(No Model.) 2 Sheets—Sheet 1.

W. W. ST. JOHN.

RECIPROCATING ENGINE.

No. 352,633. Patented Nov. 16, 1886.

Fig. 1.

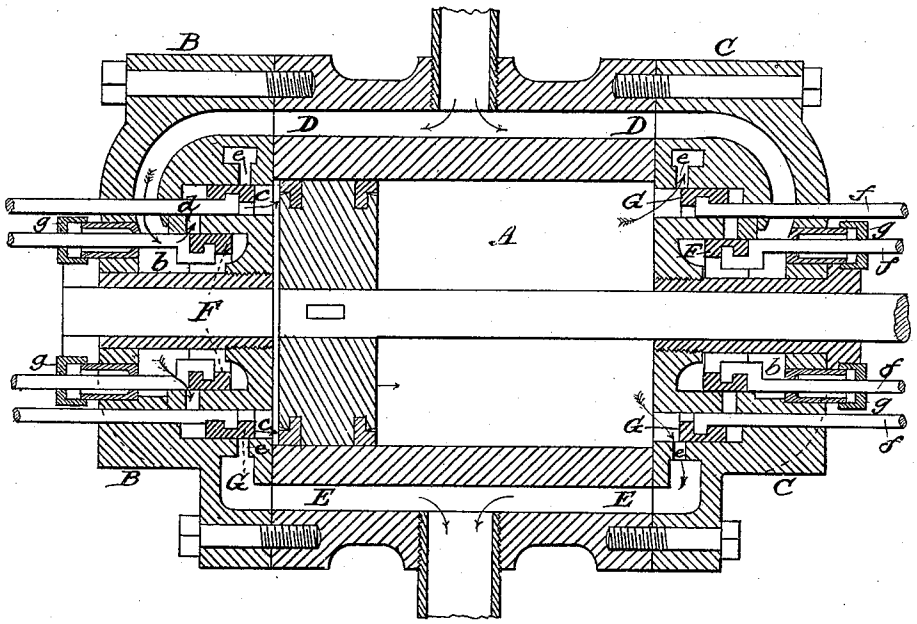


Fig. 3.

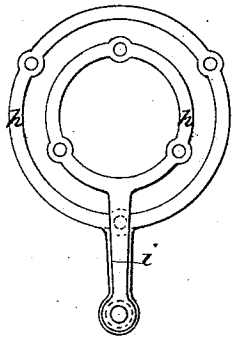


Fig. 2.

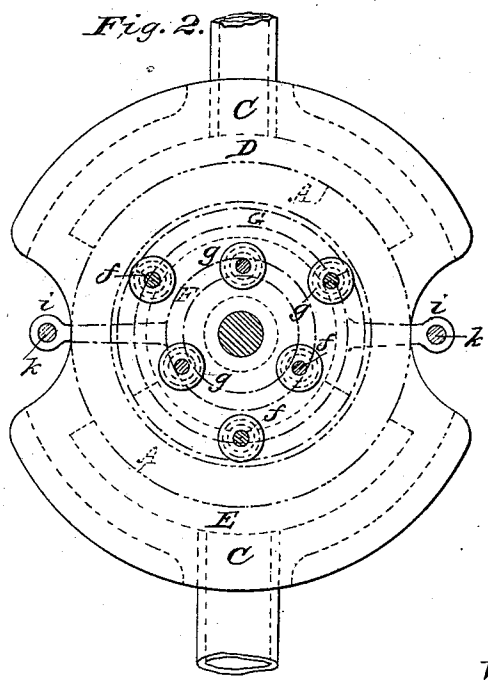
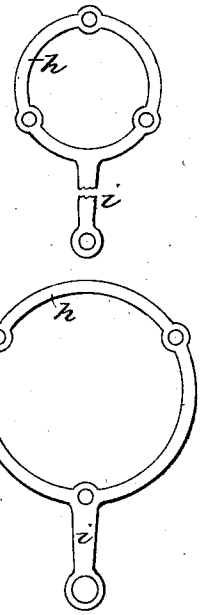


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

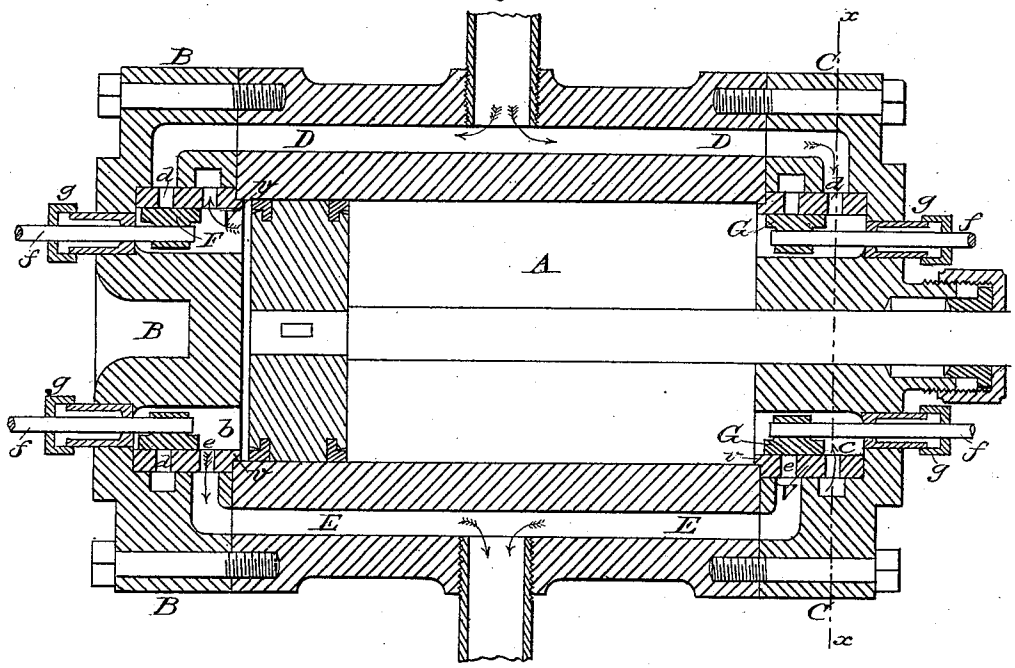


Fig. 7.

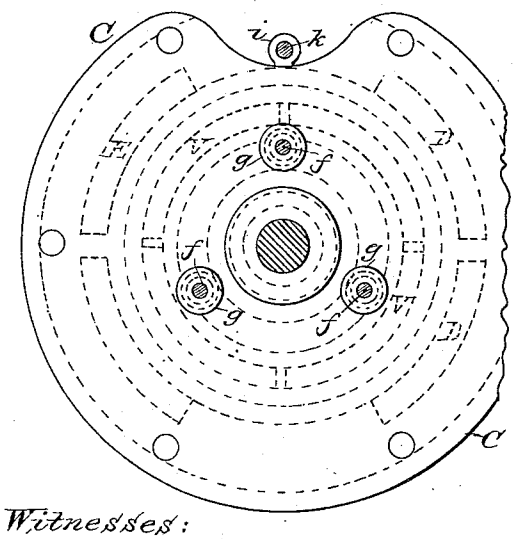
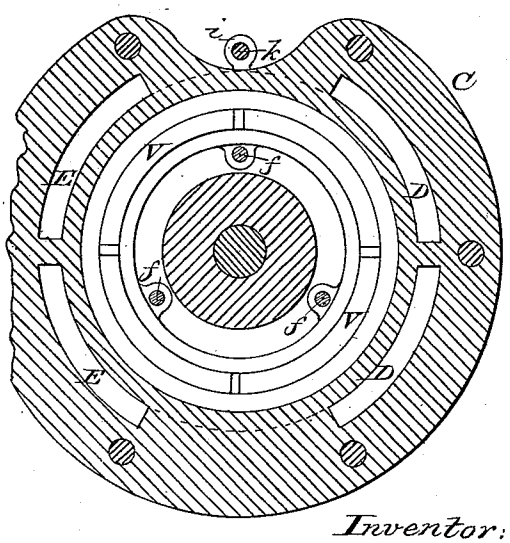


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM W. ST. JOHN, OF NEW YORK, N. Y.

RECIPROCATING ENGINE.

SPECIFICATION forming part of Letters Patent No. 352,633, dated November 16, 1886.

Application filed February 24, 1886. Serial No. 193,005. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. ST. JOHN, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Reciprocating 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 improvements in valves for reciprocating engines more especially adapted to very high speeds or velocities; and the object of the invention is to produce an engine that is more economical in the use of steam and fuel than those now in use; that is very simple in its construction and operation; also, that the valves can be easily replaced or repaired when required, and especially that a very large area of port-openings can be obtained with a very short stroke of valve; furthermore, that the valves can be easily fitted and finished to their seats, as well as removed whenever desired; and, finally, to prevent condensation of steam by long passages.

The invention consists in making the heads hollow and forming in them circular valve-seats, on which annular ring-valves fit and move to admit and exhaust the steam through the ports formed in the seats. It also consists in the construction of certain details and arrangement of parts, as will be more fully described hereinafter, and specifically pointed out in the claims, reference being had to the accompanying drawings and the letters of reference marked thereon.

Like letters indicate like parts in the different figures of the drawings, in which Figure 1 represents a longitudinal section of an engine with my improved valves. Fig. 2 is an end view of the same. Figs. 3 and 4 are detail views of the valve-gear. Fig. 5 is a longitudinal section of an engine cylinder and valves of a modified form of Fig. 1. Fig. 6 is a cross-section on line *x x* of Fig. 5. Fig. 7 is an end view of Fig. 5.

In the drawings, A is an engine-cylinder, provided with the cylinder-heads B and C. In these heads are arranged an annular steam-chamber, *b*, and an exhaust-chamber, *c*. The live steam enters through a port, D, connected to the steam-chamber *b*, and the exhaust passes out through a port, E, communicating with the exhaust-chamber *c*, and the live steam passes through the port *d* into the chamber *c* before entering the cylinder, while the exhaust-steam passes through the port *e* into the port E, and thence into the atmosphere or to a condenser.

The valves F and G are of annular form and snugly fit upon their respective seats, and in their movements backward and forward admit and exhaust the steam. To prevent binding or twisting of the valves, they are operated by two, three, or more valve-stems, *f*, passing through suitable stuffing boxes, *g*, and are connected to bands or rings *h*, having an arm, *i*, to which the side rods, *k*, are attached. The side rods, *k*, connect the rings *h* at both ends of the cylinder, and to one of said rings the main valve-stem is secured and receives motion from an eccentric, link, &c., in the ordinary manner. If desired, a side rod, *k*, may be arranged on each side of the cylinder, or one of them may be a hollow and the other a solid one. The cylinder-heads may be recessed at one side or both sides, to permit the side rods to be placed nearer the centers of the valves and reduce the length of the arms *i*, which operate the valves.

In the modification shown in Figs. 5, 6, and 7 there is but one set of valves arranged in the heads B and C. In this instance the valve-seats V are made removable. They consist of rings provided with the ports *d* and *e*, communicating with the ports D and E, alternately admitting and exhausting the steam. These rings are snugly fitted in place, and, if desired, they may be shrunk in by heating the heads. Small projections *v* on said rings prevent any lateral displacement, they fitting snugly into the cylinder. The valves alternately serve as the inlet and the outlet valve in this case. Thus if the steam is admitted through the valve F′ into the cylinder it is exhausted through the other end by the valve G′. The valve-stems are secured to lugs on the inside of the valves and pass through the stuffing-boxes. The stuffing-box for the piston-rod may be cast to the head of the cylinder, or may be made removable and screwed into its place or bolted to the head. The valve-rods *f* may be connected to the rings *h*,

as in Figs. 1 to 4, or operated in any other manner.

The operation is as follows: The steam enters the port D, Fig. 1, passes into the chambers *b* in the cylinder-head alternately, and through the steam-ports *d* and chambers *c* into the cylinder. At the same time the exhaust-steam passes through the chambers *c* at the opposite ends of the cylinder, thence through the ports *e* when uncovered by the valves G, and out through the port E into the atmosphere or a condenser, and vice versa. In Fig. 5 the steam enters through the port D, the port *d* in the valve-seat into the chamber *b*, and thence into the cylinder. At the same time the exhaust-steam passes out through the chamber *c*, port *e*, and thence through the port E into the atmosphere or condenser. In this instance the valves or ports alternately serve as inlet and outlet valves and ports, thus dispensing with one pair of valves and ports, as in Fig. 1.

The advantages of my improved engine will be readily appreciated by engineers and others skilled in the art, and among them are, that the steam enters directly into the cylinder by short ports instead of long ones; the ports can be of minimum size or width, and yet a very large area of opening is afforded by being circular; the valves and ports are easily constructed, fitted to place, and replaced or repaired; the heads, being separate from the cylinder, are easier handled and finished and the engine can be cheaper produced; the valves are perfectly balanced.

I am aware of the German Patent No. 3,298, and disclaim the construction therein shown.

I am also aware of the Patent No. 17,893 to Reed, and disclaim the construction therein shown; but,

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

1. In an engine, the valves and ports of cylindrical form arranged in the cylinder-heads, substantially in the manner and for the purpose specified.

2. In an engine, the valves made of cylindrical form and seated upon cylindrical faces, having the ports for admitting and exhausting the steam, arranged in the cylinder-heads, as set forth.

3. In an engine, the valves made of cylindrical form seated upon cylindrical faces, provided with steam inlet and outlet ports, arranged in the cylinder-heads, substantially as specified.

4. The combination of a cylinder and hollow cylinder-heads containing the valves and ports of cylindrical form with valve-stems operating said valves, substantially as and for the purpose set forth.

5. In an engine, the hollow cylinder-heads containing the valves and ports of cylindrical form, in combination with a cylinder having annular ports communicating with the ports in the cylinder-heads, as and for the purpose specified.

6. In an engine, the valves having cylindrical faces seated on cylindrical valve-seats, provided with ports and communicating with steam-chambers in the heads and ports in the cylinder, as set forth.

7. The combination of a cylinder with the cylinder-heads, provided with steam-chambers and ports of cylindrical form, and containing the valves, arranged substantially as described.

8. In an engine, the cylindrical valve-seats provided with ports and made removable, in combination with cylindrical valves, and all arranged in the cylinder-heads in the manner shown and specified.

9. The cylinder A, having ports D, and communicating by annular chamber *c* with the chambers in the cylinder-heads, containing the inlet and outlet ports, and the valves F and G, of cylindrical form, and seated on cylindrical valve-seats, all substantially as and for the purpose set forth.

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

WILLIAM W. ST. JOHN.

Witnesses:
IRA M. PHELPS,
LOUIS BEYER.