L. R. BUCKENDALE.

FUEL PRESSURE FEED SYSTEM.

APPLICATION FILED OCT. 14, 1919.

1,407,374.

Patented Feb. 21, 1922.

5 SHEETS—SHEET 1.

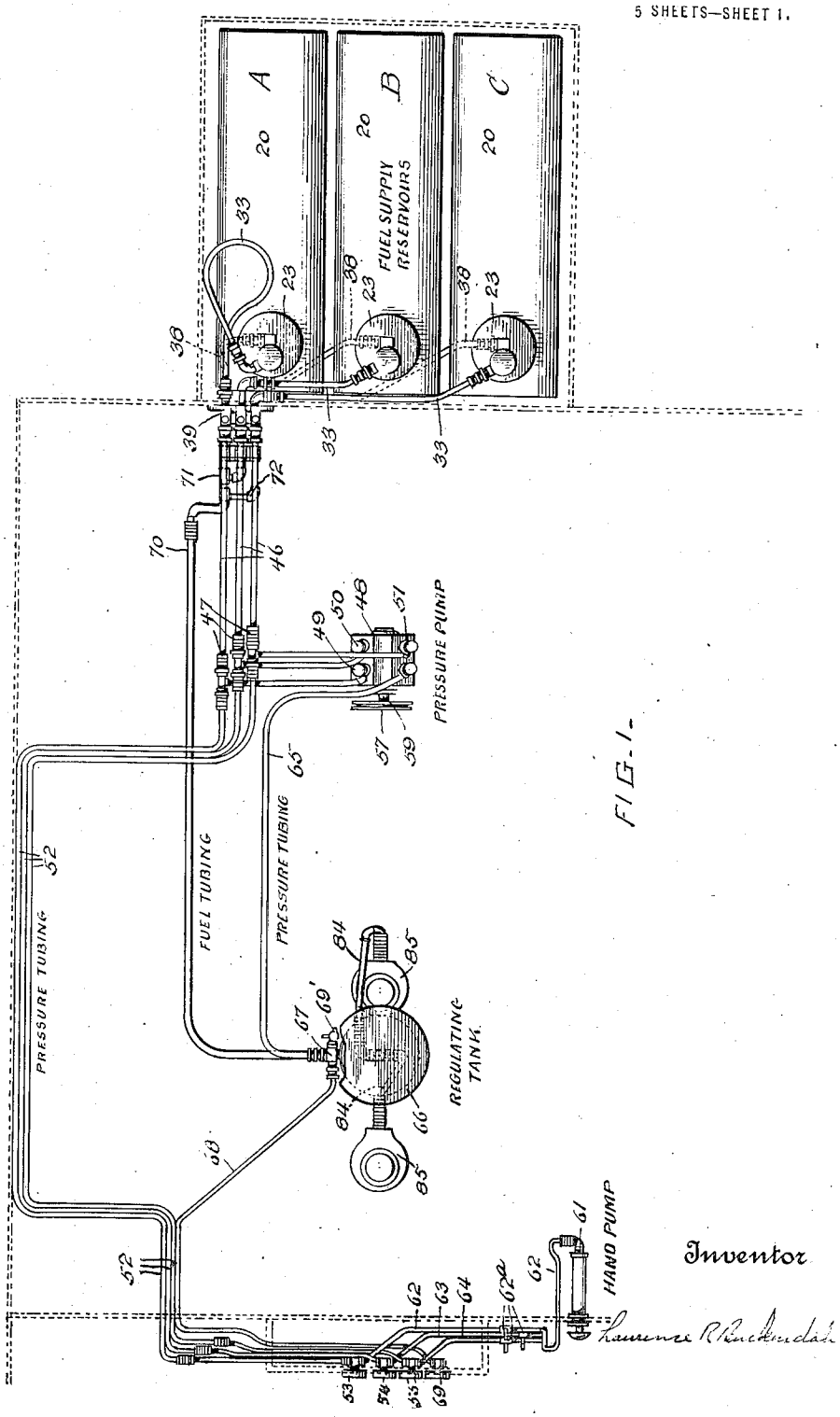


FIG. 1.

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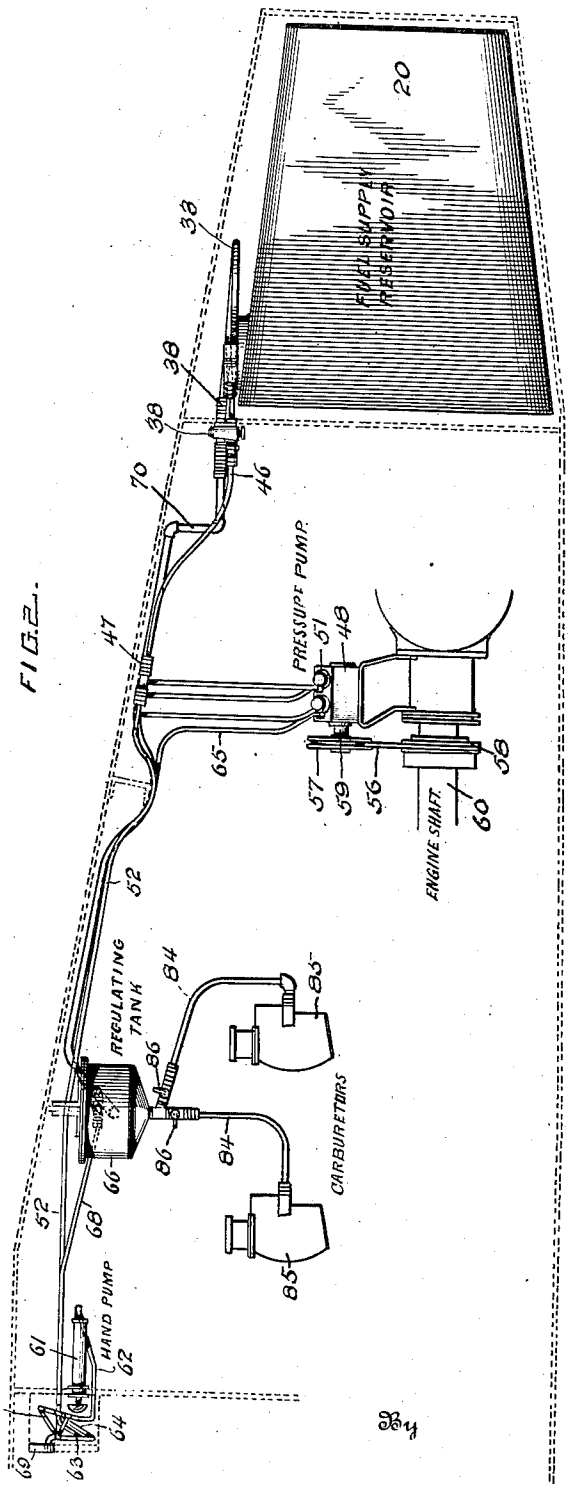


FIG. 2.

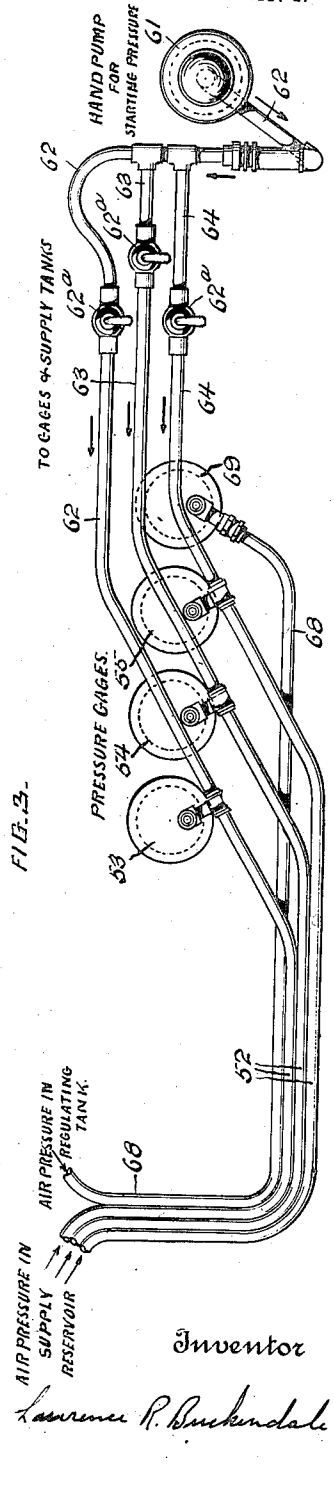


FIG. 3.

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5 SHEETS—SHEET 3.

Fig. 4.

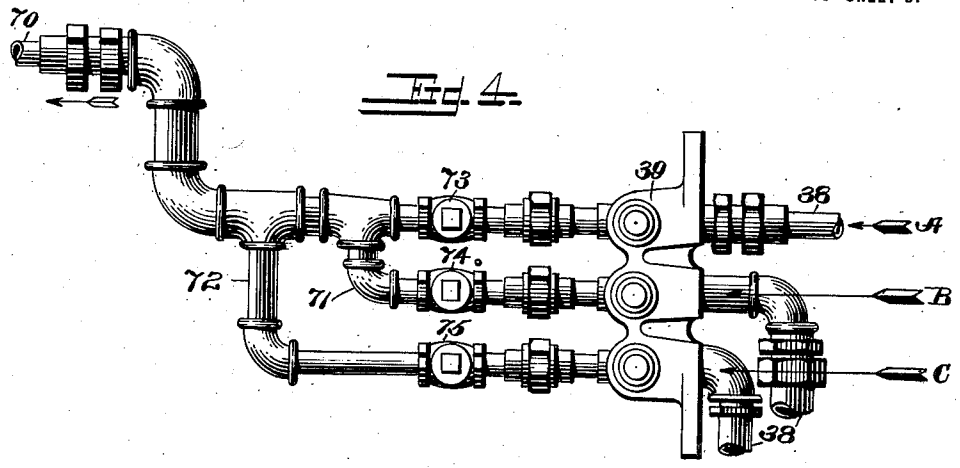


Fig. 5.

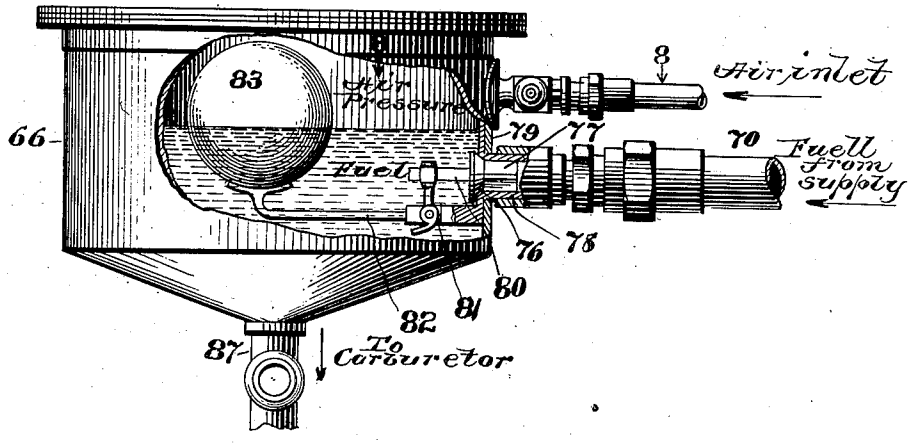
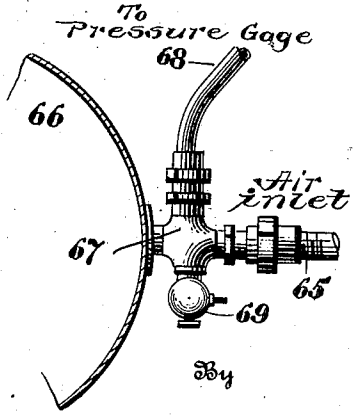


Fig. 6.



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5 SHEETS—SHEET 4.

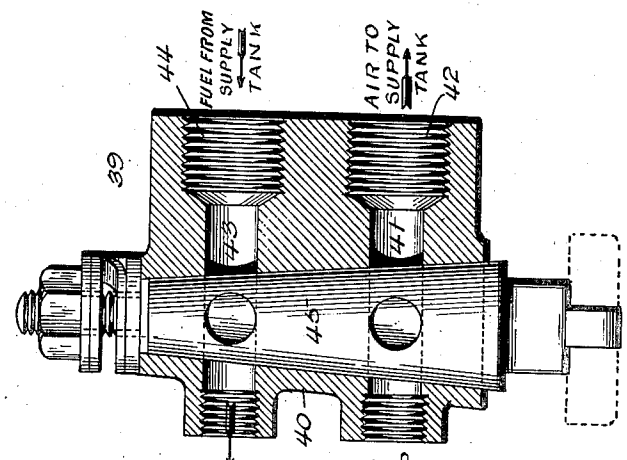


FIG. 9.

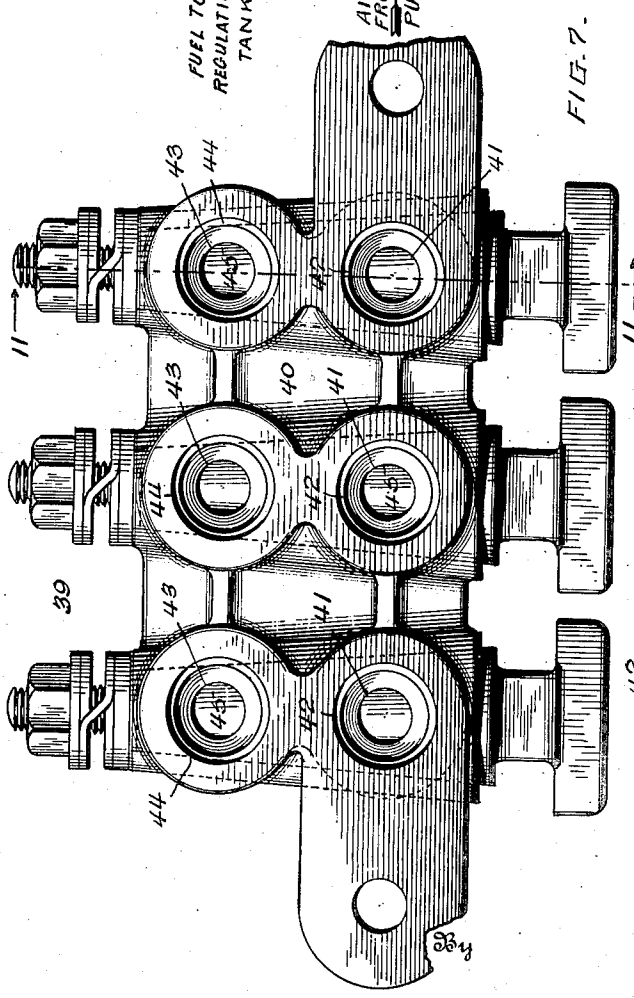


FIG. 7.

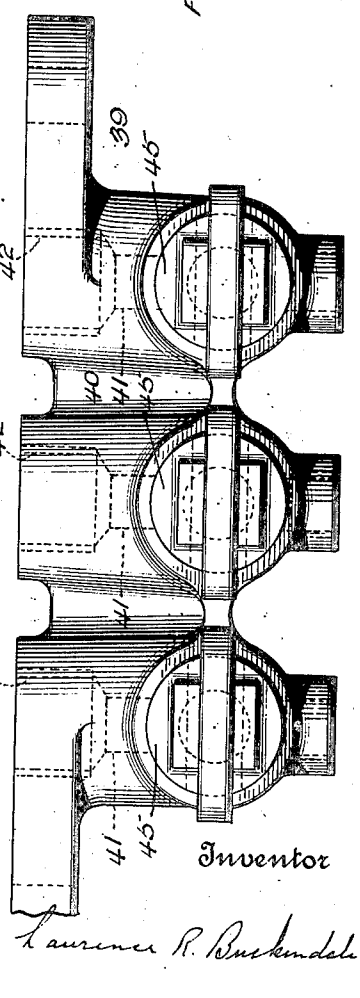


FIG. 8.

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5 SHEETS—SHEET 5.

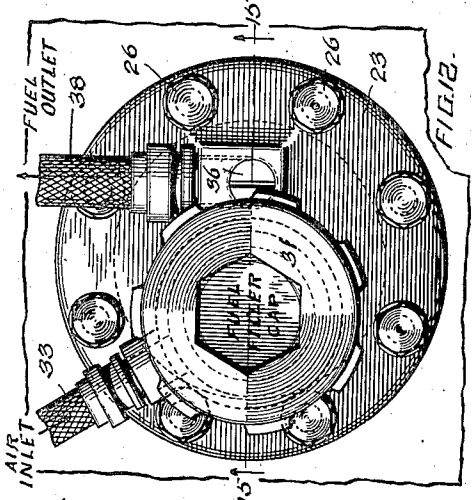


FIG. 12.

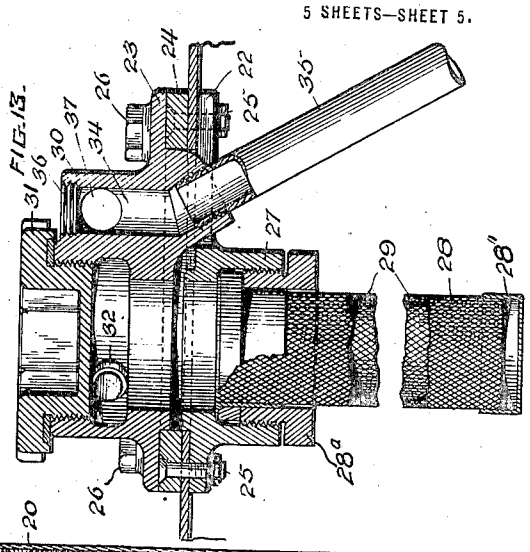


FIG. 13.

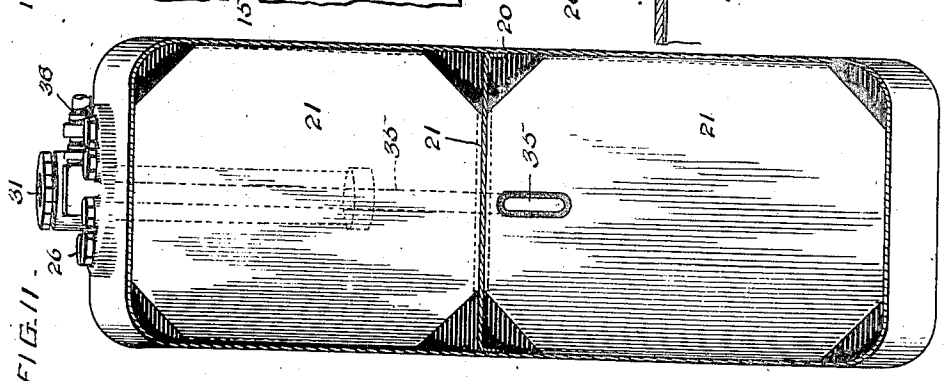


FIG. 11.

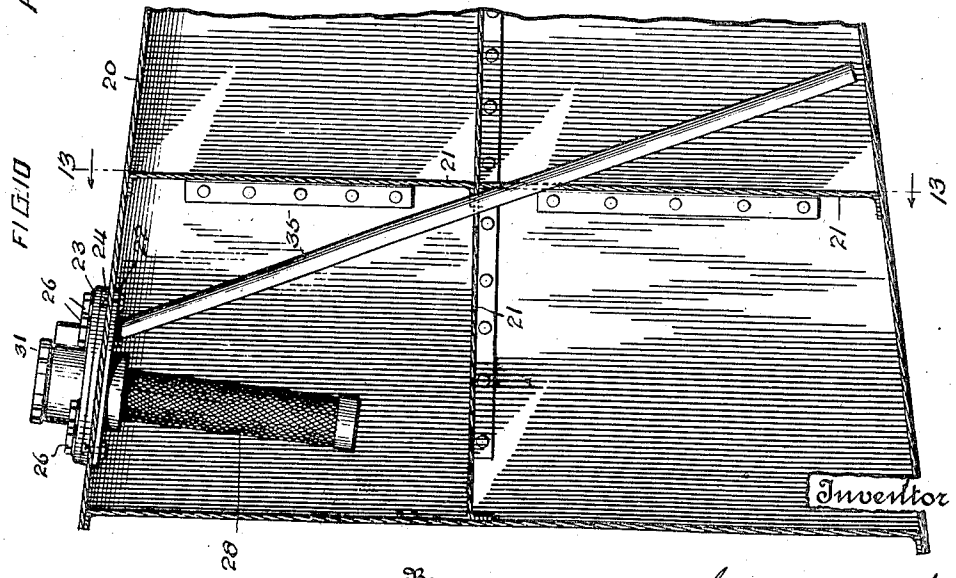


FIG. 10.

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UNITED STATES PATENT OFFICE.

LAWRENCE R. BUCKENDALE, OF THE UNITED STATES ARMY, ASSIGNOR TO NEWTON D. BAKER, SECRETARY OF WAR, TRUSTEE.

FUEL PRESSURE-FEED SYSTEM.

1,407,374. Specification of Letters Patent. Patented Feb. 21, 1922.

Application filed October 14, 1919. Serial No. 330,673.

(FILED UNDER THE ACT OF MARCH 3, 1883, 22 STAT. L., 625.)

To all whom it may concern:

Be it known that I, LAWRENCE R. BUCKENDALE, captain, Ordnance Department, United States Army, a citizen of the United States, stationed at Detroit, Mich., have invented an Improvement in Fuel Pressure-Feed Systems, of which the following is a specification.

The invention described herein may be used by the Government, or any of its officers or employees in prosecution of work for the Government, or by any other person in the United States, without payment of any royalty thereon.

This invention relates to a fuel pressure-feed system for motor driven vehicles, especially adapted for use on tractors and tanks or other machines, wherein the fall from the fuel supply tank to the carbureter is greatly varied, during the operation of the machine.

The object is to provide means whereby gasoline or other liquid fuel may be fed from the fuel supply tank to the carbureter of an engine at a predetermined uniform pressure, regardless of the relative position of these parts to each other.

It has been found in motor driven vehicles of great length, and where the fuel supply tank must be placed a considerable distance from the motor, that a variation of fourteen feet or more in the fall from the fuel tank to the motor is the result when the vehicle is traveling over very uneven ground; and it has also been found in cases where the vehicle is of great weight and the motor is of high power requiring a considerable fuel supply, that the vacuum feeds in general use are not satisfactory. Again the adjustment of the parts of the present invention is very much more expeditiously performed than is possible in a vacuum system, and the operation of this form of feed is not impaired by deterioration, as by wear, of a part of the motor, as is the case when the suction in the cylinder is depended on to create the vacuum and feed the fuel.

It is the object, therefore, to provide means that may be readily adjusted to meet a variety of conditions and as far as possible eliminate the element of gravity and that does not depend on rapidly deteriorating parts of the motor for its operation, and that may be adjusted to a capacity unobtainable in other systems.

A preferred form and arrangement of parts is shown in the accompanying drawings, in which similar numerals indicate corresponding parts in all the figures thereof.

Fig. 1 is a plan view of the improved fuel pressure feed system;

Fig. 2 is a side elevation of the parts shown in Fig. 1;

Fig. 3 is an enlarged elevation of the pressure tubing adjacent to the pressure gages and the hand pump for starting pressure;

Fig. 4 is an enlarged plan view of the cluster of fuel supply tubing, adjacent to the combination tap;

Fig. 5 is an enlarged vertical section of the pressure regulating tank showing the air and fuel inlets and the fuel outlet;

Fig. 6 is a horizontal section on line 8—8 of Fig. 5, showing the air inlet to the regulating tank and its branch pipe for connection with one of the pressure gages;

Fig. 7 is an enlarged elevation of the combination tap;

Fig. 8 is a bottom plan view of the combination tap as shown in Fig. 7;

Fig. 9 is a vertical section on line 11—11 of Fig. 7;

Fig. 10 is a vertical longitudinal section of the filling end of one of the fuel supply tanks showing the fuel strainer and some of the baffle plates;

Fig. 11 is a vertical transverse section on line 13—13 of Fig. 10;

Fig. 12 is an enlarged plan view of the fuel supply tank filler cap and flange, and its air inlet and fuel outlet connections; and

Fig. 13 is a vertical section on line 15—15 of Fig. 12 showing the filler strainer of three layers of gauze, and the upper end of the fuel outlet pipe.

Referring to the drawings, the fuel pressure feed system consists of: a sealed fuel supply reservoir; pressure generating means connected with the supply reservoir, and a pressure gage; tubing connecting the fuel supply and a regulating medium, which supplies the carbureter of the motor; means for supplying pressure to the regulating me-

dium which is also connected with a pressure gage; and an auxiliary pressure generating medium for creating the initial pressure in the fuel supply reservoir, to supply fuel in starting the engine.

In the structure shown and as applied to motor driven vehicles requiring high power motor and large supply of fuel, the fuel supply receptacle for safety purposes is preferably divided or made up into, for instance, three separate reservoirs, indicated at A, B, C, each provided (see Figs. 10, 11, 12, and 13) with vertical and horizontal baffle plates 21—21 to prevent splash of the fuel.

Each supply reservoir is provided with a filling opening in its top plate alined with which is the bore of an internally threaded filling-member 27 having a lateral, circumferential flange 22 encircling the opening and bearing against the inner face of the top plate to which it is secured by screw bolts 25, which pass through alining openings in said flange, the top plate, and a washer 24 seated on the outer face of the top plate.

Registering with the bore of said filling member 27 is the bore of a second filling member 30 having a lateral circumferential flange 23 disposed on the washer 24 and there secured, as by tap-bolts 26.

Communicating with the filling-member 27 is a fuel strainer 28, preferably consisting of a tube 29, made up of three or more thicknesses of screen of the desired mesh closed at its lower end by a cap 28′. In filling the reservoir, the fuel is admitted to the reservoir through the strainer 28, which is secured in position by a screw-coupling 28ª screwed into the filling member 27.

Passage through the filling-members 27 and 30 is normally closed by a screw cap 31, screwed into the upper part of the member 30. Communicating with the bore of said member 30, at a point beneath the cap is an air inlet opening 32 in which is secured one end of an air pressure inlet tube 33.

Extending through the filling-member 30, is a fuel outlet passage 34, having mounted therein, and extending into the supply reservoir to approximately its lowest portion, a fuel outlet pipe 35. Said passage 34 has near its upper end, which is sealed by a plug 36, a fuel outlet opening 37 in which is secured one end of a fuel outlet tube 38.

The fuel supply reservoirs and their caps are as above described, and may be used singly or in a battery, as shown, when the capacity of one is insufficient, or for other reasons the distribution of the fuel into a number of containers is found advisable.

The air inlet tube 33 and the fuel outlet tube 38, as above described are connected, at their opposite ends, with the lower and upper passages, respectively, of a combination tap 39 (see Figures 7, 8, and 9).

The combination tap 39 is provided with three cut-off valves, each controlling the air pressure to, and the fuel discharge from one of the supply reservoirs, said valves and passages for the air pressure and fuel, being so arranged as to be closed or opened at the same time by the operation of the valve.

By reference to Figs. 7, 8 and 9 of the drawings it will be seen that the combination tap 39, is preferably a casting 40, having a series of air passages 41, tapped at 42, for the reception of the ends of the air pressure tubes 33, in communication with the supply reservoirs A, B, and C, (see Fig. 1). The combination tap is also provided with fuel passages 43 arranged above the passages 41, and which are also screw threaded at 44 to receive the ends of the fuel outlet tubes 38 in communication with the supply reservoirs A, B, and C, (see Fig. 1). Stop cocks or valves 45 of the ordinary tapered type are arranged across the passages 41 and 43 and are provided with openings, registering with said passages in such a position as to open and close same simultaneously by the operation of the valve.

Secured to the combination tap 39, and in communication with the passages 41, are air pressure tubes 46, provided with check valves 47. Said tubes are connected with the pressure pump 48 as shown at 49—50 and 51 to provide pressure in the supply reservoirs A—B and C respectively. The pressure tubing 46 and pressure pump are also in communication with pressure gage tubing 52, leading to pressure gages 53—54—55 which indicate the pressure in the reservoirs A, B, and C respectively.

The pressure generator 48 may be operated by belt 56 operating over pulleys 57 and 58 on the pump shaft 59 and engine shaft 60 respectively (see Fig. 2), to maintain the required pressure in the supply reservoirs while the motor is running; but to provide the initial pressure in the reservoirs for feeding the fuel to the motor after it has been standing and the pressure has escaped from the reservoirs, a hand pump 61 (see Figs. 2 and 3) is connected through tube 62 with pressure gage 53 and back through a tube 52 to reservoir A. Branch tubes 63 and 64 connect with tubing 62 and with pressure gages 54 and 55 and back through tubes 52 to reservoirs B and C respectively.

Cut-off valves 62ª are provided in the tubes 62—63 and 64 to direct the pressure into the desired reservoir and to cut out the hand pump after the motor driven pressure generator begins to operate.

Connected with a fourth inlet or outlet of the motor driven pressure generator 48 is a pressure tube 65 (see Figs. 1, 2, 3, 5 and 6) which is connected with the regulating tank 66 through four-way connection 67, and

from said connection, pressure gage tubing 68 extends to the pressure gage 69 mounted with the other gages 53—54 and 55 in such a position as to be readily seen by the operator. The connection 67 is provided with a pet cock 69′ for relieving the pressure in the regulating tank when necessary.

The above constitutes the entire pressure system which provides means for generating the necessary initial pressure for starting, a generator for providing and maintaining pressure while the motor is running for lifting or transferring the contents of the supply reservoir to the regulating tank and also from said tank to the carbureter, and indicating to the operator by gages the pressure in said containers.

The fuel supply tubing shown in full lines in Figs. 4, 5, 6 and 8, consists of the fuel outlet tubes 38 connecting the fuel supply reservoirs 20 and the combination tap 39, and a fuel tube 70, having branches 71 and 72 all connected through check-valves 73—74—75 and passages 43 in the combination tap, with reservoirs A, B, and C, as described.

The fuel tube 70 conveys the fuel to the regulating tank 66, and is provided within said tank with a valve 76 provided with a spider guide 77 operating in a sleeve 78 of a valve seat and pocket member 79. Said valve 76 is provided with a stem 80, connected with one arm of a bell-crank 81, in the other arm of which is mounted the stem 82 of a float 83, adapted to control the depth of liquid fuel in the regulator tank by opening and closing said valve to admit or cut off the inlet of fuel and maintain the desired amount of fuel irrespective of the amount discharged.

From the lowermost part of the regulating tank, the carbureter supply tubes, extend to the carbureters 85—85, and thence the fuel mixture is taken into the engine (not shown). The supply of fuel through either of the tubes 84—84 may be cut off by valves 86—86. Two carbureters are shown merely for illustrative purposes it being obvious that one carbureter only may be used.

By reference to Fig. 5 it will be noted that fuel outlet 87 of the regulator tank is located at its lowest point and that the fuel inlet is also located as near the bottom of the tank as is possible, but on the other hand the air inlet is located at the extreme top or as near thereto as is possible, and finally that the level of the fuel maintained by the float is as far above said fuel outlet and inlet as is practicable for the reason that with this arrangement said fuel outlet and inlet will not be uncovered should the regulating tank be tilted.

It will be understood that the pressure in regulating tank 66 should be kept nearly constant and less than the air pressure in the tanks A, B, and C.

To this end a type of air pump is used in which the unit connected to the regulating tank 66 gives a maximum air pressure less than the maximum air pressure maintained by the remaining units of the pump in the tanks A, B, and C. Any preferred form of air compressor that is equipped with a pressure releasing or adjusting means may be used.

The operation of the above described fuel feed is as follows; the reservoirs 20 are first filled with fuel and the reservoir from which the fuel is to be fed to the engine determined, by opening the cock 45 in the combination tap that communicates with said reservoir. The cut-off valve 62^a in the pressure tube leading from the hand pump to the selected supply reservoir is then opened and the hand pump operated to create the necessary pressure in the reservoir to force the fuel through its fuel tubing to the regulating tank and bring the level of fuel therein up until the float 83 closes valve 76 and prohibits further transfer of fuel. When the gage connected with the reservoir from which the fuel is to be drawn, indicates the proper pressure, the hand pumping is discontinued, and the fuel supply is ready for starting the motor.

When the motor is started the pressure pump 48 is operated and the desired pressure maintained in the reservoir by said motor operated pump, through one of the tubes 46.

It was thought originally that the variation in feed due to difference in fall from the supply reservoir to the motor would be eliminated by placing the regulator immediately above the motor and feeding the fuel therefrom by gravity to the carbureters, but owing, in many instances, to lack of head-room above the motor to provide the desired fall, it was found desirable to add more or less pressure in the regulating tank, to overcome the lack of sufficient fall required to feed the fuel properly, and therefore a unit was added to the well known form of pump shown, which is connected through tube 65 with the regulating tank.

As shown the supply reservoirs A, B, and C are entirely distinct, each being connected through the combination tap and each being provided with pressure tubing, as well as separate fuel connections with the combination tap, to permit the instantaneous shifting of fuel supply from one reservoir to another, by simply closing the combination valve controlling the supply from one reservoir and opening one of the others. The above would be necessary should a leak develop in the reservoir in use, the same being indicated on the gage by an abnormal reduction in pressure, and in fact many causes may arise requiring the change from one to another of the reservoirs.

Having described my invention, what I

claim as new and desire to secure by Letters Patent, is:—

1. A fuel feed for internal combustion engines consisting of a fuel supply reservoir, a fuel regulator tank, an air pump adapted to force the fuel from the reservoir to the regulator, and means for simultaneously cutting off the inlet of air to and outlet of fuel from the reservoir.

2. A fuel feed for internal combustion engines, consisting of a fuel supply reservoir having an air inlet and a fuel outlet, a regular tank to receive the fuel from the reservoir and feed it to the engine, an air pump in communication with the reservoir to force the fuel therefrom and a combination tap located between the fuel reservoir and regulator tank and the reservoir and the air pump adapted to simultaneously cut off the air pressure to the reservoir and flow of fuel from the reservoir.

3. A fuel feed for internal combustion engines, consisting of a sealed fuel supply reservoir having a fluid pressure inlet and a fuel outlet, a fluid pressure controlled regulator having a fluid pressure inlet and a fuel inlet and a fuel outlet, a fluid pressure generator connected with the inlet of the reservoir and with the pressure inlet of the regulator, auxiliary pressure generating means for generating pressure in the reservoir in starting and means for indicating the pressure in the reservoir and in the regulator.

4. A fuel feed for internal combustion engines, consisting of a plurality of supply reservoirs, a regulator, a combination tap controlling the flow of fuel from the reservoirs, and pressure generating means connected with the reservoirs and the regulator.

5. A fuel feed for internal combustion engines, consisting of a plurality of supply reservoirs, a regulator, means for controlling the flow of fuel from the reservoirs to the regulator and pressure means for feeding the fuel from the reservoir to the regulator and from the regulator to the engine.

6. A fuel feed for internal combustion engines, consisting of a plurality of fuel reservoirs having fuel outlets, a regulator common to all of the reservoirs, a fluid pressure generator connected with the reservoirs and the regulator, and means for simultaneously closing the flow of fluid pressure to and the fuel from any one of the reservoirs.

7. A fuel feed for internal combustion engines consisting of a fuel supply reservoir, a regulator, and means for maintaining air pressure in said reservoir and a lower air pressure in said regulator thereby feeding the fuel from said reservoir to said regulator and from said regulator to the engine.

8. A fuel feed for internal combustion engines including a fuel supply reservoir, auxiliary fuel supply means situated at the engine for supplying fuel under pressure thereto and means for supplying fluid pressure to the reservoir and a less degree of fluid pressure to the auxiliary supply.

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