No. 675,681.

Patented June 4, 1901.

W. L. SILVEY.

STEAM ENGINE.

(No Model.)

(Application filed Jan. 4, 1901.)

2 Sheets—Sheet 1.

Fig. 1

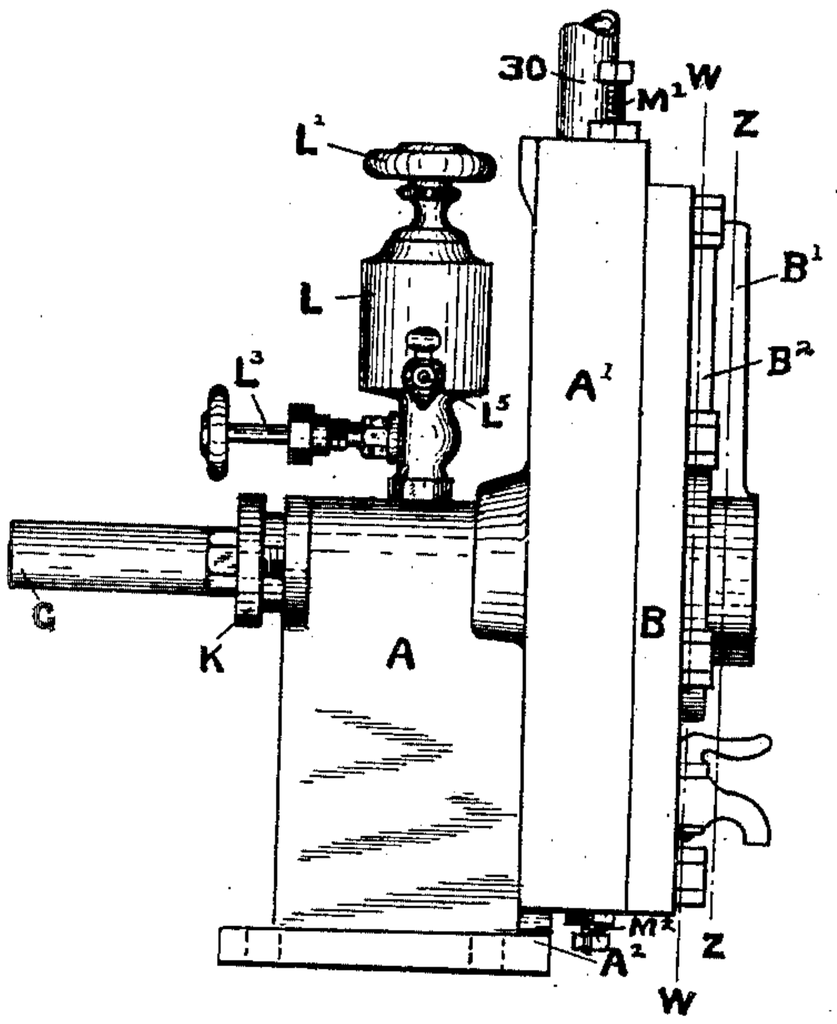


Fig. 2

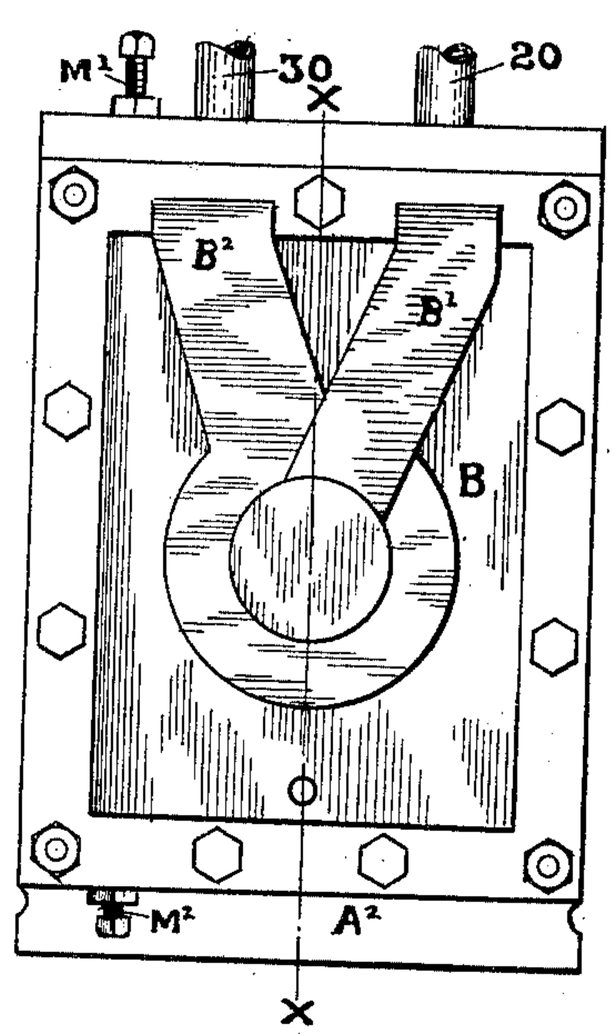


Fig. 4

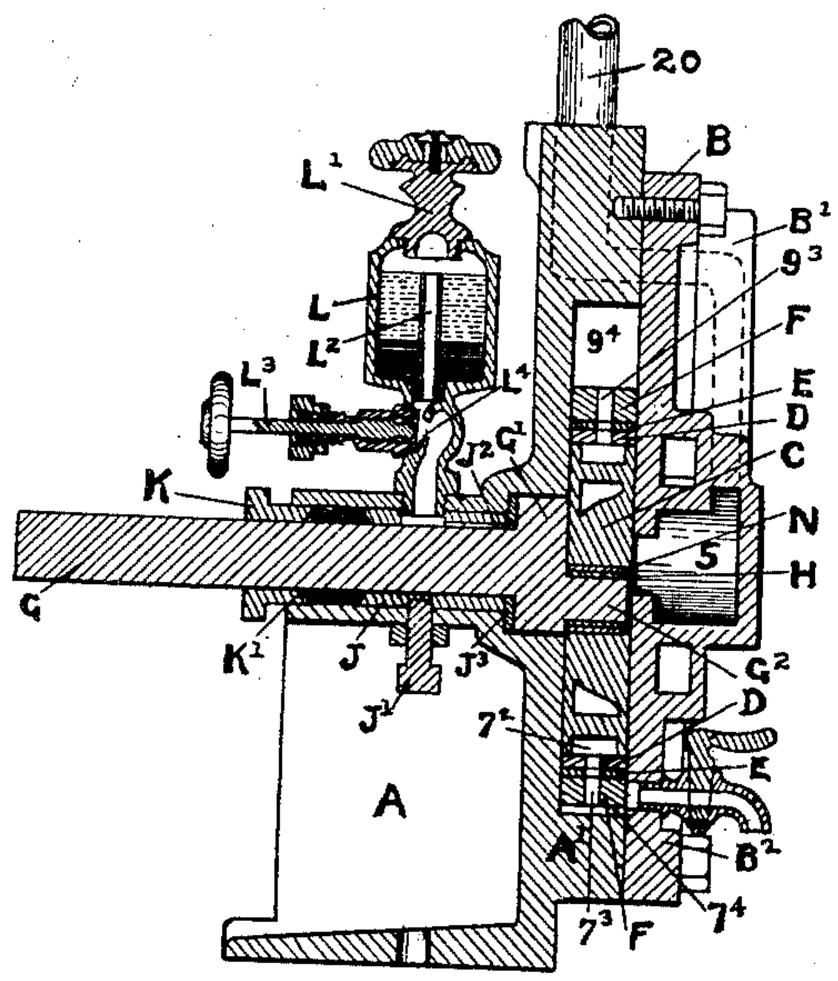
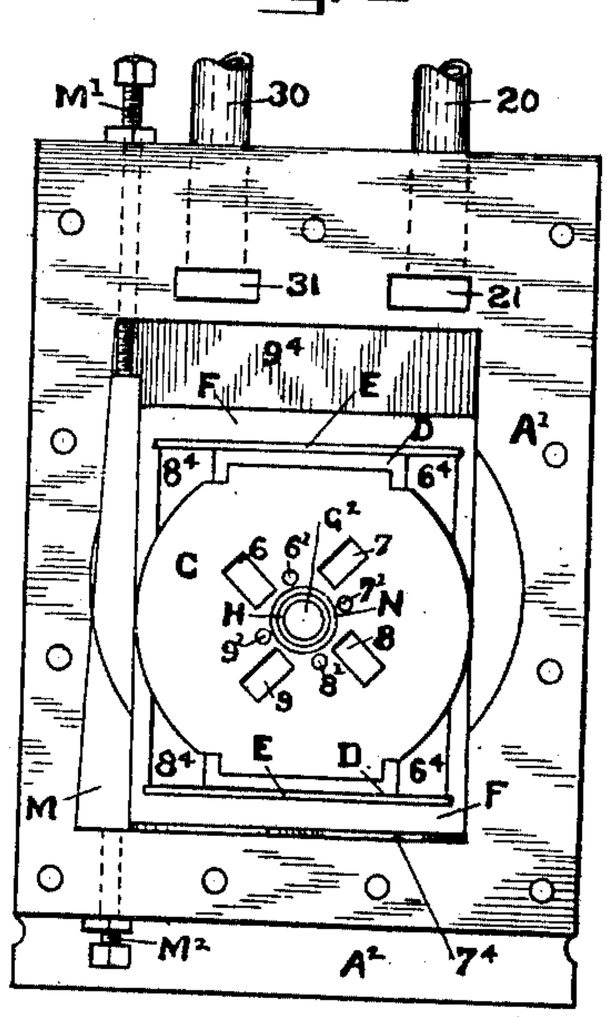


Fig. 3



Attest

F. E. Keeley

E. B. Lehmann

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STEAM ENGINE.

(Application filed Jan. 4, 1901.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 7.

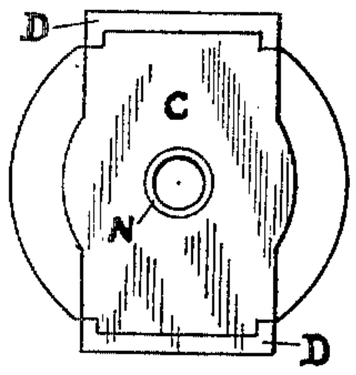


Fig. 6

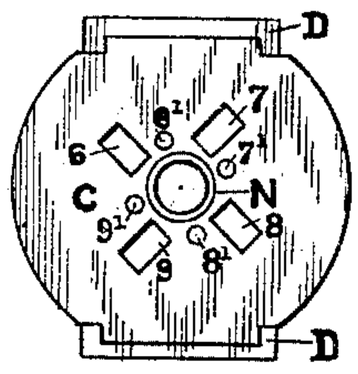


Fig. 5.

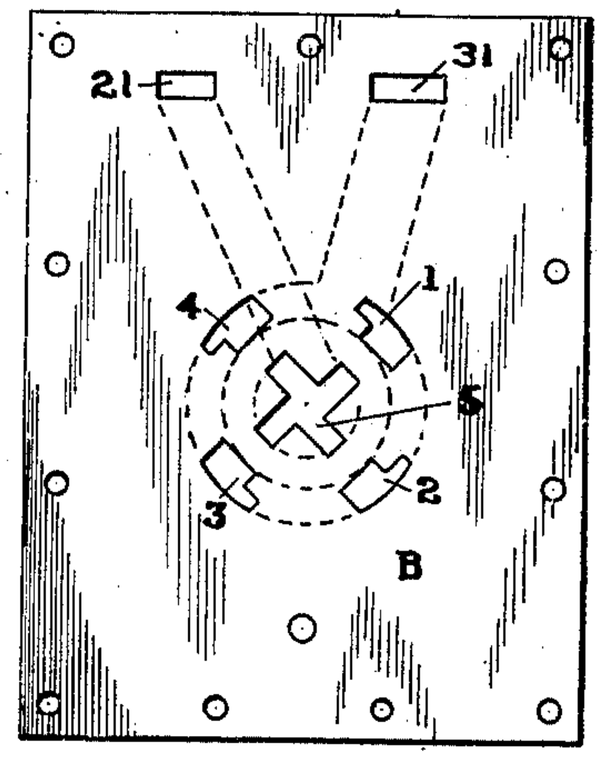


Fig. 8

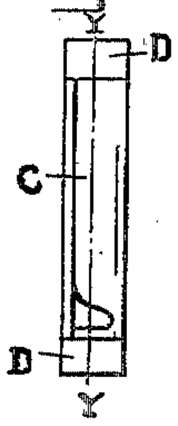


Fig. 9

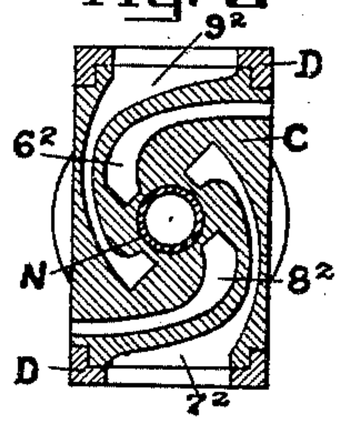


Fig. 12

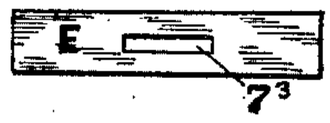


Fig. 13

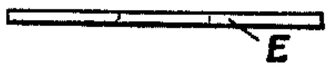


Fig. 10

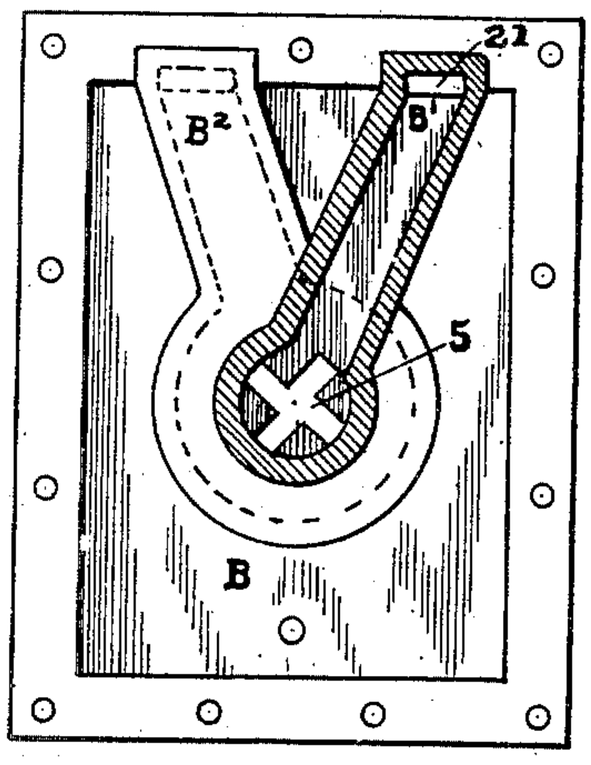


Fig. 11

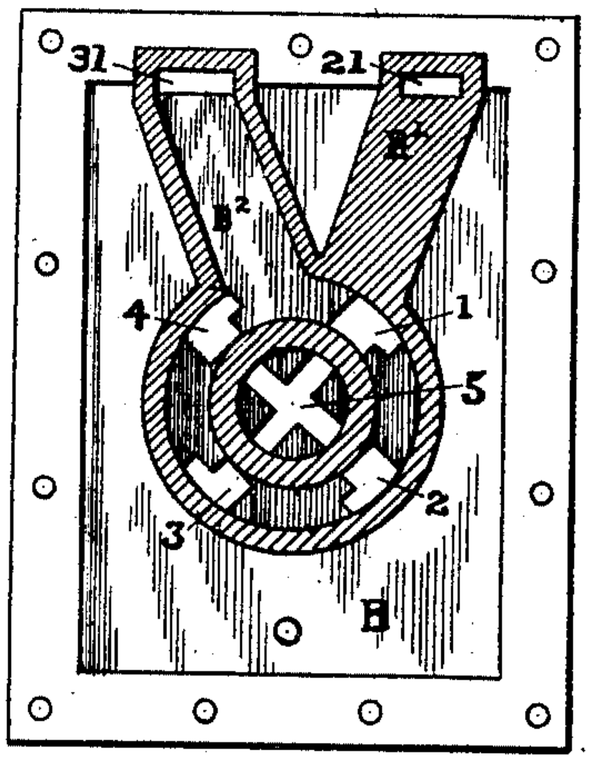


Fig. 16 Fig. 17

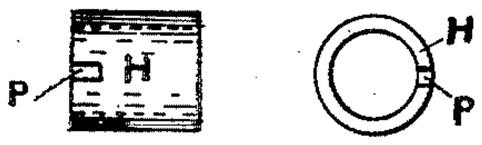


Fig. 14

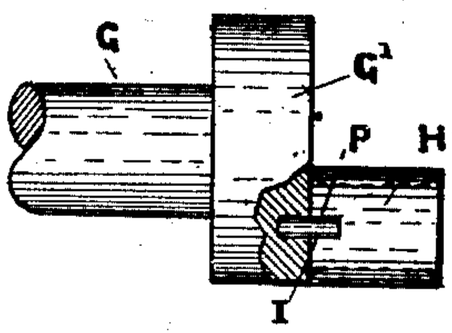
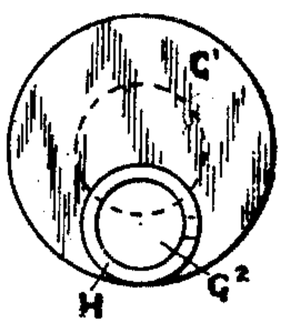


Fig. 15



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WILLIAM L. SILVEY, OF DAYTON, OHIO.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 675,681, dated June 4, 1901.

Application filed January 4, 1901. Serial No. 42,131. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. SILVEY, a citizen of the United States, residing at No. 848 East May street, in the city of Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Steam-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.

My invention relates to engines of the reciprocating type in which two pistons (each piston being double acting) operate together upon one main driving-shaft through a crank-pin, crank-head, and suitable bearings; and it is one object of my present invention to produce a more perfect engine than has been heretofore done and one that will be perfectly reliable in hard service where the engine is exposed to run with little attention, such as are experienced in operating the electric headlight, driving the propeller in steam-yachts, and ventilating-fans.

Another object is to make a reciprocating engine with one crank which will have no dead-centers, and therefore start in any position.

Another object is to provide for easy repairs to the wearing parts and so provide these parts that they may be cheaply produced, and last, but not least, to provide a means for the thorough lubrication of the main bearing.

All these objects are fully met in this invention, a description of which is set out in the body of the specification.

Referring to the accompanying drawings, which are made a part hereof and in which similar characters refer to similar parts, Figure 1 is an exterior side elevation of a complete engine. Fig. 2 is a front elevation of a complete engine. Fig. 3 is a front elevation similar to Fig. 2, but with the front cover B removed. Fig. 4 is a section of Fig. 2 along the vertical dotted line *x x*. Fig. 5 is an inner view of the cover B, showing the ports 5, through which the steam enters to the working valves and pistons, and the exhaust-ports 1 2 3 4, through which it escapes. Fig. 6 is front view of the inside piston C, showing the steam-ports 6 6′, 7 7′, 8 8′, 9 9′. Fig. 7 is a rear view of the inside piston C. Fig. 8 is an edge view of the inside piston C. Fig. 9 is a central section of the inside piston of Fig. 8 along the vertical dotted line *y y*. Fig. 10 is a vertical section of the cover B, showing steam (entering) channel B′ along the vertical dotted line *z z* in Fig. 1. Fig. 11 is a vertical section of the steam-outlet B^2 along the vertical dotted line *w w* of Fig. 1. Fig. 12 is a plan view of a fret-plate E carried by the outlet-piston F. Fig. 13 is an edge view of the fret-plate E. Fig. 14 is an enlarged view of the main shaft G with the crank-head G′ and crank-pin G^2 in position and with the friction-sleeve H on the crank-pin and having a broken section to show the key I, by which the friction-sleeve is prevented from turning on the pin. Fig. 15 is a front and enlarged view of the crank-head G′ with the crank-pin G^2 and friction-sleeve H in position. Fig. 16 is an enlarged side view of the friction-sleeve H; and Fig. 17 is an enlarged rear end view of the friction-sleeve H, showing the notch P in the sleeve, which fits over the pin I, and whereby it is prevented from turning on the crank-pin.

It will be observed that the pistons F C operate in a chamber or case A′, to which is attached a main bearing. The bearing in this case has a sleeve or lining J, preferably of phosphor-bronze, held in position by any suitable means, such as a set-screw. (Shown as J′ in the drawings.) In the bearing the shaft G is journaled, steam being prevented from escaping along the shaft by a gland K and suitable packing K′. On top of the main bearing is an oil-cup L, containing a suitable oil-chamber, which is filled with oil by removing the cover L′. Inside and projecting nearly to the top of the chamber is a tube L^2, the lower part of which may be closed by a stop-valve L^3. In operation the valve L^3 is left open and the steam from the working parts of the engine escapes around the valve and pistons along the crank-pin G^2 and around the crank-head G′ into the main bearing and from there into a suitable groove J^2 and from there into the chamber of the lubrica or through the tube L^2. This steam gradually condenses in the chamber, replacing the oil, which floats on the surface of the water, and the oil flows down the tube L^2, so that a perfect system of lubrication is maintained on

the main bearing and the crank and crank-pin. As soon as the steam-supply stops the flow of oil is discontinued, for the reason that there is no water to be condensed. In case it becomes necessary to refill the cup the valve-stem L^3 is turned and screwed down against the seat L^4, whereby the steam-passage from the bearing into the oil-tube is closed. Next remove the cover L'. Then open the drain-cock L^5 and allow the accumulated water to flow out. Then close the drain-cock and fill the oil-chamber with cylinder-oil. Then replace the cap L' and open the stop-valve L^3, and the lubricator begins to operate as soon as steam is turned on. In case of wear to the main bearing remove the sleeve J and replace it with a new sleeve, it being held in position by the set-screw and jam-nut J'. Wear against the back part of the crank-head is provided for by means of a face-plate J^3, which, like the sleeve J, is removable, being made of a softer metal than the crank-head G'. The metal which experience has taught best for the crank-head is steel and for the sleeve and face-plate phosphor-bronze or brass. It will be observed that the inner piston C is provided top and bottom with removable shoes or slippers D, which are gibbed onto the piston, as shown more particularly in Figs. 6, 7, 8, and 9. These shoes being fastened to the face of the inner piston move with it, taking up the wear between the inner piston and the outer piston F. The outer piston is further provided against wear by means of a steel sheet or face E let into it at the ends, and whereby the irregular wear on the outer piston is taken up. In case of wear on the shoe D it is taken off and a new shoe substituted in a few minutes and a new face-plate E inserted into the outer piston, thereby renewing the wearing-faces at a very small cost. The outer piston having only a to-and-fro motion is provided against steam loss from one end to the other by a packing-wedge M and set-screws M' M^2, whereby the wedge may be moved horizontally to take up any wear on the side of the piston F. The inner piston C has a hole through it at the center, into which is inserted a soft-metal bushing N, such as phosphor-bronze, whereby wear is provided for on the piston, and the crank-pin G^2 is provided with a removable thimble H, which I have found should be of steel. This thimble is prevented from turning and wearing the crank-pin by means of a small key I, inserted in a notch P or hole in the thimble, the pin being fastened permanently to the crank-head. In case of wear on the thimble by removing the cover B the worn thimble H may be removed and a new thimble inserted at a very small cost.

The wearing parts of the engine being all provided for are as follows: The wear against the side of the outer piston by means of the wedge M, wear on the inner face of the outer piston by the fret-plate E, wear on the ends of the inner piston by means of the removable shoes D, wear in the hole in the piston C (which fits on the driving-pin) by means of the bushing N, wear on the crank-pin G^2 by means of the thimble H, wear on the rear face of the crank-head by the face-plate J^3 and on the main bearing by the sleeve J, all of which being readily removable and cheap it is evident that repairs will be inexpensive and maintenance moderate, while the engine is simple, light, and efficient.

The operation is as follows: When the engine is in the position shown in Figs. 3 and 4, the steam enters by the live-steam pipe 20 and thence by steam-passage 21 to the passage B' and steam-port 5. This port is of a cruciform shape and admits live steam against the outer face of the inner piston C. The steam passes from the central opening 5 into supplementary port 7' of the inner piston, which causes a slight advance of the piston over the dead-center, at which time the steam enters at the main port 7 and to the passage 7^2 and the port 7^3 through the outer piston, which admits steam into the chamber 7^4 between the outer piston F and the end of the cylinder A'. This causes the outer piston to be lifted, and rotation is imparted to the main driving-shaft G by the inner piston C, the crank-pin G^2, and the crank-disk G'. The inner piston C in moving causes the supplementary port 8' and afterward main port 8 to register with the central port 5, so that live steam now passes into the supplementary port 8' and afterward the main port 8 and from the latter through the channel 8^2 to the chamber 8^4, which causes a further advance of the outer piston and the inner piston and a continued rotation of the main shaft G, crank-head G', and the pin G^2. Steam is next taken through the supplementary port 9' and afterward through the main port 9, from which it passes to the upper chamber 9^4 through the channels 9^2 and 9^3, causing the outer piston F to be driven downward, the crank being rotated through this fourth of the cycle by the action of the inner piston, which while sliding in its guides in the outer piston is assisted by the expansion of the steam in the chamber 8^4. Steam is next admitted into chamber 6^4 by the supplementary port 6' and afterward main port 6, being rotated under the live-steam port 5, from which steam escapes through the ports 6' 6 through the passage 6^2 into the chamber 6^4. Steam is next admitted to the chamber 7^4, then into chamber 8^4, and so on, producing continuous rotary motion.

I next describe the exhaust, which when applied to the description of one chamber will apply to all. It will be observed by looking at the cover B, Fig. 5, that it has two sets of ports, the port 5 being connected to the live-steam passage only, while ports 1 2 3 4 are connected with the exhaust-passage B^2 and the exhaust-pipe 30. Suppose steam has been admitted to the lower chamber through the ports 7' 7, forcing the piston up. Steam

will first pass through the port 5 into the valve-ports 7′ 7, and as the crank rotates the port 5 is covered up by the solid face of the plate, at which time pressure is exerted by expansion alone. Steam is next admitted from the port 5 to ports 8′ 8, which gives a second impulse to the pistons; but before the pistons have made a complete stroke the ports 7′ 7 have been rotated so as to register with one of the exhaust-ports 1 2 3 4, and the steam exhausts to the atmosphere. Steam is next admitted to the upper chamber 9^4, driving the outer piston downward, and at the same time the ports 8′ 8 register with the exhaust-ports 1 2 3 4, and so on during the revolution of the pistons, these steam admissions and exhausts being caused by the peculiar shape of the ports, together with the fact that the pistons both operate in harmony with the crank-pin and the valve-ports. The inner piston has a rotary motion around the center of the shaft and a sliding motion across the ports. It will be observed that I have small supplementary steam-inlet ports 6′ 7′ 8′ 9′, the purpose of which is to admit steam enough to overcome the dead-center when the engine is stopped. They also to a certain extent assist and operate in conjunction with the main ports 6 7 8 9, with which they are connected through the steam-passages 6^2 7^2 8^2 9^2. The peculiar wings to the exhaust-ports 1 2 3 4 are for the purpose of producing a steam-cushion.

Having fully described my improvements, what I claim as new, and wish to secure by Letters Patent of the United States, is—

1. In a steam-engine, the combination of an outer case and its cover an outer piston, an inner piston, two sets of steam-supply ports in the inner piston, and a set of wearing-plates carried by the outer piston between it and the inner piston, and a set of wearing-plates attached to the end of the inner piston, as set forth.

2. In a steam-engine, the combination of an outer casing, a steam-piston having a steam-port through its end and a wearing-plate carried by the steam-piston, the wearing-plate attached to the inner side of the piston, the steam-port passing through the wearing-plate, an inner piston having a wearing-plate attached to it, and a set of valve-ports surrounded by and operating in conjunction with the inner steam-piston, as set forth.

3. In a steam-engine, the combination of two pistons, one operating inside the other, with a series of valve-ports carried by the inside piston, the valve-ports consisting of a series of port-openings at one end on the edge of the inside piston, the other end of the port opening on the face of the piston, the opening on the face consisting of a main or operating port and a sub or starting port in advance of the operative port, the starting-ports and operating-ports separated by a bridge, and a set of steam supply and exhaust ports located in the cover of the engine-case in which the pistons operate, and a wearing-plate carried by the outer piston between it and the inner piston, as set forth.

4. In a steam-engine, the combination with the outer piston F of the removable wearing-plate E and the inner piston C having removable shoes D in contact with the wearing-plate, as set forth.

5. In a steam-engine, the combination with the piston F of a removable fret-plate E for preventing wear on the inside surface of the piston, and port-holes extending through the piston and plate, as set forth.

6. In a steam-engine the combination of the main shaft, a crank-head on the main shaft, a projecting crank-pin on the crank-head, a removable sleeve on the crank-pin, the sleeve having a notch or recess in it, registering with a pin on the crank-head, an inner and outer piston, the inner piston with a hole in its center and mounted on the crank-pin, and a wearing-shoe on one end of the inner piston between it and the outer piston, as set forth.

7. In a steam-engine, the combination with the outer case of the outer piston F, wearing or fret plate E, inner piston, C, the shoe D, and the bushing N, and a crank-head and crank-pin, as set forth.

8. In a steam-engine the combination of the outer piston F, wearing-plate E, carried by the outer piston, inner piston C, the shoe D, attached to the inner piston, removable bushing N in the inner piston, and a removable sleeve H inside of the bushing, the sleeve mounted on a crank-pin, and a crank-head and main shaft, as set forth.

9. In a steam-engine, the combination with the engine-cylinder of a crank-shaft, crank-head, and crank-pin, the crank-pin having a removable outer cover or sleeve, the sleeve having a notch for securing the sleeve on the pin, an inner and outer piston, the inner piston with a hole in its center by which it is mounted on the crank-pin, and a removable wearing-plate attached to the outer piston between it and the inner piston, as set forth.

WILLIAM L. SILVEY.

Witnesses:
EARL LONES,
JAMES GREEN.