C. E. WHITE.

PUMP.

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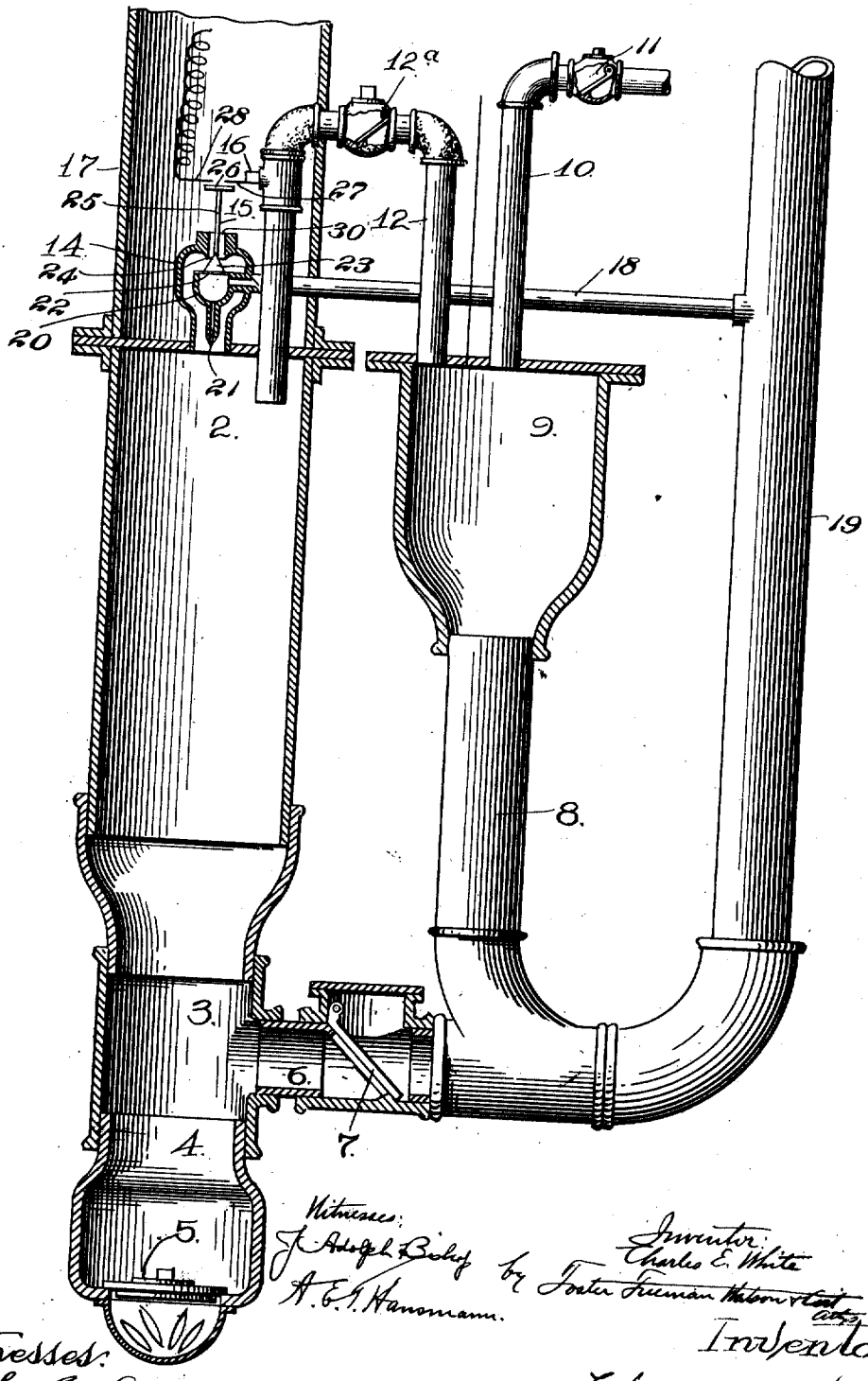

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PUMP.

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To all whom it may concern:

Be it known that I, CHARLES E. WHITE, a citizen of the United States, and a resident of the city and county of San Francisco and State of California, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

The invention relates to internal combustion pumps wherein liquid is elevated by means of the expansive force of an exploded gas.

One of the objects of the invention is to provide a pump of the character or type referred to in which the full static pressure of liquid in the discharge or delivery pipe is utilized for introducing an explosive charge into the combustion chamber and compressing it therein.

A further object of the invention is to provide means whereby the explosive charge is initially drawn into a separate gas chamber and forced from such chamber to the combustion chamber and compressed into the latter by the action or pressure of the liquid in the discharge or delivery pipe, and further to utilize the pressure of the liquid in such discharge pipe as a means for operating the igniter by which the explosive charge in the combustion chamber is exploded.

The device possesses other advantageous features which, with the foregoing, will be set forth at length in the following description, where I shall outline in full that form or embodiment of my invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. From this it will be apparent that I do not restrict myself to the showing made by such drawings and descriptions as I may adopt many variations within the scope and spirit of my invention.

The accompanying drawing illustrates in vertical cross-section the pump adapted to be immersed in liquid, also showing the gas compression chamber and connections with the combustion chamber and means for igniting the gas.

The pump consists of the chamber 2 which is preferably cylindrical in shape, but various modifications of the chamber can be used if desired. Secured to the lower end of the chamber 2 is a tee 3 having a suction or supply pipe 4. A check-valve 5 in this pipe allows the liquid to flow into the chamber 2 at the proper time. Connected to the other outlet of the tee 3 is a delivery pipe 6, through which the liquid is forced to a higher level. A similar check-valve 7 in this pipe prevents the liquid from flowing back into the combustion chamber. The liquid from the source of supply enters the chamber 2 through the supply pipe 4, the valve 5 operating to allow the entrance and is discharged from the chamber 2 through the pipe 6, the valve 7 operating to allow the liquid to pass.

A vertical pipe 8 communicates with pipe 6 on the low pressure side of valve 7 having a closed upper end, which constitutes a gas chamber 9. Secured to the upper end of the gas chamber is a gas supply pipe 10, provided with a check-valve 11. A pipe 12 connects with the top of gas chamber 9 and the combustion chamber 2 and is provided with a check valve 12^a, affording a connection between the gas chamber and the combustion chamber for the purpose of conveying an explosive gas into the combustion chamber.

An exhaust valve casing 14 connects with the top of the combustion chamber 2 and also connects with the delivery pipe 19 through a connection 18. The casing 14 is interiorly provided with a cup 20 having a bored extension 21 which extends downwardly. The upper end of the cup has a diaphragm 22 which closes the said upper end and the pipe 18 extends into the cup 20 at a point below the diaphragm. The bore of the pipe 18 is somewhat greater than the bore of the extension 21 so that the rate of discharge will be lower than that of filling. The diaphragm 22 is provided with a valve 23 to enter a seat 24 when the diaphragm moves upwardly. A vertical stem 25 is connected to the valve 23 and at its upper end is provided with a contact 26 of sufficient length to bridge the gap between the electric terminals 27 and 28 of the ignition device. When the cup 20 is empty and the diaphragm lowered the contact or circuit closer will be out of engagement with the terminals 27 and 28 and will so remain until the cup is filled with liquid and the pressure of the liquid piston in the pipe 18 forces the diaphragm upwardly to close the circuit.

Various means may be employed for operating the exhaust valve 14 and closing the ignition circuit to the spark plug 16 at the proper time, and in the drawing I have

shown one such means, but it is to be understood that I do not limit myself to such means.

The top of the combustion chamber 2 may be inclosed in a casing 17 to protect the valves and the electrical sparking device that the pump may be submerged in a liquid to any desirable depth.

The operation of the pump is as follows: It will be assumed that the pump is submerged in a liquid and the combustion chamber is filled with liquid and an explosive gas, and the delivery pipe 19, pipe 8 and chamber 9 are full of liquid; when the circuit to the spark plug closes the gas is ignited and explosion thereof forces the liquid through the pipe 6; this movement of the liquid closes the valve 5 and opens the valve 7. As the liquid moves through the pipe 6 the liquid piston in pipe 8 and chamber 9 will move downwardly and thereby create a suction in the gas chamber 9, whereupon the valve 11 will open and a fresh supply of gas be drawn into the chamber 9 through the pipe 10. As the liquid moves upwardly in the pipe 19 the liquid piston in pipe 18 will move toward pipe 19, thus removing the pressure from the diaphragm 22 and permitting the contact 26 to move downwardly. After the explosive force is spent, the action of the liquid in the delivery pipe 19 closes the valve 7 and the liquid piston in the pipe 8 and chamber 9 forces the explosive mixture from the chamber 9 into the chamber 2. It will be observed that while this action is taking place the water will have risen in the chamber 2 and above the lower end of the pipe 12, thus the gas will be compressed prior to ignition, which latter will not be effected until the liquid piston in the pipe 18 forces the diaphragm upwardly as before described. It will be observed when the diaphragm is lowered to the position shown in the figure that the valve 23 is unseated to permit the products of combustion to escape through the opening 30 in the casing 14. It is seen therefore that the force of the expanding gas when ignited serves to raise the liquid, which in turn draws in a fresh supply of an explosive gas and compresses it into the combustion chamber after the burned gases have been withdrawn from the combustion chamber, thus utilizing a high percentage of the energy obtained from the fuel used.

What I claim as new and desire to secure by Letters Patent is,

1. An internal combustion pump comprising a combustion chamber, a gas chamber connected thereto and adapted to contain a liquid piston which operates to draw an explosive charge thereinto and compress the same in the combustion chamber.

2. In an internal combustion pump in combination, a combustion chamber, an igniter associated therewith, a gas chamber connected to the combustion chamber and adapted to contain a movable liquid piston which operates to draw an explosive charge thereinto and compress the same into the combustion chamber, a delivery pipe, and a connection between the delivery pipe and igniter adapted to contain a liquid piston for operating the igniter.

3. In an internal combustion pump in combination, a combustion chamber, an igniter associated therewith, a gas chamber connected to the combustion chamber and adapted to contain a movable liquid piston which operates to draw an explosive charge thereinto and compress the same into the combustion chamber, a delivery pipe, and a connection between the delivery pipe and igniter adapted to contain a liquid piston for operating the igniter subsequent to the compression of the charge in the combustion chamber.

4. An internal combustion pump comprising a combustion chamber having a valved water inlet, a gas chamber connected at its opposite ends to the combustion chamber by valve-controlled passages, said gas chamber adapted to contain a liquid piston which operates to draw an explosive charge into the gas chamber and force the same into the combustion chamber.

5. An internal combustion pump comprising a combustion chamber, a gas chamber, a delivery pipe, a connection between the delivery pipe and gas chamber, and a valve-controlled connection between the gas chamber and combustion chamber, said gas chamber being adapted to contain a liquid piston which operates to close the valve in said connection whereby to prevent water from the delivery pipe from returning to the combustion chamber.

6. In an internal combustion pump, the combination of a combustion chamber having liquid inlet and discharge openings, an igniter for exploding a charge in the combustion chamber, a delivery pipe communicating with the liquid discharge opening of the combustion chamber, a gas chamber connected to the combustion chamber and delivery pipe, and a valve between the connection of said gas chamber with the delivery pipe and the connection between said pipe and the combustion chamber, said valve being adapted to close under pressure of liquid in said pipe and permit the full amount of such pressure to force a charge from the gas chamber into and compress it within the combustion chamber.

7. In an internal combustion pump, the combination of a combustion chamber having liquid inlet and discharge openings, an igniter for exploding a charge in the combustion chamber, a delivery pipe communicating with the liquid discharge opening of

the combustion chamber, a gas chamber connected to the combustion chamber and delivery pipe, a valved pipe connecting the gas chamber and combustion chamber, and a valve 7 arranged in the delivery pipe between the connection thereof with the combustion and gas chambers, said valve being opened by the force of an explosion in the combustion chamber and closed by the pressure of liquid in the delivery pipe whereby the full amount of such pressure is utilized to force an explosive charge from the gas chamber to the combustion chamber and compress it within the latter.

In testimony whereof I have hereunto signed my name.

CHARLES E. WHITE.

Witnesses:
P. A. PIODA,
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