

(No Model.)

4 Sheets—Sheet 1.

G. L. WHYTE.  
POWER TRANSMITTING DEVICE.

No. 602,674.

Patented Apr. 19, 1898.

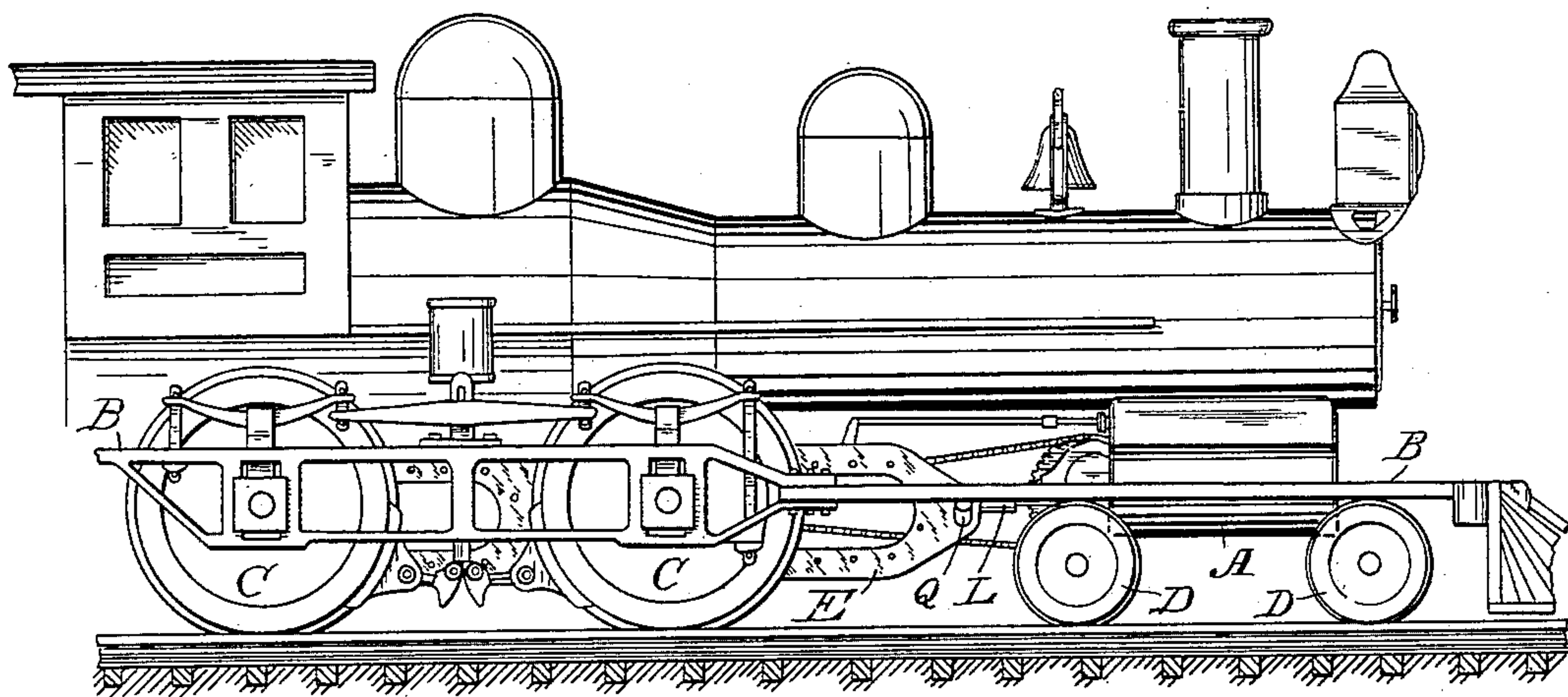


Fig. 1.

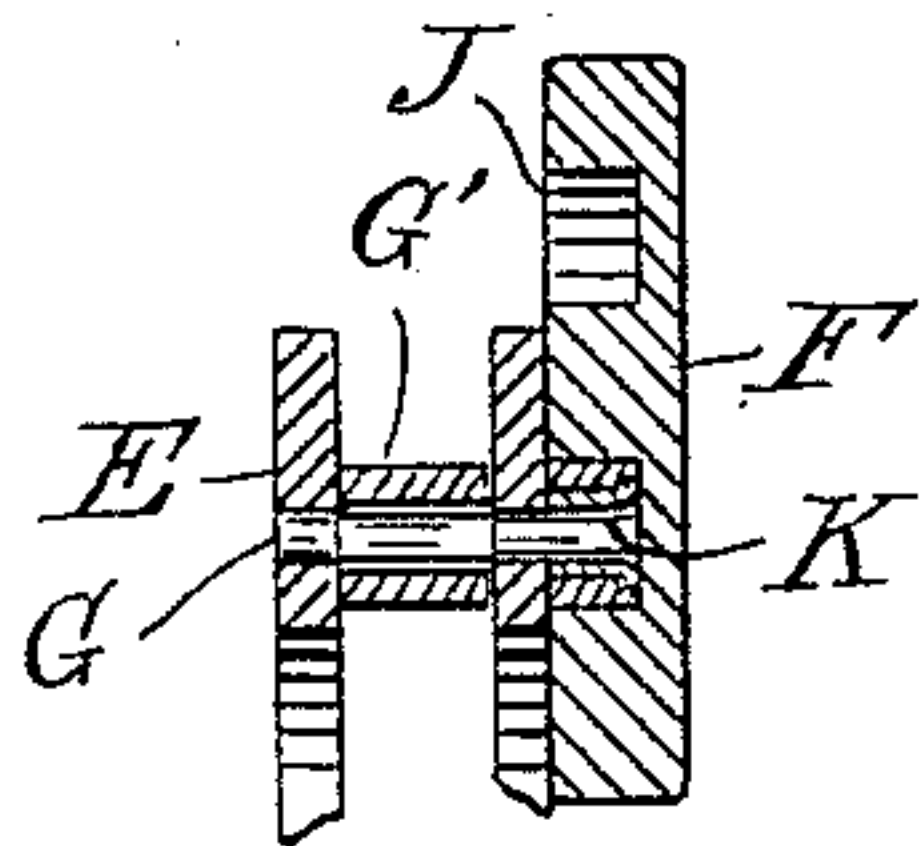


Fig. 7.

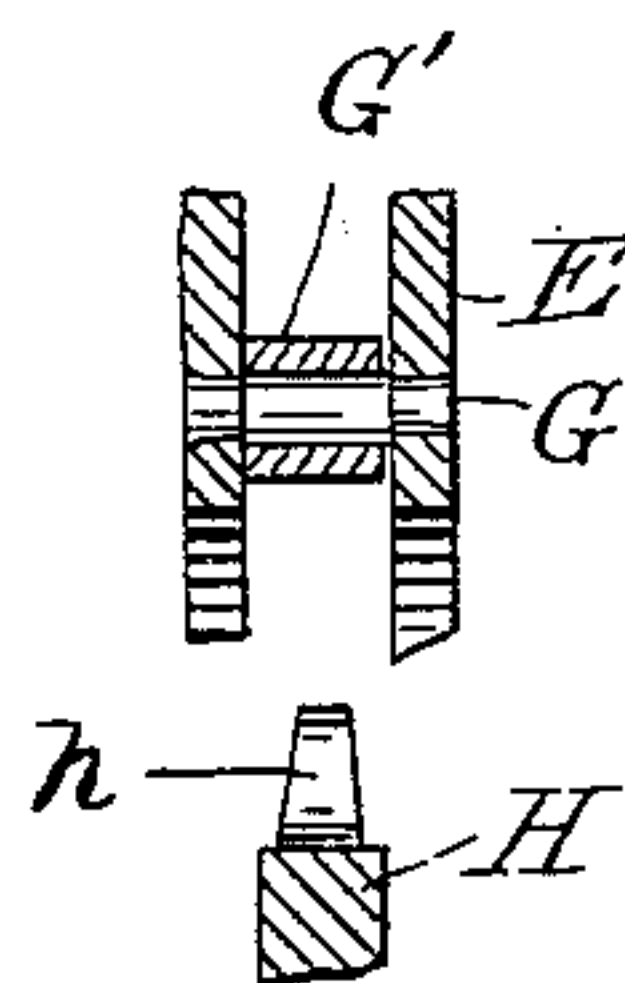


Fig. 8.

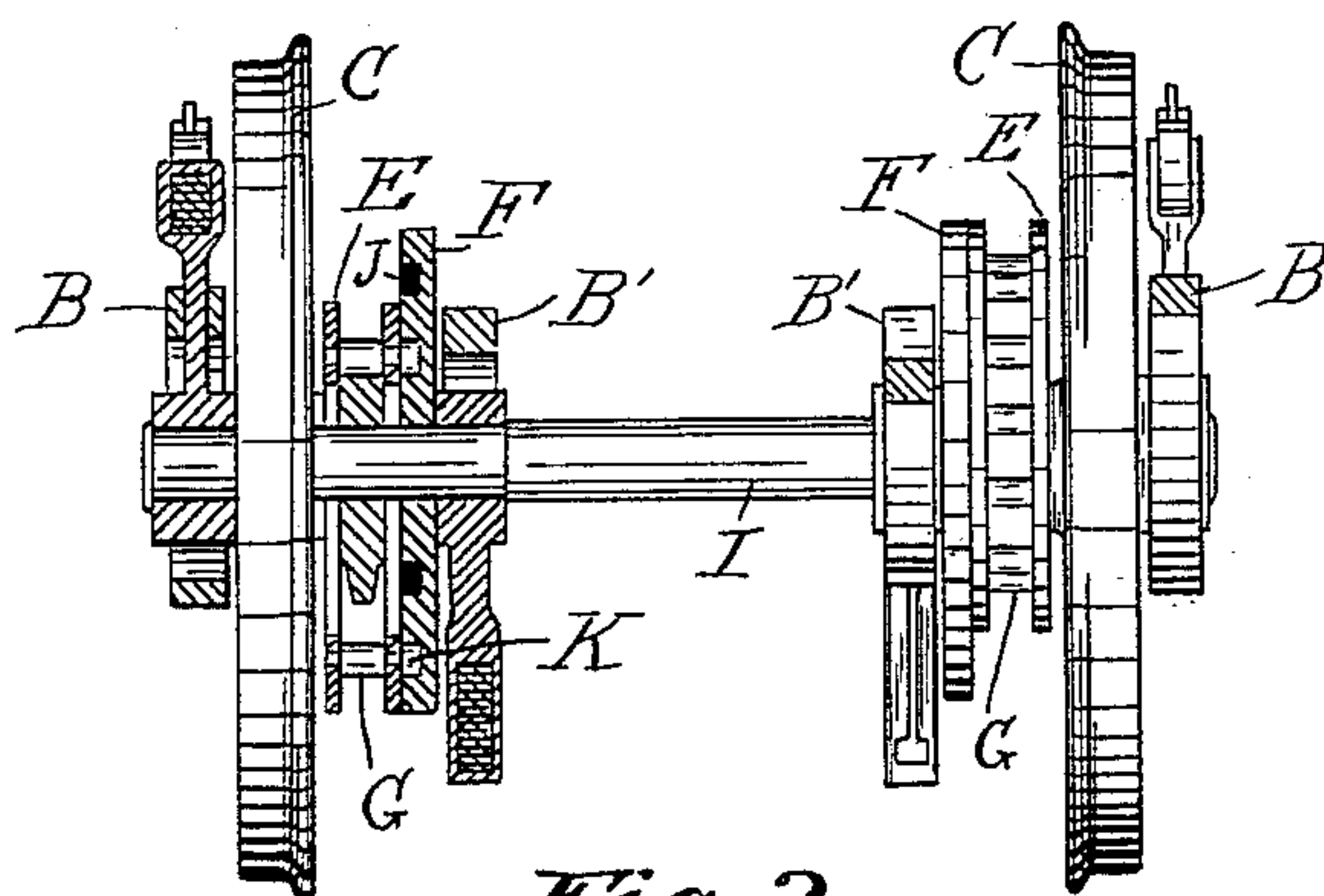


Fig. 2.

Witnesses

A. W. Hatch.  
B. E. Doll.

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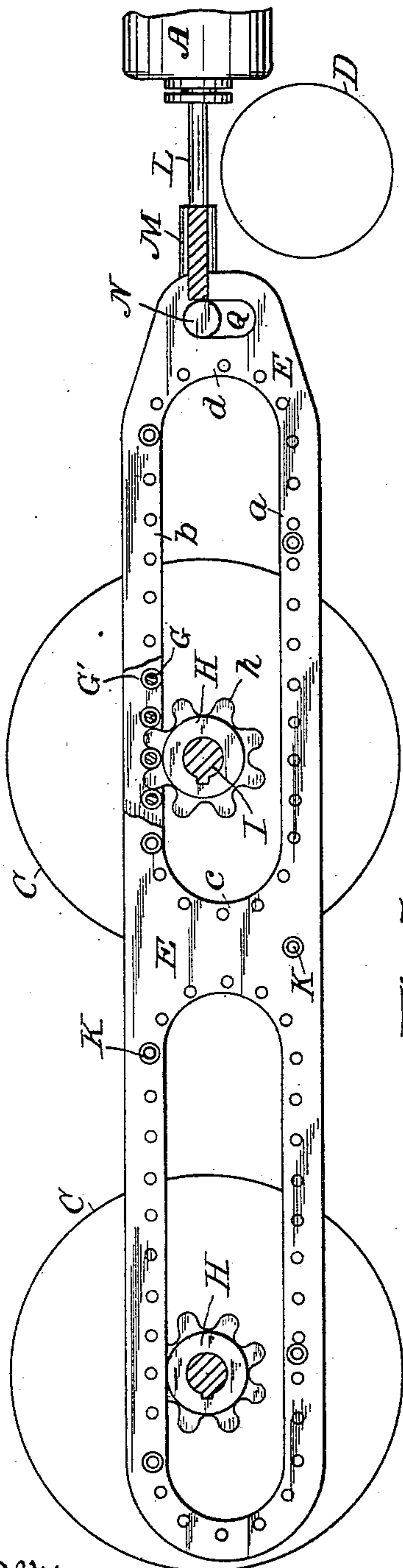


Fig. 3.

Witnesses  
A. W. Hatch.  
B. E. Doll.

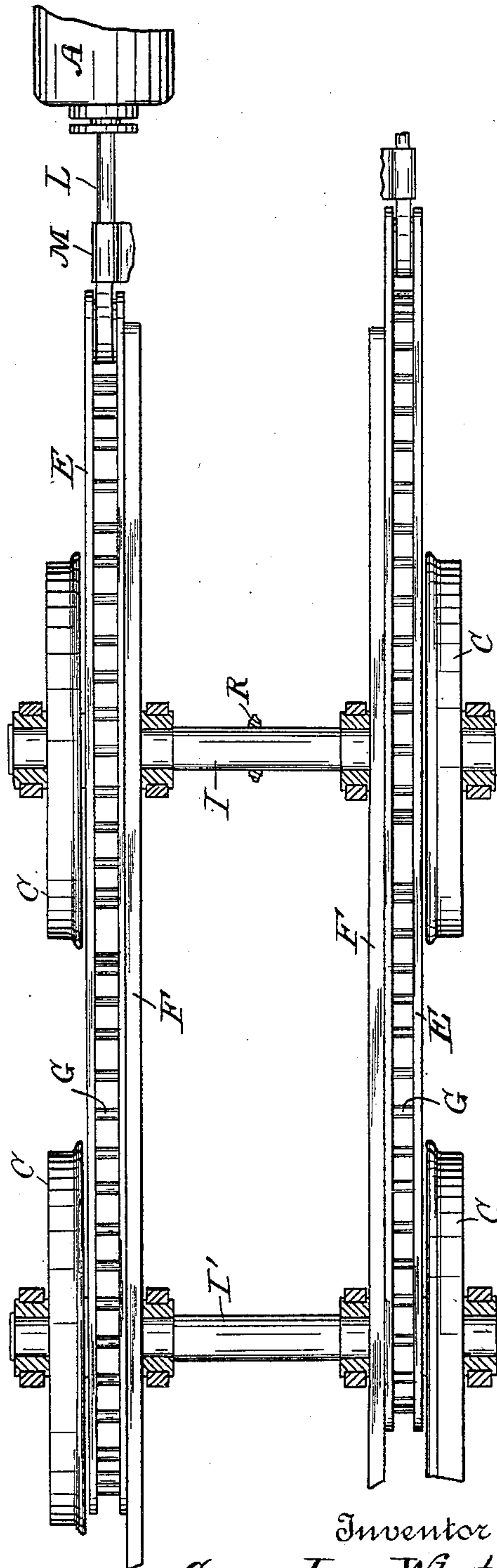


Fig. 4.

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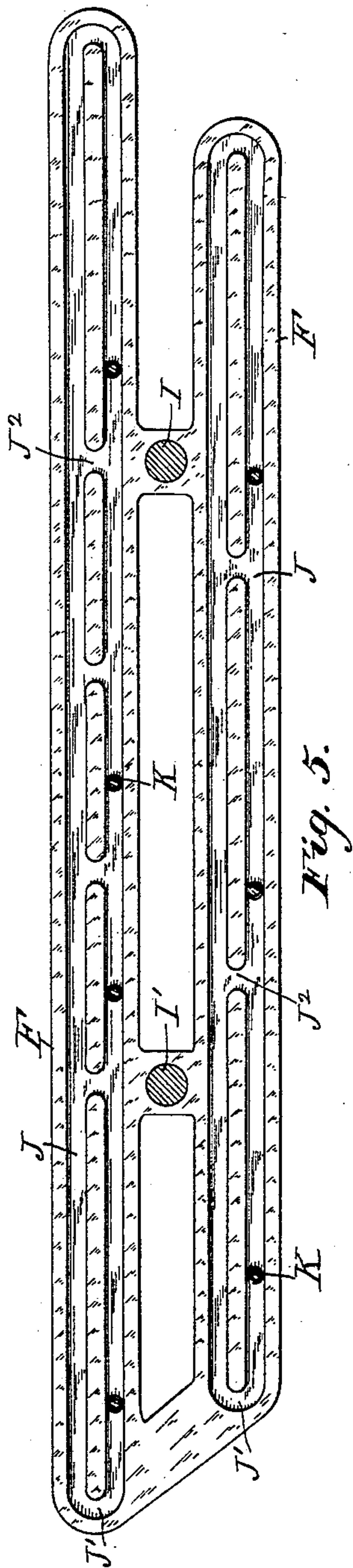


Fig. 5.

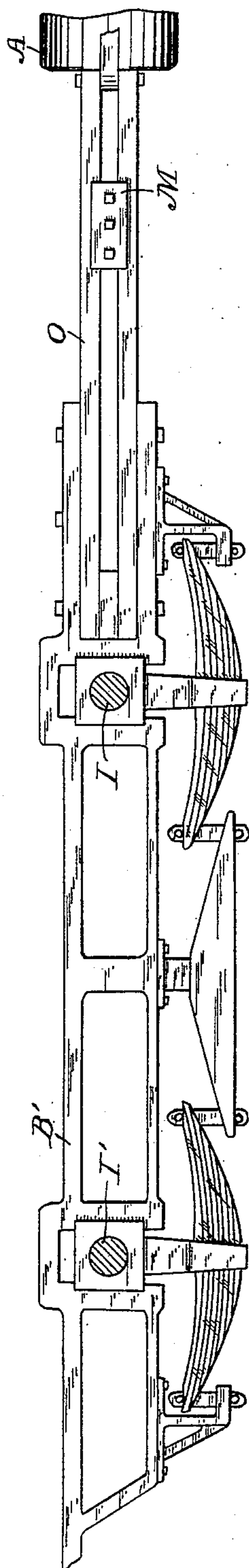


Fig. 6.

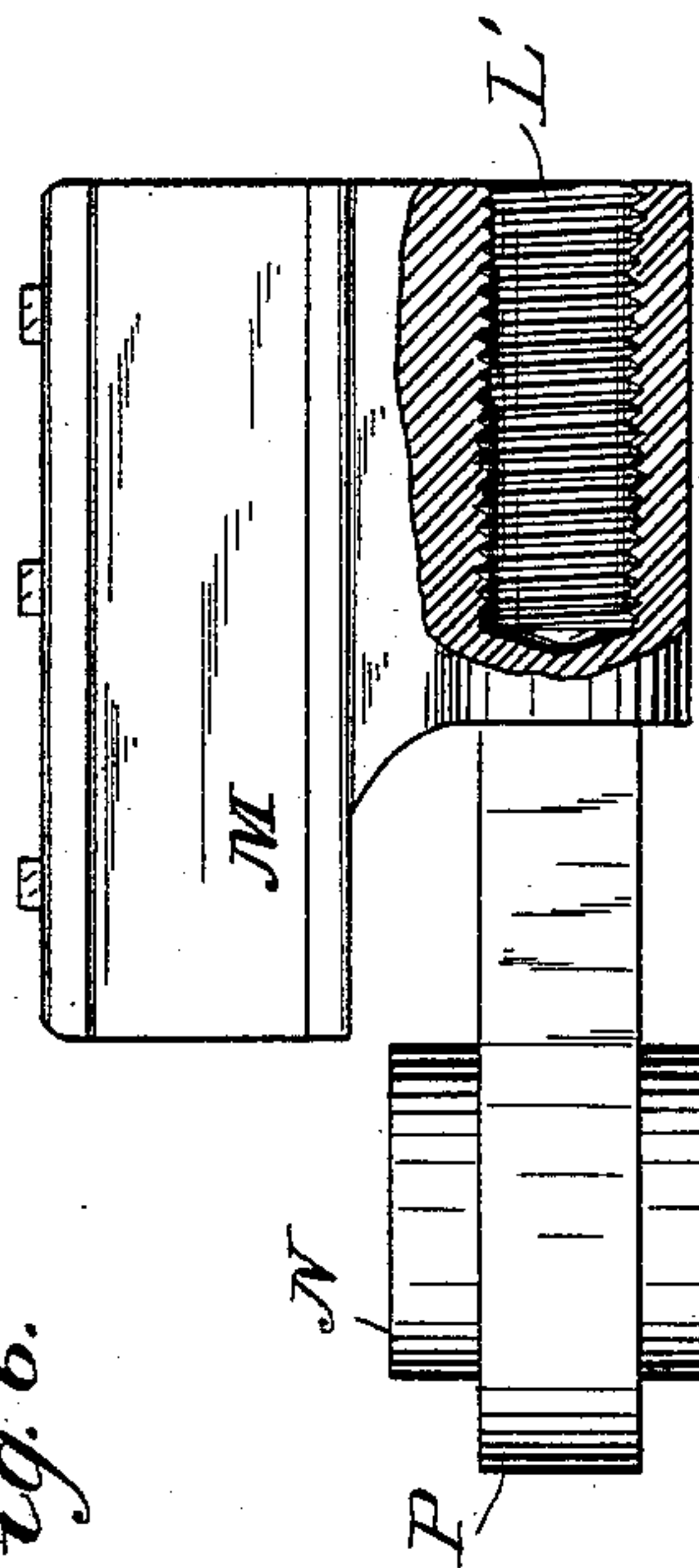


Fig. 10.

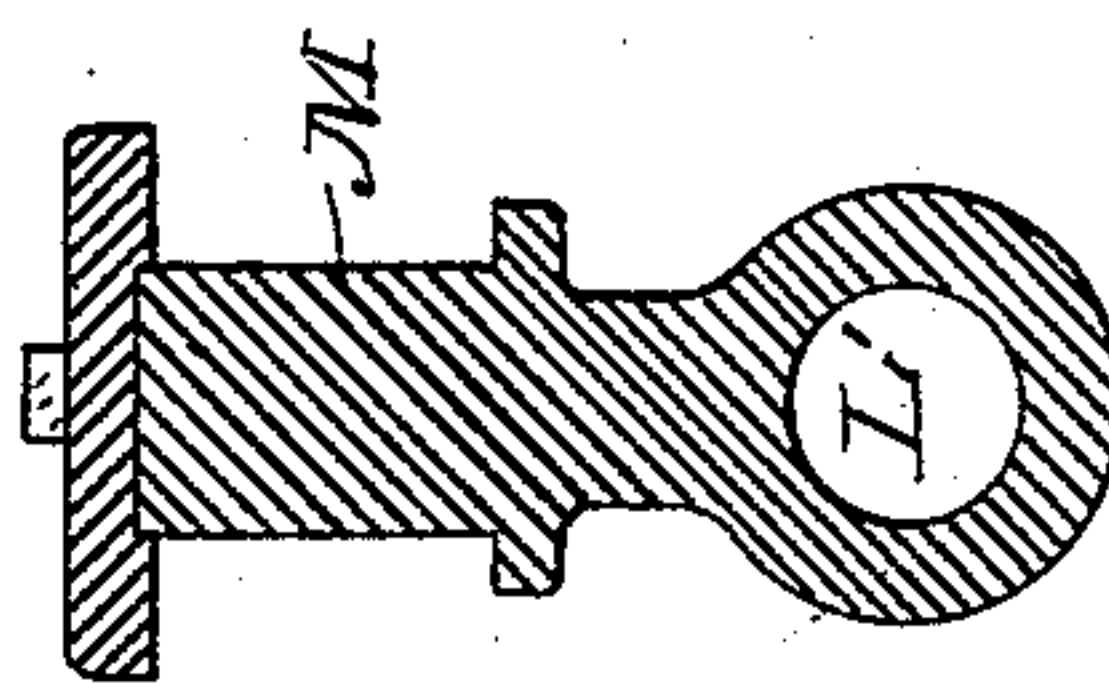


Fig. 9.

Witnesses  
A. W. Hatch.  
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(No Model.)

4 Sheets—Sheet 4.

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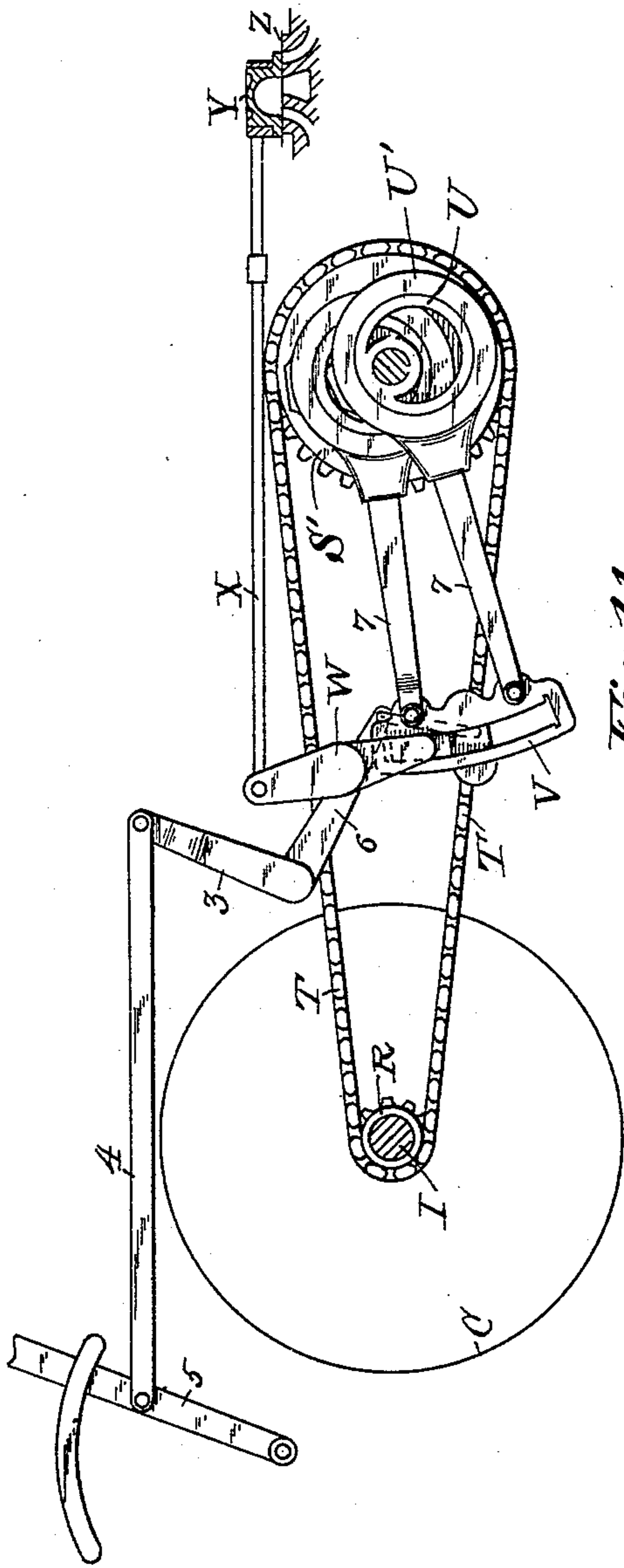


Fig. 11.

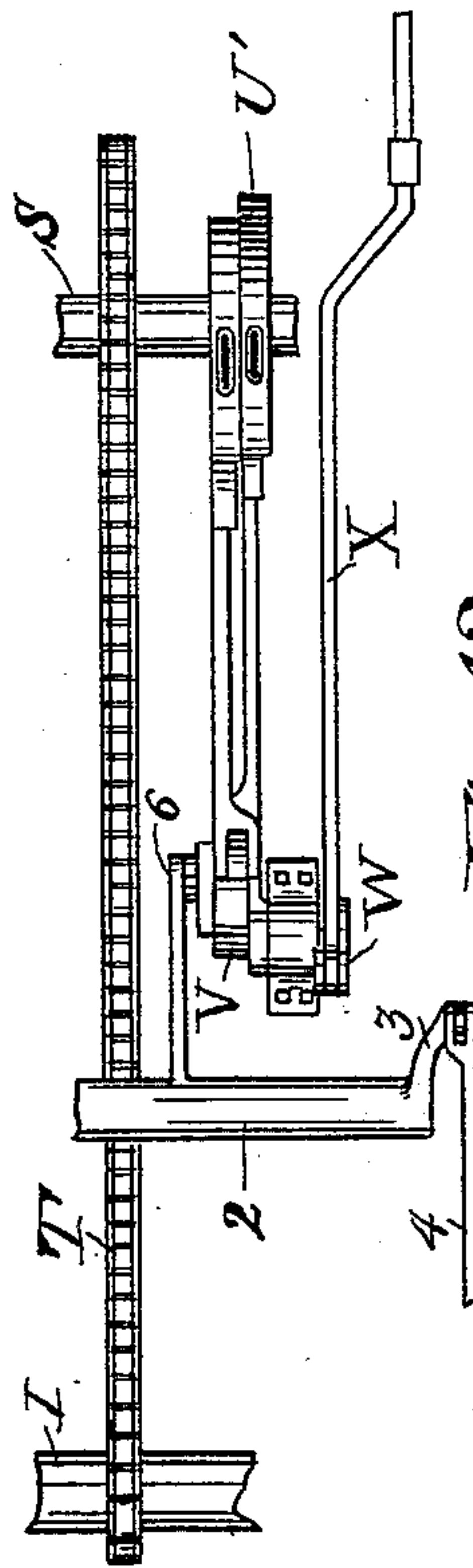


Fig. 12.

Witnesses  
A. W. Haxen.  
B. E. Doll.

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# UNITED STATES PATENT OFFICE.

GEORGE LEON WHYTE, OF DANVILLE, INDIANA.

## POWER-TRANSMITTING DEVICE.

SPECIFICATION forming part of Letters Patent No. 602,674, dated April 19, 1898.

Application filed December 27, 1897. Serial No. 663,595. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE LEON WHYTE, a citizen of the United States, residing at Danville, in the county of Hendricks and State of Indiana, have invented certain new and useful Improvements in Power-Transmitting Devices; and I do 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, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to that class of power-transmitting devices which are adapted to be used in connection with locomotive and other engines, as well as other machines—such as bicycles, sewing-machines, windmills, &c.; and it consists in a continuous novel toothed rack working in connection with a gear wheel or wheels in a novel manner and a guide of novel design for the rack by which it may be supported; and, as applied to locomotive-engines, it consists, further, in a means by which the inequality of steam distribution in the cylinders, due to the angularity of the connecting-rod, is obviated, and in all cases it provides a constant degree of leverage or force during the full stroke of the piston or plunger.

It consists, further, in the parts and combination of parts, as will be hereinafter more fully described.

My object is to provide a simple and effective means by which power may be transmitted from a lever or reciprocating motor, as a piston or plunger, to a rotating shaft, or from a rotating shaft to a plunger, by which the maximum force exerted in a given direction is utilized during the whole of the stroke as compared with a crank in which the full leverage is attained only during the short period in which the crank is in mid-position between each dead-center.

A further object is to provide means whereby a locomotive may be constructed so as to provide for the greatest economy in the use of steam and for the most even balancing of the main moving parts, whereby a relatively longer steam-cylinder may be employed with-

out the disadvantages of an abnormal length of crank.

These objects are fully attained in my invention, which, furthermore, includes a novel means by which the steam-valve may be operated in unison with the steam-piston when its stroke is greater than half the revolution of the main connected shaft or "driving-axle."

Referring to the drawings, Figure 1 represents a side elevation of the main parts of a locomotive-engine to which my invention is applied; Fig. 2, a transverse view showing the parts at one side in elevation and parts at the opposite side in vertical section; Fig. 3, a side elevation of the principal elements of my invention as applied to a locomotive and illustrating its adaptability to connect with a plurality of shafts; Fig. 4, a top plan view of Fig. 3; Fig. 5, a front side elevation of the guide for the rack-bar; Fig. 6, a side elevation of an auxiliary frame for a locomotive; Fig. 7, a transverse vertical section through rack-bar and guide; Fig. 8, a transverse vertical section through rack-bar and part of a connecting toothed wheel; Figs. 9, and 10, details of a cross-head; Fig. 11, a side view, and Fig. 12 a plan of valve-operating mechanism.

In the adaptation of my invention to locomotives its advantages will be apparent, as the main frame B and axle-boxes may be placed outside the wheels in the amount of space usually occupied by crank-pins and an auxiliary frame B' be placed inside.

C C are the driving-wheels, and D D the truck-wheels.

A A represent the steam-cylinders.

L represents the piston-rod, adapted to be attached to the cross-head M, as by screwing or keying it in the hole L'.

The axles I I' each have two wheels H, having teeth h secured rigidly thereto one at either side of the engine, either inside or outside the wheels; but I preferably place them inside. The teeth may be of either the spur or pin type.

The rack-bar E is preferably composed of two side plates suitably made in sections and connected and is provided with pin-teeth G, having rollers G' or spur-teeth of suitable



shape adapted to engage the teeth of the wheels H. The rack-bar has two parallel members *a* and *b*, connected by semicircular end webs *c* and *d*. The web at one end is suitably connected to the piston or plunger, a convenient means being that shown, in which the end P of the cross-head has a pin N, working in the slot Q in the web of the rack-bar. The pin N may have suitable bearings or sliding block forming a bearing between it and the sides of the slot. The cross-head works in suitable guides O. The rack-bar is provided with a suitable number of guide-pins K, which protrude from one side and are adapted to engage with the guide-channels in the guide-frame. The pins preferably have rollers, as is usual. The length of the parallel members is such that one member shall pass through its limit of travel a distance equal to the stroke of the piston while the axle or shaft I' or I makes one complete revolution, or it may be designed in other suitable ratios. This provides for a slow piston speed or a greater relative speed of the shaft, and it is therefore obvious that the valve Y could not be operated in unison with the piston by means of eccentrics on the axle I'. I therefore provide means by which the proper operation of the valve is accomplished, as will be further described.

The guide F is composed of a frame of suitable length to adapt it to the rack-bar, and it has channels J in its face to receive the guide-pins K, which follow the straight portion while the rack-bar is exerting its force upon the connected toothed wheel and passes around the ends J' or cross-channels J<sup>2</sup> when the direction of the motion of the rack-bar is being reversed. One or more sets of channels may be used, as may be necessary, to support and guide the rack-bar, according to its size.

The rack-bar may be used singly or in pairs, and in the latter case, as shown, they are "quartered"—that is, when one bar is being reversed in its motion the other is midway in its travel between its ends—so that one aids in smoothly carrying the other over its center or reversing point, and thus if the engine is to be started when one bar is at its "dead-point" the other may have its full power to start the motion. It will be understood that the toothed wheels engaging the rack-bars are both secured to the same shaft or axle.

In supporting the frame of the guide F it is rigidly secured if the shaft runs in fixed journal-boxes; but in its application to a locomotive, the axles having an up-and-down motion relatively to the main frame of the engine, the guide is supported by a suitable frame carried by journal-boxes on the axles, so that the axles, the rack-bar, and the guides partake of the same vertical movement.

An auxiliary shaft S is suitably mounted in journal-boxes carried by the main frame of the locomotive, and to the shaft is secured a sprocket-wheel S', connected operatively

with a sprocket-wheel R, secured to the axle I by a chain T, the relative diameter of the wheels being determined by the ratio of piston and axle speeds, as if the axle I makes a revolution during one stroke of the piston the wheel S' must be double the diameter of the wheel R, so that the shaft S shall make but half of a revolution. Eccentrics U, having straps U', are secured to the shaft S, and rods 7 connect the straps with a shifting link V, which is supported by rocking shaft 2, having arms 6 and 3, the latter being connected by a rod 4 to the reversing-lever 5. The link is connected so as to operate the rocking shaft and arms W, to the upper arm of which is connected the valve-stem X, attached to the main valve Y, working upon the valve-seat Z in a suitable steam-chest. Other equivalent mechanism may be employed in lieu of the sprocket wheels and chain, as the shaft S may be situated close to the axle and supported by it upon a suitable frame, in which case toothed wheels on the shaft may be used in direct engagement.

In operation, by reference to Figs. 3 and 5 it will be seen that should the piston and rack-bar be moved forward or backward it has a constant leverage upon the teeth of the wheels H, and in moving forward, when it has reached its limit of travel, the imparted motion of the wheels H causes the rack-bar E to rise, guided by the guide-pins K in the guide-channels, so as to engage the teeth of the wheels below the axle instead of above, as shown. Thus the motion of the bar is reversed, while the same direction of revolution of the axle continues.

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

1. The combination with a reciprocating piston or plunger and a revoluble shaft, of a rack-bar provided with an oblong opening having two parallel internal straight engagement-faces connected at each end by a web having a semicircular engagement-face, and a continuous series of gear-teeth in said engagement-faces forming a continuous toothed rack, one end of said rack-bar being connected operatively to said piston; a circular toothed wheel secured rigidly to said shaft and of less diameter than the transverse distance between said parallel faces, said toothed wheel being in engagement with said toothed rack; guide-pins secured rigidly to said rack-bar and projecting from the side thereof at right angles to said side; and a guide suitably supported and having guide-channels in its face in which said guide-pins move, whereby said rack-bar and said toothed wheel are caused to maintain a constant contact while said rack-bar has a reciprocating motion and said toothed wheel has a revolving motion in one direction, substantially as shown and described.

2. In a power-transmitting device, the combination of the reciprocating rod, the revolu-



ble shaft, the toothed wheel secured to the shaft, the toothed rack-bar having an oblong opening of greater width than the diameter of said toothed wheel and adapted to pass  
 5 over said wheel in engagement at all parts of its inner contact portion, means by which said reciprocating rod and said rack-bar may be operatively connected, guide-pins on said rack-bar, and a suitably-supported guide  
 10 having guide-channels in its front adapted to receive said guide-pins, whereby said rack-bar is caused to maintain constant contact with said toothed wheel and its motion reversed at each end of said oblong opening,  
 15 substantially as shown and described.

3. The combination of a revoluble shaft, a reciprocating piston or plunger, a rack-bar provided with an oblong opening having two straight parallel opposing sides and two semi-  
 20 circular connecting ends and said sides and said ends having a continuous series of gear-teeth forming a continuous internal toothed rack; a circular toothed wheel rigidly secured to said shaft and engaging said rack-bar; a  
 25 guide having its working face adjacent to said rack-bar; suitable guide-channels in the said face, guide-pins rigidly secured to said rack-bar and engaging said guide-channels, whereby said rack-bar is caused to maintain  
 30 constant contact with said toothed wheel and its reciprocating motion controlled; and means whereby said rack-bar and said piston may be connected, substantially as shown and described.

35 4. In combination with the locomotive-engines having the steam cylinder and valve and main axles, of toothed wheels secured to said axles by which power may be transmitted, rack-bars provided with continuous internal

gear-teeth arranged in an oblong opening 40 in said bar and adapted to provide a continuous engagement with said toothed wheels, guides by which said rack-bars are supported and maintained in contact with said toothed wheels and the contact changed from one side 45 to the other of said opening at either end thereof, means by which said rack-bar may be connected operatively to the cross-head, with a cross-head and guides therefor, and means by which the main steam-valve may 50 be operated in unison with the said rack-bars and the piston in the cylinder, substantially as shown and described.

5. The combination of the rack-bars suitably operated, the toothed wheel connecting 55 said rack-bar, the axle attached to said wheel, said toothed wheel and said rack-bar being adapted to effect a rotative travel of said axle in excess of half a revolution during the travel of said rack-bar through one horizon- 60 tal stroke, the cylinder and piston with means by which said piston and said rack-bar may be connected, the steam-valve for said cylinder, the auxiliary shaft suitably mounted with means by which said auxiliary shaft may 65 operate said valve, and means by which said axle shall impart a uniform motion to said auxiliary shaft equal to half of a revolution during a stroke of said rack-bar in one horizontal direction, substantially as shown and 70 described.

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

GEORGE LEON WHYTE.

Witnesses:

WM. C. THOMPSON,  
 E. T. SILVIUS.