

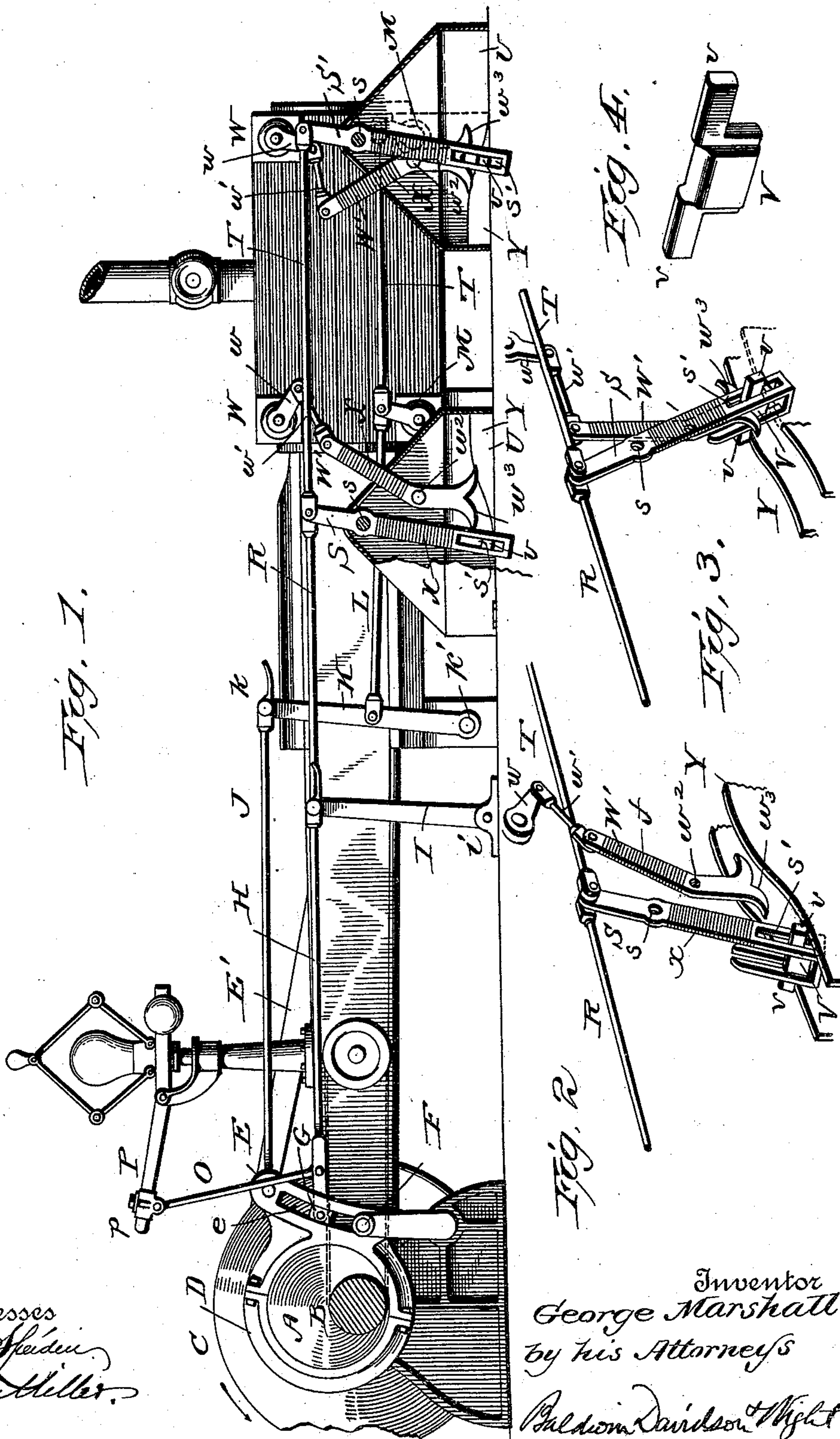
(No Model.)

2 Sheets—Sheet 1.

G. MARSHALL.  
STEAM ENGINE.

No. 549,520.

Patented Nov. 12, 1895.



Witnesses  
*W. H. Spalden*  
*B. W. Miller.*

Inventor  
George Marshall.  
by his Attorneys  
*Palmer Davidson & Wright.*

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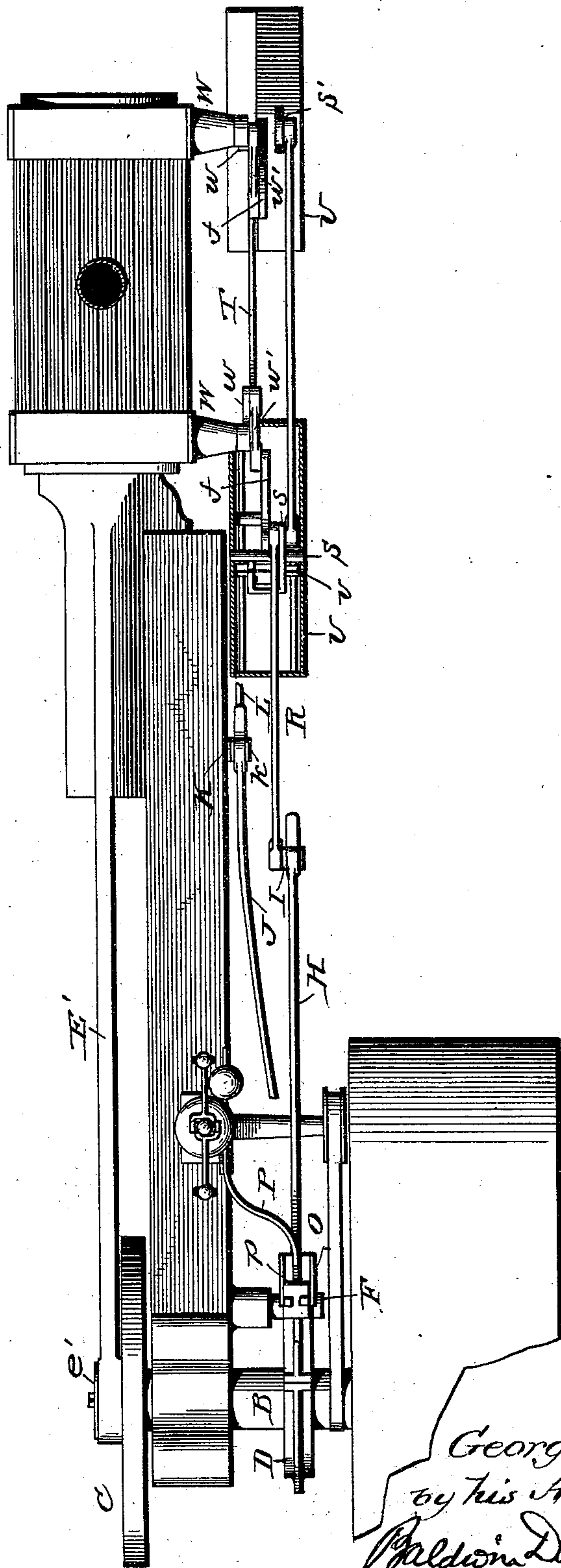
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Fig. 5.



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# UNITED STATES PATENT OFFICE.

GEORGE MARSHALL, OF FREMONT, NEBRASKA.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 549,520, dated November 12, 1895.

Application filed July 12, 1895. Serial No. 555,752. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE MARSHALL, a citizen of the United States, residing at Fremont, in the county of Dodge and State of Nebraska, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification.

My invention relates to that class of engines in which the eccentric for operating the admission-valves is placed on the same side of the main shaft as the crank instead of at right angles to it, by which organization the crank and the eccentric are made to have coincident movements, so as to arrive on their dead-points simultaneously.

My Patent No. 390,876, dated October 9, 1888, shows a steam-engine in which the eccentric-strap is connected by links and levers with exhaust slide-valves, while sliding admission-valves are connected by links and levers with a curved bar, which is operatively connected with the eccentric-strap in such manner as to move back and forth with it and also have a slight vertical or endwise movement.

My Patent No. 504,399, dated September 5, 1893, shows a slotted link of the Porter-Allen type on the eccentric connected by links and levers with rotary or oscillating exhaust-valves, while the admission-valves, which are rotary or oscillating, of the Corliss type, are connected by links and levers with a block sliding in the slot of the link and moved back and forth with the eccentric-strap. By the organization shown in this patent the admission-valves are made to operate successively in such manner as to admit steam at the proper time to the proper end of the cylinder and to quickly cut off the supply when the piston is in the right position.

The object of my present invention is to so improve the mechanism shown in my patents above mentioned, and especially in my Patent No. 504,399, as to cause the admission and exhaust of steam to be more quickly and accurately performed.

The eccentric and eccentric-strap are located as in both of my aforesaid patents, the eccentric-strap being provided with a slotted link of the Porter-Allen type, as in my Patent No. 504,399, which is connected with the exhaust-valves, and also by improved mech-

anism hereinafter described with the admission-valves.

The connection between the link and the exhaust-valves is substantially the same as that described in my Patent No. 504,399. The radius-rod is connected with a block moving in the slot of the link in substantially the same manner; but the rotary or oscillating valves of the Corliss type are operated by mechanism of improved construction, which will be hereinafter particularly described.

The accompanying drawings show so much of a steam-engine embodying my improvements as is necessary to clearly show their construction, organization, and operation.

Figure 1 shows a side elevation of such a steam-engine with some of the parts broken away to more clearly show the mechanism. Fig. 2 is a detail view in perspective of parts of the valve-operating mechanism. Fig. 3 is a similar view with the parts in a different position. Fig. 4 is a detail view in perspective of the sliding block forming part of the valve-operating mechanism, and Fig. 5 is a plan view of the engine.

The eccentric A is mounted on the shaft B with the crank-wheel C, and the eccentric-strap D is formed with or secured to a slotted link E of the Porter-Allen type. The trunnions F, of well-known construction, are pivoted in pillow-blocks and connected with the slotted link in the usual manner. A block G is arranged in the slot *e* of the link and is formed to slide therein. It is pivotally connected with the radius-rod H, which in turn is connected with an upright lever I, pivoted at its lower end in bearings *i*. A rod J is pivotally connected with the link E and is also pivotally connected at *k* with a lever K, pivoted at *k'*, to the engine-frame. The lever K is in turn connected between its pivots with a rod L, which is connected with the rotary exhaust-valves M, constructed, arranged, and operated in substantially the same way as that described in my Patent No. 504,399.

The connecting-rod E' is connected with the crank-pin *e'* and operates in the usual manner. The radius-rod H is connected by means of a link O with the lever P of the governor, which is constructed and operated in any suitable manner. The connection *p* between the



rod *o* and the lever *P* is adjustable to equalize the point of cut-off. The upright lever *I*, to which the radius-rod is connected, is connected also at its upper end by a rod *R* with the upper end of a lever *S*. A rod *T*, also connected to the upper end of the lever *S*, is connected at its opposite end with the upper end of a lever *S'*, similar to the lever *S*. These levers *S* and *S'* have their lower ends arranged within housings or casings *U*, of any suitable construction, the pivots *s* of the levers being, preferably, just within the top of the casing. At its lower end each lever *S* or *S'* is made **U**-shaped and is slotted at *s'*. Through these slots extend the ends *v* of a sliding block *V*, which is adapted to move vertically between the branches of the **U**-shaped end of the lever. Each admission-valve *W* is provided with an arm *w*, connected by a link *w'* with the upper end of a bell-crank lever *W'*, pivoted at *w<sup>2</sup>*, within the housing *U*. The lower end of each lever *W'* is enlarged and provided with a cam-surface *w<sup>3</sup>* on its lower end, deepest at the center and curving toward each end.

Each of the levers *S* and *S'* and the bell-crank levers *W'*, connected with the two admission-valves, is preferably wrapped, as indicated at *X*, with some suitable material to muffle or deaden the noise.

At the bottom of each housing is arranged a cam *Y*, formed in two parts, as indicated in Figs. 2 and 3, and constructed, as shown, to engage with the arms *v* of the blocks *V*, so that as the levers operate the cams will raise the blocks at the proper times to engage the cams *w<sup>3</sup>*, and will permit them to fall by their own weight. As the levers *S* and *S'* oscillate, the blocks will be raised by the cams *Y* and will engage with the ends of the bell-crank levers *W'* and will oscillate them, so as to correspondingly oscillate the admission-valves.

As shown in the drawings, the cams at the two ends of the cylinder are arranged on opposite sides of the housings, so that when one admission-valve is being operated the other is inactive. The arrangement is such that the lever *S* or *S'* engages with the bell-crank lever of the admission-valve for only a short period near the end of its vibrating stroke, giving it a quick movement, which causes its longer arm to give a quick and sufficiently-long movement to the oscillating admission-valve.

The valves and their operating mechanism are so organized and constructed as to move harmoniously to effect the proper operation of the engine.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of the admission valves of

a steam engine, levers connected to the valves and having cam surfaces at their ends, as described, oscillating levers adapted to connect intermittently with the cam surfaces of said first-mentioned levers to move them positively in opposite directions, the eccentric and connections between the eccentric and the oscillating levers.

2. The combination, substantially as hereinbefore set forth, of the oscillating admission valves, the bell crank levers connected therewith by pivoted links and having cam surfaces on their lower ends, oscillating levers adapted to connect alternately with the bell-crank levers of the two admission valves to move them positively in opposite directions, the eccentric and connections between the eccentric and the oscillating levers.

3. The combination, substantially as hereinbefore set forth, of the oscillating or rotary admission valves, the bell-crank levers connected therewith, the levers connected with the eccentric of the engine and having sliding blocks adapted to connect with the bell-crank levers and cams for causing the blocks to move into engagement with the bell-crank levers.

4. The combination, substantially as hereinbefore set forth, of the oscillating or rotary admission valves, the bell-crank levers connected therewith, oscillating levers having sliding blocks at their lower ends adapted to engage with the bell-crank levers, and cams for operating said sliding blocks, the eccentric, its strap, a slotted link connected therewith, the radius rod connected with the slotted link, and connections between the radius rod and the levers which operate the bell-crank levers.

5. The combination, substantially as hereinbefore set forth, of the rotary or oscillating admission valves, the bell-crank levers connected therewith, the oscillating levers having sliding blocks adapted to engage with the bell-crank levers, cams for operating the sliding blocks, the eccentric, its strap, the slotted link connected with the strap, the radius rod adjustably connected with the slotted link, the governor lever, a link adjustably connected to the governor lever and pivotally connected with the radius rod, and connections between the radius rod and the levers which operate the bell-crank levers.

In testimony whereof I have hereunto subscribed my name.

GEORGE MARSHALL.

Witnesses:

WILLIAM MARSHALL,  
W. H. FOWLER.