2 Sheets-Sheet 1.

A. Kendall,

Steam-Engine Valve-Gear.

No. 77,986. Patented May 19, 1868.

Fig 1.

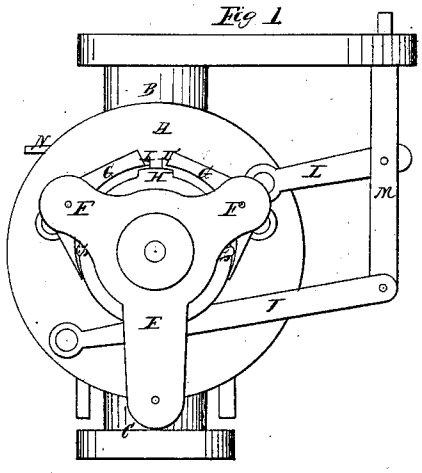


Fig 2.

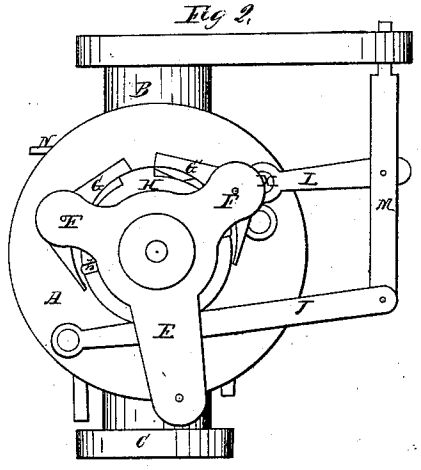


Fig 3.

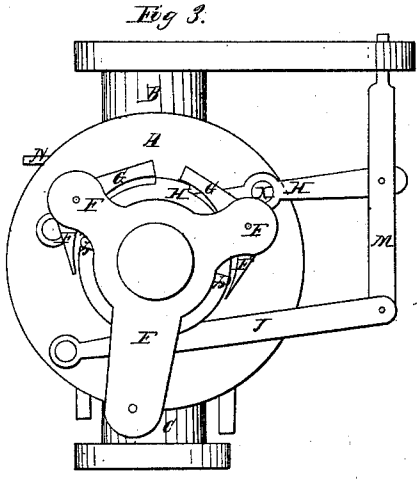
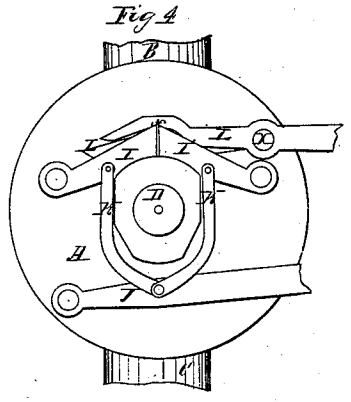


Fig 4.



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Adamum Kendall

2 Sheets. Sheet 2.

A. Kendall,

Steam-Engine Valve-Gear.

No. 77,986. Patented May 19, 1868.

Fig 5

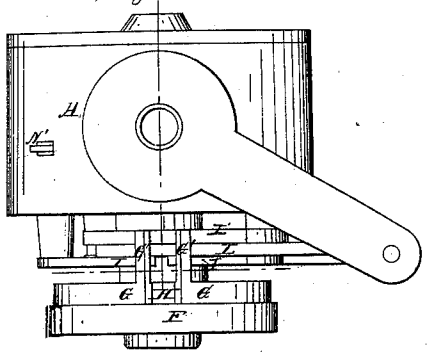


Fig 6

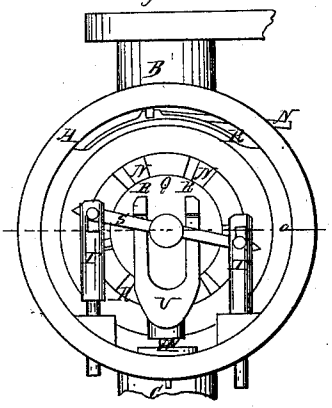


Fig 7

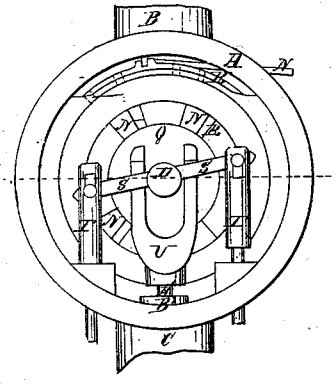


Fig 8.

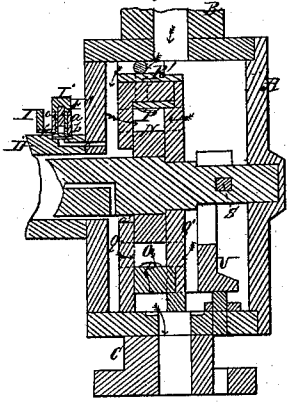


Fig 9.

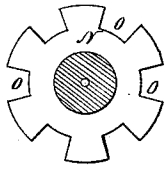


Fig 10

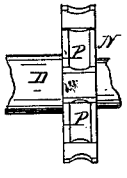
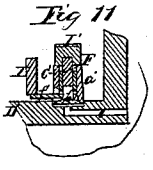


Fig 11



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United States Patent Office.

ADONIRAM KENDALL, OF BUFFALO, NEW YORK.

Letters Patent No. 77,986, *dated May* 19, 1868.

IMPROVEMENT IN CUT-OFF-VALVE GEAR.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, ADONIRAM KENDALL, of Buffalo, in the county of Erie, and State of New York, have invented certain new and useful Improvements in Steam-Regulating and Cut-off Valves; and I do hereby declare that the following is a full and complete description of the same, reference being had to the accompanying drawings making a part of this specification, in which—

Figure 1, plate 1, is a front view with the valve closed.

Figures 2 and 3 are front views with the valve open.

Figure 4 is a detached view.

Figure 5, plate 2, is a top view.

Figures 6 and 7 are inside views.

Figure 8 is a transverse section

Figures 9 and 10 detached views of the valve.

Figure 11, a detached section.

Like letters of reference refer to like parts in the several views.

I am aware that oscillating circular steam-valves have been used, and operated by pawls and levers, as described in the patent of R. Sanderson and others, but which I do not claim. That which distinguishes my invention from all others is as hereinafter described.

A, fig. 1, is a valve-chamber, in which a valve hereafter described is located, and of which B C are the steam-pipes. D, fig. 4, is a rock-shaft projected through said chamber, and to which the valve referred to is attached, and by which it is operated by the vibrator E, fig. 1.

To the upper arms F of this vibrator are pivoted pawls G, which are made to engage the lug H, and thereby operate the valve, as will hereafter be shown. Immediately back of the pawls is arranged a pair of levers, I, the lower ends of which are pivoted to the chamber. The upper or free ends are made to slant upward to a point X, as shown in fig. 4, thereby forming a pair of inclined planes upward from the pivoted ends.

These levers I are connected to a lever, J, by a pair of links, K, fig. 4 and by which the said levers I are operated as and for a purpose presently shown. Immediately behind the levers I is a lever, L, pivoted, at the point X, to the valve-chamber, and connected to the lever J by a link, M, fig. 2, the two being operated conjointly, as will hereafter be shown. N, fig. 9, plate 2, is the valve above referred to. This valve, as will be seen, is circular in form, with deep, square openings or ports O cut in the periphery. In the edge of this valve is a deep groove or channel, P.

The position of the valve when in place is shown in fig. 8, in which it will be seen that it is enclosed on the sides by the walls Q Q′, which are provided with ports R, fig. 6, corresponding in number, shape, and size, to the ports O, in the valve. S, figs. 6 and 7, are arms projecting from the end of the rock-shaft. To the extreme ends of said arms are attached the stops T, the purpose of which will hereafter be shown. U is also a stop, the arms of which reach upward on each side of the shaft D, figs. 8 and 10, plate 2, and project over and rest upon the arms S.

Having thus described the construction and arrangement of the apparatus, the practical working of the same is as follows:

The apparatus is placed on the top of the cylinder, or in any other desirable place in connection with the main steam-pipe. The lower end of the vibrator E is attached to the eccentric, and is thereby made to vibrate. Thus, as it is moved from the position shown in fig. 1 to that shown in fig. 2, the lug H, which is connected to the rock-shaft, is engaged by the pawl G′, and thereby turns the shaft, opening the ports of the valve N, as shown in fig. 6, plate 2. Through the open ports steam passes through the pipe B into the chamber A; thence through the walls Q Q′, around the edge of the valve, along the groove P, to the lower part of the chamber; thence through the pipe C to the cylinder, as indicated by the arrows. At this time the pawl G′ is disengaged from the lug H by its being made to slide upon the levers I′, which, as will be seen, throws the pawl from the lug, which on being released from the pawl returns immediately to the position shown in fig. 1, and thus closes the ports,

shutting off a further ingress of steam through the valve. On the reverse action of the vibration, the lug H is thrown in the opposite direction, as shown in fig. 3, thereby opening the valve as shown in fig. 7, admitting steam to the cylinder through the ports of the valve, along around the groove in its periphery, to the pipe C, thence into the cylinder as before. The valve is again instantly closed as before by the pawl G becoming disengaged from the lug, by means of the lever I, and so on alternately, the valve is opened as the vibrator is moved from right to left, and from left to right, and at each instant closed on the pawls becoming disengaged.

This closing of the valve immediately on the disengagement of the lug and pawls is accomplished by the stop U and arms S, fig. 6. The lower part of said stop terminates in a stem, A′, which is protruded through the side of the chamber in a stuffing-box, B′. Now, as the shaft is made to turn by means of the pawl and lug above described, the arms S will lift up the stop, as shown in fig. 6. On the pawls becoming disengaged from the lug the pressure of the steam exerted upon the broad base of the stop will instantly force it down, and thereby bring the arms S to a horizontal position, as indicated by the dotted line *a*, fig. 6, and thus close the valve, shutting off the steam immediately, as each pawl becomes disengaged from the lug.

This closing of the valve may be accomplished by the stops T, attached to the extreme end of the arms S. Thus the stop T, on being lifted, as shown in fig. 6, by turning the shaft, will, on the disengagement of the pawls and lug, be forced down by the pressure of the steam, and thereby bring the arms S to a horizontal position as did the stop U, and so on. The stop T′, being lifted as shown in fig. 7, will, on the disengagement of the pawl and lug, be forced down in like manner, each time closing the valve-ports.

It will be observed that the rock-shaft is not of a uniform diameter, that part encircled by the wall Q′, fig. 8, being somewhat less than that encircled by the wall Q, hence the pressure of the steam on the valve is unequal. To compensate for this, a space, *a′*, fig. 8, around the shaft, allows the steam to press on that side of the valve, and thereby equalize the pressure, causing the valve to be equally balanced.

In order to insure a certainty in the action of the pawls upon the lug, the said pawls are provided each with a dependent tail, F′, which are pressed outwardly by a pin *b*, fig. 3, fitted loosely in the ring, by which the lug H is secured to the shaft. These pins are forced outward by a spring located at the inner end of the pins, or by the pressure of the steam admitted to the end of the pins by having the rock-shaft hollow, with a small hole leading from the hollow of the shaft to the end of the pin, and thus bring the steam to act on the pins, and force them out against the tail of the pawl.

The action of the valve as above described is that of a cut-off. It will be obvious that the amount of steam cut off will be in proportion to the throw of the valve, as the throw of the valve depends on the length of vibration given the lug H; hence, the further it is moved either to the right or to the left, the wider the valve will be opened and the more steam cut off, and *vice versa*.

In order to produce a uniformity in the supply of steam, and thereby produce an equal movement of the engine under a variable pressure of steam, the lever J is attached to the governor by means of the link M, fig. 1. Now, as the lever will be drawn upward, and thereby push up the levers I further above the lug H, the result will be to cause the pawls G to become sooner disengaged from the lug for the reason that they do not drop so low against the shoulder, but are pushed off by the levers over which the ends G′, fig. 5, slide, and by which the pawls are made to disengage the lug. By this it will be evident that the higher the levers are pushed up, the less will be the vibration of the shaft, therefore the opening of the valve will be less, and thus cut off the steam. So, on the contrary, as the balls fall, the lever J descends, and the levers I drop more or less and allow the pawls to fall deeper against the shoulder of the lug, and thereby give to it a greater vibration, and so open the valve, and allow the steam to follow a greater distance the stroke of the piston. Should the governor cease to act in consequence of accident to it, the lever L, fig. 4, above referred to, will be thrown up above the apex of the levers, as shown in fig. 4, plate 1, and raise the pawls G sufficiently to open the valve only enough to give the engine a light-running motion, and thus prevent any breaking or injury to the engine or machinery in consequence of an accelerated movement that may be given to it by the stopping of the governor.

This same result may be obtained by the lever L′, fig. 5, plate 2. One end of this lever is pivoted to the chamber, from which it reaches across under the ends G′ of the pawls. From the under side of this lever proceeds a stem, E′, fig. 8. This stem is fitted to and made to play in a sleeve, *a′*, fig. 8, a detached view of which is shown in fig. 2, plate 2. In this sleeve is fitted a lining or bush, *c′*, attached to the lower end of which is a valve, *b′*. This valve closes an aperture or channel, *e*, fig. 2, leading from the stuffing-box D′, through into the steam-chamber A. From the lining or bush to which the valve is attached proceeds an arm, *f*, to the under side of the levers I, and by which the valve and lever L′ are operated in the following manner:

When the governor ceases to act, in consequence of accident or otherwise, the lever J drops, and brings down the levers I, so as to strike the horizontal arm *f*, which opens the valve *b*, thereby allowing steam to pass into the lining or bush *c′*, under the stem E′, and forces it up, thereby lifting the lever L′ above the apex X of the levers I, and upon which the ends G′ of the pawls will rest disengaged from the lug, or so much so as to allow the valve to operate sufficiently to give the engine a light-running motion, as did the action of the lever L above described.

I am aware that cut-off valves have been operated by means of pawls and lug, and that said pawls have been lifted for the purpose of regulating the vibration of the valve. In these cases the manner of lifting the pawls has been by a yoke, so arranged that the upper end would receive the weight of the pawls on being pushed up for that purpose. The objection to this method is that the yoke has to be raised to a considerable height in order to raise the pawls; hence its effect is not immediate, as the expansion and contraction of the governor do not act sufficiently or immediately to produce the desired result at all times; but in the arrangement of the levers I, it will be seen that the free ends or apex X, fig. 4, will move much faster and to a greater distance than the same would if the levers were united at the point X, and detached from the chamber, and then pushed

up by the lever J, which would be analogous to that of the yoke. By thus causing the levers 1 to move faster and further by the lever J, a more immediate action is obtained on the pawls, and in consequence the valve is more sensitive to the action of the governor.

R′, fig. 6, is a slide-valve operated from the outside by a stem, N′. In this valve are holes or ports *g*, as noted by the dotted lines in figs. 7 and 8, corresponding in number and size to ports in the valve-seat, as indicated by the dotted lines *c*. Through these ports the steam may be allowed to pass directly through the valve to the cylinder by passing along the grooves P, in the edge of the valve, instead of passing through the valve, in the manner as above described.

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

1. The levers I I′, links K, and lever J, as constructed and arranged in combination with the pawls G, as herein set forth.

2. The arrangement of the lever L, in combination with the pawls G, substantially as herein described.

3. The arrangement of the oscillating-valve N and walls Q Q′, as set forth.

4. The stop U or T, as constructed and arranged in relation to the valve N and arms S, so as to operate said valve by the pressure of steam, substantially as set forth.

ADONIRAM KENDALL.

Witnesses:
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J. HOLMES.