(No Model.) 3 Sheets—Sheet 1.

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LATHE.

No. 280,259. Patented June 26, 1883.

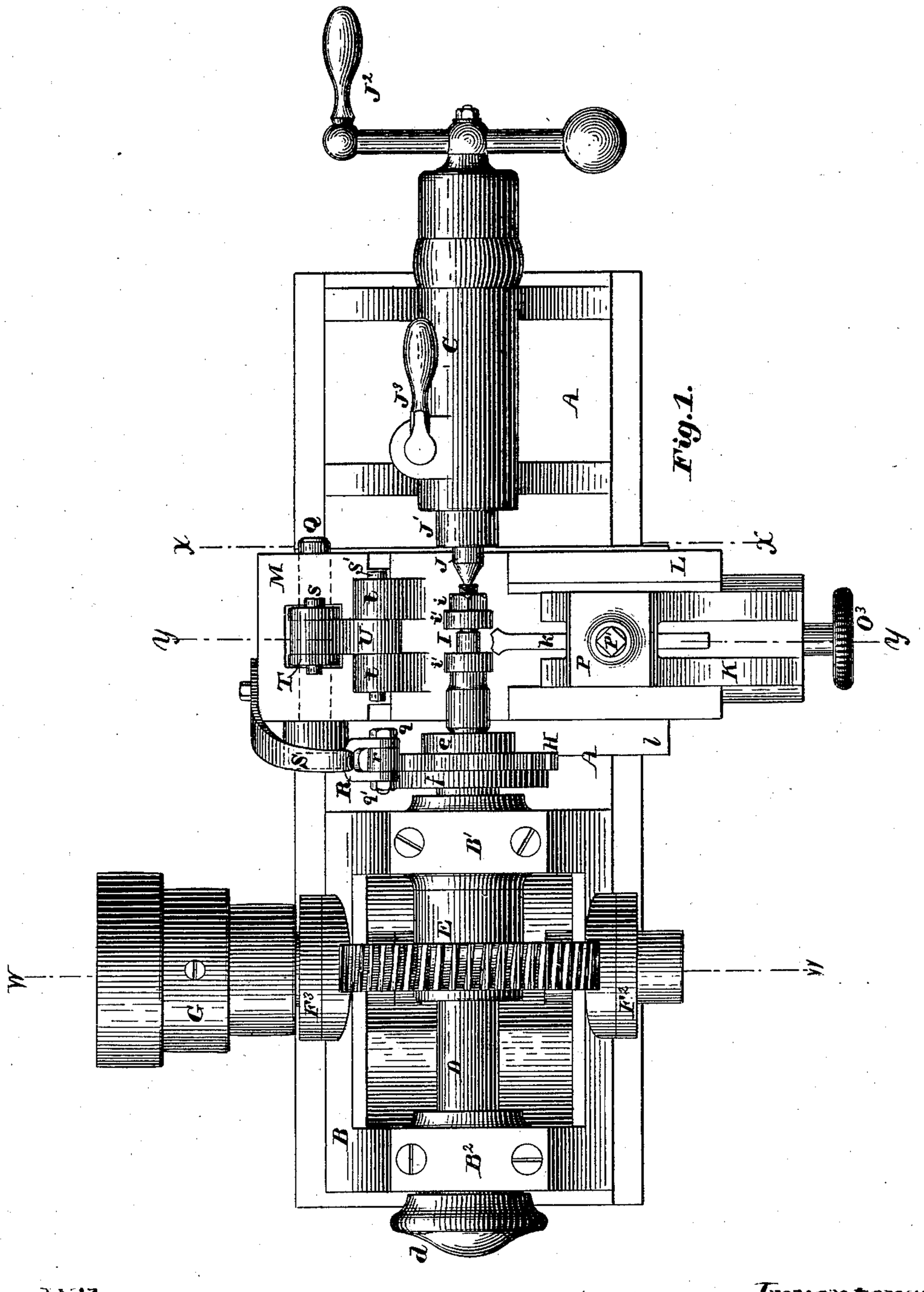

Fig. 1.

Witnesses:
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E. A. Hemmenway

Inventors:
Frank M. Stevens,
Charles E. Moore,
by N. C. Lombard Attorney

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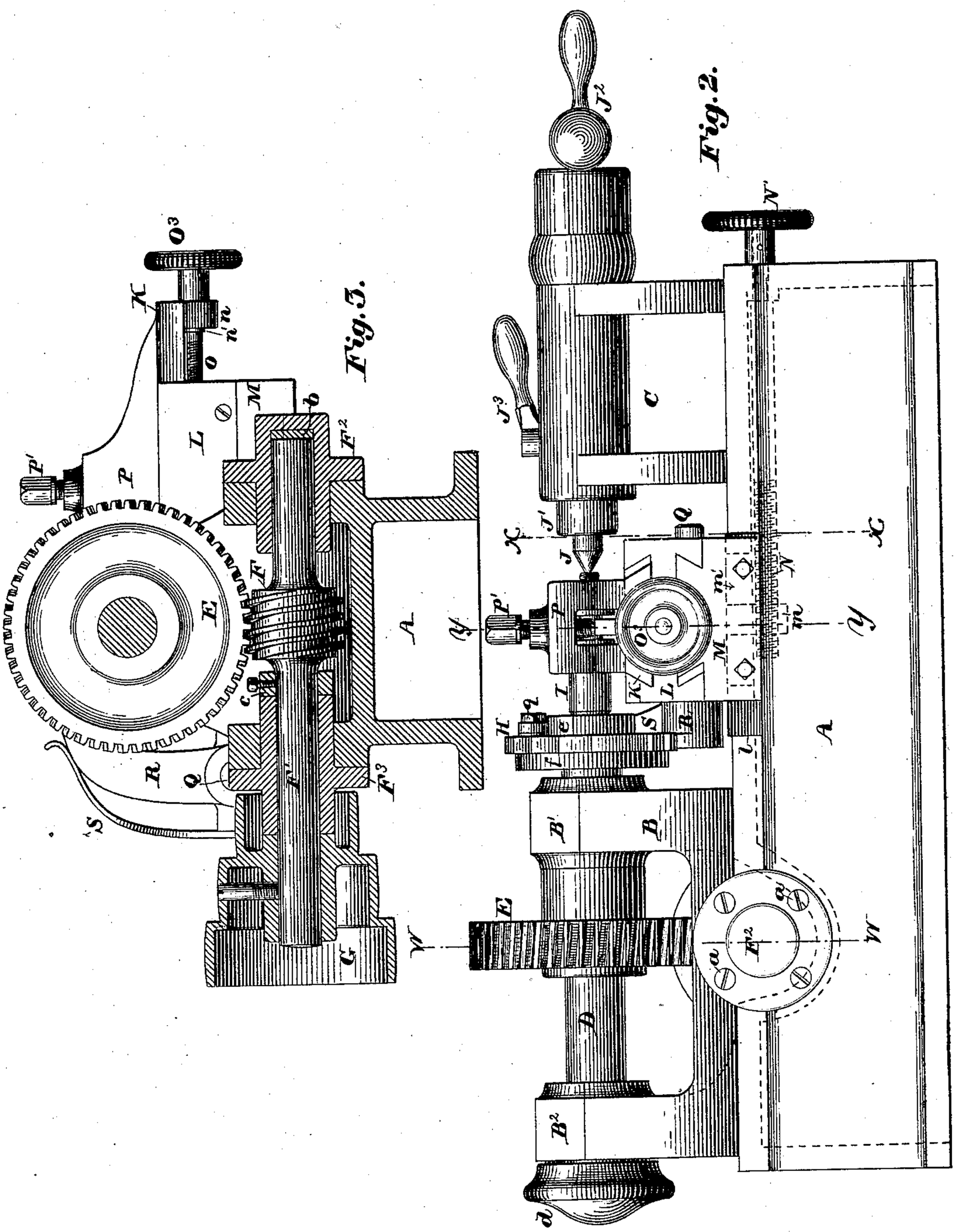

Fig. 3.

Fig. 2.

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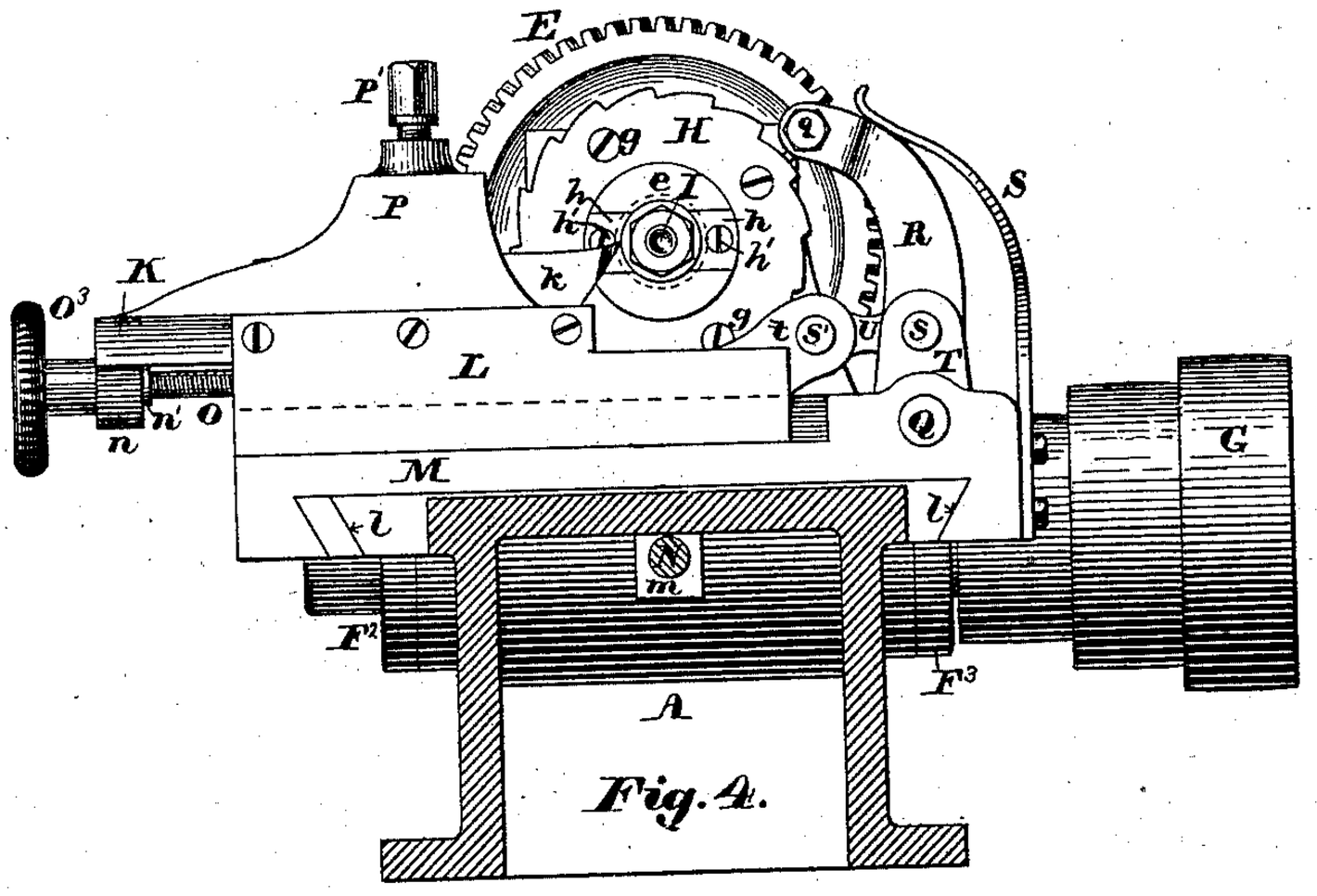

Fig. 4.

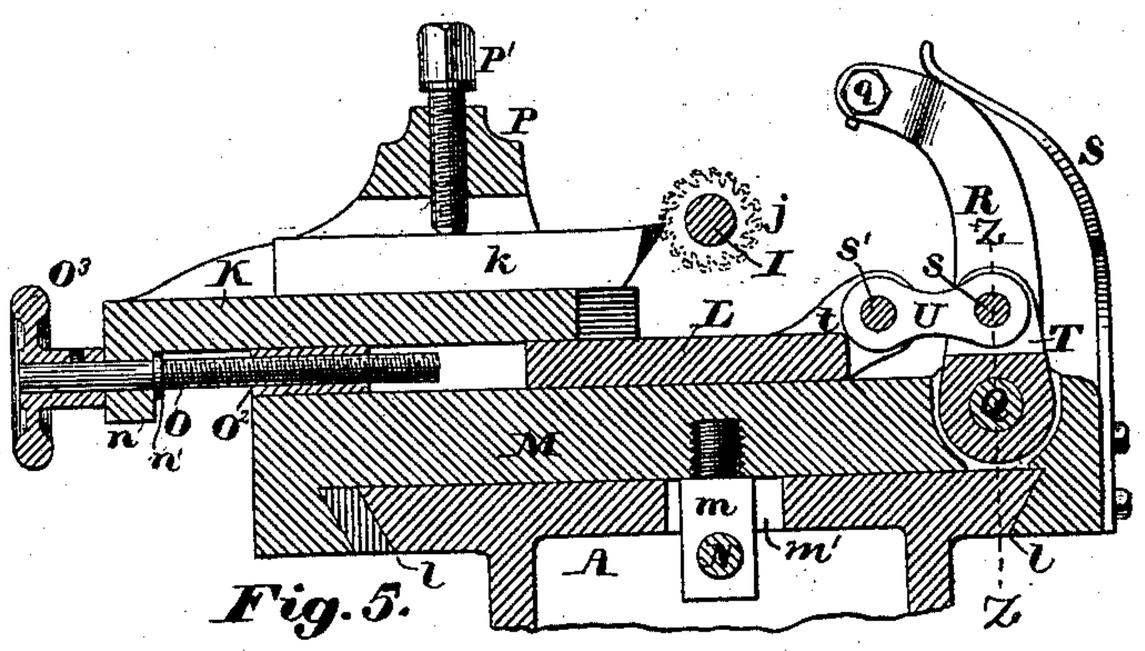

Fig. 5.

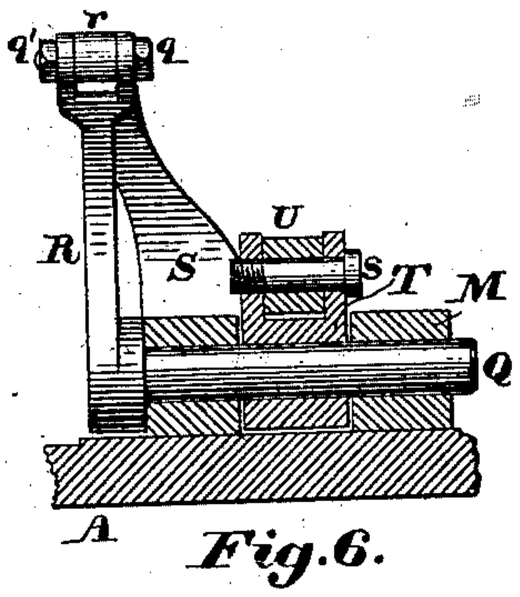

Fig. 6.

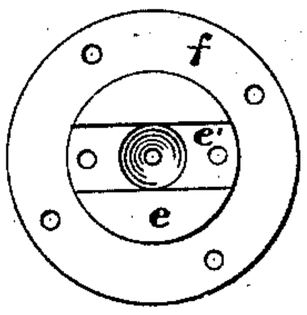

Fig. 8.

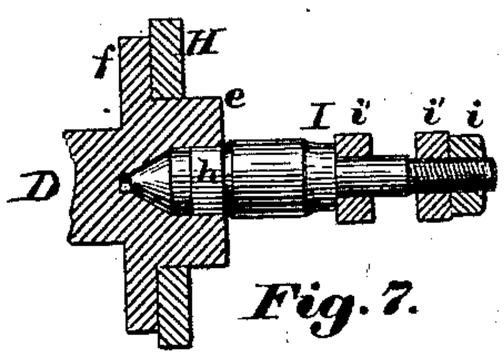

Fig. 7.

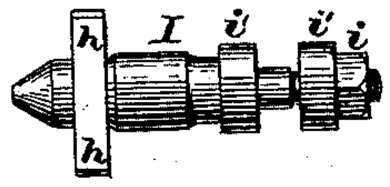

Fig. 9.

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& A. Hemmenway.

Inventors:
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Charles E. Moore,
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UNITED STATES PATENT OFFICE.

FRANK M. STEVENS AND CHARLES E. MOORE, OF BOSTON, MASSACHUSETTS;
SAID MOORE ASSIGNOR TO SAID STEVENS.

LATHE.

SPECIFICATION forming part of Letters Patent No. 280,259, dated June 26, 1883.

Application filed January 4, 1883. (No model.)

To all whom it may concern:

Be it known that we, FRANK M. STEVENS and CHARLES E. MOORE, both of Boston, in the county of Suffolk and State of Massachusetts, have jointly invented certain new and useful Improvements in Lathes, of which the following, taken in connection with the accompanying drawings, is a specification.

Our invention relates to a lathe for turning irregular forms, and to that class of such lathes in which the desired form is produced by the automatic movement of the cutting-tool controlled by a pattern-cam attached to the arbor or revolving spindle of the lathe. It may be employed in producing a variety of work, but is especially designed for "backing off" the teeth of rotary cutters, or, in other words, in producing the necessary "clearance" required by the teeth of such circular revolving cutters; and it consists in certain arrangements and combinations of mechanism, which will be best understood by reference to the description of the drawings and the claims to be hereinafter given.

In the drawings, Figure 1 is a plan of a lathe embodying our invention. Fig. 2 is an elevation of the same. Fig. 3 is a transverse section on line *w w* on Figs. 1 and 2, looking toward the tail-stock. Fig. 4 is a transverse section on line *x x* on Figs. 1 and 2, looking toward the head-stock. Fig. 5 is a partial section on line *y y* on Figs. 1 and 2, looking toward the head-stock. Fig. 6 is a section on line *z z* on Fig. 5. Fig. 7 is a partial section, showing the end of the head-stock spindle, the pattern-cam, and the arbor for holding the work. Fig. 8 is an end view of said spindle. Fig. 9 is an elevation of said arbor for holding the work.

A is the bed, having cast therewith or secured upon it the head-stock B and tail-stock C. In the bearings B′ and B² of the head-stock B is mounted the spindle D, having secured upon it, between said bearings, the worm-wheel E, which is revolved by means of the worm F, secured upon the shaft F′ and engaging with the teeth of the worm-wheel E. The worm-shaft F′ is located with its axis at right angles to that of the spindle D, and is arranged to revolve in bearings F² and F³, secured to the bed A by screws *a a*, as in Fig. 2. The shaft F′ extends through the bearing F³, and has secured upon its end outside of said bearing the cone-pulley G arranged to be driven by a suitable belt. (Not shown.) The opposite end of said shaft F′ does not extend through the bearing F², but bears against a disk or washer, *b*, in said bearing, which serves to take the end-thrust of the shaft in that direction, while it is prevented from slipping in the opposite direction by the collar *c*, secured upon it in contact with the inner end of the bearing F³. A cap, *d*, screwed upon the hub of the bearing B², serves to take the end-thrust of the spindle D, and also as a means of effecting a slight endwise adjustment of the same in a well-known manner. The end of the spindle D opposite to the cap *d* is provided with an enlarged portion, *e*, and a flange, *f*, as shown in Fig. 7, and carries the pattern-cam H, made in the form of a ring accurately fitting over the enlarged portion *e*, and secured to the flange *f* by screws *g g*, Fig. 4.

I is an arbor for holding the work, it being supported at one end by the back center, J, and having its opposite end made conical and fitted to a similarly-shaped recess in the end of the spindle D. (See Fig. 7.) The arbor I is provided with two ears, *h h*, extending at right angles to the axis thereof, and adapted to fit the groove *e′* in the enlarged end *e* of the spindle D, by which arrangement the arbor I is caused to revolve with said spindle. Two screws, *h′ h′*, pass through the ears *h h*, and are screwed into the enlarged portion *e*, thus serving to hold the arbor I in position when the back center, J, is withdrawn for the purpose of placing the work upon or removing it from the arbor I. The work to be turned or the cutter to be backed off (shown in dotted lines at *j* in Fig 5,) is placed upon the arbor I between the collars *i′ i′*, and held firmly in place by means of the nut *i* in a well-known manner.

The tail-stock C is of ordinary construction, the back center, J, being carried by the spindle J′, which is advanced or withdrawn by a screw (not shown) operated by the handle J². The bearing for the spindle J′ has a longitudinal split or cut in its rear side, and is provided with a clamping-screw having a handle, J³, for

the purpose of securing the spindle J′ in any desired position, all constructed in a well-known manner.

Mounted upon the bed A, between the head-stock B and tail-stock C, is a carriage for holding and guiding the cutting-tool *k*, said carriage being composed of the three slides K, L, and M. The slide M is fitted to a dovetail, *l*, upon the bed A, and is adapted to be adjusted longitudinally thereon, or in a line parallel to the axis of the spindle D, by means of the screw N engaging with the nut *m*, which projects downward from the under side of the slide M through an opening, *m′*, in the top of the bed A. The screw N extends to the right-hand end of the bed A, and, passing through the same, has secured upon its outer end the hand-wheel N′, by means of which it may be operated. It is of reduced diameter where it passes through the hub of said hand-wheel and the end of the bed, thus forming a shoulder upon the inside, while the hub of the hand-wheel forms another shoulder upon the outside, to prevent said screw N from slipping endwise. The slide M is provided with a dovetail upon its upper side, to which is fitted the slide L, adapted to move in a direction at right angles to the axis of the spindle D, and having a dovetailed groove in the front portion of its upper side, in which is fitted the slide K, adapted to be moved or adjusted in a parallel direction with the slide L by means of the screw O engaging with the nut O^2, which is a portion of the slide L, and provided with the hand-wheel O^3, for the purpose of operating the same. The screw O has a bearing in the ear *n*, projecting downward from the front end of the slide K, the hand-wheel O^3 upon the outside and the shoulder *n′* upon the inside of said ear causing the slide to move with said screw. The slide K carries a tool-post, P, in the slot of which the cutting-tool *k* is securely held by the set-screw P′, in the usual way. The slides K, L, and M are provided with suitable gibs, adjusted by screws in the ordinary manner. The slide L is arranged to be moved automatically, as will now be described. In the slide M, near its rear end, is mounted the rock-shaft Q, upon one end of which is secured the lever R, extending upward and curving toward the front of the machine near its upper end, which is forked, and has secured therein by the bolt *q* and nut *q′* a hardened-steel contact-point, *r*, which bears against the outer edge of the pattern-cam H, it being held against said cam by the action of the spring S, secured at its lower end to the end of the slide M and pressing at its upper end upon the lever R, as shown.

In a recess in the slide M is located a lever, T, secured firmly upon the rock-shaft Q near the middle of its length, and connected with the slide L by means of the link U, engaging at one end with the pin *s* in the forked upper end of the lever T and at the other end with the pin *s′*, set in the ears *t t*, formed upon the rear end of the slide L.

The edge of the cam H is shaped with reference to the form which it is desired to give to the work to be turned, and as each throw of said cam passes beneath the point *r* it will act, through the medium of the lever R, rock-shaft Q, lever T, and link U, to draw the slide L, and consequently the cutting-tool *k*, toward the work, the reverse motion being effected by the action of the spring S. As arranged for backing off rotary cutters, the shape of the cam H is somewhat similar to that of a ratchet-wheel, the number of throws necessarily corresponding with the number of teeth in the cutter, and the shape of the edge of the cutting-tool *k* should conform exactly to the longitudinal shape of the cutting-edges of said teeth. The transverse adjustment of the cutting-tool to regulate the depth of cut is readily effected by operating the hand-wheel O^3 and the longitudinal adjustment by means of the hand-wheel N, as previously set forth.

It will be seen that the slide L may be operated by the lever R without the interposition of the rock-shaft Q and lever T, as by a slight modification in the shape of said slide L or lever R the link U may be made to connect them directly together; also, that the contact surface or point *r* at the end of the lever R may be of a different shape, or it may consist of a small anti-friction roll.

We have shown an arbor, I, of special construction for convenience in holding a certain class of work; but it is obvious that various kinds of work may be centered or held in different ways without affecting the operative principle of the machine.

A great advantage is obtained by using the worm F and worm-wheel E as a means of imparting rotary motion to the spindle D, and through it to the work to be acted upon, over a machine in which the power is applied by means of a belt upon a pulley secured directly to the spindle, as sometimes practiced, or a machine in which spur-gear wheels are interposed between the driving-pulley and the work-carrying spindle, as in other cases is the custom. It is absolutely necessary, in performing the service intended to be performed by this machine, that the spindle D should revolve very slowly, but positively. This it is difficult, to say the least, to insure in the case of the spindle being driven by a belt acting directly upon a driving-pulley mounted upon the spindle. The use of the back gears on the head-stock of the lathe obviates this difficulty, and is all that is necessary in doing ordinary lathe-work, such as turning shafting or other circular work when a continuous chip is cut; but in doing such work as this machine is designed to do—namely, making several distinct and separate cuts to each revolution of the spindle—there is much more liability of the tool chattering, and thus making imperfect cuts, than with the worm and worm-wheel arranged as herein described, owing to the "backlash," so called, in the gear-teeth.

What we claim as new, and desire to secure by Letters Patent of the United States, is—

1. The spindle D, provided with the en-

larged portion *e* and the flange *f*, and having the ring-cam H detachably secured thereto, substantially as and for the purposes described.

2. The combination of the spindle D, having secured thereon the pattern-cam H and the worm-wheel E, the spring-actuated lever R, provided with a contact-surface to rest upon said cam, the slide L, carrying the tool-post P, means of connecting the slide L and lever R, the worm F and means of imparting rotary motion thereto, and means of holding the work and causing it to revolve with the spindle D, substantially as and for the purposes described.

3. The spindle D, provided at its inner end with the flange *f*, and having a transverse groove, *e'*, cut across its inner end face, as set forth, in combination with the arbor I, provided with the ears *h h*, and means of centering said arbor and securing thereon the work to be acted upon, substantially as and for the purposes described.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, on this 2d day of January, A. D. 1883.

FRANK M. STEVENS.
CHARLES E. MOORE.

Witnesses:
E. A. HEMMENWAY,
WALTER E. LOMBARD.