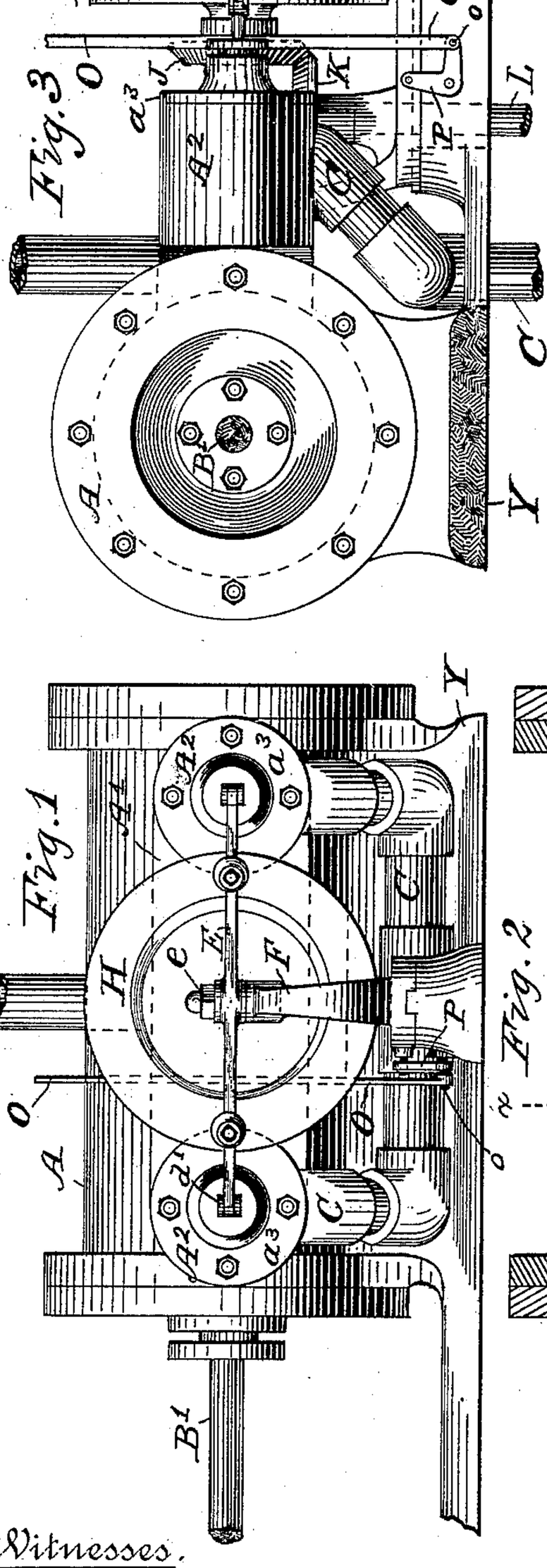
(No Model.)

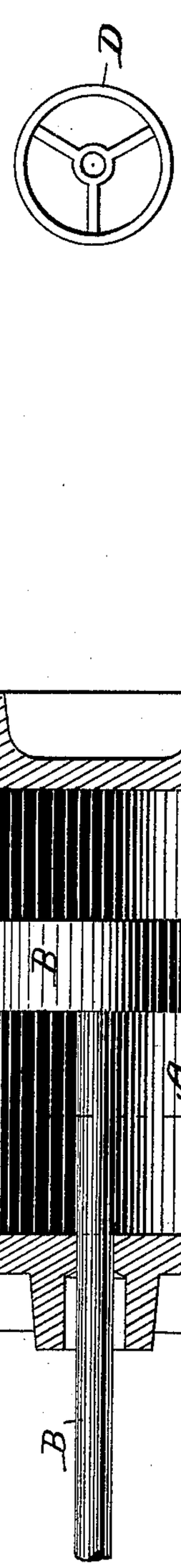
2 Sheets—Sheet 1.

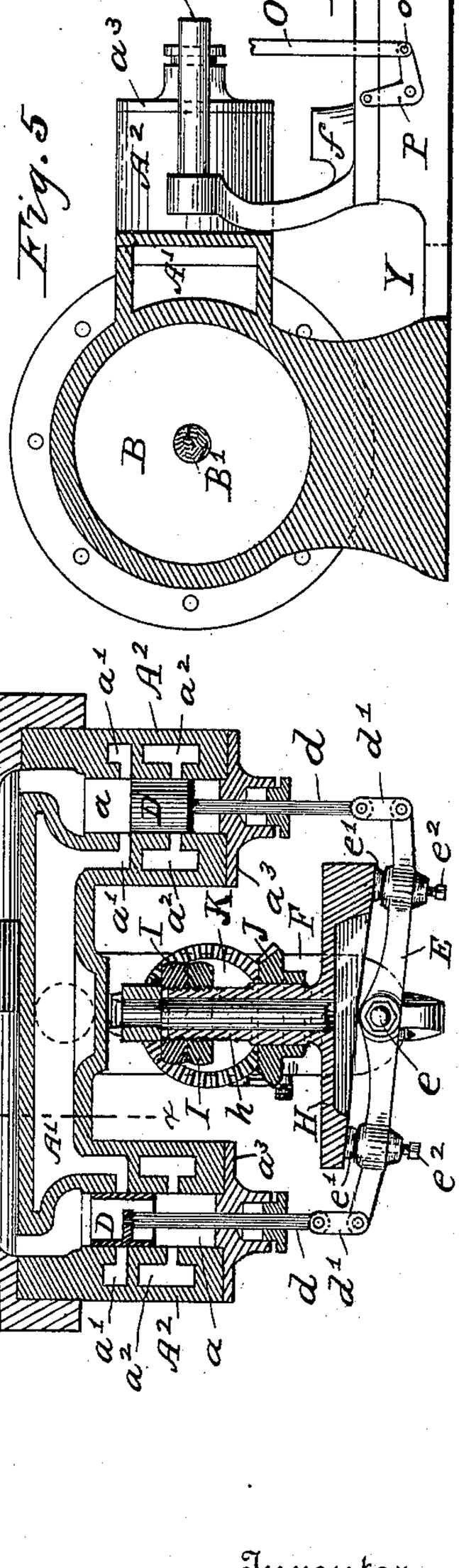
E. F. GORDON.

VALVE MECHANISM.

No. 391,960. Patented Oct. 30, 1888.







Witnesses.

C. O. Sass.

John H. Stone.

Inventor.

Edward F. Gordon.

By his Attorney J. B. Thursby.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

E. F. GORDON.

VALVE MECHANISM.

No. 391,960. Patented Oct. 30, 1888.

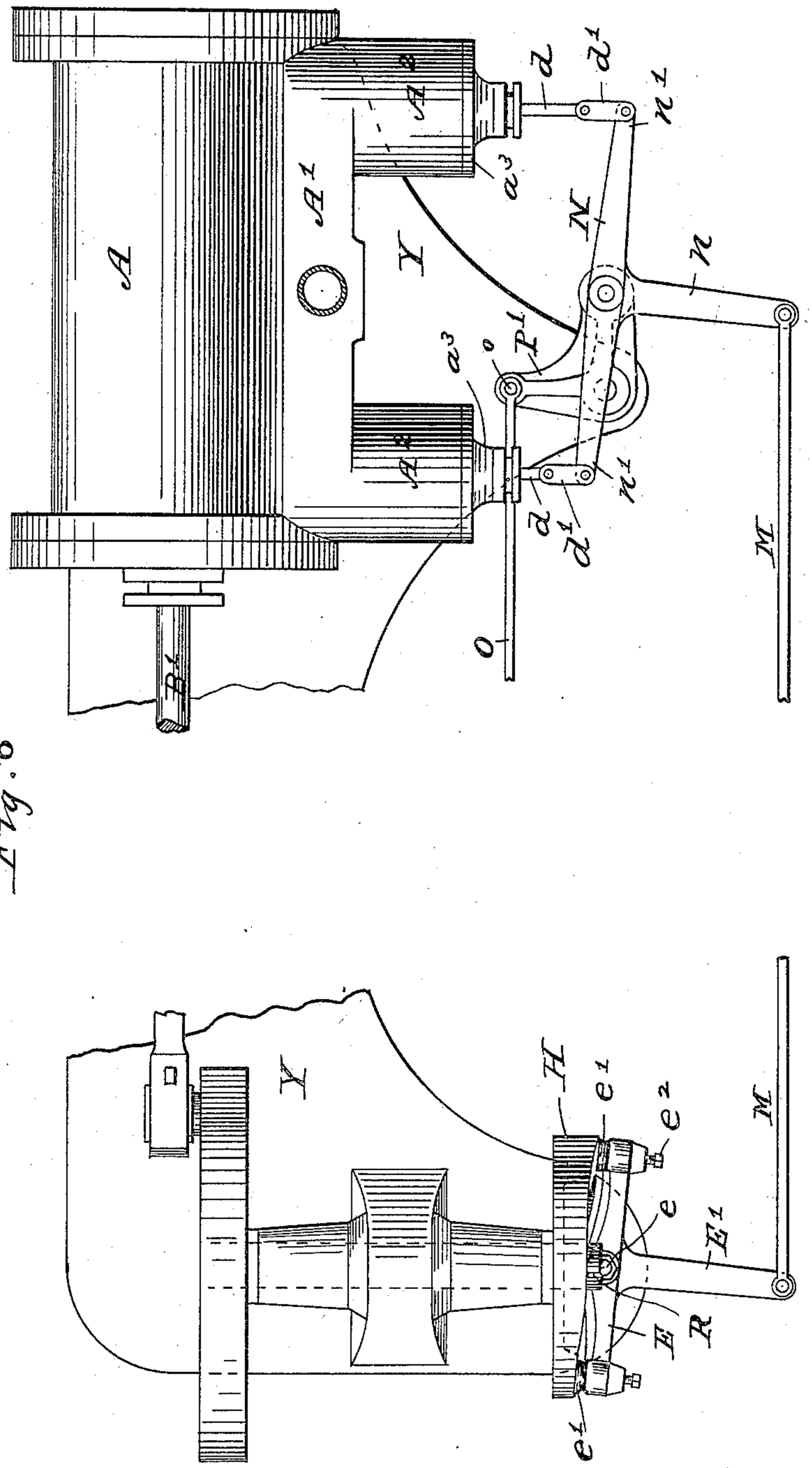


Fig. 1.

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UNITED STATES PATENT OFFICE.

EDWARD F. GORDON, OF CONCORD, NEW HAMPSHIRE, ASSIGNOR OF ONE-HALF TO HORATIO HOBBS, OF SAME PLACE.

VALVE MECHANISM.

SPECIFICATION forming part of Letters Patent No. 391,960, dated October 30, 1888.

Application filed January 3, 1888. Serial No. 259,656. (No model.)

To all whom it may concern:

Be it known that I, EDWARD F. GORDON, a citizen of the United States, residing at Concord, in the county of Merrimac and State of New Hampshire, have invented certain new and useful Improvements in Valve Mechanism, of which the following is a specification.

It is a well-known fact that an eccentric or crank gives an unvarying motion, and that irregular cams which have been used to obtain irregular motion and which have heretofore been applied to operate the valves of an engine, are defective from the fact that they are not positive, and can only be used on that class of slow-running engines where a spring is required to keep the reciprocating parts of valve mechanism in contact with the surface of the movable or rotative irregular cams.

The object of the present invention is to provide in a quick-running engine a valve mechanism which for simplicity of construction and variation of cut-off shall yield all the advantages and avoid the disadvantages of the valves and valve mechanism of the slower type of engine.

The invention consists in providing a mechanism whereby a valve (adapted for covering the supply and exhaust ports) may be given a changeable motion which shall give in one valve a variable cut-off without diminishing the exhaust-aperture, which is fully described and pointed out in the following specification and claims, and clearly illustrated in the accompanying drawings, forming an inseparable part thereof, of which—

Figure 1 represents a side elevation of a steam-cylinder provided with my improved valve mechanism. Fig. 2 is a sectional plan view in which one form of valve adapted to serve my purpose is shown. Fig. 3 is an end elevation of the same. Fig. 4 is an enlarged end view of one of the valves. Fig. 5 is a cross-section of the steam-cylinder, representing the part found at the right of the cutting-line $x\ x$ in Fig. 2, with a portion of the engine-bed and a sliding frame, which carries parts of the valve mechanism, shown in elevation and in its proper position relative to the cylinder. Fig. 6 is a broken plan view of an engine to which my improvements are applied.

Similar letters indicate like parts.

A is a steam-cylinder, B its piston, and B′ the piston-rod.

A′ is the steam-chest, which may be provided with valve-housings A^2 near either end thereof. These may be formed rectangular, if preferred, or they may be cylindrical, as shown, and project at right angles from said chest A′, each containing a valve-chamber, a, and two independent chambers, $a'\ a^2$, the chamber a' connecting with the steam-chest A′ and valve-chamber a and the chamber a^2 with said valve-chamber and suitable exhaust-pipes, C. Hollow cylinder-valves D D are fitted to said valve-chambers $a\ a$, operating at right angles with the steam-piston, and their stems $d\ d$ pass through ordinary packing-boxes in the heads $a^3\ a^3$, which close the valve-housings A^2.

When the valves are in the position shown in Fig. 2, it will be seen that live steam can pass from the steam chest A′ through the passages or chambers $a'\ a$ to the steam-cylinder A at one end, and exhaust at the opposite end through the chamber a and the hollow valve D into the chamber a^2, and thence into the exhaust-pipe C. The use of the ordinary eccentric or regular cams to operate these valves would fail to accomplish the purpose of my invention, and irregular cams for producing a variable cut-off require independent valves for the exhaust; hence, in order to dispense with the independent exhaust and obtain equally as good results, I provide valve mechanism, substantially such as represented in the drawings, consisting of a lever, E, pivoted at each end to a valve-stem, d, or a short connecting-bar, d', attached thereto, and fulcrumed midway from either end at e to to a sliding frame, F, mounted on engine-bed, as shown, and adapted to move at right angles with the steam-cylinder A. In the opposite end of the frame F is mounted a horizontal stud, G, upon which is mounted the hub h of an irregular disk cam, H. The lever E extends across the irregular face of said cam-disk, and is provided equidistant from each end with suitable socket-bearings, e', and adjusting-screws e^2 for regulating their contact with irregular side of said cam-disk. One or more nuts, I, may be threaded to the end of the hub h, acting against the frame F, for the purpose of adjusting the cam-disk relative to the lever E in order to insure perfect contact one with the other.

For transmitting a positive motion from the main shaft to the disk cam H gearing may be employed, a portion of such gearing being rep-

resented in the drawings. The bevel-gear J, which is mounted upon the hub *h* of the disk cam H, meshes with the bevel-gear K, mounted on a vertical shaft, L, which is carried in a bearing, *f*, provided upon the frame F, and the said shaft L may be connected by suitable shafts and gears to the main shaft. The gearing or belt-connection may, however, be dispensed with entirely by a modification of the application of my improved mechanism, such as shown in Fig. 6—viz., by applying the disk cam H to the main or driving shaft of an engine. In the latter case the lever E may be provided with a perpendicular extension projecting equidistant from either end, and to this extension E′ is pivoted one end of a rod, M, the other end of said rod being connected in like manner to a lever, N, which is similar in form to the lever E, having an arm, *n*, corresponding to the arm or extension E′ of said lever E. The ends *n′ n′* operate the valve-stems *d d*, and the rod M serves to move the levers E N in unison.

Instead of varying the supply of steam to the cylinder by a governor in the usual manner, I connect the rod O with a governor in a manner to give said rod a reciprocal movement, one end being pivoted at *o* to a bell-crank, P, which in Figs. 3 and 5 is shown to be pivoted to a portion of the engine-bed Y and the sliding-frame F, carrying the disk cam H and lever E. By this means the valves D are varied in their relation to the steam-ports automatically by means of the governor. The same can be accomplished with the disk cam H on the main shaft R, as shown in Fig. 6, by mounting a bell-crank, P′, upon the engine-bed in a manner to support the lever N and connect with the rod O, by which means the lever N is automatically varied at its fulcrum-point and at right angles with the cylinder parallel with the piston-valves.

Having described my improvements, what I claim as new is—

1. In a steam-engine, the combination of valve-actuating mechanism comprising an irregular disk cam and a lever pivoted and supported midway from either end and adapted for continuous contact therewith at points diametrically opposite to each other.

2. The combination, with an engine-cylinder and valve, of valve-actuating mechanism consisting of an irregular disk cam, and a lever pivoted and supported midway from either end extending across the irregular side of said disk and adapted for continuous contact therewith at points diametrically opposite to each other.

3. The combination of the valves and valve-stems, an irregular disk cam, and a lever supported midway from either end and adapted for continuous contact with said cam, having its fulcrum-point variable at right angles with the cylinder, whereby a variable cut-off is obtained.

4. The combination, with the valves and valve-stems and a lever supported and fulcrumed at a point midway from either end and adapted to transmit an alternate reciprocal motion to the said valves in a direction at right angles with the cylinder, of a similar lever held in continuous contact with an irregular disk cam at points diametrically opposite and fulcrumed at a point within the radius of said cam, the said cam, and suitable connections between the cam-actuated lever and the said lever connected with the valve-rods, substantially for the purpose explained.

5. The combination of valves and valve-stems with a lever supported and fulcrumed at a point midway from either end and adapted to transmit an alternate reciprocal motion to the said valves, and means whereby said lever is automatically variable at its point of fulcrum relative to the steam-cylinder comprising an adjustable carrying-frame, to which said lever is fulcrumed, and suitable connections with a governor, substantially for the purpose described.

6. In valve mechanism, a disk cam having an angular irregular side, the said irregularities consisting of protuberances and depressions arranged diametrically opposite to each other, a lever pivoted and supported at a point within the radius of said disk and midway from either end, having suitable adjustable bearings adapted for continuous contact (at points diametrically opposite) with said disk cam, and means whereby motion is transmitted from the driving-shaft to the valves, substantially for the purpose set forth.

7. In valve mechanism, a disk cam having an angular irregular side, a lever pivoted and supported at a point within the radius of said disk cam and midway from either end, having suitable adjustable bearings adapted for continuous contact (at points diametrically opposite) with said disk cam, the said support or fulcrum-point of said lever being automatically variable to and from the steam-cylinder, all adapted and arranged in a manner to transmit the desired motion from the driving-shaft to the valves, substantially for the purpose set forth.

8. In valve mechanism, means for automatically varying both terminal points of the stroke of the valves relative to the steam-ports without changing the length of their stroke, comprising an irregular disk cam, a lever held in continuous contact therewith at points diametrically opposite, pivoted at each end to a valve-stem, and fulcrumed midway from each within the radius of said disk cam to an adjustable frame, substantially for the purpose set forth.

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

EDWARD F. GORDON.

Witnesses:
J. B. THURSTON,
NATHL. E. MARTIN.