H. LEMP.

REGULATOR FOR KEROSENE BURNERS.

APPLICATION FILED OCT. 2, 1902.

1,024,209.

Patented Apr. 23, 1912.

3 SHEETS—SHEET 1.

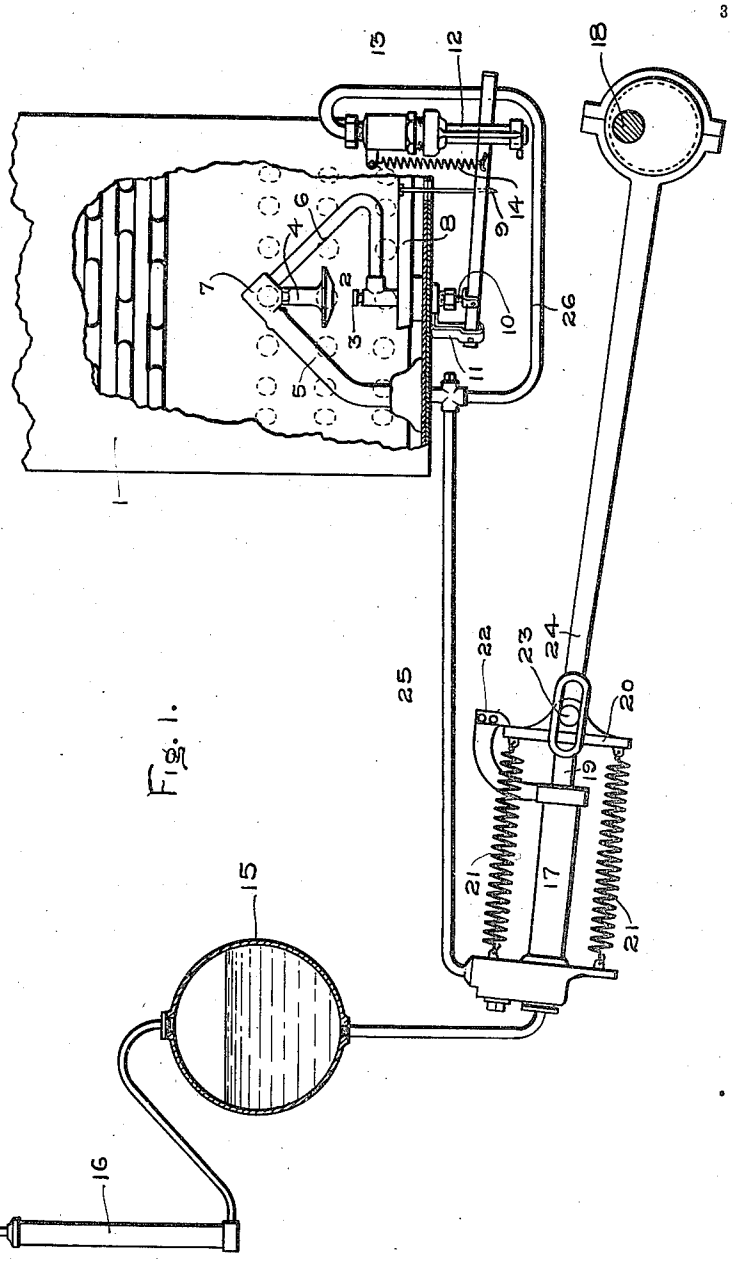

Fig. 1.

WITNESSES.

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3 SHEETS—SHEET 2.

Fig. 2.

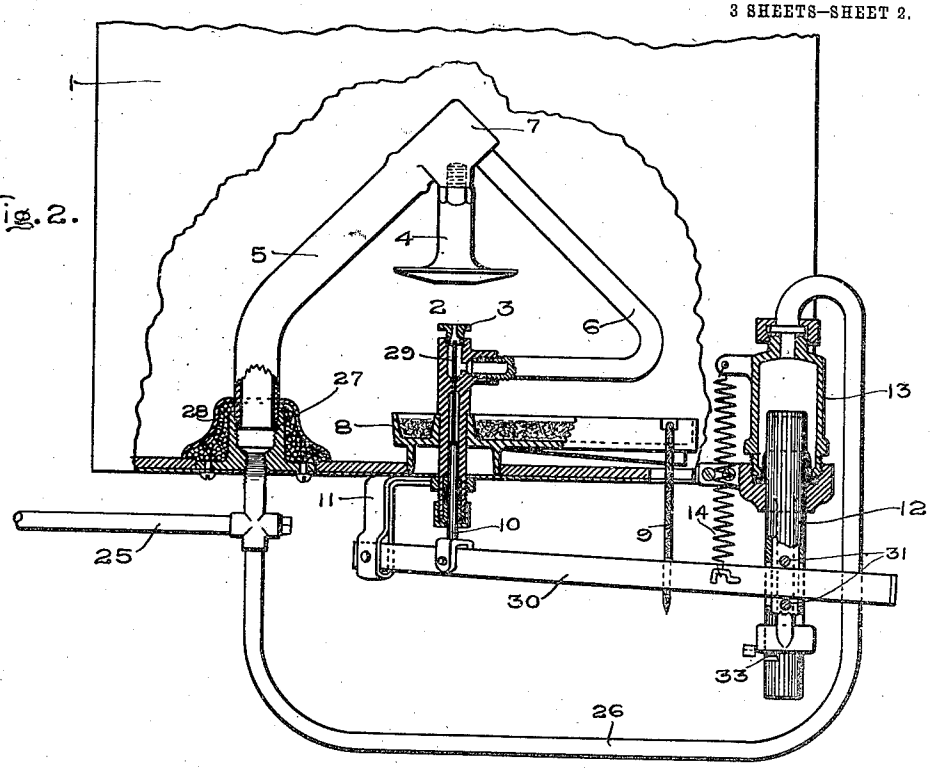


Fig. 3.

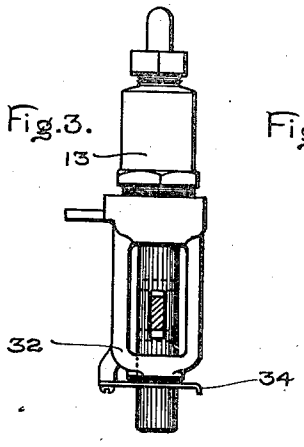


Fig. 4.

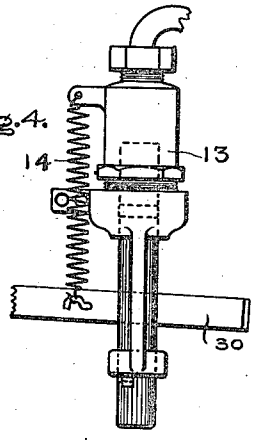
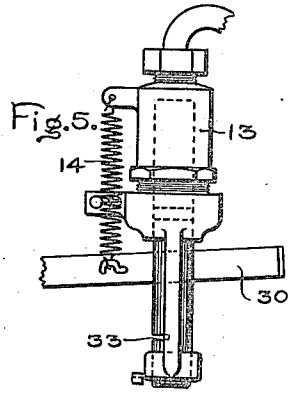


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 6.

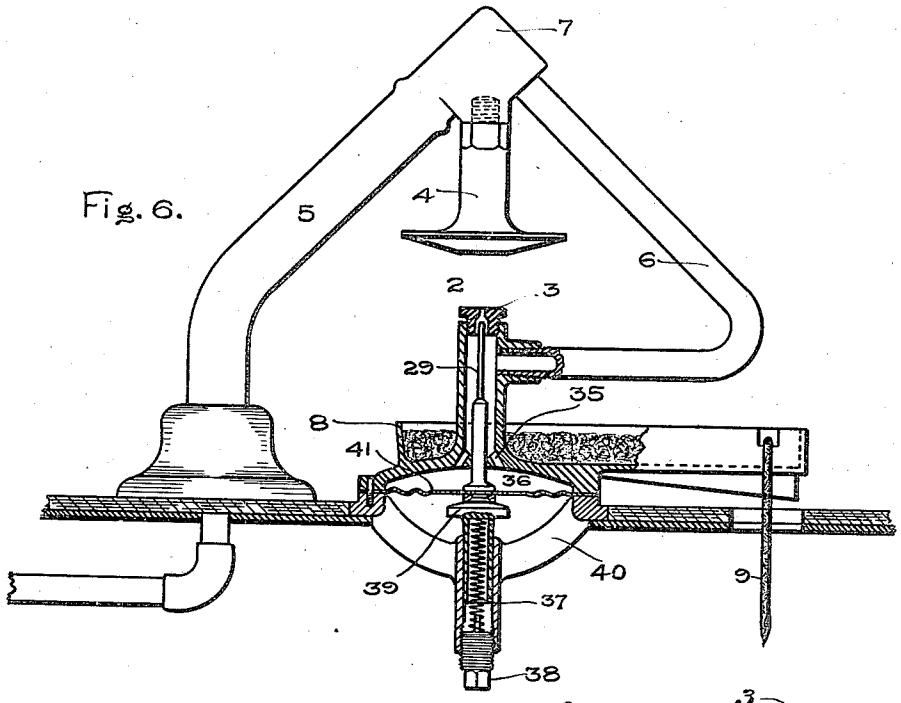

Fig. 7.

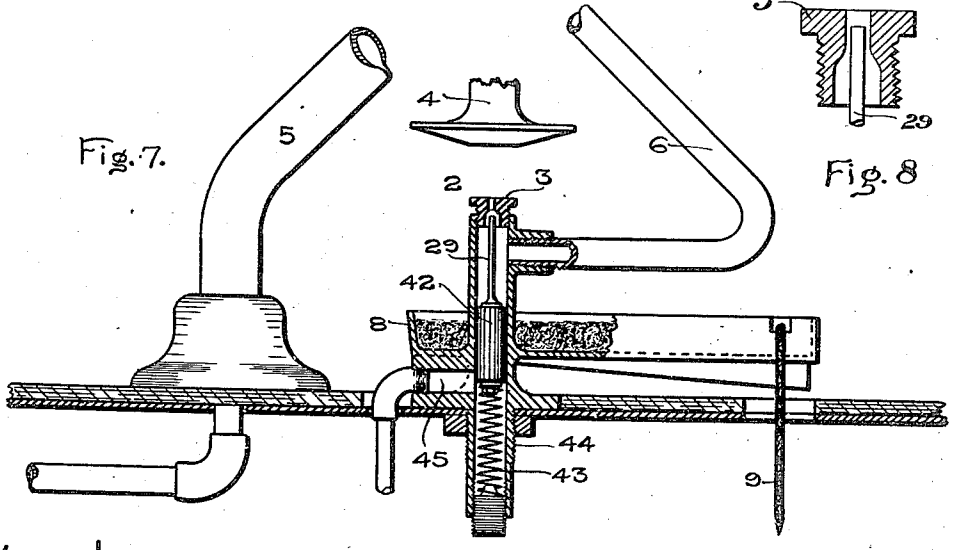

Fig. 8

WITNESSES.

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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.

REGULATOR FOR KEROSENE-BURNERS.

1,024,209. Specification of Letters Patent. Patented Apr. 23, 1912.

Application filed October 2, 1902. Serial No. 125,667.

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 Regulators for Kerosene-Burners, of which the following is a specification.

In operating burners with kerosene wherein the latter is deliverd to the burner opening or openings in the form of vapor, it is of the utmost importance that a relatively high velocity be maintained at all times in order to insure a blue flame. It is also necessary to baffle the vapor at a point a short distance beyond the burner opening so as to cause the proper amount of air to be entrained with the vapor to support complete combustion. If a stream of kerosene vapor passing through an opening at high velocity be properly baffled and ignited it will continue to burn so long as vapor is supplied, but if the baffle plate is removed, the other conditions remaining unchanged, the flame will go out. This shows how important it is to keep the baffle plate at the proper distance, and also that the flame unless properly treated is unstable.

The vapor jet should be discharged from the burner opening at a high velocity, and as the pressure on the burner rises the burner opening should be automatically increased, otherwise the very force of the vapor itself may cause the flame to be extinguished. This last action seems to be due to the fact that the vapor is not retarded sufficiently to burn. When the pressure decreases the burner opening should be correspondingly decreased otherwise the flame will be yellow, which is objectionable. In other words the burner opening should be varied to compensate for changes in fuel pressure and this variation must be made from a point below the opening, otherwise the character of the flame will be impaired.

In the operation of automobiles it is necessary to arrange the fuel system so that the burner can be kept in service with a greatly reduced flame under certain conditions of service, such for example, as when the vehicle is standing idle or is not using steam. It is customary for this purpose to place the fuel tank under a small initial air pressure of from 5 to 10 pounds, which is sufficient to supply the burner when the vehicle is standing idle. When the vehicle is in operation the power pump increases the pressure of the fuel delivered by it to 40 or 50 pounds. It will be evident from the foregoing that the regulating device must be capable of working automatically over a wide range.

The present invention has for its object to provide an automatic regulator for kerosene burners which will fulfil the conditions specified above and at the same time be free from objectionable features.

For a consideration of what I consider to be novel and my invention attention is called to the description and claims appended thereto.

In the accompanying drawings which illustrate embodiments of my invention Figure 1 is a side elevation partly in section of a burner and the means employed to maintain the desired fuel pressure thereon; Fig. 2 is an enlarged view of a burner showing the pressure device for controlling its action; Figs. 3, 4 and 5 are detail views of the means employed to actuate the burner valve; Fig. 6 is a slightly modified form, shown in vertical section, of the means employed to actuate the burner valve; Fig. 7 is a further modification, shown in vertical section, of the means employed to actuate the burner valve; and Fig. 8 is a detail view on a larger scale of the burner nozzle and a portion of the valve that controls the flow through said nozzle.

Referring particularly to Fig. 1, 1 designates a boiler of any suitable construction having boiler tubes inclosed therein. In the present instance a coil boiler designed to furnish superheated steam is shown, but any other kind of a boiler may be used in its place. Situated within the lower portion of the boiler casing is a kerosene burner 2, which is designed to burn the fuel in vapor form. It is provided with a single opening formed in the detachable nozzle or piece 3, and situated directly above the opening is a detachable baffle plate 4 having a suitably inclined baffle face or faces arranged to spread the vapor as it is received from the opening and cause it to mingle with or entrain the proper amount of air to support combustion. The wall of the fire chamber is provided with air inlets as indicated by the small dotted-line circles. The inclined tube

5 is employed to vaporize the fuel as it is received from the tank or the pump, and the inclined tube 6, which is more easily heated than is the vaporizer tube 5, connects the latter with the burner. The object in making the tube 6 thinner or more easily heated than the vaporizer 5 is to insure the proper vaporization of all of the fuel before it is discharged from the burner nozzle. The tubes 5 and 6 are united by a union 7, and I have found it desirable to electrically weld these parts together. It is advantageous to incline the vaporizer 5 so as to prevent the fuel from passing through the vaporizer in the form of separated bodies or masses and causing pulsations or fluctuations of the flame itself. With the arrangement shown there is no opportunity for this to happen or for the fuel to be pocketed. Situated below the burner opening is a tray 8 containing a body of asbestos or some similar material which forms a wick. To this wick is secured a second or lighting wick 9 that extends through a hole in the bottom of the boiler casing where it is readily accessible. The burner opening is controlled by a valve that is carried on the stem 10 which is attached to a lever 30, the latter being pivotally secured to a bracket 11 at one end and connected with a piston 12 at the other. The piston is arranged to work within the cylinder 13, and its outward movement is opposed by the extension spring 14. The pressure on the burner system acting through the piston tends at all times to force the valve downward and enlarge the burner opening, while the spring 14 tends to close or reduce the burner opening. Fuel for the system is supplied from a tank 15. This tank is preferably above the burner opening so as to cause the fuel to flow by gravity, and I prefer to place it under an initial air pressure of from 5 to 10 pounds by the air pump 16. This initial pressure is sufficient to keep the burner in operation when the vehicle or other apparatus to which the burner is connected is standing idle. In order to increase the pressure on the fuel system to the necessary point a power pump 17 is provided, which pump is of the displacement type and is driven from an eccentric that is mounted on the power shaft 18. In ordinary practice I find it desirable to drive this shaft directly from the main engine but it can be driven in any suitable way. Mounted for movement within the pump cylinder is a piston 19 having a crosshead 20. To this crosshead are secured the extension springs 21 which tend at all times to move the piston inward against the pressure of the fuel system. By adjusting the springs the pressure on the fuel system may be varied. The outward movement of the piston is limited by the stop 22. The crosshead is provided with a pin 23 which works in a slot formed in the end of the connecting rod 24. This slot and pin form a lost-motion connection between the pump and the driving means. Each time the eccentric moves the connecting rod to the extreme right the pump piston is brought to the position shown, and if the pressure on the fuel system is less than the maximum the springs 21 will move the piston inward and cause it to force the fuel through the pipe 25 to the vaporizer. On the other hand if the burner pressure is at the maximum the piston will remain against the stop 22 as is shown in the drawing, in which case the load is entirely removed from the eccentric. This is especially advantageous where the apparatus is in service on an automobile where every saving in energy is of great importance.

Connected to the pressure pipe of the fuel system and to the cylinder 13 of the regulator is a pipe 26, and as the pressure in the pipe 25 varies it follows that the pressure in the regulating cylinder 13 is correspondingly varied. Referring now to Fig. 2, the construction and action of this regulator will be described. To the base of the boiler is secured a casting 27 that is screw threaded to receive the vaporizer tube 5. This joint is suitably inclosed at 28. The burner proper is provided with a screw threaded cap or nozzle 3 containing a single opening, which opening increases rapidly in size as it recedes from the surface of the cap. Situated posterior to or, as illustrated, below the opening and directly in line therewith is a valve 29 which is mounted on the upper end of the rod 10. When the lever 30 moves up and down it follows that the valve 29 will move correspondingly. The construction of the valve and the opening and the relation between them and the pressure device is such that when the valve is in its extreme upper position an opening is provided which is sufficient to maintain the burner in operation and keep the parts hot. This opening is formed between the valve and the adjacent wall of the nozzle passage by so constructing the valve that it does not completely fill the passage, as for example, by making the valve of slightly smaller diameter than the passage. This arrangement and construction of the valve is such that when the power pump 17 is out of action and the burner is depending upon the pressure in the fuel tank, it will permit the vapor to be discharged under high velocity resulting in a blue flame. The tank pressure is not sufficient to overcome the action of the spring 14 and the burner opening remains at a minimum until the pump is started again. It will thus be seen that the parts coöperate to produce a unitary result, *i. e.* maintaining a high vapor velocity at

the nozzle, through a wide range of pressures. The piston 12 of the regulator is made tubular in order to decrease the weight, and is provided with pins 31 which engage the top and bottom of the lever 30. As the piston moves up and down under the action of the spring 14 and the pressure in the pipe 26, it is evident that the position of the valve 29 within the burner opening will be varied and the amount of fuel correspondingly increased or decreased to satisfy the conditions of operation. The character of the power pump is such that it tends to maintain a constant pressure at all times, and it coöperates with the regulator to attain this result. To put the matter in a different way the fuel pump takes care of the major changes in operating conditions while the regulator takes care of the minor changes, but they are mutually dependent one upon the other.

In Fig. 3 is shown an end elevation of the regulator together with the guide 32 for directing the movements of the piston at its outer end. Formed in the piston is a slot 33 and pivotally mounted on the guide is an arm 34 which can be moved into or out of engagement with this slot. The object of this arrangement is to cut out the automatic regulator when for any reason it becomes necessary and leave the burner with a fixed opening, the pump regulator meanwhile performing its work in the usual manner.

In Fig. 4 the actuating lever 30 is shown in its extreme lower position, and in Fig. 5 the lever is shown in its extreme raised position.

In the arrangement described, the connection 26 of the regulator is taken from a point between the pump and the vaporizer, hence the fuel itself acts on the regulating mechanism.

Referring to Fig. 6, I have shown a slight modification of my invention wherein the pressure of the vapor is employed, as distinguished from that of the liquid fuel, to actuate the valve 29. This arrangement possesses certain advantages over the one previously described in that all stuffing boxes can be dispensed with and a tight joint readily maintained around the diaphragm. The vapor enters from the pipe 6 and passes through the openings 35 into the diaphragm chamber 36. The downward movement of the diaphragm is resisted by the adjustable coil spring 37. By changing the position of the screw threaded plug 38, the compression of the spring and therefore the action of the regulator can be varied. The spring is inclosed within a tubular extension of the head 39 and is guided by the walls of the support 40. In this particular form of my invention when the pressure on the vaporizer decreases due to the stopping of the power pump, the diaphragm 41 rises and forces the valve 29 into the opening in the nozzle 3. This decreases the fuel opening in accordance with the decrease in pressure and a blue flame will be the result. When the pressure on the system increases due to the starting of the power pump, the diaphragm 41 will be forced downward owing to the increased pressure within the diaphragm chamber 36 and the valve 29 will be removed from the opening.

Referring to Fig. 7, I have shown a further modification of my invention wherein the regulator is provided with a piston 42 that is acted upon by the kerosene vapor from the vaporizer 6. To the piston is secured the valve 29. The operation of the piston is opposed by an adjustable coil spring 43. In order to prevent the accumulation of condensed fuel in the cylinder 44, a relief passage 45 is provided that is piped to the outside of the boiler and burner casing. As the vapor pressure varies the piston 42 moves up or down as the case may be and like the devices previously described varies the burner opening from a point below the flame where it will not interfere with its efficient operation and thereby maintains the velocity of the vapor approximately constant.

It is to be understood in connection with Figs. 6 and 7 that suitable means are employed for supplying fuel under pressure to the burner, such as the one shown in Fig. 1. It is to be especially noted that all regulation takes place before the vapor passes the nozzle, and by this means the character of the flame is at all times satisfactory.

In accordance with the patent statutes I have shown one form of apparatus for carrying out my invention but it is to be understood that the drawings are only illustrative and that the invention can be carried out by other and equivalent means.

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

1. In combination, a burner provided with an opening adapted to discharge a jet of vapor at high velocity, a fuel system arranged to automatically deliver fuel to the burner under high or low pressure in accordance with changes in the demand for fuel, and means for maintaining the velocity of the vapor jet which comprises a device controlled by the pressure of the fuel system and having a member arranged within the burner opening posterior to its outlet end for automatically varying the effective area of said opening.

2. In combination, a burner having an opening which discharges an unbroken stream of vapor, a fuel system arranged to supply fuel at a variable pressure, a valve situated below the burner opening and adapted to control the effective area thereof, and a device sensitive to the pressure on the

fuel system which is arranged to move the valve in the direction of the stream when the pressure is decreased and in the opposite direction when the pressure is increased.

3. In combination, a burner having an opening which discharges an unbroken jet of vapor at high velocity, a fuel system arranged to deliver fuel to the burner under pressure, a regulator for the burner which is sensitive to the pressure variation of the fuel system which regulator varies the effective area of the burner opening without changing the velocity of the issuing jet and a means for rendering the regulator inoperative to permit the burner to operate with a fixed opening.

4. In combination, a burner of the jet type, a fuel tank connected therewith, means for imparting an initial pressure to the tank for causing fuel to flow automatically therefrom to the burner, a pump arranged to receive fuel from the tank and deliver it to the burner at a different pressure, and a regulator for the burner comprising means which is subjected to the action of said pressures but is sensitive to the pressure of the fuel due to the pump and substantially insensitive to the pressure due to the tank.

5. In combination, a burner having a nozzle, a fuel tank, a pump which increases the fuel pressure between the tank and the burner, said pump having means for limiting the pressure of its delivery, conduit connections between the tank and the pump and between the pump and the burner, and a regulator for the burner which is arranged on the inlet side of the nozzle and varies the effective area of the passage through the nozzle, said regulator being acted upon by the pressure of the fuel system to move it in a direction to increase said area.

6. In combination, a burner having a nozzle, a fuel tank, a pump for increasing the pressure in the fuel system, conduit connections between the tank and the pump and between the pump and the burner, a valve located in the inlet portion of the nozzle, and means for varying the position of the valve in accordance with changes in pressure in the system comprising a device acted upon by the pressure whereby said pressure tends to open the valve, and means tending to move said device in opposition to the pressure to close the valve.

7. In combination, a burner, a source of fuel supply, a pump for delivering fuel from the source to the burner at an increased pressure, conduit means connecting the source with the pump and the pump with the burner, a valve situated below the opening of the burner and adapted to vary the effective discharge of fuel therethrough, means connected with the valve and adapted to actuate the same in one direction by the pressure of the fuel, and a tension device tending to operate against the fuel pressure for actuating the valve in the opposite direction.

8. In combination, a burner having a vapor discharging opening, a fuel supply system, a valve situated below the burner opening and having a diameter less than that of the opening so as to permit a limited flow of vapor when the valve is in its closed position, means for yieldingly supporting the valve in the opening and tending to normally retain it therein, and a pressure device connected with the fuel system and coöperating with said means for withdrawing the valve downward from the opening as the fuel pressure increases and moving it up into the opening as the fuel pressure decreases.

9. In combination, a burner, conduit means supplying fuel to the burner, a valve situated below the burner opening in coöperative relation thereto and capable of only partially closing the same so as to leave at least a small passage for the flow of fuel under all conditions, a pressure device acted upon by the fuel pressure for opening the valve, and a discharge conduit connected with the pressure device through which condensed vapor discharges.

10. In a fuel system, the combination of a burner having a nozzle, a regulator therefor which is arranged on the inlet side of the nozzle and controls the effective area of the passage through said nozzle, said regulator including a device acted upon by the pressure of the fuel for opening the valve, a pump, conduit means connecting the pump with the burner, a power shaft for driving the pump, and a driving connection between the shaft and the pump which permits the stroke of said pump to vary in accordance with changes in the pressure of the fuel.

11. In combination, a burner, a source of fuel supply capable of supplying fuel to the burner at a substantially definite pressure, a pump for increasing the pressure of the fuel supplied to the burner and having an automatic regulator which varies the effective delivery of said pump when the pressure tends to exceed the normal, and a pressure actuated regulator for the burner which is sensitive only to the pressure of the fuel delivered by the pump.

12. In combination, a burner, a source of fuel supply capable of supplying fuel to the burner at a substantially definite pressure under certain conditions, conduit means between the source and the burner, a pump arranged in said conduit means for increasing the pressure of the fuel from said source and supplying it to the burner under other conditions, said pump having automatic means for regulating its action, a valve for the burner permitting the fuel to be delivered to the burner by the pressure of said source,

and a pressure device under the control of the fuel delivered by the pump which opens the valve when the pressure of said fuel increases and vice versa.

13. In combination, a burner having an opening for delivering a jet of fuel vapor therefrom, a valve therefor capable of partially closing the burner opening in its position for least flow, and a yielding abutment responsive to changes in the full pressure which opens the valve when said pressure increases.

14. In combination, a burner having a jet orifice, a valve therefor arranged on the inlet side of the orifice, said valve being smaller than said orifice so that the valve can close the orifice to a limited extent only, and a pressure device connected with the valve which is responsive to the pressure of the fuel supplied to the burner and moves the valve to increase the effective area of the orifice as the pressure rises.

15. In combination, a burner having a permanent opening, a valve working in the inlet portion of the opening of the burner and adapted to vary the quantity of fuel discharged therefrom, means controlled by the pressure of the fuel supplied to the burner for actuating the valve, and means for supplying fuel to the burner.

16. In combination, a source of fuel supply under pressure, a burner supplied from said source and having a permanent jet opening, a valve for the burner that acts on the fuel prior to its exit from said opening, means controlled by the pressure of the fuel supply and operatively connected to the valve for automatically varying the quantity of fuel issuing from the jet opening, and a baffle plate arranged axially in the line of the fuel jet.

17. In combination, a source of fuel supply, a burner having a jet opening, a connection between the source and the burner, a valve for the opening permitting a permanent passage for the fuel therethrough, and means controlled by the pressure of the fuel supply for operating the valve for increasing the quantity of fuel passing through the opening as said pressure increases, or vice versa.

18. In combination, a burner nozzle provided with a passage having a cylindrical portion adjacent its outlet end and a portion adjacent its inlet end which is larger than the outlet, a needle valve that is made of slightly smaller diameter than said cylindrical portion to provide at least a small passage for the fuel at all times, which valve extends into said passage from its inlet end, means for supplying fuel to the nozzle, a device controlled by the pressure of the fuel supply, a spring which opposes the action of the pressure on the device, and a connection between said device and the needle valve for moving it back and forth in the nozzle passage to vary the effective area of the passage when said pressure varies.

19. In combination, a burner having an opening that discharges a stream of fuel, means which supplies fuel under pressure to the burner, a valve device arranged posterior to the outlet of the burner opening for regulating the effective area thereof, and means controlled by the pressure of the fuel which causes said device to increase said area as the pressure rises and vice versa.

In witness whereof, I have hereunto set my hand this twenty-sixth day of September, 1902.

HERMANN LEMP.

Witnesses:
HENRY O. WESTENDARP,
DUGALD McK. McKILLOP.