No. 654,153. Patented July 24, 1900.

C. H. HEROD & J. B. DETWILER.

MECHANICAL MOVEMENT

(Application filed Mar. 9, 1900.)

(No Model.)

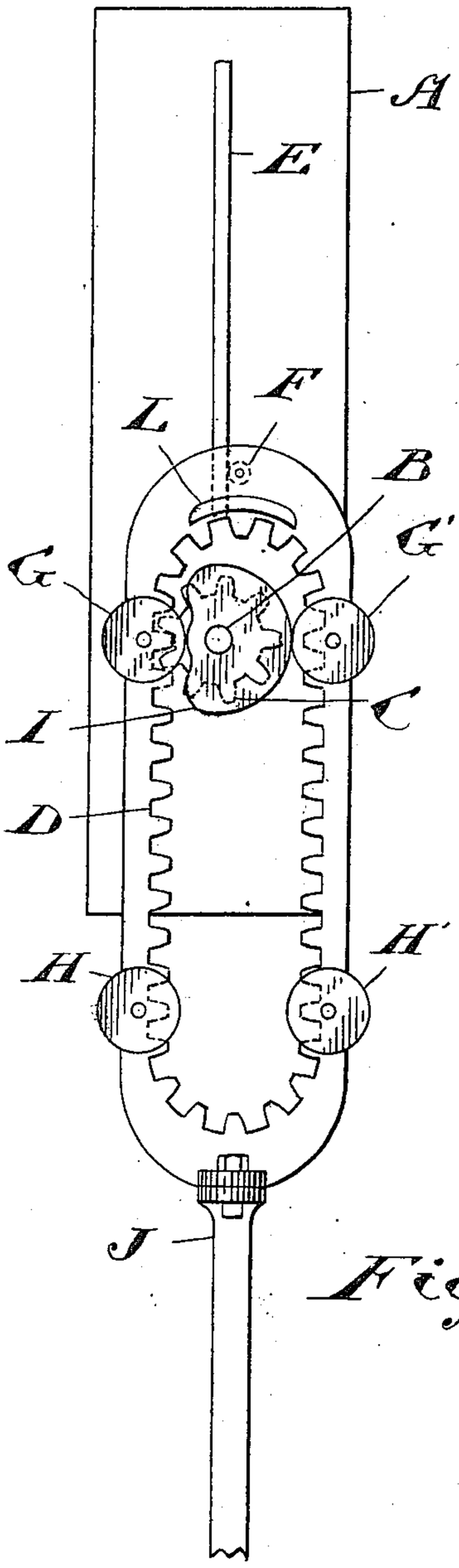

Fig. 1.

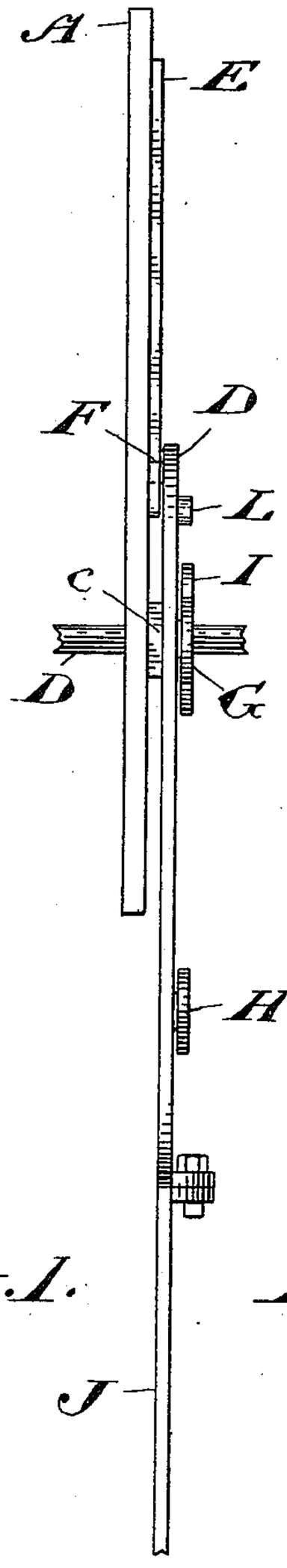

Fig. 2.

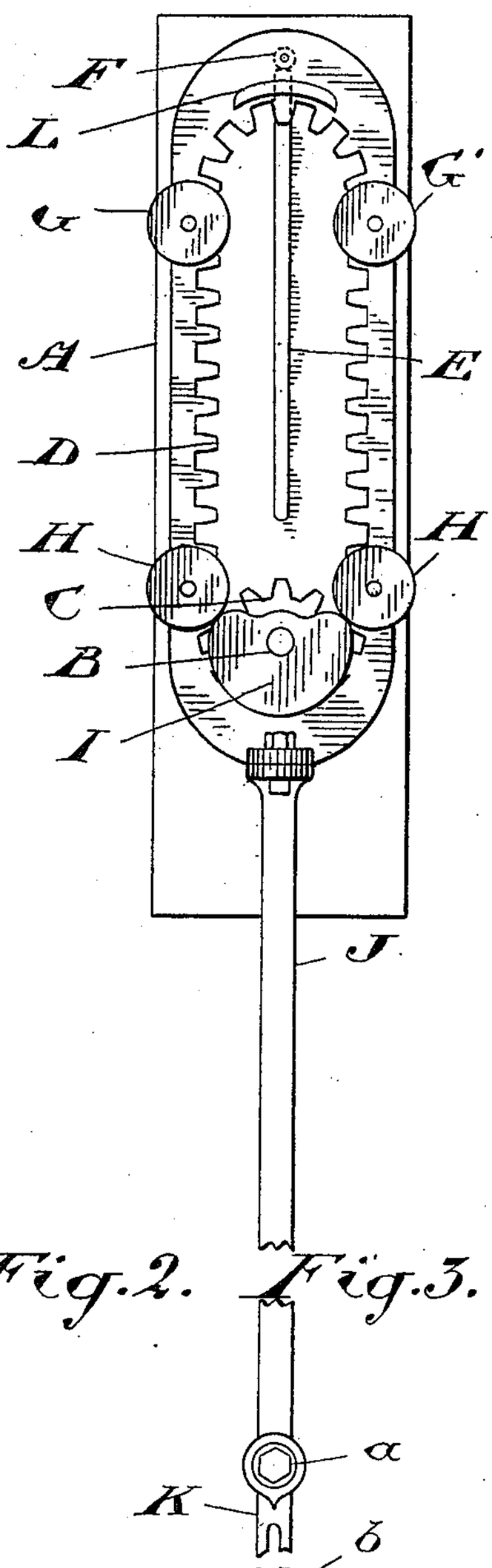

Fig. 3.

Witnesses

G. J. Colbourne.

J. M. Corbalis

Inventors

Charles H. Herod

and

John B. Detwiler.

by Ridout & Maybee

Attys

UNITED STATES PATENT OFFICE.

CHARLES HENRY HEROD AND JOHN BECHTEL DETWILER, OF BRANTFORD, CANADA.

MECHANICAL MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 654,153, dated July 24, 1900.

Application filed March 9, 1900. Serial No. 8,013. (No model.)

To all whom it may concern:

Be it known that we, CHARLES HENRY HEROD, pattern-maker, and JOHN BECHTEL DETWILER, mechanic, of the city of Brantford, in the county of Brant, Province of Ontario, Canada, have invented a certain new and useful Mechanical Movement, of which the following is a specification.

The object of our invention is to devise means for converting rotary into reciprocating rectilinear motion, more particularly for the purpose of obtaining a long stroke in windmill-pumps; and it consists, essentially, of a continuous double internal rack with which meshes a pinion fast on the driving-shaft and a roller on the rack engaging the opposite sides of a stationary guide, so as to hold either side of the rack in mesh with the pinion.

Our invention also relates to a cam connected to the pinion which is adapted to engage pairs of rollers journaled near each end of the rack for the purpose of assisting in throwing the rack from side to side when the pinion is in mesh with the ends of the rack and to certain details of construction hereinafter more specifically described and then definitely claimed.

Figure 1 is a front elevation of our movement near the end of its downward stroke. Fig. 2 is a side elevation of Fig. 1. Fig. 3 is a similar view to Fig. 1, showing the parts as they appear at the end of the upward stroke.

In the drawings like letters of reference indicate corresponding parts in the different figures.

A is a frame supporting the movement, and which may be of any suitable construction, according to the purpose for which the movement is used. B is the driving-shaft, suitably journaled therein, and C a gear-pinion secured thereto. This pinion is adapted to mesh with a continuous double internal rack D, the sides being connected by semicircular ends provided with teeth of the same pitch as the sides of the rack. The sides of the rack are of course sufficiently separated to enable the pinion C to engage with the rack at any point without interfering with the teeth at any other point. The rack may be separated from the frame A by the blocks *c*, preferably secured to the rack.

Centrally secured to the frame A is the stationary guide E, with the sides of which the projection F may engage. This projection is preferably a roller to reduce friction. This guide E is of such a length that when the rack is at one end of its stroke the roller is substantially in contact with one end of the guide, while when the rack is at the other end of its stroke the roller is substantially in contact with the other end of the guide.

Secured to the rack is a rod J, which is preferably pivotally connected to the part K to be reciprocated, as indicated at *a*. The part K, which in the present case is the piston-rod of a pump, is of course so guided that it moves vertically up and down without side motion. This may be done in any suitable manner, one means being shown in the drawings in which a pin *b* engages a slot in the piston-rod.

The exact shape of the sides of the stationary guide E will depend on the distance separating the shaft B and the pivot *a*, as the upper end of the rack will swing a little farther from side to side at the upper end of the stroke compared with the distance it will swing at the lower end of its stroke if the pivot-point *a* be close to the shaft B than it will if the pivot-point *a* be a greater distance from the shaft B. The ends of the guide E are preferably rounded.

From the construction described it is evident that the continuous rotary motion of the shaft B will alternately raise and lower the rack, the roller F moving along the sides of the stationary guide, holding the two in mesh. At the end of the downward stroke the pinion engaging with the teeth of the curved upper end of the rack will so swing the latter that the roller F will engage the other side of the guide E, enabling the pinion to raise the rack. A similar shift is of course made when the pinion has raised the rack to its highest point and is engaged with the teeth of the lower curved end.

As it is not desirable that the strain when the apparatus is doing work should be borne by the meshing teeth of the pinion and the

curved upper end of the rack, we provide the pinion C with a cam I and so proportion the number of teeth in the pinion and the rack that the number of teeth in the latter is a multiple of the number of teeth in the former, so that when the pinion is engaged with the teeth of the curved upper end of the rack the same part of the cam I will always be uppermost. The rack at its upper end is provided with the curved flange L, with which the cam I engages, and so takes all downward strain off the meshing teeth.

It is also desirable to provide other means than the engagement of the pinion with the rounded ends of the rack for throwing the rack from side to side, and for this purpose we provide the rack near its opposite ends with two sets of rollers G G′ H H′. These rollers may be stationary, though to prevent friction they are preferably journaled as indicated. The cam I, when such friction-rollers are used, is made of the shape shown in the drawings and is so proportioned and the rollers so located that the cam will pass between them, while maintaining continuous contact with both, as indicated in Fig. 1. The rollers in the apparatus illustrated are separated by a sufficient number of teeth of the rack so that the pinion must make a half-revolution in passing from one to the other, so that when the pivot-points of the rollers and cams are in line the point of the cam is in contact with one roller and the center of the back with the other, or vice versa. When a set of friction-rollers is used at each end, as indicated in the drawings, it is necessary that the number of teeth in the rack be a multiple of the number of teeth in the pinion—that is to say, if there be nine teeth in the pinion the number of teeth in the rack must be eighteen, thirty-six, fifty-four, &c.—so that at each end of the stroke the same part of the cam is turned toward the end of the rack at which it happens to be, as otherwise the cam would not be able to pass between each set of rollers, and it would be necessary to provide a separate cam on the other side of the pinion and corresponding rollers on the rack.

The lower rollers, as seen in Fig. 3, not only coact with the cam to enable the latter to move the rack accurately from side to side, but also by resting on the latter when it is in the position shown in Fig. 2 serve to sustain the weight of the rack and take any strain upon the latter while the pinion is moving over to engage the opposite side of the rack for the downstroke. For the purpose of enabling the cam to throw the rack from side to side one roller at each end of the rack on the opposite sides of the same would be sufficient; but two rollers are preferred, as they enable the cam by engaging with them to so regulate the movements of the rack that the teeth of the pinion mesh with the rounded ends of the rack as accurately and with as little friction as if the pinion were meshing with the teeth of an ordinary journaled gear-wheel.

In windmill construction it has been found that there has been great difficulty in securing a long stroke in pumping without having a very long crank on the driving-shaft, and such a crank is exceedingly undesirable, as the thrust of its connecting-rod is alternately from one side to the other, producing a great deal of undesirable side strain. By the device we have described any length of stroke desired may be given without moving the line of thrust or pull to any great degree off the center. The length of stroke is regulated purely by the number of teeth in the rack, while the leverage is dependent solely on the size of the pinion C.

What we claim as our invention is—

1. In a device of the class described, a suitably-journaled shaft; and a gear-pinion secured thereto in combination with a continuous double internal rack with which the said pinion meshes and which is connected to the part to be reciprocated; a stationary guide; a projection on the rack adapted to engage opposite sides of the guide so as to hold either side of the rack in mesh with the pinion, a cam secured to said pinion and a flange coacting therewith, substantially as and for the purpose specified.

2. In a device of the class described, a suitably-journaled shaft; and a gear-pinion secured thereto in combination with a continuous double internal rack with which the said pinion meshes and which is connected to the part to be reciprocated; a stationary guide; a projection on the rack adapted to engage opposite sides of the guide so as to hold either side of the rack in mesh with the pinion, the guide being so proportioned in length that the projection on the rack when the apparatus is in operation travels around each end substantially in contact therewith, a cam secured to said pinion and a flange coacting therewith, substantially as and for the purpose specified.

3. In a device of the class described, a suitably-journaled shaft; and a gear-pinion secured thereto in combination with a continuous double internal rack the number of teeth in which is some multiple of the number of the teeth in the pinion meshing therewith; a roller located on the rack near one end; a cam secured to the pinion, the cam being so shaped and proportioned that the engagement of the roller by the cam will throw the rack from one side to the other while the pinion is passing around from one side of the rack to the other; a stationary guide; and a projection on the rack adapted to engage opposite sides of the guide so as to hold either side of the rack in mesh with the pinion, substantially as and for the purpose specified.

4. In a device of the class described, a suitably-journaled shaft; and a gear-pinion secured thereto in combination with a continuous double internal rack the number of teeth in which is some multiple of the number of teeth in the pinion meshing therewith; a pair

of rollers located on the rack at opposite sides thereof near one end; a cam secured to the pinion, the cam and rollers being so set and proportioned that the cam while continuously in contact with each roller will throw the rack from one side to the other while the pinion is passing around from one side of the rack to the other; a stationary guide; and a projection on the rack adapted to engage opposite sides of the guide so as to hold either side of the rack in mesh with the pinion, substantially as and for the purpose specified.

5. In a device of the class described, a suitably-journaled shaft; and a gear-pinion secured thereto in combination with a continuous double internal rack the number of teeth in which is some multiple of the number of teeth in the pinion meshing therewith; a roller located on the rack near the upper end; a cam secured to the pinion; the cam being so shaped and proportioned that the engagement of the roller by the cam will throw the rack from one side to the other while the pinion is passing around from one side of the rack to the other; a stationary guide and a projection on the rack adapted to engage opposite sides of the guide so as to hold either side of the rack in mesh with the pinion; and a curved flange at the upper end with which the cam engages to take the strain while the pinion is passing around the upper end of the rack, substantially as and for the purpose specified.

6. In a device of the class described, a suitably-journaled shaft; and a gear-pinion secured thereto in combination with a continuous double internal rack the number of teeth in which is some multiple of the number of teeth in the pinion meshing therewith; a pair of rollers located on the rack at opposite sides thereof near the upper end; a cam secured to the pinion, the cam and rollers being so set and proportioned that the cam while continuously in contact with each roller will throw the rack from one side to the other while the pinion is passing around from one side of the rack to the other; a stationary guide; a projection on the rack adapted to engage opposite sides of the guide so as to hold either side of the rack in mesh with the pinion; and a curved flange at the upper end with which the cam engages to take the strain while the pinion is passing around the upper end of the rack, substantially as and for the purpose specified.

7. In a device of the class described, the combination of the journaled driving-shaft B; the pinion C, the rack D having the number of its teeth a multiple of the number of teeth in the pinion; the projection F; the guide E with the opposite sides of which the projection F may engage; the two pairs of rollers G G′ and H H′ located near opposite ends of the rack; and the cam I secured to the pinion C, the parts being proportioned and located substantially as described and illustrated.

8. In a device of the class described, the combination of the journaled driving-shaft B; the pinion C; the rack D having the number of its teeth a multiple of the number of the teeth in the pinion; the projection F; the guide E with the opposite sides of which the projection F may engage; the two pairs of rollers G G′ and H H′ located near opposite ends of the rack; the cam I secured to the pinion C; and the curved flange L at the upper end of the rack the parts being proportioned and located substantially as described and illustrated.

9. In a device of the class described, a suitably-journaled shaft; and a gear-pinion secured thereto in combination with a continuous double internal rack the number of teeth in which is some multiple of the number of the teeth in the pinion meshing therewith; a cam secured to the pinion; and a curved flange at the upper end with which the cam engages to take the strain while the pinion is passing around the upper end of the rack; a stationary guide; and a projection on the rack adapted to engage opposite sides of the guide so as to hold either side of the rack in mesh with the pinion, substantially as and for the purpose specified.

Dated at Brantford, Canada, the 1st day of March, 1900.

CHARLES HENRY HEROD.
JOHN BECHTEL DETWILER.

In presence of—
A. C. HARDY,
S. HEWITT.