J. LOFTUS.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JUNE 13, 1908.

963,449.

Patented July 5, 1910.

Fig. 4.

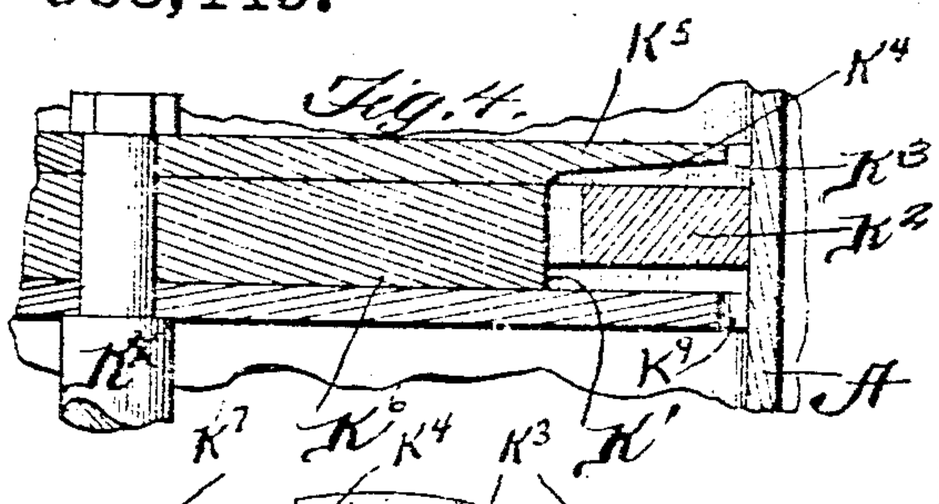


Fig. 5.

Fig. 3.

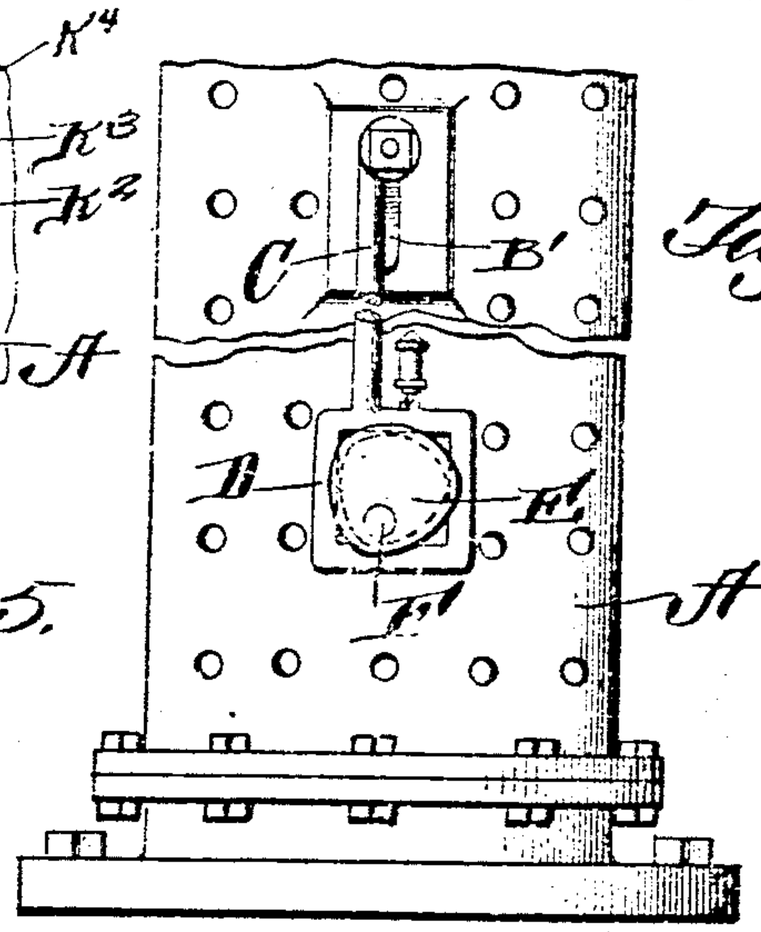


Fig. 2.

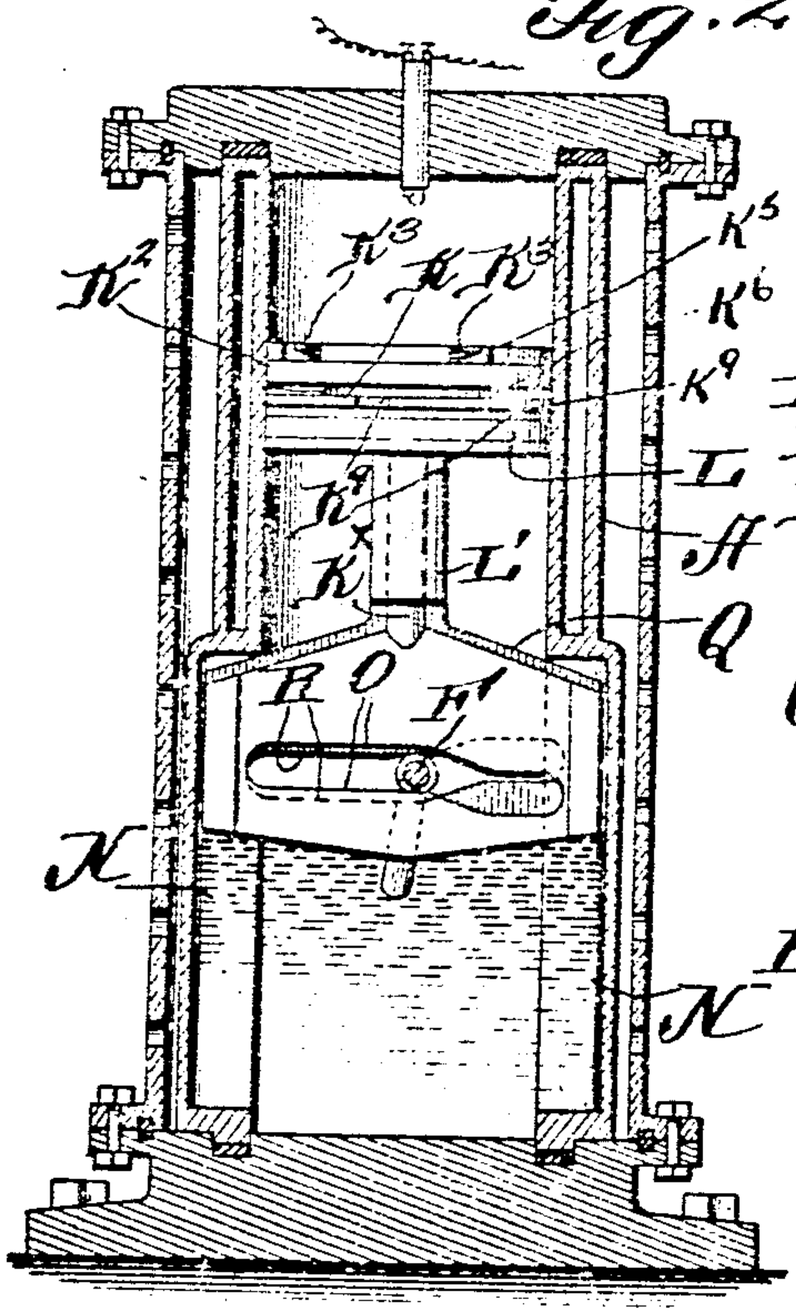
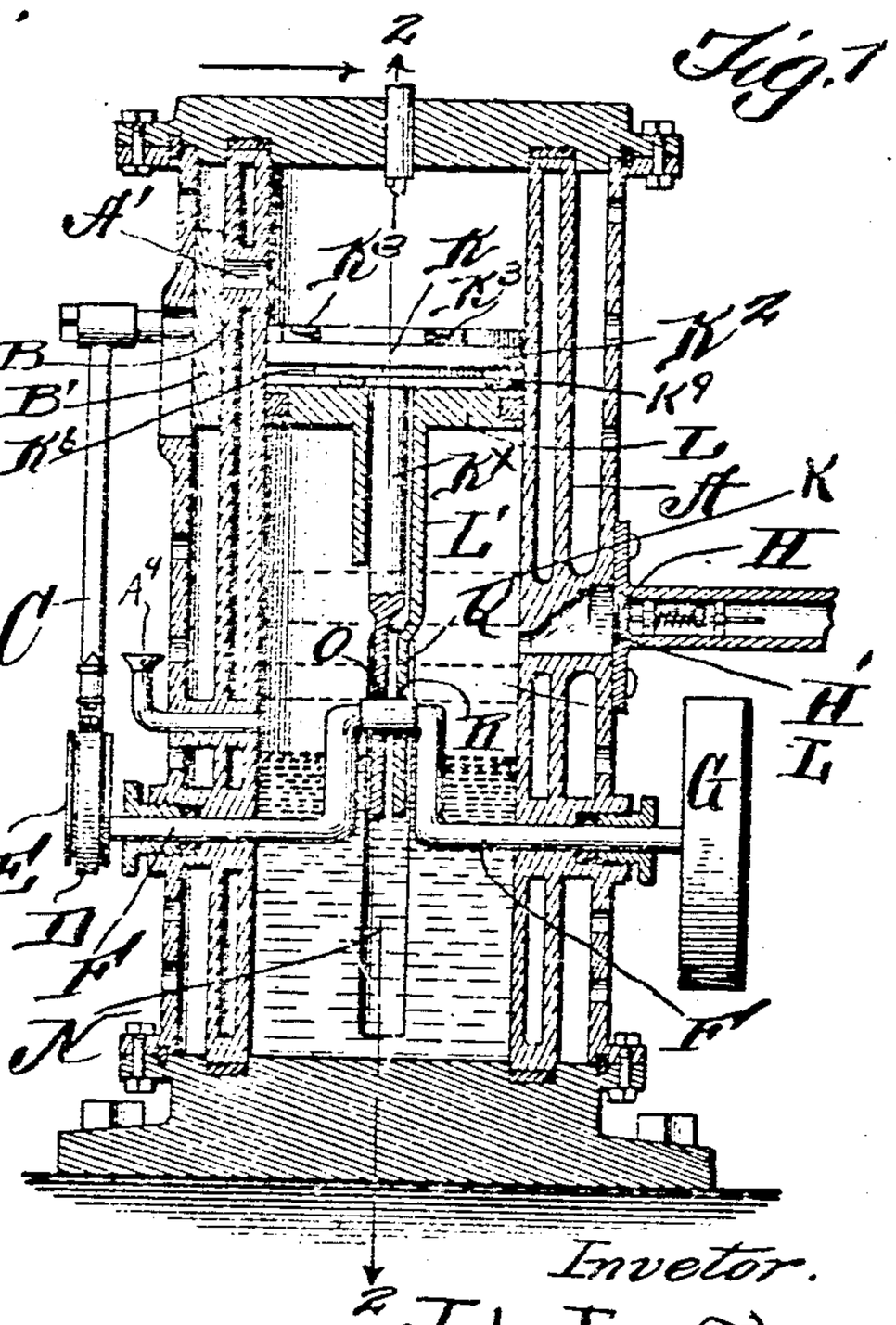


Fig. 1.



Witnesses

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INTERNAL-COMBUSTION ENGINE.

963,449. Specification of Letters Patent. Patented July 5, 1910.

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To all whom it may concern:

Be it known that I, JOHN LOFTUS, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to new and useful improvements in multi-piston explosive gas engines, having a plurality of pistons actuating a single crank shaft, and so arranged that before the pistons reach limits of their working strokes one is given a movement independent of the other.

The invention comprises various details of construction, combinations and arrangements of parts which will be hereinafter fully described and then specifically defined in the appended claims.

I illustrate my invention in the accompanying drawings, in which:—

Figure 1 is a vertical central sectional view through the cylinder of the engine, parts being shown in elevation. Fig. 2 is a vertical section on line 2—2 of Fig. 1 looking in the direction of the arrow. Fig. 3 is a side elevation of the outside of the engine. Fig. 4 is a vertical section through one of the pistons, and Fig. 5 is an enlarged detail perspective view showing the parts of one of the pistons disassembled with a valve mounted therein.

Reference now being had to the details of the drawings by letter, A designates a cylinder having an exhaust port A′ leading therefrom near one end, and B is a valve chamber into which said port leads and is provided with a sliding valve B′ of the rod C. A strap D is fastened to said rod and has an angular outlined opening therein, through which the flanged eccentric E passes, which eccentric is mounted upon the end of the crank shaft F which is journaled in suitable bearings upon the outer surface of the cylinder, and extends through the same. A balance wheel G is fixed to said crank shaft. An induction valve H regulates the port H′ in the wall of the cylinder, through which fuel and air are admitted to the interior of the latter.

Mounted within the cylinder are the two pistons K and L, the former of which has a stem $K^{\times}$ fixed thereto and one end of said stem has a widened portion, the opposite ends of which are guided in the longitudinal grooves N formed in the wall of the cylinder. Said blade has a transverse cam groove or slot O formed therein through which the crank portion of said shaft passes and has a play. The second piston L has a hollow stem L′ telescoping over the stem of the piston K and has a plate Q fixed thereto, or forming a portion of the stem L′, which is also provided with an elongated cam groove R through which the crank of said shaft passes. It will be observed that the said cam grooves or slots are of different shapes and so arranged that the crank will act upon the marginal edges thereof and cause the pistons to move independently of each other for a purpose which will be presently described.

The piston K, details of which are shown in Figs. 4 and 5 of the drawings, is provided with a circumferential groove K′ in which a ring K^2 is positioned, said ring being preferably narrower than the width of said groove in which it is positioned and having a play therein. In the marginal edge of the piston are the grooves K^3 into which the radial grooves K^4 formed in the inner surface of the disk K^5 lead. Intermediate the disks K^7 and K^5 is a washer K^6 and about which washer the ring K^2 is positioned. The disk K^7 which forms a part of the piston K, has a series of notches K^9 in the circumference thereof and which are normally closed by the ring K^2 when the latter rests in contact with the inner face of the disk K^7. The inner face of the disk K^5 having the grooves K^4 will allow an open passageway from one side of the piston to the other when the ring K^2 is in the position shown in Fig. 4 of the drawings. In order to allow oil to be inserted in the lower portion of the cylinder and also to provide a communication between the interior of the crank case below the piston and the atmosphere and avoid forming a vacuum in said crank case, a pipe A^4 leads through the wall of the cylinder and has a flaring end, as shown in Fig. 1 of the drawings.

In operation, when the crank shaft is turned in the direction of the hands of a

clock or to the right and as the crank shaft moves downward from the position shown in Fig. 2 of the drawings, the pistons will commence to separate by the crank bearing against the bottom inclined edge of the slot in the widened portion of the stem of the piston L and which separating of the pistons will tend to cause a vacuum intermediate the latter and, as the space intermediate the pistons comes opposite the induction valve H, the latter will unseat and allow a charge of fuel to be drawn into the space intermediate the pistons. When the crank assumes a position of 180 degrees from the position shown in Fig. 2, the two pistons will be drawn toward each other and the gas forced through the passageways in the upper piston into the space at the upper end of the cylinder. On the completion of the revolution of the crank shaft, the pistons will compress the charge and the pressure of the compressing of the charge will cause the ring K^2 to seat and close the passageways leading through the piston K. As the charge is compressed and exploded, the impact of the force of the explosion will exert a working impulse upon the upper piston and the ring K^2, resting upon the upper surface of the disk K^7, which forms a part of the piston K, will prevent the escape of the charge through the piston. The foregoing operation is repeated during each cycle of the engine. As the charge is compressed and exploded above the pistons, the ring K^2 will rest against the upper surface of the disk K^7 which forms a part of the piston K and prevent any escape of the charge through the piston. After the charge is exploded and the working impulse imparted to the pistons and the latter are reaching their farthest outer limits, the cam which actuates the exhaust valve will have uncovered the port A′ and allow the products of combustion to escape, the exhaust valve B′ closing the port A′ as the new charge is commencing to be compressed. As oil is placed in the lower portion of the cylinder, the rotation of the crank therein will cause the lubricant to be agitated sufficiently to thoroughly lubricate the inner portion of the cylinder.

What I claim to be new is:—

1. An internal combustion engine, comprising a cylinder having a valve regulated exhaust port, a crank shaft mounted in suitable bearings and extending through said cylinder, a plurality of pistons within the latter adapted to move relatively to each other and to separate during the working strokes, a stem to each piston, each of said stems having a widened portion with a cam slot therein through which the crank pin passes, affording means for causing the pistons to move relative to each other, an induction valve designed to allow fuel to enter the cylinder between the pistons after the latter separate, and means for allowing the charge to pass through one piston into the inner portion of the cylinder to be compressed by the pistons, as set forth.

2. An internal combustion engine comprising a cylinder having a valve regulated exhaust port, a crank shaft mounted in bearings and extending through the cylinder, a plurality of pistons within the latter adapted to move relatively to each other and to separate during the working strokes, a stem to each of said pistons, each stem having a widened portion provided with a transverse cam slot through which the crank pin passes to allow for said independent movements and the separating of the pistons, means for guiding the widened portions of said stems, an induction valve in said cylinder adapted to permit the feeding of fuel into the latter and between the pistons after the latter separate, and means for allowing the charge of fuel to pass from between the pistons into the inner end of the cylinder to be compressed by the pistons, as set forth.

3. An internal combustion engine comprising a cylinder having a valve regulated exhaust port, a crank shaft mounted in suitable bearings and extending through said cylinder, a plurality of pistons within the cylinder adapted to move relatively to each other and to separate during the working strokes, means for allowing a charge of fuel to pass from between the pistons into the inner end of the cylinder to be compressed by said pistons, a stem to each of said pistons, each stem having a widened portion with a transversely disposed cam slot therein, the crank pin passing through said slots, thus forming means for causing the pistons to move toward and away from each other, the edges of the slots bearing frictionally against the crank pin to operate the latter, the walls of the cylinder having longitudinal grooves in which the widened portions of the stems are guided, and an induction valve adapted to allow fuel to be drawn into the cylinder and between the pistons after the latter separate, as set forth.

4. An internal combustion engine, comprising a cylinder having a valve-regulated exhaust port, a crank shaft mounted in suitable bearings and extending through said cylinder, a plurality of pistons within the cylinder, a stem to each of said pistons, one of which is adapted to telescope within the other, each stem having a widened portion provided with a transverse cam slot through which the crank pin passes, said pin cooperating with the edges of the cam slots to move the pistons relatively to each other and separate the same during the working strokes, the inner surface of the cylinder provided with longitudinal slots in which said widened portions of the stems are guided, a valve-

regulated induction pipe adapted to allow fuel to be fed into the cylinder intermediate the pistons after the latter separate, one of the pistons having ducts about its edge and through which fuel between the pistons is forced into the inner end of the cylinder immediately before the commencement of the compression strokes of the pistons, as set forth.

5. An internal combustion engine comprising a cylinder having a valve regulated exhaust port, a crank shaft mounted in suitable bearings and extending through said cylinder, a plurality of pistons within the cylinder adapted to move relatively to each other and to separate during the working strokes, a stem to each of said pistons, each stem having a widened portion provided with a cam slot through which the crank pin passes, slots in the cylinder in which the widened portions of the stems are guided, one of said stems being hollow and in which the other stem is adapted to telescope, said cam slots and pin forming means for causing the pistons to move relatively to each other, a circumferential groove in one of the pistons, the wall of which is recessed, a ring seated therein, an induction valve adapted to allow fuel to be fed into the cylinder and intermediate the pistons after the latter separate, the fuel being forced from between the pistons through said groove into the inner end of the cylinder immediately before the commencement of the compression strokes of the pistons as the pistons approach each other, as set forth.

6. An internal combustion engine comprising a cylinder having a valve regulated exhaust port, a crank shaft mounted in suitable bearings and extending through said cylinder, an eccentric fixed to said crank shaft, a strap mounted about the eccentric, connections between said strap and exhaust valve, a plurality of pistons within the cylinder adapted to move relatively to each other and to separate during the working strokes, a stem to each of said pistons, each stem having a widened portion provided with a cam slot through which the crank pin passes, slots in the cylinder in which the widened portions of the stems are guided, one of said stems being hollow and in which the other stem is adapted to telescope, said cam slots and pin forming means for causing the pistons to move relatively to each other, a circumferential groove in one of the pistons, the wall of which is recessed, a ring seated therein, an induction valve adapted to allow fuel to be fed into the cylinder and intermediate the pistons after the latter separate, the fuel being forced from between the pistons through said groove into the inner end of the cylinder immediately before the commencement of the compression strokes of the pistons as the pistons approach each other, as set forth.

7. An internal combustion engine comprising a cylinder having a valve regulated exhaust port, a crank shaft mounted in suitable bearings and extending through said cylinder, a plurality of pistons within the cylinder adapted to move relatively to each other and to separate during the working strokes, a stem to each of said pistons, each stem having a widened portion provided with a cam slot through which the crank pin passes, slots in the cylinder in which the widened portions of the stems are guided, one of said stems being hollow and in which the other stem is adapted to telescope, said cam slots and pin forming means for causing the pistons to move relatively to each other, one of said pistons having a circumferential groove with ports leading thereto, a movable ring seated in said groove and designed to control said ports, an induction valve adapted to allow fuel to be fed into the cylinder and intermediate the pistons after the latter separate, the fuel being forced from between the pistons through said groove into the inner end of the cylinder immediately before the commencement of the compression strokes of the pistons as the pistons approach each other, as set forth.

8. In an internal combustion engine, the combination with a cylinder, a power piston therein and a crank to which said piston is connected, of an auxiliary piston situated within the cylinder, and a cam plate connected thereto and having a cam slot through which said crank extends.

9. In an internal combustion engine, the combination with a cylinder, a power piston therein and a crank to which said piston is connected, of an auxiliary piston within said cylinder above the power piston, a stem connected to said auxiliary piston and extending through the power piston, and a cam plate connected to said stem and having a cam slot through which said crank extends.

10. In an internal combustion engine, the combination with a cylinder, a power piston therein and a crank to which said piston is connected, of an auxiliary piston within said cylinder above the power piston, a stem connected to said auxiliary piston and extending through the power piston, and a cam plate connected to said stem and having a cam slot through which said crank extends, said cam slot having a horizontal portion and an inclined portion.

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

JOHN LOFTUS.

Witnesses:
CHARLES H. LOFTUS.
A. L. HOUGH.