(No Model.) 4 Sheets—Sheet 1.

C. E. HADLEY.

COMPOUND MILLING MACHINE.

No. 330,581. Patented Nov. 17, 1885.

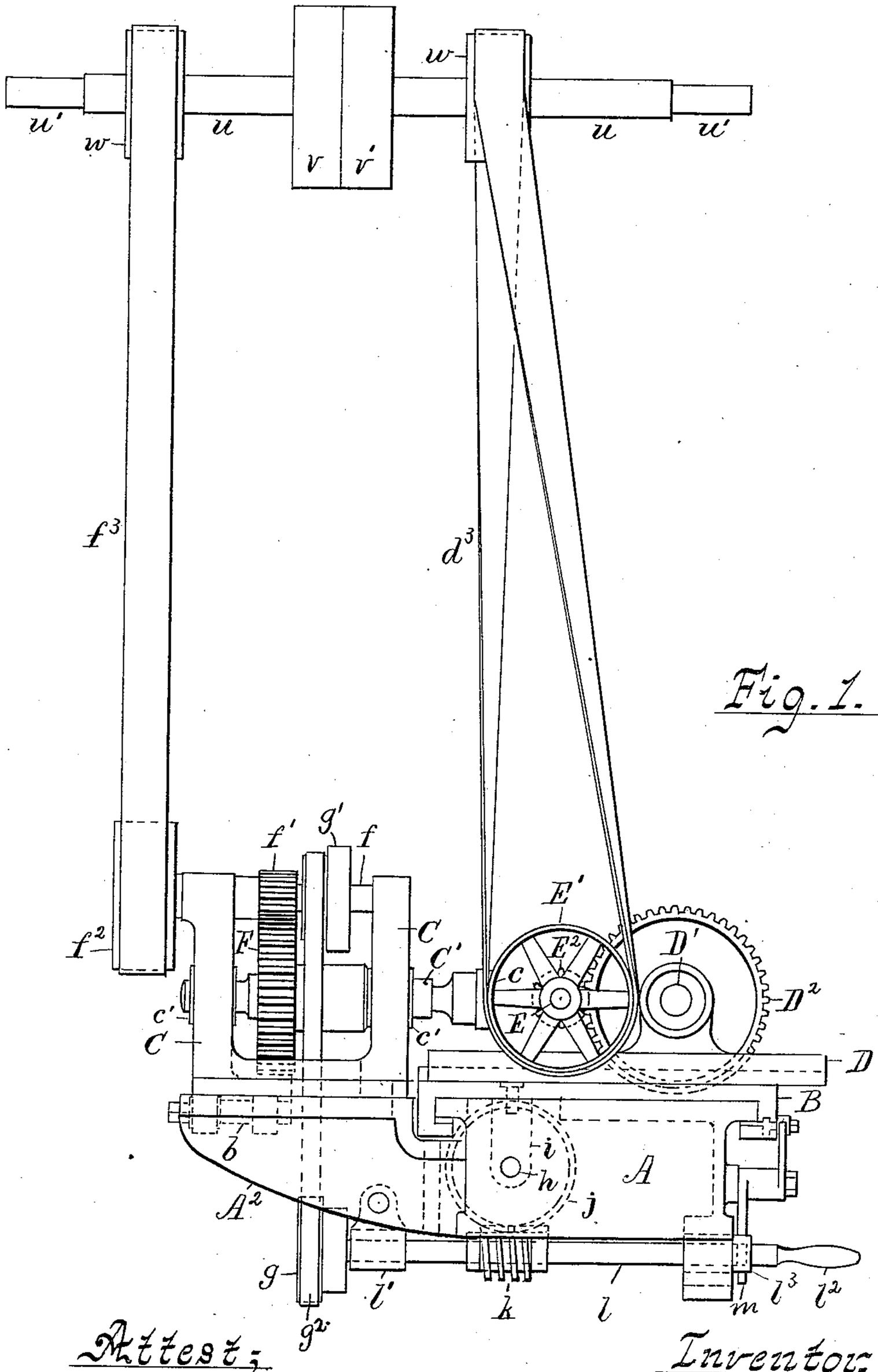

Fig. 1.

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H. J. Theberath

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per Crane & Miller, attys.

(No Model.)

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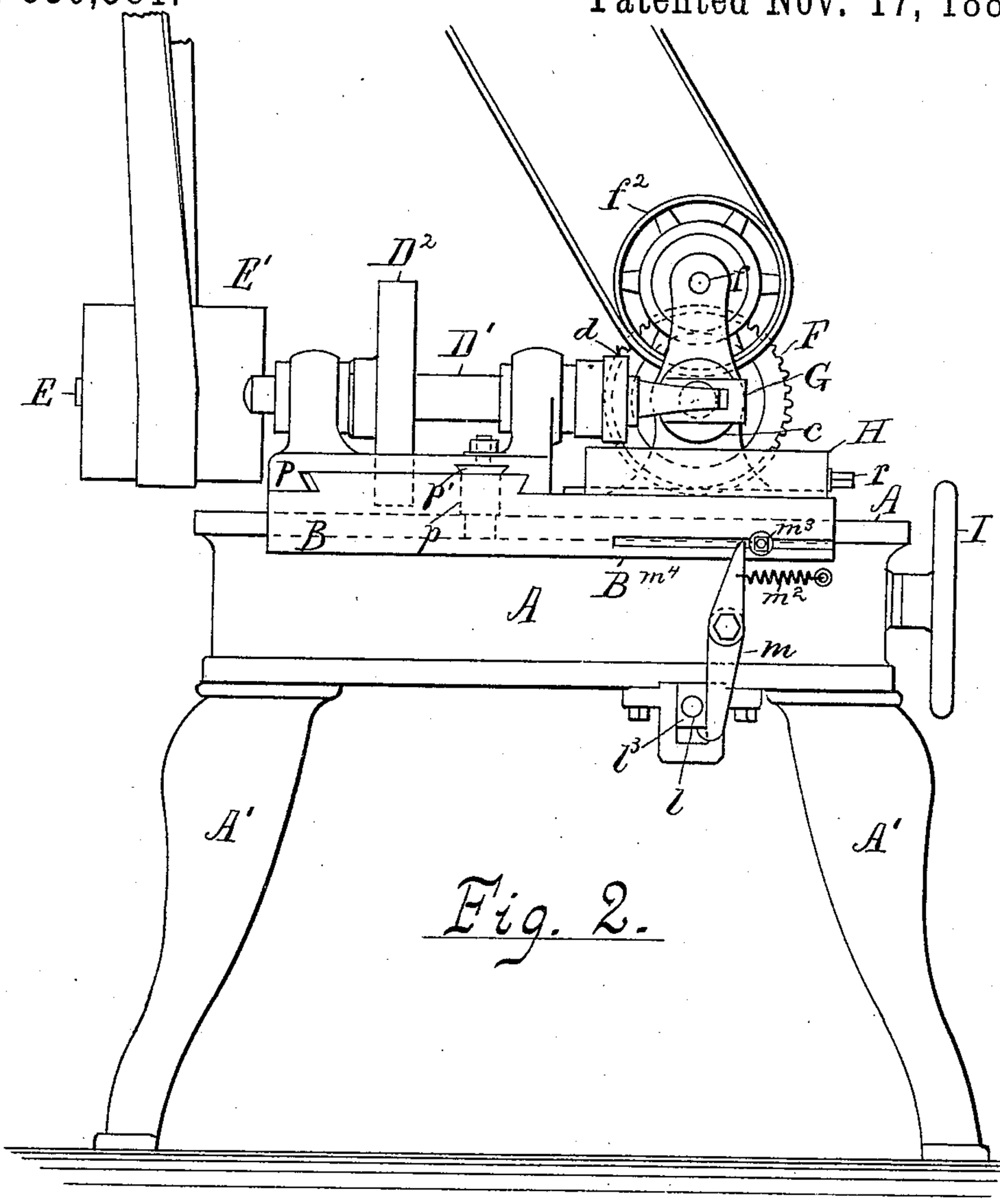

Fig. 2.

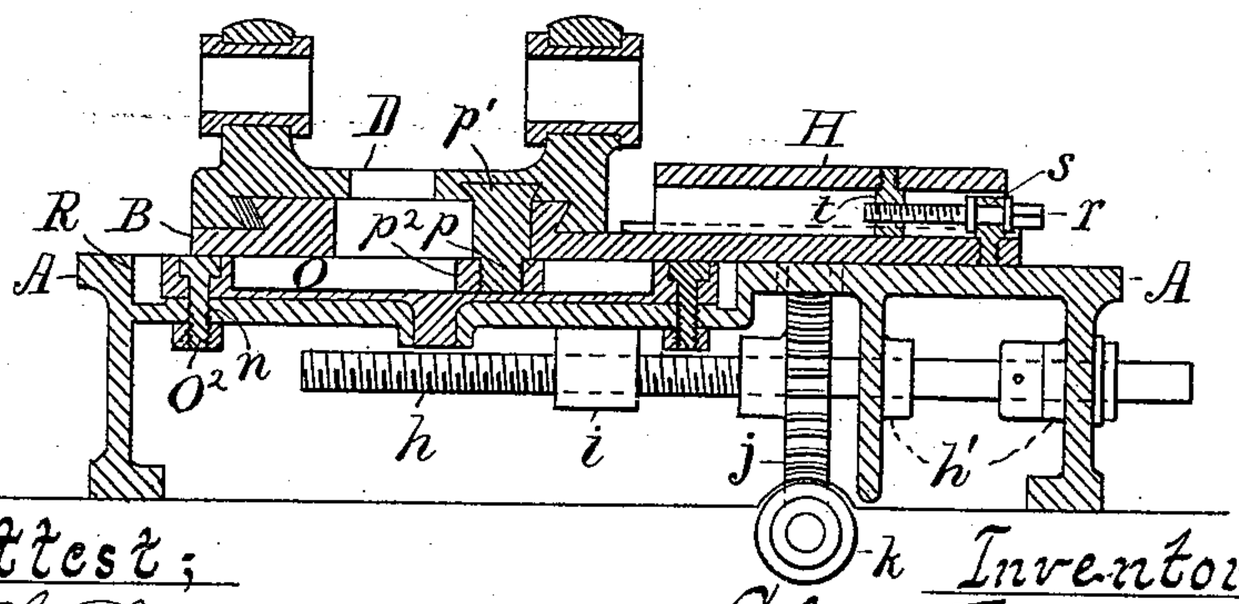

Fig. 4.

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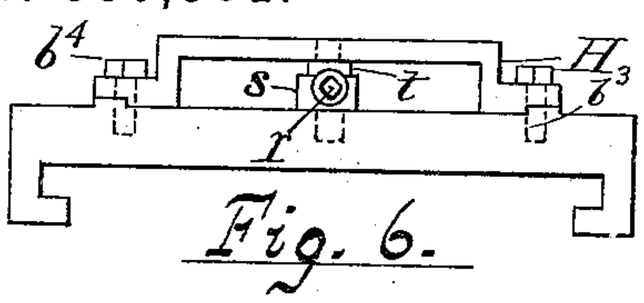


Fig. 6.

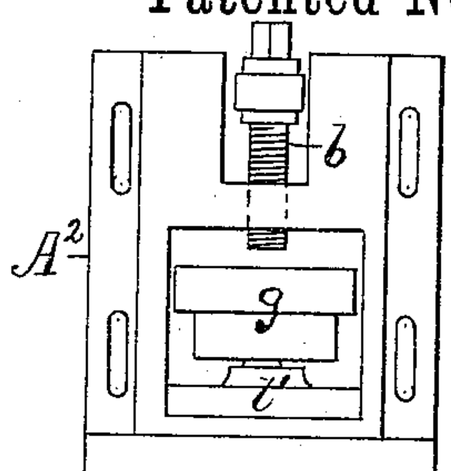


Fig. 5.

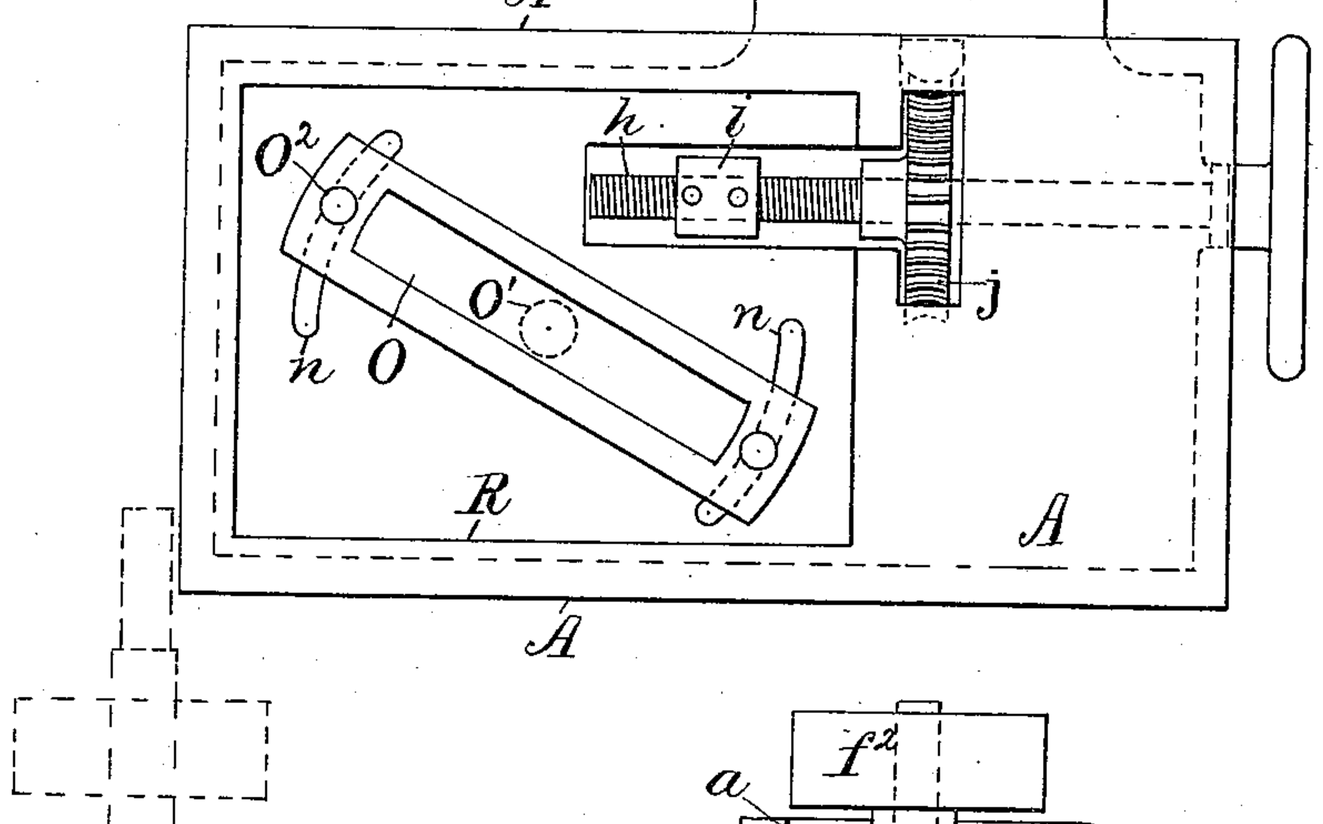
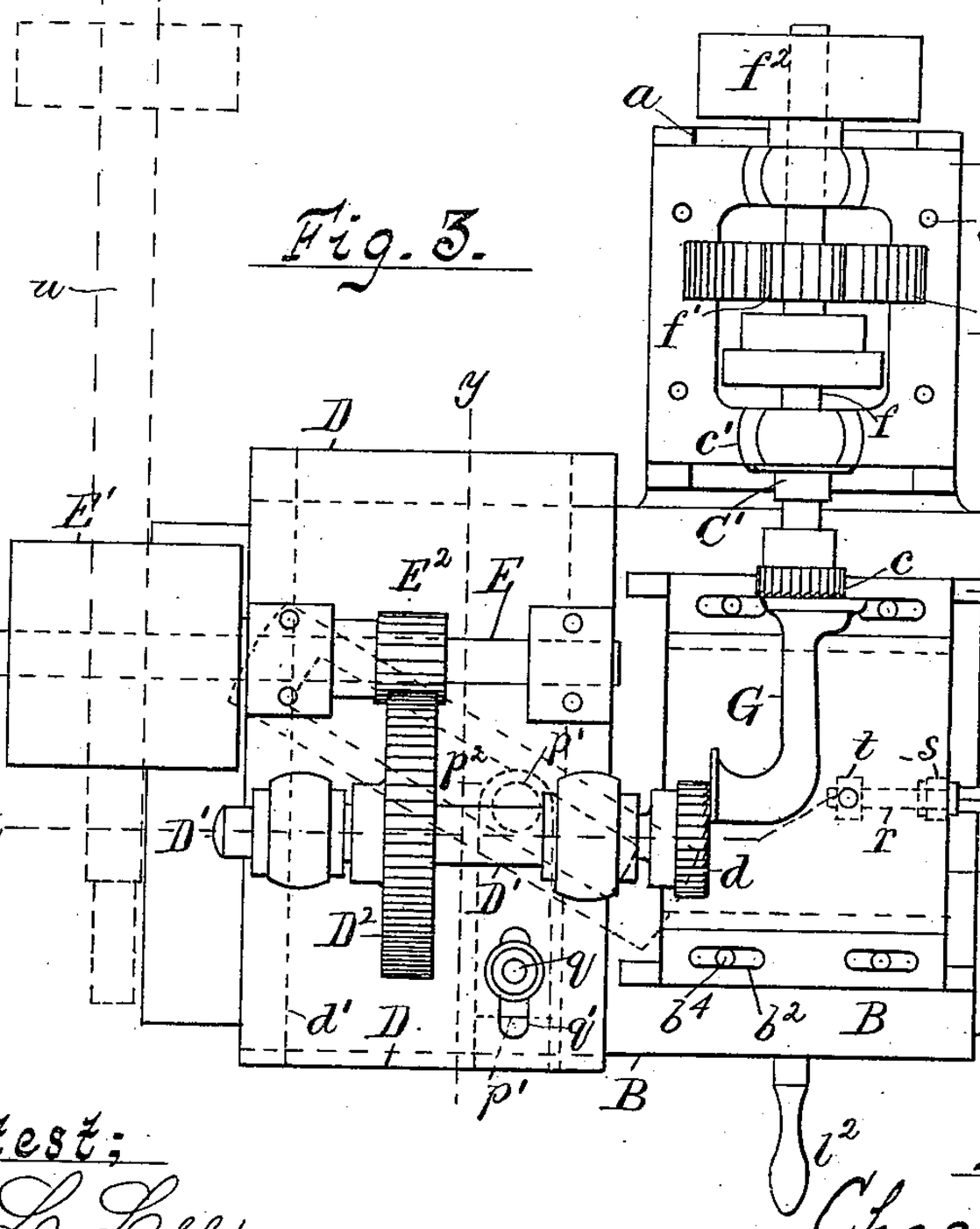


Fig. 3.



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per Cramer & Miller, attys

(No Model.)

4 Sheets—Sheet 4.

C. E. HADLEY.

COMPOUND MILLING MACHINE.

No. 330,581. Patented Nov. 17, 1885.

Fig. 9.

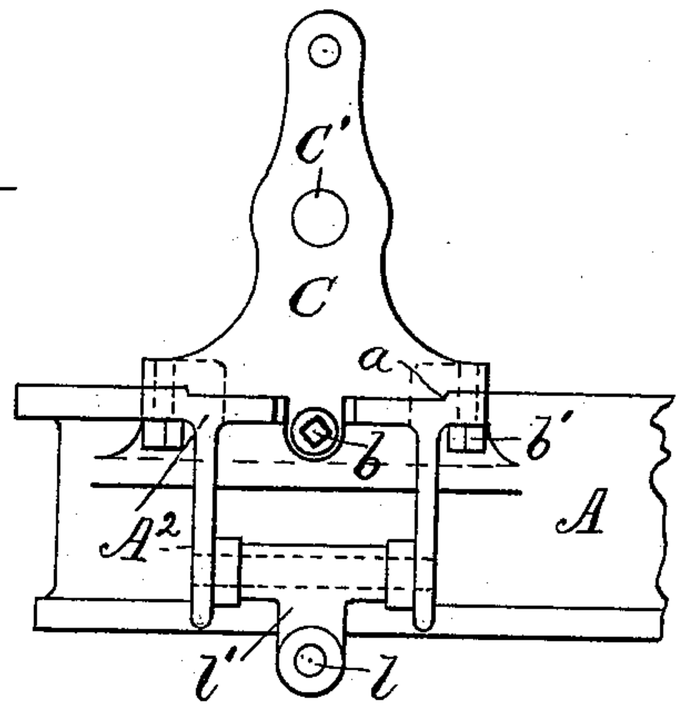


Fig. 8.

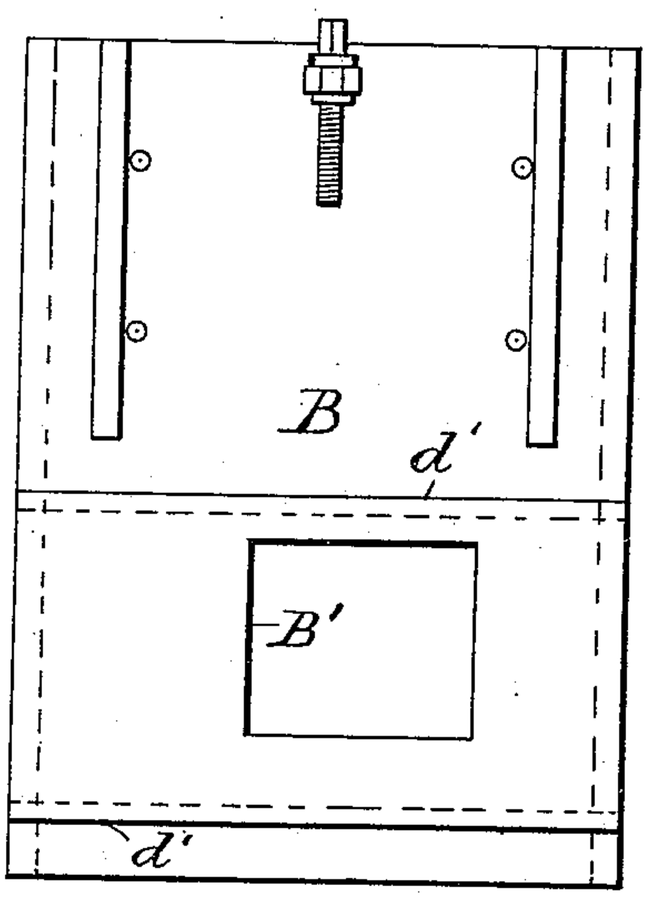
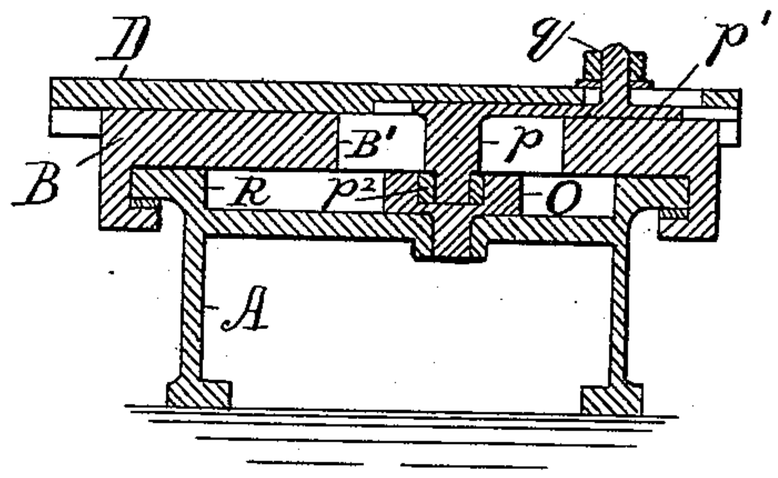


Fig. 7.



Attest:

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J. H. Theberath.

Inventor:

Chas. E. Hadley.

per Lemuel W. Serrell, Atty.

UNITED STATES PATENT OFFICE.

CHARLES E. HADLEY, OF NEW YORK, N. Y., ASSIGNOR TO E. E. GARVIN & CO., OF SAME PLACE.

COMPOUND MILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 330,581, dated November 17, 1885.

Application filed October 3, 1885. Serial No. 178,880. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. HADLEY, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Compound Milling-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to mill-off two surfaces at right angles to one another in a single operation; and the invention therefore consists, partly, in the combination, with two milling-cutters, of means for operating the cutters simultaneously in directions at right angles to one another, in means for rotating the cutters during the feeding movements, in means for adjusting one of the cutters to and from the work, and in means for adjusting the work to and from the face of the other cutter.

It also consists in a special construction and arrangement of a single counter-shaft for driving the two spindles at right angles to one another.

The construction for feeding the cutters in directions at right angles to one another consists in a bed having the bearings for one of the cutter-spindles rigidly mounted when in operation at right angles thereto, and a table movable longitudinally upon such bed, with a carriage mounted transversely upon the table, and carrying the bearings for the other spindle. The cutters being fixed at the ends of the two spindles, their faces are at right angles to one another, and the work is secured upon the table, so as to be fed past one of the cutters, while the other cutter, mounted upon the transverse carriage, is simultaneously carried past the other face of the work. The two faces of the work are thus accurately and simultaneously finished at right angles to one another, one face being finished as it moves past the fixed cutter, and the other face being finished by a movable cutter sustained upon the same bed as the work and carried transversely to the bed during the longitudinal movement of the latter.

The invention will be understood by reference to the annexed drawings, in which Figure 1 represents a view of the machine, taken at one end of the bed and showing the arrangement of the counter-shaft above the same. Fig. 2 is a front view of the machine, showing the bed mounted upon suitable legs, and with a part of the driving-belts directed toward the counter-shaft, the latter being omitted from the drawings for want of room. Fig. 3 is a plan of the machine. Fig. 4 is a longitudinal section of the same on line *x x* in Fig. 3. Fig. 5 is a plan of the bed without the table and stationary head. Fig. 6 is an end view of the table and the adjustable work-holder. Fig. 7 is a section of the machine across the bed, the table, and the transverse carriage on line *y y* in Fig. 3. Fig. 8 is a plan of the table detached, and Fig. 9 is a rear view of the bed at the bracket A^2 and the cutter-head C.

A is the bed of the machine, mounted upon legs A′, and having a table, B, fitted to its opposite edges, so as to slide longitudinally.

A^2 is a bracket at one side of the bed to sustain the fixed cutter-head C, the latter being fitted to guide-ribs *a* upon the bracket, so as to move to and from the edge of the bed, and provided with an adjusting-screw, *b*, and clamp-bolts *b′*, by which it can be adjusted and clamped at any desired point.

C′ is the fixed cutter-spindle carrying the cutter *c*, and mounted in bearings *c′* in the fixed cutter-head, and driven by a gear, F. The spindle C′ stands at right angles to the edge of the bed A, with the cutter *c* overhanging the same sufficiently to operate upon any piece carried by the table. A pulley-shaft, *f*, is mounted upon the fixed head, and carries a pinion, *f′*, to drive the gear F, and a belt-pulley, f^2, to receive the driving-belt. A sewing-machine arm, G, is shown in Figs. 2 and 3 as if fixed upon an adjustable holder, H, which is mounted upon the table B, adjacent to the cutter *c*. The head of the arm is represented in contact with the cutter *c*, and the foot of the arm, at right angles with the head, is shown in contact with a milling-cutter, *d*, which is mounted, by means of a spindle, D′, upon a movable head or carriage, D. This carriage is fitted to transverse ways *d′*, formed across the table B, and carries, besides the spindle D′, a pulley-shaft, E, which is provided with a pulley, E′, and a pinion, E^2. The cutter-spindle D′ is provided with a gear, D^2, to

mesh with the pinion E^2, and the cutter *d* and all its driving apparatus being movable with the carriage D, the cutter may be propelled across the table B, while the table is moving longitudinally to feed the head of the arm G past the cutter *c*, and the cutter *d* may thus operate simultaneously upon the foot of the same arm. The table is fed longitudinally upon the bed by a screw, *h*, fitted beneath the bed, and applied to a nut, *i*, secured upon the under side of the table. The screw is shown in Figs. 1 and 4, operated by a worm-wheel, *j*, and worm *k*, the latter being mounted upon a movable shaft, *l*, as is common in milling-machines, to detach the worm from the gear to stop the feed. The worm-shaft is shown in Fig. 1 journaled in a pivoted box, *l'*, at its rear end, and at its front end it is formed with a projecting handle, l^2, and fitted to a sliding box, l^3, which is held in place during the feeding operation by a catch, *m*. (Shown in Fig. 2.) The catch is pivoted upon the front of the bed on a stud, *m'*, and provided with a spring, m^2, and a dog, m^3, is adjustably fitted to a slot, m^4, in the edge of the table, to shift the catch *m* and stop the feed at the end of the cut. The screw *h* is mounted in bearings *h'*, under the bed A, and is provided at its outer end with a hand-wheel, I, to run the table back quickly after each cut. The carriage D is traversed or fed across the table B automatically by the contact of a projection upon the carriage with an inclined guide fixed rigidly upon the bed beneath the table, the table itself being formed with a transverse slot, B', as shown in Fig. 8, to permit the passage of such projection through it into the inclined guide. The guide O is shown in Fig. 5 as a grooved plate pivoted by a central pin, O', in a recess, R, formed in the bed A, beneath the path of the transverse carriage D, the guide being held adjustably in its place by bolts O^2, fitted in slots *n*, and provided with nuts beneath the bed to clamp the guide at the desired angle with the table. The projection from the carriage consists in an adjustable pin, *p*, attached to a slide, *p'*, which is fitted in a groove upon the under side of the carriage, parallel with its ways *d'*, so that the pin projects downward through the slot B' in the table B into the groove in the guide O, where it is provided with a swiveled block, p^2, fitted snugly to the groove in the guide. (Shown in Figs. 4, 5, 7.) The longitudinal movement of the table in carrying the work past the fixed cutter *c* obviously moves the entire carriage D, and with it the pin *p*, thereby traversing the block p^2 in the guide O and producing automatically a movement of the carriage upon its ways transverse to the table B. As the work (represented by the arm G) is rigidly held upon the table during such transverse movement of the carriage, the cutter *d* operates to mill off the foot of the arm at the same time that its head is milled by the cutter *c*. The ways *d'* are formed at right angles with the table B in the construction of the machine, and the perpendicularity of the milled faces is thus secured with positive certainty at a single setting of the work, and the danger of milling the faces at an improper angle, which sometimes occurs in a second setting in other machines, is entirely avoided. The inclination of the guide O to the table B, which may be varied by turning the guide upon the pin O', determines the rate at which the longitudinal motion of the table shall produce a transverse motion in the carriage D and movable cutter *d*. As the guide operates best at an angle below forty-five degrees, and thereby produces a smaller movement of the carriage D than of the table B, it is preferable, if the two faces which require milling should vary in their dimensions, to apply the work to the two cutters with the longer face in contact with the cutter *c*. In Fig. 3 the sewing-machine arm G is shown thus arranged; with the short foot in contact with the cutter *d* and the longer head in contact with the cutter *c*. By adjusting the guide at an angle of forty-five degrees the feed of one cutter may be made exactly equal to that of the other. The slide *p'* is provided with a bolt and nut, *q*, fitted to a slot, *q'*, in the carriage D, by which the carriage may be adjusted upon its ways *d'* in reference to the pin *p*. The object of this construction is to adapt the cutter *d* to operate simultaneously with the other cutter upon pieces of various dimensions, and, by the movement of the pin *p* in relation to the carriage D, the cutter *d* may be adjusted to and from the cutter *c*, so as to touch the nearer side of the work before the commencement of a cut. The arm G is shown in Fig. 2 as if supported above the holder H; but the "jig" or bed upon which the work would be clamped is not shown in the drawings, to avoid obscuring the holder, which is shown in plan in Fig. 3, and consists in a plate fitted upon the top of the table B, and adjustable toward the transverse carriage D, so as to bring the work in contact with the face of the cutter *d* before commencing a cut. The holder is fitted to longitudinal ribs b^3 upon the top of the table, and held thereon by bolts b^4, fitted to slots b^2 in the feet of the holder, and a screw, *r*, being shown carried by a bearing, *s*, upon the table, and fitted to a nut, *t*, upon the holder to adjust the same to and from the cutter *d*, as shown in Figs. 3 and 4. The jigs or clamping devices for securing the work upon the holder would be made and secured upon the holder in any ordinary manner, and when thus secured the work would be capable of adjustment, respectively, to the cutters *c* and *d*. In Fig. 3 it will be noticed that the pulleys E and f^2, which drive the cutters *c* and *d*, stand at some distance from and at right angles to one another in the plane of the machine, and to adapt a single counter-shaft to drive them both I have devised the arrangement shown in Figs. 1 and 3, in which the moving pulley E is driven by a quarter-turn belt and the pulley f^2 by a straight belt, the

counter-shaft being mounted parallel with the spindle C′, but arranged over the pulley E, as indicated by dotted lines *u* in Fig. 3. The counter-shaft and its attached pulleys are clearly shown in Fig. 1, *u* being the shaft; *u′*, the bearings, which would be supported in suitable hangers; *v v′*, the fast and loose pulleys for driving the shaft; *w*, the pulley for driving the fixed spindle C′ by a straight belt, f^3, to the pulley f^2, and *w′* a pulley for driving the movable spindle D′ by a belt, d^3, to the pulley E′. It will be noticed that although the spindle C′ is adjustable transversely to the bed A by means of the head C and the screw *b*, it is not movable when in operation, but rotates in a fixed head, so as to operate the cutter *c* continuously in the same spot. Upon the contrary, the cutter-spindle D′, being mounted upon the transverse carriage D, is movable across the bed during the cutting operation, but is not provided with any adjustment longitudinally, as the holder H is constructed with the necessary means—as the screw *r*—for setting the work to and from the face of the cutter *d*. It will therefore be understood that the term "movable," as applied to the cutters and their revolving spindles, is distinguished herein from the term "adjustable," the former term describing a movement of the cutter past the work during the cutting operation, while the latter term describes merely a movement of the cutter toward the face of the work for the purpose of regulating the depth of the cut. The depth of the cut effected by the cutter *c* may thus be regulated during the cutting operation, if necessary, by the screw *b*, while the depth of the cut effected by the cutter *d* is varied by the screw *r*, operating to shift the work and its holder directly toward such cutter. In practice the adjustments for depth of cut are effected prior to the cutting operation, for which reason the holder and the cutter-head C are merely fitted to ribs upon the machine and clamped in their places by clamping-bolts; but, if desired, the holder and head may be fitted to smooth ways, like those beneath the carriage D, upon which they can be moved during the cutting operation without loosening the clamping devices.

While I have claimed herein only certain means of adjustment for the work and the cutters, I do not limit myself exclusively to such means, nor to the combination of all those shown herein, as a part of them alone may adapt the machine for certain uses. The feed-shaft *l* is shown herein provided with a cone, *g*, and a similar cone, *g′*, is shown upon the pulley-shaft *f*, a belt, g^2, being carried down through an opening in the head C and bracket A^2 to operate the feed for the table B, but such device forms no part of my invention, and may be replaced by cog-wheels or other constructions, if desired.

Having thus shown the nature and object of my invention, what I claim herein is—

1. The combination, in a milling-machine, of a longitudinal bed, a fixed cutter-head supporting a fixed spindle and cutter at right angles to the bed, a table movable longitudinally upon said bed, and a movable carriage fitted transversely to said table and carrying a cutter-spindle and cutter at right angles to the fixed spindle, substantially as and for the purpose set forth.

2. The combination, in a milling-machine, of a longitudinal bed, a fixed cutter-head supporting a fixed spindle and cutter adjustably at right angles to the bed, a table movable longitudinally upon said bed, a movable carriage fitted transversely to said table and carrying a cutter-spindle and cutter at right angles to the fixed spindle, and means, as screw *b*, for adjusting the fixed cutter-head transversely to the movable table, as and for the purpose set forth.

3. The combination, in a milling-machine, of a longitudinal bed, a fixed cutter-head supporting a fixed spindle and cutter adjustably at right angles to the bed, a table movable longitudinally upon said bed, a movable carriage fitted transversely to said table and carrying a cutter-spindle and cutter at right angles to the fixed spindle, means, as screw *b*, for adjusting the fixed spindle transversely to the movable table, and a work-holder adjustable longitudinally upon the movable table adjacent to the two cutters, as and for the purpose set forth.

4. In a milling-machine having a bed, and a table provided with means for feeding it longitudinally, and with a spindle-carriage fitted transversely thereto, as described, the combination, with the bed beneath the table, of an inclined guide and a projection upon the transverse carriage fitted to said guide and adapted to move the carriage transversely by the longitudinal movement of the table, substantially as shown and described.

5. In a milling-machine, the combination, with the bed A, provided with recess R, and the adjustable guide O pivoted therein, of the table B, movable longitudinally upon the bed and formed with the transverse slot B′, the carriage D, fitted transversely to the bed, and the slide *p′*, having the pin *p* projected through the slot into the inclined guide, and provided with the swiveled block p^2, the whole arranged and operated substantially as shown and described.

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

CHARLES E. HADLEY.

Witnesses:

THOS. S. CRANE,

JOHN S. WILLIAMS.