Sept. 8, 1925. 1,552,515

I. H. SPENCER

GAS ENGINE

Filed Jan. 18, 1922 2 Sheets-Sheet 1

Fig. 1.

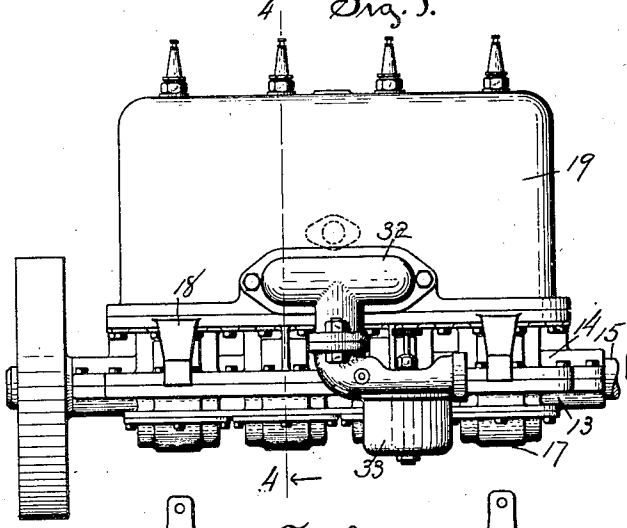


Fig. 2.

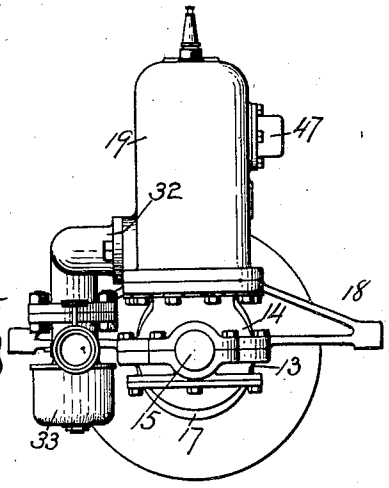


Fig. 3.

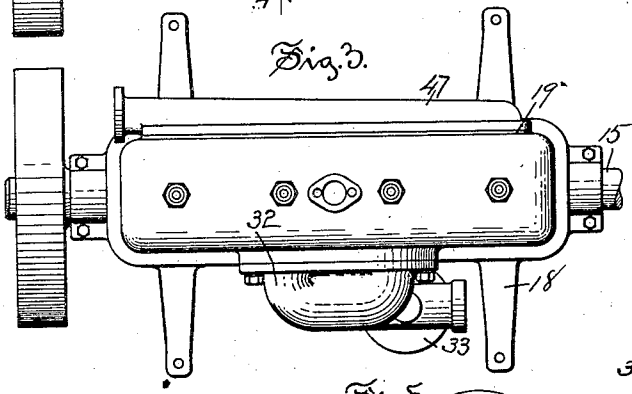


Fig. 4.

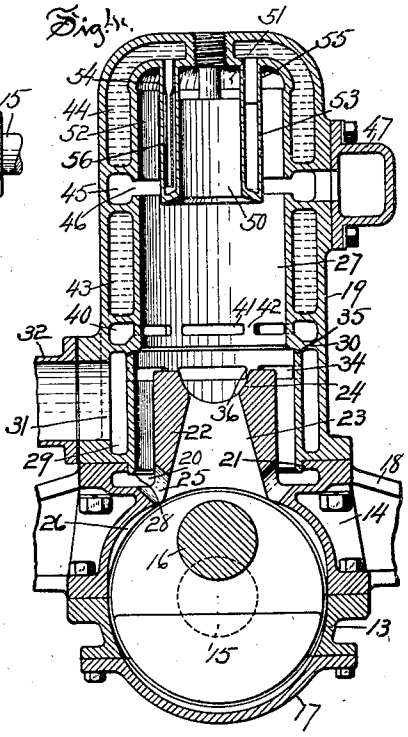


Fig. 5.

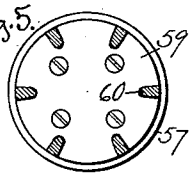


Fig. 3a.

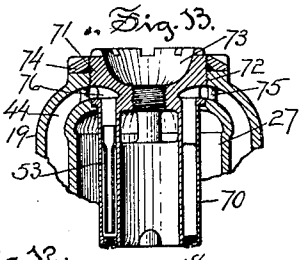


Fig. 6.

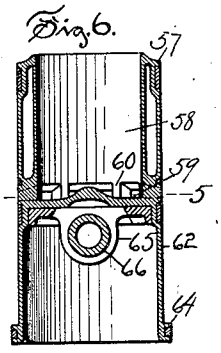
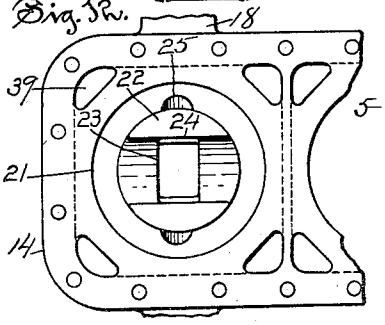


Fig. 3a.



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Fig. 7.

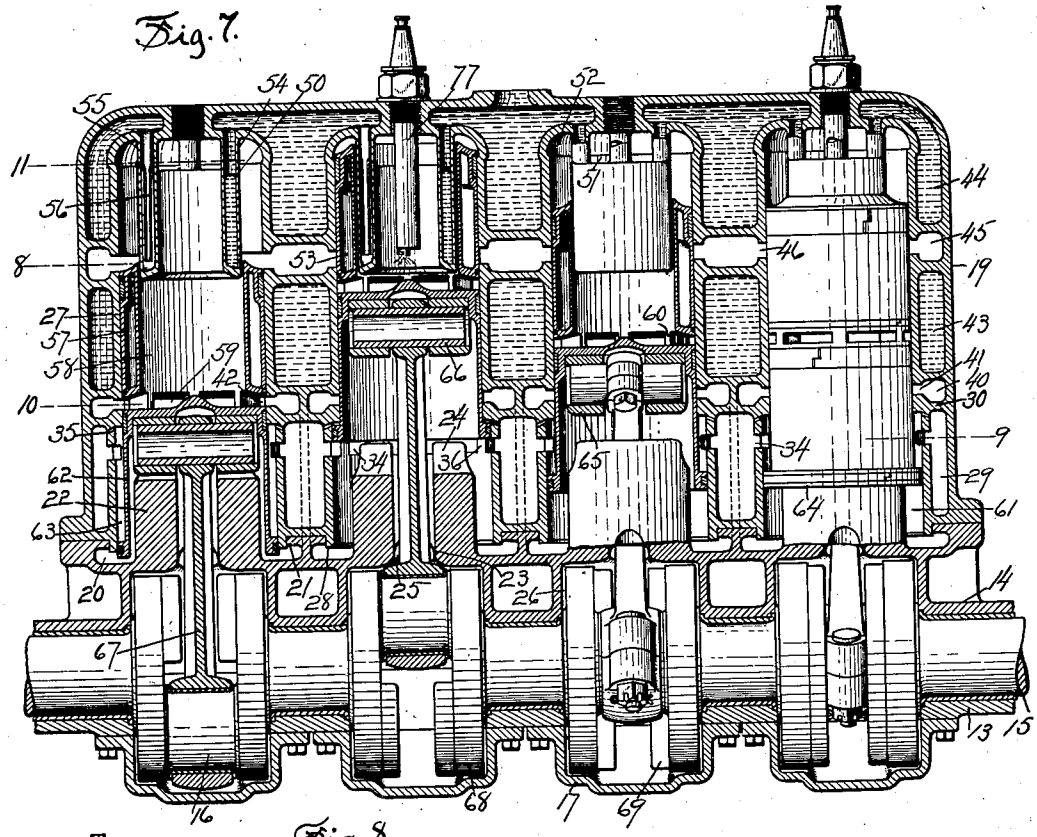


Fig. 8.

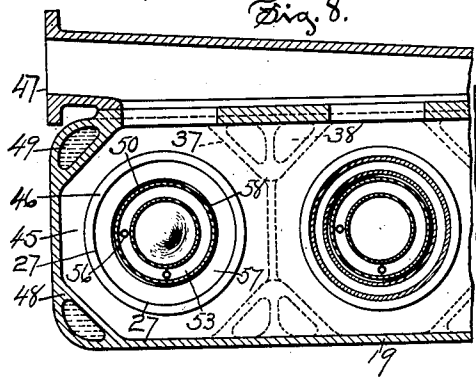


Fig. 9.

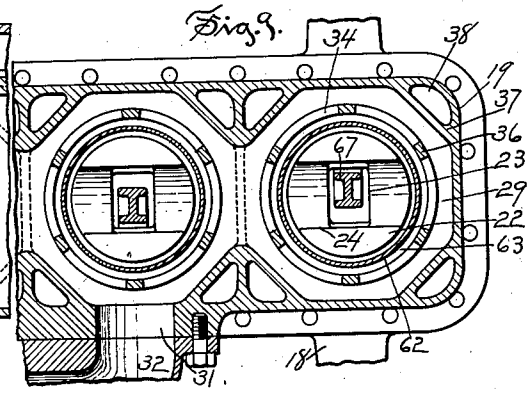


Fig. 10.

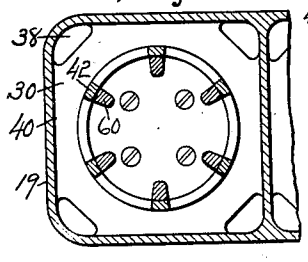
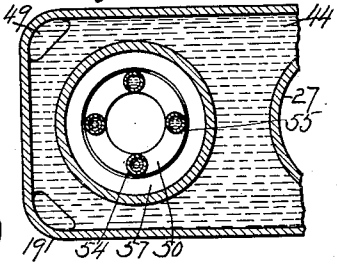


Fig. 11.



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Patented Sept. 8, 1925.

1,552,515

UNITED STATES PATENT OFFICE.

IRA H. SPENCER, OF WEST HARTFORD, CONNECTICUT.

GAS ENGINE.

Application filed January 18, 1922. Serial No. 530,043.

To all whom it may concern:

Be it known that I, IRA H. SPENCER, a citizen of the United States, and a resident of West Hartford, in the county of Hartford and State of Connecticut, have invented new and Improved Gas Engines, of which the following is a specification.

My invention relates to the class of engines in which the propelling power is developed from the explosion of a combustible mixture within the cylinder, and an object of my invention, among others, is generally to improve running conditions, and especially as to speed, of two cycle engines.

One construction of an engine embodying my invention and in the making and use of which the objects herein set out, as well as others, may be attained, is illustrated in the accompanying drawings, in which—

Figure 1 is a view in side elevation of my improved engine.

Figure 2 is an end view of the same.

Figure 3 is a top view.

Figure 4 is a view, scale enlarged, in vertical transverse section through my improved engine on a plane denoted by the dotted line 4—4 of Figure 1, the piston being removed.

Figure 5 is a view in cross section through a piston of my improved engine on a horizontal plane denoted by the dotted line 6—6 of Figure 6.

Figure 6 is a view in central longitudinal transverse section through the piston.

Figure 7 is a view in central vertical, longitudinal section through the engine, the members within the right hand cylinder, however, being shown in full, and the parts within the piston next to that at the right also being shown in full and the fillers within said cylinders being broken away at their lower ends. Spark plugs are shown in only two of these cylinders and the spacers between the ports in the central flow tube are broken off at their upper ends in the two cylinders at the right.

Figure 8 is a view in horizontal section through a portion of the engine on a plane denoted by the dotted line 8— of Figure 7.

Figure 9 is a similar view on a plane denoted by the dotted line 9— of Figure 7.

Figure 10 is a fragmentary view in horizontal section on a plane denoted by the dotted line 10— of Figure 7.

Figure 11 is a view similar to Figure 10, but on a plane denoted by the dotted line 11— of Figure 7.

Figure 12 is a top view of one end of the upper base section of the engine. (Sheet I).

Figure 13 (Sheet I) is a detail sectional view illustrating a modified construction of the upper end of the cylinder.

In the accompanying drawings the numeral 13 denotes a lower base section and 14 an upper base section of my improved engine, which sections are separated preferably on a horizontal plane passing through the axis of a crank shaft 15 having cranks 16 to which access may be readily gained as by means of bottom covers 17 removably secured to the bottom of the lower base section to close openings therein directly underneath each of the cylinders. Engine supports 18 project laterally from the base section 14 at suitable intervals as a means for supporting the engine as on the frame of the vehicle, or otherwise.

The engine proper is supported on the base, and is secured thereto in any suitable manner, as by means of screw bolts applied to flanges on the cylinder block and base, and the sections of the base may be secured together in a similar manner.

My improved engine comprises a cylinder block or case 19 composed of any suitable metal disposed in such form as may be desired, as herein shown such case being of generally rectangular shape with rounded corners when viewed from the top, and the formation of this case, together with that of the base and including the parts inclosed therein, constitutes a material feature of my invention. Various chambers for the reception of gas and for a cooling medium, as water, are formed directly in the walls of this block or case and surrounding the cylinders at points along their length, inlet and transfer ports, as well as exhaust ports, being also formed in said walls.

Bottom chambers 20 are formed in the top of the upper base section 14, one immediately underneath each of the cylinders,

these chambers each being of generally rectangular shape on a horizontal plane and preferably with rounded corners, circular openings 21 extending downwardly from the top of the base section into each of said bottom chambers. A filler 22, preferably round in cross section, rises from the floor of each of the bottom chambers 20 through the openings 21, said fillers extending for some distance above the upper surface of the section 14 and each having an opening 23 for a connecting rod to be hereinafter described, and each of said fillers also having a groove 24 for a wrist pin bearing also to be hereinafter described. Crank case supply ports 25 extend through each of the fillers, these ports being for the supply of a portion of the fuel to the crank case chamber 26 appurtenant to the filler in which said ports are formed.

The cylinder block or case, in the special form herein shown embodies four cylinders all of the same construction, and therefore any description herein as to the construction of any one cylinder will be understood as applying to all. The cylinder block or case 19 sets squarely upon the top of the upper base section 14 and is provided with four vertical bores comprising cylinders 27, flanges 28 projecting below the bottom of the cylinder block, at the bottom of the cylinders, and fitting the circular openings 21 in the upper base section 14, and as shown in Figures 4 and 7 of the drawings.

An inlet chamber 29 extends from end to end and from side to side of the cylinder block, entirely surrounding each of the cylinders, and as shown in Figures 4, 7 and 9 of the drawings, the cylinders rising through said chambers. The top 30 of this chamber is located a little above inlet openings 31, in the structure herein shown there being two of these openings located opposite the center cylinders and communicating with an intake manifold 32 that is supplied with fuel from a carbureter 33. It will, however, be understood that the number of openings to the inlet chamber 29 is immaterial, and it is not essential that a manifold be provided at the inlet to the chamber 29. Inlet ports 34 open from each of the inlet chambers 29 through the cylinder walls into the interior of the cylinders around the fillers 22, and relief ports 35 open through the cylinder walls just above the inlet ports for a purpose to be hereinafter described. The inlet ports 34 to each cylinder constitute to all intents and purposes a single port extending entirely around the cylinder, bridges 36 extending across the port to each cylinder at suitable intervals to serve as a guide for the piston in that cylinder and also as a strengthening element, the bridges for each inlet port taking up a very small part of the cylinder wall.

As hereinbefore mentioned the cylinder block or case is of generally rectangular shape on horizontal planes and while the inlet chamber 29 therein extends from end to end of the block, as hereinbefore described, it is narrowed at points between the cylinders by filling pieces 37 (see Figure 9) running from the bottom to the top of the chamber, transfer passages 38, two in each filling piece intermediate the ends of the chamber, extending through these filling pieces. These transfer passages each communicate with a transfer port 39 (see Figure 12) opening through the top wall of the bottom chamber 20, this being the top of the upper base section 14 of the engine base. There are four of these transfer ports, one at each of the four corners, of each bottom chamber 20. The transfer passages 38 also open through the top wall 30 of the inlet chamber, which is also the bottom wall of the transfer chambers 40, there being a transfer chamber 40 appurtenant to each cylinder and of a generally angular shape in horizontal planes, as shown in Figure 10 of the drawings. Ports 41 open from each of the chambers 40 through the walls of the cylinders to the interior thereof for a purpose to be hereinafter described, these ports appurtenant to each cylinder each comprising a practically continuous port, as in the case of the inlet port 34, there being very narrow bridges 42 between the ports, occupying but a very small part of the cylinder wall.

Lower and upper cooling chambers 43—44 respectively are formed in the wall of the block or case and extend from end to end and from side to side thereof, as shown in Figure 11 of the drawings, the several cylinders extending vertically through these chambers. These chambers are for the reception of any suitable cooling medium, as water, and they surround the cylinders substantially at all points where fuel is ignited therein, and especially above the transfer chamber 40.

An exhaust chamber 45 is located between the cooling chambers 43—44 with an exhaust port 46 opening from each of the cylinders into this chamber, such ports each extending completely around the cylinder which it serves. This provides for substantially an unobstructed exhaust from the cylinders into the exhaust chamber 45 and the exhaust may be conducted from this chamber in any suitable manner, and as may be desired, an exhaust manifold 47 being shown in the drawings herein for such purpose, such manifold extending the whole length of the cylinder block and thereby providing for extreme freedom in the escape of the exhaust. Another feature of the exhaust extending completely around the cylinder is that it enables the exhaust port to be made of mini-

mum width, thereby providing for a maximum amount of cooling surface lengthwise of the cylinders. A further feature of this construction is that a maximum amount of movement of the piston is obtained before the exhaust port is opened and the pressure against the piston is relieved. The driving force against the piston is, therefore, maintained for a maximum length of time. Further than this the absence of bridges across the exhaust port removes an objection, as such bridges when employed have so little metal that they are heated to an injurious extent. The corners at opposite ends of the exhaust chamber, and of the cylinder block, are filled as at 48 (see Figure 8) and circulating passages 49 extend through said filled corners to establish communication between the upper and lower cooling chambers for the purpose of circulation of cooling fluid within the chambers, and it will be understood that said chambers will be connected with any suitable fluid cooling means in a manner that will be readily understood and, therefore, such connections are omitted from the showing herein.

A central flow tube 50 is located in the upper part of each cylinder for the purpose of directing flow of fluid to the upper part of such cylinder lengthwise and through the central portion thereof, and also to prevent mixing of the burned and unburned gases, ports 51 being formed at the upper end of the central flow tube to conduct the burned products from the chamber within said tube to an outlet chamber 52 at the upper end of the cylinder and between the central flow tube and the inner surface of the cylinder. This central flow tube, in the structure herein shown, is in the form of a cooling jacket, its walls being hollow for this purpose providing an annular chamber 53 therein. This chamber is connected with the cooling chamber 44 to receive a cooling medium therefrom, as herein shown spacers 54—55 between the ports 51 being formed tubular to provide such connections. As many of these connections as may be desired may be employed, four being illustrated herein, the spacers or connections 55 each receiving a circulating tube 56 extending to a point near the bottom of the chamber 53 and spaced from the walls thereof, while the spacers or connections 54 merely connect the top of the chamber 53 with the chamber 44. This construction promotes circulation within the chamber 53, the cooler fluid passing from the chamber 44 through the tubes 56 to the bottom of the chamber 53, within which chamber said fluid is raised in temperature and flows out at the top through the connections 54.

A piston 57 in each cylinder has a double wall to serve as a cooling factor, said wall forming a central flow tube chamber 58 within the piston and within which chamber the central flow tube is received as the piston moves upward, the walls of said chamber being of a thickness to provide a running fit in the outlet chamber 52. Piston ports 59 open from the outer surface of the piston into the chamber 58, such ports being separated by comparatively thin webs 60, whereby said ports occupy by far the greater part of the distance around the piston, thus constituting for all substantial and practical purposes a single undivided port extending completely around the piston. The lower part 61 of the piston chamber within the cylinder is larger than the diameter of the upper part, a skirt 62 extending downwardly from the lower part of the piston being located in this chamber, a space 63 between the outer surface of the skirt and the inner surface of the cylinder being closed at the bottom by a flange 64 extending around the lower edge of the skirt, and the ports 35, hereinbefore referred to, preventing any compression that might otherwise take place in this space.

A wrist pin bearing 65 is secured to the top of the chamber within the skirt 62, and a wrist pin 66, preferably hollow, has its journals in said bearings to secure one end of a connecting rod or pitman 67 to the piston, the opposite end of such connecting rod being secured to one of the cranks 16. These cranks include in their construction crank discs 68 employed to fill up the space within the crank chamber and thus aid compression and results therefrom, and as a further means for occupying such space filling blocks 69 project from the facing surfaces of the discs appurtenant to each crank, such filling blocks also serving to counter balance the cranks.

In that form of the device illustrated in Figure 13 the central flow tube 70 is separately formed and secured to a cylinder as by means of a threaded head 71 fitting a threaded hole 72 in the top of the cylinder, said head having a recess 73 in its outer surface. A lock nut 74 may be employed as an additional means for securing the central flow tube tightly in place. In this form of the device struts 75 extend between the outer and inner walls of the chamber 44 adjacent to the opening 72 and as a strengthening means. Circulating recesses 76 are formed in the outer surface of the head 71 as a means of communication between the chamber 44 and the chamber 53 within the jacket of the central flow tube. Otherwise the structure is the same as that hereinbefore described.

In order to increase efficiency I provide spark plugs 77, two of which are shown in Figure 7 of the drawings, extending to a point near the bottom of the combustion chamber in the cylinder, the spark for ig-

niting the charge being thereby located in the richer part of the mixture, and the conditions whereby the spark plug may be so located are aided by the presence of the central flow tube, and the effective results of this location of the spark plug are much increased.

It is my purpose to provide means that will effect the transfer of a full charge of gas from the compression chamber in the crank case to the compression and combustion chamber in the cylinder at the end of each downward stroke of the piston. This is to insure substantially the filling of the combustion chamber with fresh gas and the driving out of all of the burned products of the previous charge. In carrying out this idea I increase the displacement of the piston at its lower end over its displacement at the upper end and within the combustion chamber by enlarging the lower end of the cylinder and of the piston as hereinbefore described. Thus a greater volume of explosive mixture than will fill the combustion chamber is taken into the compression chamber in the crank case so that when the piston moves downwardly enough of the explosive charge to supply all of the waste in transit and to completely fill the combustion chamber is provided, and such chamber is, therefore, filled to its capacity with a fresh live explosive mixture.

In order to insure the transfer of the explosive charge from the crank case to the combustion chamber in the cylinder with a rapidity to permit of the operation of the engine at a high rate of speed, I provide means for increasing the compression of such gas in the compression chamber in the crank case, this being done, in the construction herein shown, by reducing the space within the crank case to a minimum degree, as by increasing the size and form of parts, and by introducing members to more completely fill the space within the case, care being taken, however, not to increase the compression in the crank case to an injurious extent. With this high compression within the crank case, as soon as the ports into the combustion chamber are opened, gas will rush in with a rapidity to fill such combustion chamber, and this when the pistons are traveling rapidly and the engine is running at a high rate of speed.

The operation of the engine will be readily understood from a description of the operation of a single cylinder, as it will be readily understood that the invention is not confined to its embodiment in a plurality of cylinders.

As the piston moves from its lower or outer to its upper or inner position a partial vacuum is created in the crank case chamber. The inlet chamber 29 entirely surrounding the cylinder being filled with a combustible fluid, such fluid is in readiness to rush into the cylinder from all sides so that filling of the compression chamber in the crank case to its utmost capacity is insured and a supply thereto of a greater volume of gas than can be contained in the combustion chamber is compelled, and this takes place just as soon as the piston uncovers the inlet port 34. This, however, does not take place until the piston reaches practically its innermost position in the cylinder, so that a maximum amount of vacuum is created in the crank case. This causes the inlet port to remain open only for an instant during the pause of the piston in changing its direction of movement from inward to outward, but by reason of the fact that the gas rushes in from all sides the inlet port is open long enough to cause the crank case compression chamber to be filled to its utmost capacity, as above described. Following this charge along its course, as the piston moves downwardly, or outwardly, the charge is compressed within the crank case to a very high degree and passes through the transfer passage 38 when the ports 41 in the cylinder that opens into ports 59 of the piston are uncovered. These ports are uncovered for an instant only, and while the piston is changing its direction of movement. This time, however, is sufficient to enable to charge of gas sufficient to completely fill the combustion chamber to be delivered into such chamber in the cylinder as the ports 41, opening all around the cylinder, enables the gas to rush in from all sides, and the high compression and increased displacement within the crank case causes such full charge of gas to be transferred very rapidly from the crank case compression chamber to the cylinder compression chamber. This construction also enables the ports 34 and 41 to be very narrow, thereby permitting a maximum amount of movement of the piston without uncovering such ports, and the compression chambers, and especially that within the cylinder, to be open for an extremely limited time.

From the ports 41 the gas passes within the piston where it is compressed by the next inward or upward stroke of the piston and is then fired as the piston reaches the inner end of the cylinder. In the movement of the piston in this direction the burned gases of the preceding charge are forced by the incoming and fresh gas outwardly through the ports 51, the outlet chamber 52 and the exhaust port 46 into the exhaust chamber 45, from whence it passes through the manifold 47.

By reason of the exhaust port 46 extending completely around the cylinder, there is practically no obstruction to the exhaust through such port, and this feature of practically unobstructed exhaust is greatly aided

by the presence of the exhaust chamber 45 of large area entirely surrounding the cylinder. Furthermore, these features enable an extremely narrow exhaust port to be employed so that the compression chamber in the cylinder may be filled with fresh gas to a maximum extent and with little liability to any loss thereof, and this is further reduced by reason of the fact that the narrow exhaust port enables an opening of the exhaust port for a minimum length of time.

This feature of a narrow exhaust port is of further and particular advantage in that it obviates an objection to prior structures in which the wider ports to a plurality of cylinders have been open simultaneously, thereby creating a liability to premature explosions. With my narrow exhaust ports, there is never a time when the exhaust ports to more than one cylinder is open and there is, therefore, no liability to such premature explosions.

In accordance with the provisions of the patent statutes I have described the principles of operation of my invention, together with the device which I now consider to represent the best embodiment thereof; but I desire to have it understood that the device shown is only illustrative, and that the invention may be carried out by other means.

I claim—

1. An engine including a cylinder block with a plurality of cylinders therein, said block having an inlet chamber extending from side to side and from end to end and completely surrounding all of said cylinders for the supply of fuel thereto, a compression chamber appurtenant to each cylinder, inlet ports for flow of fuel from the inlet chamber to each of the compression chambers, and means for controlling flow through said ports.

2. An engine including a cylinder block with a plurality of cylinders therein, said block having an inlet chamber extending from side to side and from end to end and completely surrounding all of said cylinders for the supply of fuel thereto, a compression chamber, inlet ports opening from all sides of each cylinder for flow of fuel from the inlet chamber, and means for controlling flow of fuel through said ports.

3. An engine including a cylinder block with a cylinder therein, a bottom chamber into which said cylinder opens, a compression chamber a direct passage between said chamber and in communication with said bottom chamber, and an inlet chamber in communication with said cylinder.

4. An engine including a cylinder block with a cylinder therein, an inlet chamber of substantially rectangular shape surrounding said cylinder, ports opening through the wall of the inlet chamber on all sides of said cylinder into the latter, and a compression chamber having a communication with said cylinder extending through the wall of said block.

5. An engine including a cylinder block having a cylinder therein, an inlet chamber extending from side to side and from end to end and completely surrounding said cylinder, inlet ports between said inlet chamber and said cylinder, a compression chamber, and a transfer passage extending through a wall of the block from the compression chamber and opening into the cylinder above said inlet chamber.

6. An engine including a cylinder block having a cylinder therein, an inlet chamber extending from side to side and from end to end and completely surrounding said cylinder, inlet ports between said inlet chamber and said cylinder, a compression chamber, a transfer chamber located above the inlet chamber, and a transfer passage extending through the wall of the block from said compression chamber to said transfer chamber.

7. An engine including a cylinder block with a cylinder therein, an inlet chamber surrounding said cylinder, inlet ports opening through the wall of the cylinder chamber on all sides thereof, a compression chamber, a transfer chamber surrounding said cylinder, ports opening from said transfer chamber into the cylinder on all sides thereof, and a transfer passage extending through the wall of the block from the compression chamber to said transfer chamber.

8. An engine including a cylinder block of substantially rectangular shape in cross section, said block having a cylinder therein, an inlet chamber surrounding said cylinder and of rectangular shape in cross section and having filling pieces in the corners thereof, inlet ports opening into said cylinder from the inlet chamber on all sides thereof, a compression chamber, and transfer passages extending through said filling pieces from the compression chamber to the transfer chamber.

9. An engine including a cylinder block of substantially rectangular shape in cross section and having a plurality of cylinders therein with an inlet chamber common to and surrounding all of said cylinders, filling pieces located in the corners of said inlet chamber, ports opening from the inlet chamber into each of the cylinders, a compression chamber appurtenant to each cylinder, a transfer chamber located in the wall of the block above the inlet chamber, and transfer passages extending through the filling pieces from the compression chambers to the transfer chambers.

10. An engine including a cylinder block with a cylinder therein, said block containing a plurality of cooling chambers each extending from side to side and from end to

end and completely surrounding said cylinder, an exhaust chamber interposed between said cooling chambers and surrounding said cylinder, and means for supplying fuel to the cylinder and for removing burned gases from said exhaust chamber.

11. An engine including a cylinder block with a plurality of cylinders therein, a plurality of cooling chambers each extending from side to side and from end to end of the block and each completely surrounding all of said cylinders, an exhaust chamber common to all of the cylinders and interposed between said cooling chambers, and means for supplying fuel to said cylinder and for removing burned gases from said exhaust chamber.

12. An engine including a cylinder block with a cylinder therein, said block containing a plurality of cooling chambers each extending from side to side and from end to end and completely surrounding said cylinder, an exhaust chamber interposed between said cooling chambers and surrounding said cylinder, an unobstructed exhaust port extending entirely around the cylinder and opening therefrom to said exhaust chamber, and means for supplying fuel to the cylinder and for removing burned gases from said exhaust chamber.

13. An engine including a cylinder block with a cylinder therein, said block containing a plurality of cooling chambers extending from side to side and from end to end thereof, an exhaust chamber completely surrounding said cylinder and having filling pieces in its corners, passages extending through said filling pieces between said cooling chambers, said exhaust passage opening into said cylinder, and means for supplying fuel to said cylinder and for removing burned gases from the exhaust chamber.

14. An engine including a cylinder block with a cylinder therein, a central flow tube comprising a combustion chamber in the interior of the cylinder for the flow of gases and suspended from the dome of the cylinder, a piston having a double-wall providing a chamber therein, said piston being adapted to surround said central flow tube, driving means connected with the piston, and means for supplying fuel to said cylinder and for conducting exhaust therefrom.

15. An engine including a cylinder block with a cylinder therein, a central flow tube suspended from the dome of the cylinder and comprising a combustion chamber therein, a piston adapted to surround said central flow tube, said tube having a jacket for a cooling fluid, means for supplying a cooling fluid to said jacket, means connected with the piston to be driven thereby, and means for supplying fuel to said cylinder and for conducting exhaust therefrom.

16. An engine including a cylinder block with a cylinder therein, a central flow tube constituting a combustion chamber and comprising a double wall with a cooling chamber therebetween, means for supplying a cooling fluid to said chamber, a piston located within the cylinder and adapted to surround said central flow tube, a driving connection with said piston, and means for supplying fuel to the cylinder and for conducting exhaust therefrom.

17. An engine including a cylinder block with a cylinder therein, a central flow tube suspended from the dome of said cylinder and comprising a combustion chamber with an outlet therefrom for the products of combustion, said chamber having a cooling chamber therein, a circulating tube extending into said chamber below the top thereof and a tube extending from the top of said chamber, means for supplying a cooling fluid to said tubes, a piston located within the cylinder and adapted to surround said central flow tube, driving means connected with the piston, and means for supplying cooling fluid to the cylinder and for conducting exhaust therefrom.

18. An engine including a cylinder block with a cylinder therein, a central flow tube suspended from the dome of the cylinder and comprising a combustion chamber for the explosion of gas within said tube, with an outlet from said chamber for the products of combustion, said tube having a cooling chamber therein and such block having a cooling chamber, a connection between said cooling chambers, a piston within the cylinder and adapted to surround said central flow tube, a driving connection with said piston, and means for supplying fuel to the cylinder and for conducting exhaust therefrom.

19. An engine including a cylinder block with a cylinder therein, a central flow tube located in the upper part of the cylinder and comprising a combustion chamber with an outlet therefrom for the products of combustion, said tube having a cooling chamber, tubular supports for said central flow tube, means for supplying a cooling fluid to said tubular supports, a piston located in the cylinder and adapted to surrounding said central flow tube, driving means connected with said piston, and means for supplying fuel to said cylinder and for conducting exhaust therefrom.

20. An engine including a cylinder block with a cylinder therein, said block having a cooling chamber, a central flow tube located in the upper part of the cylinder and comprising a combustion chamber with an outlet therefrom for the products of combustion, said tube having a cooling chamber, tubular supports for said central flow tube and comprising connections between

the cooling chamber therein and that in said block, a piston located in said cylinder, a driving connection with said piston, and means for supplying fuel to said cylinder and for conducting exhaust therefrom.

21. An engine including a cylinder block with a cooling chamber therein, a cylinder within said cooling chamber, a central flow tube located within one end of the cylinder and comprising a combustion chamber with an outlet therefrom for the products of combustion, said tube having a cooling chamber therein, tubular supports for said central flow tube and to establish communication between its cooling chamber and the cooling chamber within said block, a circulating tube extending through one of said supporting tubes to conduct a cooling fluid to a lower part of the cooling chamber in the central flow tube, a piston located within the cylinder and adapted to surround said central flow tube, a driving connection with said piston, and means for conducting fuel to said cylinder and for conducting exhaust therefrom.

22. An engine including a case comprising a cylinder with a combustion chamber therein, means for supplying fuel to said combustion chamber, and means in the lower part of said combustion chamber for and at all times initially igniting the fuel therein.

23. An engine including a cylinder having a combustion chamber, means for supplying fuel to said chamber, a central flow tube extending downwardly into said chamber and comprising a combustion chamber with an outlet therefrom for the products of combustion, and means near the bottom of said chamber for and at all times initially igniting said fuel.

24. An engine comprising a cylinder with a combustion chamber therein, a piston having a central flow chamber therein, a central flow tube projecting into said combustion chamber and said central flow chamber, and means located near the bottom of said combustion chamber for and at all times initially igniting a charge therein.

25. An engine including a crank case having a compartment for a driving shaft, a cylinder, and a filler located at the top of said compartment and extending into said cylinder to reduce space therein to increase compression, and a direct passage at the lower edge of said filler for the passage of gases therethrough.

26. An engine including a compartment for a driving shaft forming a compression chamber, a cylinder, a bottom or distributing chamber, a top for said compression chamber, and an opening in said top to directly connect said compression chamber and bottom chamber.

27. An engine having a transfer chamber, a bottom or distributing chamber, and a compression chamber, means for connecting the said transfer chamber with the bottom chamber and a direct passage between the said bottom chamber and the compression chamber.

28. An engine including a base, a cylinder block having a plurality of cylinders therein, a plurality of cooling chambers surrounding said cylinders, an exhaust chamber surrounding all of said cylinders and interposed between said cooling chambers, corner fillets within said exhaust chamber with passages therein connecting the cooling chambers, a transfer chamber appurtenant to each cylinder, an inlet chamber extending to all of said cylinders, a bottom chamber formed by said base appurtenant to each of said cylinders, passages extending from said bottom chamber to said transfer chamber, a compression chamber, a direct passage from said compression chamber to said bottom chamber, and ports from said exhaust, transfer and intake chambers into said cylinder, and means within the said cylinders for directing the flow of gases therethrough.

29. An engine having a cylinder, a combustion chamber, an exhaust port, means for igniting gases within said chamber, and means whereby at the time of entry of the new charge the first entering gases are directed to a point within said chamber nearest to said exhaust ports and the last entering gases are directed to a point nearest the said igniting means.

30. An engine including a block having a generally rectangular shaped chamber, a cylinder within said chamber, and filling pieces within said chamber at the corners thereof.

31. An engine including a block rectangular in shape, a cylinder within said block, a chamber surrounding said cylinder, filling pieces within said chamber, and passages extending through said chamber and within said filling pieces.

32. An engine including a block rectangular in shape, a cylinder within said block, a rectangularly shaped chamber surrounding said cylinder, and means to confine said chamber around said cylinder and to reduce space within said chamber.

33. An engine including a block, rectangularly in shape, a cylinder within said block, a rectangularly shaped chamber surrounding said cylinder, and means to conform the shape of said chamber to the said cylinder and within said block.

34. An engine including a block rectangular in shape, a cylinder within said block, a chamber surrounding said cylinder, and means to conform the shape of said chamber to the said cylinder without projecting said chamber beyond the walls of said cylinder.

35. An engine including a block having a plurality of cylinders, an inlet chamber surrounding said cylinders, and filling pieces adjoining the walls of said chambers to confine the same around said cylinders and reduce space within said chamber.

36. An engine including a block having a cylinder therein, an exhaust chamber surrounding said cylinder, and filling pieces at the corners of said exhaust chamber to provide means for extending a passage through said exhaust chamber.

37. An engine including a block having a plurality of chambers, a chamber interposed between said chambers, filling pieces within said chamber, and passages extending through said chamber and connecting the said plurality of chambers.

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