No. 878,647. PATENTED FEB. 11, 1908.

C. I. LONGENECKER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED FEB. 25, 1907.

3 SHEETS—SHEET 1.

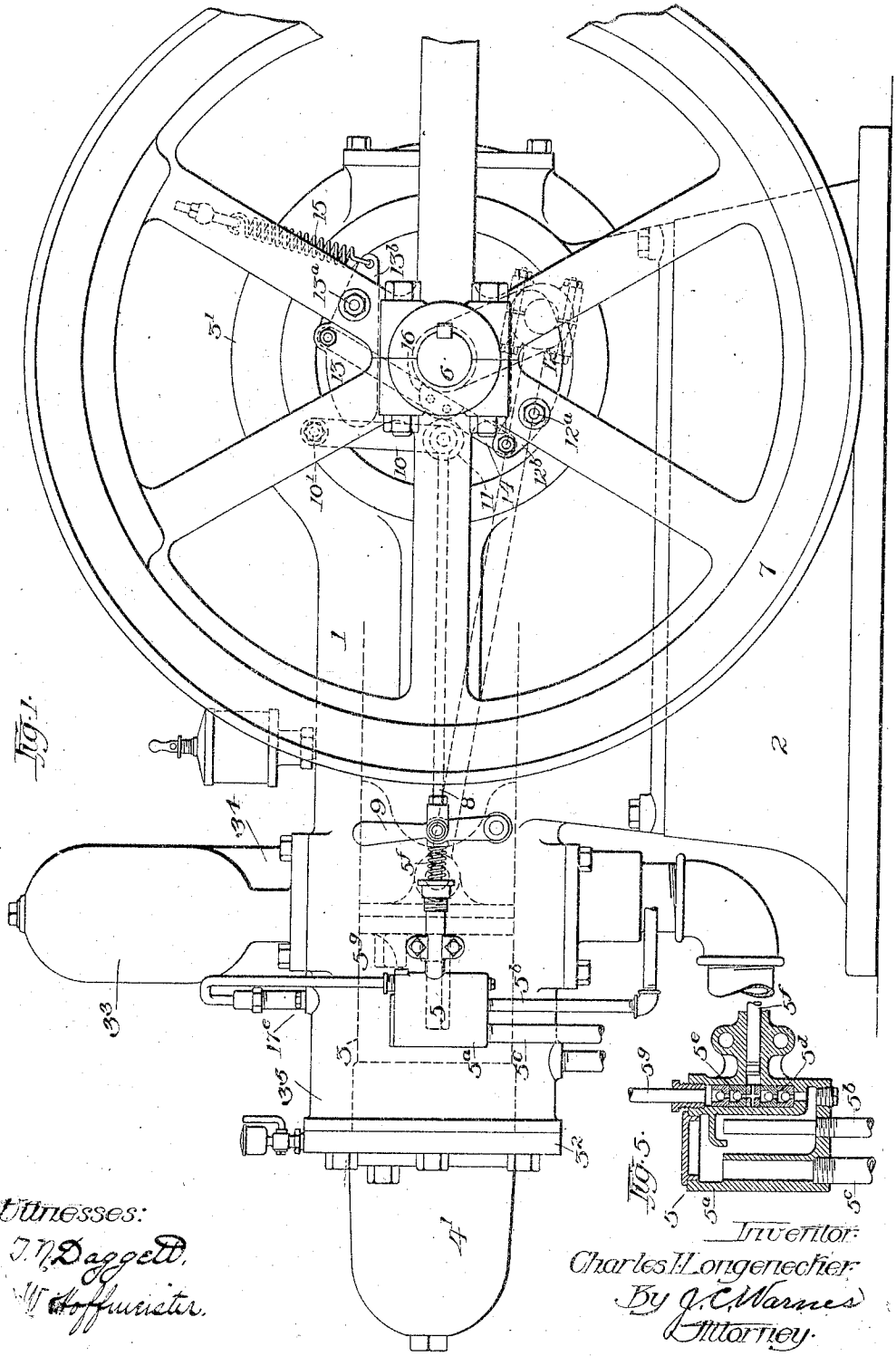

Fig. 1.

Fig. 5.

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3 SHEETS—SHEET 2.

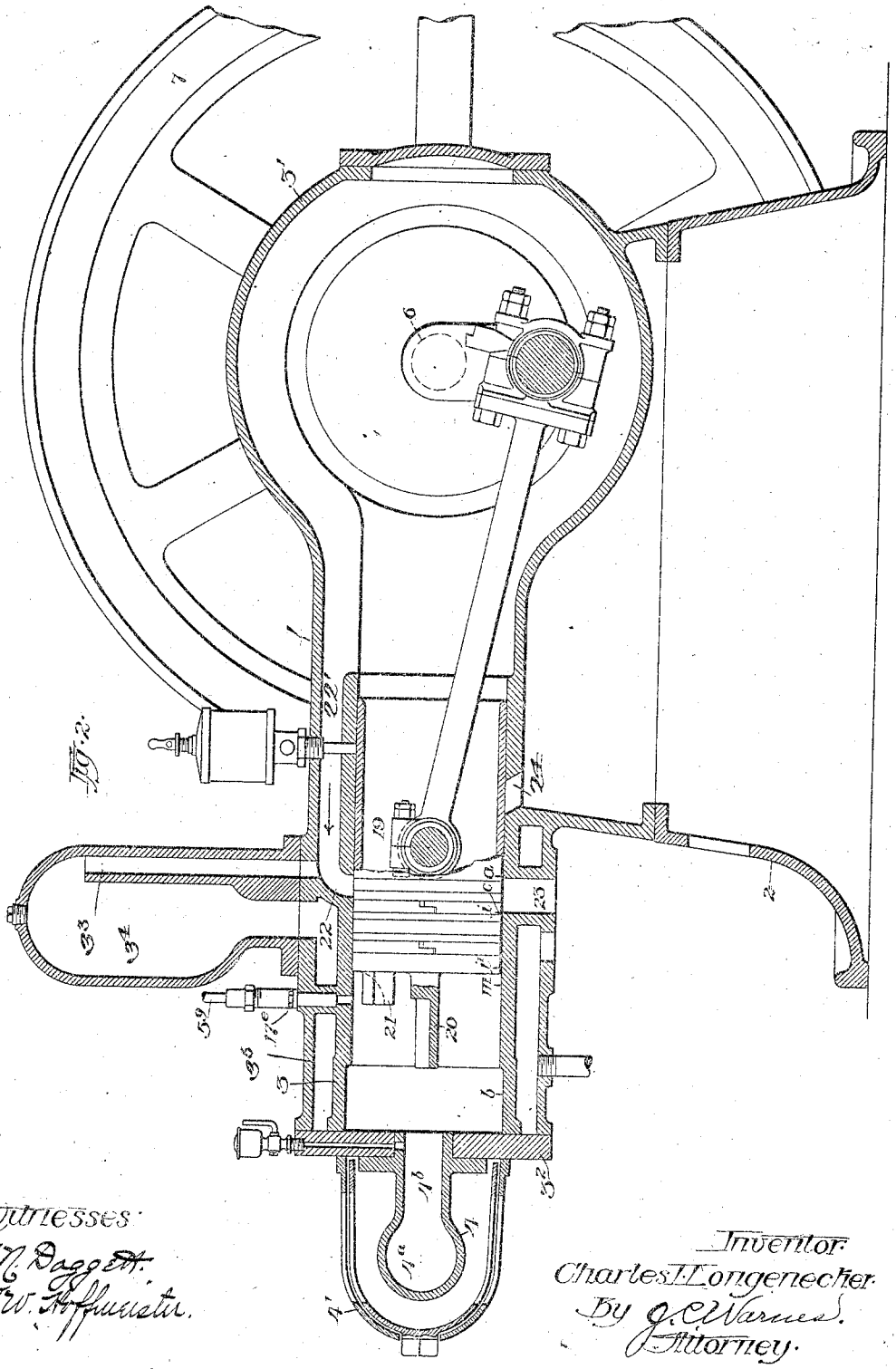

Fig. 2.

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3 SHEETS—SHEET 3.

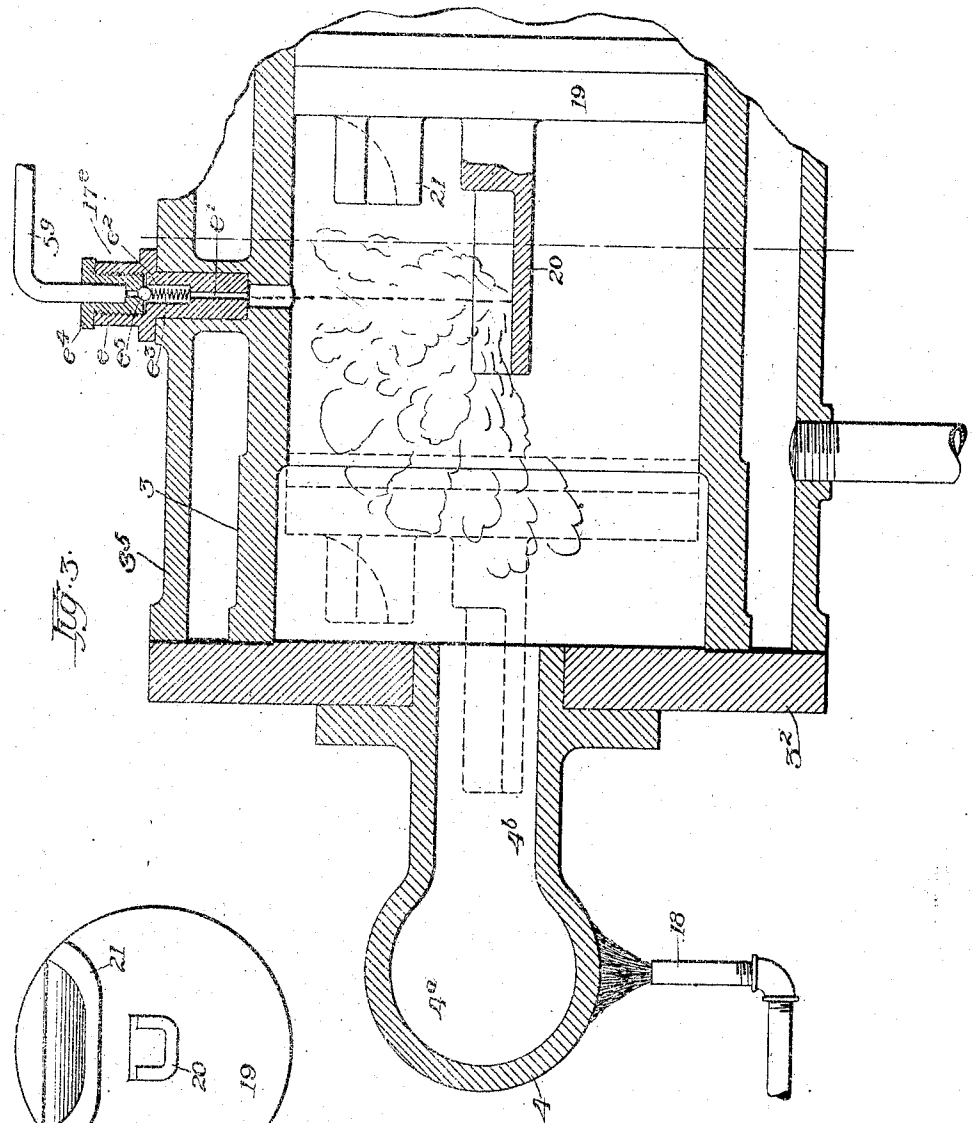

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

No. 878,647. Specification of Letters Patent. Patented Feb. 11, 1908.

Application filed February 25, 1907. Serial No. 359,076.

To all whom it may concern:

Be it known that I, CHARLES I. LONGENECKER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a new and useful Improvement in Internal-Combustion Engines, of which the following is a complete specification.

This invention relates to those elements of an explosive engine which are directly concerned with the admission and proper mixing of the charge in the cylinder, and is designed more particularly for use in connection with engines employing the heavier hydrocarbon oils, such as kerosene.

The object in view is to simplify the construction, secure more perfect vaporization of the charge, and hence increase the efficiency of the engine.

Further objects of the invention will appear in the following description, are pointed out in the appended claims and illustrated in the accompanying drawings, in which—

Figure 1 represents a side elevation of an engine in which is embodied my invention. Fig. 2 is a central longitudinal section of the engine shown in Fig. 1. Fig. 3 is an enlarged longitudinal section of the rear end of the cylinder, a portion of the piston with the projecting ledges thereon, and other coöperating members. Fig. 4 is an elevation of the rear face of the piston showing the projecting ledges formed thereon; and Fig. 5 is a detail section showing the construction of the oil injecting pump.

In the drawings, the frame of the engine is designated by the numeral 1, and the base on which it rests by 2, the engine shown being of the two cycle type operated on low gravity oils, such as kerosene. 3 designates the cylinder, and 3^1 the crank case, both being preferably cast together, and unite in forming the engine frame 1. The crank case 3^1 is closed to form an air tight chamber, in which is compressed the air for the succeeding charge. The cylinder 3 is surrounded by a water jacket 3^5, and connecting with the upper part of this water jacket is a steam dome 3^3. The air inlet port 22 and the exhaust port 23 are located near the forward end of the cylinder in order that they may be uncovered by the piston as it approaches the forward end of its stroke. The air inlet port 22 communicates with the crank chamber 3^1 through the passageway 22^1, and with the upper part of the steam dome through the connection 3^4. In order to avoid the cooling and condensation of the steam, the said connection 3^4 is placed within the walls of the dome 3^3 and, to secure simplicity of construction, is preferably integral therewith, as clearly shown in Fig. 2. As the piston moves rearward and uncovers the port 24, the crank chamber will fill with air and, as the piston returns, it will compress this air for the succeeding charge. As soon as the piston in its return movement uncovers first the exhaust port 23 and then the air inlet port 22, the compressed air in the crank chamber will enter through the passageway 22^1 and port 22 and drive out the exhaust gases from the cylinder. This compressed air entering through the port 22, will have mingled with it the dry steam from the top of the dome 3^3, which enters through the connection 3^4.

To the cylinder head 3^2 is fixed the ignition chamber 4. 4^1 is a casing surrounding said ignition chamber, and 5 designates as a unit the oil injecting pump. In the crank chamber casing 3^1 is journaled the crank shaft 6, to which is secured the fly wheel 7. The constant level cup 5^a, the supply pipe 5^b, the overflow pipe 5^c, the lower valves 5^d, the upper valves 5^e, the plunger 5^f and the supply pipe leading to the cylinder by 5^g, these parts collectively constituting the pump and its connection with the oil admission valve. The plunger 5^f is actuated by the reciprocating plunger rod 8, at the junction of which with said plunger is mounted the rocking hand lever 9 for operating the injector pump independently of the mechanically operating means. The forward end of the plunger rod 8 is supported by the swinging arm 10, which is pivoted to the frame 1 at 10^1, and on the forward end of said rod is mounted the roller 11. This arm 10 and the plunger rod 8 constitute means for operatively connecting the governor mechanism with the oil injecting pump.

The governor mechanism consists of the weights 12 and 13, which are pivotally mounted at 12^a and 13^a, respectively, on the fly wheel 7. These weights 12 and 13 are oppositely disposed on the fly wheel and are provided with short arms 12^b and 13^b, respectively. A link 14 connects the weights 12 and 13, the said link connecting with the short arm 12^b of the former, and with the weight 13 at a point thereon approximately at a distance equal to the length of the short arm 12^b, but opposite from the arm 13^b,

The spring 15 which extends between the short arm 13^b and a fixed point on the fly wheel 7, operates to hold the weights 12 and 13 toward the center of the crank shaft 6. The result of such an arrangement will be that as the weights are moved outwardly by centrifugal force against the action of the spring 15, the link 14 will be caused to move not only longitudinally but radially toward the crank shaft. To the said link, intermediate of its length, is fixed a cam projection 16, which consists of a semi-circular disk, its convex side projecting outwardly and adapted to engage the roller 11 on the end of the plunger rod 8. In the normal operation of the engine the cam projection 16 strikes the roller 11 a slight but distinct blow, each revolution of the crank shaft thus resulting in a quick endwise movement of the rod 8, which will project a stream or jet of oil into the cylinder.

The oil admission valve 17^a connects with oil supply pipe 5^g leading from the pump 5, and this valve is comprised of the following parts: A plug e is screwed or bolted in an aperture in the top of the cylinder 3, this plug being provided with the oil port e^1, the enlarged bore e^2, which receives the coil spring e^3, and the larger threaded bore at the top of said plug, which receives the valve seat plug e^4. At the inner end of this valve seat plug is formed a valve seat, against which the coil spring e^3 holds the ball valve e^5.

It will be observed that the oil admission valve 17^e is located in the cylinder wall substantially midway of its length, or at a considerable distance from the rear end of the cylinder. This particular location of the oil admission valve is important. In oil engines as heretofore constructed, the oil admission valve has been located closely adjacent to the end of the cylinder, with the result that the mouth of the valve is soon covered and choked with the deposits resulting from the combustion of the charge. By locating the valve as herein specified, this difficulty is largely overcome, as the piston lies between the valve and the exploding charge during the time of its most intense combustion.

The ignition chamber 4 is bolted or otherwise secured to the cylinder head 3^2 in a central position, and consists of the spherical end chamber 4^a and the cylindrical neck or channel 4^b extending from said chamber to the interior of the cylinder. While the engine is in operation the ignition chamber is maintained at a red heat by means of the burner 18, or by the heat resulting from the combustion of the charge.

On the rear side of the piston 19, preferably in a central position and integral therewith, is formed the rearwardly projecting ledge 20. This ledge is made upwardly concave, as clearly shown, and is so arranged that as the piston moves rearwardly the jet of oil introduced through the valve 17^e will be projected against said ledge. This ledge 20 is of such length, the valve 17^e so located on the cylinder, and the introduction of the oil jet by the oil injecting pump is so timed that it will be made to impinge said ledge throughout its length during and within the first half of the compression stroke of the piston.

In Fig. 2 a—b indicates the extent of travel of the face of the piston, m indicates the mid-stroke of same, i—i^1 the extent of travel of the piston during the admission of oil, and c the point where compression begins, this point c being coincident with the point i. It will thus be seen that the admission of oil begins concurrently with the beginning of the compression stroke of the engine; or, more properly, with the beginning of compression on said stroke, and that the charge of oil is completely injected within the first half of the compression stroke. The ledge 20 is made to traverse with its entire length the range of the jet of oil from the oil admission valve and the governor is so timed with respect to the movement of the piston that it will actuate the oil pump and project the oil upon the ledge as it passes the admission valve. The oil impinges the hot ledge 20 throughout its length and will, in consequence, be well distributed through the cylinder and thoroughly vaporized. When the piston reaches the end of its stroke rearwardly, the said ledge will project into the neck 4^b of the ignition chamber, and any oil in the liquid form remaining on the ledge will be thrown into said chamber owing to the sudden reversal of motion of the piston. In this manner fresh fuel is introduced into the ignition chamber at each impulse of the engine and ignition of the charge thus rendered more certain.

To produce a more thorough mingling of the oil and air, and a distribution thereof throughout the length of the cylinder, a supplemental ledge, or shoulder, 21 is formed on the face of the piston near the upper side thereof. The arrangement is such that when the piston 19 has reached the end of its travel forwardly the supplemental ledge 21 will occupy a position directly opposite the air inlet port 22. Instead of the air flowing directly across the cylinder to the exhaust port 23, it is deflected rearwardly and made to mix with the vaporized oil.

What I claim as my invention, and desire to secure by Letters Patent, is:

1. In an oil engine, in combination, a cylinder, a reciprocating piston operating therein, an ignition chamber arranged at the end of said cylinder, an oil admission valve located in the cylinder wall, and a projecting ledge fixed to and movable with the piston and against which the oil impinges when introduced into the cylinder through the said

admission valve, the said ledge being made to project into the ignition chamber when the piston has reached the end of its stroke.

2. In an oil engine, in combination, a cylinder, a reciprocating piston operating therein, an ignition chamber arranged at the end of said cylinder, an oil admission valve located in the cylinder wall, and a projecting, upwardly-concave ledge fixed to said piston in a central position and movable therewith, against which the oil impinges when introduced into the cylinder through the said admission valve, said ledge being made to project into the ignition chamber when the piston has reached the end of its stroke.

3. In an oil engine, in combination, a cylinder, a reciprocating piston operating therein, an oil admission valve located in the cylinder wall and substantially midway of its length, whereby the said valve is protected by the piston from the deposits resulting from the excessive heat following the initial combustion of the charge, a ledge fixed to and movable with said piston, against which the oil impinges when introduced through said valve of the cylinder, and a secondary ledge formed on the upper side of the face of the piston for deflecting the incoming current of air toward the rear end of the cylinder.

4. In an oil engine, in combination, a cylinder having an exhaust port and an air inlet port adapted to be uncovered by the piston as it approaches the forward end of its travel, a closed crank chamber communicating with the air inlet port, a piston, a water jacket surrounding said cylinder, a steam dome connected with the upper part of said water jacket, and a connection leading from the upper part of the steam dome to the air inlet port, said connection lying within the walls of said steam dome.

5. In an oil engine, in combination, a cylinder having an exhaust port and an air inlet port adapted to be uncovered by the piston as it approaches the forward end of its travel, a closed crank chamber communicating with the air inlet port, a piston, a water jacket surrounding said cylinder, a steam dome connected with the upper part of said water jacket, and a connection leading from the upper part of the steam dome to the air inlet port, said connection lying within the walls of said dome and being formed integral therewith.

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