Sheet 1-2 Sheets.

W. C. Champlin.
Cut-Off Valve.

No. 93,414. Patented Aug. 10, 1869.

Fig: 3.

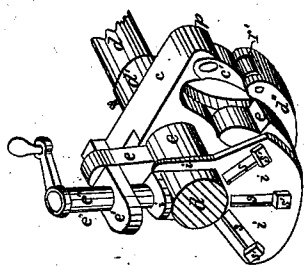

Fig: 1.

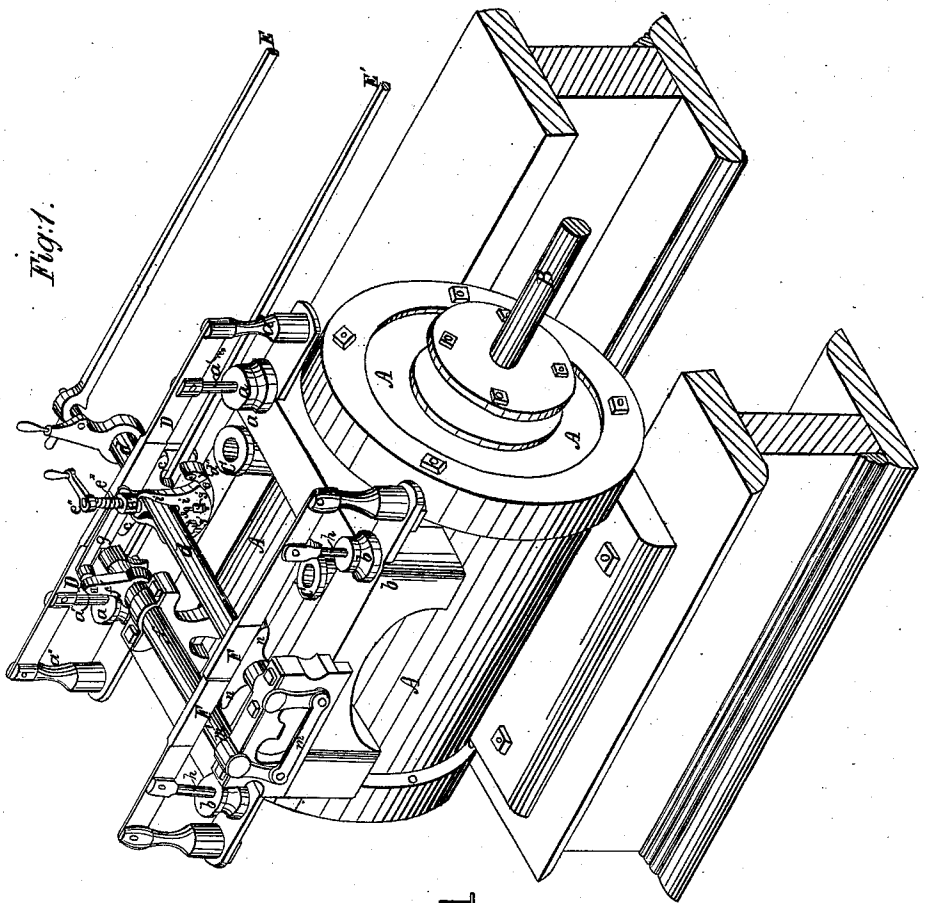

Fig: 4.

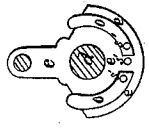

Fig: 5.

Witnesses:
Thos B. Kerr
R. Wrenshall

Inventor:
William C. Champlin
by Bakewell & Church
his Attys.

Sheet 2-2 Sheets.

W. C. Champlin.

Cut-Off Valve.

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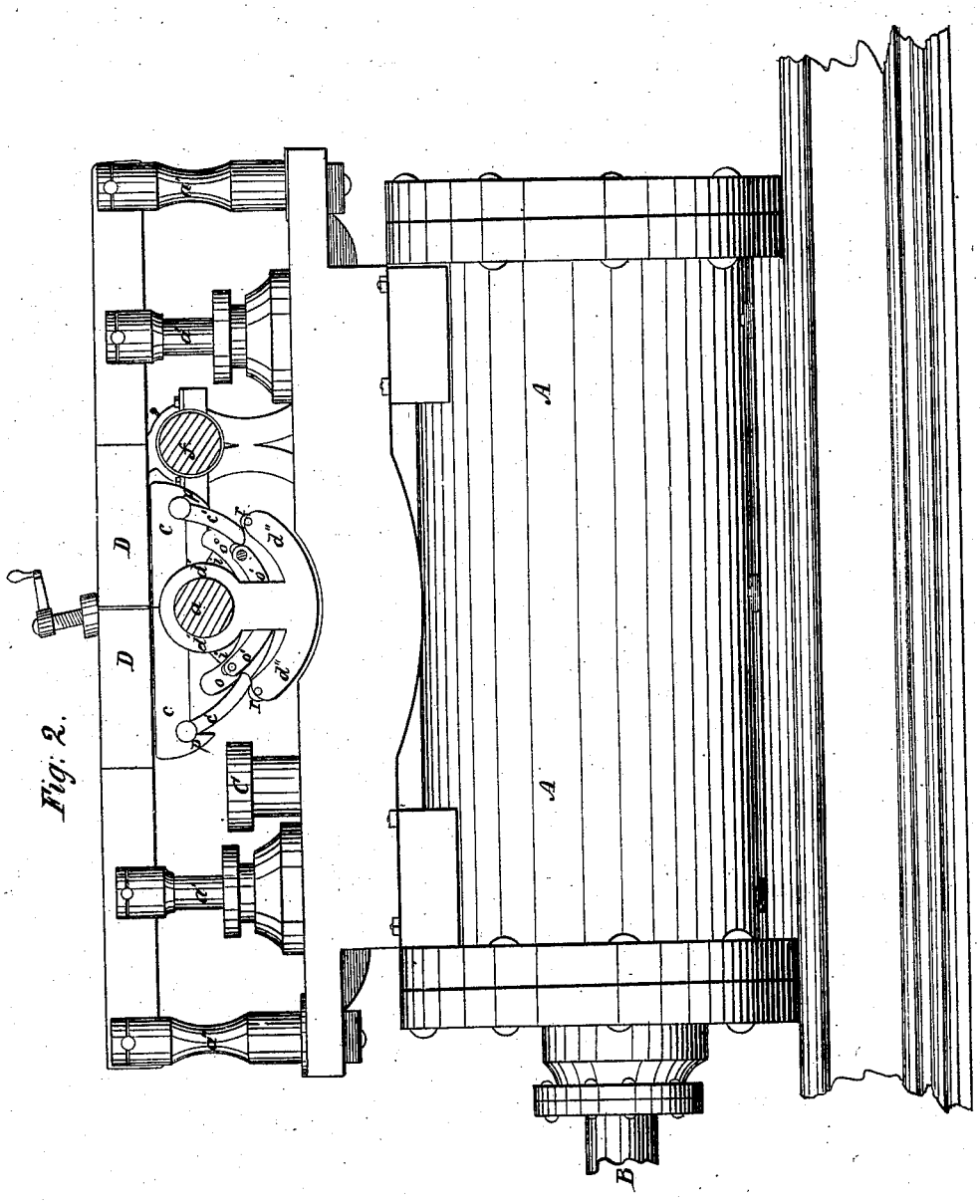

Fig. 2.

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Inventor:
William C. Champlin,
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United States Patent Office.

WILLIAM C. CHAMPLIN, OF ALLEGHENY CITY, PENNSYLVANIA.

Letters Patent No. 93,414, *dated August* 10, 1869; *antedated August* 3, 1869.

IMPROVEMENT IN 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, WILLIAM C. CHAMPLIN, of Allegheny City, in the county of Allegheny, and State of Pennsylvania, have invented a new and useful Improvement in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, in two sheets, making a part of this specification, in which—

Figure 1 shows in perspective a steam-cylinder fitted with my improvements;

Figure 2 is a sectional elevation, as looked at from the rear or further side of fig. 1, the section being formed by a plane passing vertically and longitudinally along between the cam or driving-shafts and the steam-cylinder;

Figure 3 shows, in a detached view, in perspective, the adjustable devices of figs. 1 and 2, by which I regulate the point of cut-off; and

Figures 4 and 5 are detached views, as presently to be explained.

Like letters of reference indicate, in the different figures, like parts.

The nature of my invention consists in the construction of an improved adjustable cut-off for steam-engines, such, that by its use the apparatus for opening the valves may be so adjusted at any time, and with a moment's work, and without stopping the engine, as to open and close the valves and take and cut off steam at any desirable point of the stroke; and

It further consists in the use of such adjustable devices in connection with a governor, as a means of regulating the supply of steam to the cylinder.

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

A is a steam-cylinder, of the usual or any known construction, and is fitted with a piston operating a piston-rod, B.

Into the cylinder A, at each end, steam is admitted through poppet-valves in the valve-chests *a*, the valves being operated by the valve-stems *a'* connected therewith.

In the drawings—

a a represent the steam-valve chests, and

b b, the exhaust-valve chests.

The usual ports lead from and to the steam and exhaust-pipes C and C'.

The valve-stems *a'* are connected with the valve-levers D, the latter being pivoted to the supports *a''*.

The forward or working ends of the levers D rest upon lifters or wipers, *c*, each wiper, *c*, being made independent of the other, so as to have a separate motion, and both being hung on the same axle or shaft, *d*.

From the lower face of the outer end of each lifter, *c*, is hung, so as to swing freely within certain limits, a pawl, *c'*, as shown in figs. 2 and 3.

On the same shaft, *d*, but outside the wipers or lifters *c*, is fixed a sleeve, *d'*, which carries and operates a circular or segmental head, *d''*, directly under the lifters *c* and pawls *c'*.

On the same axle, *d*, but inside the wipers or lifters *c*, I place, so as to work freely thereon, a frame, *e*, of the form shown in fig. 4.

The upper end of this frame has a projection, *e'*, on its inner side, through which I work a threaded screw, *e''*, and to the lower end of the screw, by a swivel-joint, attach a sliding guide, *i*, with its face against the frame *e*.

This sliding guide is slotted where the shaft *d* passes through it, so as to be adjustable up and down by the screw *e''*, as presently to be described.

In its lower part, it has three slots, *s s s*, which converge toward their upper ends, as shown in fig. 3.

The frame *e*, which plays on the shaft *d*, just inside the wipers *c*, has a circular or segmental groove or notch in each edge of its lower part, as shown in fig. 4.

In each groove or notch plays a segmental sliding block, *o*, made with circular edges to fit the groove or notch in which it plays.

This frame and the sliding guide *i* are so made and arranged, with reference to each other, that the middle one of the slots *s* shall come opposite to the solid part of the frame *e*, between the grooves filled by the blocks *o*, (see figs. 3 and 4,) and the outer slots *s* shall cross the blocks *o*.

Then a headed bolt, *s'*, passing through the middle slot, enters the solid frame behind it, and the other headed bolts *s'* passing through the outer slots *s*, each enter one of the sliding blocks *o*.

Then, as the sliding guide *i* is raised or lowered by the screw *e''*, the bolts *s'*, operating in the slots *s*, are made to approach to or recede from each other. As the sliding guide *i* is lowered, they are brought nearer together, and thereby the sliding blocks *o* are caused to enter the frame *e*, and *vice versa*.

These blocks *o* are virtually the arc of a circle, and by sliding them out of or into the notches in the frame *e*, I lengthen or shorten the arc.

A plan or upper face view of these blocks is given in fig. 5.

The parts which work in the notches are marked *o*.

On the rear edge of each of these, and forming in each a part thereof, is a wing, *o'*, which, when the block *o* is in place, as in figs. 1, 2, 3, and 4, so pro-

jects as to come directly under the lifters *c*, already described, and a little above the segmental head *d''*, and of course, then, in a plane with both.

In the outer or working ends of the wings *o'*, friction-rollers, *r*, are inserted, and like rollers, *r'*, in the outer ends of the segmental head *d''*.

Between each pair of friction-rollers, *r r'*, the lower end of one of the pawls, *c'*, operates.

It will now be observed that as the blocks *o* are run out, as already described, the wings *o'* will also recede from each other, and the distance between their working ends, or between the rollers *r r'*, be increased, and *vice versa*.

It will also be observed that the levers D, lifters *c*, pawls *c'*, wings *o'*, and segmental head *d''*, all stand in the same vertical plane.

Each pawl, *c'*, is brought to a point, or, in other words, its lower end is bevelled on either face, so as to roll easily on the friction-rollers *r r'*, against which it operates.

A stop, *p*, projects downward from the outer end of each lifter, *c*, so as to prevent its pawl, *c'*, from passing outside of or below the segmental head *d''*.

Its own weight prevents it from going inside or above the wing *o'*, and the segmental head *d''* and wings *o'* are adjusted so close together that the pawls *c'* cannot slide down between them. Consequently, each pawl, *c'*, must work above the segmental head *d''*, the wing *o'* being withdrawn, or below the wing *o'*, the head *d''* being withdrawn, or be carried upward by the joint action of the two.

Parallel to the shaft *d* is a similar shaft, *f*, on which is a crank, *f'*, which is connected by an arm, *g*, with the upper end of the frame *e*, which last, it will be remembered, operates freely on its shaft *d*.

Each of these shafts, *d f*, receives a motion independent of the other, by connecting-rods, E E'; the cams or eccentries which operate them being so set that one shall move a little in advance of the other.

It will be obvious, then, that the segmental head, *d''*, receiving its motion through the shaft *d*, with which it is connected, will have a motion independent of the wings *o'*, which receive their motion from the other shaft *f*, through the frame *e*. Consequently, while the head *d''* is moving by an oscillating motion in either direction, the wings *o'* may, through a part of their stroke, according to how much one eccentric shaft, E', operates in advance of the other, E, move in directly the opposite direction; or, while one is moving one way, through a part of the stroke, the other may be stationary.

At the dead-points, each pawl, *c'*, rests with its point or lower end against the friction-rollers *r r'* of the head *d''* and the corresponding wing *o'*.

The devices described are so adjusted that the shaft *f* shall work a little in advance of the shaft *d*, and consequently, the wings *o'* make their stroke a little in advance of the head *d''*; but the head *d''* soon follows, and the valve is opened by the joint action of the two, that is, they raise the pawl *c'*, lifters *c*, and lever D.

The shafts *d f* have a rocking motion.

At the point of cut-off, the wings *o'* commence their return stroke first, the pawl *c'* following down inside the head *d''*, which remains stationary, or nearly so, and the opposite wing going up inside of its pawl. Consequently, the former of the lifters *c* comes down, closes its valve, and cuts off steam, while the opposite lifter is not raised nor its valve opened until a little later, when the head *d''*, actuated by its later-moving shaft *d*, commences its return stroke. Then, the head *d''*, acting in conjunction with the opposite wing *o'*, already in advance, raises the opposite pawl, *c'*, lifter *c*, and lever D, and the opposite valve is opened, steam is admitted, and so on, alternately.

But to make the cut-off adjustable, I use the screw *e''* and frame *i* already described.

By raising the sliding frame *i*, I cause the bolts *s'*, working in the inclined slots *s*, to recede from each other. Thereby, the sliding blocks *o* are driven outward, and the wings *o'* attached thereto, of course recede from each other, and the distance from end to end of the wings *o'* becomes more nearly equal to the length of the head *d''*.

By lowering the frame *i*, exactly the opposite result is secured, that is, the distance between the opposite ends of the wings *o'* is lessened.

In either case, the valve is closed, and steam is cut off by either pawl, *c'*, following its wing *o'* downward. Consequently, the less the distance between the opposite ends of the wings *o' o'*, the sooner the pawl will reach the end of its downward stroke, the valve be closed, and steam be cut off, and *vice versa*, so that by lengthening or shortening the arc formed by the wings *o' o'*, I change the point of cut-off, making it earlier or later in the stroke of the piston.

And this lengthening or shortening of the arc, it will be remembered, is effected by the screw *e''*.

This result is further facilitated by the fact that when the wings are farthest distant from each other, and, of course, the arc formed thereby is the longest, their working ends, at the highest points of their stroke, rise higher than the working ends of the head *d''*. Then, when the wings commence their reverse stroke, they have to move till the working end uppermost has passed the working end of the head *d''*, before the pawl begins to come down and cut off steam.

Hence, the wings *o'* in such case have to move through a part of their stroke before "cutting off" begins.

As these wings are brought together, and the arc formed thereby is shortened, the length of that part of the stroke which it makes before the cut-off begins is lessened, until each wing, at the end of its outward stroke, moves no further than the corresponding end of the head *d''*.

Then, as soon as either wing begins its return stroke, its pawl will begin to fall, the lifter *c* and lever D will follow, the valve begin to close, and steam be cut off.

And to vary this point of cut-off, nothing is required except turning the screw *e''*, so as to move the sliding blocks *o* toward or away from each other.

In the front of fig. 1 are shown the devices for operating the exhaust-valves,

b b being the valve-chests.

F F are levers;

h h are valve stems; and

n n are lifters.

The shaft *d*, by a crank-connection, *m*, operates the shaft *m'*, which, though in line with the shaft *f*, yet is not a part of it.

Another crank-connection of similar character, but not shown, then communicates motion to the lifters *n n*.

By these the exhaust-valves are opened and closed alternately with the others, but, of course, at the commencement of each stroke of the piston.

To reverse the motion of the engine, the connecting-rod E may be unhooked from its crank and attached to an opposite crank-wrist on the same axle.

I also, whenever desirable, substitute, in my invention, a steam-governor for the screw *e''*, and by its action raise or lower the sliding frame or guide, and so adjust such governor thereto that if the power be too great, the engine will cut off earlier in the stroke, and *vice versa*.

In this use, any known suitable form of governor may be employed.

In this way I convert my adjustable cut-off into a

variable self-operating cut-off, and make it perform many or all of the functions of a governor at the throttle-valve; and such use I include in my invention.

Having described my invention,

What I claim therein, and desire to secure by Letters Patent, is—

1. The adjustable cut-off, in which the pawl *c'*, at the end of each lifter, *c*, shall operate against the ends of the segmental head *d''* and wing *o'*, the latter being adjustable, and all arranged substantially as set forth.

2. The frame *e*, mortised or slotted to receive the sliding blocks *o*, and hung on the shaft *d*, and connected to an independently-operating shaft, *f*, arranged substantially as hereinbefore set forth.

3. The sliding guide *i*, with inclined slots *s*, and the bolts *s'*, for adjusting the wings *o'* through the blocks *o*, and furnished with a screw, *e''*, all constructed and arranged substantially in the manner above set forth.

In testimony whereof, I, the said WILLIAM C. CHAMPLIN, have hereunto set my hand.

WM. C. CHAMPLIN.

Witnesses:

J. W. KIRKER,

G. A. SHALLENBERGER.