L. FUCHS.

MECHANICAL MOVEMENT.

APPLICATION FILED DEC. 10, 1910.

1,041,265.

Patented Oct. 15, 1912.

3 SHEETS—SHEET 1.

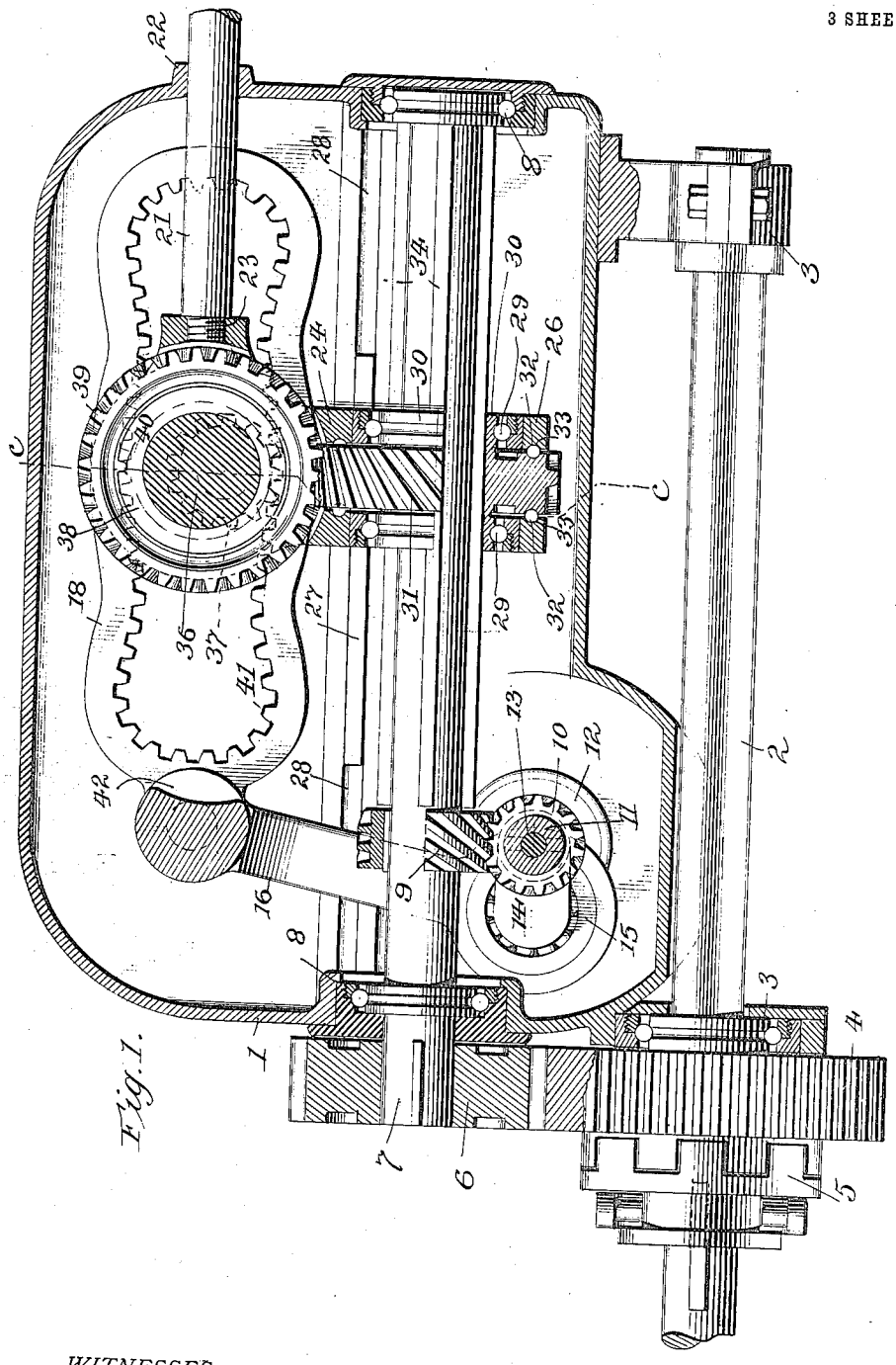

Fig. 1.

WITNESSES

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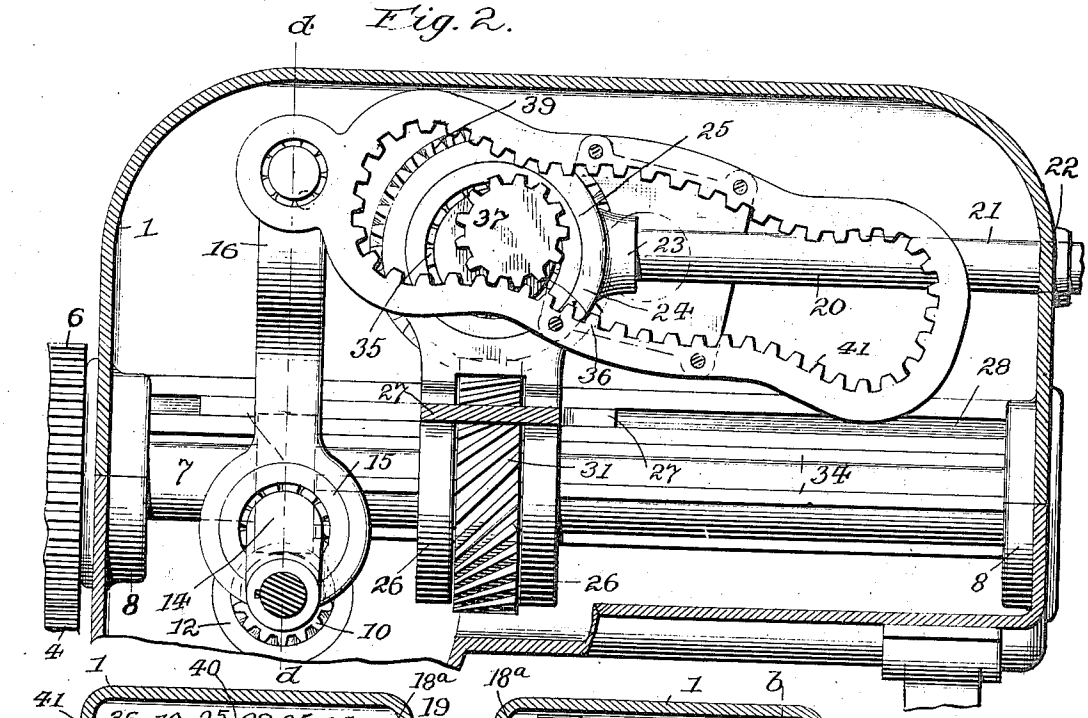

Fig. 2.

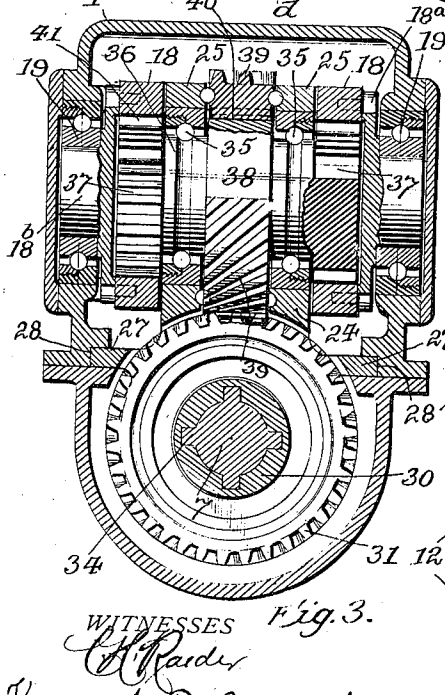

Fig. 3.

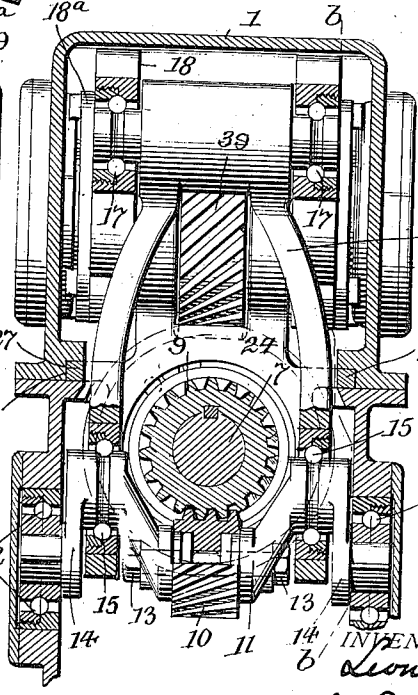

Fig. 4.

WITNESSES

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3 SHEETS—SHEET 3.

Fig. 5.

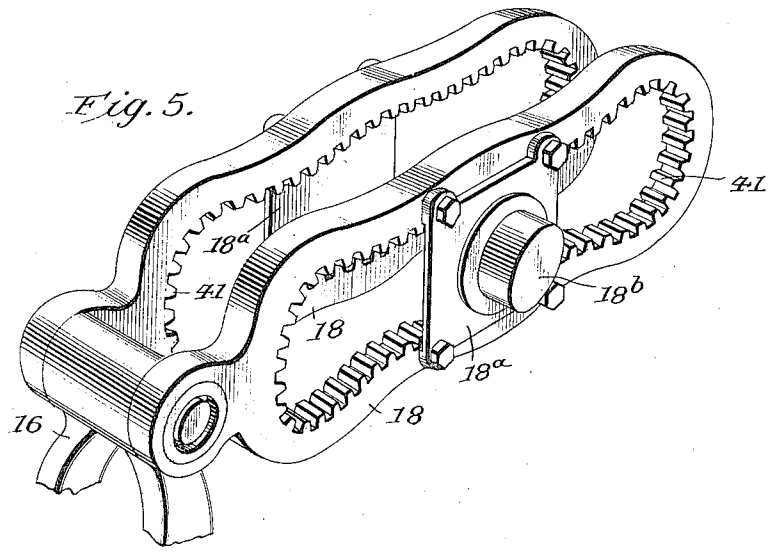
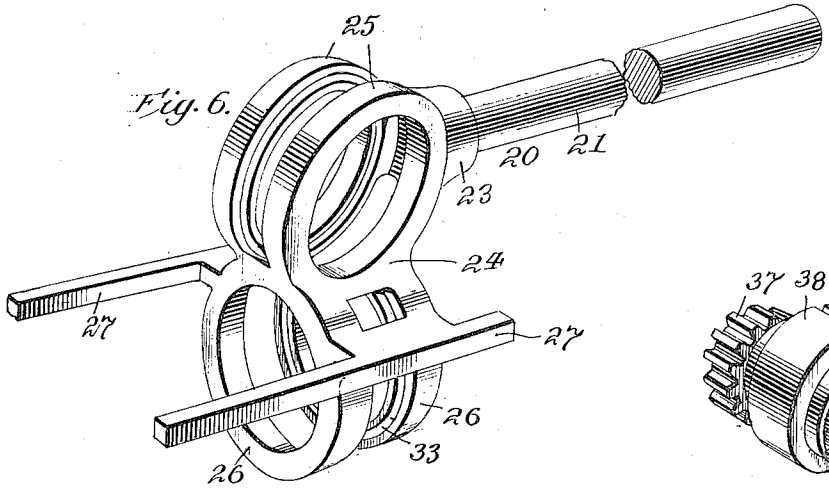


Fig. 6.



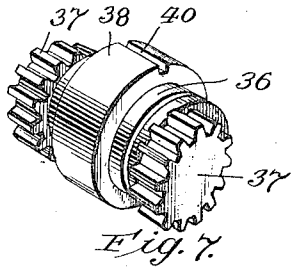


Fig. 7.

WITNESSES

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UNITED STATES PATENT OFFICE.

LEONHARD FUCHS, OF ROCHESTER, NEW YORK.

MECHANICAL MOVEMENT.

1,041,265. Specification of Letters Patent. Patented Oct. 15, 1912.

Application filed December 10, 1910. Serial No. 596,568.

To all whom it may concern:

Be it known that I, LEONHARD FUCHS, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Mechanical Movements, of which the following is a specification.

This invention relates to a mechanical movement designed to convert rotary into reciprocating motion, and suited for use in any mechanism for so converting motion in which a compact structure completely incased to run in oil is required.

A peculiar merit of the structure resides in the fact that the line of motion of the reciprocating element may be brought very close to the axis of rotation of the rotating element; and other incidental advantages will appear from the following description.

One embodiment of the invention is illustrated in the accompanying drawings, in which:—

Figure 1 is a longitudinal vertical section of such a device, the plane of section being taken on the center line; Fig. 2 is a longitudinal vertical section showing the mechanism in a different position, the plane of section being taken on the line *b*—*b* of Fig. 4; Fig. 3 is a transverse section on the line *c*—*c* of Fig. 1; Fig. 4 is a transverse section on the line *d*—*d* of Fig. 2; Fig. 5 is a perspective view of the mangle racks; Fig. 6 is a perspective view of the reciprocating element showing the mode of supporting the eccentric gears, etc., the ball races being omitted in order to avoid confusion and Fig. 7 is a perspective view of the shaft upon which the eccentric gears are mounted.

In general, the mechanism may be said to consist of a rotating element and a reciprocating element, the reciprocating element being provided with a pinion mounted to rotate eccentrically. A mechanism is provided whereby the eccentric pinion may be rotated from the rotating element and at the same time caused to engage a special form of mangle rack, moved in a peculiar manner by the rotating element, whereby the pinion is caused constantly to engage the rack, and to impart to the reciprocating element a reciprocating motion, the power causing such motion being exerted through the eccentric pinion.

Referring now to the drawings, 1 indicates the casing of the device, which is formed with suitable bearings as will later be set forth in detail, and is designed to be oil-tight, so that all parts of the mechanism may be abundantly lubricated by oil contained in the case.

2 is a drive shaft mounted in ball bearings 3, 3, carried by the case, and 4 is a gear loosely mounted on the shaft, but capable of being clutched thereto by a jaw clutch 5 of any suitable construction. The gear 4 meshes with a gear 6, keyed to the shaft 7, which I shall hereafter refer to as the rotary driving element, the shaft 2 with its gear 4 being merely accessory driving means and not forming a part of the invention.

The shaft 7 is mounted in ball bearings 8 which may be of any suitable type, supported by the casing 1. Near one end of the shaft 7 there is keyed thereon a spiral gear 9, meshing with a similar spiral gear 10 which is supported on a cranked shaft 11 turning in ball bearings 12 carried by the case 1. The cranked shaft 11 is formed in two pieces between which the gear 10 is held by means of a bolt 13 as indicated in Fig. 4, and the shaft is thus formed with a pair of alined cranks 14 on opposite sides of the spiral gear 10. Connected with these cranks by means of ball bearings 15 are the lower ends of a bifurcated connecting rod 16, which at its upper end is connected through ball bearings 17 with a pair of mangle racks 18. These mangle racks 18 are provided with supporting plates 18ª having lugs 18ᵇ turning in ball bearings 19 carried by the case 1. The racks 18 are thus mounted to rock in the case 1, the center of such rocking being at the mid-length of the racks. Through the mechanism so far described, rotation of the shaft 7 will produce simultaneous rocking of the racks 18 in their bearings 19.

The reciprocating element 20 consists of a rod 21 guided in a bearing 22 formed in the case 1 and a yoke or frame 24. The rod is threaded into the yoke at 23 for convenience in assembly. The frame 24 consists of two pairs of annular members or frames each pair being designed to support ball bearings for spiral gears as will later be set forth. The upper pair of annular frames 25 is at right angles to the lower pair 26 and one pair of frames, as 26, is provided with slides 27, which are guided in ways 28 formed in the case 1. The guides 28 and the bearing 22 constrain the reciprocating ele-

ment 20 to rectilinear movement in the case, the line of such movement being parallel to the axial line of the rotating element or shaft 7, with the annular frames 26 surrounding said shaft and concentric therewith. The frames 26 are provided with ball bearings 29 in which turn hub extensions 30 of the spiral gear 31. This gear is further provided with ball thrust bearings 32 running between the sides of the gear and the frames 26 which are provided with suitable races 33 formed in their inner faces. The gear 31 is splined on the shaft 7 by means of the feathers or keys 34 so that the gear 31 turns with the shaft 7 but moves upon the shaft longitudinally with the reciprocating element 20. In the upper annular frames 25 are mounted ball bearings 35 in which turns a shaft 36. Formed in one piece with the shaft 36 and at the ends thereof are two spur pinions 37 of circular contour formed eccentrically with respect to the shaft 36 but in alinement with each other and of equal size. These eccentric pinions or gears are adapted to coact with the racks 18. The shaft 36 is formed with an enlargement 38 upon which is forced a spiral gear 39 which meshes with the spiral gear 31. The purpose of the enlargement 38 is to permit this gear to be forced on over the gears 37 which project beyond the periphery of the shaft 36. The gear 39 is firmly held against rotation upon the enlargement 38 by means of an interengaging lug and slot indicated at 40.

Through the mechanism just described it results that a rotation of the shaft 7 will cause a rotation of the gear 31, which, through the coacting gear 39, causes an eccentric rotation of the gears 37 which are journaled to rotate in this manner in the reciprocating element 20. At the same time, through the mechanism earlier described, the mangle rack 18 is caused to rock through a limited range; and the contour of the pitch lines of the teeth 41 of the racks 18 and the various gear ratios are designed so that in the successive positions assumed by the mechanism the pitch lines of the racks will always be tangent to the pitch lines of the eccentric gears 37. Since the eccentric gears 37 are caused to rotate through the spiral gear train heretofore described, it follows that the reciprocating member 20 will be caused to move back and forth as the gears 37 travel over the racks 18.

It will be noted that the link 16 is cut away as at 42 to give clearance for the gear 39, and the links 16 are of such form as to clear the gear 9 in the various positions assumed by the mechanism.

While I illustrate but a single mechanism, that being sufficient to fully set forth the invention, it is obvious that any number of complete mechanisms might be driven from a single gear, corresponding to the gear 4. The principal advantage of the device, as has already been stated, is the possibility of bringing the center line of the rod 21 very close to the center line of the shaft 7, and modifications of the gear trains may readily be devised whereby this center line may be brought even closer than illustrated in the drawings.

The contour of the rack 18 is wholly dependent on the size and eccentricity of the gears 37, the throw of the cranks 14, and the gear ratios of intermediate trains, so that this contour would vary in mechanism having different proportions.

I do not confine myself to the specific gear trains disclosed, as equivalent trains giving somewhat different arrangements of the working parts of the invention may be devised, the essence of the invention being the use of the pinions mounted to rotate eccentrically and co-acting with a movable rack to produce the desired motion of the reciprocating member.

Having thus described my invention, what I claim is:—

1. The combination of a rotary driving element; a reciprocating driven element; a gear mounted to rotate eccentrically in the reciprocating element; means for driving said gear from the rotating driving element; a mangle rack adapted to coact with the eccentric gear when moved in a definite manner; and means for moving the rack in such manner.

2. The combination of a rotary driving element; a reciprocating driven element; a spur gear mounted to rotate eccentrically in the reciprocating element; means comprising a pair of gears one of which is splined upon the rotary element for driving the spur gear; a mangle rack adapted to coact with the eccentric gear when moved in a definite manner; and means for moving the rack in such manner.

3. The combination of a rotary driving element; a reciprocating driven element; a gear mounted to rotate eccentrically in the reciprocating element; means for driving said gear from the rotary driving element; a crank rotated from the rotating driving element; a mangle rack adapted to rock to coact with the eccentric gear; and a connecting rod connecting the crank and the rack to rock the latter.

4. The combination of a reciprocating element; a gear mounted to rotate eccentrically in said reciprocating element; means for driving the gear; a mangle rack; and means for moving the rack, whereby the rack is caused to coact with the gear.

5. The combination of a rotary driving element; a reciprocating driven element; a gear mounted to rotate eccentrically in the reciprocating element; means comprising a

pair of gears, one of which is splined upon the rotary driving element for driving the eccentric gear; a mangle rack mounted to rock; a crank; means comprising gears driven by the rotary driving element for rotating said crank; and a connecting rod connecting the crank to the mangle rack to rock the latter, the mangle rack and the various gears being so proportioned that the eccentric gear and the rack coact in all positions assumed by the mechanism.

6. The combination of a supporting case; suitable bearings and guideways in the case; a rotary driving element turning in bearings in the case; a reciprocating driven element sliding in the ways in the case; a pinion mounted to rotate eccentrically in the reciprocating element; means for driving said eccentric pinion from the rotary driving element, said means comprising gears mounted to rotate in the reciprocating element, one of said gears being splined upon the rotary driving element; a mangle rack mounted to rock in bearings in the case; a cranked shaft mounted to rotate in bearings in the case; means for rotating said cranked shaft from the rotary driving element; and a connecting rod connecting the cranked portions of said shaft to the mangle rack to rock the latter, the rack and other parts of the mechanism being so proportioned that the rack and the eccentric gear shall mesh in all positions assumed by the mechanism.

7. The combination of a supporting frame; a driving member mounted to rotate in said supporting frame; a reciprocating driven member mounted to slide in said supporting frame in a direction parallel to the axis of rotation of the driving element, the reciprocating member including a pair of bearing-supporting members one of which encircles the rotary driving element; a gear mounted to rotate eccentrically in the reciprocating member; driving gears mounted to rotate in the bearing-supporting members of the reciprocating member and adapted to drive the eccentric gear, one of said driving gears being splined upon the rotary driving element; a mangle rack adapted to coact with the eccentric gear when moved in a definite manner; and means operated by the rotary driving element for moving the rack in such manner.

8. The combination of a gear mounted to rotate eccentrically; a mangle rack adapted to coact with the gear to produce relative motion of the gear and rack; and means for oscillating the rack to maintain the gear and rack constantly in mesh.

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

LEONHARD FUCHS.

Witnesses:
K. E. MONTAGUE,
PARKER DODGE.