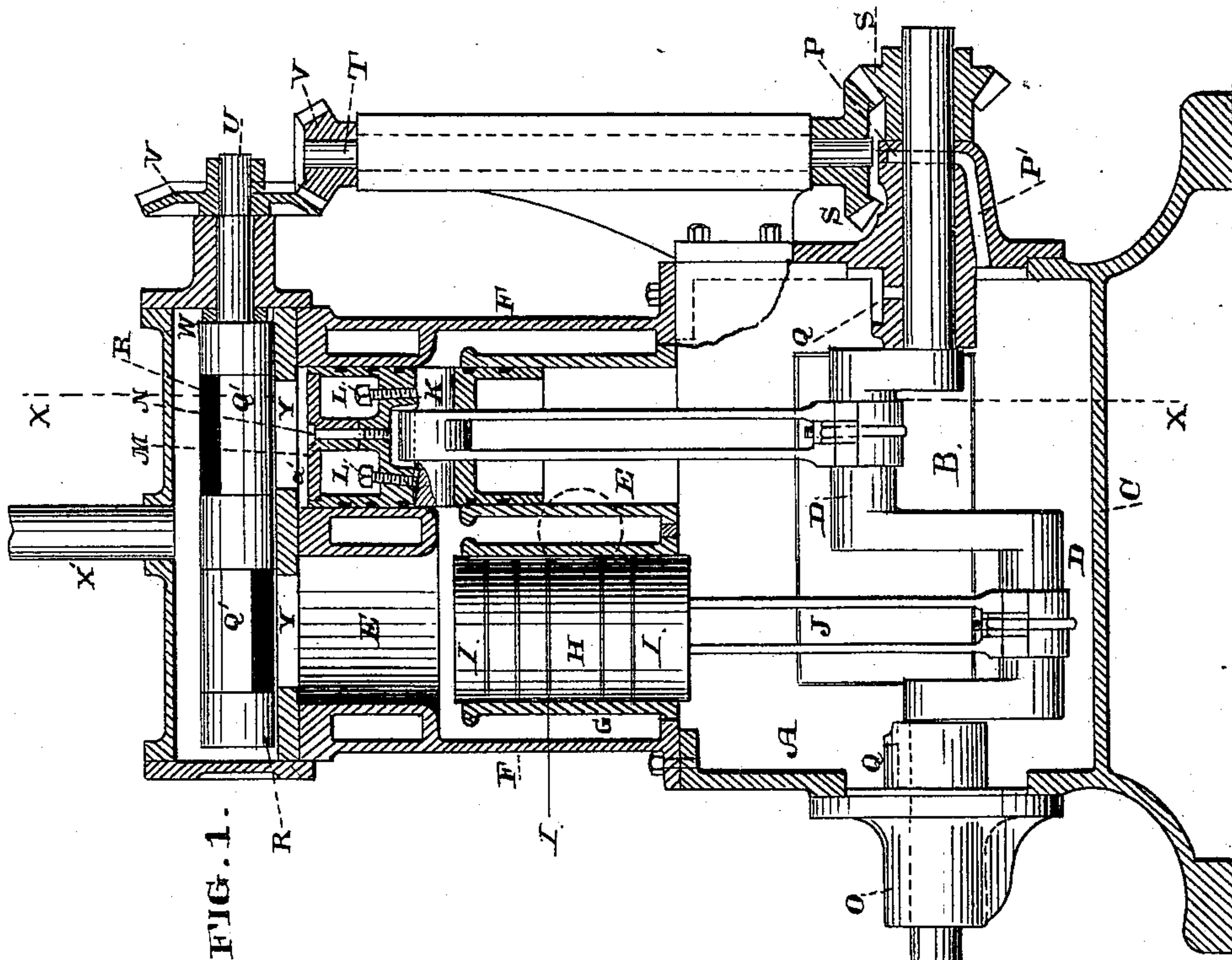
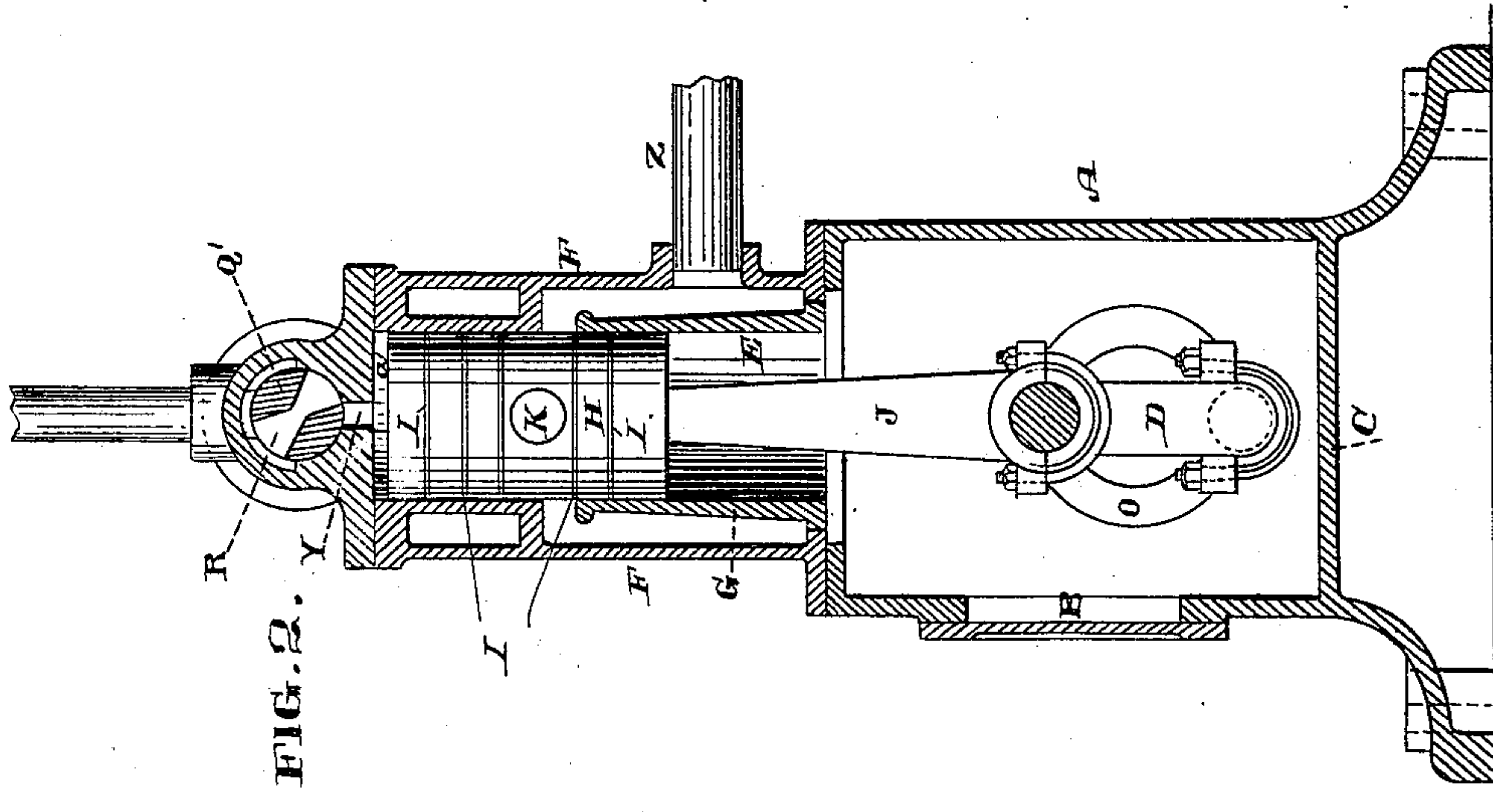


(No Model.)

J. RICHARDS.
SINGLE ACTING ENGINE.

No. 328,522.

Patented Oct. 20, 1885.



Witnesses,
Geo. H. Strong.
J. T. House.

Inventor
John Richards
By
Dewey & Co.
Attorneys

UNITED STATES PATENT OFFICE.

JOHN RICHARDS, OF SAN FRANCISCO, CALIFORNIA.

SINGLE-ACTING ENGINE.

SPECIFICATION forming part of Letters Patent No. 328,522, dated October 20, 1885.

Application filed March 16, 1885. Serial No. 159,080. (No model.)

To all whom it may concern:

Be it known that I, JOHN RICHARDS, of the city and county of San Francisco, State of California, have invented an Improvement in Single-Acting Engines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to steam-engines of that class in which steam acts upon one end of the piston, and to the construction of the cylinders and valves, and a means for operating the same.

It consists of a short steam-cylinder having a piston working within it and a piston-guide set in line with the steam-cylinder, so that the piston may pass entirely out of the cylinder at each stroke to permit the steam to escape, while its alignment will be maintained by the guide, so that it will enter the cylinder fairly on the return-stroke.

It also consists in a rotating valve with ports or perforations, whereby steam may be admitted to the cylinder during any portion of the stroke, and in an arrangement of gearing by which the valve is driven, together with certain details of construction, all of which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section taken through the engine. Fig. 2 is a vertical transverse section taken through the line X, Fig. 1.

A is the main frame, which is cast in the form of a rectangular box, within which the cranks are inclosed. This box has a door, B, which may be removed whenever it is desired to inspect the interior or the cranks. A diaphragm, C, is cast on this frame, forming the bottom of the box, so as to retain the lubricating-fluid with which the crank-case is partially filled. The crank-shaft D is formed in one piece with two or more cranks to correspond with the number of cylinders which are employed. In the present case I have shown two of these cylinders with the requisite accompanying mechanism.

E E are the steam-cylinders, which are cast integral with the casing F. This casing surrounds them, being preferably made rectangular in form to correspond with the base-frame A, to which it is bolted, as shown. The cylin-

ders may, however, if desired, be formed separate from the casing and afterward inserted. In the present case the exterior casing, F, is employed as a steam jacket or chamber, into which the exhaust-steam escapes after leaving the cylinders E.

G are guides for the pistons H H. These guides are cylindrical, having the same bore as the cylinders E, and may be formed integrally with the casing or frame F, but are preferably made of hard iron, and inserted so as to stand in line with the cylinders E, to receive the pistons when they leave the cylinders and to insure their entering the cylinders again freely on the return-stroke. The pistons are made very long and do not require expensive packing, and are kept tight by the water-grooves I I, formed around their circumference. If, however, it be found desirable to employ a packing, the slight bell-mouth at the lower ends of the cylinders will allow the packing to enter without damage or obstruction. The cranks are connected with the pistons by rods or links J, the lower ends of which are connected with the crank-pins in the usual or any suitable manner, and the upper ends with the upper pins, K. These upper pins, K, are of uniform diameter, and are set in the piston, as shown in Fig. 1, their outer ends having the upper surfaces inclined, and they are held in place by set-screws L, which are turned down so as to press upon these faces.

M is the top plate of the piston, held in place by screw N, and when this is removed the screws L are accessible. This plate also prevents the radiation of heat through the piston.

The main-shaft bearings O are bolted to the main casing A by flanges, as shown. Oil is supplied to them from a chamber or cup, Q, on the inside of the casing A, which receives the lubricant as it is dashed up by the action of the cranks dipping into that which is placed in the crank-case, as before described.

P are annular channels of larger diameter near the outer end of the bearing, so that any surplus oil which may work itself outward along the shaft will be received in these chambers, and will be returned by the ducts P', which connect with these chambers.

The steam-valve Q' is a simple cylinder extending through a corresponding casing and having ports R made entirely through it, to correspond with the number of cylinders in the engine. These ports are so arranged that by continuous rotation of the valve steam is admitted to the cylinders during such portion of the stroke as may be desirable. This valve, when driven by gearing, as shown, revolves at one-half the speed of the crank-shaft, so that when the opening R through it arrives opposite the port Y, leading into the cylinder, steam will pass through the valve and this port, and when the valve has made a half-revolution the port will again stand in line with Y and steam will again enter it. Steam enters the valve-chamber through the pipe or passage X, passing along above the valve, so as to enter the ports whenever they are in line with the cylinder-ports.

It will be obvious that the valve may be made to revolve with any positive relation to the crank-shaft D, the ports being arranged accordingly. The valve is driven by double gear-wheels S, imparting motion from the main shaft to the vertical shaft or spindle T, and this in turn drives the valve-spindle U by means of the gear-wheels shown at V.

The valve is subjected to end-pressure and a longitudinal strain equal to the area of the valve-stem U. This keeps the valve against the junk-ring W, and prevents the escape of steam around the valve-stem U.

Steam enters the valve-chamber through the pipe X' and passes through the valve Q and the ports Y Y into the cylinders alternately. When the pistons H pass out of the cylinders E, the steam escapes into the chambers around the piston-guides G, as shown by the arrows, Fig. 1, escaping thence through the exhaust-opening shown at Z. This exhaust is sufficiently free to allow the steam to escape from the cylinders nearly or quite down to atmospheric pressure, and the small amount of steam remaining and entrapped by the return of the piston is held by the clearance at Z, and serves as a cushion, being also compressed to such a point that when fresh steam is admitted it is ready to act directly upon the piston without any waste or loss.

It will be observed that by separating from the valve the function of exhausting the steam the lap and lead of the valve can be arranged to pleasure; also, that by giving the valve a continuous rotary motion in one direction it will wear to its seat and keep steam-tight. It will be obvious that the valve may be connected to the crank-shaft by any positive acting gearing; but the method shown is preferable by reason of compactness. The possibility of exhausting the steam at the end of the cylinder, and dispensing with the usual details required for that purpose, is in a degree dependent upon the large chamber around the cylinder, into which the steam passes freely. The case being rectangular, the capacity of

this chamber is such that there is no tension or pressure, and the cylinders E are emptied down to atmospheric pressure at each stroke.

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

1. In a single-acting engine, the cylinders open at the lower end, having pistons moving within them, and guides so arranged that the pistons will pass out of the lower ends of the cylinders at each stroke, a space between the cylinders and guides to allow the escape of the steam, and the surrounding case, into which the escaping steam is received, and which forms a jacket for the cylinders, substantially as herein described.

2. In a single-acting engine, an exterior rectangular casing, within which the cranks, pistons, and connections are inclosed, in combination with cylinders and piston-guides arranged with each other and within the casing which forms a jacket for the cylinders, a space being left between the lower ends of the cylinders and the upper ends of the guides, through which the steam exhausts into the jacket or casing upon each downward stroke of the piston, substantially as herein described.

3. In a single-acting engine, the vertically-arranged cylinders and piston-guides having an opening between them and forming an exterior surrounding jacket or space, into which steam is exhausted through this space, in combination with pistons connected with the cranks by links, and made of such a length that they pass entirely out of the cylinders upon each downward stroke and entirely fill the cylinders, and extend into the guides at the completion of the upward stroke, said cylinders having annular grooves or channels for liquid packing, substantially as herein described.

4. In a single-acting engine, two or more open-ended cylinders having pistons moving within them and connected with cranks, so that they pass out of the cylinders into guides at each downward stroke, exhaust-passages between the lower ends of the cylinders and said guides, through which steam exhausts, in combination with the horizontal cylindrical casing extending across the upper ends of the cylinders and connecting therewith by ports through the upper cylinder ends, and a valve rotating within said case and having slots passing diametrically through it in line with the cylinder-ports, whereby steam is only admitted to the cylinders at each semi-revolution of the valve, substantially as herein described.

5. In a single-acting engine, the rectangular containing-case with cylinders and piston-guides arranged coincidently in the upper part, with a space between the lower ends of the cylinders, and the guides for the escape of exhaust-steam, pistons moving within these cylinders, and guides connected with the cranks in the lower part of the case, so that

they pass entirely out of the cylinders at each downward stroke, in combination with the horizontal rotating valve fitted within a cylindrical case and slotted diametrically in line with ports opening into the ends of the cylinders, whereby steam is admitted through the valve into the cylinders and exhausted through the spaces at the lower end of the cylinders only, substantially as herein described.

6. In a single-acting engine having the cylinders and piston-guides arranged in line with a space between them for the escape of exhaust-steam, pistons moving within said cylinders and guides and connected with cranks, so as to pass out of the cylinders at each downward stroke, in combination with the horizontal rotating valve, slotted diametrically, and in line with ports opening into the heads of the cylinders for the admission only of steam to said cylinders, the vertical shaft T, the beveled gear-wheels S and V, crank-shaft, and valve-spindle, substantially as herein described.

7. In a single-acting engine, vertically-placed cylinders receiving steam at the upper end, open at the lower end, and having guides in line therewith, into which the pistons pass out of the cylinders at each downward stroke,

pitmen by which said pistons are connected with the cranks on the crank-shaft, and pins K, by which the upper ends of the pitmen are connected with the pistons, said pins having the upper surfaces inclined, in combination with set-screws K, by which said pins are held in place, substantially as herein described.

8. In a single-acting engine, the vertical cylinders having corresponding cylindrical guides placed in line below them, the pistons fitting said cylinders and guides and connected with cranks, so as to pass entirely out of the cylinders to allow steam to exhaust through spaces between the cylinders and guides at each downward stroke of the pistons, in combination with a cylindrical rotating valve, through which steam is admitted only to the lower ends, whereby sufficient steam is retained in the cylinders to act as a cushion for the pistons upon their return-stroke, substantially as herein described.

In witness whereof I have hereunto set my hand.

JOHN RICHARDS.

Witnesses:

S. H. NOURSE,
H. C LEE.