(No Model.) 3 Sheets—Sheet 1.

B. V. NORDBERG.

CUT-OFF GEAR FOR ENGINES.

No. 369,612. Patented Sept. 6, 1887.

Fig. 1.

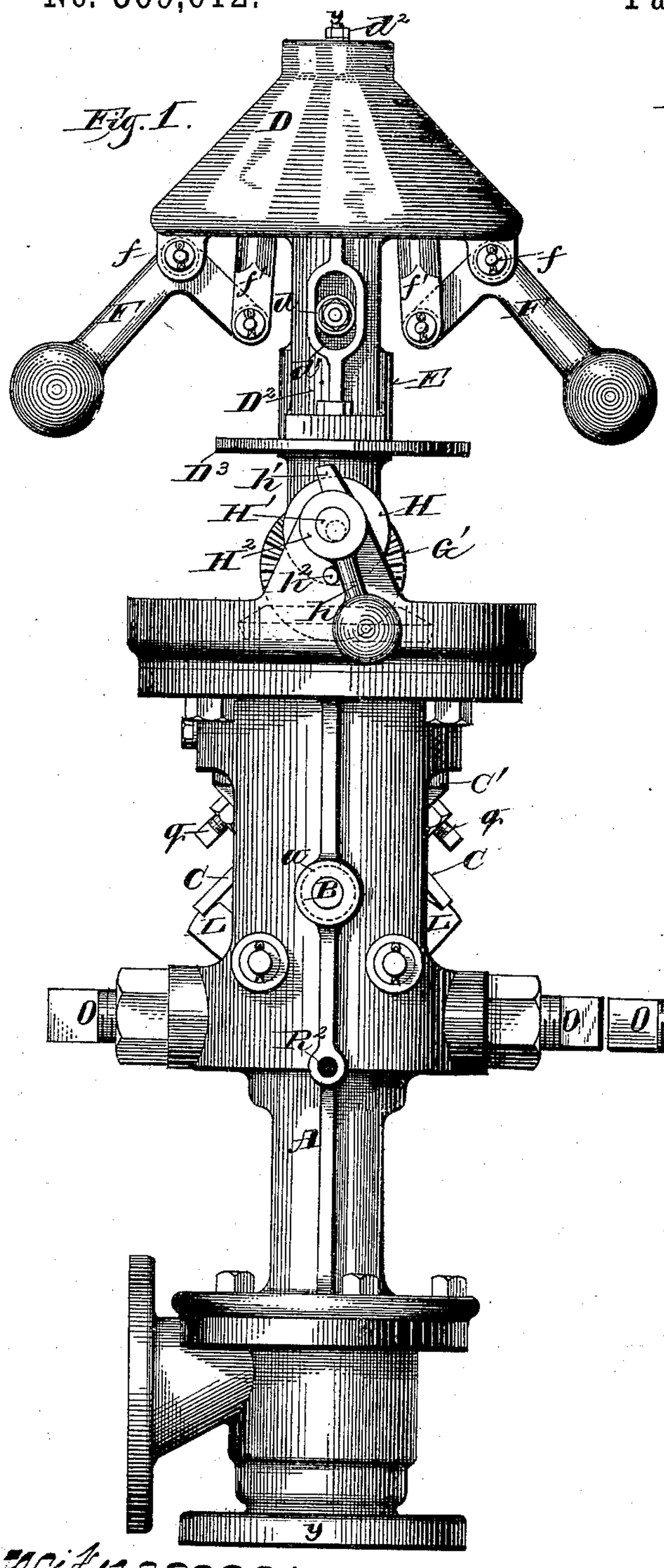
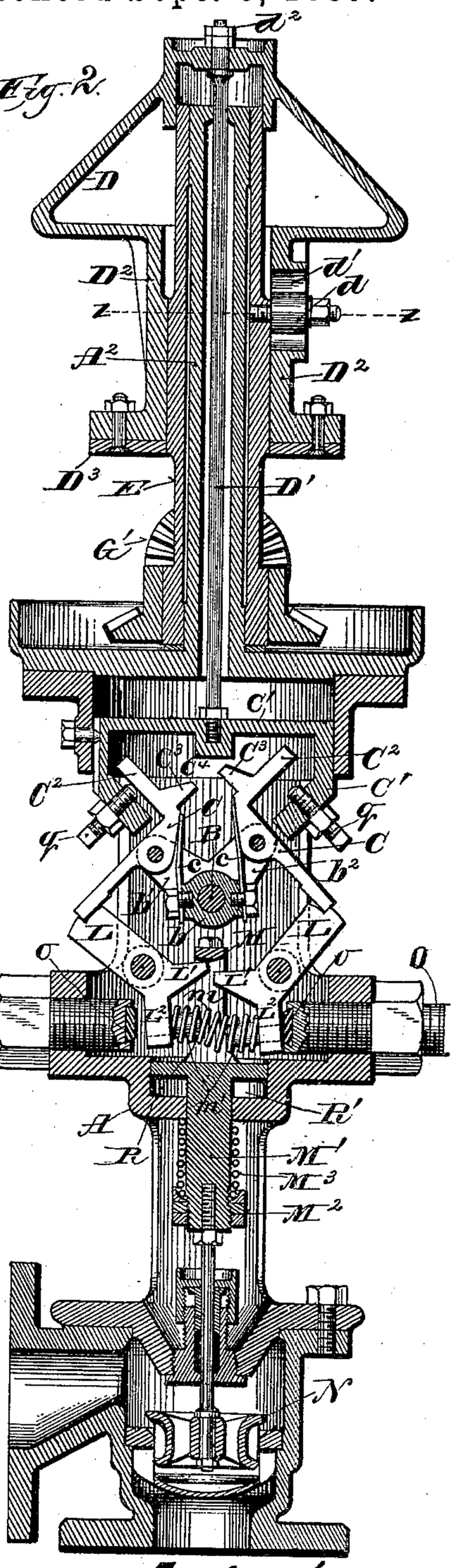


Fig. 2.



Witnesses:
E. G. Downes
Maurice F. Frear.

Inventor:
Bruno V. Nordberg
By Stout & Underwood
Attorneys.

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Fig. 3.

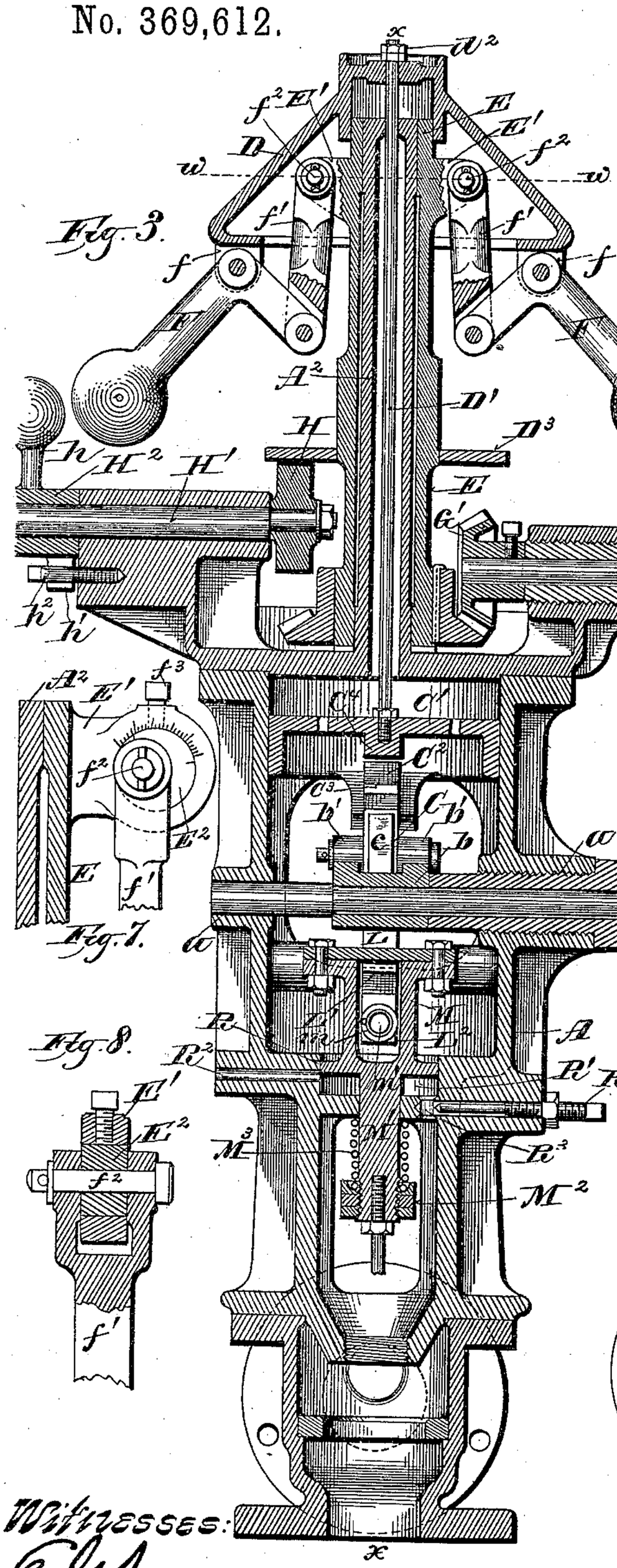


Fig. 4.

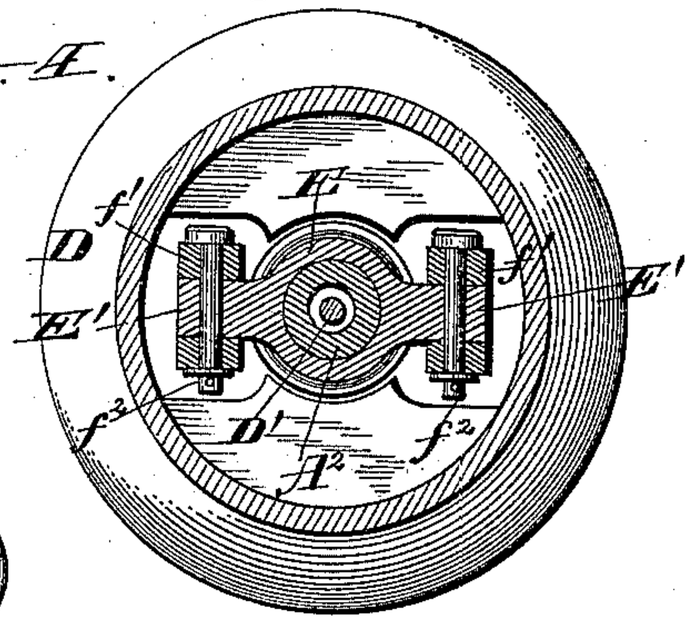


Fig. 6.

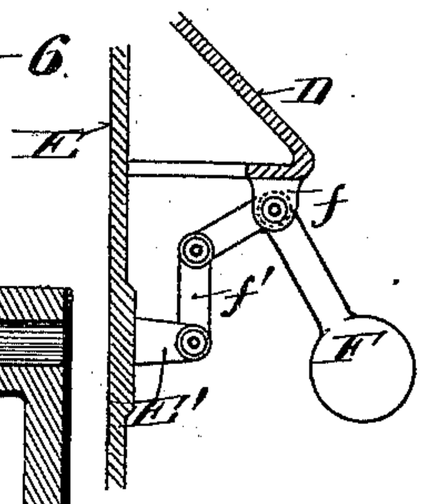
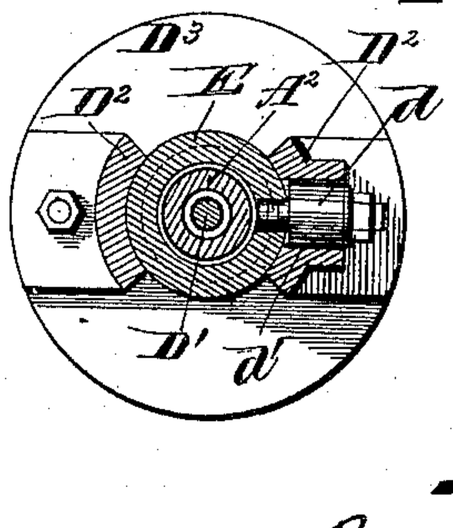


Fig. 7.

Fig. 8.

Fig. 5.



Witnesses:
E. G. Siggers
Maurice F. Frear.

Inventor:
Bruno V. Nordberg
By Stout & Underwood
Attorneys.

(No Model.) 3 Sheets—Sheet 3.

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Fig 9

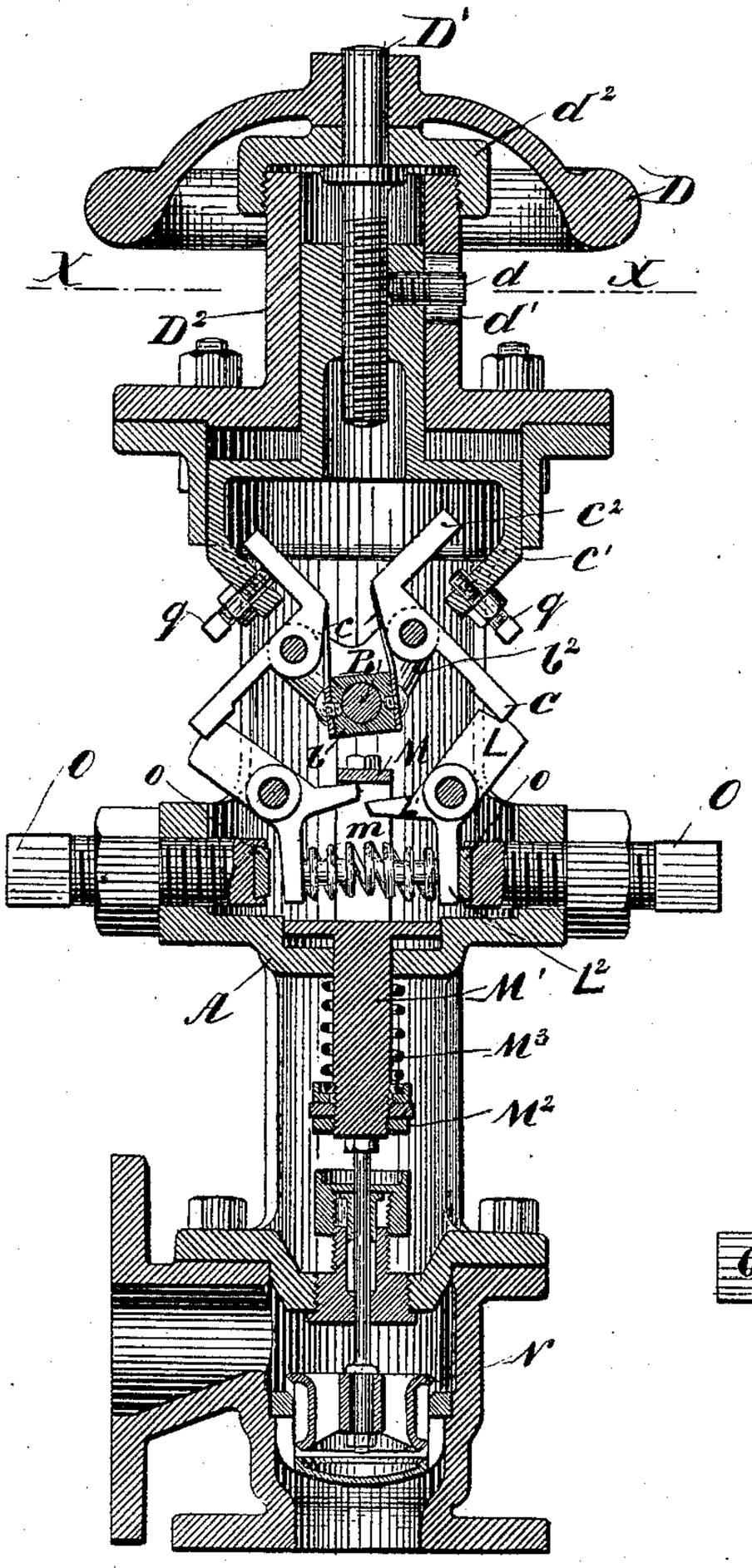
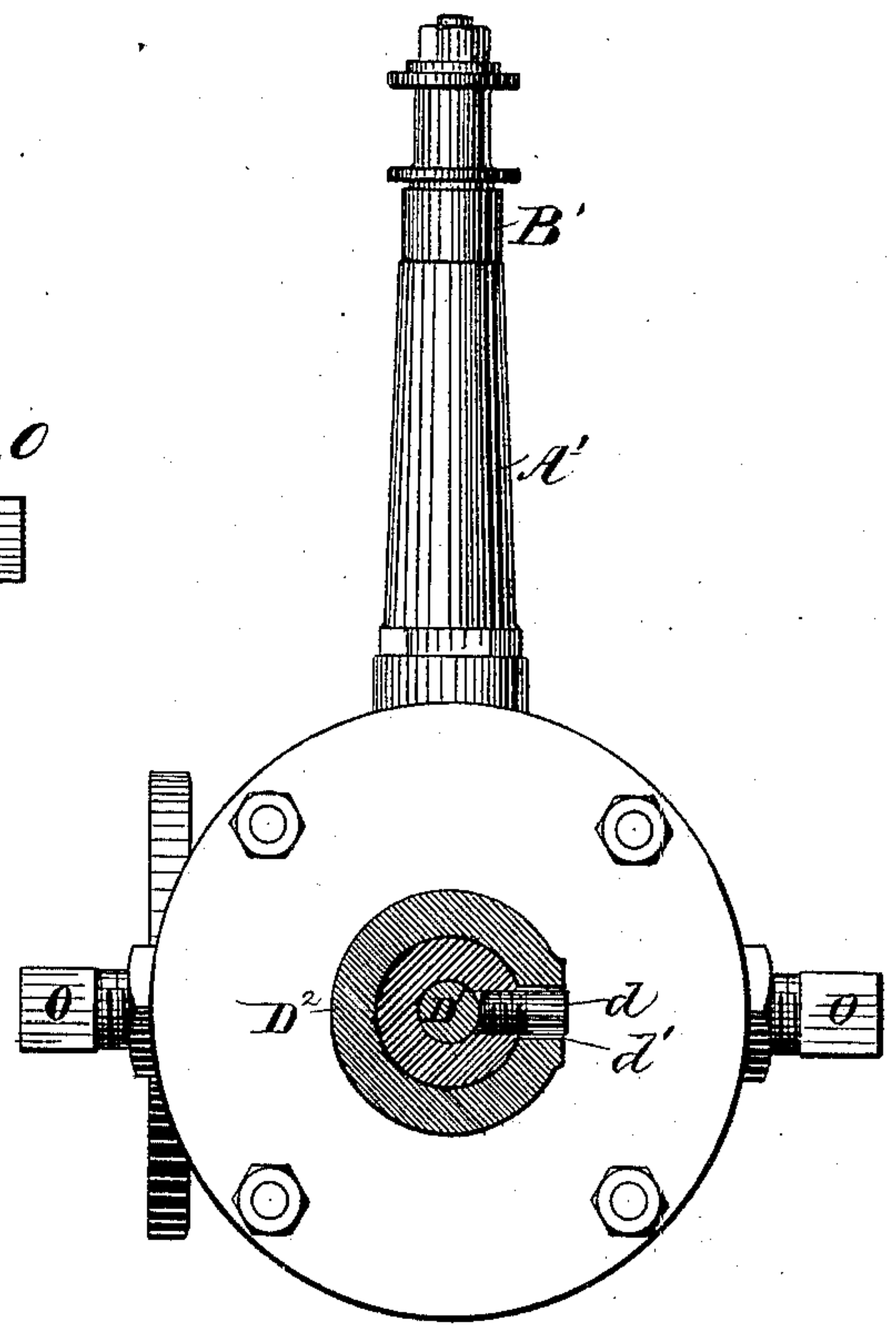


Fig 10



Witnesses
Maurice F. Frear.
N. E. Oliphant

Inventor
Bruno V. Nordberg
By Stout & Henderson
Attorneys

UNITED STATES PATENT OFFICE.

BRUNO V. NORDBERG, OF MILWAUKEE, WISCONSIN, ASSIGNOR OF ONE-HALF TO FRED L. HORNEFFER, OF SAME PLACE.

CUT-OFF GEAR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 369,612, dated September 6, 1887.

Application filed February 24, 1887. Serial No. 228,649. (No model.)

To all whom it may concern:

Be it known that I, BRUNO V. NORDBERG, of Milwaukee, in the county of Milwaukee, and in the State of Wisconsin, have invented certain new and useful Improvements in Cut-Off Gear for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to cut-off gear for steam-engines, and will be fully described hereinafter.

In the drawings, Figure 1 is a side elevation of my invention. Fig. 2 is a vertical central section on line *x x*, Fig. 3. Fig. 3 is a like section on line *y y*, Fig. 1. Fig. 4 is a section on line *w w*, Fig. 3. Fig. 5 is a section on line *z z*, Fig. 2. Figs. 6, 7, and 8 are details of modifications of some of the features of my invention. Fig. 9 is a vertical section of a modified form of my device; and Fig. 10 is a section on line *x x*, Fig. 9.

A is the stand which contains the valve and cut-off. B is a rock-shaft that has one bearing in the stand at *a* and the other in a sleeve, A′, that is screwed into the stand at *a′*. The crank-arm B′ at the outer end of rock-shaft B is to receive the eccentric-rod, (not shown,) while between its bearings the rock-shaft B carries a short sleeve, *b*, that has crank-arms *b′* b^2, standing at obtuse angles to each other and forming a bell-crank, and to the outer end of each of these arms is pivoted a trip-lever, C, as shown best in Fig. 2, which trip-levers are held in position for engagement with trip-stops *q* on the trip-frame C′ by springs *c c*, that project up from the sleeve *b*.

The upper arms, C^2, of the trip-lever C are for tripping when the engine is properly at work; but to close the valve in case of accident when the governor-arms drop entirely, I provide the trip-levers each with a lug, C^3, and the trip-frame C′ with a lug, C^4, which latter, when the frame drops, will by contact with the lugs C^3 trip both levers and permit the valve to close. The frame C′ is suspended from the top of a sleeved hood or counterpoise, D, by a rod, D′, and said hood loosely surrounds and is driven by sleeve E, that in turn surrounds and is supported by an upright stem, A^2, of the stand A. The connection is made between the driving-sleeve E and the hood by means of a sleeved wrist, *d*, which passes from sleeve E through a slot, *d′*, in the frame of the hood D.

F F are elbowed governor-arms which are pivoted to the hood or counterpoise D at *f*, while their inner ends are toggled to lugs E′ on the sleeve E by links *f′*, so that when the arms are thrown out by the speed of the engine they will lift the hood or counterpoise.

In Figs. 1 and 3 I have shown the link *f′* as pivoted to the sleeve above the plane of the pivots of the governor-arms; but they may be connected to the sleeve below said plane, as in Fig. 6; and to provide for regulating the sensitiveness of the governor-arms I may fit a bushing, E^2, in the lug E′ and pass the pivot-bolt f^2 eccentrically through after the lug has been straddled by the arms of the toggle *f′*, that the distance of the pivot-bolt from the sleeve E can be regulated by turning the bushing. The set-bolt f^3 is to secure the bushing when adjusted. The turning of bushing E^2 will slightly raise and lower the pivot f^2; but this can be compensated for by adjusting the nuts d^2 on rod D′ to lengthen or shorten the said rod.

G is the pulley-shaft that connects the sleeve E with the engine, and this shaft is connected with sleeve E by gearing G′.

The lower portion of the counterpoise carries suspended from its frame D′ an annulus, D^3, and beneath the plane in which this annulus travels is hung a roller, H, on one end of an eccentric-shaft, H′, that has its bearings in the upper portion of the stand A, and on its outer end is secured a collar, H^2, having a weighted arm, *h*, and stop-lug *h′*, a pin, h^2, that projects out from the frame serving to receive the arm *h*, as in Fig. 1, or stop-lug *h′*, as in Fig. 3, as the case may be.

Arranged below the trip-levers and sleeve *b* are lifting-levers L, which connect the trip-levers C with the hanger M, from which the valve N is suspended. These levers are pivoted in the stand A, and each has a horizontal lug, L′, and a vertical lug, L^2, beneath the plane of the axes of their pivots, the horizontal lugs for engagement with the hanger M and the vertical lugs to each receive an end of a spring, *m*, that is interposed between them

on short spindles *m'*. The upper ends of the lifting-levers are slightly rounded, and are notched to receive and engage with the lower ends of the trip-levers C, as shown in Fig. 2. Set-bolts O O, the inner ends of which are cushioned, as at *o*, serve to limit the outward throw of the lugs L^2 of levers L, which lugs are held apart by the spring *m*.

The hanger M has a stem, M', which is screw-threaded on its lower end to take nuts M^2, that confine a spring, M^3, on said stem M', and this spring, by pressure on the superjacent portion of the stand and nuts M^2, serves to close the valve N when its hanger is released by the levers L. That portion of hanger M just above its stem M' is made flat, as at R, and fits snugly in a well, R', in the stand, where it forms a piston, beneath which the air acts as a cushion to break the drop of the valves. Air is admitted to this well through ports R^2 R^3, which ports may be regulated in size by screw-valves, as shown at R^4.

In case of accident—such as the breaking of the pulley-belt—the falling of the governor-arms F will permit the dropping of the counterpoise with its rod D' and frame C' far enough to bring the lug C^4 of frame C' into contact with the lugs C^3, when both of the levers C will be tripped and the valve will be closed by its spring; and then, when the engine is to be again started, the arm *h* must be turned until the lug *h'* abuts against the pin h^2, when the eccentric H' will lift the annulus D^3 by means of the roller H. The trip-levers and lifting-levers may then be brought into engagement by oscillating the crank-arm B'.

With my device, which may be used on any slide or one-valve engine, the eccentric need be set only slightly ahead of the crank, and it will cut off at any point in the piston-stroke.

It will be observed, of course, that when the frame C' is at its highest point the bolts *q* will cause the rapid tripping of the valves, and vice versa, and thus the stroke is shortened or lengthened as the governor-arms raise or lower the tripping-frame.

When the tripping mechanism is in the position shown in Fig. 2, the governor-arms are in that shown in Fig. 3, and the annulus D^3 is resting on the roller H, the eccentric-shaft H' being turned so as to carry the roller to its highest position, and as the said roller turns loosely on its spindle the annulus will revolve freely on it. The trip-frame C' is now in its lowest working position, and the rocking of sleeve *b* will not bring the arms C^2 of the trip-levers C into contact with either of the bolts *q*. Consequently the valve will remain full open until sufficient speed has been attained to raise the arms and the trip-frame, the valve-hammer M is supported alternately by the lugs L' L' of the right and left lifting-levers L L, for as the right-hand trip-lever C depresses the upper arm of the right-hand lifting-lever L and raises its lug L' under the hanger M the left-hand trip-lever C will ease up on its lifting-lever L and permit the spring *m* to depress its lug L'. Now, when the speed attained causes the balls to fly apart and lift the frame C', the eccentric of the engine acts through arm B' to dip the sleeve *b* to the right until the arm C^2 of the right-hand trip-lever comes into contact with the bolt *q* in the frame on that side, and this throws its lower end out of engagement with the right-hand lifting-lever L after it has caused the lug L' of this lifting-lever to take the place of the lug L' of the opposite lifting-lever, and then when the arm B' returns the left-hand trip-lever C will have a like action on its side.

It is obvious that as the speed increases and the arms F separate, the trip-frame C' will raise and trip with increased rapidity to cut off sooner in the piston-stroke.

If desired, the stops *q* may be dispensed with and the tripping may be done by the under-hanging lips of the trip-frame; but the use of these stops is preferred, as they can be screwed in and out to nicely fix the tripping-point. The top of the trip-frame is perforated to admit air above it to form a cushion to prevent bumping by the sudden rise of the frame.

As shown in Figs. 9 and 10, I may regulate the tripping by a hand-wheel instead of by an automatic governor.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a cut-off valve, of trip mechanism, a counterpoise from which such trip mechanism is suspended, elbowed governor-arms pivoted to the counterpoise, a driving-sleeve, and links connecting the inner ends of the governor-arms with the driving-sleeve, substantially as described.

2. The combination, with a cut-off valve, of trip and lifting levers, a trip-frame, a counterpoise from which the latter is suspended, a driving-sleeve upon which the counterpoise slides, and elbowed levers linked to the said driving-sleeve, as set forth.

3. The combination, with the counterpoise and driving-sleeve, of elbowed governor-arms, links or toggles for connecting the inner ends of said arms to lugs on the driving-sleeves, and mechanism whereby the pivots that connect the links or toggles with the driving-wheel may be adjusted horizontally to regulate the sensitiveness of the governor-arms, as set forth.

4. The combination of the rock-shaft that connects the cut-off mechanism with the eccentric of the engine, a sleeve carried thereby having two crank-arms, angular trip-levers, lifting-levers adapted for engagement with the lower ends of said trip-levers, and a hanger from which the cut-off valve is suspended, adapted to engage arms of the lifting-levers, with a trip-frame counterpoise and governor-arms connected substantially as set forth.

5. The combination of the trip-levers and their operating mechanism, the lifting-levers, springs for forcing the lower ends of the latter apart, and cushioned set-bolts for regulating

their throw, with the cut-off valve and its hanger, and a spring for closing the valve when released by the lifting-arms.

6. The combination, with the trip frame and levers, of adjustable bolts passed through the trip-frame for receiving the impact of the trip-levers, as set forth.

7. The combination of trip-frame having a central projection or lug with the trip-levers having lugs that project under the first-named lug in position to be struck thereby when by any accident to the governor the trip-frame is allowed to fall below its normal working position.

8. The combination, with the counterpoise and its depending annulus, of the eccentrically-hung supporting-roller, its shaft, and the weighted arm thereof.

9. The combination, with the stand A, having stem A^2, of a counterpoise D, elbowed governor-arms F, driving-sleeve E and toggles f', a trip-frame suspended from the counterpoise, trip-levers C, the rock-shaft and its crank-sleeve, lifting-levers L L, hanger M, spring M^3, and the cut-off valve, as set forth.

10. The combination of trip-levers with valve and lifting-levers, the lifting-levers being independent of each other and of the valve-stem, as set forth.

In testimony that I claim the foregoing I have hereunto set my hand, at Milwaukee, in the county of Milwaukee and State of Wisconsin, in the presence of two witnesses.

BRUNO V. NORDBERG.

Witnesses:
S. S. STOUT,
MAURICE F. FREAR.