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C. R. CRANE.

STEAM ENGINE.

No. 342,782. Patented June 1, 1886.

Fig. 1.

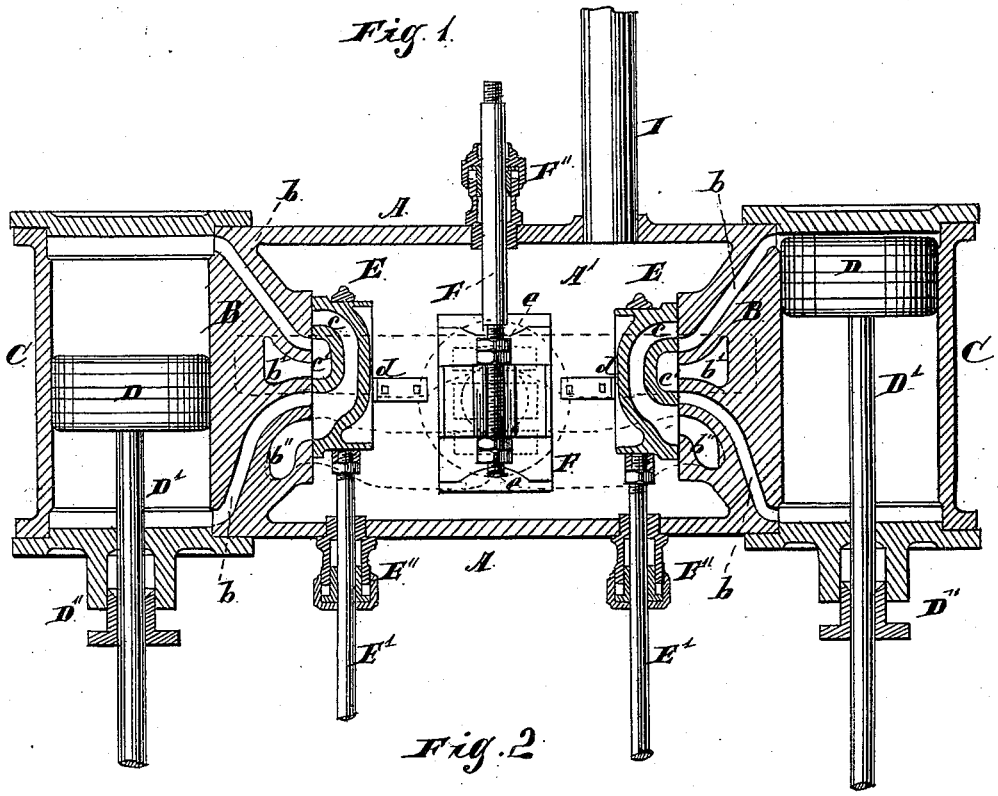
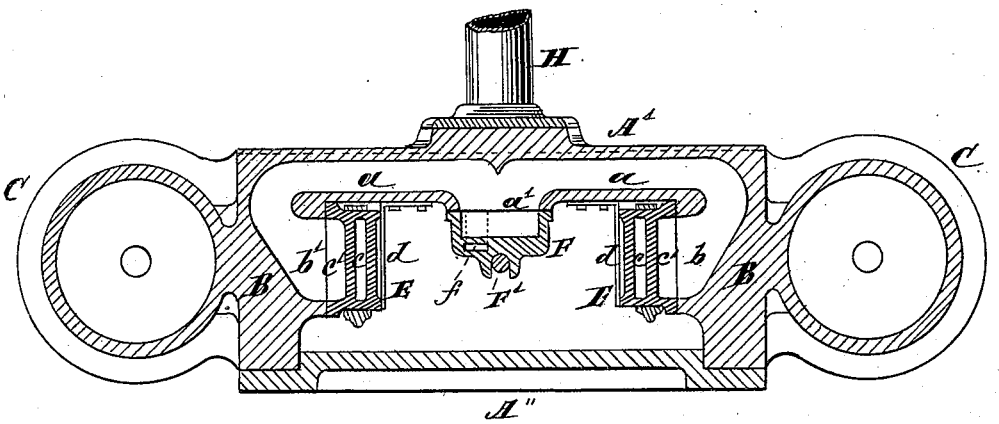


Fig. 2.



Witnesses:
Albert H. Adams.
Edgar T. Bond.

Inventor:
Charles R. Crane.
By West & Bond
His Attys.

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Fig. 3.

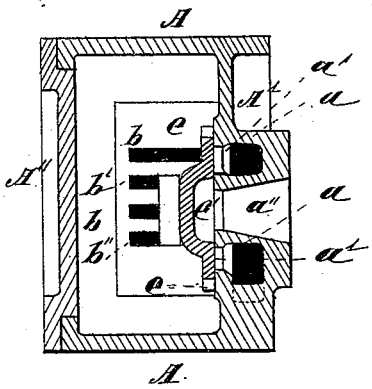


Fig. 4.

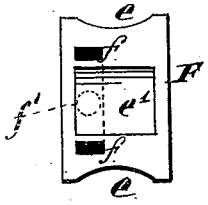


Fig. 5.

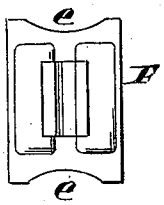


Fig. 6.

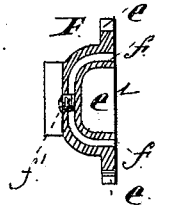


Fig. 7.

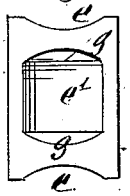


Fig. 8.

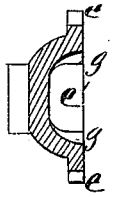
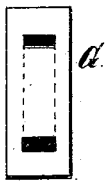


Fig. 9.



Witnesses:
Albert H. Adams.
Edgar F. Bond

Inventor:
Charles R. Crane,
By West & Bond,
His Attys.

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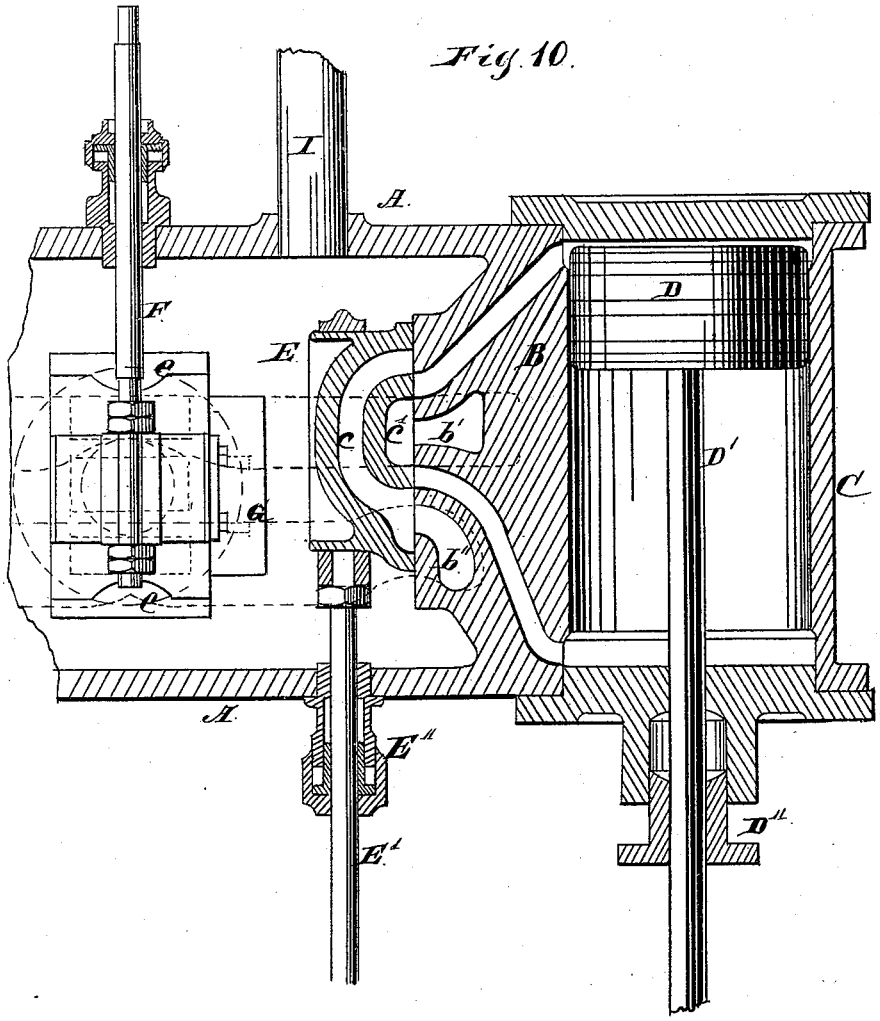
Fig. 10.



Witnesses:
Albert H. Adams
Edgar J. Bond.

Inventor:
Charles R. Crane.
By West & Bond,
His Attys.

UNITED STATES PATENT OFFICE.

CHARLES R. CRANE, OF CHICAGO, ILLINOIS.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 342,782, dated June 1, 1886.

Application filed January 23, 1885. Serial No. 153,690. (No model.)

To all whom it may concern:

Be it known that I, CHARLES R. CRANE, residing at Chicago, in the county of Cook and State of Illinois, and a citizen of the United States, have invented certain new and useful Improvements in Steam-Engines, of which the following is a full description, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section through the steam-chest cylinders and cylinder-valves; Fig. 2, a transverse longitudinal section through the steam-chest cylinders and valves; Fig. 3, a cross-section through the steam-chest and main valve; Figs. 4, 5, and 6, details showing one form of construction of the main valve for providing communication with the steam-passages; Figs. 7 and 8, details showing another form of construction for the main valve. Fig. 9 is a detail showing a secondary or relief valve to be used with the ordinary main valve. Fig. 10 is a detail, being a vertical longitudinal section of one end of the chest, showing the relief-valve of Fig. 9 applied to the main valve.

This invention relates to that class of steam-engines in which the steam-chest has located at each end thereof the cylinders, forming in effect a two-cylinder engine, and has for its object to prevent the cushioning effects of the steam on the pistons as the pistons reach the limit of their stroke in either direction, from which cushioning effects the pistons are liable to have a reverse movement given to them, by which the main valve is moved slightly on its seat, allowing steam to enter the steam-passages when the valve should act and effectually prevent the entrance of steam.

The object of my invention I accomplish in the manner and by the means hereinafter described and claimed.

In the drawings, A A′ A″ represent the four sides or walls of the steam-chest. As shown, the walls A and A′ are cast or otherwise formed from a single piece, while the wall A″ is made separate and fitted in place and secured by bolts or otherwise. The wall A′ is, as shown, thicker than the remaining walls, and in this wall is located the steam-passages *a*, through which steam from the interior of the chest is led to the cylinders, communication being had between the interior of the chest and the passage *a* by the ports *a′*, as shown in Figs. 1 and 3.

B represents the ends of the steam-chest, which may be cast with the walls A A′, or otherwise formed. These ends form the valve-seats for the valves which control the passage of steam to and from the cylinders, and each end or seat B is provided with passages *b*, leading to opposite ends of the seat, as shown in Fig. 1, with passages *b′ b″* communicating with the steam-passages *a* in the chest, as shown in Fig. 1.

C C′ are the cylinders, one for each end of the chest, and secured in place by bolts or otherwise, to have the interior for each cylinder at the end communicate with the passages *b* of the valve-seats B.

D represents the piston-heads, one for each cylinder C C′, each piston-head being attached to a piston-rod, D′, the rods passing, respectively, through suitable stuffing-boxes on the cylinder ends.

E represents the valves controlling the passage of steam to and from the cylinders through the valve-seats B. Each valve E has a passage, *c*, to communicate with the passages *b* and ports *b′ b″* of the valve-seat, and an opening or passage, *c′*, also communicating with the passages and ports in the valve-seats. Each valve is attached to a rod, E′, by means of which the valve is shifted, each rod passing through a suitable stuffing-box, E″, on the steam-chest. As shown, each valve E is held to its seat and maintained in a direct line of travel by a guide-bar, *d*, bolted or otherwise secured to the wall A′ of the steam-chest and extending across the rear face of the valve.

F is the valve controlling the passage of steam from the chest to the steam-passages *a*, and having its seat upon the wall A′, to control the ports *a′*, leading to the steam-passages *a*. This valve on its under face has a central opening, *e′*, which, as the valve is reciprocated, alternately communicates with the ports *a′*, for the passage of steam to the exhaust *a″*, and each end of the valve has a cut-away portion, *e*, for steam to pass to the ports *a′* as the valve F is reciprocated. The valve F shown in Figs. 4, 5, and 6 has a passage, *f*, leading around the opening *e′*, which passage is located on one side of the valve, as shown in Fig. 4, and is arranged to form a communication between the passages *a* of the steam-chest when the valve F is at rest or at the center of its movement, allowing steam to pass through

the valve from one passage *a* into the other. The under face of the valve between the opening *e'* and cut-away portion *e* at each end forms a cut-off for the ports leading to the steam-passages *a*, so that as the valve F is reciprocated steam enters at one end to pass to the passage *a*, while at the other end the port leading to the other passage is closed by the solid portion of the under face of the valve. The valve F is attached and operated by the valve-stem F', which stem passes through a suitable stuffing-box, F'', on the steam-chest.

Another form of construction for the valve F by which communication is had between the steam-passages *a* is shown in Figs. 7 and 8, in which, instead of having a passage leading around the opening *e'*, the ends of such opening are cut away, so as to leave a space, *g*, between the ends of the opening proper and the walls of the valve, which spaces, when the valve is at rest, communicate with the respective passages *a*, allowing steam to pass from one passage to the other by passing into the exhaust-space.

Instead of forming the passage *f* in the valve shown in Fig. 6, a supplementary valve, G, could be provided, suitably attached to the side of the main valve, which supplementary valve is provided with the passage *f*, and such form of construction is shown in Figs. 9 and 10, and in this case the passages *a* are to be provided with openings leading therefrom, arranged to communicate with the passage *f* in the supplementary valve G when the main valve is at the center of its movement.

Fig. 1 shows the several parts in the position they occupy when one of the pistons has completed its forward stroke, and the other piston has made a stroke half the length of its cylinder, in which position the valve E is in position to shut off the passage of steam into the passage *b* leading to the cylinder in which the piston has completed its stroke, and the valve E on the other side is in position for steam to pass into the passage *b* leading to the forward end of the cylinder and exhaust into the passage *b* leading from the rear end of the cylinder, and the valve F is in its central position, so as to close the ports *a'* leading into the steam-passages *a*, and the opening *e'* is in line with the exhaust *a''*. When the parts are in this position, the passage *f* in the valve F is in communication with the ports *a' a'* leading to the steam-passages *a*, so that steam can pass from one passage to the other through the passage *f*, and this free communication between the passages *a* through the valve F allows the steam to pass entirely out from in front of the advancing piston, preventing the formation of a cushion between the cylinder end and the piston. The steam forward of the piston in the cylinder C', as the piston advances, passes out through the forward passage *b* into the passage *c'*, thence into the port *b'* into the passage *a*, and through the port *a'* into the exhaust *a''*, during which time the valve E for the cylinder C' is withdrawn, and the valve F is also withdrawn to gradually open the ports and passages on one side and close them on the other, as usual, and when the piston has reached the limit of its forward movement and is in the position shown by the piston in the cylinder C, the valve E has been withdrawn to the position shown for the valve E of the cylinder C; but before this occurs the valve F has been advanced so that the opening *f* therein forms a communication between the two passages *a*, so that the steam forward of the piston D in the cylinder C' can pass from the forward passage *a* into the rear passage, thence into the passage *b''* into the passage *c*, thence through the passage *b* to the rear of the piston D, thus forming an escape for the steam forward of the piston, by which cushioning effects will be prevented, and the movement of the main valve on its seat from the action of the steam will be obviated and overcome.

The form of construction so far described overcomes the cushioning effect by allowing the steam to pass from forward of the piston in either direction to the opposite side through the main valve, and the operation of the secondary valve (shown in Figs. 9 and 10) is in effect the same as that already described.

H represents the exhaust-pipe, and I the inlet-pipe for the steam, the pipe H communicating with the exhaust-port *a''*, and the pipe I leading into the steam-chest from the boiler.

It is understood that when one valve E is advancing the other is receding, and vice versa, and that the reversing-valve F coacts with both the valves E, admitting steam on one end for one of the valves and on the other end for the other valve through the cut-away portion *e*.

The relief-passage *f* can be controlled as to the volume of steam passing through by a screw-plug, *f'*, of a diameter to fill the width of the opening and screw-thread, to have its end raised or lowered to increase or decrease the space between the walls of the passage through which steam can pass, or the passage can be closed entirely by bringing the end of the plug in contact with the inner wall of the passage, and this adjusting-plug can be applied to the main valve when the passage *f* is therein, or to the secondary valve G, when the relief-passage *f* is in such valve.

What I claim as new, and desire to secure by Letters Patent, is—

The combination of the steam-chest having a piston-cylinder at each end, the valves E, controlling the passages of steam to and from the cylinders, and the valve F, located between the said controlling-valves, and having the relief-passage *f*, for permitting steam to alternately pass from the fronts of the advancing pistons through the valve to force a communication between the ends of the cylinder, substantially as described.

Witnesses: CHARLES R. CRANE.
O. W. BOND,
H. T. JONES.