No. 618,514. Patented Jan. 31, 1899.

W. LÖW.

MICROTOME.

(Application filed Sept. 10, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

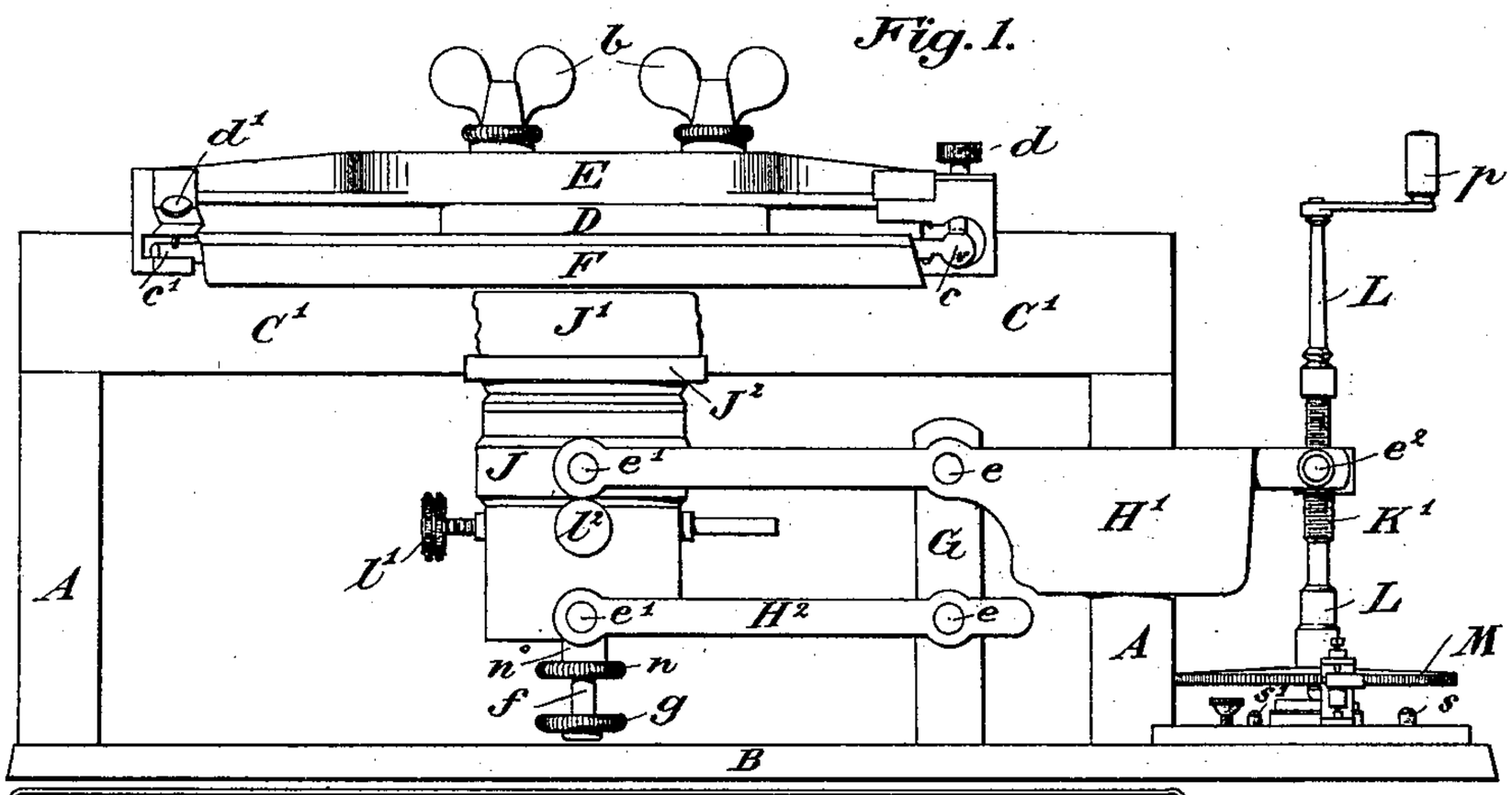


Fig. 2.

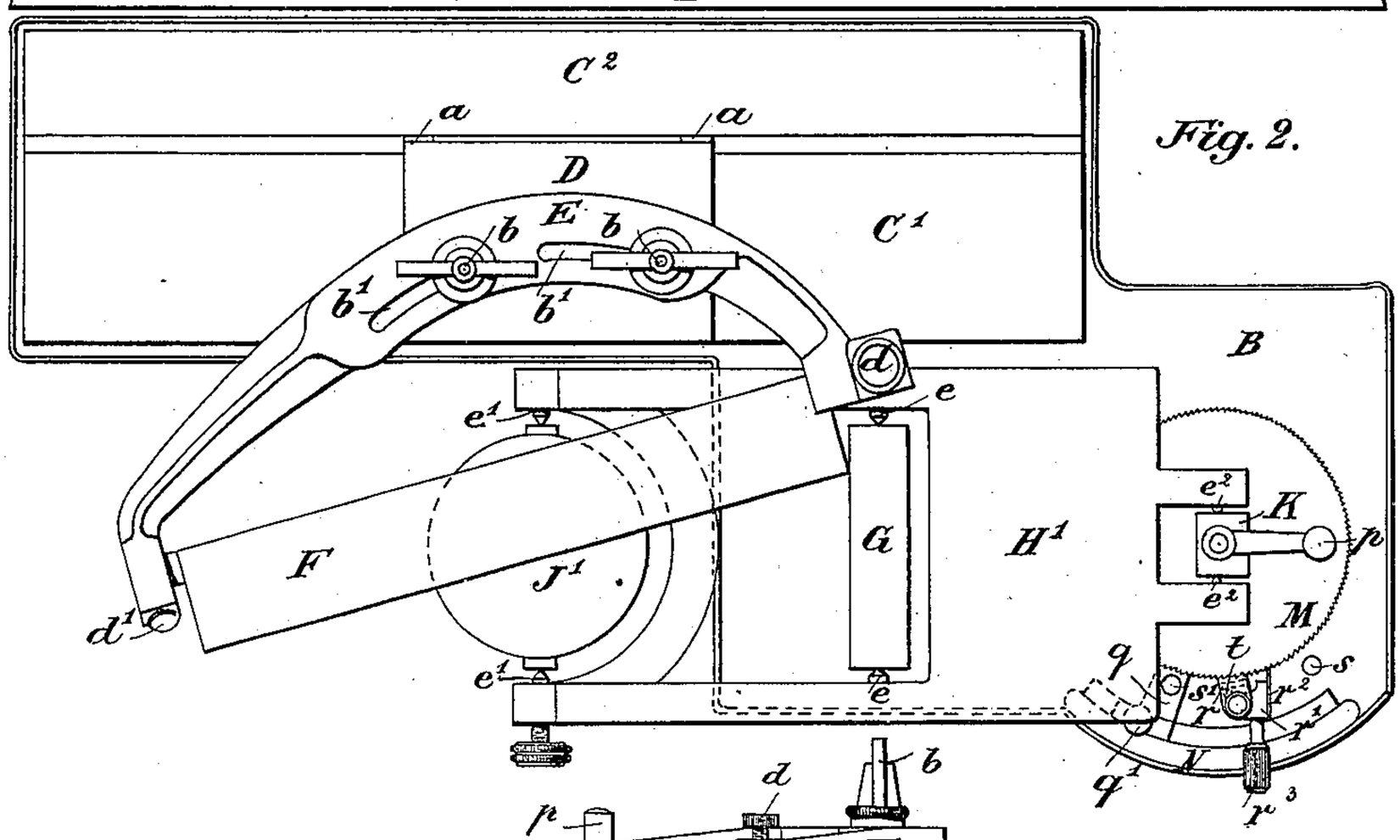
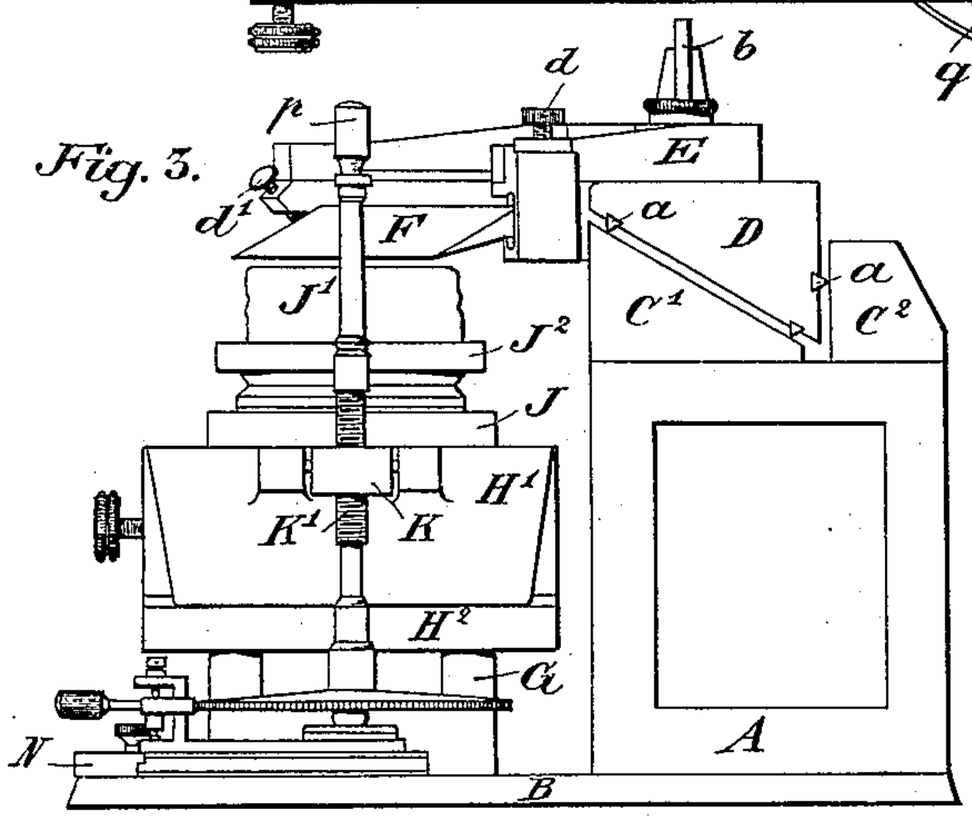


Fig. 3.



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by Marcellus Bailey
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(No Model.) 2 Sheets—Sheet 2.

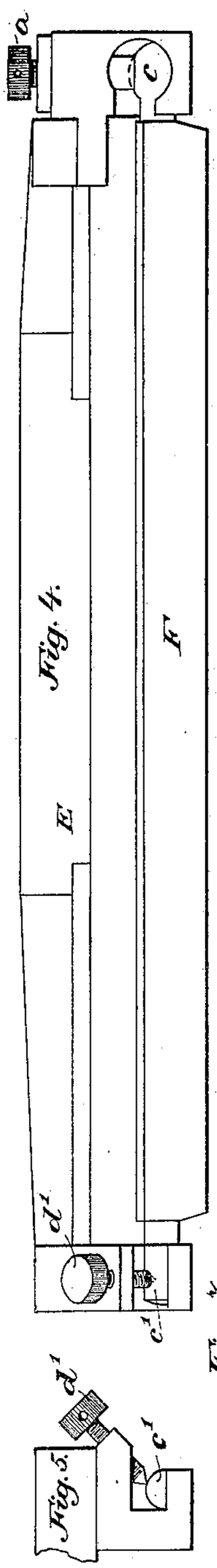

Fig. 4.

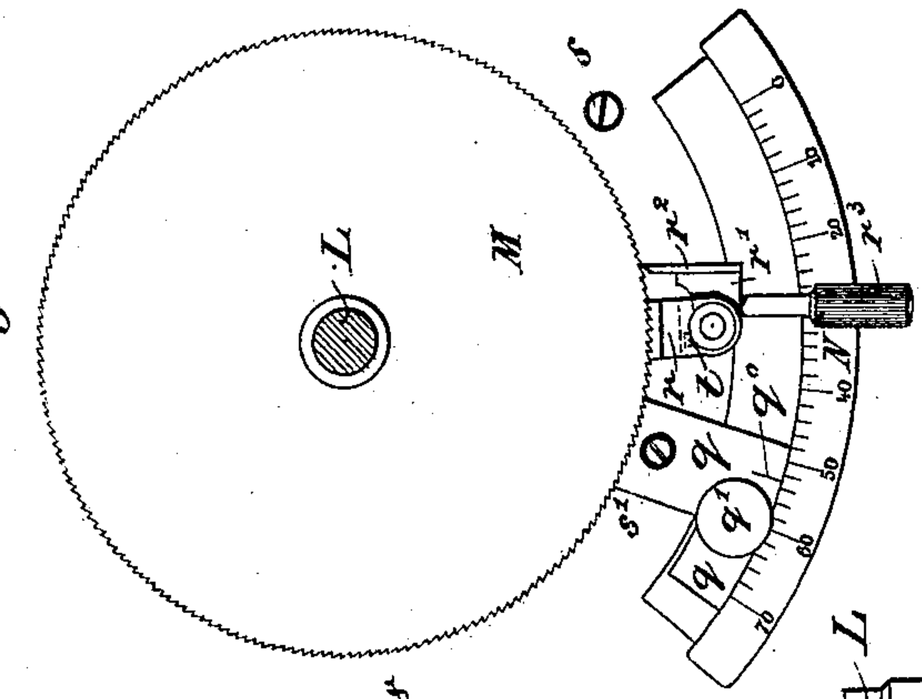

Fig. 9.

Fig. 5.

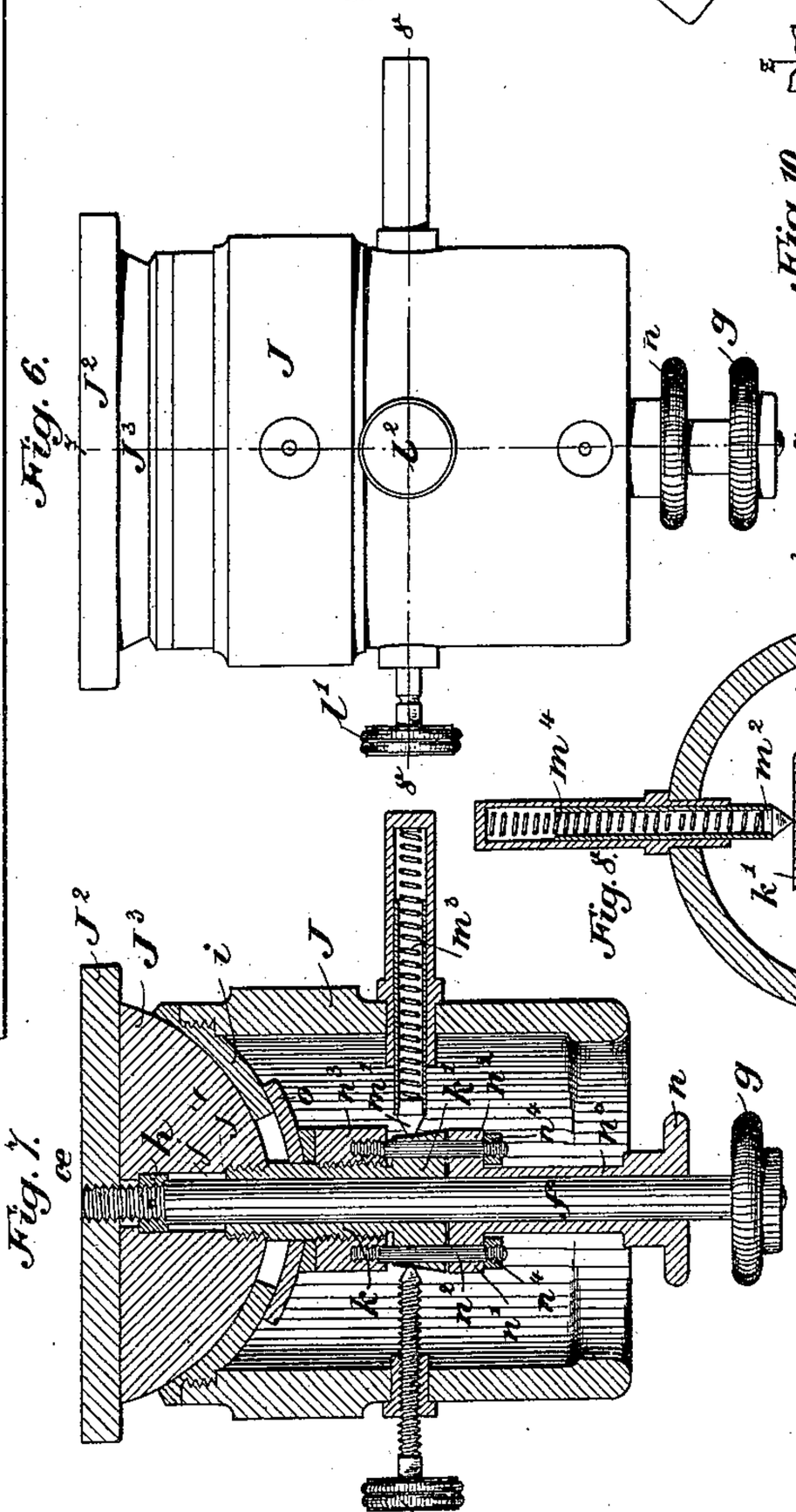

Fig. 6.

Fig. 7.

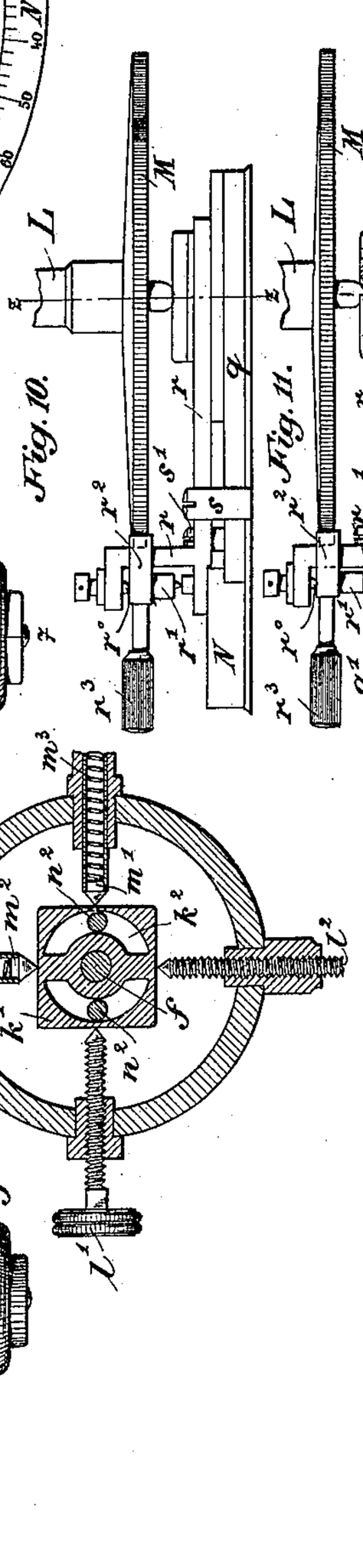

Fig. 8.

Fig. 10.

Fig. 11.

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UNITED STATES PATENT OFFICE.

WILHELM LÖW, OF HEIDELBERG, GERMANY, ASSIGNOR TO THE FIRM OF R. JUNG, OF SAME PLACE.

MICROTOME.

SPECIFICATION forming part of Letters Patent No. 618,514, dated January 31, 1899.

Application filed September 10, 1897. Serial No. 651,216. (No model.)

To all whom it may concern:

Be it known that I, WILHELM LÖW, a subject of the Grand Duke of Baden, residing at Heidelberg, in the Grand Duchy of Baden, German Empire, have invented new and useful Improvements in Microtomes, of which the following is a specification.

My invention relates to improvements in microtomes or machines for producing thin sheets or blades from objects that are to be examined microscopically.

The improvements consist in means for producing said sheets or blades from objects of any kind with such accuracy in obtaining the thicknesses required of the sheets as hitherto never has been possible to obtain, said means relating to a new manner of guiding the knife or cutter and the knife-carrier itself, a new manner of combining the object-carrier with the adjusting device, and a new mode of supporting and adjusting the object-carrier and of fixing it in any desired position. I attain these objects by mechanisms as illustrated in the accompanying drawings, in which—

Figure 1 is a front view of the entire machine. Fig. 2 is a top view thereof; Fig. 3, a side view of the machine, taken from the right side of it. Figs. 4 to 11 represent parts of the machine on a greater scale—namely, Figs. 4 and 5, the knife-carrier in front and side views; Fig. 6, the object-carrier; Fig. 7, a sectional view thereof, taken on line 7 7 in Fig. 6; Fig. 8, a cross-section of said carrier following the line 8 8 in Fig. 6. Fig. 9 is a top view of the micrometer mechanism; Fig. 10, a side view; and Fig. 11, partly taken in section, a detailed side view thereof.

Similar letters refer to similar parts throughout the several figures.

The foundation-plate B and the standards A A, having fixed to them the prisms C′ C², constitute the framework of the machine. The adjoining surfaces of the two prisms form an acute angle, as shown in Fig. 3, and on the surfaces, which are made exactly plain, the knife-block D is caused to slide. To reduce the friction as much as possible, slide-pieces *a* may be provided on the surfaces of block D. On the knife-block D is fixed the knife-carrier E by means of thumb-screws *b b*, curved slots *b′* in the knife-carrier allowing the latter to be adjusted, if required. The projecting ends of the knife-carrier are formed as bearings for the knife F, one end of which terminates in a ball *c* and the opposite end in a pivot *c′* of partly-cylindrical surface, means, such as set-screws *d d*, being provided to fix the said pivots of the knife in its bearings. As clearly shown in Figs. 4 and 5, the cylindrical surface of the pivot *c′* is partly cut away, so as to secure exactly the required inclination of the cutting edge of the knife F toward the object. This arrangement allows the knife to be secured with great accuracy without bending it.

On the pillar G, projecting upward from the bed-plate B, there are journaled upon the pivot-points *e e* two levers H′ H², forming, with the object-carrier J and the pillar G, a parallelogram. These levers hold and guide the object-carrier J, referred to hereinafter, which hangs on points *e′ e′*, between the bifurcated arms of the levers H′ H². The upper lever H′ extends in either direction from its fulcrum-points *e*, and the distance from these points *e* to the supporting-points *e′* of the object-carrier is the same as that from *e* to the pivot-points *e*²—near the opposite end of the lever from that carrying the object-carrier—by which the lever is connected with a screw-nut K, mounted upon a screw-threaded spindle K′, which is an element of the micrometer mechanism to be hereinafter described. By turning the spindle K′ in one direction or the other the nut K is moved up or down, and, through the lever H′, the object-carrier is to the same extent, but in the opposite direction, lowered or raised, the amount of lowering of the nut determining the thickness of the sheet or blade to be cut when the knife is moved across the face of the object. While the movements of the spindle K′, just described, cause the rear end of the lever H′ to move in the arc of a circle, there is no binding of the nut K upon the spindle, because not only is the nut pivotally connected with the lever, but the lower end of the spindle-shaft is supported by a ball-and-socket or cup bearing, as represented in Figs. 3, 10, and 11, which permits of a slight tipping of the shaft. Moreover, in practice the nut N is so adjusted on the spindle that the latter

does not occupy a true vertical position when the lever H′ is absolutely horizontal, but assumes the vertical position when the lever has made about one-eighth of its travel. In consequence of this deviation of the spindle K′ from the true vertical position under certain conditions the movements of the nut K and of the object-holder will generally be slightly smaller than what is shown on the micrometer-scale, to be hereinafter described; but as the difference is so exceedingly small—only a fraction of one ten-thousandth of an inch—it may in practice be disregarded altogether.

The object-carrier must be so arranged as to allow it to be moved in different directions in the most exact and at the same time in as easy and quick a manner as possible.

The plate or platform J^2, carrying the object J′, is to be turned round its axis and must be secured in any desired position. To permit of this adjustment, the object-carrier is of peculiar construction, as will be described. It is made hollow, as represented in Fig. 7, and a spindle *f*, screw-threaded at its upper end, extends through such holder and serves as the means for connecting the platform J^2 upon the holder J^3. This spindle is provided at its lower end with a milled head or disk *g*, by which it may be operated, and upon the upper screw-threaded end of the spindle there is fixed a nut or clamping-piece *h*, which is situated in a recess *j* in the holder J^3. The object-platform J^2 is engaged by the screw-threaded end of the spindle and is held thereby, as clearly represented in Fig. 7. The nut *h* operates to prevent the spindle from becoming entirely disengaged from the object-carrier when the platform J^2 is removed, and also by bearing against the shoulder *j*′ serves to clamp the platform securely to the upper face of the holder.

In order that the object may be given the required adjustments, as about the center *c e*, Fig. 7, I provide the holder J^3 with a spherical-shaped base, which is fitted to and rests in a bed *i*, arranged within the object-carrier J. To adjust the object holder and platform and to firmly hold them after adjustment, I provide the following-described mechanism: A tubular piece *k*, provided with a rectangular head *k*′, Figs. 7 and 8, is firmly secured to the holder J^3. The spindle *f* passes through this piece *k*. Adjusting-screws *l*′ and l^2 pass through the walls of the object-carrier and bear against contiguous faces of the head *k*′ of the piece *k*, while the pressure-pins m' m^2, operated upon by the springs m^3 m^4, bear against the said head directly opposite to the said adjusting-screw. By these means the head *k*, and with it the object-plate, may be exactly adjusted to any desired position. The point *c e*, Fig. 7, is the center of the spherical end of the holder J^3, and it is around this center that the adjustments, by means of the adjusting-screws *l*′ and l^2, take place, and as this point is within the body of the object upon the platform J^2 it is evident that the adjustments of the holder J^3, as described, will cause very slight lateral movements of the object.

The object-holder J^3 must be capable of being securely held in any position to which it may be adjusted. To this end a head *n*, provided with a tubular extension n^0 and a circular end or head *n*′ at the end of the extension opposite to the head *n*, is mounted upon the spindle *f* below the head *k*′. Two bolts n^2 pass through the head *n*′, to which they may be secured by the nuts n^4 through slots k^2, Fig. 8, in the head *k*′ and into a nut n^3, to which they are secured, the nut n^3 and head *n* being thus united.

On turning the head *n* in one direction—say from the left toward the right side—the nut n^3 is moved upward and presses the friction-plate *o* against the lower side of the bed *i* with the effect of fixing the object-holder J^3 in its bed, so as to prevent any movement of said holder. Before operating the screws *l*′ or l^2 for adjusting the object-holder the head *n* of course is to be turned backward, in this case from the right to the left hand. The amount by which the head *n* is turned for fixing or releasing the object-holder is about one-eighth of a whole rotation.

Another feature of my invention comprises the device or mechanism for adjusting the thickness of the sheet to be cut from the object to be examined. The shaft L of the micrometric screw K′ is provided with a crank-handle *p* for roughly adjusting the object; but for fine adjustment a device is employed, referred to hereinafter, and arranged near the lower end of the micrometric screw. A ratchet-wheel having, for instance, five-hundred teeth is keyed on the shaft close to its lower extremity. N is a segment of a ring arranged concentrically to the axis of shaft L and fixed on the plate B, the graduation on the surface of said segment corresponding to the pitch of the wheel M. Two arms *q* and *r*, Figs. 9, 10, and 11, are arranged to turn about the axis *z z* of the shaft L, the former, *q*, being marked with the index-line q^0 and provided with a set-screw *q*′ to retain the arm *q* in any desired place on the segment N, the latter, *r*, forming the bearing of a piece *r*′ by means of points r^0, carried by the bifurcated end of the arm *r*. Stay-bolts *s* and *s*′, the one fixed in the foundation-plate B and the other in the arm *q*, limit the swinging motion of the arm *r*, that may be imparted to it by a handle r^3, fixed to the piece *r*′. Thus the actual position of the arm *q* determines the angle of the movement of arm *r*. Piece *r*′ furthermore forms the carrier of a ratchet-tooth r^2, engaging with the ratchet-wheel M.

Now in order to adjust the thickness of the blade or sheet to be cut the operator, after having fixed the arm *q* in the required position, moves, by means of the handle r^3, the arm *r* toward the left side until the movement is arrested by the stud *s*′ and then toward the

right side by so much until the movement is stopped by the stud *s*. The drawings, Figs. 2 and 9, clearly illustrate that the ratchet-tooth r^2 engages with the wheel M only during the last-mentioned motion of the arm *r*, with the effect of turning said wheel, and with it the micrometric screw K′, of moving downward the nut K and raising the object I′. On moving the handle r^3 backward—that is, from the right to the left hand—the piece *r*′ turns about its axis, throws the tooth r^2 out of gear with the wheel M, (the extent of the movement of the piece *r*′ being limited by the engagement of the pin *t* with the bifurcated end of the arm *r*,) and thus the parts return to the left side without moving the wheel M.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a microtome, the combination of the knife F having a spherical pivot *c* on one end and a cylindrical pivot *c*′ on the other, with a knife-carrier E, the block D of which is guided in an acute angle by means of slide-pieces *a*, substantially as and for the purpose specified.

2. In a microtome, the combination of the object-carrier J with the levers H′, H^2, supported in the pillar G, and with the nut K of a micrometric screw K′, said nut hanging between points e^2 e^2 at the end of lever H′, essentially as set forth.

3. In a microtome, a micrometric screw, a shaft L, and a crank-handle *p*, located at the upper end of said shaft for roughly adjusting the object, in combination with a handle r^3, and a ratchet-tooth r^2 revoluble upon the lower end of shaft L, and the ratchet-wheel M, fixed to said shaft engaging with the ratchet-tooth for effecting fine adjustments, substantially as and for the purposes hereinbefore set forth.

4. In a microtome, the combination with the object-carrier J, of a plate or platform J^2 the upper face of which is arranged below the center *c e* of the spherical bed of said carrier and the spherical bed in which the carrier is mounted, substantially as and for the purposes hereinbefore set forth.

5. The combination of the platform or object-plate J^2, an object-holder to which said platform is adapted to be secured provided with an axial recess *j*, a screw-threaded spindle adapted to engage with the platform and passing through the said object-holder and provided with an operating-head, and a nut or clamping-piece *h* fixed to the spindle and situated in the said recess in the object-holder, substantially as set forth.

6. In a microtome, the combination of the object-holder J^3 provided with a tubular extension *k* threaded on its outer surface, a nut n^3 engaging therewith, a friction-plate *o*, the bed *i*, a milled disk *n* and means for connecting said nut with said milled disk, substantially as and for the purposes hereinbefore set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILHELM LOW.

Witnesses:

ERNST KAUFMANN,

JACOB ADRIAN.