(No Model.) 2 Sheets—Sheet 1.

G. H. SCRIBNER & W. HECKERT.

STEAM ENGINE.

No. 381,854. Patented Apr. 24, 1888.

Fig. 1.

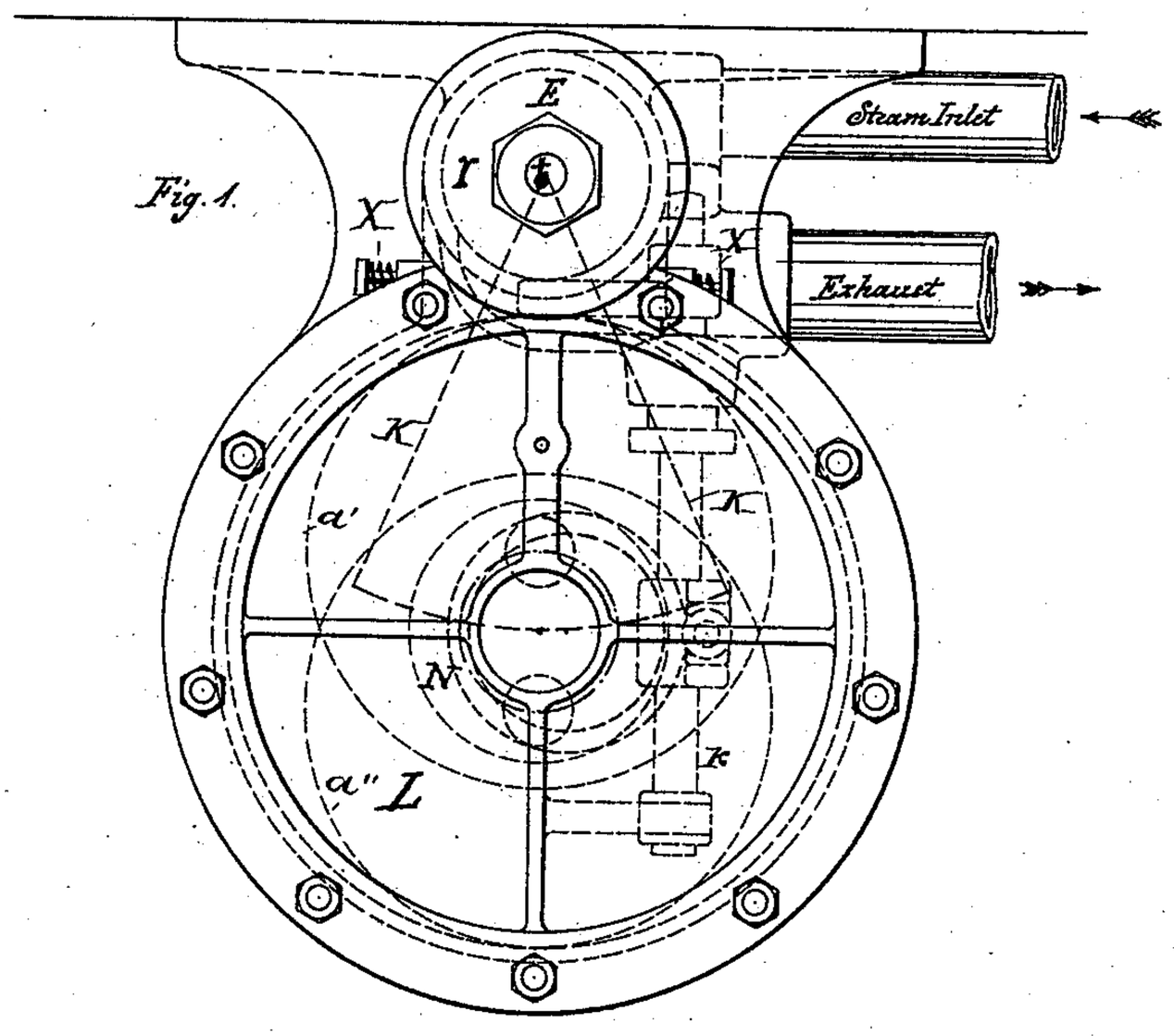
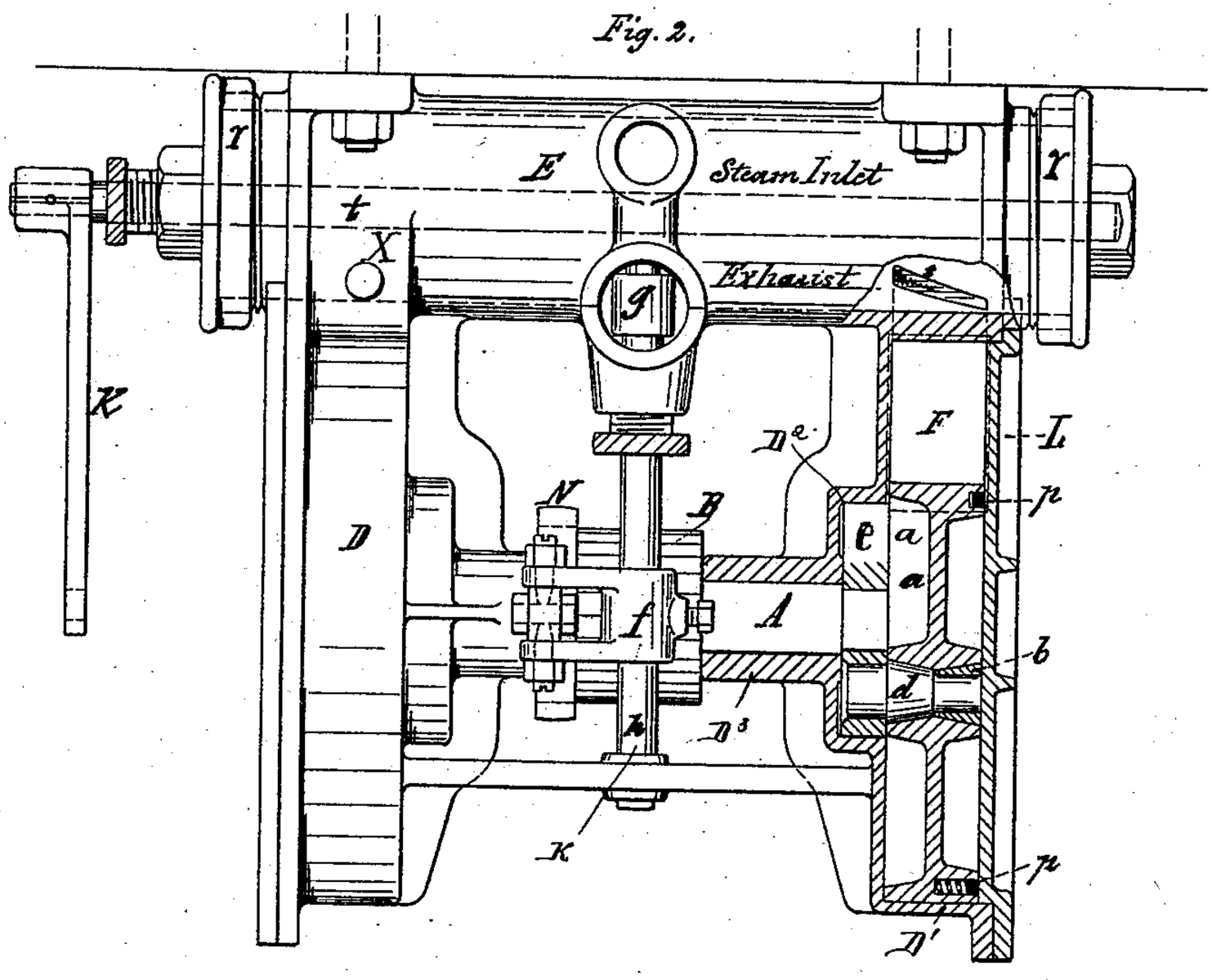


Fig. 2.



WITNESSES.

Lotta M. Allen.

S. A. Heckert.

INVENTORS.

G. Hilton Scribner.

Wm Heckert.

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Fig. 6.

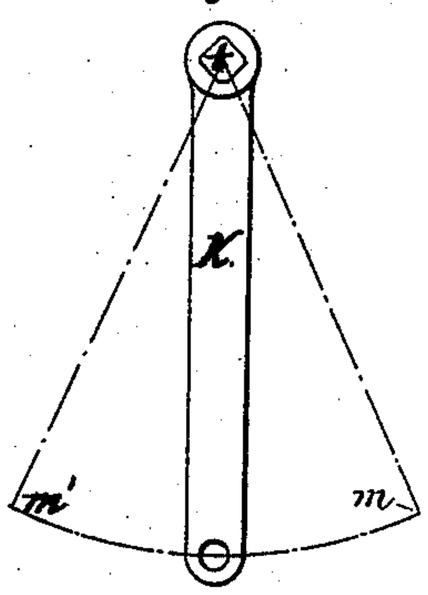


Fig. 3.

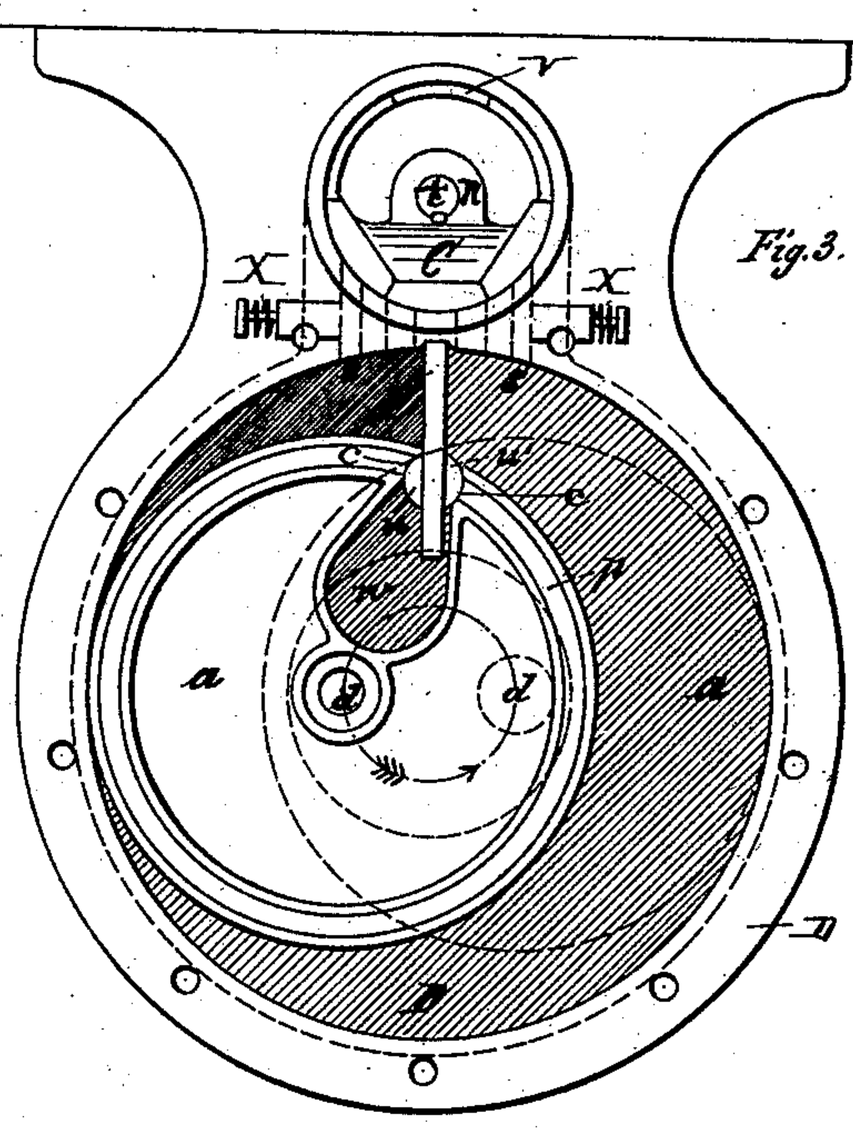


Fig. 7.

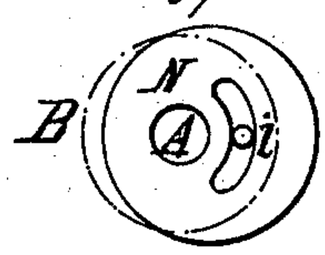


Fig. 4.

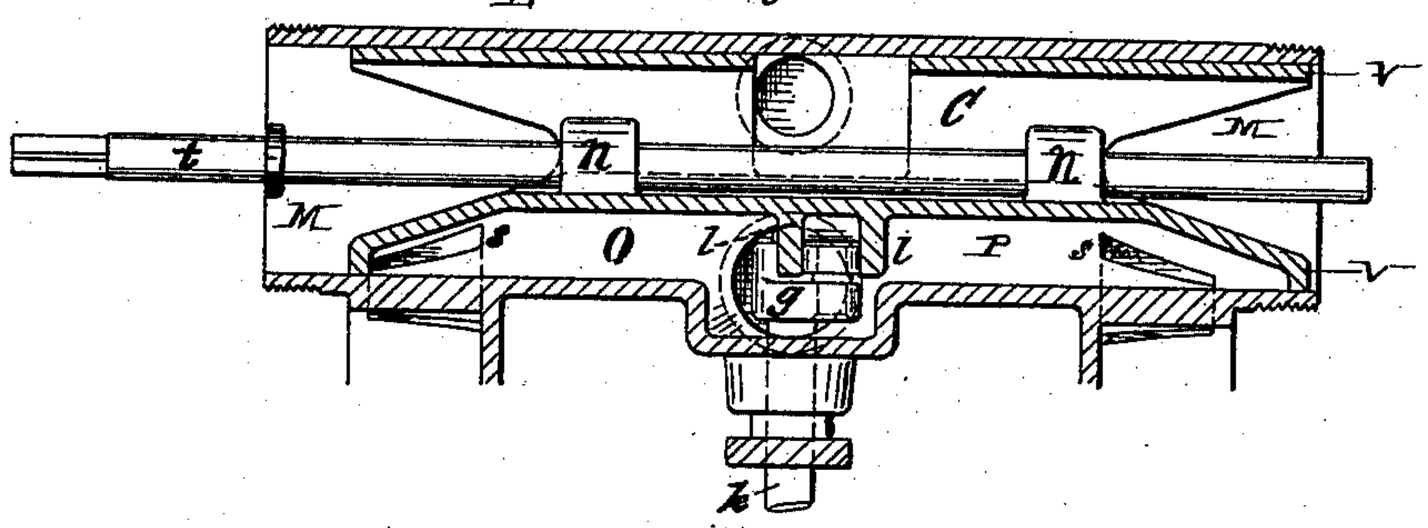
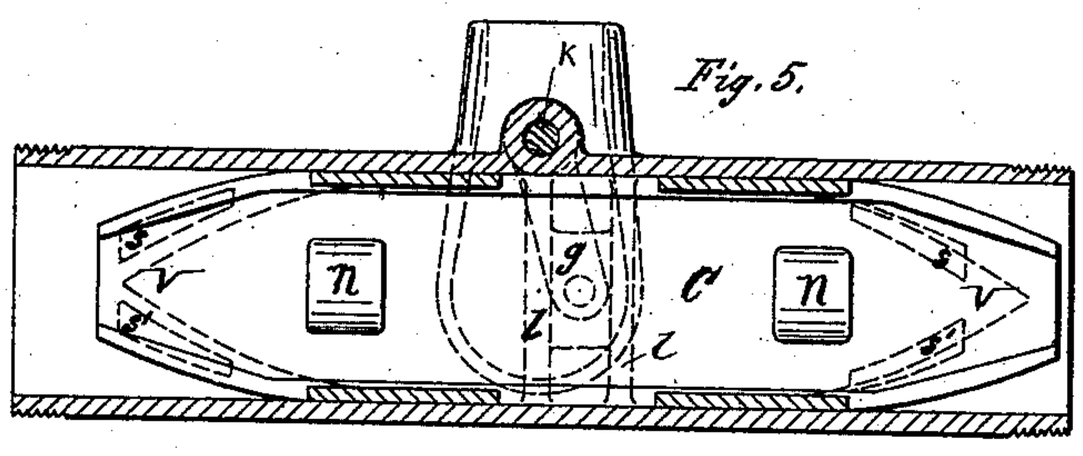


Fig. 5.



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UNITED STATES PATENT OFFICE.

G. HILTON SCRIBNER AND WILLIAM HECKERT, OF YONKERS, NEW YORK.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 381,854, dated April 24, 1888.

Application filed June 28, 1887. Serial No. 242,769. (No model.)

To all whom it may concern:

Be it known that we, G. HILTON SCRIBNER and WILLIAM HECKERT, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Steam Engines; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Our invention relates to steam-engines in which rotary oscillating pistons are connected by wrist-pins to the driven shaft, which, when the engine is connected with machinery of any description, becomes the driving-shaft. There are preferably two pistons, each of which exposes a variable effective area to the action of the steam; but they are so arranged relative to each other that the increase of area in one corresponds to an equal decrease of the area of the other piston, whereby a constant effective piston-area is obtained in an engine in which the pistons have a combined rotary and oscillating motion. In addition to this, our invention also comprises a combined slide and reversing valve, and also numerous details of construction, which will hereinafter be more fully pointed out.

In the accompanying drawings, which form a part of this specification, we have illustrated a specific embodiment of our invention, to wit:

Figure 1 is an end elevation of our improved steam-engine. Fig. 2 is a side elevation of the same, partly in section. Fig. 3 is an end elevation with the front part of the casing and cap of the valve removed. Fig. 4 is a vertical longitudinal section of our improved valve. Fig. 5 is a similar view, the section being on a horizontal plane. Fig. 6 is a view of the valve-operating lever, and Fig. 7 is an end elevation of the valve-eccentric.

The main body of our engine is composed of two flat cylindrical cases, D D, connected by a tubular steam-chest, E, which communicates with these cylinders, as hereinafter described. Each cylinder is composed of a shell, E′, and a head, L, and the shell is so formed that when the head is applied to it it incloses a cylindrical space having a cylindrical recess, D^2, from which extends centrally a bearing, D^3, for the main shaft A of the engine. The bearings D^3, extending from each shell, are in alignment, and the main shaft A extends through both of them and has in the middle a pinion, B, keyed to it. By suitable gearing the motion of pinion B is transmitted to any machine which it is desired to run by the motor.

The two cylinders are constructed alike, and it will therefore only be necessary to describe one in detail.

There is a disk, *e*, seated in recess D^3, and the shaft A is rigidly connected with the center of said disk. A wrist-pin, *d*, is secured to and extends eccentrically from disk *e* into the cylinder-chamber proper, and journaled upon such wrist-pin is a piston-disk, *a*, provided with packing-rings *p p*, so as to hermetically close against the walls of the cylinder, and the diameter of the piston-disk is such that a line in its periphery is in close contact with the inner periphery of the cylinder, as will be seen by reference to Figs. 1, 2, and 3. One half of the wrist-pin is shaped conically and the other cylindrically; but a conical sleeve, *b*, is passed over the cylindrical portion of the wrist-pin, so that both halves of the latter offer reversed conical bearings for the piston, as is well understood in the art. The piston-disk itself is preferably recessed on both faces, leaving only the hub and the rim of a width equal to the width of the space within the side walls of the cylinder. There is a gap, *w*, extending from the periphery of the piston-disk to the hub and terminating cylindrically in the rim, where it is bounded by a segmental recess, *c*, in each side of the gap within the rim. Two segmental packing-blocks, *u u*, are loosely inserted within the segmental recess *c*, so as to leave a narrow passage between them, and a partition, F, is secured with three of its edges to the walls of the shell and head of the cylinder, respectively, and extends with its fourth free edge between the packing-blocks *u u* into the gap *w*, as shown in Figs. 2 and 3. It will thus be understood that the piston thus mounted within the cylinder and guided by the partition F is capable of performing an oscillating motion about its variable pivot, while the center of said piston, which corresponds to wrist-pin *d*, will perform a rotary motion, describing a

circle the radius of which is equal to the distance of the center of the wrist-pin from the center of shaft A. The oscillating motion of the piston will be equal in extent to the stroke of the crank, and while performing this motion the piston will maintain contact with the inner surface of the flange of the cylinder, the relation of the parts being such that the contact in the rim of the piston with the inner surface of the flange of the cylinder will be practically steam-tight.

If, now, steam be admitted into the space inclosed by the cylinder, the piston, and the partition F—say on the left-hand side of said partition—the piston will, under the conditions shown in Fig. 3, be forced downwardly, so as to enlarge the space inclosed between the cylinder, piston, and partition and expose a continuously-increasing surface to the action of the steam; but, while the piston continues to expose a larger surface to the action of the steam, this action is not effective for motion in the same sense throughout the complete oscillation of the piston, but only during one-half of the oscillation—that is to say, when the piston has arrived in a position to bring the center of its hub in line with the partition F the whole of its exposed surface is acted upon by the steam in a manner to produce motion in one direction; but when the piston has passed that position, as indicated in dotted lines in Fig. 3, only a part of the exposed surface is acted upon in a manner to continue the motion, while another part is acted upon in the reversed direction, so that the resultant action will be due to the difference of pressures upon the two parts of the exposed piston-surface. The result of this is that we obtain a constantly-increasing effective piston area for one half of the oscillation and a constantly-decreasing effective surface during the second half of the oscillation, and when the piston arrives in the position where the packing-blocks *u u* come in contact with the flange of the cylinder the effective surface of the piston will be zero. Thus we have a dead-center in each cylinder; but the two pistons are originally so arranged with relation to each other in their respective cylinders that one exposes the maximum effective surface to the action of the steam or other motor-fluid, while the other exposes a minimum surface; and since the increase of force in one cylinder proceeds in accordance with the same law as the decrease of force in the other cylinder the resultant force, which is equal to the algebraic sum of the forces of the two cylinders, will always be constant. In order to obtain this result, the wrist-pin upon the crank-disk of one cylinder must be in its lowest position, while it is in the highest position in the other cylinder.

The pistons in our engine are thus connected with the main shaft by means of a crank and wrist-pin, analogous in this respect to the construction employed in ordinary reciprocating engines, and while the piston in one cylinder occupies the position indicated by the dotted line *a'* in Fig. 1 it occupies the position a^2 in the other cylinder, and vice versa.

The steam-chest E is cylindrical in form. Inlet and exhaust pipes connect with the same, as indicated in the drawings. A cylindrical plug-valve, C, is fitted to the steam-chest both for sliding and turning therein to perform dual functions, as will presently be described.

A partition, P, running longitudinally through the plug-valve, separates the inlet from the exhaust chamber, and two lugs, *n n*, fixed upon said partition, afford a central bearing for the shaft *t*, to the end of which the reversing-lever K is fixed. The valve is connected to shaft *t* by a groove and feather in lugs *n n* and shaft *t*, respectively, so that it may move longitudinally upon the shaft and may be rotated with the same.

Two V-shaped notches are cut into each end of the cylindrical valve diametrically opposite each other, as indicated at M, Fig. 4, so as to leave two solid spurs or prongs, V V, at each end, one of which at each end is in such relation to inlet and exhaust ports *s s'*, which establish communication between the cylinder *f* and the steam-chest, as to close and open the same alternately as the valve is turned to the right or to the left by the reversing-lever K, and also to open and close said ports alternately when the valve is moved longitudinally upon shaft *t*, as by the action of an eccentric, as will presently be described. One of the two ports *s s'* communicates with the steam-cylinder on one side of partition F and the other with the space on the other side of said partition, and when steam is admitted through one port the other port becomes for the time being the exhaust-port. Thus, if steam is admitted through the port on the left-hand side of the partition F in Fig. 3, the port there located is for the time being the inlet-port. The piston is driven around until it passes the port on the right-hand side of partition F, into which port the steam, which by this time has done its work, rushes. The port to the right of partition F is therefore for the time being the exhaust-port. This operation takes place when the valve has been turned by lever K to one side, which lever may then be assumed to be in the position *m*. (Indicated by dotted lines in Fig. 6.) The rectilinear oscillation of the valve, produced automatically by the eccentric, (which will presently be described,) simply opens and closes alternately the inlet-ports, but leaves the exhaust-ports open. If the lever K is turned to the position *m'*, the ports to the right of partition F become the inlet and those to the left of said partition the exhaust ports, whereby the engine is reversed. As in the former case, so here the inlet-ports are alternately opened and closed by the action of the eccentric, while the exhaust-ports remain open.

The object of closing the inlet-ports automatically is to cut the steam off when a part of the oscillation of the piston has been com-

pleted, so as to complete the stroke of the piston by expansion for the purpose of economy, as is well undestood, and the cut-off is made variable by turning the valve more or less by means of lever K. If that lever is in the central position, all ports are covered by the recess O, and are thus open to the exhaust.

The eccentric N is loosely mounted upon shaft A and connected by a yoke to crank-lever *f*, which in turn is fixed to a rocker-shaft, *k*, which is suitably journaled and extends into the exhaust-chamber O, where a crank-lever, *g*, fixed to the shaft A, extends between two lugs, *l*, projecting from the partition P into said exhaust-chamber. The operation of this part of the construction will be readily understood. As the main shaft of the engine revolves under the combined action of the two cylinders, pinion B also revolves, and a pin, *i*, projecting from the side of said pinion into a curved slot in the eccentric, as shown in Fig. 7, causes the latter to revolve with it, and by the connecting mechanism, heretofore described, the rocker-shaft *k* is actuated, which in turn actuates the crank-lever *g*, extending between the lugs or ribs *l*, which will impinge alternately against the one or the other of the said ribs and will impart a rectilinear reciprocating motion to the valve. The spurs V V of the valve will alternately open and close the inlet-ports *s s'*, as hereinbefore explained.

It is impracticable to admit steam into the cylinder precisely at the moment when the piston crosses the line of partition F. In practice the inlet-ports will be opened after the cylinder has passed that line, and there will therefore be a tendency to the formation of a vacuum behind the piston. To prevent this we locate vacuum valves one on each side of partition F, which will admit air into the cylinder behind the piston until the inlet-port is opened. These vacuum-valves *x x* are preferably made to open into the ports *s s'*, so as to be out of the way of the pistons, as shown in Fig. 3, and they are of ordinary construction, being normally closed by the action of a coiled spring and opened by air-pressure from the outside, as is well understood by those skilled in the art.

We claim as our invention and desire to secure by Letters Patent—

1. In a steam-engine, the combination, with a steam-cylinder having a radial steam-tight partition and a combined inlet and exhaust port on each side of the partition, of a cylindrical piston of smaller diameter than the cylinder, vibrating in steam-tight contact with the periphery and the flat ends of the cylinder about a movable pivot upon the partition, and vacuum-valves controlling communication between each port and the external air, substantially as described.

2. In a steam-engine, the combination, with a cylindrical steam-chest and two steam-cylinders communicating with the same by ports, of a combined expansion and reversing valve consisting of a cylindrical plug fitted to the steam-chest with V-shaped notches cut in its ends, leaving two prongs at each end for controlling the ports, a hand-lever for rotating the valve to control the admission of steam, and an eccentric for automatically reciprocating the valve, substantially as described.

3. In a steam engine, the combination of a steam-chest and a pair of steam-cylinders communicating with the chest by suitable ports, with a plug-valve fitted to the chest for rotating and reciprocating within the same to control the admission of steam, a reversing-lever for rotating the valve, and an eccentric for automatically reciprocating the same, whereby the cut-off and the direction of motion is controlled by a single valve, substantially as described.

In testimony that we claim the foregoing as our own we affix our signatures in the presence of two witnesses.

G. HILTON SCRIBNER.
WM. HECKERT.

Witnesses:
FLORENCE SCRIBNER,
JAMES S. FITCH.