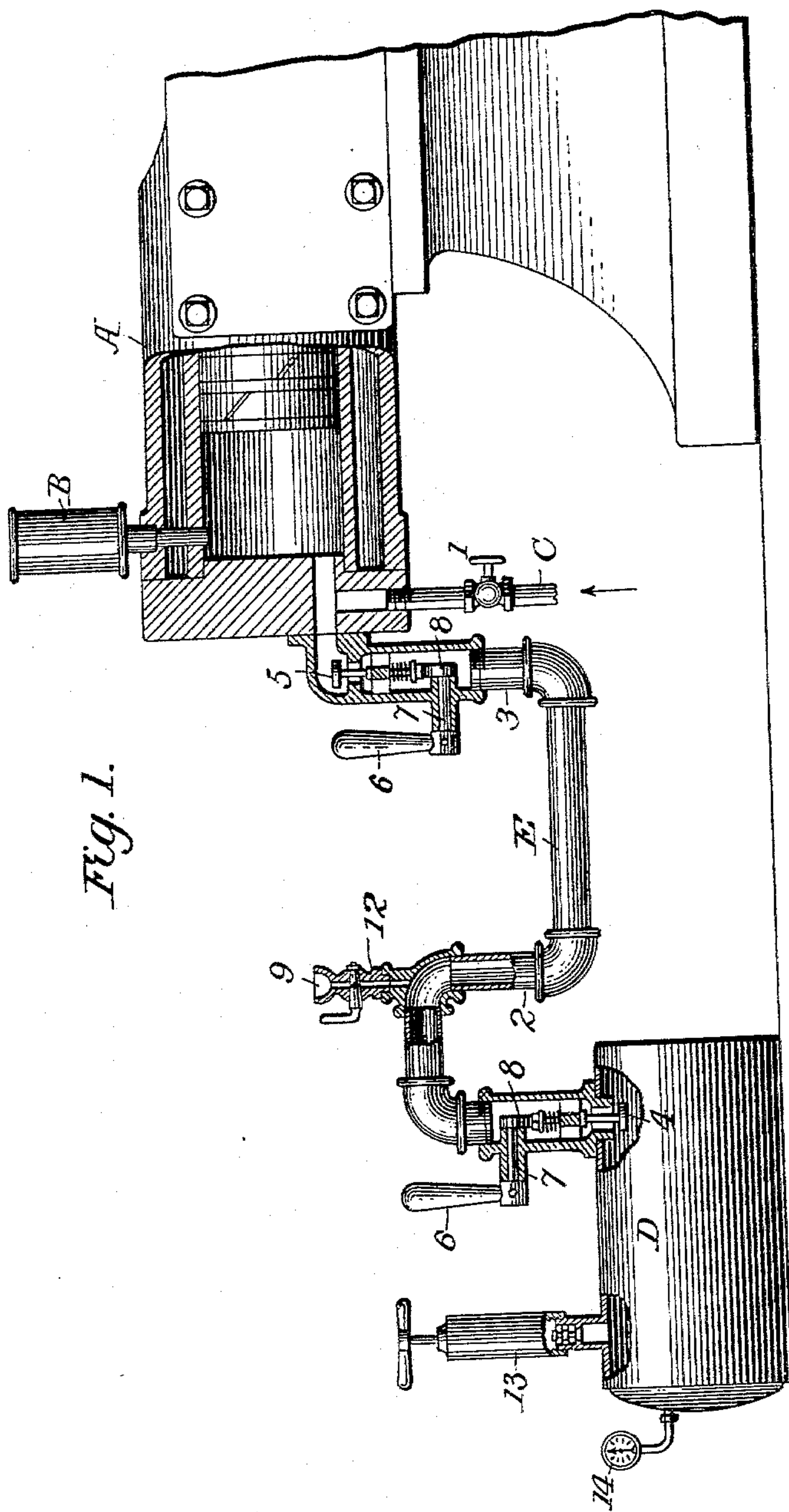


2 Sheets—Sheet 1.

No. 596,742.

Patented Jan. 4, 1898.



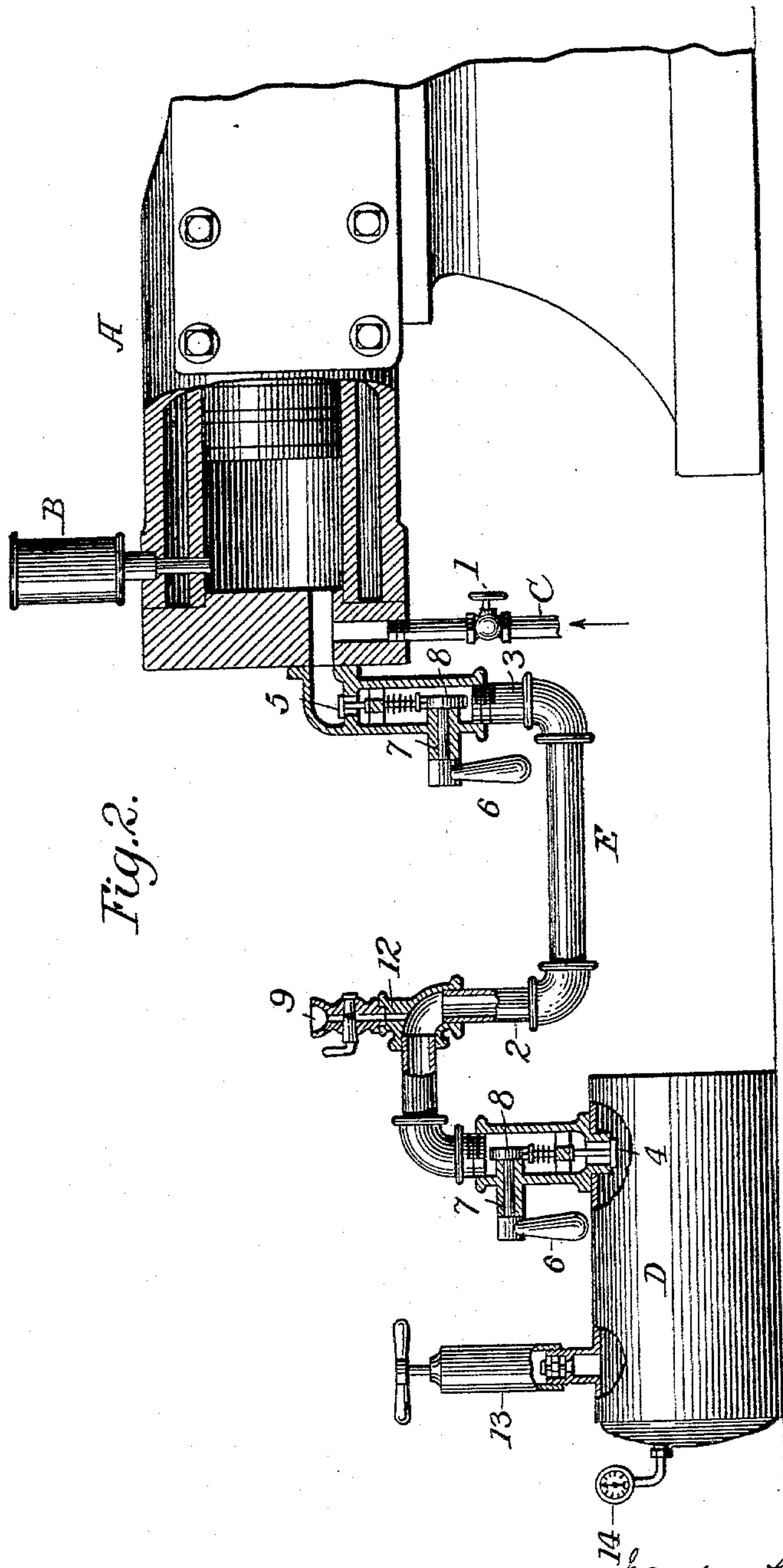
Witnesses
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2 Sheets—Sheet 2.

No. 596,742.

Patented Jan. 4, 1898.



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UNITED STATES PATENT OFFICE.

WALKER LEE CROUCH, OF NEW BRIGHTON, PENNSYLVANIA, ASSIGNOR TO
THE PIERCE-CROUCH ENGINE COMPANY, OF SAME PLACE.

STARTING APPARATUS FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 596,742, dated January 4, 1898.

Application filed April 5, 1897. Serial No. 630,877. (No model.)

To all whom it may concern:

Be it known that I, WALKER LEE CROUCH, a citizen of the United States, residing at New Brighton, in the county of Beaver and State of Pennsylvania, have invented certain new and useful Improvements in Starting Apparatus for Gas-Engines, of which the following is a specification.

This invention relates to certain new and useful improvements in starting apparatus for explosive-engines, having for its object to provide simple and efficient means for introducing a charge of gas under pressure into the engine-cylinder and exploding the same to impart the initial stroke to the piston.

With these objects in view the invention consists in the novel construction, combination, and arrangement of parts hereinafter more particularly described.

In the accompanying drawings, forming a part of this specification and in which like letters and figures of reference indicate corresponding parts, Figure 1 is a detail sectional view of the rear end of an engine-cylinder with the invention applied thereto, and Fig. 2 is a similar view with the parts in a different position.

Referring more particularly to the drawings, A designates the cylinder of an explosive-engine, which engine may be of any desirable or well-known type and is provided with the usual inlet and exhaust ports and valves and suitable valve-actuating mechanism.

The engine illustrated in the drawings is substantially identical in construction and operation with that described in my prior patent, granted December 15, 1896, No. 573,322, and it is not deemed necessary to fully describe it herein or to show it in the drawings. Communicating with the interior of the cylinder is an igniting device B, and communicating with the inlet-port is a supply-pipe C, provided with a hand valve or cock 1, and through this pipe the combustible element is conveyed from a suitable source of supply to the cylinder.

Likewise connected to the cylinder A and to a suitable reservoir D is an auxiliary supply-pipe E, through which an explosive charge under pressure is conveyed to the cylinder to impart the initial stroke to the piston. This

pipe and the reservoir may be constructed and arranged in various ways; but I prefer to arrange the pipe below the plane of the cylinder and to construct it with two vertical bends or sections 2 3, which are connected at their lower ends.

At or near opposite ends of the auxiliary supply-pipe are oppositely-opening check-valves 4 5, respectively, which may be constructed in any suitable manner, the valve 4 being adapted to open inward toward the reservoir D and the valve 5 arranged to open inward toward the cylinder. Hand devices are arranged to operate each check-valve, the devices shown comprising hand-levers 6, each provided with a shaft 7, journaled in the auxiliary pipe and provided at its end with a cam 8, adapted to be brought into engagement with the check-valve stem to open the valve.

At the top of the vertical portion 2 of the auxiliary pipe is a measuring-receptacle 9, communicating with the passage of the pipe through a valve-controlled opening 12. The receptacle 9 is adapted to hold and measure a suitable liquid hydrocarbon, which is placed therein when the engine is to be started, and the contents of the receptacle, by reason of the receptacle being arranged at the upper end of the pipe-section 2, is directed down and spread over the sides of the pipe upon the opening of the passage 12, thereby enabling it to more readily combine with or be absorbed by the air-current. Moreover, by arranging the measuring-receptacle as indicated the liquid hydrocarbon flows through the pipe toward the engine-cylinder, and it is impossible for it to enter the air-reservoir.

The air-reservoir is provided with a hand or foot pump 13, by means of which it is supplied with compressed air. A pressure-gage 14 is also connected to the reservoir to indicate when the required pressure has been attained therein.

In operation when it is desired to start the engine a quantity of liquid hydrocarbon necessary for an explosive charge is measured into the receptacle 9, and the passage 12 is opened to admit it into the auxiliary supply-pipe E. The hand-valve 1 of the supply-pipe C is then opened and the check-valve 4 is opened by hand to permit a portion of the

compressed air contained in the reservoir D to flow through the auxiliary pipe E, where it becomes saturated with the liquid therein. The laden air then lifts check-valve 5, flows into the cylinder A, and is exploded, setting the engine in motion. The check-valve 4 is closed by hand, and 5 closes automatically from pressure in cylinder, and the engine begins to draw the regular supply of gas through pipe C into the cylinder, where it is compressed and exploded in the usual manner.

To avoid the necessity of supplying the air-reservoir D with compressed air by means of the pump 13 and to accomplish this by the engine itself, the valve 1 of the supply-pipe C is closed while the engine is running, and the check-valve 5 is opened by means of its hand-lever and its cam. Fresh air only is then drawn into the cylinder A, and being compressed upon a back stroke of the piston is forced through the auxiliary supply-pipe E and by the check-valve 4 into the air-reservoir.

Without limiting myself to the exact construction and arrangement of the parts shown and described, since it will be understood that various changes may be made in such construction and arrangement without departing from the scope of my invention, what I claim is—

1. The combination with an explosive-engine, of an air-reservoir, a supply-pipe connecting said reservoir with the engine-cylinder, two separated check-valves intermediate the ends of the pipe, and means for introducing a liquid hydrocarbon into the supply-pipe, substantially as described.

2. The combination with an explosive-engine having a supply-pipe leading thereto, said pipe being provided with a hand-valve, of a starting device comprising a source of compressed-air supply communicating with the engine-cylinder through an auxiliary sup-

ply-pipe, a hand-valve within said pipe, and means for introducing a liquid hydrocarbon into the auxiliary supply-pipe intermediate the cylinder and the source of air-supply, substantially as described.

3. The combination with an explosive-engine having a valve-controlled supply-pipe, of a starting device comprising a source of compressed-air supply, an auxiliary supply-pipe having a vertical portion or section intermediate its length, said pipe being below the plane of the engine-cylinder and connecting the said cylinder with the source of air-supply, a hand-operated valve within the auxiliary supply-pipe, and means for introducing a liquid hydrocarbon into the said supply-pipe at or near the top of its vertical portion, substantially as described.

4. The combination with an explosive-engine, of a starting device comprising an air-reservoir, a supply-pipe connecting said reservoir with the engine-cylinder, provided with a hand-valve, and a valve-controlled passage communicating with the supply-pipe intermediate the cylinder and reservoir through which a liquid hydrocarbon is introduced into the supply-pipe, substantially as described.

5. The combination with an explosive-engine, of a starting device comprising an air-reservoir, a supply-pipe connecting the reservoir and engine-cylinder, said pipe having two vertical portions or sections, a hand-valve within the pipe, and means for introducing liquid hydrocarbon into the supply-pipe at or near the upper end of one of its vertical portions, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WALKER LEE CROUCH.

Witnesses:

PHILIP SCHUMACHER,
CHAS. S. BINZLEY.