No. 877,589. PATENTED JAN. 28, 1908.

D. L. OULTON.

TWO CYCLE HYDROCARBON ENGINE.

APPLICATION FILED MAR. 17, 1906.

3 SHEETS—SHEET 1.

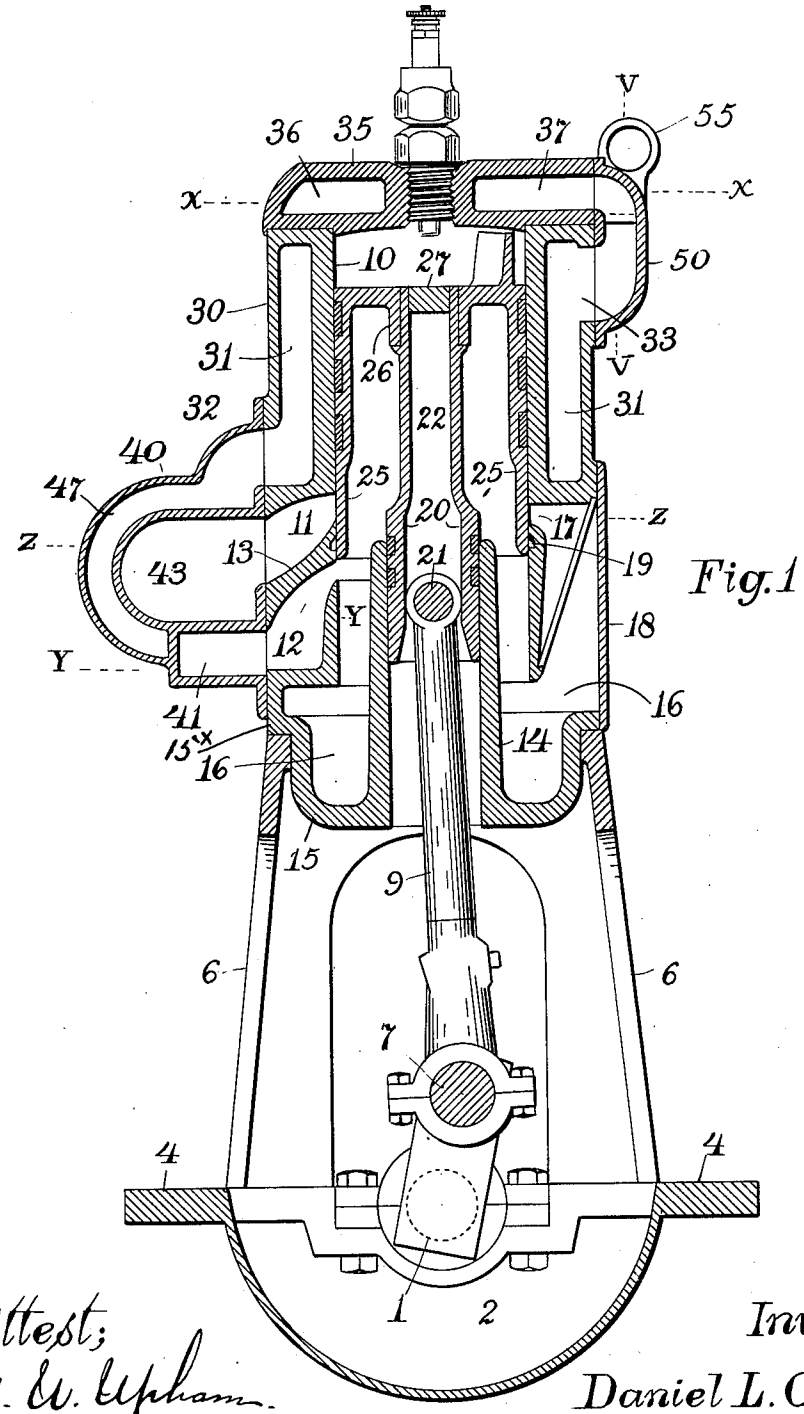

Fig. 1

Attest;
M. A. Upham.
Oscar M. Carleton

Inventor,
Daniel L. Oulton;
By A. B. Upham.
Attorney.

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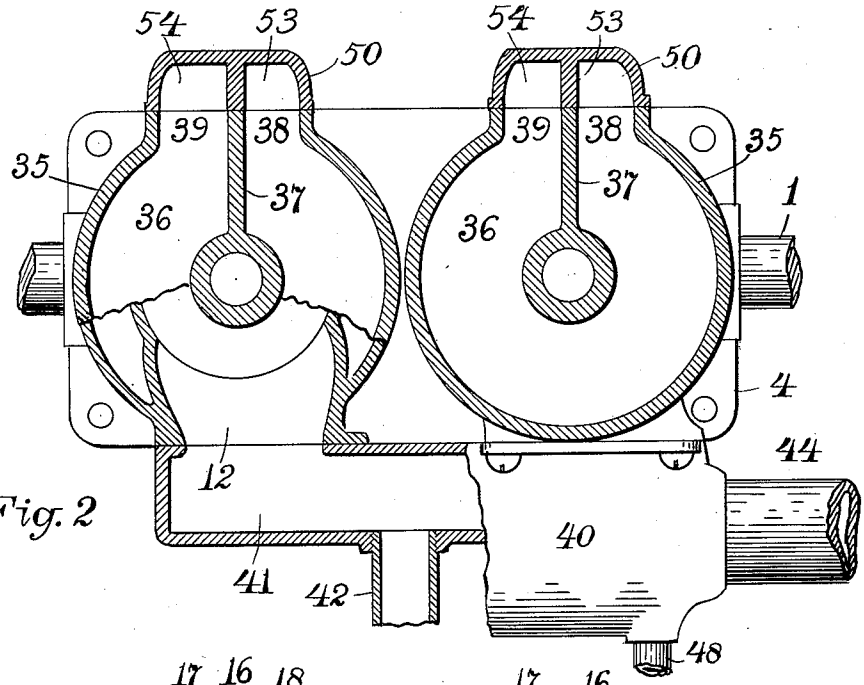

Fig. 2

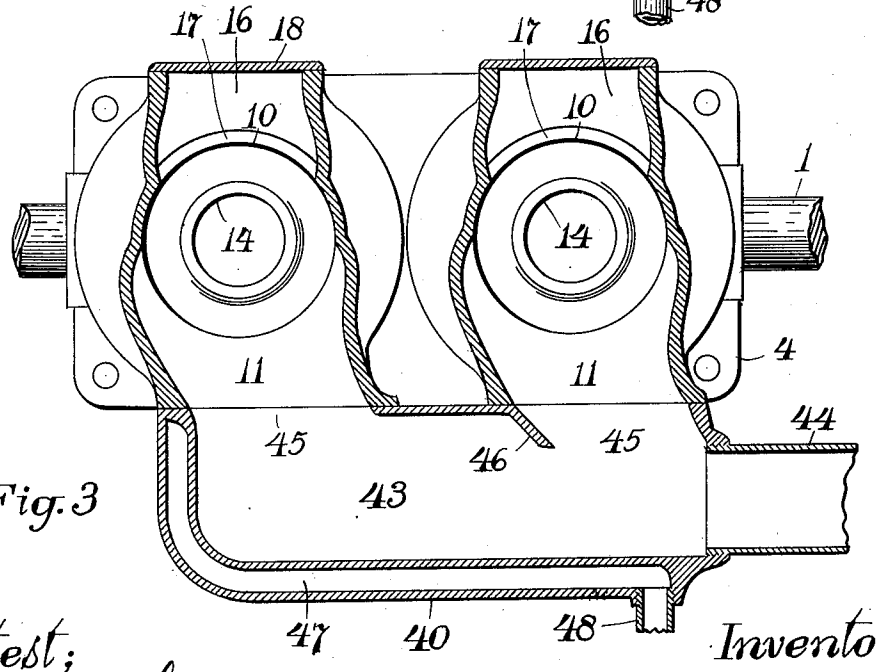

Fig. 3

Attest;
M. W. Upham.
Oscar M. Carleton

Inventor,
Daniel L. Oulton;
By A. B. Upham
Attorney.

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3 SHEETS—SHEET 3.

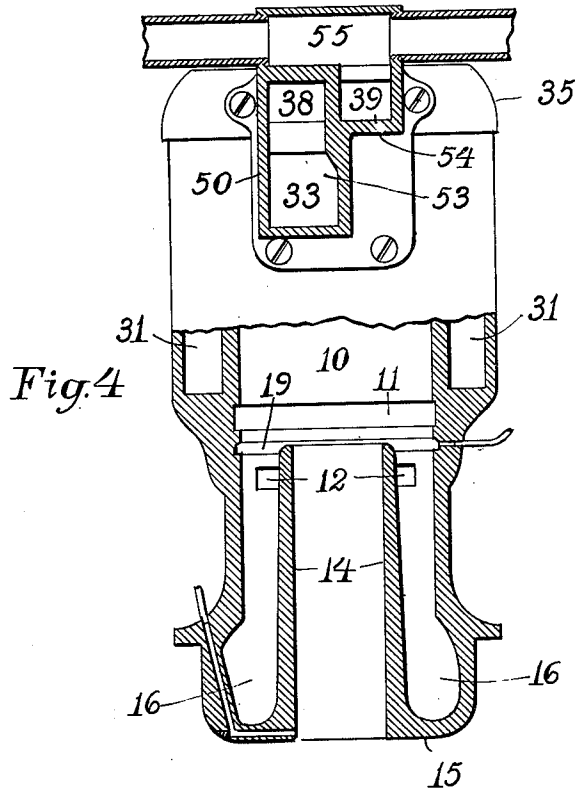

Fig. 4

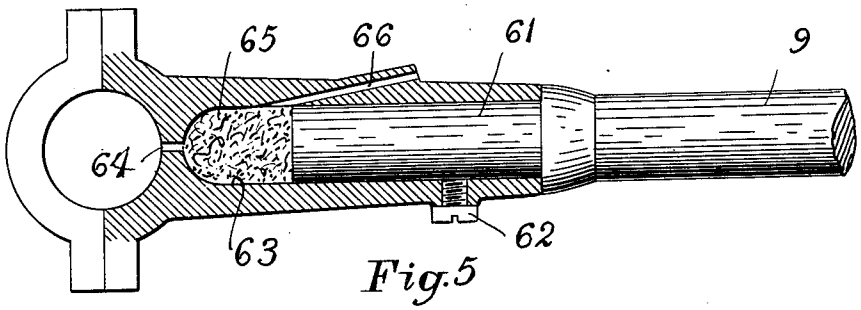

Fig. 5

Attest;
Oscar M. Carleton
Albert Roberts

Inventor,
Daniel L. Oulton;
By A. B. Upham,
Attorney.

UNITED STATES PATENT OFFICE.

DANIEL L. OULTON, OF EVERETT, MASSACHUSETTS, ASSIGNOR TO THE DUO MOTOR COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

TWO-CYCLE HYDROCARBON-ENGINE.

No. 877,589. Specification of Letters Patent. Patented Jan. 28, 1908.

Application filed March 17, 1906. Serial No. 306,526.

To all whom it may concern:

Be it known that I, DANIEL L. OULTON, a citizen of the United States, and a resident of Everett, in the county of Middlesex, Commonwealth of Massachusetts, have made certain new and useful Improvements in Two-Cycle Hydrocarbon-Engines, of which the following is a full, clear, and exact description.

This invention relates to that class of hydrocarbon, or internal combustion, engines of the two-cycle type; and relates to certain improvements in details of construction hereinafter set forth, the primary objects of which are to eliminate all possible superfluous moving parts and thereby cheapen such engines in manufacture and render them more reliable and durable in use; and to produce an engine which can be run economically through a wide range in speeds.

Referring to the drawings forming part of this specification, Figure 1 is a central sectional elevation of a hydrocarbon engine made in accordance with my invention. Fig. 2 is a horizontal section on the line X—X in Fig. 1 of a two cylinder engine, a part thereof being a section at Y—Y in Fig. 1. Fig. 3 is a horizontal section on the line Z—Z in Fig. 1. Fig. 4 an elevation of the cylinder with the upper part sectional on the line V—V in Fig. 1, and the lower part sectional through the center. Fig. 5 section of pitman.

The engine shaft 1 is mounted in the usual manner in bearings 2 supported by the base-plate 4. From this base-plate rise suitable posts 6 rigidly secured to the cylinder-casting 15, and within the cylinder 10 is the bucket-plunger 25 joined by a tubular piston rod 20 to the pitman 9; the latter being connected with the crank-pin 7. Between the upper section of said cylinder and the water-jacket 30 cast integral therewith, is the water-chamber 31; the cylinder-head 35 being also chambered and put into communication with the former as hereinafter set forth.

The bucket plunger 25 is provided with ring packing in the usual manner, and at its center is a tubular boss 26 receiving the end of the tubular piston rod 20. I prefer not to thread these parts, but turn the end of said rod slightly larger in diameter than the interior of said boss, and expand the latter in place upon the same. In the same manner the upper end of the tubular rod is expanded upon the plug 27 and thereby tightly closed.

The lower portion of the tubular piston rod is enlarged as compared with its intermediate section 22, and fits within the inner cylinder 14 cast integral with the cylinder casing. The lower part of said rod is fitted with ring packing to insure its being gas-tight in said inner cylinder, and is united to the upper end of the pitman 9 by the wrist-pin 21.

In the lower part of the cylinder-casting 15 and surrounding the base of the inner cylinder 14 is a chamber 16 designed for the initial compression of the mixture this chamber being formed by a jacket forming a part of the cylinder casting and indicated at 15× and communicating with the inlet port 17 by a passage 16 which has a side closed by a cover plate 18. By proportioning the diameter of the main and inner cylinders, and the dimensions of the chamber 16, as shown in Fig. 1, which by extended experiment I have found to be essential in the production of a practical two-cycle motor, I am enabled to secure just the right compression of the mixture fed into said chamber 16 to perfectly force out and replace the products of the previous explosion left in the main cylinder, and so be ready for final compression as the piston rises. In proportioning said parts it is, of course, necessary to avoid the danger of too much back-pressure, while at the same time securing sufficient compression of the mixture to aid in cushioning the stroke of the piston, and to obtain the necessary energy of inrush into the main cylinder for efficiently expelling the products of the explosion no matter at how high a speed the engine may be running.

As shown in Fig. 1, the intake port 12 opens into the cylinder 10 along a line just below the lower edge of the plunger 25 when the latter has reached its upper extremity of stroke, and the by-pass 17, which communicates with the compression chamber 16, is located at just above the upper surface of said piston when in its lowermost position. In order that the products of the explosive-combustion may escape as the compressed mixture enters the main cylinder, the exhaust port 11 opens from the cylinder 10 opposite to the by-pass and at substantially the same horizontal plane.

It is customary, in arranging for the lubrication of the piston to form a groove in its periphery for the retention of the oil; but inasmuch as the two ports 11 and 17 must be approximately diametrically opposite in or-

der to produce the best results, such groove would, during one period of the piston's journey, form a channel for the escape to the exhaust of the compressed mixture in the chamber 16. To avoid this, I form the lubrication groove 19 in the inner surface of the cylinder in a horizontal plane midway of the intake and exhaust, as shown in Figs. 1 and 4. This arrangement permits, in addition, the easy connection of an oil-cup with such groove, as shown in Fig. 4.

As is evident, one of the marked causes for considerable of the expense of an engine of this character is the labor entailed in the many pipe fittings ordinarily required. To minimize this as much as possible, I provide a casting 40 for securing to the cylinder-casting and taking the place of several of the pipe-sections, elbows, joints and other fittings otherwise needed. The value of this is especially great for multiple-cylinder engines, where by its means no more piping and fittings are required than for the single-cylinder engine. As shown in Figs. 1, 2 and 3, this casting is formed with a central passage 43 communicating with the various exhaust ports 11 of the various cylinders, and terminating in an exhaust pipe 44; a passage 41 taking the mixture through a supply-pipe 42 receiving the air and hydrocarbon from any suitable carbureter and delivering the same to the intake ports 12 of the cylinders. Not only does this reduce the number of pipes and fittings, but in case it is necessary to remove the cylinder for any purpose, the piping can remain in this casting 40 intact; the latter alone being unbolted from the cylinder-casting. Another and even more important function performed by this casting is that of permitting the exhaust gases to be so cooled as they escape from the cylinder, as to materially contract their volume and reduce their back-pressure. This reduction in back-pressure not only increases proportionably the work performed by the engine, but diminishes the noise of the exhaust and serves as a partial muffler without the resistance inseparable from the latter as usually constructed.

To cool the exhaust as stated, the passage 43 is almost wholly surrounded by a water-jacket 47 forming a part of the channel for conducting the water from any suitable supply-pipe 48 to the cylinder water-jacket 31; the latter being formed with ports 32 communicating with this channel 47. In addition to this advantage of cooling the exhaust, the water thus supplied to the cylinder-water-jacket is partially warmed, and so does not strike the cylinder with the chill inseparable from the usual type of internal combustion engine for marine purposes, where the water-jacket is supplied direct from the water beneath the boat. It is found that where the engine cylinder is cooled too much, the strains of the extremes of heat and cold not alone rack and weaken it with undue quickness, but the best results in the production of power are not obtained. Just what are the reasons for this I am not prepared to state, but the fact seems clear. By thus giving the water a preliminary warming, these ill effects are obviated, and at the same time the positive advantages obtained of cooling the exhaust. Ordinarily the exhaust port runs horizontally from the cylinder, but as shown in Fig. 1, I prefer to slant it downward to a considerable degree. The main advantage of this is that it permits of the water-inlet 32 being located at the lowest line of the water-jacket, as illustrated in Fig. 1, and so enables the same to be thoroughly drained whenever desired.

The partition 13 separating the intake and exhaust is concaved on both surfaces in order to render the same sufficiently thin to permit the heat from the exhaust to strike through and warm the ingoing mixture; while at the same time allowing enough surface within the cylinder for the groove 19, and enough exterior surface to give a gas-tight joint between itself and the casting 40. By having said partition 13 comparatively thin and the intake mixture warmed thereby, the latter is better prepared for its work.

As shown in Fig. 3, the exhaust port 11 of each cylinder is given a lateral curving divergence for the purpose of giving the issuing gases a sidewise impulse along the exhaust passage 43. This aids considerably in lessening the back-pressure of the engine, as compared with what it would be were the exhaust ports precisely radial, as is customary. To prevent the exhaust from one cylinder interfering with the exhaust from another and so retarding the flow of gas along the passage 43, the deflector 46 is formed in said passage and the gas passing along said passage from the cylinder farthest from the outlet pipe 44 is prevented from entering the exhaust port 11 of the cylinders between the first named cylinder and said outlet. In addition, the deflector aids the lateral divergence of the exhaust issuing from its port 11 and keeps it from interference with the flow along the passage 43. The water from the water-jacket 31 is conducted therefrom to the space 36 in the cylinder-head 35 in the following manner: This is sometimes done by means of piping, which with its attendant elbows, and unions, requires no less than nine joints. This means original expense and subsequent care and work to insure their constant water-tight character. Moreover, whenever it is necessary to remove the cylinder-head, as is so often required in order to overhaul the piston and parts within the cylinder, most of these joints have to be unscrewed, entailing much labor in separating and much more in reuniting.

By means of my improvement, which consists of a single casting 50 for each cylinder, no piping is needed but a single section uniting the castings of each pair of cylinders. As shown, the water-space in each cylinder head is formed with a radial partition 37 and the water is supplied to one side of the same, in order to force the current to flow entirely through such space 36. Over the two openings to said space, and also over the outlet 33 of the water-jacket is bolted the casting 50 which is so partitioned that it takes the water from said outlet, conveys it to the opening at one side of the partition 37, and then takes it from the other side and conducts it to the pipe tapped into the cylindrical section 55. As shown in Fig. 4, said casting 50 is divided into three sections; one section or chamber 53 communicating with the outlet 33 and one opening 38 in the head; a second chamber 54 communicating with the opening 39 in the head and also with the cylindrical section 55 into the ends of which are tapped the pipe-sections by which the water flows therefrom to the overflow. Not only is this method of conveying the water from the cylinder to its head a great advantage over the system of piping described above, but also over the more customary method of having openings directly downward from the space 37 into the space 31. The trouble with this is that it is practically impossible to insure the permanent water-tight character of such arrangement, and water is found to leak through into the cylinder itself, seriously affecting the operation of the engine. With my device, I avoid all possibility of such leakage, and at the same time dispense with the complicated piping method.

In order to withdraw the piston, the head 35 is first removed and the pitman 9 drawn up through the inner cylinder 14. It is evident that the pitman-head cannot be drawn up through so restricted an opening as said cylinder. I therefore form the pitman and pitman head in two parts separable one from the other in the way shown in Fig. 5. The lower end of the pitman is reduced in diameter, and the upper part of said pitman-head drilled out to receive said reduced end 61. A pin or screw 62 penetrating said parts secures them against accidental separation; but inasmuch as the greater part of the work performed by the pitman is that of thrust, said pin or screw needs to resist but comparatively little strain. The hole 63 continues nearly to the crank-pin 7; the balance of the way thereto being a small hole 64. The pitman-end 61 does not reach to the bottom of this hole 63, but stops short sufficiently to leave a chamber 65 designed to be filled by any suitable fibrous material, as cotton waste. From near the upper part of this chamber 65 a small hole 66 rises to a suitable exterior point. By introducing oil through said hole 66, the said waste is saturated therewith and so gives, to lubricate the crank-pin 7, a sufficient amount, but not too much, of the oil delivered to the oil-chamber 65. This arrangement, by which the pitman is rendered capable of withdrawal through the inner cylinder 14, consequently serves two purposes;—both the separation of the pitman from its head, and the lubrication of the crank-pin.

What I claim as my invention and for which I desire Letters Patent is as follows, to wit;—

1. An internal combustion engine comprising a main cylinder, an inner cylinder at the lower part of the main cylinder and in axial alinement therewith, a wall or jacket connecting the main and inner cylinders at the lower end forming an initial compression chamber, a bucket plunger or piston fitted to the main cylinder and having a piston rod fitting the inner cylinder, a crank shaft and a pitman connecting the same to the piston rod, said main cylinder having inlet and exhaust ports to the combustion space designed to be uncovered by the piston when at or near the limit of its downward or outward stroke, said inlet port communicating with the initial compression space, and said main cylinder having also a fuel inlet port leading to the initial compression chamber arranged to be uncovered by the piston when at or near the limit of its upward or compression stroke, substantially as described.

2. In an internal combustion engine, a main cylinder, an inner cylinder in the lower end thereof comprising an annular initial compression space, a wall closing the lower end of said space, inlet and exhaust ports to the combustion space of the main cylinder, and an inlet port to the initial compression chamber or space, a bucket plunger or piston fitted to the main cylinder and adapted to open and close the ports leading to the combustion chamber, a member carried by the piston and sliding within said inner cylinder and suitably packed to form a tight joint, a crank shaft, a piston connecting said member with the crank shaft, and a removable head for the main cylinder, substantially as described.

3. In an internal combustion engine, the combination with a main cylinder and inner cylinder, of the bucket plunger having a central tubular boss, a tubular piston rod fixed in said boss, a pitman pivoted in said piston rod, a crank shaft having its crank pin engaged by said pitman, and a removable head for said main cylinder; said pitman being made separable to permit said plunger and tubular piston rod to be withdrawn from said cylinders.

4. In a two-cycle internal combustion engine, the main cylinder having its exhaust port and by-pass in substantially the same

plane, and an intake close below said exhaust, in combination with a piston reciprocating therein, said cylinder being formed with an internal groove immediately below said exhaust port and by-pass and above said intake.

5. The combination with a water-jacketed internal combustion engine having a plane surface through which are the intake and exhaust ports and the inlet to the water-jacket, of a member removably secured to said surface and formed with separate passages communicating with said intake, exhaust and inlet respectively, and suitable piping to said passages; whereby said cylinder can be freed from said piping by simply disconnecting said member from the cylinder.

6. The combination with an internal combustion engine cylinder having a surface through which are the intake and exhaust ports, of a member removably secured to said surface and formed with separate passages communicating with said intake and exhaust port, and suitable piping to said passages; whereby said cylinder can be freed from said piping by simply disconnecting said member from the cylinder.

7. The combination with a water jacketed internal combustion engine cylinder having a surface through which are intake and exhaust ports and an inlet to the water jacket of a member removably secured to said surface and formed with separate passages communicating with said intake and exhaust and inlet respectively, and suitable piping to said passages whereby said cylinder can be freed from said piping by disconnecting said member from the cylinder, the passage to the exhaust being surrounded for the greater part by said water inlet and the remaining part of said exhaust passage being in proximity to the fuel intake whereby said exhaust is cooled by both the cooling and combustible fluids and said fluids are initially heated, substantially as described.

8. In a multiple cylinder internal combustion engine, a plurality of vertical cylinders having water jackets and an exhaust port for each below the level of the bottom of the water jackets, of a horizontal exhaust pipe connecting with all of said exhaust ports and a concentric water passage encircling said exhaust pipe, said water jackets having water outlet openings at their lower ends leading into said concentric water passage.

9. The combination with a water-jacketed internal combustion engine having a surface through which are the intake and exhaust ports and the inlet to the water jacket, of a member removably secured to said surface and having passages communicating with said intake, exhaust and inlet; said intake and exhaust ports having externally depressed openings to said passages for the purpose of permitting the inlet to the water-jacket to be sufficient to drain the latter.

10. In an internal combustion engine, a single casting composing a main cylinder, an inner cylinder rising from the lower part of the casting into said main cylinder, a compression chamber surrounding the base of said inner cylinder, a by-pass opening into the main cylinder and communicating with the compression chamber, an exhaust port from the main cylinder substantially opposite the by-pass, an intake opening into the main cylinder just below said exhaust port, and a bucket plunger and piston rod fitting in said main and inner cylinder respectively.

In testimony that I claim the foregoing invention, I have hereunto set my hand this 15th day of March, 1906.

DANIEL L. OULTON.

Witnesses:

FRED G. TILTON,

A. B. UPHAM.