June 2, 1942. O. E. ZODER 2,284,709

SAFETY APPARATUS

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FIG. 1.

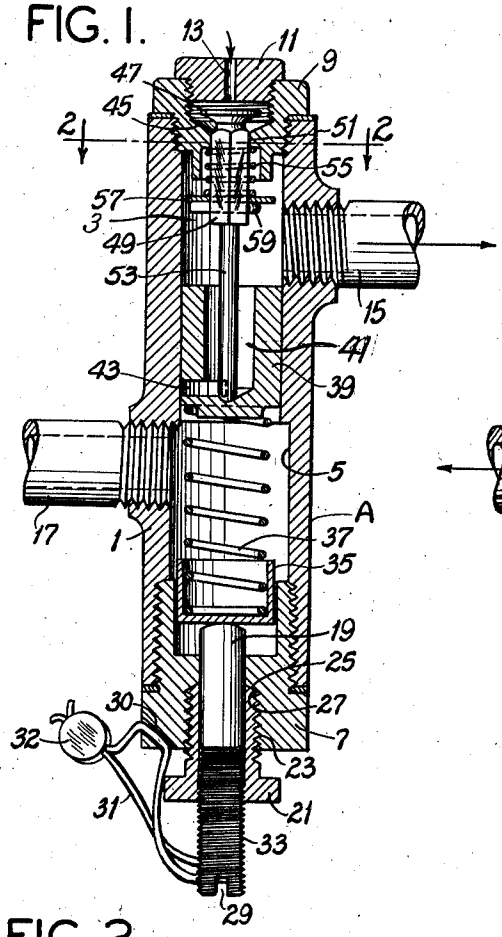


FIG. 3.

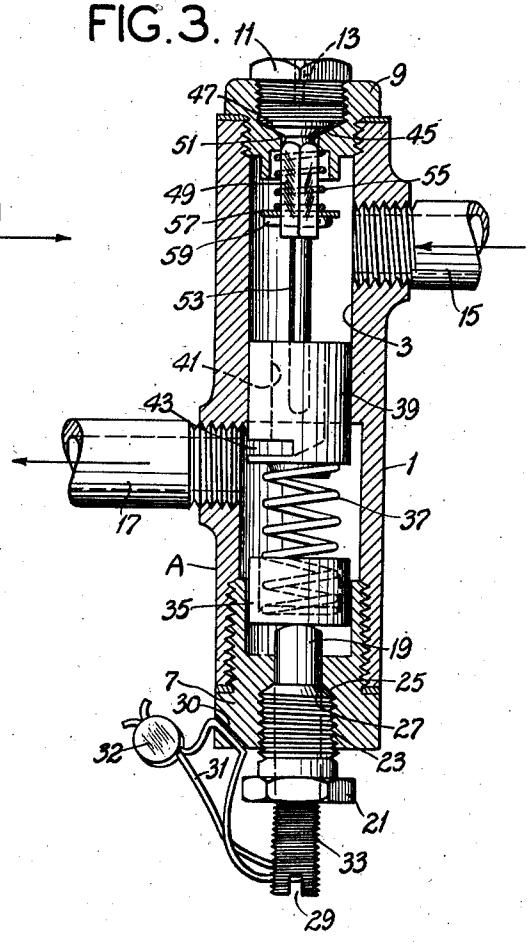


FIG. 2.

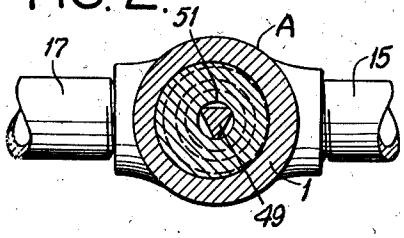
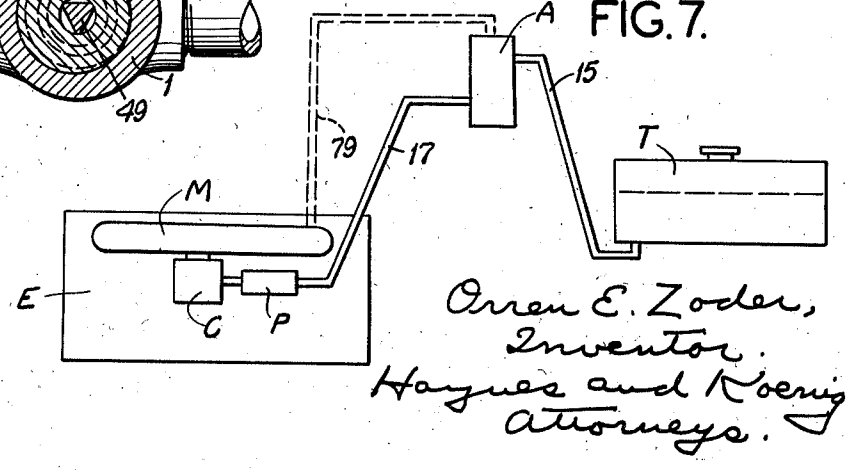


FIG. 7.



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SAFETY APPARATUS

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FIG 4.

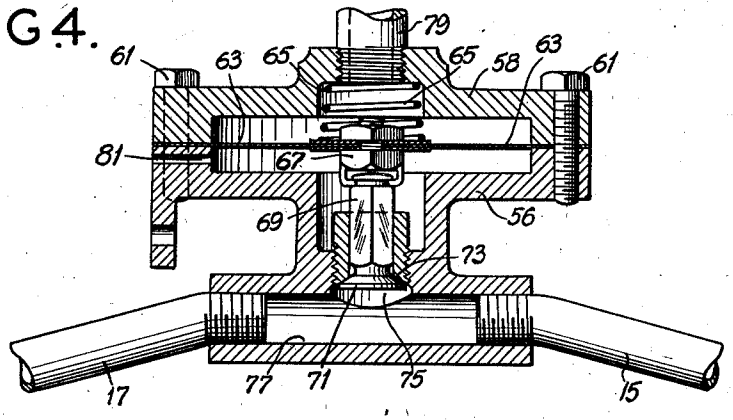


FIG.6

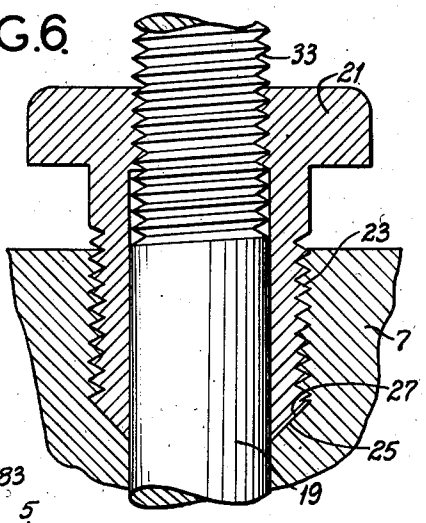


FIG.5.

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UNITED STATES PATENT OFFICE

2,284,709

SAFETY APPARATUS

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Application May 25, 1940, Serial No. 337,182

18 Claims. (Cl. 123—136)

This invention relates to safety apparatus, and with regard to certain more specific features to safety apparatus for transferring hazardous fluids, such as inflammables.

The invention is an improvement upon the invention disclosed in my United States patent application Serial No. 320,015, filed February 21, 1940, for Safety apparatus, issued Aug. 20, 1940 as Patent No. 2,212,486.

Among the several objects of the invention may be noted the provision of reliable liquid transferring and shut-off apparatus which is anti-syphoning and which will avoid abnormal emptying action under syphon conditions from a tank through a pump or carbureter or the like or through broken or loose lines; the provision of apparatus of the class described which makes use of a valve system which cannot be made inoperative by dirt on the valve seat; the provision of apparatus of the class described which may be used without shielding screens or the like; and the provision of apparatus of this class which is adjustable from the exterior but which is packless. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are illustrated three of various possible embodiments of the invention,

Fig. 1 is a vertical section taken through one form of the apparatus, the parts being shown in anti-syphoning positions;

Fig. 2 is a horizontal section taken on line 2—2 of Fig. 1;

Fig. 3 is a view similar to Fig. 1, but showing the parts in suction positions;

Fig. 4 is a vertical section through an alternative form of the invention;

Fig. 5 is a vertical section taken through another alternative form;

Fig. 6 is an enlarged detail cross section of an adjusting feature; and,

Fig. 7 is a diagram showing the relation of the present invention and the apparatus to which it is attached.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

The apparatus disclosed in my said application Serial No. 320,015 is effective for use with a fluid supply of ordinary impurity. Furthermore, the screens therein shown prevent dirt from becoming located on the valve seat, which location would permit syphoning action. However, with excessively dirty liquid supplies, the screen in performing its function of protecting the valve seat against entry of dirt may gather so much impurity that the rate of liquid passage is seriously reduced. A typical example would be met with in the application of the device to gasoline supply tanks on river vessels where sometimes as much as several inches of free sludge may be found in tank bottoms.

The present invention overcomes the above difficulties by making the use of a screen or filter altogether unnecessary. This eliminates the clogging problem. Safety is maintained by arranging the valve structure so that no clogging of the seat can occur.

Referring now more particularly to Figs. 1 and 7, there is shown at A the transfer apparatus which is the subject of the invention. This is connected by means of pipe 15 with a tank T and by means of a pipe 17 with a pump P. The pump P is operated from the engine E which is being supplied with fluid (gasoline from the tank T). The pump P serves the carbureter C. At M is shown the suction intake manifold of the engine which in the alternative construction described in connection with Fig. 4 has a suction connection with A via pipe 79. Pipe 79 is shown in dotted lines in Fig. 7, because it is used only with said Fig. 4 alternative, as will appear.

As shown in Fig. 7, the tank T carries a liquid level which usually is higher than the pump P and carbureter C. This condition quite often occurs in certain installations such as in boats. It can be seen that, if a direct connection were made from the tank T to the pump P, there would be danger of a tank-emptying syphoning action, should leakage occur through the pump P and out of a leaky carbureter valve during the time that the engine E is inoperative. Heretofore this has sometimes led to the emptying of dangerous amounts of fluid from supply tanks with resultant fire hazard. The insertion of the device A eliminates this hazard.

At numeral 1 is shown the casing of A. This casing has an inner cylindric portion 3 which is in communication with an enlarged counterbore 5. The body 1 is enclosed at the bottom by a cap 7 and at the top by a cap 9. The latter carries a plug 11 with a bleeder air inlet 13. Attached to the cylinder 3 is the pipe connection 15 leading down to the supply tank T. Com-

municating with the counterbore 5 is the connection 17 which leads down to the suction pump P of the engine E which is being served by the apparatus. The device A is at the highest point in the liquid line between the tank T and the pump P, for reasons which will appear.

In the cap 7 is an adjustable abutment which is in the form of a cylinder 19 threaded into the inside of gland 21 (see also Fig. 6). The gland 21 is exteriorly threaded as at 23 into the threaded interior of the cap 7. The threaded opening in the cap 7 is chamfered at the bottom as shown at 25 to be engaged by the lower tapered portion 27 of the gland 21. Thus by screwing down the gland 21, the tapered portion 27 moves into the chamfer 25. This squeezes the lower edge of the taper 27 against the cylinder 19 so as to seal and lock it in a given adjusted position. The fit between 19 and the interior of 21 is close enough for the desired sealing effect. To adjust the abutment 19, the gland 21 is backed off slightly so as to remove the compressive effect above referred to, whereupon the abutment 19 may be threaded in or out to effect any desired adjustment. The threads 23 and 33 preferably have substantially the same lead so that after adjustment at 19 the tightening of 21 will not substantially change the adjustment. A screw-driver slot 29 serves as the means by which the adjustment may be made of the abutment in the gland 21. This adjustable abutment it will be seen has no packing and this is considered to be novel.

To render a given adjustment tamper-proof, a wire 31 may be passed through openings 30 and this wire carries a seal 32.

The upper end of the adjustable abutment 19 serves as a backing for a socket 35 forming a seat for a valve-closing spring 37. The other end of the spring presses upon the end of a piston valve 39, the latter being slidable with a sealing fit in cylinder 3. The clearance between the cylinder valve 39 and the cylinder 3 is of an order to prevent any substantial leakage of fluid past the piston valve. It will be understood that a lap fit may be employed, or piston rings if desirable, to obtain any degree of protection against leakage which may be desired.

The piston valve 39 is hollow as shown at 41 for accommodating fluid flow. A slot 43 communicates from the outer surface of the piston to the passage 41. The slot 43 is sealed when the piston 39 is in the cylinder 3, but when the piston is moved so that its upper end extends into the counterbore 5, as shown in Fig. 3, then the slot 43 serves to provide communication between the cylinder 3 and the connection 17. This occurs under suction conditions in the connection 17 (due to the action of the pump therein) sufficient to overcome the force of the spring 37 (see Fig. 3).

The upper cap 9 includes a valve seat 45 for a valve head 47 on a triangular stem 49. The stem passes through a circular passage 51 at the end of seat 45, but the stem 49 being triangular permits air flow when the valve head 47 is open, as shown in Fig. 1. The head 47 is pressed open by a spacing pillar 53 which extends from the triangular shank 49 to the inner end of the passage 41. Thus in the absence of suction in the pump connection 17, the spring 37 presses open the valve (as shown in Fig. 1) while closing the valve 39. The pillar 53 is maintained in contact with the inner end of the passage 41 by a spring 55 which is weaker than the spring 37. This spring reacts from a shoulder at 51 against a washer 57 held by means of a cotter key 59. Other fluid-passing forms may be used for the triangular shank 49.

Operation is as follows:

When the engine is inoperative, its gasoline pump is inoperative, and therefore there is no suction in the connection 17. Hence, there is no vacuum beneath the piston 39, and the spring 37 pushes the piston up to a position where the slot 43 is sealed, and in which the pillar 53 is raised so as to open the valve head 47. This admits air over the air bleeder 13, underneath the head 47, past the triangular stem 49 and to a point above the piston 39. The gravity head in the line 15 will then return the fluid in line 15 back into the supply tank.

Assuming that the engine E is now operated, the pump P will effect a vacuum in the connection 17. The adjustment of the spring 37 is such that a normal vacuum thus engendered will draw down the piston valve 39 to cause the slot 43 to be exposed to the connection 17. When the piston valve 39 opens, the valve 47 closes, and thus there is established a direct connection between 17 and 15 so that liquid is withdrawn from the tank and passes to 17 and thence to pump P. As soon as the pump ceases operation, the state of affairs above described and shown in Fig. 1 again inheres.

From the above it will be seen that, whether or not leaks occur in the pump and carbureter, the liquid head in connection 15 assures return of liquid to the tank instead of leakage by syphon action over the line 17. That is to say, the syphon is broken. This occurs whether or not the fit between the piston 39 and the cylinder 33 is good or poor.

On the other hand, the liquid head in the connection 17, when the pump is inoperative and there is leakage, is ineffective to cause emptying of the connection 17 as long as there is a proper fit between the piston 39 and the cylinder 3. Should it occur after wear or due to a poor fit of the piston 39 that air would leak in from the bleeder 13 past the piston 39 to let down the liquid head in the connection 17, the damage would be inconsequential, because the amount of liquid in the line 17 between the body 1 and the pump is ordinarily negligible. At any rate, only that amount would leak, and it would still be impossible to cause a continuous syphoning from the supply tank. It is this continuous syphoning action that has been dangerous heretofore in the case of leaky pumps and carbureters, or broken or leaky lines.

Any required adjustment of spring 37 can be made by adjusting the stop 19 by use of a screw driver in the slot 29, after loosening of the gland 21. It will be seen that the clinching action at 27 around 19 after tightening of the gland is such as slightly to deform the metal of the gland into gripping relationship with the cylinder 19. This is enough to prevent leakage without the necessity for soft packing material.

Referring to Fig. 4, there is shown another form of the invention in which a body 56 is provided with a cap 58 which, in connection with bolts 61, holds a flexible and impervious diaphragm 63. Above the diaphragm 63 is a compression spring 65 which normally presses the diaphragm downward. At the center of the diaphragm is a connection 67 with the upper end of a polygonal valve stem 69. Polygonal stem 69 passes through a circular bearing, thus allowing

space therebetween for passage of air. At the lower end of the stem 69 is a valve head 71 which seats upon a valve seat 73. The valve 71, 73 is in a lateral passage 75 associated with a through passage 77 which communicates between connections 15 and 17. The former leads to the supply tank at the lower elevation and the latter to the pump at the lower elevation. A connection 79 above the diaphragm 63 leads to the intake suction manifold of the engine which operates the pump connected to 17. This is indicated in dotted lines in Fig. 7. Below the diaphragm 63 is an atmospheric connection 81.

As to the second form of the invention (Fig. 4), operation is as follows:

When the engine which drives the pump is started, the reduced pressure in the suction manifold M is communicated through 79 to a point above the diaphragm 63, thus raising said diaphragm against the compression of spring 65. This closes the valve 71 and the pump is then enabled to draw liquid over the connections 15 and 17 via the communication 77. As soon as the engine stops operation, the vacuum is broken in its intake manifold and also above the diaphragm 63. Thus the spring 65 depresses the diaphragm and causes opening of the valve 71, 73. At this time the pump has ceased operation and the result is a bleeding of air in through the passage 81 and around the valve stem 69 and through the valve 71, 73 so that the syphon is broken and the head of liquid in the line 15 drops back into the supply tank. The head of liquid in the connection 17 may be maintained in the connection, provided the pump and associated carbureter are in good condition, or it may run out in the case of leaks, but the amount of liquid in the connection 17 is negligible, so far as is concerned the question of safety.

In Fig. 5 is shown a third form of the invention which consists of a combination of the forms of Figs. 1 and 4, with some modifications. Like numerals designate like parts. In this case the vacuum above the diaphragm 63 is obtained not from the intake manifold, as in the Fig. 4 construction, but from the pump line 17. This is done by a passage 83 leading from above the diaphragm 63 and to the counterbore 5.

In this case also a substitution has been made for the piston valve 39 by means of the poppet valve 40 which has a head 42 and polygonal stem 44 in a round guide 52. The head 42 cooperates with a seat 46. The valve is drawn open by suction in the line 17 against action of the spring 37.

Operation of this form of the invention is as follows:

Upon starting the engine, the pump evacuates the connection 17 and thus produces a vacuum above the diaphragm 63 (through passage 83) and at the same time draws open the valve head 42, so as to open the connection with the inlet 15 from the supply tank. Thus, while the connection is open and fluid is flowing from 15 to 17, the air bleeder valve 71 is drawn shut by the pump working against the action of the compression spring 65. As soon as the pump stops, the vacuum in the line 17 is broken, whereupon the spring 65 pushes down the diaphragm 63 to cause opening of the valve 71. Thus the liquid head in the line 15 returns liquid in line 15 back to the tank. The liquid head in the line 17 will be maintained if the pump and the carbureter are in good condition, but if leakage occurs, the small amount of liquid in said line 17 may escape, but not necessarily so if the valve 40 is tight.

If any dirt gets under the seat of the valve 42, it is of slight consequence, because the liquid in line 15 returns to the tank anyway and the other functions of the valve 42 are not substantially impaired. The liquid in the suction line 17 passes out through the pump and carbureter if they leak. This being a negligible amount as before, it is of no moment. If the pump and carbureter valves do not leak, then of course an open condition of the valve 42 has no effect at all.

It will be seen that all forms of the invention operate upon the principle that an air relief or bleeder valve opens as soon as the pump stops its operation, said valve being located at or near the high point in respect to a two-legged syphon connection between the liquid tank and the pump.

Under the worst conditions of operation, only a very small amount of fluid can leak out, and in any event there is never, in the case of a defective pump and carbureter, any possibility of syphoning out from the tank supply.

The piston valve 39 of course is not subjected to clogging by any dirt particles, because there is no seat upon which the particles can rest to prevent valve closure at the slot 43.

The seat of valve 47 is not subjected to substantial liquid flow or clogging by dirt particles, but even if it should be clogged, the worst that could happen would be for the vacuum to be broken permanently in the line 17, so that upon starting of the engine liquid could not be supplied to the carbureter. In this case, the operator would have knowledge of something being wrong, and such a condition is preferential to one in which a syphoning action could take place while the operator is absent. The latter event could not occur with the present construction.

In the form of the invention shown in Fig. 5, the spring 37 should be stronger than the spring 65, or at least designed so that the air valve 71 will surely close before the fuel valve 42 opens. The adjustments shown provide for this in various applications to various heads. The large area of the diaphragm 63, which is exposed to suction pressure as compared to the small area of the piston 39, aids in accomplishing this end. This assures also that, when the tank in connection with 15 is empty, and only air is being pumped by the gasoline pump, the air valve 71 will positively be shut so that the pump can thereafter prime.

The purpose of having all forms of the invention adjustable is so that the variable heads of liquid which are encountered in practice can be accommodated. This is because it is necessary to have the spring, such as 37 for example in Figs. 1 and 5, adjusted so that the liquid head in line 17 is not enough to draw open the piston valve 39 under the condition when the pump has stopped, but additional suction head from the pump should draw this valve open.

The spring 37 must be adjusted so that it will hold the valve 39 shut against suction from any mere liquid head in the line 17, when the engine is stationary. This liquid head in line 17 must not pull open the valve 39, but the sum of this head plus the vacuum head of pump P must do so. The spring 65 in Fig. 5 must likewise be adjusted to hold open valve 71 under mere liquid suction head in line 17, but to permit closing of the valve under liquid head plus pump suction head in line 17.

The piston valve 39 of Figs. 1–3 and the diaphragms 63 of Figs. 4 and 5 are equivalent in the sense that they present an area which, if suction

is presented to one side, effects or permits closure of the air relief valve (47 in Figs. 1–3 and 71 in Figs. 4 and 5). The difference is simply that the diaphragm in Figs. 1–3 consists of a movable piston and in Figs. 4 and 5 consists of a flexible member. There is also a form of diaphragm which responds by substantial movement, which is flexible and consists of the so-called sylphon bellows. It is understood that this equivalent might also be used for the piston valve 39 on the diaphragm 63 and would be described as a diaphragm.

The fuel suction apparatus which supplies the engine E with fuel is the intake manifold M, the carburetor C and the pump P. These, when the engine E operates, produce suction (reduced pressure) within the lines 17 and 79. As is known the engine E drives its own pistons to produce suction in manifold M and drives the pump P to produce suction at the pump inlet.

It will be seen that the fuel-line from the tank to the engine cylinders constitutes the pipe 15, 17, the device A, the pump P, the carburetor C and the manifold M. This line has liquid fuel in it in the parts 15, 17, P and a part of the carburetor C and has gaseous fuel in it in part of the carburetor C and the manifold M. Generically speaking, reduced pressure or suction is obtained either from the pump P or the manifold M for the purpose of closing the bleeder valve in the device A which is located above the pump P and the tank, the tank being also located above the pump.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. Safety apparatus comprising a body located at a higher elevation and having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to fuel suction apparatus including an intake manifold and a pump, said pump also being at a lower elevation and below the tank, a bleeder valve at the higher elevation biased to an open position to communicate air to the connection with the tank, and means responsive to suction of said fuel suction apparatus adapted to close said valve when the suction apparatus operates.

2. Safety apparatus comprising a body located at an elevation and having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to fuel suction apparatus including an intake manifold and a pump, said pump also being at a lower elevation and below the tank, a bleeder valve in said body biased to an open position to communicate air to the connection with the tank, and means responsive to suction of said fuel suction apparatus adapted to close said valve when the suction apparatus operates comprising a flexible diaphragm connected to the valve to move it against its bias in response to said suction.

3. Safety apparatus comprising a body having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to an engine having a suction manifold and a pump also at a lower elevation, a bleeder valve normally biased open and adapted when open to communicate air to at least the connection with the tank, and diaphragm means responsive to suction in the manifold adapted to close said valve.

4. Safety apparatus comprising a body located at an elevation and having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to the pump of an automotive engine which pump is also at a lower elevation and below the tank, a bleeder valve in said body normally biased open and when open communicating air to the connection with the tank, and means responsive to suction from the pump for closing said valve.

5. Safety apparatus comprising a body having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to an engine having a pump also at a lower elevation and below the tank, a bleeder valve normally biased open and adapted when open to communicate air to the connection with the tank, and means responsive to suction from the pump for closing said valve and comprising a movable diaphragm.

6. Safety apparatus comprising a body having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to the pump of an engine said pump being also at a lower elevation, a bleeder valve normally biased open and adapted when open to communicate air to the connection with the tank, and means responsive to suction from the pump for closing said valve and comprising a movable valve for opening communication between the inlet and outlet connections in response to pump suction.

7. Safety apparatus comprising a body having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to suction apparatus including an intake manifold and a pump, said pump also being at a lower elevation and below the tank, a bleeder valve adapted when open to communicate air to the connection with the tank, means responsive to suction adapted to close said valve when the suction apparatus operates, and a liquid valve controlling fluid flow through the connection to the suction apparatus, said valve being normally biased shut but drawn open under suction conditions when the air valve is closed.

8. Safety apparatus comprising a body having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to suction apparatus also at a lower elevation, a bleeder valve adapted when open to communicate air to the connection with the tank, biasing means to close said valve, and a liquid valve controlling fluid flow through the body, said valve being normally biased shut but adapted to be drawn open under suction conditions, the means for opening the air valve comprising said liquid valve when the latter is in closed position.

9. Safety apparatus comprising a body having a liquid inlet connection with a tank at a lower elevation, a liquid outlet suction connection to suction apparatus also at a lower elevation, a bleeder valve adapted when open to communicate air to the connection with the tank, means responsive to suction of the suction apparatus in said suction connection adapted to close said valve when the suction apparatus operates, and a liquid valve controlling fluid flow through the body, said liquid valve being normally biased shut but adapted to be drawn open under suction conditions in said suction connection and when the air valve is closed, the means for closing the air valve comprising a diaphragm connected to the

bleeder valve and a suction connection from the said suction connection to the diaphragm.

10. Safety apparatus comprising a body having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to a pump also at a lower elevation, a control valve, means normally biasing said control valve to a closed position upon non-operation of the pump, and exposed to suction pressure of the pump for opening, said control valve when open connecting the inlet and the outlet, and a bleeder valve connected with and opened by said control valve when the latter is biased to closed position said bleeder valve bleeding air to the inlet connection.

11. Safety apparatus comprising a body having a liquid inlet connection with a tank at a lower elevation, a liquid outlet connection to a pump at a lower elevation, a piston valve, means normally biasing said piston valve to a closed position upon non-operation of the pump, and exposed to suction pressure of the pump to be placed in open position, said valve when open connecting the inlet and the outlet, an air relief valve for the inlet connection opened by said piston valve when the latter is biased to closed position, and means biasing the air relief valve to a closed position against the bias of the piston valve.

12. Safety apparatus comprising a body having an inlet connection with a lower supply tank and an outlet suction connection with suction means, an air relief valve for admitting air when open to the inlet connection, means normally biasing said valve to open position, a diaphragm movable therewith, and a suction connection arranged on the side of the diaphragm to effect opposition to said bias to close the air relief valve when said suction means is operative.

13. Safety apparatus comprising a body having an inlet connection with a lower supply tank and an outlet suction connection with an engine operated pump, an air relief valve for admitting air when open to said connections, means normally biasing said valve to open position, a diaphragm movable therewith, an engine intake manifold and a suction connection thereto arranged on the side of the diaphragm to effect opposition to said bias to close the air relief valve when said pump is operated, said manifold being operative as part of the engine which operates said pump.

14. Safety apparatus comprising a body having an inlet connection with a lower supply tank and an outlet suction connection with a pump, an air relief valve for admitting air when open to said supply tank connection, means normally biasing said valve to open position, a diaphragm movable therewith, and a suction connection arranged on the side of the diaphragm to effect opposition to said bias to close the air relief valve when said pump is operative, said suction connection comprising a communication with said outlet suction connection.

15. Safety apparatus comprising a body having an outlet suction connection with a pump at a lower elevation, an inlet connection with a supply tank at a lower elevation but above the pump, movable means having an area exposed to suction in said outlet suction connection, an air relief valve adapted when open to admit air to the inlet connection and operative to be opened by said movable means, said outlet suction connections having a connection with said movable means.

16. Safety apparatus for use in a fuel-line between a fuel tank and the fuel connection of an automotive engine, to make said line anti-siphoning, said tank holding a fuel supply above said connection, comprising a part in said line at an elevation above the tank and the connection, a bleeder valve at said elevated part of the line, means biasing said bleeder valve to open position for bleeding air into the line, and suction-responsive means connected with said bleeder valve responsive to engine suction to close the bleeder valve and responsive to cessation of engine suction to open the bleeder valve.

17. Safety apparatus for use in a fuel-line between a fuel tank and the fuel connection of an automotive engine, to make said line anti-siphoning, said tank holding a fuel supply above said connection, said engine having fuel supply appurtenances operative when the engine is operative to produce suction, comprising a part in said line at an elevation above the tank and the connection, a bleeder valve at said elevated part, means normally biasing said bleeder valve to open position for bleeding air into the line, pressure-responsive means connected with said bleeder valve and responsive to said suction to close the valve against said bias.

18. Safety apparatus for use in a fuel-line between a fuel tank and the cylinder block of an automotive engine, said fuel-line including an engine manifold providing suction, and a pump providing suction, said tank being elevated with respect to the pump, means for making said line anti-siphoning with respect to said elevated tank comprising a device in the fuel-line, a bleeder valve in said device at an elevation above the tank and said pump, means biasing said bleeder valve to open position for bleeding air into the line, a movable member mechanically connected with said bleeder valve and being in a compartment having a connection with a suction portion of said fuel-line whereby suction in said fuel-line actuates the movable member to close said bleeder valve.

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