No. 725,789.

PATENTED APR. 21, 1903.

L. F. SPLITT.

EXPLOSION ENGINE.

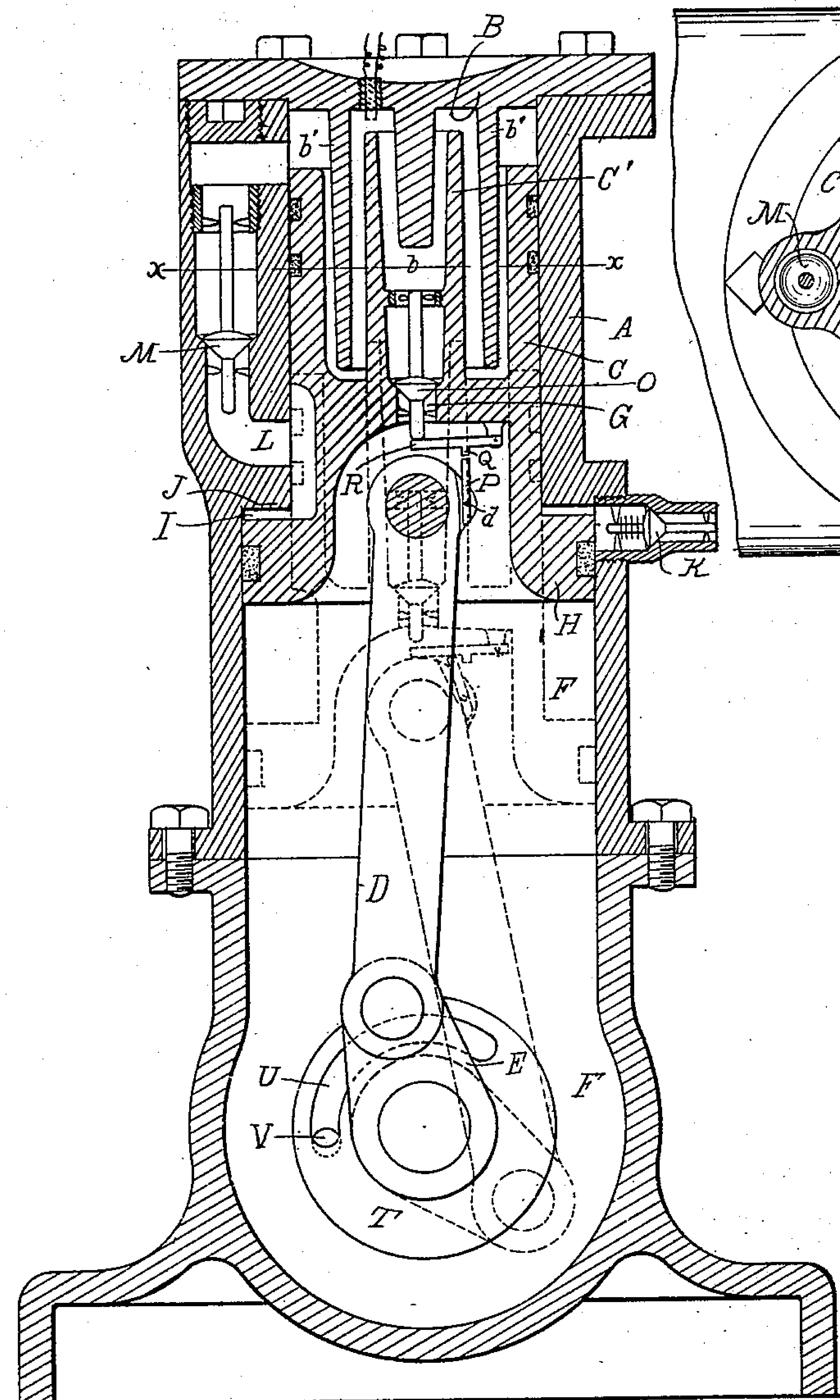
APPLICATION FILED JULY 16, 1900.

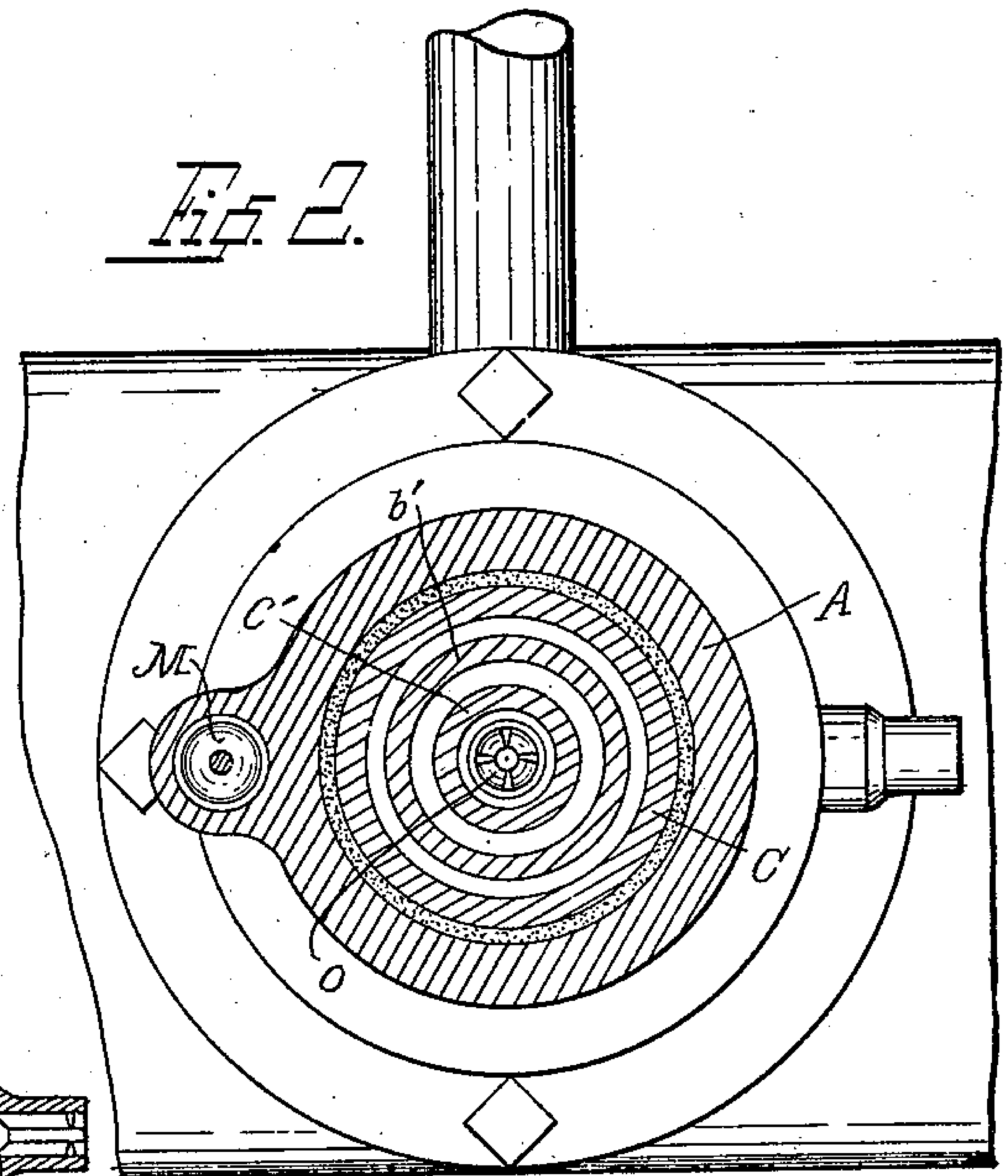
NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.

Fig. 2.





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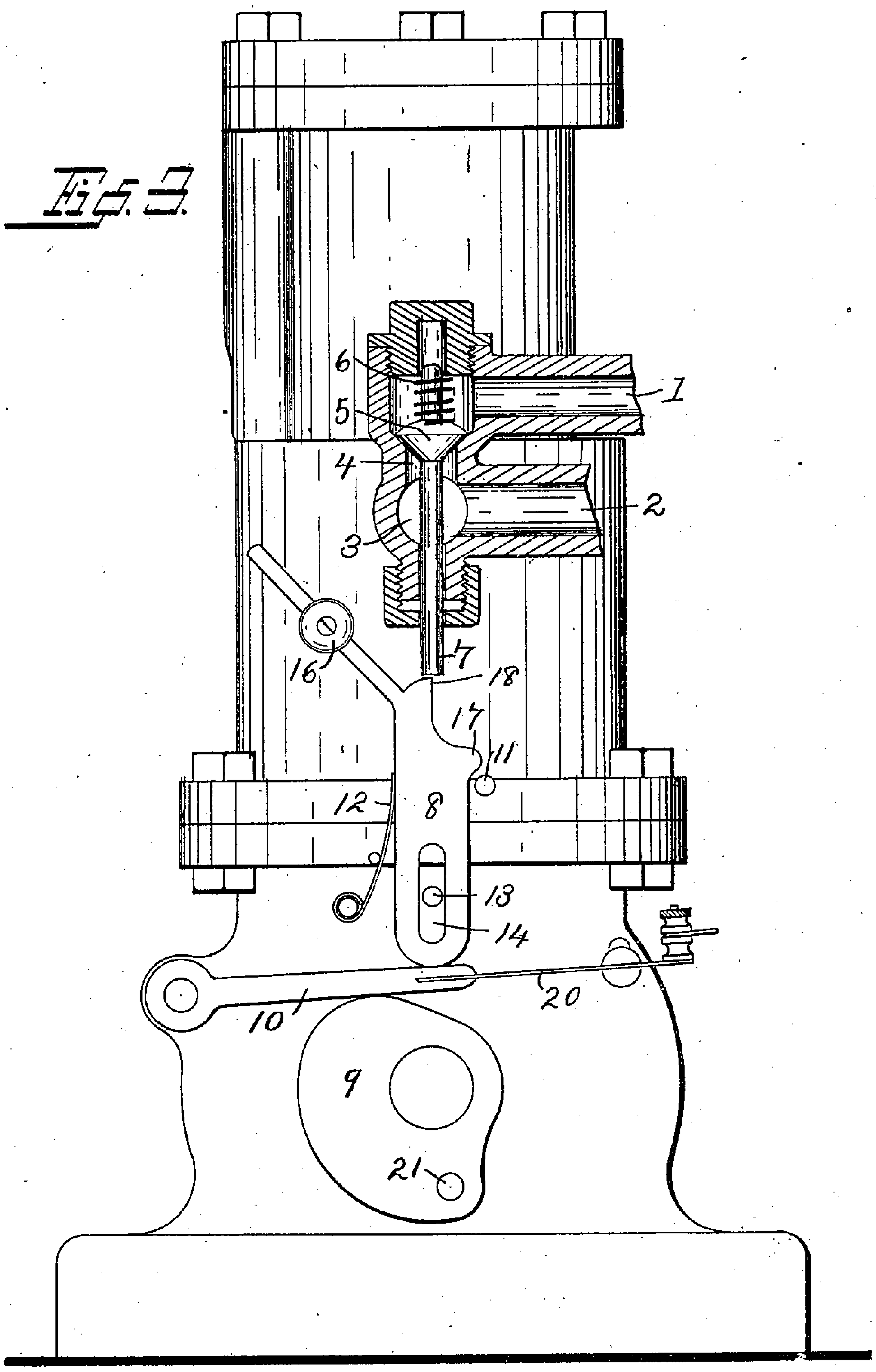
NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

LOUIS F. SPLITT, OF LAYTON PARK, WISCONSIN.

EXPLOSION-ENGINE.

SPECIFICATION forming part of Letters Patent No. 725,789, dated April 21, 1903.

Application filed July 16, 1900. Serial No. 23,736. (No model.)

To all whom it may concern:

Be it known that I, LOUIS F. SPLITT, a citizen of the United States, residing at Layton Park, Milwaukee county, and State of Wisconsin, have invented new and useful Improvements in Explosion-Engines, of which the following is a specification.

My invention relates to improvements in combined gas and hot-air engines.

The objects of my invention are, first, to provide means for recharging the explosion-chamber with each backward stroke of the piston; second, to provide means for utilizing the heat of the exploding gas to expand the next succeeding charge introduced into the cylinder or explosion-chamber, whereby the piston may be driven alternately by an exploded and a non-exploded charge; third, to provide a muffling-chamber which will not only prevent the explosive escape of the gases from the exhaust-port of the explosion-chamber, but in which the residual force of the exhaust will be utilized in compressing the gases used for the next succeeding charge.

In the following description reference is had to the accompanying drawings, in which—

Figure 1 is a central vertical sectional view of my improved engine. Fig. 2 is a cross-sectional view drawn on line x x of Fig. 1. Fig. 3 is a side elevation showing means for controlling the admission of gas to the engine and also illustrating the means for making and breaking the electric circuit of the sparking mechanism.

Like parts are identified by the same reference characters in all the views.

A is the cylindrical wall of the explosion-chamber.

B is a cylinder-head, which I have provided with inwardly-projecting walls b b', adapted to present a large heat-radiating surface in the interior of the cylinder.

C is a piston, which is also provided with projections or walls C', positioned to enter the annular spaces formed by the walls b b' of the cylinder-head.

D is a connecting-rod, and E a crank, both located in a muffling-chamber F, with which the exhaust-port G communicates. The muffling-chamber F is of greater diameter than the explosion-chamber, and the piston H, located therein, is rigidly or integrally connected with the piston C, so as to form a compression-chamber I between the piston H, the abutment J, the connecting-walls of the two pistons, and the cylindrical walls of the chamber F. A valve K is adapted to admit the charge to this chamber from any suitable source of supply during the outward movement of the piston, and during the return movement this charge is compressed and driven through a port L and valve M to the explosion-chamber. The port L is covered by the piston C until the latter has nearly completed its backward movement, the charge being therefore compressed in the chamber I and thereafter admitted to the explosion-chamber, when such chamber is contracted to its smallest dimensions by the rearward movement of the piston. The exploded charge will of course consist in the usual mixture of combustible gas and air, and so far as the operation of the engine is concerned the non-exploded charge may be of the same composition, although for the sake of economy the supply of combustible gas may be cut off by any suitable valve mechanism at the time the non-exploded charge is drawn in, in which case this charge will consist of air alone. The discharge of the burned gases into the muffling-chamber is controlled by means of a valve O. The bar P is pivotally secured at p to the connecting-rod D in a position to contact with an arm Q of the valve-connecting lever R. This contact is made as soon as the connecting-rod swings to the opposite side of the line of centers from that occupied during the outward stroke, and the continued lateral movement or oscillation of the connecting-rod is then communicated to the valve O through the bar P, arm Q, and lever R to open the valve and hold it open until the lateral or swinging movement of the bar P on the pivot d as a center causes it to slip from the end of the arm Q to the position indicated by dotted lines in Fig. 1, when the exhaust-valve O is permitted to drop to its seat. The exhaust-valve is closed at about the time or immediately before the port L has been uncovered by the backward movement of the piston C.

Reviewing the operation of the engine and assuming that an explosion has taken place, (the parts being in the position in which they are shown in Fig. 1,) it is obvious that as the pistons move outwardly the compression-chamber is expanded and a fresh charge is drawn into this chamber through the valve K. During the return movement the valve O is first opened through the medium of the bar P, permitting the exhaust to enter the muffling-chamber, where the residual pressure is utilized on the increased area of the piston H to drive the latter backwardly and compress the new charge in the compression-chamber. The arm P slips from the arm Q and permits the valve to close before or at about the same time that the backward movement of the piston C uncovers the port L and permits the fresh charge to enter the cylinder, when such charge is heated by contact with the surfaces of the cylinder and piston and their respective projections and by its expansion drives the piston on the succeeding stroke, whether an explosion takes place or not. It is therefore obvious that I am able to drive the piston alternately by means of an explosion of the gases and by the expansion of a charge which is not exploded, but merely heated by contact with the surfaces of the explosion-chamber, as the walls of said chamber have been raised to a high temperature by the preceding explosion. If greater power is desired, however, the charge may be ignited after each backward stroke of the piston by adjusting the igniter for that purpose.

By providing the explosion-chamber with the interlapping projections heretofore described a large amount of heat will be stored up in the explosion-chamber at each explosion, and owing to the large radiating-surface it will be quickly imparted to the next succeeding charge, so that in case no explosion of such charge takes place the piston will nevertheless be driven (with reduced force) by reason of the expansion caused by heat radiation.

In order to permit the escape of the burned gas from the muffling-chamber, I have provided a valve T, consisting in a slotted disk located on the crank-shaft, with the slot U adapted to register with the port V in the wall of the casing. Where the engine is being driven alternately by an explosive and an expanded non-explosive charge, it will be evident that the expanded charge will carry out and dissipate the burned gases resulting from the preceding explosion.

In Fig. 3 I have illustrated means for controlling the admission of gas to the engine, whereby either an explosive charge or a charge consisting merely of air to be heated, as above explained, may be admitted to the engine, according to the power required, this being accomplished by providing the engine with a miss-and-hit governor of any ordinary construction adapted to control the valve mechanism. In this construction, 1 is the inlet-duct, communicating with any suitable source of gas-supply. 2 is a similar duct communicating with the open air. Both of these ducts lead to a passage 3, closed by the valve K, (shown in Fig. 1,) the gas-inlet leading through a valved aperture 4, normally closed by a valve 5, this valve being preferably held to its seat by a spring 6. The valve 5 is provided with a depending stem 7, adapted to be engaged by a governing-bar 8 and lifted to open the valve, as heretofore described. 9 is a cam mounted upon a protruding portion of the crank-shaft. This cam engages and actuates a lever 10, which lever bears upon the lower end of the governing-bar 8, as shown in Fig. 3. This bar 8 is arranged to move vertically between the fixed abutment 11 and the controlling-spring 12, a pin 13, projecting through a slot 14 in the bar, coöperating with the abutment 11 and spring 12 to hold the bar substantially in an upright position. 16 is a weight located on the upper end of the bar. The bar is also provided with a rounded projection 17, adapted to impinge upon the fixed projection 11 when the bar 8 is raised, whereby the continued upward movement of the bar causes it to move backwardly from the abutment 11 in opposition to the pressure of spring 12 until the projection 17 clears the abutment 11, when the operation of the spring will force the bar backwardly to its vertical position, with the shoulder 18 in position to engage the valve-stem 7. When the crank-shaft revolves slowly, the bar 8 will be lifted so slowly that it will in each case assume its normal position after the projection 17 passes the abutment 11, so that the shoulder 18 will in each case engage the valve-stem 7 and open the valve 5 for the admission of gas. As the speed of the crank-shaft increases, however, the tendency of the shoulder 18 to clear the lower end of the stem 7 will be increased, both owing to the quickness of the upper stroke of the bar 8 and the momentum of the bar and weight 16 as opposed to the action of the spring 12 until the speed becomes such that the shoulder 18 will no longer engage the stem 7, whereupon the engine will continue to take in air with each stroke of the piston, but no gas until the speed decreases sufficiently to permit the spring 12 to restore bar 8 to a position for engagement with the stem 7 after the projection 17 has cleared the part 11. In this manner the engine may be made to take in an explosive and a non-explosive charge in alternation, according to the required speed, the non-explosive charge being utilized through the medium of the heat-distributing projections in the piston-chamber to drive the engine with reduced force, and this conserves the energy which would otherwise be lost by heat radiation into a water-jacket. 20 is a terminal of an electric circuit which includes the sparking device of an engine, and 21 is a contact device carried by the cam 9 in position to strike said terminal during the revolution of the cam, whereby the circuit is closed and broken once during each revolution of the crank-shaft, the time of contact corresponding with the time of ignition. I do not, however, claim the above-described miss-and-hit governor mechanism, such mechanism being well known in the art.

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

1. In an explosion-engine, the combination of an explosion-chamber; an auxiliary compression-chamber; a valved passage communicating between said chambers; pistons located in the chambers and connected with each other; means for supplying the compression-chamber with both explosive and non-explosive gases; and mechanism, operated by the engine for cutting off the supply of explosive gas at intervals, whereby the non-explosive gas is compressed and delivered to the explosion-chamber to drive the piston by the residual heat of a preceding exploded charge.

2. In an explosion-engine, the combination of an explosion-chamber; an auxiliary compression-chamber; pistons located in said chambers, and having motion-transmitting connections with each other; a passage leading from one chamber to another; a self-closing valve located in the passage, and adapted to be opened by the pressure of gas in the compression-chamber; and mechanism controlled by the engine, for selecting explosive and non-explosive charges for the compression-chamber, whereby the piston is driven through the medium of exploded charges, and the expansion by residual heat in the explosion-chamber of intervening non-explosive gases.

3. In an explosion-engine, the combination of an explosion-chamber; a compression-chamber; pistons located in the respective chambers and connected with each other; means for closing the compression-chamber at all times, except when its piston is in the rear portion thereof; and means for permitting the discharge of air or gas from such chamber to the explosion-chamber, after it has been compressed in the compression-chamber; together with a series of heat-collecting projections in the explosion-chamber, adapted, by contact, to raise the compressed air or gas entering from the compression-chamber, to a high temperature and means for controlling the admission of explosive and non-explosive charges to the compression-chamber.

4. In an explosion-engine, the combination of an explosion-chamber; a piston located therein; a muffling-chamber located in the field of movement of the piston; a valved passage between the explosion and muffling chambers; a piston located in said muffling-chamber; a compression-chamber formed between the piston and the rear walls of the muffling-chamber; a valved passage communicating between the compression and explosion chambers; and means for closing said passage, except during the final backward stroke of pistons, the walls and pistons of the explosion-chamber being provided with a series of projections adapted to subdivide said chamber into a series of narrow passages when the piston is at the limit of its backward stroke and means, controlled by the engine, for admitting explosive and non-explosive charges to the compression-chamber in alternation.

5. In an explosion-engine, the combination of an explosion-chamber; a piston located therein; a muffling-chamber located in the field of movement of the piston; a valved passage between the explosion and muffling chambers; a piston located in said muffling-chamber; a compression-chamber formed between the piston and the rear walls of the muffling-chamber; a valved passage communicating between the compression and explosion chambers; and means for closing said passage, except during the final backward stroke of pistons, the explosion-chamber being arranged to present a large heat collecting and radiating surface in proportion to its capacity and means, controlled by the engine, for admitting explosive and non-explosive charges to the compression-chamber in alternation.

6. In an explosion-engine, the combination of an explosion-chamber; a piston located therein; heat receiving and distributing projections in said chamber; a compression-chamber having suction-pipe connections with separate sources of air and gas supply; and mechanism, connected with the engine, for cutting off the supply of gas at intervals, and admitting a non-explosive air-charge.

In testimony whereof I affix my signature in the presence of two witnesses.

LOUIS F. SPLITT.

Witnesses:

LEVERETT C. WHEELER,

JAS. B. ERWIN.