(No Model.) 2 Sheets—Sheet 1.

C. C. ABBE.

MULTIPLE CYLINDER ENGINE.

No. 396,451. Patented Jan. 22, 1889.

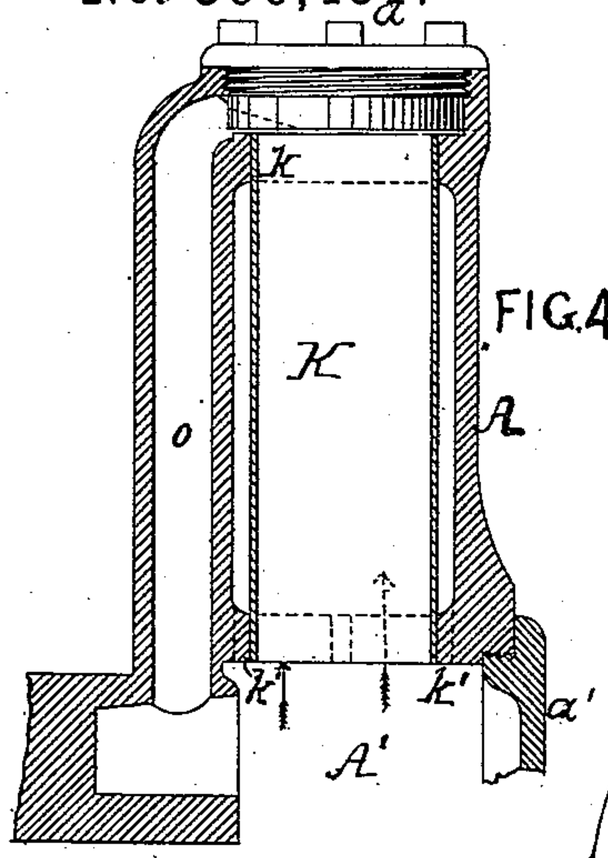


FIG. 4.

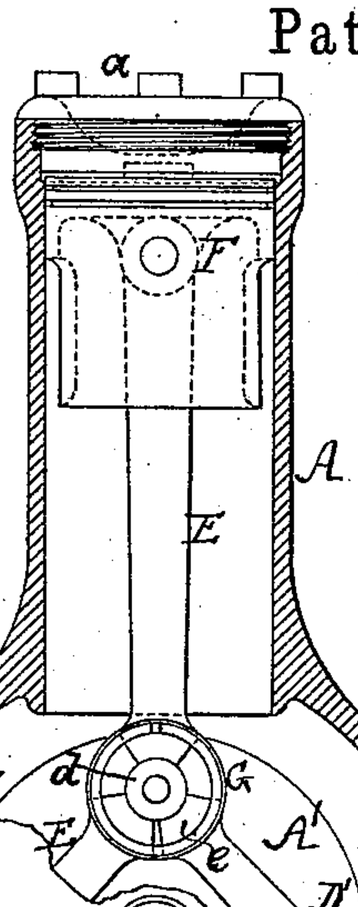


FIG. 1.

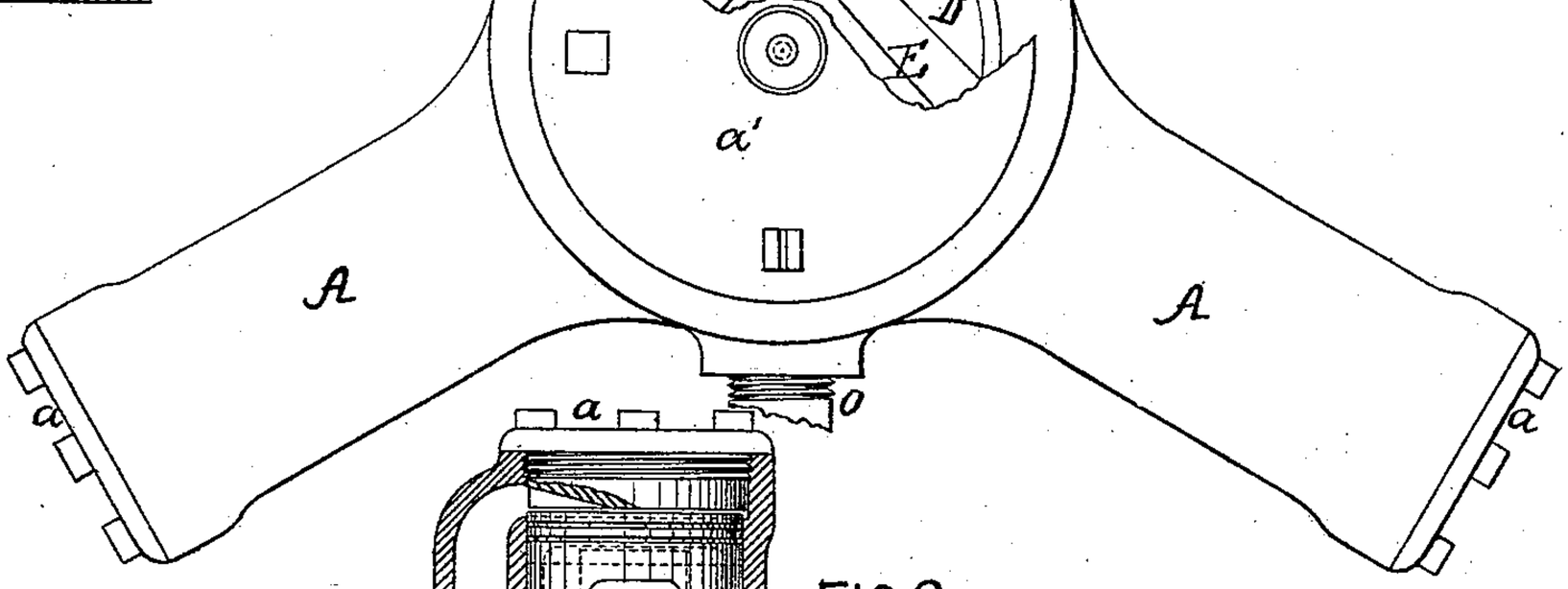
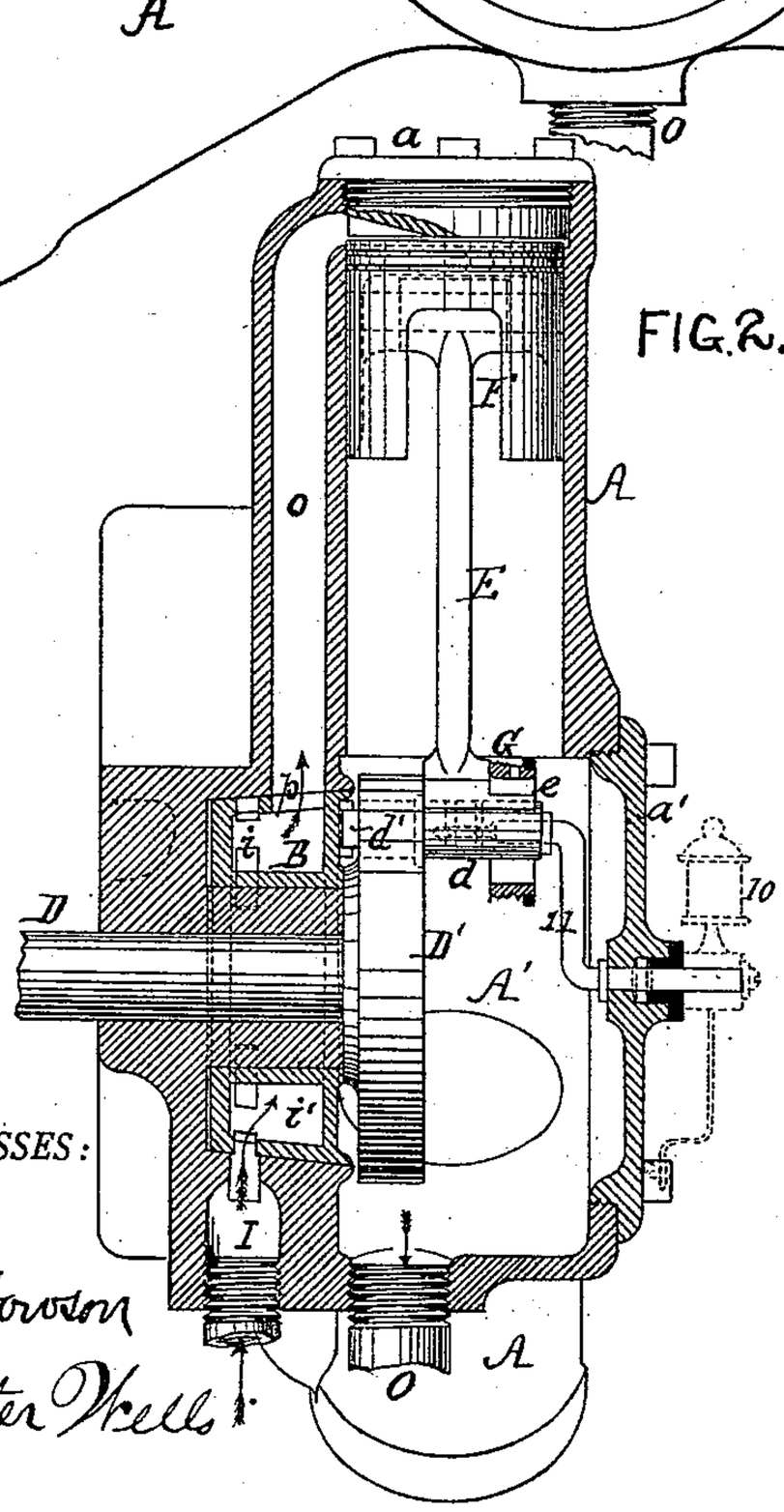


FIG. 2.



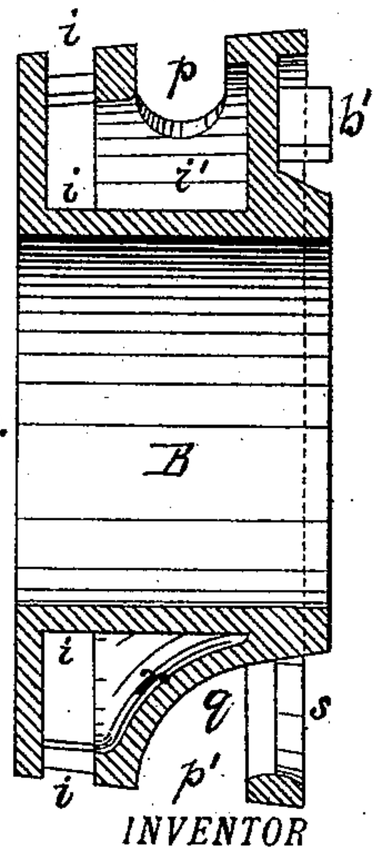


FIG. 3.

INVENTOR

Charles C. Abbe

WITNESSES:

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Wm Chester Wells

(No Model.) 2 Sheets—Sheet 2.

C. C. ABBE.

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FIG. 5.

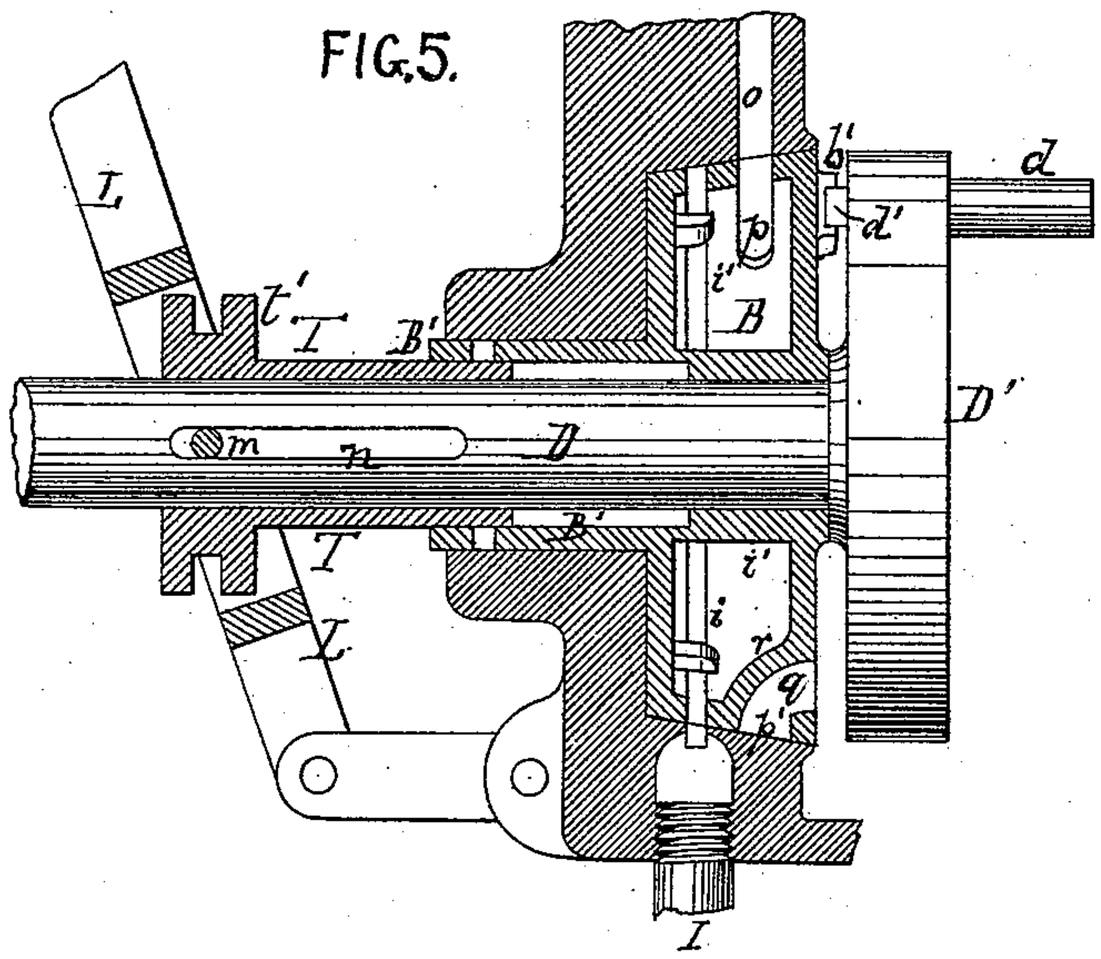


FIG. 7.

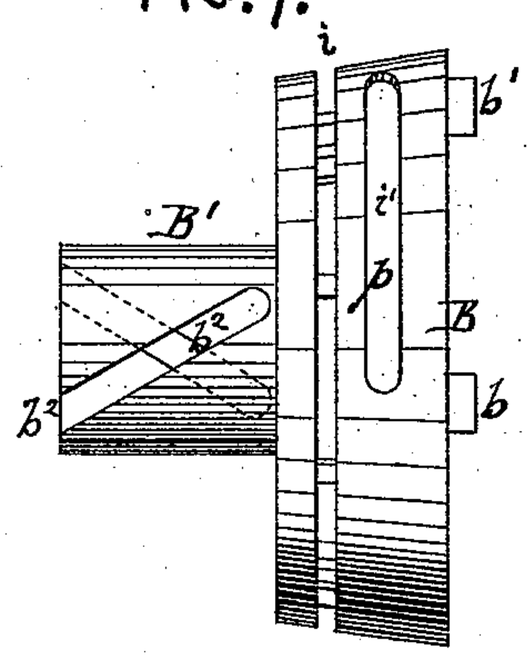


FIG. 9.

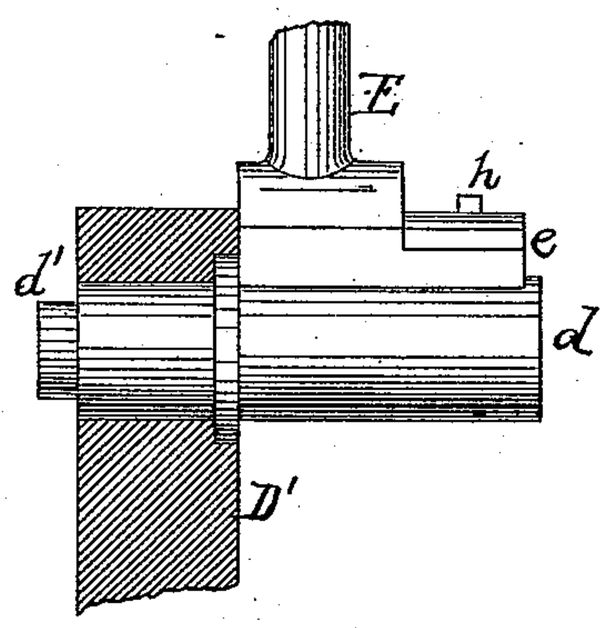


FIG. 6.

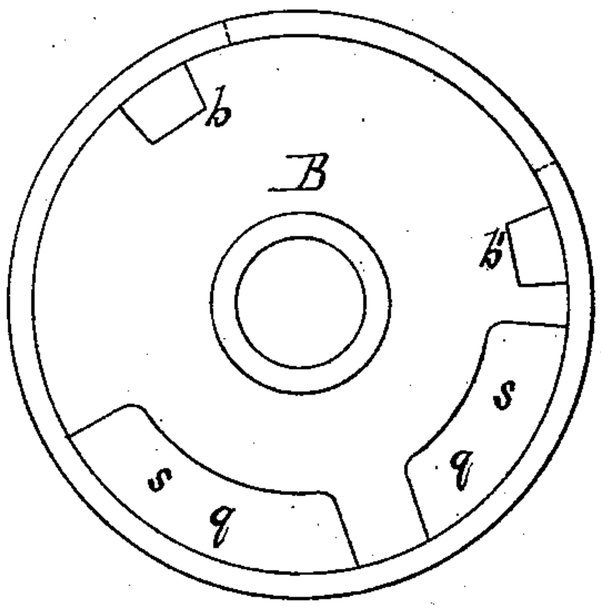


FIG. 10.

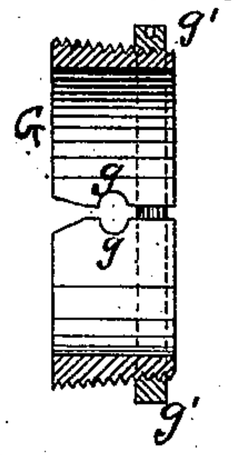
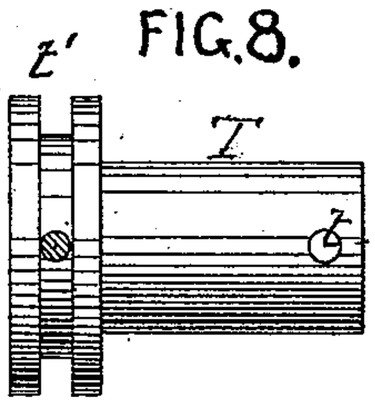


FIG. 8.



WITNESSES:

Hubert Howson

Wm Chester Wells.

INVENTOR,

Charles C. Abbe

UNITED STATES PATENT OFFICE.

CHARLES C. ABBE, OF BROOKLYN, NEW YORK.

MULTIPLE-CYLINDER ENGINE.

SPECIFICATION forming part of Letters Patent No. 396,451, dated January 22, 1889.

Application filed January 24, 1888. Serial No. 261,774. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. ABBE, a citizen of the United States, and a resident of Brooklyn, New York, have invented certain Improvements in Multiple-Cylinder Engines, of which the following is a specification.

My invention relates more particularly to that class of multiple-cylinder engines in which the several piston-rods are connected to a crank, and in which the valve is a rotary valve connected to or operated by a crank-shaft.

My invention consists, mainly, in improvements in the construction of the valve and its combination with the other parts, and in the construction of the devices for reversing the engine, and in the construction of the cylinder, all designed with a view to simplicity and economy of construction and efficiency of operation.

In the accompanying drawings, Figure 1 is a front view, partly in section, of a three-cylinder engine constructed in accordance with my invention. Fig. 2 is a vertical section of the same, one only of the pistons and piston-rods being shown in this view. Fig. 3 is a vertical section of the valve detached and drawn to a larger scale, the section being taken through both the steam and exhaust ports. Fig. 4 is a vertical section through one of the cylinders and showing a further improvement. Fig. 5 is a vertical section of the valve and reversing mechanism of my improved engine. Fig. 6 is a side view of the valve detached. Fig. 7 is an edge view of the valve. Fig. 8 is a detached view of the reversing-sleeve for the valve. Figs. 9 and 10 are views of the means for connecting the piston-rods to the crank-pin.

In the drawings I have shown the engine as a three-cylinder engine as the most convenient for both illustration and use; but it should be understood that my improvements may be applied to engines with two cylinders, or with more than three, if desired.

In Figs. 1, 2, and 3 I have shown my improvements as applied to an engine without reversing mechanism. In Figs. 5, 6, 7, and 8 I have shown how the valve may be provided with means for reversing.

A A A are the cylinders, all open at their inner ends to a common chamber, A′, which I use as an exhaust-chamber, so that the exhaust-steam may serve to some extent to balance the pistons. This exhaust-chamber is closed at the back by the casing containing the valve-seat and valve B and at the front by a cap, *a′*, which is threaded to screw into place. The outer ends of the several cylinders are closed by heads or caps *a*, which are in the form of threaded plugs screwing into the ends of the cylinders.

By forming the cylinders, central exhaust-chamber, valve-chamber, and bearing for the main crank or driving shaft all in one casting, bolts for holding the parts together, as formerly used in such class of engines, are entirely dispensed with, and the construction of the engine thus considerably simplified and made more economical.

D is the crank-shaft, which is adapted to turn in central bearings in the body of the casing, and is provided within the exhaust-chamber A′ with a crank-disk, D′, having a crank-pin, *d*. To this crank-pin are connected the inner ends of the several piston-rods E, which are pivoted at their outer ends to their several pistons F, working in the cylinders A. I prefer to connect these piston-rods E to the crank-pin by the simple means shown in Figs. 1, 2, 9, and 10. The end of each rod is made in the form of a segment, with the inner face concave to fit the periphery of the crank-pin, and each rod has a laterally-projecting foot, *e*, turned on the outside to receive a retaining-ring, G. I use a split ring for this purpose, as shown in Fig. 10, and in the slit I form recesses *g*, which, after the ring has been forced into place over the feet of the piston-rods, receive and embrace a pin, *h*, on one of said feet, whereby the ring is held in place. The outside of the ring is tapered and threaded for the reception of a corresponding threaded confining-ring, G′, by the turning of which the split ring may be tightened to make up for wear. The crank-pin may be provided with any suitable or convenient lubricating devices.

In Fig. 2 I have shown an oil-cup, 10, loose on the end of a bent or cranked tube, 11, the opposite end of which is connected to the crank-pin and leads the oil to suitable openings in said crank-pin.

I arrange the valve B in a suitable seat in

the casing behind the crank-disk, which I employ to confine the valve to its seat. The valve is a rotary valve turning with the crank-shaft, and as a convenient means of connecting the two I adapt an extension, d', of the crank-pin to enter between two lugs, b b', on the face of the valve.

The valve B is in the form of a hollow ring placed around the crank-shaft. In the construction shown in Fig. 1 I have illustrated the bearing of the crank-shaft as extending within the annular valve; but, as will be seen on reference to Fig. 5, the valve may be in contact with the shaft, with which it turns. The bearing-surface of the valve is tapered, and in the drawings it is the outer periphery of the ring which is fitted to the seat, so that the ring presents in its exterior view the form of a truncated cone, as will be understood by reference to Figs. 3 and 6. The seat in the casing being correspondingly tapered or coned, the valve, it will be seen, is a self-fitting one. The annular valve, as I have said, is hollow, and around its periphery is a continuous inlet-opening or series of inlet-openings, i, with which communicates the inlet-pipe I, so that the steam has access to the interior of the valve at all times. In the periphery of the valve are two other ports, p and p', in line with each other. The former of these ports, p, makes the communication between the interior steam-passage, i', of the valve and the passages o, leading to the ends of the cylinders, while the port p' makes the communication between the exhaust-passage q in the valve and the said passages o, leading from the ends of the cylinders. This exhaust-passage q is separated from the steam-passage in the valve by a diaphragm, r, and communicates at all times with the central exhaust-chamber, A′, through the opening or openings s in the side of the valve, Figs. 3 and 7.

O is the outlet or exhaust pipe from the chamber A′.

From the above description it will be seen that the valve is not only self-fitting, but is perfectly balanced at all times.

In engines of this class as usually constructed the valve, if a rotary one, has been placed in front of the main crank, so that an extension or auxiliary crank-shaft with bearings has had to be provided in front of the main crank. By mounting the valve around the main shaft behind the main crank, as above described, I am enabled to avoid the use of this extension or auxiliary crank-shaft and bearings, and at the same time I make the crank and interior of the engine more accessible.

The engine as above described is in its simplest form, in which reversing devices are unnecessary. In Figs. 5, 6, 7, and 8 I have shown the valve as provided with reversing mechanism. In this case the valve itself is substantially the same in construction as that shown in Figs. 2 and 3, except that it comes down close to or in contact with the shaft and is provided with a tubular extension or sleeve, B′, having inclined or spiral slots b^2, to which are adapted pins t on a sliding sleeve, T. This sleeve is connected to the shaft D by a feather or pin, m, adapted to a groove, n, in the shaft, so that the sleeve must turn with the shaft, but is free to be moved longitudinally thereon. As a means of so moving the said sleeve T on the shaft, the sleeve may be under the control of a pivoted lever, L, having a pin or pins adapted to a groove in a collar, t', on the sleeve. The lugs b and b' on the face of the valve in this case, instead of closely embracing the pin d' on the crank-disk, are placed at a distance apart a little greater than the length of the steam-port p, Fig. 6. To reverse the engine, the sleeve T is moved inward or outward, as the case may be, to throw the pin d' from contact with one lug into contact with the other, as will be readily understood.

In some circumstances—as where the engine is to be used to drive a fan or blower mounted on the shaft of the engine, for instance—it may be desirable, in order to avoid possible condensation of steam in the cylinder, to put a steam-jacket around it. As a convenient way of doing this, I cast the interiors of the cylinders larger than the diameters of their pistons and drive into the cylinders tubes K, Fig. 4, each of which at its outer end fits the contracted part k of the outer cylinder and at its inner end fits lugs k', so that exhaust-steam from the central chamber, A′, has access at all times to the space around the tube K, in which the piston works.

Although I have described my improved engine as a steam-engine, it may be operated by other motive fluids without material alteration; or it may be used as a meter by combining indicating devices with the crank-shaft, or as a pump by applying power to the said shaft, as will be readily understood.

I claim as my invention—

1. A multiple-cylinder engine having the cylinders and shaft-bearing formed in one piece and the crank, valve, and cylinder-chambers open to each other.

2. A multiple-cylinder engine having a driving-shaft provided with a crank and a valve around the shaft and between the crank and the power-transmitting end of the shaft.

3. A multiple-cylinder engine having a shaft with a single crank, and a valve around the shaft and between the crank and the bearing of the shaft.

4. A multiple-cylinder engine having a balanced valve surrounding the driving-shaft and provided with an annular distributing-chamber communicating with the cylinders.

5. A multiple-cylinder engine having a shaft provided with a single crank, and a valve seated in a casing around the shaft and between the crank and the power-transmitting end of the shaft.

6. A multiple-cylinder engine having a hollow valve seated in a valve-chamber around the driving-shaft and behind a single crank and held to its seat by the crank.

7. A multiple-cylinder engine having a valve behind the crank and supported upon a hub which forms the bearing for the crank-shaft.

8. A multiple-cylinder engine having a crank-shaft, and a valve in the form of a hollow ring around the shaft and behind a single crank, the outer periphery of the valve being tapered and adapted to a corresponding seat in the casing.

9. The combination of a crank, pistons, and piston-rods having feet adapted to a crank-pin with a tapering threaded split ring and a corresponding threaded confining-ring.

10. The combination of a crank, pistons, and piston-rods having feet adapted to a crank-pin, and one of said feet having a pin adapted to a split ring provided with a recess for said pin, and a confining-ring for the split ring.

11. A multiple-cylinder engine having a valve with an inlet-port, *i*, around its periphery opening into an annular chamber within the valve, a port, *p*, in the periphery opening from the annular chamber, and an exhaust-port, *p'*, also in the periphery in same plane with port *p*, and a diaphragm separating the steam from the exhaust-space.

12. A multiple-cylinder engine having an annular chamber with cylinder-casings radiating from same and adapted to support within the casings the cylinder-tubes proper, which are held in position at the outer ends by close frictional contact and at the inner ends by projecting lugs, whereby exhaust-steam from the crank-chamber is permitted to circulate around the cylinders.

In testimony whereof I have hereunto set my hand.

CHARLES C. ABBE.

Witnesses:
HUBERT HOWSON,
WM. CHESTER WELLS.