

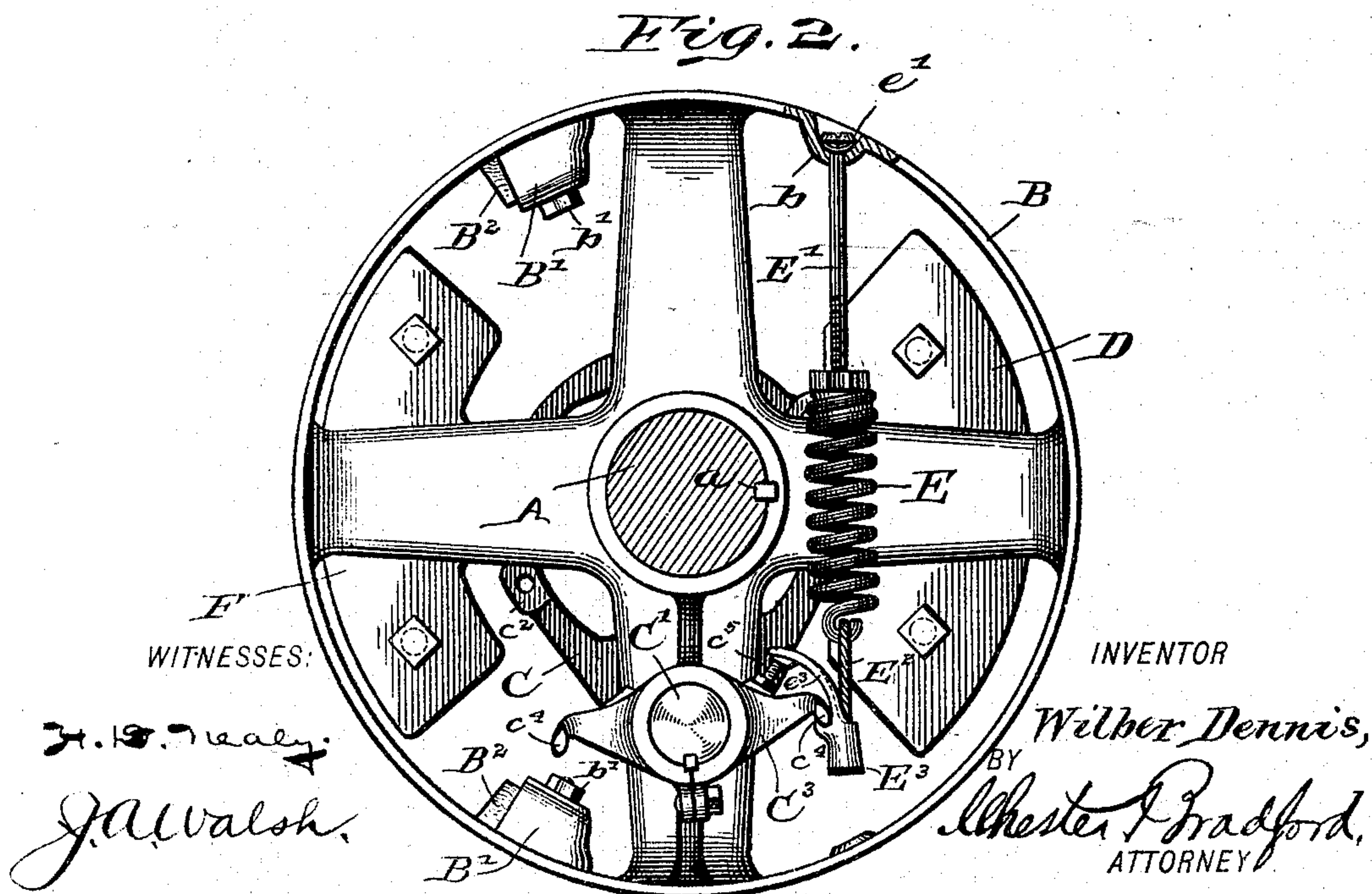
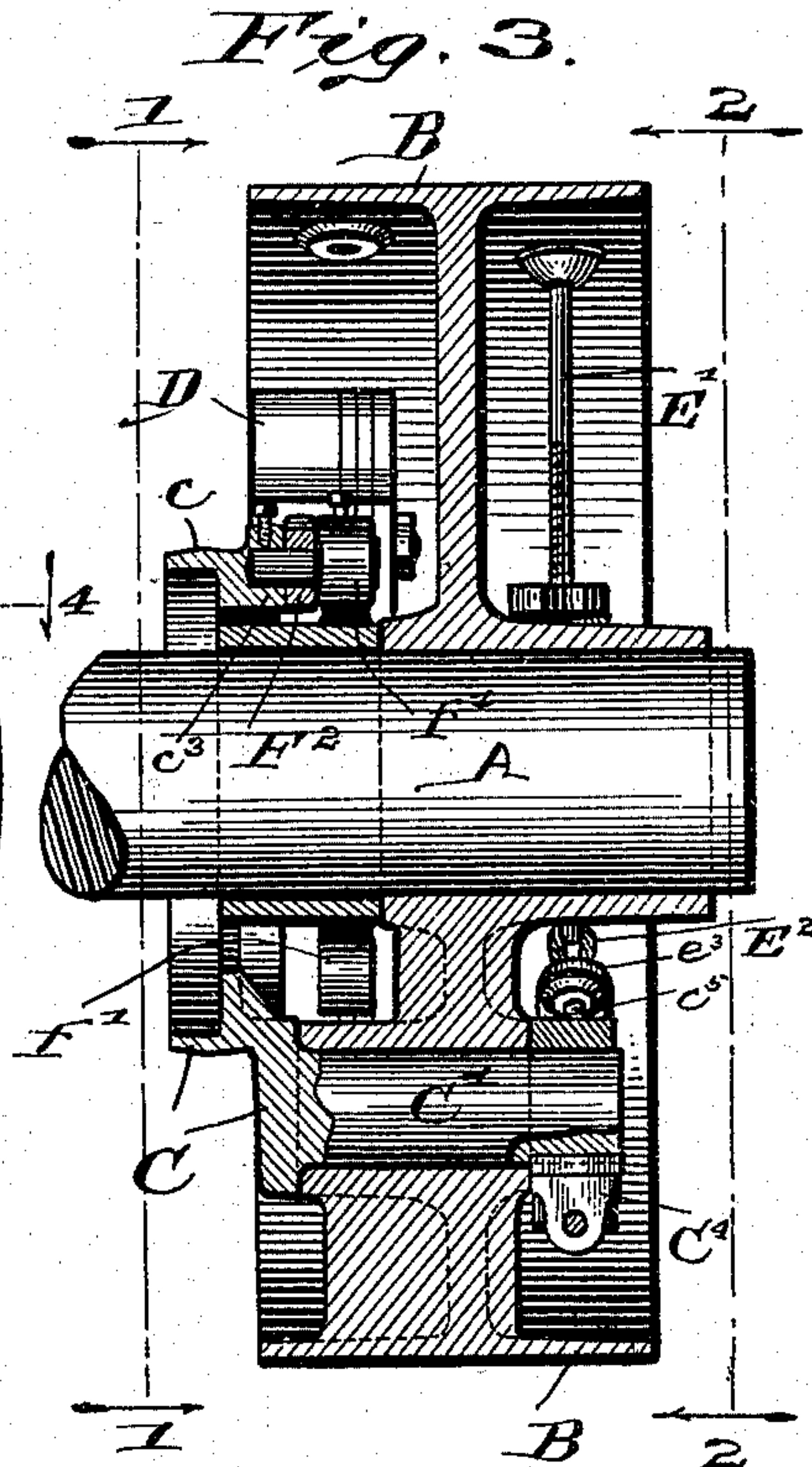
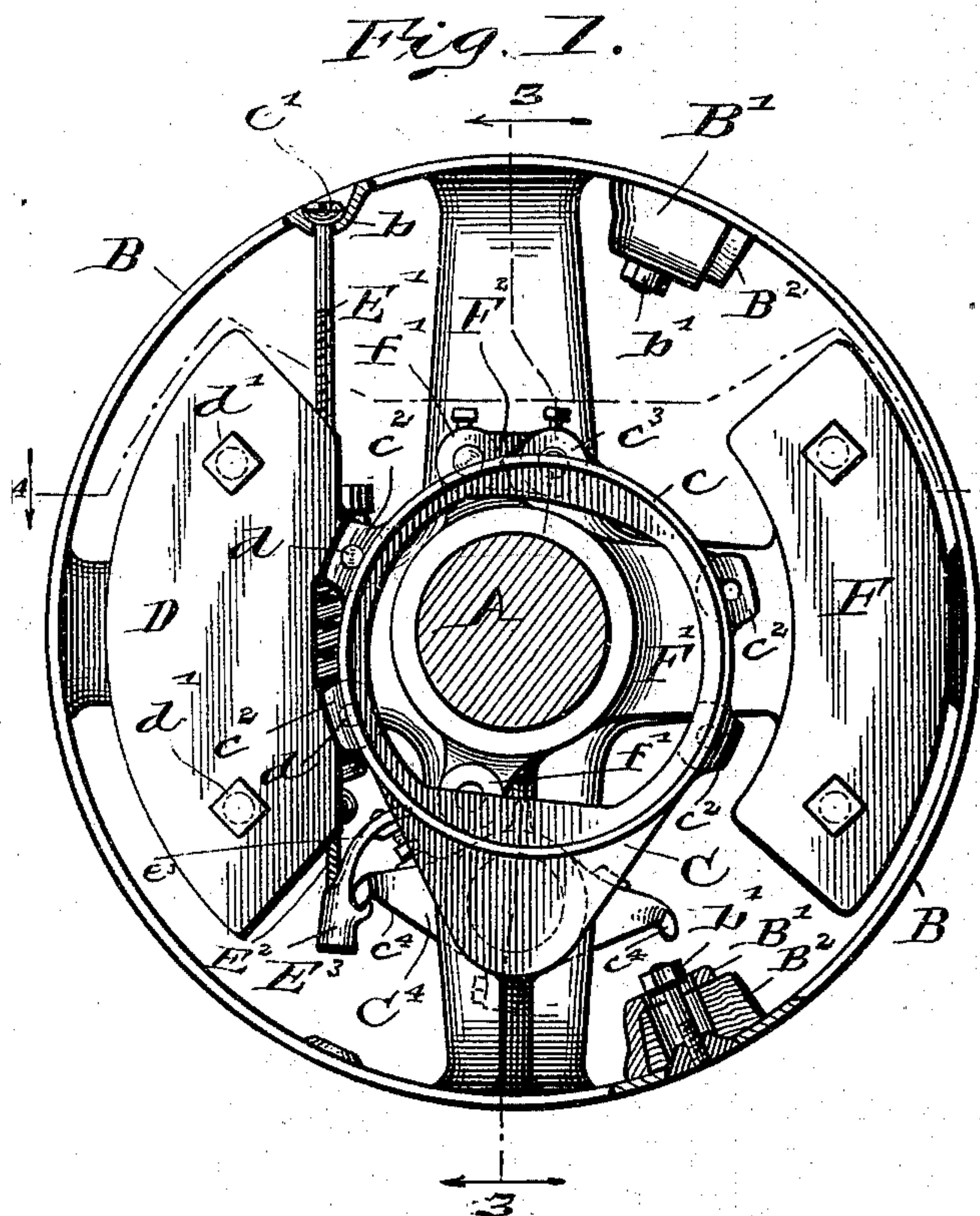
(No Model.)

2 Sheets—Sheet 1.

W. DENNIS.
GOVERNOR FOR ENGINES.

No. 559,054.

Patented Apr. 28, 1896.



WITNESSES:

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J. A. Walsh.

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(No Model.)

2 Sheets—Sheet 2.

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Fig. 4.

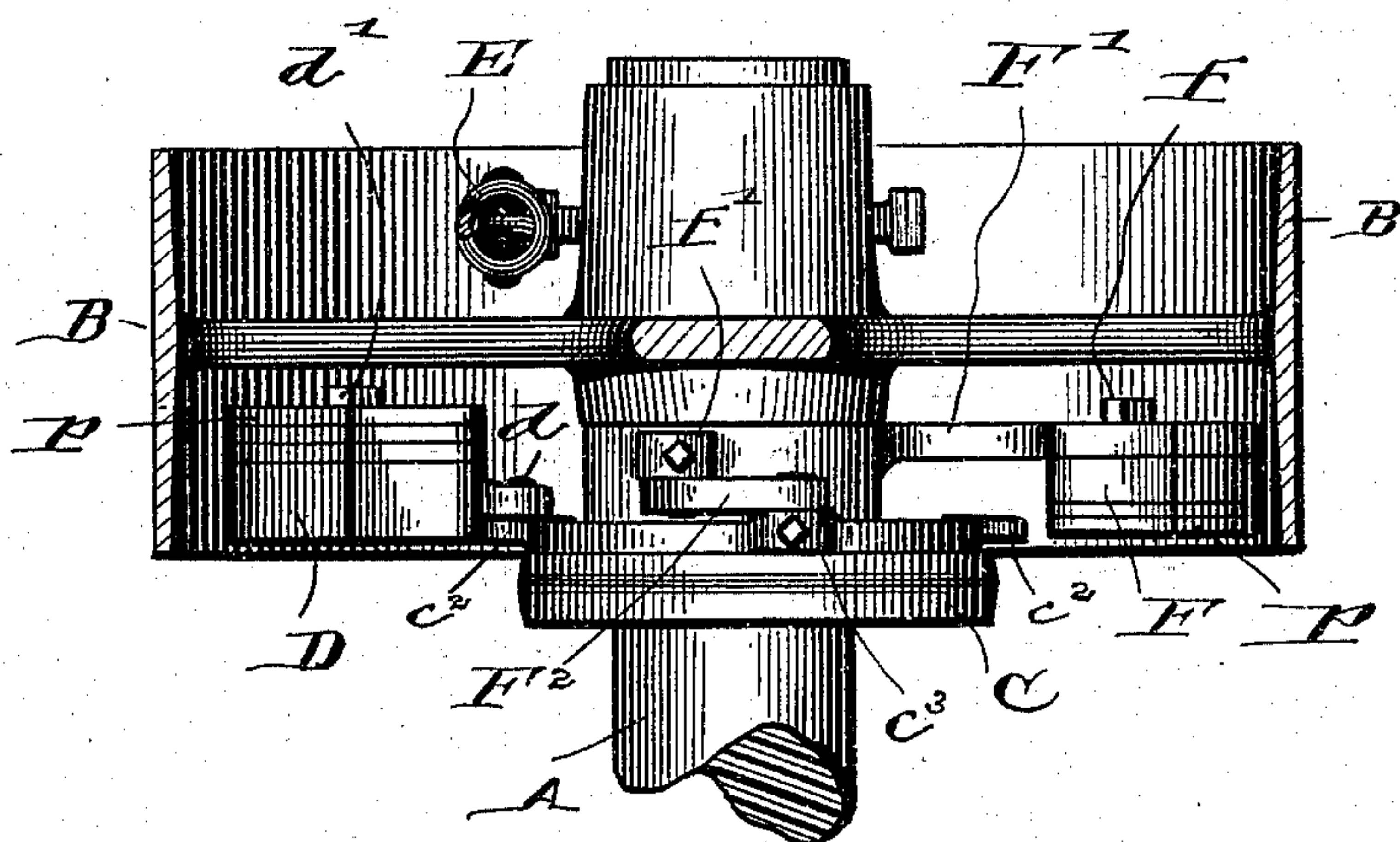


Fig. 5.

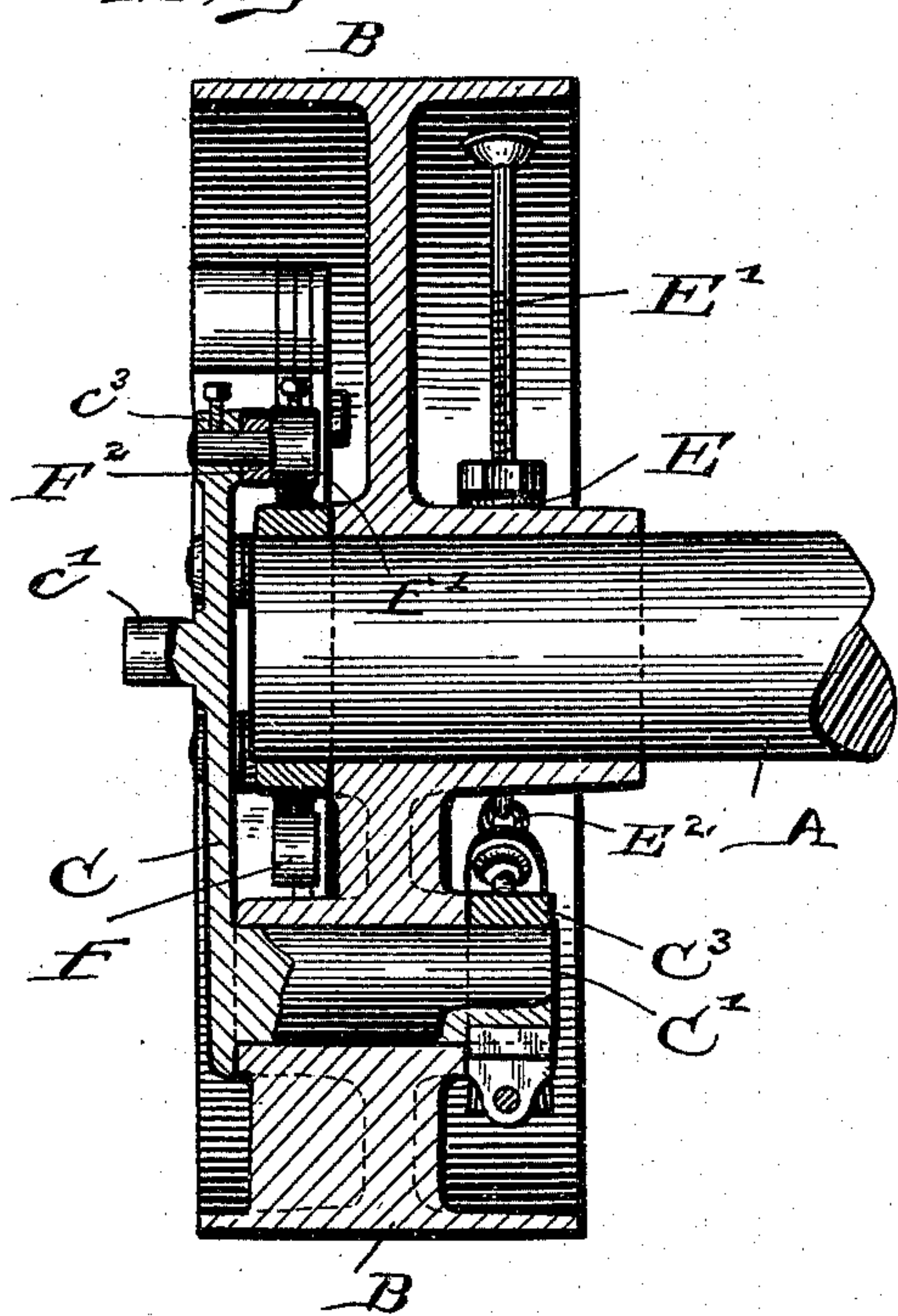
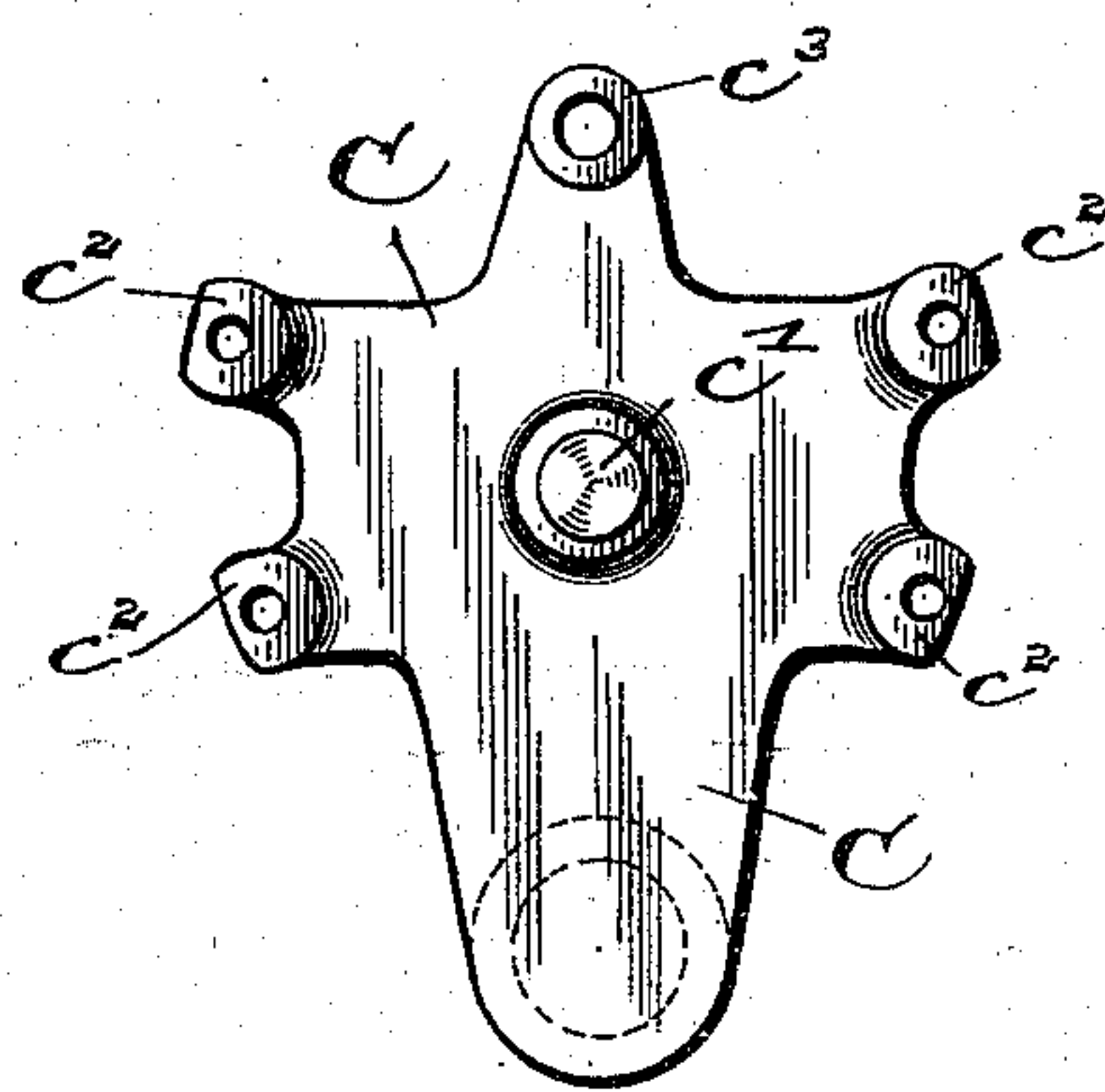


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILBER DENNIS, OF INDIANAPOLIS, INDIANA.

GOVERNOR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 559,054, dated April 28, 1896.

Application filed January 29, 1896. Serial No. 577,291. (No model.)

To all whom it may concern:

Be it known that I, WILBER DENNIS, 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 Governors for Engines, of which the following is a specification.

My invention relates to that class of engine-governors wherein the mechanism is secured upon a suitable frame or pulley mounted or secured upon the engine-shaft or upon a shaft having coincident motion therewith; and it consists in certain improvements whereby great steadiness of motion is secured and a substantially perfect balancing maintained.

It further consists in such a construction of the parts as enables the governor to be assembled to run in either direction, as may be desired, so that the governor may be applied to any engine without change, except in the matter of assembling the parts.

Said invention will be first fully described, and the novel features thereof then pointed out in the claims.

Referring to the accompanying drawings, which are made a part hereof and on which similar letters of reference indicate similar parts, Figure 1 is a side elevation of a governor with its frame or pulley embodying my said invention as seen from the dotted line 1 1 in Fig. 3; Fig. 2, an elevation of the opposite side thereof as seen from the dotted line 2 2 in Fig. 3; Fig. 3, a vertical sectional view as seen when looking in the direction indicated by the arrows from the dotted line 3 3 in Fig. 1; Fig. 4, a horizontal sectional view as seen when looking downwardly from the dotted line 4 4 in Fig. 1; Fig. 5, a view similar to Fig. 3, illustrating an alternative construction of the eccentric-frame; and Fig. 6, a detail elevation of said eccentric-frame separately.

In said drawings the portions marked A represent the engine-shaft or a shaft having coincident motion; B, the governor-frame or pulley thereon; C, the eccentric-frame; D, the "centrifugal" weight secured to said eccentric-frame; E, a spring operating oppositely thereto, and F an "inertia-weight."

In the following description, while of course it is understood that the parts are re-

volving and do not remain in the same position when in use, the terms "horizontal," "vertical," or such like terms will be understood to relate to lines or planes through or adjacent to the parts when in the positions shown in the drawings. Said drawings are also intended to illustrate my improved governor mechanism in its middle position, from which the parts may move in either direction as the speed is accelerated or decreased.

The shaft A is the ordinary engine-shaft, except as noted above, and is driven directly from the engine in the ordinary manner.

The frame or pulley B is mounted upon and rigidly secured to the shaft A, usually by means of a spline *a*, as shown in Fig. 2. It is provided with cup-like spaces *b* to receive the head *e'* of the spring-bolt E' and with sockets B' to receive the bumpers B², which are secured therein by bolts *b'*, as shown, and which are for the purpose of limiting the movement of the inertia-weight F, and are preferably of wood or rubber, or some other material calculated to soften the impact when said weight reaches the limit of its movement.

The eccentric-frame C is pivoted in a bearing in the main governor-frame B, having preferably a shaft-like extension C', which serves as such pivot, and extends up, around, or past the end of the shaft A, according to its construction, as shown most plainly in Figs. 3 and 5, the construction shown in Fig. 3 being also illustrated in Figs. 1, 2, and 4. Said eccentric-frame carries the eccentric by which the valve-rod is driven, said eccentric being either an annular rim *c*, as in the constructions shown in Figs. 1 to 4, inclusive, or a wrist-pin *c'*, as in the construction shown in Figs. 5 and 6. The center in each case being in the same position, the operation is manifestly the same, and the two forms simply show a choice of construction where the eccentric-frame passes over the end of the shaft on the outside, as shown in Fig. 5. Where the eccentric is on the inside of the wheel, as shown in Figs. 1 and 3, manifestly the annular-ring construction must be employed, and it may be employed, if desired, where the device passes the end of the shaft, as in Fig. 5. This frame rocks on its pivot-shaft C', and its center thus approaches or re-

cedes from the axis of the shaft A and thus effects the variation in stroke of the valve-rod, which is the work all such governors are designed to perform. This eccentric-frame 5 has a pair of lugs c^2 upon each side, to one pair of which the centrifugal weight D is attached by means of bolts. Said frame also has another lug c^3 at the top, to which to connect the link which connects this frame and 10 a corresponding lug on the lever-arm of the inertia-weight.

The eccentric-frame C has its two pairs of lugs c^2 directly opposite to each other on the two sides of said frame and equidistant from 15 a central line passing through said frame and equidistant from a plane at right angles therewith, so that if the centrifugal weight D be connected to the other side of the frame from that shown the proportions and arrangement 20 will be precisely the same, except as to the shifting of sides. The lug c^3 is at the opposite end of the frame from the pivot C' , and a line drawn through the center of the frame C would cut the centers of both said pivot and 25 said lug. Uniformity of operation, regardless of the direction of rotation, is thus secured.

The centrifugal weight D is rigidly secured to the lugs c^2 on the eccentric-frame C by 30 means of the bolts d , and operates, by means of centrifugal force, to carry said eccentric-frame transversely of the shaft A, and thus bring the centers of said shaft and of the eccentric nearer to each other as the speed in- 35 creases, with the well-known result of shortening the valve-stroke, and thus shutting off the steam earlier. As shown in the drawings, particularly in Fig. 4, said centrifugal weight D is provided with the plates p , of any re- 40 quired number and thickness, which are secured thereto by bolts d' . By adding or removing such plates the weight may be varied as desired, and consequently the force thereof acting upon the governor mechanism, and 45 this, of course, also somewhat affects the speed. Similar plates p are also secured to the inertia-weight F by bolts f and are capable of removal and attachment in a similar manner and for a similar purpose, and of 50 course these plates also may be of any number and of varying thickness, so that the adjustment may be varied as desired.

The spring E is arranged to act in opposition to the centrifugal force of the weight D, 55 as shown, and as will be readily understood. A cross-arm C^3 is secured upon that end of the pivot C' opposite to where the eccentric-frame C is connected thereto, and one member of this cross-arm serves as a lever to 60 which to connect the spring E. The construction and attachment of this spring and arm are best shown in Fig. 2, where the spring is shown as suspended from a rod E' , having a screw adjustment thereon, whereby the ten- 65 sion of the spring may be adjusted as desired. At the lower end the immediate means of attachment between the arm C^3 and the spring

is preferably a rope E^2 and a hook E^3 thereon, and which engages with what is substantially a knife-edge projection c^4 . As the force ex- 70 erted by the centrifugal weight at its different positions is rarely the equivalent of the spring-tension at the corresponding position, I have provided a curved bearing or arc e^3 , extending toward the axis from the hook E^3 , and 75 against which the flexible connecting device or rope E^2 may rest, and this is capable of being adjusted toward or from the pivot c' by means, preferably, of a screw-stop e^5 , inter- 80 posed between the hub of the arm C^3 and the free end of this arc e^3 . As will be readily understood, the adjustment just described varies the force of the spring, as the arc constitutes in effect the bearing-surface of a lever capa- 85 ble of being increased or diminished in length, whereby the spring-tension may be given a slightly greater or less effect in opposing the outward tendency of the centrifugal weight, as may be desired.

The inertia-weight F is mounted rigidly 90 upon or formed integrally with an arm F' , which is journaled upon the shaft A, and whose axis of rotation is therefore coincident with that of said shaft. A lug f' extends out from the hub of the arm F' , and the link F^2 95 is connected thereto and to the lug c^3 , and forms the means of union between the inertia-weight and the eccentric-frame and the centrifugal weight carried thereby. These lugs and their pin-holes are arranged at equal dis- 100 tances from the axis of the bearing and at equal angles to its center lines. This inertia-weight is thus also rendered capable of being shifted to the other side of the governor apparatus and helps to form a governor run- 105 ning in the opposite direction. Thus I am enabled by a different assemblage of the same parts to produce a governor which will control an engine running in either direction ac- 110 cording as the connections are made.

The use of an inertia-weight of one form and another is known, but most of them are pivoted eccentrically to the shaft-center about which they move, and when not embody various defects, which I have avoided. 115 The most common defect in such governors is that every alteration of position due to the required changes of the governor also changes the radial distance of the inertia-weight from the center of the shaft, which 120 produces or sets up a centrifugal force, disturbing proper action and causing undue oscillations in such governors, rendering some corrective device a necessity. A dash- 125 pot is sometimes used as such a device, but this is nothing but a brake operating against and impairing the efficiency of the governor, and this is especially true with sudden and violent fluctuations in the amount of power being furnished by the engine. Another 130 form of inertia-governor includes a wheel of some considerable weight journaled loosely upon the shaft and applies the inertia of this wheel to move the eccentric, but the centrifu-

gal force, which forms the ultimate source of government in all this class of governors, is in this case produced by weights pivoted within this inertia-wheel, which is an anomaly in this connection, as the centrifugal forces are supposed to be changing with every change of speed, while the inertia-wheel under theoretically perfect practice would never change its speed.

10 In my present invention in combining the axes of the eccentric pivot and of the centrifugal weight I have rid myself of one or more bearings, and in combining the eccentric-frame and ring with the centrifugal weight I have still further simplified the device. In journaling the inertia-weight concentric to the shaft the inertia is always confined to one concentric circle and is not disturbed by the absorption of its force required to carry its weight to and from the shaft-center, as in those pivoted eccentric to such center, nor is it disturbed by any centrifugal force generated within itself, as are those differently pivoted. Further, the centrifugal weight being placed opposite to the inertia-weight, such weights when properly proportioned serve to act as gravity-balances, one to the other, only a slight disturbance of this balance taking place as the centrifugal weight moves in or out from the center of the shaft. Further, the application of the spring-lever out of the plane of movement of the rest of the governor affords ample room for any form of connection I may see fit to use, and this I have taken advantage of to apply the adjustable arc lever or hook E^3 , and the flexible connection between said lever or hook and the spring is enabled, by means of the adjustment afforded by the set-screw c^5 , to pull over an arc of slightly greater or less radius as the lever C^3 oscillates on its pivot. This admits of its adjustment both to a spring of slightly unequal tension and to varying lengths and compensates for the differences of the centrifugal force of the weight at its different radial distances from the shaft-center. It also provides means whereby the engine can be made to run slightly faster when loaded than when running empty or unloaded.

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

1. The combination, in an engine-governor, with the governor mechanism, of an inertia-weight in the general form of an arm or lever provided with a hub or bearing at one end loosely journaled upon the shaft with which the governor revolves, which bearing is concentric with the axis of rotation of said shaft, and which has at the outer end a mass of sufficient weight to provide the inertia required for operating the governor, substantially as shown and described and for the purposes specified.

65 2. The combination, in an engine-governor, with the eccentric-plate, of a double-armed lever secured to the opposite end of the pivot-

shaft thereof from said frame, and a spring adapted to be attached to either end of said double-armed lever, a centrifugal weight adapted to be secured to either side of said eccentric-frame, and means for adjusting the said spring to either position, substantially as shown and described.

3. The combination, in an engine-governor, of an eccentric-frame carrying the eccentric whereby the valve-rod is operated, and provided with a pivot-shaft whereby it is supported in the governor-wheel, a centrifugal weight fastened to said eccentric-frame, an inertia-weight loosely journaled upon the governor-shaft with its weight or mass nearly opposite to the centrifugal weight, and a flexible connector from one to the other by means of which they are enabled to closely approximate to a gravity-balance, substantially as shown and described.

4. The combination, in a steam-engine governor, with the shaft, the main frame or pulley mounted thereon, an eccentric frame or plate pivoted to said frame-pulley, a centrifugal weight secured to said frame, an inertia-weight pivoted upon the shaft, and a flexible connection between said inertia-weight and said eccentric-frame, a lever secured to the pivot-shaft of said frame, and a spring extending from a fixed point on the wheel to an arm of said lever, substantially as and for the purposes described.

5. The combination, in an engine-governor, of the shaft, the main frame or pulley secured thereon, an eccentric frame or plate pivoted in a bearing in said wheel, a centrifugal weight secured to said eccentric-frame, an inertia-weight journaled upon said shaft and positioned oppositely to the centrifugal weight, a flexible connection between said inertia-weight and eccentric-frame or centrifugal weight, an arm or lever upon the pivot-shaft of the eccentric-frame, and a spring secured to said arm or lever and to a fixed point within the wheel, said several parts being arranged and operating substantially as shown and described.

6. The combination, in an engine-governor, with the shaft, frame or pulley, and weights, of an eccentric-frame carrying the centrifugal weight and provided with an arm upon its pivot-shaft, a spring connecting said arm and a fixed point upon the frame or wheel, the lower connection consisting of a flexible portion E^2 and a hook E^3 thereon, said hook being provided with the arc e^3 extending toward the axis therefrom whereby the pull on the spring may be adjusted as desired, substantially as shown and described.

In witness whereof I have hereunto set my hand and seal at Indianapolis, Indiana, this 21st day of January, A. D. 1896.

WILBER DENNIS. [L. S.]

Witnesses:

JAMES A. WALSH,
H. D. NEALY.