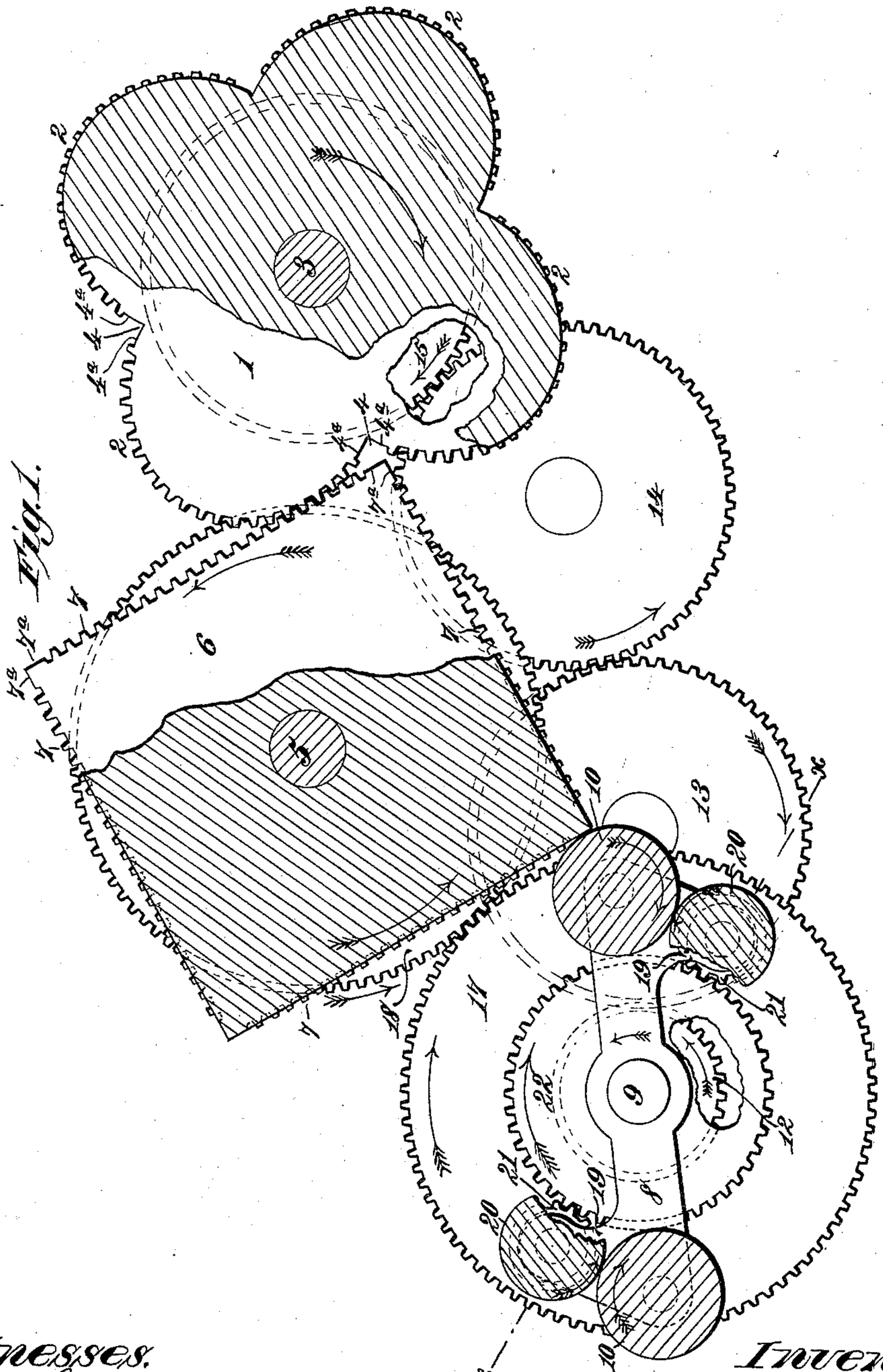
(No Model.)

2 Sheets—Sheet 1.

J. C. FOWLER.

MECHANICAL MOVEMENT.

No. 415,630. Patented Nov. 19, 1889.



Witnesses.
Robt Everett.
J. A. Rutherford.

Inventor:
Joseph C. Fowler.
By James L. Norris
Atty.

(No Model.) 2 Sheets—Sheet 2.

J. C. FOWLER.

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Fig. 2.

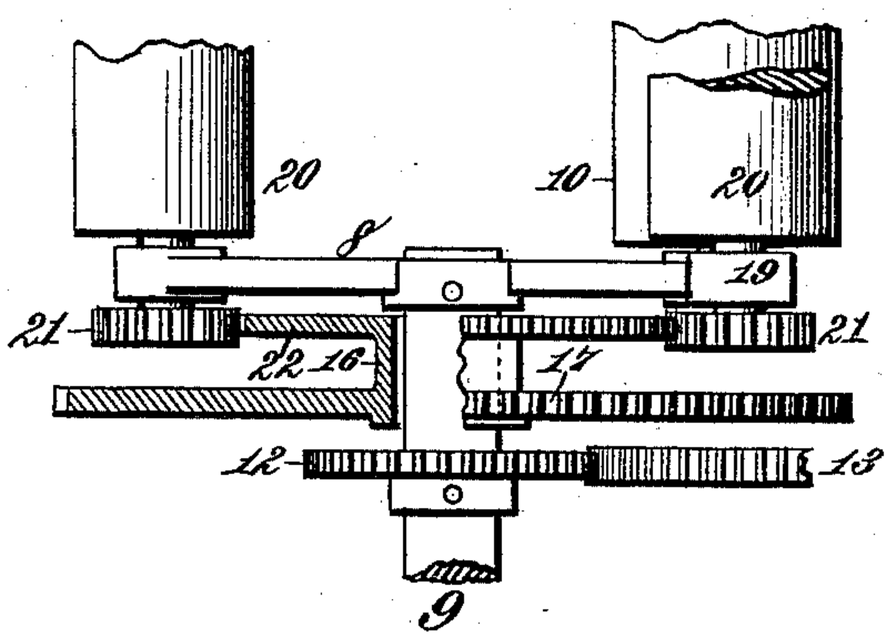
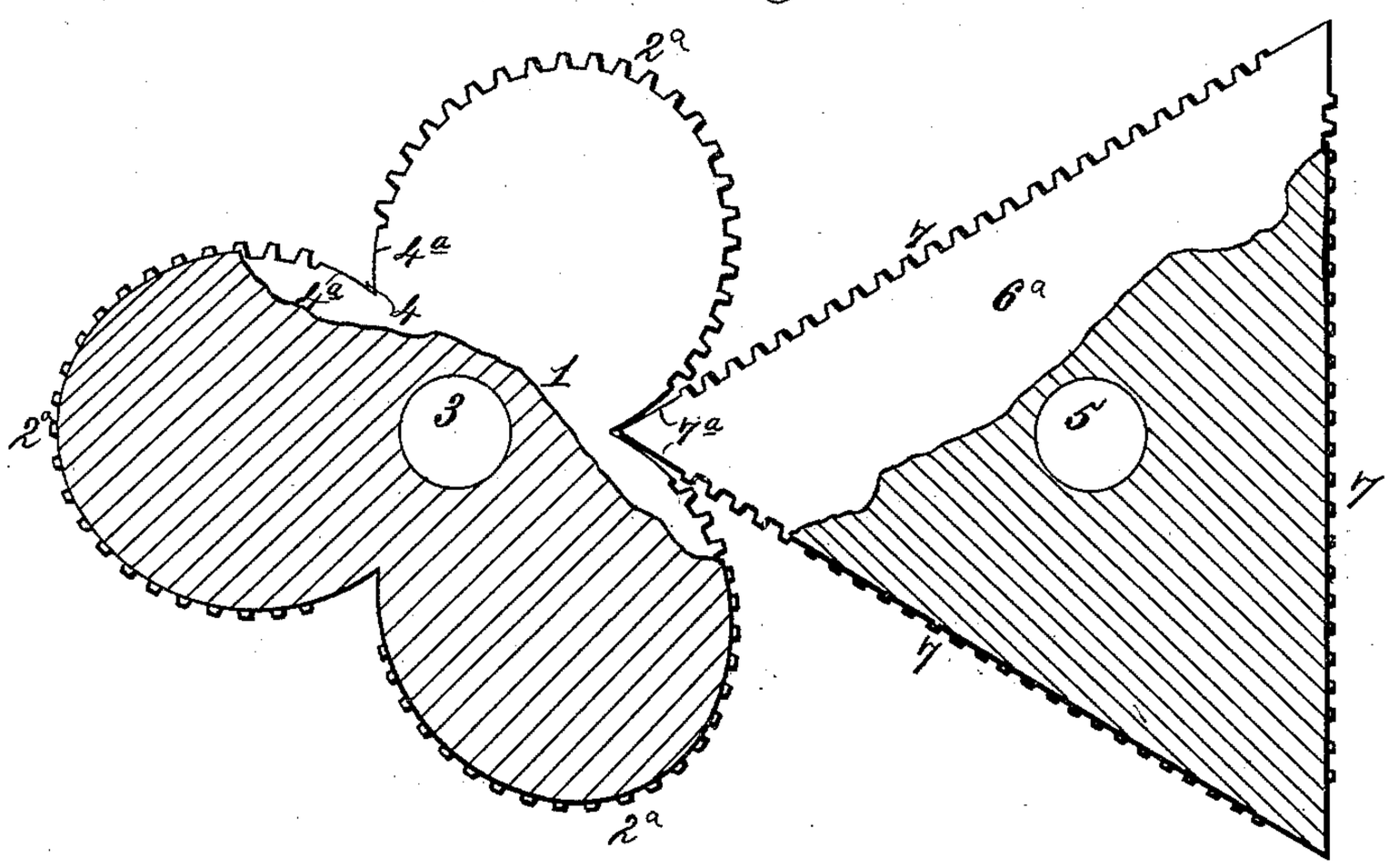


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOSEPH C. FOWLER, OF WASHINGTON, DISTRICT OF COLUMBIA.

MECHANICAL MOVEMENT.

SPECIFICATION forming part of Letters Patent No. 415,630, dated November 19, 1889

Application filed March 7, 1889. Renewed October 22, 1889. Serial No. 327,786. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH C. FOWLER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented new and useful Improvements in Mechanical Movements, of which the following is a specification.

My invention relates to mechanical movements, the purpose thereof being to provide an apparatus wherein movement is communicated from a quadrilobate gear, or a gear composed of four similar lobe-shaped gear-sections, to a rectangular gear, or a gear having four equal straight racks set at an angle to each other of ninety degrees. It is my purpose to so gear these elements together that rotary motion shall be imparted from one to the other without shock, with the minimum wear and tear of the engaging surfaces, and without loss of mesh at the angles of the quadrilobate and rectangular gears.

It is my purpose, further, to combine with the mechanism referred to a frame rotating on a central axis and carrying independently and positively driven rolls, the frame having a constant uniform or regular rotation and the rolls an irregular or varying rotation, whereby they may travel upon the four plane faces of a rectangular bed or body mounted on the rectangular gear and roll upon said plane surfaces without slip.

It is my purpose, further, to so construct a polygonal gear composed of a plurality of equal angles one with another, and to so combine with the same multilobate gear, or a gear having a series of equal and similar curved or lobe-shaped gear-sections, that the one gear may be driven by the other without practical loss of mesh at the angles between the respective meshing surfaces and without shock or irregularity other than is caused by the constant variation of radial distance of the meshing point as it recedes from one axis and approaches the other, and vice versa, whereby a varying rotation of one axis is derived from the uniform rotation of the other. With these elements I combine two separate series or trains of gearing, one driven from the uniformly-rotating shaft-initiating motion and the other train deriving movement from the shaft to which varying rotation is imparted. From the former train I propose to drive a frame rotating upon a central axis and speeded relatively to the speed of the initial shaft at a definite ratio, said frame carrying rolls whose outer peripheries revolve within a circle having an area equal to the area of the space inclosed within the pitch-lines of the polygonal gear. From the latter train of gearing it is my purpose to drive friction-gears by which revolution is imparted to the rolls of the frame, the speed of rotation being such that said rolls shall travel without slip upon the plane surfaces parallel with the pitch-lines of the polygonal gear, said rolls having a varying rotation or surface feed corresponding with the variations in a surface speed of the polygonal body.

The uses to which a mechanism organized in accordance with my invention may be put will be set forth hereinafter.

The invention consists in the several novel features of construction and new combinations and arrangements of parts hereinafter fully set forth, and then definitely pointed out in the claims which follow this specification.

Referring to the accompanying drawings, Figure 1 is a view, partly in section, illustrating my invention. Fig. 2 is a section on the line x x, Fig. 1. Fig. 3 is a view, partly in section, showing a modified construction and arrangement.

In the said drawings, the reference-numeral 1 in Figs. 1 and 2 designates a quadrilobate gear, or a gear consisting of four similar and equal-curved or lobe-shaped gear-sections 2, the special construction of which will be hereinafter referred to. These gear-sections are so formed or mounted as to constitute the four-lobed gear 1, being so arranged relatively to one another that two lines drawn through the axis or shaft 3 at right angles will pass through the centers of the lobes.

Between the adjacent lobes 2 are necessarily formed angles or pockets 4, and these angles are denuded of gear-teeth; but the metal is cut away over a space equivalent to that occupied by about two teeth upon each lobe, and the denuded surfaces 4^a are brought into the pitch-lines of the lobes to which they belong, and may have a very slight curvature

which corresponds to the line of curve followed by the pitch-line of the gear-section.

Upon a separate axis or shaft 5 is mounted a rectangular gear 6, consisting of four straight racks 7, each toothed to correspond with the lobe-shaped gears 2, and each having a number of teeth corresponding with said lobes. Similar to the latter, also, the extremities of the straight racks are denuded of teeth throughout a space corresponding with that of the denuded surfaces 4^a of the lobular gears. Like the latter, moreover, the denuded edges 7^a of the racks are brought into the pitch-lines of their respective racks to enable the denuded angle of the rectangular gear to roll upon the denuded edges forming the pockets 4. Thus I am able to transform the four pockets of the quadrilobate gear into meshing recesses, and the angles of the rectangular gear into enlarged gear projections or teeth which mesh with said recesses and form a positive gear-connection between the successive racks and lobes, whereby all interference between the gear-teeth is avoided and a smooth and easy transmission of motion is effected without perceptible wear. It will readily be seen that if uniform rotation be imparted to the axis or shaft 3, a rotation of varying speed will be given to the axis or shaft 5, owing to the fact that by reason of the form of the intermeshing surfaces the point of engagement is constantly approaching and then receding from either axis, thus giving successively a greater and a less axial speed, which corresponds mathematically with the variation of rotary speed or surface rotation, due to the successively increasing and decreasing distances from the center of initial revolution.

Upon an independent support of any suitable character I mount a frame 8, having a central axis or shaft 9, and in or near the extremities of said frame are journaled rolls 10. These rolls are preferably of such diameter that their circumference shall equal in measurement one of the pitch-lines of the straight racks 7, and the arrangement is such that the outer peripheries of said rolls shall rotate in or within a circle having an area equal to that inclosed by the four pitch-lines of the rectangular gear 6. Upon the shaft 9 is mounted a pinion 12, with which meshes a gear 13 of double the diameter. With the latter gear 13 meshes a second and similar gear 14 of equal diameter, and with the latter gear 14 meshes a gear 15 on the shaft of the quadrilobate gear, said gear 15 being of equal diameter with both the gears 14 and 13. The train of gears thus described gives constant and uniform revolution to the frame 8 in the direction indicated by the arrows in Fig. 1.

Upon the end of the shaft 9 is mounted a sleeve 16, upon which is rigidly mounted a pinion 17, having an area within its pitch-line which is equal to the area inclosed by the pitch-lines of the rectangular gear 6. This gear or pinion 17 meshes with and is driven by a similar and equal gear 18, carried by the shaft 5 of the rectangular gear 6, and partaking of the variations in rotary speed imparted to the latter by the means already set forth.

Mounted in bracket projections 19 on the frame 8 are rolls 20, which have frictional engagement with the rolls 10. On the shafts of these friction-rolls 20 are mounted pinions 21, which mesh with a gear 22, rigid with the sleeve 16. The parts thus connected are, as will readily be seen, driven with a speed which varies with the surface rotation of the rectangular body 6, it being understood that the rolls 10 are, as already stated, of such diameter that they shall complete a single revolution in traversing one plane face of the rectangular body, while the pinions 21 are of such diameter, relatively, to their gear 22 as to impart the required movement.

The construction described may be varied by modifying the number of sides of the rectangular gear—as, for example, constituting it a triangle, as in Fig. 3—although any other polygonal form may be employed, provided that the gear from which it is driven has an equal number of similar lobular sections. In such modifications the same general principles of construction are observed as already described, the separate trains of gearing cooperating therewith being merely modified in size to correspond with the proportions already alluded to. In the said Fig. 3 the reference-numeral 2^a denotes the equal lobular portions of a trilobate, or three-part gear, while the numeral 6^a designates the triangular or three-sided gear meshing therewith.

One purpose to which this mechanical movement is especially adapted is to drive a rectangular-bed printing-press and to operate the inking-rolls which supply the forms. I may, however, organize a lathe upon the same general mechanical principles herein involved, and may substitute for the rolls 10 any suitable form of milling or other tool whereby a given form may be imparted to a body driven by the quadrilobed gear 1. In like manner other forms polygonal in cross-section may be produced by modifying the shape of the mechanical elements in the manner shown.

In laying out the pitch-line of each of the lobe-shaped gears 2 it should be noted that said lines, in order to enable the gear-sections to mesh properly with the straight racks 7, are not arcs of circles. Taking the distance from center to center between the axes 3 and 5, the curved pitch-line will recede from the axis 3 by a constantly-increasing distance equal to the difference between the distance from center to center and the successive lines drawn from the center 5 to the successive points of meshing engagement of the rack 7. For example, when the angle of the rectangular gear is centrally meshed in one of the pockets 4^a of the quadrilobate gear 1 the pitch-line of the first tooth of the gear-section 2

will be at a radial distance from the axis 3 which will be equal to the distance from center 3 to center 5 minus the line drawn from the center 5 through the corresponding pitch of the first tooth in the intermeshing rack 7, and this rule will easily give the true curvature of the pitch-line of the lobe-shaped gears.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a mechanical movement, a lobe-gear meshing with a polygonal gear, the angles of the latter and the intersections of the former being plane surfaces or edges lying in the pitch-lines of the respective gears, substantially as described.

2. In a mechanical movement, the combination, with a lobe-gear having similar gear-sections with teeth cut upon a curved pitch-line, of a polygonal gear having teeth cut upon straight pitch-lines, the angles of the latter being plane surfaces denuded of teeth and lying in the straight pitch-lines of the respective gear-surfaces, and the intersections of the lobe-gears being similarly denuded of teeth, forming edges cut in the pitch-lines of the adjacent lobes, substantially as described.

3. In a mechanical movement, the combination, with a multilobular gear composed of a series of curved gear-sections having intermediate pockets or re-entrant angles denuded of teeth and lying in the pitch-lines of the adjacent gear-sections, of a polygonal gear consisting of an equal number of straight racks, forming equal angles and having at the salient angles spaces or edges denuded of teeth and lying in the pitch-lines of the adjacent rack-teeth, said angles forming teeth which mesh with said pockets, substantially as described.

4. In a mechanical movement, the combination, with a multilobular gear composed of a series of curved similar gear-sections, of a polygonal gear consisting of a similar series of straight racks, a frame rotating on a central axis and having rolls whose outer peripheries lie in a circle having an area equal to that inclosed by the pitch-lines of the rectangular gear, positively-driven gears imparting rotation to said rolls, a train of gearing driven from the initial shaft and imparting uniform rotation to the frame, and an independent train of gearing driven from the variably-rotating shaft carrying the polygonal gear and imparting a correspondingly-varied surface revolution to said rolls, substantially as described.

5. In a mechanical movement, the combination, with a multilobular gear composed of a series of lobe-shaped gear-sections and provided with pockets or re-entrant angles 4, denuded of teeth upon surfaces 4^a, which are slightly curved and formed in the pitch-lines of the teeth of gear-sections 2, of a polygonal gear composed of straight racks and provided with salient angles formed by edges 7^a, lying in the line of pitch of the rack-teeth, and denuded of teeth throughout a space equal to that of the pocket 4^a, substantially as described.

6. In a mechanical movement, the combination, with a multilobular gear carried by a shaft rotating at uniform speed, of a polygonal gear driven thereby at a varying speed, a frame mounted on a central axis and having rolls whose outer peripheries lie within a circle of area equal to that of the rectangular gear, a train of gearing driven from the initial shaft and revolving said frame at a speed double that of the said initial shaft, a separate train of gearing driven from the shaft of the rectangular gear, and friction-gears driven by the latter train and imparting a varying surface revolution to the said rolls, substantially as described.

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

JOSEPH C. FOWLER.

Witnesses:

JAMES L. NORRIS,

JAMES A. RUTHERFORD.