H. S. MAXIM.

Engine-Governor.

No. 165,744. Patented July 20, 1875.

Fig. 1.

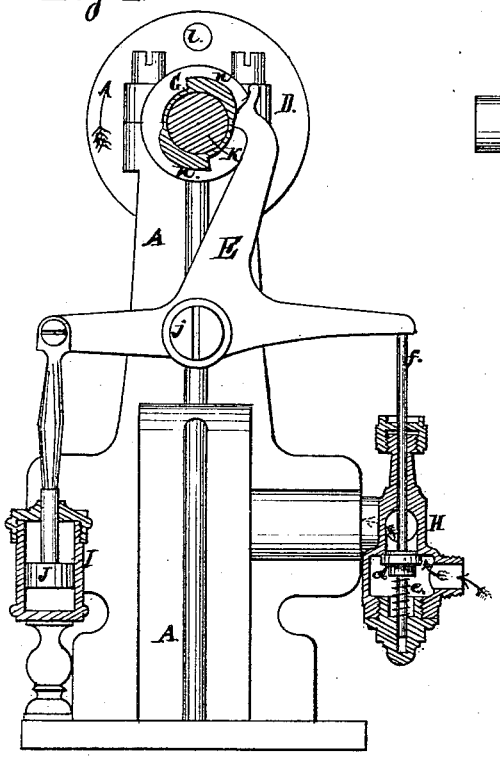


Fig. 2.

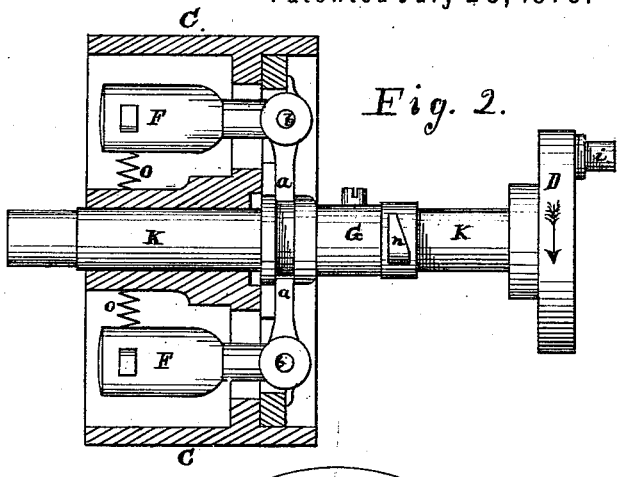


Fig. 3.

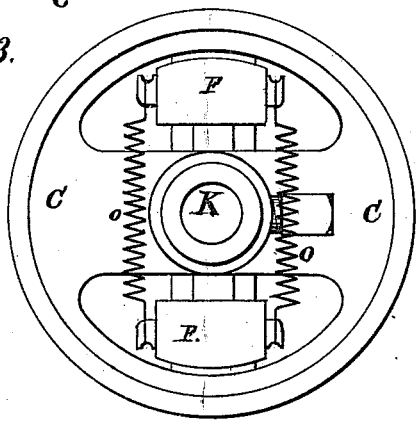


Fig. 4.

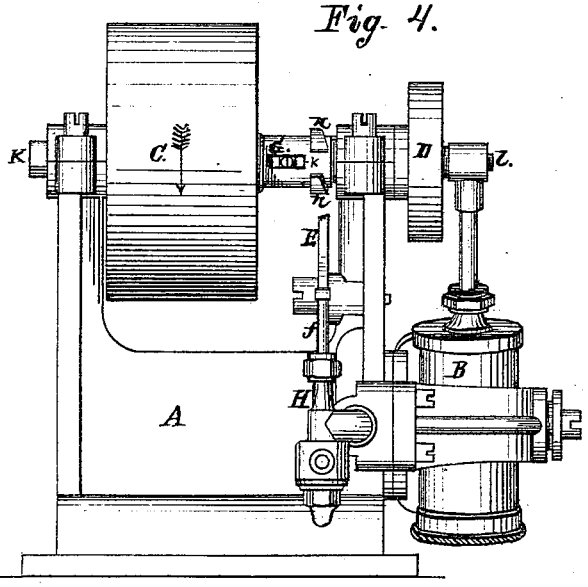
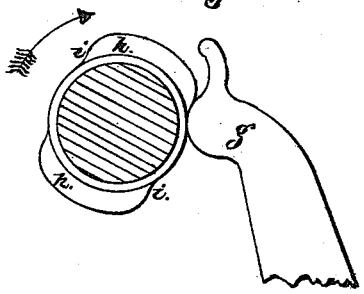


Fig. 5.



Witnesses;
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A. T. Welch.

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UNITED STATES PATENT OFFICE.

HIRAM S. MAXIM, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF HIS RIGHT TO ALONZO T. WELCH, OF SAME PLACE.

IMPROVEMENT IN ENGINE-GOVERNORS.

Specification forming part of Letters Patent No. **165,744**, dated July 20, 1875; application filed March 17, 1875.

To all whom it may concern:

Be it known that I, HIRAM S. MAXIM, of Brooklyn, Kings county, New York, have invented an Improvement in Automatic Cut-Offs and Steam-Engine Governors, of which the following is a specification:

The object of my invention is the construction of an automatic cut-off and steam-engine governor, arranged and constructed in such a manner that the point of cut-off in the cylinder is controlled entirely by the work or load on the engine itself. It belongs to that class of governors that control the speed of the engine by the length of time they allow the steam-valve to remain open, rather than the distance that said valve opens. When an engine having this governor is running with but little load the steam is cut off early in the stroke. When the load is increased, then the steam follows the piston farther, and is cut off at a much later period of the stroke.

It is a well-known fact in steam-engineering that there is a great loss of power in checking the steam before it enters the cylinder, as is the rule with all ordinary governors, and to obviate this fault, known as "wire-drawing the steam," many attempts have been made; but the character of governors heretofore used, that operated directly on the point of cut-off, has been so very complicated, cumbersome, and expensive as to preclude their use except in very large engines. Besides, none of them have been suitable for quick-running engines; therefore, all small engines have been compelled to use the old-fashioned governor, which simply throttles and renders inert a portion of the energy of the steam before it enters the cylinder at all.

The object of this my present invention is to make an automatic cut-off and steam-engine governor so simple, cheap, and reliable that it can be applied to the less expensive class of engines, and at the same time produce the best attainable results, and, being placed within the belt pulley or wheel, it necessitates no belt or cog-wheels to transmit motion to it. This governor may be applied to any kind of an engine equally well, but I have shown it as applied to the kind known as oscillating.

Figure 1 is a view, partly in section, cut perpendicular to the crank-shaft and axis, and exhibits a cross-section of the cam-valve chamber and dash-pot. Fig. 2 is a side elevation of the crank or main shaft, and the sliding cam; also, a section of the pulley and governor. Fig. 3 is an end elevation of the pulley and the weights of the governor. Fig. 4 is a side elevation of an engine with the governor applied, having the end of the vibrating arm broken off to exhibit the cam. Fig. 5 exhibits a modification of the cam and vibrating arm, such as I prefer to use without a dash-pot, or where no dash-pot is allowable.

A A is the frame of the engine. B is the cylinder. C C is the belt-pulley, in which are situated the governor weights and arms. D is the crank. E is a lever, whose fulcrum is at *j*, and which transmits motion from the cam G to the governor-valve H and the dash-pot I. F F are the two balls or weights of the governor. G is a sliding cam, secured to the shaft K by the screw *k* in such a manner that, while it cannot revolve on the shaft, it is free to move longitudinally in the direction of the axis of the shaft. H is a valve-chamber, provided with a valve opening downward against the pressure of steam, the valve *d* being held to its seat by means of spring *e*. K is the crank-shaft.

The operation of this automatic cut-off and governor is as follows: Steam being admitted at the valve-chamber H, in the direction of the arrows, it passes upward through valve *d*, enters the cylinder, and gives motion to the engine. While the engine is still running slow the steam will enter the cylinder with the full boiler-pressure so long as the valve *d* remains open, and said valve will remain open only while the upper end of the lever E rests upon the projections *n n* of cam G, which projections extend through degrees sufficient to hold the valve open about three-fourths of the time occupied by the piston making one forward or back stroke. When the speed of the engine has increased until the centrifugal force of the weights F F is more than equal to the tension of the springs *o o*, then said weights will be thrown outward, and the cam G will be drawn back by the arms *a a*, thus bringing a shorter portion of the projection *n'* under

the lever E, and allowing the valve *d* to close at an earlier period of the stroke. Any increase in the speed of the engine shortens the point of cut-off, while a decrease lengthens it. The advancing faces of the projections *n n* are in line with the shaft, so that the sliding of the cam G does not change the point at which the steam is let in the cylinder, but the receding face is cut spiral in such a manner that a slight change in the position of the cam G changes the point at which the lever D falls back from the projection *n* to the cylindrical portion of the cam G; and, as the valve *d* is only open during the time the lever is riding the projections, it is obvious that the closing of the valve and the consequent cutting off of the steam depend only on the position of cam G in relation to the lever E, and as the position of said cam is controlled solely by the weights F F, and they again by the speed of the engine, it will therefore be seen that the speed of the engine operates directly and at once on the point of cut-off.

This device operates equally as well as a marine-governor, as a very slight increase of speed in the engine instantaneously closes off the steam.

The dash-pot I is to prevent a too sudden closing of the valve *d;* but when this governor is used on a small and quick-running engine I prefer to modify the cam and lever, as shown in Fig. 5, where, instead of an abrupt termination of the projections, a gradual incline is used, as shown at *i i*. The spiral portion may also have an inclined termination, thus allowing the lever *g*, Fig. 5, to fall gently against the cylindrical portion of the cam G. When a governor only is required a cone can be substituted for the cam G and accompanying devices.

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

The adjustable sleeve G, carrying the cams *n n*, having spiral ends, in combination with the cut-off valve *d*, the dash-pot I, and the three-armed lever E, substantially as described, and for the purpose as set forth.

HIRAM S. MAXIM.

Witnesses:
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