

(No Model.)

J. ERICSSON.  
SPEED REGULATOR.

No. 288,699.

Patented Nov. 20, 1883.

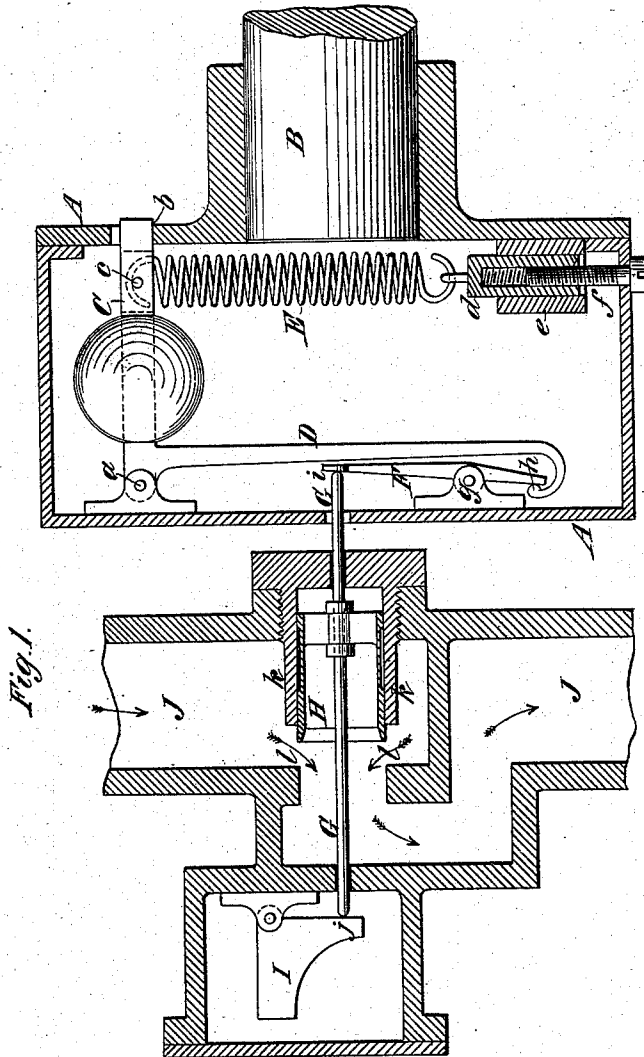


Fig. 2.



Witnesses:  
Lud. Wagner  
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Inventor:  
John Ericsson  
by his Attorneys  
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# UNITED STATES PATENT OFFICE.

JOHN ERICSSON, OF NEW YORK, N. Y.

## SPEED-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 288,699, dated November 20, 1883.

Application filed April 11, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN ERICSSON, of the city and county of New York, and State of New York, have invented a new and Improved  
5 Speed-Regulator for Engines, of which the following is a specification, reference being had to the accompanying drawings.

The object of my invention is to attain in steam-engines running at a very high velocity  
10 a degree of accuracy of regulation not attainable by the speed-regulators in common use. In order to obtain in the highest degree the sensitiveness requisite in a speed-regulator to accomplish the above result, it is necessary that  
15 the operation of the regulator be effected with the least possible movement in its bearings relatively to each other, and of its connections or means of communication with the regulating-valve, and that the friction of all its  
20 parts and connections be reduced to a minimum.

My invention consists, essentially, in a novel combination and arrangement of a centrifugally-operating lever and a counterbalancing-  
25 spring, and a novel system of connections or means of communication between the said lever and the regulating-valve, whereby the requisite reduction of the movement in the bearings and their friction and consequent  
30 sensitiveness are obtained.

Figure 1 in the drawings exhibits a view of my speed-regulator taken in a plane parallel with its axis, and showing its casing or  
35 carrier in section, and represents also a section of the steam-pipe and the regulating-valve to which the speed-regulator is applied. Fig. 2 is a face view of a secondary lever through which the centrifugally-operating  
40 lever acts upon the valve.

A is what may be termed the "carrier" of the speed-regulator, to which all of its rotating parts are attached, and which I prefer to  
45 attach directly to the shaft B of the engine to be regulated, though it might be attached to another shaft deriving motion from the engine. The carrier A might consist of a frame of suitable form to carry the working parts of the regulator, but is represented in the form which I prefer—viz., that of a cylindrical box, with  
50 in which all operating parts are inclosed and protected.

C D is the centrifugally-operating lever, attached by its fulcrum-pin *a* to the carrier A at a point distant from the axis of the shaft and of the regulator. This lever is of what  
55 is known as "bell-crank" form. It has one arm, C, parallel, or nearly so, with the axis of the shaft, and this arm is loaded with a ball, or otherwise made of suitable weight to develop the requisite amount of centrifugal force in  
60 its revolution with the shaft. The other arm, D, which is preferably longer than C, is parallel, or nearly so, with the planes of revolution of the regulator and projects across and beyond the axis of the regulator. The loaded  
65 arm C has provided for it a support, *b*, in an opening in the back of the carrier A, and when the regulator is not in operation the said arm is held to this support by the counterbalancing-spring E, one end of which  
70 hooks onto a pin, *c*, on the said arm, and the other end of which is connected with a nut, *d*, which is fitted to slide without turning in a guide, *e*, on the carrier, and to which is fitted an adjusting-screw, *f*, the head of which  
75 bears against the carrier.

The spring E, represented of spiral form, is so adjusted by the screw *f* that when the engine is running exactly at the speed desired  
80 its tension will so counterbalance the centrifugal force developed in the lever C D that the latter will just touch, without pressing against, the support *b*.

F is the secondary lever, through which the centrifugally-acting lever C D acts upon the  
85 regulating-valve. This lever F is connected by its fulcrum-pin *g* with the carrier A on the opposite side of the axis to that on which the fulcrum *a* is situated. The shorter arm of this lever F is in contact at *h* with the hooked  
90 extremity of the arm D of the centrifugally-operating lever, and the head *i* of its longer arm is in contact with one end of the valve-operating rod G, which is situated in line and concentric with the shaft B. This rod G, in  
95 the example of my invention represented, is the stem of the regulating-valve H; but it is obvious that a rod occupying the same position might have the valve differently applied in relation with it to be operated upon by it.  
100 The said rod has applied to its other end a small hanging weight, I, which so presses

against it at *j* as to keep it always pressing against the head of the lever *F* with just sufficient force to keep the said lever in contact at *h* with the centrifugally-operating lever.

5 This weight serves also to open the valve.

The regulating-valve *H* represented, and which I propose generally to employ on account of the very slight friction involved in its operation and the great variation of opening which it gives with a slight movement, consists of a hollow cylinder which slides in a casing, *k*, fitted to the steam-pipe *J*, and which controls the passage at *l l*.

15 While the speed of the engine does not exceed that desired, and for which the tension of the spring *E* is adjusted by the screw *f*, the centrifugally-acting lever remains just touching, but not pressing against, the support *b*, the centrifugal force developed in said lever being just counteracted by the spring; but when  
20 that speed is exceeded the consequent increase of centrifugal force developed in the lever *C D* will tend to cause its arm *C* to assume a position farther from the axis of the regulator, and so cause its hooked longer arm, *D*, to pull  
25 on the shorter arm of the lever *F* and cause the longer arm of the latter to so move the rod *G* as to contract the opening of the valve and reduce the supply of steam. As the arm  
30 *C* moves outward the tension of the spring *E* is increased, so that it continues to counterbalance the centrifugal force very nearly. The necessary action on the valve is effected by an extremely slight movement of the arm *C*,  
35 as this movement is multiplied in the arm *D*, and also by the lever *F* on the valve. The movements of the levers on the fulera *a g*, which consist of very small pins, is exceedingly slight, and there is no perceptible relative  
40 movement of the centrifugally-acting and secondary levers at their point of contact *h*, the latter being always very nearly in a line passing through the centers of the fulerum-pins *a g*, while the relative movement between

the lever *F* and the rod *G* is simply that of a surface turning on a point, and there is no appreciable movement of the connection of the spring *E* with the lever at *c*. These movements being all so slight, there is no appreciable friction in the regulator or between it and the valve.

The speed of the engine may be increased by simply screwing up the screw *f* to increase the tension of the spring *E*, and may be reduced by turning back the said screw to reduce the said tension.

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

1. The combination, in a speed-regulator, of a rotary carrier, a centrifugally-operating lever attached to said carrier, and having one arm parallel, or nearly so, with the axis thereof, and another and longer arm extended across and beyond the said axis, an adjustable counterbalancing-spring applied to the first-mentioned arm, and means of transmitting motion from said longer arm to the regulating-valve, substantially as herein described.

2. The combination, with a rotary carrier, of a centrifugally-operating lever, *C D*, of the bell-crank form, and a secondary lever, *F*, having their fulera in the said carrier on opposite sides of the axis thereof, a counterbalancing-spring, *E*, applied to the bell-crank lever, and a screw, *f*, applied to said spring and carrier for adjusting the tension of said spring, all substantially as herein described.

3. The combination, with a rotary carrier, of the centrifugally-operating lever *C D*, the secondary lever *D*, and the valve-operating rod *G*, arranged in line and concentric with the axis of said carrier, substantially as herein described.

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Witnesses:

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