No. 765,783. PATENTED JULY 26, 1904.

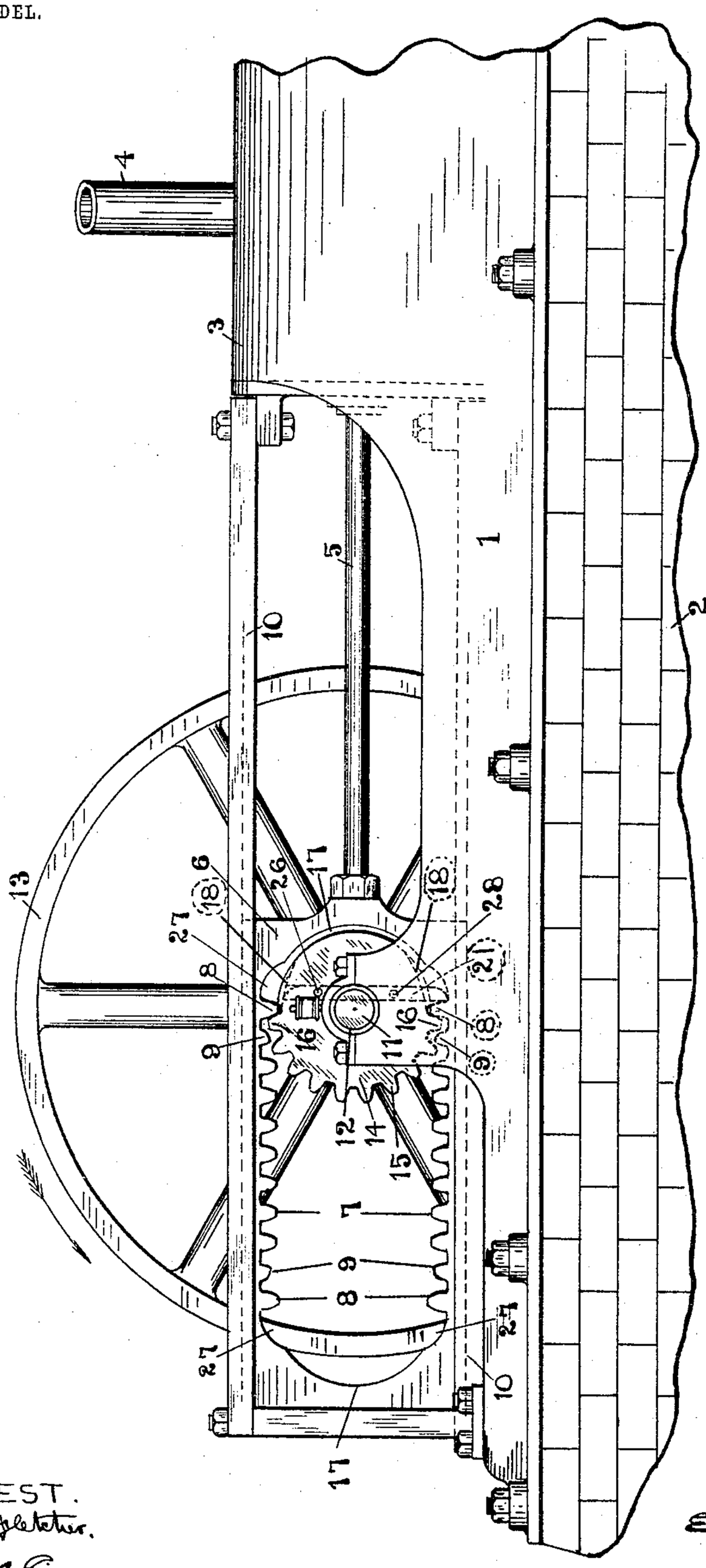
E. S. MORTON.

DEVICE FOR CONVERTING MOTION.

APPLICATION FILED NOV. 5, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. I



ATTEST.

H. J. Fletcher.

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ATTY'S.

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NO MODEL. 2 SHEETS—SHEET 2.

FIG. II

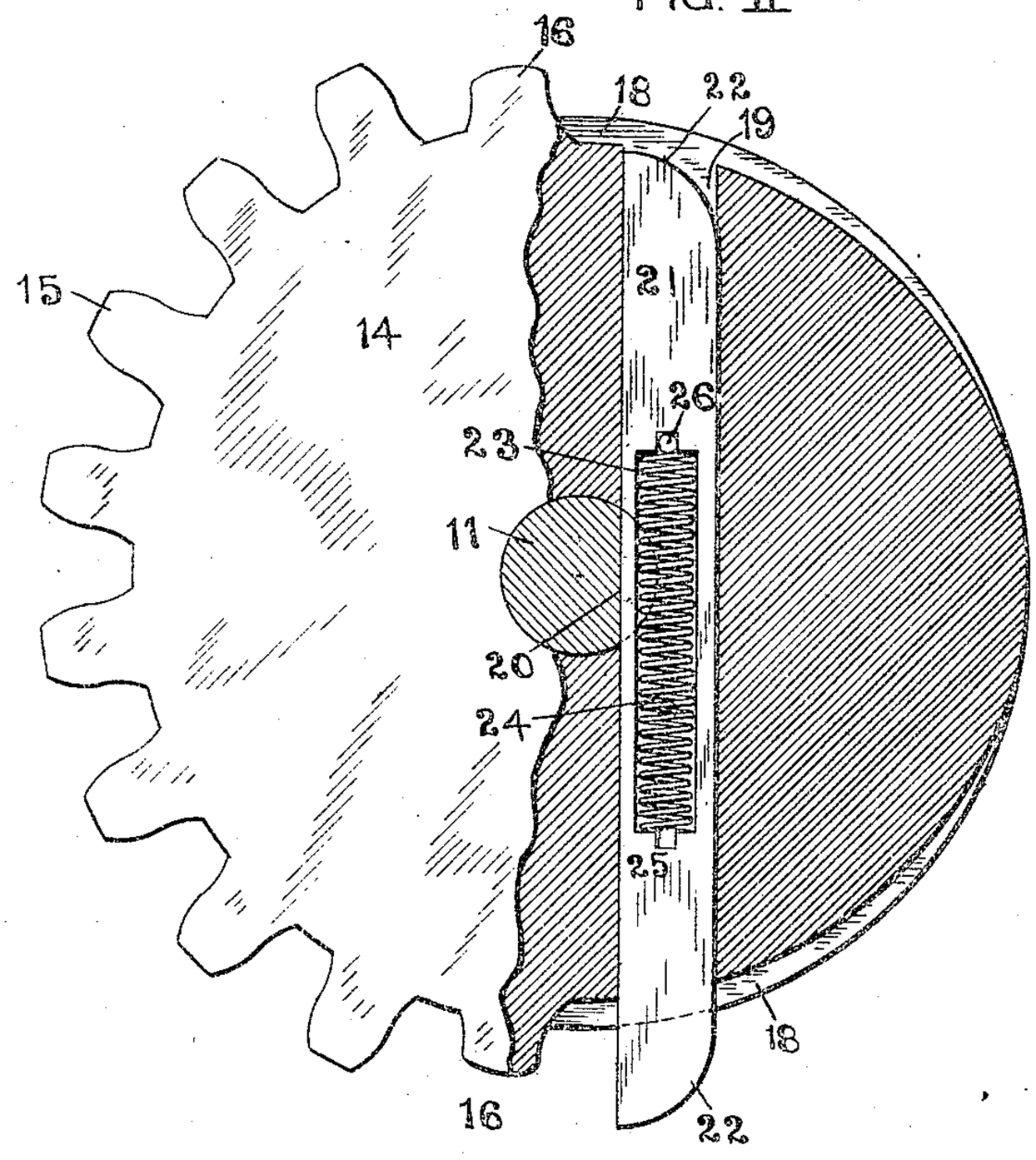
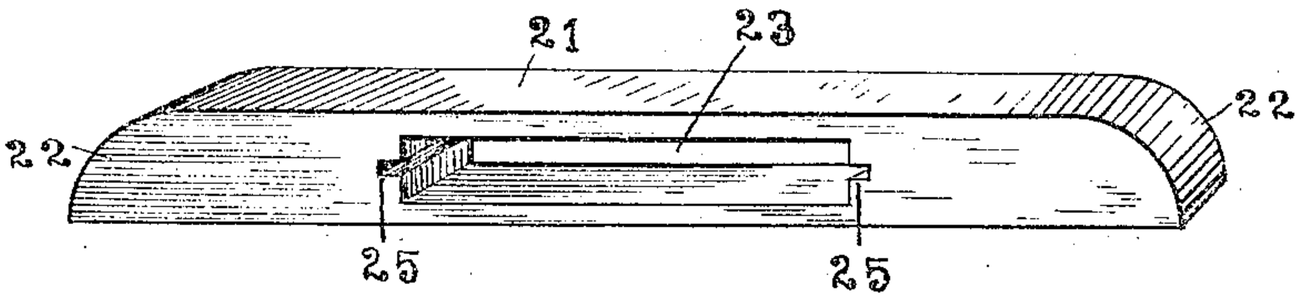


FIG. III



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No. 765,783. Patented July 26, 1904.

UNITED STATES PATENT OFFICE.

ELLIS S. MORTON, OF ST. LOUIS, MISSOURI, ASSIGNOR OF ONE-HALF TO J. H. KUECHENMIESTER AND H. KUECHENMIESTER, OF ST. LOUIS, MISSOURI.

DEVICE FOR CONVERTING MOTION.

SPECIFICATION forming part of Letters Patent No. 765,783, dated July 26, 1904.

Application filed November 5, 1903. Serial No. 179,921. (No model.)

To all whom it may concern:

Be it known that I, ELLIS S. MORTON, a citizen of the United States, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Devices for Converting Motion, of which the following is a specification containing a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to devices for converting reciprocating into continuous rotary motion; and it consists of the novel construction hereinafter described and claimed.

The object of my invention is to provide an improved device which shall possess a number of points of efficiency and advantage over devices heretofore in use for such purpose.

My invention is applicable for use wherever it is necessary to convert reciprocating into circular motion for steam, gas, electric, water, horse, boat, or hand power, and is useful for boring, drilling, and screw-driving machines and for hoisting heavy weights and locomotive purposes.

In the drawings, Figure I is a side elevation of a steam-engine having my invention applied thereto. Fig. II is a detail sectional side elevation of my improved mutilated pinion and its reversible double-ended plunger-tooth. Fig. III is a detail perspective view of the reversible double-ended plunger-tooth.

1 indicates the engine-frame, supported upon the usual foundation 2 and having the cylinder 3 and steam-pipe 4 and other common operative connections.

5 indicates the piston-rod, which should have its inner end connected, as usual, to the piston or other desired source of power. The outer end of the piston is connected to my improved double rack 6, which has two sets of oppositely-projecting teeth, the upper set being identical in construction with that of the lower set.

In the present instance I have shown each rack with seven intermediate teeth 7; but it is obvious that said number may be increased or diminished, depending only upon the length of the stroke of the piston-rod or other source of power.

It is essential in my construction that there be provided at each end of each rack an extra-long tooth 8 and also an extra-short tooth 9, located intermediate of the extra-long tooth and the next adjacent regular tooth 7, for a purpose herinafter mentioned.

Both racks are in vertical alinement, and together they constitute what I may term the "cross-head." Said cross-head is mounted to reciprocate in parallel grooved guides 10.

11 indicates the main shaft, which is mounted to revolve in suitable bearings, such as 12, and may have fixed upon it the usual fly-wheel 13.

Fixed upon the main shaft 11 in vertical alinement with the upper and lower grooved guides 10 is my improved mutilated pinion 14, which has in the present instance eight teeth 15 of uniform length and a shorter tooth 16 at each end of the series of regular teeth 15.

The cross-head 6 is provided with a curved internal recess 17 at each end to avoid weight and also to permit of a more compact construction.

The smooth periphery of the pinion is provided with two tapered opposite grooves 18, the deepest ends of which terminate at the short teeth 16, and the purpose of these grooves is to permit the opposite long teeth 8 of the cross-head to pass over said pinion until they occupy a position in vertical alinement with the axis of the main shaft 11.

Formed in the pinion 14 and extending therein from one groove 18 to the opposite one is a rectangular passage 19. Said passage is preferably located as near as possible to the axis of the main shaft 11, and for this purpose said shaft is slightly cut away at 20. (See Fig. II.) Mounted to slide loosely in said passage 19 is a reversible double-ended plunger-tooth 21, the ends of which are rounded or inclined at 22. A recess 23 is formed in said plunger-tooth 21 midway of its length, and within said recess is a coiled spring 24. At each end of said recess 23 is a smaller recess 25, which opens into said main recess. Said plunger-tooth 21 is held within said passage 19 by means of a bolt 26, which extends

through one of the subrecesses 25 and through a suitable aperture in the pinion 14. The plunger-tooth is held within said passage 19 by contact of its material at the outer side of one of the said recesses 25 with the pin or bolt 26, and such contact prevents the withdrawal of said plunger-tooth in one direction. Its withdrawal in the opposite direction is prevented by contact of the spring 24 with said pin or bolt.

Upon reciprocation of the piston-rod 5 the following-described movements take place: I will first describe the function of the parts in making an inward stroke from the position in which they are shown in Figs. I and II to that occupied by them at the completion of such inward stroke of the piston-rod. The inward movement of the piston-rod of course moves the cross-head 6, and the initial movement forces the tooth 8 at the inner end of the lower rack into contact with the downwardly-projecting end of the reversible double-ended plunger-tooth 21, and thereby moves the pinion 14, the main shaft 11, and the fly-wheel 13 a corresponding distance in the direction indicated by the arrow in Fig. I. Then as such movement continues the intermediate teeth of said rack will successively engage the teeth of said pinion and rotate the pinion until the rack is near the limit of its inward stroke, at which time the projecting end of said plunger-tooth 21 will of course have rotated with said pinion and will come in contact successively with the three teeth of the upper rack which are nearest its outer end, and as a final function of the inward movement of said rack the long tooth 8 at the outer end of the upper rack will engage the rounded or inclined face of the said projecting end and force the said plunger-tooth inwardly and downwardly in opposition to the power of its spring 24 and force its opposite end into the recess 27 between the long tooth 8 and the outer end of the lower rack until the long tooth 8 near the outer end of said upper rack passes the vertical plane of the said plunger-tooth, when the latter will be released thereby, and the power of said spring will cause said tooth to resume its previous position; but its first-mentioned end will occupy a position in a recess 27 near the outer end of the upper rack ready to receive the reverse pressure of said long tooth 8 at the beginning of the reverse or outward stroke of said rack. The short teeth 16 of said pinion are made short, so that they will readily pass by the short teeth 9 of the racks without engaging the same, as it is not necessary that said teeth should engage each other at any time, although they may and do engage adjacent longer teeth. The outward stroke produces a repetition of the functions just described, as said long tooth 8 of the upper rack near its outer end will engage the projecting end of said plunger-tooth and continue the rotation of said pinion, and such rotation will also be continued by the succeeding teeth of said upper rack until the rack nears the limit of its outward stroke and until said projecting end of said plunger-tooth will have reached a position beneath said pinion and will have been engaged by the three teeth near the inner end of the lower rack and will have been forced inwardly by the long tooth 8 at that point until said tooth has passed the vertical plane of said plunger-tooth, when said spring will have caused said tooth to be thrown outwardly into its normal position, in which it is shown in dotted lines in Fig. I and in solid lines in Fig. II. Continued reciprocation of the piston-rod will cause a repetition of the operation above described and the continuous rotation of the pinion and the fly-wheel in the direction of said arrow.

The direction of rotation may be reversed by simply removing the pin or bolt 26 from the recess 25, in which it is shown at one end of the main recess 23, and placing said pin or bolt in the opposite recess 25 at the opposite end of said main recess and of course reversing the position of the said plunger-tooth, so that instead of its end projecting beneath the pinion its upper end will project above the pinion. For this purpose another hole 28 is formed in the pinion to receive the said pin or bolt 26.

I do not limit myself to the exact construction of details herein shown and described, as it is obvious that the same may be varied by skilled workmen without departing from the scope of my invention.

What I claim is—

1. An improved device for converting reciprocating into rotary motion, comprising upper and lower racks each having a long and short tooth near each end and intermediate teeth of medium length, means for reciprocating said racks, a pinion having a series of teeth terminating at each end with a short tooth and mounted to rotate and having a plunger-tooth passage, and a double-ended plunger-tooth mounted in said passage and adapted to have its opposite ends successively projected beyond the ends of said passage, substantially as described.

2. An improved device for converting reciprocating into rotary motion, comprising upper and lower racks each having a long and short tooth near each end and intermediate teeth of medium length, means for reciprocating said racks, a pinion having a series of teeth terminating at each end with a short tooth and mounted to rotate and having a plunger-tooth passage, a double-ended plunger-tooth mounted in said passage and adapted to have its opposite ends successively projected beyond the ends of said passage, said plunger-tooth having an internal spring-recess, and a spring mounted in said recess and adapted to urge outwardly one end of said plunger-tooth, substantially as described.

3. An improved device for converting re-

ciprocating into rotary motion, comprising upper and lower racks each having a long and short tooth near each end and intermediate teeth of medium length, means for reciprocating said racks, a pinion having a series of teeth terminating at each end with a short tooth and mounted to rotate and having a plunger-tooth passage, a double-ended plunger-tooth mounted in said passage and adapted to have its opposite ends successively projected beyond the ends of said passage, said plunger-tooth having an internal spring-recess, and a spring mounted in said recess and adapted to urge outwardly one end of said plunger-tooth, there being means whereby the movement of said spring and plunger-tooth may be reversed when the movement of the said pinion is to be reversed, substantially as described.

In testimony whereof I have signed my name to this specification in presence of two subscribing witnesses.

ELLIS S. MORTON.

Witnesses:
ALFRED A. EICKS,
M. G. IRION.