(No Model.) 3 Sheets—Sheet 1.

J. ABELL.

VARIABLE CUT-OFF ENGINE.

No. 560,182. Patented May 19, 1896.

Fig. 2

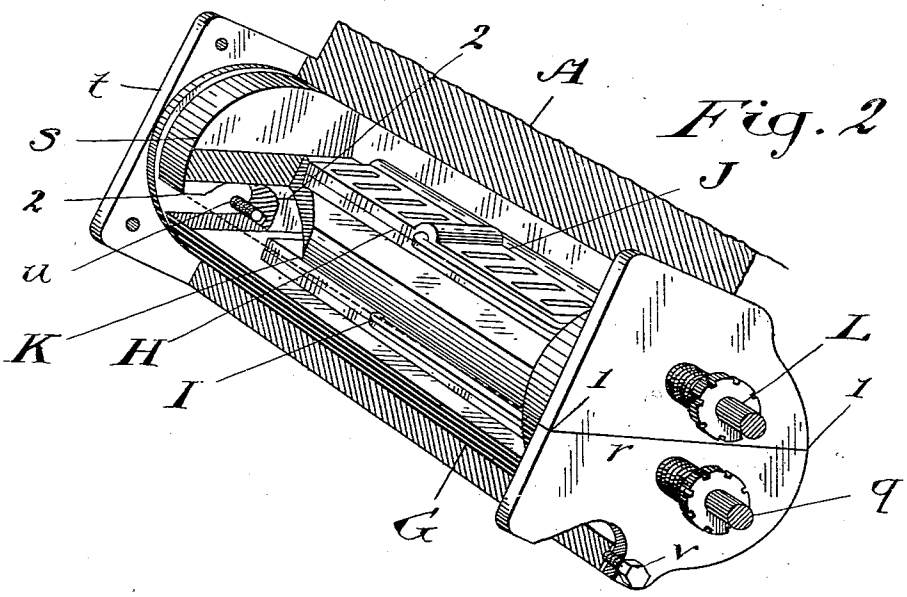
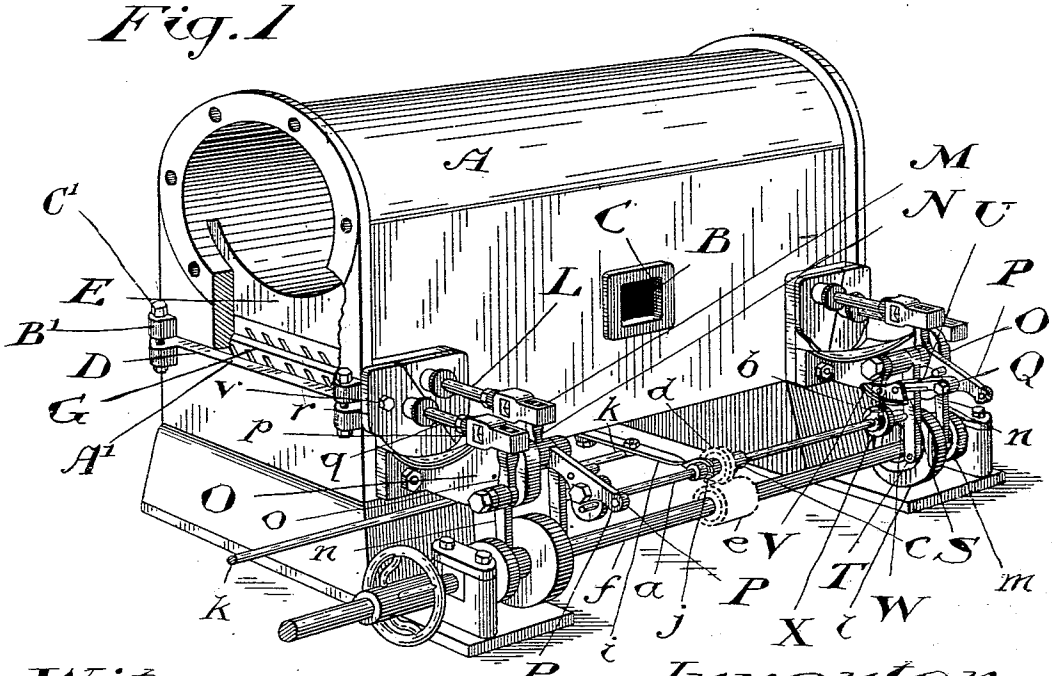


Fig. 1



Witnesses

Fred Clarke

A. M. Neff

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(No Model.) 3 Sheets—Sheet 2.

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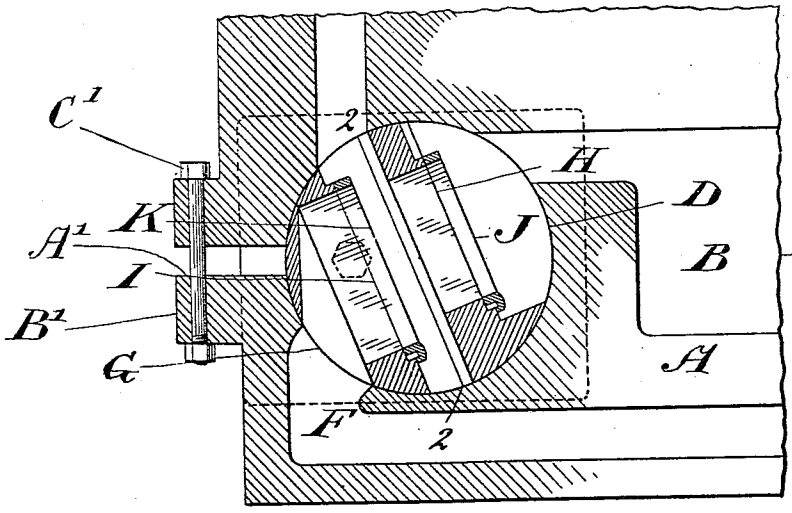

Fig. 3.

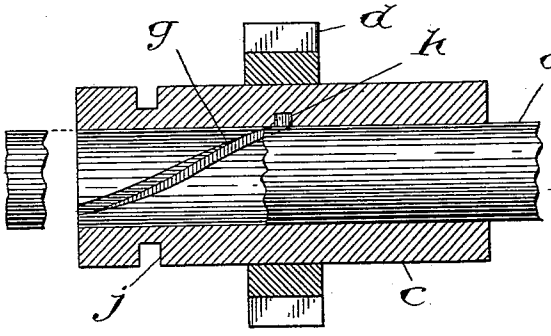

Fig. 4.

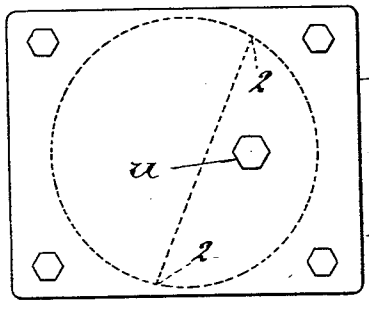

Fig. 5.

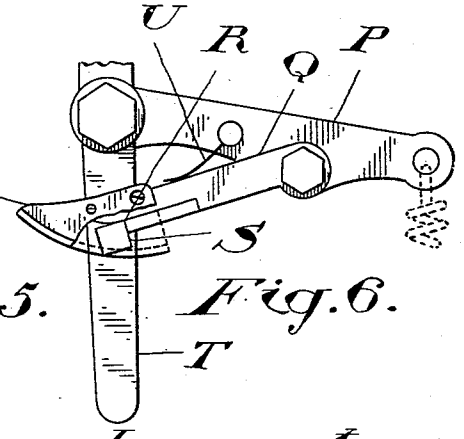

Fig. 6.

Witnesses

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(No Model.) 3 Sheets—Sheet 3.

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VARIABLE CUT-OFF ENGINE.

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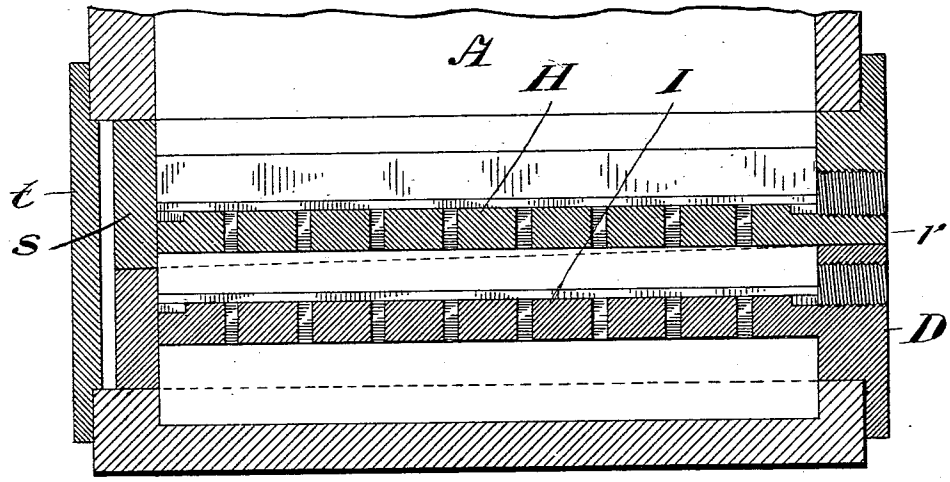

Fig. 7

Witnesses.

Fred Clarke

W. J. McMillan

Inventor.

John Abell

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Attys

UNITED STATES PATENT OFFICE.

JOHN ABELL, OF TORONTO, CANADA.

VARIABLE-CUT-OFF ENGINE.

SPECIFICATION forming part of Letters Patent No. 560,182, dated May 19, 1896.

Application filed August 14, 1895. Serial No. 559,207. (No model.)

To all whom it may concern:

Be it known that I, JOHN ABELL, of the city of Toronto, in the county of York and Province of Ontario, Canada, have invented certain new and useful Improvements in Variable-Cut-Off Engines, of which the following is a specification.

The object of the invention is to effect certain improvements in the valve-seats and cut-off mechanism of a variable-cut-off engine patented to me in the United States under No. 499,493, dated June 13, 1893; and it consists, essentially, in such details of construction as are hereinafter specifically described and then definitely claimed.

Figure 1 is a perspective view of a portion of an engine provided with my improvements. Fig. 2 is a perspective detail of the valve-casing tipped sidewise. Fig. 3 is a cross-section showing the location of the valve-seats at the end of the cylinder. Fig. 4 is a sectional detail of a part of the cut-off mechanism. Fig. 5 is an end view of the far end of the valve-casing. Fig. 6 is a side elevation of one of the levers operating the steam-valve and its cut-off connections. Fig. 7 is a longitudinal section of the valve-casing.

In the drawings like letters of reference indicate corresponding parts in the different figures.

In its general arrangements the engine is similar to that described in my former United States patent.

In Fig. 1 A is the cylinder, in the body of which is formed a steam-chamber B, with which the steam-pipe (not shown) connects by means of the opening C. At each end of the cylinder a cylindrical chamber D is formed, which is connected by a short port E with the interior of the cylinder and with the exhaust-port F, as shown.

G is a valve-casing divided into two parts shaped to fit the cylindrical chamber D.

It will be seen that a split or opening A′ is formed between the end of the cylinder and the side of the cylindrical chamber. Lugs B′ are formed on the opposite sides of this opening at each end. These lugs may be drawn together by bolts C′, so as to compress the walls of the chamber D against the valve-casing.

Two valve-seats H and I are formed in the casing G, a space being left between the two, which space connects with the port E. Grid-iron openings are formed in the seats H and I, and the valves J and K, with corresponding openings, are fitted on the seats.

As indicated in Fig. 1, a single steam-valve J and a single exhaust-valve K are provided for each end of the cylinder, and each pair are operated by the following simple gear: L is the spindle of the valve J. On the end of this spindle I form or connect a head M, to which is connected, as indicated, an arm N. This arm is pivoted on a bracket O and has fast to it the arm P, to each end of which a spring or dash-pot is connected in the usual way. The dash-pot is not shown in the drawings, though a portion of a spring is indicated in Fig. 6. On the arm P is pivoted an arm or detent Q, which is notched at R to engage with a lug or projection S, formed on or connected to an arm T, independently pivoted on the same spindle as the arm N. (See Fig. 6.)

U is a spring connected to the arm P and engaging with the detent Q, so as to tend to retain it in the position shown in Fig. 6.

V is a cam projection connected to the detent Q. This cam lies in the path of a pin W, connected near the periphery of a disk X, rigidly connected to the spindle *a*. Each end of this spindle is journaled in an arm *b*, rigidly connected with the bracket O or some other suitable part of the machine. One of these arms is shown in dotted lines at the far end of Fig. 1, the arm at the near end of the machine being omitted in order to show the parts behind it. On the middle of this spindle slides a sleeve *c*, carrying a pinion *d*, engaging with a pinion *e*, fast on the spindle *f*, suitably journaled in bearings connected to the bed of the machine, as shown. On the inner face of the sleeve *c* is cut a spiral groove *g*, into which fits a pin *h* on the spindle *a*. From this construction it follows that the sleeve *c*, by sliding longitudinally on the spindle, will impart a rotary motion thereto at the same time.

i is an arm pivoted at one end to the cylinder A or other suitable part and having jaws set at its other end adapted to engage with the groove *j* in the sleeve *c*. To the center of this arm *i* is pivoted a rod *k*, by the longitudinal movement of which the arm *i* is rocked and the longitudinal movement imparted to

the sleeve *c*. In practice this rod is connected to the governor of the engine in any suitable way. The spindle *f* is also connected with any suitable part of the engine by which a rotary motion can be imparted to it. As I claim nothing new in the governor or in the means of revolving the spindle *e*, these parts are not shown in the drawings.

On the spindle *f* are two cams *l* and *m*, the cam *l* being adapted to rock the arm T, while the cam *m* is adapted to rock the arm *n*, pivoted on the other side of the bracket O. An arm *o* extends upwardly from the arm *n* and engages with a head *p*, formed on or connected to the spindle *q* of the valve K.

The cylindrical casing containing the valve-seats H and I is divided into two parts on a plane starting from a line 1 1 in the head *r* and running to the line 2 2 in the head *s*. By thus cutting the valve-casing the two halves are wedge-shaped, and by sliding them one on the other the valve-casing may be made to fit tightly the cylindrical chamber for its reception in the cylinder. In order to effect this, after inserting the valve-casing in the chamber, with the upper edge of its head horizontal, I screw over the other end of the chamber a rectangular plate *t*, having a slight circular projection thereon adapted to enter the chamber D. Through this plate passes a set-screw *u*, which is screwed into the end of the half of the valve-casing containing the valve-seat I. By adjusting this set-screw that half of the valve-casing is drawn in the direction indicated by the arrow in Fig. 2 and the two halves of the valve-casing securely jammed in the cylindrical chamber B. Through the corresponding half of the head *r* passes a set-screw *v*, which bears against the side of the cylinder A. By adjusting this set-screw the above-mentioned half of the valve-casing is drawn in a direction contrary to that indicated by the arrow and the valve-casing consequently loosened in its chamber. It is of course previously necessary to loosen the set-screw *u*. From this construction of the casing G it follows that it may be much more easily placed in position or removed than if formed in the shape of a divided and tapered plug, which requires careful grinding and considerable work to fit in place.

By forming the split or opening A′ as already described it is quite impossible for the valve-casing to become jammed in the chamber, as it may be always released by loosening the bolts C′, and these bolts can be tightened at any time to make a tight fit between the valve-casing and the cylindrical chamber.

Having described the construction of my invention, I will now briefly set out its operation.

When the engine is in operation, the cam *l* at one end of the cylinder rocks the arm T, which, through the medium of the projection S, detent Q, arm P, and the arm N, operates the valve J. While this is going on the spindle *a* is being revolved from the spindle *f* by means of the pinions *e* and *d*. Thus the pin W on the disk X is brought against the cam projection V and the detent Q disengaged from the projection S. The valve is then quickly returned to its closed position by means of the spring or dash-pot connected to the arm P. This disengagement, which marks the point at which the steam is cut off, varies as the arm *b* is rocked through the medium of the governor operating the rod *k*. As this arm is rocked either one way or the other the spindle *f* will be revolved slightly according to the direction of the motion, and thus the pin W will be brought into contact with the cam projection V a little earlier or later, as the case may be. Thus a perfect variable cut-off is provided for the engine. It should be mentioned here that the pinion *e* is made sufficiently wide to engage with the pinion *d* at the extreme limits of its motion. At the same time that steam is being admitted at one end of the cylinder the exhaust-valve K is opened at the other end by means of the cam *m*, arm *n*, arm *o*, head *p*, and spindle *q*. When the piston has reached the end of its stroke in that direction, this exhaust-valve is closed and the proper steam and exhaust valves opened to effect the return stroke.

From this description it will be seen that I have produced a simple and effective cut-off mechanism and means for placing valve-seats in position at each end of the cylinder.

While it may be preferable in some instances to connect a spring to the arm N, as hereinbefore described, is is evident that a weight could accomplish the desired purpose. A dash-pot could also be constructed for the same purpose, and I therefore intend the following claims to be considered broad enough to cover any of these devices when used in the combinations therein claimed.

What I claim as my invention is—

1. In a steam-engine, a cylinder having a cylindrical chamber formed therein in combination with a removable cylindrical casing provided with seats for steam and exhaust valves and divided into two parts on a plane at a slight angle to the longitudinal axis of the casing so that by sliding the parts on one another the casing may be tightened in place in the cylindrical chamber in the cylinder or loosened therein for removal, substantially as and for the purpose specified.

2. In a steam-engine the cylinder A, having a cylindrical chamber D, formed therein, in combination with the cylindrical casing G, divided into two parts at 1 1, 2 2; the plate *t;* and the set-screw *u*, passing through the plate *t*, into the smaller end of one of the halves of the casing substantially as and for the purpose specified.

3. In a steam-engine the cylinder A, having a cylindrical chamber D, formed therein, in combination with the cylindrical casing G, divided into two parts at 1 1, 2 2; the plate *t;* the set-screw *u*, passing through the plate *t*, into the smaller end of one of the halves of the

casing and the set-screw *v*, passing through the overlapping edge of the opposite head of the same part of the casing and bearing against the side of the cylinder, substantially as and for the purpose specified.

4. In a steam-engine a pivoted arm N, connected with the spindle of the steam-valve J; an arm P, connected to the arm N, to which arm P, a spring or equivalent device is connected; the notched detent Q pivoted on the arm P; the pivoted arm T; and the lug or projection S on the arm T; in combination with the suitably-driven spindle *f*, and the cam *l*, adapted to rock the arm T, substantially as and for the purpose specified.

5. In a steam-engine, a pivoted arm N, connected with the spindle of the steam-valve J; an arm P, connected to the arm N, to which arm P, a spring or equivalent device is connected; the notched detent Q, pivoted on the arm P; the cam projection V, connected to the said detent; the pivoted arm T; and the lug or projection S, on the arm T; in combination with the suitably-driven spindle *f;* the cam *l*, adapted to rock the arm T; the spindle *a*, geared to the spindle *f;* and the disk X on the said spindle *a*, carrying a pin W, adapted to engage with the cam projection V, and disengage the notched detent Q, from the lug S, substantially as and for the purpose specified.

6. In a steam-engine, a pivoted arm N, connected with the spindle of the steam-valve J; an arm P, connected to the arm N, to which arm P, a spring or equivalent device is connected; the notched detent Q, pivoted on the arm P; the cam projection V, connected to the said detent; the pivoted arm T; and the lug or projection S, on the arm T; in combination with the suitably-driven spindle *f;* the cam *l*, adapted to rock the arm T; the spindle *a*, geared to the spindle *f;* and the disk X on the said spindle *a*, carrying a pin W, adapted to engage with the cam projection V, and disengage the notched detent Q, from the lug S; and means for revolving the spindle *a*, by the action of the governor independent of its gear connection with the spindle *f*, substantially as and for the purpose specified.

7. In a steam-engine the combination of the pivoted arm N, connected with the spindle of the steam-valve J; the arm P, connected to the arm N, to which arm a spring or equivalent device is connected; the notched detent Q, pivoted on the arm P; the spring U; the cam projection V, connected to the said detent; the pivoted arm T; the lug or projection S; the cam *l;* the spindle *f* suitably driven; the pinion *e;* the spindle *a;* the pin W; the sleeve *c* spirally grooved at *q;* the pinion *d;* and means for imparting a longitudinal motion to the sleeve *c*, by the governor of the engine, substantially as and for the purpose specified.

8. In a steam-engine a detent adapted to form a connection between a cam-operated arm and an arm suitably connected either directly or indirectly with the spindle of the steam-valve, in combination with a disk carrying a pin adapted to release the detent when the disk is rotated, and with means controlled by the governor for rotating the said shaft in either direction independent of the gearing by which it is driven from a moving part of the engine so that the pin may be made to raise the detent a little sooner or later as the case may be, substantially as and for the purpose specified.

9. In a steam-engine, a cylinder having a chamber formed therein and a split or opening between the end of the cylinder and the chamber in combination with a valve-casing fitting the said chamber, substantially as and for the purpose specified.

10. In a steam-engine, a cylinder having a chamber formed therein and a split or opening between the end of the cylinder and the chamber, in combination with a valve-casing fitting the said chamber; lugs formed on the cylinder on opposite sides of the split; and bolts through the lugs, substantially as and for the purpose specified.

Toronto July 18, 1895.

JOHN ABELL.

In presence of—
E. KATE PHILLIPS,
FRED CLARKE.