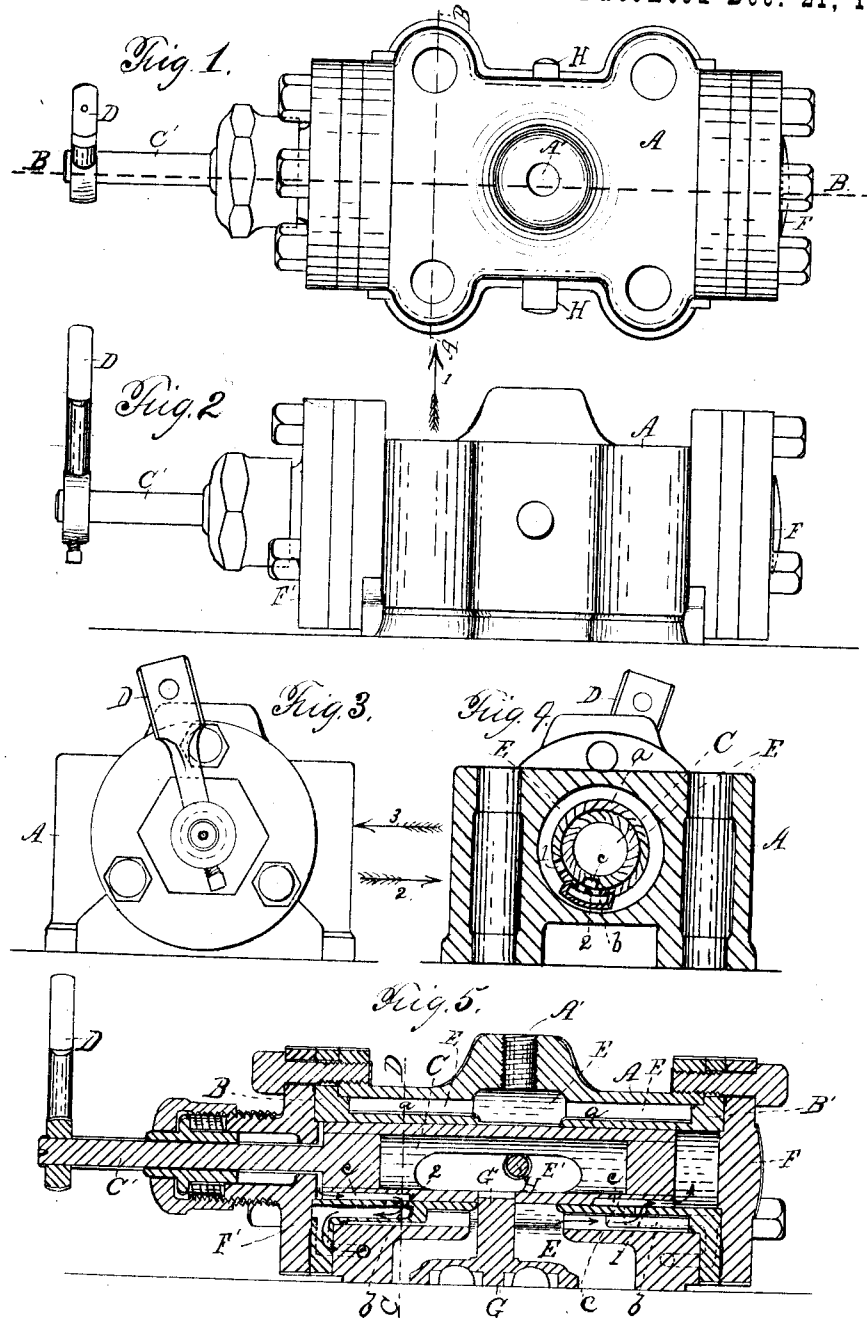


L. J. KNOWLES.
VALVES FOR STEAM PUMPING ENGINES.
No. 171,390. Patented Dec. 21, 1875.



WITNESSES;

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IMPROVEMENT IN VALVES FOR STEAM PUMPING-ENGINES.

Specification forming part of Letters Patent No. **171,390**, dated December 21, 1875; application filed October 26, 1875.

To all whom it may concern:

Be it known that I, LUCIUS J. KNOWLES, of the city and county of Worcester, and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Mechanism for Operating Valves of Steam-Pumps by Steam; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings forming a part of this specification, and in which—

Figure 1 represents a top or plan view of a steam-chest with my improvements applied thereto. Fig. 2 represents a side view, looking in the direction of arrow 1, Fig. 1. Fig. 3 represents an end view of Fig. 1, looking in the direction of arrow 2. Fig. 4 represents a vertical section on lines A B and C D, Figs. 1 and 5, respectively. Fig. 5 represents a longitudinal vertical central section on line B B, Fig. 1.

To enable those skilled in the art to which my invention belongs to make and use the same, I will proceed to describe it more in detail.

In the drawings the part marked A represents a steam-chest of a steam-pump having a steam-port, A'. Each end of the steam-chest is bored out to receive flanged tubular head-pieces B B', and which flanged tubular head-pieces are provided with tubular projections *a a*, within which the piston C is fitted to work, the said piston being made hollow in the center, with its solid ends working with an easy but close fit in the projecting tubular ends *a a*, while from one end a stem, C', projects through a proper stuffing-box, and is provided with a rocking lever, D. The projecting tubular parts *a a* are provided with longitudinal hollow projections *b*, one of which is shown in section in Figs. 4 and 5, while each end of piston C has a longitudinal slot, *c*, extending in so as to form a communication with steam-passage 1 and exhaust-port 2 in the tubular projections *a a*, when the piston is rocked into the position shown in the drawings, and the arrows in Fig. 5 show the course or passage of the steam from the steam-chamber E in through steam-port 1 into the right-hand cylinder *a*, between the head F and the right-hand end of piston C, whereby the piston C is driven

to the left, the steam escaping through the slot in the left-hand end of piston C, through exhaust-port 2, into the passage-way in projection *b*, and down and out through proper passage-ways, as indicated by arrows, to the main exhaust-port of the steam-pump. G is the main valve to the steam-pump provided with a stem, G', which projects up and enters a slot in the tubular part of piston C, as indicated in Fig. 5, whereby, when piston C is worked back and forth, as above indicated, valve G will be worked back and forth to open and close alternately the steam and exhaust ports of the steam-pump. It will be understood that the hollow projections *b* and steam and exhaust ports 1 and 2 are so arranged relatively to each other that when piston C is rocked back by turning lever D in the opposite direction, so as to stand in the same relative position on the opposite side of a vertical line passing through the center of the piston, steam-port 1 will be closed, and the slot which communicates with it, as shown in Fig. 5, will communicate with the exhaust-port 2, leading into the hollow projection *b* on the right-hand end of the steam-chest; or, in other words, that the relative position of the ports will be reversed from what they occupy as shown in Fig. 5, whereby steam will be admitted between the piston C and the stationary head F' on the left-hand end of the steam-chest, so that the motion of piston C will be reversed, thus giving to the main steam-valve G a back-and-forth motion upon its seat. The steam and exhaust ports 1 and 2 are so arranged that the rocking of piston C will shut off the exhaust-port before the piston reaches the head of the steam-chest, thereby cushioning the piston-head and preventing it from striking hard against the steam-chest. The piston C I make of iron, while the tubular projections or cylinders *a* are made of brass, so that when steam is admitted around the cylinders *a* they will expand away from the iron piston, so as to make an easy fit between the piston C and the cylinders *a*, even after the piston has been heated up by steam. This is owing to the greater expansion of brass over iron, and which fact I take advantage of to produce the results stated. The cylinders *a* might be made of other sensitive and expanding metal.

The piston is represented, in this instance, as being hollow in the center. It is also provided with a longitudinal slot, through which a pin, H, is passed to keep the piston from rocking too far in each direction.

In Fig. 4, which shows a cross-section of the left-hand end of the steam-chest, piston, and the tubular projection *a* on that end, it will be observed that the tubular projection *a* is secured to the steam-chest, so that its hollow projection *b* stands inclined to the left of a vertical line passing up through the center of the piston; and it will be understood from the foregoing description that the tubular projection *a* on the other end of the steam-chest will be secured in such a position that the hollow projection *b* will stand correspondingly inclined in an opposite direction, whereby, when piston C is rocked back and forth, as before explained, steam will be admitted at one end of the piston, while it is exhausted at the other, and vice versa.

The mode, however, of admitting and exhausting steam to drive piston C back and forth may be varied to suit manufacturers without changing the nature of my invention, which consists in the combination, with an iron piston, of one or more tubular projections, *a a*, of brass, or other metal more sensitive to heat than iron, whereby, when steam is admitted into the main steam-chest, it immediately passes entirely around the cylinder in which the piston works, thereby causing the cylinder to expand slightly and sufficiently, so as to prevent any binding of the piston by rust or otherwise, since it is important in the operation of steam-pumps, especially as their valves are worked by steam in most cases, that the piston which works the main valve should start easily as soon as steam is admitted; but in practice it has been found that when the pumps have been unused some little time the pistons become stuck in consequence of rust or contraction of the cylinders in which they work, so that in case of fire they are not always reliable; in fact, it is believed that some of the most serious fires would have been prevented but for this cause, which proves the most serious in that class of steam-pumps in which the piston does not have any projecting stem, as shown in the drawings, for, in such case, the head of the steam-chest must necessarily be taken off before the piston can

be reached by a hammer or other mechanical device to start or loosen it.

I prefer to make the internally-projecting cylinders *a a* of brass, and the piston of common cast-iron.

It will be observed that when steam is admitted through the port A' into steam-chest A, it has free access to the entire outer surfaces of the cylinders *a a*, in which the piston works, and as they are comparatively thin they become quickly heated, and thus, by expansion, are lifted sufficiently away from the piston to break any rusty contact, and also to relieve the piston from undue friction or contraction of the cylinders or otherwise before the steam has time to act upon the piston.

It will also be observed that said cylinders *a a* are arranged, in this instance, so as to leave quite an open space between their inner ends; but it is apparent that they may be arranged differently without departing from the principle of my invention—as, for instance, a single cylinder, *a*, could be used, in which case, however, it would have to be provided with two heads.

Referring to Fig. 5, it will be seen that the steam-chamber E extends entirely around the piston C and cylinders *a*, and also that steam can pass freely through the slot or opening E' in the piston, through which the rod H is passed.

Having described my improved mechanism for operating valves of steam-pumps by steam, what I claim therein as new and of my invention, and desire to secure by Letters Patent, is—

1. The combination, with steam-chest A, main steam-valve G, and the inwardly-projecting cylinders *a a*, having steam-ports 1 and exhaust-ports 2, of piston C, provided with slots *c c*, said parts being constructed and arranged substantially as and for the purposes set forth.

2. The combination, in a steam-pump in which the main steam-valve is driven by a supplemental steam-operated piston, of an iron piston, in combination with a thin cylinder made of brass or other similar sensitive and expanding metal, for the purposes stated.

LUCIUS J. KNOWLES.

Witnesses:

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