H. CASSEDY, Sr. & R. S. PURSER.

CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAY 6, 1910.

971,971. Patented Oct. 4, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

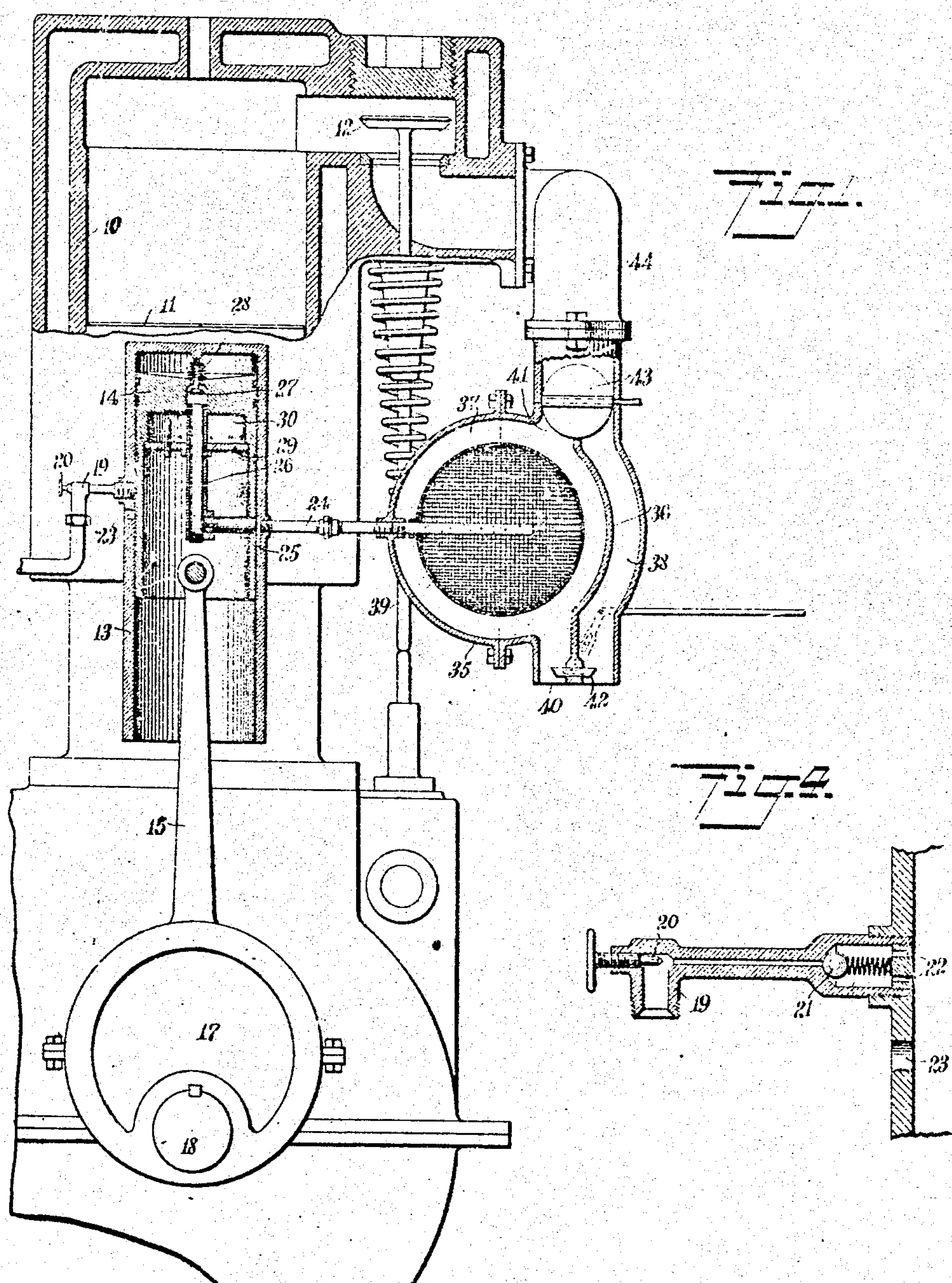


Fig. 4.

WITNESSES:
Ben. Jaffe
C. W. Fairbank

INVENTORS
Hiram Cassedy Sr
Robert S. Purser
BY
Munn & Co
ATTORNEYS

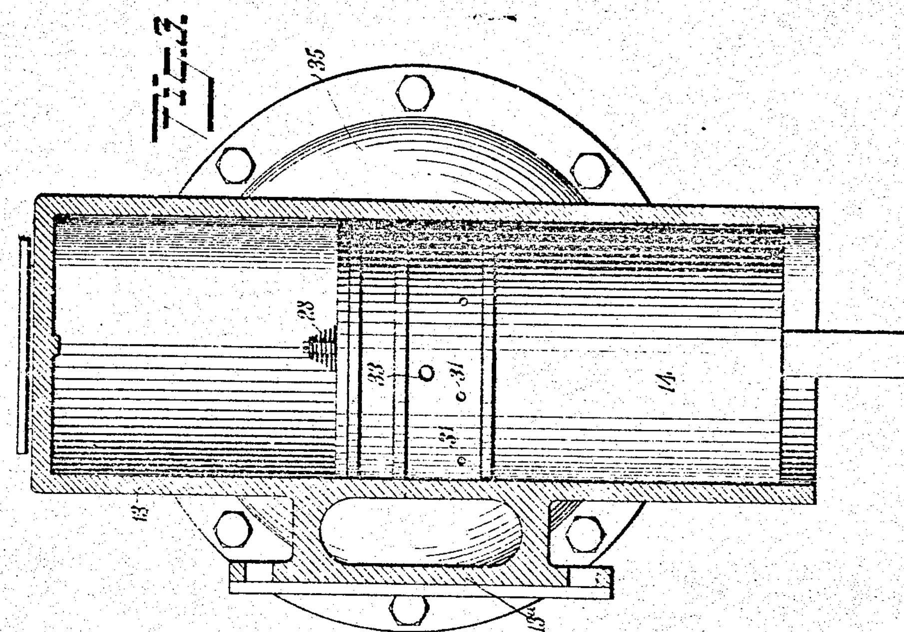
H. CASSEDY, Sr. & R. S. PURSER.

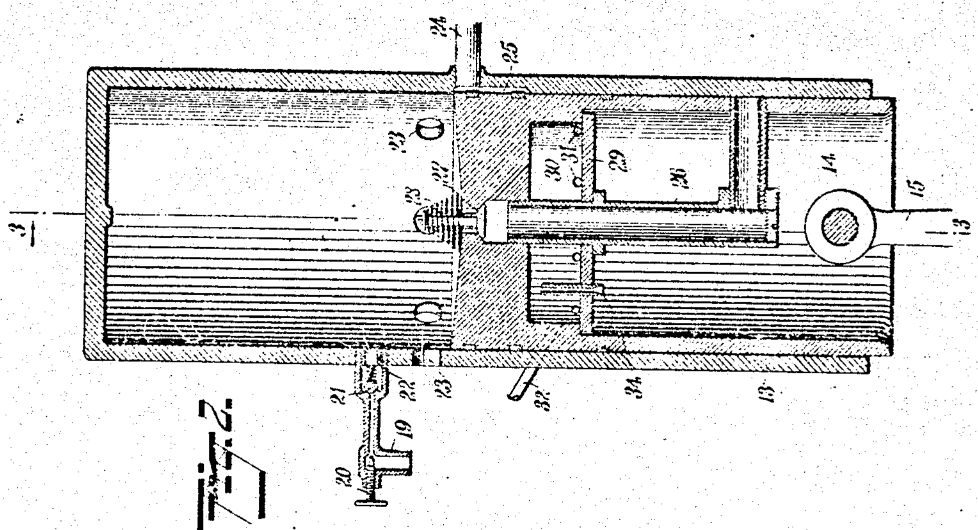
CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAY 6, 1910.

971,971. Patented Oct. 4, 1910.

2 SHEETS—SHEET 2.





WITNESSES:

[signature]

C. W. Fairbank

INVENTORS

Hiram Cassedy Sr

Robert S. Purser

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

HIRAM CASSEDY, SR., AND ROBERT SEAL PURSER, OF BROOKHAVEN, MISSISSIPPI.

CHARGE-FORMING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

971,971. Specification of Letters Patent. Patented Oct. 4, 1910.

Application filed May 6, 1910. Serial No. 559,739.

To all whom it may concern:

Be it known that we, HIRAM CASSEDY, Sr., and ROBERT SEAL PURSER, both citizens of the United States, and residents of Brookhaven, in the county of Lincoln and State of Mississippi, have invented a new and Improved Charge-Forming Device for Internal-Combustion Engines, of which the following is a full, clear, and exact description.

This invention relates to certain improvements in mechanism for forming, controlling, and delivering charges of explosive mixture to internal combustion engines, and the object of the invention is to provide for the delivery of a uniform mixture of air supercharged with the vaporized fuel and to dilute this mixture to the desired extent before delivering it to the engine.

Our invention in its preferred form embodies a pump which takes in air and liquid fuel, vaporizes the latter and delivers the supercharged air to a special mixing chamber. The piston of the pump is so timed in regard to the engine piston that it delivers its charge during the suction stroke of the piston of the engine. By regulating the dilution of the mixture, proper mixture may be delivered to the engine for any desired speed or power, and there will be no excess fuel for forming carbon or carbonaceous deposits within the cylinder. Any form of liquid fuel may be used, for instance, alcohol, kerosene, or gasolene, without altering in any way the construction of the mechanism.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures, and in which—

Figure 1 is a side elevation of an engine provided with our improved charge-forming device, the latter and a portion of the engine cylinder being shown in section; Fig. 2 is a longitudinal section through the pump, the piston being at the limit of its downward stroke; Fig. 3 is a longitudinal section on the line 3—3 of Fig. 2, the piston being shown in side elevation; and Fig. 4 is a sectional detail of the liquid fuel delivery for the pump and on a somewhat larger scale than Fig. 2.

To clearly set forth the construction and operation of our improved mechanism, we have illustrated it in the accompanying drawings in connection with an internal combustion engine having a cylinder 10, a piston 11, and an inwardly-opening mechanically-operated inlet valve 12.

Our improved mechanism includes a cylinder 13 having means for securing the same in place to the engine cylinder, base or other stationary support. As illustrated, the cylinder 13 has a base 13^a adapted to be bolted to the side of the engine cylinder so that the axis of the engine cylinder and the axis of the pump cylinder 13 will be substantially parallel. Within the pump cylinder is a piston 14 driven from the crank shaft in any suitable manner, as, for instance, by a piston rod 15 terminating in an eccentric strap encircling an eccentric 17 on the crank shaft 18. This piston is so mounted that it reaches the upper end of its stroke just prior to the opening of the inlet valve 12. The pump cylinder serves not only for delivering the mixture, but it also serves to vaporize the liquid fuel. The liquid fuel is delivered through a suitable conduit to a valve casing 19, shown particularly in Fig. 4. Within this casing is a needle valve 20, by means of which the liquid fuel may be regulated, and a spring-pressed ball valve 21 for preventing the return flow of fuel through the casing. The spring is of sufficient strength to hold the valve closed, save when there is a partial vacuum in the cylinder. Thus, if the engine stops with the ports 22 uncovered, no liquid will escape.

The valve casing 19 is screwed into the side of the cylinder at a point intermediate the ends of the latter, and the inlet ports 22 from the casing are normally covered by the piston 14. The port is uncovered after the piston has completed the major portion of its down stroke but before said piston reaches the end of the stroke. Below the fuel inlet port 22 are one or more air inlet ports 23, leading through the wall of the cylinder and serving to establish communication between the interior of the cylinder and the outside atmosphere. These ports 23 are uncovered after the fuel inlets or ports 22 are uncovered and just before the piston reaches the extreme end of the stroke. The delivery conduit 24 leads through the wall of the cylinder and at such a point that it is never uncovered by the piston. At the inner end of the delivery conduit 24 is a small chamber 25 formed upon the inner surface of the cylinder. A conduit 26 leads through the head of the piston and to the outer periphery of the skirt of the piston at such a point that it communicates with this chamber 25 when the piston is at the extreme upper end of its stroke. This passage or conduit 26 is controlled by a valve 27, which opens downwardly and is normally held in closed position by a spring 28.

In the operation of the pumping and mixing mechanism, the piston descends from the position indicated in Fig. 1 and the valve 27 instantly closes. The descent of the piston causes a partial vacuum within the cylinder 13 and this vacuum continuously increases until the inlet port 22 is uncovered. Liquid fuel then rushes in past the needle valve 20 and the ball valve 21, and is sprayed into the cylinder. Immediately thereafter the ports 23 are uncovered and air rushes in from the outside atmosphere to reduce the pressure in the pump cylinder to that of the atmosphere. The pump piston immediately returns to cover first the ports 23 and then the ports 22, and to compress the charge within the cylinder. When the piston reaches approximately the upper end of its stroke, the valve stem of the valve 27 abuts against the cylinder head, and the lower end of the conduit 26 comes into communication with the chamber 25. The mixture within the pump cylinder and under high pressure then rushes past the valve 27 and through the delivery conduit 24. It is evident that the valve 27 is opened not only mechanically but also by the pressure of the gas upon the uncovering of the lower end of the conduit 26. Either the mechanical or the automatic opening of the valve may be relied upon to the exclusion of the other. The valve 27 is located at the center of the piston and the upper surface of the face of the piston is dished or inclined downwardly from the periphery toward the center, so that any fuel which is not vaporized in the cylinder and which collects on the piston, will flow to the valve 27 and be delivered with the charge when the latter escapes through the conduits 26 and 24.

For facilitating the lubrication of the piston, we preferably provide a transverse wall or partition 29, within the piston and encircling the conduit 26. Between this partition and the cylinder head is a chamber 30, from which a plurality of passages 31 lead outwardly to the periphery of the piston. For delivering lubricant to the chamber, a conduit 32 leads downwardly through the wall of the cylinder and registers with an inclined passage 33 in the wall of the piston, when the latter is at the lower end of its stroke. This passage and the conduit are shown in dotted lines in Fig. 2. A suitable overflow conduit 34 may lead through the partition 29 and have its upper end terminate adjacent the under surface of the piston face, so that a quantity of lubricant may normally be stored within the chamber 30, and air or an excess of lubricant may escape.

For properly diluting the charge delivered through the conduit 24 and for delivering the resulting explosive mixture to the inlet port of the engine, we provide a casing 35 subdivided into two parts by a partition 36. This partition and the walls of the casing are so formed as to produce a substantially spherical chamber 37 and a passageway 38 along one side thereof but out of direct communication therewith. The delivery conduit 24 extends through the wall of the casing into the chamber 37 and its inner end is provided with a large number of small perforations through which the charge from the pump is delivered. This perforated inner end constitutes a spray nozzle and aids in the vaporization of any liquid which may not have been vaporized in the pump and carried through in a liquid state. The spray nozzle supports a substantially spherical wire gauze inner casing 39, somewhat smaller than the casing 35 and substantially concentric therewith. The supercharged mixture is delivered from the spray nozzle to the interior of this casing and in escaping through the wire gauze wall any small particles of liquid carried along with the mixture are caught and exposed to facilitate their vaporization.

The chamber 37 has an inlet port 40, adjacent the inlet end of the passage 38 and an outlet port 41 adjacent the delivery end of the passage 38. Within the partition 36 and adjacent the inlet to the casing, is a slide valve 42, which may be moved transversely, so as to close either the port 40 or the inlet end of the passage 38, or to vary their relative effective sizes. Any suitable mechanism, as, for instance, a lever and rod, may be employed for operating this slide valve. Adjacent the outlet port 41 and the outlet end of the passage 38, is any suitable form of throttle valve 43, as, for instance, the ordinary butterfly valve. From this throttle valve, a conduit, for instance an elbow 44, delivers to the inlet port of the engine. The inlet port 40 to the chamber 37, is at one side of the bottom of the latter, so that a small quantity of liquid may collect upon the bottom of the chamber without flowing out through the inlet port 40.

In operating the engine, the throttle valve 43 is opened to the desired extent to deliver the proper quantity of mixture, and the slide 42 is operated to vary the percentage composition of the mixture. For instance, with the slide 42 moved to the extreme right-hand position from the position shown in Fig. 1, all of the air admitted to the engine would have to pass through the port 40 and the charge thus delivered to the engine would contain the maximum quantity of the liquid fuel. By moving the slide 42 to the extreme left-hand position, the port 40 would be closed and uncharged air would be delivered to the engine. The mixture entering the chamber 37 is of uniform composition and too rich to be efficient. The extent to which it is diluted determines the force of the explosion in the cylinder. It will thus be noted that in our improved charge-forming device, we first form the rich charge of uniform composition by forced vaporization which permits of the use of any vaporizable liquid fuel. We then dilute this mixture to the desired extent, and thereby can so regulate the mixture as to secure the greatest efficiency. The liquid even though it have a low vaporizing point, yet our improved device forces the vaporization to form a saturated mixture. The liquid is first sucked into a vacuum, then subjected to an inrushing current of air, then compressed with the air, then blown out through the conduit 26 with the air, and finally discharged through the spray nozzle and the wire gauze wall.

Having thus described our invention, we claim as new and desire to secure by Letters Patent:

1. A charge-forming device for internal combustion engines, including a pump having separate fuel and air inlet ports, and a mixing chamber, to which said pump delivers, and provided with an air inlet port.

2. A charge-forming device for internal combustion engines, having a pump provided with a liquid fuel inlet and an air inlet, a delivery passage, a mixing chamber to which said passage delivers, connections between said mixing chamber and the inlet of the engine, and an independent air inlet for the engine.

3. A charge-forming device for internal combustion engines, having a pump including a cylinder and a piston, said cylinder having a liquid fuel inlet, an air inlet and an outlet conduit, a spray nozzle on said outlet conduit, and a mixing chamber, having a partition subdividing the same into two substantially parallel passages, both delivering to the inlet of the engine, one of which incloses said spray nozzle and the other of which constitutes an air passage.

4. A charge-forming device for internal combustion engines, including a pump having a cylinder and a piston, said cylinder having an inlet port for liquid fuel and an inlet port for air, both of which ports are uncovered by the piston and in the order named when said piston is adjacent the end of its suction stroke, an outlet passage communicating with the interior of the cylinder when the piston is adjacent the end of its compression stroke, and a mixing chamber connected to said outlet passage and provided with an air inlet independent of said passage.

5. A charge-forming device for internal combustion engines, including a pump cylinder, a piston movable therein, said cylinder having a fuel inlet port and an air inlet port uncovered in succession as said piston approaches the end of its suction stroke, an outlet conduit, a conduit leading through said piston and communicating with said outlet conduit when the piston is adjacent the end of its compression stroke, means for diluting the charge delivered through said outlet conduit, and connections between said diluting means and the inlet of the engine.

6. A charge-forming device for internal combustion engines, having a cylinder, a piston movable therein and having a concave upper face, a conduit having one end thereof communicating with the center of said piston face and the opposite end delivering through the periphery of the piston, a valve for controlling said conduit, said cylinder having a fuel inlet port and an air inlet port uncovered in succession by said piston when the latter is adjacent the end of its suction stroke, and a delivery conduit communicating with the conduit in said piston when said piston is adjacent the end of its compression stroke.

7. A charge-forming device for internal combustion engines, having a pump adapted to deliver supercharged mixture, a casing having a partition dividing the same into two passages, one of which is substantially spherical in form, a substantially spherical wire gauze casing within said spherical passage, a spray nozzle within said wire gauze casing, connections between said pump and said spray nozzle, and connections between both of the passages in said casing and the inlet of the engine.

8. A charge-forming device for internal combustion engines, having a pump adapted to deliver supercharged mixture, a casing having a partition dividing the same into two passages, one of which is substantially spherical in form, a substantially spherical wire gauze casing within said spherical passage, a spray nozzle within said wire gauze casing, connections between said pump and said spray nozzle, connections between both of the passages in said casing and the inlet of the engine, and a valve for controlling the relative sizes of the inlets to said passages.

In testimony whereof we have signed our names to this specification in the presence of the subscribing witnesses.

HIRAM CASSEDY, Sr.
ROBERT SEAL PURSER.

Witnesses:
S. P. Oliver,
C. T. Montgomery,
S. B. McNair.