

May 11, 1926.

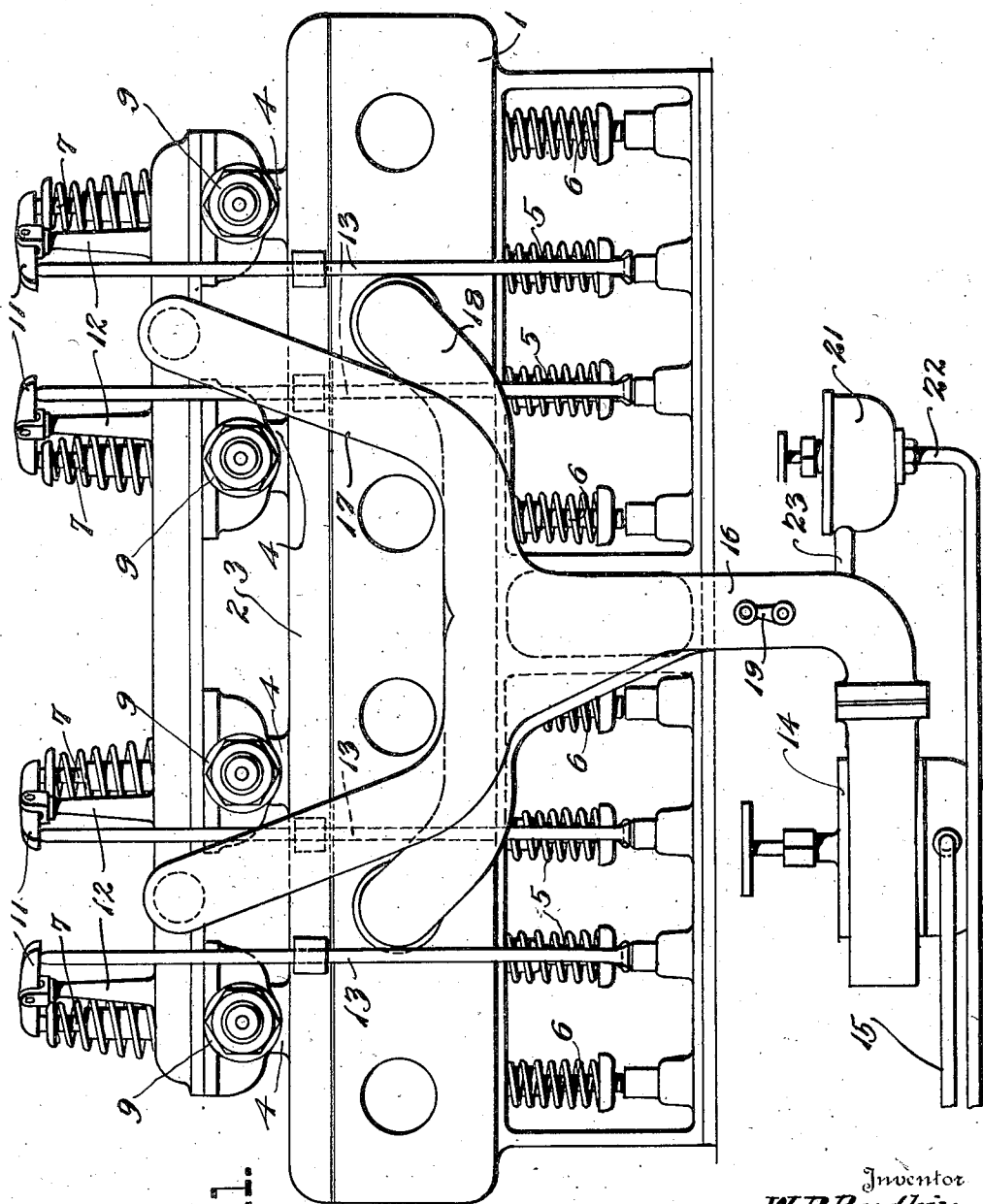
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W. P. RUDKIN

INTERNAL COMBUSTION ENGINE

Filed Oct. 31, 1921

2 Sheets-Sheet 1



Witness:
E. Wagner

FILED

Inventor
W. P. Rudkin

By

Robb Robb & Hill

Attorneys

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Fig. 2.

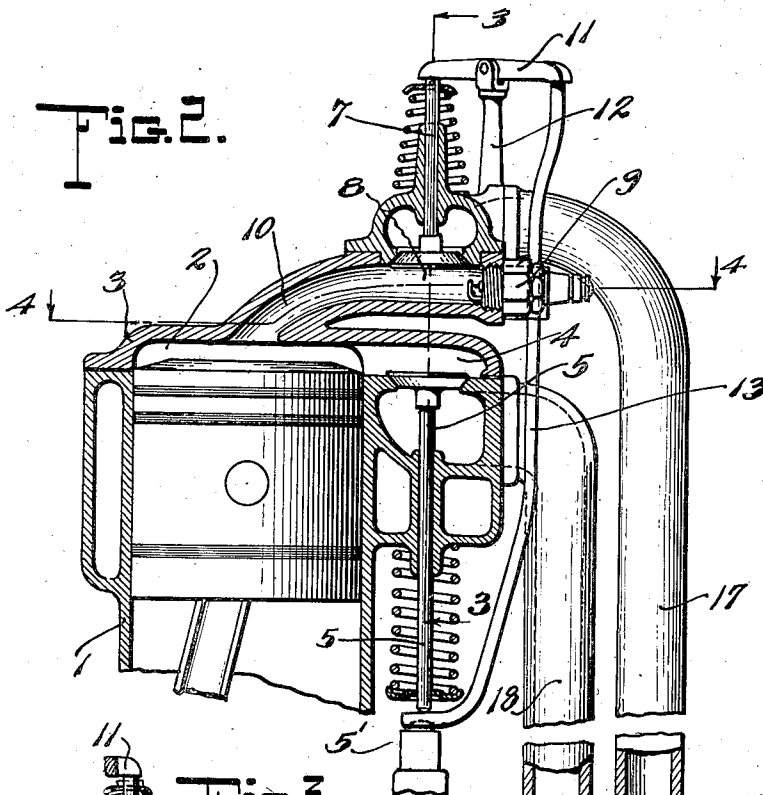


Fig. 3.

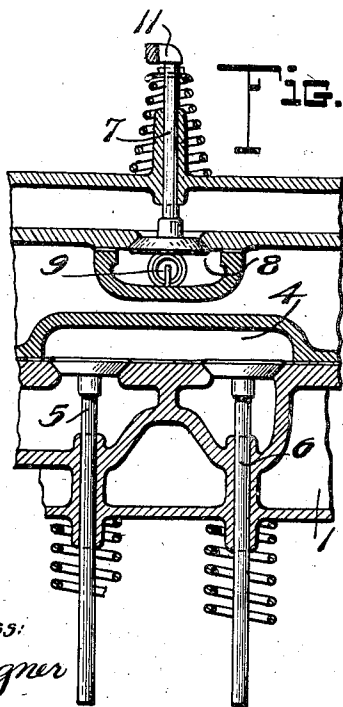
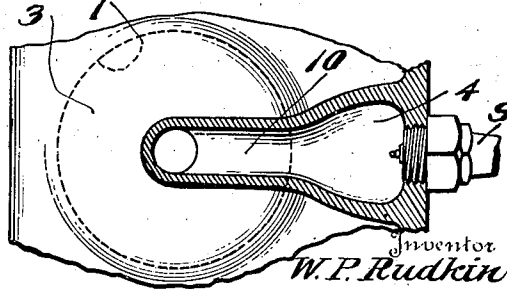


Fig. 4.



Witness:
C. H. Wagner

By

Robt. Robb & Hill

Attorneys

Patented May 11, 1926.

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UNITED STATES PATENT OFFICE.

WILLIAM PAUL RUDKIN, OF OKLAHOMA CITY, OKLAHOMA.

INTERNAL-COMBUSTION ENGINE.

Application filed October 31, 1921. Serial No. 511,688.

The present invention relates to improvements in internal combustion engines and it has for its primary object to provide for utilization of an auxiliary fuel in conjunction with the regular fuel supply, the essential novelty residing in the manner in which said auxiliary fuel is introduced into the firing chamber at a point which will tend to prevent impairment of the highly explosive character of the firing charge or the rendering of the ignition means inoperative as a consequence of the contact of said auxiliary fuel with the igniter.

to the same, and the adaptation of my invention to known types of engines with but slight or relatively unimportant modification of their conventional construction.

These and such other objects as may hereinafter appear are attained by the novel construction, combination and arrangement of parts to be hereinafter specifically described and claimed.

Reference will now be had to the accompanying drawings forming a part of this specification, wherein:

Figure 1 is a side elevation of an engine construction having an embodiment of my invention applied thereto.

Figure 2 is a vertical sectional view showing the details of arrangement of the construction of the invention.

Figure 3 is a sectional view on the line 3—3 of Figure 2.

Figure 4 is a horizontal sectional view on the line 4—4 of Figure 2.

Throughout the following detailed description and on the several figures of the drawing, similar parts are referred to by like reference characters.

Referring to the drawings, 1 designates the cylinder of a conventional engine construction and 2 the combustion chamber thereof which in the particular case is formed in the detachable head 3. Directly adjacent and at one side is the valve chamber 4 and its associated main intake valve 5 and its exhaust valve 6, these valves being actuated in the customary manner by the valve lifters 5'. It will be particularly observed that the valve chamber 4 is closely disposed with reference to the chamber 2, the chamber being flat in form so that the gases admitted into the chamber pass directly to the cylinder in the operation of the engine.

In the head of the engine, speaking with reference to the mechanism for a single cylinder, I mount an auxiliary valve 7 which is inverted with reference to the main valve 5, this valve having its valve chamber 8 directly therebeneath in which the spark plug 9 is disposed. The special feature of this invention lies particularly in the relationship between the valve chamber 8 and the valve chamber 4 with respect to the engine cylinder, the first mentioned chamber communicating with said cylinder by the relatively small curved passage 10. In other words, the spark plug 9 is arranged at the

It should be noted that the term "auxiliary fuel" is here used in its loose sense so as to comprehend either the employment of water vapor or a relatively low combustible hydro-carbon fuel, and this will become more apparent as this description proceeds. To be more specific, it has become quite generally known that considerable advantage is derived, so far as power and non-carbonization is concerned, from introducing moisture into the combustion chamber of a hydro-carbon engine, but the actual effectiveness of this combination with the fuel is materially reduced because it is necessary to maintain the proportion of moisture relatively low owing to the tendency, when a large amount of moisture is employed, to reduce the volatility of the combustible gases and the likelihood of putting the spark plug or igniter out of commission by the deposit of excess moisture upon the terminals thereof.

Thus when using water vapor for the moisture ingredient, only a very small quantity can be permitted to enter into the combustion chamber, whereas if a larger proportion were usable a greater amount of expansive power could be produced from the steam generated. This has led me to devise my special arrangement or construction wherein I propose to introduce the water vapor into the combustion chamber in such a manner as to prevent it from diluting the combustible fuel gases, which latter are led directly to the igniter in which position they act as a barrier between the water vapor and the igniter when under compression. In the carrying out of this invention, among other objects in view, there are the provision for independently conveying the auxiliary fuel into the engine combustion chamber, the utilization of separate valves with actuating means common

terminus of this passage 10 including the valve chamber 8 and is therefore relatively remote in its position as regards the engine cylinder. This arrangement gives rise to the particular advantages for my construction and is therefore of prime importance. The auxiliary valve 7 is operated by a rocker arm 11 pivotally mounted upon the standard 12, which arm is in turn actuated through the rod 13 which extends downwardly into cooperation with the main valve 5, the lower extremity of said rod being bent inwardly so as to lie between the valve lifter 5' and the stem of said main valve. By this arrangement the two valves 5 and 7 are simultaneously actuated to control the admission of the gases into the respective valve chambers and the cylinder.

A carburetor 14 of conventional type is arranged at the customary place to receive its supply of hydro-carbon or fuel through the supply pipe 15, and communication between the carburetor and the valve chambers is established by means of a special manifold 16 which branches from the lower neck so as to convey a portion of the gases to the auxiliary valve chamber 8 by way of the branch 17 and a portion to the main valve chamber 4 by way of a second branch 18, each of these branches being provided with independent throttle valves 19 and 20, respectively. Also at a convenient point I dispose the auxiliary fuel float chamber 21 adapted to receive its supply through the conduit 22 and from this device the liquid passes by the conduit 23 into the branch 18 of the manifold within which is provided a nozzle or jet 24 beneath the throttle valve 20.

The foregoing embodies the details of construction of my invention and the operation of the device will now be specifically set forth. In this connection I desire it to be understood that while I propose to introduce water vapor into the engine through the auxiliary fuel supply 21, it is within the purview of this invention to employ the carburetor 14 for supplying highly volatile fuel and the device 21 for supplying a fuel of low volatility. For the purposes of this description, however, it is contemplated that the water supply from a suitable source will enter the manifold passage 18 under the induction action of the engine in the form of water vapor which will intermingle with that portion or stream of the volatile gases which enters branch 18 of the manifold. This water-vapor-laden fuel passes to the valve chamber 4 under the control of the main valve and is directly introduced into the cylinder. On the other hand, the other portion of the gas steam in its dry state passes by the branch 17 to the valve chamber 8 under the control of the valve 7 so that it is the dry gas which is ignited by the

spark at the plug 9, which latter is not affected by the water-vapor-laden gas which enters the cylinder through the other passage. That is to say, owing to the long passage 10 the dry gas entering the cylinder therethrough will be compressed on the compression stroke of the piston by the water-laden gases which are prevented by this passage from intermingling with the dry gases and diluting the same. The ignition of the dry gas preliminarily causes a supplemental compression of the water laden gases immediately prior to their ignition. In fact, as hereinbefore premised, this dry gas acts as a barrier between the water-vapor-laden gas and the igniter. Owing to this arrangement I am therefore able to introduce into the cylinder a large proportion of water-vapor which serves its function in maintaining the engine cool and increasing the power owing to the expansion caused by the firing of the charge through the medium of the dry gases which are ignited. Obviously, therefore, it is possible with my apparatus to use a combination of high volatile gases and low volatile gases with equal advantages and the terms employed in the claims hereto appended are to be construed in the light of this understanding.

Owing to the provision of the throttle control in each of the passages 17 and 18, the operator of the engine is able to modify the fuel ingredients as found desirable, increasing the water-vapor content or decreasing the same according to the heat condition of the engine.

Since the passage 10 is not water jacketed this becomes highly heated and therefore serves to advantage in the vaporization of the fuel. It will be apparent, however, that where desirable the auxiliary attachment may be formed with a water jacket in the customary manner.

One of the advantageous features of the construction resides in the fact that my mechanism by which the operation of the device is carried out may be constructed in the form of a unitary attachment so that it is applicable to the conventional type of cylinder construction by merely the replacement of the regular engine head with the head attachment of this device together with the proper manifold.

It should be understood, however, that modifications may be made in the details of construction of my device without departing from the spirit of the invention and within the terms of the claims hereto annexed.

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

1. In an internal combustion engine, the combination with a cylinder, of main and auxiliary valve chambers each communicating with a common fuel supply by separate

passages, means for supplying fuel through each of said chambers, means separate from the fuel supply for introducing moisture to one of the passages to said chambers, and
5 ignition means associated with the other of said chambers.

2. In an internal combustion engine, the combination with a cylinder, of main and auxiliary valve chambers, a branch passage
10 between the auxiliary valve chamber and the cylinder of a diameter throughout its length not less than said chamber, separate intake passages leading to the respective valve chambers, and ignition means associated
15 with the auxiliary valve chamber whereby firing of the charge is effective primarily upon that portion admitted to the auxiliary valve chamber.

3. In an internal combustion engine, the combination with a cylinder, of main and auxiliary valve chambers, a branch passage
20 between the auxiliary valve chamber and the cylinder in which the charge is fired, separate intake passages leading to the respective valve chambers, ignition means associated
25 with one of said chambers, a common source of fuel supply for the intake passages and means communicating with one of said passages for altering the volatility of the
30 fuel therein.

4. In an internal combustion engine, the combination with a cylinder, of main and auxiliary valve chambers, a branch passage
35 between the auxiliary valve chamber and the cylinder in which the charge is fired, separate intake passages leading to the respective valve chambers, ignition means associated
40 with one of said chambers, and means for introducing moisture through the intake passage leading to the other of said chambers whereby firing of the charge is effective
45 primarily upon that portion admitted through the chamber of said ignition means.

5. In an internal combustion engine, a cylinder provided with a valve chamber communicating directly therewith, an auxiliary valve chamber, a passage leading
50 therefrom to the cylinder, intake valves for joint movement for each of said chambers, ignition means disposed in one of said valve chambers, and actuating means operatively
55 connecting said valves to simultaneously admit charges to both of said chambers.

6. In an internal combustion engine, a cylinder provided with a valve chamber communicating directly therewith, an auxiliary valve chamber, a passage leading
60 therefrom to the cylinder opposite the piston therein, intake valves for each of said chambers, ignition means disposed in one

of said valve chambers, and actuating means comprising a rock arm and pusher rod directly connected with each of said intake valves to effect simultaneous operation thereof.

7. An attachment for internal combustion engines comprising a cylinder provided with an intake valve, an engine head having a passage leading to the cylinder, an intake valve to control said passage, and a valve
70 actuating rod connecting the cylinder intake valve mechanism and the intake valve upon said head.

8. The combination with an engine cylinder and intake valve therefor, of an engine
75 head having a passage leading to said cylinder, an intake valve mounted to feed to said passage, ignition means associated with said passage, operating connections between the intake valves to effect their joint operation, separate manifold passages leading to the cylinder and to the head and having a common carbureter connection, throttle
80 means for controlling the gases passing through each of the manifold passages and an independent fuel connection with one of
85 said manifold passages.

9. In an internal combustion engine, a piston and cylinder having a normal intake valve, controlling means for said valve, a
90 cylinder head provided with an auxiliary intake valve and casing having a combustion chamber disposed substantially in alinement with the normal intake valve, and means actuated by the controlling means for the
95 normal intake valve for simultaneously actuating the auxiliary intake valve.

10. In an internal combustion engine, an auxiliary valve attachment adapted for application to said engine and comprising a
100 casing provided with an intake valve and ignition means, and actuating means for said auxiliary intake valve constructed and arranged for cooperation with the controlling means for the normal intake valve of
105 the engine.

11. In an internal combustion engine, an auxiliary valve attachment adapted for application to the engine and comprising a casing, an auxiliary intake valve and ignition
110 means within said casing, a bracket supported upon the engine frame carrying means to actuate said valve, and an operative connection from said actuating means disposed to be engaged by the controlling means for the
115 normal intake valve of said engine.

In testimony whereof I affix my signature.

WILLIAM PAUL RUDKIN.