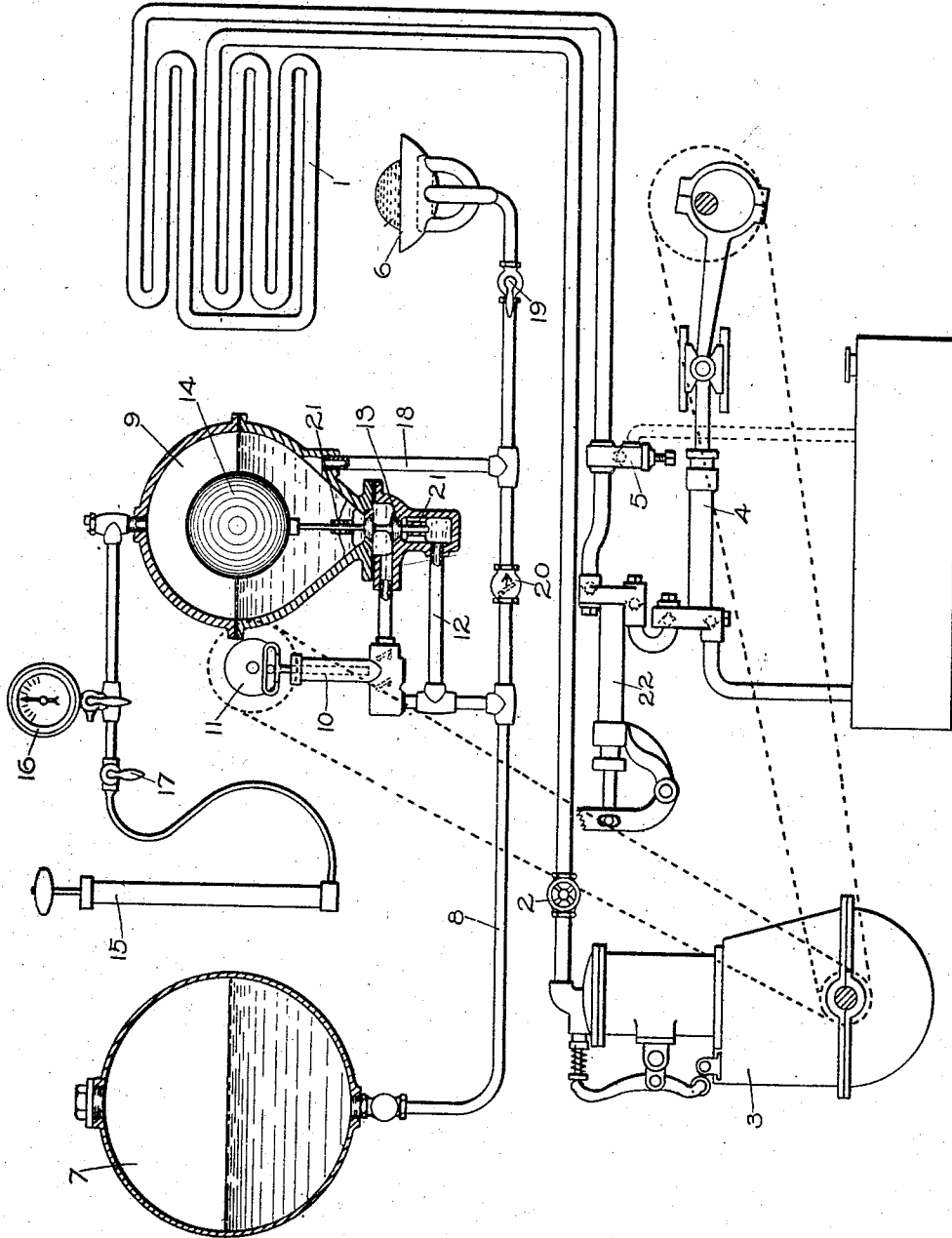


H. LEMP.
SYSTEM OF FUEL REGULATION.
APPLICATION FILED JAN. 13, 1902.

935,916.

Patented Oct. 5, 1909.



WITNESSES.

Robert L. Chapman
Albert F. Macdonald

INVENTOR-

Hermann Lemp,

By *Alfred H. Davis*
Att'y.

UNITED STATES PATENT OFFICE.

HERMANN LEMP, OF LYNN, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SYSTEM OF FUEL REGULATION.

935,916.

Specification of Letters Patent.

Patented Oct. 5, 1909.

Application filed January 13, 1902. Serial No. 89,463.

To all whom it may concern:

Be it known that I, HERMANN LEMP, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Systems of Fuel Regulation, of which the following is a specification.

The present invention relates to steam-generating systems in which a liquid hydrocarbon is used as fuel, and its object is to provide a system of fuel regulation for hydrocarbon burners wherein the supply is maintained under a constant definite pressure at the burner, without subjecting the main fuel tank to other than atmospheric pressure. In this way I avoid storing a large quantity of liquid fuel under an air pressure varying from thirty to fifty pounds per square inch, and thus escape the danger due to possible leakage of the gasoline or other fuel or its sudden discharge in case of a broken pipe.

In the accompanying drawing I have diagrammatically illustrated an embodiment of my invention in connection with a steam generator of the flasher type.

1 represents a boiler, and connected therewith, and controlled by the throttle valve 2, is an engine 3. Water is supplied to the boiler by a pump 4, the latter being driven from the engine by sprockets and chains or other equivalent devices. On account of economical considerations it is preferable that the pump should vary in speed with the engine, but it can be driven from an independent source of power. The pump is capable of delivering at all times the maximum amount of water required by the boiler, and when the demand decreases a suitable regulating device is provided to take care of the excess. In the present instance a relief valve 5 is employed which opens when the pressure on the water end of the boiler exceeds a predetermined amount. It is obvious that other and equivalent means may be employed for effecting this same purpose.

It frequently happens with a system employing a flash boiler that the amount of water contained in the boiler, after a more or less protracted stop, is insufficient for steaming purposes. To obviate this I provide a manually-actuated pump 22, which is used momentarily at starting. It is connected in series with the power pump 4, and its deliv-

ery may be added to that of the latter whenever it be found desirable, as for example when the load is particularly heavy for a brief interval.

Situated in operative relation to the boiler is a combined vaporizer and burner 6, adapted to consume hydrocarbon vapor; it may be of any suitable construction. The fuel is contained in a tank 7, that works at or about atmospheric pressure, and said tank is connected by the pipe 8 with an auxiliary fuel tank 9, containing air under pressure. The fuel tank is preferably, although not necessarily, placed above the burner so that fuel will flow by gravity thereto. Such an arrangement is desirable for starting the system into operation. In series relation with the tanks is a fuel pump 10, of the ordinary displacement type, which increases the fuel pressure between the supply tank 7 and the burner. The pump is driven by a crank-pin mounted on the disk 11, and the latter is connected to the engine by a sprocket and chain or other equivalent device. It is preferable to drive the pump from the same engine which receives steam from the boiler and drives the water pump, as it makes the whole system more flexible and dispenses with secondary motive devices; it also reduces the number of controlling devices required in starting and stopping the system. The pump is provided with the usual suction and discharge valves. Shunting the pump is a by-pass connection 12, containing a valve 13. The ends of the pipes forming the by-pass connection enter the lower portion of the auxiliary tank 9, which portion is made detachable to permit of machining and also to enable the parts to be assembled in place. The valve 13 is provided with two seats and is double acting; when the valve is in the position shown, the continuity of the by-pass connection is interrupted and fuel from the pump is delivered to the auxiliary chamber or tank 9. The valve seats are so arranged that the valve has only a very limited amount of travel, and the parts should be so related that when one valve seat is uncovered the second seat is covered. To the valve stem is secured a float 14, so that when the latter rises to a certain point it opens the by-pass and closes the entrance to the chamber. On the other hand, when the amount of fluid in the tank decreases the valve drops to the position shown and

closes the by-pass. The float 14 is mounted on an extension of the rod carrying the valves 13, which rod is guided above and below the valves by bearings 21. The auxiliary tank 9 is small as compared to the main fuel tank, and the contents thereof are placed under such an air pressure as is suitable to force fuel into the burner under all conditions of operation. For this purpose an air pump 15 is provided, and connected between the pump and the tank is a pressure gage 16. The air pump may with advantage be actuated by hand, since once the tank 9 is subject to pressure it will remain so for a long time. I do not, however, exclude from my invention power pumps for accomplishing this result. Between the gage and the pump is a valve 17, for preventing the escape of air from the tank 9 after the pump has ceased working. The tank may with advantage be placed under an initial pressure, and when the fuel pump 10 is started into operation the pressure will be increased to the predetermined maximum. When this point is reached the level of the fluid will be such that the valve is lifted from its seat and the pump will be by-passed, and thus cease to deliver fuel to the tank.

Connected to the auxiliary tank 9 is a pipe 18, which opens into the vaporizer and burner; and located in the pipe between the tank and burner is a valve 19 for manually controlling the fuel supply to the burner. In addition to acting as a limiting device for the passage of fuel to the burner, the valve is used to interrupt the supply and maintain the pressure in the auxiliary tank when the operation of the system is discontinued. Between the pipe 8 leading from the main tank and the pipe 18 leading from the auxiliary tank is a connection containing a check valve 20, the latter being arranged to open only toward the burner. The object in this check valve is to permit fuel to flow by gravity from the tank 7 to the burner for the purpose of starting, and at the same time prevent fuel from working back to the tank when the pressure on the burner side exceeds that on the tank side.

In starting the system into operation the valve 19 is opened to admit fuel to the vaporizer and burner. If there is no pressure on the tank 9, fuel will flow by gravity from the main tank 7; a torch is then applied to the vaporizer and burner in a manner to heat the parts. The auxiliary tank should then be placed under pressure, and as soon as the burner has heated the boiler to the proper temperature steam is admitted to the engine by means of the throttle. The engine being connected to the pumps will maintain the necessary supply of fuel and water. In case the boiler does not contain sufficient water for steaming purposes, the manually actuated pump 22 is brought into service

for a brief period. Inasmuch as the water pump and fuel pump are both mechanically connected with and driven by the engine, it follows that the whole system of fuel and water supply and regulation is practically under the control of the throttle valve 2.

The regulation of the fuel supply is exceedingly close because the difference between the upper and lower fluid level in the auxiliary tank is very small.

It will be seen that the automatic valve controlling the action of the fuel pump is governed by the level of the liquid in the auxiliary tank, and that is determined by the resultant of two forces, *i. e.*, the air pressure in the auxiliary tank due to the air pump, and the pressure of the fuel system due to the fuel pump.

My invention is particularly useful in connection with self-propelled vehicles, but is not limited thereto, since it can be used in connection with various other power systems.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. In a system of fuel regulation, the combination of a fuel tank working at or about atmospheric pressure, a burner, an auxiliary fuel tank supplied from the first, a pump for increasing the pressure of the fuel supplied to the auxiliary tank, a by-pass valve for regulating the pump, and a float which is acted upon by the fluid level in the auxiliary tank for operating the by-pass valve to regulate the delivery of the pump.

2. In a system of fuel regulation, the combination of a fuel tank, an auxiliary tank working under pressure, a burner receiving fuel from the auxiliary tank, a pump for increasing the fuel pressure in the auxiliary tank, and a means for closing the auxiliary fuel tank against the delivery of the pump and simultaneously opening another delivery for the pump under certain conditions.

3. In a system of fuel regulation, the combination of a fuel supply tank, an auxiliary tank receiving fuel from the first, a pump for placing the contents of the auxiliary tank under air pressure, a pump for maintaining a difference in pressure between the tanks, and means for closing the auxiliary tank against the delivery of the second pump and simultaneously opening another delivery for the pump.

4. In combination, a fuel tank, a fuel pump connected thereto, an auxiliary fuel tank which is fed by the pump, a by-pass

connection around the pump, and a valve which closes the entrance to the auxiliary tank and opens the by-pass under certain conditions.

5 5. In combination, a fuel tank working at or about atmospheric pressure, a burner, a pump for increasing the pressure of the fuel supplied to the burner, an auxiliary tank which is connected to the pump and to the
10 burner and which is working under pressure, and a float located within the auxiliary tank for cutting said tank into and out of connection with the pump and simultaneously closing and opening another delivery for the
15 pump.

6. In a fuel system, the combination of a burner, a fuel tank which is in permanent connection with the burner, a fuel pump arranged to deliver fuel to the tank under
20 pressure, and a valve which automatically closes the tank against the pump and opens another delivery for said pump when the supply in the tank reaches a predetermined amount.

25 7. In a steam generating system, the combination of a boiler, a burner for heating the boiler, a fuel tank, an auxiliary fuel tank, a conduit leading from the auxiliary tank to the burner, a pump for taking fuel from the
30 first tank and supplying it to the second under pressure, a float-valve in the auxiliary tank for by-passing the pump, an engine for driving the pump which receives steam from the boiler, and a throttle valve for the engine which controls the operation of the
35 system.

8. In combination, a burner, a fuel tank, a connection between the tank and the burner, a pump arranged to create a pressure
40 within the tank, a valve, and means for automatically actuating the valve to cut the pump into and out of communication with

the tank and simultaneously disconnect and connect it with another delivery.

9. In a fuel system, the combination of a 45 burner, a source of liquid fuel supply, an auxiliary fuel tank, a pump for forcing fuel into said tank, a pump for creating an air pressure in said tank, a valve controlling the delivery into said tank, and a means which is 50 governed by the varying level of the fuel in said tank for actuating the valve.

10. In a motor vehicle, a vehicle propelling motor, a boiler connected therewith, a fuel reservoir and a pump supplied there- 55 from, means to operate the pump from said motor, a burner with which the delivery pipe of the pump is connected, a pressure chamber connecting with said pump delivery, means responsive to changes in the 60 quantity of fuel in said chamber for positively opening and closing communication with the latter to control the pump delivery to said burner independently of the propelling motor and a relief device for the pump. 65

11. In a motor vehicle, a propelling motor for said vehicle, a boiler connected with said motor, a burner, a fuel reservoir, a pump connected with said reservoir and delivering to said burner, means to operate the pump 70 from said motor, a pressure chamber connected with the pump delivery, a by-pass around said pump, and a pressure regulator which controls said by-pass and positively opens and closes communication between the 75 pressure chamber and the pump whereby a constant pressure may be maintained in said pressure chamber.

In witness whereof, I have hereunto set my hand this tenth day of January, 1902. 80
HERMANN LEMP.

Witnesses:

DUGALD MCK. MCKILLOP,
JOHN J. WALKER.