# J. C. HOADLEY.

## Governor for Steam-Engines.

No. 164,917. Patented June 29, 1875.

*Fig. 1.*

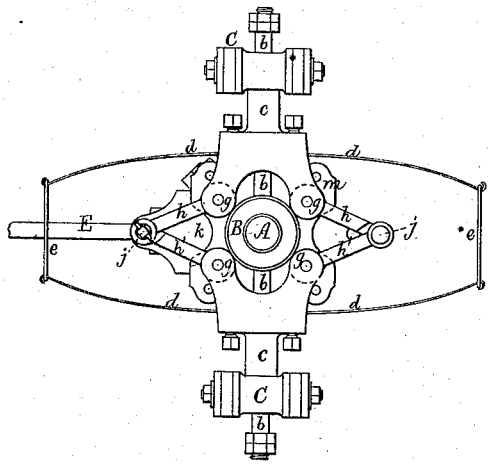



*Fig. 2.*

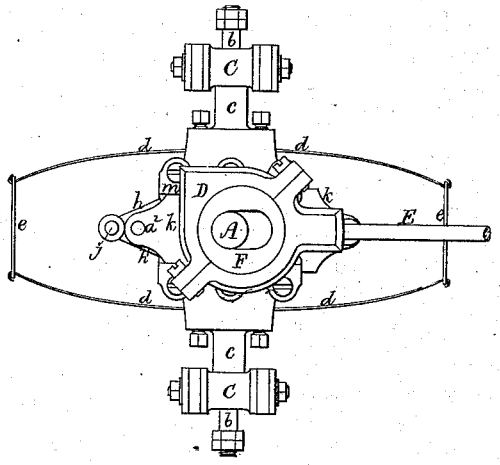



*Fig. 3.*

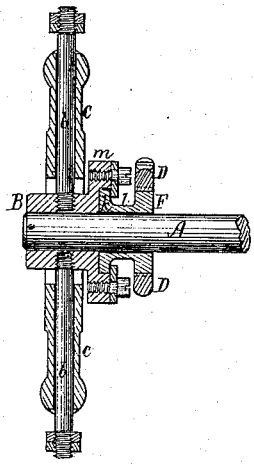
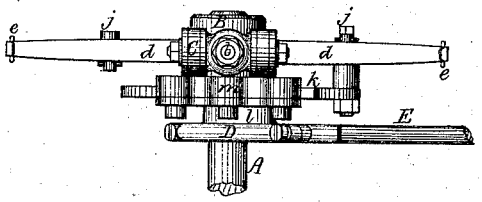
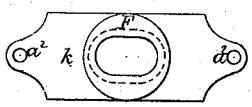



*Fig. 4.*




Witnesses.
S. N. Piper
L. N. Müller

John C. Hoadley.
by his attorney.
R. H. Ladd

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

# UNITED STATES PATENT OFFICE.

JOHN C. HOADLEY, OF LAWRENCE, MASSACHUSETTS, ASSIGNOR TO THE J. C. HOADLEY COMPANY, OF SAME PLACE.

## IMPROVEMENT IN GOVERNORS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **164,917**, dated June 29, 1875; application filed May 22, 1875.

*To all whom it may concern:*

Be it known that I, JOHN C. HOADLEY, of Lawrence, of the county of Essex and State of Massachusetts, have invented a new and useful Improvement in Governors for Steam-Engines; and do hereby declare the same to be fully described in the following specification and represented in the accompanying drawings, of which—

Figure 1 is a front elevation, Fig. 2 a rear view, Fig. 3 a transverse section, and Fig. 4 a top view, of a governor placed on the crank-shaft of a steam-engine. Fig. 5 is a rear view of the slide *k*, to be hereinafter described.

It may be placed upon any shaft driven by the crank-shaft of a steam-engine, so as to revolve in equal and identical times therewith, the governor revolving with said crank-shaft, or with another shaft geared thereto, and, through centrifugal force, operating to vary, in a rectilinear direction, the position of the eccentric more or less with reference to the axis of the shaft.

My invention relates principally to mechanism for supporting and moving the eccentric, and may be termed an improvement upon the mechanism described in Letters Patent of the United States, No. 144,098, granted to me, and dated October 28, 1873.

In the accompanying drawings, the balance-wheel is omitted, and the governor, which, in said patent, is shown as placed upon the hub of the balance-wheel, is here placed directly upon the shaft. In the said drawings, A denotes the driving-shaft, and B a hub separate from the hub of the band-pulley or fly-wheel, which may be called the hub of the governor. From the hub B two arms, *b b*, project in opposite radial directions, and in line with each other. These may extend through the slides or sleeves *c c*, which are fixed to two bow-springs, *d d*, arranged as shown, and connected at their opposite ends by links *e e*. Furthermore, there is applied to each of the sleeves *c* a weight or a series, C, of weights arranged on arms projecting in opposite directions from the sleeve. Furthermore, to each sleeve, at its inner end, there are two slotted hubs or bosses, *g g*, from which two links or toggles pivoted thereto extend to meet two other similar and corresponding links extending from, and pivoted to, the other sleeve. These links or toggles are shown at *h h h′ h′*, the upper ones, at their outer ends, being pivoted to the lower ones at their outer ends. They are connected, when they meet at their outer ends, by pins, bolts, or studs *j j*, the outer end of one pair of links being forked to receive the outer end of the other pair of links, as shown. On one side the pin, bolt, or stud *j* extends only through the links *h h′*, and unites them, but so that they can turn freely on this pin; but on the other side of the pin is a stud, securely fastened to, and projecting from, a slide, *k*, affixed to one end of a short tubular shaft, *l*, carrying the eccentric F, such eccentric being provided with the collar D, fixed to the connection or valve-rod E, all being arranged as shown. The slide *k* is supported by, and so as to be capable of sliding rectilinearly in, a head, *m*, which is fixed to, and projects in opposite directions from, the inner end of the hub B. Such slide has holes $a^2$ $a^2$ at its two opposite ends, for connecting it to either pair *h h′* of links.

While the said hub and all its attachments may be in revolution with the shaft A, to which it is fastened, the centrifugal force exerted by the two series of weights C, together with that of the sleeves *c c*, and that of the springs *d d*, will tend to cause the sleeves *c c* to move radially away from one another by sliding along the arms *b b* in opposition to the force of the springs *d d*. Whenever the velocity of revolution shall have reached a point at which the centrifugal force above mentioned is greater than the opposing force of the springs *d d*, the sleeves will be moved outward by this centrifugal force; and whenever this centrifugal force is diminished by reduced velocity of rotation, the sleeves will be drawn inward toward each other by the force of the springs. Whenever the sleeves move outward the connected ends of the links *h h h′ h′* will necessarily be drawn inward; and when the sleeves move inward the ends of the links will be moved outward; and since the sliding plate *k* is connected, by means of the stud *j*, with one of the joints of the links *h h′*, it follows that the sliding plate *k* will participate in all the motions of the sleeves *c c* which may take place on account of the varying centrifugal force occasioned by variations of rotatory velocity of the shaft A.

Since the angle which the axes of the links form with one another varies with every sliding motion of the sleeves, the motion of the sliding plate *k* will not be quite uniform in relation to the motion of the sleeves; but, within useful limits, it is sufficiently nearly uniform to be as good as if it were absolutely uniform.

It will be seen, by comparing the action of the mechanism herein to be described, that the motion imparted to the sliding plate *k*, and all the useful results of such motion in varying the throw of the eccentric F, and in regulating the cut-off of steam, are very similar (although not identical) to those produced by crossed slots acting upon a stud at their point of crossing; such being shown in my Patent No. 144,098, above referred to. This my present invention is really an improvement on my former patented mechanism.

The advantages of this improvement are, first, that it greatly cheapens the construction; second, that the friction is reduced, and the governor is rendered more sensitive and accurate; third, that there is less lost motion or play resulting from original looseness of the parts or from wear; fourth, that the two pairs of links (one pair on each side of the radial arms *b b*) act together, so as to relieve the sleeves of strain and of consequent friction and wear on the arms *b b;* and, fifth, that great facility of reversing the direction of the motion of the engine results from the use of two pairs of links, as nothing more is required than to exchange the studs or pins *j j*, the one for the other.

This governor, in the engines to which it may be applied, may be placed within the belt-pulley, serving as a balance-wheel; but, instead thereof, it may be placed on any convenient part of the shaft, or, as hereinbefore mentioned, on any other shaft having motion in equal identical time with the crank-shaft.

What I claim as my invention in the governor, as described, is—

The links *h h h′ h′*, in combination with the sleeves *c c* and the sliding plate *k*, all substantially as set forth herein.

JOHN C. HOADLEY.

Witnesses:
R. H. EDDY,
J. R. SNOW.