(No Model.) 4 Sheets—Sheet 1.

F. HOLZ.

MILLING MACHINE.

No. 432,621. Patented July 22, 1890.

Fig. 1.

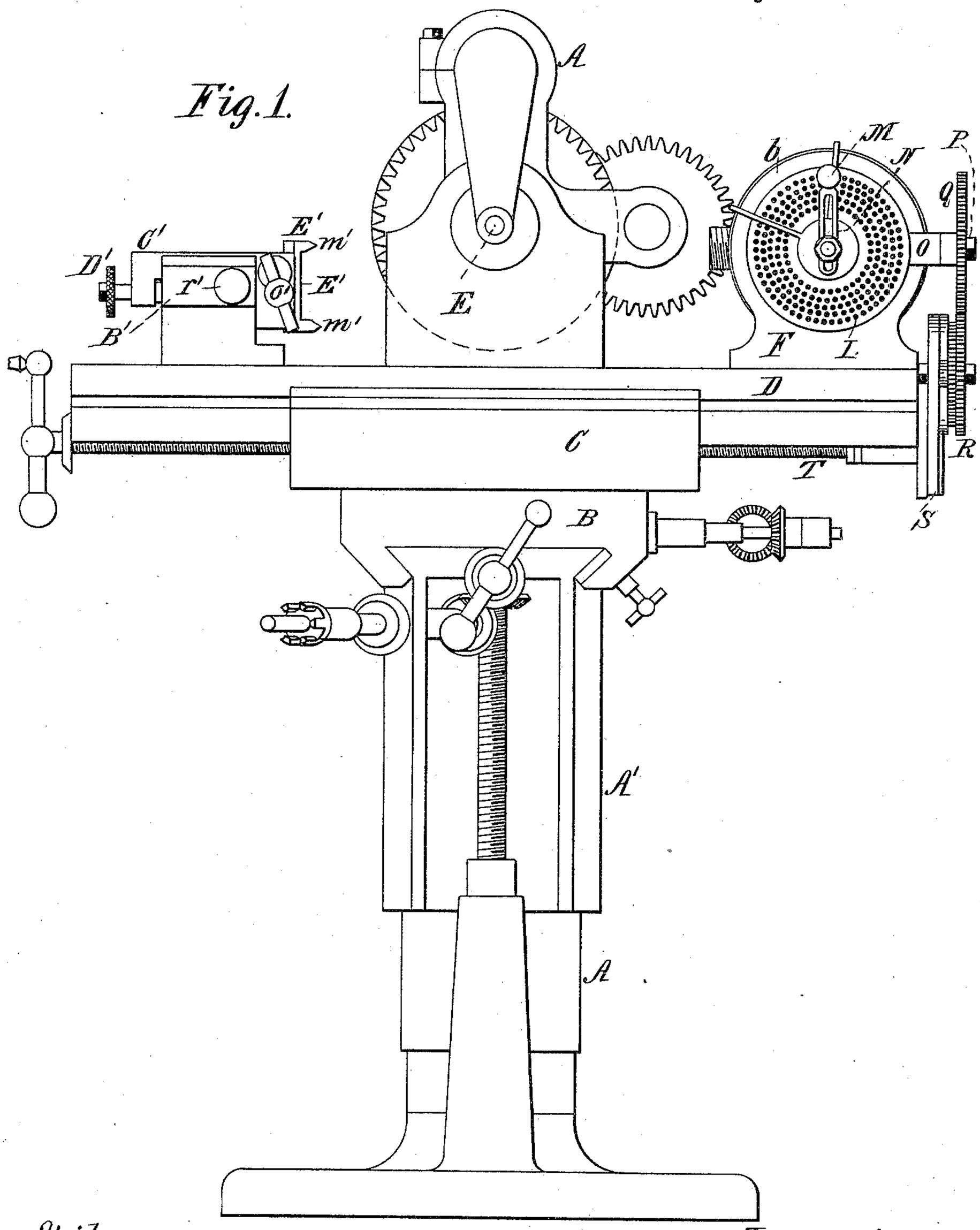

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Fig. 2.

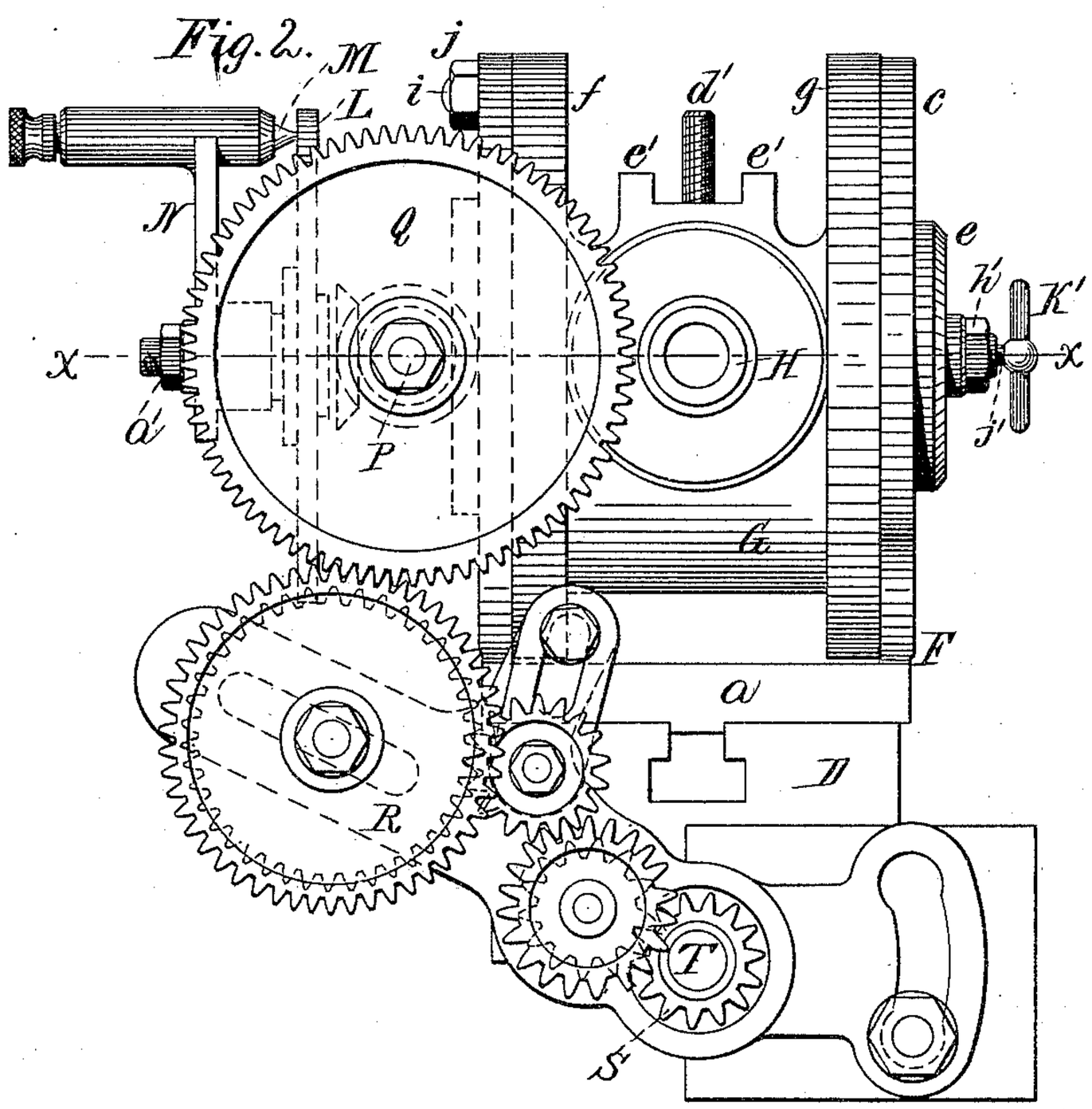

Fig. 3.

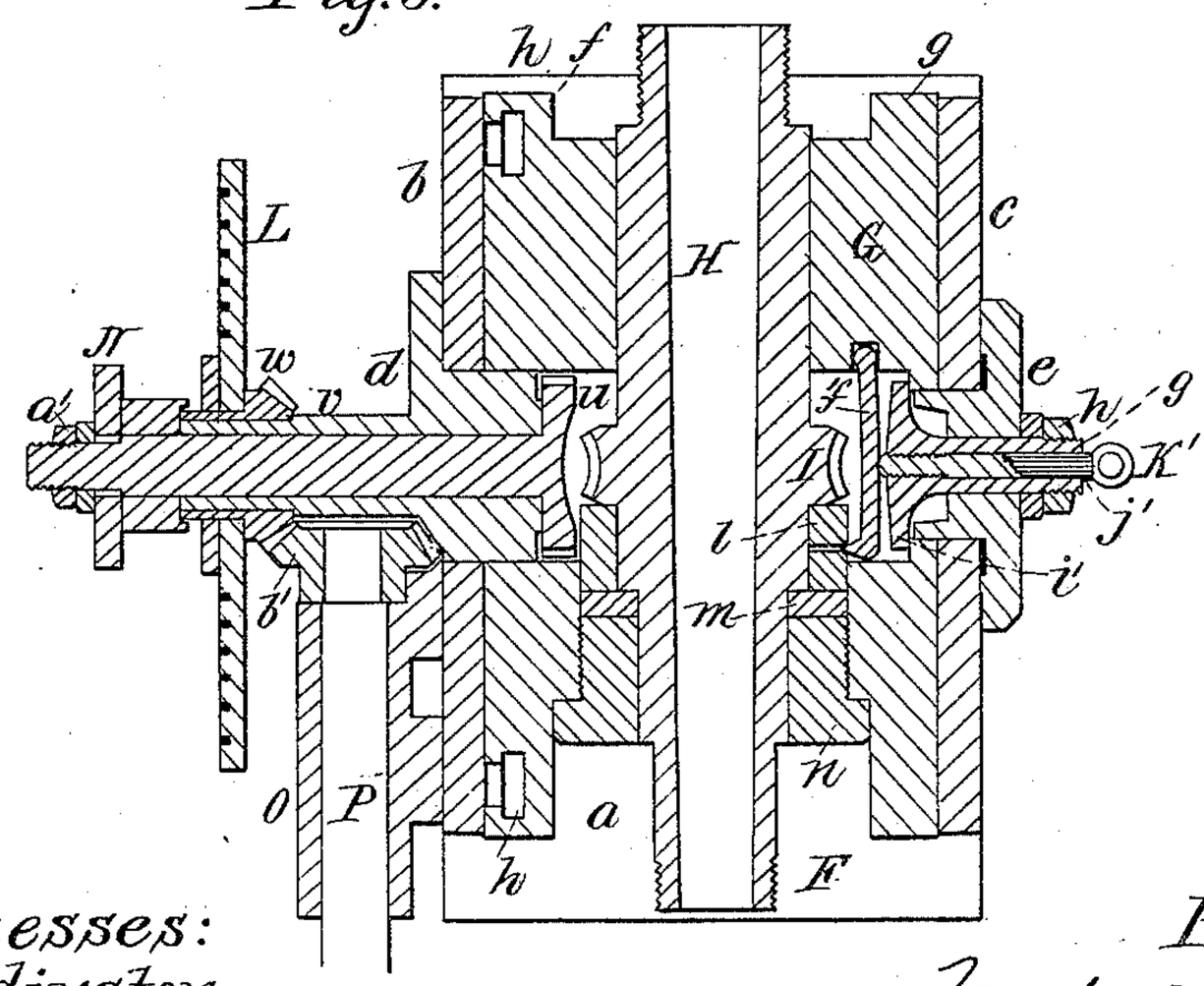

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Fig. 4.

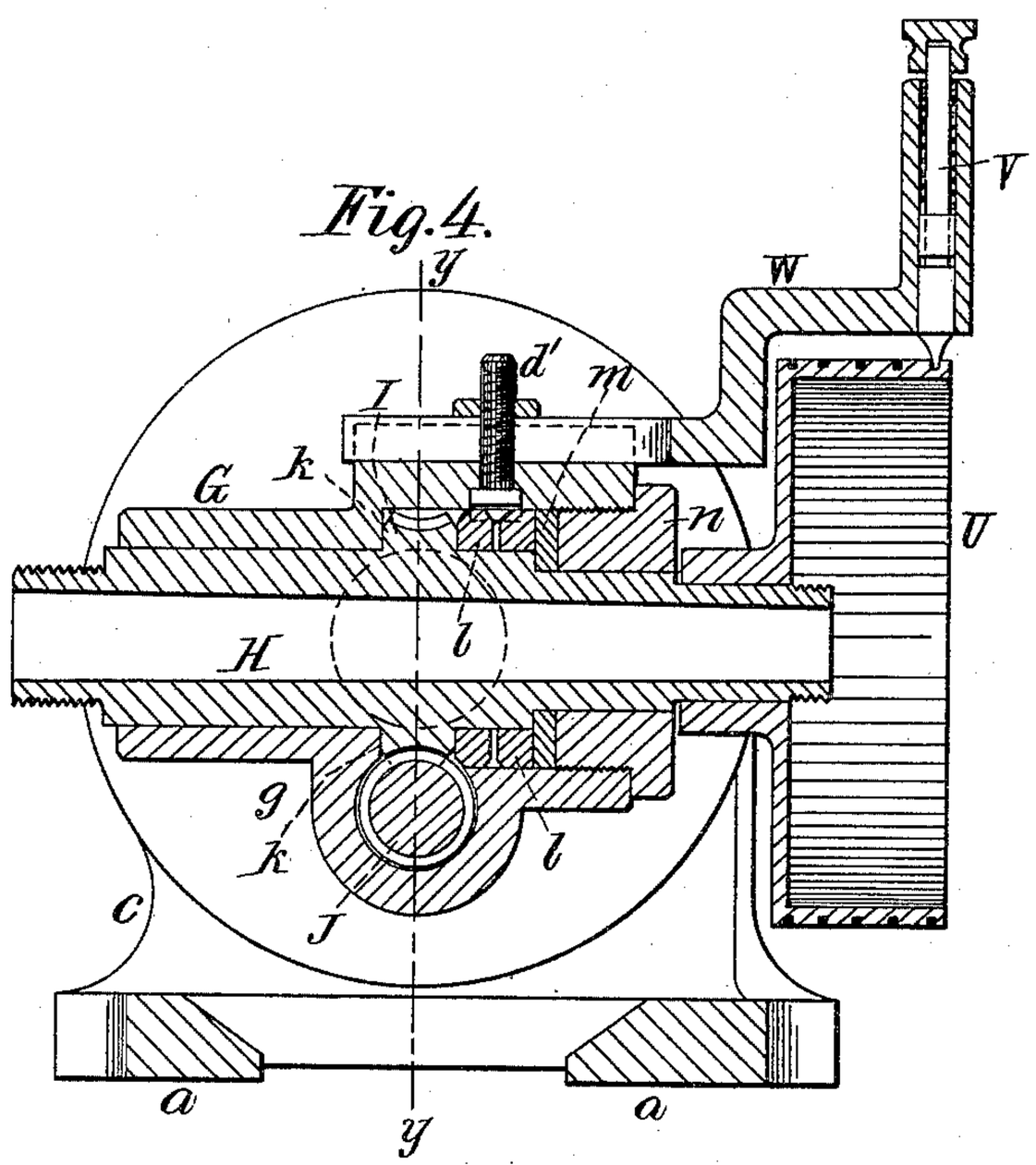


Fig. 5.

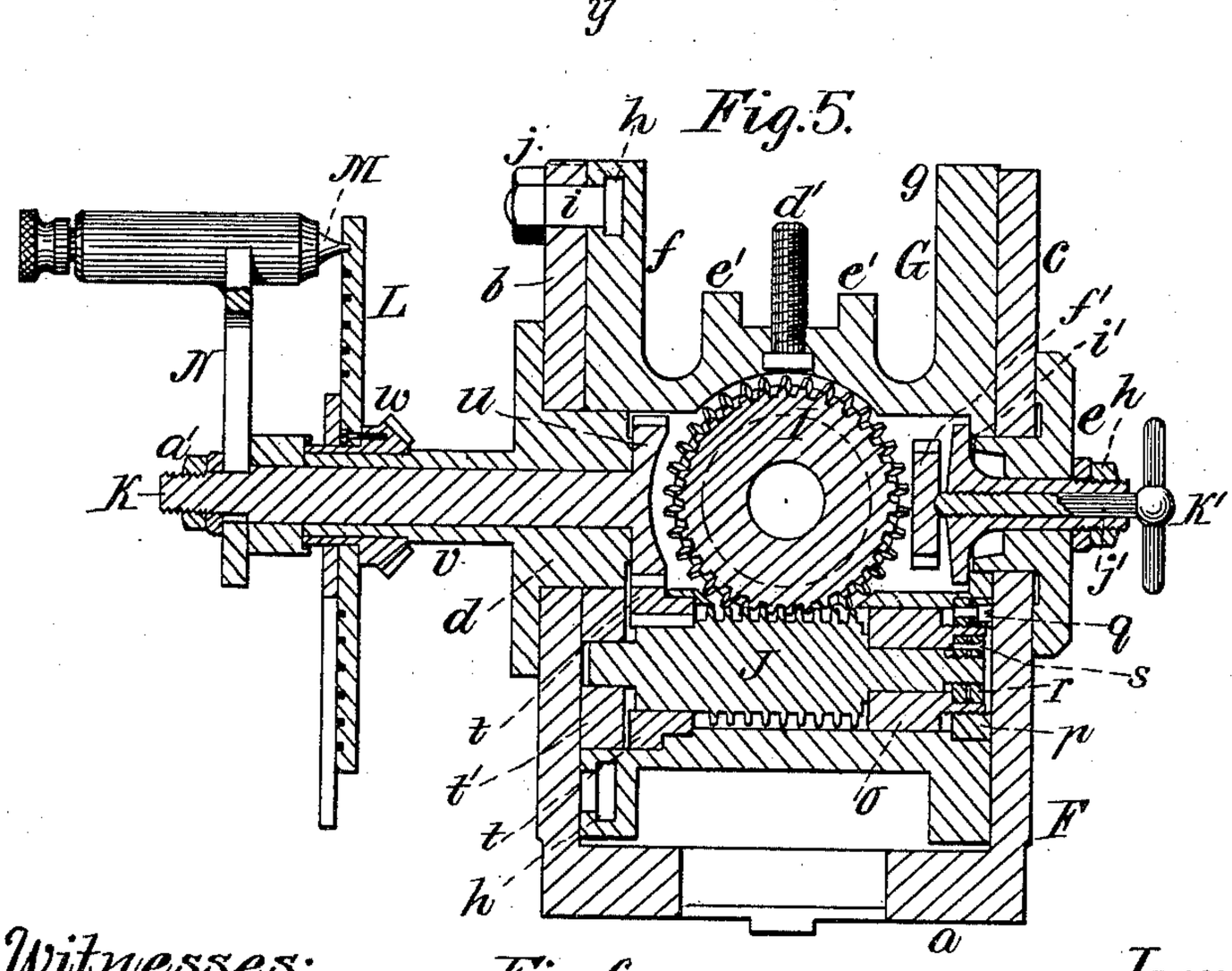
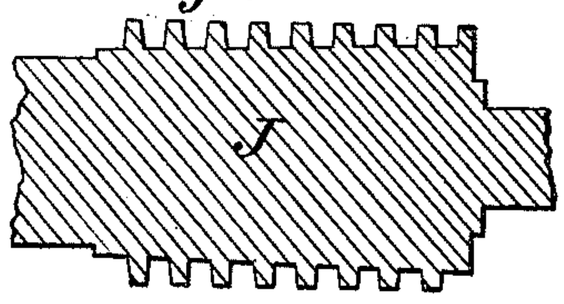


Fig. 6.



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MILLING MACHINE.

No. 432,621. Patented July 22, 1890.

Fig. 7.

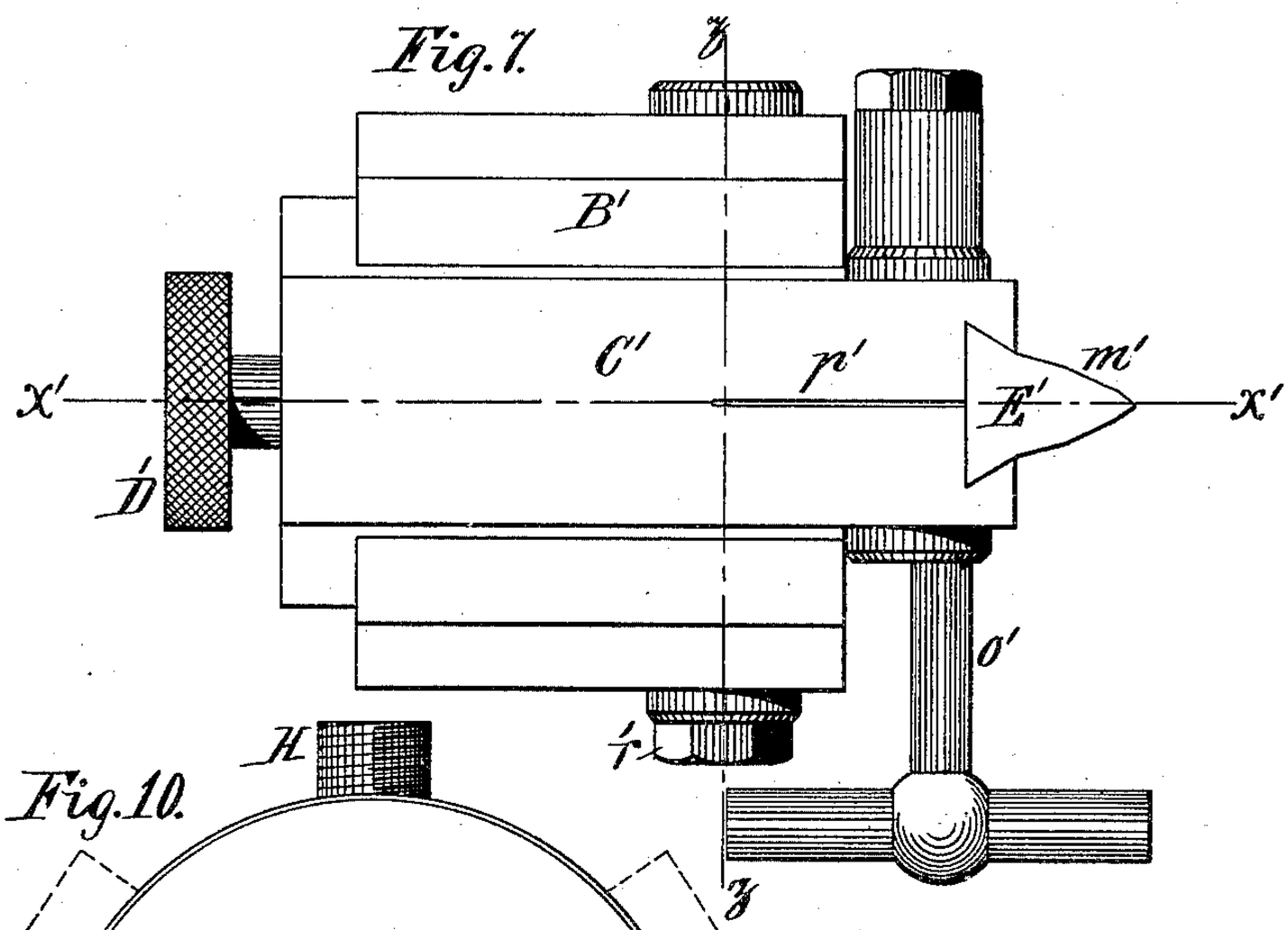


Fig. 10.

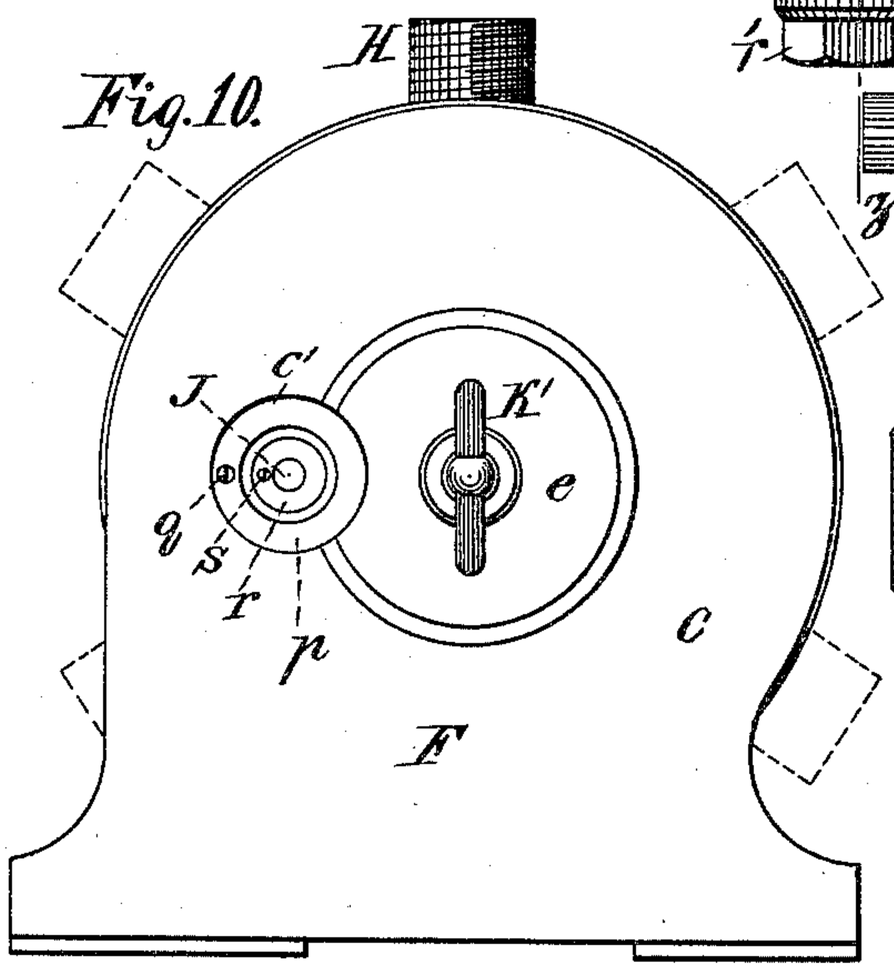


Fig. 8.

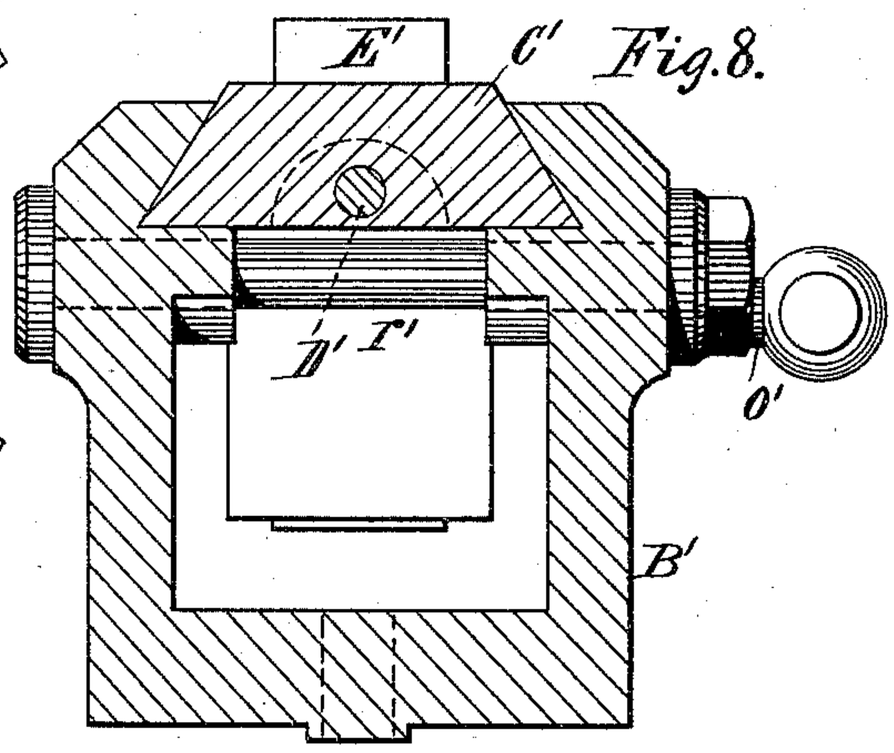
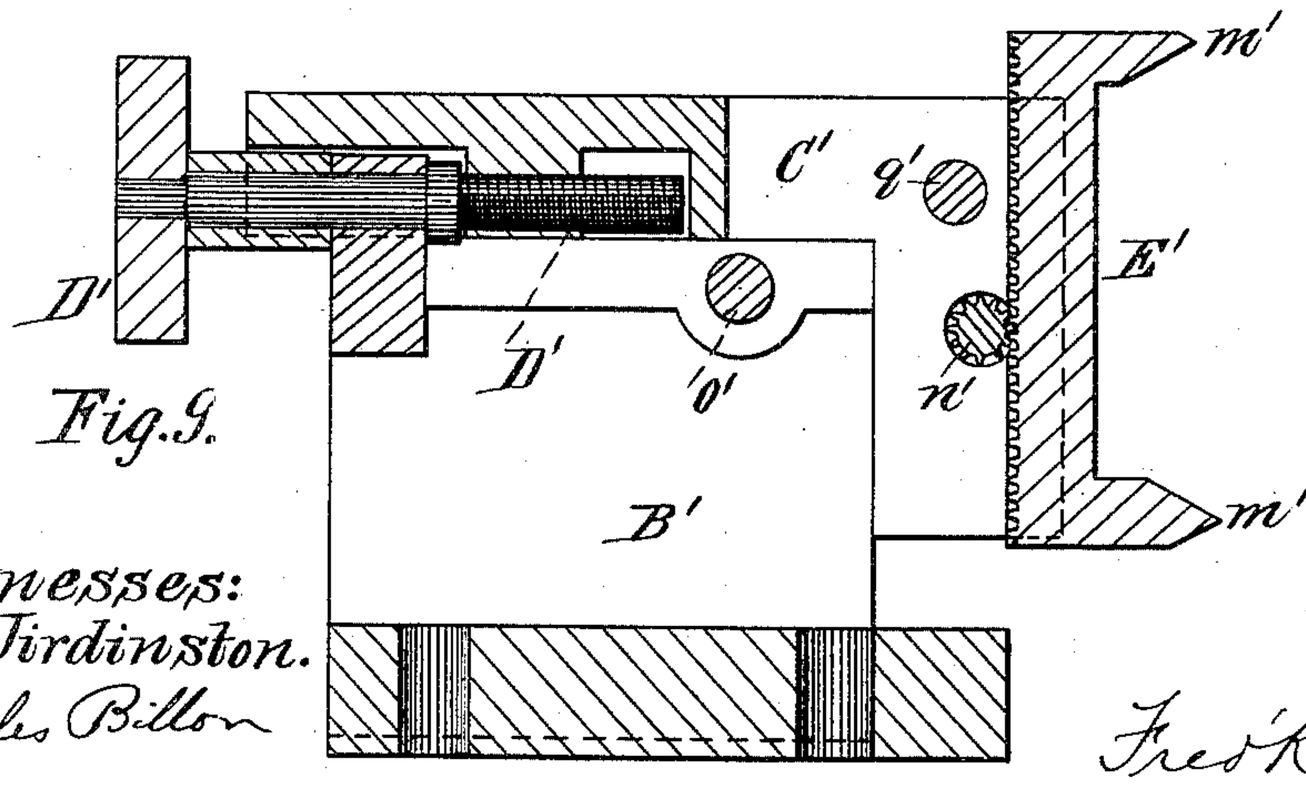


Fig. 9.



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UNITED STATES PATENT OFFICE.

FREDERICK HOLZ, OF CINCINNATI, OHIO, ASSIGNOR TO THE CINCINNATI MILLING MACHINE COMPANY, OF SAME PLACE.

MILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 432,621, dated July 22, 1890.

Application filed November 18, 1889. Serial No. 330,717. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK HOLZ, a citizen of the United States, residing in Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Milling-Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to all classes of milling-machines, and has for its object the improved construction of the head and tail stocks, whereby I secure a greater universality and more perfect control in the adjustment and presentation of the work to the cutting-tool.

The novelty of my invention will be hereinafter set forth, and specifically pointed out in the claims.

In the accompanying drawings, Figure 1, Sheet 1, is a front elevation of a milling-machine embodying my invention. Fig. 2, Sheet 2, is a rear elevation of the head-stock and associated parts. Fig. 3, Sheet 2, is a sectional plan view through the dotted line *x x* of Fig. 2. Fig. 4, Sheet 3, is a side elevation in central section of the head-stock. Fig. 5, Sheet 3, is a sectional elevation through the dotted line *y y* of Fig. 4. Fig. 6, Sheet 3, is an enlarged sectional detail of the worm. Fig. 7, Sheet 4, is a plan view of the tail-stock. Fig. 8, Sheet 4, is a sectional elevation through the dotted line *z z* of Fig. 7. Fig. 9, Sheet 4, is a sectional elevation through the dotted line *x' x'* of Fig. 7. Fig. 10, Sheet 4, is a side elevation of the rear side of the head-stock.

The same letters of reference are used to indicate identical parts in all the figures.

As the milling-machine to which my invention is applicable may be of any suitable construction, it is only necessary in referring to Fig. 1 to state that A is the frame-work; A', the knee or vertically-moving carriage; B, the in-and-out carriage or saddle; C, the swinging carriage or housing; D, the shifting top table carrying the bodily-adjustable head and tail stocks by which the work is supported, and E the tool-arbor or live spindle.

The head-stock, Figs. 2, 3, 4, and 5, is composed of a carrying-frame F, consisting of a bottom plate *a*, clamped and adjustable in the groove of the table D, and two vertical circular side plates *b c*, between which is pivoted and clamped the body G of the stock carrying the work-supporting spindle H.

By reference to Figs. 3 and 5 the manner of pivoting the body G is shown. Here a tubular trunnion or sleeve *d* is inserted through a central aperature in the plate *b*, and enters and snugly fits a horizontal bore in the body G, and is secured by a flange bolted to the plate *b*. On the opposite side a trunnion-block *e* is similarly inserted through a central aperture in the plate *c*, and enters and snugly fits the opposite end of the horizontal bore and is secured by an outer flange bolted to the plate *c*. It will thus be seen that the body G, carrying the spindle H, can be swung completely around in a vertical plane on the blocks *d e*, and, to afford a large and firm bearing for said body, it has circular side plates *f g*, coincident with and fitting snugly against the inner sides of the plates *b c*, respectively. The plate *f* has on its outer face an annular T-slot *h*, containing a clamping-bolt *i*, inserted through an aperature in the plate *b* and provided with a nut *j*, and by means of which the body G is firmly clamped to the carrier F after being adjusted on the trunnion-blocks, as will be readily understood.

The spindle H is journaled in the body G in the following manner: Secured upon or formed integral with it at about its middle is a worm-wheel I, which, when the forward end of the spindle is inserted through the bore in the body, bears against a shoulder *k*, Fig. 4, to prevent further movement. A circumferentially split or partially split metal washer *l* is slipped upon the spindle and bears against the rear side of the worm-wheel, and just behind the split washer is a rawhide or other non-cutting washer *m*, bearing against a shoulder on the spindle. Finally, a tubular plug or stuffing-box *n* is slipped over the rear end of the spindle and is screwed into the rear end of the spindle-bore in the body G, and has its inner end bearing against the washer *m*, thus securing the spindle in place and holding it against endwise motion, but not preventing its rotation, except when it is desired to lock the spindle to the body G in making straight cuts, as presently explained. Directly under the transverse trunnion-bore is another transverse bore through the body G, in which is journaled a worm-shaft J,

meshing with the worm-wheel I. The forward end of the worm-shaft bears in a plug t', and its rear end within the bore has slipped upon it a collar o, Fig. 5, upon the outer threaded end of which is secured a partially-split nut p, made to bind when adjusted by a screw q through its split portion. The rear end of the collar o is recessed to receive a partially-split nut r, which is screwed upon the rear threaded end of the worm-shaft and is made to bind or jam by a screw s through its split portion. By means of the nuts p and r the worm-shaft is kept tight in its bearings and lost motion can be taken up.

Supported by its hub in a bearing in the forward part of the worm-shaft bore and feathered upon the worm-shaft is a small pinion t, which constantly meshes with a pinion u upon the inner end of the dividing-shaft K, journaled through the trunnion-block d, and an outward prolongation thereof constituting a sleeve v.

Journaled upon the outer end of the sleeve v is a beveled pinion w, having secured thereto the usual or any suitable index or dividing plate L, with which engages the usual or any suitable spring locking-pin M in a housing upon the end of a slotted arm N longitudinally adjustable upon the outer end of the shaft K, whose sides are flattened to embrace the walls of the slots. Nuts a' lock the arm N when adjusted.

Journaled in a housing O, Figs. 1 and 3, secured to the front face of the plate b, is a horizontal shaft P, having secured on its forward end a beveled pinion b', meshing with the pinion w, and on its rear end a pinion Q, connected by a train of intermeshing, changable, and adjustable gears R with a pinion S upon the end of the feed-screw T, which imparts longitudinal motion to the table D.

It will be seen from the above-described construction that not only can the spindle H be adjusted to any angle desired in a vertical plane, but that at the same time it can be rotated automatically through the medium of the worm-wheel and worm-shaft and its described connections to the feed-screw T, so as to cut spirals either straight or tapering. Again, at the end of a cut and upon the retraction of the table the proper division can be made by unlocking the pin M from the plate L and turning the shaft K by hand, to thereby partially rotate the spindle to set it for the next kerf to be cut, and with absolute accuracy; also, right or left hand work may be cut without changing cutters by setting the spindle first on one side of vertical line for right-hand work and then on the other side of vertical line for left-hand work, as indicated by the dotted lines of Fig. 9. By reference to Fig. 6 my preferred construction of worm will be understood. Here it is seen that the worm-thread is first cut on a taper and then the tops of the thread are turned to a true perimeter of a cylinder, thereby giving thickness to the rear threads to compensate for wear, which can be taken up by adjusting the worm-shaft forward in its bearings.

For rapid indexing or such work as milling reamers, taps, nuts, &c., and cutting spur-wheels with less than forty teeth the worm-shaft is disengaged from the worm-wheel and a hand index-wheel U, Fig. 4, is employed. To remove the worm-shaft, it is only necessary to swing the spindle with its work-holding end down to the vertical position shown by the solid lines, Fig. 9, when the worm-shaft will register exactly with an opening c' in the plate c. By now rotating the spindle to the left the worm-shaft will be ejected through the opening c', and can be laid aside until again wanted. It is inserted in a similar manner by rotating the spindle to the right. As the spindle is never used for work when set vertically in this position—that is, with its working end down—there is no danger of the accidental displacement of the worm-shaft, as it is always at other times held locked in place by the plate c. The hand-index U is a drum-shaped plate perforated on its periphery and secured by a nut upon the rear projecting end of the spindle H. The spring-locking pin V is carried in a slotted bracket-plate W, clamped by a bolt d', and is adjustable between guides c', Fig. 5, in the direction of the axis of the spindle to bring the pin V over the proper row of holes in the index-plate.

By reference to Figs. 3 and 5, the mechanism for locking the spindle to the body G after the indexing has been done will be readily understood. Here I provide a wedging-bar f', held at its forward end in a recess in the body G, and having at its rear end a wedging point or edge which engages between the two parts of the split washer l. Inserted through the trunnion-block e is a socket-piece g', clamped by nuts h', and having an enlarged inner head i' engaging with a shoulder in the transverse trunnion-bore, as shown, to aid the screw-bolt i in clamping the body to the carrier-frame, as will be readily understood. Inserted through and engaging with the piece g' is a screw j', provided with a turning-handle k', and whose inner end bears against the wedging-bar, as shown. Now, by turning in the screw j' the wedge of the bar f' is forced between the split parts of the washer l and spreads the same, thereby wedging the washer l between the washer m and worm-wheel and locking the spindle H securely to the body G. It is only necessary to turn out the screw j' to release the spindle from the body in indexing. In milling with the spindle in a horizontal or nearly horizontal position it will be found desirable to use both the plates L and U, as the dividing may be done upon the former and the latter be be used as a tally.

Referring now to Figs. 1, 6, 7, and 8, the remaining feature of my invention relating to the tail-stock may be thus described. Upon the bed D is adjustably clamped by one or

more bolts a removable sliding tail-stock carrier consisting of a substantially rectangular hollow box B′ with a dovetailed groove or slot in its top, in which is confined a horizontal slide C′, actuated by a screw D′, engaging with a lug on the under side of said slide and having a fixed bearing in the carrier-block B′. In the front face of the slide C′ is a vertical dovetailed groove or slot, in which is fitted the vertical stock-piece E′, provided with upper and lower centers m' on its front face, and having a rack upon its rear face with which a pinion n' upon a handle-shaft o', journaled in the slide C′, engages to adjust the centers up or down to suit the requirements of the work. The front part of the slide C′ is split, as seen at p', Fig. 6, so that when the centers are adjusted vertically the piece E′ can be firmly clamped by a bolt q', passed through the split portion of the slide, as will be readily understood, and to clamp the slide C′ when adjusted horizontally I employ a bolt r', passed through the carrier B′ just beneath the slide, by tightening which the box B′ is caused to tightly embrace the slide C′, as will be readily understood. It will be seen from this construction that considerable adjustment is given to the centers both vertically and horizontally without unclamping the carrier B′ from the bed D, which is a great saving of time and labor, especially in milling a number of similar articles where it is only necessary to reciprocate the slide C′ to remove a milled article and to insert a blank to be milled. The work is carried by the spindle H in the usual or any suitable manner, as by a center face-plate and dog.

Having thus fully described my invention, I claim—

1. In a milling-machine, the combination, with the feed-bed, of a head-stock carrier adjustable on said bed, a stock-body pivoted and adjustable in said carrier, a clamp for said carrier and body, a work-carrying spindle journaled in said body and provided with a worm-wheel, a worm-shaft journaled in said body and meshing with said worm-wheel, a dividing-shaft provided with a pinion meshing with a pinion on the worm-shaft, and indexing mechanism, substantially as described.

2. In a milling-machine, the combination, with the feed-bed and its feed-screw, of a head-stock carrier adjustable on said bed, a stock-body pivoted and adjustable in said carrier, a clamp for said carrier and body, a work-carrying spindle journaled in said body and provided with a worm-wheel, a worm-shaft journaled in said body and meshing with said worm-wheel, a dividing-shaft provided with a pinion meshing with a pinion on the worm-shaft, indexing mechanism, and connecting mechanism between said screw and indexing mechanism, substantially as described.

3. In a milling-machine, the combination, with the feed-bed, of a head-stock carrier adjustable on said bed, a stock-body pivoted and adjustable in said carrier, a clamp for said carrier and body, a work-carrying spindle journaled in said body and provided with a worm-wheel and hand indexing and tallying mechanism, a worm-shaft removably journaled in said body and meshing with said wheel, a dividing-shaft provided with a pinion meshing with a pinion on the worm-shaft, and indexing mechanism for said dividing-shaft, substantially as described.

4. The combination, in a dividing head-stock, of a work-carrying spindle provided with a worm-wheel and an adjustable tapering worm-shaft, substantially as and for the purpose described.

5. The combination, with the carrier F, having the vertical side walls b c, of the body G, hung between said side walls on trunnion-blocks d e, and clamped thereto when adjusted by the bolt i, the spindle H, journaled in said body and provided with the worm-wheel I, split washer l, and screw-plug n, the worm-shaft J, meshing with the worm-wheel I, journaled in the body G and provided with the pinion t, the dividing-shaft K, with indexing mechanism, carrying pinion u, meshing with pinion t, and the wedge-bar f', engaging with the split nut l and operated by the screw j'.

6. In a dividing-head, substantially as described, the worm-shaft J, journaled at one end in the plug t' and carrying the pinion t, and provided at its opposite end with the sleeve o and nuts p r, substantially in the manner and for the purpose described.

7. In a dividing-head, substantially as described, the combination, with the rotating body G and carrier F, of the trunnion-block e and tubular clamping-bolt i', substantially in the manner and for the purpose described.

8. In a dividing-head, substantially as described, the combination, with the carrier F, having a vertical back-plate c, provided with an aperture c', of the rotating body G, having journaled therein a worm-shaft for turning the work-carrying spindle, whereby upon turning said body the worm-shaft can be caused to register with the aperture c' for the removal and insertion of the worm-shaft, substantially as described.

9. In a milling-machine, the combination, with the feed-bed, of a tail-stock carrier adjustable on said bed, an adjustable horizontal slide on said carrier, and a vertically-adjustable center-piece carried by said slide, substantially as described.

10. The combination and arrangement of the carrier B′, bolt o', horizontal slide C′, screw D′, bolt q', pinion n', and center-piece E′, having a rack on its back engaging with pinion n' and provided with centers m', substantially as described.

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