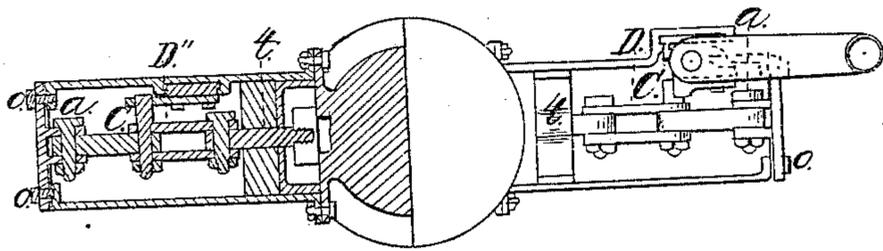
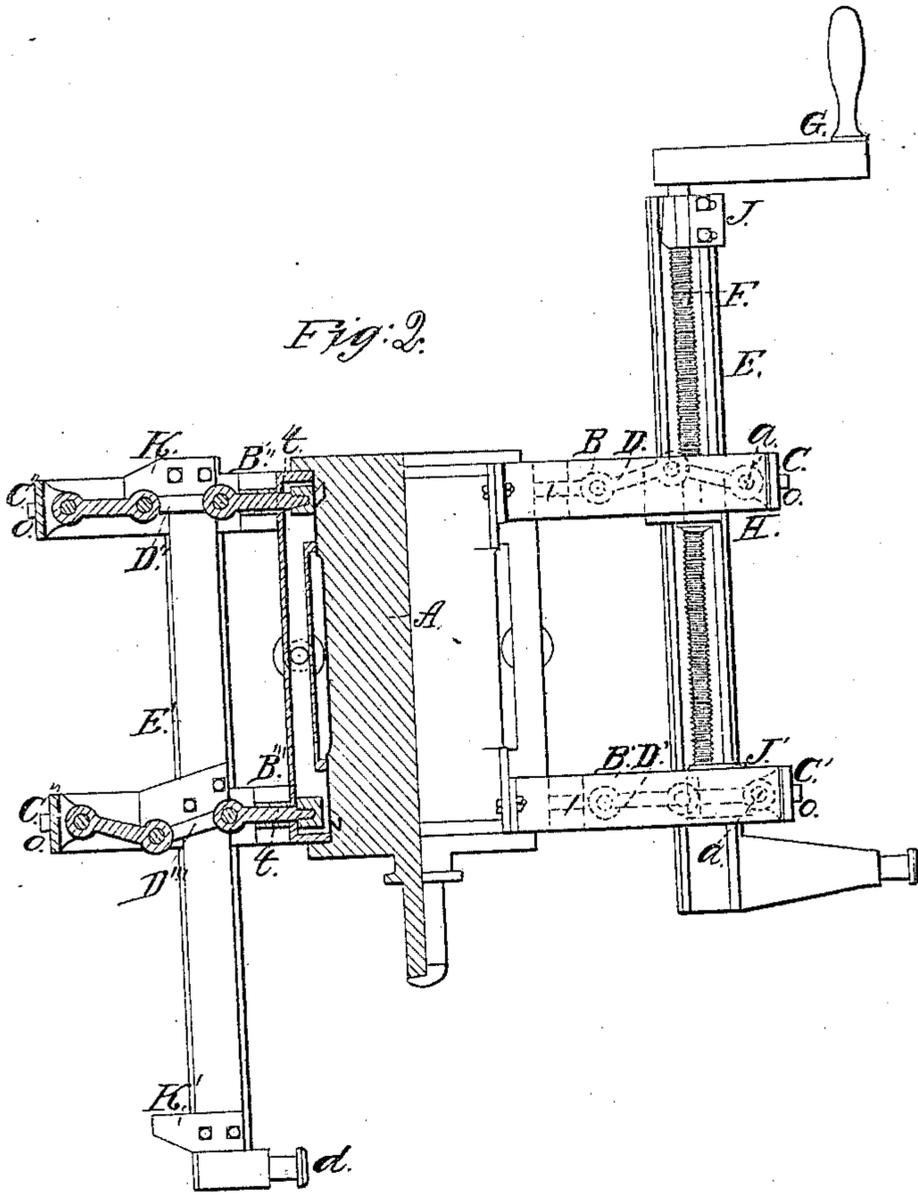


*C. W. Wailey,*  
*Steam-Engine Valve-Gear.*  
*No. 82,184.      Patented Sep. 15, 1868.*

*Fig. 1*



*Fig. 2*



*Witnesses:*  
*Rufus B. Rhoads*  
*H. A. Jenkins*

*Inventor:*  
*C. W. Wailey*

# United States Patent Office.

C. W. WAILEY, OF NEW ORLEANS, LOUISIANA, ASSIGNOR TO THE NEW ORLEANS PNEUMATIC-PROPELLING COMPANY.

*Letters Patent No. 82,184, dated September 15, 1868.*

## IMPROVEMENT IN CUT-OFF VALVE-GEAR FOR STEAM-ENGINES.

*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, C. W. WAILEY, of the city of New Orleans, parish of Orleans, and State of Louisiana, have invented a certain new, useful, and improved Cut-Off Valve for Steam and Pneumatic Engines, or, more properly, a new and improved method of operating the valves of such engines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the annexed drawings, making a part of this specification.

The object of my invention is to utilize or make practicably available the whole power or force that results from the principle of expansion, and to avoid friction, and the consequent abrasion and wear of the contiguous surfaces of the valves and their seats. But, before I enter upon a detailed description of my invention, it is proper to remark that in order to make the whole force of the expansive power of steam or compressed atmospheric air available, either in a steam or in a pneumatic engine, the receiving or the induction-valves of the cylinder should be made to open wide enough to admit the steam or compressed air, as the case may be, between the head of the cylinder and the follower, or head of the piston, in sufficient volume to fill the space therein contained, at a density or pressure equal to the pressure that obtains in the generator, or the reservoir or tank in which the atmospheric air is contained and compressed, and to close the moment the piston has travelled far enough on its stroke to increase the space sufficiently to hold enough of the motor to finish the stroke by its power of expansion, independently of other air or force. In all existing valves, but especially in slide-valves, the opening and closing operation is gradual, and hence it is impossible to obtain a pressure on the piston equal to the pressure in the steam-generator or air-tank, without making the openings disproportionately and inconveniently large. The reason of this is, that the space is increased by the movement of the piston, whilst the induction is going on as fast as or faster than the induction takes place. In fact, as most cylinders are now constructed, it is wholly impracticable to make the openings sufficiently large to secure a pressure therein that even approximately equals that which obtains in the generator or air-tank, and this is the reason why the full force of the elastic or expansive power of the motor has not heretofore been brought into use.

My invention remedies this difficulty, for it consists of a mechanical arrangement or adaption, by which the induction-ports are instantly opened to their utmost capacity or width, and kept thus open until the piston has moved upon its stroke far enough to make room between its head and the head of the cylinder, to admit a sufficient quantity of steam or compressed air, as the case may be, to complete the stroke by the force of its expansion, and then, as suddenly as they were opened, to close the ports, and this, too, without that severe and wearing friction that is inevitably incident to the operation of every existing valve of which I have any knowledge.

Nor are these the only advantages to which my improvement may justly lay claim. Its use entirely avoids the waste of the motor, whether the same be steam or compressed air, which is necessarily involved in the filling of the long steam-ways that are common to existing engines, for it requires no steam-ways except through the shell of the cylinder, and these consist of the perfectly-straight ports, through which the motor enters the cylinder. In other words, my invention consists of a toggle-joint, which, it is well known, possesses, when its two sections or members are brought into the same straight line, a mechanical power that is infinite, or rather of the application of a toggle, or its combination with the valves of steam or pneumatic engines, in order to operate them. By the employment of the toggle-joint, I meet all the requisite conditions to produce a perfect valve-motion, by which I mean the lifting and the pressing down of the same, without any appreciable friction between the surfaces that come in contact with one another, and hence without any appreciable wear of the same, however prolonged the use. In fact, there may be said to be no friction or wear in a valve that is moved by a toggle, excepting only where the stem to which the valve is attached, passes through its stuffing-box, where its effects may be remedied very easily, as frequently as necessity shall require.

In applying my invention to practice, it is necessary that the induction and exhaust-valves should be placed on opposite sides of the cylinder, and so arranged as to be worked independently of each other, as will be very clearly manifest after I have explained its nature and operation.

But my invention will be better and more quickly understood by referring to the drawings, in which front and top views are given, both, however, being in part sectional, the line of bisection being through the exhaust or eduction-valves.

On the drawings, A is a cylinder, it may be either a steam or a compressed-air cylinder, which, inasmuch as I make no claim to having made any improvement thereupon or in, is shown as though it is in solid form. From the opposite sides of the cylinder A, project, in the same axial line or plane, the arms B B' B'' B''', on the outer extremities of which are fitted or placed the adjustable caps C C' C'' C''', that are held in position by screws *o*, as shown. To these caps the outer sections or arms of the toggles D D' D'' D''' are secured, and moved on the pivot-pins *a*. And to the rods I, which are connected to the inner section of the toggles by movable joints, the valves are secured. These rods constitute the stems proper of the valves, which move in right or straight lines, through proper stuffing-boxes at *t*. In guide-ways or grooves that are cut transversely across the projecting arms B B' B'' B''', are fitted the sliding bars E E'. The bar E, on the induction-side of the cylinder, is provided with a longitudinal-adjusting screw-rod, F, to which the crank G is secured, in order that it may be rotated in either direction. This screw-rod passes through a fixed centre-piece, H, that has a collar on both sides of it, and it is through the agency of this centre-piece that the rotation of the rod may be effected to the right or to the left, and both ends of the same, with respect to the said centre-piece, be shortened or lengthened at will. J J' are movable blocks or stoppers on the bar E, which, being fitted on screw-rod F by female-screw threads, afford the means for adjusting the cut-off at any point at which it may be desired to make it, for accordingly as the screw-rod is turned to the right or to the left, are these stoppers drawn towards or pushed from the centre-piece H, and the cut-off effected at a shorter or longer distance from the induction-valves at the extremities of the cylinder. These stoppers slide in grooves in the bar E, in order to make this movement, and on their front faces are fixed adjustable plates, that are so formed, that whilst they strike against the pins *c* in the toggles D and D', and thereby actuate the said toggles, whilst the bar E moves in one direction, they pass over the said pins without affecting the toggles when this bar is moving in the other or reverse direction. A reciprocating or backward-and-forward motion is imparted to the bar E, by gearing the same to the main shaft of the machine, or to some other part, to which a crank or pulley may be easily affixed.

The bar E' has no adjusting-screw rod corresponding with that connected with the bar E, for, being on the eduction-side of the cylinder, and operating the exhaust-valves, no adjustment of the stoppers connected therewith is necessary. This bar is connected with the shaft of the engine at the wrist *d*, and, through the action of an eccentric placed on said shaft, has a reciprocating motion imparted to it that is nearly coincident, in the length of its stroke, to that of the piston of the cylinder. This bar E' works on the same principle as the bar E, and it is provided with the same adjuncts, but the stopper-blocks K K' are fixed, there being no need of an adjusting-screw rod, F, so as alternately to open the exhaust-valves at each end of the cylinder to their greatest capacity, at every stroke of the piston, to allow of the instant escape of the motor at the instant the return-stroke begins.

The operation of my invention is as follows :

When the piston arrives at the end of its stroke, the stopper-block J or J', accordingly as the stroke has been in the one or the other direction, strikes, by means of its face-plate, against the pin *c* in the toggle D or D', as the case may be, and by bending the said toggle at its central joint from a straight line, as shown at D, lifts the valve connected with it from off its seat, and permits the steam or compressed air to rush under the said valve, which is thereby, by reason of the expansive power of the same, carried up to the full extent of its lift, without further aid from the stopper-block, the same, in fact, being relieved from all further duty of pressing against the pin *c*, to operate the valve. The stopper-blocks K K' on the bar E', are adjusted in such manner as always to open the eduction-valves at the instant the piston changes its motion to make a return-stroke, so as to prevent any resistance thereto by the presence of steam or air, as the case may be, in the cylinder.

To illustrate the operation of my invention still more clearly, suppose the stoppers J J' to be so set or adjusted as that the induction of the motor shall continue nearly the whole, or during nearly the whole stroke of the piston, the stopper J', for example, will have closed the port of the valve that is operated by the toggle D', by passing over the pin *c* projecting therefrom, but the valve worked by toggle D will be open, and the induction of the motor will continue until the piston shall have travelled nearly its whole stroke, because the stopper J will not in that case be brought into contact with the pin *c*, projecting from toggle D, and thus close the valve connected with said toggle, until the stroke of the piston is nearly completed. The sliding bar E has always the same stroke, but by moving the stopper-blocks J J', through the agency of the screw-rod F, the cut-off may be made at any point, and hence if the compression of the motor be very great, as in the case of a pneumatic engine, the expansive force of the same may be made to do nearly all the work of driving the machine.

The advantages of my invention are that it is simple and yet very powerful in its action, whilst at the same time it opens and closes a valve with inconceivable rapidity, without appreciable friction or wear of the parts that come in contact with each other.

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

1. The arrangement of the toggle-joints D D' D'' D''', with reference to the induction and eduction-valves, when those parts are constructed substantially as herein described.
2. The arrangement of the toggle-joints D D' D'' D''' with the bars E and E', substantially as herein described.

Witnesses:

RUFUS R. RHODES,  
H. N. JENKINS.

C. W. WAILEY.