

(No Model.)

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G. MARSHALL.
STEAM ENGINE.

No. 390,876.

Patented Oct. 9, 1888.

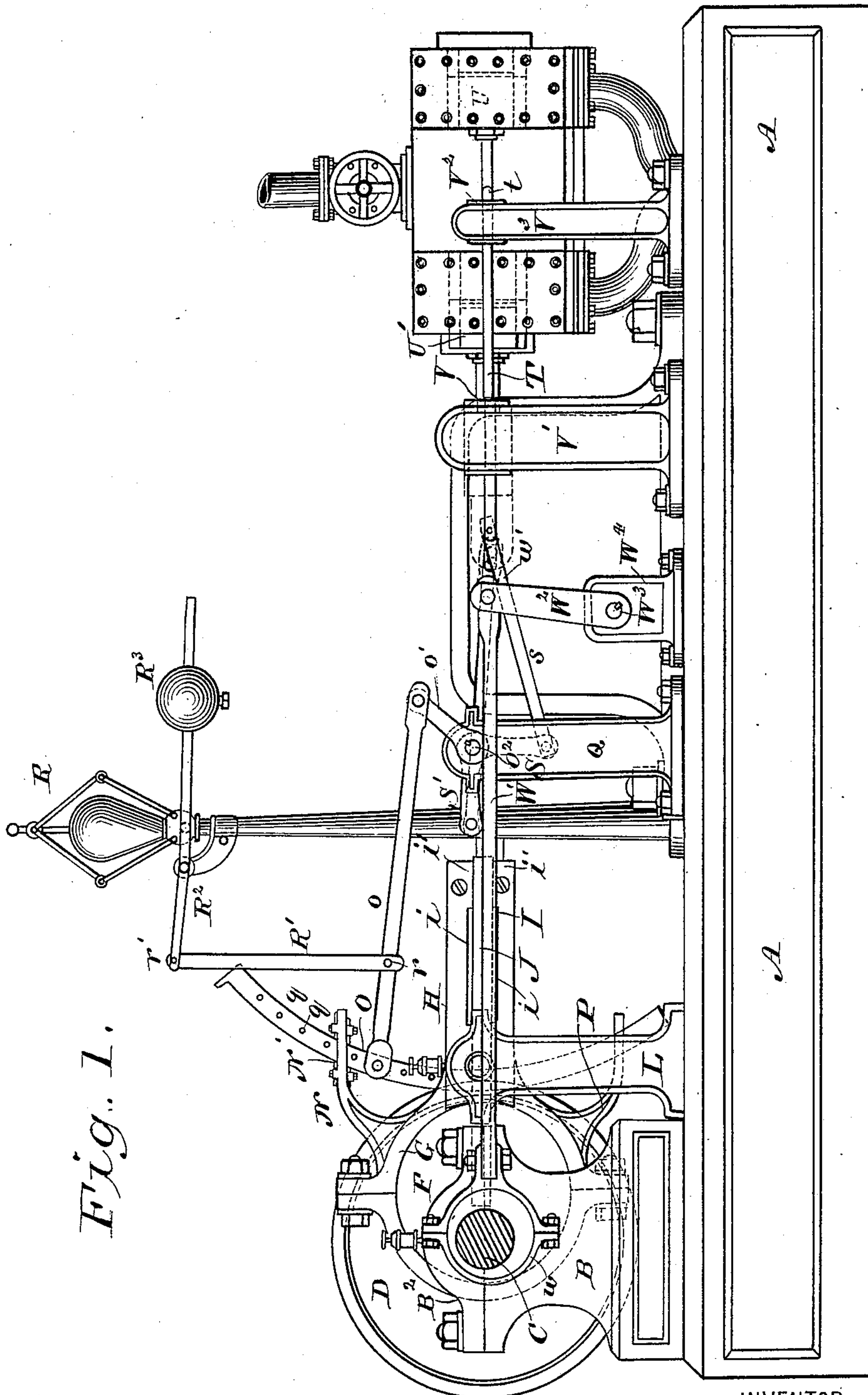


Fig. 1.

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(No Model.)

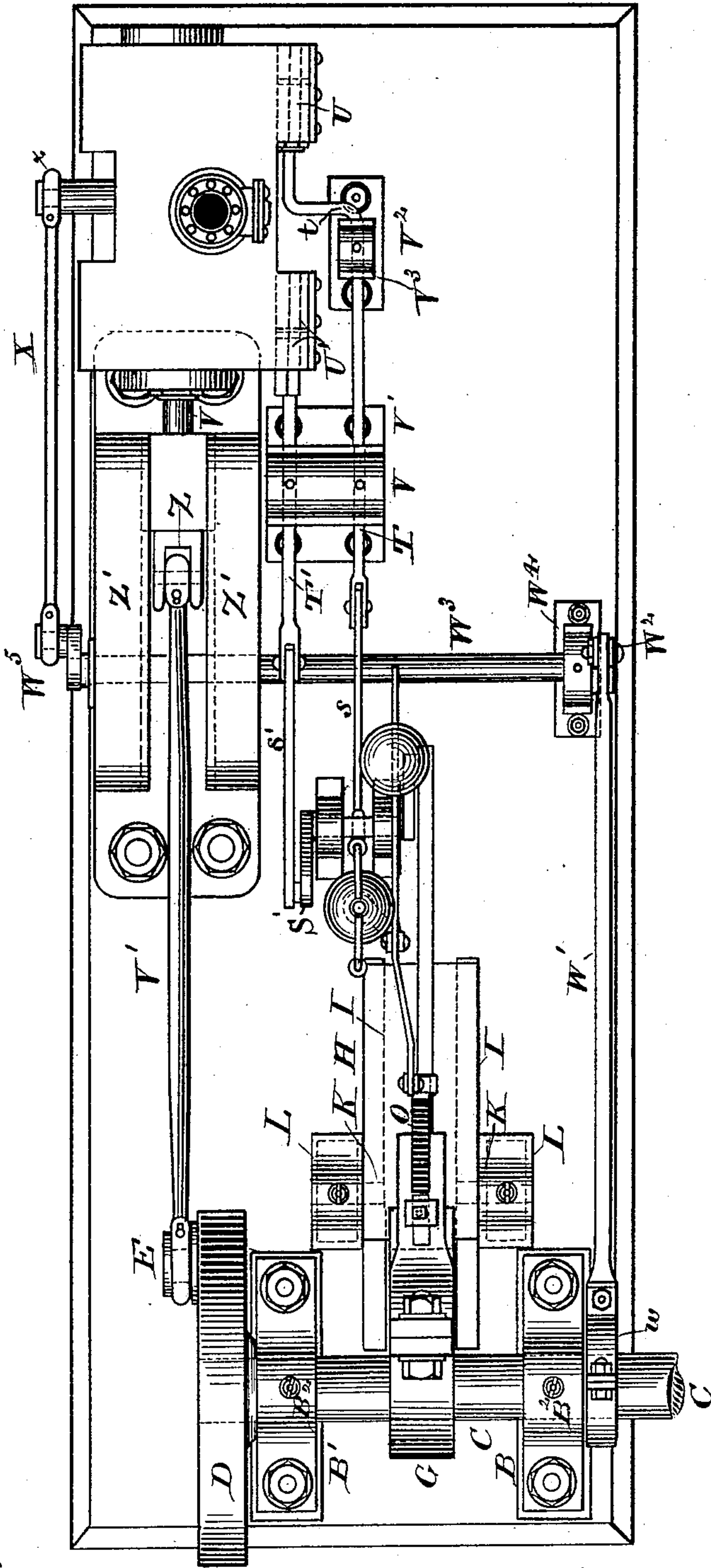
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Fig. 2.



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Fig. 5.

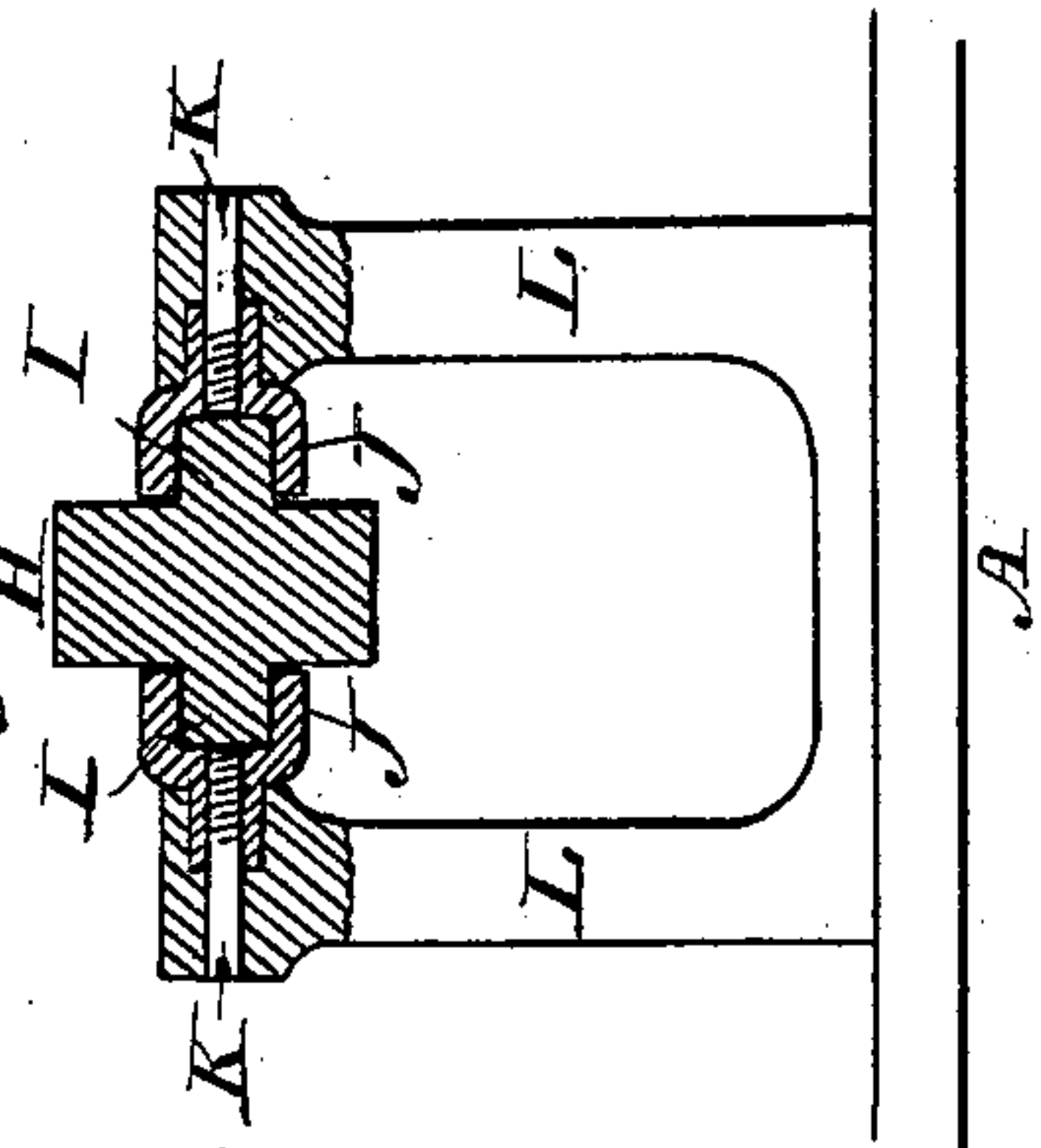
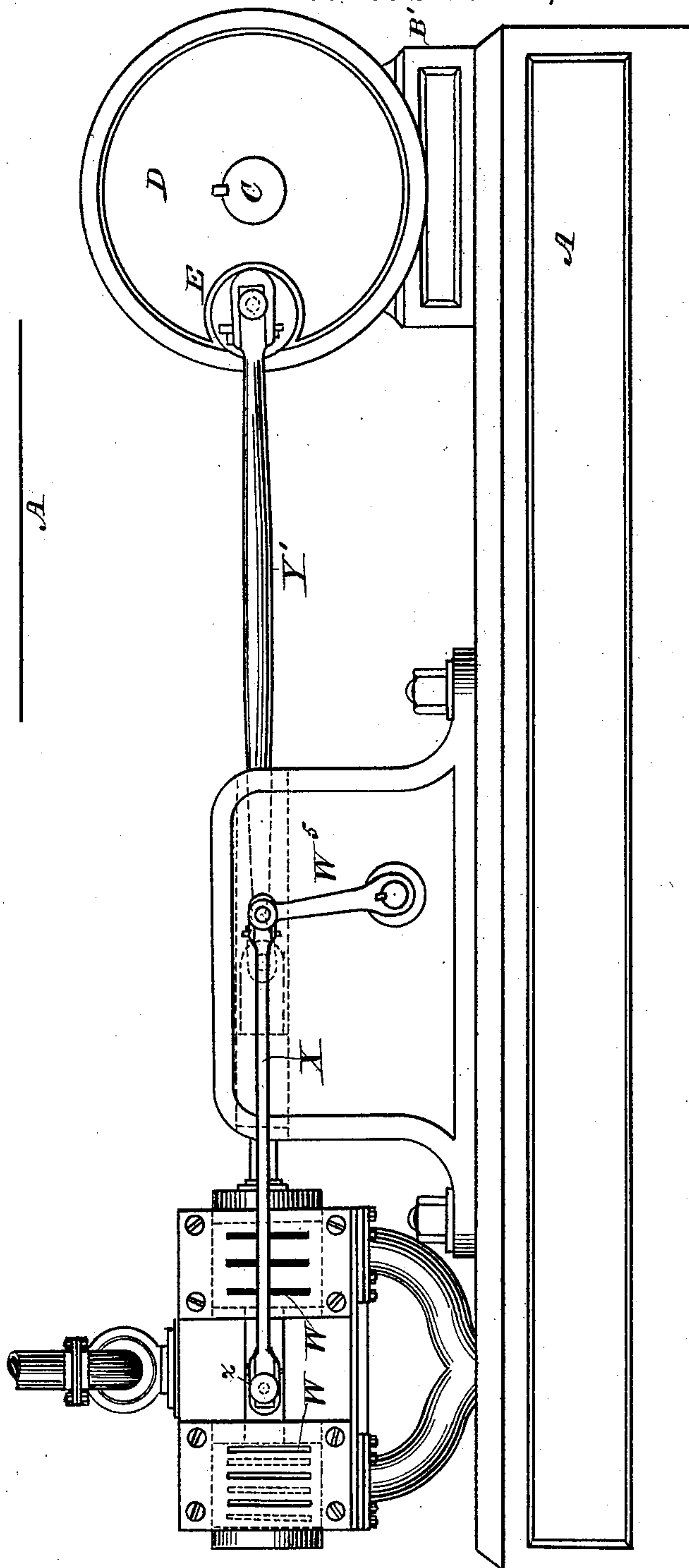


Fig. 3.



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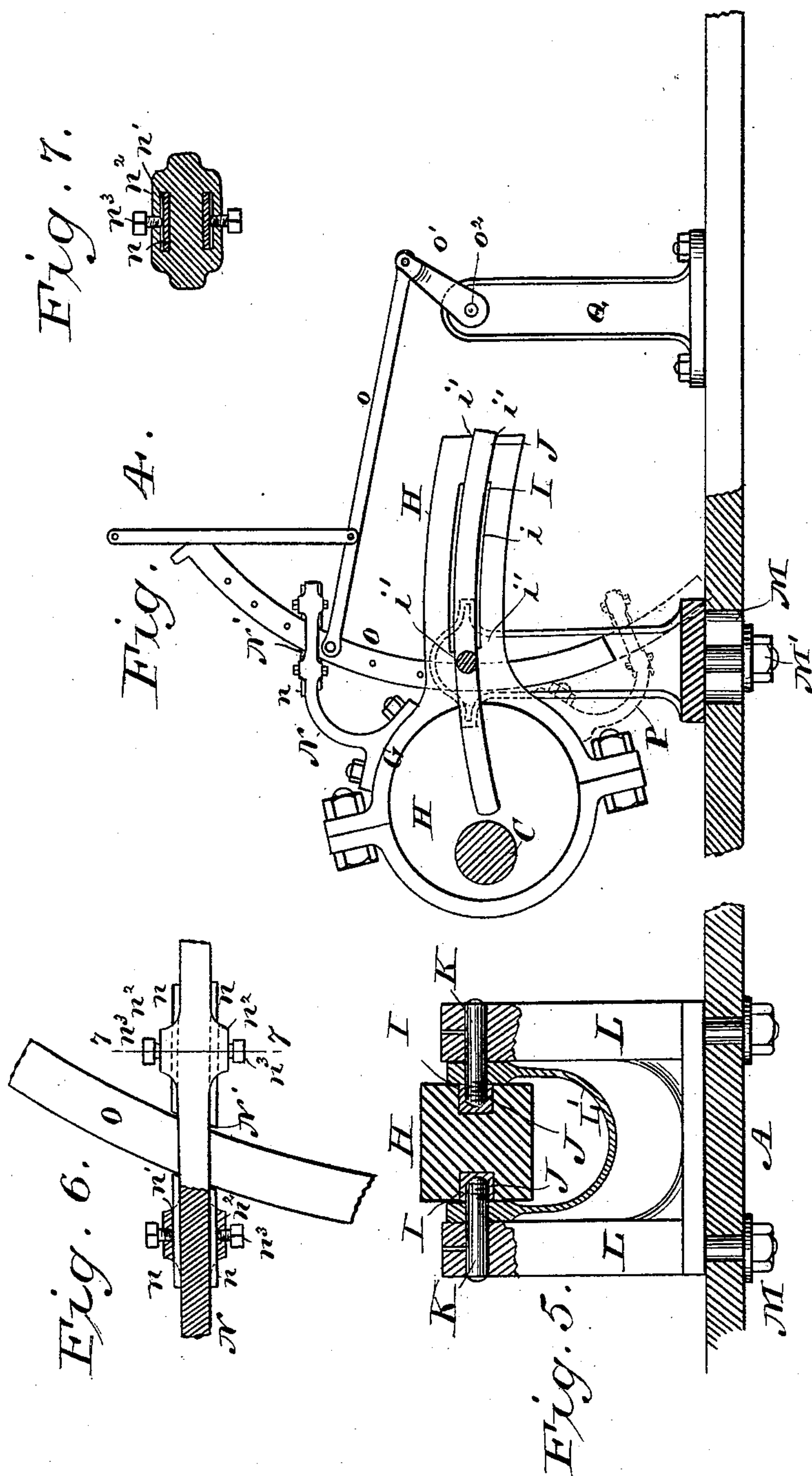
(No Model.)

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G. MARSHALL.
STEAM ENGINE.

No. 390,876.

Patented Oct. 9, 1888.



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UNITED STATES PATENT OFFICE.

GEORGE MARSHALL, OF FREMONT, NEBRASKA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 390,876, dated October 9, 1888.

Application filed May 12, 1888. Serial No. 273,663. (No model.)

To all whom it may concern:

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

My invention especially relates to the valve-gear of steam-engines.

10 The object of the first part of my invention is to provide improved means for imparting the requisite movement to the admission or induction valves of the steam-cylinder.

To this end my invention consists in providing a curved bar extending through brackets
15 on the eccentric-strap of the engine and operatively connected with the admission-valves.

The object of the next part of my invention is to provide improved means for limiting the
20 movement of the eccentric-strap, and thus regulate the movement of the admission-valves.

To this end my invention consists in providing the eccentric-strap with an arm or extension having ways or guides which move astride
25 of tongues or bars pivoted to uprights or standards mounted on the base-plate, or in providing the eccentric-strap with an arm or extension having tongues or bars which move in ways or guides pivoted to the standards.

30 The object of the next part of my invention is to provide improved means for adjusting the mechanism for operating the admission-valves to vary the cut-off at the opposite ends of the cylinder.

35 To this end my invention consists in providing the eccentric-strap of the engine with an arm or extension having ways or guides which move astride of tongues or bars pivoted to adjustable uprights or standards secured on the
40 base-plate of the engine, or in providing the eccentric-strap with an arm or extension having tongues or bars which move in ways or guides pivoted to adjustable standards secured to the base-plate of the engine.

45 My invention also consists in certain organizations of instrumentalities and details of construction, which will be hereinafter described and claimed.

50 In the accompanying drawings, illustrating my invention, Figure 1 is a side elevation of the admission side of the engine. Fig. 2 is a plan view. Fig. 3 is a side elevation of the

exhaust side of the engine. Fig. 4 is an elevation of a modification of the mechanism for limiting and adjusting the movement of the
55 eccentric-strap. Fig. 5 is a view, partly in section, of the adjustable standards, the arm on the eccentric-strap, and the connections between the arm and the standards. Fig. 5^x shows a modified way of arranging the guide-
60 ways and tongues. Fig. 6 is a detail view of the end of the bracket of the eccentric-strap, showing adjustable plates on the bracket; and Fig. 7 is a cross-section of the same on the line 7 7 of Fig. 6.

65 My invention is shown as applied 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 with it, as in most forms of
70 valve-gear, by which organization the crank and the eccentric are made to have coincident movements, so as to arrive on their dead-points or lines of centers simultaneously.

The base-plate A may be of any suitable
75 construction, but preferably that shown in the drawings. At one end of the base-plate are mounted the pillow-blocks B B', in which is journaled in suitable bearings, B², the main shaft C. The crank-wheel D is mounted on
80 one end of the shaft and carries the crank-pin E. The eccentric F is mounted on the main shaft C between the pillow-blocks B B' on the same side of the shaft as the crank-pin E, and around the eccentric is arranged the strap G,
85 which imparts motion from the eccentric to the other parts of the valve-gear. The eccentric-strap G is provided with an arm or projection, H, extending from the strap in a direction toward the steam-cylinder.

90 On each side of the strap are formed guides or ways I, which may be either straight or curved, as indicated in the drawings, (see Figs. 1, 4, and 5;) or the tongues or bars, either straight or curved, may be formed on the extension of the eccentric-strap, and the guides
95 may be formed in blocks pivoted to the standards, as shown in Fig. 5^x. They are, however, preferably made straight and arranged as shown in Fig. 1. The central portions of
100 the guideways are cut away or recessed at *i*, as shown, and the bearing-surfaces are at each end of the ways at *i'*. J J indicate tongues or bars adapted to slide back and forth in the

ways I, and are secured to stud journals or trunnions K, which, as shown in Figs. 1, 4, and 5, have their bearings in standards L, mounted on the base plate A. These standards are adjustable longitudinally of the guideways—that is, toward and from the main shaft C. This adjustment may be effected in any suitable way, but preferably by forming slots M in the base-plate A, as shown in Fig. 4, adapted to receive bolts M', extending into or through the slots and attached to the standards. By loosening and tightening the bolts and moving the standards to the desired position, the axial line of the trunnions may be varied. The object of this adjustment is to equalize or vary the point of cut-off of the admission of steam to the cylinder, as will be more fully described farther on.

On the upper side of the eccentric-strap G is a bracket, N, which may be formed integrally with the strap or secured thereto in any suitable way. The front end of the bracket is provided with an opening, N', adapted to receive the curved bar O, which connects with the admission-valves. On opposite sides of the opening N', I provide adjustable plates n , Fig. 6, for the purpose of taking up the wear caused by the contact of the curved bar with the bracket. Any suitable means may be provided for securing the plates in place and adjusting them; but preferably I form slots n' in raised portions n'' of the bracket, adapted to receive the plates, and use set-screws n''' to clamp them in place. By loosening and tightening the screws and adjusting the plates the size of the opening may be correspondingly varied. I have shown the wearing-plates on opposite sides of the bar, and also on the upper and lower sides of the bracket, as by this means the size of the opening may be kept uniform.

On the lower side or bottom of the eccentric-strap is arranged a bracket, P, similar in all respects to the bracket N, and having the same relative position to the curved bar O that the bracket N has. The bar O is connected by means of a radius-rod, o , to a crank-arm, o' , mounted on a shaft, o'' , journaled in suitable bearings in standards Q. The radius-rod o is pivoted to the curved bar O, and also to the crank-arm o' , in the usual way. The curved bar is provided with a series of perforations, g , to allow for the adjustment of the radius-rod on the curved bar.

It should be noted that the bar O is formed in the arc of a circle from the pivot-pin of the crank-arm o' as a center. The relative position of the curved bar to the brackets is varied by means of a governor, R, which is operatively connected with a rod, R', pivoted at r to the radius-rod o , and at r' to the end of the weighted lever R². Any form of governor adapted to effect this adjustment may be used; but I prefer a fly-ball governor having an adjustable weight, R³, as illustrated in the drawings, which is of well-known construction and needs no further description.

On the rock-shaft o'' are mounted the arms S S', for operating the admission-valves. The arm S', as shown in the drawings, is placed on the rock-shaft at an angle of about one hundred and thirty-five degrees to the arm o' , to which the radius-rod is connected, and the arm S is placed on the rock-shaft at an angle of about one-hundred and thirty-five degrees to the arm o' . The arms S and S' are at an angle of about ninety degrees to each other. This relative arrangement of the arms is preferred; but the angles may be varied to perfectly operate the valves and valve-gear should it be necessary.

The arm S is hinged to a link, s , which is at its opposite end hinged to the valve rod T, which is secured to the admission-valve U at the crank end of the cylinder. The valve-rod T passes through a guide-block, V, on the standard V', and through a second guide block, V², on the standard V³. The valve-rod T is bent, as shown at t , so as to bring the outer ends of the rod close to the valve U at the crank end of the cylinder. The arm S' is similarly connected by a link, s' , to the valve-rod T', which passes through the bearing-block V, and is secured to the admission-valve U' at the shaft end of the cylinder.

It will be observed that the valve rod is extended through openings in the same horizontal plane instead of in a vertical plane, as is the case generally in this kind of engines; but the arms are connected to the valves on the same horizontal line and reciprocate in the steam-chest of the cylinder in the usual way. By this arrangement the valve rods are carried into the steam-chest and connected with the valves without interfering with each other and without any complicated bearings or packings.

The steam-chests of the cylinder may be constructed in any suitable way, and the admission-ports are formed suitably to permit the admission of steam to the cylinder as regulated by the valves. Any form of valve may be used in this connection. I have shown ordinary flat slide-valves; but of course the valves and the admission-ports may be suitably varied to suit circumstances.

The arrangement of the rock-shaft for operating the admission-valves is the ordinary Corliss wrist-motion. By this arrangement each arm on the rock-shaft imparts by a separate connection movement to one of the admission-valves, and at the bottom of its vibration causes it to open and close its port swiftly, and then, ascending to its idle arc, reduces the motion of the valve to an interval practically of rest.

The exhaust-valves W shown in the drawings are the ordinary three-port gridiron flat valves, suitably arranged to exhaust the steam at each end of the cylinder at the proper times. The valves are operated from the main shaft C by means of a rod, W', connected eccentrically at w to the shaft C, and at its opposite end, w'' , to a crank-arm, W², on a rock-

shaft, W^3 , which is mounted in suitable bearings, W^4 , on the base-plate. The opposite end of the rock-shaft W^3 is provided with a crank-arm, W^5 , to the outer end of which is hinged a link-rod, X , which connects with the exhaust-valves at x between the exhaust-chambers. The piston is connected by its rod Y and connecting-rod Y' to the crank-pin E on the crank-wheel D . The inner end of the connecting-rod is hinged in the usual way to a cross-head, Z , secured to the piston-rod and reciprocating in guides Z' .

The operation of the piston and the exhaust-valves is similar to that of other engines of this class.

The operation of the admission-valves is as follows: As the main shaft revolves, the eccentric F bears on the eccentric-strap G and moves it back and forth and up and down in the usual way. The brackets N and P move coincidentally with the strap and impart motion to the curved bar O , which connects, by means of rod o and crank-arm o' , to the rock-shaft o^2 , the rock-shaft being connected to the valves by means of the arms $S S'$, links $s s'$, and rods $T T'$. In connection with this organization for operating the admission-valves, the employment of the bars or tongues J , which slide in guideways I on the extension H of the eccentric strap, regulates the throw of the valves in this way. The leverage being shorter at that end of the guideway next the eccentric, when the steam is admitted to the crank end of the cylinder it gives a greater tipping movement to the upper brackets on account of the shorter leverage between the shaft end of the guideways and the trunnions than it does when admitting steam at the shaft end of the cylinder when the shaft end of the guideways is farther from the trunnions, so that a larger port is opened in a shorter time at the crank end of the cylinder than at the shaft end of the cylinder, at the same time maintaining the lead at each end. The adjustment of the standards L of course varies the upward and downward movement of the outer end of the extension of the eccentric-strap, thereby varying the throw of the valves and the point of cut-off.

The guideways or the tongues and bars operated on the trunnions may be fastened together, so as to be rigid with reference to each guideway, by means of a stirrup or other rigid connection, L , somewhat after the manner shown in Fig. 5.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination, substantially as here-

inbefore set forth, of the steam-cylinder, the main shaft, the eccentric on the main shaft, the eccentric-strap, the brackets thereon, the curved bar extending through the brackets, the admission-valves, and connections between the admission-valves and the curved bar.

2. The combination, substantially as here- inbefore set forth, of the steam-cylinder, the main shaft, the eccentric on the main shaft, the eccentric-strap, the brackets thereon, the curved bar extending through the brackets, the admission-valves, connections between the admission-valves and the curved bar, and means for limiting the upward and downward movement of the eccentric-strap.

3. The combination, substantially as here- inbefore set forth, of the bed-plate, the main shaft, the eccentric, the eccentric-strap, its extending arm, the tongues or bars, the guideways for the tongues or bars, the trunnions, and the uprights or standards on the bed-plate.

4. The combination, substantially as here- inbefore set forth, of the main shaft, the eccentric, the eccentric-strap, its extending arm, the guideways thereon, the tongues or bars that move in the guideways, their trunnions, and the adjustable standards in which the trunnions are mounted.

5. The combination, substantially as here- inbefore set forth, of the main shaft, the eccentric, the eccentric-strap, its projecting arm, the guideways formed in the arm, having bearing-surfaces at each end and recessed between the ends, the tongues or bars that move in the guideways, and the supports for the tongues or bars in which they are pivoted.

6. The combination, substantially as here- inbefore set forth, of the steam-cylinder, the main shaft, the eccentric, the eccentric-strap, the valve-rod S , the valve-rod T , bent at t , as shown, the bearing-block through which the valve-rods extend, and connections between the valve-rods and the eccentric-strap.

7. The combination, substantially as here- inbefore set forth, of the main shaft, the eccentric, the eccentric-strap, its extending arm, the guideways thereon, the tongues or bars that move in the guideways, their trunnions, and the standards in which the trunnions are mounted.

In testimony whereof I have hereunto subscribed my name.

GEORGE MARSHALL.

Witnesses:

FRANK FOWLER,
W. B. FORMAN.