

(No Model.)

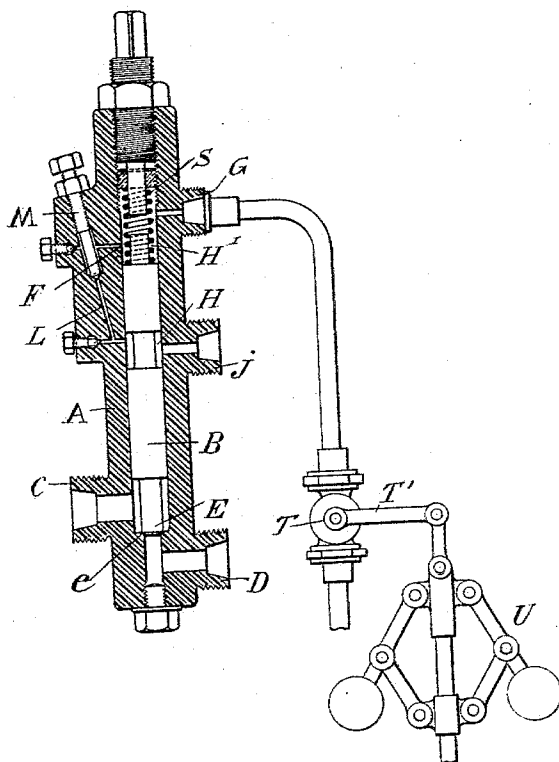
3 Sheets—Sheet 1.

C. G. P. DE LAVAL.  
GOVERNOR FOR MOTORS.

No. 569,834.

Patented Oct. 20, 1896.

*Fig. 1.*



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(No Model.)

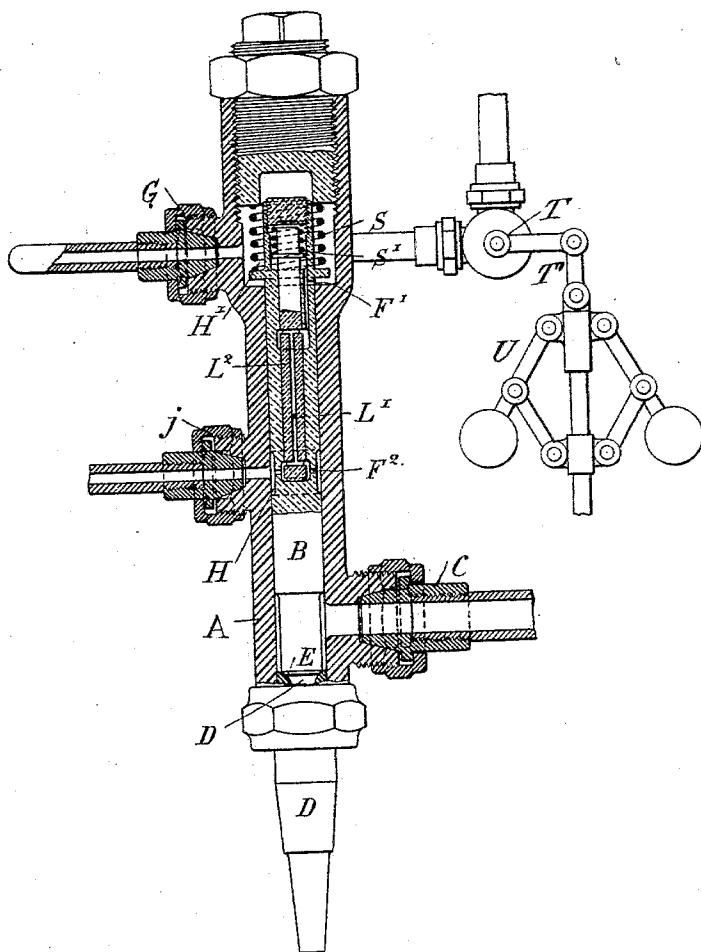
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C. G. P. DE LAVAL.  
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No. 569,834.

Patented Oct. 20, 1896.

Fig. 2.



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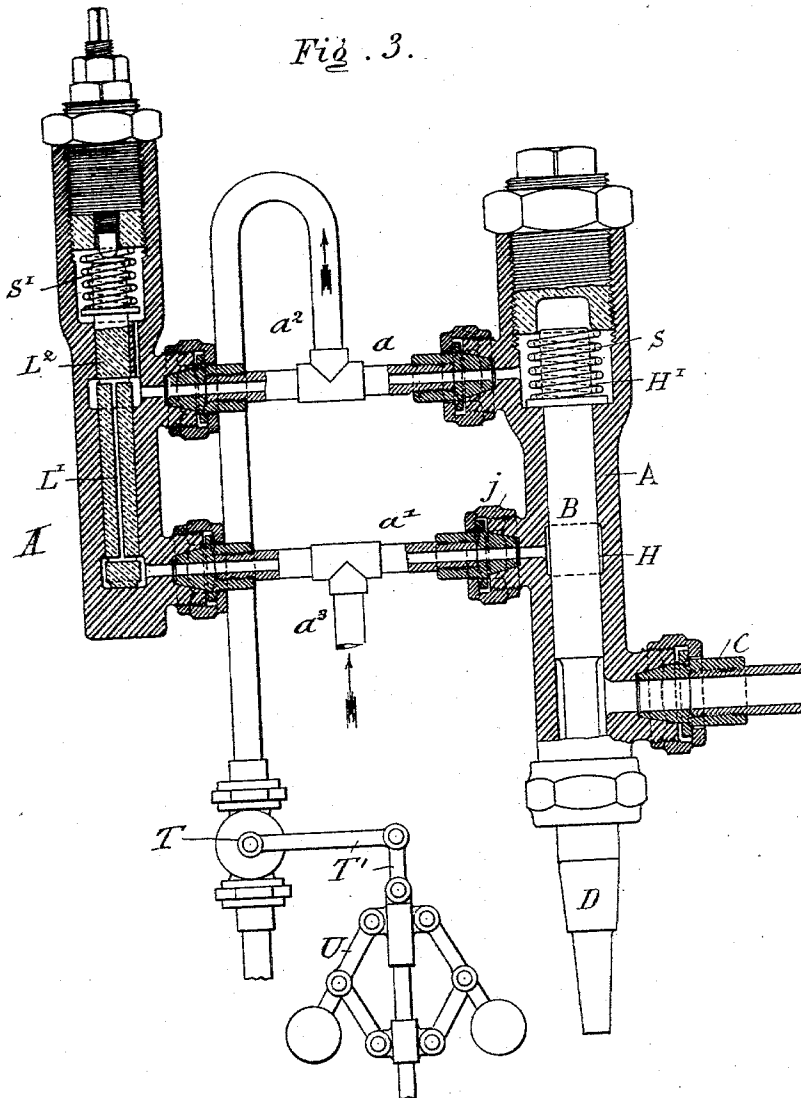
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Fig. 3.



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# UNITED STATES PATENT OFFICE.

CARL GUSTAF PATRIK DE LAVAL, OF STOCKHOLM, SWEDEN.

## GOVERNOR FOR MOTORS.

SPECIFICATION forming part of Letters Patent No. 569,834, dated October 20, 1896.

Application filed January 22, 1895. Serial No. 535,818. (No model.) Patented in Sweden June 22, 1894, No. 6,008; in England June 22, 1894, No. 1,418; in Germany July 2, 1894, No. 84,915; in France December 21, 1894, No. 243,832; in Belgium December 21, 1894, No. 113,301; in Switzerland December 21, 1894, No. 9,806; in Norway December 21, 1894, No. 4,160; in Italy December 31, 1894, No. 37,826; in Hungary January 18, 1895, No. 1,985; in Spain February 6, 1895, No. 16,757; in Denmark July 17, 1895, No. 119, and in Austria September 23, 1895, No. 3,433.

*To all whom it may concern:*

Be it known that I, CARL GUSTAF PATRIK DE LAVAL, of 16<sup>A</sup> Handtverkaregatan, Stockholm, Sweden, have invented certain new and useful Improvements in Governors for Motors, (for which I have obtained Letters Patent in Sweden, No. 6,008, dated June 22, 1894; in Germany, No. 84,915, dated July 2, 1894; in England, No. 1,418, dated June 22, 1894; in France, No. 243,832, dated December 21, 1894; in Belgium, No. 113,301, dated December 21, 1894; in Spain, No. 16,757, dated February 6, 1895; in Switzerland, No. 9,806, dated December 21, 1894; in Norway, No. 4,160, dated December 21, 1894; in Denmark, No. 119, dated July 17, 1895; in Italy, No. 37,826, dated December 31, 1894; in Austria, No. 3,435, dated September 23, 1895, and in Hungary, No. 1,985, dated January 18, 1895,) of which the following is a specification.

For the purpose of regulating the supply of power to steam-motors a piston movable in a cylinder may be provided, said piston in all positions being kept in equilibrium by the following pressures, namely: on one side by the available steam-pressure and on the other side by the pressure of a fluid passing through the cylinder, together with the pressure of a spring. The piston is connected with the steam-admission mechanism, while the motor-governor mechanism is combined with a throttling device which determines the pressure action of the said fluid upon the piston. The steam-pressure thus balances the spring-pressure and the liquid-pressure. As, however, during work the governor mechanism produces rather large variations in the liquid-pressure, the difference between the steam-pressure on one side of the piston and the liquid-pressure on the other side of the piston may become rather considerable, the consequence being a leakage of steam from the steam-space to the liquid-space. This leakage might be partly obviated by the use of a very deep piston, but such an one would work hard, and it is of importance for obtaining a

quick and certain regulation that the piston should work with great ease.

This invention has for its object to avoid this inconvenience; and it consists in arranging the piston as a double piston, upon whose intermediate part the liquid is let in, which piston, by a specially-constituted apparatus, is kept at a pressure that at any moment is either as high as the steam-pressure or somewhat lower or higher than it. It has been found suitable to keep the liquid-pressure slightly lower than the steam-pressure, for in that case only an insignificant amount of steam can leak through from the steam-space to the liquid-space, which is preferable to the liquid leaking into the steam-space. This liquid will thus, by an adjustable leak arrangement, leak through to the other end of the double piston, and in the conduit therefrom the throttle-valve which is influenced by the motive governor is inserted for carrying out the regulation. This arrangement is applicable in all apparatus where movable and necessarily light working parts are made use of for the purpose of regulation.

In the accompanying drawings, Figure 1 is a vertical section of the main form of my invention, and Figs. 2 and 3 are similar views showing modified forms of the invention.

Similar letters of reference indicate corresponding parts.

A, Fig. 1, indicates the cylinder, and B the piston. The steam enters at inlet-opening C and passes to the motor through outlet-opening D, both openings being at the lower end of the cylinder. The steam admission is here effected by a valve E made in one piece with the piston and having its seat at *e* in the cylinder. The steam-pressure at said end of the piston has to balance against the spring S and the pressure of the liquid flowing through the upper part of the cylinder, and which enters the upper part at orifice F and passes out at outlet-opening G. In the conduit screwed on at G may be inserted a throttling device of any known construction—for instance, a

usual cock, the tap T of which is connected with the governor U of the motor by means of levers T' for varying the water-pressure on the upper end of the piston and thus to regulate the steam admission. In order that the piston B should work easily, as aforesaid, it is provided with an annularly-reduced part, forming an annular space H, into which liquid is let from the inlet-opening J. If the pressure of the feed-water, as in the case with boilers with long spiral tubes, be considerably higher than the steam-pressure, the water-pressure is lowered by a special apparatus, so that it becomes nearly that of the steam-pressure. This water leaks through from the space H to the upper part of the piston by a small passage L, formed in the wall of the cylinder A and controlled, as to its sectional area, by a screw-spindle M. The water-pressure in the space H is not influenced by the variations in pressure caused by the governor in the space above the piston.

The modification in Fig. 2 consists chiefly in that the sectional area of the leak-passage L, Fig. 1, is automatically rendered variable according to the pressure variations on the upper end of the piston, so that this area is throttled or diminished when the pressure diminishes and opened or enlarged when the pressure increases. A indicates, as above, the cylinder; B, the piston; C, the inlet and D the outlet opening for the steam, both openings being at the lower end of the cylinder; E, the admission-valve; H, the annular space of the piston B, in which liquid is let from the inlet-opening j. The liquid leaks from the annular space H to the space H' above the piston through the passages F<sup>2</sup> L' F' and runs away through the outlet G. The passage L' is provided, as shown, in the piston L<sup>2</sup>, which is movable in an axial boring in the upper part of the piston B, and communicates with the annular space H through the cross-passage F<sup>2</sup> in the piston B and with the upper space H' through the side hole or passage F' in the piston B. The piston L<sup>2</sup> is acted upon by a small spring S'. When now the pressure in the space H' diminishes, the piston L<sup>2</sup> moves upward by the pressure in the space H, which now overcomes the spring S' and the diminished water-pressure on the upper side of the piston. Thus the passages F' and F are throttled until equilibrium is again established. If, on the contrary, the water-pressure in H' be increased, the constant water-pressure in H is overcome and the piston moves downward, opening the passages F' and F<sup>2</sup>. Thus the leak-passage from H to H' is automatically rendered variable.

Instead of having the plunger L<sup>2</sup> in a bored-out part of the piston B, it may, as shown in Fig. 3, be arranged in a separate cylinder A', outside of the regulating apparatus proper, A, the upper and lower ends of said cylinder being connected with the spaces H and H', respectively, by pipe connections a a', hav-

ing branch pipes a<sup>2</sup> a<sup>3</sup> for the outlet and admission of liquid, respectively. In the same way the passage L, with the screw-spindle M, may be arranged in a piece separate from the cylinder A. The recess H may also, as shown in Fig. 3, be in the cylinder A.

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

1. In regulating means for steam-motors, the combination of a cylinder, constructed with steam and liquid inlets and outlets, a piston guided in the cylinder, throttling means, inserted in the outlet-conduit for the liquid and adapted to be acted on by the governor of the motor, and a spring, said piston at one side being adapted to be acted on by the steam-pressure, and at the other by that of the combined spring and liquid pressures, substantially as set forth.

2. In regulating means for steam-motors, the combination of a cylinder, constructed with steam and liquid inlets and outlets, a piston guided in the cylinder and provided with an annular recess at a point intermediate of its ends, throttling means, inserted in the outlet-conduit for the liquid and adapted to be acted on by the governor of the motor, and a spring, said annular recess being adapted to receive liquid at approximately the same pressure as that of the steam, and said piston, at one side, being adapted to be acted on by the steam-pressure, and at the other by that of the combined spring and liquid pressures, substantially as set forth.

3. In regulating means for steam-motors, the combination of a cylinder, constructed with steam and liquid inlets and outlets, and provided with an annular recess at a point intermediate of its ends adapted to receive liquid at approximately the same pressure as that of the steam, throttling means, inserted in the outlet-conduit for the liquid and adapted to be acted on by the governor of the motor, a spring, and throttling means, arranged between the said recess and the liquid-space at one end of the cylinder, said piston at one side being adapted to be acted on by the steam-pressure and at the other by that of the combined spring and liquid pressure, substantially as set forth.

4. In regulating means for steam-motors, the combination of a cylinder, constructed with steam and liquid inlets and outlets, a piston guided in the cylinder and provided with an annular recess at a point intermediate of its ends adapted to receive liquid at approximately the same pressure as that of the steam, throttling means, inserted in the outlet-conduit for the liquid and adapted to be acted on by the governor of the motor, a spring, and throttling means, arranged between the said recess and the liquid-space at one end of the cylinder, and consisting of a spring-actuated plunger, guided in a cylin-

der and having a passage communicating at  
one end with said annular recess and at the  
other end with said liquid-space, said piston  
at one side being adapted to be acted on by  
5 the steam-pressure, and at the other side by  
that of the combined spring and liquid pres-  
sures, substantially as set forth.

In testimony that I claim the foregoing as  
my invention I have signed my name in pres-  
ence of two subscribing witnesses.

CARL GUSTAF PATRIK DE LAVAL.

Witnesses:

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WALDEMAR BOMAN.