(No Model.) 2 Sheets—Sheet 1.

W. W. WAINWRIGHT & J. H. MORRISON.

DEVICE FOR PRODUCING CYCLOIDAL CURVES.

No. 533,025. Patented Jan. 22, 1895.

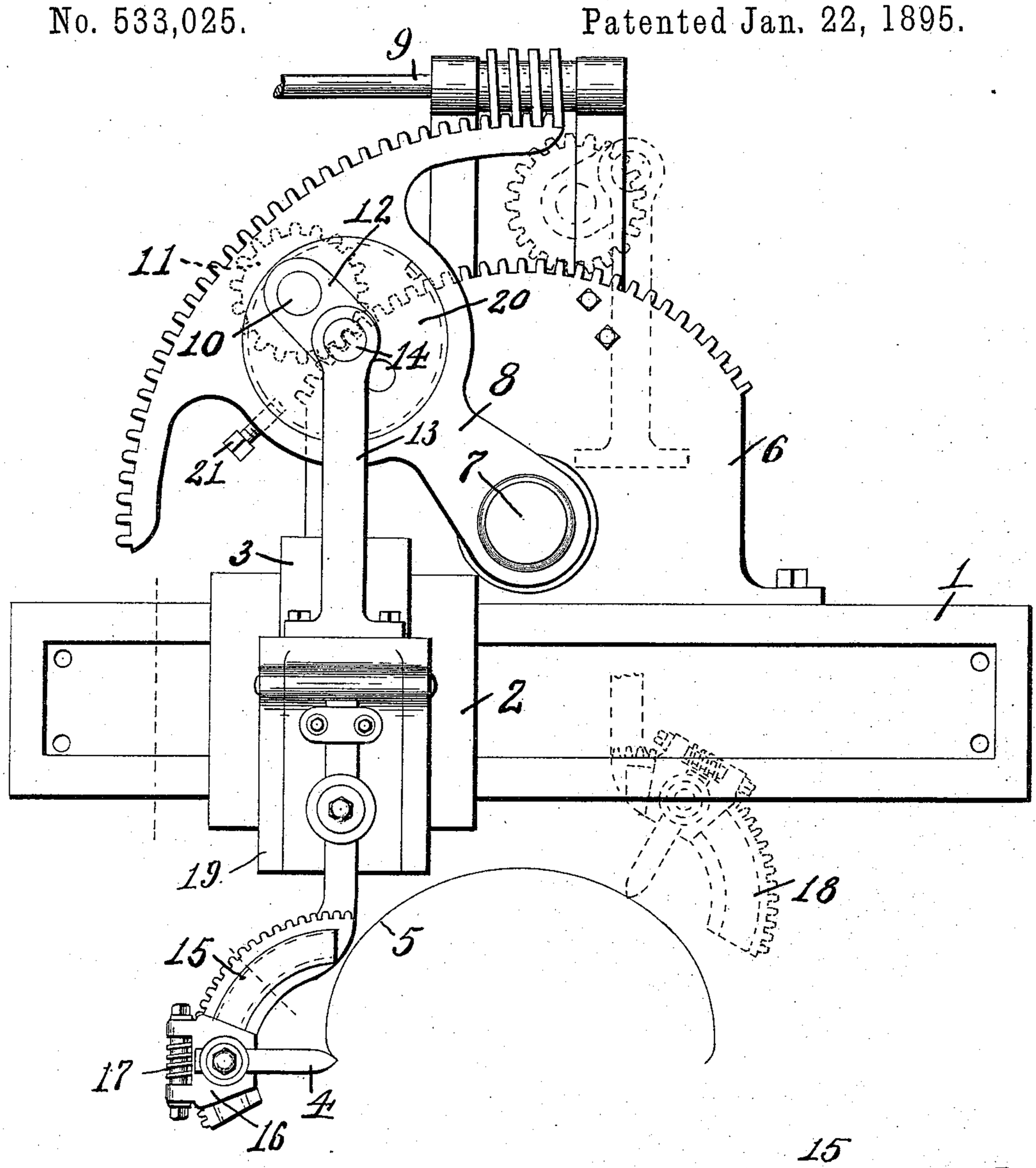

FIG. 1.

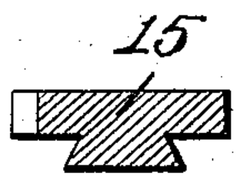

FIG. 5.

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(No Model.) 2 Sheets—Sheet 2.

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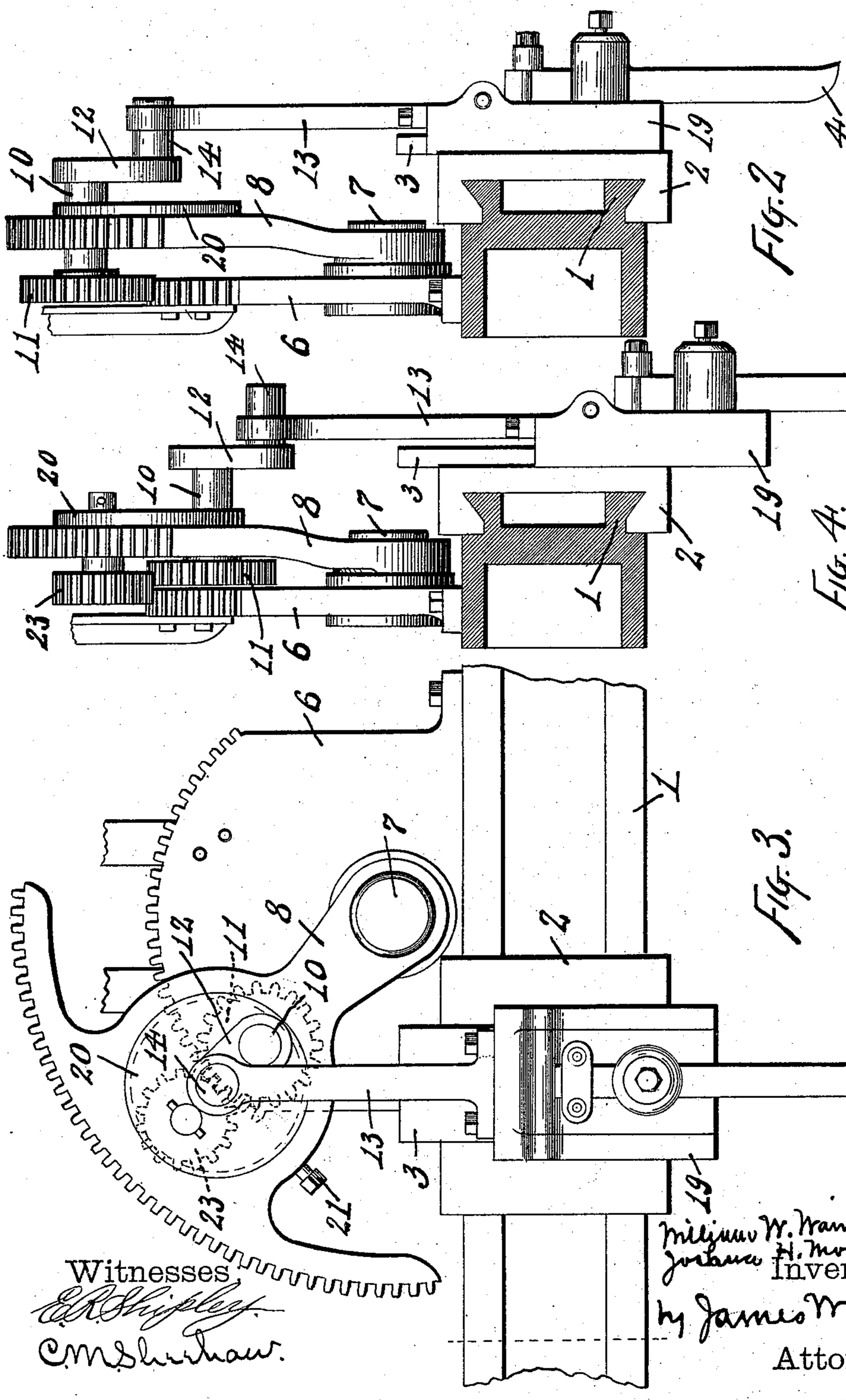

FIG. 2.

FIG. 4.

FIG. 3.

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UNITED STATES PATENT OFFICE.

WILLIAM W. WAINWRIGHT AND JOSHUA H. MORRISON, OF CONNERSVILLE, INDIANA.

DEVICE FOR PRODUCING CYCLOIDAL CURVES.

SPECIFICATION forming part of Letters Patent No. 533,025, dated January 22, 1895.

Application filed July 11, 1894. Serial No. 517,182. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM W. WAINWRIGHT and JOSHUA H. MORRISON, of Connersville, Fayette county, Indiana, have invented certain new and useful Improvements in Devices for Producing Cycloidal Curves, of which the following is a specification.

Our invention pertains to mechanism for describing cycloidal lines and has been devised with special reference to metal planing machines in which it is desirable to give to the point of the cutting tool a feed movement in a cycloidal path. While we illustrate our new device as adapted for such planer-feeding we suggest its utility under other conditions where cycloidal lines are to be mechanically described.

We use the term cycloidal in a generic sense as comprehending cycloids, epicycloids, hypocycloids, epitrochoids, &c.

Our invention will be readily understood from the following description taken in connection with the accompanying drawings, in which—

Figure 1 is a front elevation of a mechanism exemplifying our invention as applied to a metal planing machine; Fig. 2, a side elevation of the same; Fig. 3, a front elevation of the mechanism adjusted for describing hypocycloids; Fig. 4, a side elevation of the device adjusted for describing hypocycloids, and Fig. 5 a diagonal section of the tool-adjusting segment.

In the drawings, and confining attention at present entirely to Figs. 1 and 2:—1, indicates a horizontal straight slide-way, exemplified as the cross-rail of an ordinary metal planing machine; 2, the saddle sliding thereon; 3, the vertical slide-way on the saddle, at right angles to the slide-way 1, the tool-block 19 moving vertically on the slide-way 3; 4, the cutting-tool; 5, the epicycloidal contour line of the work to be produced by the cutting-tool; 6, a toothed segment fixed upon the rail 1, this segment representing the fundamental circle of the epicycloid to be produced; 7, a pivot at the center of this segment; 8, an arm swinging on that center; 9, a worm device for swinging arm 8 upon its center; 10, a spindle journaled in arm 8 exterior to the periphery of segment 6; 11, a pinion fast on this spindle and meshing with segment 6, the pitch diameter of this pinion representing the generating circle; 12, a crank fast on spindle 10, its length between the center corresponding with the radius of the generating circle represented by the pinion 11; 13, a rigid connection from tool-block 19 to the crank-pin of crank 12; and 14, the crank-pin of crank 12.

It will be at once observed that the center of crank-pin 14 represents a point in the circumference of the generating circle represented by pinion 11, and that if arm 8 be swung to the right the center of the crank-pin 14 will describe the desired epicycloid. Tool-block 19, and consequently the point of tool 4, will obviously have the same movement as the center of the crank-pin, tool-block 19 sliding on slide-way 3, and saddle 2 sliding on rail 1 as impelled by the crank-pin. It follows that the point of tool 4 will describe the epicycloid described by the crank-pin.

It will be obvious that certain portions of the epicycloidal contour indicated by line 5, the upper portions for instance, could be planed with a single tool without adjustment, but it is also obvious that if a pointed tool be used and an attempt be made to plane the entire epicycloidal contour, the tool will not present itself properly to the work. Provision is therefore made for adjusting the tool at various angles, with the tool point as a center.

Referring further to the drawings:—15, indicates a segmental dove-tail guide-way carried by the tool-block and forming a part of the tool-holder, the center of the segment being the point of the cutting-tool 16, the tool-holder, carrying the cutting-tool and fitted to slide upon the guide-way 15; 17, a worm carried by the tool-holder 16 and engaging the segment of tool on the guide-way 15 and providing for the convenient angular adjustment of the tool, and 18 another one of these segmental tool-holding arrangements but made left handed, calling the other right handed, this second tool-holding arrangement being employed for operating upon the opposite side of the epicycloid, the dotted lines above and below indicating the position of the generating pinion and of the tool-holding arrangement, respectively, when working upon the right hand portion of the epicycloid.

As shown in Fig. 1 tool 4 is just ready to

begin its feeding movement upward and to the right. As the movement progresses the angle of the tool may be adjusted on segment 15 so that there is always maintained a fair tool presentation. When a crown of the epicycloid has been passed, or so far passed that the lower extremity of segment 15 would strike the work then the tool-holding arrangement is removed and the left handed one 18 substituted.

In the example shown in Fig. 1 crank 12 has a length equal to the radius of the generating circle. If epitrochoids are to be described then the length of the crank arm will be modified accordingly. It is of course to be understood that the proportion or geometric character of all of the controlling parts is to be arranged with reference to the desired cycloidal curve to be described, the radius of the fundamental circle represented by segment 6 being made as desired between possible minimum and infinity, the segment in the latter case becoming of course a rack.

Proceeding with the drawings, but giving attention now to Figs. 3 and 4:—20, indicates a circular disk mounted for rotation in the arm 8, the center of this disk coinciding with the pitch line of segment 6, and the spindle 10 being journaled in the disk so that by turning the disk spindle 10 may be brought outside the fundamental circle represented by segment 6, as in the case of Fig. 1, or inside that circle, as in Fig. 3; 21, a set screw for securing the disk 20 in either one of the two positions just mentioned; 22, the hypocycloid to be produced, and 23, a pinion carried by arm 8 and meshing at once with the segment 6 and with generating pinion 11 which, under the new adjustment, no longer meshes with the segment 6 but has a position against its face.

In Fig. 2, representing the device when adjusted as in Fig. 1, for describing epicycloids, pinion 11 is exterior to and meshes with the segment 6; but notice in Fig. 4 that pinion 11 has been pulled forward thus permitting disk 20 to be turned, thus carrying pinion 11 down alongside of segment 6 with their peripheries even. Pinion 23, which is an idler, may now engage pinion 11 and the segment 6, the effect upon pinion 11 as arm 8 moves being precisely the same as if segment 6 had been changed to an internal segment to engage pinion 11. Under these conditions the generating circle is within the fundamental circle and a hypocycloid is described by the point of the tool.

We claim as our invention—

1. In a device for producing cycloidal curves, the combination, substantially as set forth, of a fixed fundamental line of teeth, a spindle carrier arranged for movement along said line of teeth, a spindle carried by said spindle carrier, a pinion on said spindle and connected with said fundamental line of teeth, a crank on said spindle, a curve-tracer, as a cutting-tool, having two guides in right lines at right angles to each other, and a connection from said curve-tracer to the crank-pin of said crank, and steadied by said right-line guides.

2. In a device for producing cycloidal curves, the combination, substantially as set forth, of a fixed fundamental line of teeth, a spindle-carrier arranged to move along said line of teeth, a spindle mounted in said spindle-carrier in a bearing adjustable to positions inside and outside of said fundamental line of teeth, a pinion on said spindle, a crank on said spindle, a removable idle pinion mounted on said spindle-carrier and engaging said first mentioned pinion and said fundamental line of teeth, a curve tracer, as a cutting-tool, mounted upon a pair of slide-ways at right angles to each other, and a connection from said curve tracer to said crank.

3. In a device for producing cycloidal curves, the combination, substantially as set forth, of a slide-way, a fundamental segment fixed thereto, an arm pivoted at the center of said fundamental segment, a spindle journaled in said arm, a crank carried by said spindle, a pinion on said spindle and connected with said fundamental segment, a saddle fitted upon said slide-way and carrying a slide-way at right angles to said first mentioned slide-way, a curve tracer, as a cutting-tool, arranged to be guided by said second slide-way, and a connection from said curve tracer to said crank.

4. In a device for producing cycloidal curves, the combination, substantially as set forth, of a slide-way, a saddle thereon, a guide-way on the saddle at right angles to said slide-way, a curve tracer, as a cutting-tool, mounted on said guide-way, a fundamental segment fixed to said slide-way, an arm pivoted at the center of said segment, a spindle mounted in said arm, a pinion carried by said spindle, a crank carried by said spindle and connected with said curve tracer, and a removable idle pinion carried by said arm and engaging said first mentioned pinion and said segment.

5. In a device for producing cycloidal curves, the combination, substantially as set forth, of a slide-way, a saddle mounted thereon and carrying a guide-way at right angles to said slide-way, a curve tracer, as a cutting-tool, mounted on said guide-way, a fundamental segment fixed to said slide-way, an arm pivoted at the center of said segment, a disk mounted in said arm, a removable idle pinion mounted on said arm and engaging said fundamental segment, a spindle journaled in said disk, a pinion on said spindle and engaging said idle pinion, and a crank on said spindle and connected with said curve tracer.

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