G. E. WHITNEY.

HYDROCARBON BURNER.

APPLICATION FILED AUG. 9, 1900.

933,684. Patented Sept. 7, 1909.

4 SHEETS—SHEET 1.

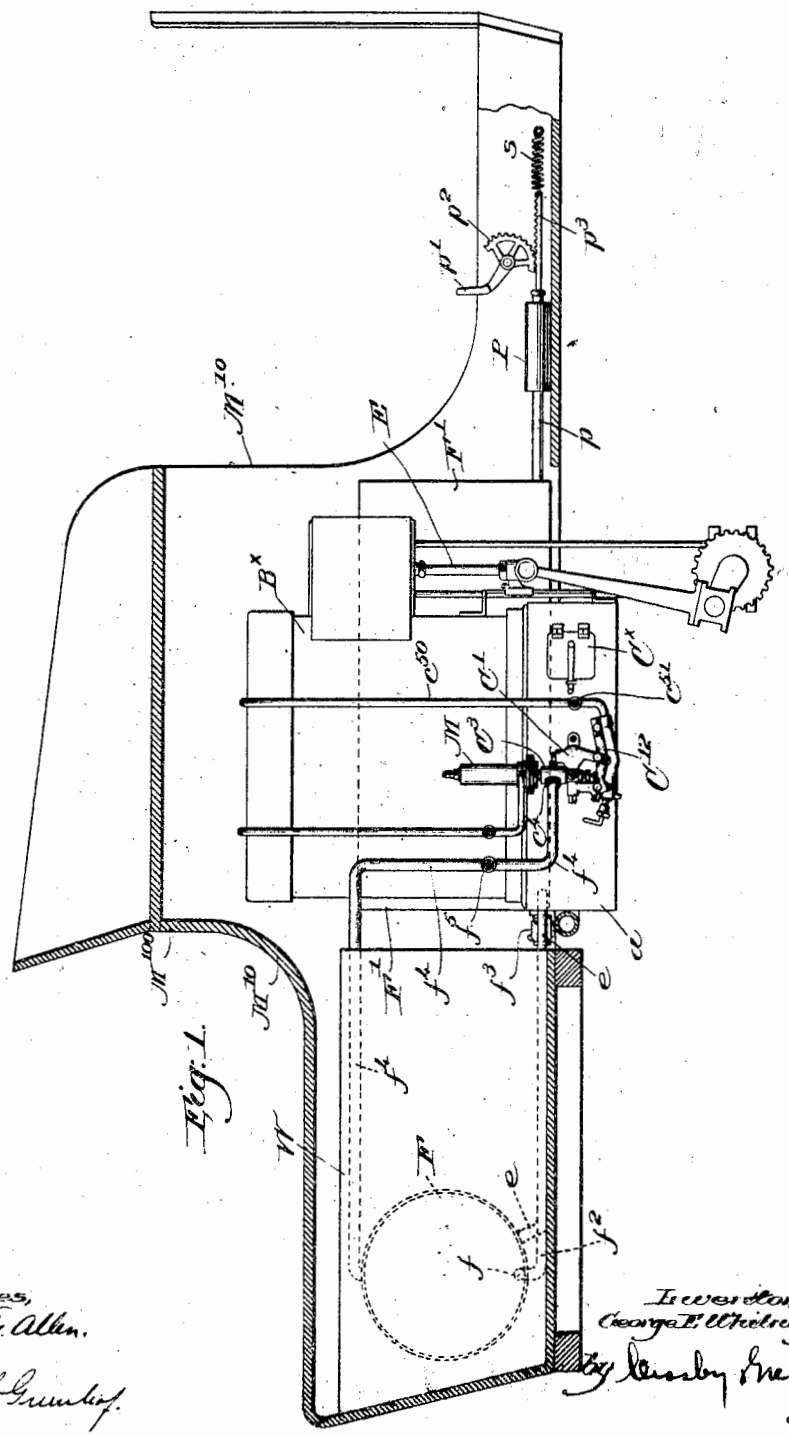

Fig. 1.

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4 SHEETS—SHEET 2.

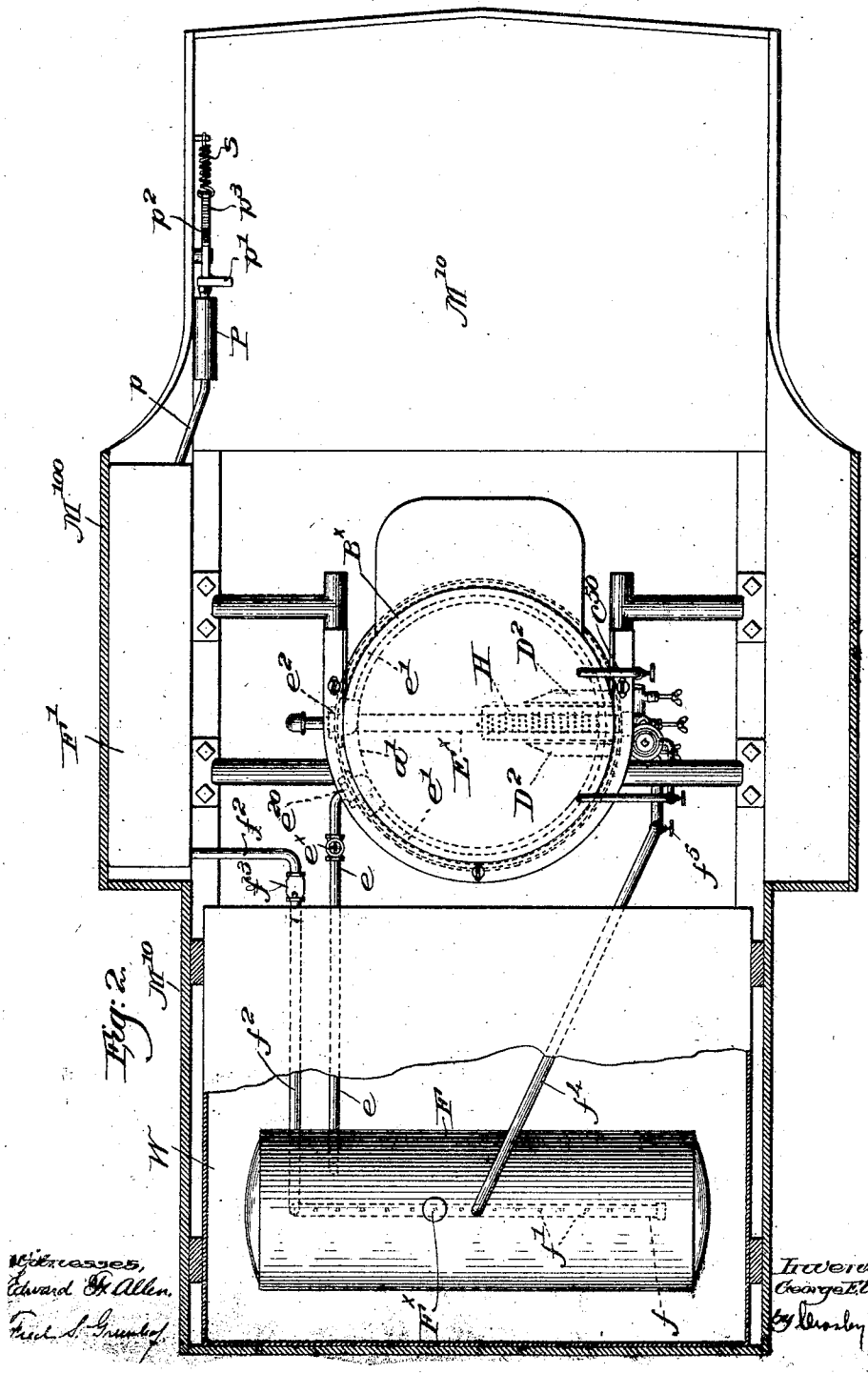

Fig. 2.

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4 SHEETS—SHEET 3.

Fig: 3.

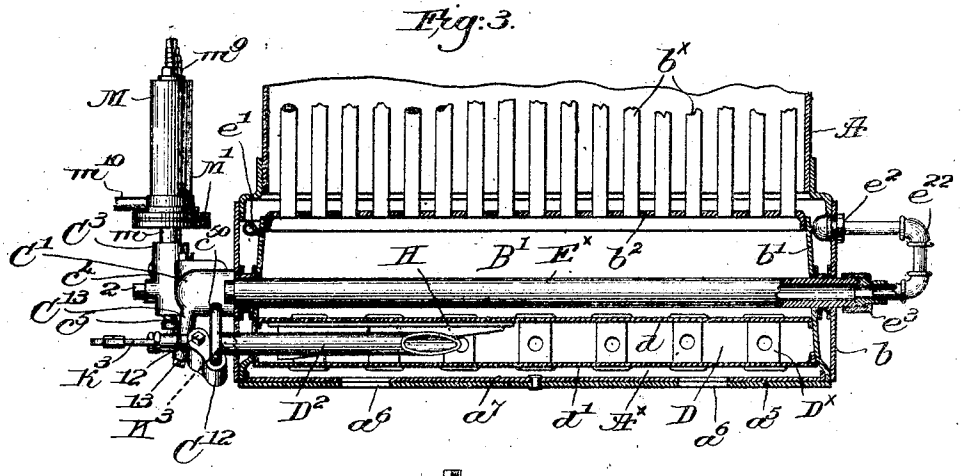
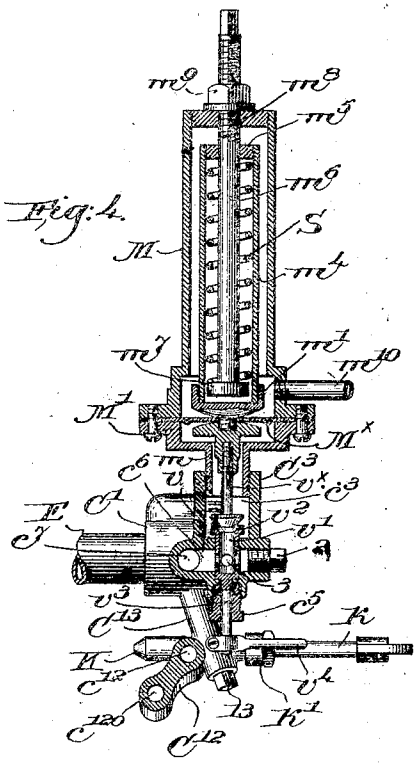


Fig: 4.



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4 SHEETS—SHEET 4.

Fig. 5.

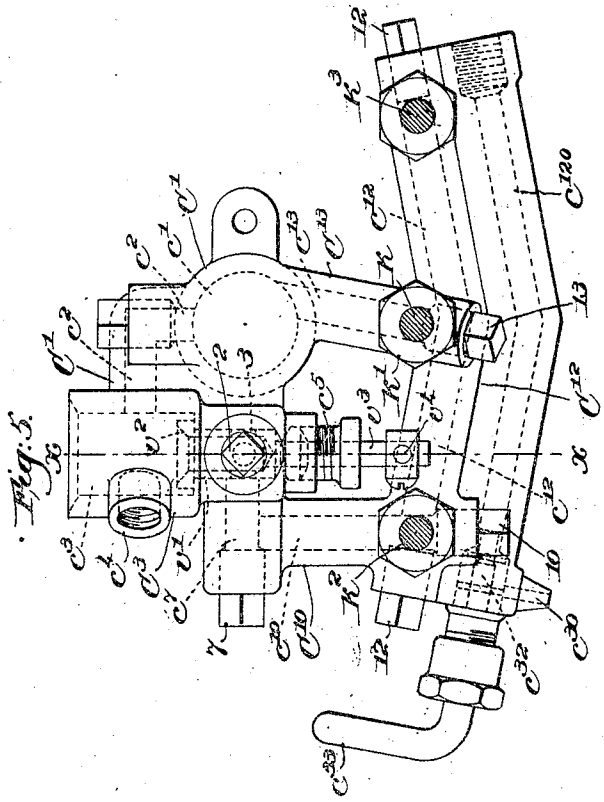
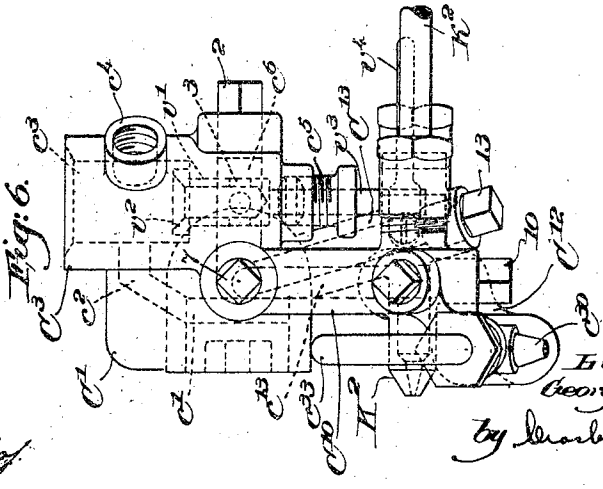


Fig. 6.



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UNITED STATES PATENT OFFICE.

GEORGE E. WHITNEY, OF BOSTON, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO STANLEY MOTOR CARRIAGE COMPANY, A CORPORATION OF MASSACHUSETTS.

HYDROCARBON-BURNER.

933,684. Specification of Letters Patent. Patented Sept. 7, 1909.

Application filed August 9, 1900. Serial No. 26,432.

To all whom it may concern:

Be it known that I, GEORGE E. WHITNEY, a citizen of the United States, residing at Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Hydrocarbon-Burners, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to that class of steam generators wherein the heat is provided by the combustion of suitable liquid fuel, such as gasolene, naphtha, etc., and it has for its general object the improvement in effectiveness of the heating means for such apparatus, whereby the use of the same is made convenient, safe, and highly efficient.

One of the particular objects of my invention is to provide means for readily lighting the burner of the generator when all parts thereof are cold, without the aid of extraneous heat, obtained from alcohol, raw oil, etc., to primarily heat the burner or any of the parts thereof, as is now the general practice.

Another object of my invention is to provide novel means for readily lighting the burner when the steam generator is hot, as for instance, after steam has been raised and the burner has been temporarily shut off.

Various other objects of my invention, and novel features thereof, will be hereinafter fully described, and particularly pointed out in the following claims.

My present invention is particularly well adapted for use in connection with motor vehicles, as will be manifest hereinafter, and I have herein illustrated my invention as applied to such a vehicle, but I wish it to be understood that it is not in any sense restricted to such employment or use.

Figure 1 represents in side elevation a steam generator apparatus embodying one form of my invention, illustrated in connection with the body of a motor vehicle, the body being for the most part shown in longitudinal section. Fig. 2 is a top or plan view of the apparatus shown in Fig. 1, the top or cover of the water tank being partly broken out, and the vehicle body partly in section. Fig. 3 is a diametral sectional view, enlarged, through the water leg and combustion chamber of the boiler, showing the burner, vaporizer and other features to be referred to. Fig. 4 is a view principally in section, of the fuel controlling devices, on the line x—x, Fig. 5, looking toward the right, and showing the automatic regulator applied thereto. Fig. 5 is an enlarged front view of the fuel controlling device shown in Fig. 1, but omitting the automatic regulator, the injector valve-stems being shown in section, and Fig. 6 is a left hand end elevation, also enlarged, of the fuel controlling device shown in Fig. 5.

In order to clearly understand the practical embodiment of my invention herein illustrated certain details of construction will be shown and described which form the subject matter of claims in another application filed by me and hereinafter referred to, and any suitable burner may be employed instead of the one herein shown, my present invention, while relating to the burner and adjacent parts of the apparatus, not being dependent upon any particular type thereof.

I have herein chosen to illustrate my invention in connection with a boiler similar to that shown in United States Patent No. 601,218, granted to me Mar. 22, 1898, the engine being mounted on the boiler, Fig. 1, the combustion chamber B′, see Fig. 3, being formed by the double walls b, b', constituting a water leg, the outer wall being connected with or forming a continuation of the boiler shell A, the crown sheet b^2 of the boiler, which forms the top of the chamber, having upright fire tubes or flues b^x opening at their lower ends into the combustion chamber, substantially as in said patent. The bottom of the said chamber is herein formed by the top plate d of a distributing chamber D, having a bottom plate d', from which chambe. the combustible gas is distributed to the burners D^x, mounted in said plates d, d'. A door C^x, Fig. 1, in the side wall of the chamber C affords access to the interior thereof, the boiler preferably being surrounded by a suitable casing or jacket B^x, and herein illustrated as mounted on the body M^{10} of the vehicle.

A water supply tank or receptacle W is shown on the rear portion of the vehicle body, and I have shown an air-tight fuel tank F in the water receptacle, preferably made cylindrical in shape, and so arranged

as to be more or less submerged in the water, a suitable filling opening F^x, Fig. 2, being provided.

Along the bottom of the fuel tank I arrange a longitudinal pipe f, having a series of fine perforations f' therein, this foraminous pipe being connected by a pipe f^2 with an air receiver or reservoir F', in the present embodiment of my invention, located for convenience beneath the seat portion of the vehicle body, a suitable check valve f^3 being located in the pipe f^2 between the receiver and fuel tank, said pipe leading out through the water tank.

An air pump P of any desirable construction has its eduction pipe p leading to the receiver F', the pump being actuated by a foot lever p' and segment p^2 working in a rack p^3 forming a part of the piston rod of the pump, a spring s moving the piston in one direction, but any other form of air compressing device may be used.

It is usual to employ air pressure upon the surface of the fuel in the supply tank to effect the efficient feed of liquid fuel to the burner in apparatus of this general type, and particularly in motor vehicles, and in my present invention I utilize this practice, with certain important changes, to effect the initial lighting of the burner and heating of the parts adjacent thereto before turning on the normal fuel supply. I prefer to employ an air receiver or reservoir between the pump and the fuel tank, as by so doing the requisite air pressure for feed and other purposes to be described is attained and held with more infrequent pumping. The air under pressure is thus admitted to the tank F at or near the bottom, in the form of fine sprays or jets, the bubbles rising through the liquid hydrocarbon in the tank and becoming impregnated or enriched with the gas therefrom, forming a readily combustible mixture of air and gas lighter than the oil, and which rises and accumulates at the top of the fuel tank above the surface of the liquid therein. From at or near the top of the tank a pipe f^4 leads to the burner, a valve f^5 controlling the passage of the combustible vapor therethrough, and this latter, which will burn readily, no matter how cold the burner or adjacent parts, is led to the burner, as will be described, and when lighted soon heats the burner and adjacent parts, sufficiently to permit the regular fuel feed to be turned on, the starting vapor being then shut off. By such arrangement no alcohol, crude oil, or other inflammable substance is used extraneously as a preliminary to the regular operation of the burner, nor is any auxiliary and removable heater employed, consequently the safety and ease of operation of the apparatus is greatly enhanced, while the convenience and rapidity of manipulation in getting up steam is very much increased. Inasmuch as the air pressure is always available, by the use of a receiver, as described, the proper feeding pressure upon the fuel in the tank is maintained when the burner is operating normally, after the flow of gas from the tank to the burner has been shut off, it being manifest that the feeding pressure is the same whether the air is admitted above or below the liquid in the tank F.

As shown in Fig. 3, an air chamber A^x is formed below the distributing chamber D by a plate a^5, having apertures a^6 therein, the apertures being regulated as to size by a shutter a^7. Pure air enters chamber A^x and passes to the burners D^x, and thence to the combustion chamber B', while the combustible mixture of liquid fuel and air enters the distributing chamber D, substantially as shown and described in another application Se. No. 706253, filed by me the 20th day of February, 1899. As in said application, a sub-chamber or heater H is made in the chamber D, which at its outer end is arranged to receive air and an injector K, Fig. 4, of the pilot light or torch to be referred to, the part of the plate d which forms the top of the heater being perforated to permit the escape of the combustible gas from the heater to the combustion chamber B', this gas being readily ignited by means of a lighted match or torch.

A fuel feed pipe e leads from at or near the bottom of the fuel tank F to the burner, but this pipe is arranged to be heated by the fluid contents of the generator or boiler when such contents are heated, to more or less thoroughly vaporize the liquid fuel before it reaches the burner, and to this end the pipe is carried through the outer wall b of the water leg, at e^{20}, Fig. 2, in the present embodiment of my invention, and around the combustion chamber between the walls of the water leg, as at e', Figs. 2 and 3, and then out again, as at e^2, the pipe passing through the upper portion of the water leg. A preferably larger tube E^x is extended through the combustion chamber, as best shown in Fig. 3, just above the heater H, and connected by a suitable coupling e^3 and bend e^{22} with the end of the fuel feed pipe at e^2, the tube E^x constituting a vaporizer, to thoroughly vaporize the liquid fuel before its delivery to the burner, when the apparatus is in complete operation, the vaporizer completing the auxiliary vaporization instituted by the part e' of the feed pipe, a valve e^x Fig. 2, controlling the exit of fuel from the tank F, the vaporizer being exposed to the intense heat in the combustion chamber generated by the burners when the apparatus is in operation.

If the burners have been shut off, after the apparatus has been in use it will be manifest that the temperature of the combustion

chamber may fall to such an extent that the fuel will not be sufficiently vaporized in the vaporizer, even though there be steam or very hot water still in the boiler, when it is desired to start up again. At such time the auxiliary vaporizer e' is utilized to vaporize sufficient fuel to start the burners again, advantage being taken of the very slow rate of cooling of steam and hot water in the boiler. Upon shutting off the burner and after the vehicle has stood long enough to permit steam to disappear, the water in the boiler which retains its heat even after steam has disappeared, then constitutes a heater for the pipe or conduit, e', or a means for supplying heat to said pipe or conduit, independent of the burner but of course receiving its heat primarily therefrom, this heater or heating means consisting of a substance that absorbs and retains heat and which is adapted to maintain fluid brought in close proximity or contact to it, such as the liquid fuel in the said pipe e', in the vaporized condition, even after the cooling or disappearance of steam and the cooling of parts of the apparatus other than said heater or heating means.

The user of a motor vehicle very often finds it necessary or desirable to make a stop of considerable duration, and it is not economy to keep up even a low fire, nor is it convenient or safe to use an extraneous heater to vaporize some of the fuel when he is again ready to start off. By means of the features of my invention hereinbefore described, such stops can be made as often as desired, the fuel being completely shut off, and when it is desired to light up again, so long as the boiler contents are hot, the vaporizing action of such contents will be sufficient to provide vaporized fuel for starting the burner. If the stop has been so long that the boiler and contents are cold, as well as all parts of the burner, then the combustible gas from the fuel supply tank will be used for the initial heating of the burner and adjacent parts of the apparatus, as at such time this gas is directed into the heater H, as will be described, so that the vaporizer E^x is rapidly heated to a temperature high enough to vaporize the fuel led thereinto from the supply tank F by the pipe e, it being remembered that the delivery end of the vaporizer is directly above and closely adjacent to the perforated top of the heater H, see Figs. 2 and 3.

The fuel controlling device will now be described, and referring to Figs. 3, 4, 5 and 6, a casting C′ is attached to the exterior of the water leg, said casting having a threaded chamber c' into which the outer end of the vaporizer E^x is screwed, the chamber c' communicating by a passage c^2 with a chamber c^3 in a part C^3 of the casting, said chamber having a threaded hub c^4 which is connected to the gas pipe f^4, described. The bottom of the chamber c^3 is drilled to receive a hollow sleeve v', see Fig. 4 and dotted lines Figs. 5 and 6, having at its upper end an annular, internally conical valve seat v^2, the lower closed end of the sleeve being secured to or forming part of a spindle v^3, which is extended through a gland c^5 mounted on the lower end of the part C^3 of the casting, the lower end of the sleeve being seated in the part C^3, the latter having a lateral duct or passage c^6 drilled thereinto and closed at its outer end by a screw plug 2, the sleeve v' intersecting the duct and having openings 3 to communicate therewith. A handle v^4 on the projecting end of the spindle v^3, provides for partial rotation thereof, to clear any slight obstruction which will prevent the valve from firmly seating on the valve seat v^2, a relative rotative movement of valve and seat, as herein provided for, generally serving to remove the obstruction without removing either the valve or its seat. The part C^3 of the casting is offset at its lower end and downwardly extended to form a depending foot C^{10}, connected by a lateral branch C^{12} about midway between its ends with a downward extension C^{13} of the main part C′ of the casting, the extension C^{13} being drilled to form a passage c^{13} communicating with the chamber c', said passage being closed at its lower end by a screw plug 13. A nozzle on the extension C^{13} communicates with the passage c^{13}, forming an injector K, Fig. 4, which enters the heater or torch H, described, this injector being always in communication with the chambers c' and c^3, and hence through the latter with the gas pipe f^4. A suitable valve for the injector K is controlled by a stem k, passing through a suitable stuffing box k'. Two longitudinal passages c^{12}, c^{120}, are made in the branch C^{12}, the former closed at its ends by screw plugs 12, as herein shown, and two injector nozzles communicate with the passage c^{12}, one of the injectors being shown at K^2, Fig. 6, its valve being controlled by a suitable stem k^2, the other injector K^3, Fig. 3, having its valve controlled by a stem k^3. A bent duct or passage c^7, c^{10}, in the part C^3 and foot C^{10} respectively, are formed by drilling and the ends are closed by screw plugs 7 and 10 respectively, the passage communicating with the passage c^{12}, so that the injectors K^2 K^3, communicate with the chamber c^3 by the ducts c^{12}, c^{10}, c^7 and c^6, and through the valve seat sleeve v'. Communication between the vaporizer E^x, which opens into the chamber c' and said sleeve is controlled, however, by a valve v, which is automatically regulated, as will be described, so that the supply of fuel is governed by or through variation in boiler pressure, the supply being reduced when boiler pressure rises above a desired point, and increased when such pres-

sure falls below the desired point. The working injectors, K^2, K^3, as they may be termed, open into air inlets or mixing tubes which enter the chamber D, one at each side of the heater, as in my application referred to, one of said inlets D^2 being shown in full lines Fig. 3, a jet of gas being injected directly into each tube, under pressure.

The device for automatically regulating the supply of fuel to the burner in accordance with boiler pressure is best illustrated in Fig. 4, and it comprises a case M having an attached cap M′ provided with a hollow boss m screwed into the top of the chamber c^6, the stem v^x of a valve v extending through the boss, so that the valve coöperates with the valve seat v^2, described. A flexible diaphragm M^x securely held between the case M and cap M′, has suitably attached to it the valve stem v^x, a cylinder head m' on the opposite side of the diaphragm being connected to the latter, a cylinder m^4, loosely held in the case M being attached to the head m', while the closed upper end m^5 of the cylinder has loosely extended through it a rod m^6 headed at its inner end, at m^7, and threaded at its upper end, as at m^8 to engage a threaded hole in the top of the case M, as in my application hereinbefore referred to, a check nut m^9 preventing accidental movement of the rod. A strong spring S within the cylinder is interposed between the upper end m^5 of the latter and the head m^7 of the rod, tending to lift the valve v from its seat, and a pipe m^{10} communicates with the steam space of the boiler and leads into the case M on the spring side of the diaphragm, so that boiler pressure acts on the diaphragm in opposition to the action of the spring. When the pressure in the boiler overcomes the spring tension the valve is more or less closed, to shut off communication between the chamber c^3 and the burner injectors. When boiler pressure falls below the desired point the spring S causes the valve v to open, admitting more fuel from the chamber c^3 to the injectors and thence to the burner.

From the foregoing description it will be understood that while the supply of fuel to the working injectors K^2, K^3, is always under the control of the automatic regulator the pilot injector K is not so controlled, and fuel can be supplied to the latter even though the valve v is seated, thus making provision for a constantly acting injector if desired. This injector can be operated either with fuel from the tank F, vaporized either by the main or auxiliary vaporizer described, or it can be used with the combustible gas drawn from the upper part of the fuel tank when starting the apparatus, all the parts being cold, the heating of the main vaporizer E^x by the heater or torch H, through the action of the pilot K, being very rapid. In practice the gas is shut off after the parts of the burner have become heated sufficiently to permit of the use of the liquid fuel in the normal manner.

When there is steam in the boiler I may heat the casting C′ C^{12} to vaporize some of the fuel sufficiently to start the apparatus, and to this end I connect one end of the passage c^{120} with the steam space of the boiler by means of a pipe c^{50}, having a suitable valve c^{51}, the other end of the passage c^{120} being provided with a blow-off nozzle c^{30} and controlling valve c^{32}, operated by a handle c^{33}. The valve c^{32} is opened, and also valve c^{51}, and steam passes through the passage c^{120}, heating the branch C^{12} very rapidly, sufficiently to vaporize the liquid fuel if the latter is permitted to enter said passage, so that no extraneous heat, such as by burning alcohol, etc., in a pan under the branch and the working injectors is necessary. Instead of leading the pipe c^{50} to the steam space it could communicate with the water in the boiler and operate precisely as described, the hot water acting as the heating medium, instead of steam.

While I have shown herein and described certain mechanism which is shown and described in my application hereinbefore referred to, I do not claim the same herein, as such features form the subject matter of claims in my other application.

I have herein shown and described one practical embodiment of my invention, without describing or illustrating various changes or modifications thereof which might be made by those skilled in the art, as such changes or modifications would fall within the spirit and scope of my invention.

Having fully described my invention, what I claim and desire to secure by Letters Patent, is:—

1. In an apparatus of the class described, a main burner and its liquid fuel supply conduit heated thereby, combined with a torch also to apply heat to a portion of said conduit, a branch connecting said conduit with said torch, and means to apply heat thereto, a source of gaseous supply for said torch, and means to supply the latter from said source, said several means of sustaining the torch flame being available separately, as desired.

2. In an apparatus of the class described, a main burner and a liquid fuel-supply conduit therefor and to be heated thereby combined with a lighting torch connected with and to be supplied also from said conduit and arranged also to heat a portion of the latter to vaporize the contents thereof, a source of steam supply and means to conduct steam to the vicinity of said torch for vaporizing the liquid fuel supplied thereto for initial lighting of the torch, and a source of gaseous supply for said torch and means to supply the latter from said source, as desired.

3. A steam generator, a combustion chamber therefor provided with liquid fuel burning means, a fuel vaporizer within the chamber, a fuel supply-tank, a pipe connecting it with the vaporizer and arranged to derive vaporizing heat from the contents of the generator when hot, and means to operate the fuel burning means by gas derived from the supply tank when the apparatus is cold.

4. A steam generator, means, including a vaporizer and pilot lighting and working injectors, to heat the same by combustion of liquid fuel, a closed fuel-supply tank connected with the vaporizer, the pilot injector being at all times operatively connected with the vaporizer and serving to light said combustion means, means to operate the said injector by inflammable gas from the fuel supply tank, and independent means to utilize boiler heat to vaporize the fuel adjacent the injectors when the vaporizer is inactive.

5. A steam generator, means to heat the same by the combustion of liquid fuel, including main and auxiliary vaporizers for the latter, the former operating by the heat of combustion and the latter by heat derived from the contents of the generator, a tank for the liquid fuel, connected with the vaporizers, means to effect feeding pressure for the fuel and to generate an inflammable gas in the tank, means to utilize such gas to initially vaporize a portion of the fuel when the apparatus is cold, and a device to vaporize fuel independently of the vaporizers by the contents of the generator when hot.

6. In an apparatus of the class described a main burner, its liquid fuel supply conduit and a vaporizer therein combined with a torch to supply heat to said vaporizer, means to supply said torch with fuel from said vaporizer, means to supply carbureted air to said torch for initial lighting, and means independent of the said vaporizer to vaporize liquid fuel and supply the latter in gaseous form to said torch.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE E. WHITNEY.

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LAURA P. MANIX.