No. 719,249. PATENTED JAN. 27, 1903.

B. NILES.

EXPLOSIVE ENGINE.

APPLICATION FILED APR. 20, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

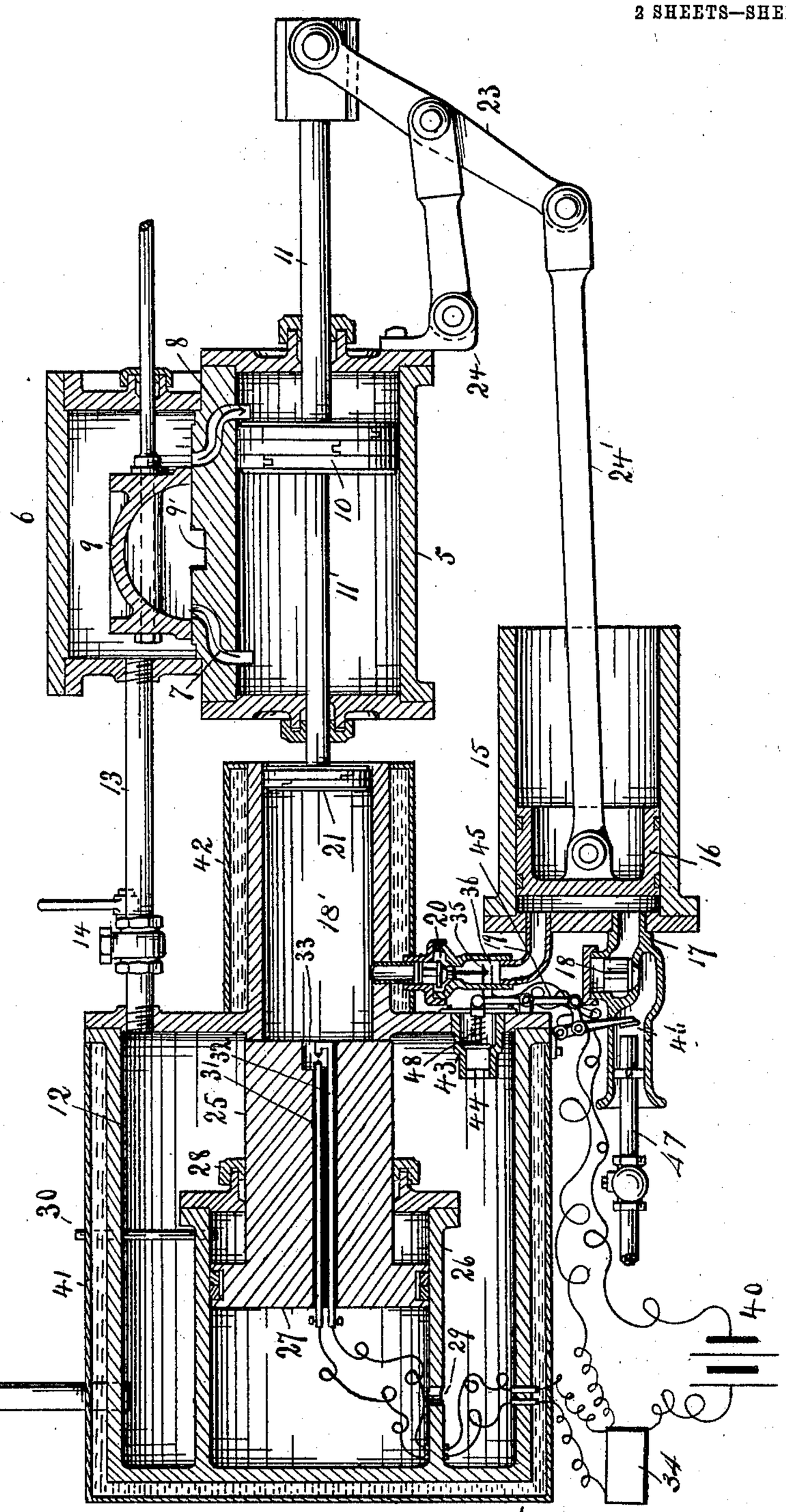

Fig. 1.

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NO MODEL. 2 SHEETS—SHEET 2.

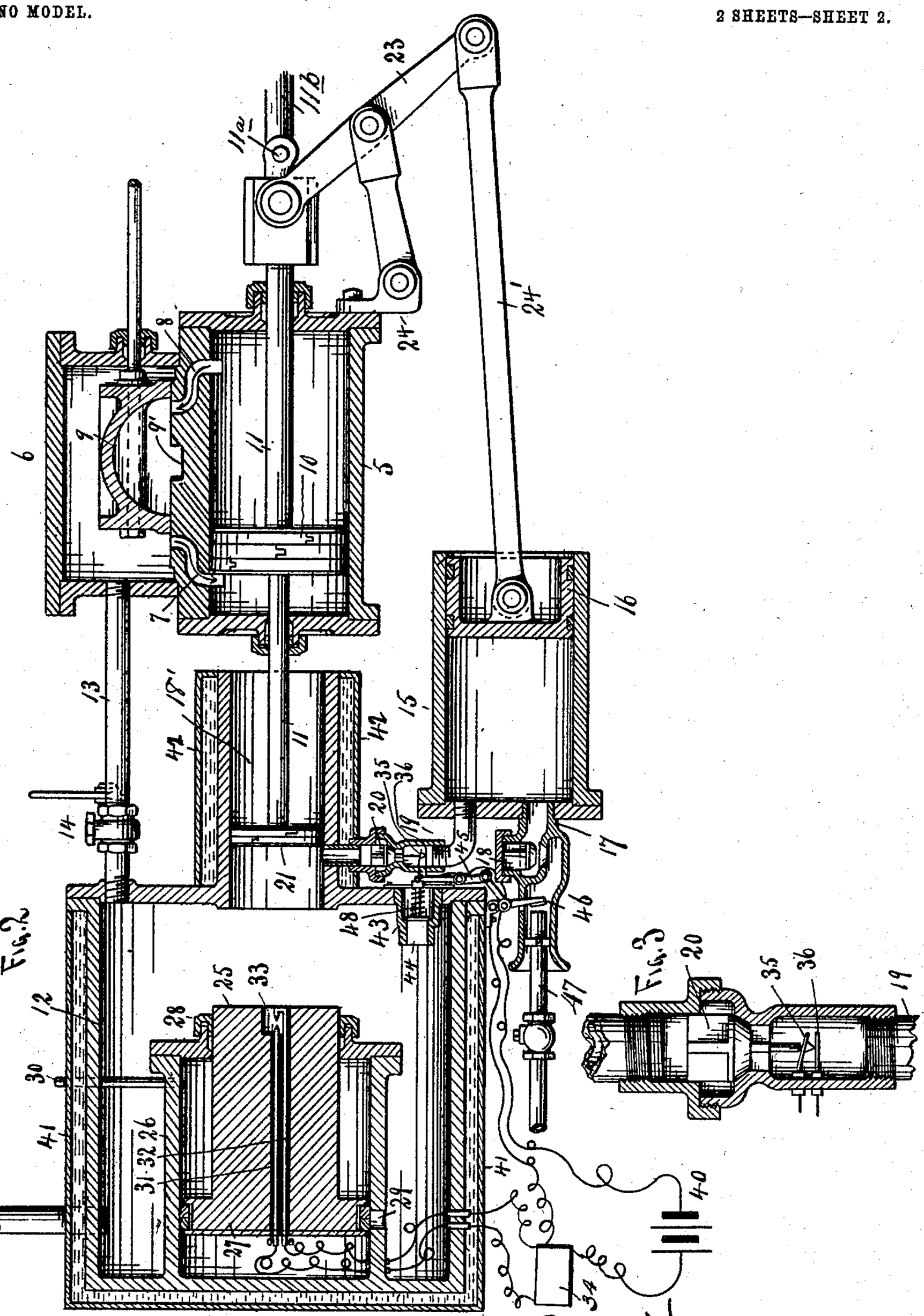

FIG. 2.

FIG. 3.

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UNITED STATES PATENT OFFICE.

BERT NILES, OF CROSWELL, MICHIGAN.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 719,249, dated January 27, 1903.

Application filed April 20, 1901. Serial No. 56,782. (No model.)

To all whom it may concern:

Be it known that I, BERT NILES, a citizen of the United States, residing at Croswell, in the county of Sanilac and State of Michigan, have invented a new and useful Explosive-Engine, of which the following is a specification.

This invention relates to explosive-engines; and it has for its object to provide in connection with an ordinary cylinder having a reciprocatory piston therein and provided with a chest and cut-off valve a gas-reservoir and means for compressing and exploding successive charges of a hydrocarbon fluid and air and passing it to the reservoir, from which it is to be fed, to the chest, and thence to the cylinder to reciprocate the piston therein.

In the drawings forming a portion of this specification, and in which like numerals of reference indicate similar parts in the several views, Figure 1 is a longitudinal section through the mechanism and showing the parts in the positions they assume when the charge of fluid is about to be exploded. Fig. 2 is a view similar to Fig. 1 and showing the parts in their opposite positions, with a charge drawn into the compression-cylinder and ready to be forced into the explosion or ignition cylinder. Fig. 3 is a detail view, partly in section and partly in elevation, and showing the check-valve between the compression and ignition cylinders and the circuit-closer operated thereby.

Referring now to the drawings, there is shown a cylinder 5, on which is disposed a valve-chest 6, and between which cylinder and chest are the ports 7 and 8, which are to be alternately and interchangeably covered and uncovered by the slide-valve 9, the chest being provided with the usual exhaust-port 9′. In the cylinder 5 is a piston 10, and connected thereto is a rod 11 for attachment of a pitman to lead to a crank to be rotated, the valve-rod having operative connection with the piston in the usual manner and which need not be shown nor described. As herein shown, the rod 11 is provided with a stud or projection 11^a, to which is pivotally connected the pitman 11^b, which connects with the crank-shaft of a suitable fly-wheel, from which power is transmitted, and as this construction will be well understood further illustration is deemed unnecessary. Fluid under pressure is supplied to the valve-chest 6 from a reservoir 12 through a supply-pipe 13, having a controlling-throttle 14. The reservoir 12 is furnished with its gas through the medium of the following mechanism: A compression-cylinder 15 is provided with a piston 16, which is operatively connected with the piston-rod 11, and connected with cylinder 15 is a pipe 17, through which carbureted air or other vapor or gas admixed with air is drawn into the compression-cylinder in the usual manner employed with gas-engines, the pipe 17 having an upward-opening check-valve 18 for preventing back escape of the gas. An ignition-cylinder 18′ is connected directly to the reservoir and opens at one end thereinto, and connected with this ignition-cylinder through the wall thereof and near to the wall of the reservoir is a pipe 19, in which is a puppet check-valve 20, which opens in the direction of the ignition-cylinder, the pipe 19 at the opposite side of the valve being connected to the compression-cylinder, as shown, so that as the piston 16 is reciprocated in the compression-cylinder it will first draw the fuel into the compression-cylinder and will then force it outwardly through the pipe 19 and into the ignition-cylinder. The cylinder 5 and the ignition-cylinder are disposed in axial alinement, and the rod 11 is continued through the rear of the cylinder 5 and into the ignition-cylinder, where it is connected with the piston 21, so that as the piston 10 is moved the piston 21 will be moved and in the same direction, it being noted that the compression-cylinder is of less diameter than the cylinder 5, while the ignition-cylinder is of lesser diameter than the compression-cylinder. It will be also noted that the connection of the piston 16 with rod 11 is through the medium of a rocker 23 mounted upon an arm 24 upon the cylinder 5, one end of this rocker being connected to the rod 11, while the other end has the rod 24′ pivoted thereto, and which rod 24′ is pivoted to the piston 16. Thus the piston 16 is reciprocated oppositely to the pistons 10 and 21, so that as the piston 16 moves in a direction to compress the fluids in the compression-cylinder the piston 21 moves toward the outer end of the ignition-cylinder to permit the fluids to pass through pipe 19 and into the ignition-cylinder. When the

compression-stroke is at an end, the piston 21 is at the end of its outward movement, at which time the fluids are ignited, and as they expand they pass in part into the reservoir 12, the remaining fluids being forced into the reservoir upon the return stroke of the piston 21.

To prevent passage of the unignited fluids into the reservoir, a valve is provided and consists of a piston 25, disposed in a cylinder 26 within the reservoir 12, the piston having a head 27, which fits the interior of the cylinder snugly, while the body of the piston projects through a stuffing-box 28 at the end of the cylinder and is adapted for movement therethrough to cover the adjacent end of the ignition-cylinder. An opening 29 is formed through a wall of the cylinder 26, so that gas may pass into the cylinder 26 behind the head 27 and hold the valve with its end normally over the end of the ignition-cylinder to close it, this result being due to the fact that the head of the piston-valve is of greater area than the exposed end of the valve that covers the ignition-cylinder. An air-pipe 30 leads through the reservoir to the interspace between the head of the piston-valve and the head of the cylinder through which the valve is passed, so that the valve may move freely.

The ignition of the charge of gas is effected through the medium of the terminals 31 and 32, that are disposed in a recess 33 in the end of the piston-valve, so that when the said valve is in position to close the end of the ignition-cylinder and form an end therefor this recess will communicate directly with the ignition-chamber and gas therefrom will pass into the recess and around the terminals. These terminals are in circuit with a suitable source of electricity, and the circuit includes a sparking-coil 34 and two contact-fingers 35 and 36, which project through the wall of the pipe 19 and in close proximity to each other. The upper finger 35 is so positioned that when the puppet-valve 20 is in closed position its stem will rest against this upper finger and press and hold it down against the lower finger, and thus close the circuit, whereupon a spark will leap from one of the terminals 31 and 32 to the other to ignite the charge of gas in the ignition-cylinder. When the gas is thus ignited, it expands and blows the valve 25 back and the expanded gas passes into the reservoir.

The operation of the engine is as follows: The parts being in the positions shown in Fig. 1 of the drawings and the engine being in operation, the piston 16 moves rearwardly and draws the fuel into the cylinder 15. At the same time piston 21 moves inwardly, and the valve 20 being seated the stem thereof presses against the finger 35 and moves it into contact with finger 36, thereby closing the circuit of the source of electricity 40, with the result that a spark is passed from one to the other of the terminals 31 and 32 and the fluids in the cylinder are ignited. When the fluids are ignited, they expand and press the valve 25 back and pass into the reservoir 12, the return movement of the piston 21 forcing the remainder of the gas into the reservoir, with the exception of what little fills the interspace between the end of the cylinder and the piston 21 at the inner end of its stroke. When the piston 16 returns, it forces the fluids from the cylinder 15 and into the ignition-cylinder, the piston 21 at the same time moving to permit filling of cylinder 18′. In this manner charges are successively forced into the ignition-cylinder and exploded and the gas permitted to flow into the reservoir, from which they are permitted to pass to the chest 6 and thence through ports 7 and 8 to the cylinder 5 to actuate the piston 10.

The reservoir 12 and the ignition-cylinder have water-jackets 41 and 42, respectively, and in order to start the engine an air-pump 42′ may be connected with the reservoir. Furthermore, the reservoir is provided with a cylindrical extension 43, in which is disposed a piston 44, which is connected with a lever 45, pivoted upon the end of the reservoir, and this lever is connected with a valve 46, disposed to cover the end of the fuel-inlet pipe 47 when the pressure in the reservoir reaches a sufficient height to move the piston 44 against the resistance of its retaining-spring 48, thus cutting off the supply of fuel to the engine.

What is claimed is—

1. In combination, a motor-cylinder having a piston, a valve for controlling the admission of exploded gases under pressure to said cylinder, a reservoir for storing such gas, an ignition-chamber connected with the reservoir and provided with a piston, a rod connecting the pistons of the motor-cylinder and ignition-chamber, a cylinder-head movable to close the end of the ignition-chamber by the pressure of gas in the reservoir and movable to open position by the pressure of exploded gases in the ignition-chamber, a compression-cylinder connected with the ignition-chamber, and means under the control of the pressure of gas in the ignition-chamber for igniting an explosive charge therein.

2. The combination with a motor-cylinder having a piston, of a valve for controlling the admission of exploded gases to said motor-cylinder, a reservoir for said gases, an ignition-chamber having a piston connected to the piston of the motor-cylinder, an auxiliary cylinder connected to the reservoir, a movable cylinder-head having a portion extending within said auxiliary cylinder and movable by the pressure of gas therein to close the end of the ignition-chamber, said cylinder-head being movable to open position by the pressure of exploded gases in the ignition-chamber, a compression-cylinder in communication with the ignition-chamber, and means for automatically exploding a charge in the ignition-chamber when the flow of gas from the com-

pression-cylinder to the ignition-chamber is stopped.

3. In combination, a motor-cylinder having a piston, a valve-chest having a ported connection with the cylinder, a reservoir for the storage of exploded gases, said reservoir being in communication with the valve-chest, an ignition-chamber having a piston connected to and movable with the piston of the motor-cylinder, an auxiliary cylinder arranged within and connected to the reservoir, a movable cylinder-head having an enlarged piston-head fitted within said auxiliary cylinder and movable by the reservoir-pressure to close the end of the ignition-chamber, said cylinder-head being movable to open position by the pressure of exploding gases in the ignition-chamber, a compression-cylinder connected to the ignition-chamber, a piston in said compression-chamber and having an operable connection with the piston of the motor-cylinder, a check-valve controlling the flow of a charge from the compression-cylinder to the ignition-chamber, and contacts arranged in circuit with sparking-terminals in the ignition-chamber, said contacts being arranged in the path of movement of the check-valve and adapted to be closed on the closing movement of said check-valve.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

BERT NILES.

Witnesses:
IRVIN S. NILES,
WALTER CALKINS,