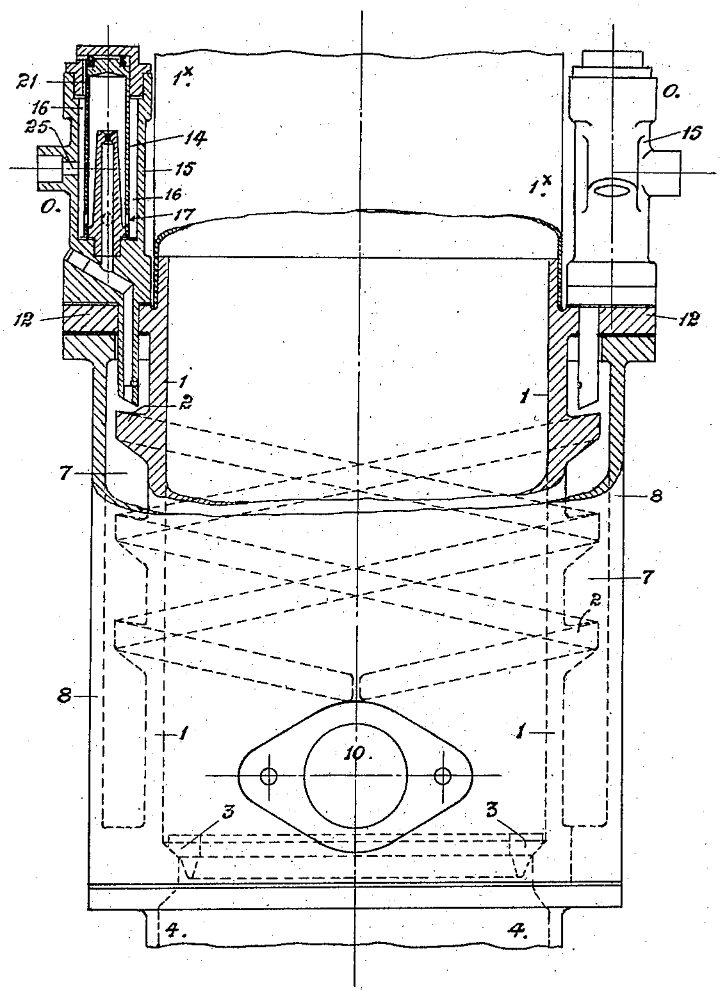
P. O. ROWLANDS.
VAPORIZER.
APPLICATION FILED APR. 9, 1919.

1,400,377. Patented Dec. 13, 1921.

2 SHEETS—SHEET 1.

FIG. 1.



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2 SHEETS—SHEET 2.

FIG. 2.

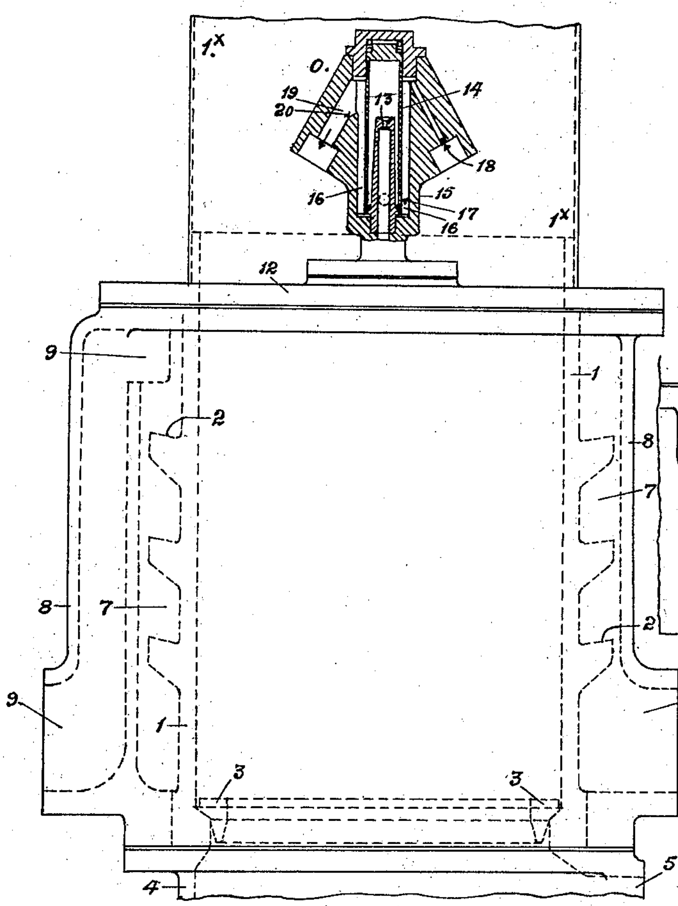
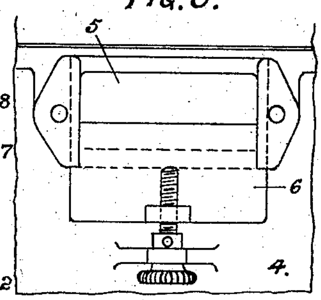


FIG. 3.



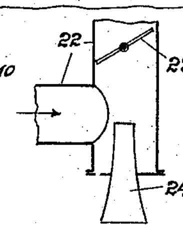


FIG. 4.

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UNITED STATES PATENT OFFICE.

PERCY OCTAVIUS ROWLANDS, OF LIVERPOOL, ENGLAND.

VAPORIZER.

1,400,377. Specification of Letters Patent. Patented Dec. 13, 1921.

Application filed April 9, 1919. Serial No. 288,875.

To all whom it may concern:

Be it known that I, PERCY OCTAVIUS ROWLANDS, a subject of the King of England, and residing at Liverpool, in the county of Lancaster, England, have invented Improvements in Vaporizers, of which the following is a specification.

This invention has reference to the feeding of liquid hydro-carbon—and more particularly such as have a greater specific gravity than gasolene, as kerosene or the like—and its conversion to a vaporous or "steam" state, for use primarily as a power fuel for combustion in internal combustion engines of self propelled vehicles, motor-boats and the like; and it also relates to the systems of converting the liquid fuel to a vaporous or steam state, wherein it is supplied to a downwardly inclined conductor whereon it is heated by heat produced in the converting or vaporizing apparatus by the combustion of fuel—of solid or gaseous or other form—therein, and either directly or indirectly, and vaporized or converted to the steam state in its flow down the conductor, and is conducted thence directly to the engine, either by the action of the piston thereof, or its pump as the case may be, and used therein in any known suitable way. Further, the invention is more especially directed to, and capable of being advantageously used in connection with a system of the kind referred to where the liquid hydro-carbon to be vaporized or converted to the steam state is supplied to the vaporizing apparatus by suction created in the vaporizing apparatus by the induction or drawing-in action of the engine piston.

One form of apparatus, which is convenient and advantageous, for carrying out the system of vaporizing liquid hydro-carbons of the kind referred to, is that in which solid fuel is burnt within a container having connected with an inclined conduit, preferably of helical form, heated by the heat due to the combustion of the solid fuel within the apparatus, to the upper part of which the oil or liquid fuel is supplied, in flowing down which it is vaporized or converted to the steam state by the heat of or within the conduit; the apparatus having a liquid fuel supply apparatus or device as hereinafter described, adapted to supply liquid in variable quantity in the manner above described. And this apparatus may be of a type in which the conversion of the oil to the vaporous or steam state is effected partly by heat conducted to it by the heat of the conduit down which it flows itself, (which heat is produced by the combustion of fuel within the container or furnace proper of the apparatus).

Instead of the oil being supplied by a pump or gravity as stated, it may be supplied through a float regulated device, by which the constant level referred to is maintained.

In the drawings hereto annexed, an oil feeding and vaporizing apparatus is shown in which the heat applied to the apparatus is furnished by burning solid fuel within a container, on the outer surface part of which two vaporizing helically shaped conduits are provided, and two oil fuel supply devices supply oil to the two separate conduits, the oil supply devices being disposed on opposite sides of the apparatus.

In these drawings, Figure 1 is an elevation partly in section; Fig. 2 is an outside elevation partly in section; and Figs. 3 and 4 are details hereinafter described.

Referring now to the drawings, the oil feeding devices are generally designated 0, and 1 represents the container for holding the solid fuel having on its wall exteriorly, two helical conduits 2, the upper faces of which incline upward from the exterior of the wall of the container.

At the bottom of the container is a fuel supporting grate 3, beneath which is the ash box or chamber 4, into which the ashes fall, and which may be assumed to be closed below, while air is supplied to the upper part of it through an air inlet conduit 5, which has upon it an air regulating shutter or device 6 shown in Fig. 3, so that more or less air can be supplied to the fuel in the container by opening or closing this shutter or damper more or less.

In the case of the application to a self-propelled vehicle internal combustion engine, the mouth of the conduit 5 (or the open end of a pipe on it) is so disposed as to face the current of air which is produced by the fan which is used in motor vehicles in connection with their radiators, so that when the engine is running, air will always be being blown on to this mouth or pipe end, as the case may be, and so that the draft in the vaporizing apparatus is not entirely dependent upon the natural draft created by the combustion of the fuel.

Outside the conduits 2 is a cylindrical

casing or wall 8, inclosing the conduits 2, the interior of which is larger than the diameter of the vaporizing conduits 2, so that an annular space exists outside these conduits, which permits of the vapor driven off from the oil, and air which is supplied to the annular space 7 between the container 1 and the casing 8, to pass down through the latter.

In the case shown the air is supplied to the space 7 through a conduit 9, and it is taken away from the apparatus through a discharge branch 10, which is connected up with the induction pipe or conduit of the engine which the apparatus is attached, or the supply pump of same.

Part of this air, therefore passes helically down through the part of the space 7 between the convolutions of the conduits 2, and part between the space between the edges of the conduits and the interior of the casing 8; and in flowing through this space it is heated by the hot surfaces over which it passes; and the oil is vaporized partly by the heat of the conduits 2, due to the heat of combustion of fuel in the container 1, and partly by the action of the air flowing over these conduits.

The inlet of the conduit 9 to the annular space 7 and conduits 2, is at a point removed from the points at which the oil is introduced; and the parts are so arranged and adapted that the streams of falling oil from the oil feeding devices, on to the surfaces of the helical conduits 2, are not interfered with by this inflowing stream of air; that is, the oil feed takes place in a quiescent part of the heating apparatus, remote from this air inlet conduit 9.

The container 1 is extended a considerable height above the upper portions of the vaporizing conduits 2 as shown; and this upper part, marked 1^x, forms a species of hopper or reservoir for the solid fuel; while the oil supply devices are situated on a flange 12 of the container 1, which lies above the annular space 7, into the upper part of which the oil delivery pipes of the oil feeding devices, project.

Regarding the oil feeding devices 0, in the case shown, these are adapted to be supplied with liquid by a pump, and they each comprise an induction nozzle device 13 disposed within, and projecting up into an internal thimble 14 closed at its upper end in the casing 15 of the device, between which is an annular space 16, which communicates with the interior of the thimble 14 by apertures 17 in the bottom of the thimble 14.

Oil is supplied to the annular space 16 from the pump through a conduit 18, leading into the upper part of it; and excess of oil above the maximum amount required is always delivered to the device, the surplus flowing away through a conduit 19, the overflow lip or weir 20, of which stands slightly above the orifice in the upper end of the induction nozzle device 13. It is obvious that the oil will pass downwardly through the opening 13, and a vacuum cannot form within the upper end of the thimble 14 to prevent this downward feeding, since air can enter the space 16 through the conduit 19, as its bore will not be completely filled with the discharging oil.

It is to be assumed that when the engine is not running the oil pump will be stationary, and only when the engine is turning around is oil delivered by the pump to the oil feeding devices.

In action, according the degree of suction created by the engine or its pump within the annular space 7, varies, so will the mean pressure acting upon the surface of the oil in the thimble 14, vary (the entrance head of the nozzle 13 being submerged); and so will vary the quantity of oil which will be fed on to the conduits 2; and therefore the amount of vapor supplied to the engine will automatically vary according to the oil supplied to the vaporizing apparatus. The degree of suction created in the space 7 will be governed by the speed of the engine, and the degree of opening of the throttle valve or equivalent regulating device employed in the conduit between the inlet valve of the engine, and the vaporizing apparatus.

When the minus pressure in the feed or supply tube from the entrance head ceases, or when the engine stops, siphonic action of the apparatus ceases, as the cross sectional area of the supply conduit beyond or below the small entrance aperture and below it thereto is such that it does not act siphonically. It may be assumed that the orifice or entrance aperture in the supply conduit is within the range of sizes of nozzle apertures of an ordinary carburetor.

In order to facilitate the starting and slow running of the engine, the supply tube or nozzle device part 13 in one or more of the fuel feeding devices would be arranged so that its inlet or orifice is slightly below the overflow lip or weir 20, the head resulting from this difference of level thus supplementing a difference of level or pressure in the thimble 14, due to the suction acting on the device created by the engine or its pump.

If only a portion of the air used to support combustion of the oil vapor in the engine is admitted to and passed through the vaporizing apparatus, there may be used on the conduit connected with the branch 10 and extending to the inlet valve of the engine, a separate air inlet means, which is illustrated diagrammatically in Fig. 4.

The said connecting conduit is marked 22, and has within it the regulating throttle valve 23; and air is admitted to this conduit by a contracted or tapered inlet tube 24, the restricted end of which is in line with the portion of the conduit 22 on the vaporizer side of the throttle valve 23.

By this "*vena contracta*" form of air inlet for introducing the extra air, the quantity of air supplied through the *contracta* nozzle when the engine is running slowly, will be relatively less than when the engine is running at a higher rate, and a higher degree of minus pressure exists; and this stream of extra air, in flowing through the tube 24 at right angles to the portion of the tube 22 coming from the vaporizer, will create an induction effect upon the air in the conduit, and a greater quantity of air therefore will enter and pass through the vaporizing space 7.

Air is admitted to the annular space 16 at the upper end of the oil feeding devices through a hole 21, so that atmospheric pressure always exists on the surface of the oil in this space.

A "priming" oil inlet 25 is provided on the casing 15 of the fuel supply devices.

In some cases, outside the casing 8 and at a suitable distance therefrom, there may be another cylinder or casing, with an annular space between them, through which the air which is to be passed through the space 7, will pass prior to entering the latter space; and in passing through which it will be heated more or less. In this outer annular space helical divisions may be employed, so as to constitute a helical air heating way; and the air inlet to this space or way may be provided with a regulating means, which can be fixed in any suitable position, so that the quantity of air admitted may be regulated to that desired.

The whole apparatus may be suitably combined and arranged with the engine as may be convenient; namely, in the case of a motor vehicle, it may be placed under the engine bonnet, or adjacent to the seat of the driver, so as to be capable of being manipulated directly by him from the seat, or in any other convenient position.

In some cases, instead of the conductors for the oil to be vaporized, being in the form of helical conduits as shown in the drawings, they may be in the form of rods with roughened or irregular surfaces on to the upper parts of which the oil is fed; or the outer surface of the heating fuel containing wall 1 may serve as the conduit onto which the oil is fed; or the surface may be provided with checker work on the like to which the heat of the wall is conducted, and onto which the oil to be vaporized is fed.

In case of crude oil of a character possessing a percentage of unevaporable matter, such as that having an asphaltum base, being used, it will be so supplied that the unvaporizable or residue portion of the oil will be carried off the ends of the conduits down which it has passed; and it will be arranged to flow into suitable conduits in the casing, by which it will be carried away from the apparatus.

What is claimed is:—

1. In a vaporizer of the character described having an outer casing, a tube arranged therein in spaced concentric relation thereto, a spiral conduit formed upon the exterior of the tube, an oil feeding device arranged above the upper end of the spiral conduit, said device comprising a shell provided with an inlet and outlet, said outlet having a weir for determining the level of the oil within the shell, a nozzle arranged substantially vertically within the shell and having an inlet at its top which is arranged in a horizontal plane beneath the weir, a conduit receiving the oil from the nozzle and discharging it upon the spiral conduit, inlet means to supply air to the space between the outer casing and tube, and an outlet for such space.

2. In a vaporizer of the character described having an outer casing, a tube arranged therein in spaced concentric relation for forming an annular passage, a spiral conduit formed upon the exterior of the tube, an oil feeding device arranged above the upper end of the spiral conduit, said device comprising a shell provided with an inlet and outlet, said outlet having a weir for determining the level of the oil therein, a vertical nozzle arranged within the shell and having an inlet at its top which is arranged in a horizontal plane beneath the weir, a tubular thimble arranged within the shell and surrounding the nozzle in spaced relation and projecting above the weir and provided near its lower end with apertures, a conduit receiving oil from the lower end of the nozzle and discharging the same upon the top of the spiral conduit, means for supplying air to the annular passage, and an outlet for the annular passage.

3. In a liquid fuel vaporizer of the character described having a vaporizing conduit to which the liquid fuel is delivered, adapted to have created within it a pressure less than that of the atmosphere by a pump or engine to be fed by the vapor produced; a liquid fuel supply conduit, the entrance aperture to which is a relatively small area and is disposed above the delivery part of the said conduit, and the part of which is below the entrance aperture is of relatively large cross sectional area, and down which conduit the liquid is caused to flow by gravity and the said pressure; substantially as set forth.

4. In a liquid fuel vaporizer of the character described having a vaporizing conduit to which the liquid fuel is delivered adapted to have created within it a pressure less than that of the atmosphere by a pump or engine to be fed by the vapor produced; a liquid

fuel supply conduit, a surplus liquid fuel discharge, the entrance aperture to the liquid fuel supply conduit being disposed above the delivery part, and below the level of the surplus liquid fuel discharge, and a closed chamber above and inclosing said entrance aperture and into which the liquid is fed by gravity; substantially as set forth.

5. In a liquid fuel vaporizer of the character described having a vaporizing conduit to which the liquid fuel is delivered adapted to have created within it a pressure less than that of the atmosphere by a pump or engine to be fed by the vapor produced; a liquid fuel feed conduit, the entrance aperture of which is disposed above the delivery part, a closed chamber above and inclosing said entrance aperture and into which the liquid flows by gravity; a second liquid chamber communicating with the said closed chamber to which latter chamber the liquid passes by the communicating aperture or apertures, and an overflow conduit in the second liquid chamber adapted to keep a conduit level of liquid in the latter chamber at a constant level, substantially as set forth.

6. In a liquid fuel vaporizer of the character described having a vaporizing conduit to which the liquid fuel is delivered adapted to have created within it a pressure less than that of the atmosphere by a pump or engine to be fed by the vapor produced; a liquid fuel feed conduit, the entrance aperture of which is disposed above the delivery part, a closed chamber above and inclosing said entrance aperture and into which the liquid flows by gravity, a second liquid chamber communicating with the said closed chamber to which latter chamber the liquid passes by the communicating aperture or apertures; and an overflow discharge conduit in the second liquid chamber disposed at a level above that of the aperture in the feed conduit down which the liquid flows to the vaporizing conduit, and adapted to keep a constant level is maintained in the latter chamber, substantially as set forth.

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

PERCY OCTAVIUS ROWLANDS.

Witnesses:

A. M. HANNAY,

SOMERVILLE GOODALL.