(No Model.) 2 Sheets—Sheet 1.

S. MALTBY.

FLUID PRESSURE ENGINE.

No. 301,378. Patented July 1, 1884.

Fig. 1.

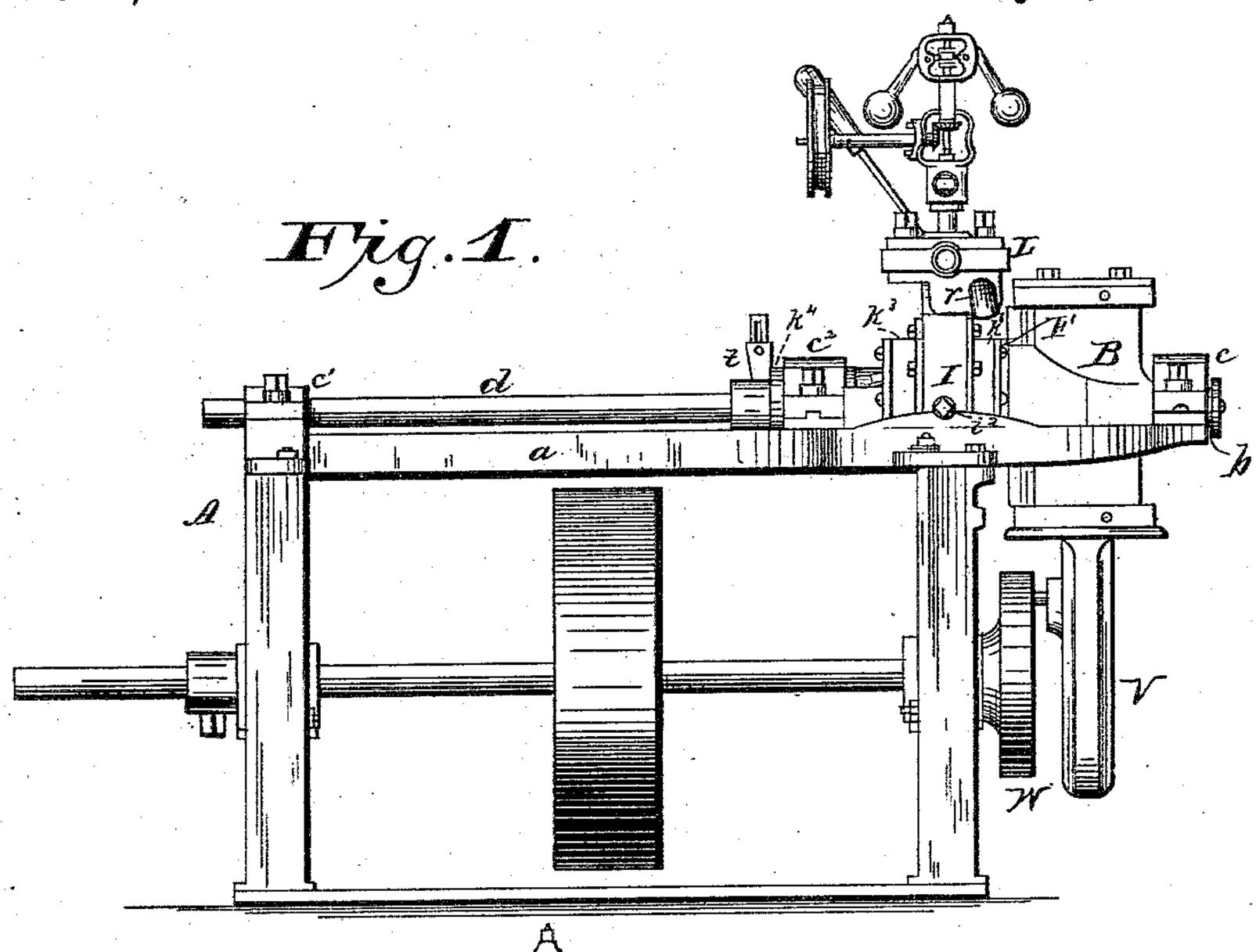
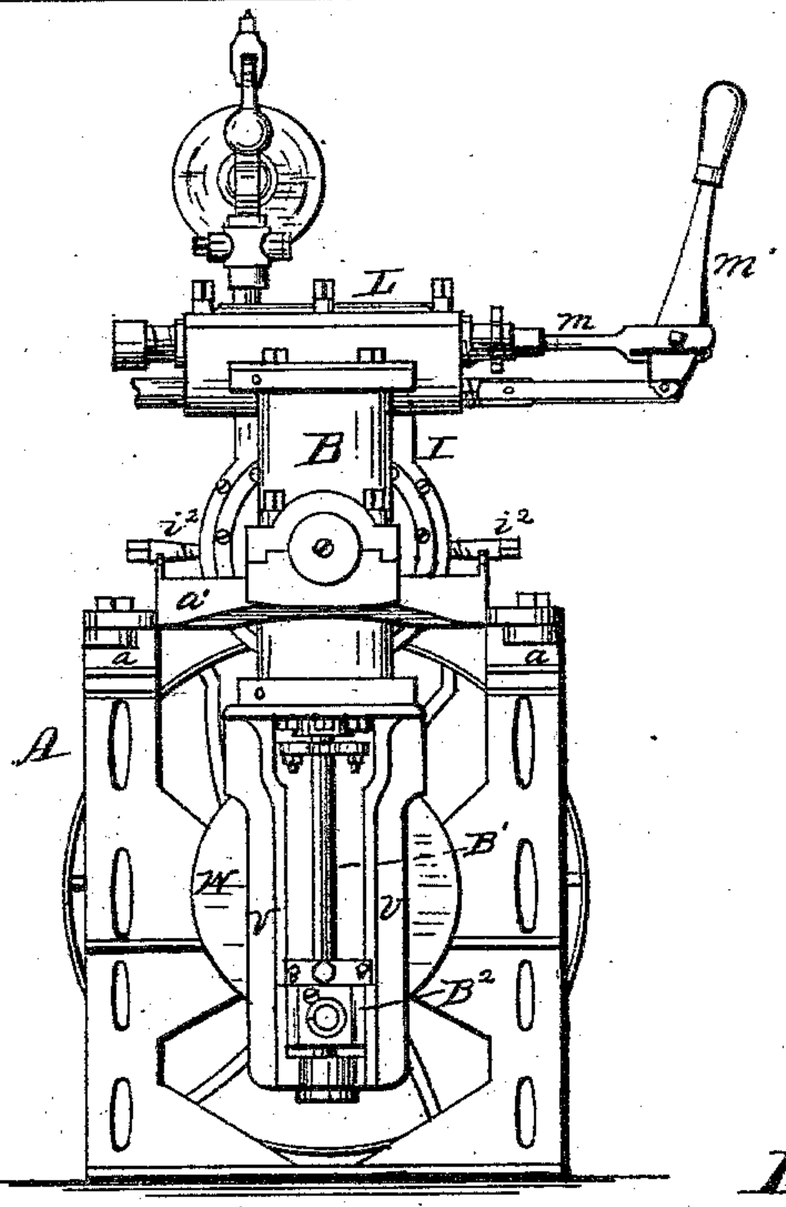


Fig. 2.



Witnesses:
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Inventor:
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by W. B. Hale,
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

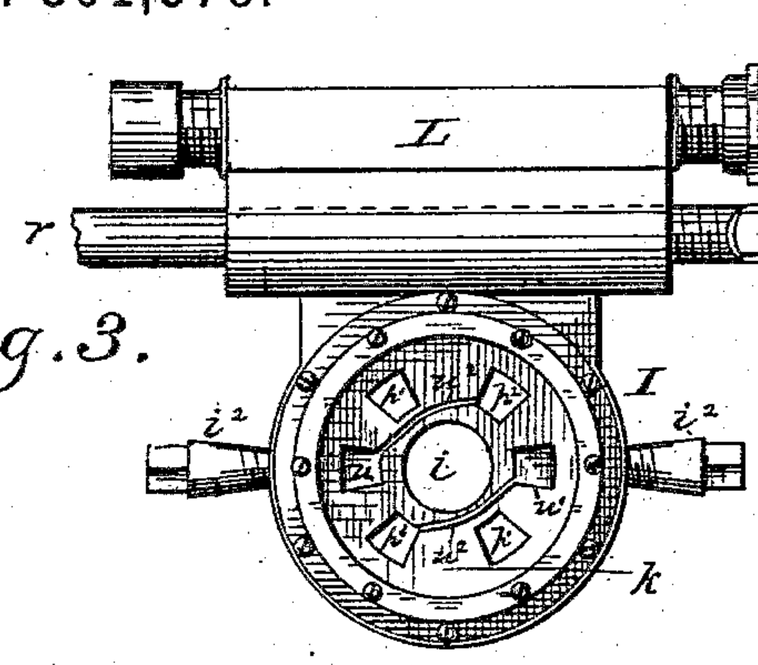


Fig. 4.

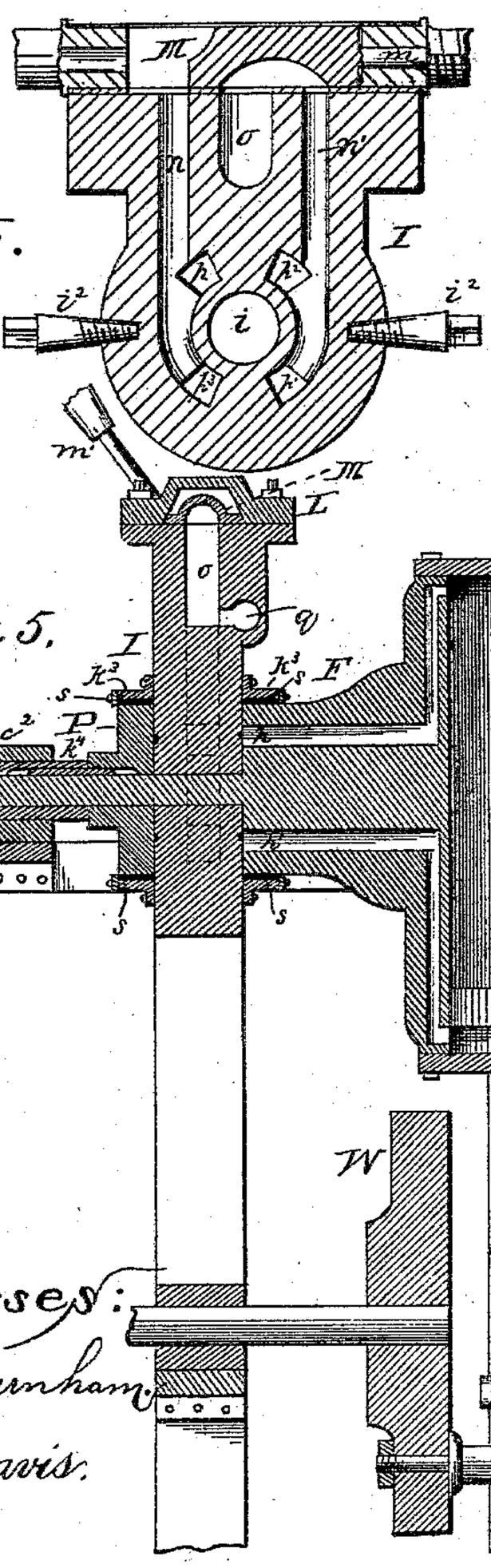
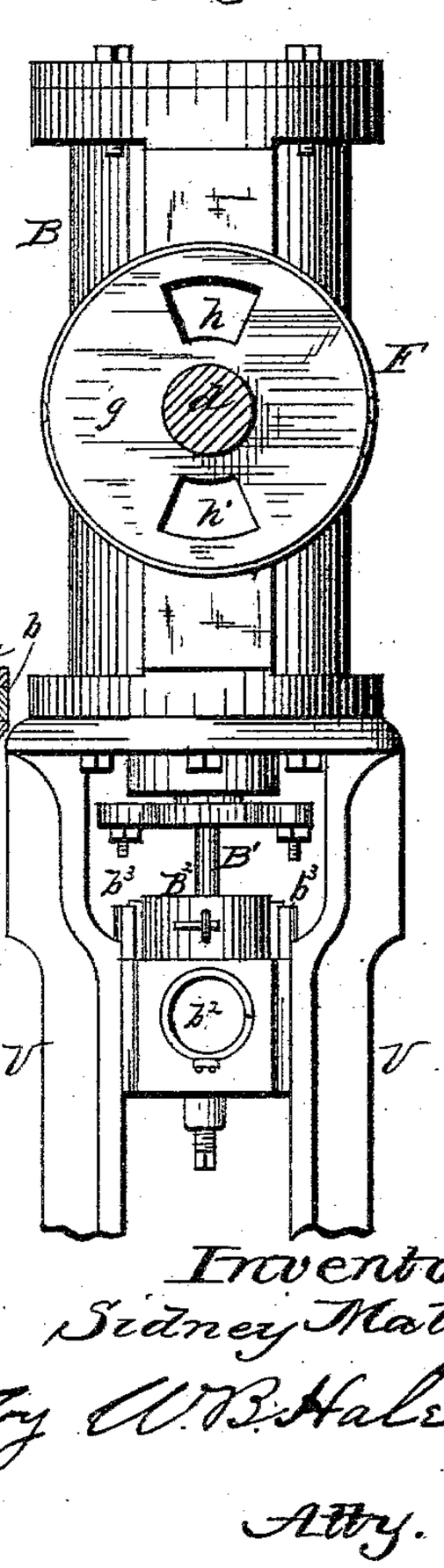


Fig. 5.

Fig. 6.



Witnesses:
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H. Y. Davis.

Inventor:
Sidney Maltby.
by W. B. Hale,
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UNITED STATES PATENT OFFICE.

SIDNEY MALTBY, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF TWO-THIRDS TO EDWARD L. LAMBIE AND SAMUEL R. BOND, BOTH OF SAME PLACE.

FLUID-PRESSURE ENGINE.

SPECIFICATION forming part of Letters Patent No. 301,378, dated July 1, 1884.

Application filed April 28, 1883. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY MALTBY, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Valves for Fluid-Pressure Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to means for conducting the impelling medium to and from the cylinders of engines driven by steam, air, gas, or other fluid pressure.

The objects of my invention are to prevent excessive friction between the parts concerned in directly opening and closing the fluid-passages, to facilitate the reversing of fluid-pressure engines and simplify the reversing devices, and to relieve the pistons and piston-rods of oscillating and revolving engines of lateral strain.

The invention will be fully understood from the following particular description in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of an oscillating steam-engine provided with my improvements. Fig. 2 is an end view thereof. Fig. 3 is a detail view illustrating the main valve. Fig. 4 is a section on the line *x x* of Figs. 1 and 5. Fig. 5 is a section through a portion of the engine on line *y y* of Fig. 2. Fig. 6 is a view of the cylinder detached, with a portion of its cross-head guides, the trunnion-shaft being shown in section.

Referring to Figs. 1 and 2, the letter A designates the supporting-frame, between the top bars, *a a*, of which the cylinder B is mounted, being supported on one side by a trunnion, *b*, which turns in a bearing, *c*, carried by one of the end bars, *a'*, of the supporting-frame, and on the other side by a trunnion-shaft, *d*, which has one bearing, *c'*, supported by the other end bar, a^2, and an intermediate bearing, c^2, upon a cross-bar, *e*. From about the middle of the cylinder B, on one side, projects a boss, F, from the center of which projects the trunnion-shaft *d*. This boss has an outer flat and smoothly-planed face, *g*, through which are cut passages *h* and *h'*, connecting inwardly, respectively, with passages which lead through the cylinder-shell, in the usual manner, to opposite ends of the cylinder. The face *g* of the boss F works against a seat, *k*, formed to receive it on one side of a stationary valve, I, which is supported between the side bars of the frame by pins i^2 i^2, and carries at its top a steam-chest, L, in which is arranged a combined reversing and throttle valve, M, which with its operation will presently be particularly described.

Through the valve I is formed a central passage, *i*, through which passes the trunnion-shaft *d*, and on opposite sides of this passage *i* steam passages or ports *p p'* and p^2 p^3 are arranged in pairs. These ports are cut through the valve and connect its opposite faces, which are precisely alike, and will be more particularly described hereinafter. The port *p* of one pair is about thirty degrees to one side (the left as we look at it in Fig. 6) of the vertical diameter of the shaft-passage, and the port *p'* of the same pair is diametrically opposite the port *p*. The ports p^2 and p^3 of the other pair are diametrically opposite each other, and on opposite sides of the vertical diameter from the other ports, respectively.

From one side of the steam-chest L a steam-passage, *n*, leads down through the valve I, and connects with the two ports *p* and p^3, and from the opposite end of said steam-chest leads a similar passage, *n'*, which connects with the ports p^2 and *p'*.

Between the passages *n* and *n'* an exhaust-passage, *o*, leads from the steam-chest partially through the valve I, and then extends laterally to connect with a passage, *q*, which connects with an exhaust-pipe, *r*, which may lead off to any desired point. The passages *n*, *n'*, and *o* at their upper ends open into the steam-chest L, through a seat formed upon the top of the stationary valve I, and upon this seat is arranged the sliding reversing-valve M, which is connected to an outwardly-extending stem, *m*, the outer end of which is connected to a hand-lever, *m'*. By operating this lever the valve M may be shifted to connect either of the passages *n* or *n'* with the exhaust-passage

o, or to cover both the passages *n n'*. If the engine should be in motion with the passage *n* connected with the passage *o*, the supply of steam for driving the engine should be through the passage *n'*, and if the valve should be shifted to leave open the passage *n*, and connect passage *n'* with passage *o*, the motion would be reversed. If the valve should be shifted to close both passages *n* and *n'*, the supply of steam would be cut off and the engine stopped, and by partially closing both supply-passages the movement of the engine would be "slowed up," in accordance with the area of passage-way left open. It will be seen, then, that the valve M serves as both a reversing and throttle valve.

Returning, now, to the main valve I, it will be remembered that this valve has two opposite seat-faces precisely alike. Each face is surrounded by a circular outwardly-projecting flange or rim, k^3. Against one of the faces *k* works the flat face *g* of the boss, and against the outer face works the flat face of a flange, P, which is feathered upon the shaft *d*, as shown clearly in Fig. 5. This flange abuts outwardly against a sleeve, k^4, upon the shaft *d*, and may, by means of a key, *t*, be adjusted to bear with greater or less force upon the face of the valve, as desired. The sleeve k^4 is a movable bushing or bearing movable in the stationary bearing or box c^2. The flange P and boss F are surrounded by packing, as shown at *s s*, within the rims k^3 and said packing. The peculiar advantage of this valve I will now be explained. It will be understood that when steam passes to the cylinder through one of the passages *n* or *n'* and its connected supply-ports *p* p^3 or p^2 *p'* it exerts the same pressure upon the flange P that it does on the boss F, as the ports of the valve are open at both ends, and therefore there is never any steam-load to force the valve or its seats in excessive frictional contact with each other.

In ordinary engines, as is well known, the greater the steam-pressure the greater is the load which the main valve carries and the greater the wear between it and its seat. While in my improvement the valve carries no steam-load, however great may be the pressure, the more is the valve relieved of friction from the faces which work against it, for the steam-pressure tends to force these faces apart and away from the valve rather than to bind them upon it. The changing of the steam from end to end of the cylinder by the arrangement of the stationary valve-ports with relation to the passages *h* and *h'* of the oscillating boss on the cylinders will be readily understood. Supposing, for instance, that the engine were to be in motion, steam would be supplied through the passage *n* and the port *p* or p^3, and exhausted through the diametrically-opposite ports, the turning of the cylinder on its bearings bringing the ports of the boss in coincidence with two diametrically-opposite ports on different lines alternately. It will be understood that when steam alternately enters the opposite ends of the cylinder and drives the piston the action of the piston-rod and fly-wheel causes the cylinder to oscillate in the usual manner for changing the ports.

It will be observed that both the ports which at any time supply the cylinder are on the same side of the shaft *d* and to one side of a center line of the friction-faces, and that therefore, unless provision were made to prevent it, there would be an uneven distribution of pressure on the faces between which the valve I is situated, and consequently a tendency to uneven wear. To prevent such a difficulty I provide upon opposite sides of each face of the valve two cavities, *u* and *u'*, which may be called "blind ports," and each of these cavities I connect by a groove, as at u^2, with a through-port on the opposite side of the same face. It will now be seen that, for instance, if the right-hand through-ports in Fig. 3 are supplying steam to the cylinder, they also supply steam to the cavities *u* on the opposite side of the valve, and the steam-pressure will thus be balanced on the boss and the flange P. If the valve M were reversed, the equalizing-pressure would come from the left-hand through-ports.

The letter B' indicates the piston-rod of the piston within the cylinder, and B^2 is a cross-head fixed to the end of said rod, and provided with a bearing, b^2, to receive the wrist-pin of the fly-wheel W. The opposite edges of the cross-head are provided with double-faced gibs b^3 b^3, which play in grooves formed in the inner edges of two guide-arms, V, which are firmly secured to the cylinder-head, and preferably connected at their outer ends, as shown in Fig. 2. It will be seen that by means of these guide-arms the piston-rod is held to a true rectilineal movement, and I thus obviate all lateral strain, which is so deleterious in oscillating and revolving engines as heretofore constructed, as such steam not only tends to bend the piston-rod, but also to loosen the stuffing-box and packing, and to cause the piston to wear excessively upon two opposite sides of the cylinder.

It will be understood that the valve I need not be stationary, but may either oscillate or revolve. If the cylinder were stationary, then the valve would be connected with suitable gear to change its position so as to cause the steam-supply to go to opposite ends of the cylinder, and to change the exhaust accordingly.

It will also be understood that the steam-supply passages and the exhaust-passage of the valve might be extended to any desired distance by means of pipes, and terminate in a steam-chest or valve-casing containing the combined reversing and throttle valve; and the passages from two or more valves might terminate in the same chest or casing and be controlled by the same combined reversing and throttle valve.

What I claim is—

1. In a fluid-pressure engine, a main valve provided with through-ports and working between two bearing-faces, upon which the steam entering said ports acts with equal pressure, substantially as described, and for the purpose set forth.

2. In a fluid-pressure engine, the combination, with a friction or bearing face having ports leading therefrom to opposite ends of a cylinder, of a main valve having two opposite friction-faces and through-ports connecting the same, one of said faces being in frictional contact with the face from which ports lead to the cylinder, and the other in frictional contact with a blind bearing-face, substantially as described.

3. The combination, with the cylinder having the boss provided with a friction-face, from which ports lead to the opposite end of the cylinder, of the valve having through-ports and two opposite frictional faces, one of which is in contact with the face of the boss, and a blind or blank face in frictional contact with the other face of said valve, substantially as described.

4. The combination, with two supply-passages, each connected with two ports arranged for alternate connection with the opposite ends of a cylinder, and an intermediate exhaust-passage, of an adjustable reversing and throttle valve, arranged to connect either of the supply-passages with the exhaust-passage, or to close both of the supply-passages, substantially as described.

5. The valve I, having friction-faces on opposite sides and provided with the steam-passages and through-ports, as described, and also the cavities or blind ports connected with through-ports on opposite sides of the valve-center, in combination with friction or bearing faces arranged in contact with the faces of the valve, one of said bearing-faces being provided with ports, as described, for co-operation with the valve-ports.

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

SIDNEY MALTBY.

Witnesses:
J. M. YZNAGA,
W. B. HALE.