No. 815,828. PATENTED MAR. 20, 1906.

D. J. HOISINGTON.

STEAM ENGINE VALVE.

APPLICATION FILED AUG. 11, 1905.

3 SHEETS—SHEET 1.

FIG. 1.

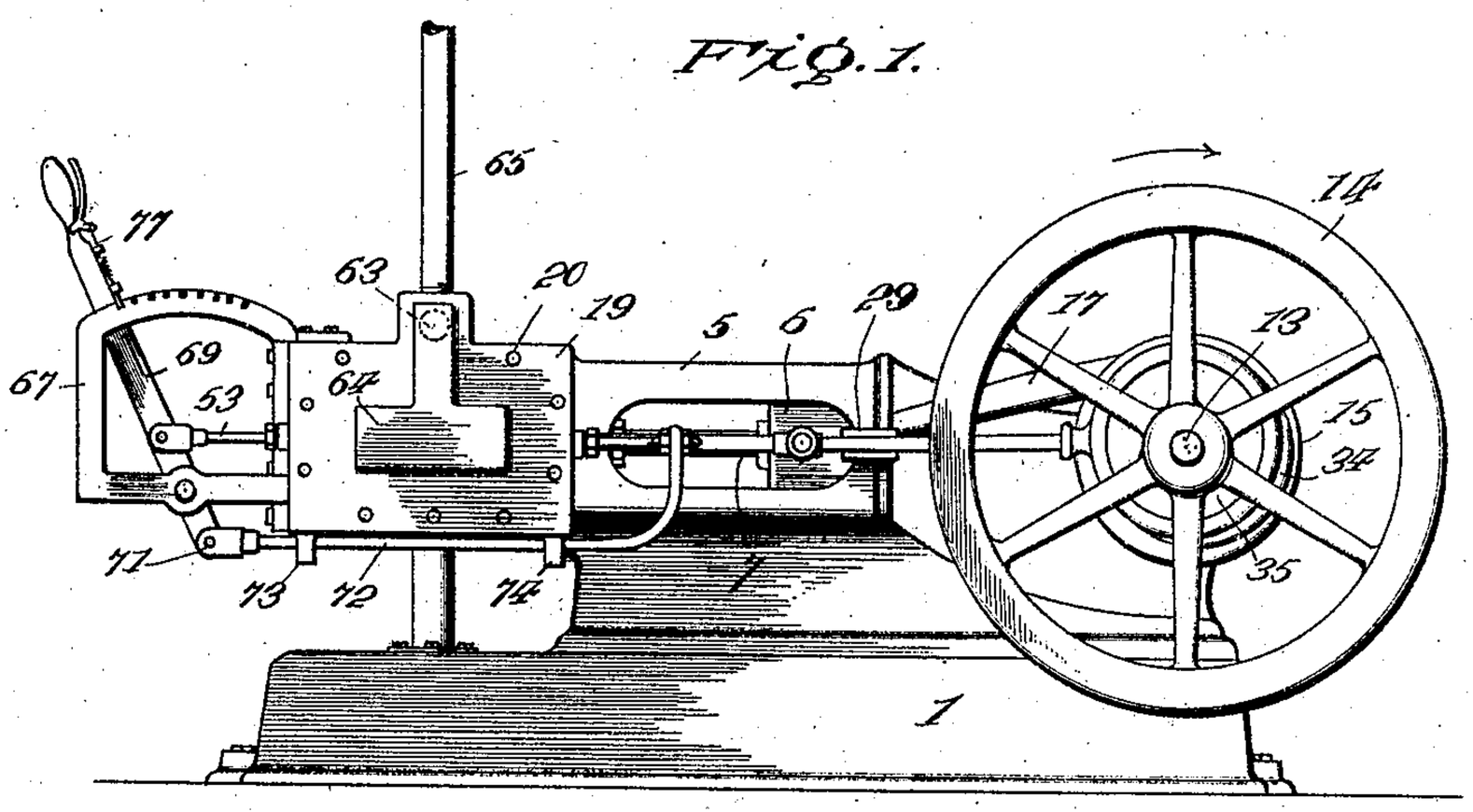
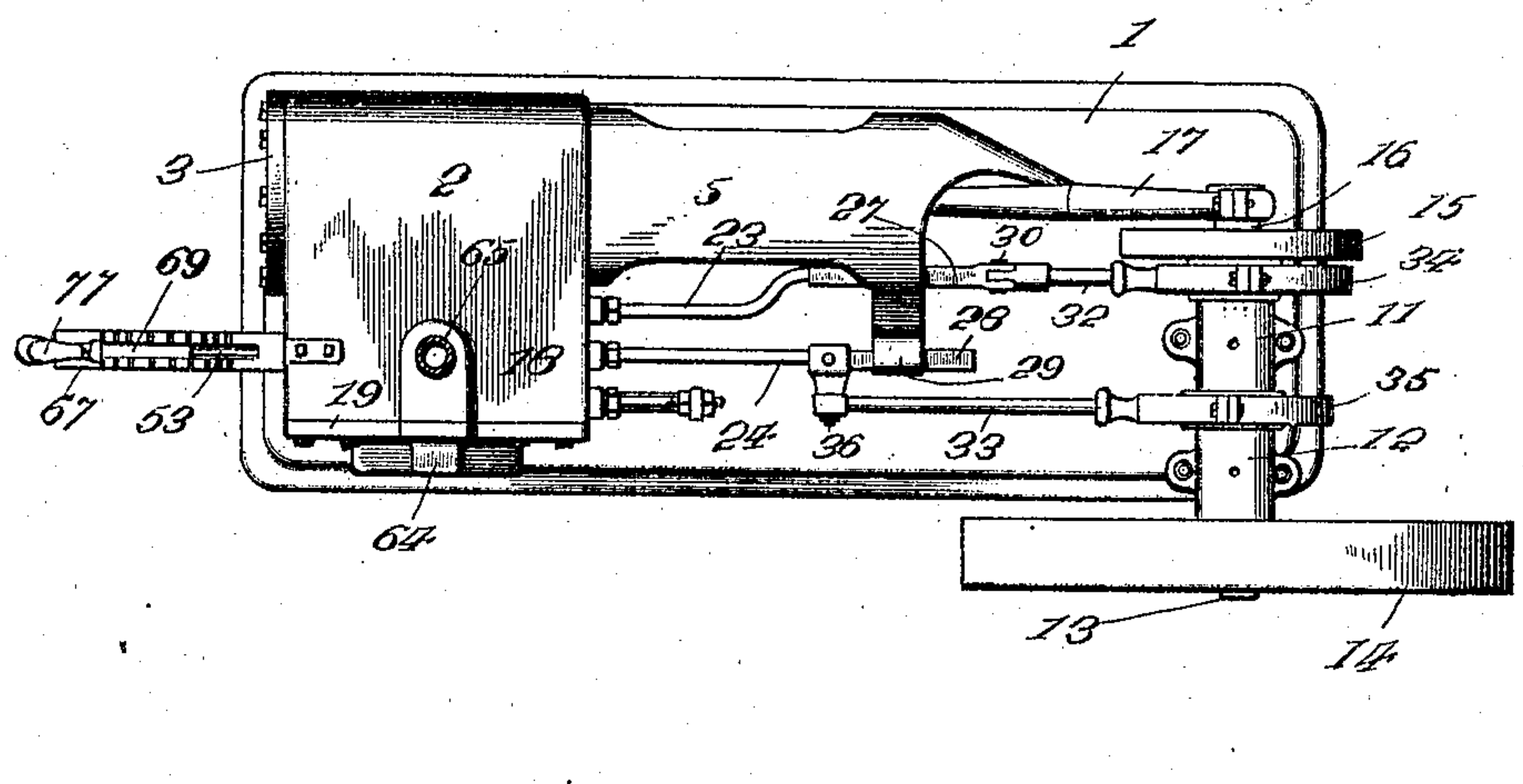


FIG. 2.



Witnesses

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3 SHEETS—SHEET 2.

FIG. 3.

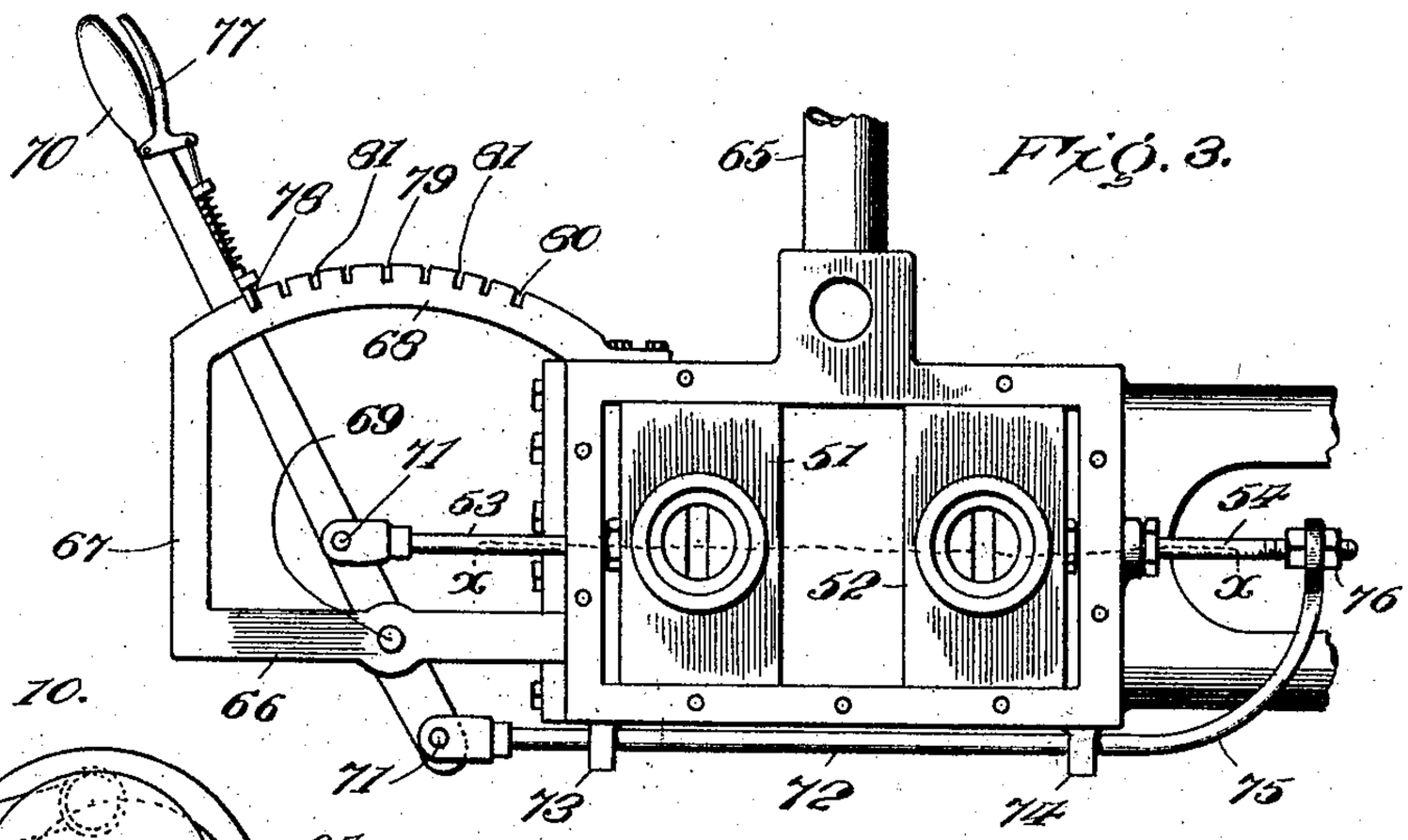


FIG. 10.

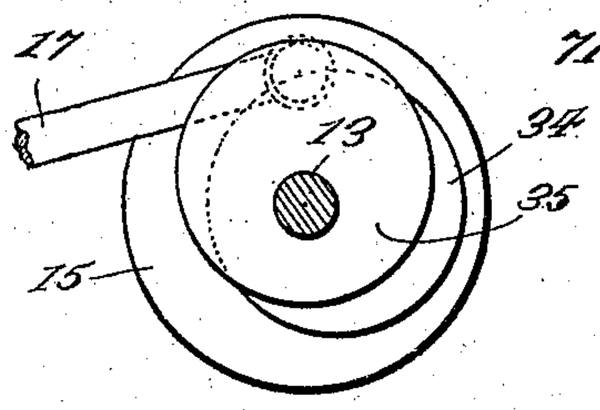


FIG. 4.

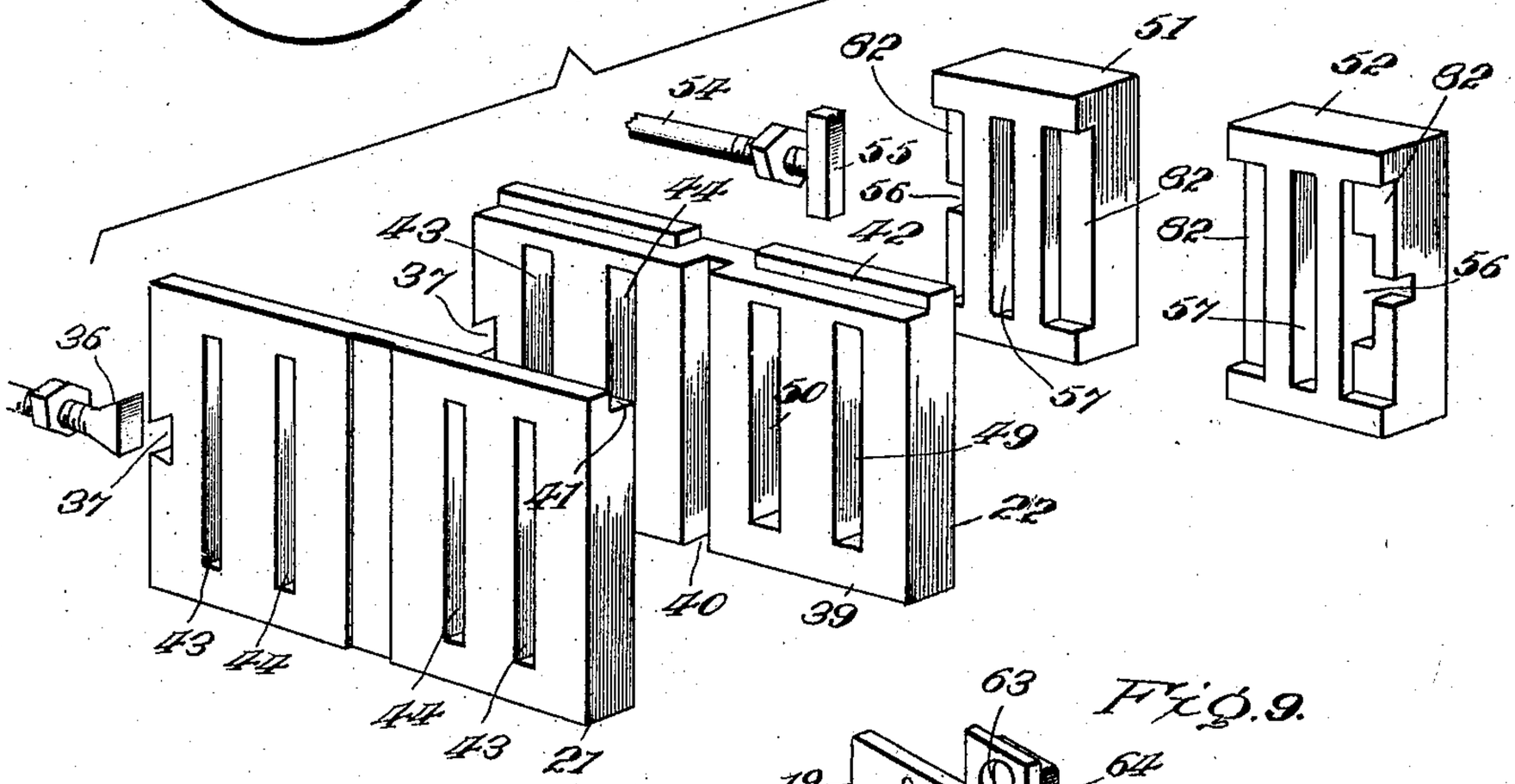
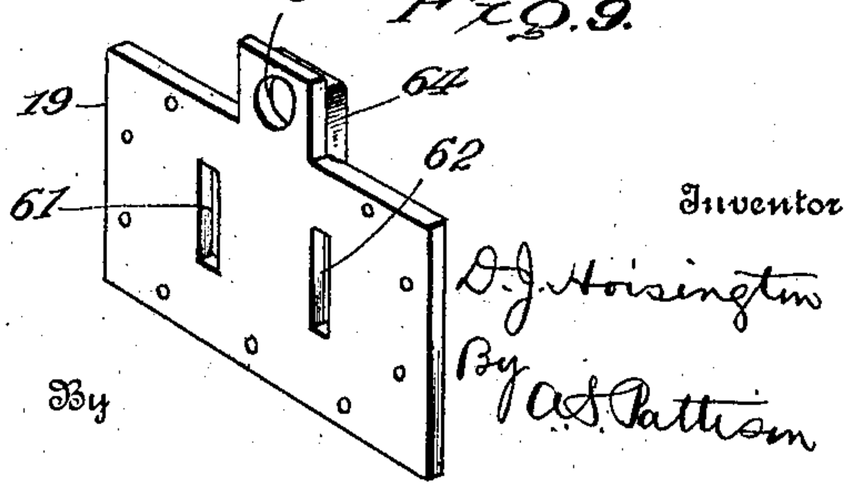


FIG. 9.



Witnesses

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3 SHEETS—SHEET 3.

FIG. 5.

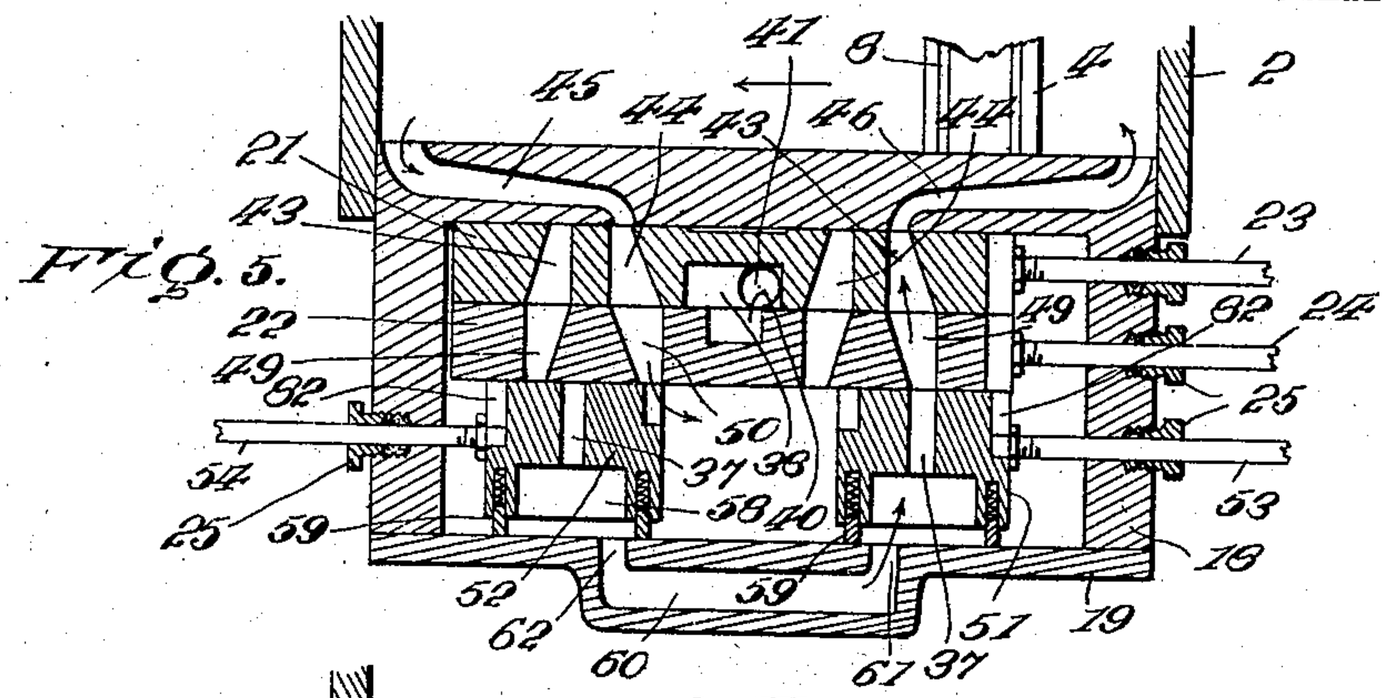


FIG. 6.

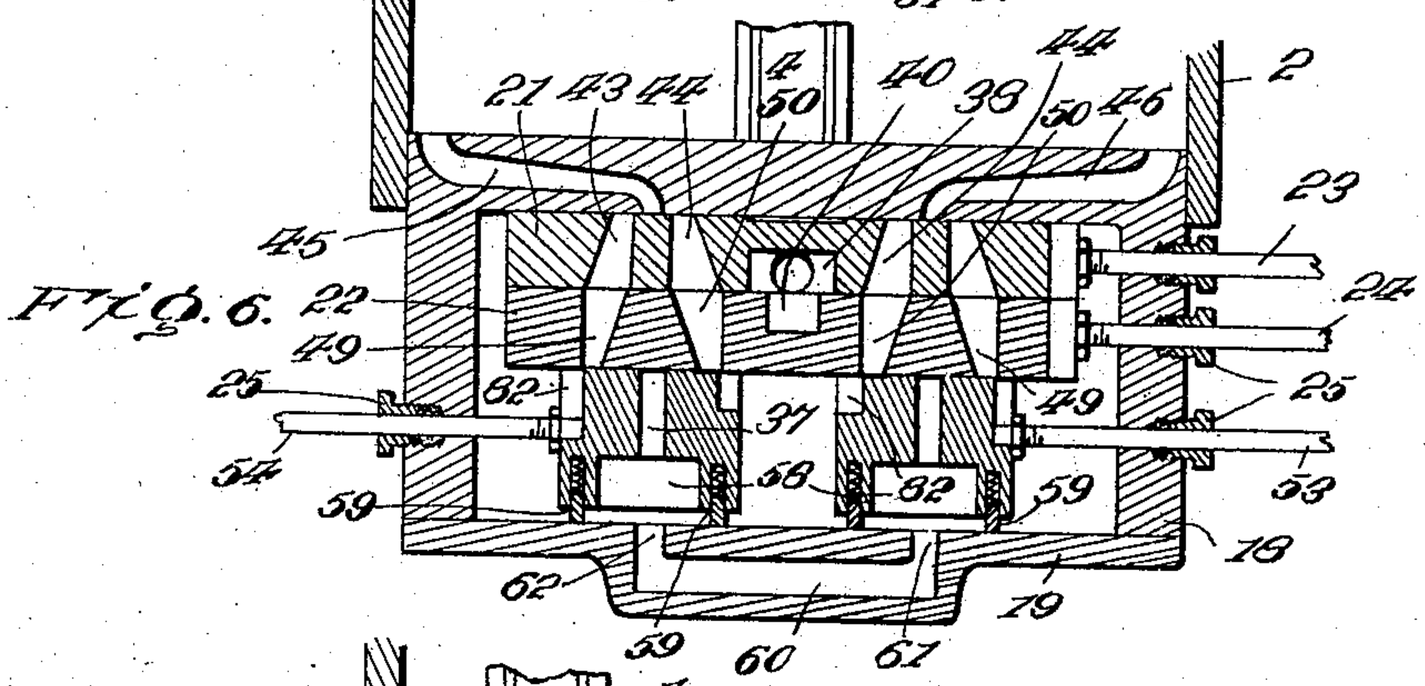


FIG. 7.

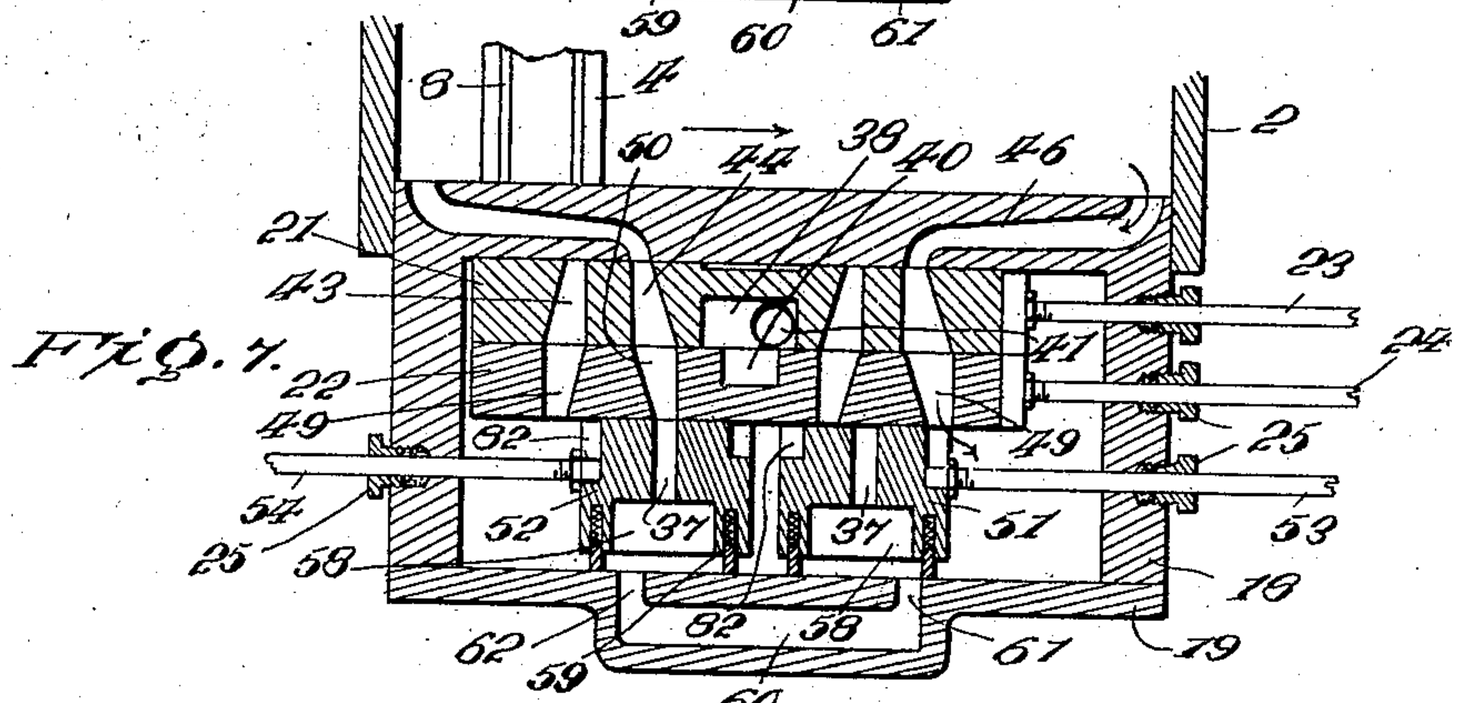
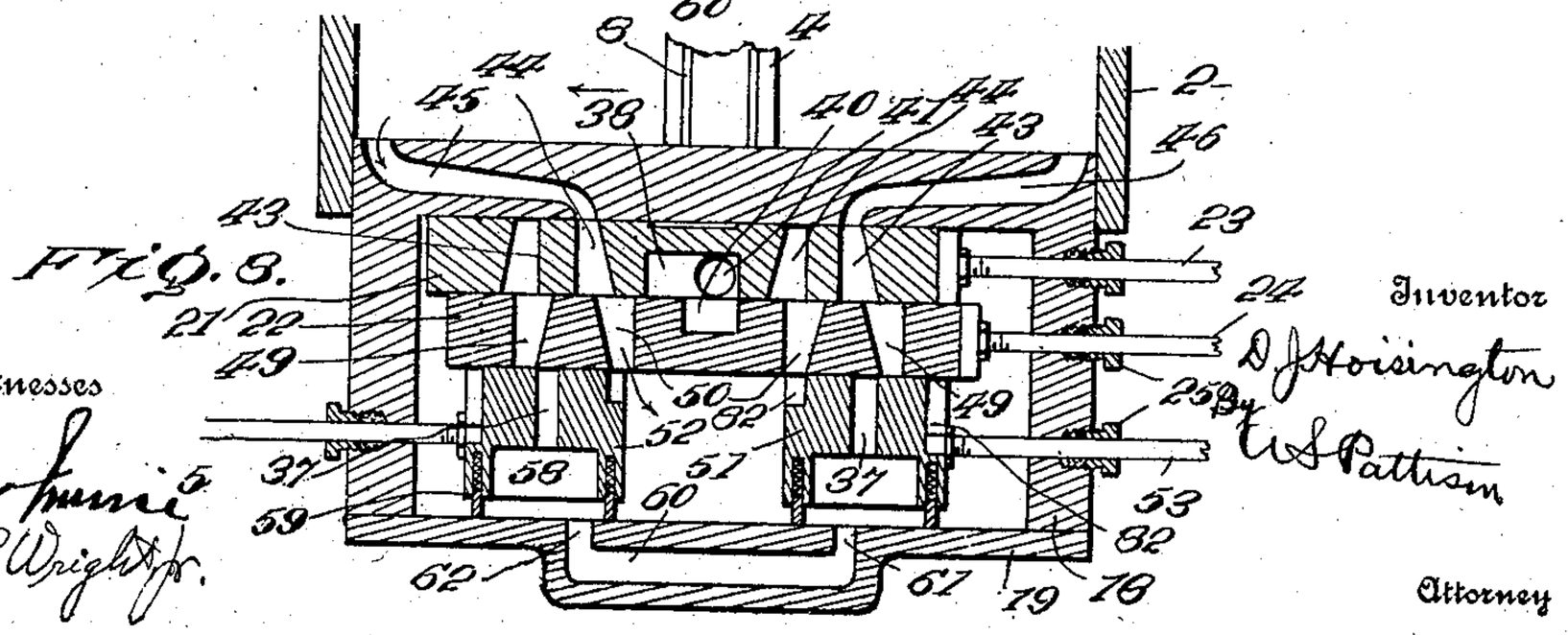


FIG. 8.



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UNITED STATES PATENT OFFICE.

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STEAM-ENGINE VALVE.

No. 815,828. Specification of Letters Patent. Patented March 20, 1906.

Application filed August 11, 1905. Serial No. 273,779.

To all whom it may concern:

Be it known that I, DANIEL J. HOISINGTON, a citizen of the United States, residing at Crescent, in the county of Logan and Territory of Oklahoma, have invented certain new and useful Improvements in Steam-Engine Valves, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in steam-valves, and pertains particularly to that class used on a reciprocating engine.

The object of my invention is to provide a sliding valve of this character composed of two sliding members operated by cams on the engine-shaft and so positioned that the engine can be readily reversed and in which steam can be admitted to the cyilnder during the full stroke of the piston or steam can be admitted to the cylinder during but a part of the stroke of the piston and the expansion of the steam used during the remainder of the stroke. I also provide means whereby steam is admitted for any part of the stroke of the piston—say a quarter, half, or three-quarter stroke—and each instance the expansion of the steam completes the stroke of the piston.

Another object of my invention is to so connect the sliding valves to the engine-shaft by means of cams or eccentrics that said valves travel in the same direction during a part of a revolution and travel in opposite directions during the remainder of the movement.

A further object of my invention is to provide a valve of this character in which the sliding valves are relieved of the steam-pressure usually existing in the steam-chest, thus reducing the friction of said sliding valve or valves and the steam-chest being used as an exhaust-chamber.

A still further object of my invention is to provide a more simple, cheap, and effective valve of this character than has heretofore been produced.

In the accompanying drawings, Figure 1 is a side elevation of a reciprocating engine, showing the usual steam-chest and the valve-rods leading therefrom and the eccentrics for operating the two sliding valves. Fig. 2 is a top plan view of Fig. 1 and more fully showing the valve-operating rods and eccentrics. Fig. 3 is an enlarged side elevation of the steam-chest, showing the reverse-levers and the lid of the chest removed, showing the steam-controlling blocks in one position. Fig. 4 is an enlarged perspective view of the sliding valves and steam-controlling blocks removed and separated, showing the specific construction of the same and showing the means by which they are connected to the cam-rods. Fig. 5 is a horizontal longitudinal sectional view taken on the line *x x* of Fig. 3, the valves and steam-controlling blocks in one position for allowing the steam to enter one end of the cylinder for working the piston in one direction. Fig. 6 is a horizontal sectional view of the same as Fig. 5, only showing the steam-controlling blocks so positioned that the steam-ports thereof are in between the ports of the outer sliding valve and that the movement of said valve cannot bring the ports opposite the ports of the blocks, and thus the piston is at rest. Fig. 7 is a horizontal sectional view the same as Fig. 5, only showing the steam-controlling blocks moved in an inward position and the steam being admitted at the opposite end of the cylinder for reversing the engine. Fig. 8 is a horizontal longitudinal sectional view taken the same as that shown in Figs. 5, 6, and 7, but showing the steam-controlled blocks in such a position that the cylinder is taking steam during only half of the stroke of the piston and during the other half the expansion is used. Fig. 9 is a perspective view of the lid for the steam-chest. Fig. 10 is a diagrammatical view of the cams arranged upon the engine-shaft and showing their relative position to each other.

Referring now to the drawings, 1 represents an engine-base, at one end of which is horizontally arranged a cylinder 2, one end of which is provided with the usual cylinder-head 3, which is removably held by bolts, so that the piston 4 may be removed from the cylinder. The said cylinder at the opposite end is provided with a cross-head casing or guide 5, in which is slidably mounted the cross-head 6, which is made of a form to snugly fit within the guide, and secured to said cross-head is the piston-rod 7, which passes through the end of the cylinder and secured to the piston 4, and thus the piston-rod has a straight throw. The piston may be of any desired form, but preferably of that shown, and that is of a solid form, having two circumferential grooves in which is placed the packing 8, which forms a steam-tight joint with the inner surface of the cylinder. The said cylinder is provided with any desired means for lubricating the same, which,

as well known, is necessary in engines of this character. The opposite end of the base 1 is provided with standards the upper end of which are provided with journals 11 and 12, in which is rotatably mounted the engine-shaft 13, one end of said shaft carrying a fly-wheel 14, while the opposite end of said shaft is provided with a disk 15 in a line with the cross-head 6. The said disk has a wrist-pin 16, carried thereby, and to which is secured the pitman 17, and the opposite end of said pitman is pivotally connected to the cross-head 6, whereby the reciprocation of the piston will rotate the engine-shaft 13, as is well understood.

The side of the cylinder 2 is provided with the usual steam-chest 18, which is provided with the usual removable lid 19, which is held in position by means of the bolts 20, and said lid is provided with a packing to make the same steam-tight for the purpose which will be hereinafter more fully described.

The valve, as shown in Fig. 5, is composed of two independent valves 21 and 22, which are of a length considerably less than that of the interior of the steam-chest, so that the same will have a longitudinal movement therein. Secured to the end of said valve members are rods 23 and 24, which extend out through the end of the steam-chest, and said chest is provided with packings 25, which prevent the leakage of the steam from the chest. While I speak of steam-chest 18 as a "steam-chest," it is not a steam-chest in the same sense of the word as is usually the case, as it does not receive the live steam, but receives the exhaust-steam, and thus sliding valves are relieved of the great pressure to which they are usually subjected, as only the exhaust-steam directly enters the chest around the sliding valves. The said rods, as shown, are rigidly connected to the cross-heads 27 and 28, which are slidably mounted in a bracket 29, carried by the cross-head housing 5, and thus give a straight throw of the rods 23 and 24, secured to the valves 21 and 22. The outer ends of said cross-heads 27 and 28 have pivotally connected thereto at 30 and 31 the pitmen 32 and 33, which are operatively connected to cams 34 and 35, carried by the engine-shaft 13, the cam 35 being set with the wrist-pin 16, and thus the pitmen 17 and 33 move together in the same direction; but the cam or eccentric 34 is set at a quarter in respect to the wrist-pin 17. The setting of the cam 34 at a quarter in respect to the cam 35 it will be readily seen that the pitmen 32 and 33 travel in opposite directions one-half of both the backward and forward stroke; but during the other half of the stroke the rods move in the same direction, thus moving the valves 21 and 22 in corresponding directions, as will be hereinafter more fully described. The sliding valves, as shown, are of an elongated form and are made, as shown in Fig. 4, of flat pieces of metal having their faces ground to form a steam-tight joint with the inner face of the chest and with each other and with the steam-controlling blocks, as hereinafter more fully described. The inner ends of the rods 23 and 24 are provided with enlarged dovetail ends 36, which are adapted to enter the corresponding dovetail recesses 37, whereby the said valves are reciprocated with the rods 23 and 24. The dovetail connections allow said valves to have a lateral movement for removing the same readily and also for allowing the same to be readily inserted in the chest and operatively connected to the rods. The abutting faces of said valves are provided with recesses forming the exhaust-ports for the chest. The inner valve, as shown, has an opening 38 therein, while the abutting face 39 of the valve 21 is provided with a recess or groove 40, which is of a width considerably less than that of the recess 38. The steam-chest 18 is provided with an exhaust-port 41, and the opening 38 is of such a width that it is always in communication with said exhaust-opening, and thus the steam from the chest is at all times allowed to exhaust. The said grooves 38 and 40, as clearly shown, extend entirely through the slide-valves, and the upper edges of said valves on their inner faces are provided with longitudinally-arranged cut-away portions 41 and 42, which form a longitudinally-arranged passage above the valves and communicating with the space at each end of the chest, and the exhaust-port at all times being open it will be seen that there is practically no steam-pressure upon the valve, thus allowing them to freely move and gaining power which has heretofore been lost in operating the valves. The said valves 22 on each side of the groove 38 are provided with two vertically-disposed slots 43 and 44, which extend through the said valves and said opening, gradually widening toward the abutting face. The inner opening 44 of one of said pairs communicates with a steam passage-way 45, and, as shown in Fig. 5, the outer opening 43 of the other pair communicates with the opening 46 and serves, as shown, as the inlet for the steam, while the passage-way 45 serves as the exhaust. In running in one direction the inner slots or openings 44 serve as the exhausts and the outer openings 43 as the supply, while in the opposite direction the inner openings serve as the live-steam supply and the outer openings as the exhaust. The inner face of the slide-valve 21 is ground smooth and is adapted to bear firmly against the wall 47 and form a tight joint therewith. The second slide-valve 21 is provided on each side of the slot 40 with the vertically-disposed slots or ports 49 and 50, which communicate with the openings 43 and 44 in the slide-valve 21, and thus when in the position shown in Fig. 5 form continuous ports through the valves,

the ports at one end serving as an exhaust-port and the ports at the opposite end serving as inlet-ports, as clearly shown. The adjoining faces of the valves 21 and 22 are ground to form a tight joint to prevent the passage of the steam from between the same.

As before described, the rods 23 and 24, carrying the slide-valves 21 and 22, move in opposite directions and also together, the purpose of which I will now proceed to describe. The passages 43 and 44, carried by the inner valves, and the passages 49 and 50, carried by the outer valve, are enlarged at their abutting faces, and thus the said passage-ways are at all times in communication with each other regardless of the position of the two valves in respect to each other, as clearly shown in Fig. 8, and the steam is cut off by the movement of the outer valve by its movement in respect to the steam-supply blocks. The inner valve 21, as described, is connected to the rod 23, and said rod carried by the cam is arranged on the quarter, and thus it will be seen that upon one revolution of the engine-shaft the inner valve starts from the position shown in Fig. 6 across, so that the port 44 is opposite the steam-passage 45, and then back, so that the port 43 is opposite the steam-passage 45, and then back to the position shown in Fig. 6. The outer valve being set with the piston travels forward, as shown in Fig. 5, the port 50 registering with the port 44 of the inner valve, while the outer end of the port 50 communicates with the steam-supply block, and then back again, closing said inlet-port and opening the one in the other steam-supply block. By this structure it will be seen that the inner valve 21 opens and closes the ports leading to the cylinder and opens the exhausts, while the outer valve 22 communicates with the inlet-ports of the steam-supply blocks.

Within the chest, on the outside of the slide-valve 22, are two steam-supply blocks 51 and 52, which, as shown, are independently slidably mounted therein and have connected thereto the rods 53 and 54, which extend outwardly through the ends of the chest and connected to the reverse-lever, as hereinafter more fully described. The inner ends of said rods are provided with T-shaped ends 55, which rest within corresponding slots 56 in the edge of the blocks, and thus the said blocks are removably held within the steam-chest. The blocks are provided with a passage-way 57 through the inner face, which communicates with an enlarged recess 58, which is surrounded by a packing 59, which bears against the inner face of the lid 19 of the chest, and said lid is provided with a steam-passage 60, which has two openings 61 and 62, which are at all times in communication with the enlarged recess 58 when the blocks are in their inward, intermediate, or outward position, as clearly shown in Figs. 5, 6, and 7. The steam-passage 60 in the lid 19 is provided with an opening 63, which is in communication with a hollow projection 64, carried by the upper edge of the chest, and said projection has a steam-supply pipe 65 in communication therewith.

The end of the steam-chest is provided with an outwardly-extending arm 66, which extends upwardly at 67 and is provided with a curved segmental bar 68, which has its inner end connected to the upper end of the chest. Pivotally connected intermediate its ends at 69 is a reverse-lever 70, which has connected thereto above the pivotal connection the outer end of the rod 53 at 71. The lower end of said reverse-lever has pivoted thereto, the same distance from the pivotal connection as the rod 53, a bar 72, which passes through two guides 73 and 74, carried by the under side of the chest, and has its outer end turned upwardly at 75 and secured to the rod 54 at 76. The said connection is adjustable, so that any slight variations in the parts can be overcome, and thus the two rods 53 and 54 have precisely the same movement, and thus the blocks 51 and 52 are moved inward and outward together precisely the same distance. The upper end of the reverse-lever 69 is provided with a catch 77, which is adapted to engage the notches carried by the segmental bar 69. When the reverse-lever has its catch 77 in the notch 78, the piston is being reciprocated in the position shown in Fig. 5, and when in the notch 79 the steam-supply blocks are in such a position that steam cannot be supplied to either end of the cylinder, and thus the engine is at rest, as shown in Fig. 6, and when in the notch 80 the piston is being operated in the position shown in Fig. 7, or just the reverse to Fig. 5. The intermediate notches 81 are for the purpose of so setting the steam-supply blocks 51 and 52 that the steam is being admitted to the cylinder during a partial movement of the piston, and the expansion of the steam finishes the stroke. As shown in Fig. 8, the steam has been admitted to the cylinder until the piston has reached the point as shown in said Fig. 8, when, as shown, the supply-ports are closed and the expansion of the steam is relied upon. The exhaust-ports being open, as shown, thus allow the steam to exhaust, as will be hereinafter more fully described.

The steam-supply blocks 51 and 52, as shown, have their inner faces cut away at the edges at 82, as shown, and thus the cut-away portion of one block communicates with one of the ports of the slide-valve 22 for allowing the exhaust-steam to pass into the chest while the other block is supplying steam to the cylinder, it being understood that the sliding movement of the valve serves to cut off the steam and open the exhaust-ports. The exhaust-steam passes from the space at the ends of the chest through the grooves 41

and 42 in the slide-valves and down through vertical recesses 38 and 40 and out through the opening 41 in the lower face of the chest and is conveyed off by a pipe or any other means.

By this structure it will be seen that the steam passes directly through the sliding parts of the valves to the cylinder, and the exhaust surrounding the sliding valves causes very little friction thereon and makes the operation of the valves much easier, and thus saves power. This arrangement, as before described, also allows of using the expansion of the steam from a quarter to three-quarters of the stroke of the piston, according to the positioning of the reverse-lever.

By the construction and arrangement of the two valves as heretofore described it will be seen that the said valves do not change their relative position in respect to the piston, and thus the cylinder at all times takes steam at the same point regardless of the amount of expansion used, as the sliding blocks govern the supply of steam and are moved within the steam-chest.

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

1. A steam-valve, comprising a chest, two sliding valves within the chest, each having four ports at all times communicating, the outside ports at one end serving as inlet-ports and the inside ports at the opposite end serving as exhaust-ports when the engine is running in one direction, and the outer ports serving as exhaust-ports and the inside ports serving as inlet-ports when running in the opposite direction, means for moving said valves back and forth, blocks within the chest between the valves and steam-inlet passages, and having steam-passages therethrough, exhaust-passages therein, the block at one end allowing the steam to pass therethrough to the ports in one end of the sliding valves, and the block at the opposite end closing the inlet-ports and having the exhaust-passages in communication with the ports in the opposite end of the sliding valves and allowing the exhaust to pass to the space surrounding the blocks.

2. A steam-valve, comprising a chest, sliding valves within the chest, and having ports at all times communicating with each other, and sliding steam-supply blocks adjusted at places within the chest between the valves and the lid of the chest, and means for simultaneously moving said blocks in opposite direction.

3. A steam-valve, comprising a chest, sliding valves within the chest and having ports at all times communicating with each other, and sliding steam-supply blocks having ports therein, the inner end of said ports adapted to communicate with the ports of the valve, and the outer end of said port at all times in direct communication with an inlet supply-pipe, whereby the steam passes directly through the blocks and valves without entering the chest around the blocks and valves, thus reducing the resistance of the movement of the valves and blocks.

4. The combination with an engine, a chest in communication with the cylinder, two sliding valves within the chest and having ports at all times in communication with each other, steam-supply blocks within the chest bearing against the outer sliding valves and having ports extending therethrough and adapted to cut off the steam from the ports in the valves, and circular packing-rings carried by the blocks and surrounding the inlet-ports and bearing against the inner face of the chest.

5. The combination with an engine-cylinder, a piston within the cylinder, a steam-chest in communication therewith, two sliding valves within the chest and at all times held in their relative position in respect to the piston, whereby the cylinder takes steam at the same time under all conditions, and sliding blocks for controllng the supply of steam to the sliding valves.

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

DANIEL J. HOISINGTON.

Witnesses:
A. S. PATTISON,
C. R. WRIGHT, Jr.