

Sept. 22, 1936.

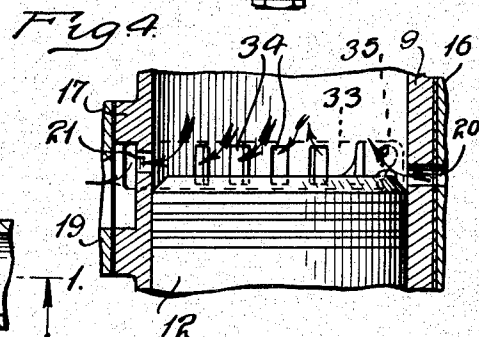
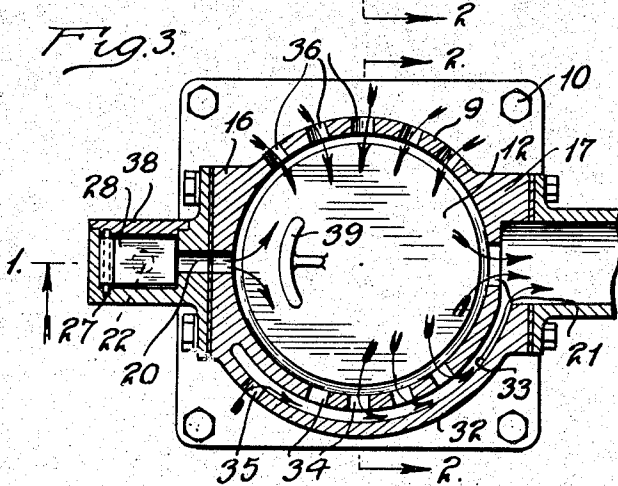
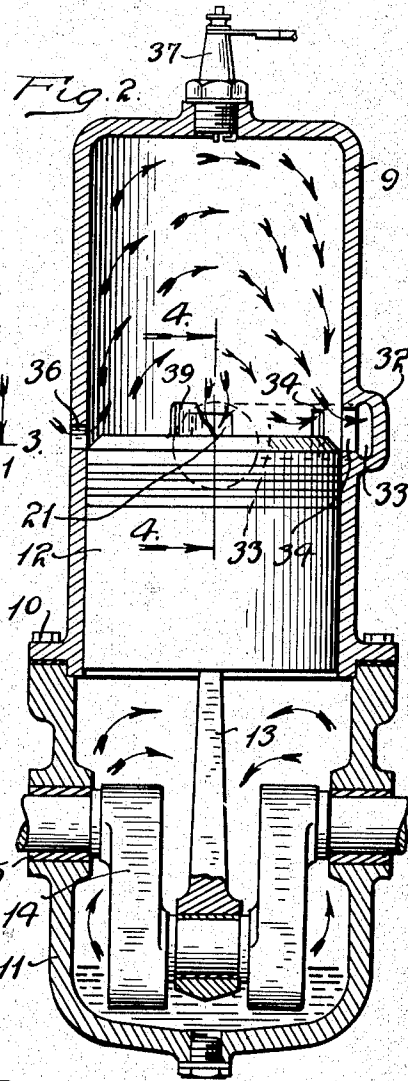
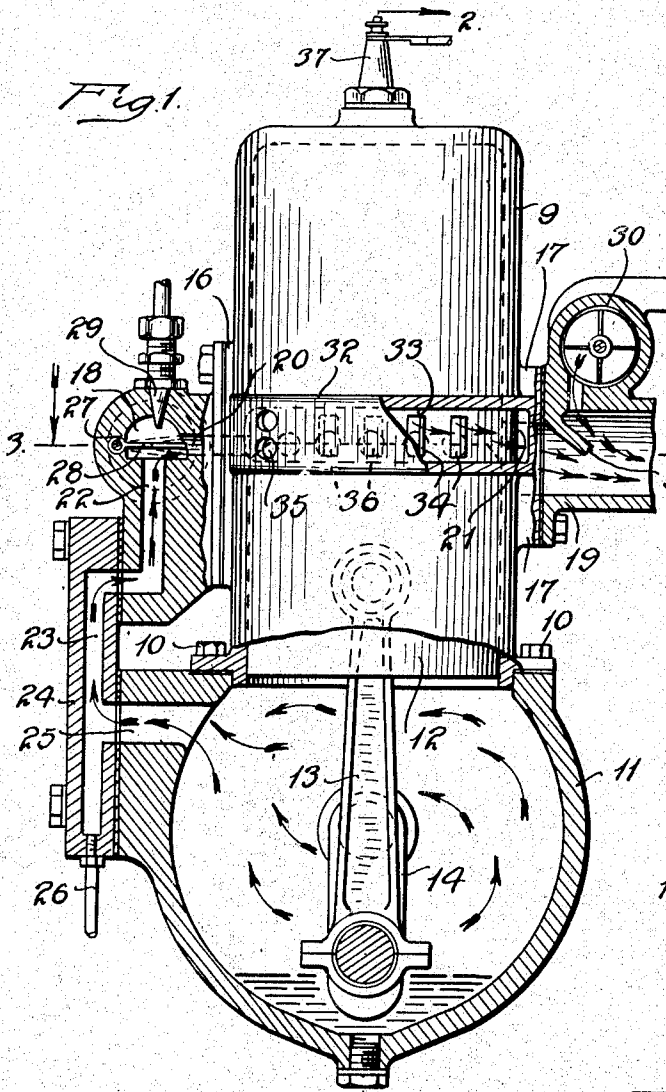
J. H. COOK

2,055,026

INTERNAL COMBUSTION ENGINE

Filed Dec. 7, 1933

3 Sheets-Sheet 1



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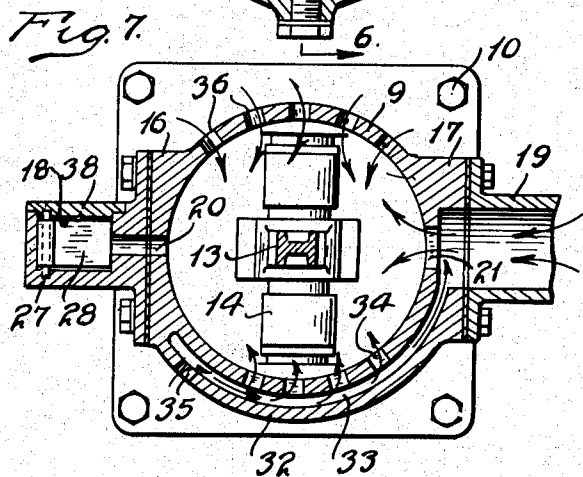
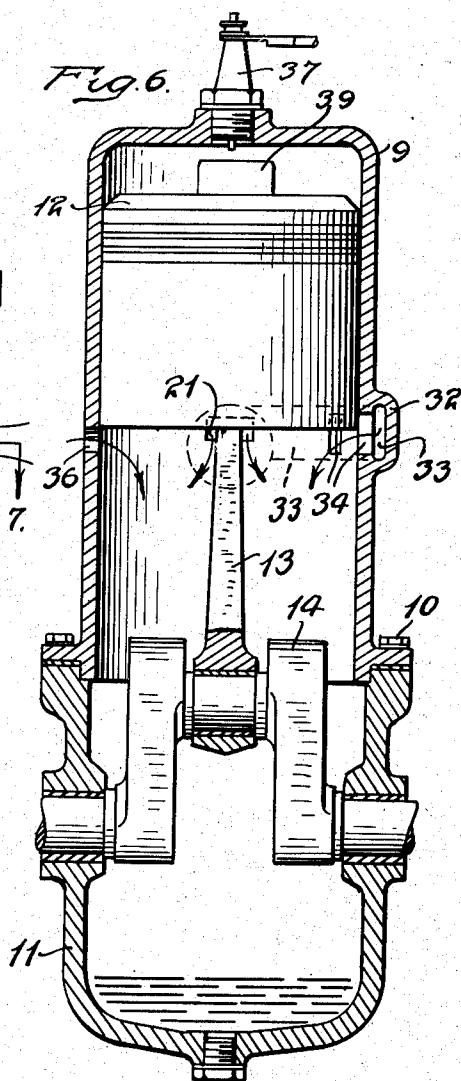
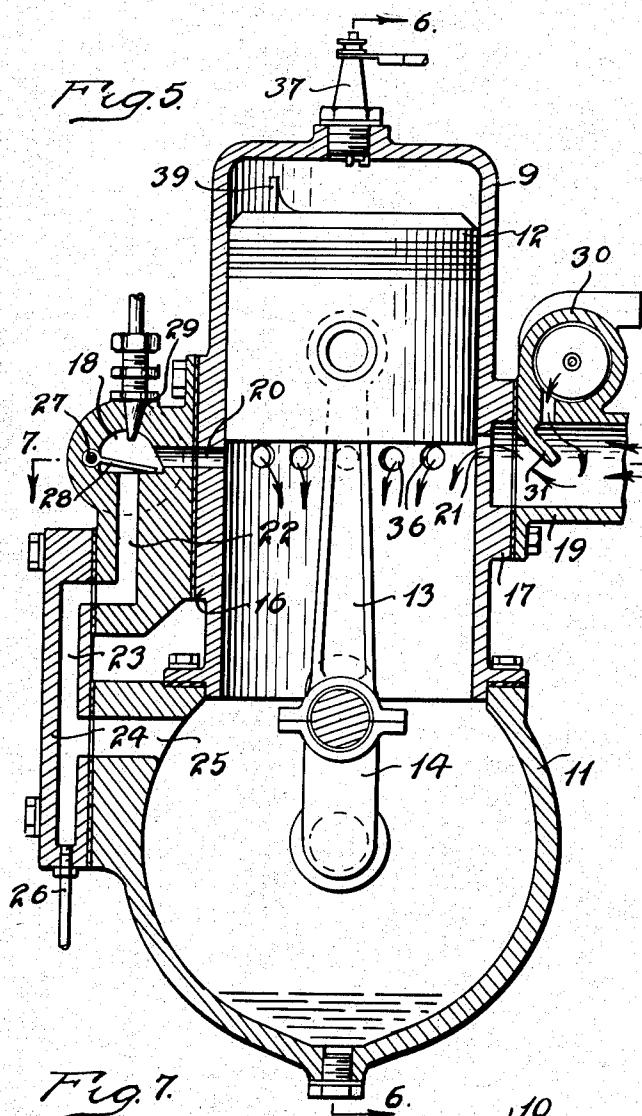
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3 Sheets-Sheet 2



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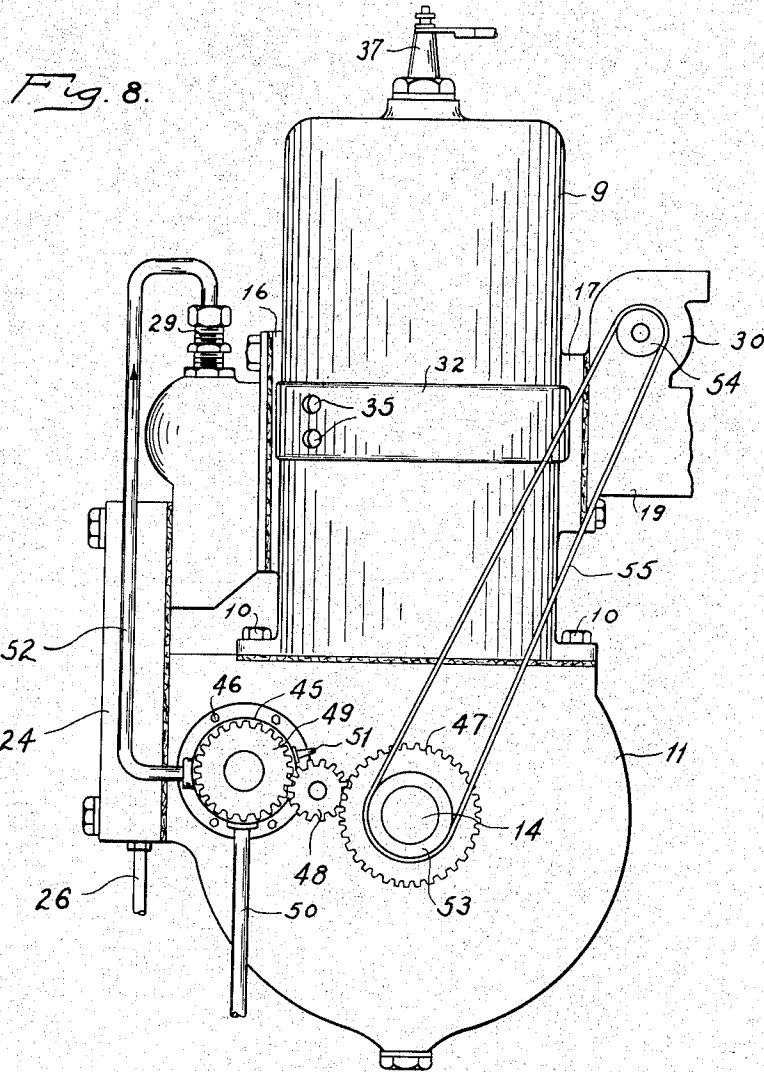
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,055,026

INTERNAL COMBUSTION ENGINE

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Application December 7, 1933, Serial No. 701,260

11 Claims. (Cl. 123—65)

This invention relates broadly to internal combustion engines and particularly to that type of engine designed to take a power impulse on every revolution.

5 The principal object of the invention is the provision of an internal combustion engine which is simple in construction, economical to manufacture and highly efficient in operation.

10 Another object of the invention is the provision of a device of the character referred to which has a greatly reduced number of working parts and which eliminates entirely the necessity of valves, valve springs and associated parts.

15 Another object of the invention is the provision of a device of the character referred to which may be efficiently operated at a greatly increased rate of speed.

20 Another object of the invention is the provision of a high speed engine which is practically self cooling.

25 Another object of the invention is the provision of a high speed internal combustion engine which has a greatly increased capacity for rapidly exhausting unburned gases, and preventing the formation of hard carbon deposits.

30 Further objects and advantages of the invention will be apparent to those skilled in the art from a careful examination of the following description, taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view, partly in elevation, with parts broken away, illustrating a device embodying my invention, when the piston is at the end of its downward stroke.

35 Fig. 2 is a vertical sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 1.

40 Fig. 4 is a fragmentary sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a vertical sectional view, similar to Fig. 1, but showing the piston at the end of its upstroke.

45 Fig. 6 is a vertical sectional view taken on line 6—6 of Fig. 5.

Fig. 7 is a horizontal sectional view taken on line 7—7 of Fig. 5.

50 Fig. 8 is an elevation, similar to Fig. 1 with all parts intact, illustrating the means for driving the fuel and air pump and the blower.

Referring now more particularly to the drawings, it will be seen that, in practice, my improved engine consists of a one piece cylinder 9, to which is bolted, as at 10, the air-tight crank case 11, and in which is reciprocally mounted a conven-

tional piston 12 having an upstanding copper-plated deflecting plate 39 on its head.

The piston 12 is fastened by means of the connecting rod 13, to the crank shaft 14, which in turn is suitably journaled in bearings 15, positioned in the walls of the crank case 11.

5 The foregoing conventional elements form no part of my invention, in themselves, but when combined with my new and improved intake and exhaust means and other elements here-in-after described, a most efficient high speed engine is the result.

15 Cast integrally with, and on opposite sides of, the cylinder 9 are flat-faced portions 16 and 17 to which are bolted respectively the mixing chamber 18 and the exhaust manifold 19, each of which communicates with the interior of the cylinder 9, by means of suitable horizontal ports 20 and 21.

20 The mixing chamber 18 comprises, a separate casting which has a downwardly extending L shaped passageway 22, adapted to communicate with the vertical passageway 23, formed in the plate 24, and the horizontal passageway 25, which communicates with the interior of the crank case 11. Conventional gaskets are positioned between the several parts to make them air-tight. The vertical passageway 23 terminates at the lower end of the plate 24 in a well, to which is connected a normally closed drain tube 26, adapted to permit unburned liquid fuel to escape. Within the mixing chamber 18 is pivoted, as at 27, an agitator 28, which is preferably made of a rectangular piece of thin sheet metal or spring steel, which, when motivated by the forces here-in-after described, causes a more perfect mixture of the fuel to be combusted. The agitator 28 also serves as a stop to prevent warm air from entering the crank case 11, through the passageway 23, during the operation of the engine. 40 The agitator 28 has a tendency to become heated when in use, which tends to assist in making more perfect carburetion. A removable plate 38, on the side of the casting 18, permits the insertion of the agitator 28. Fuel and air in rich mixture are time injected into the mixing chamber 18 through the injector 29 (Fig. 8) by means of a combined fuel and air pump 45, which is secured to the crank case housing by means of machine screws 46, and is driven by the crank shaft 14, through the gears 47, 48, and 49. Fuel enters the pump 45 through the line 50, and air is drawn into the pump 45, through the nipple 51. The fuel and air mixture is carried to the injector 29 through the line 52. 55

Associated, and in communication, with the exhaust manifold 19, is a blower 30, which acts to assist in the removal of burned gases from the exhaust port and forces them beyond the point where they might be drawn back into the cylinder. This is an important feature of my invention as it overcomes one of the chief objections to the two cycle engine. After the burned gases are dispelled, some of the air from the blower is forced into the cylinder, thereby assisting the partial vacuum in making the exhaust port a valuable air intake port. The blower 30, may be driven in any suitable manner from the crank shaft, or it may be located elsewhere than on the manifold, and may be connected thereto by a tube or the like. In Fig. 8, I show the blower 30 being driven by the crank shaft 14 through the pulley wheels 53 and 54 and the belt 55.

A deflector plate 31, is provided in the exhaust manifold to impart proper direction to the air from the blower 30.

Formed integrally along one side of the cylinder 9, (Fig. 1) is an arcuate off-set member 32, which has a curved passageway 33 extending its full length. The passageway 33, is blind at one end and opens at the opposite end into the exhaust port 21. A plurality of rectangular auxiliary exhaust ports 34 communicate with the passageway 33, and the interior of the cylinder 9. A plurality of air intake ports 35, positioned near the blind end of passageway 33, communicate with said passageway 33 and the exterior of said arcuate member 32 and serve to permit the introduction of fresh air to the passageway 33, back of the gases being exhausted. On the side of the cylinder 9, opposite the off-set member 32, is a plurality of circular air intake ports 36, which communicate with the interior of the cylinder 9 to permit fresh air to enter, alternately, directly into the combustion chamber of the cylinder 9, and the crank case 11, as the piston 12 reaches its lower position and upper position respectively. It will be noted that the rectangular auxiliary exhaust ports 34, extend to a higher position than the circular air intake ports 35, which allows them to be opened before the air intake ports 35, are opened on the downward stroke of the piston 12. The exhaust ports 34 are also higher than the main exhaust port 21.

The combustion chamber of the cylinder 9, is provided with a spark-plug 37, which is connected to a suitable spark timing device, (not shown). Lubrication may be provided by any conventional method. In the drawings I disclose a splash-system. A conventional starter may be used.

The operation of the engine is as follows:

In Fig. 1 the piston 12, is shown at its lowermost position and at the completion of its power stroke. During the travel of the piston 12, from the upper position to the position shown in Fig. 1, the exhaust ports 21 and 34 are first opened and a partial vacuum is set up in the combustion chamber of the cylinder 9, as the gases escape. At the same time an air pressure is being built up in the crank case 11. As the piston 12 travels farther, the air intake ports 35 and 36, are uncovered allowing fresh air to enter the combustion chamber of the cylinder 9. This inrushing air tends to cool the combustion chamber and greatly assists in scavenging and driving out any remaining unburned gases, through the exhaust port 21 and the auxiliary exhaust ports 34. The rapid exhausting of the unburned gases is further aided by the action of the blower 30 as here-tofore explained, and by the driving action of the

inrushing fresh air which enters back of the outgoing gases through the ports 35.

When the piston 12, reaches the end of the downward stroke and is ready to travel upward, the exhausting operation is completed. Immediately following the exhausting operation, and while the intake port 20 remains open, a charge of fuel with air under pressure, is injected into the mixing chamber 18 through 29. The injected fuel and air strikes the agitator 28, which is also being actuated from below, by the compressed air which enters the chamber 18, from the crank case 11, through the passageway 23. The agitator 28 causes the fuel and air to become thoroughly pre-mixed in the chamber 18, before it is forced into the combustion chamber of the cylinder 9. The rich mixture entering the cylinder 9 strikes the deflecting plate 39 and is finely dispersed so that when it combines with the fresh air admitted through ports 35 and 36, a very high explosive mixture results. On the upward stroke of the piston 12, the intake ports are closed, and a partial vacuum is created in the crank case 11. At the same time the explosive mixture is greatly compressed and is then fired by the spark-plug 37, when the compression stroke is completed. When the piston 12, reaches its uppermost position, the ports 36 are opened permitting air to enter below the piston 12, into the bottom of the cylinder 9 and the crank case 11. On the downward stroke of the piston 12 the exhaust port 21 and the auxiliary exhaust ports 34 open slightly ahead of the intake port 20, and the air ports 35 and 36, so that the exhaust operation is partly completed when fresh air is permitted to enter the combustion chamber and is completely finished before the next fuel injection, and before the piston 12 reaches the end of its downward stroke.

So far as I am aware no one has ever attempted to have the explosive charge forced into the cylinder, following the exhaust on the down stroke. This is possible in my engine because an inrush of fresh air follows the exhaust gases and precedes the entrance of the explosive mixture.

With the device just described, I avoid the burning off of uncarbureted fuel as is the result when a rich mixture is injected directly into the firing chamber and I have overcome the difficulties encountered in using a lean mixture such as used in the well known two cycle engine, wherein the fuel and air are mixed in the base, or drawn in through a check valve.

My device produces an automatic air controlled mixture of high explosive quality at all speeds. The device can be operated at very high speed by a simple adjustment of the needle valve controlling the fuel. Any desired multiple of cylinders may be combined if greater out-put is desired.

It is to be understood that certain modifications are within the contemplation of the invention and are intended to be included in the appended claims.

Having described my invention, what I claim and desire to protect by Letters Patent is:

1. In an internal combustion engine adapted to take a power impulse on each revolution, in combination, a cylinder having a combustion chamber, an air-tight crank case secured to said cylinder, intake means, including an intake port, a mixing chamber communicating with said intake port, and also with said crank case and a source of fuel and air supply, firing means, exhaust means, including a primary exhaust port and secondary exhaust ports which communicate with

an auxiliary exhaust passageway connected to said primary exhaust port, a plurality of air ports in the walls of said cylinder, and a piston reciprocally mounted in said cylinder adapted to open said exhaust port, said intake port and said air ports on its downward stroke and adapted to open said air ports, to admit fresh air to said crank case, upon its upward stroke.

2. In an internal combustion engine, the combination of a cylinder, a piston in said cylinder, a combustion chamber, a compression chamber, a mixing chamber, means connecting said mixing chamber with said compression chamber and said combustion chamber, intake means, exhaust means, firing means, a plurality of ports in the walls of said cylinder, arranged to be opened and closed by said piston, the ports in one side of said cylinder communicating with the atmosphere, and alternately with said combustion chamber and said compression chamber, the ports in the opposite side of said cylinder ports communicating with said combustion chamber, said compression chamber, and a passageway extending along one side of said cylinder.

3. In an internal combustion engine, the combination of a cylinder having a combustion chamber, intake, firing, and exhaust means, a piston in said cylinder, a crank case secured to said cylinder, said crank case having a compression chamber therein, a mixing chamber, means connecting said mixing chamber with said combustion chamber and said compression chamber, a group of ports in said cylinder opening to the atmosphere, a second group of ports in said cylinder opening into a passageway which extends along one side of said cylinder, and communicates with said exhaust means, and means for assisting the out-flow of gas from and the in-flow of air to said combustion chamber.

4. In an internal combustion engine, the combination of a cylinder provided with a combustion chamber and having a piston reciprocally mounted therein, a crank case comprising a compression chamber, intake, firing and exhaust means, a group of annular ports on one side of said cylinder, a group of elongated ports on the other side of said cylinder, said annular ports communicating with the atmosphere and said elongated ports communicating with a passageway, one end of which is open to the atmosphere, the other end of which communicates with said exhaust means, all of said ports being arranged to be opened and closed by said piston.

5. In an internal combustion engine, the combination of a cylinder provided with a combustion chamber and having a piston reciprocally mounted therein, a crank case comprising a compression chamber, intake, firing and exhaust means, a group of annular ports on one side of said cylinder, a group of elongated ports on the other side of said cylinder, said annular ports communicating with the atmosphere and said elongated ports communicating with a passageway, one end of which is open to the atmosphere, the other end of which communicates with said exhaust means, all of said ports being arranged to be opened and closed by said piston, and means to assist the outflow of gas from, and the inflow of air to said combustion chamber.

6. In an internal combustion engine, the combination of a cylinder provided with a combustion chamber and having a piston reciprocally mounted therein, a crank case comprising a compression chamber, intake, firing and exhaust means, a group of annular ports on one side of said cylinder, a group of elongated ports on the other side of said cylinder, said annular ports communicating with the atmosphere and said elongated ports communicating with a passageway, one end of which is open to the atmosphere, the other end of which communicates with said exhaust means, all of said ports being arranged to be opened and closed by said piston, and means to assist the outflow of gas from, and the inflow of air to said combustion chamber.

der, a group of elongated ports on the other side of said cylinder, said annular ports communicating with the atmosphere and said elongated ports communicating with a passageway, one end of which is open to the atmosphere, the other end of which communicates with said exhaust means, all of said ports being arranged to be opened and closed by said piston, and means communicating with said passageway to assist the outflow of gas from, and the inflow of air to said combustion chamber.

7. In an internal combustion engine, the combination of a cylinder having a combustion chamber, a crank case comprising a compression chamber, intake, firing, and exhaust means, a piston reciprocally mounted in said cylinder, a group of elongated ports on one side of said cylinder arranged to be opened by said piston on its downward stroke, to permit the outflow of gas from said combustion chamber, and a group of annular ports on the other side of said cylinder arranged to be subsequently opened by said piston on its downward stroke to permit the flow of air into said combustion chamber while said elongated ports remain open.

8. In an internal combustion engine, the combination of a cylinder having a combustion chamber, a crank case comprising a compression chamber, intake, firing, and exhaust means, a piston reciprocally mounted in said cylinder, a group of elongated ports on one side of said cylinder arranged to be opened by said piston on its downward stroke, to permit the outflow of gas from said combustion chamber, and a group of annular ports on the other side of said cylinder arranged to be subsequently opened by said piston on its downward stroke to permit the flow of air into said combustion chamber while said elongated ports remain open, all of said ports being arranged to admit air to said compression chamber upon the upward stroke of said piston.

9. In an internal combustion engine, the combination of a cylinder having a combustion chamber, a crank case comprising a compression chamber, intake, firing, and exhaust means, a piston reciprocally mounted in said cylinder, a group of elongated ports on one side of said cylinder arranged to be opened by said piston on its downward stroke, to permit the outflow of gas from said combustion chamber, and a group of annular ports on the other side of said cylinder arranged to be subsequently opened by said piston on its downward stroke to permit the flow of air into said combustion chamber while said elongated ports remain open, all of said ports being arranged to admit air to said compression chamber upon the upward stroke of said piston and means for forcibly assisting the outflow of gas and the inflow of air through said ports.

10. In an internal combustion engine, the combination of a cylinder, having a combustion chamber therein, a crank case having a compression chamber, an intake port, an exhaust port, firing means, a mixing chamber communicating with said compression chamber, said combustion chamber and a source of fuel and air supply, an auxiliary passageway extending along one side of said cylinder, said passageway communicating at one end with the atmosphere and at the other end with said exhaust port, a group of elongated ports on one side of said cylinder in communication with said passageway, a group of annular ports on the other side of said cylinder in communication with the atmosphere and said combustion chamber, and a piston reciprocally mounted in said cylinder,

adapted to open all of said ports to the combustion chamber on its downward stroke, and open all of said ports to the compression chamber on its upward stroke.

- 5 11. In an internal combustion engine, the combination of a cylinder, having a combustion chamber therein, a crank case having a compression chamber, an intake port, an exhaust port, firing means, a mixing chamber communicating with said compression chamber, said combustion chamber and a source of fuel and air supply, an auxiliary passageway extending along one side of said cylinder, said passageway communicating at one end with the atmosphere and
10 at the other end with said exhaust port, a group
15

of elongated ports on one side of said cylinder in communication with said passageway, a group of annular ports on the other side of said cylinder in communication with the atmosphere and said combustion chamber, and a piston reciprocally mounted in said cylinder, adapted to open all of said ports to the combustion chamber on its downward stroke, and open all of said ports to the compression chamber on its upward stroke, and means for forcibly assisting the outflow of gas from said combustion chamber and the inflow of air to said combustion chamber and to said compression chamber.

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