137 - 13

Draft

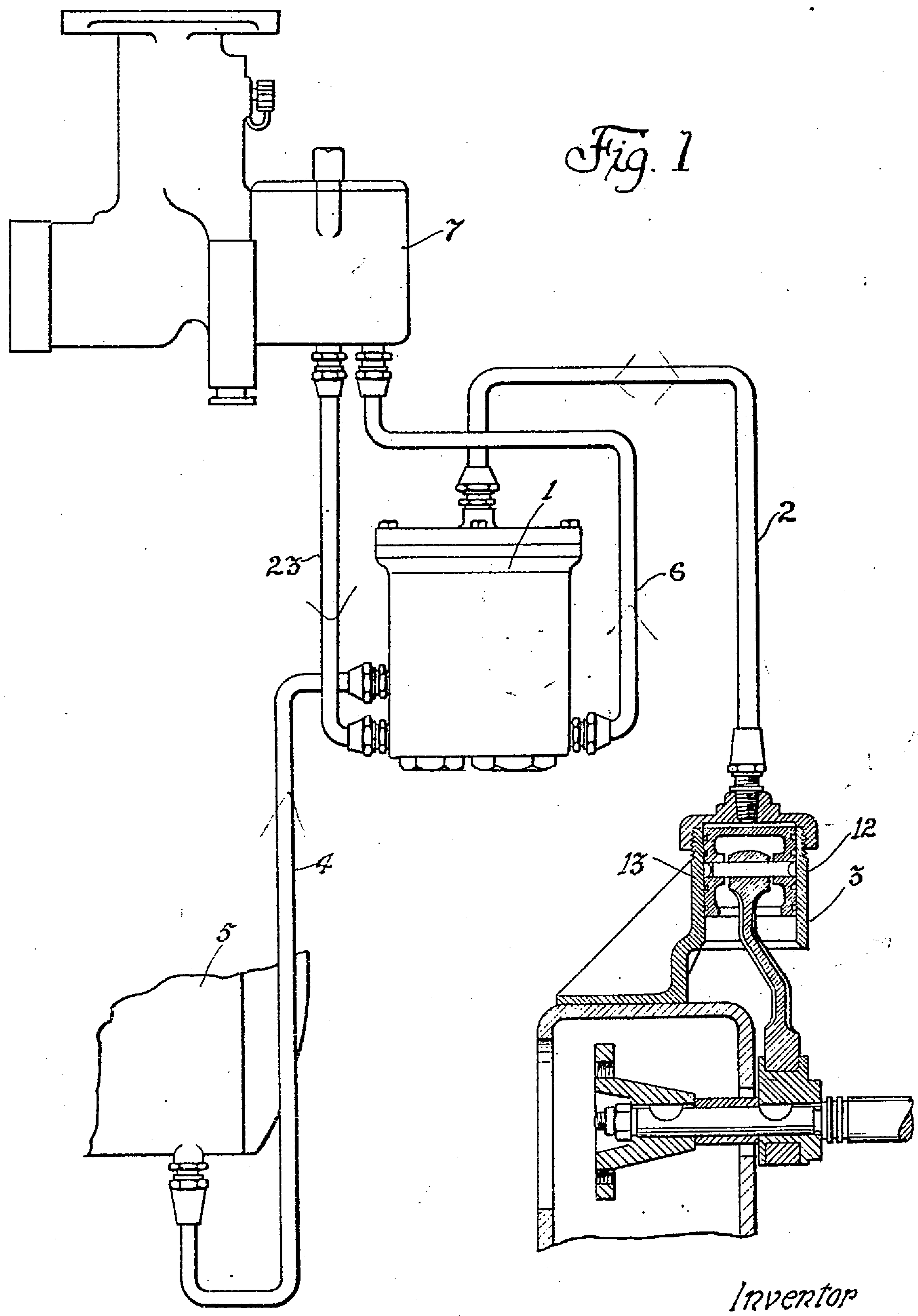
Jan. 2, 1923.

F. E. EDWARDS.
FUEL FEED SYSTEM.
FILED APR. 30, 1920.

1,440,382

3 SHEETS-SHEET 1

Fig. 1



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3 SHEETS-SHEET 2

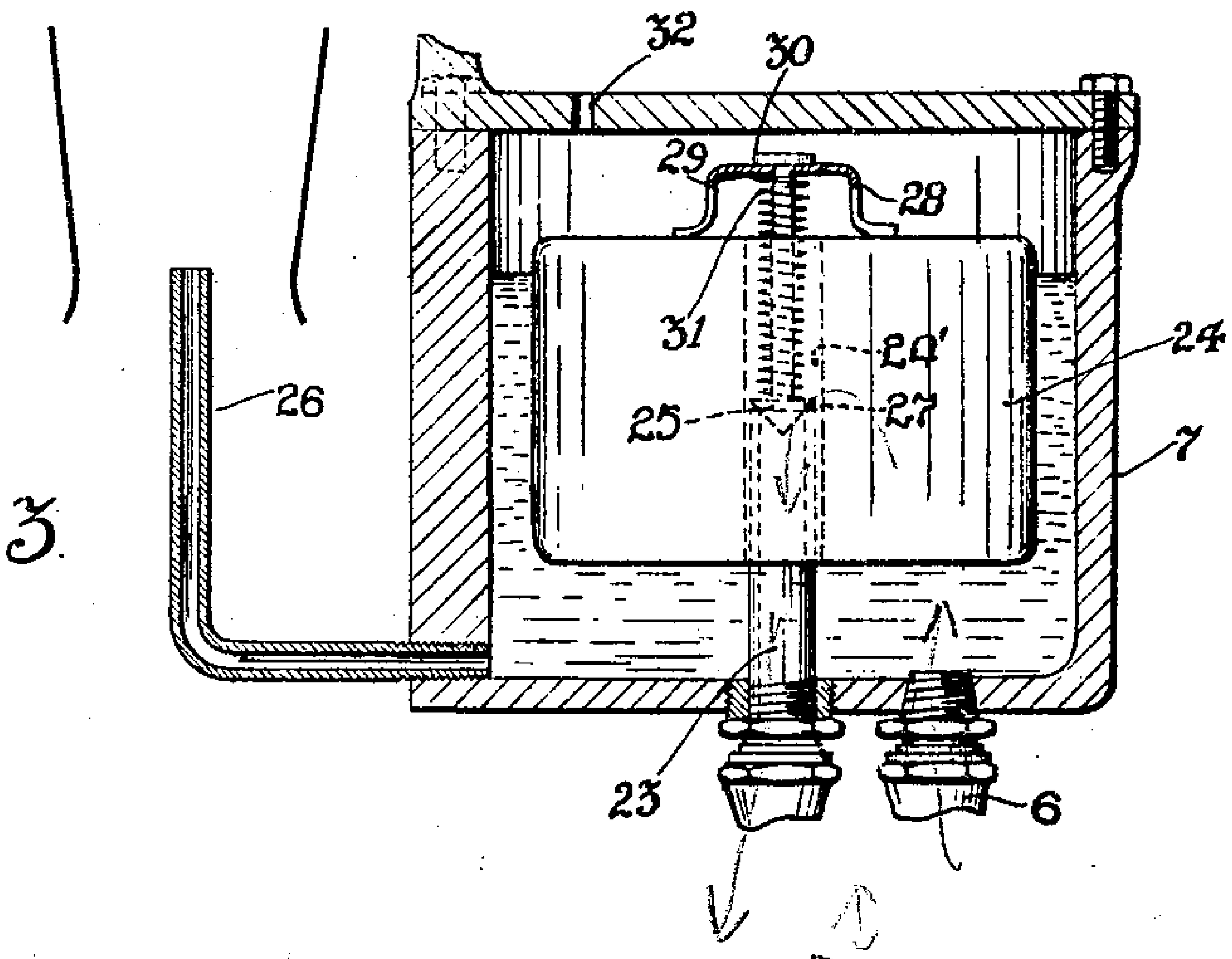

Fig. 3.

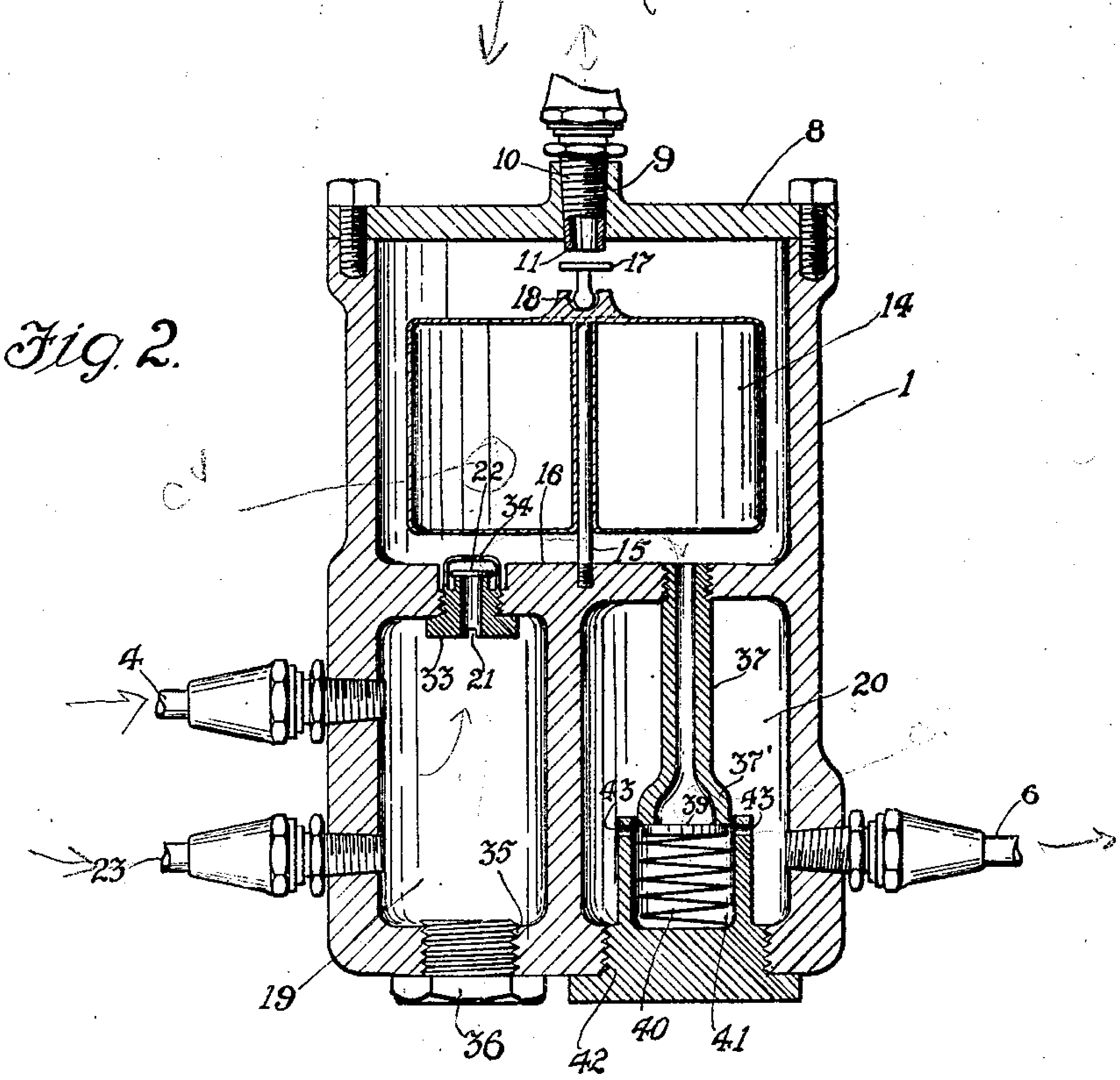

Fig. 2.

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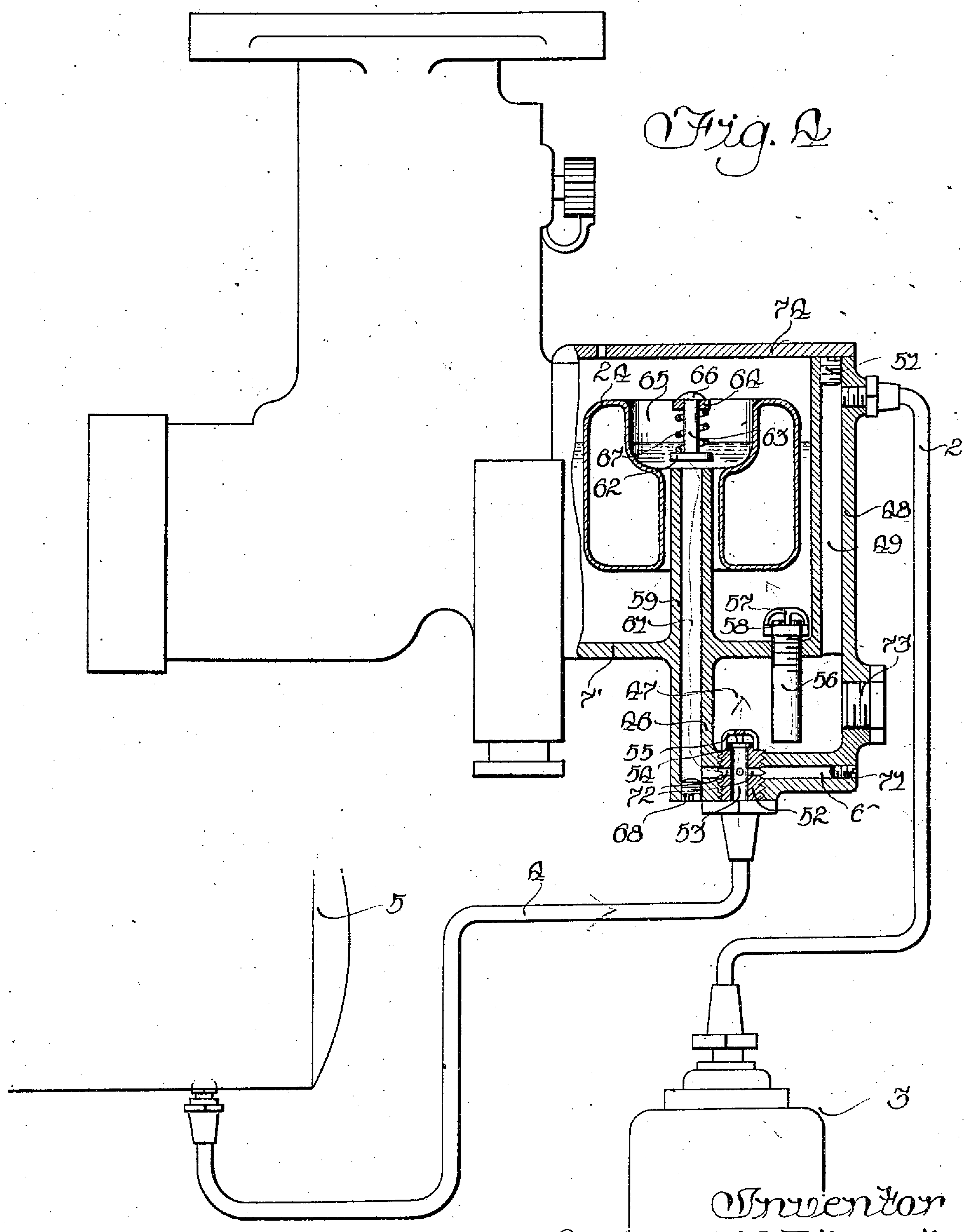
3 SHEETS-SHEET 3

Fig. 2



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364

d Jan. 2, 1923.

1,440,382

UNITED STATES PATENT OFFICE.

FRANCIS EDWIN EDWARDS, OF CRYSTAL LAKE, ILLINOIS, ASSIGNOR TO STROMBERG MOTOR DEVICES COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

FUEL-FEED SYSTEM.

Application filed April 30, 1920. Serial No. 377,924.

To all whom it may concern:

Be it known that I, Francis E. Edwards, a citizen of the United States, residing at Crystal Lake, in the county of McHenry and State of Illinois, have invented a certain new and useful Improvement in Fuel-Feed Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to improvements in means for lifting and delivering liquid from a lower level to a higher level and has special reference to improved means for feeding liquid fuel to internal combustion engines and for automatically controlling the delivery of the fuel in accordance with the quantity being used by the engine.

This present application, in so far as the subject matter thereof has been disclosed in my copending application, Serial No. 236,271, filed May 24, 1918, is a continuation in part thereof.

The feeding of liquid fuel to automobile engines has been accomplished primarily by one of three well known systems, known generally as gravity feed, pressure feed or suction feed.

Of these three systems the suction feed, or a combination of suction and gravity feed, has now come into particular favor on account of the undesirable features of the gravity and pressure systems.

The usual suction feed, so called, which depends upon the suction in the intake of the engine as the source of power with which to raise the liquid from a lower level supply tank is not altogether satisfactory as the suction upon wide open throttle is reduced to such a low point as to be practically ineffective.

In this present invention I use a pulsating device or pulsometer positively operated by the engine, when running, as the source of power, and which effects the lifting of the liquid fuel from a lower level storage tank for ultimate delivery to the carburetor float chamber and I automatically govern the pumping action so that the desired level of liquid is constantly maintained in the carburetor float chamber.

In applying the power from the pulsating device to the delivery of the liquid, I provide a body of air enclosed partly in what I term a pumping chamber, partly in the pulsating device, and partly in the pipe connecting these two. The pulsometer which I preferably use is a cylinder and piston, though obviously other forms might be made use of. The piston is operatively connected to the engine and is reciprocated when the engine runs. The reciprocation of the piston in the cylinder alternately compresses and rarefies the body of confined air which effects the alternate lowering and raising of pressure in the pumping chamber. This chamber has check valve controlled ports, one connected to the lower level storage tank which is vented to the atmosphere and the other connected to the carburetor float chamber arranged at a higher level than the storage tank and which is also preferably vented to the atmosphere. At times the pumping effect of the pulsations may be greater than the quantity used by the engine, and I provide simple means for stopping or diminishing the further entrance of fuel into the system and for preventing excessive rise of the liquid level in the carburetor float chamber.

Primarily I arrange a means for obtaining an overflow discharge of the liquid from the carburetor float chamber to the pumping chamber when the level in the carburetor float chamber exceeds a predetermined limit. The arrangement is such that when the liquid in the carburetor float chamber rises above the normal level thereof, the float opens a submerged overflow port leading to the suction intake of the pumping chamber, thus causing an overflow discharge of liquid to the suction intake, which overflow discharge stops or diminishes the further drawing of liquid from the storage tank by satisfying or partially satisfying the suction created at the suction intake. My system also includes means for automatically regulating the pumping action in accordance with the height of liquid in the pumping chamber itself.

Under normal action the pressure in the pumping chamber varies substantially equally above and below atmospheric pressure upon the compression and rarefaction strokes. As the liquid rises in the pumping chamber the air space is reduced and the maximum pressure increases and in consequence the suction pressure does not drop so low until a point is reached when the pressure on the suction stroke does not drop below atmosphere and at which point obviously the flow of liquid into the chamber from the storage tank will cease, thus preventing an overfilling of the pumping chamber. I may also provide simple positive means for cutting off the pumping action from the pumping chamber when the liquid rises therein above a predetermined level. This consists of a valve controlled by a float in the pumping chamber and arranged to close off the pipe leading to the pulsometer.

To minimize the pumping effect of the pulsations and provide a substantially constant steady flow of the liquid from the pumping chamber to the carburetor float chamber, instead of the unsteady flow which would result from a direct connection between the pumping chamber and the float chamber, I provide an air cushion control between the two chambers, this air chamber absorbs the high pressure discharge on the pressure stroke and causes the liquid to flow steadily to the carburetor. This air cushion control of the delivery of the liquid from the pumping chamber to the carburetor chamber is of importance in connection with the control of the overflow discharge of fuel by the carburetor float, for the reason that, otherwise, when the float is just at the overflow level, the delivery impulse of fuel raises the float momentarily by slightly raising the level and the overflow discharge immediately lowers the float by lowering the level so that the float vibrates off and on its valve seat and the level fluctuates undesirably. This is overcome by the provision of the air cushion, which maintains a slow discharge of liquid to the float chamber after the pressure impulse in the pumping chamber has ceased, and thus maintains a more constant level in the float chamber.

For a clear understanding of my invention attention is directed to said accompanying drawings, in which:

Figure 1 is a diagrammatic view of my improved fuel feed system showing the air impulse pump construction;

Figure 2 is a central vertical sectional view of the pumping chamber and associated parts and connections;

Figure 3 is a fragmentary diagrammatic view of the carburetor; and

Figure 4 is a diagrammatic view of my improved fuel feed system showing a combined construction of pumping chamber and carburetor float chamber.

Referring to Figures 1 and 2, the pumping chamber, which is designated 1 is connected by a pipe 2 to a simple pulsating device 3. The chamber is also connected by a suction pipe 4 to a supply tank 5 arranged at a lower level and by a delivery pipe 6 to the float chamber 7 of the carburetor which is adapted to supply fuel to an internal combustion engine (not shown). The several connecting pipes are connective to the several devices by suitable couplings. The pumping chamber 1 is closed at its top by a removable cover 8 having a central threaded opening 9 in which a threaded nipple 10 is inserted, the lower end 11 of which projects into the pumping chamber to form a valve seat. The nipple 10 is connected by the pipe 2 to the pulsating device 3, which in this instance comprises an open ended cylinder 12 in which a piston 13 is mounted for reciprocation. The piston is operatively connected to the engine and is reciprocated when the engine is running. The air in the chamber 1, the pipe 2 and the cylinder 12 constitutes an elastic piston between the piston 13 and the liquid which is contained in the pumping chamber for transmitting the power pulsations from the piston 13 to the liquid in the chamber 1. For the purpose of positively shutting off the action of the pulsations from the chamber 1 at times when the liquid therein rises above a predetermined level, I provide a float 14 in the chamber 1, guided on the central guide pin 15, mounted on the bottom wall 16 of the pump chamber. The float carries a valve 17 mounted on its upper wall and adapted to be lifted by the float to close against the lower end 11 of the nipple 10 and shut off the pulsations. The valve 17 is preferably connected to the float 14 by a ball and socket connection 18 which permits the valve to accommodate itself to the seat and tightly close off the pipe 2. I arrange the float and the valve so that the float cuts off the pulsations when the chamber 1 fills to a predetermined level, this being of importance when the device is used in connection with a carburetor which is adapted to cut off the flow of liquid to the carburetor float chamber, when the liquid therein rises above the normal level thereof.

Below the pump chamber 1 and preferably in the same casting therewith, I provide an inlet or a suction chamber 19 and a delivery or pressure chamber 20. The suction chamber is connected to the pumping chamber 1 through a small inlet port or passage 21 controlled by a check valve 22 arranged to admit the liquid to the pumping chamber on the suction stroke and to prevent the return of the liquid to the suction chamber on the pressure stroke. The suction chamber is connected by the pipe 4 to the supply tank 5 and by the pipe 23 to the carburetor 7.

I preferably project the pipe 23 up

through the bottom of the carburetor chamber extending it centrally up through the chamber to form a guide for the carburetor float 24. The upper end 25 of the pipe 23 terminates sufficiently below the normal liquid level of the carburetor float chamber, which is substantially the level illustrated, to be submerged at all times. The open end of the pipe 25 is normally closed by a valve 27 which is carried by a yoke 28 secured upon the top of the float 24. The valve 27 is extended down through a central well 24′ formed in the float 24; this well being slightly larger than the pipe 23 to permit free access of the liquid fuel up around the pipe to the valve opening in the top thereof. The valve is arranged to permit of some slight movement of the float without disturbing the valve on its seat so that the valve will not be oversensitive. For this purpose the valve and float are yieldingly connected. The valve is provided with a stem 29 projecting through the yoke 28 and a head 30 is arranged above the yoke, the valve being held pressed to its seat by a spring 31 between the valve and the yoke. Normally the head 30 is spaced slightly above the yoke so that the float can raise and lower slightly without disturbing the valve, and the valve can accommodate itself to the seat to tightly close the end of the pipe 23 at all times when it is not lifted free of the seat by the float.

It will now be clear that in case the liquid level in the carburetor chamber 7 rises sufficiently to lift the float and to lift the valve 27 from its seat, liquid will be admitted to the suction chamber 19 from the carburetor float chamber 7 through the pipe 23. It will be noted that the liquid enters the suction chamber under atmospheric pressure, the carburetor chamber being vented to the atmosphere through the small vent opening 32. The admission of this liquid to the suction chamber 19 relieves the suction impulses acting therein and interrupts or diminishes further drawing of the liquid through the supply pipe 4. Only a small quantity of liquid will be admitted to the pipe 23, whereupon the valve 27 will again reseat by reason of the drop in level. This quantity will, however, momentarily relieve the admission of further fuel into the system by satisfying the suction impulse, and will in whole or in part, enter the pumping chamber 1 under the suction impulses. Here it will be again subjected to the pressure impulses and will be forced back into the carburetor float chamber 7, whence it will be seen that a continual circulation of the liquid will be normally maintained through the float chamber and through the pumping chamber. As more fuel is used, less is returned through the pipe 23 and consequently larger increments are necessarily drawn up through the supply pipe 4 in relieving the suction impulses in the suction chamber 19. I preferably make the inlet passage 21 in a threaded plug 33 which also carries a cage 34 for holding the valve 22 in place, and for convenience in assembling the device I provide an opening 35 in the lower wall of the suction chamber 19, through which the plug 33 can be inserted into place, said opening being closed by a removable screw plug 36.

For controlling the delivery of the liquid from the pumping chamber 1 to the pipe 6 and through the delivery chamber 20, I connect the pipe 6 to the lower part of the chamber 20 and I provide a delivery tube screwed tightly into the bottom wall 16 of the pumping chamber and extending down to the lower part of the delivery chamber. The lower end 37′ of this tube 37 is enlarged to provide an enlarged valve seat which is normally maintained closed by a check valve 39, which is held upwardly against the lower end of the delivery tube by a spring 40. The spring 40 is housed in a chamber 41 provided in a plug 42 which tightly closes the lower end of the chamber 20. As the pipe 6 is connected to the lower end of the delivery chamber 20 and as the delivery tube 37 extends into the lower part thereof, the upper part of the chamber constitutes an air cushion, as I provide no means of venting the upper part of the chamber. The action of the delivery of the liquid from the pumping chamber upon the impulse stroke of the device is to force the liquid down through the delivery tube 37, forcing the valve 39 from its seat, flowing into the delivery chamber 20 and compressing the air therein to the extent that the liquid does not immediately escape through the delivery pipe 6. The wall of the plug 42 surrounding the valve 39 is provided with delivery openings 43 to permit the liquid to flow freely into the chamber 20 as it escapes past the valve 39.

In the normal operation of the device the pulsations in the pumping chamber raise the liquid fuel from the tank 5 and deliver it to the carburetor in a constant and steady flow. If for some reason the liquid is carried into the pumping chamber faster than it can escape to the carburetor, the liquid will rise therein and thereby either reduce the suction effect as explained or by the lifting of the float close off the connection to the pump 3 thus stopping the pumping action. If the demand upon the carburetor is less than the quantity delivered to the carburetor, the level of liquid rises in the carburetor and lifts the valve 27, thereby causing an overflow discharge of the liquid back to the pumping chamber 1 and stopping or diminishing the further drawing of liquid into the system by relieving the suction impulses. It will be understood that the carburetor can be equipped with any of the well known admission control valves by which the flow of liquid fuel to the carburetor is stopped off when the liquid level therein rises above normal, at the same time that the overflow port is opened and the suction pulsations in the pumping chamber are relieved.

In Figure 4, I have illustrated a modified construction, showing the pumping chamber embodied integrally with the carburetor float chamber. The float chamber 7′ is formed with a depending portion 46 in which is cored out a pumping chamber 47. The vertical wall 48 of the float chamber 7′ is increased in thickness at one point to allow for a vertical passage 49, which extends up from the pumping chamber 47 to the top of the float chamber wall 48. At its upper end the passage 49 is closed off by a screw plug 51 or the like. This passage 49 has communication at a point above the level of the liquid in the float chamber 7′ with the pipe 2 which leads to the pulsating pump 3. The pumping chamber 47 has inlet communication from the liquid fuel pipe 4 through a threaded nipple or plug 52 which screws up into the bottom of the pumping chamber 47. The plug 52 is formed with a central opening 53, the upper end of which is controlled by a disc check valve 54 which is confined within a valve cage 55, carried on the upper end of the plug 52. The plug 52 and valve and valve cage 54 and 55 are so constructed that they may be threaded up through the bottom of the pumping chamber as a unit. The discharge of the liquid fuel from the pumping chamber 47 to the float chamber 7′ is by way of a short pipe 56 which threads down through the bottom wall of the float chamber 7′ and terminates at a point adjacent the bottom of the pumping chamber 47. The upper end of the discharge pipe 56 carries a valve cage 57 in which is confined a disc check valve 58 for controlling the discharge outlet opening into the float chamber 7′.

The float 24 is guided in its rise and fall on a central stem 59 which terminates at a point below the normal liquid level, as indicated. This stem is bored out to provide the overflow passage 61, which is controlled by the float valve 62. This float valve is yieldably supported by the float 24, as in the previous embodiment, being supported upon a stem 63, which is guided for limited reciprocation in a bridge member 64, extending across a depression 65 in the top of the float. The upper end of the stem 63 is headed, as indicated at 66, and a spring 67 is coiled about the pin to normally retain the valve 62 in its lowermost position. The overflow passage 61 is extended down through the depending casting portion 46 and is closed off at its lower end by a suitable screw plug 68. A drill hole 69 is bored transversely across the bottom of the casting extension 46, so as to intersect the overflow passage 61 and also the fuel inlet plug 52. The end of this cross bore 69 is closed by a suitable screw plug 71. The inlet plug 52 is provided with lateral drill holes 72 in the plane of the drill hole 69 so as to establish communication between the overflow passage 61 and the central passage 53 extending through the plug 52. The interior of the pumping chamber 47 is made accessible by providing a large screw plug 73 in the wall thereof. The top of the float chamber 7′ is closed by a removable cover 74.

The operation is substantially identical with that previously described. The liquid fuel is successively drawn into the pumping chamber 47 and discharged into the float chamber 7′ by the alternating suction and compression impulses transmitted from the pulsator 3. When liquid level in the float chamber 7′ rises above its pre-determined height, the overflow passage 61 is opened by the unseating of the valve 62 and an overflow discharge takes place down into the admission passage 53 in the fuel inlet plug 52. As previously described, this overflow discharge satisfies or partially satisfies the suction impulses acting in the pumping chamber 47, whereby further induction of fuel into the pumping system through the pipe 4 is stopped or diminished. As the liquid tends to maintain a higher level than the predetermined level the float valve 62 will remain off its seat to a limited extent, whereby a small, continuous circulation of fuel will be established through the overflow passage 61, the pumping chamber 47 and the float chamber 7′ so long as the pumping chamber 47 tends to supply fuel to the float chamber 7′ at a faster rate than it is used in the carburetor. It will be apparent that any tendency of the level of the liquid fuel to rise in the pumping chamber 47 and possibly into the vertical passage 49, will diminish the volumetric area of the elastic piston to such an extent that the suction impulses will be insufficient in degree to raise the fuel from the supply tank, and thus there is no possibility of drawing liquid fuel over into the pulsator or pipe line. The discharge pipe 56 by opening at the lowermost point of the pumping chamber 47 prevents any air from being injected into the float chamber 7′ on the compression impulses.

Without further elaboration, the foregoing will so fully explain the gist of my invention, that others may, by applying current knowledge, readily adapt the same for use under various conditions of service, without eliminating certain features which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to me by the following claims.

I claim:

1. In a fuel feed system, a pumping chamber, means for pulsating the air in said chamber for pumping liquid into and out of the same, said chamber having a check valved inlet and a check valved outlet, a supply tank connected with the inlet, a carburetor float chamber communicating with the outlet, a vent connected with the inlet and a float controlled valve in the float chamber controlling said vent.

2. In a fuel feed system, a pumping chamber, air pulsating means connected with said chamber, an outlet port at the lower part of said chamber, a check valve controlling said port, a carburetor float chamber having communication with the outlet port, a supply tank connected to the inlet port, a conduit connecting the inlet with said carburetor float chamber, and a float controlled valve in the carburetor float chamber controlling said conduit.

3. In a fuel feed system, a substantially closed pumping chamber, a pulsometer connected to the upper part thereof, check valved inlet and outlet passages opening into the lower part of said chamber, a carburetor float chamber connected to the outlet, a supply tank connected to the inlet, and means controlled by the carburetor float for admitting an overflow discharge to the inlet.

4. In a fuel feed system, a pumping chamber, means for pulsating the air in said chamber for pumping liquid into and out of the same, said chamber having a check valved inlet and a check valved outlet, a supply tank connected with the inlet, a chamber communicating with the outlet, a vent connected with the inlet and a float controlled valve in the chamber controlling said vent.

5. In a fuel feed system of the kind described, a substantially closed pumping chamber, means connected with the upper part of the chamber for pulsating the air therein, the chamber having valved inlet and outlet ports opening into the lower part thereof, a carburetor float chamber communicating with said outlet port, a supply tank connected with the inlet port, a conduit for connecting the outlet port with said float chamber, and means controlled by the height of liquid in the carburetor float chamber for controlling the admission of fluid to said conduit.

6. In a fuel system of the kind described, a substantially closed pumping chamber, means for pulsating the air therein, said chamber having check valved inlet and outlet passages opening into the lower part thereof, a carburetor float chamber connected to the outlet, a pressure equalizing air chamber interposed between the pumping chamber and the carbureting chamber, a source of liquid supply connected with the inlet, and means controlled by the carburetor float for controlling the supply of liquid to said inlet.

7. In a fuel feed system of the kind described, a closed pumping chamber, means for pulsating the air therein, said pumping chamber having inlet and outlet passages opening into the lower part thereof and controlled by check valves, a carburetor float chamber connected with the outlet, an air cushioning chamber connected with the outlet, a supply tank connected with the inlet, and means controlled by the level of liquid in the carburetor float chamber for controlling the supply of liquid to the inlet.

8. In a fuel feed system of the kind described, a closed pumping chamber, inlet and outlet ports entering the lower part of said chamber, a delivery chamber connected to the pumping chamber, a delivery tube opening into the lower part of the delivery chamber, a check valve at the discharge end of said tube for preventing the return of the liquid to the pumping chamber, a delivery pipe connected to the lower part of the delivery chamber, whereby the upper part of the delivery chamber forms an air cushion and a carburetor chamber connected to said delivery pipe.

9. In a fuel feed system of the kind described, a closed pumping chamber, means connected to the upper part thereof for pulsating the air therein for pumping the liquid into and out of said chamber, the chamber having check valved inlet and outlet ports at its lower part, a carburetor float chamber and a valve controlled by the pulsating means, and means controlled by the level of liquid in the carburetor float chamber for controlling the supply of liquid to the pumping chamber.

10. In a fuel feed system, the combination of a pumping chamber, air pulsating means connected with said chamber, inlet and outlet ports in said pumping chamber, a supply tank connected to said inlet port, a carburetor chamber connected to said outlet port, and means controlled by the liquid fuel in said carburetor chamber for permitting a circulation of liquid fuel from said carburetor chamber into said pumping chamber and back into said carburetor chamber.

11. In a fuel feed system, the combination of a pumping chamber, air pulsating means connected with said chamber, inlet and outlet ports in said pumping chamber, a supply tank connected to said inlet port, a carburetor float chamber connected to said outlet port, and a by-pass controlled by the float in said float chamber for permitting a closed circulation of liquid fuel between said

pumping chamber and said carburetor float chamber.

12. The method of feeding liquid fuel which comprises creating alternating compressions and rarefactions of gas in a closed pumping chamber, drawing liquid fuel into said pumping chamber on the rarefaction impulses, discharging the fuel from the pumping chamber into a carburetor float chamber on the compression impulses, creating a circulation of liquid fuel through the pumping chamber and the carburetor float chamber, and withdrawing fuel for carburation from the volume of fuel circulating through the carburetor float chamber.

13. In a fuel feed system, a pumping chamber, air pulsating means connected with said chamber, an outlet port at the lower part of said chamber, a check valve controlling said port, a chamber having communication with the inlet port, a supply tank connected to the inlet port, a conduit connecting the inlet with said chamber, and a float controlled valve in said chamber controlling said conduit.

14. In a fuel feed system, a substantially closed pumping chamber, a pulsometer connected to the upper part thereof, check valved inlet and outlet passages opening into the lower part of said chamber, a chamber connected to the outlet, a supply tank connected to the inlet, and means controlled by the level in said last mentioned chamber for admitting an overflow discharge to the inlet.

15. The method of feeding liquid fuel which comprises creating alternating compressions and rarefactions of gas in a closed pumping chamber, drawing liquid fuel into said pumping chamber on the rarefaction impulses, discharging the fuel from the pumping chamber into a receiving chamber on the compression impulses, creating a circulation of liquid fuel through the pumping chamber and the receiving chamber, and withdrawing fuel for carburation from the volume of fuel circulating through the receiving chamber.

In witness whereof I hereunto subscribe my name this 20th day of April, 1920.

FRANCIS EDWIN EDWARDS.