No. 853,808. PATENTED MAY 14, 1907.

H. LEMP.

BURNER REGULATOR.

APPLICATION FILED JULY 15, 1901.

2 SHEETS—SHEET 1.

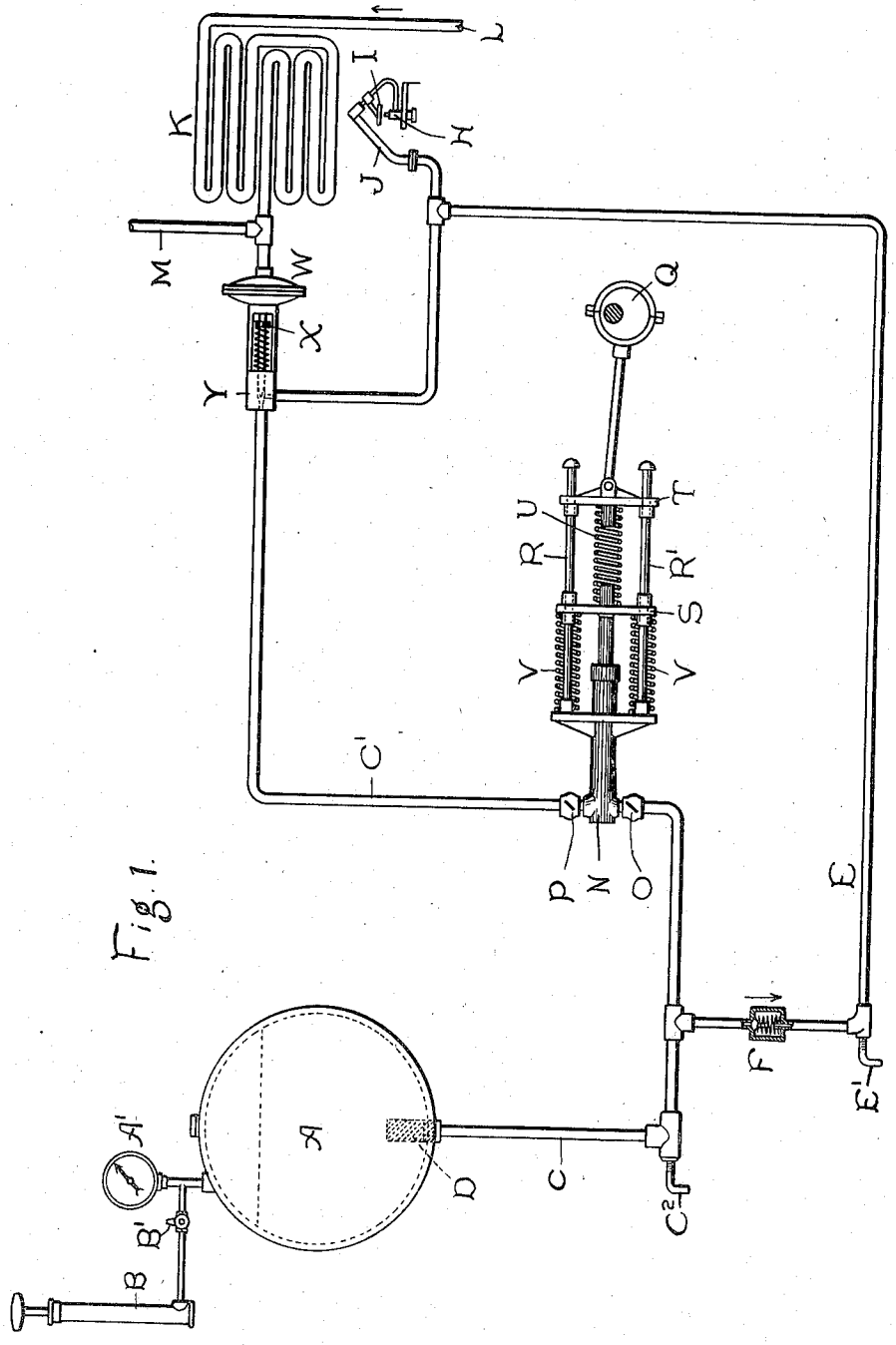


Fig. 1.

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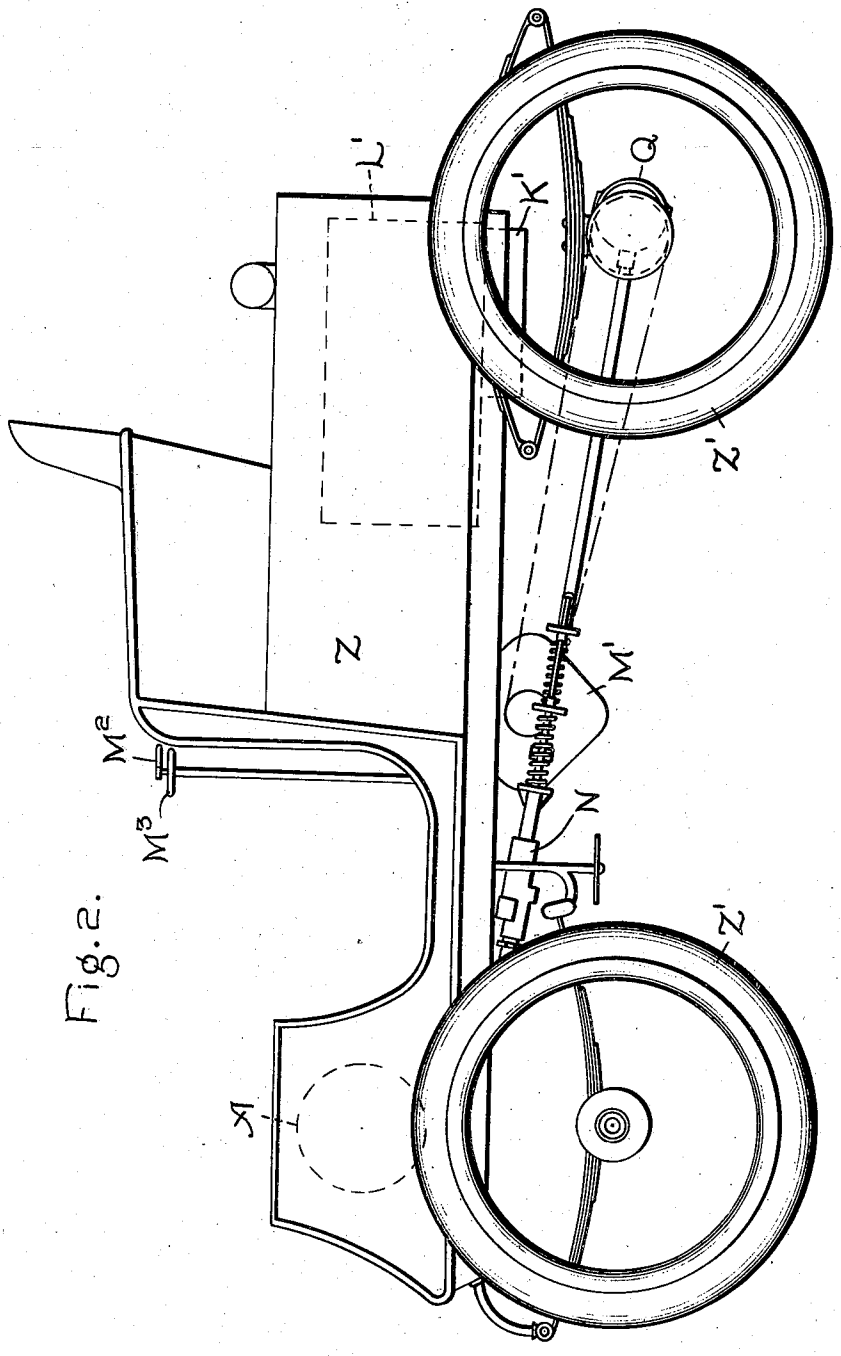


Fig. 2.

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UNITED STATES PATENT OFFICE.

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

BURNER-REGULATOR.

No. 853,808. Specification of Letters Patent. Patented May 14, 1907.

Application filed July 15, 1901. Serial No. 68,347.

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 Burner-Regulators, of which the following is a specification.

The present invention relates to regulators employed to control the supply of liquid fuel to burners, and is more especially intended for automobile service although it is applicable to other uses.

In operating a self propelled vehicle the energy required to drive it varies greatly as the character of the road changes, and in order to operate the same economically, the amount of fuel delivered to the burner should be automatically varied in accordance with the demand made on the boiler for steam. The object of the present invention is to provide a regulator for a system of fuel supply, which regulator is so arranged that the supply of fuel to the burner is always maintained in accordance with the demand on the boiler for steam, and this in a simple and reliable manner.

In the accompanying drawings attached to and made a part of this specification, Figure 1 illustrates diagrammatically an embodiment of my invention wherein the parts are arranged to supply the necessary amount of fuel to a flash boiler, and Fig. 2 represents a side elevation of an automobile.

A represents a tank which is more or less filled with a liquid fuel such as kerosene for example. The fuel in the tank is, when the system is in operative condition, under a certain air pressure, derived from the small hand pump B. A pressure of from two to five pounds on the fuel tank will be sufficient to supply the necessary amount of fuel to the burner when the fire is "banked," or in other words, is reduced to a point where it is sufficient to keep the vaporizer and burner parts hot so that they are in condition for instant starting. Mounted on the tank is a small pressure gage A′ to indicate to the operator the air pressure therein. In the pipe leading from the pump B to the tank is a small cock B′ by means of which the air pressure on the tank may be reduced. This would be done when it was intended to leave the vehicle for a considerable length of time or when it was desired to put more fuel in the tank. Connected to the under portion of the fuel tank is a pipe C which is provided with a filter D to prevent impurities in the fuel from passing to the burner. Connected to the pipe C is a pipe E which leads to the burner, and mounted in this pipe is a check valve F that permits fuel to flow to the burner in the direction of the arrow but prevents it from returning due to back pressure from any cause. In addition to the check valve F between the pipes C and E, a valve C^2 is provided whereby the delivery of fuel to the burner may be regulated; this valve is adjusted for the maximum delivery and forms no part of the automatic regulation. When it is desired to leave the vehicle for any length of time the valve may be closed, thus entirely cutting off the fuel supply. A second regulating valve E′ is placed in the fuel pipe E so that the feeding of the burner due to the air pressure in the tank can be adjusted or cut off entirely, as desired.

The burner may be of any suitable kind, the one illustrated consists of a nozzle H, a baffling plate I for distributing the flames and a vaporizer J. Situated in a manner to be acted upon by the burner is a boiler K, which in the present instance is shown as being of the flash type, but any other suitable form of boiler may be employed if desired. Water enters the boiler through the inlet pipe L, and after passing through the various convolutions of the boiler tubing leaves as steam through the delivery pipe M.

In order to supply the necessary amount of fuel to the burner when the vehicle is in operation, or when power is required when the system is employed for other service, an automatic power pump N is employed having the usual controlling valves O and P. The pump is driven by means of an eccentric Q placed on one of the vehicle axles or on some other driven shaft. The pump is capable of delivering fuel to the burner at all times at a definite pressure, such as 30 pounds for example, even when the eccentric is moving very slowly as would sometimes be the case in going up a steep grade. This means that some compensating or governing device must be provided to take care of the excess fuel supply when the demand for steam is light. Such a device is provided in the combined spring actuating and governing mechanism of the pump.

R and R′ represent stationary guides, and mounted thereon is a sliding cross-head S which is rigidly secured to the pump piston. Connected to the shaft of the eccentric is a sliding cross-head T, and between this cross-head and the pump cross-head S is a stiff spring U. Between the piston cross-head and stationary abutments on the cylinder are coiled compression springs V, which surround the guides R and R′, these springs are intended to compensate for friction and to return the piston to the outer end of its stroke when the eccentric moves the cross-head T to the outer end of its stroke.

As the back pressure on the pump rises to a maximum the piston stroke becomes shorter and shorter, until finally the piston stands still. In the meantime the stroke of the cross-head T continues the same as before since it is connected to the eccentric on the driving shaft, but the difference in movements between the cross-heads is taken up by the coiled compression spring U. Thus the pump is enabled to deliver a variable quantity of fuel, and thereby tends to maintain the pressure of the fuel substantially constant.

Extending between the fuel pipe C and the burner is a pipe C′ which includes the pump N. The passage of fuel from the pump to the burner is under the control of a steam pressure regulator comprising a diaphragm W and a spring pressed plunger X which varies the opening in the fuel controlling valve Y. As the steam pressure on the diaphragm rises, the plunger X more nearly closes the valve opening and therefore reduces the supply of fuel to the burner. On the other hand when the pressure falls, the spring withdraws the plunger from the valve opening and permits more fuel to flow to the burner.

When the pump is in operation the return of fuel to the tank through the auxiliary supply pipe is prevented by means of the check valve in the latter, so that all the fuel delivered by the pump is supplied to the burner, and the pressure of the fuel in the auxiliary supply pipe, on the burner side of the check valve, is always the same as that which exists at the burner. In other words the high pressure supply of fuel controls the low pressure supply as respecting the supply of fuel by the latter to the burner, thus rendering the auxiliary supply subordinate to the main or high pressure supply. When, by reason of high pressure in the steam boiler, or when the pump ceases operating, there is a cessation of the high pressure supply the pressure on the check valve is immediately removed and the auxiliary supply comes into service in direct continuity to the cessation of the main fuel supply. This arrangement presents advantages over systems of fuel supply where by-pass valves are employed as the latter are liable to leak, and it also presents advantages over those systems wherein a high pressure is constantly maintained on the fuel tank for the same reason.

When the steam pressure rises to a predetermined point it closes the valve Y and therefore the passage of fuel from the pump to the burner ceases, but the tank A continues to supply fuel to the burner through the pipes C and E owing to the air pressure contained therein. It will thus be seen that a small amount of fuel is supplied to the burner at all times when the system is in operation. When the boiler pressure falls the valve Y opens and the pump N resumes its duty of supplying fuel to the burner.

Referring to Fig. 2, I have illustrated a self-propelled vehicle in side elevation, wherein Z represents the vehicle body and Z^1 the wheels. K^1 represents the boiler casing which incloses the boiler tubes, and M^1 indicates the engine which receives steam from the boiler. Mounted on the rear axle is an eccentric Q which is connected to the pump N through a flexible connection. At L^1 is indicated in dotted lines the water tank which supplies water to the boiler through the pipe L. The speed of the engine is controlled by the throttle lever M^2 and the reversing lever M^3. The fuel tank A is situated in the front of the vehicle body and is suitably inclosed.

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 combination, a burner, a single source of fuel supply, separate conduits receiving fuel from said source and delivering it at different pressures to the burner through a common delivery pipe, a check valve included in one of the conduits which opens and permits fuel to flow to the burner under a given condition as to pressure and which closes and prevents it from flowing when the other conduit is in service, and means controlling the other conduit.

2. In combination, a burner, a conduit for delivering a low pressure supply of fuel thereto, a check valve in said conduit and means for delivering a high pressure supply of fuel to the burner, the said latter means when operating causing the fuel of high pressure to actuate said check valve to interrupt the supply of fuel through the means for delivering the low pressure fuel supply.

3. In a steam generating system, the combination of a fuel supply tank, means for creating an air pressure within the fuel tank, a burner, a connection from the tank to the

burner, a check valve in the connection which freely admits fuel to the burner at all times, but prevents it from working back into the tank, a second connection between the tank and the burner, a pump in said second connection for increasing the fuel pressure between the tank and burner, which pump is driven from a source of power having a constant stroke, a means for permitting the stroke of the pump to vary, and a device acted upon by the steam pressure of the boiler for varying the opening in the delivery pipe of the pump.

4. In combination, a steam generator, a burner therefor, a fuel tank, two fuel-carrying connections between the tank and the burner, a pump which is included in one of the connections on the burner side for increasing the pressure between the tank and the burner, a check valve in the other connection, means for varying the stroke of the pump, a valve for regulating the fuel supplied by the pump, and means acted upon by the steam pressure for moving the valve.

5. In a steam generating system, the combination of a fuel tank, means for creating an initial air pressure in the tank, a burner, a connection between the tank and the burner, a pump in the connection for increasing the pressure of the fuel delivered to the burner, a second connection leading directly from the tank to the burner so that fuel will be shunted around the pump to the burner when the pump for any reason is not delivering fuel to the burner, a check valve in the second connection and a steam-actuated valve for regulating the delivery of the fuel pump.

6. In combination, a burner, a conduit for supplying fuel to the burner at a low pressure, a check valve in said conduit and means for supplying fuel to the burner at a relatively high pressure which operates to close the valve and interrupt the supply of low pressure fuel and to permit the valve to open for the continuance of low pressure fuel supply upon cessation of the high pressure supply.

7. In combination, a single burner, a single source of fuel supply under pressure, means for supplying fuel therefrom to the burner at a predetermined pressure, mechanically actuated means capable of irregular intermittent action for supplying fuel to the burner at a pressure exceeding that of the other supplying means, and means whereby the supply of fuel through the means for delivering the fuel at a low pressure will be discontinued upon the operation of the means for delivering fuel at a high pressure.

8. In combination, a burner, a source of fuel supply under a predetermined pressure, means for supplying fuel to the burner at substantially said pressure, a power means for supplying fuel to the burner at a relatively high pressure, and means whereby the supply of fuel through the means for delivering the fuel at a low pressure will be discontinued upon the operation of the means for delivering fuel at a high pressure.

9. In combination, a burner, a single source of fuel supply under an initial pressure, two independent conduits directly connecting the burner and source of fuel supply and receiving fuel at the same pressure therefrom, one conduit being adapted to supply fuel from said source to the burner at a constant pressure and the other conduit to supply fuel also from said source to the burner at pressures varying approximately from initial to pressures higher than that of the source, and a means in the first conduit for preventing fuel supplied by the other conduit from flowing back to the tank.

10. In combination, a burner, a single source of fuel supply under an initial air pressure, independent conduits leading directly from the source of fuel supply to the burner, a device in one conduit which permits the fuel to flow from said source to the burner at substantially the pressure on the source and prevents a reverse flow of fuel, and means in the other conduit which receives fuel from said source and supplies it to the burner at variable pressures which are higher than that of the source of supply.

11. In combination, a burner, a source of fuel supply under pressure, independent conduits extending from the source of fuel supply to the burner, one conduit for supplying fuel at the pressure derived from the source of fuel supply, means in the other conduit whereby the fuel may be supplied to the burner at a higher pressure than by the other conduit, and means whereby the supply of fuel through the means for delivering the fuel at a low pressure will be discontinued upon the operation of the means for delivering fuel at a high pressure.

12. In combination, a steam generator, a burner therefor, a source of fuel supply under air pressure, a main supply connection and an auxiliary supply connection between said source and the burner, a pump in the main supply connection, and a means in the auxiliary supply connection which prevents the supply of fuel from the main connection from flowing back to the source of fuel supply and interrupts the auxiliary supply of fuel to the burner.

13. In combination, a steam generator, a burner therefor, a source of fuel supply under air pressure, a main and an auxiliary supply connection between the source and burner, a means in the main supply connection which increases the pressure of the fuel supplied to the burner to a point above that of the source, a valve in the auxiliary supply connection which prevents fuel from passing there-

through from the main supply connection and also interrupts the auxiliary supply, and a single means controlled by the steam in the generator for regulating the main fuel supply.

14. In combination, a steam generator, a burner therefor, a source of fuel supply under air pressure, an auxiliary fuel supply pipe connection, a main fuel supply pipe connection, a pump in the latter tending to deliver fuel at a constant pressure to the burner, a device for checking the reverse flow of fuel delivered by the pump through the former connection, and means in the main fuel supply connection adapted to be acted upon by the boiler pressure for directly controlling the quantity of fuel delivered to the burner by the pump and indirectly to control the auxiliary fuel supply through the fuel delivered by the pump.

15. In combination, a generator, a burner therefor, a pump for supplying fuel to the burner, an automatic regulator for the pump, a steam-controlled regulator for controlling the quantity of fuel delivered by the pump, a conduit for supplying fuel to the burner when the steam controlled regulator interrupts the supply from the pump or when the pump is idle, and a device for preventing backward flow of the fuel in said conduit.

In witness whereof, I have hereunto set my hand this 12th day of July, 1901.

HERMANN LEMP.

Witnesses:

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