J. R. Robinson,

Steam-Engine Valve-Gear.

No. 32,534. Patented June 11, 1861.

Fig. 1.

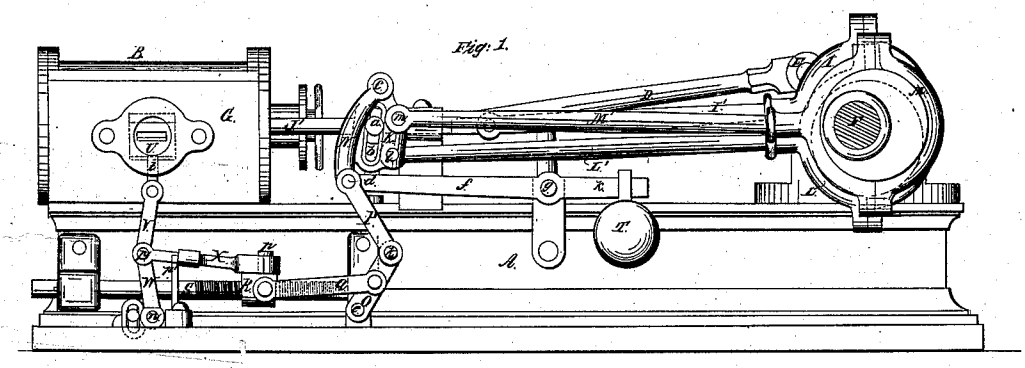


Fig. 2.

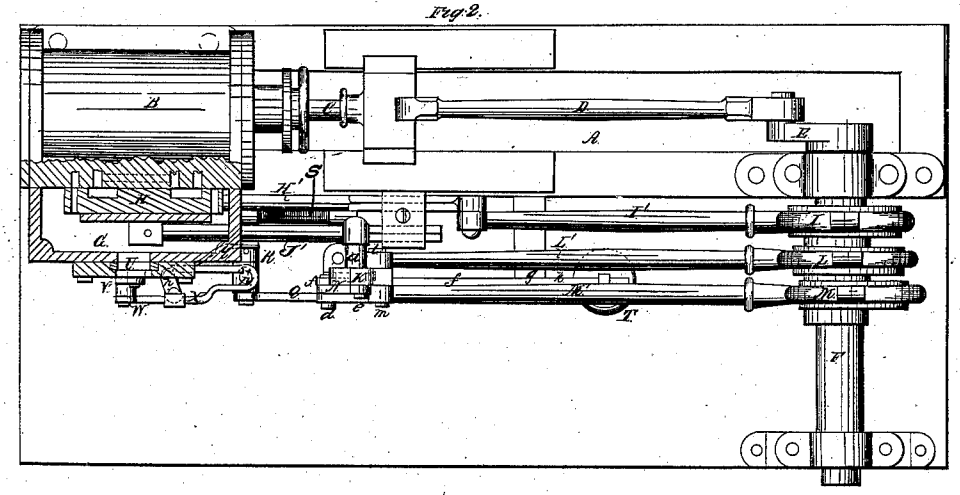


Fig. 3.

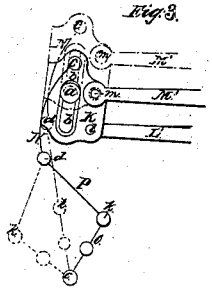
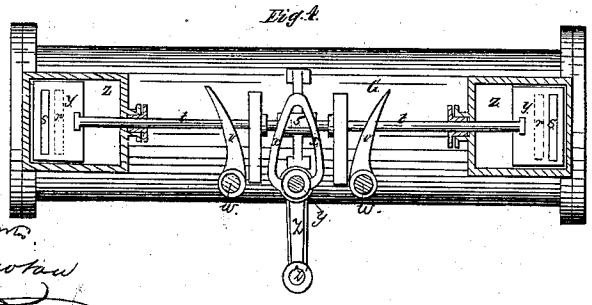


Fig. 4.



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UNITED STATES PATENT OFFICE.

J. R. ROBINSON, OF BOSTON, MASSACHUSETTS.

VALVE-GEAR OF STEAM-ENGINES.

Specification of Letters Patent No. 32,534, dated June 11, 1861.

To all whom it may concern:

Be it known that I, J. R. ROBINSON, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in the Valve-Gear of Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1, is a side elevation of a horizontal engine with my invention applied. Fig. 2, is a plan of the same with the valve chest and valves in section. Fig. 3, is a diagram illustrating the action of a portion of the valve gear. Fig. 4, illustrates a modification of my invention.

Similar characters of reference indicate corresponding parts in the several figures.

My invention consists in the employment of two eccentrics, connected by a link for the purpose of closing the parts to cut off steam from the cylinder at various points in the stroke of the piston, in combination with independent means of opening the ports for the induction of the steam.

It also consists in certain means of controlling or adjusting the position of the said link for the purpose of cutting off at various points in the stroke of the piston; and it further consists in certain means of effecting the connection of a throttle valve with the aforesaid means of adjusting the position of the link for the purpose of bringing the said valve into operation when the resistance to the motion of the engine is such, that, to regulate by the cut-off alone, it would require the steam to be cut off within a certain distance from the commencement of the stroke and throwing it out of operation when the resistance is above that point.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

The drawing represents my invention applied in connection with a sliding cut-off valve riding against the back of the main slide valve, for the reason that I prefer to use that system of valves.

A, is the bed-plate, of the engine; B, the cylinder; C, the piston rod; D, the connecting rod; E, the crank, and F, the crank shaft.

G, is the valve chest; H, the main valve; and I, the main eccentric fast on the crank shaft and connected by its rod I′, with the stem H′, of the main valve.

All the above mentioned parts are of well known construction.

J, is the sliding cut-off-valve applied to work against the back of the main valve in the manner common to valves of its class. J′, is the stem of said valve working through a stuffing box in the valve chest and furnished outside of the chest with a wrist *a*, for the connection of the slotted link K, with which the rods L′, and M′, of the two cut-off eccentrics L, M, are connected. These eccentrics are so arranged upon the shaft relatively to the main eccentric that L, by direct connection with the wrist *a*, would effect the cutting off of the steam at the earliest point in the stroke of the piston that is desired, and that M, by a similar direct connection would permit the steam to follow throughout the greatest length of stroke that is desired. The eccentric L, is connected with the link K, by a joint pin *l*, nearly opposite to the lower end of its arc formed slot *b*, and the eccentric M, connects with the said link by a joint pin *m*, nearly opposite to the upper end of the said slot, and the said slot receives the wrist *a*, which should be fitted with a box to work in the said slot. By bringing the link to the position in which the pin *l*, is opposite to the wrist *a*, the cutting off is effected at the earliest point in the stroke, and by bringing it to the position in which the pin *m*, is opposite to the wrist *a*, the steam is caused to follow the piston to the farthest point, and hence by shifting the link between those two positions, the combined action of the two eccentrics will effect the cut off at any intermediate point more or less distant from those points in the stroke according as the studs *l*, or *m*, are more or less distant from the wrist *a*. The link is suspended from a pin *c*, in a rocker N, which is caused by the movement given to the link by the eccentrics, to have a vibrating movement on the pin *d*, which, while the speed of the engine is uniform, is perfectly stationary, but which is made capable of being raised and lowered under the control of a governor or other device to raise and lower the link for the purpose of regulating the speed of the engine. Various provisions may be made for raising and lowering the said pin, but that which I use is as follows: O, P, is a toggle, one arm

O, of which is arranged to swing on a fixed pin *e*, arranged below the pin *d*, and the other arm P, of which has the said pin *d*, inserted through it. The said pin *d*, is also inserted through a vertically vibrating bridle rod *f*, working on a fixed pin *g*. The lower arm O, of the toggle is connected by a rod Q, with a slide R, which is tapped to receive a screw thread on a shaft S, which is arranged to turn but not to move longitudinally in fixed bearings *j*, *j*. By the turning of this shaft S, the slide R, is caused to move along its screw thread and by this movement of the slide, the joint "*k*'," of the toggle O, P, is bent or straightened. The straightening of the toggle raises the pin *d*; and the link K, is elevated to the highest position and the cutting off caused to take place at the point nearest the commencement of the stroke when the toggle is quite straight, as shown in red outline in Fig. 3. The bending of the toggle in either direction from this position lowers the pin *d*, and the link as illustrated by the black and blue outlines in Fig. 3, and so causes the steam to follow the piston further. The toggle may be moved from the position shown in blue to that shown in black, or vice versa, by the continued movement of the slide R, in one direction, thus shifting the link from the position by which the steam is caused to follow the piston throughout the greatest portion of its stroke, to the position in which the cut off takes place nearest the commencement of stroke and bringing it back again to the position in which the steam follows the greatest distance, by one movement. The bridle rod *f*, prevents the lateral displacement of the pin *d*, and enables the toggle to move the said pin in the desired direction, that is to say, vertically or thereabout; and it constitutes in fact a guide for the said pin; but by extending the said rod beyond the fixed pin *g*, on which it vibrates, as shown at *k*, it becomes a lever *f*, *k*, and a weight T, hung on the so extended part *k*, is made to counterbalance the weight of the eccentric rods, link K, rocker N, and bridle rod *f*. The shaft S, may be connected with or have its operation controlled by a governor or be adjustable by hand.

I will now explain the combination of the cut-off gear with the throttle valve, such combination being for the purpose of regulating the engine by the throttle valve when, with the latter open, the regulation by the cut-off would require steam to be cut off within a certain distance of the commencement of the stroke of the piston.

The throttle valve U, represented in the drawing is of the sliding kind applied close to the valve chest. V, W, is a toggle connecting the stem *t*, of this valve with a fixed pin *n*.

X, is a hook for connecting the joint "p^2", of the toggle V, W, with a pin "*p*" secured in the slide R; *p'*, is a fixed pin for disengaging a notch 5, in the hook X, from a tooth 4, on the said pin *p*.

q, is a spring for causing the tooth 4, on the pin *r*, to engage in the notch 5, of the hook, as shown in Fig. 2.

The screw S, as the speed increases, is turned in a direction to move the slide R, to the right, and vice versa. When the toggle O, P, is straight as shown in red outline in Fig. 3, and the cut off takes place at the nearest point to the commencement of the stroke, the throttle valve is wide open; but as the slide R, is moved to the left in consequence of a diminution of speed of the engine the toggle O, P, is deflected in the same direction, the hook X, is disconnected from the pin *p* by coming in contact with the pin *p'*, and the throttle valve remains disconnected while the link is lowered and steam admitted to follow the piston through a greater portion of the stroke. When the speed of the engine increases while the toggle is deflected to the left, the screw S, is turned in a direction to move the slide R, to the right and straighten the toggle, and the cutting off of the steam is caused to take place earlier in the stroke, but the throttle valve remains disconnected from the slide R, till the toggle O, P, is straight and the steam is cut off at the point nearest the commencement of the stroke, when the pin *p'*, arrives at the bend of the hook X and the notch 5, in the said hook locks with the tooth 4, on the said pin; and the continued movement of the slide R, while it closes the throttle valve by means of the toggle V, W, causes the deflection of the toggle O, P, to the right, and so as the throttle valve closes, causes the steam to be admitted to follow the piston through a greater portion of the stroke. When by the diminution of the speed of the engine the screw S, is again turned in a direction to move the slide R, to the left, the tooth 4, of the pin *r*, of the slide, still remaining engaged in the notch 5, of the hook X, opens the throttle valve, and at the same time the gradual straightening of the toggle O, P, takes place causing the cut-off to operate earlier in the stroke until the toggle is perfectly straight by which time the throttle valve is wide open and the hook is disengaged from the pin *p*, by coming in contact with the pin *p'*, and the cut-off is taking place at the earliest point permitted.

The part of the valve gear which operates the cut-off is not by any means limited in its application to the use, in combination with a throttle valve in the manner described, but on the contrary may be applied very advantageously with a riding cut-off valve as represented, and in combination with a governor for regulating an engine, without any

connection with the throttle valve. It may be used with a slide valve or slide valves without a separate cut-off valve, the main eccentric in that case being so combined with the valve that it will actuate it to open the ports for induction and then leave it to be closed by the action of the two cut-off eccentrics and link, but in that case owing to the character of the operation of the valve it cannot be advantageously used to regulate under the control of a governor unless combined with a throttle valve as described.

Fig. 4, exhibits such modifications as are necessary to adapt the valve gear to the use of two short slide valves without a separate cut-off, separate valves of any suitable kind (not shown) being used for eduction. In this figure G, is the cylinder. Y, Y, are the valves arranged in separate steam chests Z, Z. r, r, are the cylinder ports, and s, s, are ports in the valves. The valve stems t, t, work in a fixed guide 5, and each has secured to it a cross head u, which is acted upon on one side for the purpose of opening the valves by one of two toes v, v, on two rock-shafts w, w, and on the other side for the purpose of closing the valves by a double toe or cam x, x, on a rock-shaft y. The rock-shafts w, w, are worked by means of a separate fixed eccentric on the crank shaft, and the rock-shaft y, is worked by the two eccentrics and link represented in Figs. 1, 2, and 3, the link being connected with a stud z', in the arm z, of the said rock-shaft in the same manner as with the pin a, on the valve stem represented in those figures. The two eccentrics connected by the link may also be used in a substantially similar manner in combination with puppet or other kinds of valves with a suitable system of connections.

I will here remark that the use of the two eccentrics connected by a link for closing the ports in combination with a separate eccentric or other independent means for opening the ports, differs very materially in its effects from link motions before used; for in those the cut-off or expansion is varied entirely by varying the length of stroke of the valve, and this variation of the stroke of the valve is for reasons known to engineers very objectionable; but in my link motion even if used in connection with a single slide valve, the length of stroke is not changed, or not materially so, the variation being effected entirely by a variation in the time of movement for closing the ports.

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

1. The employment of two eccentrics connected by a link for the purpose of closing the ports at various points in the stroke of the piston in, combination with independent means of opening the ports for the induction of steam, substantially as herein described.

2. The employment in combination with the so applied link and its supporting rocker N, of a toggle O, P, so arranged and applied that by a continued movement in one direction it will carry the link throughout its whole range of motion on the valve wrist, and back again substantially as and for the purpose herein specified.

3. The employment, for combining the throttle valve with the toggle O, P, which effects the movement of the cut-off link, of a toothed pin p, a notched hook X, or its equivalent, a stationary pin p', and a spring q, the whole combined and operating substantially as herein specified.

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