sealing member 412 nested within a suitable annular recess 414 for slidably, but sealingly, engaging the inner periphery of the housing 328. Another O-ring member 416 is nested within a second annular recess 418 formed around the periphery of the piston member 410 adjacent the left end thereof, which O-ring 416 is adapted to resiliently urge a Delrin or similar type anti-friction bearing ring 420 that is disposed within the recess 418 radially outwardly toward the inner periphery of the housing 328 to provide a slidable fluid-tight seal therebetween. The piston member 410 is formed with a central annular recess 422 within which an elongated cylindrical shaft 424 is disposed. The shaft 424 is formed with a reduced diameter externally threaded section 426 at the left end thereof which is threadably received within a suitable bore 428 located in a mounting section 430 that is integrally formed within the recess 422, whereby the shaft 424 extends outwardly from the left side of the piston member 410 coaxially of the housing 328. The shaft 424 is adapted to support a plunger 432 for reciprocal move-

ment relative to the piston member 410, which plunger 430 is formed with a central bore 434 adapted to receive the outer or left end of the shaft 424, as illustrated in FIG. 2. The plunger 434 is resiliently urged toward the left end of the shaft 424 by means of a helical coil spring 436 which is disposed circumjacent the right end of the shaft 424 and a portion of the mounting section 430 extending coaxially of the shaft 424. Means in the form of a conventional snap-ring or the like 438 is disposed within the recess 422 and adapted to engage a radially outwardly extending shoulder section 440 formed on the right end of the plunger 432 to limit movement of this member toward the left end of the shaft 424. The left end of the plunger 432 is formed with a longitudinally extending cylindrical end section 442 which, upon appropriate longitudinal movement of the assembly 408 relative to the housing 328, is adapted to be inserted between the face portions 404 and 406 of the clip members 384 and 386 to break the electrical circuit normally maintained therebetween.

It will be seen from the above construction that a pre-selected increase in fluid pressure on the right side of the piston member 410 will move the assembly 408 toward the left within the housing 328, whereby the end section 442 of the plunger 432 will engage the clips 384 and 386; however, the coil spring 436 is selected such that it will be compressed as the plunger 432 initially engages the clips 384, 386 so that the end section 442 will not be interposed between the clip members to break the circuit therebetween until such time as the spring 436 is entirely compressed and the piston member 410 moves further toward the left. With this construction, there is a certain amount of differential movement between the plunger 432 and the piston member 410 to enable the latter to reciprocate within the housing 328 without the end section 442 of the plunger 432 breaking the circuit between the clips 384 and 386. Briefly, the purpose for such an arrangement is to prevent the clips 384 and 386 from being separated when the vehicle traverses small bumps or similar type irregularities in the road surface. Accordingly, the leveling system 10 of the present invention will not be deenergized when there is a temporary change in attitude between the vehicle body with respect to the axle assembly 24 thereof.

Mounted on the top of the housing 328 is a combination fluid fitting and terminal support member, generally designated by the numeral 444. As best seen in FIG. 2, the member 444 is formed with a transversely extending fluid passage 446 which includes enlarged diameter internally threaded sections 448 and 450 adapted to receive fluid fittings 452 and 454, respectively, which are communicable with a pair of fluid conduits 456 and 458, respectively. The opposite ends of the conduits 456 and 458 are communicable with the shock absorbers 28 and 26, respectively, in a manner such that when fluid is pumped to or from the shock absorbers 26, 28 through the conduits 456 and 458, the shock absorbers will expand or contract longitudinally to raise or lower the rear end of the vehicle body with respect to the axial assembly 24, as will later be described. The member 444 is also formed with a generally vertically extending bore 460 which intersects the aforescribed passage 446 and has an elongated cylindrical terminal rod 462 extending coaxially therethrough. The upper end of the rod 462 is threaded and adapted to receive a suitable nut 464 thereon for attaching an electrical conductor later to be described to the rod 462. An insulating washer 466 is interposed between the nut 464 and the upper end of the member 444 for insulating the nut 464 from the member 444. The rod 462 is supported within the bore 460 by means of an annular guide member 468 which is supported upon a shoulder 470 formed directly above the intersection of the bore 460 with the passage 446, and by an annular retainer cylinder 472 having an internally threaded bore 474 which is threadedly received upon an intermediate portion of the rod 462. Sealing means in the form of a pair of O-rings 476 and 478

5

are interposed between the outer periphery of the cylinder 472 and the inner periphery of the bore 460, and between the outer periphery of the rod 462 and the inner periphery of the bore 474, respectively, to prevent any fluid leakage through the upper end of the bore 460 or around the rod 462. A retaining ring 480 is provided directly above the upper end of the cylinder 472 to lockingly secure the members 468 and 472 within the bore 460.

The member 444 is formed with a cylindrical shaped mounting section 480 which extends coaxially of the bore 460 and is secured as by welding or the like within an annular opening 482 formed in the upper end of the housing 328 intermediate the opposite ends thereof. An annular metal reinforcing ring 484 extends around the inner periphery of the housing 328 at a position longitudinally aligned with the opening 482, the ring 484 being formed with a suitable opening 486 adapted to receive the lower end of the section 480 of the member 444. It will be seen that the lower end of the rod 462 extends downwardly within the chamber 330 and is adapted to be in contact with the upper end section 488 of a generally J-shaped spring contact 490 disposed within the housing 328 subjacent the member 444. The contact 490, together with an associated contact 442, is supported within the chamber 330 by means of an annular retaining ring 494 which is preferably constructed out of plastic or the like and is formed such that the outer periphery thereof is contiguously engaged with the inner periphery of the housing 328, as illustrated in FIG. 2. The contacts 490 and 492 are secured to the inner periphery of the retaining ring 494 by means of suitable screws, bolts or the like 496 and 498, and nuts 500 and 502, the former of which extend through countersunk bores 504 and 506, respectively. The contact 492 is formed with a downwardly extending section 508 which engages the inner periphery of the reinforcing ring 484 so that the contact 492 is in electrical communication with the ground wire secured to the housing 328 by means of the screw 350. The contacts 490 and 492 are formed with converging sections 510, 512, and with diverging sections 514, 516, respectively, which define normally engaged face portions 518 and 520. It will be seen that an electrical circuit is normally completed through the rod 462, the contacts 490 and 492, the reinforcing ring 486, housing 328, end header 332, and the aforesaid ground wire, which circuit will be broken at such time as the face portions 518 and 520 are separated.

The member 444 is formed with another transversely extending fluid passage 522 which, as illustrated in FIG. 3, intersects the passage 446 and bore 460 and extends outwardly therefrom within a mounting section 524 formed on the rearward side of the member 444. The outer end of the passage 522 is internally threaded and is thereby adapted to receive a suitable fluid fitting 526 which connects the conduit 170 with the assembly 32. It will be seen that the power steering fluid pumped through the conduit 170 will flow through the passage 522 into the bore 460 and will thereafter either flow into the housing 328 or through the conduits 456 and 458 to the shock absorbers 26 and 28, as will later be described.

Reciprocally mounted within the right end of the housing 328 is another piston assembly, generally designated 528, which comprises a generally cup-shaped piston member 530, the outer periphery of which slidably engages the inner periphery of the housing 328. An O-ring sealing member 532 is nested within an annular recess 534 formed around the outer periphery of the piston 530 and is adapted to provide a fluid-tight seal between the outer periphery thereof and the inner periphery of the housing 328. Another O-ring member 536 is nested within a second annular recess 538 formed around the periphery of the piston member 530 adjacent the left end thereof, which O-ring 536 is adapted to resiliently urge a Delrin or similar type anti-friction bearing ring 540 that is disposed within the recess 536 radially outwardly toward the inner periphery of the housing 328 to provide a slidable, yet fluid-tight seal therebetween. An elongated cylindrical

6

contact engaging rod 542 extends coaxially within the right end of the housing 328 and is threadably secured at its right end within an internally threaded bore 544 formed in the left side of the piston member 530. The rod 542 is preferably constructed of plastic or similar dielectric material and is adapted to be inserted between the face portions 518 and 520 of the contacts 490 and 492 upon longitudinal movement of the piston assembly 528 toward the left end of the housing 328. It will be seen that when the rod 542 is interposed between the face portions 518 and 520, the contacts 490 and 492 will be biased apart a sufficient amount to open the electric circuit between the terminal rod 462 and the above described ground wire connected to the accumulator assembly 32. Conversely, when the assembly 528 moves toward the right end of the housing 328, the rod 542 will move from between the face portions 518 and 520 to establish electric contact between the members 490 and 492. An annular plastic or similar type spacer ring 546 is disposed within the housing 328 directly on the right side of the reinforcing ring 484 and is adapted to prevent the piston assembly 528 from engaging the ring 484 as the assembly 528 moves toward the left end of the housing 328 during operation of the assembly 32, thereby reducing any noise or vibration which might occur upon engagement of the assembly 528 with the ring 484.

The portion of the housing 328 interjacent the piston assembly 528 and the end header 332 is adapted to be charged with a gaseous substance to provide a cushion which resists movement of the assembly 528 toward the right end of the housing 328. Preferably, this portion of the housing 328 is filed with compressed nitrogen or a similar inert gas at a pressure of approximately 140 p.s.i. In a similar manner, the portion of the housing 328 interjacent the end header 334 and the piston assembly 408 is also charged with a compressed gas, preferably nitrogen, at a pressure of approximately 425 p.s.i., which is adapted to resist movement of the piston assembly 408 toward the left end of the housing 328. It will be seen that when power steering fluid from the vehicle's power steering unit 12 is pumped through the conduit 170 to the member 444, a portion of the fluid will flow through the passage 522 and bore 460 into the central portion of the housing 328 defined between the piston members 410 and 530. The remaining portion of the fluid pumped through the conduit 170 will flow through the conduits 456 and 458 to the shock absorbers 26 and 28. When the hydraulic pressure within the shock absorbers 26 and 28 exceeds 140 p.s.i. (the pressure of the compressed nitrogen behind the piston assembly 528), the piston member 530 will move to the right within the housing 328 against the resistance of the compressed nitrogen. Likewise, when the hydraulic pressure within the shock absorbers 26 and 28 exceeds 425 p.s.i. (the pressure of the compressed nitrogen behind the piston assembly 408), the piston member 410 will move toward the left end of the housing 328, as will later be described.

As best seen in FIGS. 2 and 3, the power steering fluid which is pumped through the conduit 170 flows into the bore 460 of the fluid fitting and terminal support member 444, and thereafter flows downwardly into the interior of the housing 328. Due to the fact that the pressure of the power steering fluid flowing into the housing 328 is somewhat greater than 140 p.s.i., the pressure of the compressed nitrogen on the right side of the piston member 530, the entire piston assembly 532 is urged toward the right end of the housing 328. It will be noted that under normal loading conditions, the pressure of the power steering fluid initially pumped to the accumulator assembly 32 is less than 425 p.s.i., the pressure of the compressed nitrogen disposed in the housing 328 interjacent the piston assembly 408 and the end header member 334, so that the pressure of the power steering fluid is not sufficient to bias the piston assembly 408 toward the left end of the housing 328. Since the fluid pressure of the

power steering fluid which flows into the housing 328 is determined by the pressure of the compressed nitrogen at the opposite ends thereof, at such time as the pressure of the power steering fluid in the housing 328 reaches a predetermined level, any further fluid pumped from the power steering unit 12 will flow from the member 444 through the conduits 456 and 458 to the shock absorber members 28 and 26, respectively, causing the members 26 and 28 to longitudinally expand and thereby raise the rear end portion of the vehicle with respect to the axle assembly 24 thereof and thereby effect leveling of the vehicle body.

In the event that the vehicle is overloaded, the fluid pressure within the housing 328 will exceed 900 p.s.i. due to the relatively high pressure required to expand the shock absorber members 26 and 28. Accordingly, the piston assembly 408 will be biased toward the left end of the housing 328, thereby causing the end section 442 of the plunger 432 to be interposed between the face portions 404 and 406 of the clips 384 and 386 to break the circuit to the loading solenoid 184 and terminate the flow of power steering fluid to the assembly 32. This, of course, assures that the power steering pump will not operate to pump power steering fluid to the assembly 32 when the vehicle is overloaded. As above stated, there is some differential movement provided between the plunger member 432 and the piston member 410 so that as the assembly 408 moves toward the left end of the housing 328, the end section 442 of the plunger member 432 will not separate the clips 384 and 386 until the coil spring 436 has been compressed. Such differential movement between the plunger member 432 and piston member 410 prevents the clips 384 and 386 from being separated when there is a temporary pressure increase within the chamber 330, as might occur when the vehicle traverses road bumps or similar surface irregularities in the road which cause a momentary change in attitude in the vehicle body with respect to the axle assembly 24. Also, the differential movement provided between the members 432 and 410 prevents the clips 384 and 386 from being separated when there is a change in attitude of the vehicle body with respect to the axle assembly 24 resulting from acceleration of the vehicle.

It will be seen from the above description of the operation of the accumulator assembly 32 that this assembly is adapted to minimize to the extreme the volume of power steering fluid required to expand the shock absorber members 26 and 28 since the compressed nitrogen in the opposite ends of the housing 328 continuously force the piston assemblies 528 and 48 away from the opposite ends thereof, thus forcing the power steering fluid to the shock absorber members 26, 28. Moreover, the provision of the accumulator assembly 32 serves to minimize the spring rate of the shock absorber members 26 and 28 and hence reduce frequency of oscillation created as the vehicle traverses road bumps and the like.

What is claimed is:

1. In combination in a fluid actuated electrical switch, an elongated generally cylindrical housing defining an internal fluid chamber,
- a piston member longitudinally slidably disposed within said housing and dividing the interior thereof into first and second fluid compartments,
- at least one of said compartments being communicable with a source of fluid pressure, with said piston member being longitudinally movable within said housing in response to preselected differential pressure conditions between said compartments,
- first and second terminal members on said housing,
- first and second contact means for completing an electrical circuit between said terminal means,
- each of said contact means having a first portion connected to one of said terminal means and a second generally leaf spring-like portion extending interior-

ly of said housing and terminating adjacent the longitudinal axis thereof,

said second portions of said contact means being resiliently spring biased toward engagement with and adapted to be moved between positions opening and closing said electrical circuit between said first and second terminal means, and

a probe member connected to said piston member and extending longitudinally of the interior of said housing,

said probe member being movable in response to longitudinal movement of said piston means into and out of engagement with said second portions of said contact means for moving the same between said positions opening and closing said electrical circuit.

2. The invention as set forth in claim 1 which includes means for resisting movement of said piston means toward said contact means.

3. The invention as set forth in claim 1 which includes a compressed fluid within said chamber for resisting movement of said piston means toward said contact means.

4. The invention as set forth in claim 1 wherein said piston means comprises a generally cup-shaped piston member and a plunger member longitudinally movable with respect to said piston member and insertable between said contact means to open said circuit.

5. The invention as set forth in claim 4 wherein said piston member includes spring means normally biasing said plunger member toward said contact means and providing for differential longitudinal movement of said piston member and said plunger member within said compartment, whereby each of said members is movable toward said contacts until said plunger member is initially engaged therewith, said plunger not being inserted therebetween until further movement of said piston member toward said contact means and compression of said spring means.

6. The combination as set forth in claim 5 which includes first and second piston members longitudinally slidable within said housing and dividing the interior thereof into first, second and third compartments.

7. The combination as set forth in claim 6 wherein said first and second compartments are spaced apart on the opposite sides of said third compartment and are pressurized at different fluid pressures.

8. The combination as set forth in claim 7 which includes a fluid actuatable device, a source of fluid for said device and means for pumping fluid from said source to said device.

9. The combination as set forth in claim 8 wherein said fluid source is communicable with said third chamber and wherein said electrical circuit controls actuation of said pumping means, whereby longitudinal sliding movement of one of said piston members in response to differential fluid pressure conditions between the two adjacent of said chambers controls actuation of said pumping means.

References Cited

UNITED STATES PATENTS

1,704,627	3/1929	Osterheld	200—82
1,936,821	11/1933	Bizzarri	
2,254,347	9/1941	Blakesley	
2,838,629	6/1958	Panzenhagen	200—153.14 X
3,207,871	9/1965	Dally	200—82
3,374,331	3/1968	Brockhaus et al.	200—148.2 X

FOREIGN PATENTS

1,150,735 11/1957 Germany.

ROBERT K. SCHAEFER, Primary Examiner
R. A. VANDERHYTE, Assistant Examiner

U.S. Cl. X.R.

200—153