No. 715,131. Patented Dec. 2, 1902.

F. L. ORR.

PUMPING ENGINE.

(Application filed May 6, 1902.)

(No Model.)

Fig. 1.

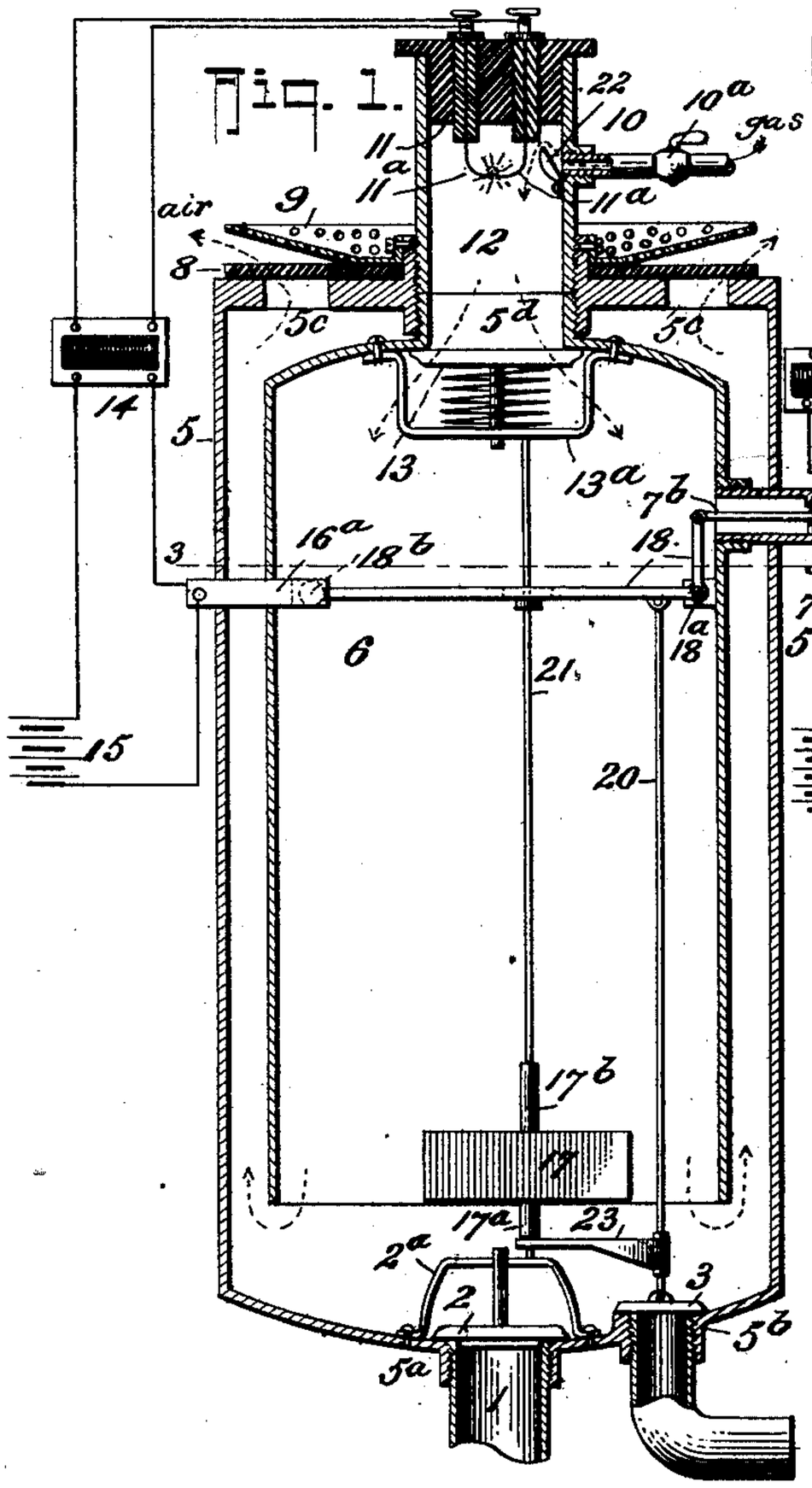


Fig. 2.

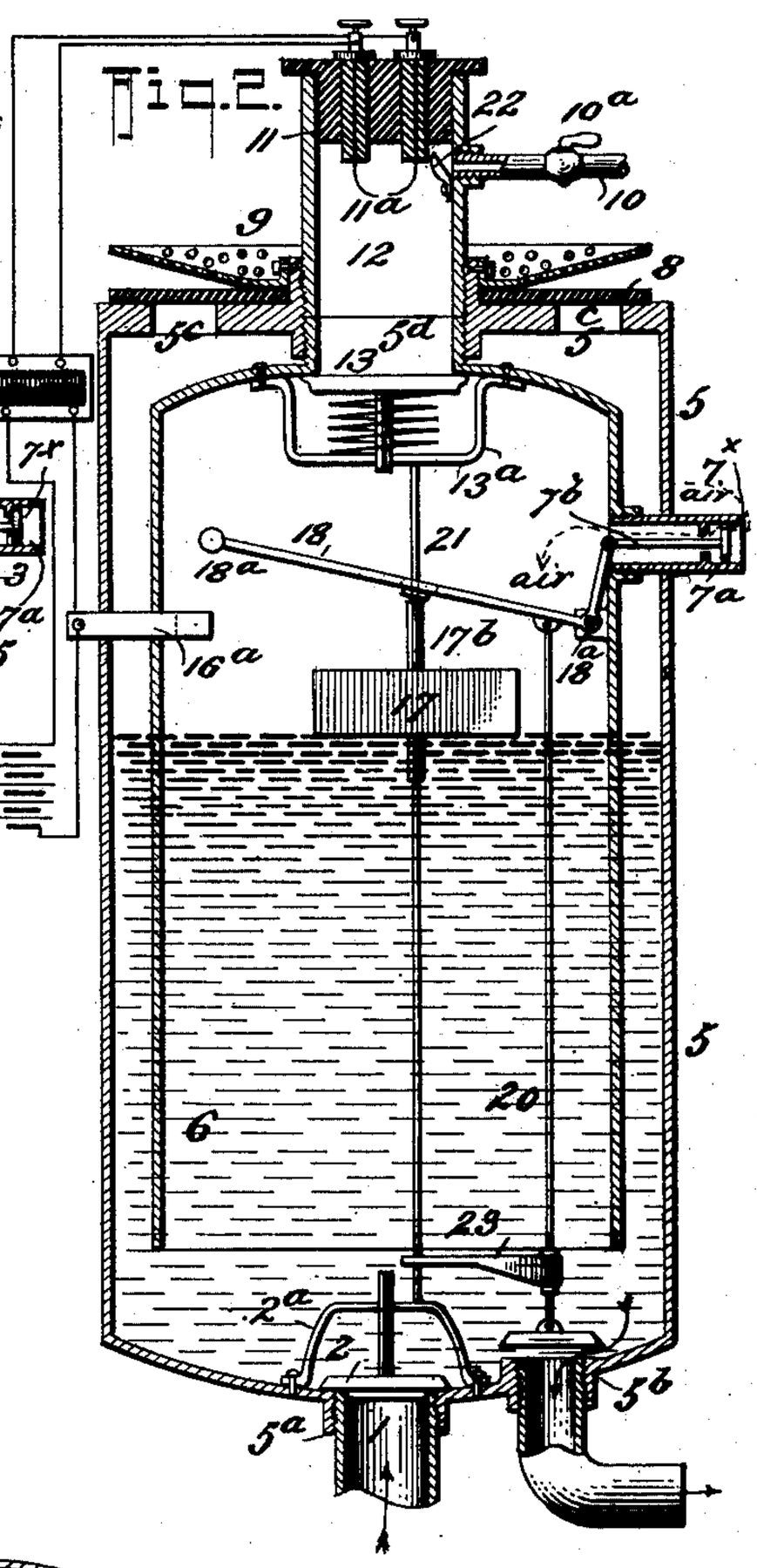
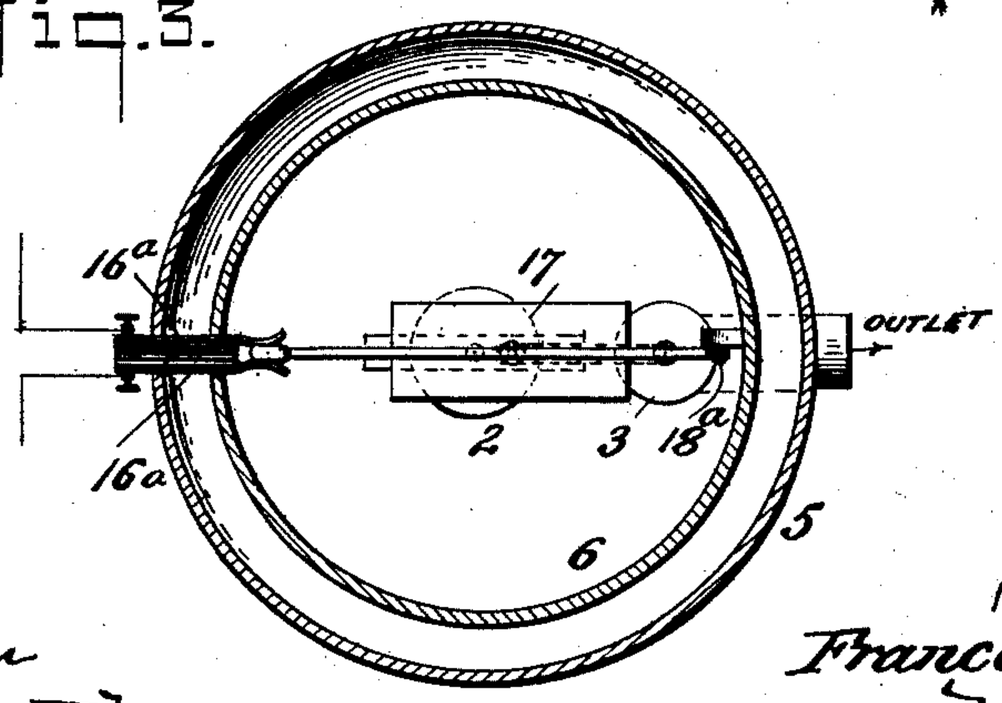


Fig. 3.



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FRANCIS LEONARD ORR, OF THURMAN, IOWA.

PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 715,131, dated December 2, 1902.

Application filed May 6, 1902. Serial No. 106,161. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS LEONARD ORR, residing at Thurman, in the county of Fremont and State of Iowa, have invented a new and Improved Pumping-Engine, of which the following is a specification.

My invention relates to improvements in that type of liquid-elevating means operating under an explosive and a vacuum energy created by the combustion of the explosive mixture and in which after being started the operation will continue so long as the working agent is fed thereto; and the same primarily seeks to provide a pumping means or engine of the character stated of a simple, effective, and economical construction and in which the operation can be conveniently controlled.

In its generic nature my invention comprehends a casing, a supplemental cylinder within the casing and in communication therewith, a liquid inlet and offtake for the casing, an explosion-chamber having a valved exhaust through which the exploded gases pass to the supplemental cylinder for creating a vacuum within the casing, and a novel coöperative arrangement of automatically-operating valves and electric closing means controlled by the rise and fall of the fluid drawn within the casing by the intermittent vacuum operations.

In its more complete make-up this invention includes a combined air-supply-regulating valve and spark-circuit controller, a closure-valve for the fluid-offtake, a float for cooperating with said combined valve and circuit-controller; and in its still more subordinate features this invention consists in certain novel details of construction and peculiar combination of parts, all of which will hereinafter be fully described and specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section of my explosive-engine pump, the electric igniting means being diagrammatically represented and the several parts shown in position for igniting a charge of the working agent for expelling the air and to create a vacuum within the pump-casing. Fig. 2 is a similar view illustrating a charge of water drawn into the casing by a whole or partial vacuum therein, the float-valve being shown in a position for opening the offtake-controlling valve and air-inlet and for moving the igniting-circuit controller or switch in its open position. Fig. 3 is a horizontal section on the line 3 3 of Fig. 2.

In the practical construction my invention comprises an outer casing 5 of suitable size and shape, preferably cylindrical, the lower end of which has a threaded tap 5^a for connecting with the water lift or feed pipe 1, and adjacent the threaded tap 5^a it has a second threaded tap or boss 5^b, to which the outlet or offtake pipe joins, as clearly shown.

At the upper end the casing 5 has two or more outlets 5^c surrounding a central opening 5^d, to which the combustion-chamber 12 connects, and the said openings 5^c are normally closed by a disk, of rubber, leather, or other suitable material, protected by a spherical metal guide 9, perforated to give quick relief to the movement of the disk 8, for reasons hereinafter explained.

The opening 5^d to the combustion-chamber is normally closed by a spring-held valve 13, operating in a valve-cage 13^a, located in the upper end of an internal or supplemental cylinder 6, closed at the top from the casing 5, but open at the bottom and in communication with the said casing 5, the parts being arranged to provide for communication between the explosion-chamber 12 and the casing 5 through the internal cylinder 6, for reasons hereinafter set forth.

11 designates an insulated plug that fits into the combustion-chamber 12 and carries the terminals 11^a 11^a of the igniting-circuit, which terminals to insure a positive ignition of the working agent at the proper time are disposed adjacent the intake 10, provided with a back-check valve 22, as clearly shown. The intake 10 in practice is provided with a suitable source of supply with the working agent, (explosive mixture,) the feed of which may be cut off by valve 10^a, located at any point in the pipe 10.

Near the upper end the inner cylinder 6 has an air-intake that projects through the outer casing 5, the entrant end 7^a of which is controlled by the slide-valve $7^\times$, mounted on the stem 7^b, projected into the cylinder 6. This

stem 7^b is pivotally connected to one arm of the bell-crank lever 18, fulcrumed at 18^a at a point diametrically opposite to a pair of contact-plates 16^a 16^a of the electric-current-controlling means, which includes a circuit-closing head 18^b on the outer end of the lever 18, as best shown in Fig. 4.

15 indicates a battery, and 14 an induction-coil, forming a part of the igniting means and of the ordinary construction.

2 designates a gravity fluid-pressure valve for closing off the lift-pipe 1, and 2^a a cage for the said valve.

21 designates a vertical stem secured at the upper end to the valve-cage 13^a and at the lower end to the valve-cage 2^a, and 20 indicates the stem of the offtake-closing valve 3, connected at the upper end to the long arm of the lever 18. A float 17 is held to slide upon the rod 21, and the said float includes a tubular pendent extension 17^a, adapted to engage with a laterally-extending member 23, fixedly joined with the stem 20 of the valve 3.

The manner in which my engine-pump operates is best explained as follows: Assuming the parts to be in the position shown in Fig. 1 and a charge of air to be within the casing 5 and a working-agent charge to be collecting within the combustion-chamber 12, when the said charge is of sufficient pressure it is ignited and the explosive force pushes back the valve 13 and allows the exploded mixture to pass into the cylinder 6, which mixture forces out the air within the cylinder and casing in the direction indicated by the arrow and out through the openings 5^c to atmosphere, the disk valve 8 at this time being forced open by pressure within the casing 5. The air within the casing 5 being exhausted, a vacuum is created within the casing 5, and by reason thereof the water is drawn up the lift-pipe and the valve 2 raised thereby to permit the water flowing into and filling the casing 5. As the water fills into the casing 5 the float 17 rises until its extension 17^b engages with the lever 18, and in so doing the electric igniting-circuit is broken, and at the same time the valve 3 to the offtake is open, and the valve $7^\times$, that controls the air-inlet in the casing 5, is also open, thereby allowing the atmospheric pressure to force out the water charge drawn into the casing 5 by the prior vacuum energy through the outlet-pipe, it being understood that in practice the lever 18, and its connections controlled thereby, is held in the position to which it was shifted by the float 17, and thereby keeps the valve 3 open until the water within the casing is practically exhausted, or at least to a point below the lower edge of the inner cylinder 6. At this time the float 17 in descending engages the member 23 and forces the valve 3 to its closed position, the valve 2 at this time being held closed by the water below it and its own gravity, it being also understood that as the float engages the member 23 and pulls down on the stem 20 the lever 18 will be shifted back to its first position, with its head 18^b contacting with the plates 16^a 16^a to again close off the igniting-circuit, and with the valve $7^\times$ to close off air from the inner cylinder 6, the spring action on the valve 13 during the aforesaid operation closing the combustion-chamber from the cylinder 6 and holding in a new charge of working agent. After the parts again assume the position shown in Fig. 1 a new charge is exploded in the chamber 12, and the operation of the pump is repeated as before, and which operation continues so long as the working-agent feed is permitted to flow into the combustion-chamber 12.

While the special arrangement of parts shown in the drawings clearly illustrate my invention, yet it will be understood that the said arrangement, particularly the details of construction, may be varied or modified without departing from the principle of my invention or the scope of the appended claims.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A pumping means of the character described, comprising a vacuum-cylinder including an internal supplemental chamber, a valved intake and valved outlet communicating with said chamber, an explosion-chamber for coöperating with said cylinder, an automatically-operating valve for normally closing off the explosion-chamber from the vacuum-cylinder, and adapted to open under the explosive charge, means for exhausting the air from the vacuum-cylinder, controlled by the explosive force within the cylinder, a working-agent feed and igniting means cooperating with the explosion-chamber, an air-inlet to the vacuum-cylinder, and mechanism governed by the liquid within the vacuum-cylinder for operating the offtake and the air-inlet to the cylinder, for the purposes set forth.

2. A pumping means of the character stated, comprising a casing having a valved intake and a valved offtake for the liquid at the lower end, and valved outlets for exhausting the air at the top, a supplemental chamber within the casing, whose lower end communicates with the casing, an explosion-chamber opening into the supplemental chamber, a valve for normally cutting off the explosion-chamber, a working-agent feed and an igniting means for the explosion-chamber, an air-inlet for the aforesaid supplemental chamber, an automatically-operating valve for closing said inlet, trip devices for opening the liquid-offtake from the outer casing, and for simultaneously opening the air-inlet to the supplemental chamber, controlled by the rise of the liquid drawn into the casing by vacuum energy.

3. In a means for producing a vacuum or partial vacuum by explosions; the combination of a closed vessel, having an inlet for the explosive mixture, and a valve-controlled in-

let and outlet for liquid, an air-feed to the vessel, an electric sparking mechanism, including a circuit maker and breaker, and a single shifting mechanism for coöperating with the air-feed and the circuit breaker and maker, and the valve for the liquid-offtake, controlled by the rise of the liquid within the vessel and adapted when said liquid fills the vessel to a predetermined point to simultaneously break the sparking circuit, open the valve to the air-inlet, and the valve of the liquid-offtake, as set forth.

4. In a means for producing a vacuum or partial vacuum by explosions; the combination of a closed vessel having an inlet and an outlet for liquid, a controlling-valve therefor, means for supplying explosive to the vessel, a sparking mechanism including a circuit, which is closed incident to the feed of an explosive working agent, a float, and a pivoted circuit-controller within the vessel connected with the valve of the liquid-outlet, the two being coöperatively arranged whereby the float, as it rises, trips the controller to break the sparking circuit and restores said controller to its closed position as the liquid discharges from the vessel, for the purposes stated.

5. In a means for producing a vacuum or partial vacuum by explosions, a vessel having a valved inlet and a valved outlet for liquid, means for supplying an explosive force to the vessel and simultaneously exhaust the air therefrom to produce a vacuum, a valve-controlled air-inlet to the vessel, a sparking mechanism for igniting the working or explosive agent, including a circuit-controller located within the vessel, and a mechanism governed by the rise and fall of the liquid in the vessel, adapted to move the circuit-controller to a circuit-breaking position on the rise of the liquid and simultaneously open up the liquid-outlet and the air-inlet, substantially as shown and described.

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