

J. H. SHUMAKER.  
 CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES.  
 APPLICATION FILED AUG. 5, 1913.

1,138,581.

Patented May 4, 1915.  
 2 SHEETS—SHEET 1.

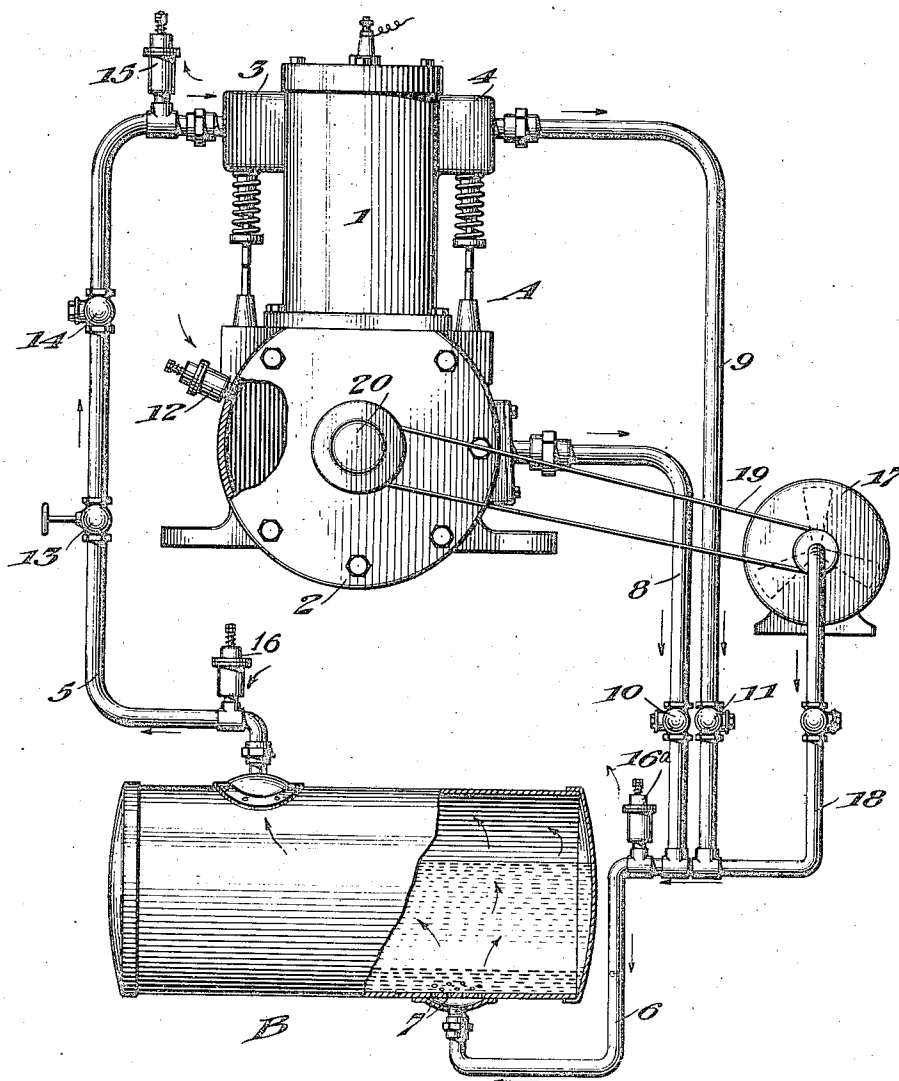


Fig. 1.

Witnesses:

Ruth B. King

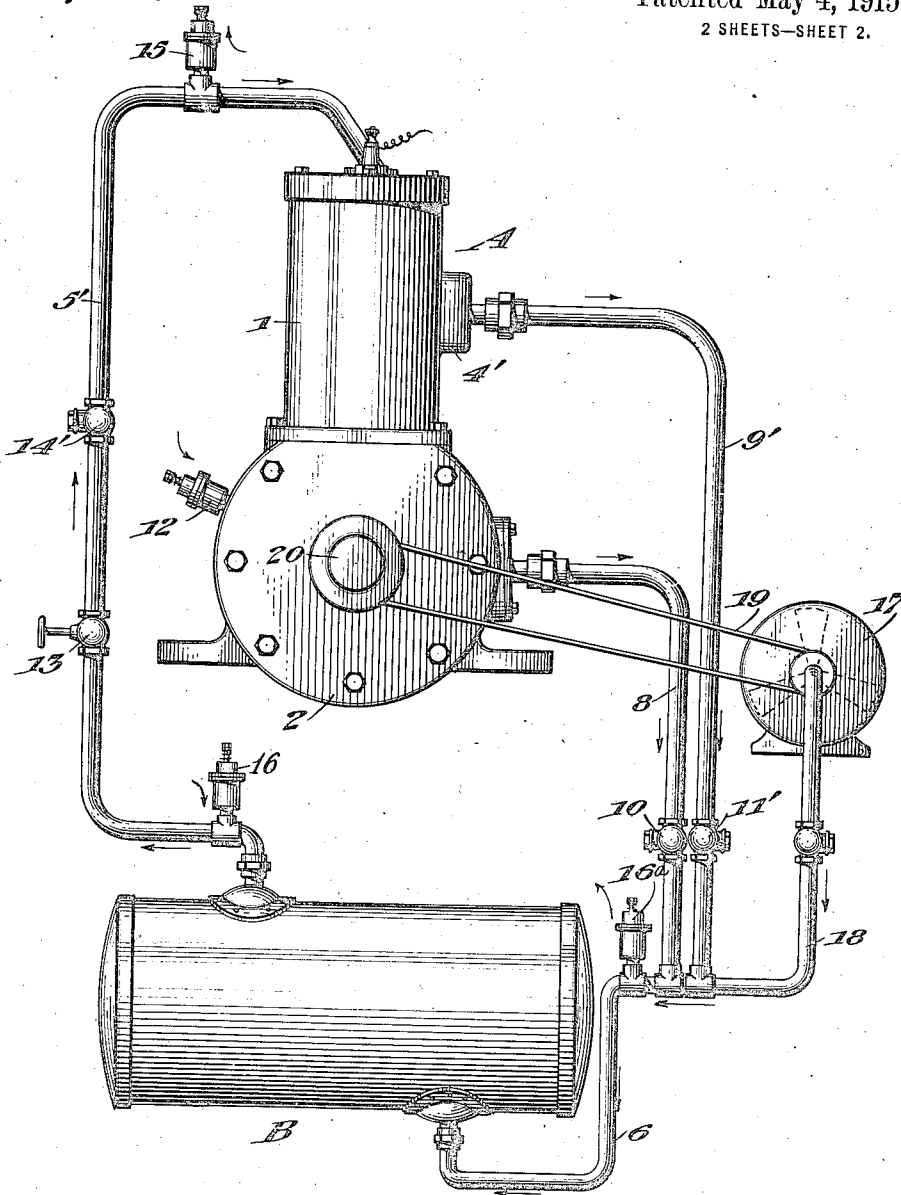
Lloyd W. Patch

Inventor:  
 J. H. Shumaker  
 By Louis Baggett  
 his Atty.

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*Fig. 2.*

*Witnesses:*  
*Ruth B. King*  
*Clayton W. Patch*

*Inventor:*  
*J. H. Shumaker*  
*By Louis R. Poffe & Co.*  
*Attorneys*

# UNITED STATES PATENT OFFICE.

JIM H. SHUMAKER, OF BEAVER FALLS, PENNSYLVANIA.

CHARGE-FORMING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,138,581.

Specification of Letters Patent.

Patented May 4, 1915.

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*To all whom it may concern:*

Be it known that I, JIM H. SHUMAKER, a citizen of the United States, residing at Beaver Falls, in county of Beaver and State of Pennsylvania, have invented certain new and useful Improvements in Charge-Forming Devices for Internal-Combustion Engines, of which the following is a specification.

My invention relates to an improvement in charge-forming devices for internal-combustion engines, and more particularly to such devices intended for use with engines of the two-cycle or four-cycle type, to be applied as an attachment to a standard engine or built in in the design of the engine, and is adaptable to single or multiple cylinders.

It has been determined that when the explosive charge is introduced into the explosion-chamber at a pressure greater than atmospheric, and is then ignited, the force of the explosion and consequently the driving power exerted against the piston are greatly increased.

The object of this invention is to provide a device in which the normal operation of the engine acts to force the explosive mixture into the explosion chamber at a pressure greater than atmospheric pressure, and at the same time maintains the pressure at the source of the explosive charge without materially detracting from the power of the engine.

A further object is to so connect and assemble the parts that a self-starting device of the explosive mixture supply type is formed.

A still further object is to eliminate the exhaust into the atmosphere and utilize the power which has heretofore escaped through the exhaust.

This invention relates to certain novel features of construction and combinations of parts, which will be hereinafter fully described and pointed out in the claims.

In the accompanying drawings:—Figure 1 is a view in side elevation of a standard engine showing my improvement applied thereto, and with parts broken away, and Fig. 2 is a similar view showing my invention applied in a slightly different manner.

The engine A, which is of the standard type, has the cylinder 1, the crank-case 2, and the inlet and exhaust and exhaust ports 3 and 4 respectively.

A mixing-tank B is mounted at any suitable point adjacent the engine, and has a pipe 5 leading therefrom to the inlet 3 of the engine. The tank B is intended to be only partly filled with gasolene or other volatile liquid from which the gas is formed, and the pipe 5 preferably connects with the gas chamber thus left in the upper part of the tank.

Air is supplied to the tank B through a pipe 6, the outlet from which is submerged and is preferably at the point where the liquid has the greatest depth, thus insuring that the air is sufficiently enriched before it rises to the gas chamber or the upper part of the tank. It is preferred that the air volume from the pipe 6 be broken up as it passes into the tank, and I have provided a number of perforations 7, which form an outlet from the pipe 6 into the tank.

A pipe 8 is connected with the crank-case 2, and at its free end with the air supply pipe 6, and a like pipe 9 connects the exhaust 4 with the air supply pipe 6. Check-valves 10 and 11 are provided in the pipes 8 and 9, so that the pipes are left free to the passage of fluid only in a direction from the engine to the air supply pipes 6. An inlet valve 12 is secured to the wall of the crank-case 2. As the piston is thrown on its downward stroke by the ignition of the explosive charge, the air in the crank-case 2 is compressed and is forced through pipe 8 to pipe 6, and thence into the mixing-tank B. As the piston turns and starts on the upward or exhaust stroke, the contents of the explosion chamber is forced out through the outlet 4 in pipe 9 from which it passes to pipe 6, and thence to the mixing tank B. At the same time that the piston travels on its upward stroke, air is drawn into the crank-case through the inlet valve 12, and when the piston again travels at a downward stroke, this fresh supply of air is compressed and forced out through the pipe 8.

As the exhaust from the engine is into the air supply pipe 6, it is preferable that the air be strained and cleansed before it is permitted to rise through the liquid in the mixing-tank to the gas chamber, and to accomplish this straining and purifying action I place water or other cleansing liquid, which would be heavier than the volatile liquid, in the bottom of the mixing-tank B, and as this water would flow back into the air supply pipe 6 by reason of the fact that this pipe

is connected with the bottom of the tank, all air passing into the mixing-tank B would be filtered through the water, and all foreign particles removed.

5 A valve 13 is provided in the gas-pipe 5 to shut off the supply of gas to the inlet when the engine is not in use. When the valve 13 is open and gas is being supplied through the pipe 5, any back firing which  
10 might ignite the gas contained in the mixing-tank B is prevented by a check-valve 14, which is connected in the gas pipe 5, and a safety valve 15 is provided in the gas-pipe 5 between the inlet and the check-valve 14  
15 to permit the escape of back-pressure.

Under some conditions, the air supplied from the exhaust may not prove sufficient for the intake of the engine, and air would then be taken into the pipe 5 through the  
20 air inlet valve 16. It may also be desirable to provide a fan or blower 17, and connect this by a pipe 18 with the air supply pipe 6 to form an auxiliary air supply, and in this connection the additional air would  
25 pass through the volatile liquid. By connecting the belt 19, which drives the fan, to run with the crank-shaft 20 of the engine, and providing any form of suitable clutch (not shown), the supply of air to the tank  
30 B may be augmented at any time during the normal running of the engine.

To guard against too great pressure in the mixing tank B, an escape valve 16<sup>a</sup> is provided in the pipe 6, so that when the  
35 supply of air from the several sources becomes excessive, the air is not forced into the mixing-tank but is permitted to escape to the atmosphere. The valves 16 and 16<sup>a</sup> are preferably of a type that they can be  
40 regulated to open at various pressures to suit the different running requirements.

With the four-cycle engine as shown in Fig. 1, all of the parts would be standard, the inlet and exhaust being controlled by  
45 the valves in the usual manner, and the only change which would be necessary would be to connect the air inlet valve 12 and the air pipe 8 with the crank-case.

With the two-cycle engine, as shown in  
50 Fig. 2, the gas supply pipe 5' may be extended and tapped into the explosion chamber at any convenient point. For instance, the passage can be formed as shown adjacent the spark-plug at the top of the cylinder, the gas pipe 5' could lead into the  
55 spark-plug opening, and the spark-plug be inserted in the special socket provided in the pipe; or any other arrangement which may seem feasible can be made, and the  
60 function yet retained.

The exhaust 4' can, as shown, be used without a mechanically-operated valve for the reason that the check-valve 11' in the pipe 9 will perform the function of a  
65 mechanically-operated valve; and the same is

true of the check-valve 14' in the gas supply pipe 5'. In some cases, however, it may seem desirable to provide mechanically-operated valves, and in such a structure the connection would be formed in a manner  
70 similar to that disclosed in Fig. 1. Apart from the differences pointed out, the structure disclosed in Fig. 2 is identical with that shown in Fig. 1.

By varying the supply of air through the  
75 air pipe 6, the mixture supplied through the gas-pipe 5 or 5' can be varied. By experiment I have found that the mixture passing to the inlet can be composed of up to 90% air, although a perhaps more efficient  
80 result is obtained when the percentage of air in the mixture supplied is maintained slightly lower, say at 86%.

This structure is admirably fitted as a self-starting device, as there is a supply of  
85 gas under pressure maintained at all times within the mixing-tank B. By opening the valve 13 in the gas-pipe 5, gas is admitted into the explosion chamber of the engine, and when the switch is thrown the circuit  
90 is formed at the spark-plug, this charge is ignited, which causes the piston to be driven on its downward path, and, as the supply of gas through the gas-pipe 5 is constant, the operation of the engine continues, and air  
95 is forced through the volatile liquid in the mixing-chamber, and the gas pressure is thus maintained.

From the foregoing, it will be seen that  
100 I have provided a structure by which the charge is introduced under pressure into the explosion chamber by the normal operation of the engine, and without materially detracting from the power of the engine.  
105 Further, the down-stroke of the piston is cushioned by the compression of the air in the crank-case and at the same time the engine is not permitted to exhaust to the atmosphere, but the exhaust is turned to a useful purpose. Still further, a supply of gas  
110 is always maintained. The engine may be started at any time, regardless of climatic or atmospheric conditions, and by first permitting the gas to flow to the explosion chamber, and then closing the ignition circuit, the engine can be started without the  
115 usual objectionable cranking to volatilize the liquid fuel and draw the gas thus formed into the explosion chamber.

It is evident that changes might be made  
120 in the form and arrangement of the several parts described to adapt the device to different types and designs of engine without departing from the spirit and scope of my invention, and hence I do not wish to  
125 be limited to the exact construction herein set forth, but:—

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

1. A device of the character described, comprising, in combination with an internal combustion engine, a mixing-tank made fluid-tight and adapted to contain a volatile liquid used to enrich air for forming an explosive charge for the engine, an air supply pipe connected with the mixing-tank, a gas supply pipe leading from said tank and connected to have an opening into the explosion chamber of the engine, a pipe connected with said air supply pipe and with the chamber of the cylinder at a suitable point to provide an exhaust opening, a pipe leading from the crank-case to said air supply pipe, and valves located in each of said pipes connecting with the air supply pipe and in the gas supply pipe to be opened and closed at the proper intervals by the suction and compression of the fluid carried by the pipes.

2. A device of the character described, comprising, in combination with an internal combustion engine, a mixing-tank made fluid-tight and adapted to contain the volatile liquid used to enrich air for forming an explosive charge for the engine, an air supply pipe connected with the mixing-tank, a gas supply pipe leading from said tank and connected with the inlet of the engine, a pipe connected with the exhaust of the engine and with the air supply pipe, and a pipe leading from the crank-case to said air supply pipe.

3. A device of the character described, comprising, in combination with an internal combustion engine, a mixing tank made fluid-tight and adapted to contain the volatile liquid used to enrich air for forming an explosive charge for the engine, an air supply pipe connected with the mixing-tank and having the opening therefrom submerged in the liquid, a gas supply pipe leading from said tank and connected with the inlet of the engine, a pipe connected with the exhaust of the engine and with the air supply pipe, an air inlet valve placed to admit air to the crank-case, a pipe leading from the crank-case to said air supply pipe to contain the air from said crank-case as it is compressed by the down-stroke of the piston, and valves located in said gas supply pipe and in the pipes from the exhaust and the crank-case.

4. A device of the character described, comprising, in combination with an internal combustion engine, a mixing-tank made fluid-tight and adapted to contain the volatile

liquid used to enrich air for forming an explosive charge for the engine, an air supply pipe connected with the mixing-tank preferably at the lowest point thereof, the liquid level in the tank maintained at such a level that a gas chamber is formed in the upper part of the tank, a gas supply pipe leading from the gas chamber and connected with the inlet of the engine, a pipe connected with the exhaust of the engine and with the air supply pipe, a pipe leading from the crank-case to said air supply pipe, and an auxiliary source of air supply arranged to be operated by the normal running of the engine for augmenting the supply of air forced into the mixing-tank.

5. A device of the character described, comprising, in combination with an internal combustion engine, a mixing-tank made fluid-tight and adapted to contain a volatile liquid used to enrich air for forming an explosive charge for the engine, an air supply pipe connected with the mixing-tank preferably at the lowest point thereof, said air supply pipe and tank so constructed that a straining and moistening liquid heavier than the volatile liquid can be placed in the bottom of the tank and in the air supply pipe for straining and moistening air before it passes through the volatile liquid, a gas supply pipe connected with the mixing-tank in the upper part thereof and leading to the inlet of the engine, a pipe from the exhaust of the engine and connected with the air supply pipe, an air inlet valve connected with the crank-case, an air outlet pipe from the crank-case to the air supply pipe, an auxiliary source of air supply adapted to derive its driving power from the engine for augmenting the supply of air fed through the air supply pipe.

6. A device of the character described comprising an internal combustion engine, a mixing tank adapted to contain liquid fuel, means for forcing air through said liquid fuel under pressure, a pipe leading from the tank to the cylinder of the engine, and several valves in said pipe, namely a check-valve, a safety-valve, an air inlet valve, and a valve under the control of the operator.

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

JIM H. SHUMAKER.

Witnesses:

RALPH T. SAYRE,  
WM. BLOOM.