A. L. CROXTON.

INTERNAL COMBUSTION PUMPING ENGINE.

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996,565.

Patented June 27, 1911.

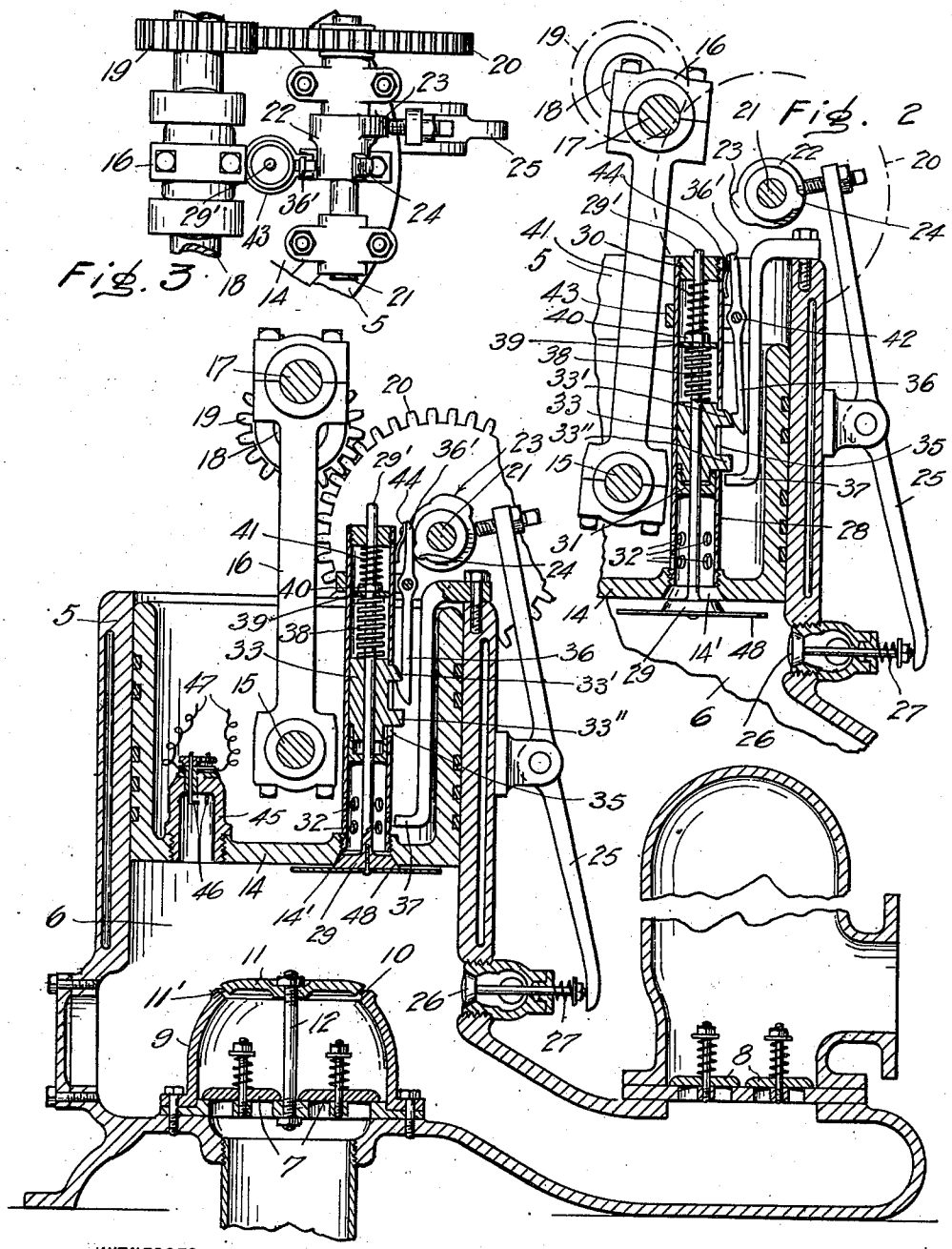

Fig. 1

Fig. 2

Fig. 3

WITNESSES:

H. Barnes.

G. S. Staly

INVENTOR:

Alvyn L. Croxton

BY

Pierre Barnes

ATTORNEY

UNITED STATES PATENT OFFICE.

ALVYN L. CROXTON, OF BREMERTON, WASHINGTON.

INTERNAL-COMBUSTION PUMPING-ENGINE.

996,565. Specification of Letters Patent. Patented June 27, 1911.

Application filed September 28, 1909. Serial No. 519,993.

To all whom it may concern:

Be it known that I, ALVYN L. CROXTON, a citizen of the United States, residing at Bremerton, in the county of Kitsap and State of Washington, have invented certain new and useful Improvements in Internal-Combustion Pumping-Engines, of which the following is a specification.

This invention relates to pumps, or pumping engines; and its principal object is to produce apparatus of this nature which is operated by the combustion of explosive gases to directly effect the pumping operations from the power of such explosions and also perform such function indirectly through the offices of a piston which operates as in an internal combustion engine as well as like a pump plunger.

A further object of the invention is to afford means, as by the provision of improved valves and the mechanism for operating the same, whereby the efficiency of the pumping engine is improved.

The invention consists in the novel construction, and combination of devices, as will be hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a vertical longitudinal section of a pumping engine embodying my invention. Fig. 2 is a fragmentary like section with parts thereof in different operative positions. Fig. 3 is a detail plan view.

The reference numeral 5 designates the engine cylinder which is desirably of the upright type and communicates at its lower end with a water-chamber 6. Provided for the latter are non-return liquid-suction and delivery valves 7 and 8, whereof the suction valves 7 are desirably disposed directly below the said cylinder chamber.

9 represents a hood which incloses the suction valves and is provided with an outlet at the top which is arranged to be open more or less by a plate 11 through adjusting the elevation of the same upon a supporting post 12. As shown, the periphery 11′ of said plate is formed somewhat conical in order to cause the water discharging through the annular space 10 thereabout being delivered as a spray or in a circular sheet into the lower end of the cylinder.

14 is a piston fitted for reciprocatory movement in the cylinder and provided with a pin 15 for a connecting rod 16 whose other end is coupled with the crank-pin 17 of a superposed shaft 18. Mounted upon the shaft is a toothed pinion 19 in mesh with a gear-wheel 20 which is mounted upon an ancillary shaft 21. The ratio of the wheels, as illustrated, is as one is to two and, in consequence, the main shaft will make two rotations to one of the ancillary shaft. Fixedly secured to the latter shaft 21 is a member 22 provided with spaced peripheral projections 23 and 24 which serve as cams. The cam 23 exercises a tilting movement upon a lever 25 which upon the alternate upward strokes of the piston effects the opening of a valve 26 against the power of a spring 27. The valve 26 serves to control the admission of the explosive fluid or power medium and is desirably located to be in proximity to the bottom of the piston when the latter is at the termination of its downward strokes.

Rigidly connected with the piston and communicating with an opening 14′ thereof is a cylindrical casing 28. The opening 14′ affords a port for the outflow of the spent combustion gases after the successive explosions and at other times is closed by a valve 29 which opens downwardly and has a stem 29′ arranged axially of the cylinder. Said stem passes through guides 30 and 31 which are respectively located at the upper end and intermediate the length of said casing. Apertures 32 are provided in the peripheral wall of the casing (below the guide 31) for the escape of the spent gases which are admitted into the casing through the port opening 14′.

Loosely fitted upon the valve stem and within the casing 28 is a block 33 having two lateral projections, or lugs, 33′ and 33″ which extend outwardly through a slot 35 in the casing. The upper of these lugs, 33′, is arranged to be engaged by the hooked end of a dog 36 when the block is in its uppermost position with relation to the casing, as represented in Fig. 1; and the other lug 33″ is arranged to be impinged by a stop 37, which is fixedly connected with the cylinder, when the block is free from the dog and in the downward stroke of the piston. 38 is a spring interposed between said block and a washer 39 which is secured by a nut 40 adjustable upon the valve stem 29′. The function of this spring is to urge the block downwardly when the dog 36 is disengaged. A spring 41 of less power than spring 38 is interposed between said nut and the aforesaid guide 30 and is em-

ployed to open the valve 29 when the block is in a released condition. Said dog is advantageously in the form of a lever which is fulcrumed to a pin 42 supported by an attachment 43 of said casing. The upper arm 36′ of the dog is yieldingly held outwardly by a spring 44 and when the piston is at or near the top stroke such arm is arranged to be influenced by the referred to cam element 24 to swerve the dog in a manner to disengage the same from the block-lug 33′.

45 designates an inverted cup-shaped vessel which is rigidly secured to the bottom of the piston and communicates with the space below such piston. Within the cavity of such vessel are the terminals 46 of the electro-sparking circuit wires 47 which circuit is periodically completed by any well known or suitable devices.

Secured to the underside of the valve 29 is a plate 48 which presents a relatively large surface so that in the event of its encountering a body of water in its downward strokes with the piston the resistance afforded by the water acting over such surface will be sufficient to overcome the power of the spring 41 and the closing of the valve 29 against the discharge of water therethrough.

The operation of the invention may be explained as follows: An explosive gas or mixture is admitted during an upward stroke of the piston 14 by the opening of the valve 26. Simultaneously a suction is created by the receding piston to facilitate the intake of the gas and to induce the flow of water through valves 7 into the pumping chamber 6. Upon the return or downward stroke of the piston the previously admitted gases are compressed to be ignited by the sparking devices near the termination of this stroke with the result that the expansion of gases, due to the explosion, will act to not only expel the liquid through valves 8 but will also afford power to drive the piston and associated parts until the following explosion. During the next upward stroke of the piston a suction is created to induce a charge of liquid being drawn into the pumping chamber through said suction valves 7 which being delivered substantially as a spray through the annular orifice 10 of the hood acts to condense the previously exploded gases. Such condensation of the exploded gases tends to make a vacuum in the pumping chamber and thereby supplements the power of the upwardly moving piston in drawing the aforesaid charge of water into the chamber. Upon the next downward stroke of the piston the cam 24 becomes operative to effect the release of the block-lug 33′ from the dog 36 whereupon the block and valve 29 are respectively forced down by the springs 38 and 41. With the valve 29 open the uncondensed gases escape into the atmosphere through the relatively small apertures 32 of the valve casing 28 and without materially interfering with the discharge of water through the valves 8 which occurs during this stage of the operation. During the latter portion of this stroke the block-lug 33″ strikes the stop 37 to prevent further downward motion of the block with the consequent closing of the valve 29 and the re-engagement of the block 33 with the dog 36 when the latter is presented through the continued travel thereof with the piston. During the second downward stroke of the piston the latter acts as a force-pump plunger to force the liquid therebelow through the exhaust valves 8. Should the liquid within the pumping chamber be at a height greater than that occupied by the piston when the valve 29 is closed through the agency of the block when encountered by stop 37, then the plate 48, as before explained, will act to close the valve when the plate strikes the liquid. In operation, the cavity within the cup 45, or at least the upper portion of the cavity, is filled with gas to prevent the electric terminals therein from becoming wet to interfere with their properly performing their functions.

What I claim as my invention, is—

1. In a pumping engine wherein an explosive power agent is employed between a body of liquid and a movable piston, the combination with the cylinder, a piston therein, a pumping chamber provided with valved openings for the intake and discharge of liquid therefrom, a valve for the admission of explosive gas into the pumping chamber, an exhaust valve carried by the piston to control the discharge of the spent explosive gases from the pumping chamber, and means for opening and closing said valve.

2. In an internal combustion pumping engine, an exhaust valve for the spent combustive gases, of means for periodically opening the valve, and means for retaining the same in open condition until closed by impact with a body of water within the pumping chamber of the engine or by contact with a fixed stop.

3. In an internal combustion pumping engine, an exhaust valve for controlling the discharge of the spent combustive gases, a spring tending to open the valve, means to cause said spring to be temporarily inoperative, means for effecting the disengagement of the aforesaid means, and a means operated by contacting with a body of water within the pumping chamber of the engine for overcoming the power of said spring to restore the valve to its closed condition.

4. In an internal combustion pumping engine, the combination with a casing provided with a cylinder and a water chamber, a piston operable in said cylinder, valves for the intake of water into said chamber and its

discharge therefrom, valves for the admission of an explosive gas and the discharge of the exhausted gas, of means to ignite said explosive gas, and an inverted cup-shaped vessel secured to the piston to accommodate said ignition means and protect the same from the water contained within the pumping chamber.

5. In an internal combustion pumping engine, the combination with a cylinder, a pumping chamber communicating therewith and provided with valve openings for the intake and discharge of liquid therefrom, a piston, a valve for the admission of explosive gas into the pumping chamber, and means for exhausting the spent gases, of ignition terminals carried by said piston in communication with said pumping chamber and protected from contact with the liquid therein.

6. In an internal combustion pumping engine, a hood for the liquid suction valves and adjustable means coöperating with the hood whereby the supply of liquid admitted to the pumping chamber is employed to facilitate the condensation of an exploded power charge.

7. An internal combustion pumping engine comprised of a cylinder with a communicating water chamber, valves for the intake of liquid into said chamber and its discharge therefrom, a piston, a crank-shaft, a connecting rod between the crank-shaft and the piston, a second shaft, driving connection between the aforesaid shafts, a valve for the admission of an explosive gas within said cylinder, means actuated from the second shaft for operating said valve, a valve carried by said piston, a spring tending to open the last named valve to permit the expulsion of spent explosive gases from the cylinder, automatic means for normally retaining this valve in closed condition and in opposition to the referred to spring, means actuated from the second shaft for disengaging such valve retaining means, and a positive means for closing the last named valve and rendering said valve retaining means operative.

8. An internal combustion pumping engine, comprised of a cylinder with a communicating water chamber, valves for the intake of liquid into said chamber and its discharge therefrom, a piston, a crank-shaft, a connecting rod between the crank shaft and the piston, a second shaft, driving connection between the aforesaid shafts, a valve for the admission of an explosive gas within the said cylinder, means actuated from the second shaft for operating said valve, a valve carried by said piston, a spring tending to open the last named valve to permit the expulsion of spent explosive gases from the cylinder, automatic means for normally retaining this valve in closed condition and in opposition to the referred to spring, means actuated from the second named shaft for disengaging such valve retaining means, and devices arranged to be operated by impinging with a body of water in said pumping chamber for closing the last named valve and causing said valve retaining means to become operative.

9. In an internal combustion pumping engine, comprised of a cylinder with a communicating water chamber, valves for the intake of liquid into said chamber and its discharge therefrom, a hood for inclosing the intake valves and provided with an opening at its top, a cover for the hood opening, means for adjusting the positions of said cover to regulate the effective extent of the hood opening, a piston, a crank shaft, a connecting rod between the crank shaft and the piston, a second shaft, driving connection between the aforesaid shafts, a valve for the admission of an explosive gas within said cylinder, means actuated from the second shaft for operating said valve, a valve carried by said piston, a spring tending to open the last named valve, to permit the expulsion of spent explosive gases from the cylinder, automatic means for normally retaining this valve in closed condition and in opposition to the referred to spring, means actuated from the second shaft for disengaging such valve retaining means, and a positive means for closing the last named valve and rendering said valve retaining means operative.

10. An internal combustion pumping engine, comprised of a cylinder with a communicating water chamber, valves for the intake of liquid into said chamber and its discharge therefrom, a piston, a crank-shaft, a connecting rod between the crank-shaft and the piston, a second shaft, driving connections between the aforesaid shafts, a valve for the admission of an explosive gas within the said cylinder, means actuated from the second shaft for operating said valve, a valve carried by said piston, a spring tending to open the last named valve to permit the expulsion of spent explosive gases from the cylinder, automatic means for normally retaining this valve in closed condition and in opposition to the referred to spring, means actuated from the second shaft for disengaging such valve retaining means, a positive means for closing the last named valve and rendering said valve retaining means operative, and an inverted cup shaped vessel carried by said piston to accommodate the sparking terminals and serving as the ignition chamber of the engine.

11. An internal combustion pumping engine comprised of a cylinder with a communicating water chamber, valves for the intake of liquid into said chamber and its discharge therefrom, a hood for inclosing the intake valves and provided with an open-

ing at its top, a cover for the hood opening. means for adjusting the positions of said cover to regulate the effective extent of the hood opening, a piston, a crank shaft, a connecting rod between the crank shaft and the piston, a second shaft, driving connection between the aforesaid shafts, a valve for the admission of an explosive gas within said cylinder, means actuated from the second shaft for operating said valve, a valve carried by said piston, a spring tending to open the last named valve, to permit the expulsion of spent explosive gases from the cylinder, automatic means for normally retaining the valve in closed condition and in opposition to the referred to spring, means actuated from the second shaft for disengaging such valve retaining means, a positive means for closing the last named valve and rendering said valve retaining means operative, and an inverted cup shaped vessel carried by said piston to accommodate the sparking terminals and serve as the ignition chamber of the engine.

12. In an internal combustion pumping engine, the combination with the engine cylinder, the piston, and a crank shaft operatively connected with the piston, of a casing secured to the piston and communicating with an opening extending through the latter, a valve for said opening, a stem provided for the valve, a guide for the stem, a block mounted for reciprocatory movements in the casing and inclosing said stem, a spring interposed between the block and an abutment secured to the stem, a spring interposed between the abutment and said guide and tending to open the valve, a stationary stop adapted to be encountered by said block in the downward travel of the same with the piston and thereby serving to compress both of the springs to close the valve, a dog adapted to engage the block when the latter is restrained by said stop, and means for disengaging the dog from the block.

13. In an internal combustion pumping engine, the combination of a cylinder, a pumping chamber communicating therewith and provided with valved openings for the intake and discharge of liquid therefrom, a piston, a valve for the admission of an explosive gas into the pumping-chamber, means for periodically operating the gas-admission valve, a gas-exhaust valve carried by the piston, a spring tending to open said gas exhaust valve, automatic means for normally retaining the last named valve in closed condition, means for disengaging such valve retaining means, and a positive means for closing the last named valve and causing said valve retaining means to be inoperative.

14. In an internal combustion pumping engine, the combination of a cylinder, a pumping-chamber communicating therewith and provided with valved openings for the intake and discharge of liquid therefrom, a piston, a valve for the admission of an explosive gas into the pumping-chamber, means for periodically operating the gas-admission valve, a gas-exhaust valve carried by the piston, and means for periodically operating the gas-exhaust valve.

15. In an internal combustion pumping engine wherein an explosive power agent is employed between a body of water and a movable piston, an inverted cup-shaped vessel carried by the piston, and ignition means within said vessel and protected thereby from contact with the water.

Signed at Seattle, Washington, this 22nd day of September, 1909.

ALVYN L. CROXTON.

Witnesses:
H. BARNES,
G. S. STALY.