B. S. Lawson, Engine Governor,

Fig. 2.

PATENTED JUL 11 1871

Fig. 3.

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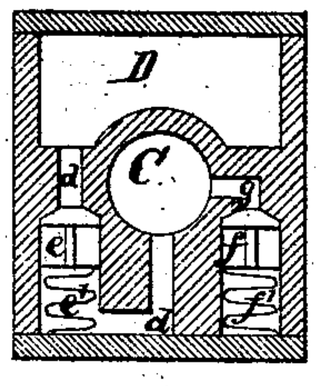
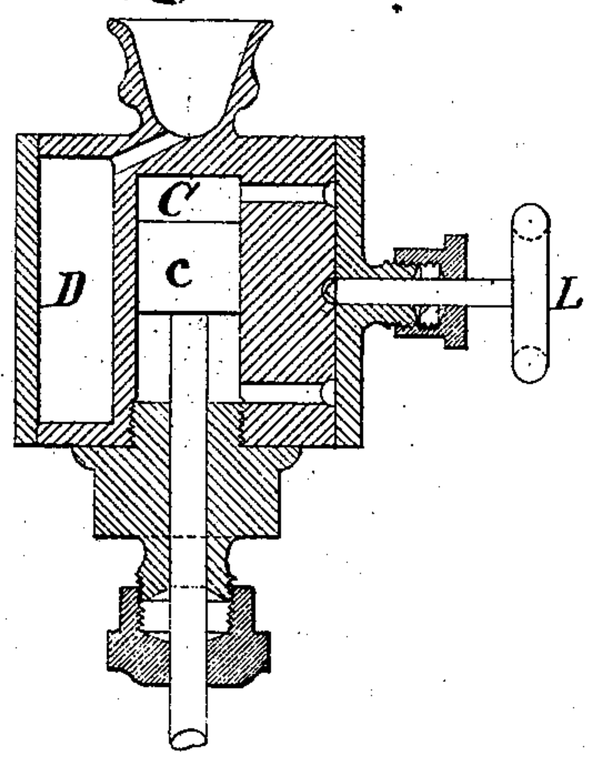
Fig. 4.





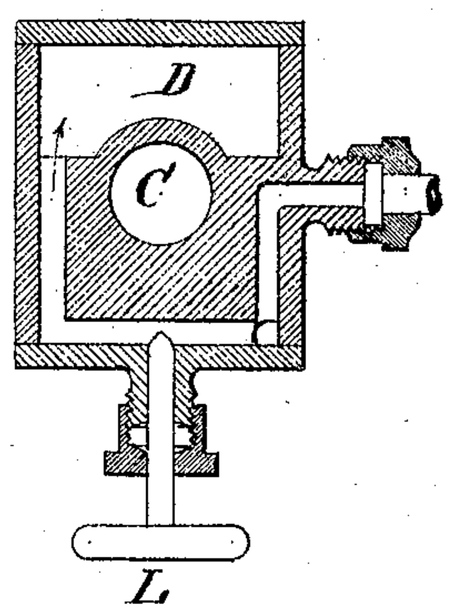
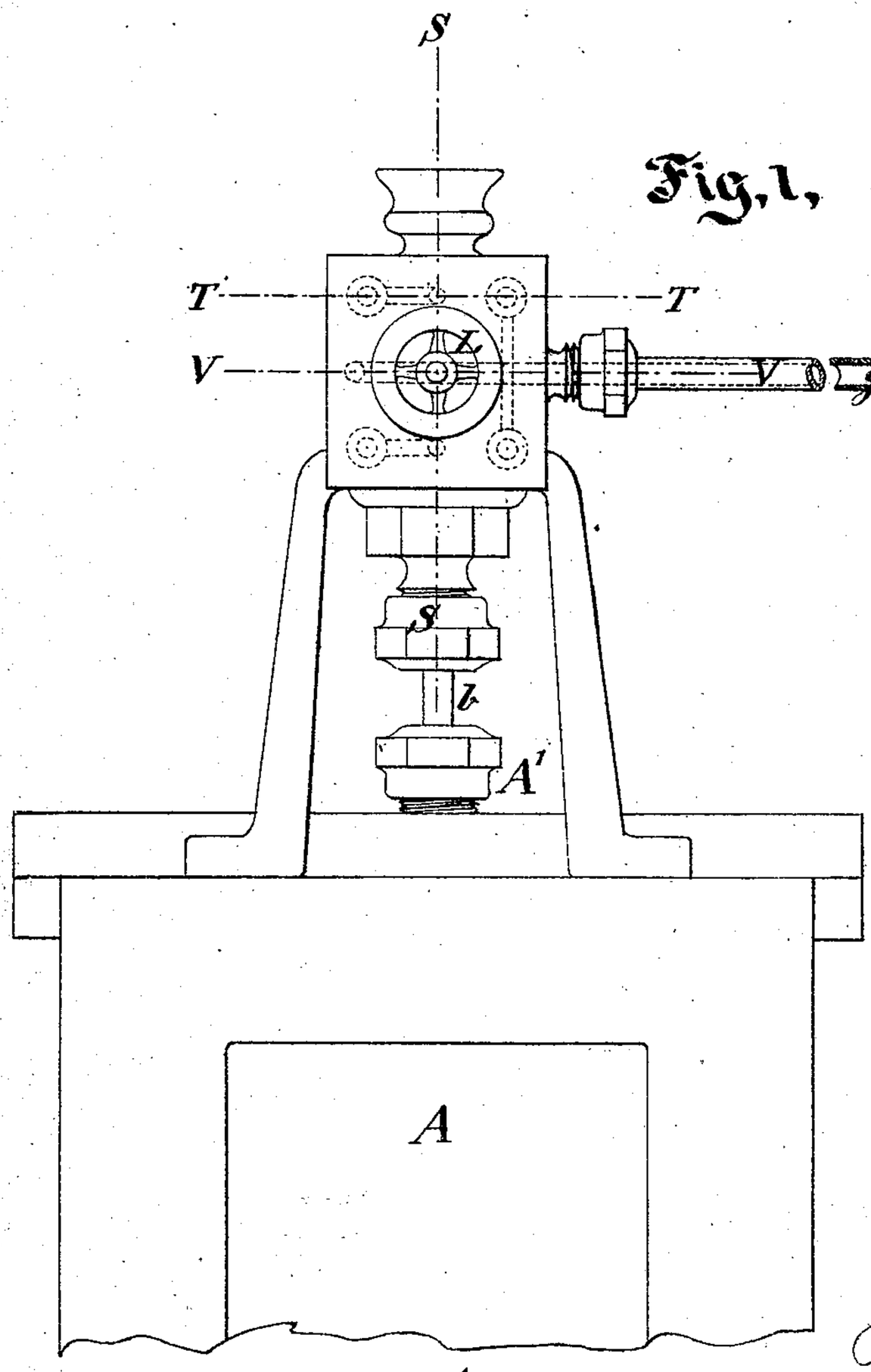


Fig. 1.

Fig. 1a.



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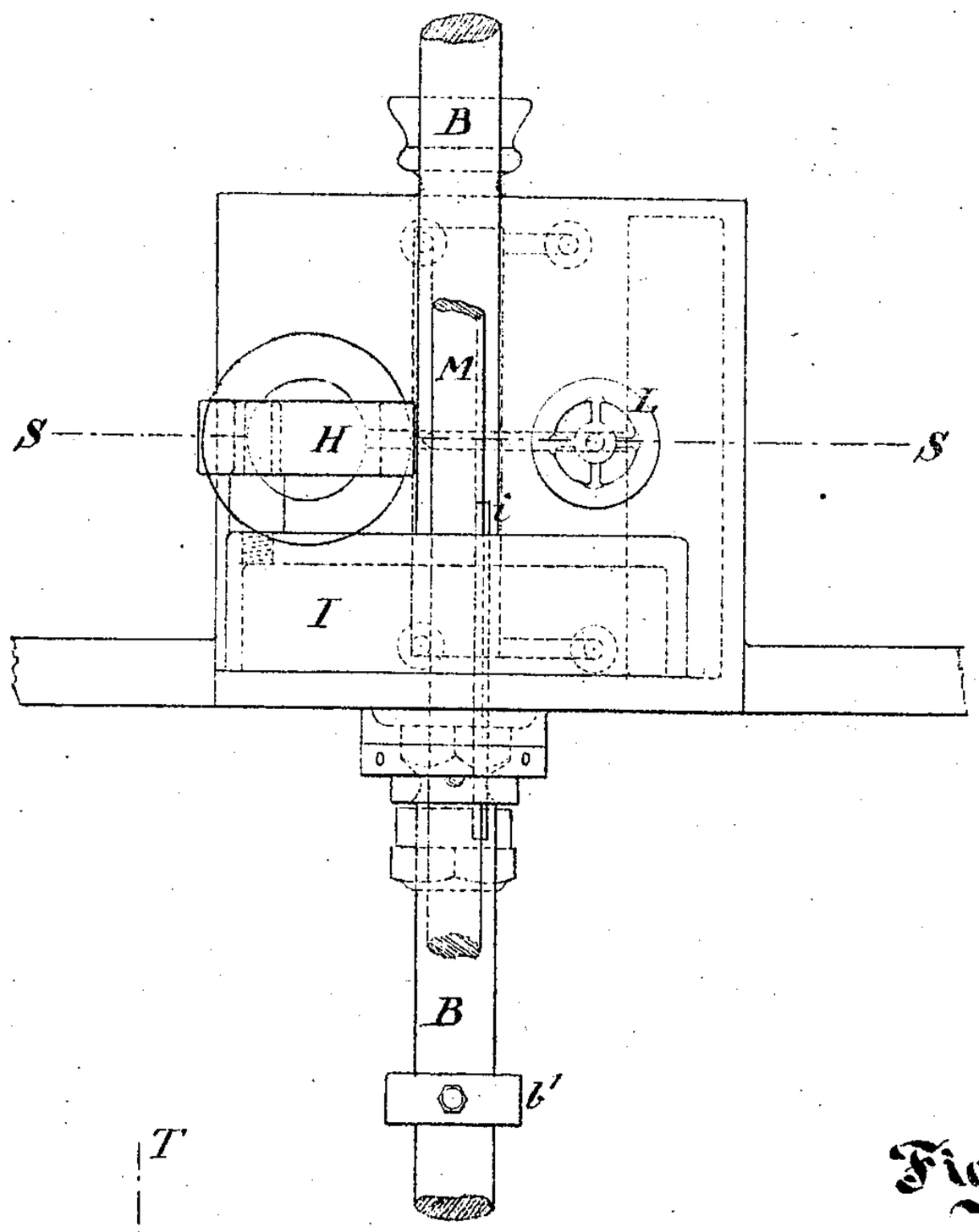
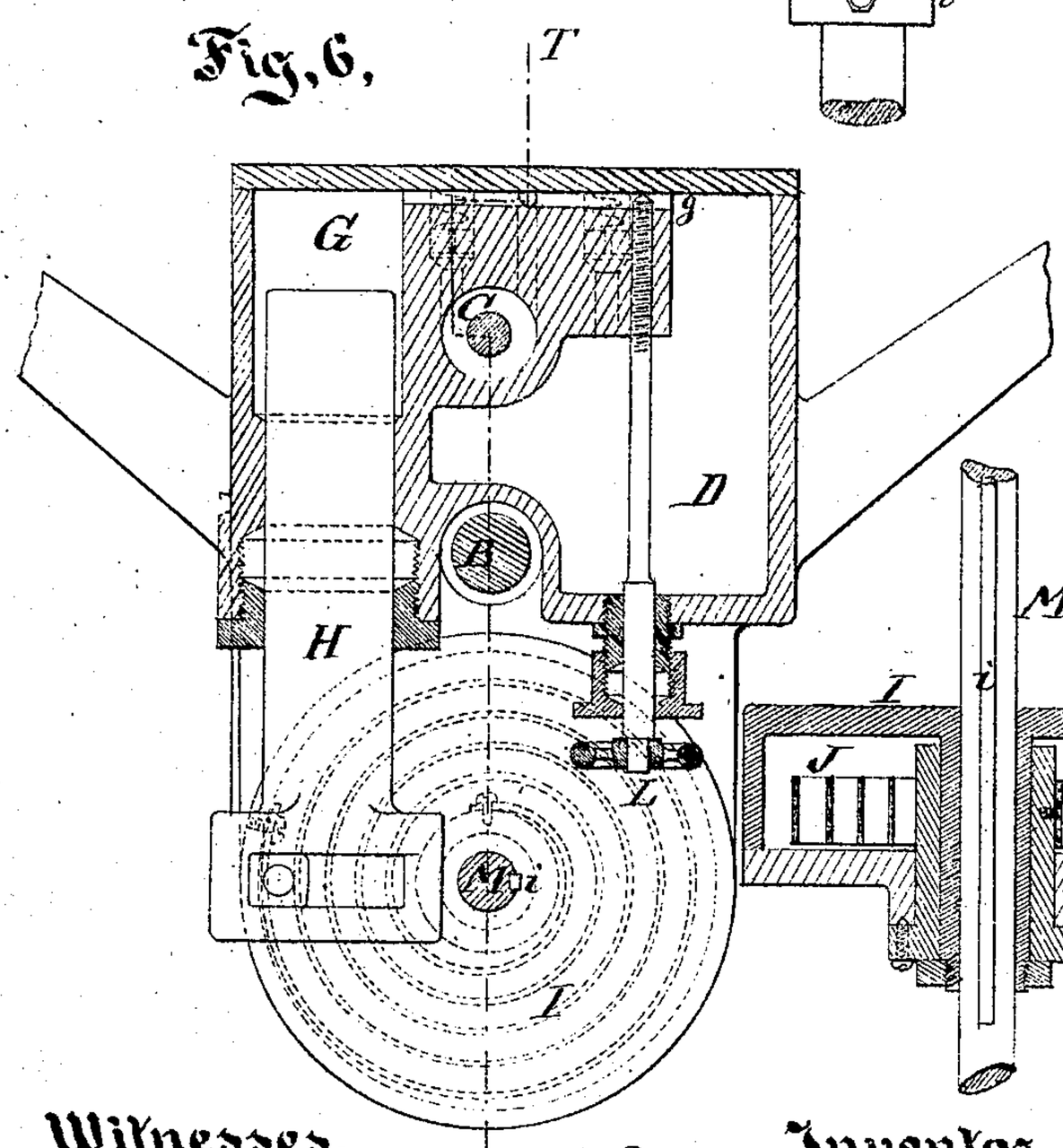
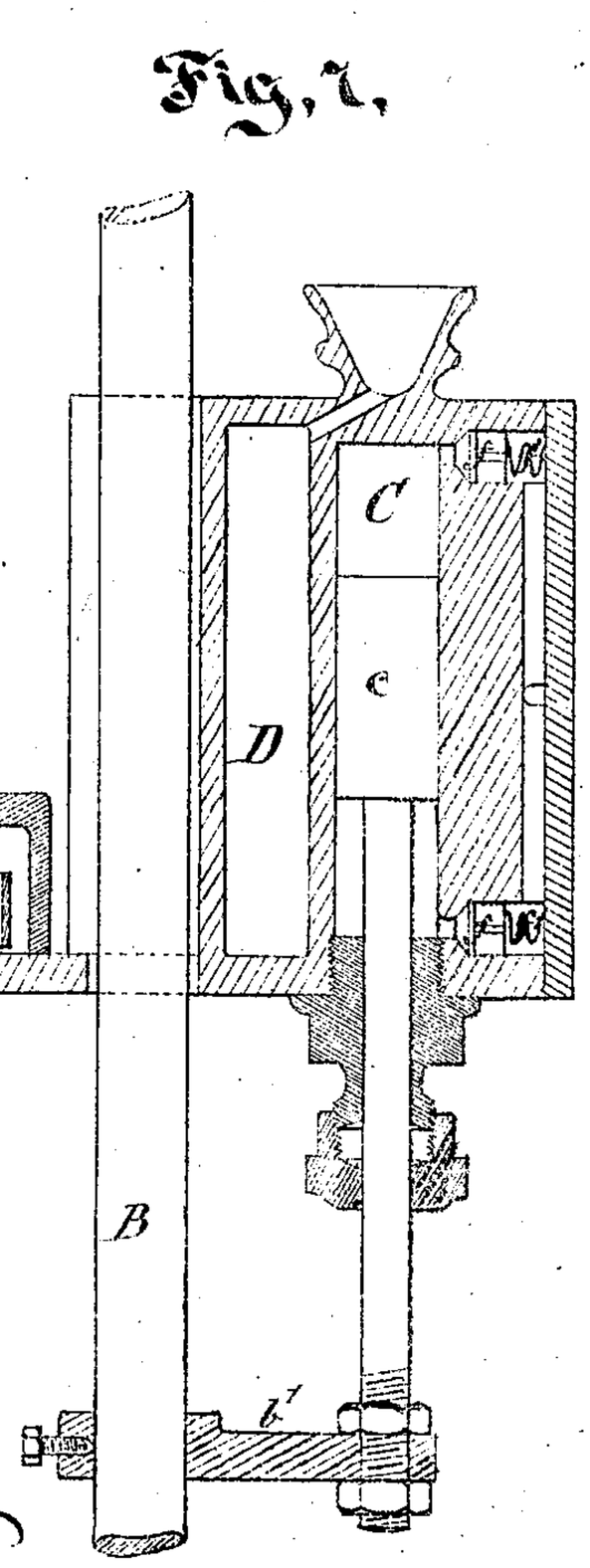
Fig, 5.



Fig, 6.



Fig, 7.



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116,968

UNITED STATES PATENT OFFICE.

BENJAMIN S. LAWSON, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN STEAM-ENGINE GOVERNORS.

Specification forming part of Letters Patent No. 116,968, dated July 11, 1871.

To all whom it may concern:

Be it known that I, BENJAMIN S. LAWSON, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Means for Regulating Steam-Engines.

I employ a pump operated directly from the mechanism which works the slide-valve, and, by means of what is commonly known as a "Pitcher governor," I cause the working of this pump to adjust or change the point of cutting off the steam in the cylinder. A part of the invention consists in operating the pump of the Pitcher governor directly from the valve mechanism; and another part consists in the combination for varying the point of cut-off by means of the Pitcher governor. The first part is applicable to all engines, and may be carried out by means of any device for regulating speed. The second part is applicable to all variable cut-off engines in which the main-valve mechanism has a rod or analogous part which works with a uniform extent of motion.

The following is a description of what I consider the best means of carrying out the invention as applied to a reciprocating steam-engine:

The accompanying drawing forms a part of this specification. Figure 1 is a plan view of a portion of a vertical engine. It shows the upper end of the cylinder with an attachment which carries the pump and connections for a part of the Pitcher governor. Fig. 1ª shows, in section, another portion of the mechanism, which is, by preference, in a most distant position, but is here represented close to indicate the directness of the connection by the pipe, shown as broken away. Figs. 2, 3, and 4 are sections through the pump-work, showing clearly the arrangement of the valves and passages. The effect of the whole of these parts is to constitute simply an efficient and uniformly-reliable double-acting pump, operated by a direct connection from the slide-valve. Fig. 2 is a section on line S S in Fig. 1. Fig. 3 is a section on line T T in Fig. 1, and Fig. 4 is a section on line V V in Fig. 1. The above figures show one portion of the invention in one of its most desirable forms—that is to say, they show the connection of the pump-plunger to the slide-valve, which, it will be understood, works as usual within the steam-chest, and the connection is shorter and involves less parts than the complete form of the invention, to be shown in the other figures. I esteem each form of the connection to be properly comprehended under the term "direct." Figs. 5, 6, and 7 show a construction and arrangement better adapted to allow the entire invention to be made available, including the attachment of the Pitcher governor to a cut-off, so as to regulate, by changing thereby, the extent to which the steam is worked expansively. It is a vertical engine, with the Rider cut-off, as set forth in the patent to A. K. Rider, dated May 6, 1862. The piston-rod and connections being below the cylinder in both forms of the devices, the views in Figs. 1 to 4, show no valve-stem, but the views in Figs. 5, 6, and 7 show the valve-stem, and also an extra valve-stem, which works the Rider valve. Fig. 5 is a front view, showing a portion of the stem of the Rider valve and the body of the casting which contains the pump and the other parts essential to the Pitcher governor. The main valve-stem is shown just beyond the Rider stem, and of larger diameter. Below is the connection for an arm, which is rigidly attached and provides means for making the pump of the Pitcher work. Fig. 6 is a section on the line S S in Fig. 5. It presents a top view of the strong volute-spring, which acts on the Rider valve-stem under the control of the plunger of the Pitcher governor, as will be explained. Fig. 7 is a section on the line T T in Fig. 5, and on the same line in Fig. 6, the only discrepancy being in the slight offset by which, as shown in Fig. 6, the section is made to pass through the center of the valves. This will be readily understood.

Similar letters of reference indicate corresponding parts in all the figures.

Referring to Figs. 1 to 4, A is the steam-chest or valve-chest, and *b* is an extension of the valve-stem working through a stuffing-box, A′, on the end of the valve-chest, and entering, through a suitable stuffing-box, into the cylindrical chamber C, where it carries a piston, *c*, adapted, by means of passages connected to each other controlled by valves, to serve as a double-acting pump. The fluid used is preferably oil. A store of this fluid is maintained in the chamber D near the cylinder C, and at each movement or half-reciprocation of the pump-piston *c* a quantity of oil is driven out of one end of the pump-chamber C and drawn into the other end, it being re-

ceived in such other end from the chamber D through the aperture *d*, as will be understood. Valves *e f*, controlled by springs *e' f'*, are mounted in such position as to properly admit the oil and discharge it again from the pump-chamber C. The oil is discharged from the pump-chamber at each motion, through the pipe *g*, into a plunger-chamber, G, where is received a plunger, H, pressed inward by the constant force of the spring J, which acts on the toothed segment I meshing into the rack H' connected with the plunger H, as represented. The segment I, which may, if preferred, be an entire wheel, is fixed on the shaft M of a throttle-valve or any other device for controlling the steam. The oil is discharged again from the plunger-chamber G, through a channel or passage, which may be for a good part of the way the same pipe *g*, into the chamber or reservoir D, passing on its way an adjusting-screw or cock, L, which affords a ready means of contracting and enlarging the passage for the flow of the oil by very delicate gradations or increments, as will be readily understood.

So far the description, although confined to Figs. 1, 2, 3, 4, may apply in substance to both forms of the apparatus. I will now confine my attention to the form shown in Figs. 5, 6, and 7:

In the first form the shaft M may be the shaft of a throttle-valve. In the second form, that now to be described, the shaft M is the stem of the Rider valve-member, which determines the point of cut-off. The pump-cylinder C is mounted alongside of the main valve-stem B, and the pump-plunger *c* is worked by an arm, *b'*, extending out laterally. The plunger-chamber G is close by the pump, and the plunger H is connected by a crank-pin and slot, instead of a rack and pinion, to the wheel I. These modifications induce no substantial change in the action which results in turning the wheel one way and the other as the speed gets above or below the proper rate.

The engine is operated, as before stated, by the Rider cut-off. This cut-off may not be familiar to all engineers, and may be briefly described as having an extra slide-valve, V-shaped, or with corresponding oblique edges reciprocating over ports standing in correspondingly oblique positions in the back of the ordinary slide. The two slides are so operated that, while the time and extent of the longitudinal movements of the Rider valve are always uniform, the times of opening and closing the ports are changed by another and independent movement or adjustment of the valve sidewise upon its seat. An effect, in some respects similar to that of the Rider cut-off, may be obtained by exactly the construction above described, working with a flat valve on a flat back of the main slide, but it is preferable to curl the surfaces so that the valve shall be partially or entirely cylindrical or piston-formed, the surface on which it works being correspondingly hollowed out. This form allows the lateral movement of the valve to be effected by simply twisting the stem or rod by which it is operated. This is the form here adopted.

I mount the wheel I around the Rider valve-stem with a feather, as shown by *i*, so that it shall control the position of the Rider valve with respect to its turning or twisting, while it shall not interfere with its longitudinal motion. As the plunger H is driven outward it turns the segment or wheel I, and, consequently, the valve-stem which slides through it and the attached valve, in one direction, and causes the steam to be cut off earlier. As the plunger H moves inward again by the action of the spring J it turns the valve-stem and valve back, and cuts off the steam later.

I need not explain that when, as shown in Figs. 1 and 1ª, I employ but one pipe, *k*, between the pump-casing and the plunger-casing, the oil moves alternately in one direction and the other through this pipe, which becomes, in fact, a part of the chamber G. When the engine works too fast the pump forces the oil into the chamber G faster than it can escape, and the plunger H is forced out, and the steam is cut off earlier, thus diminishing the motive force and lessening the speed. As the speed of the engine decreases and the pumping is less rapid the oil, continuing to flow out from the chamber G at a uniform rate, allows the plunger H to enter farther into the chamber G, and the valve is shifted so as to allow the steam to follow further.

The action of the Pitcher governor is very well understood, and is the same in this case as in all others. The flow of oil back from the chamber G to the chamber D being constant, the plunger H enters deeper into the chamber G or is driven out of it just in proportion as the pump gains or loses relatively to the discharge. The connection of the pump-plunger *c* to the slide-valve (not represented) by means of the rod *b*, Fig. 1, or arm *b'*, Fig. 7, which I consider as equivalent, simplifies the mechanism beyond anything previously known to me for such purposes. The governor is operated silently, without offending the eye or involving any large amount of material or labor in the construction of the governor. I have experimented with the device, and it promises to be the most complete, simple, and reliable of any yet proposed. There is no belt to slip or connection which is liable to break. The working of my governor cannot involve accident to the attendant by striking his head or limbs while performing his duties about the engine.

The dotted lines in Fig. 1 show the arrangement of the induction and eduction-valves of the pump in the four corners of the casting which contains the pump-cylinder. The several sectional views, 2, 3, and 4, indicate their positions as being all inserted from the same face, and provided with springs from the same side, and all made accessible by removing a single plate. The action of the valves, causing two to act as induction and two as eduction-valves, is induced by the arrangement of the passages, as shown in Figs. 2, 3, and 4, and in dotted lines

in Fig. 1, so that at each end of the pump are two connected passages, one of which leads to the upper or broadest face of a valve and forms the receiving-aperture, and the other leads to the smallest, or what is ordinarily the lower side of a valve, and forms the delivering-aperture for that end of the pump.

This construction and arrangement of the valves and springs and passages gives a very important advantage in simplifying the construction and facilitating the repairs, as I find that in this, as in many other branches of mechanism, complexity of form involves little evil in comparison with the advantage due to the reduction of the number of parts. A single plate, secured by a half-dozen gun-screws, covers and secures the entire set of valves and springs.

I claim as my invention—

1. Operating the pump of a Pitcher governor from the valve-motion of a steam-engine by means of the rod *b*, or its equivalent, directly connecting the two, substantially as and for the purposes herein specified.

2. The Pitcher or pump-governor and its regulating means L, so arranged and operating relatively to the variable cut-off mechanism of a steam-engine, by which it is operated, that the governor shall adjust the point of cut off correctly to maintain a uniform or approximately uniform speed, while the mean speed is itself increased or diminished at will by adjusting the piece L, or its equivalent, all substantially as herein set forth.

3. The within-described construction and arrangement of the valves and passages of the pump of the Pitcher governor, whereby all the four valves and their controlling springs are secured by a single plate, and may be got at for repairs by the removal thereof, as set forth.

In testimony whereof I have hereunto set my name in presence of two subscribing witnesses.

BENJAMIN S. LAWSON.

Witnesses:

THOMAS D. STETSON,

C. C. LIVINGS.