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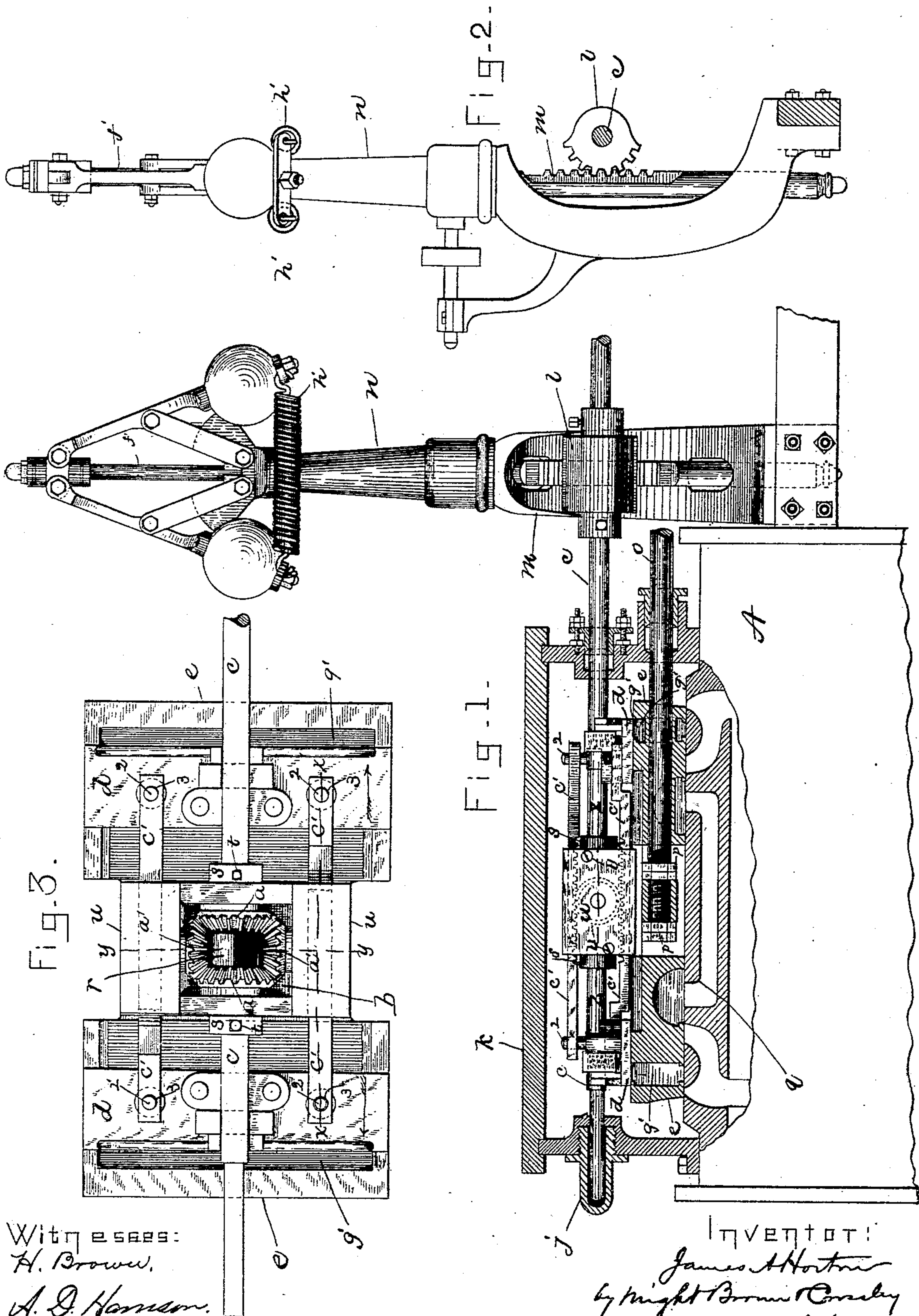
2 Sheets—Sheet 1.

J. A. HORTON.

CUT-OFF VALVE.

No. 355,993.

Patented Jan. 11, 1887.



Witnesses:
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Inventor:
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(No Model.)

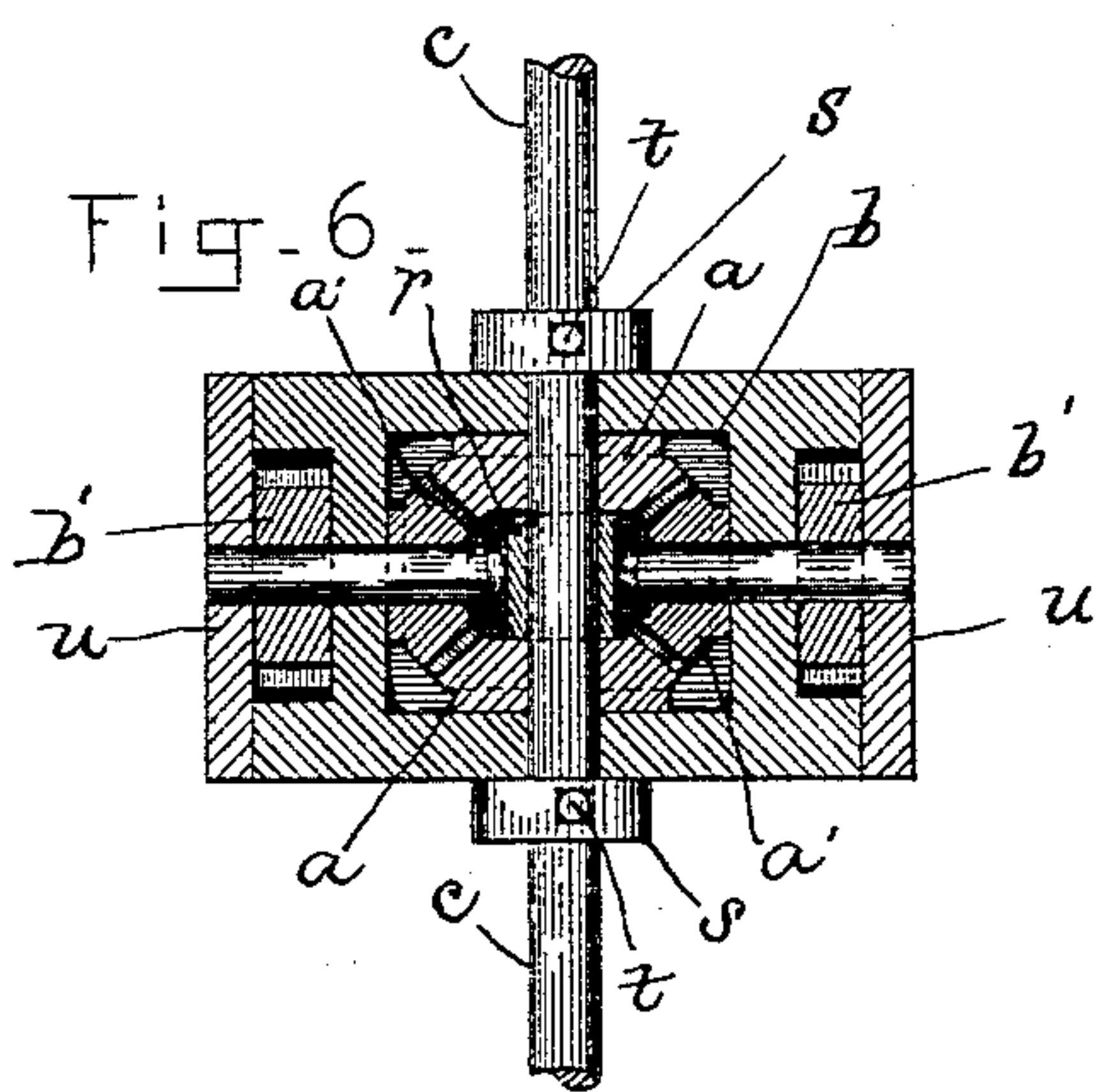
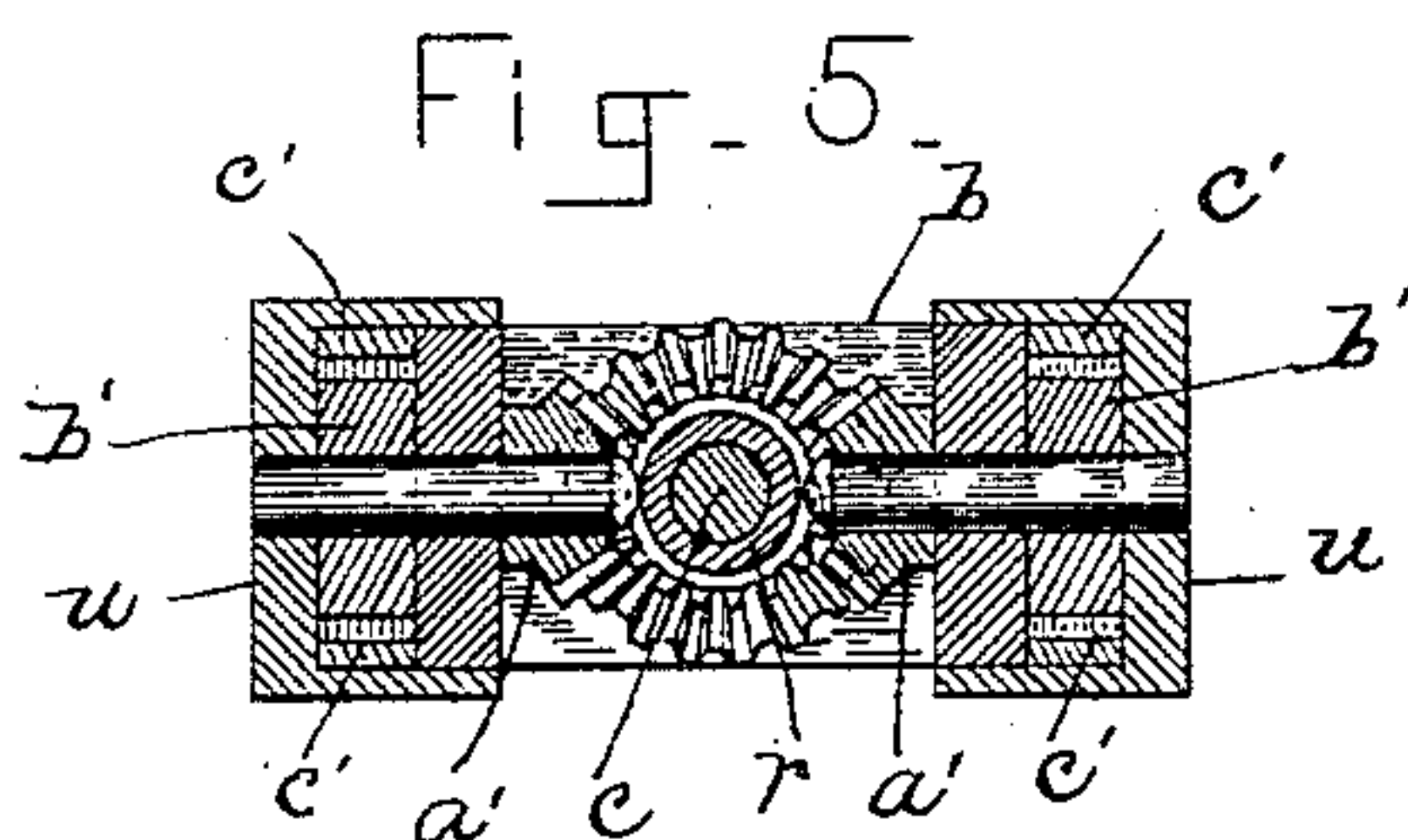
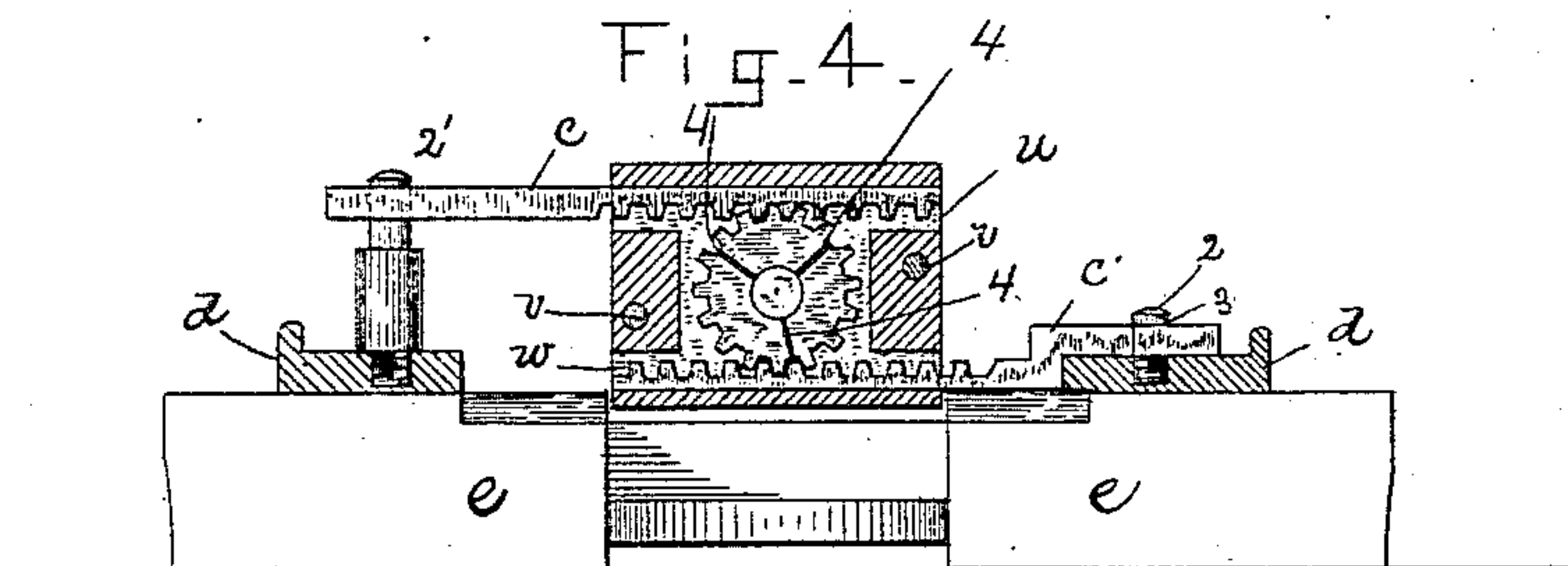
2 Sheets—Sheet 2.

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CUT-OFF VALVE.

No. 355,993.

Patented Jan. 11, 1887.



Witnesses:

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UNITED STATES PATENT OFFICE.

JAMES A. HORTON, OF READING, MASSACHUSETTS.

CUT-OFF VALVE.

SPECIFICATION forming part of Letters Patent No. 355,993, dated January 11, 1887.

Application filed October 8, 1886. Serial No. 215,655. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. HORTON, of Reading, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Governed Cut-Off Valves for Steam-Engines, of which the following is a specification.

This invention relates to governed cut-off valves, such as are used on stationary engines to regulate the admission of steam to the main valve and cylinder in such quantities as are required to maintain a uniform speed of the engine; and it consists in the combination, with the cylinder, of two slide-valves, to which are attached rack-gears so arranged as that said rack-gears engage with spur-gears, which are operated by a governor and devices connected thereto, so that with the movements of the governor the cut-off valves will be given the desired amount of length, and thus open and close the openings in the main valve earlier or later in the stroke.

The invention also consists in the arrangement of four bevel-gears placed in such a manner as to communicate motion from the governor through the valve-stem to the spur-gears and racks connected to the cut-off valves.

The invention also consists in the means for partially rotating the valve-stem, whereby the cut-off valve is automatically governed.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a side elevation of my improved cut-off and governor in operative position on the main valve of a stationary engine, said main valve, valve-seat, and steam-chest being shown in section. Fig. 2 represents a side view of the governing devices. Fig. 3 represents a top view of the cut-off in position on the main valve, and showing the steam-ports of the latter as open. Fig. 4 represents a section on line *x x*, Fig. 3, showing a side elevation of the main valve. Fig. 5 represents a section on line *y y*, Fig. 3. Fig. 6 represents a section on line *z z*, Fig. 1.

The same letters of reference indicate the same parts in all the figures.

In carrying out my invention, I provide four bevel-gears, *a a a' a'*, Figs. 3 and 6, so arranged as to mesh with each other, and placed in such position in a box or frame, *b*, that the valve-stem *c* passes through the two gears *a a*,

one of which is rigidly secured to said valve-stem, the other being "idle" or loose on the stem for the purpose of preventing cramping, which might occur if said gear were left off. Gears *a' a'* impart motion to spur-gears *b' b'*, Figs. 5 and 6, meshing with racks *c' c'*, attached to the valves *d d*, as shown in Fig. 4.

2 2 2' 2' represent studs screwed into or otherwise attached to the valves *d d*, and forming the connection of the racks *c'* with the valves *d*. The outer ends of said racks are provided with holes 3 3 3 3, which admit of the studs 2 2 2' fitting loosely therein. It will be seen that the racks *c' c'*, situated on the under side of spur-gears *b' b'*, are provided with an offset and rest on the valve, the stud 2 of such racks being shorter than the stud 2' on the opposite valve. (See Figs. 3 and 4.)

By reference to Figs. 3, 5, and 6 it will be seen that the gears *a a a' a'* for operating the valves *d d* are confined in a small box or frame, *b*. Said box or frame is adapted to be placed in the center of the main valve, but does not interfere or come in contact with the same, it being supported by the valve-stem *c*. The main valve *e* is provided with a depression in its center to allow the bottom of the gear box or frame to be located below its upper surface, so that the studs 2 2 engaged with the racks *c' c'* may not be too long and give the valves a tipping motion, and to permit said valves to rest firmly on the upper face or surface of said main valve *e*.

By reference to Fig. 1 it will be observed that the valve-stem *c* extends through the gear and rack box or frame *b*, and at one end enters a socket or "horn," *j*, attached to the forward end of the steam-chest *k*, which horn is adapted to contain "live steam" from the chest, so that the valve-stem *c* may be lubricated at the point where it enters said horn, which fits it closely in order to keep it steady. The valve-stem extends back through the back end of the steam-chest, where it is properly packed in any suitable manner, and the outer end has a suitable connection (not shown) with an eccentric or like device of any known or common construction adapted to impart a reciprocating motion to said valve-stem.

7 represents an elongated gear-segment secured to the valve-stem *c*, Figs. 1 and 2, and meshing with a rack, *m*. Said rack is adapted

to be vertically reciprocated by the governor n , and imparts a partial rotation to the valve-stem which operates the governing devices in a manner referred to hereinafter. The elongated character of the gear-segment l permits of the valve-stem c , with which it is connected, being moved longitudinally without disengaging said gear or segment from said rack.

o represents the main-valve stem, which passes through core-passages in the valve e , and is secured thereto by nuts $p p$. Said stem is connected with the appurtenances of the engine and operates the valve e in the usual and well-known manner.

q represents the valve-seat and a portion of the cylinder A and steam-cavities. I have shown in Fig. 4 a side view of the main valve, which will give a clear understanding of the relative position of the cut-off devices (shown in section in the same figure) with said valve.

r represents a thimble or roller placed on the outside of the valve-stem c , and adapted to rotate with the same between the heads or outer faces of the bevel-gears $a a' a'$. Said thimble is intended to fill the space between the gears, and serve as a distance piece or guard to prevent the accidental displacement of the same, (shown in Figs. 3, 5, and 6,) and serves to keep the "idler" or loose gear in place, the manner in which I place the several gears in position in the box or frame b rendering the above-named device necessary, viz: I drop the idler or loose gear into the box or frame, then place the thimble or distance-piece in the center of the same, then the gear which is secured to the valve-stem c by a feather-and-groove connection. I pass the valve-stem through the above-named devices, securing said stem from moving endwise by the collars $s s$ on each side of the gear box or frame b , and secured to the valve-stem c by set-screws $t t$. (See Fig. 6.) Gears $a' a'$, which rotate spur-gears $b' b'$, are secured in the box or frame b in a similar manner to that just described, with the exception of the same stem extending through both gears. In this case the shafts of gears $b' b'$ are secured to said gears by any suitable means, and the inner ends of said shafts project through said gears far enough to nearly engage the distance-piece, and the outer ends have a bearing in a cap or end piece, u , secured to the box or frame b by screws $v v$, Figs. 1 and 4, which end piece extends on to the box or frame on its top and bottom sides, thus forming a pocket or groove, w , to contain the racks, allowing them to move freely therein when reciprocated by the rotation of spur-gears $b' b'$, Figs. 4, 5, and 6.

The operation is as follows: The main valve and its stem o and cut-off-valve stem c , being operated by the usual devices, and the governor n being connected with the engine in any suitable manner, the rotation of the governor causes the balls of the same to fly outwardly from the center, which movement causes the rack m to be moved downwardly by the connection of the ball-carrying arms of the gov-

ernor with the spindle or rod f' , extending down into and secured to said rack m . The downward movement of the rack partially rotates the elongated gear-segment l meshing therewith, which movement imparts a like motion to the valve-stem c , causing the bevel-gears to rotate and impart motion to the spur-gears $b' b'$, meshing with racks $c' c' c' c'$, (shown in Figs. 4, 5, and 6,) causing said racks to be reciprocated in opposite directions simultaneously, and also causing (through said racks) valves $d d$ to be moved in a similar manner, thus regulating the time of closing the main-valve ports for the passage of steam into the cylinder. The movement of the rack m and the rotation of the gear-segment l is limited in extent, and only a slight movement in either direction is necessary to operate the cut-off sufficiently.

The variable operation of the cut-off valves does not take place until the engine has attained a rate of piston-speed required, (this being a matter to be regulated by adjustment of speed to the requirements.) The main valve has a uniform or invariable travel, so that when the maximum speed has been reached the rotation of the governor commences to operate the cut-off valves, (which also have an invariable travel so far as the longitudinal movement of valve-stem c is concerned,) and limits the time that the ports shall lie open to admit steam to the cylinder to the extent required to maintain the required rate of speed. As the engine increases its speed in the beginning, the governor-balls are thrown outward by centrifugal force, causing the rack m to be depressed, which motion communicated to the devices described causes the valves $d d$ to be moved outwardly from the center in the direction of the arrows in Fig. 3, and thus causing an earlier cut-off or closing of ports in the main valve. This operation is continued until the speed of the engine is lessened by any cause—as, for instance, the sudden application of additional machinery, when the opposing springs $h' h'$, attached to the balls of the governor, instantly draw said balls together, which movement causes the opposite position to that just described to be assumed by the cut-off valves, thus quickly changing the time that the ports in the main valve shall remain closed, thus governing without perceptible change in speed. The operation above described continues, a uniform rate of speed being maintained.

By reference to Fig. 1, it will be observed that the space required by my device is very limited, and that it is entirely out of the way, being inclosed in the steam-chest and out of sight, there being no complicated mechanism connected therewith, as is the case with many of the governed cut-off valves now in use.

The gears for operating the cut-off valves being inclosed in the steam-chest are provided with grooves $4 4$, Fig. 4, in their surfaces for the admission of steam to all parts for the purpose of lubrication. The steam, together with

the oil used for lubricating the main valve and cylinder, serves to keep all the parts well oiled, and renders it impossible for them to become dry.

5 The racks *c' c'* have sufficient room in the groove or cavity *u* to prevent any frictional contact therewith. (See Fig. 4.)

My device is easily operated, the power required to move it under pressure being nominal.

10 I do not limit myself to the precise form of the governor-stem *f'* and the valve-stem *c*, as shown—viz., the segmental gear *l* and rack *m*—as other devices having the same object in view may be used without departing from the spirit of my invention.

Having thus described my invention, what I claim is—

1. The cylinder provided with steam-ports, 20 the main valve having the usual openings or ports, cut-off slide-valves resting on said main valve, the valve-stems for reciprocating said valves, racks connected with said cut-off slide-valves to move the same independent of the reciprocating movement imparted to them by 25 their valve-stem, spur-gears intermeshing with said racks to move the same, the governor, and mechanism intermediate of the governor and spur-gears whereby the latter are actuated 30 from the former as aforesaid, all combined and operating as and for the purposes set forth.

2. The cylinder provided with steam-ports, the main valve having the usual openings, cut-off slide-valves resting on said main valve, the 35 valve-stems for reciprocating said valves, racks connected with said cut-off slide-valves to move the same independent of the reciprocating movement imparted thereto by their valve-stem, spur-gears intermeshing with said racks 40 to move the same, the governor, a rack actu-

ated thereby, valve-stem *c*, an elongated gear on said valve-stem intermeshing with said last-mentioned rack, and gears connected with said valve-stem for actuating said spur-gears, all combined and operating as and for the pur- 45 poses set forth.

3. The steam-chest, a main valve, governed cut-off valves adapted to slide on said main valve, racks connected with said cut-off valves, spur-gears intermeshing with said racks to 50 move the same, a box or frame, *b*, and gears within said box or frame to actuate said spur-gears, all inclosed within the steam-chest, the governor, and mechanism, substantially as set forth, intermediate of the governor, and the 55 gears in said box or frame to actuate the same, all combined and operating as and for the purposes set forth.

4. The main valve, cut-off valves, racks connected with said cut-off valves, spur-gears in- 60 termeshing with said racks to move the same, the shafts or journals of said spur-gears, gears *a a' a'*, valve-stem *c*, segment *l*, rack *m*, and a governor, all combined and operating as and for the purposes set forth. 65

5. The steam-chest and main valve, governed cut-off valves, box or frame *b*, cut-off actuating-gears in said box or frame, and de- 70 vices connecting said gears with said cut-off valves, all contained within the steam-chest, a governor, and means, as described, connecting the same with said gears, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 20th day of September, 1886. 75

JAMES A. HORTON.

Witnesses:

C. F. BROWN,
ARTHUR W. CROSSLEY.