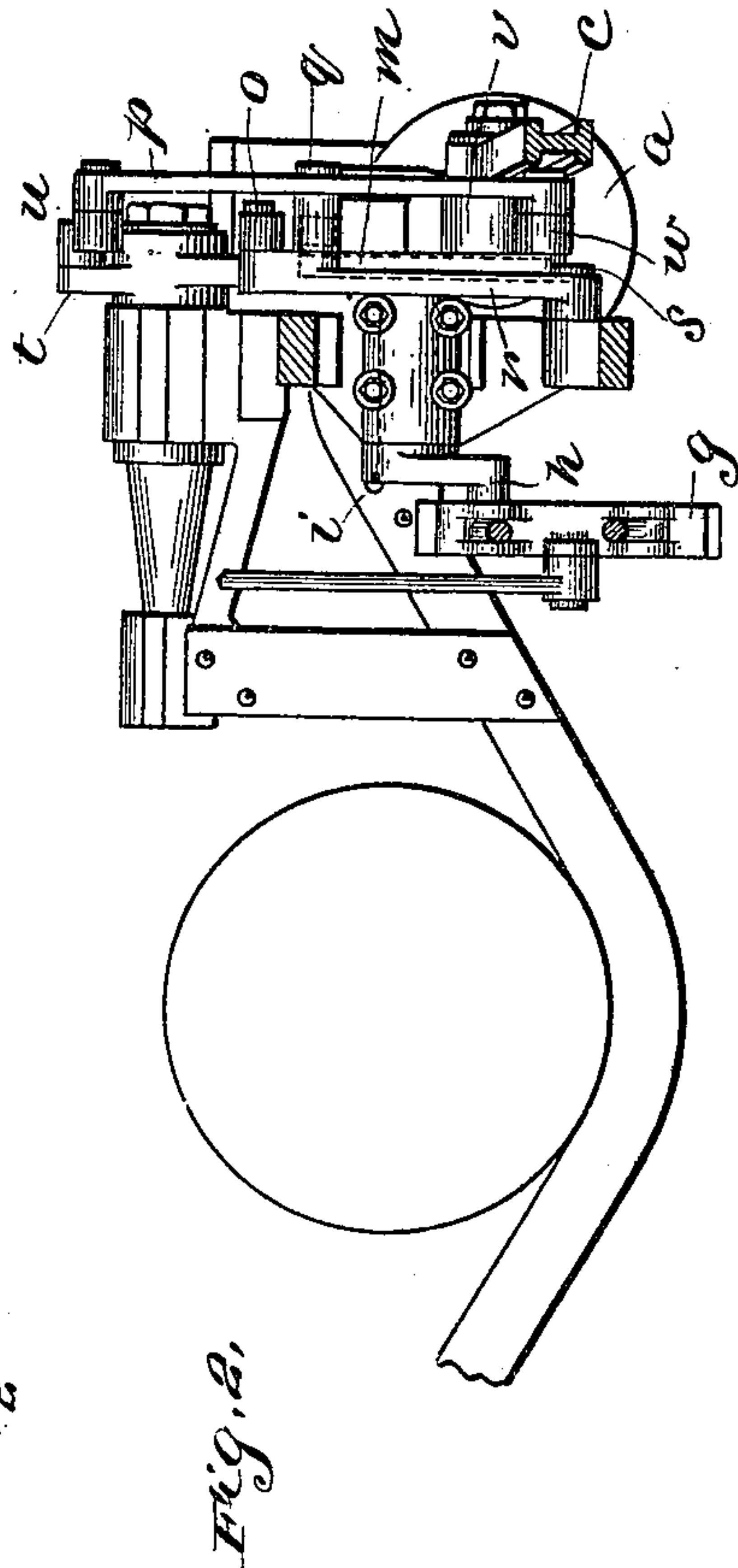
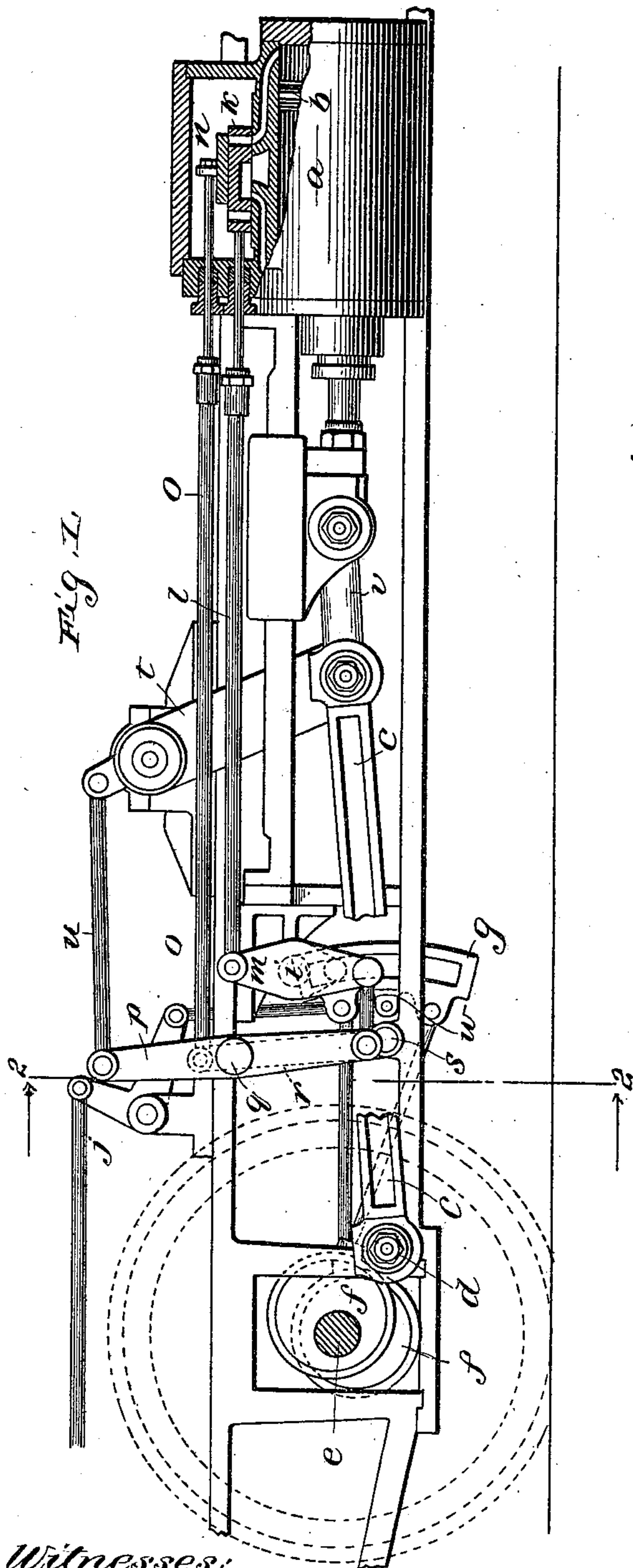


No. 665,524.

Patented Jan. 8, 1901.

R. HARDIE.
CUT-OFF VALVE GEAR.
(Application filed Mar. 6, 1900.)

(No Model.)



Witnesses:
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UNITED STATES PATENT OFFICE.

ROBERT HARDIE, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE COMPRESSED AIR MOTOR COMPANY, OF SAME PLACE.

CUT-OFF-VALVE GEAR.

SPECIFICATION forming part of Letters Patent No. 665,524, dated January 8, 1901.

Application filed March 6, 1900. Serial No. 7,480. (No model.)

To all whom it may concern:

Be it known that I, ROBERT HARDIE, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Cut-Off-Valve Gear, of which the following is a specification.

The valve-gear forming the subject of this invention is designed to control the cut-off valves of engines actuated by expansible fluids; and it consists of a system of levers so arranged and connected to a part of the engine directly controlled by the piston and to the mechanism operating the main valve that the action of the cut-off valve partakes of the combined movements of the piston and main valve and is variable in relation to both of said movements in such manner that the resultant of these two movements is to impart to the cut-off valve an accelerated speed relatively to the main valve during the early portion of the piston's motion and when it is performing its function to arrest the flow of the active fluid through the main valve to the cylinder and that during the latter portion of the piston's motion the resultant of the movements of the piston and main valve act differentially on the cut-off valve to retard its movement on the main valve. Valve-gears constructed to actuate cut-off valves under this principle of operation insures a quick and positive closing of the inlet-ports at any and all points of cut-off desired, such points of cut-off being determined by the extent of travel imparted to the main valve.

The valve-gear illustrated and described in my previous application filed April 3, 1899, under Serial No. 711,505, carries a construction by which the principles of operation above set forth are carried out, and the valve-gear here shown and described embodies another construction operating functionally similar.

Figure 1 represents in side elevation my improvements applied to a locomotive-engine, sufficient of the locomotive only being shown to impart an understanding of the construction and operation of my invention; and Fig. 2 is a transverse section taken on the line 2 2, Fig. 1.

The operating portions of the engine here shown, which are old, comprises the cylinder *a*, the piston *b*, the connecting-rod *c*, the crank *d*, which projects from the side of the wheel shown in dotted lines on the axle *e*, the eccentrics *f f*, also secured to the axle *e*, the link *g*, connected to and operated by the eccentrics *f f*, the inner arm *h*, controlled by the link *g* and carried by the rock-shaft *i*, the lever and rod *j*, controlling the position of the link *g*, the main valve *k*, its rod *l*, and the outer arm *m*, to which the rod *l* is attached.

The cut-off valve *n*, which is represented as a flat plate fitted to slide on the top of the main valve *k*, is connected to the upper end of the rocking arm *r*, having its lower end pivotally connected at *s* to a suitable part of the engine-frame.

The cut-off valve *n* is controlled and actuated by the floating lever *p*, whose fulcrum *q* is on the rocking arm *r*, just below the pivotal connection of this arm to the rod *o*. This rock-arm *r* may be considered simply as a guide for the outer end of the rod *o* of the cut-off valve *n* to insure the proper action of the fulcrum *q* of the floating lever *p* thereof, and other forms of guides may be substituted for it. The lower end of lever *p* may be directly attached to arm *m*, the proportional lengths of the arms of the floating lever being varied as desired to impart the desired movement to the cut-off valve. The upper end of the floating lever *p* is controlled by and actuated from the piston *b* through the medium of the rocking lever *t*, whose shaft fits in suitable bearings on the engine-frame, the rod *u*, connecting the upper end of this arm to the floating lever *p*, and the short link *v*, which connects the lower end of the lever *t* to the cross-head of the engine. The connecting-rod *c* is in this case carried at its inner end by the stud at the lower end of the lever *t*, to which the link *v* is attached. The lower end of the floating lever *p* is connected with the rod *w* to a depending extension of the outer arm *m* of the main-valve-actuating device. It will thus be seen that the cut-off valve is actuated by the fulcrum of the floating lever *p*, which is a moving fulcrum whose position and extent of movement are determined by the combined actions of the piston and main valve. The

point of cut-off increases as the travel of the main valve is caused to decrease by the setting of the link *g* to cause it to act on the arm *n* at points approaching its dead-center. With the parts proportioned about as illustrated in the drawings the cut-off valve *n* is shown as just closing the port-opening of the main valve *k*, the link *g* being set to impart full movement to the main valve and the crank *d* having moved about thirty degrees from the dead-center. With the link *g* set to impart about three-quarter travel to the main valve the cut-off will occur when the crank has moved about forty-seven degrees, and with the link *g* set to impart about one-half travel to the main valve the cut-off will occur when the crank has moved about eighty degrees. These data are given merely for illustrative purposes, it being understood that the parts may be varied in their proportion to cause the cut-off to act as desired within practical limits, the positive and quick action of the cut-off valve being maintained for all proportions of and active positions in which the parts of the engine may be adjusted.

I claim as my invention—

1. In a steam-engine of the locomotive type, the combination therewith, of a cut-off valve arranged to act in conjunction with the main valve; a floating lever; means for connecting one of its ends to a part of the main-valve-actuating means, whereby this end of said floating lever is caused to be moved in direction opposite to that of the main valve; means connecting the other end of the floating lever to a moving part of the engine acting in unison with the piston, whereby this end of the floating lever is caused to be moved in direction opposite to that of the piston; and a connection between the central part of the floating lever and the cut-off valve.

2. In an engine, the combination with a cylinder, a piston and its rod, a crank and its connecting-rod, a main valve, and means for actuating the main valve, of a cut-off valve arranged to act in conjunction with the main valve, a floating lever having a centrally-located fulcrum and connected at one end to a rocking arm of the main-valve-actuating means, so as to cause said fulcrum to be moved in opposite direction to the main valve, and at its other end to a rocking lever connected to a moving part of the engine acting in unison with the piston so as to cause said fulcrum to be moved in opposite direction to the piston, and connection between the fulcrum of the floating lever and the cut-off valve.

3. In an engine, the combination with a cylinder, a piston and its rod, a crank and its connecting-rod, a main valve, and means for actuating the main valve, of a cut-off valve arranged to act in conjunction with the main valve, a floating lever having a centrally-located fulcrum and connected at one end to a rocking arm of the main-valve-actuating means, so as to cause said fulcrum to be moved in opposite direction to the main valve, and at its other end to a rocking lever, a connecting-link between the lower end of the rocking lever and the end of the piston-rod, the inner end of the connecting-rod also being connected to this end of the rocking lever, and a rocking arm carrying the fulcrum-pivot of the floating lever and connected to the cut-off valve.

Signed at New York, in the county of New York and State of New York, this 23d day of February, A. D. 1900.

ROBERT HARDIE.

Witnesses:

ARTHUR C. BLATZ,
M. NIXON.