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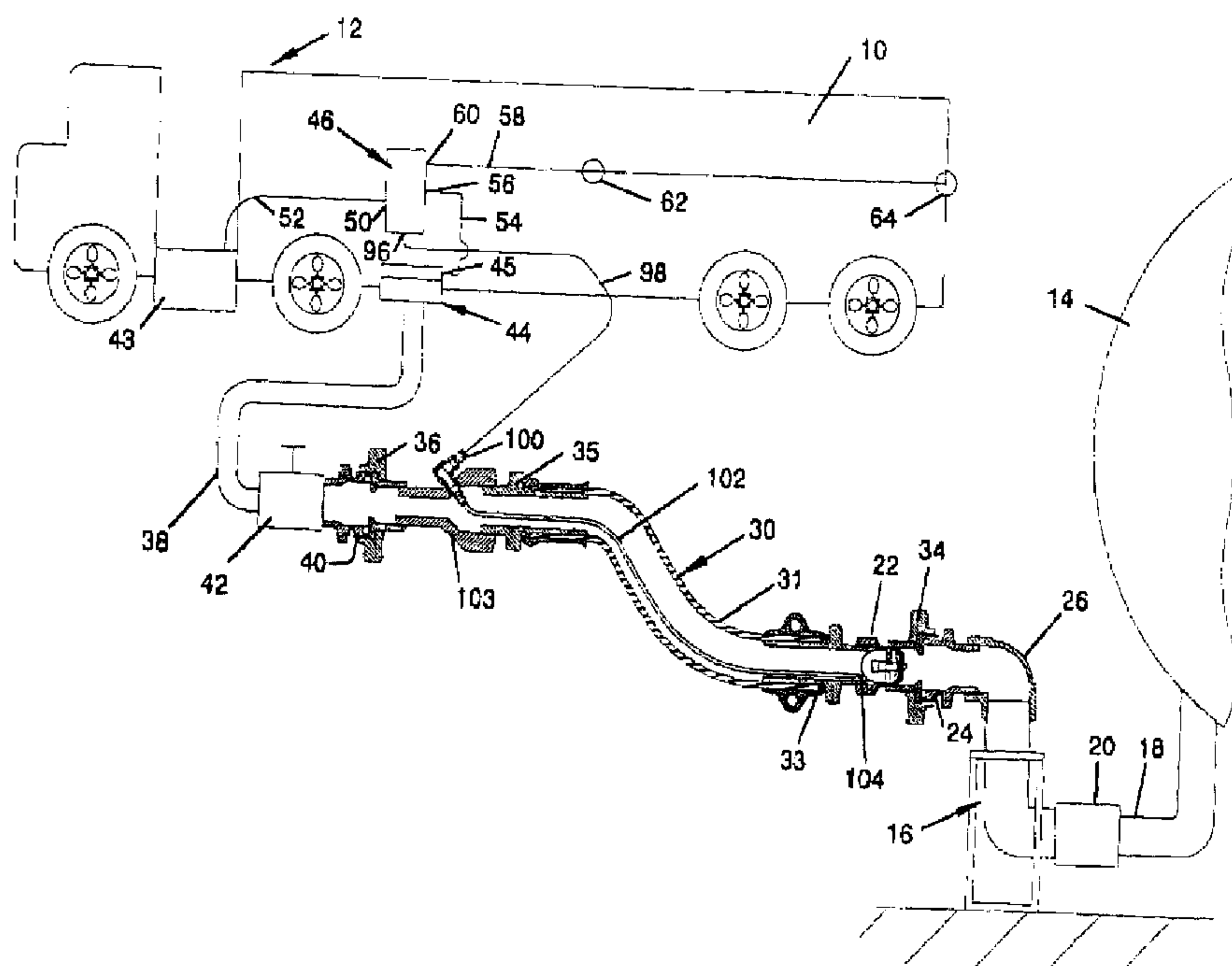
(71) Demandeur/Applicant:
PGI INTERNATIONAL, LTD., US

(72) Inventeurs/Inventors:
WARD, ROBERT L., US;
NIMBERGER, SPENCER M., US

(74) Agent: FINLAYSON & SINGLEHURST

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(54) Title: SYSTEM FOR LOADING AND UNLOADING FLUID TANKS CONTAINING HAZARDOUS FLUIDS



(57) Abrégé/Abstract:

A system for transferring a hazardous fluid product from a transport tank (10) of a roadway vehicle (12) to a fixed storage tank (14). A flexible transfer hose assembly (30) has end couplings (34, 36) which are detachably connected between the transport tank (10) and storage tank (14). A gas operated product supply valve (44) is opened by pressurized gas to permit flow of the hazardous product, such as propane, from tank (10). A gas control valve (46) controls the flow of pressurized gas to gas operated product supply valve (44). Upon a separation or rupture of flexible hose (31) or couplings (34, 36), the fluid pressure of the hazardous product in hose (31) is sensed at fluid sensing chamber (94) in gas control valve (46). A reduction in sensed fluid pressure to a predetermined maximum pressure results in movement of piston (82) to the position shown in Figure 2 in which pressurized gas from gas source (43) is vented to atmosphere to result in closing of gas operated product supply valve (44) to stop the flow of hazardous product from tank (10). Figure 7 shows the transfer of the hazardous fluid from a storage tank (14A) to a tank (10A) of a roadway vehicle.



SYSTEM FOR LOADING AND UNLOADING FLUID TANKS
CONTAINING HAZARDOUS FLUIDS

ABSTRACT

A system for transferring a hazardous fluid product from a transport tank (10) of a roadway vehicle (12) to a fixed storage tank (14). A flexible transfer hose assembly (30) has end couplings (34, 36) which are detachably connected between the transport tank (10) and storage tank (14). A gas operated product supply valve (44) is opened by pressurized gas to permit flow of the hazardous product, such as propane, from tank (10). A gas control valve (46) controls the flow of pressurized gas to gas operated product supply valve (44). Upon a separation or rupture of flexible hose (31) or couplings (34, 36), the fluid pressure of the hazardous product in hose (31) is sensed at fluid sensing chamber (94) in gas control valve (46). A reduction in sensed fluid pressure to a predetermined maximum pressure results in movement of piston (82) to the position shown in Figure 2 in which pressurized gas from gas source (43) is vented to atmosphere to result in closing of gas operated product supply valve (44) to stop the flow of hazardous product from tank (10). Figure 7 shows the transfer of the hazardous fluid from a storage tank (14A) to a tank (10A) of a roadway vehicle.

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**SYSTEM FOR LOADING AND UNLOADING FLUID TANKS
CONTAINING HAZARDOUS FLUIDS**

Field of the Invention

This invention relates to a system for loading and unloading fluid tanks containing hazardous fluids, and more particularly to such a system in which one of the tanks is mounted on a roadway vehicle and the other tank is a fixed storage tank.

Background of the Invention

Hazardous fluid products are transferred between a fixed storage tank and a tank on a roadway vehicle. Normally, a flexible transfer hose assembly is detachably coupled to the tank at the loading or unloading site. The opposed ends of the transfer hose assembly are normally fitted with rotatable couplings that are threaded onto male pipe ends extending from the tanks for connection of the flexible hose assembly. It is possible under certain conditions during transfer of the hazardous fluid product that the flexible hose of the hose assembly may separate from the couplings, or the flexible hose may fail, resulting in release of the hazardous product to atmosphere. Such a release of the hazardous product, such as propane or anhydrous ammonia, for example, could result in a life threatening situation.

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While back check valves adjacent the tanks may, in many instances, stop the flow of the hazardous product upon failure of the flexible hose or couplings, pumps or other inline devices at the unloading tank in many instances will restrict the effectiveness of the excess flow valve typically installed in the outlet piping on the vehicle. It is necessary that flow of the hazardous fluid product be stopped at each of the tanks upon failure of the hose assembly in order to stop discharge of the hazardous product into the atmosphere.

It is desired that a safety system be provided for automatically shutting off the flow of product for each tank without human intervention upon a failure in the hose assembly between the tanks.

SUMMARY OF THE INVENTION

The present invention is directed to a system for loading and unloading fluid tanks containing hazardous fluids, and particularly an apparatus and method for transferring a hazardous fluid product through a flexible hose assembly detachably connected between a tank of a roadway vehicle and a fixed storage tank. The hazardous fluid product in one embodiment is transferred from the roadway vehicle tank to the storage tank and in another embodiment the hazardous fluid product is transferred from the storage tank to the roadway vehicle tank.

A gas operated product supply valve from the tank being unloaded is maintained in an open position during normal product transfer by pressurized gas

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to permit product flow to the tank being loaded. A gas control valve is mounted between a gas source for the gas operated product supply valve and the product supply valve to control the supply of pressurized gas to the product supply valve. The gas control valve senses the product fluid pressure in the flexible transfer hose and is effective in the event a predetermined low pressure is sensed in the transfer hose to exhaust gas from the gas operated product supply valve to effect movement of the product supply valve to a closed position to stop product flow from the tank being unloaded. A back check valve for the tank being loaded is effective to stop any back flow from the tank being loaded.

The gas control valve has an inlet port in fluid communication with a pressurized gas source, an outlet port in fluid communication with the gas operated product supply valve and a vent between the ports. A piston valve member in the gas control valve is responsive to fluid pressure from the product flowing through the flexible hose and is movable between a pressurized normal operating position and a non-pressurized emergency position. In the pressurized normal operating position, the piston valve member is actuated and effective to block fluid communication between the inlet port and vent, and to permit the supply of pressurized gas to the gas operated product supply valve for opening of the product supply valve during normal operation for product transfer between the tanks. In the emergency position, the piston valve member is responsive to zero or low fluid pressure from the product flowing through the flexible hose to permit fluid

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communication between the inlet port and the vent for exhaust of pressurized gas from the gas operated product supply valve when the fluid pressure of the product flowing through the flexible hose is below a predetermined minimal pressure.

5 A sensing line in the flexible hose extends to a piston sensing chamber for the piston valve member to communicate product pressure to the piston valve member. Thus, in the event the product transfer hose is separated from end couplings, or fails, and the product is being discharged into the atmosphere, a low pressure in the transfer hose is sensed by the gas control valve to exhaust gas from the gas operated product supply valve for moving the product supply valve to a closed position to stop product flow automatically from the tank being unloaded.

10 The fluid sensing line has a small diameter internal portion extending from a fitting on the hose assembly within the flexible hose for sensing the fluid pressure resulting from product flow in the hose. A flexible external portion of the sensing line extending from the fitting is detachably connected to the gas control valve to provide fluid communication with the sensing chamber adjacent the piston valve member of the gas control valve. Upon a break or separation in the hose, a rapid reduction or decrease in the fluid pressure of the hose results which is sensed by the gas control valve for movement of the piston valve member to an exhaust position for exhausting the gas from the gas operated product supply valve to effect closing or shut-off of the product supply valve. The internal portion of the product sensing line in the transfer hose comprises a relatively small diameter tube having

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an open end and preferably formed of a plastic material of a diameter of about 1/4 inch. Any failure of the sensing line results in a reduction or decrease of the fluid pressure sensed by the gas control valve resulting in the exhaust of pressurized gas to the gas operated product supply valve.

5 It is an object of this invention to provide a safety system for a detachable flexible hose assembly coupled between a storage tank and a tank of a roadway vehicle for transferring a hazardous fluid product between the tanks so that product flow is stopped in both directions without human intervention upon a hose or coupling separation or failure.

10 It is a further object of the invention to provide such a safety system in which the tank for the hazardous fluid product being unloaded has a gas operated product supply valve which is maintained in a normal operating open position by pressurized gas and moves to a closed position to stop flow of hazardous product from the tank upon an exhaust of gas from the gas operated product supply valve.

15 Another object of the invention is the provision of a gas control valve to control the supply of pressurized gas to the gas operated product supply valve for the opening and closing of the gas operated product supply valve upstream of the flexible hose.

20 A further object of the invention is the provision of a passive shut-off means for stopping the flow of product from the tank being unloaded without the need for

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human intervention within twenty (20) seconds of the occurrence of an unintentional release caused by separation of the discharge hose or coupling.

Other objects, features, and advantages of the invention will be apparent from the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic view of the system comprising the present invention in which a flexible hose assembly is coupled between a tank for a roadway vehicle and a fixed storage tank for transferring a hazardous fluid product from the tank of the roadway vehicle to the fixed storage tank;

Figure 2 is a longitudinal sectional view of a gas control valve for controlling the supply of pressurized gas to a gas operated product supply valve upstream of the flexible hose assembly for maintaining the product supply valve in an open position during normal operations and for effecting automatically a fast closing of the product supply valve to stop flow of the hazardous product upstream of the hose assembly upon a hose or coupling failure;

Figure 3 is a cross sectional view of the gas control valve taken generally along line 3-3 of Figure 2 and showing a manual actuator for the gas control valve with the actuator in a closed position in which pressurized gas is provided to the gas operated product supply valve;

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Figure 4 is a cross sectional view similar to Figure 3 but showing the manual actuator pushed inwardly manually to an exhaust position for venting the gas supply to the gas operated product supply valve to stop flow of the hazardous fluid product from the tank being unloaded;

5 Figure 5 is an enlarged fragmentary view of a coupling for detachably connecting an end of the flexible transfer hose assembly;

Figure 6 is an end elevational view of a screen adjacent the end of the flexible hose assembly; and

10 Figure 7 is a schematic view of a modification of the system comprising the present invention in which the hazardous fluid product is being transferred from the fixed storage tank to the tank of a roadway vehicle.

Embodiment of Figures 1-6

15 The system including the apparatus and method of the present invention shown in Figures 1-6 illustrates the transfer of a hazardous fluid product from a transport tank 10 of a roadway vehicle generally indicated at 12 to a fixed storage tank 14. A fixed bulkhead generally indicated at 16 adjacent fixed storage tank 14 provides a support for a supply pipe 18 extending from storage tank 14. Mounted in supply pipe 18 is a gas operated emergency shut-off valve generally indicated at 20. An externally threaded male fitting 24 on the extending end of elbow 26 on
20 pipe 18 is adapted to receive in threaded relation a detachable flexible transfer

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hose assembly generally indicated at 30. Hose assembly 30 includes a flexible hose 31 extending between internally threaded couplings 34 and 36 on opposed ends of the transfer hose assembly 30. A back check valve assembly generally indicated at 22 is mounted on hose assembly 30 adjacent coupling 34. Suitable sleeve fittings 33 and 35 extend between flexible hose 31 and end couplings 34 and 36. Transfer hose assembly 30, for example, may be about twenty (20) feet in length. Transport tank 10 is particularly adapted for the transport of hazardous liquid or gaseous fluid products, such as propane or anhydrous ammonia, for example, and it is necessary that the flow of the hazardous product be stopped immediately upon the occurrence of an unsafe condition, such as the rupture or separation of the hose or coupling during loading or unloading of the hazardous product.

Tank 10 has a rigid unloading line or pipe 38 with an externally threaded male end 40 thereon for detachable connection to coupling 36 of hose assembly 30. A manually operated outlet valve 42 is mounted in line 38 and is manually opened for flow of the hazardous product to tank 14. A gas operated product supply valve generally indicated at 44 is mounted on tank 10 and opens only when pressurized gas, such as air, is supplied to a gas actuator 45 for product supply valve 44. A suitable air operated product supply valve for outlet valve 44 is sold as model C404A-32 by Fisher Controls.

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It is necessary that a passive shut-off means be provided that will automatically shut-off the flow of the hazardous product at tank 10 without the need for human intervention within a short time after any separation or failure of hose 31 or hose assembly 30 between tanks 10 and 14. The present invention is directed particularly to such a passive shut-off means. For that purpose, a gas control valve generally indicated at 46 is provided to control the flow of pressurized gas to gas operated product supply valve 44.

Referring also to Figures 2-4, a gas source 43 on roadway vehicle 12 comprises an air compressor for supplying pressurized air to air control valve 44 through line 52 and port 50. As shown particularly in Figure 3, pressurized air from line 52 and port 50 is communicated through port 56 and line 54 to gas actuator 45 of gas operated product supply valve 44. A line 58 extends from port 60 and provides air to other areas of tank 10 typically with a fusible plastic line on which one or more manual dump valves 62, 64 are located. a fire would burn thru the plastic line 58 and initiate the shutdown sequence. Similar shutdown would occur if one of the strategically located dump valves 62 or 64 is activated manually. A restricted fluid passage 61 is in fluid communication with air supply port 50 and restricts the supply of air to line 58 in which dump valves 62 and 64 are mounted. Dump valves 62 and 64 are conventional dump valves and commonly utilized with a transport tank. Passage 61 restricts the supply of fluid from the pressurized source 43 to allow the manual or automatic exhaust action to close supply valve 44.

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Air control valve 46 has a main body 66 with an end body portion 67 connected thereto and having a central bore 68 therein. A fluid passage 70 extends from port 60 to bore 68 and a vent passage 72 extends from bore 68 to atmosphere. A lateral bore 77 as shown in Figures 3 and 4 extends from port 60 through main body 66 and a vent passage 83 extends from lateral bore 77 to atmosphere. A manually operated laterally extending exhaust plunger is shown generally at 73 and has an outer handle 75 adapted to be gripped by an operator. Exhaust plunger 73 has a reduced diameter section 79 and an O-ring seal 81 is mounted about the inner end of plunger 73. In normal operation as shown in the position of Figure 3, air supply port 50 is in fluid communication with port 56 and line 54 to gas actuator 45 to supply pressurized gas to gas operated product supply valve 44. When it is desired to manually initiate the exhaust and shutdown sequence, plunger 73 is manually pushed inwardly to the position of Figure 4 for venting the pressurized air supply from line 54 to atmosphere through vent 83 thereof and also venting pressurized air from line 54 and gas actuator 45 to atmosphere through vent passage 83, which will close product supply valve 44.

A manually operated start-up plunger 74 is mounted in bore 68 in end body portion 67 as shown in Figure 2. A spring 76 urges plunger 74 outwardly to a position so that the inner end 78 of plunger 74 clears vent passage 72. When start-up plunger 74 is manually pushed inwardly against seat 80, vent passage 72 is blocked from communication with bore 68 and air supply line 52 so that gas inlet

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port 50 is supplying pressurized gas to line 54 and gas operated product supply valve 44.

Air control valve 46 has a piston or piston valve member 82 mounted within a piston chamber 84 having a vent and condensate drain 85. A spring 86 urges piston 82 outwardly to the seated position shown in Figure 2. A piston rod 88 extending inwardly from piston 82 is received within bore 68. An O-ring 90 extends about piston rod 88 and an O-ring 92 in bore 68 seals against piston rod 88 in the normal operating pressurized position of piston 82 and piston rod 88 as shown by the broken line position of piston rod 88 in Figure 2.

Fluid sensing chamber 94 has a sensing port 96 provided adjacent piston 82 for continuously sensing the fluid pressure of the fluid product being transferred by detachable transfer hose assembly 30. The sensing line connected to port 96 for communicating the fluid pressure in the hazardous product being unloaded includes a flexible external sensing line section or tube generally designated at 98 extending between air control valve 46 to a fitting 100 secured to an end tubular sleeve 103 of flexible hose assembly 30, and an internal sensing line section or tube 102 extending from fitting 100 within flexible hose assembly 30. External sensing line section or tube 98 is detachable and is mounted between port 96 of air control valve 46 and fitting 100 at the unloading site. Internal sensing line tube 102 preferably comprises a plastic tube of about 1/4 inch in diameter and having an open free end

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104 positioned adjacent end coupling 34 for sensing the fluid pressure in the flowing product.

Check valve assembly 22 as shown on Figure 5 includes an outer check valve body 105 having a bore 107 in which a dome-shaped protective screen 122 is mounted adjacent the free end 104 of plastic tube 102 as a safety device to prevent a loose internal sensing line tube 102 from moving downstream in the event of a separation of tube 102. Back check valve assembly 22 includes a check valve member 109 urged by spring 111 to a closed position. An O-ring 113 is provided for sealing back check valve member 109.

As shown further in Figure 5, a connection is illustrated for connecting detachable transfer hose assembly 30 to externally threaded male member 24 of pipe 18 for storage tank 14. Back check valve body 105 is externally threaded and has an internally threaded tubular member 106 threaded thereon for supporting coupler 34. To connect hose assembly 30 to male pipe end 24, coupler 34 is manually rotated with internal screw threads on coupler 34 engaging externally threaded male member 24 with annular seal 110 sealing therebetween.

Operation

Upon arrival of roadway vehicle 12 and transport tank 10 at the unloading site for storage tank 14, transfer hose assembly 30 is connected by end couplings 34 and 36 to externally threaded male pipe members 24 and 40. Fitting 100 and

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internal sensing line tube 102 have been previously mounted on transfer hose assembly 30. The external sensing line tube 98 is then connected by quick disconnects to fitting 100 and port 96 of gas control valve 46. After connection of flexible hose assembly 30 and external sensing line tube 98, outlet valve 42 is manually opened. Then, pressurized air source 43 is energized and pressurized air from air supply line 52 is vented to atmosphere by gas control valve 46 through vent 70 as shown in Figure 2. Start-up plunger 74 is in the position shown in Figure 2 with air supply line 52 in fluid communication with port 60. To open gas operated product supply valve 44, start-up plunger 74 in a start-up operation is manually pushed inwardly to the broken line indication of Figure 2 to close vent 72 for the supply of pressurized air through air supply line 52 to port 60 as shown in Figure 3 for gas operated product supply valve 44 to open product supply valve 44 for the unloading of hazardous fluid product from transport tank 10. Fluid pressure of the hazardous fluid product being transferred by hose assembly 30 is communicated from end 104 of internal sensing tube 102 to external sensing tube 98 and sensing chamber 94 to move piston 82 inwardly to block vent 70. In this position, manual pressure on start-up plunger 74 may be released to permit return of plunger 74 under the bias of spring 76 to the extended position shown in Figure 2. Gas operated product supply valve 44 thus remains open.

The pressure of the hazardous product being unloaded, such as propane, may vary substantially from ambient temperatures. For example, propane has a

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pressure of 150 psi at 90F, 50 psi at 0F, and 25 psi at -20F. Thus, any passive shut-off system must be effective for a wide variation in pressures of the hazardous fluid product being unloaded. A fluid pressure of about 10 psi or greater is effective for movement of piston 82 against the bias of spring 86. Spring 86 may be set for actuation of piston 82 at a predetermined fluid pressure.

In the event of a hose or coupling rupture or failure, the hazardous fluid product will be discharged into the atmosphere resulting in a decrease in the fluid pressure being sensed at end 104 of internal sensing tube 102. The fluid pressure is transmitted through external sensing tube 98 to sensing chamber 94. The fluid pressure in fluid chamber 94 when it reaches 10 psi or less results in piston 82 moving to the seated position shown in Figure 2. Line 54 is vented to atmosphere through vent passages 70 and 72 which results in the closing of gas operated product supply valve 44 thereby to stop the flow of hazardous product from tank 10. Any flow from storage tank 14 is stopped by back check valve member 109 adjacent end coupling 34. Supply air continues to enter the system thru restriction 61 but at a rate less than the venting rate thru vent 72. Thus, a highly effective shut-off means is automatically achieved without human intervention within a very short time period. Any decrease in fluid pressure in the sensing line below a fluid pressure of 10 psi or other predetermined fluid pressure will automatically result in the closing of gas operated product supply valve 44.

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Embodiment of Figure 7

The embodiment shown in Figure 7 illustrates the transfer of hazardous fluid product from storage tank 14A to roadway vehicle tank 10A. The ends of flexible hose assembly 30A are reversed from the embodiment of Figures 1-6 and end couplings 34A and 103A of flexible hose assembly 30A are connected to tank 10A and storage tank 14A. External sensing line 98A extends to gas control valve 46A which is similar to gas control valve 46 in the embodiment of Figures 1-6 but does not include a port or passage for a separate air supply line to other areas such as illustrated by port 60 and line 58 in the embodiment shown in Figures 1-6. Line 54A extends from gas control valve 46A to the gas operated product supply valve 44A having a gas actuator 45A. A pressurized gas source port 43A utilizing the stored product pressure has a line 52A extending therefrom to port 50A of gas control valve 46A. The operation of gas operated product supply valve 44A is similar to valve 44 shown in the embodiment of Figures 1-6. A back check valve 22A is normally provided for tank 10A and upon the rupture or separation of hose assembly 30A, back check valve 22A will stop the flow of fluid from tank 10A. A drop in fluid pressure occurs in sensing lines 98A and 102A to gas control valve 46A upon a failure in hose assembly 30A and is effective to exhaust pressurized gas from the gas operated product supply valve 44A to close gas operated product supply valve 44A to stop the flow of hazardous product from storage tank 14A.

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This invention is particularly directed to loading and unloading hazardous product between the tank of a roadway vehicle and a storage tank with a flexible detachable hose assembly connected at opposed ends to the tanks. The tank being unloaded has a gas operated product supply valve and the gas control valve of the present invention is effective to exhaust pressurized gas from the gas operated product supply valve in the event of a failure in the flexible hose assembly for stopping the flow of the hazardous product from the tank being unloaded without human intervention. Various types of gas control valves may be provided to effect an exhaust of pressurized fluid from a gas operated product supply valve on a tank to stop automatically without human intervention the flow of hazardous product from the tank being unloaded. The present invention shows one gas control valve which has been found to be highly effective but it is apparent that various other gas control valves might be effective and within the scope of the present invention.

While preferred embodiments of the present invention have been illustrated in detail, it is apparent that modifications and adaptations of the preferred embodiments will occur to those skilled in the art. However, it is to be expressly understood that such modifications and adaptations are within the spirit and scope of the present invention as set forth in the following claims.

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What Is Claimed Is:

1. In apparatus for transferring a hazardous fluid product through a flexible hose assembly detachably coupled between a tank of a roadway vehicle and a fixed storage tank, one of said tanks having a gas operated product supply valve maintained in an open position for product flow to the other tank by pressurized gas from a pressurized gas source during a normal product transfer operation; a gas control assembly for controlling the supply of pressurized gas to said gas operated product supply valve; said gas control assembly comprising:

a gas control valve mounted between said pressurized gas source and said gas operated product supply valve to control the supply of gas to said product supply valve; and

a fluid sensing line for said flexible hose assembly for sensing the fluid pressure therein of product flowing between said tanks during normal transfer operation;

said gas control valve having a valve member therein movable between a normal product transfer position to permit fluid flow to said product supply valve to maintain said product supply valve open, and an emergency position for exhausting gas from said gas operated product supply valve for closing of said product supply valve and stopping product flow from said tank being unloaded; said valve member responsive to said fluid sensing line and moving to

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said emergency position upon a reduction in fluid pressure in said fluid sensing line below a predetermined minimal fluid pressure.

2. In apparatus as defined in claim 1 wherein said valve member comprises a piston and a sensing chamber is provided adjacent said piston in fluid communication with said fluid sensing line.

3. In apparatus as defined in claim 2, wherein said sensing line includes an internal portion within said flexible hose assembly and an external portion extending between said hose assembly and said sensing chamber.

4. In apparatus as defined in claim 3 wherein said external portion of said sensing line is detachable and connected at the product transfer site between said flexible hose assembly and said sensing chamber.

5. In apparatus as defined in claim 1, wherein said gas control valve has an inlet port in fluid communication with said gas source, an outlet port in fluid communication with said product supply valve, and a vent between said ports; and a manually operated start-up valve member is mounted on said gas control valve for blocking fluid communication between said inlet port and vent upon manual actuation thereof to permit fluid communication between said inlet port and outlet

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port and opening of said product supply valve for start-up of the normal product transfer operation.

5 6. In apparatus as defined in claim 5 wherein said manually operated start-up valve member comprises a plunger and a spring member continuously urges said plunger to a position permitting fluid communication between said inlet port and said vent.

 7. In apparatus as defined in claim 2 wherein said piston has a piston rod movable upon actuation of said piston to a position blocking fluid communication between said inlet port and vent in said normal transfer operation.

10 8. In apparatus as defined in claim 1 wherein said gas operated product supply valve is connected to said roadway vehicle tank and said hazardous fluid product is transferred from said roadway vehicle tank to said storage tank.

 9. In apparatus as defined in claim 1 wherein said gas operated product supply valve is connected to said storage tank and said hazardous fluid product is
15 transferred from said storage tank to said roadway vehicle tank.

 10. In apparatus as defined in claim 1, further comprising,

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a manually operated exhaust valve member for said gas control member providing fluid communication between said inlet port and atmosphere upon manual actuation thereof.

11. A system for transferring a hazardous fluid product between a tank of
5 a roadway vehicle and a fixed storage tank, one of said tanks being unloaded and having a gas operated product supply valve maintained in an open position for product flow to the other tank by pressurized gas from a gas source; said system including:

10 a flexible hose assembly detachably connected between said tanks;
a gas control valve mounted between said gas source and said product supply valve to control the supply of gas to said product supply valve, said gas control valve having an inlet port in fluid communication with said gas source, an outlet port in fluid communication with said product supply valve, and a vent between said ports; and

15 a fluid sensing line for said flexible hose assembly for sensing the fluid pressure of product flowing between said tanks during a normal transfer operation;

20 said gas control valve having a valve member therein movable between a normal product transfer position blocking fluid communication between said inlet port and vent during the normal transfer operation for opening of said

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product supply valve, and an emergency position permitting fluid communication between said inlet port and said vent for exhaust of gas from said gas operated product supply valve for closing of said product supply valve; said valve member responsive to fluid pressure in said fluid sensing line and moving to said emergency position upon a reduction in fluid pressure in said fluid sensing line below a predetermined minimal fluid pressure.

12. The system as defined in claim 11, wherein said valve member comprises a piston and a sensing chamber is provided adjacent said piston in fluid communication with said fluid sensing line.

13. The system as defined in claim 12 wherein said piston is movable upon actuation of said piston from fluid pressure in said fluid sensing line to a position blocking fluid communication between said inlet port and vent.

14. The system as defined in claim 12, wherein said sensing line includes an internal portion within said flexible hose assembly and an external portion extending between said flexible hose assembly and said sensing chamber.

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15. The system as defined in claim 14, wherein said external portion is detachable and connected at the product transfer site between said flexible hose assembly and said sensing chamber.

5 16. The system as defined in claim 15 wherein said internal portion comprises a small diameter flexible tube having an open end and extending longitudinally within said flexible hose assembly.

10 17. The system as defined in claim 11, further comprising, a manually operated start-up valve member mounted on said gas control valve for blocking fluid communication between said inlet port and vent upon manual actuation thereof to permit opening of said product supply valve for start-up of the normal transfer operation, said inlet port and said vent being in fluid communication in an inoperable rest position of said start-up valve member prior to start-up.

15 18. The system as defined in claim 17, wherein said manually operated start-up valve member comprises a plunger and a spring member continuously urges said plunger to a position permitting fluid communication between said inlet port and said vent.

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19. The system as defined in claim 11 wherein said flexible hose assembly includes couplings on opposed ends thereof for connecting said hose assembly between said tanks.

20. The system as defined in claim 11, further comprising, a manually operated dump valve member on said gas control valve is movable manually to a position to exhaust gas from said gas operated product supply valve during normal transfer operation for shutting off product flow.

21. A gas control assembly for controlling the supply of pressurized gas from a gas source to a gas operated product supply valve on a tank being unloaded for maintaining the product supply valve in an open position during a normal product transfer of a hazardous fluid product through a flexible hose assembly detachably connected to another tank being loaded, and for closing said gas operated product supply valve during an emergency without human intervention; said gas control assembly comprising:

a gas control valve mounted between said gas source and said product supply valve to control the supply of gas to said product supply valve; and

a fluid sensing line for said flexible hose assembly for sensing the fluid pressure in said flexible hose assembly resulting from the flow of product between said tanks during normal product transfer;

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5 said gas control valve having a valve member therein movable between a normal product transfer position to permit fluid flow to said product supply valve to maintain said product supply valve open, and an emergency position for exhausting gas from said gas operated product supply valve for closing of said product supply valve and stopping product flow from said tank being unloaded; said valve member responsive to said fluid sensing line and moving to said emergency position upon a reduction in fluid pressure in said fluid sensing line below a predetermined minimal fluid pressure.

10 22. A gas control assembly as defined in claim 21, wherein said gas control valve has a body and a piston chamber in said body in fluid communication with said fluid sensing line, and said valve member comprises a piston mounted within said piston chamber responsive to fluid pressure in said sensing line.

5 23. A gas control assembly as defined in claim 22 wherein said body has an inlet port in fluid communication with a source of pressurized air and an outlet port in fluid communication with said gas operated product supply valve, said piston upon actuation thereof in response to the sensed product flow in said flexible hose assembly effective to provide fluid communication between said inlet port and said outlet port to maintain said gas operated product supply valve in an open position.

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24. A gas control assembly as defined in claim 22 wherein said body has an inlet port in fluid communication with a source of pressurized air, an outlet port in fluid communication with said gas operated product supply valve, and an exhaust passage; and

5 a manually operated start-up valve member is positioned between said outlet port and said exhaust passage with said outlet port and exhaust passage being in fluid communication prior to start-up of the product transfer, said manually operated start-up valve member being manually actuated to block fluid communication between said inlet port and exhaust passage for permitting fluid
10 communication between said inlet port and outlet port for opening of said gas operated product supply valve.

25. A gas control assembly as defined in claim 24 wherein said manually operated start-up valve member comprises a plunger and a spring continuously urging said plunger to a position in which the inlet port and exhaust passage are in
15 fluid communication.

26. The gas control assembly is defined in claim 21 wherein said sensing line includes an internal portion within said flexible hose assembly and an external portion extending between said flexible hose assembly and said sensing chamber.

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27. The gas control assembly as defined in claim 26, wherein said external portion is detachable and connected at the transfer site between said flexible hose assembly and said sensing chamber.

28. A method for transferring a hazardous fluid product through a flexible hose assembly detachably coupled between a tank of a roadway vehicle and a fixed storage tank, one of said tanks having a gas operated product supply valve maintained in an open position for product flow to the other tank by pressurized gas during a normal transfer operation; said method comprising:

providing a gas control valve for controlling the supply of pressurized gas to said gas operated product supply valve and movable between a supply position providing pressurized gas to said product supply valve and an exhaust position exhausting pressurized gas from said product supply valve, said gas control valve responsive to fluid pressure of the product flowing through said flexible hose assembly between said tanks; and

providing a fluid sensing line for said flexible hose assembly for communicating fluid pressure from said flexible hose assembly to said gas control valve to maintain said gas control valve in a supply position when the fluid pressure in said flexible conduit is above a predetermined minimum and to exhaust pressurized gas from said product supply valve in an exhaust position when the

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fluid pressure in said flexible hose assembly is below a predetermined minimum to stop the transfer of product from said one tank.

29. The method as defined in claim 28, further comprising:
removably connecting said sensing line between said flexible hose assembly and said gas control valve.

30. The method as defined in claim 28, further comprising:
providing a manually operated dump valve member for said gas control valve to exhaust pressurized gas from said gas operated product supply valve upon manual actuation thereof.

31. The method as defined in claim 28, further comprising:
providing a manually operated start-up valve member for said gas control valve to permit pressurizing of said product supply valve for initial opening of said product supply valve for start up operation.

32. The method as defined in claim 28, further comprising:
providing a back check valve in said flexible hose assembly to prevent a fluid back flow from said other tank.

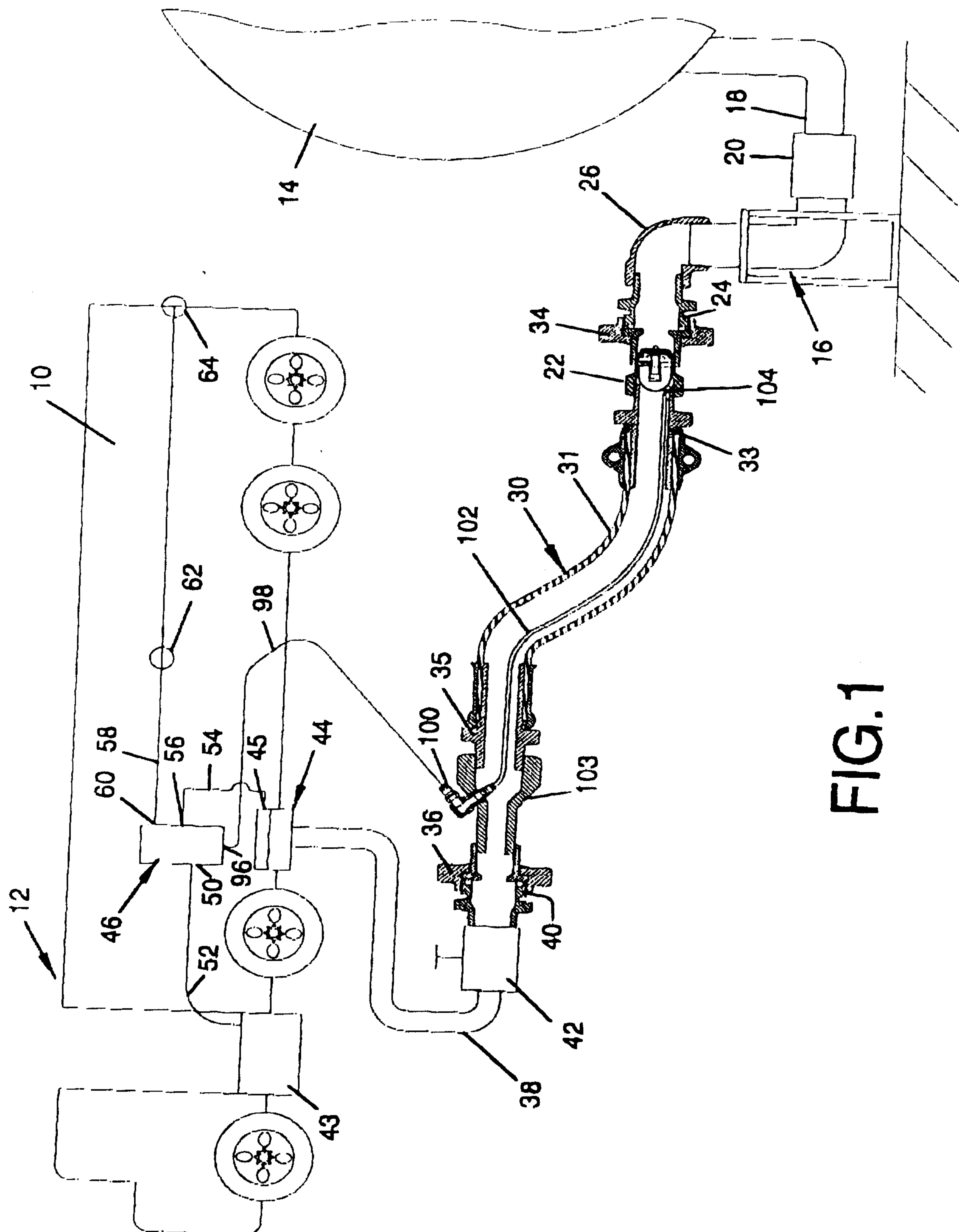
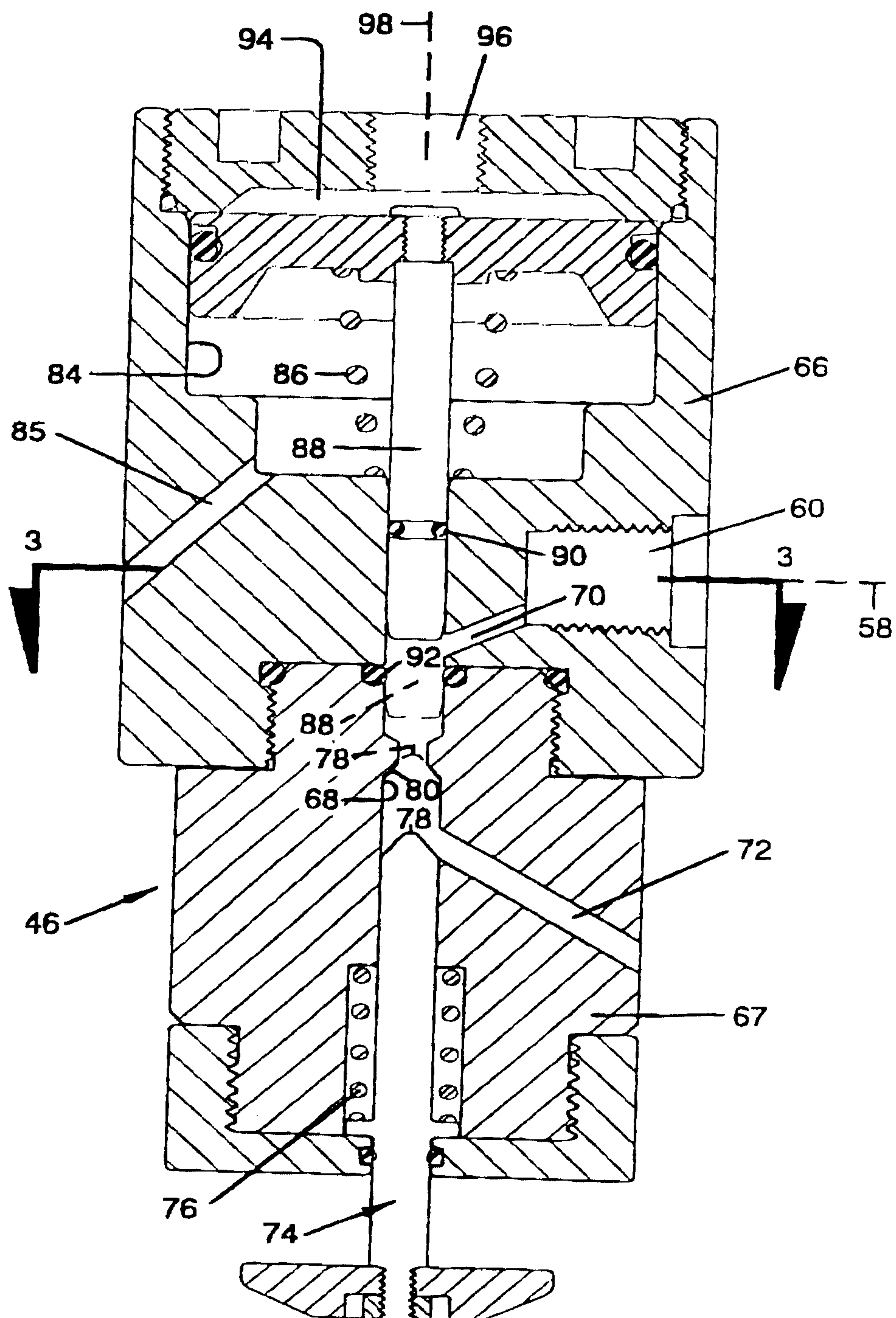


FIG. 1

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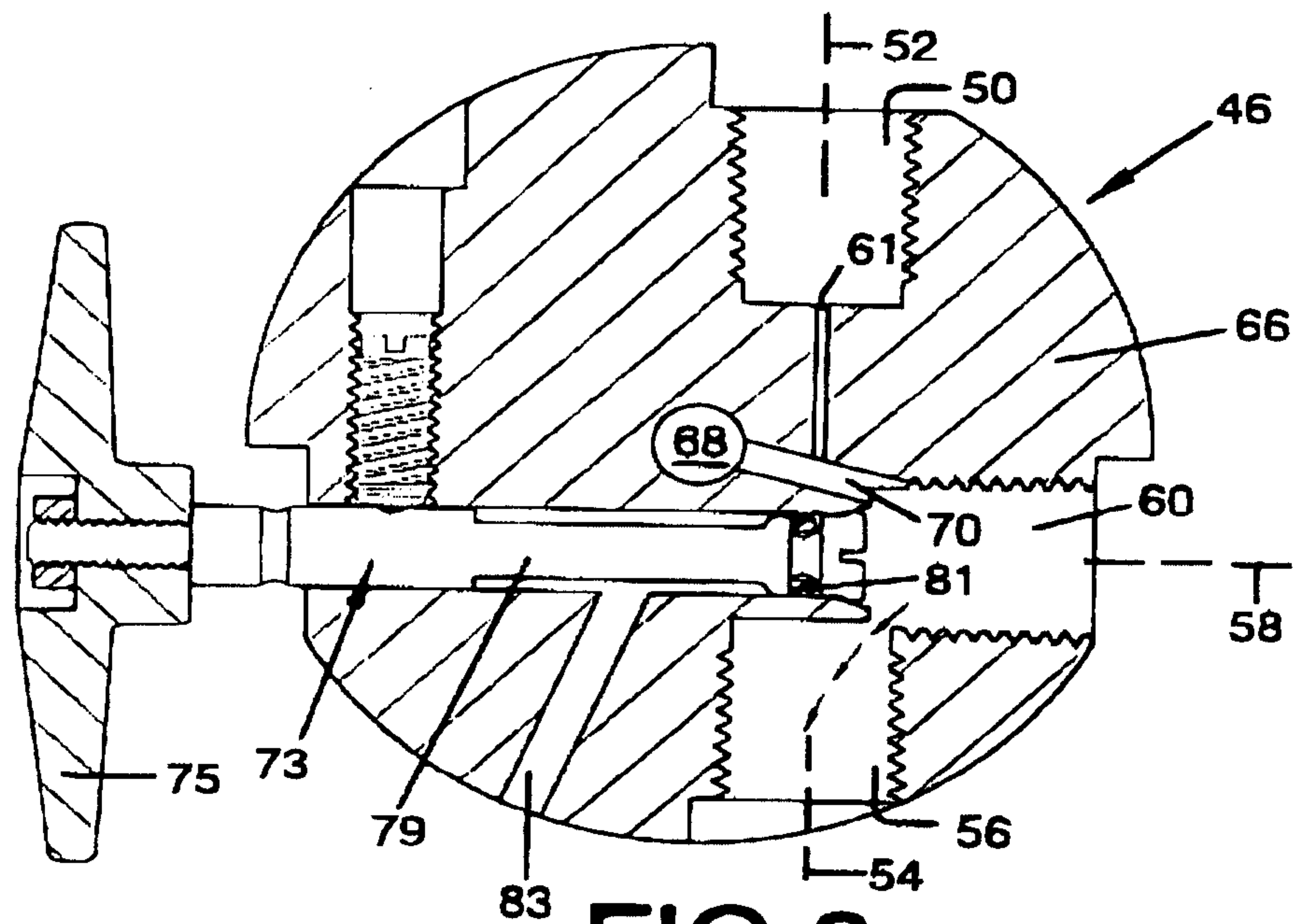


FIG.3

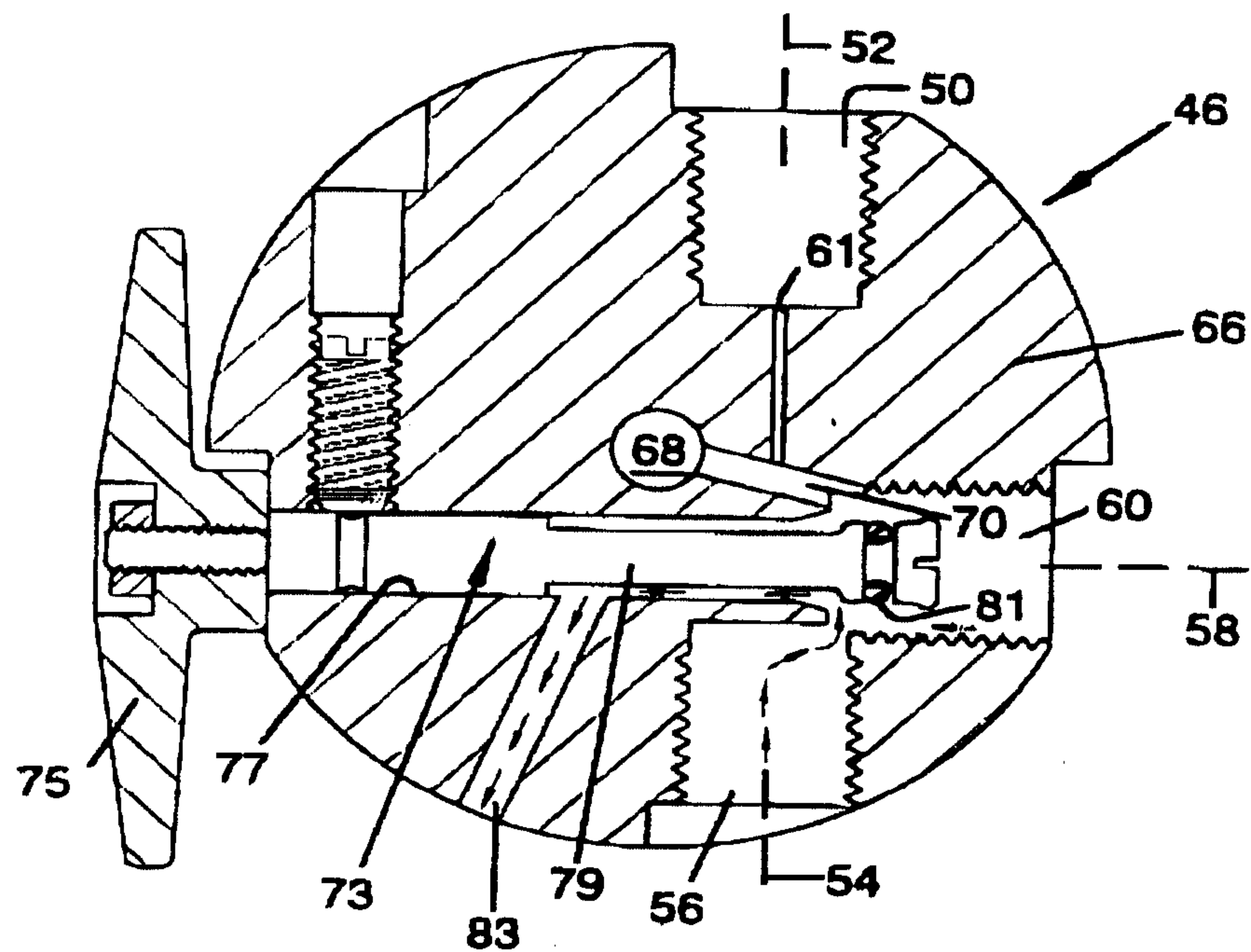


FIG.4

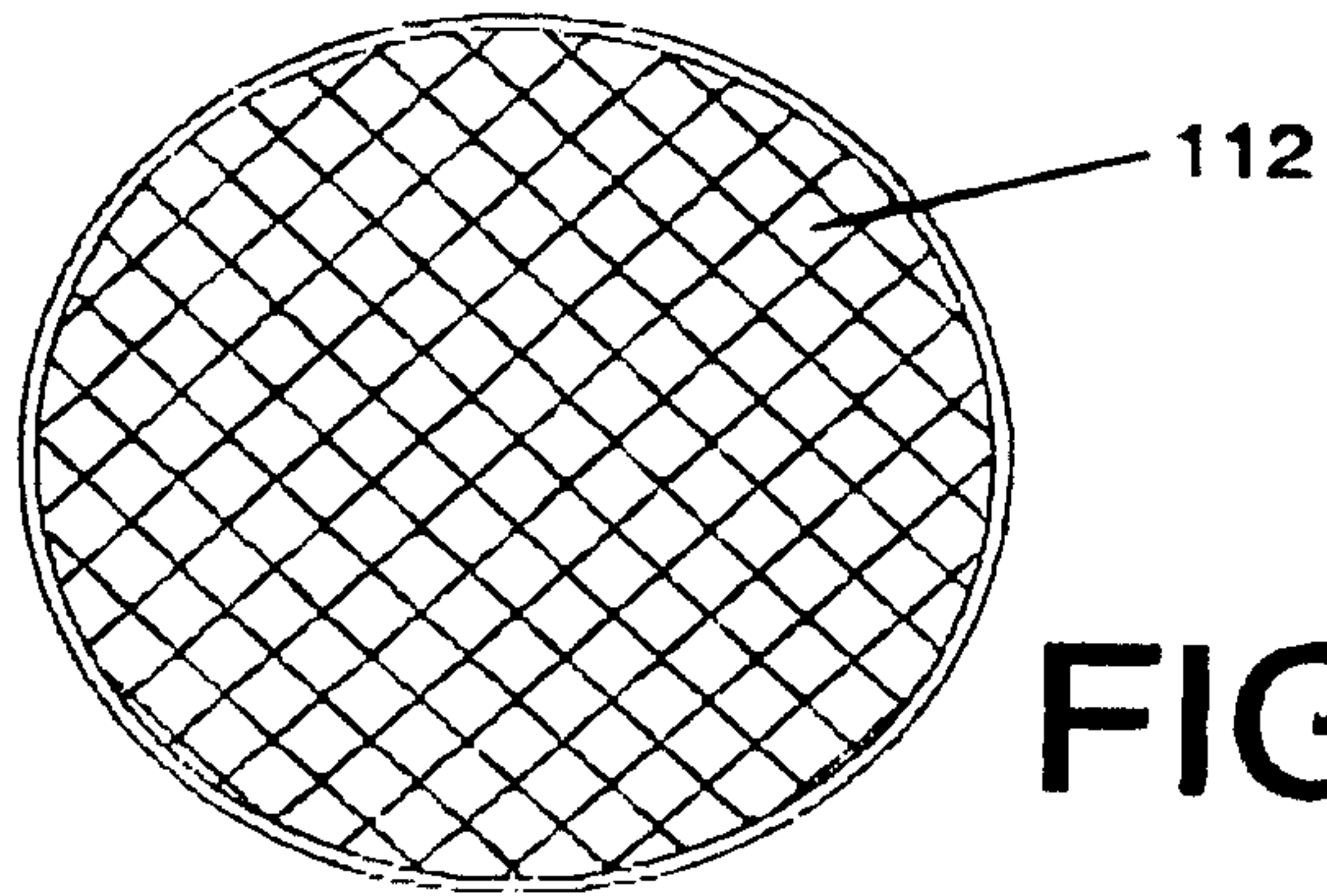


FIG. 6

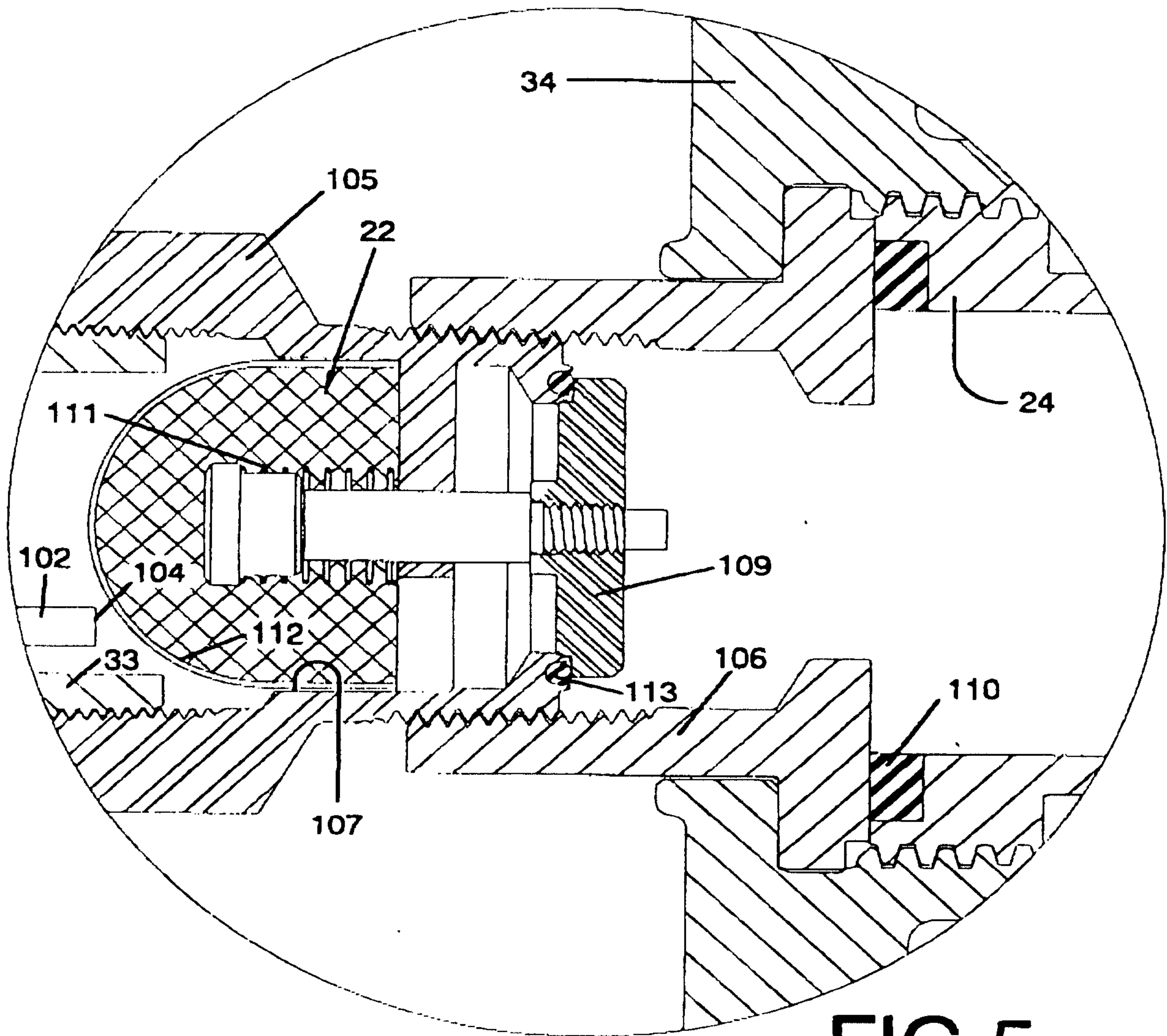


FIG. 5

For many years, the firm has been providing

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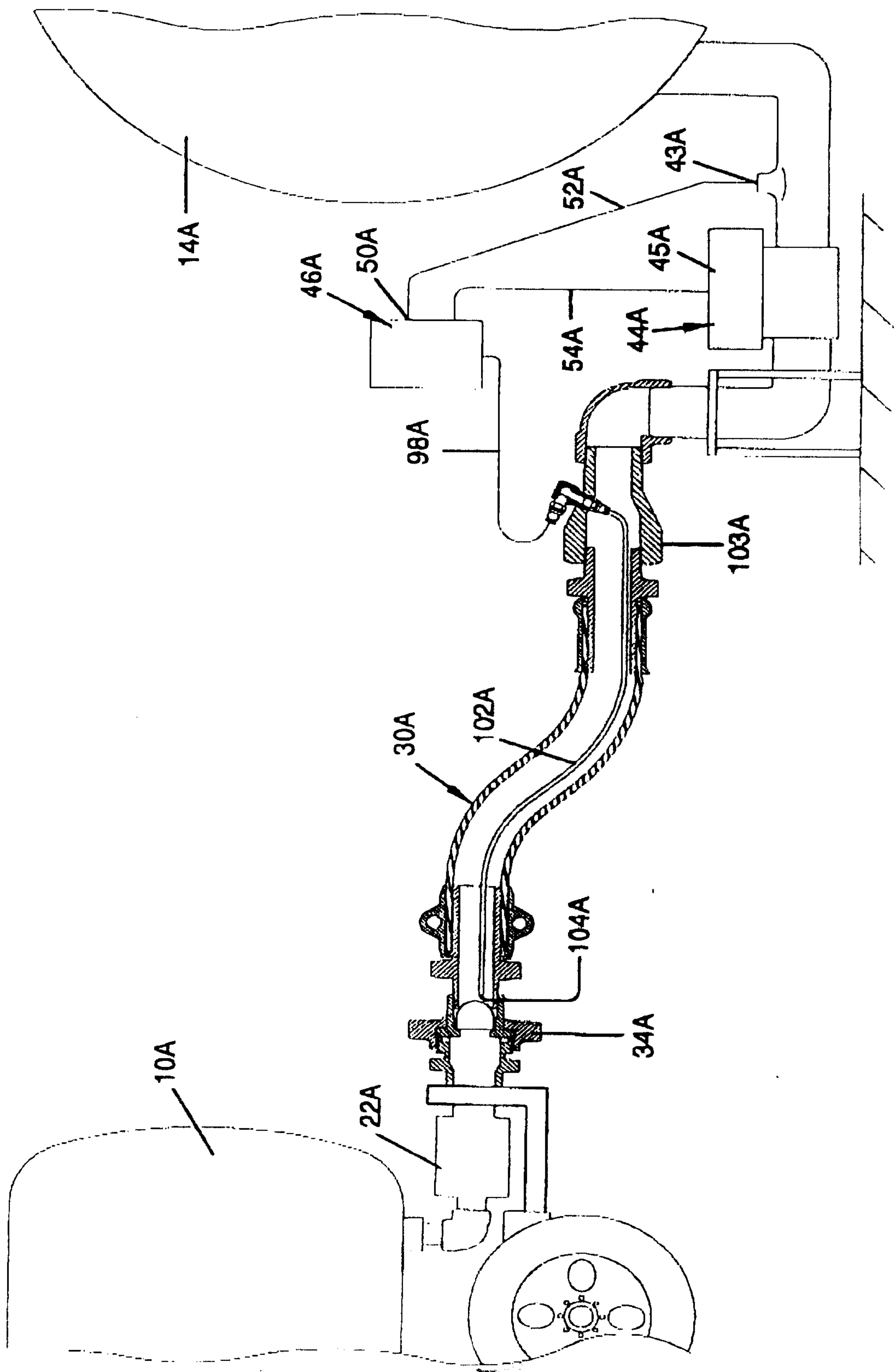


FIG.7

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