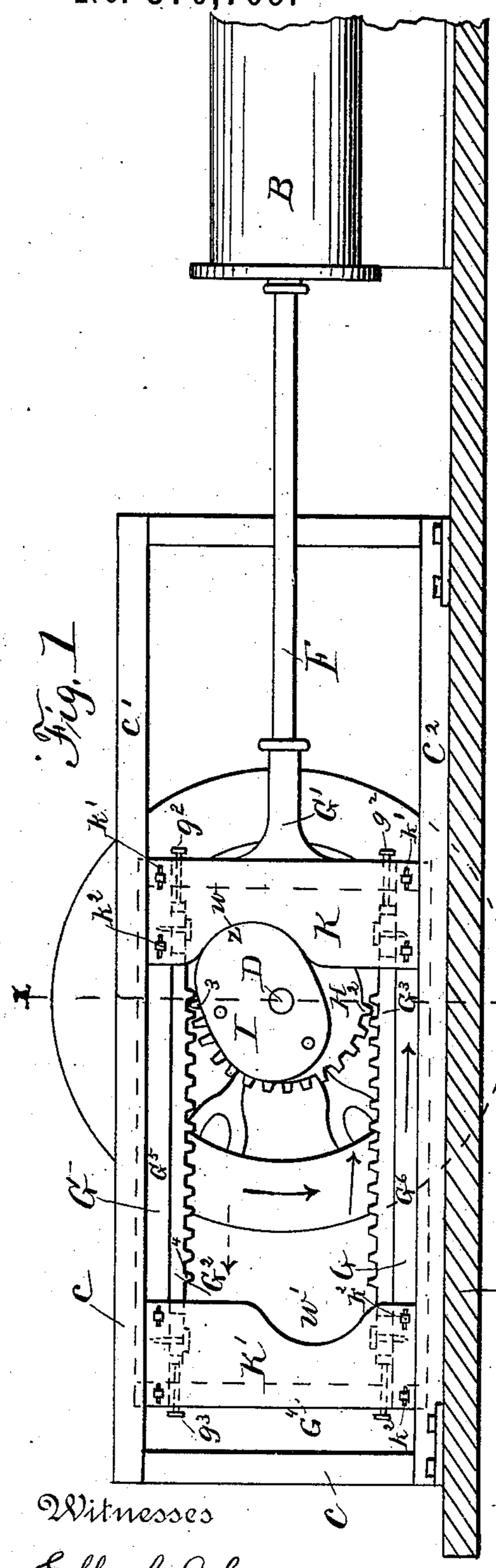
(No Model.) 2 Sheets—Sheet 1.

L. MATHIAS & V. A. WALKUP.

RACK AND PINION DEVICE.

No. 370,709. Patented Sept. 27, 1887.

Fig. 1.



Witnesses

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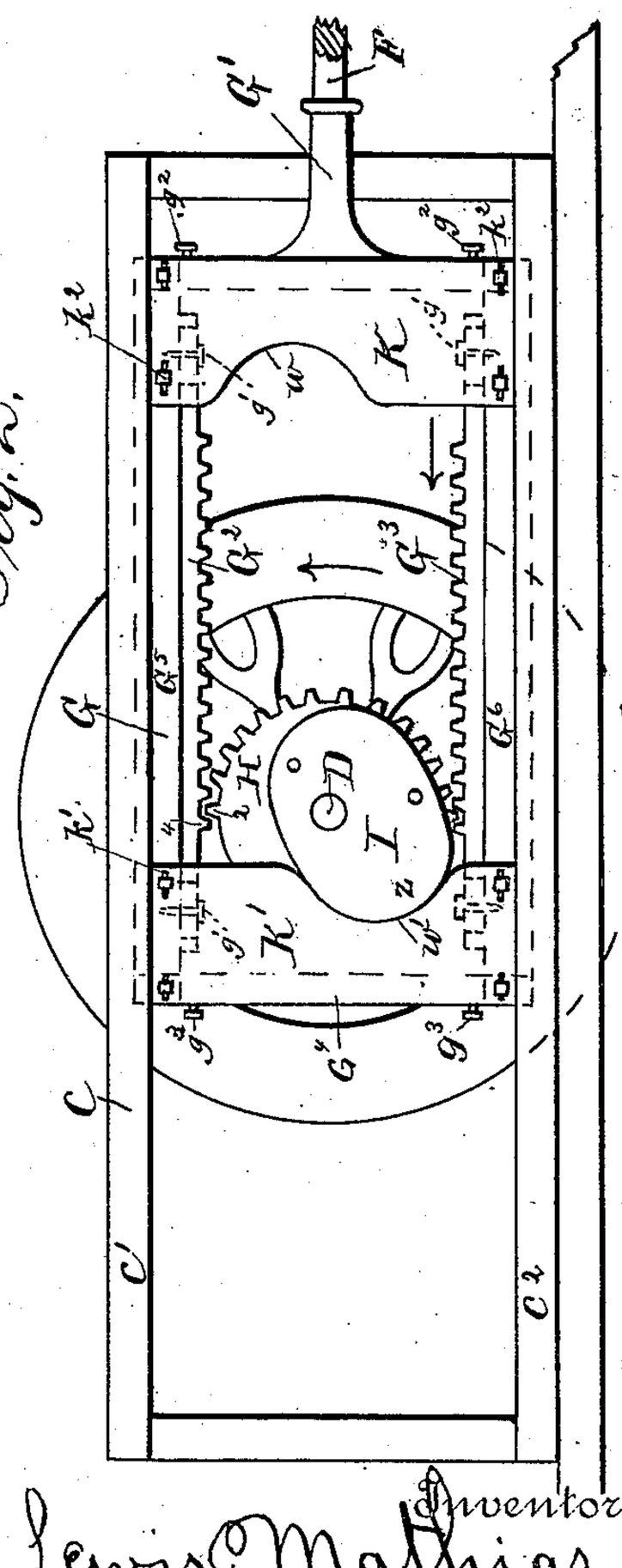
Wm. R. Mackrille.

Fig. 2.



Inventors.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3

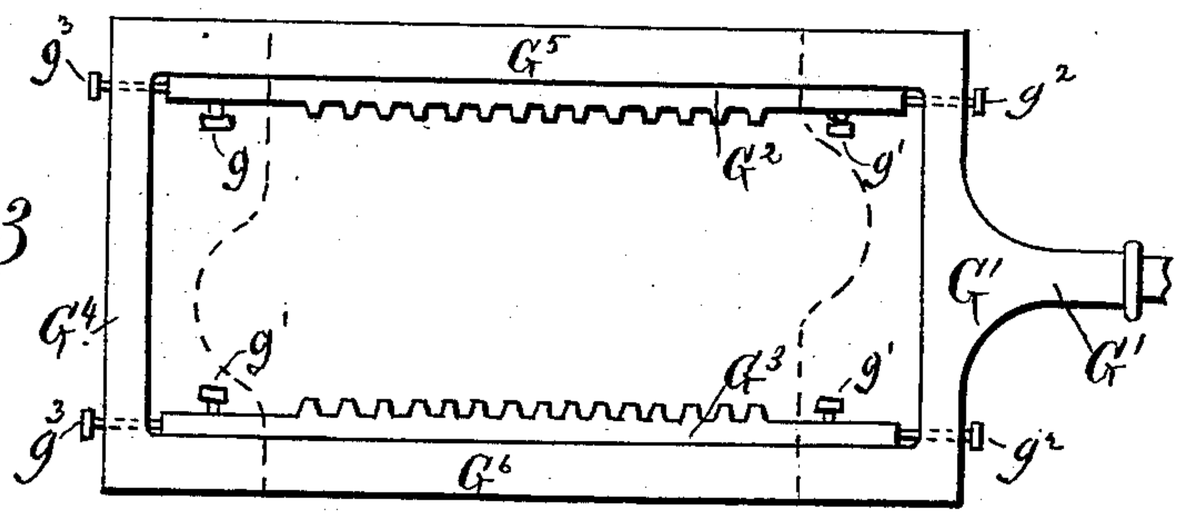


Fig. 4.

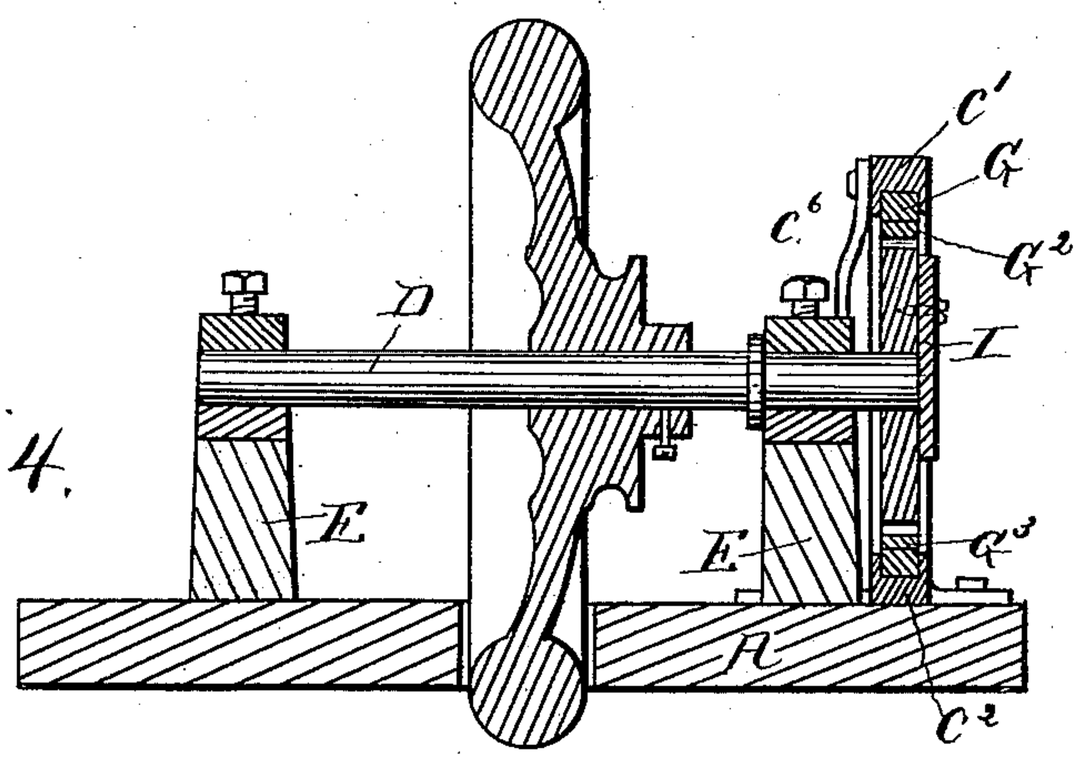
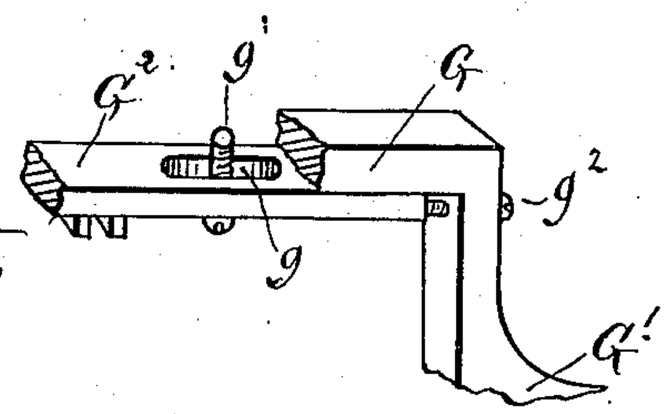


Fig. 5.



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UNITED STATES PATENT OFFICE.

LEWIS MATHIAS AND VINCENT A. WALKUP, OF AUDUBON, IOWA; SAID WALKUP ASSIGNOR TO SAID MATHIAS.

RACK-AND-PINION DEVICE.

SPECIFICATION forming part of Letters Patent No. 370,709, dated September 27, 1887.

Application filed June 16, 1887. Serial No. 241,499. (No model.)

To all whom it may concern:

Be it known that we, LEWIS MATHIAS and VINCENT A. WALKUP, citizens of the United States, residing at Audubon, in the county of Audubon and State of Iowa, have invented new and useful Improvements in Racks and Pinions, of which the following is a specification.

Our invention relates to the class of mechanical movements used to convert rectilinear reciprocating motion into continuous rotary motion, the means employed consisting, essentially, in a pair of reciprocating racks supported in guides and connected at their ends by cam-bearing plates; a mutilated gear-pinion secured to a continuously-rotating shaft to engage successively with each of the rack-bars, and a cam-plate to operate upon the bearing-plates at each end of the stroke, and thus preserve a continuous rotary motion.

Our improvement consists in its general features in the form of the bearing-plates and of the cam-plates secured to the mutilated gear and adapted to fit the bearing-plates, the form and arrangement of which give to the rack-frame a steady movement at the end of the stroke without offering dead-centers or other obstructions to its regular movement, and also in means for adjusting the rack-bars and bearing-plates to take up wear and lost motion, and in certain details of construction and combinations of parts, hereinafter particularly described, and designated in the claims.

In the accompanying drawings, Figure 1 is a side elevation of our invention applied to a single-acting steam-engine representing the piston and the reciprocating rack-frame at one end of its stroke; Fig, 2, a similar view of the said rack-frame at the other end of the stroke; Fig. 3, an elevation in detail of the rack-frame, showing means for adjusting the rack-bars. Fig. 4 is a sectional elevation on line *x x* of Fig. 1; and Fig. 5, a perspective of one corner of the rack-frame enlarged, showing means for adjusting the rack-bars.

The bed-plate A of the engine supports a steam-cylinder, B, securely bolted to one end thereof, a guide-frame, C, supported at the other end of the bed-plate, and a driving-shaft, D, supported upon pillow-blocks E, secured to the bed-plate and located in a plane transverse with and intermediate of the length of the guide-frame.

The rod F of a piston, adapted to reciprocate within the cylinder B, having suitable valves for receiving and exhausting the steam, is secured to the head G′ of a rack-frame, G, supported in the guide-frame C to reciprocate with the piston of the engine. The rack-frame G has a rack-bar, G^2, located above and a similar rack-bar, G^3, located below a mutilated gear-pinion, H, secured to the end of the driving-shaft D, the said rack-bars being adjustably secured to the frame G, as hereinafter described, to properly engage with the teeth of the mutilated gear-pinion.

A cam-plate, I, of peculiar shape, secured to the outer face of the gear-pinion H, engages with bearing-plates K K′, bolted to the opposite ends of the rack-frame, and shaped upon their bearing-edges *w w′* to fit or conform to the shape of one end Z of the cam-plate I, and serve, together with the rack-bars and mutilated gear-pinion, to impart to the drive-shaft D a continuous uniform rotary motion without material loss of power or undue friction at the end of the stroke of the piston, thus obviating dead-centers and the constantly-changing force incident to the use of the ordinary crank-and-pitman connection between the drive-shaft and piston of an engine.

The guide-frame C is composed of parallel guides C′ C^2, arranged horizontally, and pieces arranged vertically, to form a solid rectangular frame. The bars C′ C^2 are located one above the other, and the latter, C^2, is secured firmly to the bed-plate A. The bars C′ C^2 guide the rack-frame, and may be either solid or grooved.

The rack-frame G is formed of parallel bars G^5 G^6, head G′, and post G^4, solidly secured or cast together, and is similar to the guide-frame C, being made about one-half the length thereof to fit and slide within the same. The bars G^5 G^6 in the bars C′ C^2 of the guide-frame, as shown in Fig. 4, or other forms of guide-bars and cross-head connections with adjustable brasses for bearing-surfaces may be secured to the ends of the frame G to fit the guide-bars C′ C^2 in any well-known or preferred manner.

The bearing-frame plate K, secured to the head G′ of the rack-frame, is shaped or cut away at the upper part of its inner edge at *w* to receive

and approximately fit the end Z of the cam-plate I at the end of the stroke, and the bearing-plate K′ is secured to the post G^4 of the rack-frame, and is similarly cut away at the lower part of its inner edge at *w′* to receive and approximately fit the bearing-plate K′ at the other end of the stroke of the piston and rack-frame.

In operation the forward end of the lower rack-bar, G^3, will engage with the first tooth, 2, of the mutilated gear-pinion, and, moving in the direction of the arrow, will rotate the said pinion H and drive-shaft D until the other end of the rack-bar G^3 has been reached and the teeth thereof shall have cleared the last tooth, 3, of the mutilated gear-pinion. A continuation of the movement of the rack-frame in the direction of the arrow will cause the bearing-plate K′ to press against the curved end Z of the cam-plate I, (see Fig. 2,) which will at this time have been brought together, and thus continue the rotation of the pinion H in the direction of the arrow until the tooth 2 of the pinion H shall have become fairly engaged with the tooth 4 of the upper rack-bar, G^2. A reversal of the movement of the rack-frame in the direction of the dotted arrow then occurs, when the piston moves forward again and the pinion H continues its rotation in the same direction and reaches the position shown in Fig. 1, near the end of the stroke and while the cam-plate I is acting upon the plate K to bring the tooth 2 in engagement with the tooth at the forward end of the rack-bar G^3, as first described, thus producing an uninterrupted continuous rotary motion of the shaft D in the same direction indicated by the curved arrow.

The plates K K′ each have slots *k′* at their four corners, which will receive bolts k^2, screwed into the ends and face of the rack-frame bars G^5 G^6, by which means said plates may be adjusted upon the rack-frame to fit the cam-plate I and take up any lost motion from wear or inaccurate fitting when desired.

The ends of the rack-bars G^2 G^3 have slots *g*, through which screw-bolts *g′* pass and fit into the ends of the rack-frame bars G^5 and G^6 to clamp the rack-bars in any required position securely to the rack-frame, and set-screws g^2 in the head G′ and a similar set-screw, g^3, in the post G^4 of the rack-frame bear against the ends of the said rack-bars G^2 G^3 and serve to adjust them upon the frame. When it is required to adjust the rack-bars upon the frame to properly engage with the teeth of the mutilated pinion, the screw-bolts *g′* are first loosened, and the said bars may then be freely adjusted to the proper position upon the frame by the set-screws g^2 and g^3, after which the screw-bolts *g′* may be screwed tight to firmly clamp the bars.

A very high rate of speed can be obtained by the above-described means without vibration, which is a great desideratum in engines used for many purposes.

What we claim as our invention is—

1. The reciprocating rack-frame having end plates each having a curved recess on its inner edge, arranged one at its junction with the lower rack and one at its junction with the upper rack, in combination with the cam-plate I, having its ends curved to conform to the recesses, the shaft, and the mutilated pinion, the said cam-plate being eccentrically secured to the outer face of said pinion in such relation to its center and to the said recesses as to leave a revolving sliding action therein upon said plates at the end of each stroke of the rack-frame, as set forth.

2. The combination of the rack-frame, the guide-frame, the drive-shaft, the pinion, the cam-plate I, secured thereto, and the end bearing-plates K K′, secured to the rack-frame by set-screws and slots for rigid adjustment, substantially as described.

3. The combination of the guide-frame, the reciprocating rack-frame, the drive shaft, the mutilated pinion, the rack-bars having slots, screw-bolts passing through the slots and into the rack-frame, and set-screws in the rack-frame to adjust the said rack-bars upon the frame, substantially as described.

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VINCENT A. WALKUP.

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JAMES ANDERSON.