(No Model.) 3 Sheets—Sheet 1.

H. J. JOHNSON.

MECHANISM FOR REGULATING STEAM ENGINES.

No. 335,933. Patented Feb. 9, 1886.

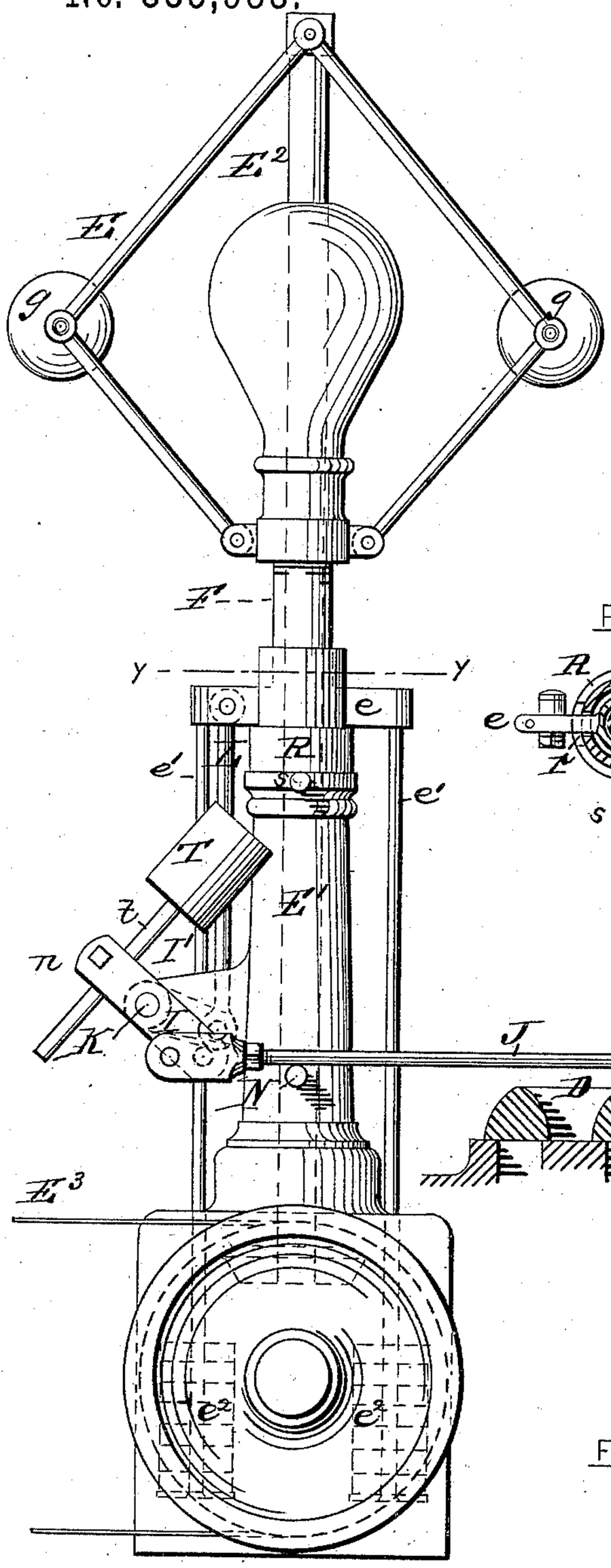


FIG 1

FIG 3

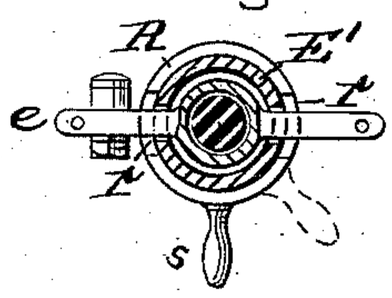
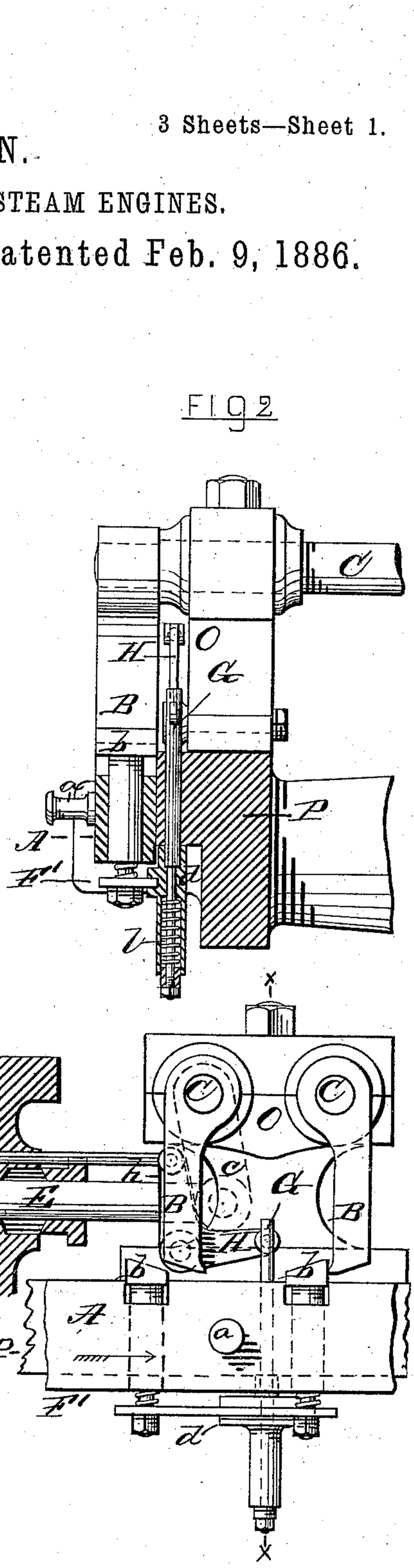


FIG 2



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(No Model.)

3 Sheets—Sheet 2.

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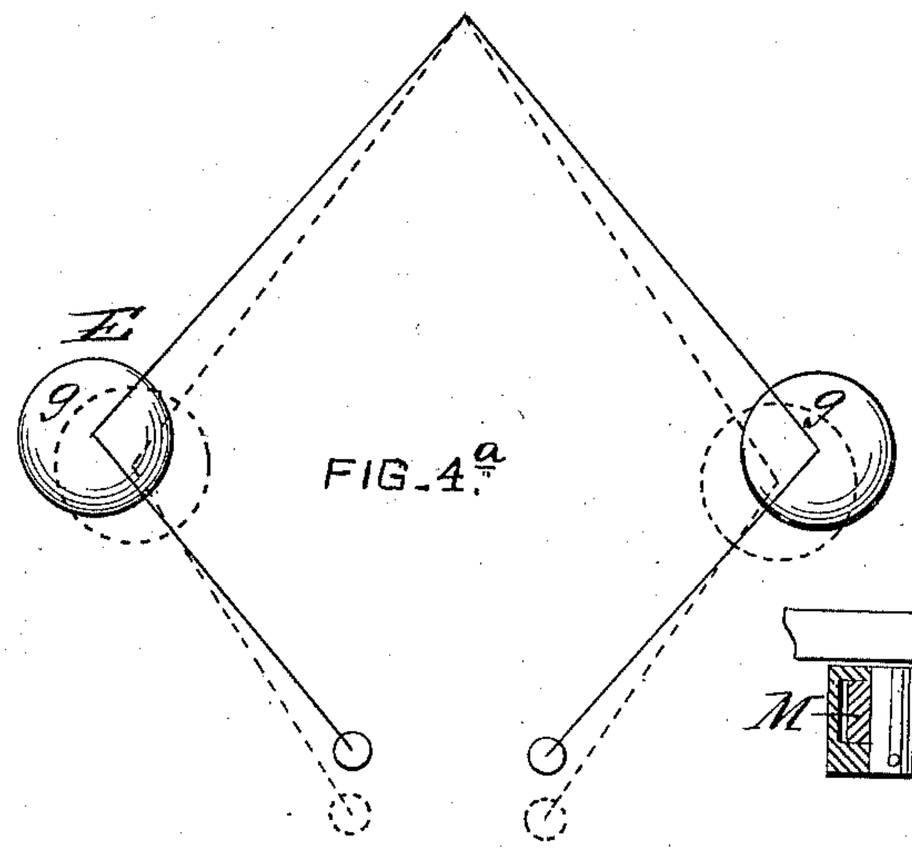


FIG. 4a.

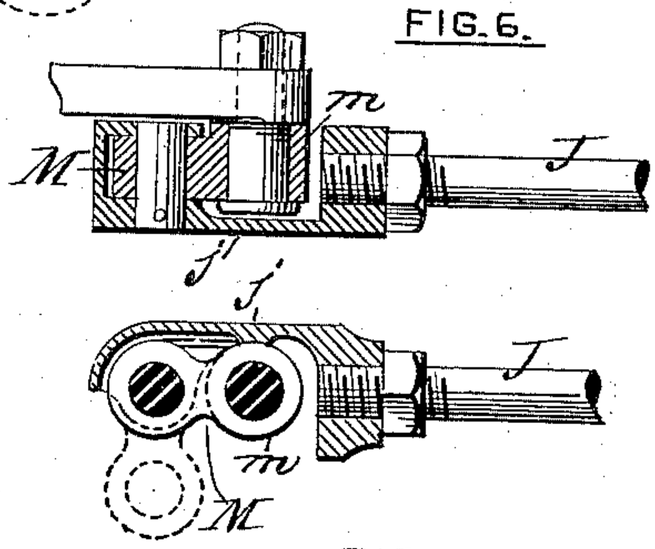


FIG. 6.

FIG. 5.

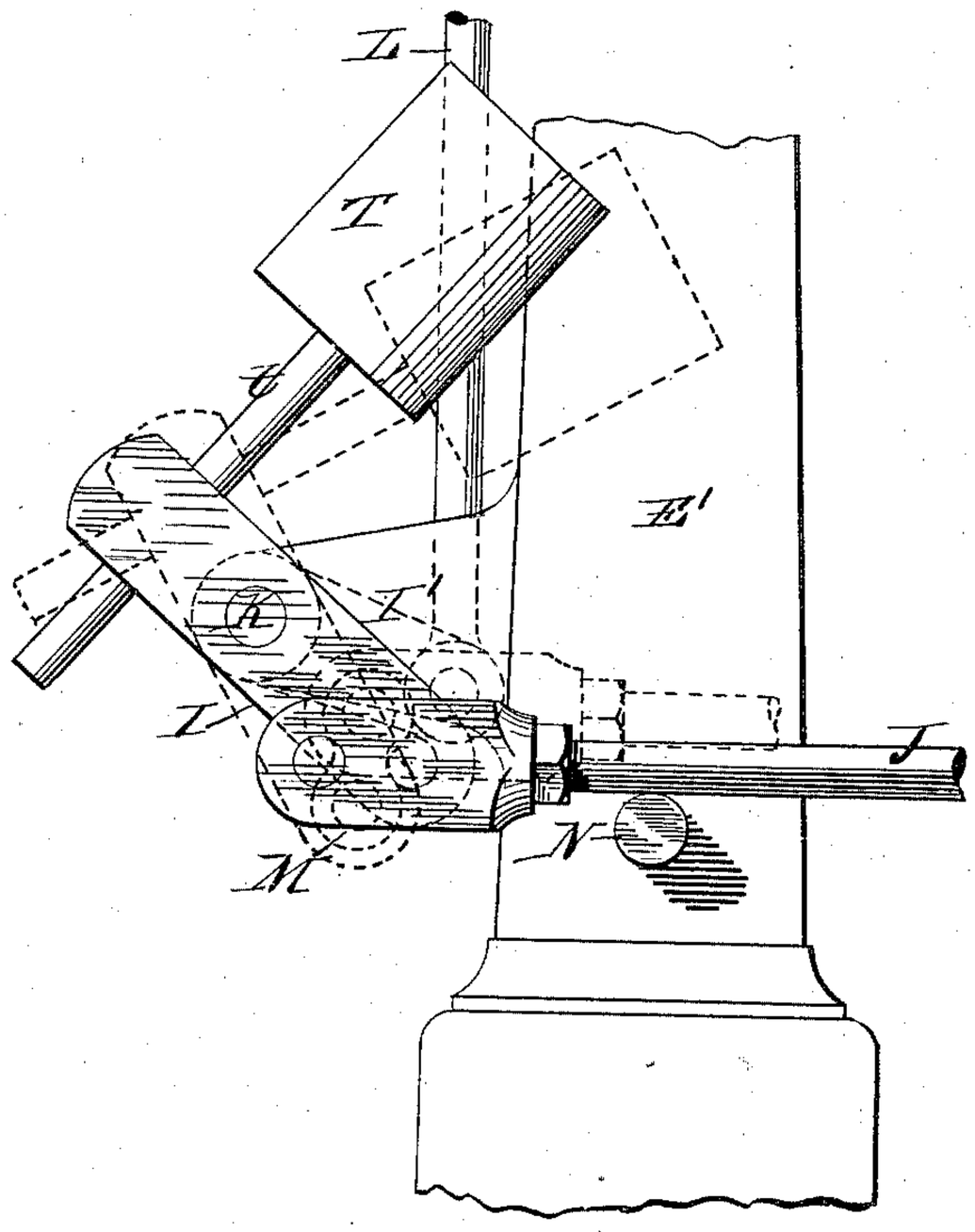
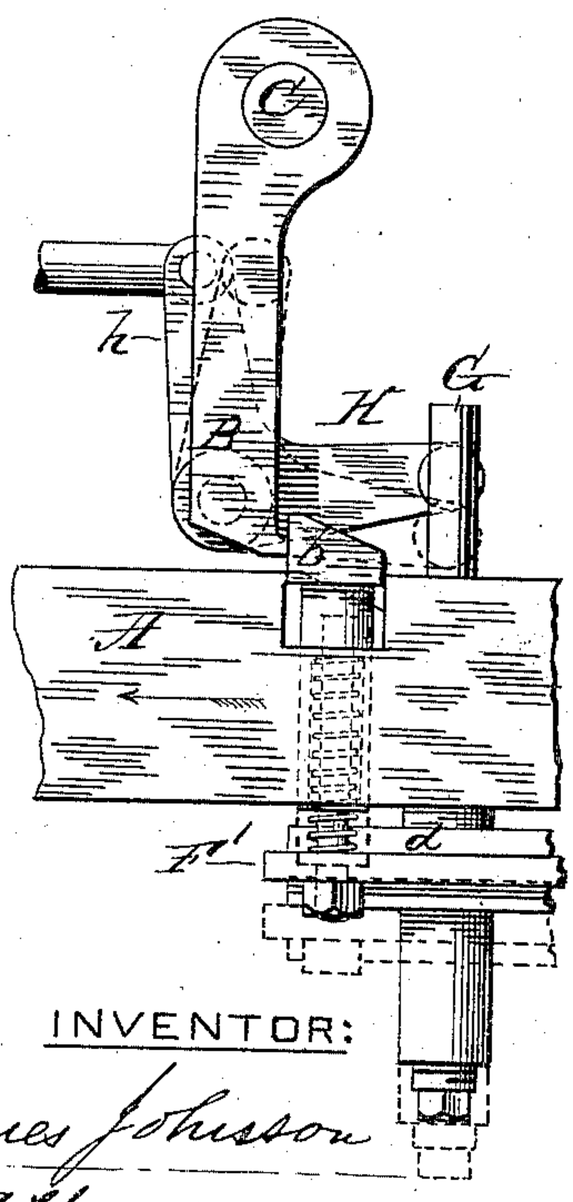


FIG. 4.



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(No Model.) 3 Sheets—Sheet 3.

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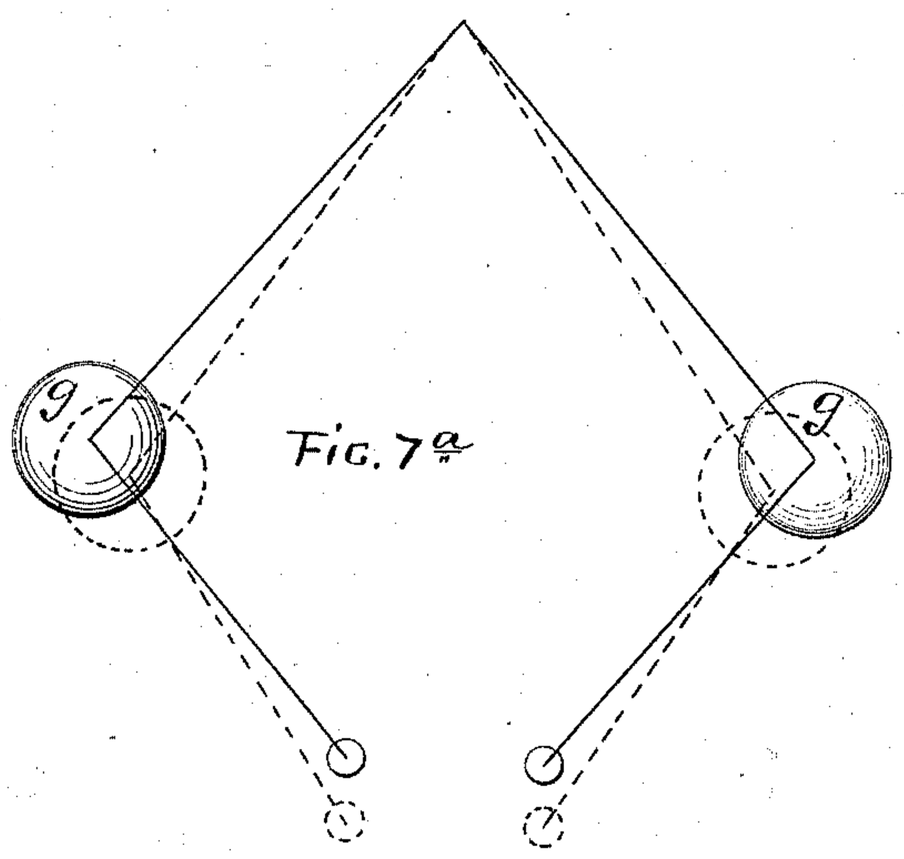

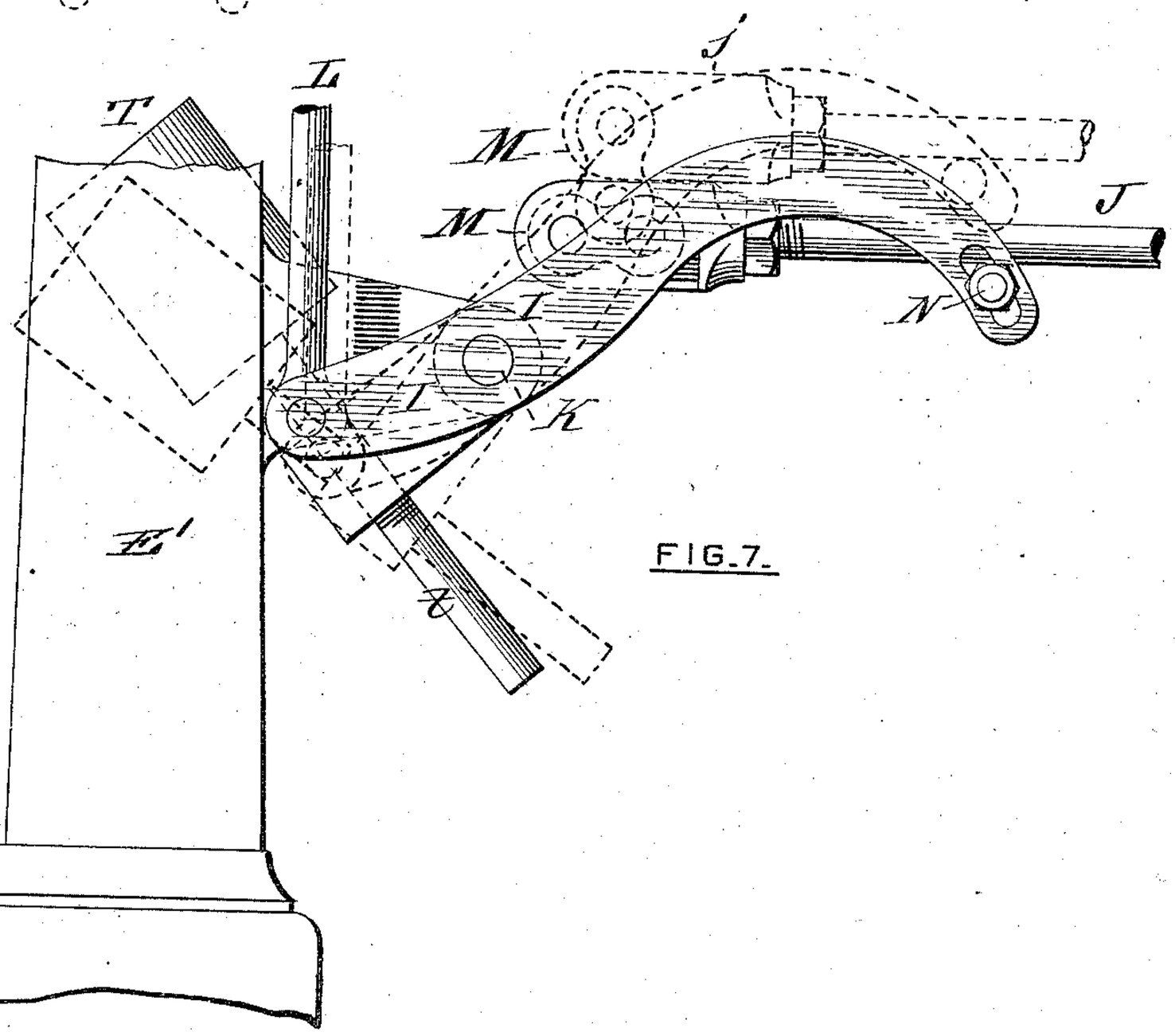

FIG. 7.

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UNITED STATES PATENT OFFICE.

HENRY JAMES JOHNSON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO THE PROVIDENCE STEAM ENGINE COMPANY, OF SAME PLACE.

MECHANISM FOR REGULATING STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 335,933, dated February 9, 1886.

Application filed October 6, 1885. Serial No. 179,119. (No model.)

To all whom it may concern:

Be it known that I, HENRY JAMES JOHNSON, of Providence, in the county of Providence and State of Rhode Island, have made an invention of certain new and useful Improvements in Mechanism for Regulating Steam-Engines; and I do hereby declare that the following, in connection with the accompanying drawings, is a full, clear, and exact description and specification of the same.

In drop cut-off-valve engines in which the governor regulates the point at which the cut-off takes place—such, for example, as the engine known as the "Greene Engine"—it sometimes happens that the driving-belt of the governor breaks or runs off the pulley, in which cases the steam-valves cease to cut off the admission of steam from the boiler, and unless the engineer is at hand to close the throttle-valve the engine receives far more steam than is necessary for the work to be performed and suddenly increases its speed.

The principal object of the present invention is to automatically shut off the steam from the engine under such a contingency, although the same mechanism is useful for suddenly shutting off the steam by hand in case of other contingencies.

The invention consists of certain combinations of mechanical devices by which the above object is attained, and by which the management of the engine is facilitated. These combinations are recited in detail in the claims at the close of this specification.

In order that they may be fully understood, I have represented in the accompanying drawings, and will proceed to describe, the best modes in which I have thus far embodied the invention for practical use, it being understood that the construction and arrangement of the mechanism may be greatly varied, as circumstances or the peculiar views of users or builders of engines render expedient.

Figure 1 of the said drawings represents a side view of the devices for opening and controlling the steam-valves of an engine, with a fragment of one of the valve-chests in section showing the valve. Fig. 2 is a transverse view, partly in section, of the mechanism, the section being at the line *x x* of Fig. 1. Fig. 3 is a horizontal section of a portion of the mechanism at the line *y y* of Fig. 1. Fig. 4 is a side view of parts of the mechanism, designated by the same letters of reference as the corresponding parts in the preceding figure. Fig. 4ª represents different positions of the governor-balls. Figs. 5 and 6 represent views, partly in section, of the head of the link-rod. Figs. 7 and 7ª represent views of a modification of the mechanism as hereinafter described.

The engine to which the mechanism represented in the drawings is more particularly adapted is the well-known Greene engine, in which the steam-valves are opened by means of tappets carried by a reciprocating sliding bar, and in which the position of the tappets in the sliding bar is varied by the operation of the governor, so as to effect the cutting off of the supply of steam to the steam-cylinder by the steam-valves when the piston has traveled more or less of its stroke.

As the construction and operation of the Greene engine is well understood by mechanical engineers, I have represented in the accompanying drawings, and will proceed to describe, only the portions of the engine to which my improvements are applied. The sliding bar A, which carries the tappets for opening and releasing the steam-valves, is constructed in the usual manner, and may be operated by means of an eccentric, as is customary, the eccentric being connected with a stud-pin, *a*, secured to the sliding bar. This sliding bar carries the tappets *b b*, which engage with the toes B B of the rock-shafts C C, for moving the steam-valves, and the said tappets are fitted in the usual manner to move crosswise of the sliding bar, so that they may be adjusted and controlled by the governor for the purpose of causing them to protrude greater or less distances above the sliding bar A, so as to engage for a greater or less length of time with the points of the valve-toes B B, and thus vary the point at which the steam-valves are permitted to close and cut off the supply of steam to the steam-cylinder. Each steam-valve D is connected with its respective rock-shaft C, by means of a valve-rod, E, and an arm, *c*, in the usual way. The governor E of the engine is supported upon a standard, E′, which by preference is erected upon the bed-plate of the engine, and

the governor-spindle E^2 is caused to revolve by means of a belt, E^3, leading from a pulley on the fly-wheel shaft of the engine to a pulley secured to a counter-shaft which is arranged beneath the governor, and is connected with the governor-spindle by means of beveled wheels. The governor is fitted with a slide, F, which is raised and lowered as the fly-balls *g* separate or approach each other, according to the variations in speed of the steam-engine.

In order that the speed at which the engine is to be run may be adjusted, the yoke *e* of the governor-slide is fitted with two rods, *e' e'*, to which more or less weights may be applied, as represented in dotted lines at e^2 e^2, Fig. 1.

In order that the governor may regulate the periods in the stroke of the piston at which the steam-valves are liberated for the purpose of cutting off the supply of steam from the boiler, the governor is connected with the said tappets *b b*, the connections being made through the intervention of the following mechanism: The stems of the tappets *b b* are connected beneath the sliding bar A with a plate, F', whose edge is fitted to slide in a groove formed in the side of the sleeve *d* of the gage-rod G, and the upper end of this gage-rod is connected with one arm of a bell-crank, H, whose other arm, *h*, is connected with the slide of the governor E through the intervention of the connecting-rod J, the vibrating arm I, the rock-shaft K, the second arm, I', and the yoke-rod L, which connects that second arm, I', with the yoke *e* of the governor-slide E'; hence it follows that when the governor-balls *g* diverge, by reason of an increase of speed, the gage-rod G is forced down, and the tappets *b* are depressed, so as to protrude a less distance above the sliding bar A, thereby causing the tappets to hold their respective toes B B for a shorter period, and to release the steam-valves and effect cut-off at an earlier point of the stroke. On the other hand, when the governor-balls *g* converge, by reason of a decrease of speed, the gage-rod is raised, and the tappets *b b* are permitted to protrude farther above the sliding bar A, thereby causing the tappets *b* to hold their respective toes B for a longer period, and to continue the opening movement of the steam-valves longer, so as to effect the cut-off at a later point of the stroke of the piston.

In order that the principal part of my invention may be embodied in the valve mechanism above described, the head of the connecting-rod J is not jointed directly to the vibrating arm I of the rock-shaft K, but is connected with that arm through the intervention of a short shifting link, M, as represented in detail in Figs. 5 and 6. A shifting-pin, N, also, is provided to cause the shifting of the position of the shifting link M from the normal position it occupies, as represented in full lines at Fig. 5, to the position in which it is represented in dotted lines in Figs. 4 and 5. So long as the governor operates regularly the shifting link M occupies the position in which it is represented in continuous lines at Figs. 5 and 6, with the swinging end *m* of the link bearing against the inner side of the cavity of the head *j* of the connecting-rod, and the connecting-rod J then has the relation to the vibrating arm I which it is represented as having in full lines in Figs. 1 and 4. If, however, the revolution of the governor be stopped by the breaking of its driving-belt or by other cause, the governor-balls suddenly converge, the governor-slide F is depressed, the vibrating arm I is rocked downward, and the connecting-rod J is brought in contact with the shifting-pin N, which, in the modification of my mechanism represented in Figs. 1 to 6, inclusive, stops the descent of the connecting-rod J, and then the continued descent of the governor-slide F and downward rocking of the vibrating arm I shifts the position of the shifting link M, as represented in dotted lines at Fig. 5, thereby permitting the connecting-rod J to move toward the stand O of the rock-shafts C C, and to drop the gage-rod G, thus lowering the tappets *b b* so far that they cease to project above the sliding bar A sufficiently to engage with the toes B B, and consequently cease to operate the steam-valves; hence whenever this operation takes place no steam is admitted to the steam-cylinder, and the engine must come to rest.

It will be noticed that the shifting link M and the vibrating arm I turn on center pins which are not concentric. In order to prevent any strain arising from this cause when the shifting link M is shifted, the sleeve *d* of the gage-rod G is connected with the gage-rod through the intervention of a spring, *l*, Fig. 2. Consequently when the upper end of the sleeve strikes the under side of the shelf P (that sustains the stand O) and the downward turning of the link M tends to strain the connecting-rod J, the said spring *l* yields and prevents the straining of the various connections. When the engine is stopped by closing the throttle-valve, the governor-balls *g g* converge and the governor-slide F is depressed by the gradual reduction and final stoppage of the speed of the engine, although the governor-belt remains intact. Such a movement on the part of the governor would, as previously stated, shift the link M, and would then prevent the opening of the steam-valves when steam was let on the engine, unless the governor should be raised by hand, so as to replace the shifting link M in its normal position.

In order to obviate the necessity of thus raising the governor by hand, a stop is provided to prevent the descent of the governor-slide sufficiently to shift the link M at the times the engine is purposely stopped by shutting the throttle-valve, so that when the engine is to be restarted by opening the throttle-valve the link is in its normal position and the steam-valves will be opened by the tappets. The form in which it is preferred to construct this stop is represented in Figs. 1

and 3, in which the stop is shown as consisting of a ring, R, which is fitted to turn upon the upper end of the tubular standard E′ of the governor. The upper edge of this ring-stop is slotted at opposite sides, as at *r r*, so that when the ring is in the position represented at Fig. 3 the slots correspond with the slide-yoke *e* and permit that yoke to descend when the governor-balls converge. If, however, the ring-stop R be partially turned, its unslotted portions are brought beneath the yoke of the governor and prevent its descent to the point at which it would effect the shifting of the shifting link M; hence when the engine is to be stopped by closing the throttle-valve the ring-stop R is turned to prevent the descent of the governor-yoke and leave the tappets *b b* in their proper positions for operating the steam-valves, and when the engine is restarted the ring-stop is turned to its normal position, as represented at Fig. 3, as soon as the speed of the governor rises sufficiently to lift the yoke from the stop. A handle, *s*, is applied to the ring-stop R, to enable it to be conveniently turned from one position to the other, and a spring-catch may be added to secure the ring in its positions.

As governors frequently act sluggishly, I find it expedient to connect an adjustable swinging weight with the governor for the purpose of improving its natural action.

A convenient mode of applying this swinging weight is represented in Figs. 1 and 4, in which the swinging weight T is represented as provided with a stem, *t*, which is fitted to slide in a hole formed in an upward extension of the vibrating arm I, and this extension is by preference slit vertically, so as to form the two cheeks of a clamp, and a clamp-screw, *n*, is provided to draw the two cheeks together, so that the stem of the adjustable weight T may be clamped fast in any position in which it may be adjusted.

My invention is not restricted to the precise mechanism which I have above described, as the mechanism may be modified without ceasing to embody the invention. One modification which I have devised is represented at Fig. 7, in which the governor E is connected with the connecting-rod J through the intervention of the yoke-rod L, the vibrating arm or lever I, and the shifting link M, which last is constructed and connected with the head of the connecting-rod J in the same manner as is represented in Figs. 5 and 6. In this modification of the mechanism the shifting-pin N is not a fixture, as it is represented to be in Fig. 1, but is carried by an extension of the arm I, so that when the governor-slide is excessively depressed by the sudden stoppage of the governor the shifting-pin is raised so as to come in contact with and raise the connecting-rod J and shift the position of the shifting-link M, as represented in dotted lines in Fig. 7.

The principal part of my invention is useful, not only for automatically stopping the operation of the steam-valves when the governor-belt breaks, but may be used also to stop the engine by hand without closing the throttle-valve. Thus the engine may be stopped by raising the head end of the connecting-rod by hand, thereby shifting the position of the shifting link M and permitting the tappets to sink below the points of the valve-toes B B, and to cease to operate the steam-valves, which then remain closed. In practical use a ring may be applied to the connecting-rod J, and a cord or wire may be connected with the ring and led to distant parts of the establishment where contingencies may arise that may require the rapid stoppage of the engine. In this case the pulling of the cord will raise the head of the connecting rod J and shift the shifting link M, thereby stopping the action of the steam-valves and causing the engine to come to rest.

I claim as my invention—

1. The combination, substantially as before set forth, of the governor-slide, the tappets which operate the steam-valves of the steam-engine, with the intervening connecting-rod, and the shifting link of that rod.

2. The combination, substantially as before set forth, of the governor-slide with the vibrating arm, the connecting-rod which is operated by the vibrating arm, and the shifting link which connects the vibrating arm with the said connecting-rod.

3. The combination, substantially as before set forth, of the governor-slide, the vibrating arm, the connecting-rod operated by said vibrating arm, the shifting link which connects the vibrating arm and said connecting-rod, and the shifting-pin which effects the change in position of the shifting link automatically.

4. The combination, substantially as before set forth, of the governor-slide, the shifting link, the shifting-pin, and the movable stop, whereby the excessive descent of the governor-slide may be prevented when the shifting link has been shifted by the action of the governor-slide and shifting-pin.

5. The combination, substantially as before set forth, of the sliding bar which carries the tappets, the gage-rod for moving the tappets, the sleeve of the gage-rod, and the spring thereof.

In witnesss whereof I have hereto set my hand this 28th day of September, A D. 1885.

HENRY JAMES JOHNSON.

Witnesses:

T. W. PHILLIPS,

A. M. LAKE.