No. 705,499. Patented July 22, 1902.

J. T. WATTS.

MECHANICAL MOVEMENT FOR CONVERTING MOTION.

(Application filed Apr. 12, 1902.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1

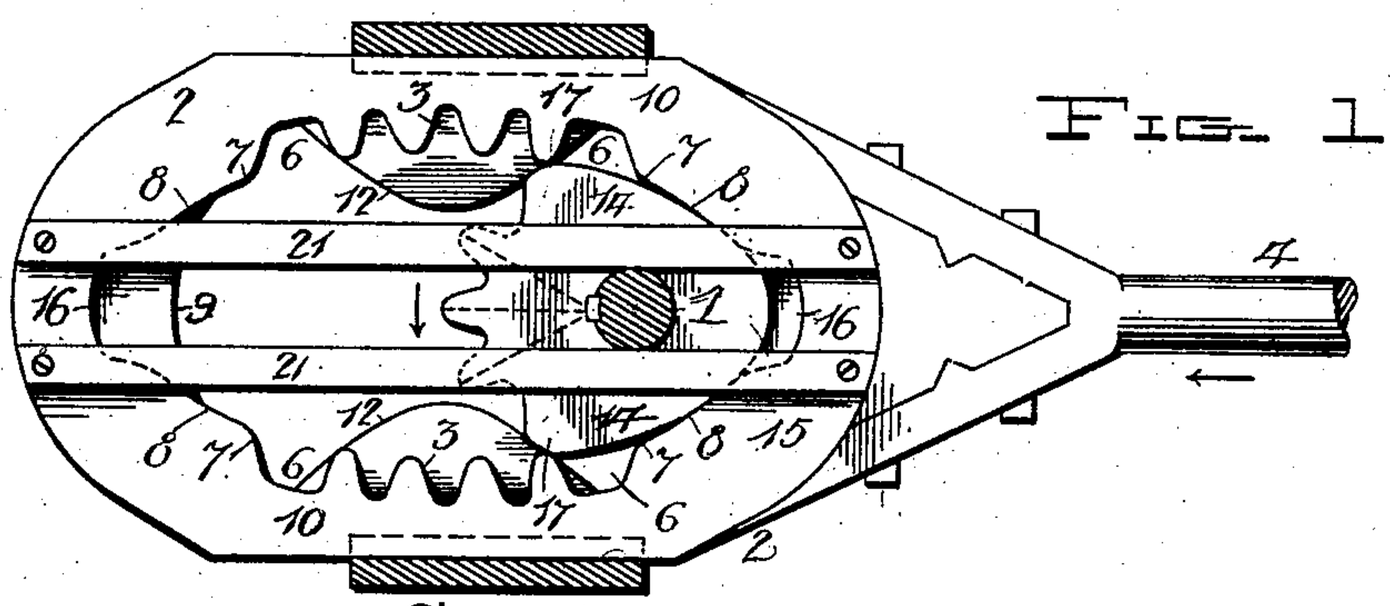


FIG. 2

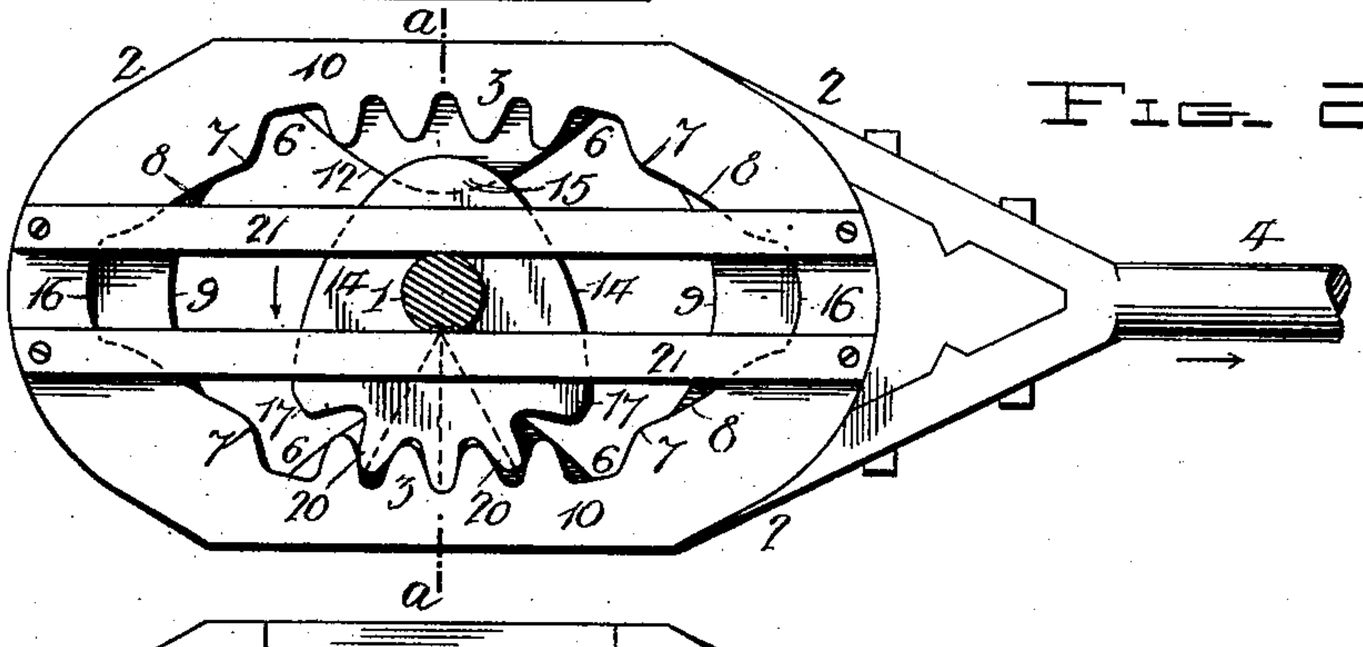


FIG. 3

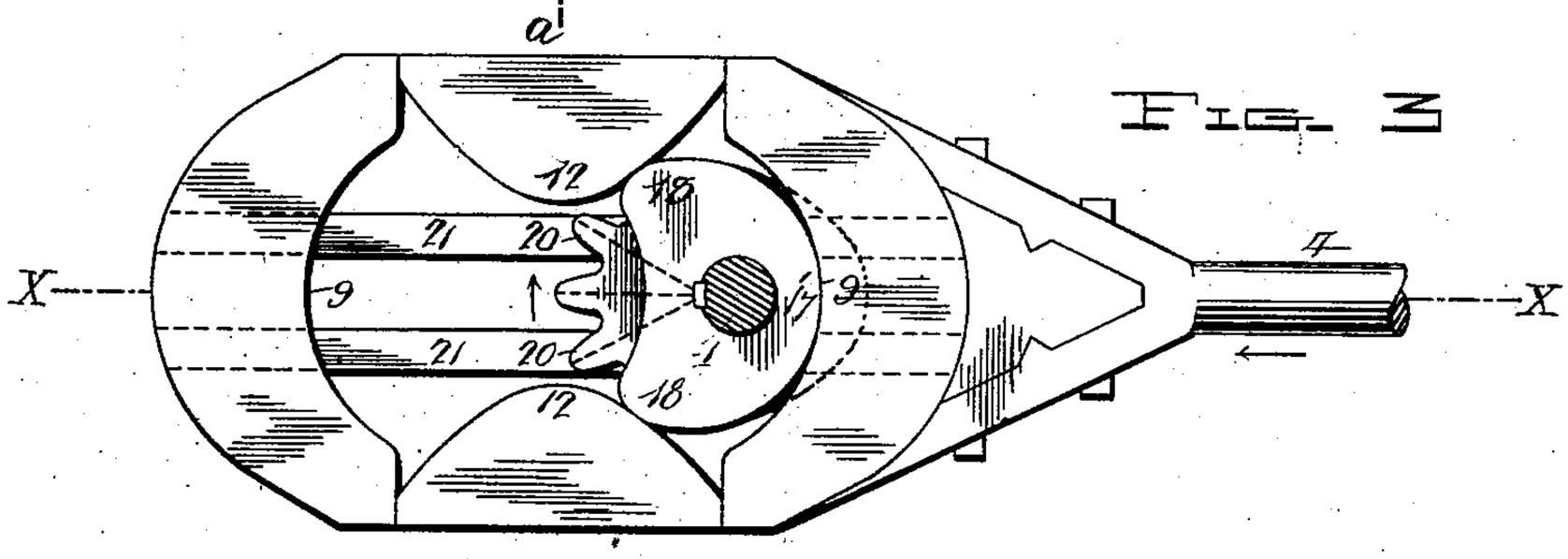
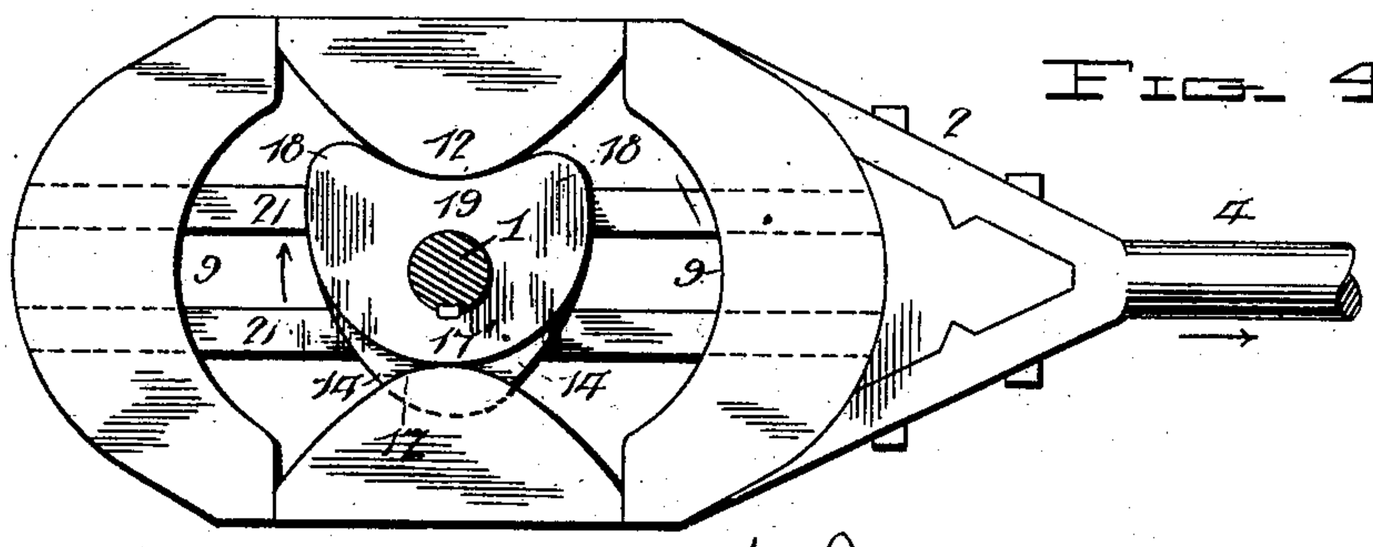


FIG. 4



WITNESSES

J. L. Boudinot

John E. Burch.

INVENTOR

John T. Watts

By Johnson and Johnson

Attorneys

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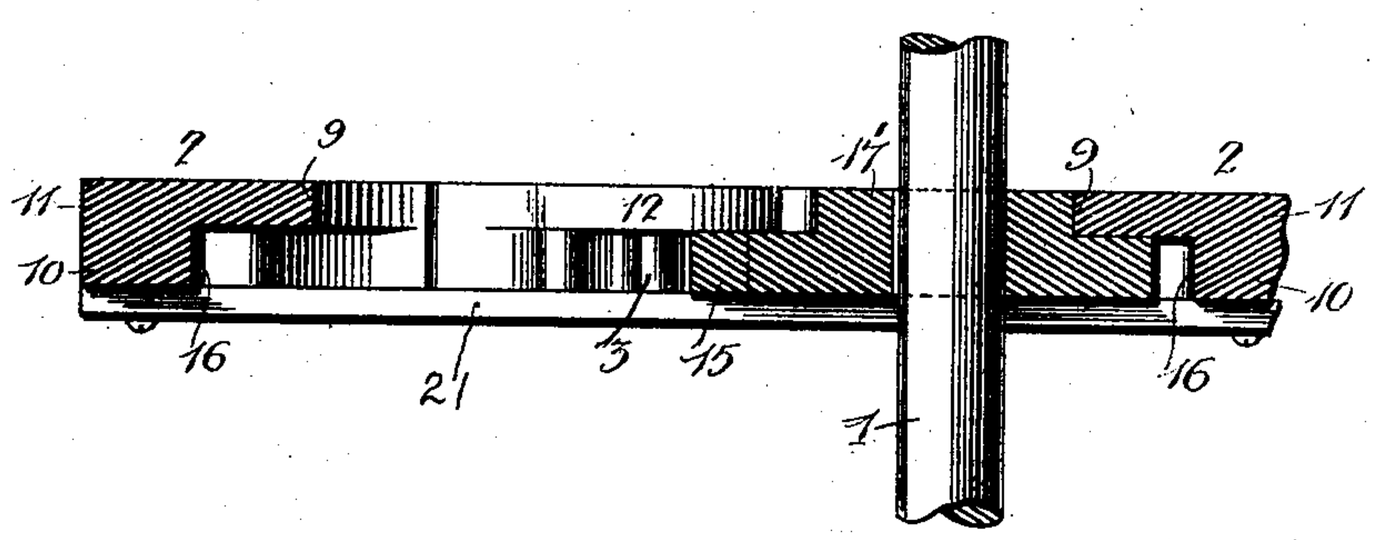
FIG. 5



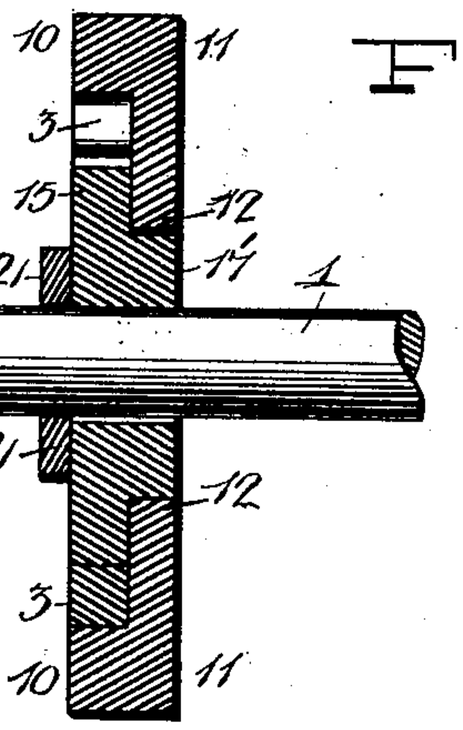
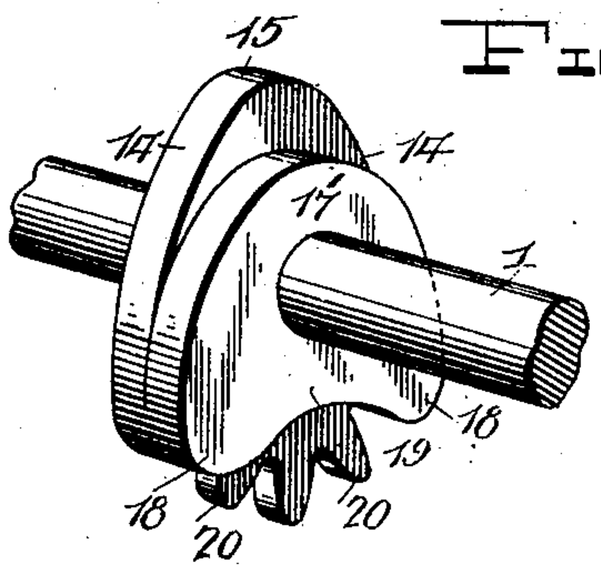


FIG. 6

FIG. 7



WITNESSES

D. L. Bowers

John E. Burch.

INVENTOR

John T. Watts

By Johnson and Johnson

Attorneys

UNITED STATES PATENT OFFICE.

JOHN T. WATTS, OF CROOKSTON, MINNESOTA.

MECHANICAL MOVEMENT FOR CONVERTING MOTION.

SPECIFICATION forming part of Letters Patent No. 705,499, dated July 22, 1902.

Application filed April 12, 1902. Serial No. 102,604. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. WATTS, a citizen of the United States, residing at Crookston, in the county of Polk and State of Minnesota, have invented certain new and useful Improvements in Mechanical Movements for Converting Motion, of which the following is a specification.

My present invention, which relates to mechanical movements for converting motion, contemplates certain improvements in the type of mechanical movement patented to me January 21, 1902, No. 691,511, the said improvements having for their object increased efficiency in the working of the device, and particularly in maintaining the smooth alinement in the reciprocation of the cogged frame in engagement with a cogged revoluble sector and the certain and smooth engagement of the cogs of the sector with the cogs of the frame in the operation in which a reciprocating motion is converted into a rotary motion, or vice versa.

The accompanying drawings illustrate a converting-motion device embodying my said improvements, and in the claims appended hereto I will specifically state the improvements.

Referring to these drawings, Figure 1 is a side view of my improved device for converting motion, the reciprocating cogged frame being shown at the limit of its stroke in the direction of the arrow and the cogged sector in the position for engagement with one of the cogged racks of the frame in the movement of the latter. Fig. 2 is a like view, the cogged frame moving in the direction of the arrow and the cogged segment in engagement with one of the cogged racks of the reciprocating frame. Fig. 3 is a view of the opposite side of the device, the reciprocating frame being in the position seen in Fig. 1. Fig. 4 is a like view, the reciprocating frame being in the position shown in Fig. 2. Fig. 5 is a longitudinal section on the line *x* of Fig. 3. Fig. 6 is a cross-section on the line *a* of Fig. 2, showing the lapping relation of the cams 12, standing into the frame-opening, with the opposite sides of the cogged sector while it is engaging one of the cog-racks. Fig. 7 shows the cogged sector and its cam for guiding and aiding in reversing the movement of the frame and insuring the proper engagement of the frame-cogs with the sector-cogs.

For converting motion a shaft 1, mounted in fixed bearings, has a cogged sector, and a frame 2, having an oblong opening the sides of which are provided with cogs 3, adapted for alternate engagement with the cogs of the sector, constitute the moving parts of the device, and it will be understood that the shaft may be rotated as the driving power for the cogged frame or the latter may be the driving power for the shaft, and in such case it is operated by the piston-rod 4 of a motor. The frame opening is of an elliptical form. The side walls of this opening are formed with the cogs, which form racks at the ends of which there is a recess 6 6 of a greater width than the space between the cogs, and the walls of these recesses terminate in shoulders 7 7, from which the elliptical walls 8 of the frame-opening extend toward the end of said opening. This construction is identical at each end of the opening, the elliptical form of which gives it a greater width mediately of its length, so that the middle cogs are farthest from a middle line drawn longitudinally from the center of the shaft. At each end the frame is recessed on one side to a depth about half its thickness, making the opening on one side of the frame of less length than the opposite side, so as to form cam-walls 9 9, for a purpose which I will presently state. The frame-cogs are on the same plane as the inner surfaces of the end recesses, as in Fig. 5, and these recesses form the inward projecting cams 9 9 on a plane at the side of the racks. Looking at Fig. 5 this construction will appear as if the frame was made of two longitudinal face parts, one, 10, of which has the cogs 3 and the other part, 11, the end cams 9 9 and the side cams 12, Fig. 4, and so far as I know and can find these side and cams constitute a new feature in the rack-frame of a mechanical converting-motion device, the purpose of which I will presently state. The cogs of the sector stand on one side of the shaft, and from the end cogs the sector has an elliptical rounded form extending diametrically on the other side of the shaft. The elliptical walls 8 at each end of the frame-opening and

the elliptical sides 14 of the toothed sector are substantially of like form, and the stroke of the frame is such that at the limit of each stroke the elliptical end 15 of the sector will always come and turn in contact with the elliptical walls 8 8 of the openings in the toothed part or plate of the frame, as seen in Fig. 1. In this turning of the sector it will be noted that its elliptical end has no contact with the ends of the opening, because at the extreme ends 16 of the opening the walls are contracted and form dead spaces extending beyond the stroke of the frame, so that the contact of the latter is only at its walls 8 with the end 15 and the sides 14 of the sector. On that side of the frame which has the inward standing side cams the sector is provided with a cam having a circular form 17, crossing the elliptical part 14 of the shaft-sector and terminating in rounded points 18 on each side of the shaft, and between which points it has a concave formation 19, the counterpart of side cams. (See Fig. 7.) In the reciprocation of the frame its concave end cams 9 9 match the convex side 17′ of the cogged sector, as in Fig. 3, while the convex and concave walls 17 19 of the sector-cam will pass and rotate freely over the convex walls of the side cams 12 of the frame, as in Fig. 4, the sector merely engaging said walls to aid in keeping the reciprocating frame in a true longitudinal line. The purpose of the sector-cam is to form a contact with the concave walls of the frame-opening to assist in making a gradual arrest at the end and a gradual start at the beginning of the stroke and to coact with the edges of the elliptical side cams 12 to preserve the alinement of the movement of the frame with the cogged sector, and thereby render certain and easy the engagement of the sector-cogs with the cogged racks of the frame, so that such engagement will be without impact. While the sector-cam and the frame-cams maintain the true movement of the cogged frame at right angles to the shaft, the side and end cams 12 and 9 9 of the frame in their alternate engagement with the elliptical part of the sector and with its cogged part, both of which project beyond its cam and lap with the side cams 12 in passing them, as in Figs. 4 and 5, serve to maintain the cogged frame in its true transverse relation to the shaft. Therefore the form of the sector, the form of its cam, and the form of the end and the side cams 8, 9, and 12 of the cogged frame have a conjoint coöperative relation in maintaining the true relation of the frame with the sector, the certain engagement of the sector with the opposite cog-racks of the frame, and the easy and certain turning of the cogged sector always in the proper direction at the ends of its stroke. In this easy and smooth turn of the sector it will be noted, referring to Figs. 1 and 3, that the rounded end 17′ of the sector-cam in turning roll in contact with the walls 9 9 of the frame, and this contact acts to push the sector around. This turn may be short and quick or comparatively long and slow, according to the shape of the coacting parts.

Referring to Figs. 1 and 2, it is important to note that the cogs 20 of the sector, except the middle one, stand away from the middle cog at an angle greater than they would have if they were radial with the center of the shaft, as shown by the dotted lines, and it is this angle of the cogs that causes them to engage the cogs of the frame without cramping or striking. In this action, caused by the obliquity of the cogs, the initial cogs of the sector formed by its rounded ends 17 are larger and of different shape to enter the larger spaces 6 6, formed between the end cogs of the racks and the terminal side points 7 7 of the end cams.

Looking at Figs. 1, 2, and 6 it will be seen that the frame is supported for reciprocation upon the shaft by guides or ways 21, provided on the face of the frame and by which the latter is confined in proper relation to the cogged sector, so that these guides or ways being at one face of the sector and the frame-cams 9 12 by their lapping relation with the sector at the other face of the sector keep the frame in true line and prevent it from lateral cramping in its reciprocation on the shaft. The guideways may be on both sides of the frame.

I have stated that the opening in the frame is elliptical and forms the bounding-line of the ends of the cogs, and as this will give the opening its greatest width mediately of its length the middle cogs of the sector are made farthest from the center of the shaft, and this construction causes the frame to have a greater speed in the movement from the middle toward each end of the opening, while the speed is slowed toward each end.

I have described and shown the cams 9 and 12 as being on one side of the frame; but obviously they may be on both sides of the frame, in which case the cogged sector would be provided with a cam on both faces and the guides or ways dispensed with. As the frame reciprocates over the sector its cogged side and its elliptical end 15 lap with the side cams 12, as seen in Figs. 2 and 4, and act to steady the frame.

I claim—

1. In a device for converting motion, the combination of a reciprocating frame having an opening the opposite sides of which are provided with racks of cogs, a shaft, a cogged sector thereon the cogs on each side of the middle cog standing obliquely away from the middle cog at angles not radial with the center of the shaft, whereby to render certain the engagement of the sector with the racks of cogs and to prevent cramping and striking in such engagement.

2. In a device for converting motion, the combination of a reciprocating frame having an opening the sides of which are provided

with cog-racks, cams projecting into said opening adjacent to each rack and cams at the ends of the opening, a shaft, and a cogged sector thereon adapted to engage the racks, and provided with a cam adapted to engage the frame-cams, for the purpose stated.

3. In a device for converting motion, the combination of a reciprocating frame having an opening the sides of which are provided with cog-racks, cams projecting into said opening adjacent to each rack on one side of the frame, a shaft and a cogged sector thereon adapted to engage the racks and having a cam adapted to engage the frame-cams, and guides or ways on the other side of said frame, whereby the frame is prevented from lateral cramping on the shaft.

4. In a converting-motion device, a reciprocating frame having an opening the sides of which are provided with cog-racks, and formed with elliptical side walls 8 8 which are contracted to form dead spaces at the ends of said opening, frame-cams projecting into said opening adjacent each rack, a cam at each end of said frame-opening overhanging the said dead spaces, a shaft, and a cogged sector thereon adapted to engage the racks and the elliptical side walls 8, and having a cam adapted to engage the aforesaid frame-cams, for the purpose stated.

5. In a device for converting motion, the combination of a reciprocating frame having an opening the longitudinal sides of which are provided with cog-racks, and with cams extending into the opening at one side of and beyond the cogs, a shaft, and a cogged sector thereon adapted to engage the racks and to lap with the side cams in passing them, and provided with a cam adapted to engage the inner edges of the said side cams, for the purpose stated.

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

JOHN T. WATTS.

Witnesses:
A. E. H. JOHNSON,
W. T. NORTON.