

*J. R. Robinson,*  
*Reciprocating Steam Engine,*



J. W. Coombs  
R. S. Spencer

*Inventor.*



# UNITED STATES PATENT OFFICE.

J. R. ROBINSON, OF BOSTON, MASSACHUSETTS.

## STEAM-ENGINE.

Specification of Letters Patent No. 32,205, dated April 30, 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 a new and useful Improvement in 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 drawings, forming part of this specification, in which—

Figure 1 is a side elevation of a horizontal non condensing steam engine with my improvement, partly in section. Fig. 2 is a plan of the same partly in section. Fig. 3 is a side view of the cut off eccentric.

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

In the use of a cut off on a steam engine, so long as the resistance to the motion of the engine is so great as to require an amount of steam in the cylinder that shall at the end of the stroke be at a pressure above that of the exhaust, the full advantage of the expansive action of the steam is obtained; but when the cutting off of the steam is effected so early in the stroke that the pressure of steam in the cylinder at the end of the stroke is less than that of the exhaust, there is a great loss.

My invention consists in so combining a variable cut off and a throttle valve under the control of a governor, or other controlling device with which both are connected, that the cut off will operate alone as the regulator while it can do so economically, the throttle valve being in the mean time inoperative and open, and that when the cut off, to continue regulating, would require to operate so early in the stroke of the piston that its use would cease to be attended with economy, or be less economical than the use of the throttle valve, its further operation will be suspended or checked, and the throttle valve shall be brought into operation as the regulator.

To enable those skilled in the art to make and use my invention I will proceed to describe it with reference to the drawings.

A, is the bed-plate of the engine; B, the cylinder; S, the valve chest; C, the piston rod; D, the connecting rod; E, the crank; F, the crank shaft; G, the main eccentric operating the main slide valve H, by which the induction and eduction of steam are effected, G', is the main eccentric rod, and

H', is the valve stem. All these parts are of well known construction.

I, is the cut off valve resting upon or against the back of the main valve, and constructed and operating in a well known manner. I', is the stem of said valve; J, is the cut-off eccentric fitted to turn a short distance back and forth around a sleeve g, that is fitted and firmly secured to the shaft F, but confined lengthwise of the said sleeve and connected with the valve stem I', by the rod J'. This eccentric has cut in its bore a recess a, b, see Figs. 2 and 3, for the admission of a double inclined piece K, see Fig. 2, which is rigidly secured to a slide L, which is fitted to work in a longitudinal groove f, in the sleeve g, the inclined faces c, d, of the said piece K, acting against the front a, of the recess a, b, to drive the eccentric. The front a, of the said recess is beveled from the middle toward the sides of the eccentric, and the inclined faces c, d, of the piece K, terminate in a flattened point e. By moving the slide L, along the groove f, the eccentric is caused to effect the cutting off of the steam earlier or later in the stroke of the piston. The cutting off is effected at the earliest desirable point in the stroke of the piston when the point e, is opposite to the most prominent point in the face a, as shown in Fig. 2, and the induction of steam is made to continue during a longer portion of the stroke by shifting the slide L, in either direction from this position, such movement of the slide causing the eccentric to recede upon the shaft. The said slide L, and its double inclined piece K, are used to give the cut off the necessary variations to effect the regulation of the engine, while the regulation is effected by the cut-off; but the sleeve g, can be moved upon the shaft to advance or draw back the eccentric for the purpose of varying the point in the stroke at which the regulation by the cut-off commences. The slide L, is firmly secured to a circumferentially grooved collar L', which surrounds the shaft F, and is caused to rotate therewith by the said slide fitting the groove f. To the groove of this collar there is fitted a loose ring M, which is made in two parts to enable it to be put on, and which is connected by two pins h, h, with a rigid forked bar N, which contains a female screw thread fitting to a male screw thread on a shaft P, which is arranged parallel with the shaft F, in fixed



bearings *i*, *i*, and which is represented as furnished with a hand wheel *Q*, to enable it to be turned by hand but which may be suitably connected with a governor. By turning the said shaft *P*, the bar *N*, is caused to move along it, and so to move the slide *L*, and its double inclined piece *K*, and so shift the eccentric *J*, for the purpose of regulating the engine by the cut-off.

*R*, is the throttle valve of the construction known as the gridiron valve. The stem *j*, of this valve is connected by a toggle *k*, *k*, with a fixed pin *l*, and the joint pin *m*, of this toggle is connected by a rod *n*, with one arm of an elbow lever *T*, which works on a fixed fulcrum *p*; and whose other arm, has connected with it a slotted rod *U*, whose slot *q* receives within it a stud *r*, which is secured to the bar *N*, by which the variation of the cut-off for the purpose of regulation, is effected. The length of the slot *q*, is such that the stud *r*, is capable of moving within it a distance equal, or very nearly equal to half the length of the double inclined piece *K*, taken in a direction parallel with the shaft. The said slot *q* has in one side near one end a notch 7, (see Fig. 2) for the reception of a tooth 8, which is formed by cutting a notch in the stud *r*; and there is attached to the bar *N*, a spring *t*, which presses against the rod *U*, in such a manner that the notch 7, will slip over and engage with the tooth 8, when the said tooth arrives opposite to the said notch. On the opposite side of the rod *U*, to the spring *t*, there is arranged a stationary pin *u*, or other equivalent stationary piece against which a curved portion *v*, of the rod *U*, is brought by the movement of the said rod with the stud *r*, for the purpose of unlocking the said rod from the said stud by pushing aside the said rod far enough for its notch 7, to slip off the tooth 8.

The operation of the combined cut-off and throttle valve in regulating the engine may be described as follows. While the resistance to the motion of the engine is such that in regulating with the cut-off without throttling, it requires the admission of steam to the cylinder beyond that point in the stroke within which the cut-off is inoperative by reason of the permanent adjustment of the sleeve *g*, the face *d*, of the piece *K*, remains in operation upon the eccentric under all variations in such resistance, and the movement given to the slide *L*, and bar *N*, to control said variations causes the pin *r*, attached to and moving with the said bar to move back and forth in the slot *q*, without disturbing the open throttle valve, until the resistance diminishes to nearly the point which will require the cut-off to take place at the earliest practicable point, viz: when the point *e*, has nearly arrived opposite the point *a*, when the pin *r*, will arrive at that end of the

slot *q*, next the notch 7, and the spring *t*, will cause the said notch to engage with the tooth 8. The continued diminution of resistance beyond this point causes the movement of the bar *N*, and slide *L*, to continue in the direction of the arrow shown on the slide *L*, in Fig. 2, and the pin *r*, operating against the end of the slot *q*, commences to close the throttle valve by its action upon said valve through the rod *U*, lever *T*, rod *n*, and toggle *k*, and a still further diminution of resistance causes the point *e*, to pass the point *a*, and bring the inclined face *c*, into operation on the eccentric *J*, and hence as the throttle valve continues closing, the variation of the cut-off is reversed and the steam is cut-off from the cylinder later and later in the stroke, and by this means, while the steam is being throttled, less condensation is produced in the cylinder, and the valves are relieved of excessive pressure. When the resistance increases again, the movement of the bar *N*, and the slide *L*, is reversed, the tooth 8, of the pin *r*, operating in the notch 7, of the slot *q*, moves back the rod *U*, and so closes the throttle valve, the movement of the piece *K*, at the same time causing the cut-off to operate earlier in the stroke as the throttle valve opens. The throttle valve will have been opened wide as the front *e*, passes the front *a*, and when this has taken place, the curved portion *v*, of the rod *U*, having just previously come in contact with the stationary pin *u*, will by its movement against the said pin in the direction of the arrow, shown on the rod *U*, cause the said rod to be moved aside far enough to liberate it from the tooth 8, of the pin *r*, and in any continued movement of the bar *N*, in the direction of the last mentioned arrow, occasioned by a further increase of resistance to the motion of the engine, the pin *r*, will move freely along the slot *q*, and the throttle valve will be again undisturbed until the diminution of resistance again occurs and reaches the point at which the pin moves forward again to the notched end of the slot *q*, when the action will again be as before described with reference to that condition.

I will here remark that in speaking of the degree of resistance to the motion of the engine I have meant resistance relatively to the pressure of steam in the boiler or steam pipe, such resistance varying not only with the load on the engine but with the pressure of steam.

The particular system of induction, education and cut-off valves, valve gear, and variable cut-off gear, throttle valve and its operating mechanism which I have represented are by no means indispensable to the success of my invention, but are merely represented as being as well adapted as any other to illustrate the invention.



I do not confine myself to the use of any particular kind of cut-off, or any particular kind of throttle valve, or to the use of any particular mechanism for operating the cut-off, or combining the throttle valve therewith; but

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

1. So combining a variable cut-off and a throttle valve in connection with a steam engine that the cut-off, only, will act as the regulator when the engine is subjected to a resistance which requires the admission of the steam beyond a certain point in the

stroke of the piston, and the throttle valve, only, will act as the regulator when the engine is subjected to less resistance, substantially as herein specified.

2. So constructing and applying a variable cut-off gear which is combined with a throttle valve as above specified, that as the throttle valve closes, the cut-off will operate later in the stroke of the engine, substantially as herein described.

J. R. ROBINSON.

Witnesses:

LEWIS A. TUCKER,  
C. W. COWTAN.