W. M. HARPSTER.

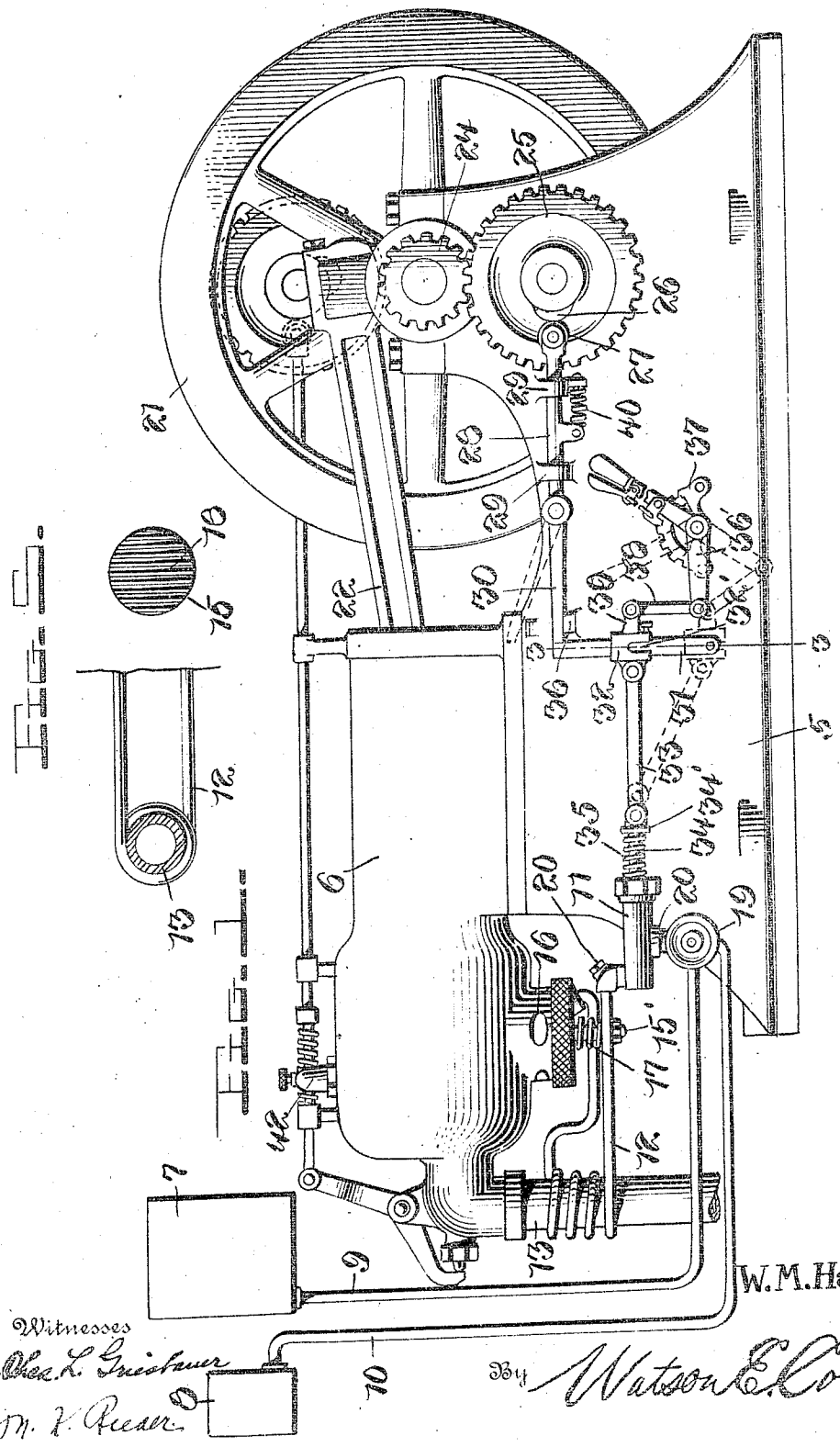
VAPORIZER FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED AUG. 10, 1910.

979,667.

Patented Dec. 27, 1910

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 2.

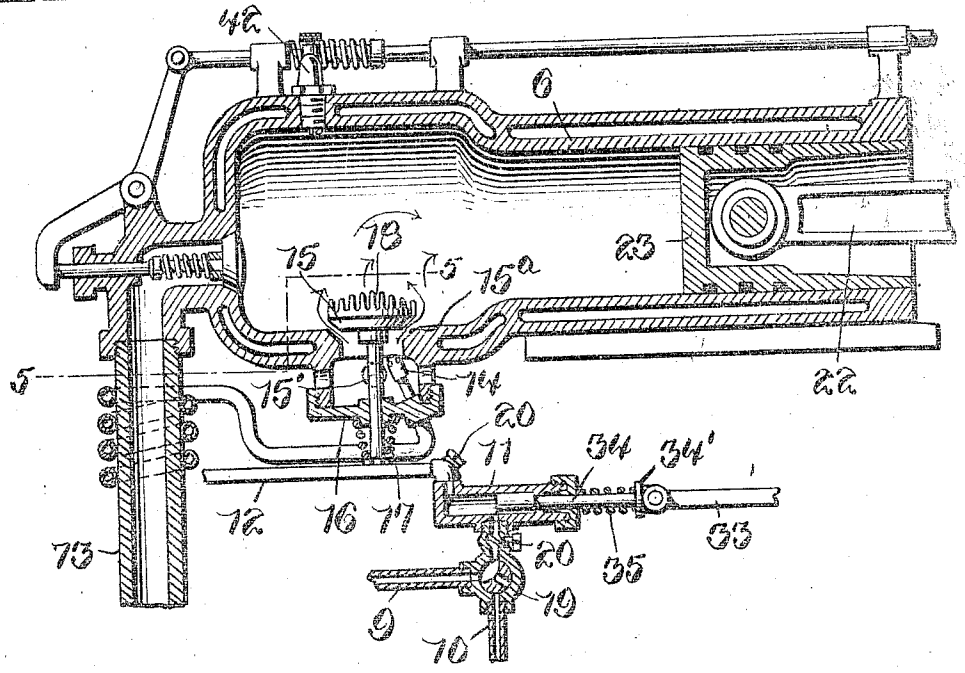


Fig. 4.

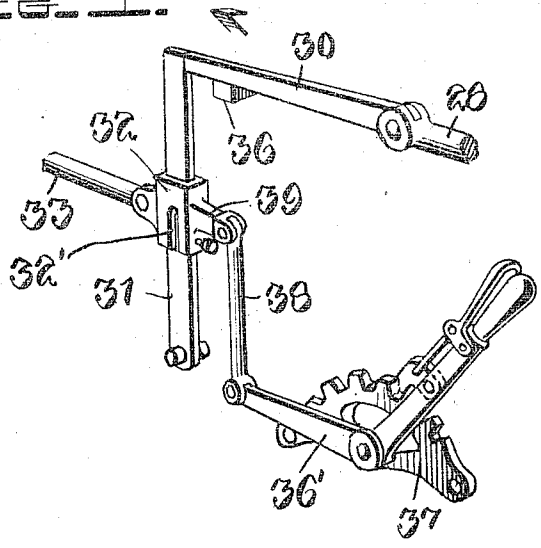
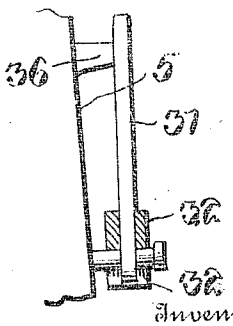


Fig. 3.



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UNITED STATES PATENT OFFICE.

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VAPORIZER FOR INTERNAL-COMBUSTION ENGINES.

979,667. Specification of Letters Patent. Patented Dec. 27, 1910.

Application filed August 10, 1910. Serial No. 576,459.

To all whom it may concern:

Be it known that I, WILLIS M. HARPSTER, a citizen of the United States, residing at Florence, in the county of Marion and State of Kansas, have invented certain new and useful Improvements in Vaporizers for Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to improvements in internal combustion engines and more particularly to a vaporizer for engines of that type which utilize a gaseous mixture as the propelling medium, the invention having for its primary object the provision of a device whereby low grades of liquid hydrocarbon may be easily and successfully vaporized.

Another object of the invention resides in the provision of new and novel means for charging the ignition chamber of the cylinder with the gaseous mixture at the proper point in the movement of the engine piston.

A still further object of the invention is to provide a very simple and efficient mechanism whereby any desired amount of fuel may be fed in accordance with the speed which is required.

A still further object of the invention exists in the utilization of the exhaust of the burned gases from the explosion chamber for heating the liquid hydrocarbon before the same reaches the cylinder, and means arranged in the cylinder wall for supplying the air to be mixed with the vapor and also for completing the vaporization of the liquid fluid before it is finally discharged into the ignition chamber.

With these and other objects in view, the invention consists of the novel features of construction, combination and arrangement of parts hereinafter fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of an engine embodying my invention; Fig. 2 is an enlarged longitudinal section through the engine cylinder and the pump cylinder; Fig 3 is a section taken on the line 3—3 of Fig. 1; Fig. 4 is a detail perspective view of the means for regulating the feed of the liquid fuel; and Fig. 5 is a section taken on the line 5—5 of Fig. 2.

Referring more particularly to the drawings 5 indicates the engine bed which may be of any conventional form and has mounted thereon the cylinder 6. Before proceeding further with the detail description of my invention, it may be stated, that while I have illustrated in the accompanying drawings the well known horizontal reciprocating engine of the internal combustion type, it will be obvious that my invention is not limited in its application to this broad form of engine but may be applied to the vertical type of engine as well and also to a single double or multiple cylinder engine, the number of cylinders requiring only a simple duplication of parts.

It is a well known fact that the lower heavier grades of liquid hydrocarbon which is generally used as fuel for engines of the internal combustion type, is much more difficult to vaporize than the lighter and more refined grades of such fuel. It has therefore become necessary in order to reduce the cost of operation and maintenance to a minimum, to supply suitable devices whereby these heavier grades of hydrocarbon liquid may be vaporized. Such devices have heretofore been complicated in construction, thus rendering their adoption very expensive while at the same time their practical efficiency has been unsatisfactory. In overcoming the above mentioned difficulties, I provide a main supply tank 7 and an auxiliary tank or reservoir 8. Each of these supply tanks is connected by means of the pipes 9 and 10 respectively with the pump cylinder 11 which is suitably mounted upon the bed 5 of the engine. A pipe 12 also extends from the pump cylinder 11 to the engine cylinder 6 and between its ends is coiled about the exhaust pipe 13 which communicates with the explosion chamber of the cylinder. The end of the pipe extends through the cylinder wall and is provided with a spraying nozzle 14. This nozzle is disposed immediately beneath a spring pressed valve 15, the stem 15′ of which extends through and is movable in the casing wall 16 secured to the wall of the cylinder 6. Between the end of this stem and the casing wall an extension spring 17 is arranged. This spring is normally adapted to lift the valve 15 upon its seat 15ª formed in the cylinder wall. The surface of the valve 15 is corrugated as shown at 18 for a purpose which will be more fully hereinafter set forth.

The supply pipes 9 and 10 are connected before reaching the pump cylinder 11 and are extended to said cylinder in the form of a single pipe. At this connection a three-

way cock 19 is arranged in the supply pipe whereby the flow of fuel from the supply tanks 7 and 8 to the pump cylinder may be controlled. Suitable check valves 20 are provided to prevent back pressure of the fluid from the pump cylinder into the supply pipes and from the conducting pipe 12 back into the pump cylinder. After the liquid hydrocarbon or other fuel reaches the pump cylinder, it is forcibly ejected from said cylinder through the pipe 12 from the spray nozzle 14 beneath the valve 15. It will be obvious that for different speeds of the engine various amounts of the liquid must be ejected at predetermined intervals in accordance with the reciprocation of the engine piston. This function I accomplish by means of the mechanism which will now be described in detail.

The usual fly wheel 21 is of course employed, and to the crank shaft of this fly wheel one end of the piston rod 22 is connected, the other end of said rod being pivoted in the piston head 23 mounted to reciprocate in the engine cylinder 6. A gear 24 is also fixed upon the fly wheel shaft and meshes with a larger gear 25 mounted upon a stud shaft mounted on the engine bed. Upon one face of the gear 25 a cam 26 is arranged which is adapted to engage a roller 27 mounted on the end of a longitudinally movable bar 28 mounted in guides 29 secured to the side of the engine bed. To the other end of this bar a lever 30 is pivoted and is normally disposed in longitudinal alinement with the bar 28. With the end of the lever 30 the upper end of a vertically disposed oscillatory arm 31 is engaged. This arm is pivoted at its lower end to the side of the engine bed and a sleeve 32 is arranged thereon for longitudinal movement. A link 33 connects the sleeve 32 to the outer end of a plunger 34 longitudinally movable in the pump cylinder 11. The outer end of this plunger is formed with a head plate 34′ between which and the end of the cylinder 11 a coil spring 35 is disposed upon the plunger. This spring normally acts to force the link bar 33 away from the pump cylinder thereby oscillating the vertical arm 31 and also moving the plunger 34 toward the end of the casing 11 away from the port in said casing communicating with the pipe 12. This movement is limited by a stop 36 which engages the upper end of the arm 31. It will thus be obvious that the extent of longitudinal movement of the plunger 34 depends entirely upon the extent of oscillatory movement of the arm 31. Consequently by adjusting the extent of oscillatory movement of the arm 31 the amount of liquid fuel fed to the cylinder may be regulated. This adjusting means involves an angular adjusting lever 36′ pivoted intermediate of its ends upon a rack segment 37. The usual spring actuated locking dog is carried by the lever 36′ for engagement with the teeth of the rack segment. A link 38 is pivoted to one end of the adjusting lever 36′ and at its other end to a pin 39 extending from one side of the vertically movable sleeve 32.

Upon observing Fig. 1 of the drawings it will be seen that when the lever 36′ is moved upon the rack segment, the sleeve 32 is moved vertically up or down upon the pivoted arm 31. When said sleeve is moved on the arm to its lower pivoted end as shown in dotted lines, there is no longitudinal movement whatever of the link bar 33 and consequently no movement of the plunger 19 so that the oil will no longer be fed to the engine cylinder. In order to permit of this extreme movement of the sleeve 32, the opposite side walls of the sleeve at its lower end are slotted as indicated at 32′ to receive the pivot pin upon which the arm 31 is mounted. It is of course understood that the oscillatory movement of the arm 31 is occasioned by the contact of the cam 26 carried by the gear 25 with the roller on the end of the longitudinally movable bar 28. After the cam passes said roller the bar 28 is returned to its normal position by means of a spring 40 one end of which is secured to the bar and its other end to the bed 5 of the engine. In the event that too much fuel is being fed to the engine in proportion to its speed, the pivoted lever 30, which is connected to the end of the bar 28 may be elevated as shown in dotted lines in Fig. 1 so that it will not contact with the upper end of the arm 31 in the longitudinal movement of the bar 28.

In the operation of the mechanism above described, it will be seen that the liquid hydrocarbon will be automatically fed at the proper intervals to the ignition chamber of the engine cylinder. When the engine is first started, the cock 19 is turned so that the lighter and more refined fuel contained in the reservoir 8 is allowed to enter the pump cylinder 11, communication between the tank 7 and said cylinder being cut off. In the operation of the pump as above set forth, the oil is forced through the pipe 12 and is discharged in a fine spray from the nozzle 14. In its movement from the pump cylinder to the nozzle the oil passes through the coiled portion of the pipe which is disposed about the exhaust 13 of the engine. The liquid is thus heated to a certain extent but not enough to vaporize the same. As the engine piston 23 moves to the position indicated in Fig. 2 of the drawings, the valve 15 is lifted from its seat and the heat caused by the previous explosion in the ignition chamber is retained by the corrugated surface 18 of the valve. Simultaneously with the rising of the valve the oil is sprayed from the nozzle 14 upon the same at which

time air is admitted through the skeleton casing 16 into the ignition chamber. As the fine jets of highly heated fuel strike upon the heated valve 15, they are completely vaporized and mixed with the ingoing cold air currents. After entering the ignition chamber and upon the return stroke of the piston 23, the valve 15 automatically closes so as to retain the gaseous mixture in the chamber until it is sufficiently compressed by the engine piston. The combustion of the mixture then takes place and is caused by a spark plug 42 of the usual form which extends into the ignition chamber. After the explosion takes place, the burned gases are exhausted through the pipe 13 so that the fuel in the pipe 12 is heated in its passage through the exhaust pipe when the same action is repeated.

From the foregoing it is believed that the construction, operation, and many advantages of my improved vaporizing device and feeding mechanism will be readily understood. Its construction is comparatively simple and it is highly efficient in practical use. It is obvious that owing to the fact that the lower and heavier grades of oils may be successfully vaporized, the cost of operation and maintenance of the engine is greatly reduced.

While I have shown and described the preferred construction and arrangement of the various elements of the invention, it will be understood that the same may be variously modified without departing from the essential feature or sacrificing any of the advantages involved therein.

Having thus described the invention what is claimed is:—

In combination with an internal combustion engine including a cylinder, ignition chamber, piston, and crank shaft, a spring controlled air valve seated in the wall of the ignition chamber, the inner surface of said valve being corrugated, a liquid fuel supply pipe coiled about the exhaust pipe from the ignition chamber and provided with a spraying nozzle on its discharge end disposed beneath the air valve, a pump for forcibly ejecting the liquid fuel from the spraying nozzle, said pump comprising a plunger, an oscillatory arm, a link connecting the arm and plunger, means operable from the crank shaft of the engine engaging said arm to reciprocate the plunger, and means for adjusting the link on said arm to vary the stroke of the plunger and regulate the supply of fuel to the engine.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

WILLIS M. HARPSTER.

Witnesses:

M. M. GINETTE,

C. M. LINCOLN.