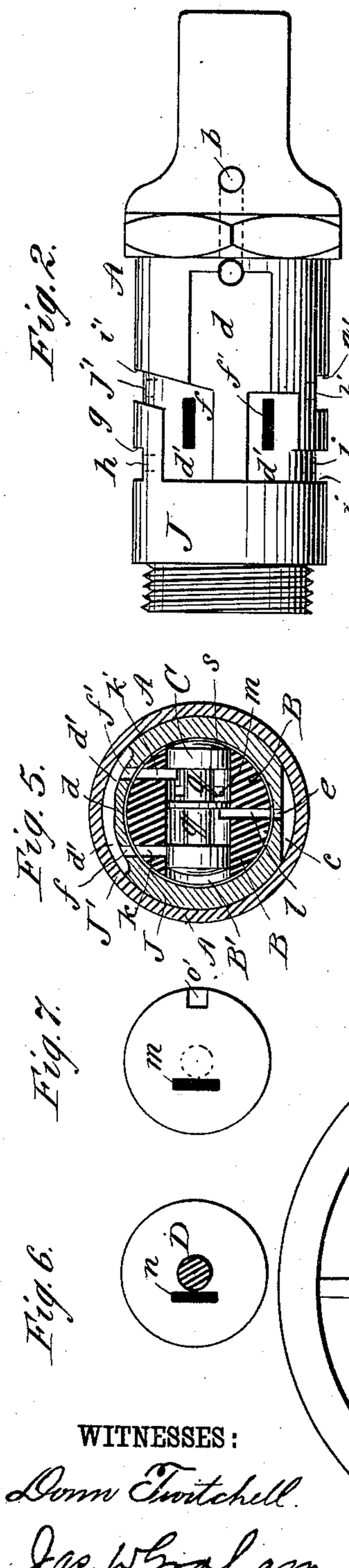
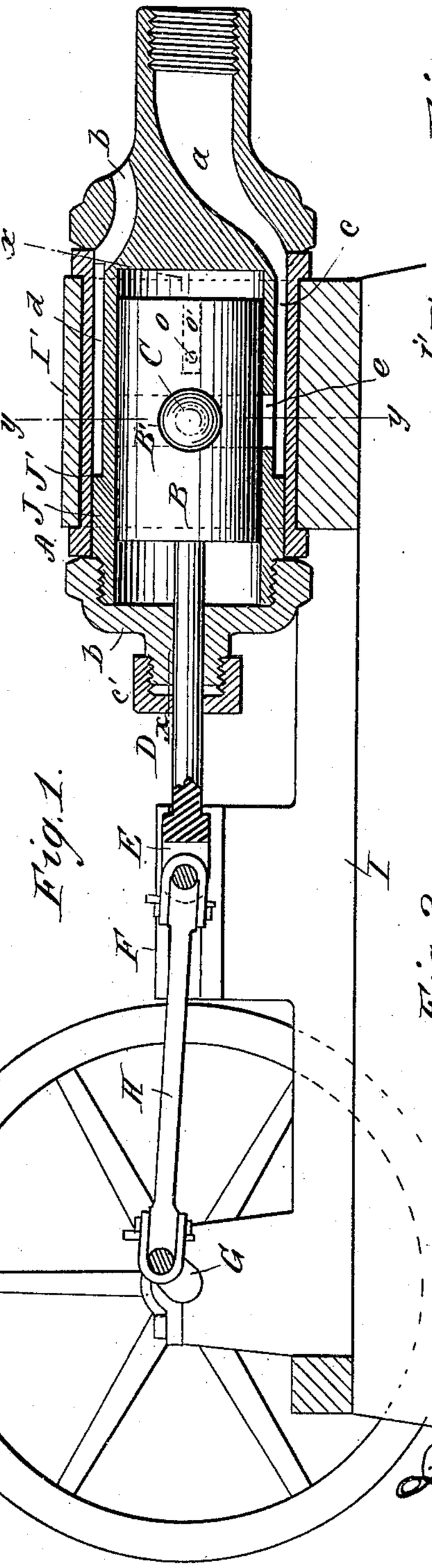
(No Model.)

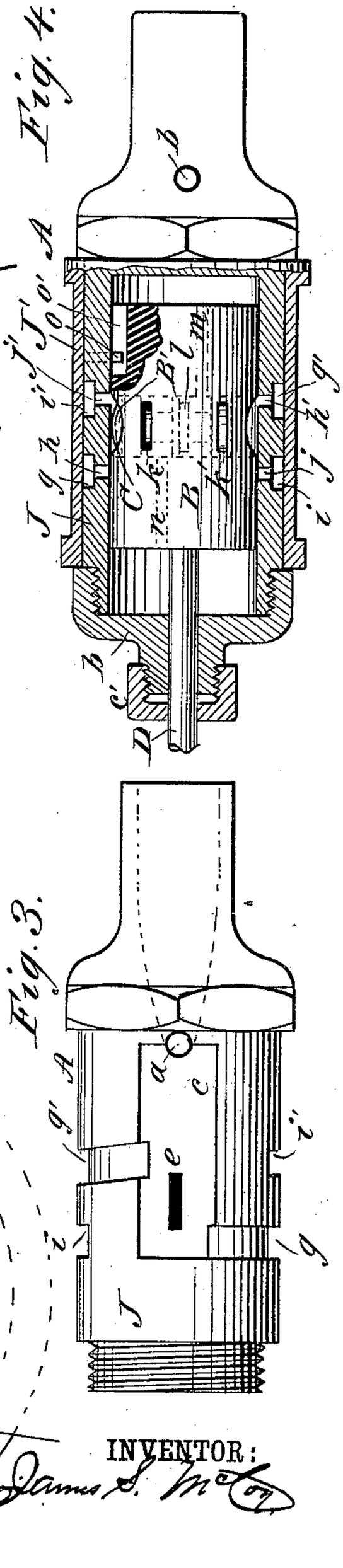
J. S. McCOY.

STEAM ENGINE.

No. 343,385. Patented June 8, 1886.







WITNESSES:

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JAMES S. McCOY, OF BROOKLYN, NEW YORK.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 343,385, dated June 8, 1836.

Application filed October 8, 1885. Serial No. 179,279. (No model.)

To all whom it may concern:

Be it known that I, JAMES S. McCOY, of Brooklyn, in the county of Kings and State of New York, have invented a new and Improved Steam-Engine, of which the following is a full, clear, and exact description.

My invention relates to a steam-engine wherein the slide-valve is carried by and within the piston; and the invention consists, principally, of a steam-engine wherein a steam-space is formed around the piston in the cylinder, so that the piston is rendered almost entirely frictionless in the cylinder by a surrounding packing or cushion of steam.

The invention also consists of the arrangement and relative size of the steam inlet and exhaust ports with the space surrounding the piston, whereby proper retention of steam is effected for filling the space around the piston, so as to prevent contact of the piston with the cylinder, and also to prevent excessive upward pressure of steam on the piston, to avoid friction of the piston with the cylinder opposite the induction-port.

The invention further consists in forming the steam-inlet port to the cylinder immediately below the piston, whereby the pressure of steam entering the port will counteract the weight of the piston and tend to lift it out of frictional contact with the inner lower wall of the cylinder.

The invention finally consists of the piston carrying the slide-valve and attached rigidly to the piston-rod, and working in a cylinder having suitable steam inlet and exhaust ports, combined with a crank-shaft and connecting-rod connecting the shaft with the piston-rod.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional elevation of my new and improved steam-engine. Figs. 2 and 3 are reverse views of the cylinder, the outer casing being removed. Fig. 4 is a sectional plan view on the line *x x* of Fig. 1. Fig. 5 is a transverse sectional elevation of the cylinder and piston, taken on the line *y y* of Fig. 1; and Figs. 6 and 7 are reverse views of the opposite ends of the piston.

A represents the cylinder; B, the piston, and C the valve, placed in a transverse chamber, B′, made through the piston B. The piston B is attached rigidly to the piston-rod D, which passes through the cylinder-cap *b* and stuffing-box *c′*, and is connected to the cross-head E, which runs in ways F, and is connected with the crank-shaft G by the connecting-rod H.

The cylinder A is mounted on a support, I, and held firmly thereto by the cap I′, and is composed of the shell J and tube or outer casing, J′, that surrounds the shell J, as shown clearly in Figs. 1, 4, and 5.

The shell J is formed with the main steam-inlet port *a* and exhaust-passage *b*, and it is faced off at *c*, as shown in Figs. 3 and 5, and also at *d d′ d′* on the opposite side, as shown in Figs. 2 and 5.

In the flat surface *c* is formed the port *e*, and the steam-inlet port *a* opens into the flat surface *c*. The exhaust-passage *b* is the same size as the inlet-port *a*, and opens out of the flat surface *d*, and in the flat surfaces *d′ d′* are formed through the shell J the steam-passages *f f′*. From the flat surface *c* the casing J is grooved, as shown at *g*, and again on the opposite side at *g′*. The groove *g* leads to a port, *h*, made in the shell J, while the groove *g′* on the opposite side leads to the port *h′*. From the flat surfaces *d′ d′* the shell J is grooved, as shown at *i i′*. The groove *i* leads to the port *j*, while the groove *i′* leads to the port *j′*, both ports shown in full lines in Fig. 4, and in dotted lines in Fig. 2.

The piston B is made of considerable length, and is of smaller diameter than the interior of the shell J, so as to leave an appreciable space, *s*, between the outer surface of the piston and the inner wall of the shell, as shown in Fig. 5, so that when steam enters the shell J it will envelop the piston B, occupying space *s*, and completely cushion the piston all about with steam, so that there is practically no friction of the piston with the steam-chest.

The valve C is of a length nearly equal to the diameter of the piston B, and the latter has the passages *k k′* formed in it, which reach through to the chamber B′ in the piston that contains the valve C, and these openings coincide with or stand in the same plane with the ports *f f′* of the shell J, Figs. 2 and 5, and the piston also has the passage *l* formed in it. (Shown in dotted lines in Fig. 4, and in full

lines in Fig. 5.) The passage *l* also reaches through to the valve-chamber B′, and it coincides with or stands in the same plane with the steam-inlet port *e*, made in the shell J. The piston B also has the longitudinal passages *m n* formed in it, which reach, respectively, from the valve-chamber B′ to the opposite ends of the piston, as shown in dotted lines in Fig. 4, and in full lines in Figs. 6 and 7, and the piston is kept from turning axially in the shell J by the pin or rib *o* in the shell entering the slot *o′* made in the piston. The valve C is circumferentially grooved at *q q*, so that the valve in its reciprocation in the valve-chamber B′, caused by steam-pressure entering the ports *h h′*, alternately opens and closes the steam ports or passages in the piston B.

In horizontal engines the shell J will be set with the main steam-inlet port *e* immediately below the piston B, as shown in Fig. 1, so that the pressure of steam entering the engine will impinge upon and lift the piston in the cylinder, and thus overcome the friction which would otherwise be due to the weight of the piston resting and moving upon the inner lower surface of the cylinder. This lifting of the piston by steam-pressure also prevents uneven wear of the piston B.

The operation of the engine is as follows: The piston B being in its rearward position, steam admitted to the port *a* enters the passage formed by the flat surface *c*, and passes through the passage *e*, lifts and surrounds the piston, and passes through groove *g′* and port *h′*, moving valve C to close passage *k′* and connect passages *e*, *l*, and *m*, thus admitting steam back of the piston B, and at the same time opening or connecting passages *k*, *f*, and *n*, to allow exhaust from in front of the piston to and through the space formed by the flat surfaces *d d′* and the passage *b*. Then the steam entering through the groove *g* and passage *h* moves valve C to close passage *k*, and to connect passages *e l n* to admit steam in front of the piston, and also to connect passages *m k′ f′* to open the exhaust from back of the piston, and so on alternately causing the piston B to have a reciprocating motion, causing it to transmit rotary motion to the crank-shaft G. Exhaust from the valve-chamber B′ is permitted through the grooves and ports *i j* and *i′* and *j′* to the main exhaust *d′ d b*, so there will be no back-pressure to impede the movement of the valve, and the exhaust-port *b* being of the same size as the steam-inlet port *a*, the steam will be confined in the space *s* sufficiently to support the piston and prevent friction, and the retarded exhaust, consequent upon the comparatively small exhaust-port *b*, causes the steam above the piston in the space *s* to counteract the upward pressure of the steam on the piston and prevent it from being lifted into contact with the cylinder.

Instead of using steam, compressed air or other gas may be used for operating the engine.

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

1. The piston B, formed with steam-passages, as described, and carrying a transversely-arranged slide-valve, C, and made of smaller diameter than the interior of the steam-chest A, to form the space *s* around the piston, in combination with the cylinder having steam inlet and exhaust ports formed at or near the center of the piston-stroke, whereby the piston is surrounded and cushioned with steam, substantially as and for the purposes set forth.

2. In an engine, the exhaust-port *b*, Fig. 2, made of the same size as induction-port *a*, Fig. 3, in combination with said induction-port *a*, and the several eduction ports and channels, as described, for the purpose of properly filling space *s* with steam, so as to prevent contact between the piston and cylinder.

3. In an engine, the combination of the eduction-ports *i i′ f f′ b* and eduction-channels *d d′ d′*, Fig. 2, in cylinder A, of such size and position in relation to induction-ports *a e g g′* in cylinder A as to detain the exhaust-steam, so as to counteract the upward pressure of the steam on the piston sufficiently to prevent frictional contact of the piston and cylinder at the opposite side from the induction-port *e*.

4. The piston B, made smaller in diameter than the cylinder-bore to form the surrounding space *s*, and provided with slide-valve C, and formed with ports controlled by the valve C, to admit steam to and exhaust it from both ends of the cylinder, in combination with the cylinder having medial exhaust-ports and the medial bottom steam-inlet port, *e*, whereby the pressure of steam entering the port *e* will lift the piston in space *s* and prevent friction, substantially as described.

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Witnesses:
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C. SEDGWICK.