

(No Model.)

E. F. WILLIAMS.
CUT-OFF REGULATOR.

No. 347,979.

Patented Aug. 24, 1886.

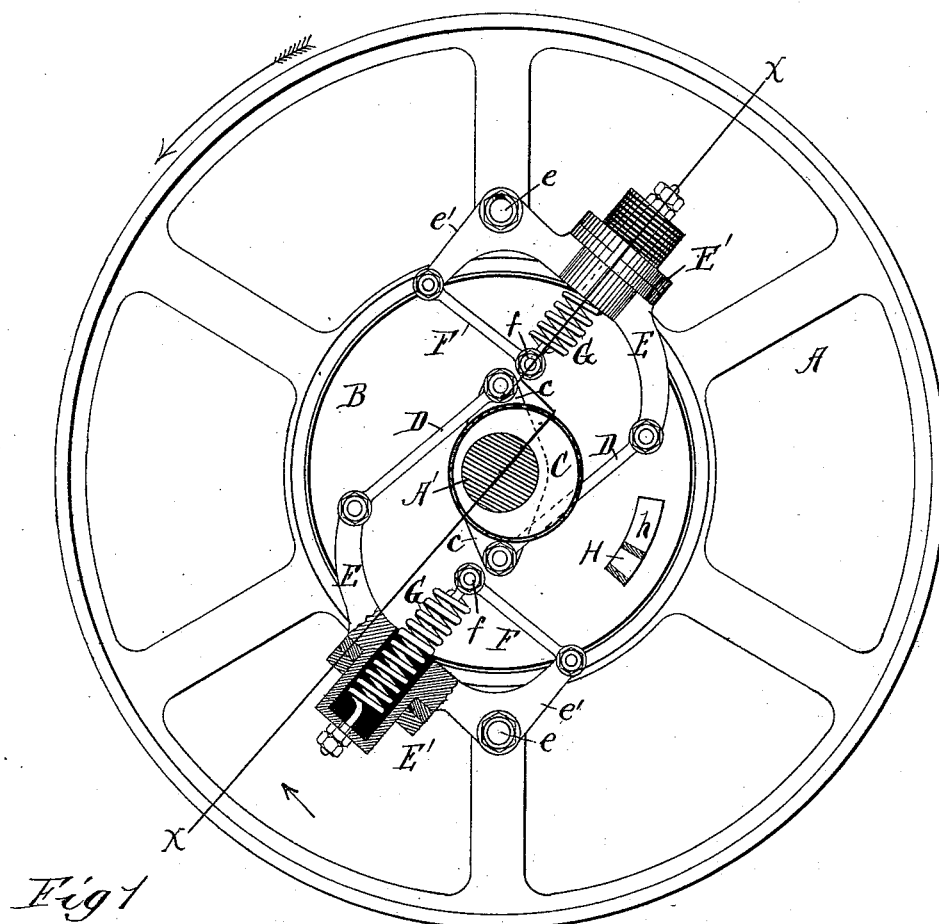


Fig 1

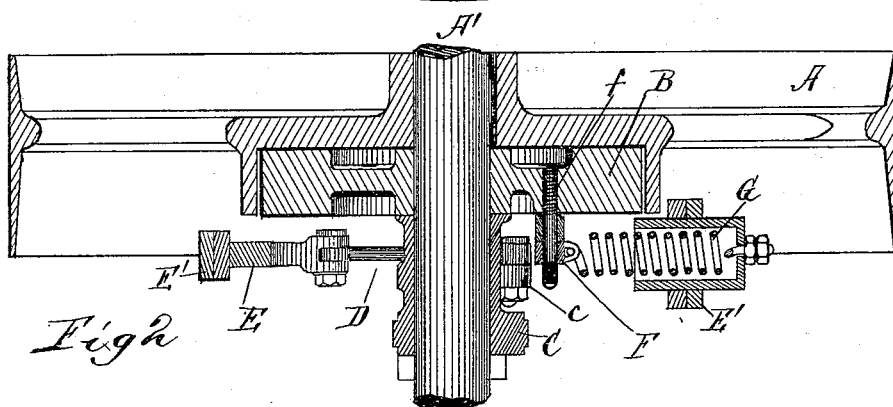


Fig 2

WITNESSES:

N. C. Corlies
A. M. Best

INVENTOR

Edwin F. Williams

B. J. Coburn & Thacher

ATTORNEYS

UNITED STATES PATENT OFFICE.

EDWIN F. WILLIAMS, OF CHICAGO, ILLINOIS.

CUT-OFF REGULATOR.

SPECIFICATION forming part of Letters Patent No. 347,979, dated August 24, 1886.

Application filed December 17, 1885. Serial No. 186,006. (No model.)

To all whom it may concern:

Be it known that I, EDWIN F. WILLIAMS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Automatic Cut-Off Regulators, which is fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 represents an elevation of a mechanism embodying my invention; and Fig. 2, a sectional view of the same, taken on the line *x x* of Fig. 1.

Like letters refer to like parts in all the figures of the drawings.

My invention relates to automatic cut-off governors or regulators for steam-engines, and more particularly to that class in which a governor wheel or disk, or the fly-wheel of the engine, has applied to it, to revolve with or be revolved by it, the remaining parts of the governor, its object being to provide a mechanism which shall effectually regulate with great nicety the speed of the engine.

I will now proceed to describe a construction in which I have practically carried out my invention in one form, and will then particularly point out in the claims those features which I deem to be new and desire to protect by Letters Patent.

In the drawings, A represents the governor-wheel, and A' the crank-shaft, to which the said wheel is keyed or otherwise rigidly attached.

B represents a disk, which I shall term the "inertia-disk." This disk is mounted loosely upon the crank-shaft A', or upon the hub of the governor-wheel A.

C represents a cut-off eccentric, which is mounted loosely upon the crank-shaft A'. This eccentric is provided with the lugs *c*, attached to or formed in one piece with it, which lugs serve as points of attachments, to which are pivoted the inner ends of links D. The outer ends of these links are pivoted to the ends of the weight-arms or governor-arms E. Each governor-arm is provided with means—such, for instance, as that shown—for the attachment of weights E', which may be placed thereon in any desired number, and secured in any suitable manner. Each weight-arm is pivoted, by means of a suitable stud or bolt, *e*, to one of the arms of the governor-wheel A,

and is provided with a short arm, *e'*, to which is pivoted one end of a link, F, the other end of which is pivotally connected to a stud or pin, *f*, attached to the inertia-disk B. Springs G are employed to draw the weight-arms E inward toward the central shaft, A', these springs being shown in the present instance as connected at one end to the studs *f*, and at the other end to the weight-arms, either in the manner shown or in any other suitable manner.

H indicates a stop, consisting of a lug attached to the governor-wheel A, and extending into a slot, *h*, in the inertia-disk B, the movement of which it limits by contact with the ends of the slot in an obvious manner.

It will be seen that since the weight-arms E are attached to the governor-wheel A, and they are connected to the eccentric by means of the links D, and to the inertia-wheel by means of the links F, a connection is thus established between these two latter parts and the governor-wheel, which will cause them to revolve with this latter. It is of course understood that the cut-off eccentric C will be in practice connected to the cut-off valve in any approved manner.

The operation of the device is as follows: As the governor-wheel revolves in the direction of the arrow shown in Fig. 1, when the speed is sufficient the governor-weights, by reason of their centrifugal force, overcome the resistance of the springs G, and move outward from the central shaft, carrying the eccentric forward around the shaft through the medium of the links D, and thereby effecting an earlier cut-off. Upon this movement of the weight-arms and eccentric it is obvious that the inertia-disk B must also move around the shaft, since it is connected to the short arms *e* of the weight-arms, by means of the links F. This movement of the inertia-disk is, however, a movement in a direction opposite to that of the eccentric—i. e., it is a backward movement. It will thus be seen that an earlier cut-off is effected by means of a backward movement of the inertia-disk, and it follows that a later cut-off will be effected by a forward movement of the inertia-disk. It is therefore evident that an accelerating movement of the engine will have the effect of shortening the cut-off, and a retarding movement will have the effect of lengthening it. Whenever the mo-

tion is uniform, however, there will be no change whatever in the cut-off.

In all centrifugal governors the governor-weights have a certain mass which requires force to either set it in motion or bring it to rest. For this reason these weights cannot respond the instant that the equilibrium between the spring-pressure resistance and the centrifugal force is disturbed by a change in the speed of the engine, and for this same reason, when once set in motion, they are carried beyond the point where this equilibrium exists, and must therefore have a return motion, which "unsettles" the governor and causes "racing" when adjusted for close regulation. It is this cause, among others, that renders inadmissible fineness or extreme accuracy of adjustment, which would be practicable were it not for the inertia of the governor-weights. It is to remedy this defect that I employ the inertia-disk, which is calculated to urge the weights to immediate action upon any change in the speed of the engine, and to immediately oppose their movement whenever the said speed is either above or below the normal rate of rotation. In order to explain this action of the disk, let us suppose the engine to be running at the uniform speed required to establish an equilibrium between the weight and spring forces at any position within the range of the governor. If the speed should then suddenly increase, as it would were a large portion of the load taken off, the acceleration would give to the weights a greater centrifugal force, which, in the ordinary governor, would require a certain time to overcome the inertia of the weights, and if the actuating force is very small, the weights would move slowly at first, allowing the speed of the engine to increase considerably before the governor would act to check it. Moreover, when the weights were once in motion, they would, as hereinbefore explained, go beyond the position at which they should stop. The inertia-disk acts instantaneously with any acceleration of speed to push the weights into their proper position and to stop them the instant that retardation sets in. The effect of the said disk is not to establish the speed at which the engine shall run, but to oppose instantly any change in speed by pushing or pulling the governor-weights into their proper position, or nearly so, the difference being finally made up by the opposing force of the springs and weights finding their equilibrium. Upon any change in speed the *vis inertia* of the disk is expended in urging the weights into action, and when this inertia has been spent the movement of the weights is arrested by the same force, the tendency being to hold the governor-weights in their proper position when the speed is right, and to urge them into immediate action upon any change of that speed. It will be observed that by reason of the particular manner of attaching the spring shown in the drawings and hereinbefore described, these

latter will be always kept substantially at right angles to the weight-arms, since as these latter move inward or outward the pins *f* on the inertia-disk to which the inner end of the springs are attached will be carried by the movement of the said disk into such a position as to always maintain this same relative position of the springs to the arms.

It is obvious that various modifications in the details of construction and arrangement of the parts may be made without departing from the principle of my invention. For instance, the governor-wheel may be fitted loosely on the shaft and used as an inertia-disk. In this construction the disk B will be secured to the shaft, and the weight-arms will be pivoted thereto, the studs *f* being attached to the governor-wheel and extending through slots in the disk. The springs G may be also differently arranged. For instance, they may be attached to the inner edge of the governor-wheel and to the extremity of the short arms *e* of the weight-arms E. I prefer, however, the construction shown and described, for the reasons already stated. In view of these and other obvious modifications I do not wish to be understood as limiting myself strictly to the precise details hereinbefore described, and shown in the drawings.

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

1. In a steam engine governor, the governor-wheel and eccentric, in combination with the weight-arms connected to the eccentric and the inertia-disk connected to the weight-arms, substantially as and for the purposes specified.

2. The combination, with the governor-wheel and the weight-arms pivoted thereon, of the eccentric connected to the weight-arms by suitable links, centripetally-acting springs connected to the weight-arms, and the inertia-disk provided with links connected to the short arms of the weight-arms, substantially as and for the purposes specified.

3. In a steam-engine governor of the character described, the combination, with the weight-arms and the inertia-disk, of the springs connected to the weight-arms and to pins on the disk, whereby the said springs act constantly at right angles to the arms, substantially as and for the purposes specified.

4. The combination, with the shaft A', of the governor-wheel A, secured thereto, the weight-arms E, pivoted to the governor-wheel and provided with short arms *e*', the loose eccentric C, connected to the weight-arms by links D, the loose inertia-wheel B, connected to the short arms *e*' by links F, and springs connected to the weight-arms to draw them toward the center, substantially as and for the purposes specified.

EDWIN F. WILLIAMS.

Witnesses:

IRVINE MILLER,
W. C. CORLIES.