(No Model.)

4 Sheets—Sheet 1.

B. TOPMILLER.

CUT-OFF VALVE.

No. 355,627. Patented Jan. 4, 1887.

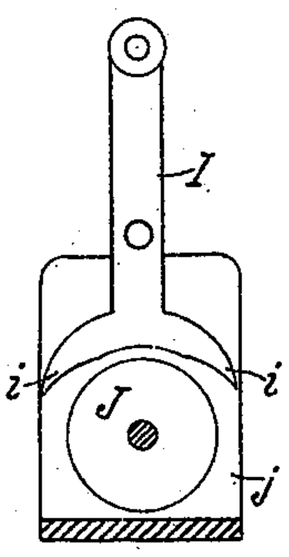


Fig. 2.

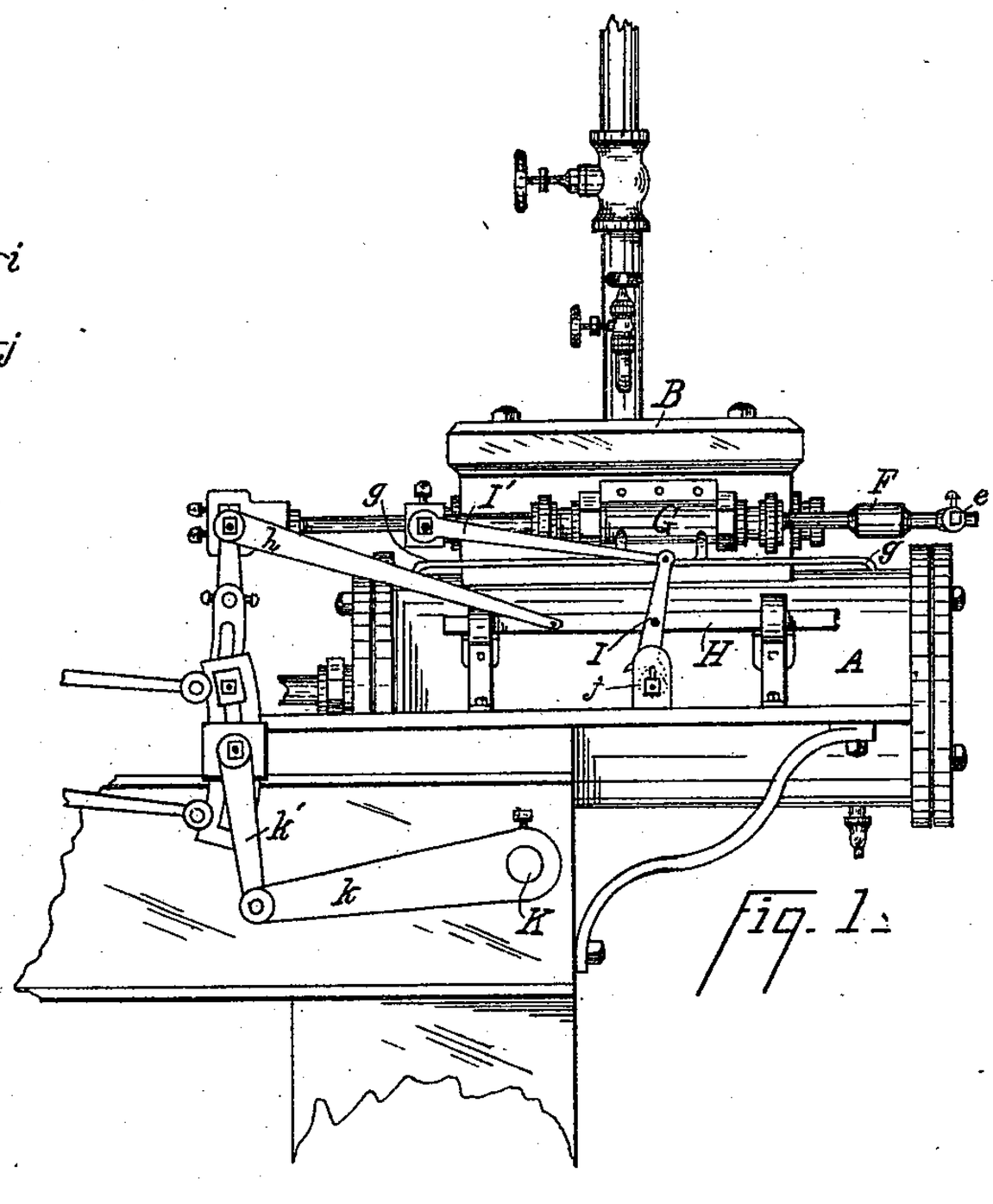


Fig. 1.

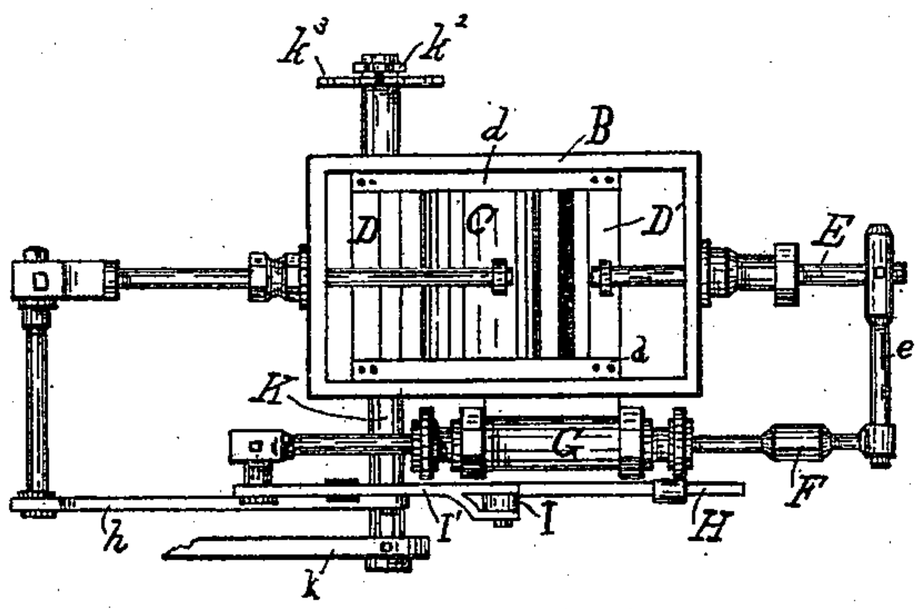


Fig. 3.

Attest—
Walter Chamberlin
Christian D. Rapp

Inventor—
Bernard Topmiller
By Geo. Gilmore
Atty

(No Model.)

4 Sheets—Sheet 2.

B. TOPMILLER.

CUT-OFF VALVE.

No. 355,627. Patented Jan. 4, 1887.

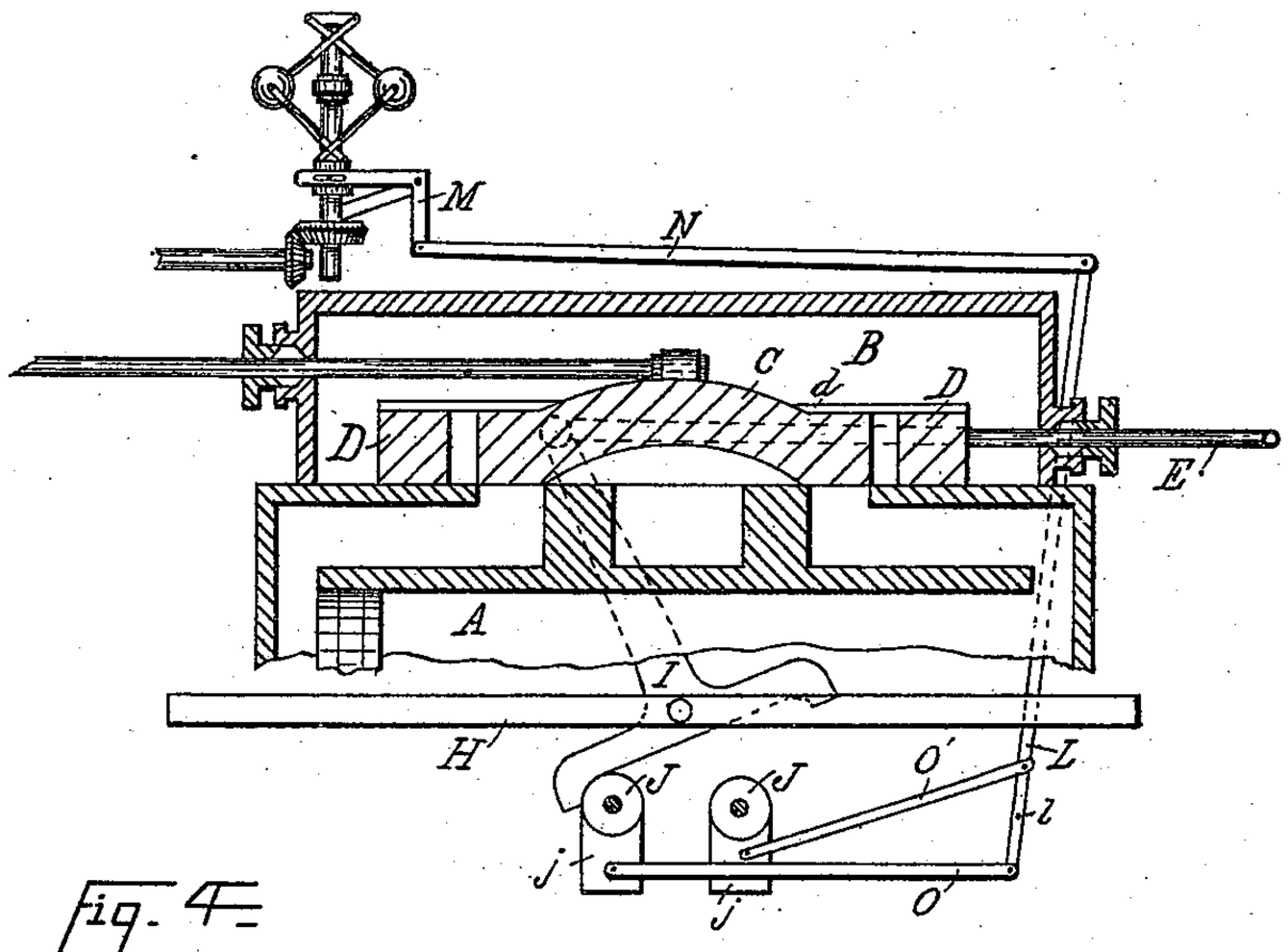


Fig. 4.

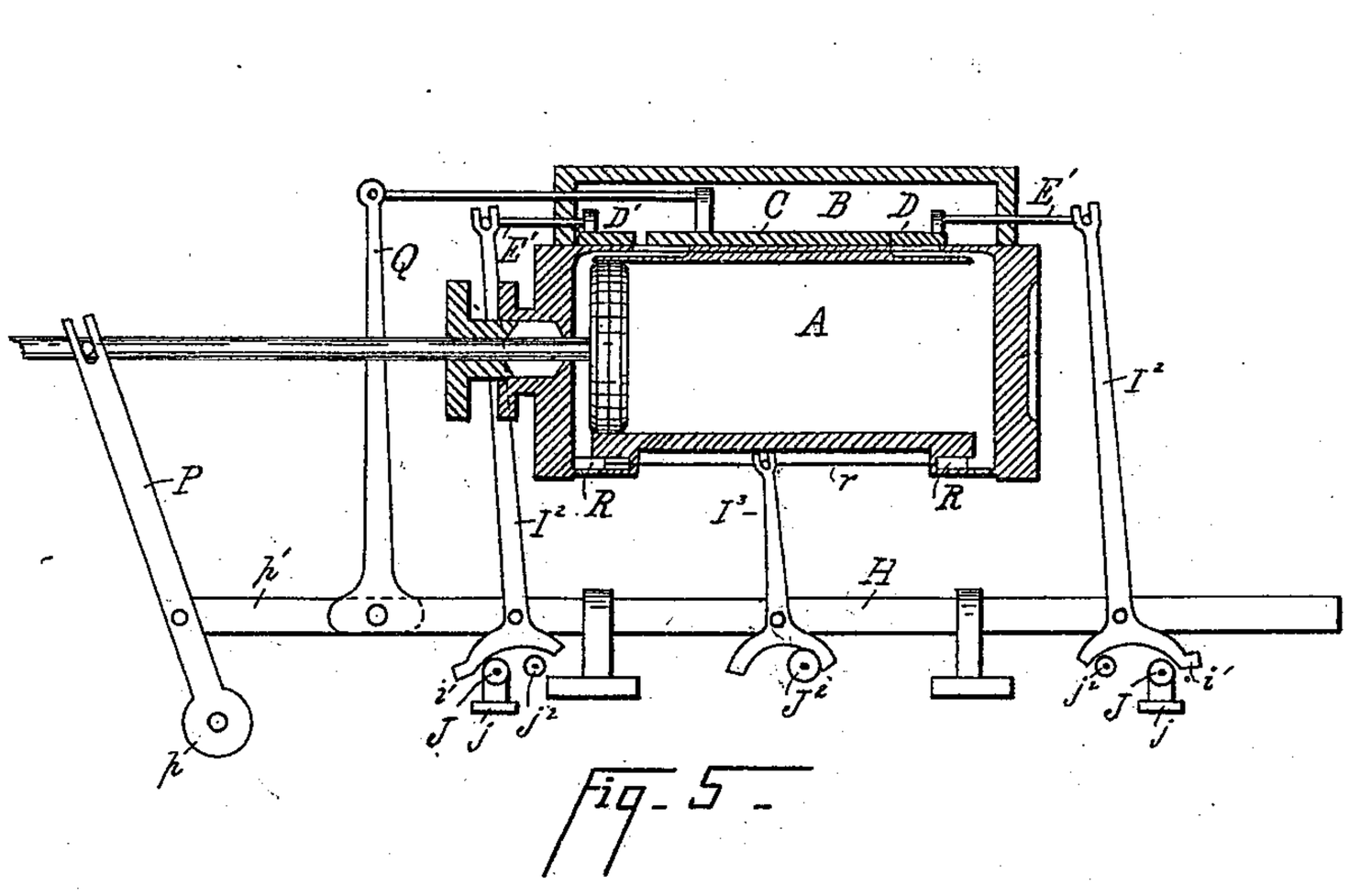


Fig. 5.

Attest—
Walter Chamberlin
Casper Miles.

Inventor—
Bernard Topmiller
By Geo. J. Murray Atty

(No Model.) 4 Sheets—Sheet 3.

B. TOPMILLER.

CUT-OFF VALVE.

No. 355,627. Patented Jan. 4, 1887.

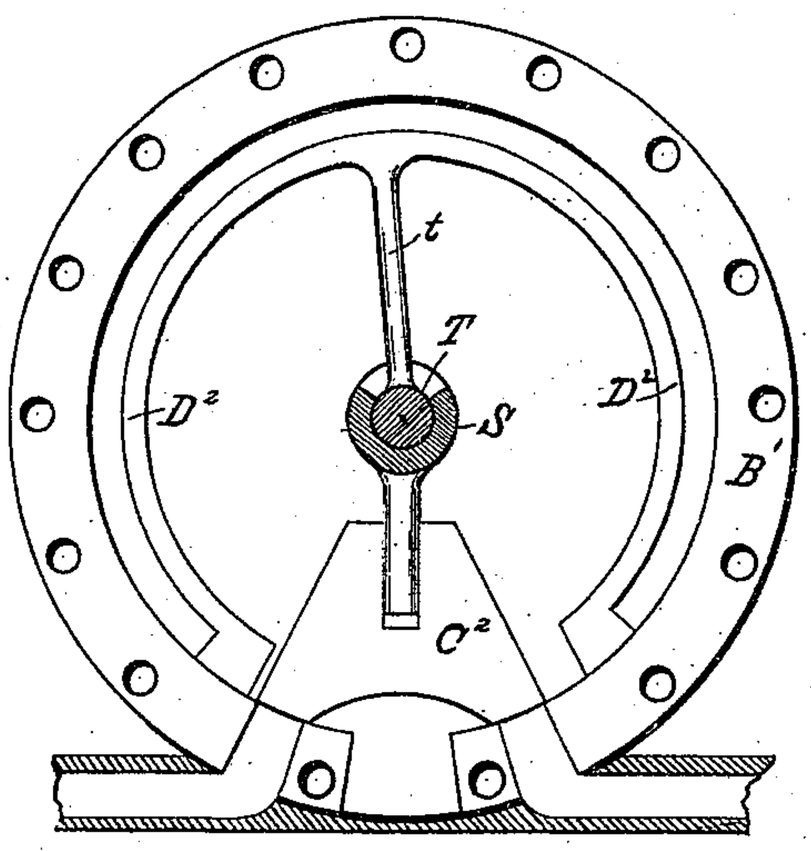


Fig. 6.

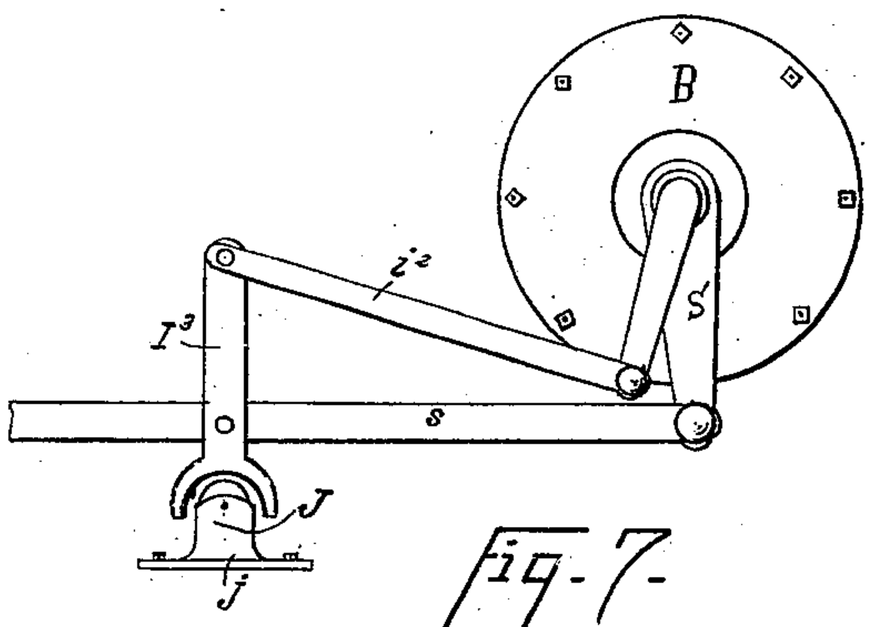
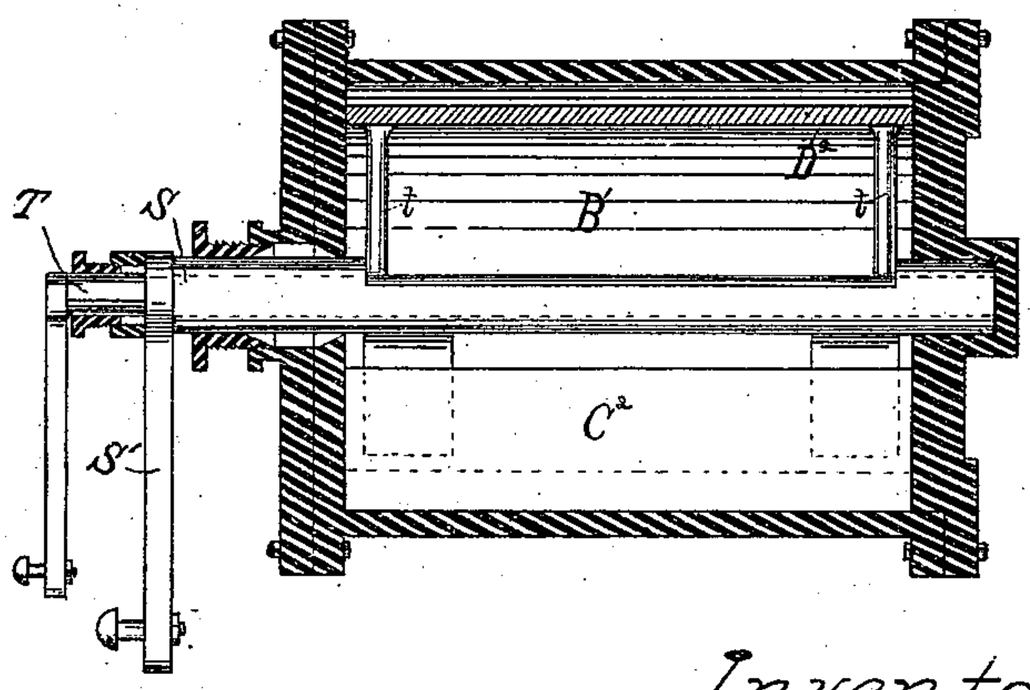


Fig. 7.

Fig. 8.



Attest ——
Walter Chamberlin
Christiano D. Rapp

Inventor ——
Bernard Topmiller
By Geo. H. Kinney
Atty

(No Model.) 4 Sheets—Sheet 4.

B. TOPMILLER.

CUT-OFF VALVE.

No. 355,627. Patented Jan. 4, 1887.

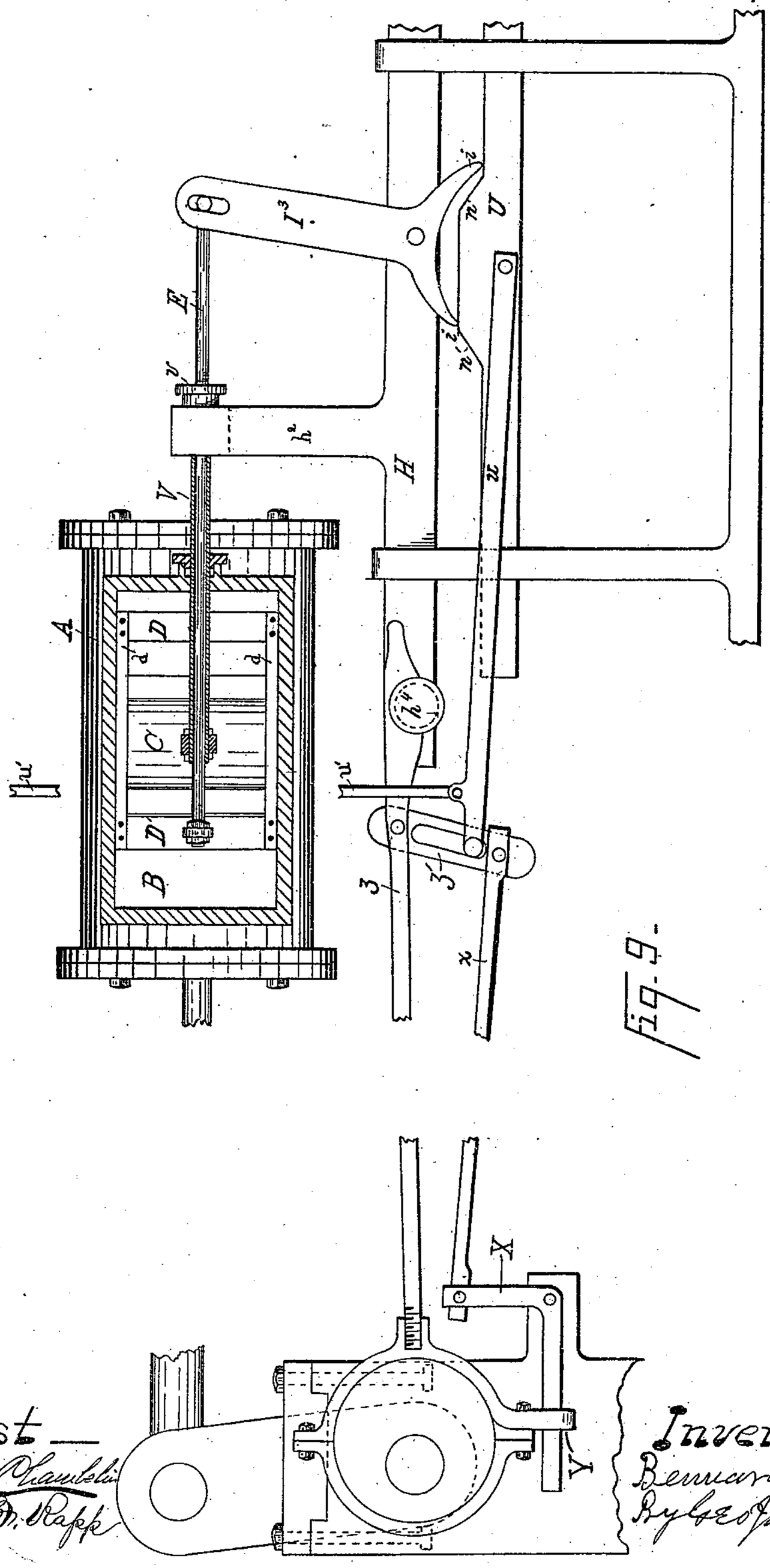


Fig. 9.

Attest—
Walter Chamblin
Christian D. Rapp

Inventor—
Bernard Topmiller
By Geo. J. Murray
Atty

UNITED STATES PATENT OFFICE.

BENNARD TOPMILLER, OF CINCINNATI, OHIO, ASSIGNOR OF TWO-THIRDS TO SIMON OBERMAYER AND JACOB A. HEINSHEIMER, BOTH OF SAME PLACE.

CUT-OFF VALVE.

SPECIFICATION forming part of Letters Patent No. 355,627, dated January 4, 1887.

Application filed October 9, 1884. Serial No. 145,046. (No model.)

To all whom it may concern:

Be it known that I, BENNARD TOPMILLER, a citizen of the United States, and a resident of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Cut-Off Valves, of which the following is a specification.

My invention relates to that class of steam-engines which are provided with separate valves to control the admission and exhaust ports. Its object is to control the cut-off at any point of the stroke, depending upon the pressure of steam carried or the duty required of the engine.

With this object in view my invention consists in a peculiar arrangement of independent laps and means for operating them, whereby they may be controlled either to cut off at any fixed part of the stroke or automatically regulated by the speed of the engine.

In the accompanying drawings, in which similar reference-letters indicate identical parts wherever they occur throughout the various views, Figure 1 is a side elevation of the cylinder end of an engine having my improvements attached. Fig. 2 is an enlarged view of the lever which trips the cut-off. Fig. 3 is a plan view of the steam-chest and its attachments with the top removed. Fig. 4 is a vertical section of a steam chest, showing the means of controlling the cut-off automatically by the governor. Fig. 5 is a longitudinal section of a modification of my invention, in which the supply-valves are disconnected from each other, but controlled by my tripping mechanism, and having exhaust-ports at each end, connected together and controlled by the tripping-lever. Fig. 6 is an elevation, with the cap removed, of a cylindrical steam-chest having my improvements attached. Fig. 7 is a side elevation of the tripping mechanism. Fig. 8 is a longitudinal section through the axes of the rock-shafts which actuate the valve and cut-off. Fig. 9 is a side elevation of another form of my valve-tripping mechanism. The steam-chest is in this view applied to the side of the steam-cylinder, and is shown in vertical section cut longitudinally through the main-valve rod, the rod which actuates the cut-off laps being shown in elevation.

Referring, first, to Figs. 1, 2, and 3, the cylinder A, steam-chest B, and slide-valve C are of ordinary construction, except that the laps of the valve C are made only wide enough to cover the steam-ports. The cut-off laps D D′ on each end of the valve are yoked together by bars *d*. To one of these laps, D, is secured the rod E, which passes through a stuffing-box in one end of the steam-chest to the outside, and has secured on its outer end a cross-bar, *e*. To this cross-bar is secured the rod F, which passes upon one side of the steam-chest, to guide and steady the movement of the rod E, and also to cushion the laps, so as to prevent them from being brought forcibly against the sides of the main valve C. This result is accomplished by passing the rod F through a cylinder, G, which is provided with a piston secured upon and driven by said rod F, and connecting this cylinder with the steam-cylinder by means of pipes *g g*, which pass from each end of the cylinder G to the opposite ends of the steam-engine cylinder A. It will thus be seen that the steam which has been forced into this small cylinder will be forced out by the rapid advance of the piston upon rod F, and the piston will be cushioned by the steam between it and the end of the cylinder, and as the valves D D′ are also driven by rod F they will be prevented from striking with force against the ends of the main valve C.

I will now describe the means by which the cut-off valves D D′ are actuated.

H is a sliding bar mounted in guides upon one side of the cylinder, and connected to the main-valve rod or cross-head by a link, *h*. The bar H has a fulcrum-pin projecting from it into a hole in the lever I. The lever I has curved fingers at its lower end, which overhang a friction-roller, J, which is vertically adjustable in a bearing, *j*, secured to a stationary part of the engine. The upper end of this lever I is connected to the rod F by a link, I′. Now it will be seen that when the main-valve rod moves in either direction the sliding bar H and lever I will be carried with it. So soon as one of the curved fingers *i* is arrested by the roller J the upper end of lever I will be thrown in the direction the main valve is traveling, and, carrying rod F with it, will rapidly close the following lap D or D′ against

the following end of the main valve C, thus cutting off the steam from the cylinder A. The point of cut-off is determined by the position of the wheel J with relation to the lower bifurcated end of lever I. The raising of the wheel J shortens and the lowering of it lengthens the cut-off. The shaft K, passing transversely through the bed-plate of the engine, has a crank-arm, *k*, upon one side, which is connected to the cross-head by a link, *k'*, in the usual manner. Upon the opposite end of the shaft K is the customary lever, k^2, and ratchet-segment k^3, for stopping the engine or starting it in either the forward or reverse direction. This form is applicable to locomotive and other engines that are run without the governor.

Referring, now, to Fig. 4, I will describe a means for automatically regulating the cut-off by the governor. The valves and means for operating them are precisely as before described. The only difference is in the tripping mechanism. Instead of the vertically-adjustable roller J, I have here substituted two rollers similar to it, but adjustable nearer to or farther from each other by means of their bearings, which are made to slide upon their seats. The lower end of the lever I is also extended to overhang both rollers. L is a lever fulcrumed at *l* upon a pin projecting from the bed of the engine. M is a bell-crank lever fulcrumed upon some stationary object and connected to the slide of the governor. The upper end of lever L and the bell-crank M are connected by a rod, N. The sliding roller-bearings *j* are connected to the lever L by link-rods O O', the rod O being connected to the lever L below and the rod O' above the fulcrum *l*. It will thus be seen that when the governor-slide is elevated by the rapid movement of the engine the rollers J will be moved apart and the valves D D' made to cut off the supply of steam to the cylinder A at an earlier point of the piston-stroke, and as the slide of the governor is carried down by the slower movement of the engine more steam will be supplied to the cylinder by bringing the rollers J nearer together. Thus the cut-off is regulated from the earliest desirable point to the full stroke of the piston, depending upon the pressure of steam in the boiler or the duty required of the engine.

Referring, now, to Fig. 5, the sliding bar H' is driven by a lever, P, which is fulcrumed upon a stationary pin, *p*, and rocked by the piston-rod through a pin which enters the upper bifurcated end of the lever P, the bar H' and lever P being connected by a link, *p'*. Projecting from the sliding bar H' is a rigid arm, Q, which drives the main valve C. Fulcrumed upon the sliding bar H', at opposite ends of the steam-cylinder and steam-chest, are two levers, I^2. The upper ends of these levers are bifurcated to receive the spade-handle ends of the cut-off-valve rods E' E', and the lower ends are formed into circular fingers *i*, like the lever I. Friction-rollers J are journaled in bearing *j*, arranged below and to one side of the vertical plane of the lever I^2. In the same horizontal plane as the rollers J' are stationary pins j^2. The bearings of rollers J' are adjustable nearer to or farther from the stationary pins j^2, so that the point of cut-off is determined the same as described with relation to the figures previously referred to. The exhaust-ports in this view, Fig. 5, are controlled by independent cut-offs R, arranged below the steam-cylinder and united by a rod, *r*. This rod has a pin projecting from it into the upper bifurcated end of the lever I^3, which is fulcrumed upon a pin projecting from bar H'. This lever has also arranged below its downwardly-curved fingers a vertically-adjustable roller, J^2, to trip the valve R at the proper time to open the exhaust.

In the position shown in the drawings the piston has just commenced its movement to the right, the supply-port to the left has just commenced to open to admit steam back of the piston, and the exhaust-port at the opposite end of the cylinder is thrown wide open. As the piston advances it carries the bar H' with it. So soon as the left curved finger of the lever I^2 reaches the wheel J', the lever I^2 will be rocked forward and instantly cut off the supply of steam to the cylinder. As the bar H' advances, the finger, sliding up upon the roller, as shown upon the right-hand end of the drawings, will keep the cut-off lap in contact with the main slide-valve until the stroke is completed.

In the illustration Fig. 5 I have shown the sliding bar H' below the cylinder and the valve-tripping arms necessarily lengthened, because in this way the principle of my invention is more clearly illustrated; but for actual use the whole mechanism will be made more compact. For instance, the sliding bar H' will be placed alongside of the cylinder, as in Fig. 1, and the lever I^3, for tripping the exhaust-valve, will be inverted, so that the roller J^2 is above the bar H' and the long arm of the lever below it.

Referring, now, to Figs. 6, 7, and 8, I will describe my improvements as applied to a cylindrical steam-chest. The chest B' is a plain cylinder with flanged ends to receive heads, one of which has a stuffing-box to receive the rock-shafts which actuate the main and cut-off valves, and the other head has a pocket to furnish a bearing for the opposite end of the shaft. The hollow shaft S, which actuates the main valve C^2, has wings projecting from it into a mortise in the top of valve C^2. It will be seen that when the shaft S is rocked by its arm S' the valve C^2 will be moved on its seat, and alternately open and close the steam-ports. Through the hollow shaft S passes the shaft T, which is also provided with a stuffing-box at the point where it enters the tubular shaft S. This shaft has arms *t* projecting up from it through the cut-away portion of the shaft S within the steam-chest, which arms are secured to the cut-off valve D^2. The valve

C^2 is driven by the connecting-rod *s*, which may be connected to the eccentric or cross-head of the engine. Upon this rod *s* is fulcrumed the lever I^3, which actuates the cut-off D^2 through the rod i^2. Below the lower bifurcated end of the rod I^3 is the roller J, which is vertically adjustable in its bearing *j*, to regulate the point of cut-off, in the same manner as before described.

Fig. 9 represents a modification in which two sliding bars are used—one to drive the main valve and carry the tripping-lever of the cut-off laps and the other to control the cut-off—both being actuated by the eccentric. The main valve is operated substantially as in Fig. 5; but the lever I^3 is tripped by inclines upon the sliding bar U.

The sliding bar H, which carries the tripping-lever I^3, has an arm, h^2, projecting up from it, to which is secured the hollow rod V, which drives the main valve. Through this hollow rod passes the rod E, which operates the cut-off laps D D′. The outer end of rod V is provided with a stuffing-box, *v*, to prevent the escape of steam. The bent end of rod E enters a slot in the upper end of the lever I^3. The bar H is driven by the eccentric-rod *z*, the notched end of which engages a pin, h^4, which projects from bar H. Depending from rod *z* is a slotted link, *z′*, which is rocked by a rod, *x*, one end of which is connected to the lower end of the link, and the opposite end is connected to an angular lever, X, which is pivoted at its angle to an extension of the pillar-block. The horizontal arm of lever X passes through a slot in an arm, Y, extending down from the eccentric-strap. The sliding bar U is connected to the link *z′* by the bar or rod *u*. The bar U has an upward projection with inclined ends *n′ n′*, which, when the bar is moved back and forth, alternately engage the fingers *i* of the lever I^3, and by rocking it operate the cut-off. The point of cut-off is controlled by the governor through a rod, *u′*. As the governor-balls are carried outward by the speed of the engine the rod *u* is carried down to the position shown. The slides H and U, then moving in opposite directions, effect a quick cut-off, and less steam is admitted to the cylinder. As the governor-balls fall at a slower speed the bar *u′* is carried up, causing a slower cut-off. When the bar *u′* is drawn to the upper end of the slot in link *z′*, the two sliding bars H and U will move together and the laps D D′ remain at equal distances from the main valve C during the entire stroke, so that there is no cut-off except by the main valve. Thus the cut-off is effected at any point desired. It will be seen that whatever position the bar U occupies the fingers *i* will rest upon it and the cut-off valves be prevented from moving, except when the lever I^3 is tripped by the inclines *n′ n′*, and it is also evident that inclines such as here shown may be substituted for the rollers J in the preceding figures of the drawings.

The valve C and independent cut-offs or laps herein shown are substantially the same as shown in my two patents dated September 23, 1884. The invention herein described is an improvement upon these former devices.

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

1. The combination of a steam-chest, a valve to open the steam-ports, operated in the usual manner, and independent cut-off valves at each end of the main valve, with a tripping-lever connected to the cut-off valves and mounted upon a movable bearing which is actuated by the engine to alternately close said cut-off valves against the opposite ends of the center valve, substantially as specified.

2. The combination, substantially as specified, of a steam-chest, a valve to open the steam-ports in the usual manner, and independent cut-off valves at each end of the main valve, with a tripping-lever connected to the cut-off valves and mounted upon a movable bearing which is actuated by the engine, and an adjustable stop in the path of the free end of the tripping-lever to force said lever to rock upon its fulcrum and quickly bring the following lap or cut-off against the following end of the main valve to effect a rapid cut-off at the point desired.

3. The combination of the steam-chest, the main valve, the independent cut-offs to close alternately against the opposite ends of the center main valve, with the tripping-lever connected to the cut-off valves and fulcrumed on a movable bearing which is actuated by the engine, and movable stops in the path of the free end of the tripping-lever, which stops are regulated by the governor of the engine for the purpose of controlling the cut-off according to the rate of speed or the duty required of the engine, substantially as described.

4. The combination, substantially as specified, of the slide-valve C and independent cut-off valves D D′ with sliding bar H, lever I, fulcrumed upon said sliding bar and having its free end bifurcated to engage a tripping-stop arranged in the path of the said lever I, and a link, as *h*, connecting the sliding bar with the engine, for the purpose specified.

BENNARD TOPMILLER.

Witnesses:
GEO. J. MURRAY,
CASPER MILES.