2 Sheets--Sheet 1.

C. R. RUNGVIST.

Governors for Steam-Engines.

No. 143,642. Patented Oct. 14, 1873.

Fig: 1.

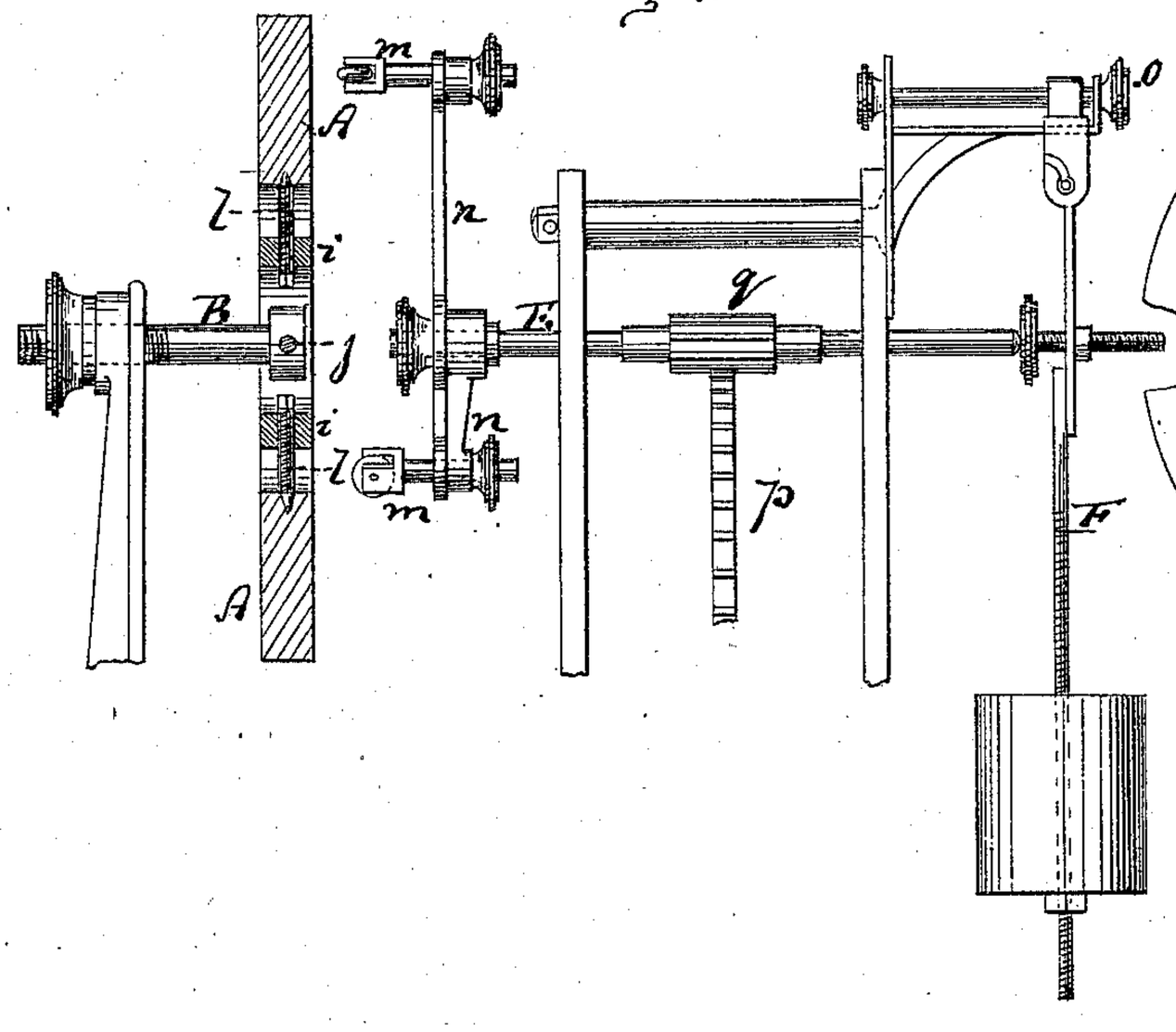


Fig: 2.

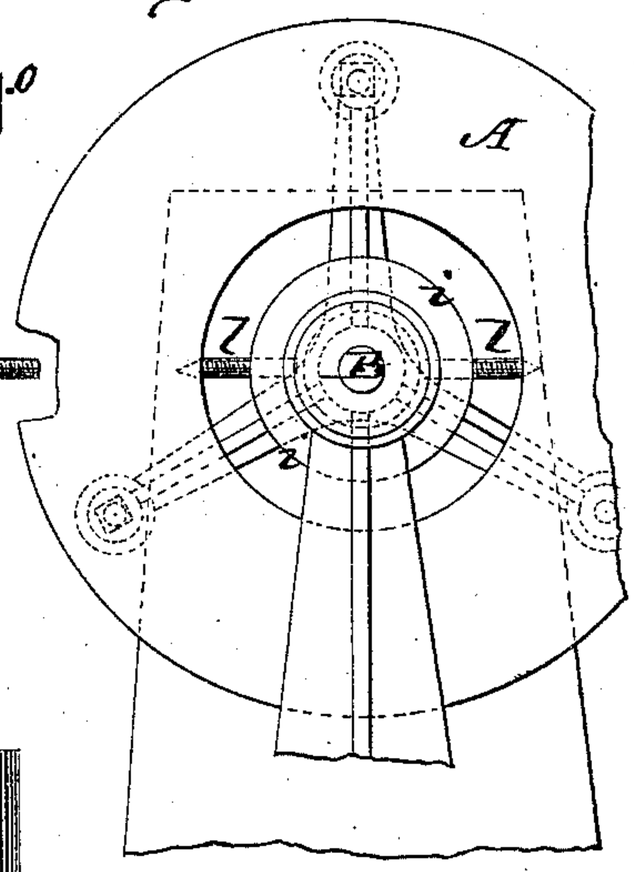
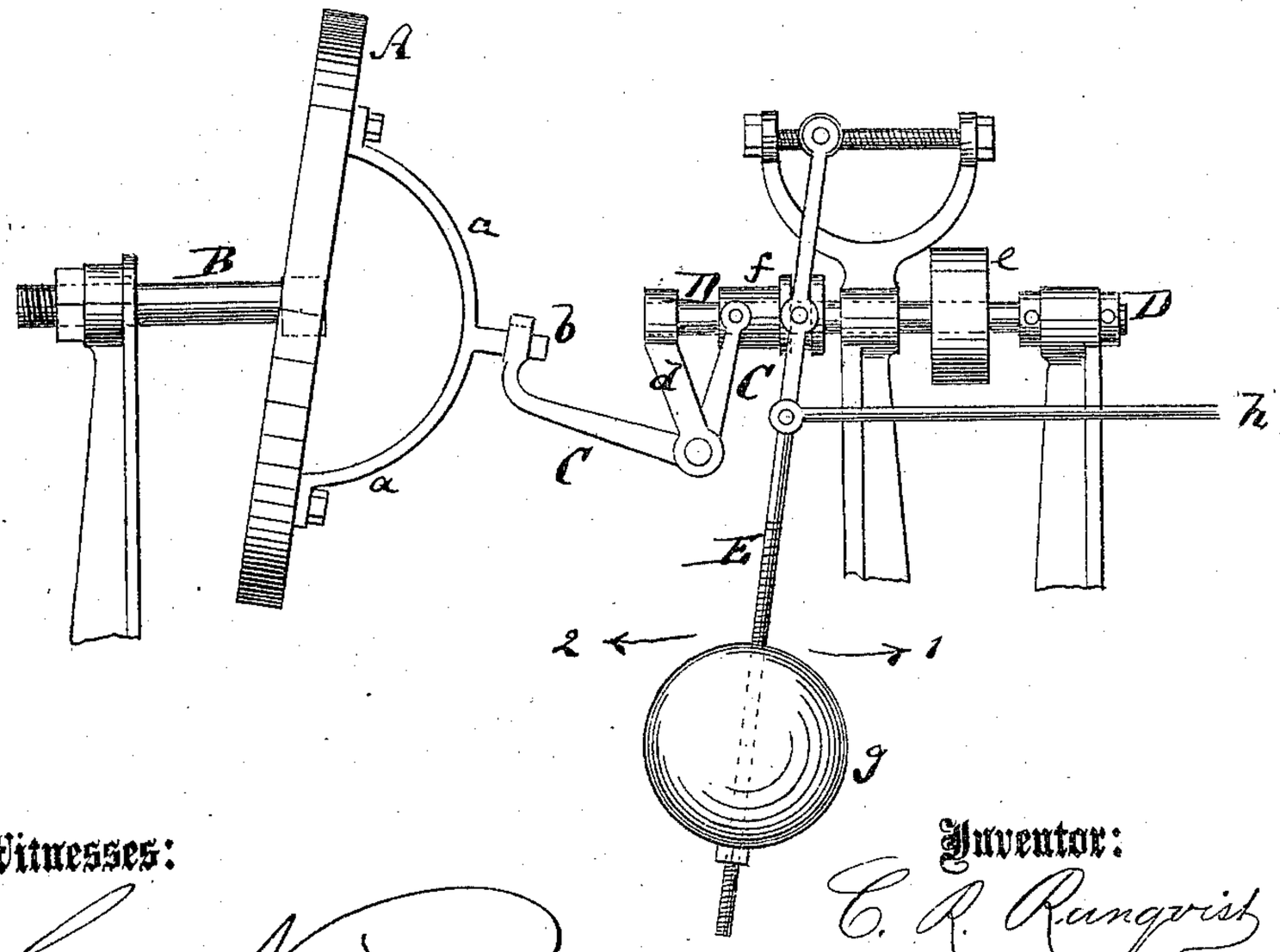


Fig: 3.



Witnesses:

Chas Neida

Sedgwick

Inventor:

C. R. Rungvist

Per Munn & Co

Attorneys.

2 Sheets--Sheet 2.

C. R. RUNGVIST.

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Fig: 4.

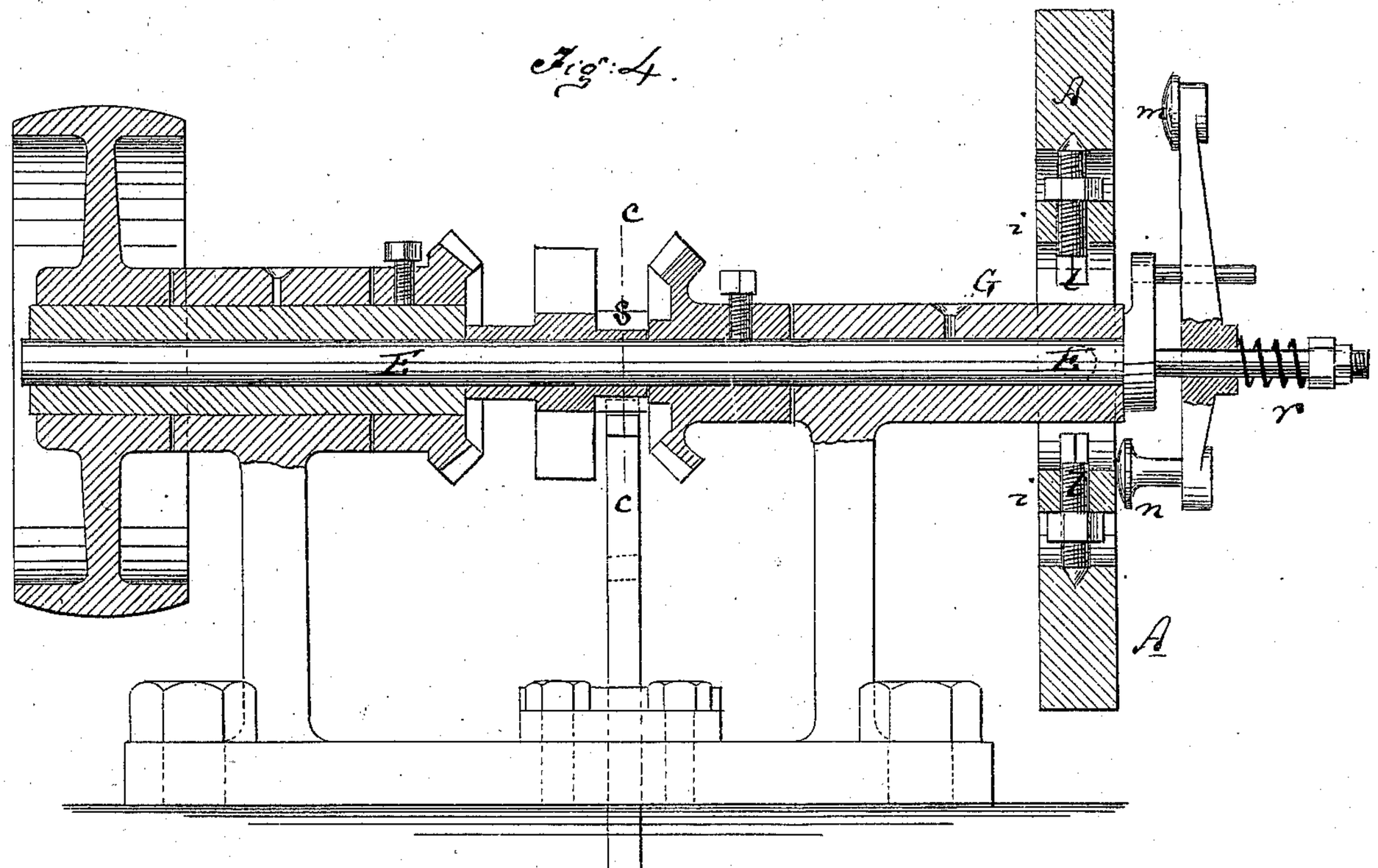


Fig: 5.

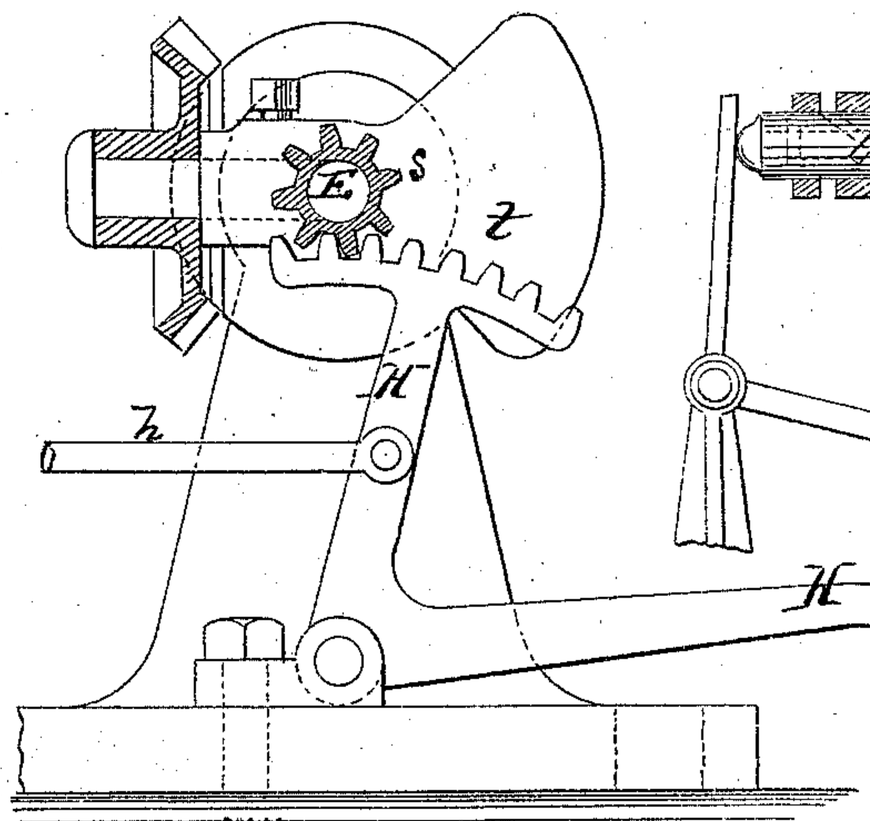
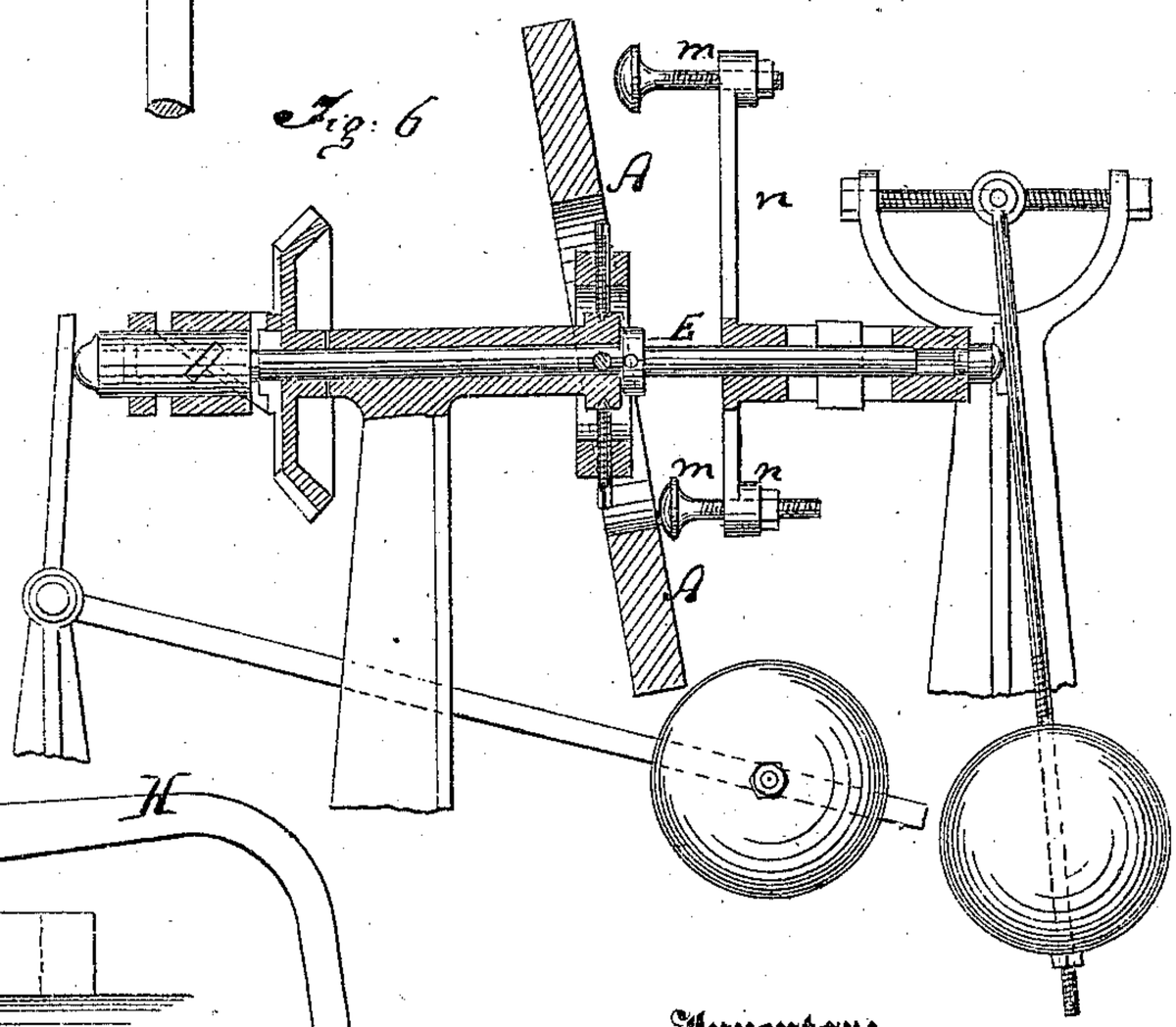


Fig: 6



Witnesses:

Chas. Nida.
C. Sedgwick

Inventor:

C. R. Rungvist

Munn & Co

Attorneys.

PER

UNITED STATES PATENT OFFICE.

CARL ROBERT RUNGVIST, OF STOCKHOLM, SWEDEN.

IMPROVEMENT IN GOVERNORS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **143,642**, dated October 14, 1873; application filed February 15, 1873.

To all whom it may concern:

Be it known that I, CARL ROBERT RUNGVIST, of Stockholm, in the Kingdom of Sweden, have invented a new and useful Improvement in Governors for Steam-Engines, of which the following is a specification:

Figure 1 is a side view, partly in section, of my improved governor, and Fig. 2 a face view of the oscillating disk thereon employed. Fig. 3 is a side view of a modification of this invention. Fig. 4 is a vertical longitudinal section of still another modification, and Fig. 5 a vertical transverse section of the same on the line C C, Fig. 4. Fig. 6 is a longitudinal section of further modification.

Similar letters of reference indicate corresponding parts.

This invention has for its object to produce a governor for steam-engines and other motors, also for wheel-works, which will be simple but absolutely obedient to the various velocities of the engine, and therefore effective upon the valve, whose position it controls, and which, as to wheel-works, will, through direct frictional counteraction, keep them going at a regular speed. The invention consists, more particularly, in the use of an oscillating ring or plate, or of a combination of several parts, which are more or less symmetrically placed around a common center of support and gravity. This plate or ring is kept in continuous oscillation, so that any point on a line drawn from the center of gravity, at right angles with the plane of this plate or ring, will describe a circle in space.

In Fig. 3 of the drawing the principle of the invention is most plainly illustrated. In the same, the letter A represents a ring or plate showing a projecting bow, *a*, fastened to it, from the center of which bow a pin, *b*, projects in line with the axis of the plate A. By universal coupling the plate A is supported on a center pin, B, so that on such coupling it may oscillate. The projection *b* connects with, or, rather, is embraced by, an eye or end of the bell-crank C, which is pivoted to a pendent arm, *d*, of a shaft, D, which shaft receives rotary motion from the engine by means of a pulley, *e*, or otherwise. Upon the shaft D is loosely fitted a sliding clutch, *f*, to which the end of the bell-crank C is pivoted, and which is also connected with the stem-shank E of a weight, *g*, in manner clearly shown. This weight *g* and stem E are so placed that they will tend to move the clutch *f* in the direction of the arrow I shown in Fig. 3. A rod, *h*, extends from the stem E to the valve which is to be controlled by the governor. The connection is such that the valve is opened more or less when the stem E moves in the direction of the arrow 1, but closed when the said stem moves in the direction of the arrow 2. As the speed of the engine increases, and with it the speed of the shaft D, the centrifugal power of the projection *b* on the disk will be increased in consequence of the more speedy oscillations of the plate A. The weight *g* is then, by such increase of oscillations, pushed in the direction of the arrow 2, and the valve is thereby closed to reduce the speed to the desired ratio.

In order to explain the above operation it must be observed that the laws of centrifugal force and of the various oscillations are in general analogical. The law that "with unaltered angular speed the centrifugal force of a rotating material point is in direct proportion with the radius of the rotation," may also here be applied. It may be expressed in this manner: When a system of material points oscillates in a ring or plate on a pin, as in the case now under consideration, and when the oscillations, their amplitudes being either large or small, are isochronous, the force of oscillation is in direct proportion to the amplitudes of the oscillations; consequently if a force, as is necessary, counteracts the force of oscillation, unfolding the same power as this force—or, in other words, being in direct proportion to the amplitudes of the oscillations—these must be isochronous, whether they be larger or smaller. The condition of isochronism being thus observed, the raising power of the weight *g* grows in proportion to the extent of oscillations and of their power, and the perfectly isochronous rotation is kept up, so that the engine will, at all circumstances, receive isochronous speed—the usual action of fits and starts exerted by governors upon their valves being thus, at least for all ordinary changes of the engine's speed, avoided. But even for the most abrupt variance of the engine-speed, the

aforementioned isochronism may be obtained by applying two weights to act in opposite parts in the periphery of the ring or plate.

Another arrangement is shown in Fig. 1, in which a plate, A, is represented as mounted upon a support, B, the same as in Fig. 3. The universal joint connecting the support and plate consists of a ring, *i*, which can turn on horizontal pins *j* that project from opposite sides of the pin B, and which comes at right angles to the pins *j*, two pins, *l l*, on which the plate A is held, and whereon it may oscillate. In a position of rest the plate A stands at an acute angle to the vertical plane, which is at right angles with the axis of the support B, by the resting against it of three pins or friction-rollers, *m m*, that are mounted upon arms *n*, which project from the shaft E. This shaft is connected with a weighted bar, F, by which it is pressed toward the plate A, a set-screw, *o*, serving to control the position of the weighted bar F, so that it may keep the plate A in requisite inclination. Rotary motion is imparted to the shaft E by the driving-wheel *p* meshing into the teeth of an elongated pinion, *q*, that is mounted upon E. The pinion *q* is of sufficient length to allow the shaft E to move longitudinally in obedience to the action upon it of the weighted bar F and oscillating plate A. If the oscillations of the plate A increase in speed and in extent of motion, even for an almost imperceptible short space of time, it will bear against the pins or rollers *m m* and crowd them away from its support, and will move the shaft E against the weight F, tending to bring the latter more into a vertical line, and to cause it to shut the valve, while reduction of speed will cause an equivalent reduction in oscillations of the plate A, and a greater liberation of the weighted lever F, so that the valve may, by the same, be more opened.

The same system substantially is illustrated in Figs. 4, 5, and 6, the only difference being in the manner of connecting the several parts, for in Fig. 4 the disk A is represented as being mounted by its universal joint upon a hollow support, G, through which a shaft, E, carrying the three arms *n n* and buttons *m* is fitted, a spring, *r*, crowding said pins against the plate A, and serving as equivalent for the weight F of Fig. 1.

A pinion, *s*, hung loose upon the shaft E, meshes into a toothed segment, *t*, that is mounted upon a weighted crank-lever, H, from which the connecting-rod *h* extends to the valve. When the speed of the engine is increased, the increased friction on the buttons *m* causes the loose pinions *s* to act upon the lever H in such manner as to move it to more or less shut the valve.

In Fig. 6 the same invention again is represented in connection with a still different means of transmitting the sliding motion of the rotary shaft to the valve, and of operating the same by two connecting-weights, all of which will be clearly understood by reference to the drawings.

It may be observed that, in the last two arrangements, the difference in speed eventually arising between the engine and the governor causes the steam-valve to be shut or opened. The greater force of resistance of the governor, which is required when the valve is to be shut, arises from the disk then making wider oscillations, which are, however, isochronous with the less wide, and causing, in this manner, greater frictional resistance in the buttons *m*.

Instead of the three buttons *m* may be used a ring of smaller dimensions than the oscillating ring or plate, having about the same outer diameter. This ring rotates with the shaft E, and is applied to it in such a manner that a greater or less inclination against the same is obtained, following thereby the oscillations. The counter-pressure of the ring is suitably regulated by a weight in conformity with the general law of isochronous oscillations.

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

1. The oscillating plate A and radial arms *m n*, combined with the shaft E and weighted lever F, substantially as and for the purpose described.

2. The weighted bar F, arranged in conjunction with the sliding shaft E and plate A, for the purpose specified.

The above specification of my invention signed by me this 6th day of August, 1872.

CARL ROBERT RUNGVIST.

Witnesses:

EGENHANDIGA NAMNTUKNINGER CWITTNA,
OL STRANDBERG RUNNOKOLMBLAD.