

F. H. WALKER.

AIR PUMP.

APPLICATION FILED OCT. 30, 1911. RENEWED JULY 31, 1912.

1,055,004.

Patented Mar. 4, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

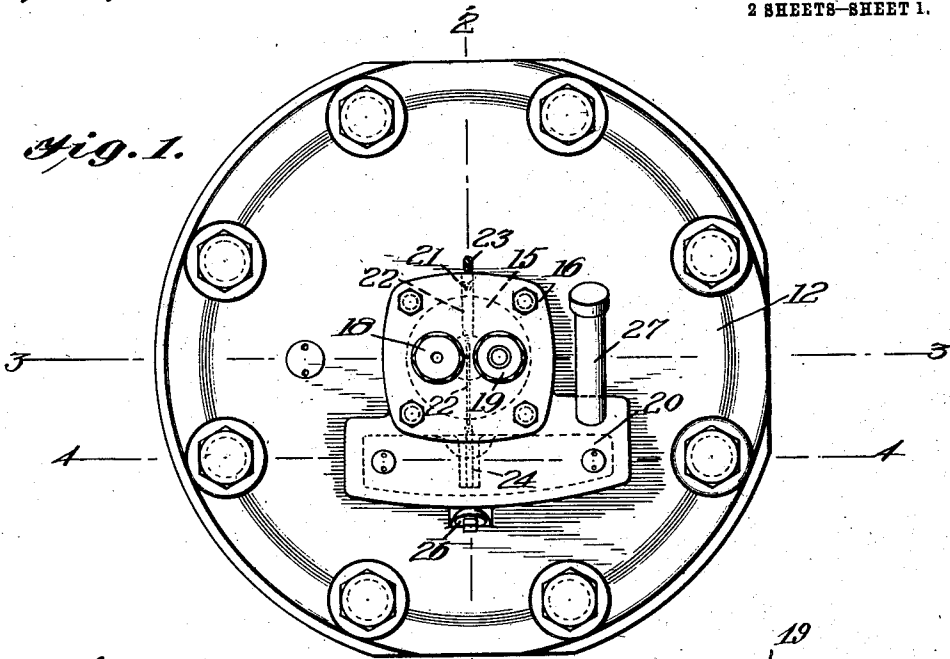
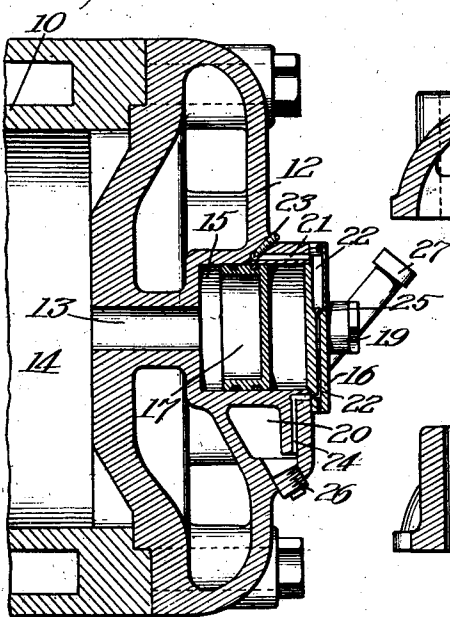


Fig. 2.



WITNESSES

H. C. Barry

W. H. H. H.

Fig. 3.

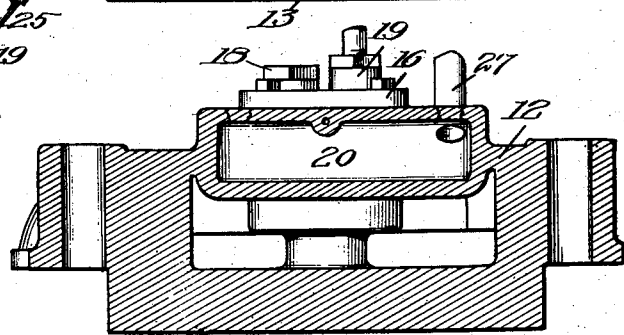
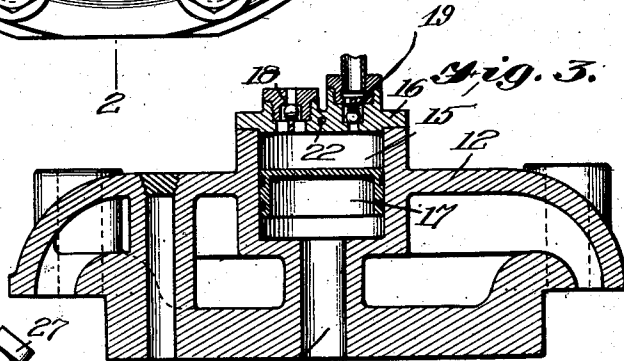


Fig. 4.

INVENTOR

Frank H. Walker

By Milo S. Thomas & Co. Attorneys

F. H. WALKER.
AIR PUMP.

APPLICATION FILED OCT. 30, 1911. RENEWED JULY 31, 1912.

1,055,004.

Patented Mar. 4, 1913.

2 SHEETS—SHEET 2.

Fig. 5.

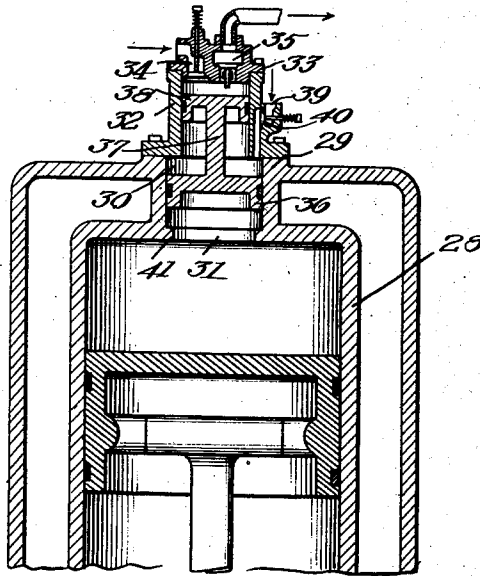
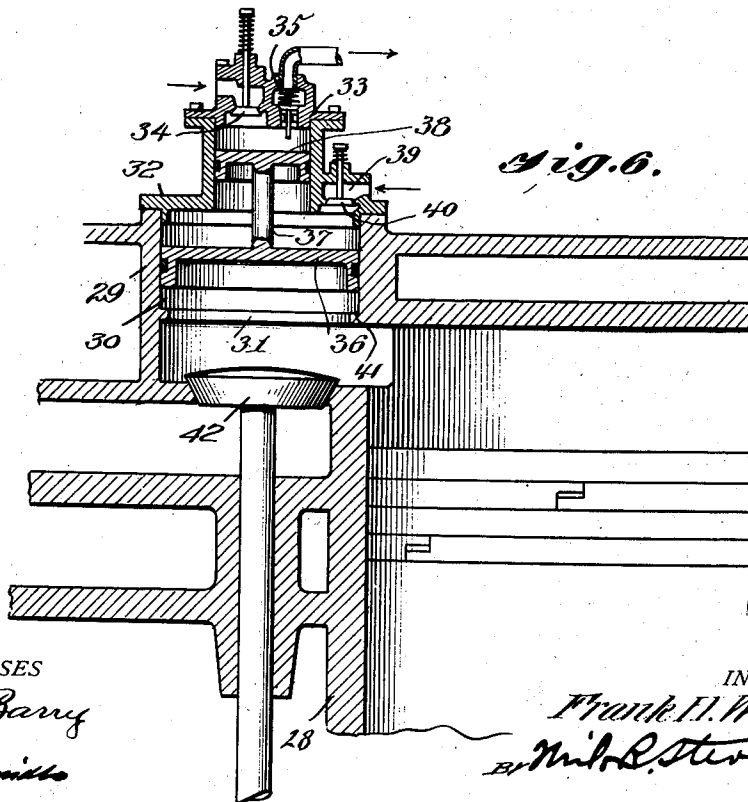


Fig. 6.



WITNESSES

F. C. Barry

M. Schmidt

INVENTOR

Frank H. Walker

By M. R. Stevens, Jr.
Attorneys

UNITED STATES PATENT OFFICE.

FRANK H. WALKER, OF LAPORTE, INDIANA.

AIR-PUMP.

1,055,004.

Specification of Letters Patent.

Patented Mar. 4, 1913.

Application filed October 30, 1911, Serial No. 657,463. Renewed July 31, 1912. Serial No. 712,521.

To all whom it may concern:

Be it known that I, FRANK H. WALKER, a citizen of the United States, residing at Laporte, in the county of Laporte and State of Indiana, have invented certain new and useful Improvements in Air-Pumps, of which the following is a specification.

This invention relates to that class of air pumps which are operated by the explosion pressure of an internal-combustion engine by exposing the pump plunger to such pressure; and it is the object of the invention to provide a novel and improved structure, the pump cylinder being formed directly in the cylinder head of the engine, thereby dispensing with all outside connections and greatly simplifying the structure.

A further object of the invention is to provide an improved lubricating system whereby the pump plunger is automatically lubricated.

The invention also has for its object to provide a novel construction and arrangement of parts to be hereinafter described and claimed.

In order that the invention may be better understood, reference is had to the accompanying drawings in which—

Figure 1 is an end view of the cylinder of an internal-combustion engine showing the cylinder head equipped with the air pump to be hereinafter described. Figs. 2, 3 and 4 are sectional views on the lines 2—2, 3—3 and 4—4, respectively, of Fig. 1. Figs. 5 and 6 are sectional views showing modified structures.

Referring specifically to the drawing, 10 denotes a fragment of the cylinder of an internal-combustion engine. The engine, *per se*, forms no part of the present invention, and a detailed description, or a further illustration thereof, is therefore deemed unnecessary. The cylinder head 12 is water-jacketed, and bolted or otherwise secured to the cylinder in the ordinary manner.

Centrally formed within the cylinder head 12 is a longitudinal bore 13 extending entirely therethrough from its inner to its outer face, so that the inner end of said bore opens into the explosion chamber 14 of the engine cylinder. The outer end of the bore is enlarged in diameter as indicated at 15 and forms a pump chamber which is closed by a head 16. In the pump chamber 15 is located a floating plunger 17, one side of which latter is exposed to the explosion

pressure in the chamber 14. The head 16 has an air inlet valve 18 and an air outlet valve 19, which latter will be connected to a tank or other suitable storage reservoir (not shown).

The action of the pump is as follows: When the engine is running and compression takes place in the chamber 14, a pressure is placed on the plunger 17 whereby it is forced outwardly until the air in front of it is compressed to a pressure equal to the compression pressure in the chamber 14. When the explosion occurs in the chamber 14, it exerts a greater force on the plunger, thereby causing it to travel to the end of the chamber 15, whereby the air in said chamber, in front of the plunger, is forced out through the valve 19 into the reservoir. Air is forced into the reservoir as long as the pressure therein remains below the explosion pressure. On the intake stroke of the engine piston 11, the suction draws the pump plunger inwardly, a charge of air being drawn in behind the same through the valve 18. As compression and explosion occur, this air will be forced into the tank as already described. Thus, on each explosion stroke, a small amount of air is forced into the reservoir, to be used for starting the engine, inflating tires, operating air brakes, etc.

In order that the pump may work well, the chamber 15 must be large and unobstructed so that the slightest change of pressure in the chamber 14 will make itself noticed on the pump plunger. If there is no pressure in the reservoir, the pump plunger will be forced to the limit of its outward stroke by the initial compression, and if there is a pressure in the reservoir, the compression forces the pump plunger the greater part of its stroke, which prevents it from being shot forward the full length of its stroke by the explosion pressure, thereby preventing a knock on the head 16. The inner end of the bore 13 which forms a port leading from the chamber 14 to the chamber 15, must also be of large area, as otherwise the explosion occurs before the compression pressure has a chance to act on the pump plunger.

In order to provide for the lubrication of the pump plunger 17, there is formed a lubricant reservoir 20 in the cylinder head 12, said reservoir being a cavity which extends transversely in the cylinder head be-

neath the pump chamber 15. Above the pump chamber, the wall thereof is formed with a duct 21 which opens at one end into a duct 22 in the head 16, and at its other end into the pump chamber, the last-mentioned end being provided with a needle valve 23 to control the flow of lubricant into the pump chamber. The duct 22 extends vertically through the head 16 between the valves 18 and 19, and at its lower end it is in communication with a duct 24 in the cylinder head 12 which latter duct leads into the bottom of the reservoir 20. The upper end of the duct 22 is of enlarged diameter which forms a valve seat in said duct, said valve seat being engageable by a ball valve 25. The reservoir is provided with a drain opening which is closed by a screw plug 26, and to one end of the reservoir is connected a filling tube 27.

The lubricator operates as follows: The plunger 17 passes the outlet end of the duct 21 at the end of each stroke, so that a slight suction is produced there at each suction stroke. This causes the lubricant to be drawn up from the reservoir 20, and to be discharged on the side of the plunger to lubricate the same. The valve 25 acts as a check to prevent the lubricant being forced back during the compression and explosion.

Referring to Fig. 5 of the drawing, there is shown a fragment of the cylinder 28 of an internal-combustion engine, the head 29 of which is formed with a pump chamber 30 opening at one end through a contracted portion 31 into the explosion chamber of the engine. Over the other end of the pump chamber is mounted a cylinder 32 which forms a second pump chamber and is in communication with the chamber 30. The outer end of the cylinder 32 is closed by a head 33 having air inlet and outlet valves 34 and 35, respectively. In the chamber 30 works a plunger 36 which is connected by a stem 37 to a plunger 38 working in the cylinder 32, the diameter of the latter being less than that of the chamber 30. In the wall of the cylinder 32 is an air inlet port 39 which opens into the space between the plungers 36 and 38, and has a valve 40 which opens to admit air and closes to prevent the escape thereof. The reduced portion 31 of the chamber 30 forms a shoulder 41 which limits the inward stroke of the plunger 36.

In operation, the compression and explosion act on the plunger 36 in the same manner as on the plunger 17 already described, whereby the plunger 38 is actuated to compress the air in the cylinder 32 in an obvious manner. On the outward stroke, the valve 40 closes, and the air ahead of the plunger 36 is therefore compressed, so that it will tend to start the plunger on its return stroke. This is desirable in high speed work as the suction of the engine need not

be depended on to give the plunger its back stroke as in the first-described structure.

Fig. 6 shows the last-described structure so mounted that it may be utilized to facilitate the removal of the exhaust or intake valve 42 of the engine. As shown, the chamber 30 is so located in the cylinder head 29 as to be in line with the valve 42, so that by removing the cylinder 32, said valve can be removed through the chamber 30, the cross-sectional area of the latter being such that the valve may readily pass therethrough.

I claim:

1. The combination of an internal-combustion engine having its cylinder head formed with a pump chamber and a port leading from one end of said chamber to the explosion chamber of the engine, a closure for the other end of the pump chamber, inlet and outlet valves carried by said closure, and a plunger in the pump chamber.

2. The combination of an internal-combustion engine having a pump chamber integral with the cylinder head of the engine and opening into the explosion chamber thereof, inlet and outlets for the pump chamber, and a plunger working in the pump chamber.

3. The combination of an internal-combustion engine having a pump chamber integral with the cylinder head of the engine and opening into the explosion chamber thereof, and said cylinder head having a lubricant reservoir and a duct leading from said reservoir into the pump chamber, inlet and outlets for the pump chamber, and a plunger working in the pump chamber and uncovering the outlet end of the aforesaid duct at the ends of its stroke.

4. The combination of an internal-combustion engine having its cylinder head formed with a lubricant reservoir and a pump chamber, and a port leading from one end of said chamber to the explosion chamber of the engine, and said cylinder head having a duct opening into the pump chamber, a head closing the pump chamber, said head having a duct which communicates at one of its ends with the lubricant reservoir, and at its other end with the first-mentioned duct, inlet and outlet valves carried by the head of the pump chamber, and a plunger working in the pump chamber and uncovering the outlet end of the first-mentioned duct at the ends of its stroke.

5. The combination of an internal-combustion engine, a pump having its plunger exposed on one side to the explosion and compression of the engine, and an air cushion on the other side of the plunger to produce the return stroke thereof.

6. The combination of an internal-combustion engine, a pump chamber communicating at one of its ends with the explosion chamber of the engine, a cylinder connected

to the other end of the pump chamber, inlet and outlet valves connected to the cylinder, connected plungers working in the pump chamber and the cylinder, and an air cushion between the plungers.

5 7. The combination of an internal-combustion engine, a pump chamber communicating at one of its ends with the explosion chamber of the engine, a cylinder connected
10 to the other end of the pump chamber, the diameter of said cylinder being less than that of the pump chamber, inlet and outlet valves connected to the cylinder, connected plungers working in the pump chamber and
15 the cylinder, and a valve for admitting air into the space between the plungers.

8. The combination of an internal-combustion engine having its cylinder head formed with a pump chamber which communicates with the explosion chamber of the engine, a valve, said pump chamber being in line with the valve, and having an area which permits said valve to pass there-through, and a removable closure for the pump chamber.

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

FRANK H. WALKER.

Witnesses:

MATE G. LINE,
LEE L. OSBORN.