

(No Model.)

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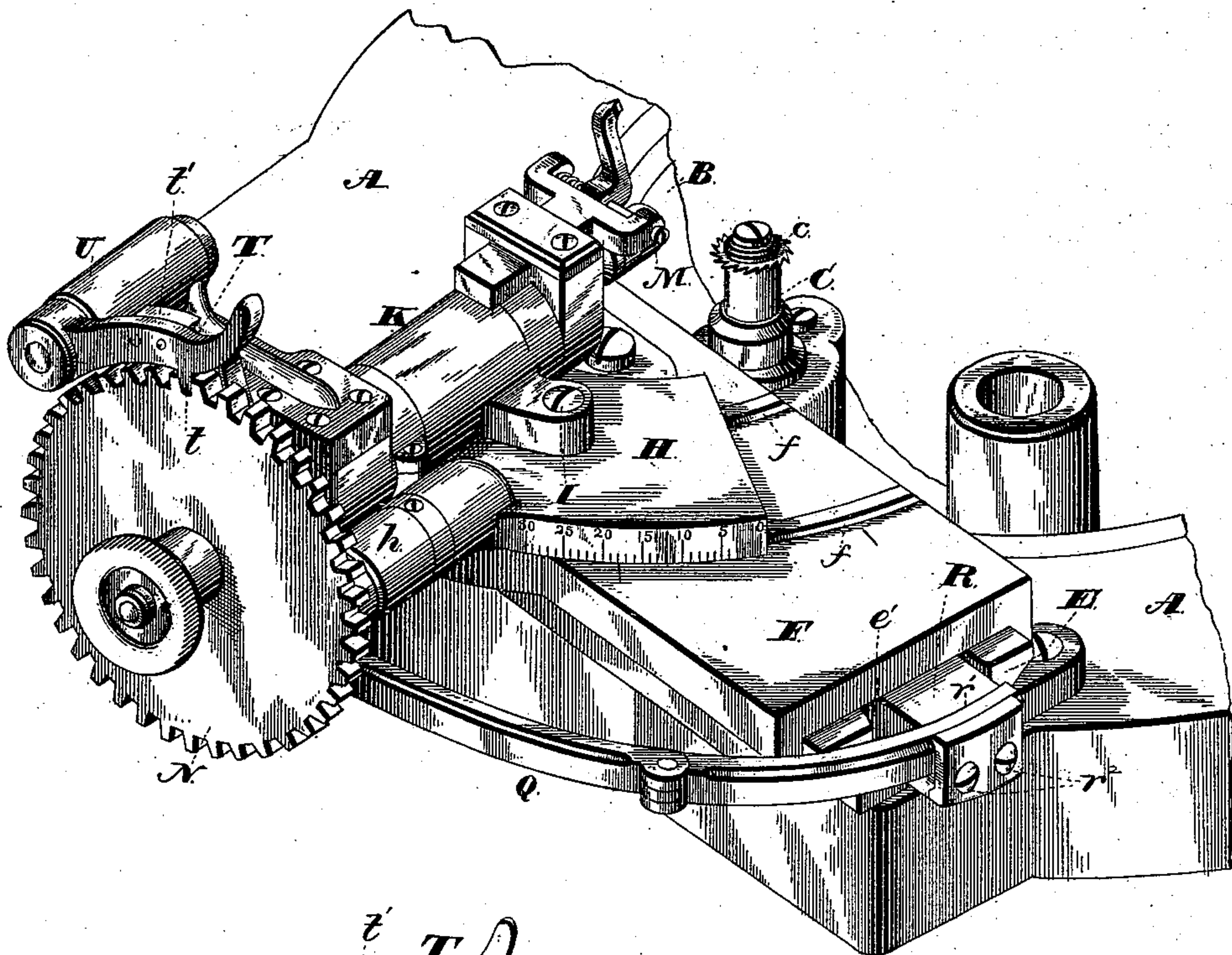
F. LEMAN.

PINION CUTTING MACHINE.

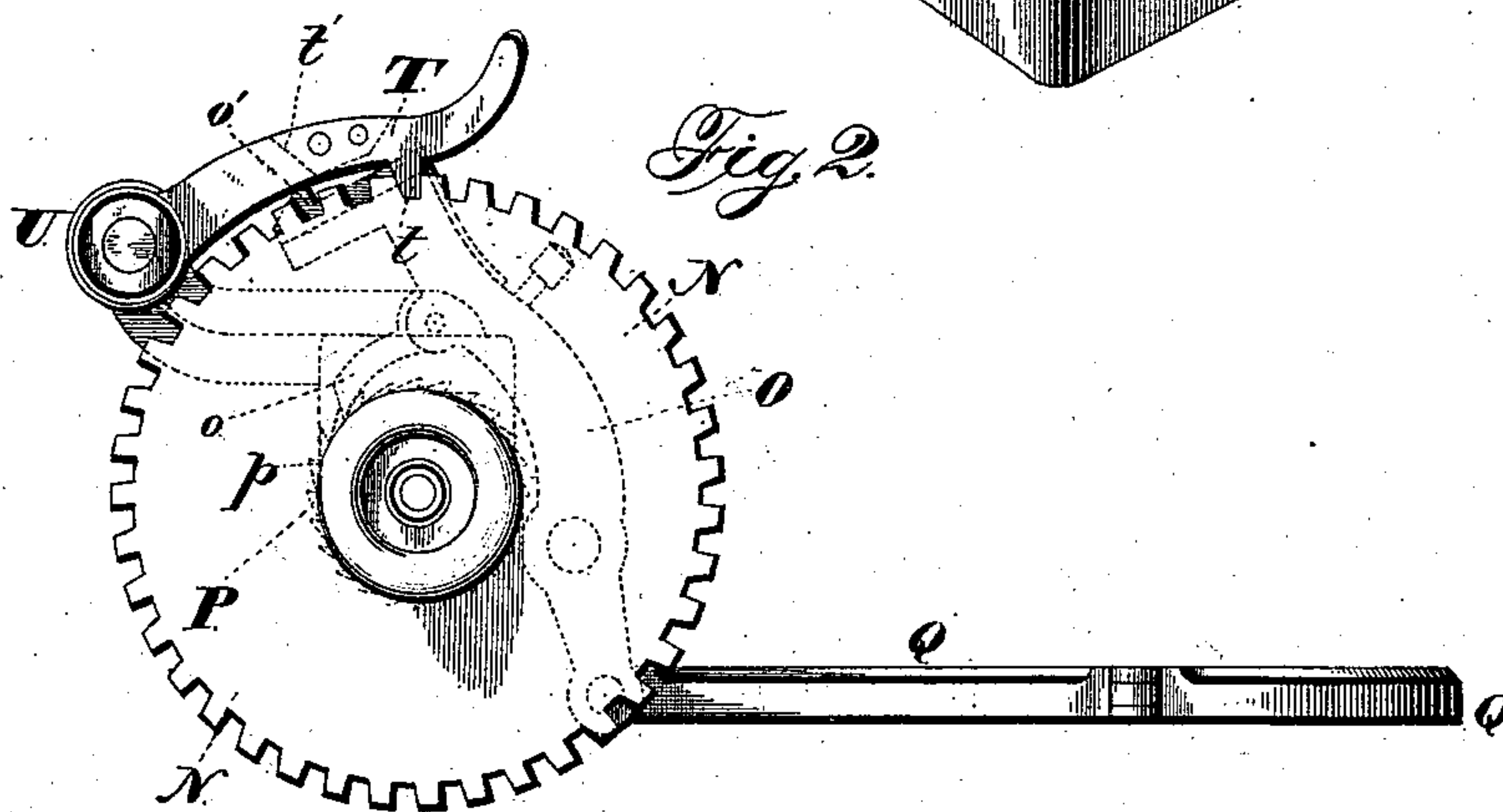
No. 377,945.

Patented Feb. 14, 1888.

*Fig. 1.*



*Fig. 2.*



*Witnesses:*  
*Chas. Williamson.*  
*Henry C. Hazard.*

*Inventor:*  
*Frank Lemman, by*  
*Erindell Russell, his Attys.*

(No Model.)

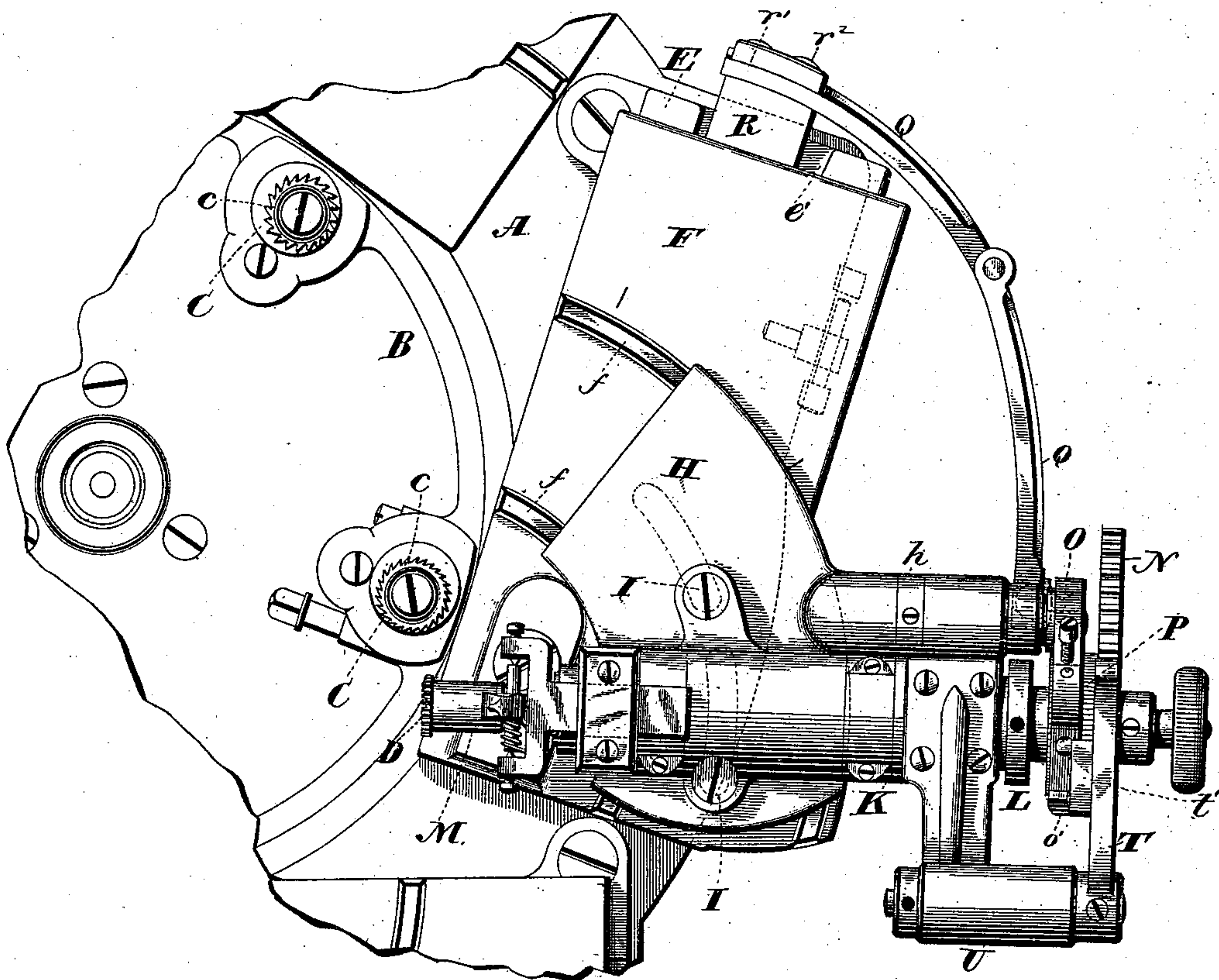
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*Fig. 3.*



*Witnesses:*  
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*Henry L. Hazard*

*Inventor:*  
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*Prindle & Russell, his Attys*



(No Model.)

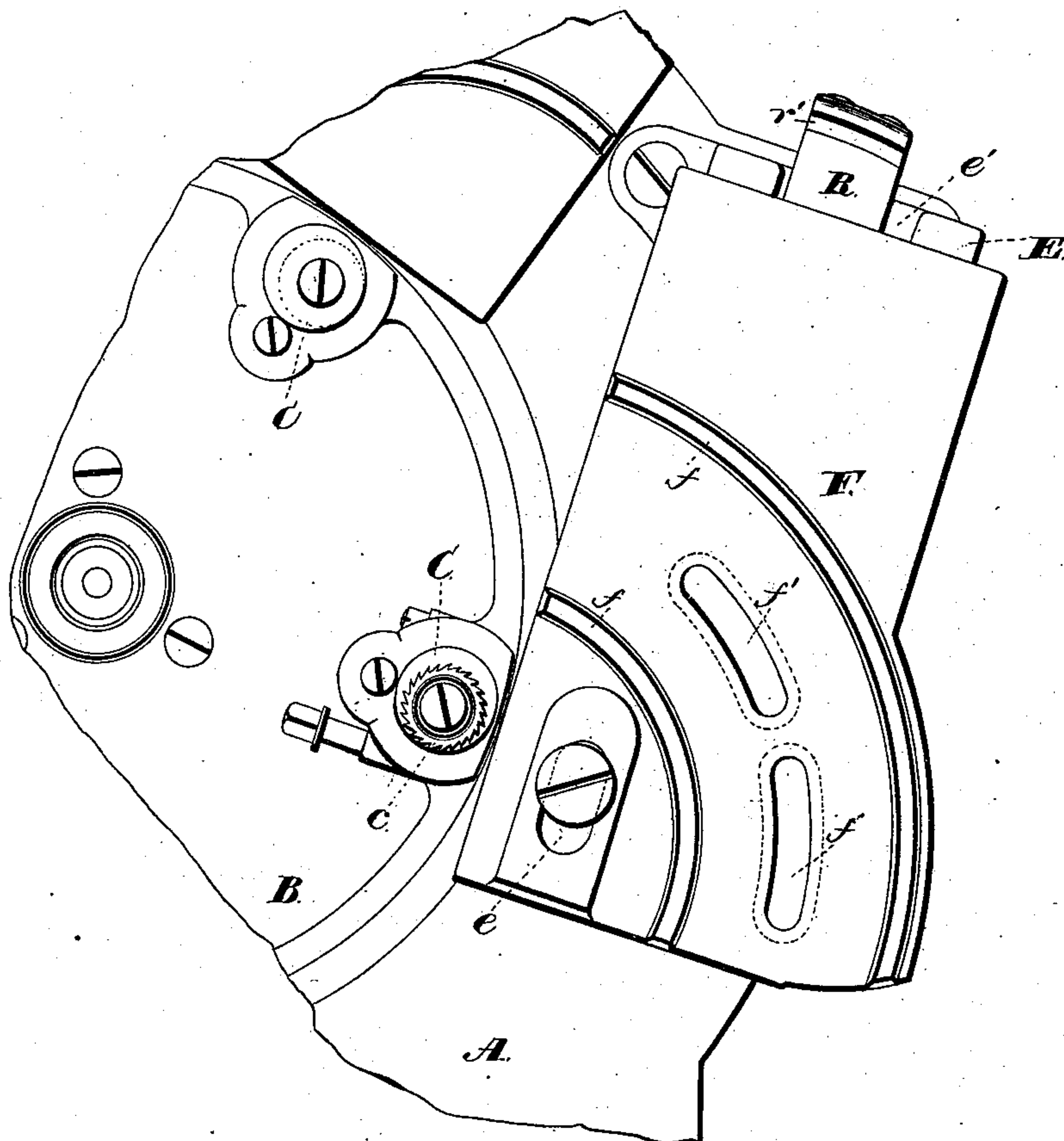
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*Fig. 4.*



*Witnesses,*  
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*Erindell W. Russell, his Attys*

(No Model.)

4 Sheets—Sheet 4.

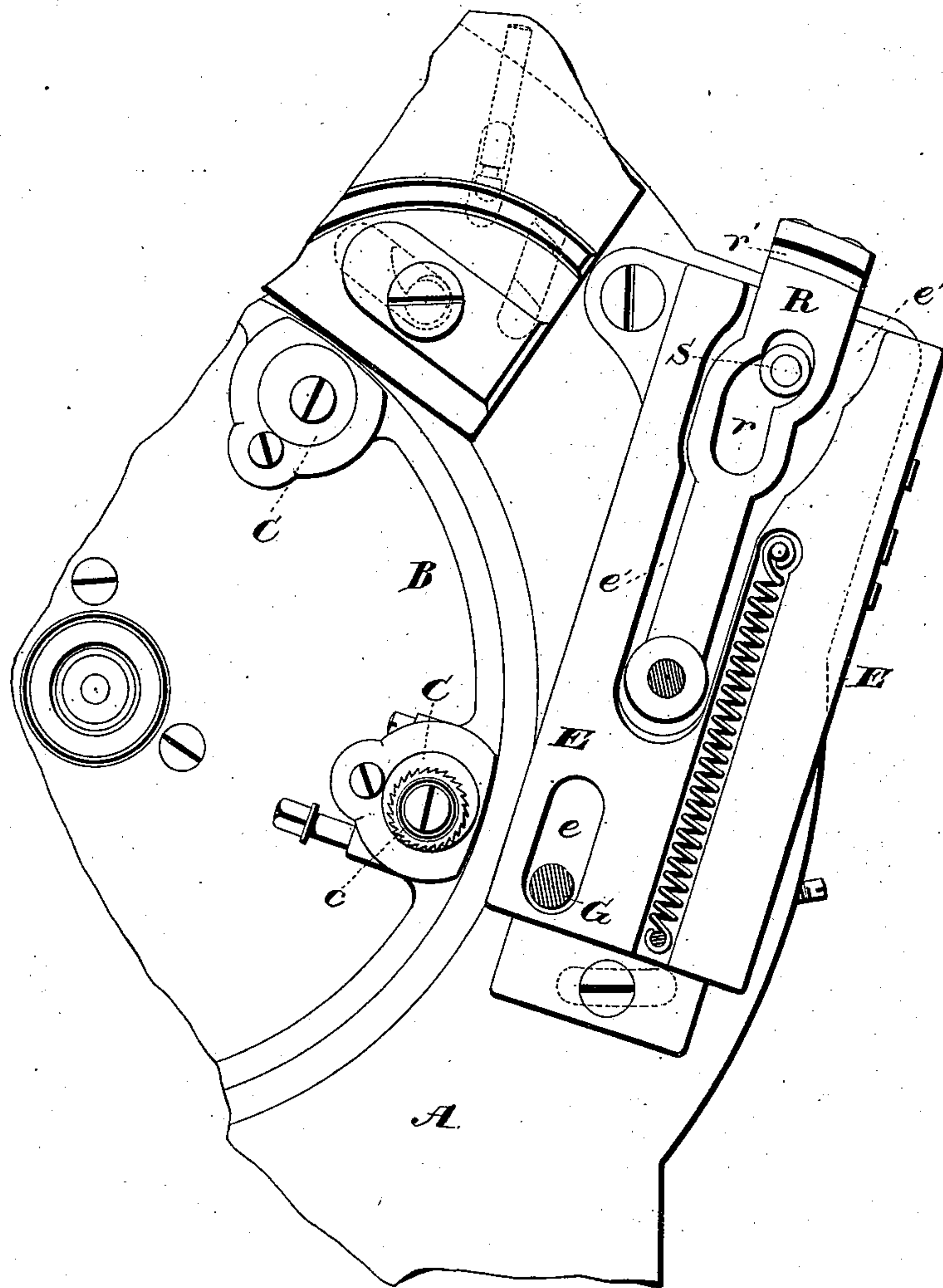
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*Fig. 5.*



*Witnesses:*  
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*Henry L. Hazard.*

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# UNITED STATES PATENT OFFICE.

FRANK LEMAN, OF ELGIN, ILLINOIS.

## PINION-CUTTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 377,945, dated February 14, 1888.

Application filed August 5, 1886. Renewed August 18, 1887. Serial No. 247,287. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK LEMAN, of Elgin, in the county of Kane, and in the State of Illinois, have invented certain new and useful  
5 Improvements in the Manufacture of Bevel-Pinions; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

10 Figure 1 is a perspective view of one of a series of work-holding slides and a portion of the rotatable table upon which it is supported. Fig. 2 is an elevation of the index-plate and its operating mechanism. Fig. 3 is a plan  
15 view of the same from the upper side. Fig. 4 is a like view of the parts with the pivoted spindle-carrying housing removed, and Fig. 5 is a plan view of the same with the slide removed.

20 Letters of like name and kind refer to like parts in each of the figures.

My invention is an improvement upon a machine in which a series of cutter-spindles are arranged around a common center and a  
25 number of blank-holding mechanisms are adapted to be placed in position successively before and moved back and forth in front of each cutter of the series, so that by the successive action of said cutters upon each blank  
30 teeth will be blocked out and finished around the periphery of the same.

The object of my invention is to enable the cutting of the teeth of bevel-wheels and pinions having any desired angle with reference  
35 to the plane of rotation; and to this end it consists, principally, in the means employed for varying the position of the blank-holding and rotating spindle with relation to the line of its reciprocating motion, substantially as and  
40 for the purpose hereinafter specified.

It consists, further, in the means employed for giving to the blank-carrying spindle a step-by-step rotation, substantially as and for the purpose hereinafter shown.

45 In the use of my invention an annular table, A, is journaled upon a circular frame, B, and is adapted to be rotated upon or around the same step by step by suitable mechanism. As my improvements do not require that the  
50 whole of said parts be illustrated, a portion only of each is shown in the drawings.

At equidistant points within the frame B

are journaled a number of spindles, C and C, that are each adapted to carry a cutter, c, which cutter is one of a series of cutters c that, 55 by successive action upon a properly-presented blank, D, are adapted to form gear-teeth within the side edge of the same. Secured at equidistant points upon the face of the table A are a number of ways, E and E, each of 60 which is adapted to carry a slide, F, and is arranged with its longitudinal axis at or near a right angle to a line passing radially from the center of said frame B.

The slide F is fitted upon and adapted to be 65 moved longitudinally back and forth over the way E, and is so moved within the necessary limits by means of a pin, G, which projects from its lower side downward through a slot, e, in said slide, and at its lower end below the 70 table A is engaged by any suitable form of reciprocable mechanism.

Upon the upper side, near the front end of the slide F, there is provided two concentric 75 A-shaped ways, f, upon which is fitted a plate, H, that, in plan view, has the form seen in Fig. 3, and is adapted to be moved lengthwise of said ways and to be secured in place thereon by means of two screws, I, that pass through 80 said plate and through curved slots f' in said slide, with nuts upon their ends below the latter.

Formed upon or secured to the upper face at one side of the plate H is a cylindrical housing, K, that receives and contains a rotatable 85 spindle, L, which spindle carries within its front end a chuck, M, that is adapted to engage with a wheel-blank, D, while to its rear projecting end said spindle has secured a peripherally-toothed index-plate, N. 90

Pivoted upon or within a boss, h, which projects horizontally outward from the plate H, is a lever, O, that has the form shown in Fig. 2, and carries a spring-actuated pawl, o, which, by the oscillation of said lever, may 95 be caused to engage with or slip over the teeth p of a ratchet-wheel, P, upon the spindle L just inside of the index N.

To the lower end of the lever O is pivoted one end of a bar, Q, which from thence extends 100 in a curve forward to a point in line with the outer end of the way E, where it engages with one end of a bar, R, that from thence extends inward within a recess, e', in the upper side of the



way E, and has its opposite inner end pivoted to the latter in front of the longitudinal center of the same. The recess  $e'$  has such transverse dimensions as to permit the outer end of the pivoted bar R to have a certain amount of lateral motion, which motion is secured by means of a stud, S, that projects from the way E upward into a cam-groove,  $r$ , which is provided within said bar. Said groove has such longitudinal shape that as said slide moves inward no change is effected in the position of said bar until, as the former nears the end of its stroke inward, the outer end of said bar is quickly moved in the direction of the lever O, and through the bar Q causes the same to turn upon its pivotal bearing so as to retract its pawl  $o$ . When said slide moves outward, the bar R is returned to its normal position, and by the movement of said lever O said pawl  $o$  is caused to engage with and partially rotate the ratchet-wheel P and spindle L.

The bar Q is jointed at or near its longitudinal center in order to enable it to conform to the different planes of motion of the lever O and the pivoted cam-bar R, and also to permit of changes in the position of the spindle L with relation to the line of motion of the slide F. Such change of position necessitates a change in the length of said bar Q between said lever and cam-bar, for which purpose the portion of said bar that is connected with said cam-bar is contained within a transverse groove,  $r'$ , and is locked therein by means of set-screws  $r''$ , or by forming the outer wall of said groove separate from said bar, and by the operation of screws causing it to act as a clamp.

By means of the arrangement shown the pawl-lever O may be operated from the cam-bar R, while the spindle L occupies any position within the limits of motion of the supporting-plate H.

The index-plate is locked in position by means of a pawl, T, which is pivoted upon a suitable support, U, and has its hooked end  $t$  held with a yielding pressure in peripheral engagement with said plate by means of a spring. Said locking-pawl is released from engagement when the pawl  $o$  moves forward by means of a lug,  $o'$ , upon the upper end of the lever O, which lug passes beneath an inclined lug,  $t'$ , upon the side of said lever T

just as said pawl  $o$  commences to move forward. The lug  $o'$  is adapted to swing laterally out of the way of said lug  $t'$  upon the backward movement of said lever O, and is held in its normal position by means of a spring.

In the use of the machine a wheel-blank is placed upon the chuck, when, as the slide is moved back and forth, the cutter comes into contact with its front side and edge and performs its part in forming thereon the bevel-teeth. At the close of each inward movement of said slide the spindle is given a partial revolution, so as to bring each time a new portion of the periphery of said wheel-blank into contact with said cutter.

While the chuck-spindle is preferably rotated at inner end of the stroke of the slide, it may, if desired, be rotated at the outer end of the stroke of said slide by a reversal of the groove within the cam-bar.

Having thus described my invention, what I claim is—

1. In combination with the reciprocating slide of a gear-cutter, and with a chuck-spindle which is journaled thereon and adapted to be arranged in a line with or at an angle to the line of motion of said slide, a bar that is pivoted at one end to the latter, and is provided with a longitudinal cam-groove which engages with a stationary stud, and by the reciprocation of said slide is given a lateral movement of its rear end, together with a curved bar that is pivoted at one end to the index-operating pawl-lever, and at its opposite end is connected with the outer end of said cam-bar, substantially as and for the purpose specified.

2. In combination with the cam-bar and with the pawl-lever which moves in a plane at an angle to the plane of motion of said cam-bar, a jointed connecting-bar that extends between and is connected with said parts, and is adapted to communicate the motion of said cam-bar to said pawl-lever, substantially as and for the purpose shown.

In testimony that I claim the foregoing I have hereunto set my hand this 14th day of May, 1886.

FRANK LEMAN.

Witnesses:

GEO. S. PRINDLE,  
CARLOS H. SMITH.