C. ROGERS.

VALVES FOR DIRECT-ACTING ENGINES.

No. 173,063. Patented Feb. 1, 1876.

Fig. 2.

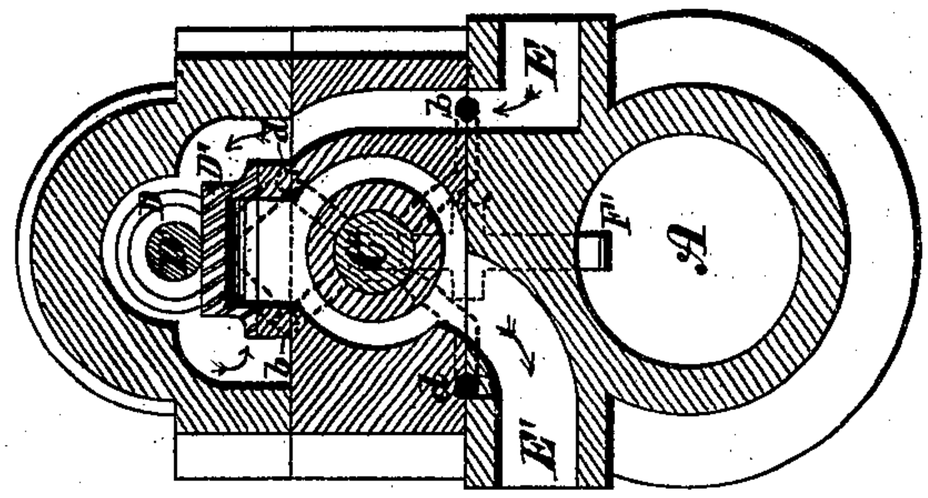


Fig. 5.

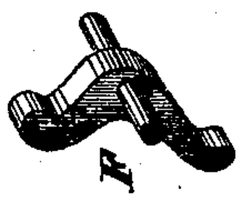


Fig. 1.

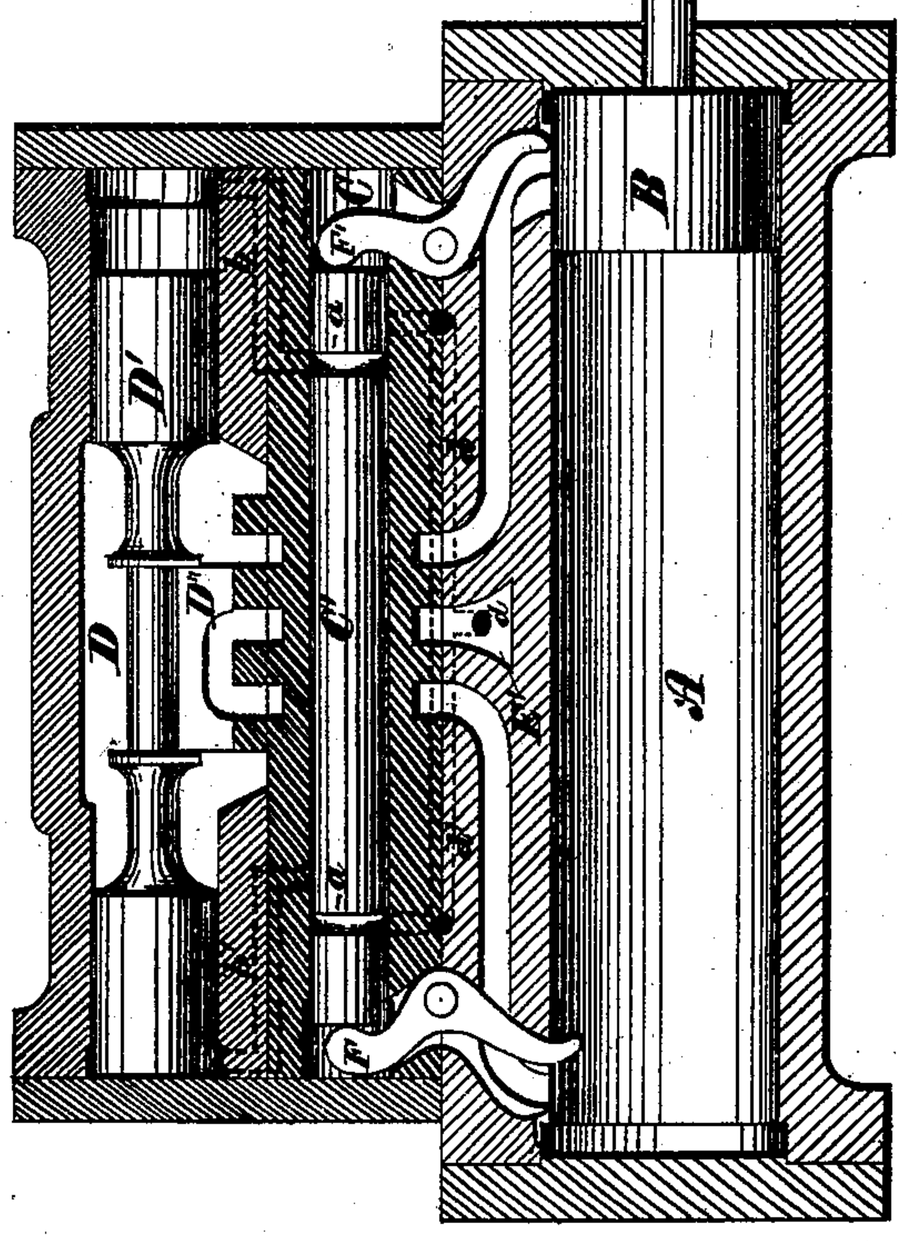


Fig. 4.

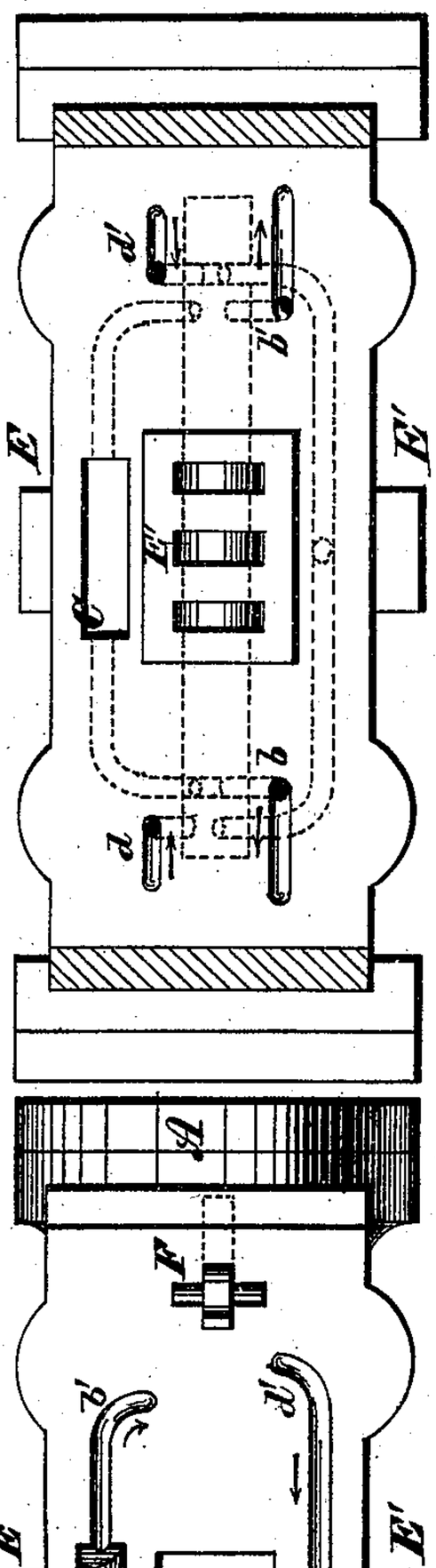
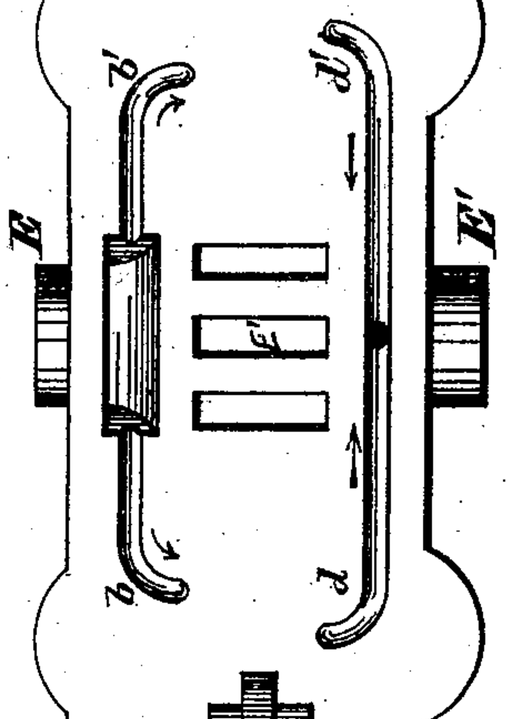


Fig. 3.



Witnesses

Jo. Tenma

F. A. Pollock.

Charles Rogers, Inventor

By Connolly Bovard McGighe Attorneys

UNITED STATES PATENT OFFICE.

CHARLES ROGERS, OF ALLEGHENY, PENNSYLVANIA.

IMPROVEMENT IN VALVES FOR DIRECT-ACTING ENGINES.

Specification forming part of Letters Patent No. **173,063**, dated February 1, 1876; application filed November 15, 1875.

To all whom it may concern:

Be it known that I, CHARLES ROGERS, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Valve-Gear for Direct-Acting Engines; and I do hereby declare the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a vertical longitudinal middle section. Fig. 2 is a vertical transverse middle section. Fig. 3 is a plan view on upper face of main cylinder. Fig. 4 is a plan view on upper face of auxiliary cylinder. Fig. 5 is a perspective of one of the levers.

This invention relates to the construction of valve-gear for direct-acting steam and other engines, and is designed as an improvement on my Letters Patent No. 157,027, dated November 17, 1874.

The present improvements consist mainly in the devices I adopt as hereinafter fully described, whereby the operation of the auxiliary double-headed piston is effected by positive means, the live steam serving not only as a support to maintain it in its proper position during the passage of the main piston through the cylinder, but also serving to drive the auxiliary piston home in case the lever is not struck sharply enough to fully perform its work; and further consists in the arrangement of the various entrance and exit ports, particularly those of the upper cylinder, whereby the greatest possible amount of work is obtained from the steam, and the possibility of a dead-point is obviated, thus conferring the most perfect reliability on the engine to which it is attached.

In the drawings herewith, A represents the main cylinder, and B its piston, both of the usual form. Outside A is a second cylinder, C, with a double-headed piston, C′, and having steam and exhaust ports, as hereinafter fully shown. Above this, again, is the steam-chest D, in which also works a double-headed piston D′, provided with the slide-valve D″. This vertical arrangement is merely arbitrary, since the operation is not affected by exact location.

Through the walls of the main and auxiliary cylinders A and C, near each end, projecting into the cylinders, is an oscillating lever, F and F′, respectively, provided with trunnions, which turn in seats cut in the solid meeting faces of the two cylinders, so arranged that their line of motion is in the plane of the two coincident diameters of the cylinders. Between their ends in the cylinder C lies the piston C′, and operated by them, as shown hereinafter. The lower ends of these levers describe an arc, whose extreme points are inside the cylinder and at its inner face respectively. The operation of these levers is as follows:

Suppose the main piston B is at the right of cylinder A. Steam coming in behind it drives it to the left. But the lower end of lever F projects into the cylinder in its path. The piston B drives its lower end to the left, and its upper to the right, which, in turn, drives the piston C′ to the right also, thus (by means of its connection with piston D′, to be shown) cutting off steam from the right of piston B, opening exhaust-port at that side, and live-steam port on the left of piston B, which then travels to the right, where the same operation is repeated by lever F′, whose lower end was projected into cylinder A by piston C′. The bearing ends of the two levers are rounded off to diminish friction. Thus a sure and effectual operation of the piston C′ is effected—a very important result, since the piston C′ controls the admission of steam and exhaust. This will be seen from what follows.

The piston C′ has a perforation, or an annular groove, *a*, near each end, which communicate, as hereinafter shown, with two other channels, *b d*, cut in walls of chamber C, which serve respectively as ports for the live and exhaust steam to the ends of the chamber D, which, by operating piston D′ with its slide-valve, regulates the steam for main cylinder A. Channels *a*, their position varied by the stroke of piston C′, serve either as steam-port for one end, and exhaust for the other end of chamber D, or vice versa, ac-

cording as they register with channels *b d* and *b′ d′*.

These channels *b d* are made as follows: Channel *b* starts from steam-port E, where it cuts through the meeting faces of chamber C and cylinder A, and in both directions longitudinally still on the meeting faces, it continues toward both ends, near which it turns upward diagonally through the walls of chamber C on a diametrical line, till it emerges into chamber C. Exactly opposite this point of emergence the channel *b* continues till it meets the upper face of chamber C. Then it is cut lengthwise along the face and toward the ends, near which it is turned upwardly and inwardly till it finally opens into the ends of chamber D. This construction, it must be remembered, is duplicate—*i. e.*, the two corresponding channels, *b b′*, lead from the steam-port E each to one end of steam-chest D. The channels *d d′* are similarly constructed, but on opposite side and in opposite directions diametrically from channels *b b′*, and starting from the exhaust-port E′, but leading into the ends of steam-chest D at points further in than mouth of channels *b b′*. This is to avoid leakage, and cushion the steam on piston D′.

Where the channels *b d* and *b′ d′* cross the chamber C they must be so situated that at each end of the stroke of piston C′ the channels *a* will register either with *b* and *d′*, or with *b′* and *d* at the respective ends. In other words, they are so arranged that when piston *c′* is at either limit the channels *a* will register with steam-port *b* at one end and exhaust-port *d′* at the other, or with steam-port *b′* at one and exhaust-port *d* at the other end—that is to say, the steam and exhaust ports for operating piston D′. According to the position of the latter its slide-valve D″ admits steam to and exausts it from alternately-opposite ends of cylinder A through steam-port E and exhaust-port E′, respectively, which are the same as in my former patent, except that the exhaust-port E′ is not open to the space about the middle of piston C′. Therefore, as no leakage can occur there the piston C′ may be lightened as much as possible by cutting its middle part away, leaving only a thin shaft connecting the two heads, thus diminishing friction. This is a necessity in large engines.

The trippers F F′, it is to be remarked, are specially constructed and arranged with reference to the piston C′, chamber C, and piston B, so that when driven back by the action of the piston C′ the blows and pressure will be resisted by the ends of the chamber C through the heads of said trippers, thereby relieving the trunnions and other parts of the trippers of injurious consequences.

When the trippers are constructed with shoulders on their lower portions, through which alone the blows of the piston C are to be resisted, the consequence is soon a battering of said shoulders, and a disturbance of the uniform action of the valve-gear.

The operation of the whole, then, is as follows: Suppose the engine had been stopped when piston B had just reached the extreme right, and before change of motion could be effected—this would leave piston C′ at the extreme left, and piston D′ at the left also, whose slide-valve then would give open communication between steam-port E and right of cylinder A, at the same time piston C′ giving steam-port to left of piston D′. Now, let on steam. It will enter behind piston B, force it to the left, and at the same time press up through the working space of lever F′ to support piston C′ during the stroke of piston B. The latter continues its stroke to the left under pressure till it strikes lever F, which throws piston C′ to the right. This, with grooves *a* by the channels *b′ d*, opens the exhaust on the right and steam-port on left of piston D′, forcing it to the right, and by means of its slide-valve D″ opening the steam-port to the left and exhaust to the right of the main piston B; and so on. No special steam-port is needed for the ends of piston C′, because steam will find its way through the working-space of levers F F′ to serve the purpose of support to it.

This is a chief point in my invention. If the main piston move slowly it will strike the lever, but not hard enough to drive the piston C′ home to the other end, thereby causing only a small modicum of steam to enter behind the main piston. This may not suffice to move it; but the steam-pressure extends up through the working-space of the lever, and exerts itself in aid of the lever, shooting piston C′ to the full limit instantly, which then gives more steam to piston D′, which opens the full steam area to the main piston, causing it to start in its reciprocation.

The steam is not admitted at one end till it has fully done its work at the other, the change being effected by means that defy the condensation of steam, or formation of water, since the devices must work whether water be formed or not. A further advantage is the impossibility of dead-points.

The mere arrangement of the channels *b b′ d d′* may be altered at pleasure, so long as they retain their alternative functions.

The levers might be replaced by cams or circular rods or bolts shooting in circular grooves, or other equivalents suggested by mechanical skill.

Heretofore when attempts have been made to effect these results by trippers, and such devices protruding into the cylinder, they have all been of such a nature as to require a strictly steam-tight joint, which, under the circumstances, is not easy to effect; but by my invention no tightness of joint is wanted. In fact a loose joint is necessary, as will be easily understood from the foregoing.

Having fully described my invention what

I claim, and desire to secure by Letters Patent, is as follows:

1. The combination, with the chamber D and the double-headed piston C′, annularly grooved or diametrically perforated and working in the chamber C, of the steam and exhaust ports *b b′ d d′*, registering alternately at opposite ends, said piston C′ being cushioned by steam entering chamber C from chamber A, substantially as specified.

2. In combination with the double-headed auxiliary piston C, operating substantially as described, and the main piston B, the levers or trippers F F′, constructed and located with reference to the piston C′ and the ends of chamber C, as specified, whereby their heads will alternately strike the said ends at each full stroke of the piston C′, substantially as and for the purpose specified.

In testimony that I claim the foregoing I have hereunto set my hand this 6th day of November, 1875.

CHAS. ROGERS.

Witnesses:

THOS. J. MCTIGHE,

A. CORCORAN.