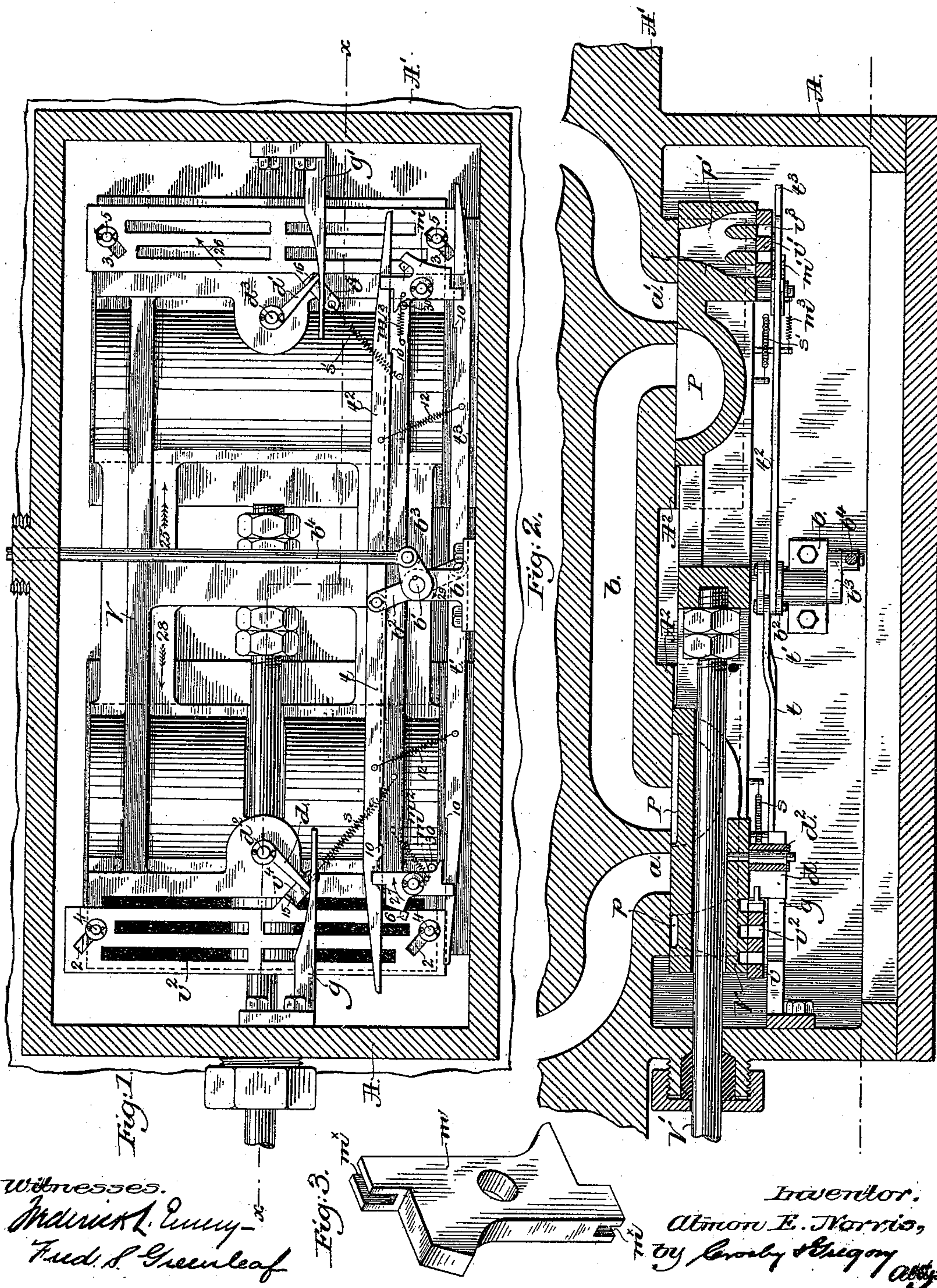


(No Model.)

A. E. NORRIS.  
CUT-OFF VALVE.

No. 438,637.

Patented Oct. 21, 1890.



Witnesses.  
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# UNITED STATES PATENT OFFICE.

ALMON E. NORRIS, OF CAMBRIDGE, MASSACHUSETTS.

## CUT-OFF VALVE.

SPECIFICATION forming part of Letters Patent No. 438,637, dated October 21, 1890.

Application filed April 12, 1890. Serial No. 347,686. (No model.)

*To all whom it may concern:*

Be it known that I, ALMON E. NORRIS, of Cambridge, county of Middlesex, State of Massachusetts, have invented an Improvement in Automatic Cut-Off Valves, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

10 This invention has for its object to improve automatic cut-off valves for steam-engines; and it consists in the combination of the reciprocating main valve, the cut-off valves movable with and also independently of the main valve, and means whereby each cut-off valve after being moved from its port-closed position to its port-open position by the movement of the main valve may be released from the latter position to assume its port-closed position during either the corresponding port-opening or port-closing movement of the main valve, substantially as will be described.

20 My invention also consists in certain improvements in arrangement and construction of parts, to be hereinafter described, and pointed out in the claims at the end of this specification.

30 Figure 1 shows in plan view a slide-valve of common construction provided with my improved cut-off valves. Fig. 2 is a horizontal section taken on irregular dotted lines  $x x$ , Fig. 1, and Fig. 3 a perspective detail to be referred to.

35 The steam-chest A is supposed to be located upon one side of, and, as herein shown, forms a part of the cylinder-casting A', only a portion of which casting is shown, but which may be of any usual construction, the steam-chest presenting within a vertically-arranged valve-seat A<sup>2</sup>, having steam-ports  $a a'$ , communicating with the opposite ends of the cylinder and the exhaust-port  $b$ .

45 The main slide-valve V, having the steam-ports  $p p'$  and the exhaust-port P, is seated on the valve-seat A<sup>2</sup>, and is reciprocated by the valve-stem V' from the usual eccentric located upon the main shaft of the engine, or the said valve may be moved in any other usual or well-known manner.

50 Upon the outer face of the main valve V are seated the cut-off valves  $v v'$  of the "grid-iron" type, and having, as herein shown,

ports  $v^2 v^3$ , which register with the steam-ports  $p p'$  of the main valve, and the said cut-off valves are provided near their ends 55 with angular slots 2 3, which receive pins or studs 4 5, projecting upwardly from the main valve V, the said slots being preferably located at an angle of about forty-five degrees, more or less, with the line of motion of the main 60 valve, said angle varying according to the engine-speed for which the valve is designed. By this arrangement the least possible number of parts is required, and the friction is reduced to a minimum, as the slots have the 65 same direction as the average resultant of the weight and inertia of the cut-off valves at the positions where their port-closing movement takes place.

The cut-off valves  $v v'$  are provided with 70 arms or studs  $v^4 v^5$ , extending diagonally inward in the same line of direction as the slots 2 3, the said arms having shoulders 15 16 to be acted upon by suitable dogs  $d d'$ , mounted loosely upon studs  $d^2 d^3$ , carried by the main 75 valve, the said dogs being slotted to embrace the said arms or studs and normally resting with their free ends upon the inclined or cam faces of the guides  $g g'$ , bolted or otherwise 80 secured to the walls of the steam-chest, as shown. Springs  $s s'$ , attached to the said arms or studs  $v^4 v^5$  and to the main valve and acting in the direction of slots 2 3, tend to keep the cut-off valves normally in their lowermost positions, with the ports  $p p'$  covered or closed. 85

Pivoted to opposite ends of the main slide-valve are the pawls  $m m'$ , under the control of light springs  $m^2 m^3$  and adapted to co-operate with the pins 6 7, carried by the cut-off valves, to hold said valves in their elevated or port-open position, when desired. The pawls  $m m'$  90 are slotted at top and bottom, as at  $m'$ , (see Fig. 3,) to receive the tripping-rods  $t t' t^2 t^3$ , jointed, as shown, to opposite ends of the lever  $b^2$ , on one end of the rock-shaft  $b'$ , mounted in a bracket 95  $b$ , bolted or otherwise secured to the interior of the steam-chest, as shown. The opposite end of the rock-shaft  $b'$  has an arm  $b^3$ , to which is jointed the rod  $b^4$ , which passes out from the steam-chest through a suitable stuffing- 100 box and may be connected to a governor of any usual construction, (not shown,) whereby the rod  $b^4$  may be lifted or depressed as the speed of the engine varies. The tripping-rods  $t t'$



$t^2 t^3$  are each provided with a shoulder 10 to engage the pawls  $m m'$  to trip the cut-off valves, as will be hereinafter described, the tripping-rods being held in operative contact with the said pawls by suitable springs 12.

The valve is shown in the drawings as in its middle position, both steam-ports being covered, this being the position when the piston is near the middle of its stroke.

Assuming the main valve to be in its middle position, as shown, with the cut-off valve  $v$  held in its elevated position by the pawl  $m$ , uncovering the port  $p$ , and the cut-off valve  $v'$  in its lowermost position, covering the port  $p'$ , and with the piston approaching the left-hand end of the cylinder, the operation of the various parts is as follows: The main valve is moved to the right in the direction of arrow 25, carrying the cut-off valves with it, and when the valves shall have moved a distance equal to its outside lap, steam will be admitted to the left-hand end of cylinder through the open ports  $p$  and  $a$  to force the piston to the opposite end of the cylinder, and at the same time the dog  $d'$  will ride up the inclined surface of its guide  $g'$  and, acting against the shoulder 16 of the arm or stud  $b^5$ , will lift the cut-off valve  $v'$ , guided by the slots 3 in the direction of arrow 26, uncovering the port  $p'$ , and as the said valve reaches its elevated or open position the pawl  $m$ , acted upon by its spring  $m^3$ , will spring behind the pin 7 and against the stop 30 to hold said valve in said elevated or open position, the other pawl  $m$  having in the meantime passed beyond the shoulder 10 of the tripping-rod  $t$ . The valve has now reached the end of its travel. As the piston in the cylinder continues to approach the middle of its stroke, moving toward the right, the main valve will be caused to move in the direction of arrow 28, when the pawl  $m$ , engaging the shoulder 10 of tripping-rod  $t$ , will be turned on its pivot in the direction of arrow 27, releasing it from engagement with pin 6 and allowing the cut-off valve  $v$ , acted upon by gravity, inertia, and the spring  $s$ , to drop immediately to its lowermost or normal position, covering the port  $p$  and cutting off the steam. The main valve continuing to move in the direction of arrow 28 carrying the cut-off valve  $v'$  still held in its elevated or open position by pawl  $m'$ , the port  $a'$  will be uncovered, admitting steam to the right-hand end of the cylinder, and when the valve approaches the end of its travel in this direction, the pawl  $m'$  will pass over the shoulder 10 of the tripping-rod  $t^3$  which will trip said pawl upon its return movement. When the rod  $b^4$  is sufficiently depressed to turn the rock-shaft  $b'$  and its lever  $b^2$  in the direction of arrow 29, the shoulders 10 of the tripping-rods  $t t^3$  will be moved farther away from their respective pawls  $m m'$  and beyond their travel, but at the same time bringing the shoulders 10 of tripping-rods  $t' t^2$  nearer the pawls, where they will be engaged by said pawls to trip the cut-off valves upon the cor-

responding opening movement of the main valve.

I do not desire to limit myself to the particular construction of tripping mechanism shown, as the same may be somewhat varied without departing from the scope of this invention. Neither do I desire to limit myself to any particular mechanism for moving the rod  $b^4$ .

It will be seen from the foregoing description that the cut-off valves are raised to their port-open position with relation to the main valve on the corresponding port-closing stroke, so that they are completely open at the beginning of the travel of the main valve, and may be tripped to cut off the steam from the cylinder at any point in the stroke of the piston between the admission and cut-off of the main valve, making the range of cut-off from zero up to three-fourths or seven-eighths stroke.

In the foregoing description I have described my invention as applied to a horizontal engine having the steam-chest located upon one side of the cylinder; but my invention is also applicable to a horizontal engine, wherein the steam-chest is located upon the top side of the cylinder or to a vertical engine.

I claim—

1. The combination of the reciprocating main valve, the cut-off valves movable with and also independently of the main valve, and means whereby each cut-off valve after being moved from its port-closed position to its port-open position by the movement of the main valve may be released from the latter position to assume its port-closed position during either the corresponding port-opening or port-closing movement of the main valve, substantially as described.

2. The combination, with the reciprocating main valve, of the cut-off valves carried thereby and having diagonal slots and guide-pins for said slots, and operating mechanism whereby said cut-off valves are caused to move in a direction inclined to the line of motion of main valve to first uncover and then cover the ports of said main valve, substantially as described.

3. The combination, with the reciprocating main valve and cut-off valves carried thereby and movable in a straight line inclined to the direction of motion of said main valve, of pawls carried by said main valve to support and trip said cut-off valves and means for moving said pawls, substantially as described.

4. The combination, with the reciprocating main valve and cut-off valves carried thereby, of a dog or dogs carried by said main valve to lift said cut-off valves and pawls for thereafter supporting and tripping said cut-off valves, substantially as described.

5. The reciprocating main valve and cut-off valves carried thereby, combined with the dogs  $d d'$  and guides  $g g'$  for lifting said cut-off valves, substantially as described.

6. The reciprocating main valve and cut-



off valves carried thereby and dogs for lifting said cut-off valves, combined with the pins 5 6 and pawls *m m'*, for supporting said cut-off valves, and means for tripping said  
5 pawls, substantially as described.

7. The reciprocating main valve, cut-off valves carried thereby, dogs for lifting said cut-off valves, and pawls for supporting the same, combined with the tripping-levers *t t' t<sup>2</sup>*  
10 *t<sup>3</sup>*, substantially as described.

8. The reciprocating main valve, cut-off valves carried thereby, dogs for lifting said

cut-off valves, and pawls for supporting the same, combined with the tripping-levers *t t' t<sup>2</sup>* *t<sup>3</sup>*, the positions of which are controlled by 15 the governor, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALMON E. NORRIS.

Witnesses:

EMMA J. BENNETT,  
BERNICE J. NOYES.