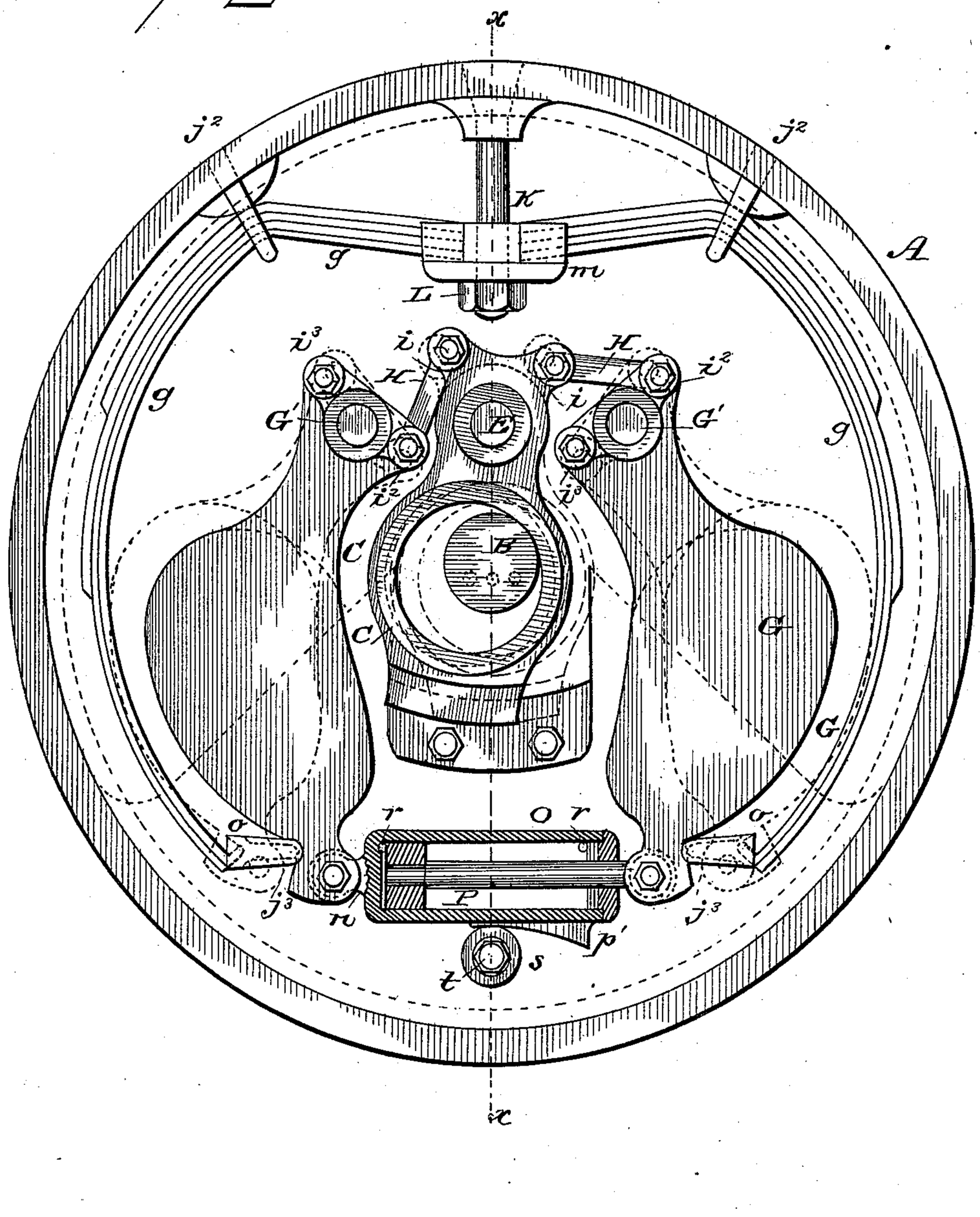
(No Model.) 4 Sheets—Sheet 1.

H. T. GILES.

STEAM ENGINE GOVERNOR.

No. 363,888. Patented May 31, 1887.

Fig. 1.



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4 Sheets—Sheet 2.

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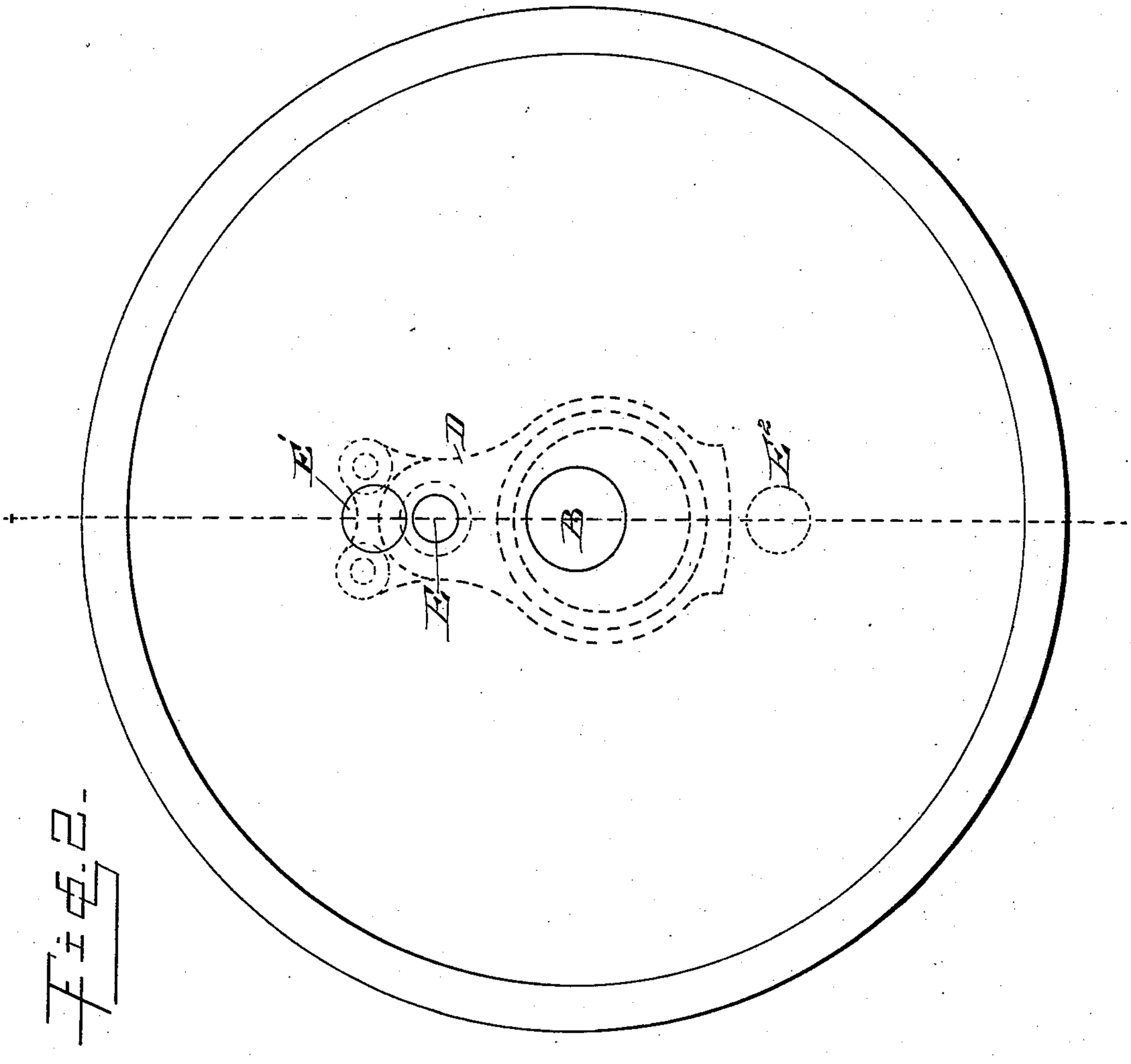

Fig. 2.

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Fig. 3.

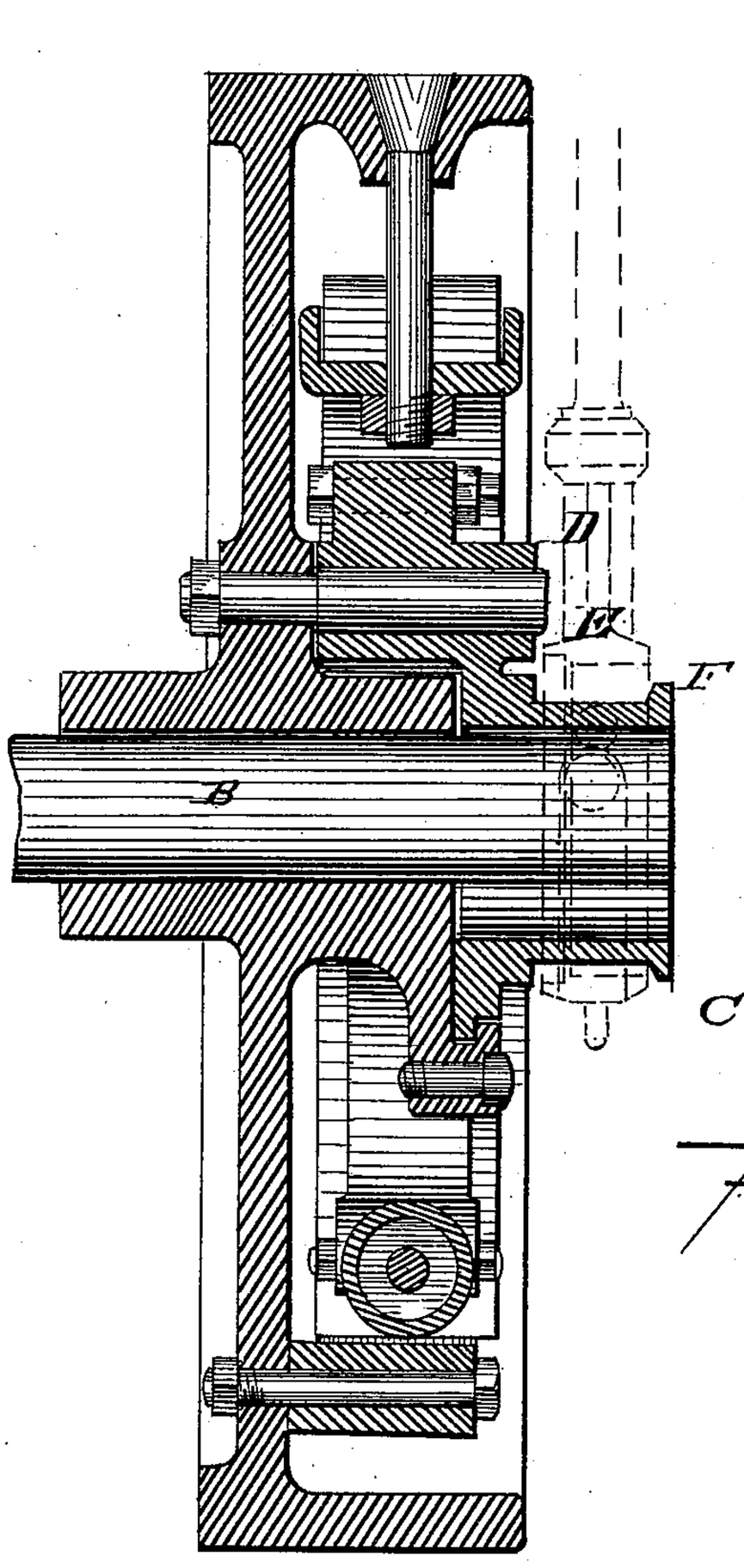

Fig. 4.

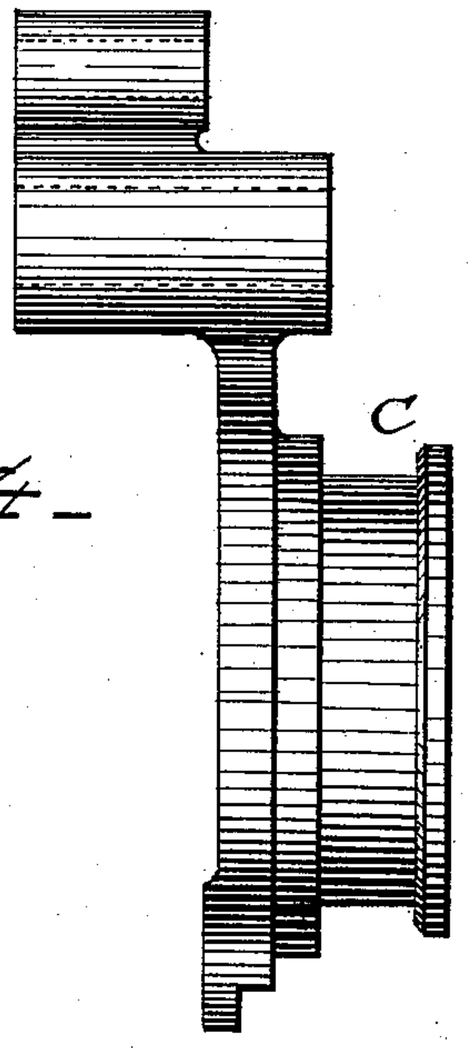

Fig. 5.

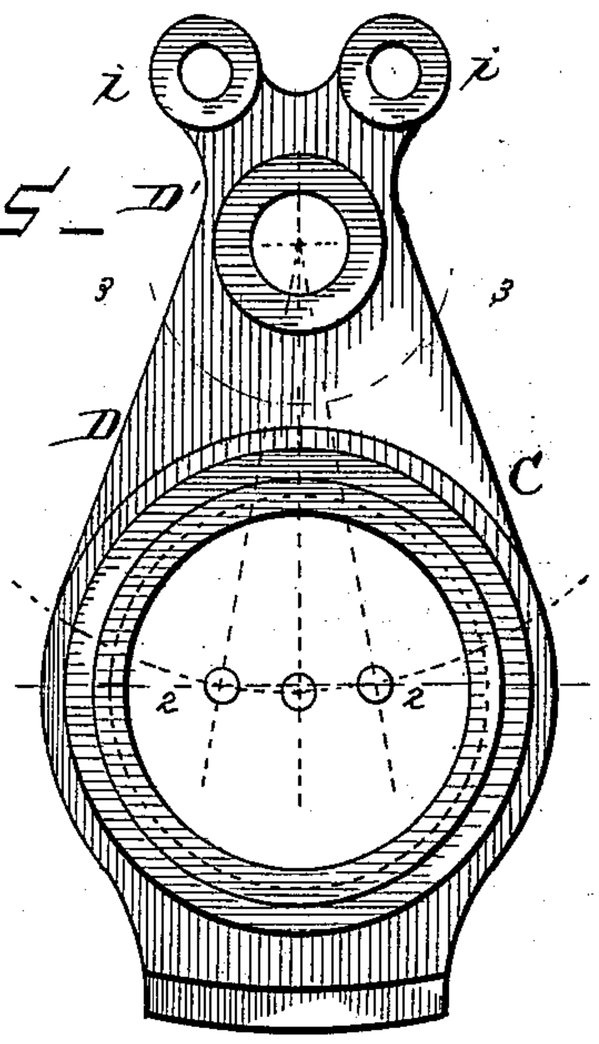

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Fig. 8.

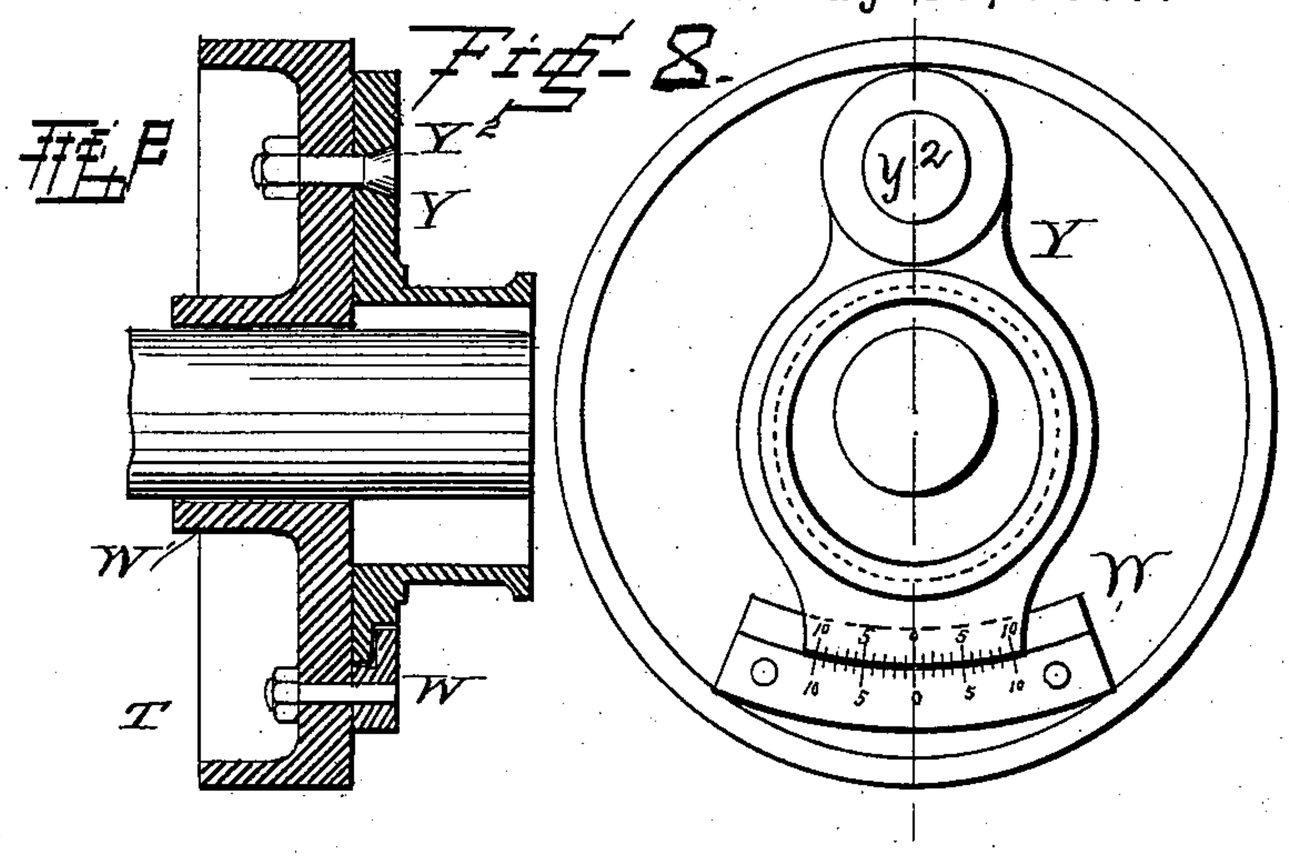
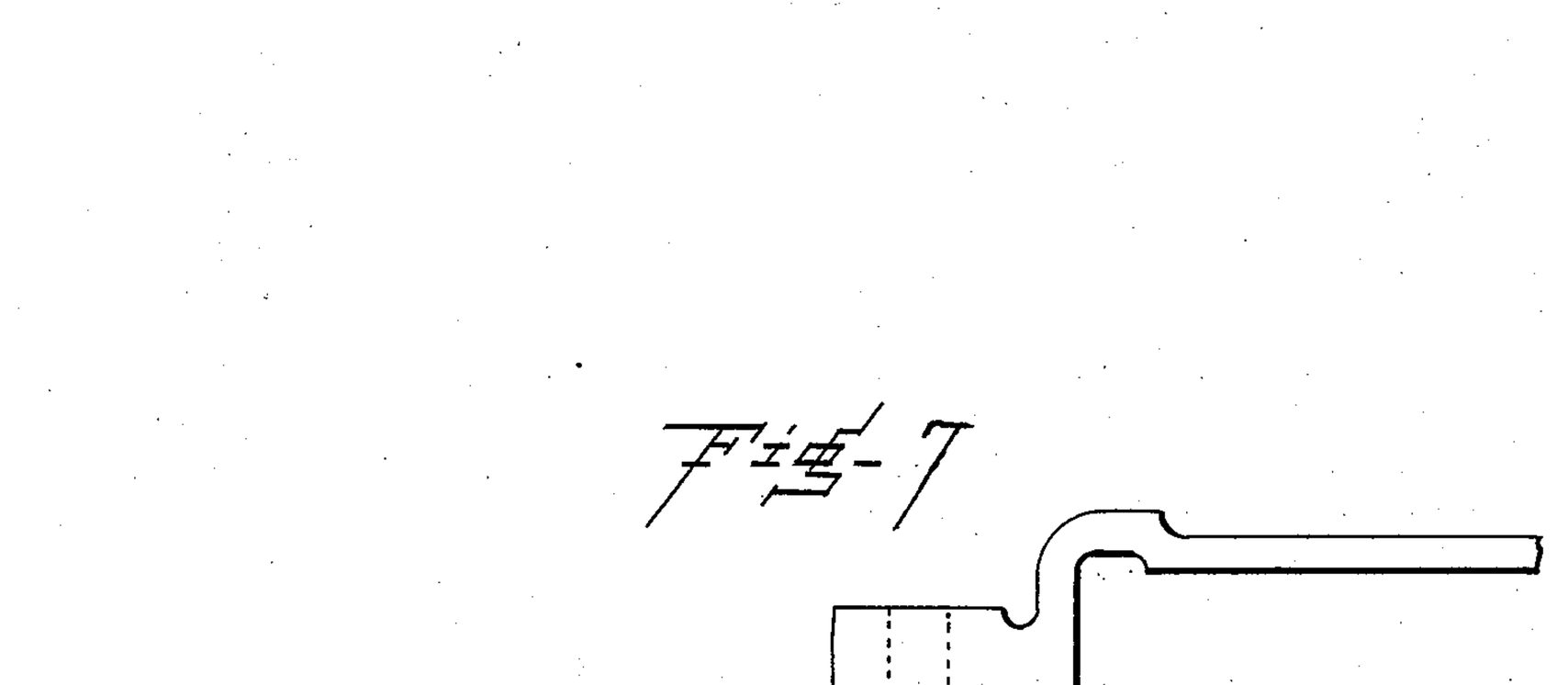


Fig. 7

Fig. 6.



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UNITED STATES PATENT OFFICE.

HENRY T. GILES, OF WASHINGTON, DISTRICT OF COLUMBIA.

STEAM-ENGINE GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 363,888, dated May 31, 1887.

Application filed September 12, 1884. Serial No. 142,878. (No model.)

To all whom it may concern:

Be it known that I, HENRY T. GILES, a citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Steam-Engine Governors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to that class of automatic disk-governors for steam-engines in which the throw of a valve-operating eccentric and the travel of the valve operated thereby is effected by centrifugal force acting upon counterbalanced weights; and it has for its objects the improvement in the relative position, construction, and arrangement of the principal parts of a governor—such as the eccentric, the centrifugal levers, the centripetal springs, and other means for counterbalancing the weights and overcoming their shock—and also in the manner of connecting the centrifugal levers to the valve-rod without the use of the eccentric, whereby a comparatively higher initial pressure of steam is produced than is ordinarily obtained in the cylinder at the commencement of the stroke on a short cut-off, the direction of motion of the engine easily reversed, the governor rendered more delicate, sensitive, and uniform in action, and under certain conditions the employment of the eccentric dispensed with. These improvements are illustrated in the accompanying drawings, in which—

Figure 1 is a face view of a disk or case provided with the principal features of the invention, with the eccentric-strap omitted; Fig. 2, a view of the back of the case, showing the relative position of the main shaft, pivotal support of eccentric, and crank-pin; Fig. 3, a vertical section on line *x x* of Fig. 1, with addition of eccentric-strap in dotted lines; Fig. 4, an edge view of the eccentric, and Fig. 5 a front view of the same; Fig. 6, a detached view of air-cylinder; Fig. 7, a detail of the same; Fig. 8, a front and Fig. 9 a side sectional view of an eccentric, showing graduated plate for indicating length of throw.

In the drawings, A is a driving pulley, disk, or case, within which the governor mechanism is placed. It is rigidly mounted on the main shaft B.

C is an eccentric movably embracing the shaft B, and provided with an arm, D, which is pivotally connected to the stud E.

In the back view, Fig. 2, E′ is the crank-pin, on a direct line with E, the pivotal support of the eccentric, and the center of the shaft B. E^2 shows the same relative position of the crank-pin when used in connection with a reversed rock-shaft.

In Fig. 3, in dotted lines, is shown the eccentric-strap F, which is applied in any approved manner to the eccentric and valve-rod.

G G are weighted centrifugal levers, each of which is pivoted on a stud, G′, and hung by links H to lugs *i* on arm D of the eccentric by means of bolts which pass through the lugs *i*. The links H are connected to the weighted levers by bolts passing through lug i^2 on the levers.

The eccentric may be thrown to the other side of the main shaft and the motion of the engine reversed by simply disconnecting the links H from the lugs i^2 of the weights and connecting them to the opposite lugs, i^3, of the weights. The requisite centripetal force is given by the elliptic springs J, extending around the inner sides of the disk and secured thereto by means of bosses j^2. These springs are turned across the upper part of the disk, as shown in Fig. 1, and there supported by a screw-bolt, K, provided with a nut, L, and a plate, M, through which the bolt is passed. The ends of the springs are placed upon the plate M, and the tension of the springs is regulated by turning the nut L from or against the plate. The lower ends of the springs terminate in a hook, *o*, curved as shown, which hook fits into the notch of a spring-carrier, j^3, placed loosely against a curve in the lower end of the weighted lever and held there by the pressure of the spring.

O is an air-cylinder, which at its closed end is provided with a lug, *n*, by which it is pivotally connected to one of the weighted levers. It is also provided with a piston and piston-rod, P, which rod passes through a suitable stuffing-box and is connected to the lower end of the opposite weighted lever.

Air is to be admitted to or discharged from

the cylinder in accordance with the movement of the piston through passages *r* in the cylinder from pipe *r'* on opposite sides of piston-head. Air may be admitted through passages r^2, as shown in Fig. 7, which are partly closed by thumb-screws r^3, and through these passages oil may be introduced to lubricate the piston. The cylinder may also be lubricated by admitting the oil through the pipe *r'* and the passages *r* by means of a cup and turn-cock, r^4, to both sides of the piston-head. The cylinder is also provided on its lower side with a shoe, *p'*, having a curved face, on which travels a friction-wheel, S, placed on a stud, *t*, extending from the disk. By this means the tendency to bind the piston-rod when the weight to which it is attached is expanded is obviated, and friction caused by the reciprocal movement of the cylinder is also prevented. It is not essential that it be connected to the weighted levers placed in the precise position shown, although I prefer that position.

The pneumatic cylinder as thus constructed acts as an air-cushion against the movement of the weights, thus aiding in giving steadiness and regularity to the movable parts of the governor, as well as increased accuracy to the cut-off action of the valve.

The normal position of the weights and eccentric before being thrown out by the action of the engine is shown by the full lines, Fig. 1, and the position of the parts at the extreme throw of the valve.

The weights and eccentric are shown by the dotted lines in the same figure at zero. It will be seen that the parts as thus described are so arranged that when in the latter position a vertical line drawn through the center of the disk, as *x x*, Fig. 1, will pass directly through the center of the main shaft, eccentric, and the center of the pivotal support E of the eccentric. When the engine is on its center, the center of the eccentric extends beyond the center of the driving-shaft fifty to sixty one-hundredths of the full lap of the valve, depending on amount of valve travel required by different-sized engines. By this arrangement a circular advance of the eccentric, as it moves toward the center, is obtained. The extent of this circular advance is indicated by the circular and horizontal dotted lines in Fig. 5. The extent of throw of the eccentric is indicated by the straight dotted lines 2 2 in Fig. 5. The range of cut-off is from zero to about two-thirds of the stroke of the engine. By this arrangement and operation of the parts an increased lead is obtained at a short cut-off.

The line of center of the crank-pin, rocker-arm, and rock-shaft is the same as is above explained in relation to the eccentric and main shaft in Fig. 1.

The same motion of connecting and valve rods and the same increase of lead may be obtained by my invention by dispensing with the eccentric, or that part of it shown below the dotted lines 3 3, Fig. 5, and extending the rocker-shaft into the part D', thus making the part cut away answering as a rocking fulcrum, to which the weights are connected. The respective centers of the supporting and actuating parts are maintained in a direct line, as before stated.

In Fig. 8 I have shown a modification, Y, of the eccentric to be used in the place of the ordinary eccentric in a variable instead of an automatic cut-off, in which W is a graduated plate bolted to a disk, W', behind the eccentric Y, and which is keyed to the main shaft. The eccentric swings from a bolt, y^2, passing through the disk W', and also is provided with a correspondingly-graduated scale, to show the different points of cut-off when the eccentric is thrown to the right or left of line of center in reversing the motion of the engine. This modification I do not herein claim, but reserve the right to file another application for the same.

The operation of the invention will be readily seen. As the disk or case revolves, the centrifugal force developed in the weighted levers throws them outward, the centripetal force being furnished by the stiff elliptic springs coupled and arranged so as to be independent of gravity, and the parts being centered, as described, the weighted levers respond instantaneously to the variations in the speed of the containing-case from a full to a minimum stroke, as indicated in Fig. 1, which movement determines the circular advance of the eccentric relative to the main shaft, as also indicated in Fig. 1, and thereby also controls the point of cut-off. As the eccentric swings down from full stroke to zero the center of the eccentric follows the line of curvature, and gives preadmission or lead while cutting off at short stroke, thus more nearly approximating a horizontal steam-line up to the point of cut-off, while maintaining a comparatively higher initial and boiler pressure than is ordinarily obtained, as may be shown by an indicator-card.

By my improvement, the lap of the valve being positive and the valve parallel with the piston-rod when the engine is on its centers, and the eccentric when at zero being hung to swing at right angles to the line of centers for the admission of steam, an angular advance of the eccentric is dispensed with, and less movement of the same is required for the regulation of the engine.

Having thus described my invention, what I claim is—

1. In an automatic steam-engine governor, the combination of the case, the driving-shaft, the eccentric and its pivotal support, and the crank-pin, the said eccentric-support and the crank-pin arranged in a direct line with each other and with the center of the said shaft, substantially as described.

2. In an automatic steam-engine governor, the case, the driving-shaft, the eccentric and its pivotal support, said support arranged in a direct line with the center of the shaft, in

combination with the weighted levers and their pivotal supports, the said pivotal supports of the weights fixed on a horizontal line with said pivotal support of the eccentric, substantially as described.

3. In an automatic steam-engine governor, the combination of the weighted centrifugal levers G, provided with lugs i^2 and i^3, the links H, and the eccentric C, provided with the lugs i, to which the said levers are attached by means of the link, whereby the eccentric may be thrown to the other side of the main shaft, and the motion of the engine reversed by attaching the links to the opposite lugs on the weights, substantially as described.

4. The weighted levers, in combination with the elliptic springs, provided with the curved ends O, and the spring-carriers j^3, substantially as and for the purpose described.

5. In combination with the disk, the elliptic springs extending around the inner sides of the disk and across its upper part, the plate M, to which the upper ends of the springs are secured, the screw bolt and nut, by which the tension of said springs against the plate is regulated, substantially as described.

6. In an automatic steam-engine governor, the air-cylinder provided with piston and air-passages on both sides of the piston, in combination with weighted levers, to which said cylinder is directly pivoted, substantially as and for the purpose described.

7. The combination, with the weighted levers, of the air-cylinder provided with the curved shoe, and the friction-wheel, substantially as and for the purpose described.

8. The combination, in a steam-engine governor, of the eccentric C, provided with lugs i, the weighted levers, the elliptic springs, the air-cylinder, and the valve-rod, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY T. GILES.

Witnesses:
J. H. BLACKWOOD,
R. G. DU BOIS.