(No Model.) 2 Sheets—Sheet 1.

J. B. STANWOOD.

STEAM ENGINE.

No. 423,963. Patented Mar. 25, 1890.

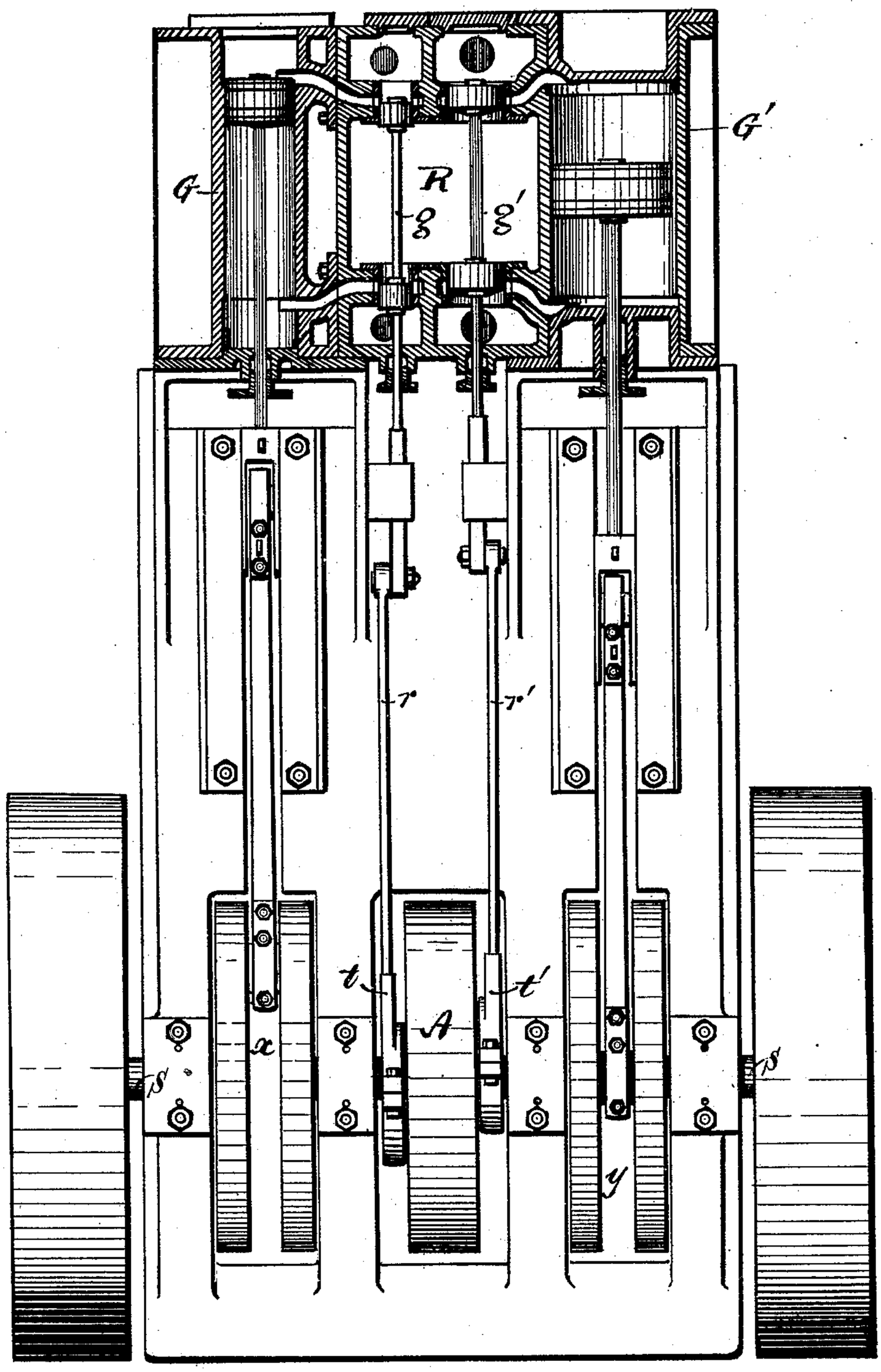

Fig. 1

Attest:
Wm. G. Hosea
L. W. Prince

James B. Stanwood
by K. W. Hosea
Atty.

(No Model.) 2 Sheets—Sheet 2.

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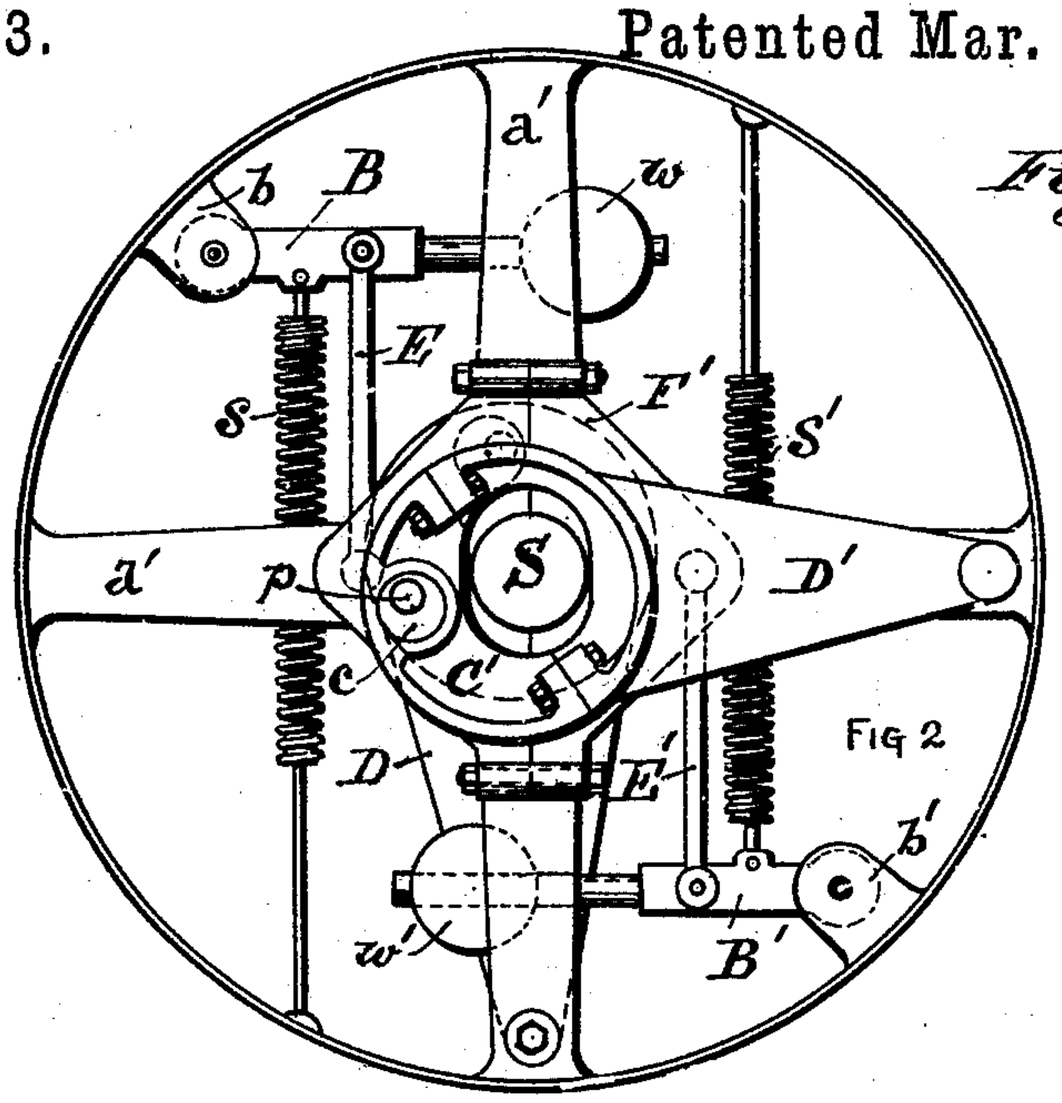

Fig. 2

Fig 2

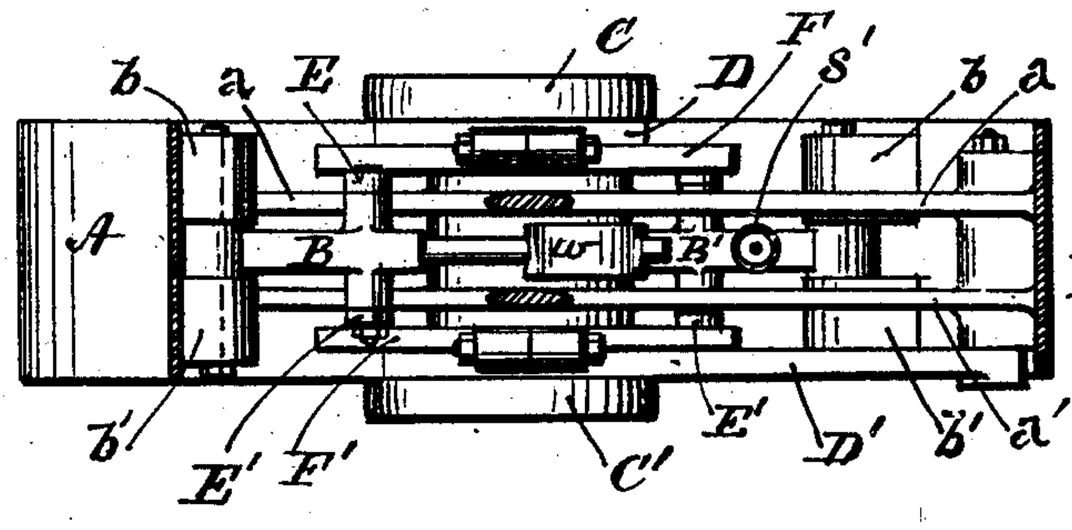

Fig 3

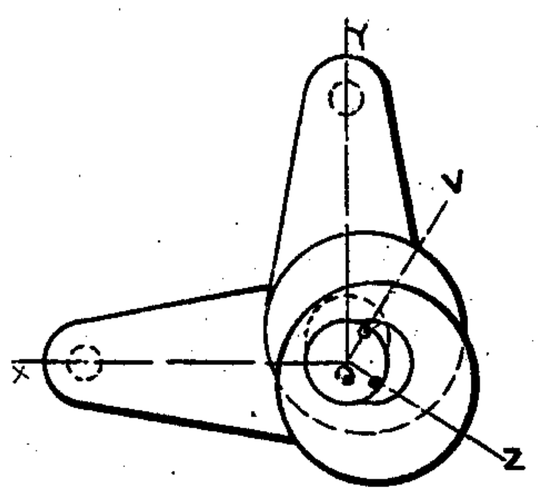

Fig 4.

Attest:
Wm. L. Hozea
H. W. Pierce

James B. Stanwood
by
L. W. Hozea
Atty.

UNITED STATES PATENT OFFICE.

JAMES B. STANWOOD, OF CINCINNATI, OHIO.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 423,963, dated March 25, 1890.

Application filed July 8, 1889. Serial No. 316,884. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. STANWOOD, a citizen of the United States, residing at Cincinnati, Ohio, have invented new and useful Improvements in Valve-Gear for Steam-Engines, of which the following is a specification.

My invention relates to that class of steam-engines employing two or more steam-distributing valves, each having a separate and positive actuating mechanism, its object being to bring the entire operation of the valves under the control of a common governor.

The invention is applicable not only to automatic cut-off engines, where the distribution to and from a single cylinder is effected by an ordinary controlling valve or valves and a cut-off valve or valves, but also and particularly to engines having one or more cylinders and pistons operating cranks upon a common shaft.

An important illustration of the last-mentioned type of engines, to which my invention is particularly applicable, is the modern compound engine, where the steam exhausted from a high-pressure cylinder is utilized at a lower pressure in one or more secondary cylinders.

Heretofore the principle of governing automatically the steam distribution in response to variations of load upon the engine has been applied in various forms; but in no case, so far as I am aware, have two or more valves operated by distinct and positive connecting mechanisms from the main shaft been brought under the control of a common governor. By way of illustration of the approximations to this result it may be mentioned that engines employing two cylinders have been constructed with their cranks occupying the same or opposite radial planes, in order that the valves might be actuated by a single eccentric in the same or in opposite directions and controlled by a single governor. Obviously this construction forfeits one of the greatest advantages of coupling two cylinders to the same crank-shaft—that is to say, the advantage of placing cranks ninety degrees apart to avoid dead-centers—and is inherently limited to an engine of two cylinders, and therefore cannot be applied to one of three cylinders with cranks one hundred and twenty degrees apart. Another example, though perhaps less pertinent, is the case of compound engines of the Corliss type, in which the releasing mechanism of the admission-valves only is brought under the control of the governor. There being serious difficulty in constructing two governors having precisely the same action or to maintain them in operation always in exactly the same adjustment, it is obvious that the action of two governors in regulating the distribution of steam can never be as effective and uniform as that of one and the same governor.

My invention obviates these difficulties and is not subject to the limitations referred to. It governs the distribution of steam, both as to induction and eduction, by controlling the operation of the valve or valves at the fountain-head of its or their motion, and gives to each valve its independent actuating-eccentric, thus leaving the designer free to give to each valve its appropriate motion, yet controls the position of both eccentrics so as to respond in unison to variations of load.

The advantages of the improvement are more especially realized in compound engines whether of two or more cylinders, for in these, where a receiver is employed and the distribution-valves are controlled by one governor and one positive valve-operating mechanism, the point of cut-off is varied by varying the travel of the valves, which is attended by varying times and degrees of compression. This is of course a serious detriment to the distribution of steam to the high-pressure cylinder, for in such case the compression, in combination with a high receiver-pressure, may vary from an excess of the initial boiler-pressure to the opposite extreme. It is for this reason, among others, that, notwithstanding its advantages in other respects, the receiver has been in many cases abandoned and a single valve employed combining the functions of an initial governing-valve and an expansion-valve arranged to cut off at the expansion-cylinder simultaneously with compression in the high-pressure cylinder. This latter construction, however, introduces disadvantages of another kind—for example, leakage without that utilization which is had

in the receiver type—for there are intervals when the single valve forms the sole partition between high-pressure steam and the exhaust-passages; also, varying conditions of pressure in the passages, which destroy the heat equilibrium and produce loss by condensation. These objections also are overcome by my invention, for by controlling two distinct valve-motions by one governor each valve motion can be designed to produce its own variations of cut-off independently to produce the greatest efficiency of action, and the simultaneous governing control insures the preservation of the proper relations between them at all times.

Mechanism embodying my invention in its preferred form is illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of a two-cylinder compound engine to which my invention is applied in the form of a centrifugal shaft-governor, showing the cylinders and the valve-chests in section. Fig. 2 is a side view of the centrifugal governor detached; Fig. 3, an edge or plan view of the centrifugal governor with part of the pulley-rim removed to exhibit the eccentrics and connections; and Fig. 4 a diagram of the cranks and eccentrics at ninety degrees apart, showing their relations.

Referring now to the drawings, exhibiting a preferred form of my invention, A designates the governor pulley or casing, which is centered on the main shaft S of the engine between the driving-cranks *x y*. The governor-pulley A is cast with two sets of spokes *a a'*, with a free radial space between for the play of the centrifugal arms B B', which are pivotally held in lugs *b b'* at the inner side of the rim (or between adjacent spokes) and controlled by spiral springs *s s'*, secured and operating in the usual manner.

The eccentrics C C' are formed with or attached to arms D D', respectively pivoted at or near the rim ninety degrees apart, as shown. The eccentrics are "split" for convenience of attaching to or detaching from the shaft in the usual manner of such constructions, and are each provided with an elongated arc slot the width of the shaft S, described by radii from the pivotal axis of the arms D D', respectively, to permit the necessary amount of side play upon the shaft S, which passes through the slots.

The arms B B' are furnished with weights *w w'* at their extremities for centrifugal action in opposition to the springs *s s'*. Each of the arms B B' is connected by a pair of links E or E' with a pair of plates F F', centered loosely on the shaft S, each pair of links connecting plates with one of the centrifugal arms, the two sets of connections being at diametrically-opposite points of the plates, so that the action of the centrifugal arms rotate the plates in unison and the plates control the position of the eccentrics by the connection about to be described. Each plate is connected with its adjacent eccentric by a short link, which for convenience I construct in the form of a small disk *c*, rotating in a circular aperture in the body of the main eccentric and eccentrically pivoted by a pin *p* to the adjacent controlling-plate. The parts and connections described are all duplicates placed at opposite sides of the pulley or casing A, except that the centrifugal arms, weights, and springs are in the central plane of the pulley at opposite sides of the center.

In the present illustration of the invention the driving-cranks of the engine are set at ninety degrees apart radially, in which case the swinging arms D D' are placed at corresponding angles, and the eccentric slots are likewise formed for the adjustment of the respective eccentrics across the shaft substantially at right angles, as indicated in the diagram Fig. 4. Thus *o x* and *o y* are the crank-lines and *x o y* the angle of divergence between the same, while *v o* and *z o* are the lines of extreme throw of the eccentrics and *v o z* the angle of divergence, the adjustment of the eccentrics taking place substantially at right angles to the respective cranks.

In Fig. 1 I have shown the application of the invention to a two-cylinder engine—to wit, a compound steam-engine having high and low pressure cylinders G G' placed side by side, with valve-chests and an intermediate receiver R placed between the cylinders. The valves, in the form of plungers or pistons L L' upon the valve-rods *g g'*, operate between the receiver and the steam-passages *d* and exhaust-passages *e* in the usual manner, and the valve-rods are coupled by connecting-rods *r* and yokes *t t'* to the eccentrics C C', respectively, in the usual manner.

The general relations of the parts is fully shown in the drawings.

The extension of the invention to three or even four cylinder engines involves only simple mechanical operations, and I have not thought it necessary to illustrate it here; but it should be understood that in practically applying my invention to such uses two or more governors in structure may be combined into one by a rigid connection, compelling their single operation as one device.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In an automatic cut-off steam-engine, the combination of two or more distributing-valves, two or more distinct and positive valve-operating mechanisms, and a single governor mounted upon and operated by the main shaft and connected with and controlling the said valve-operating mechanism in unison, substantially as set forth.

2. In an automatic cut-off steam-engine, the combination of two steam-distributing valves, two distinct and positive sets of operating-connections, two adjustable valve-movers driven by the main shaft, and a centrifugal governor mounted upon and operated by the main shaft and connected with both valve-

movers and simultaneously controlling the position of the same, substantially as set forth.

3. In an automatic cut-off steam-engine, the combination of two distributing-valves, two distinct positive valve-operating mechanisms, two shifting eccentrics, each independently adjustable and controlling the operation and position of one of said valves, and a centrifugal governor connected with and controlling both of said eccentrics simultaneously, substantially as set forth.

4. In an automatic cut-off steam-engine, with two or more main cranks driving cylinders and connections, each of said cylinders having a steam-distribution valve and independent driving-eccentric and distinct and positive operating-connections with said valves, respectively, a centrifugal governor connected with and simultaneously controlling two or more of said eccentrics, substantially as set forth.

5. In an automatic cut-off steam-engine having two or more cranks and driving-connections, a centrifugal shaft-governor, in combination with two adjustable valve-operating eccentrics arranged one at each side of said governor and connected in common with the centrifugal arms of the governor and adjusted in unison thereby, substantially as set forth.

6. The double-centrifugal governor embodying two shifting eccentrics carried upon pivoted arms, one at each side of the governor pulley or casing, and two controlling plates or cranks pivotally connected at diametrically-opposite points with the centrifugal arms of the governor and eccentrically connected with the adjacent valve-moving eccentrics or their carrying-arms, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JAMES B. STANWOOD.

Witnesses:
L. M. HOSEA,
ELLA HOSEA.