

No. 627,887.

Patented June 27, 1899.

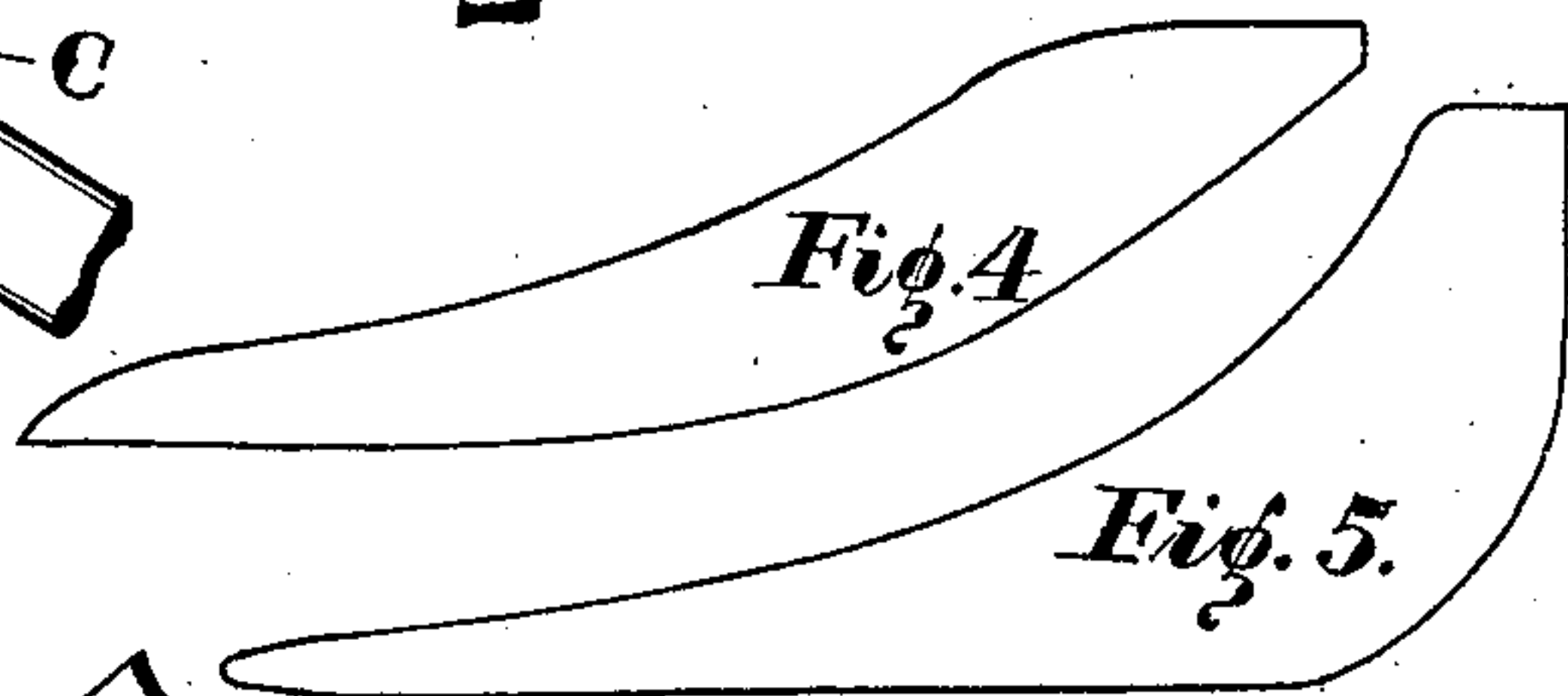
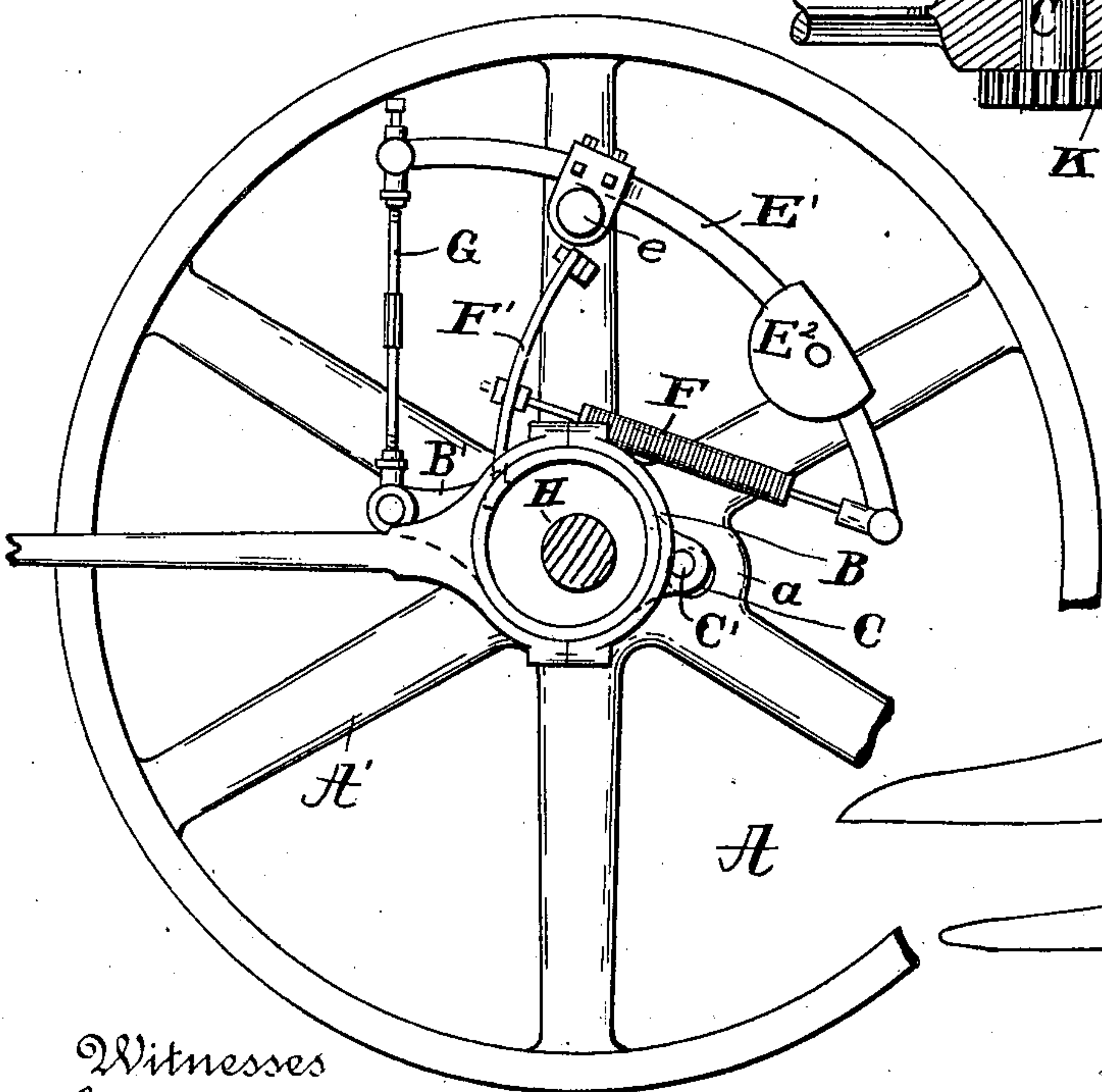
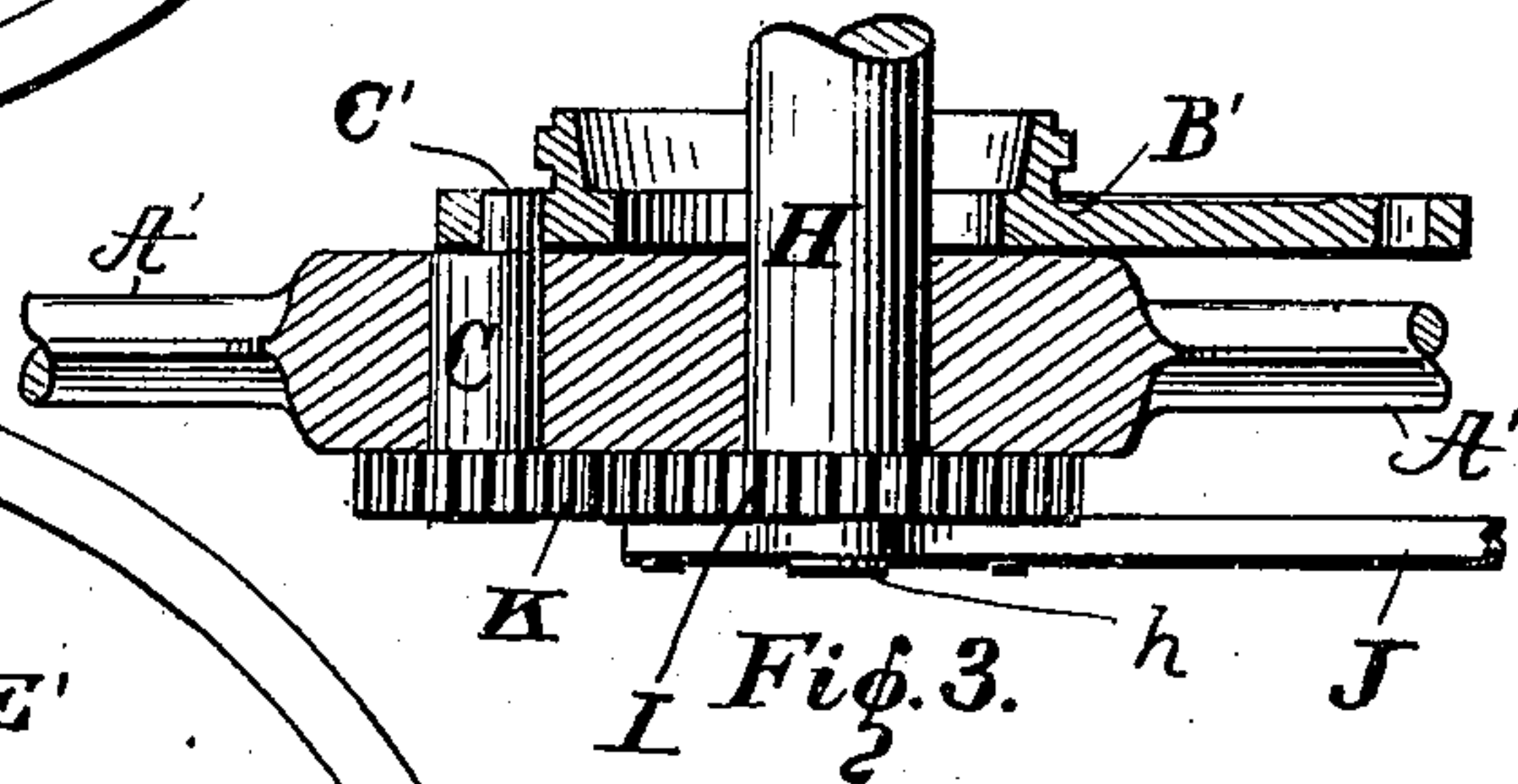
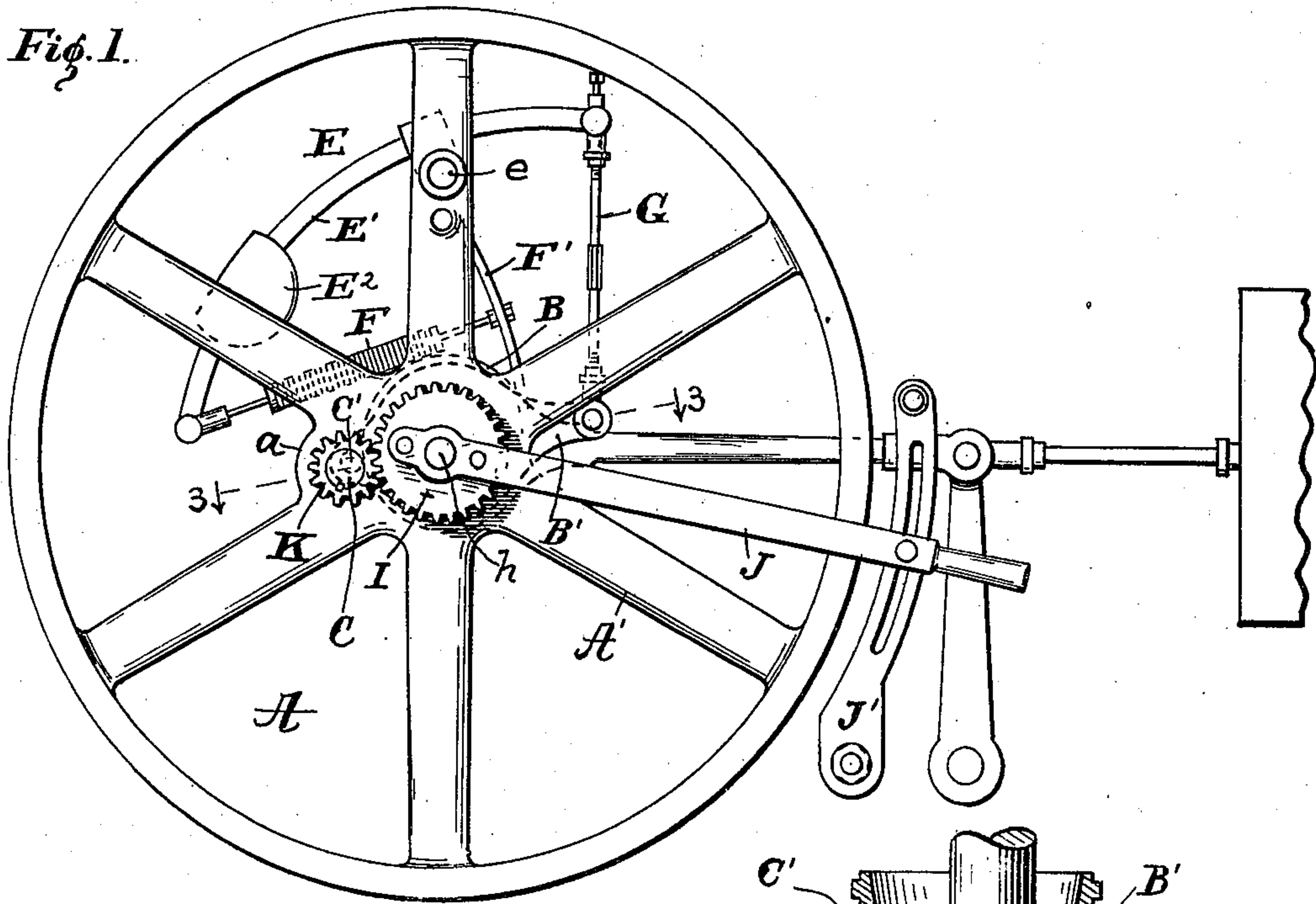
J. B. ALLFREE.

VALVE GEAR AND GOVERNING MECHANISM FOR STEAM ENGINES.

(Application filed Feb. 4, 1898.)

(No Model.)

Fig. 1.



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UNITED STATES PATENT OFFICE.

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VALVE-GEAR AND GOVERNING MECHANISM FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 627,887, dated June 27, 1899.

Application filed February 4, 1898. Serial No. 669,053. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. ALLFREE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Valve-Gear and Governing Mechanism for Steam-Engines, of which the following is a specification.

This invention relates to improvements in automatic slide-valve engines; and its object is to provide means whereby the valve can be opened and closed at the ends of the stroke with an accelerated movement over that which obtains at intermediate points, the present invention having the same ultimate object as my former invention, for which I made application for Letters Patent of the United States on June 7, 1897, Serial No. 639,713, and differs from it essentially in the use of gear-wheels in place of cams for varying the eccentricity of the eccentric.

I accomplish the objects of this invention by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a detail in side elevation of an engine, showing the governor-wheel equipped with my invention and showing enough of the related parts of the engine to make the invention fully understood. Fig. 2 is a side elevation of the governor-wheel with my invention as illustrated in Fig. 1, but viewed from the opposite side of the wheel. Fig. 3 is a detail in cross-section on the line 3 3 of Fig. 1. Fig. 4 is a copy of an indicator-diagram made on an ordinary high-speed automatic engine, and Fig. 5 the copy of a diagram made from the same engine after it had been equipped with my invention.

Similar letters of reference indicate like parts throughout the several views of the drawings.

A represents a governor-wheel having the arms A', and B is a variable eccentric, all of which parts are of the usual construction. A hub *a* is formed on one side of the arms of the wheel or between two of the arms and has a transverse bore in which a shaft C is mounted.

C' is a pin, which is preferably integral with the shaft C and which is eccentric to the shaft. An eccentric plate or frame B', carrying the eccentric B, is pivoted at one of its ends to

the pin. The other end of the plate is connected with a centrifugal governor of any usual or desired construction, by which the eccentric will be automatically shifted to keep the engine within regulation speed.

The form of governor shown in the drawings comprises the lever E, which is pivoted at *e* to one of the arms of the governor-wheel. The long arm E' has the adjustable weight E², the tendency of which is to move out by centrifugal action when the wheel revolves. This outward tendency will be counteracted by the spring F, which is connected at one end with the lever E and at its other end with the slotted bar F'. The bar F' is fastened to the wheel A. The short arm of the lever E is connected by the link G with the frame B.

H is the main shaft of the engine, on which the governor-wheel is mounted. The outer end of the shaft H is reduced to form the end *h*, which projects beyond the hub of the governor-wheel, and on this reduced end the spur gear-wheel I is mounted. The shaft *h* rotates within the wheel I; but the latter is held in a stationary position by the handle-bar J. A standard J', bolted to the frame of the engine and to which the handle-bar is adjustably secured, provides means for locking the wheel I against rotation.

K is a pinion one-half of the diameter of the wheel I, which is keyed or otherwise fastened to the end of the shaft C opposite that which carries the eccentric-pin C'.

The length of the normal stroke of the valve depends on the eccentricity of the eccentric resulting from the position of the frame B', due to the influence of the governor on said frame; but with the construction as above described, in which the frame swings from a pin which is eccentric to a constantly-rotating shaft, it is obvious that the eccentricity of the eccentric will be changed with every revolution of said shaft. The action of the eccentric-pivot will be, first, to accelerate the normal movement of the valve and augment its normal maximum opening, and, second, to retard the movement of the valve in the same proportion that it had been previously augmented. The mechanism can be adjusted to make the maximum augmented opening coincident with the end of the stroke of the

valve, in which case the full admission and exhaust of the steam would take place much nearer the beginning of the stroke and its end, respectively, than heretofore and a much wider opening would be secured with a quicker opening and closing of the valve.

By making the pinion K one-half of the diameter of the wheel I the eccentric-pivot will revolve twice with each revolution of the governor-wheel and the valve will be acted on alike at both ends of its stroke, imparting to the valve a much more rapid movement at each end and a much slower movement throughout the middle portion of the stroke. By reason of this rapid travel at the ends of the stroke the steam-openings may be made and closed with a much greater rapidity and a wider opening obtained for an equivalent cut-off than is possible with a single eccentric movement of the valve. It will thus be seen that the effect of the auxiliary or modifying connections between the governor-wheel and the eccentric is to cause a resultant motion, which will impart to the valve accelerated movements for quickly opening and closing the admission and exhaust ports and retarded movements that cause the valve to dwell or stop after the close of admission and before the close of exhaust, which retarded movements take place during the middle portion of the travel of the valve. When the eccentric-pin on the wheel acts in conjunction with the eccentric, the resultant motion is an accelerated movement, and when the motions of the said pin and eccentric are opposed to each other the resultant movement is a retardation until the valve dwells or stops or ceases to have effective movement at the points where such opposed motions are equal or nearly equal.

By reason of its slower travel through the middle portion of its stroke the exhaust-valve remains closed longer before releasing the steam and closes much later at the opposite end of the stroke, thereby materially lowering the compression.

A comparison of the diagrams shown in Figs. 4 and 5 indicates at once the advantage and economy of my invention. The original diagram shown in Fig. 4 was traced by an indicator on a high-speed automatic engine and shows the ordinary practice, and the original diagram shown in Fig. 5 was taken from the same engine having the same valve and under conditions precisely similar to those existing when diagram 4 was taken, except that my improved valve mechanism herein described had been added.

The broad features of my invention herein disclosed, consisting of the use of an auxiliary device or connection in combination with the primary valve-operating gear, so disposed as to cause a resultant accelerated movement to be imparted to the valve for quick opening and closing of the admission and exhaust ports, and a movement retarded until the valve either dwells or stops after the close of

admission and before the close of exhaust, during each stroke of the piston, is not claimed in this application, as such generic form of my invention is covered by my Patent No. 613,184, dated October 25, 1898; nor do I claim herein the combination directly with the eccentric of an auxiliary or modifying connection between said eccentric and the governor-wheel, as that forms the subject of my earlier application, Serial No. 639,713, filed June 7, 1897, and while my present improvement is preferably applied to a variable or shifting eccentric it is obvious that it is not limited thereto, as it may be applied to an ordinary eccentric as well.

Having thus fully described my invention, what I claim as new, and wish to secure by Letters Patent of the United States, is—

1. In an engine, the combination with the cylinder and valve, of a rotating main shaft, a wheel mounted on said shaft, an eccentric carried by the wheel and connected to the valve, a shaft journaled upon and revolving with the wheel and connected eccentrically to its axis with said eccentric, and means interposed between the main shaft and said shaft for continuously rotating said shaft in a given direction, the said parts being so arranged or disposed that the resultant motion imparted to the valve by said eccentric causes said valve to move with an accelerated speed during opening and closing of the ports, and to dwell or stop after the close of admission and before the close or exhaust during each stroke, substantially as described.

2. A governor, a main or valve-operating eccentric connected with and governed in its eccentricity by said governor, an eccentric-pin whereon said main eccentric is pivoted, said eccentric-pin having a rotation around its own axis of rotation and also around the axis of rotation of said main eccentric, substantially as and for the purposes specified.

3. A governor, a main or valve-operating eccentric connected with and governed in eccentricity by said governor, an eccentric-pin whereon said main eccentric is pivoted, said eccentric-pin having continuous rotation in one direction around its own axis of rotation and also rotation in the same direction around the axis of rotation of said main eccentric, substantially as described and for the purposes specified.

4. A governor, a variable eccentric connected with and changed in eccentricity by said governor, a slide-valve connected with the eccentric, an auxiliary eccentric having continuous rotation around an axis which rotates continuously around the axis of rotation of the variable eccentric, and means for connecting the two eccentrics, substantially as described and for the purposes specified.

5. A governor, a variable eccentric connected with and varied in eccentricity by said governor, a slide-valve connected with the eccentric, a shaft traveling around the axis of the variable eccentric and having rotation on its

own axis always in the same direction, said shaft having an eccentric-pin, and means, substantially as described for connecting the pin with the variable eccentric for the purposes specified.

6. A revoluble shaft, a governor-wheel mounted thereon, a spur gear-wheel mounted on the other end of the shaft, a centrifugal governor, a variable eccentric connected with the governor, a slide-valve connected with the eccentric, a shaft traveling in a circle around the axis of the variable eccentric and having an eccentric-pin, a pinion on the end of the shaft opposite the eccentric-pin, said pinion meshing with the spur gear-wheel, and means, substantially as described, for connecting the pin with the variable eccentric, for the purposes specified.

7. A revoluble shaft, a governor-wheel mounted on said shaft, a non-revoluble spur gear mounted on the shaft outside of the governor-wheel, a second shaft parallel with the first and revolving in a circle around the axis of the first-mentioned shaft, a pinion on the end of the second shaft meshing with the gear-wheel on the other shaft, an eccentric-pin on the end of the second shaft opposite the pinion, a centrifugal governor, a plate or frame

pivoted at one end to the eccentric-pin and suspended at its other end from the governor and having an intermediate laterally-projected annular flange, an eccentric-ring mounted on said flange and a slide-valve secured to the eccentric, all substantially as described and specified.

8. The combination, with a rotating shaft, a governor-wheel mounted on the shaft, an eccentric, a governor-frame carrying the eccentric and oscillating around an eccentric-pivot, a centrifugal governor connected with and operating the governor-frame, a pivot mounted eccentrically on a rotating shaft, a rotating shaft carrying an eccentric-pivot, a pinion mounted on and moving with the shaft which carries the eccentric-pivot and a spur gear twice the diameter of the pinion meshing therewith and held in a fixed position, all substantially as described and for the purposes specified.

In witness whereof I have hereunto set my hand and seal, at Indianapolis, Indiana, this 19th day of January, A. D. 1898.

JAMES B. ALLFREE. [L. S.]

Witnesses:

JOSEPH A. MINTURN,
THOMAS H. DAVIDSON.