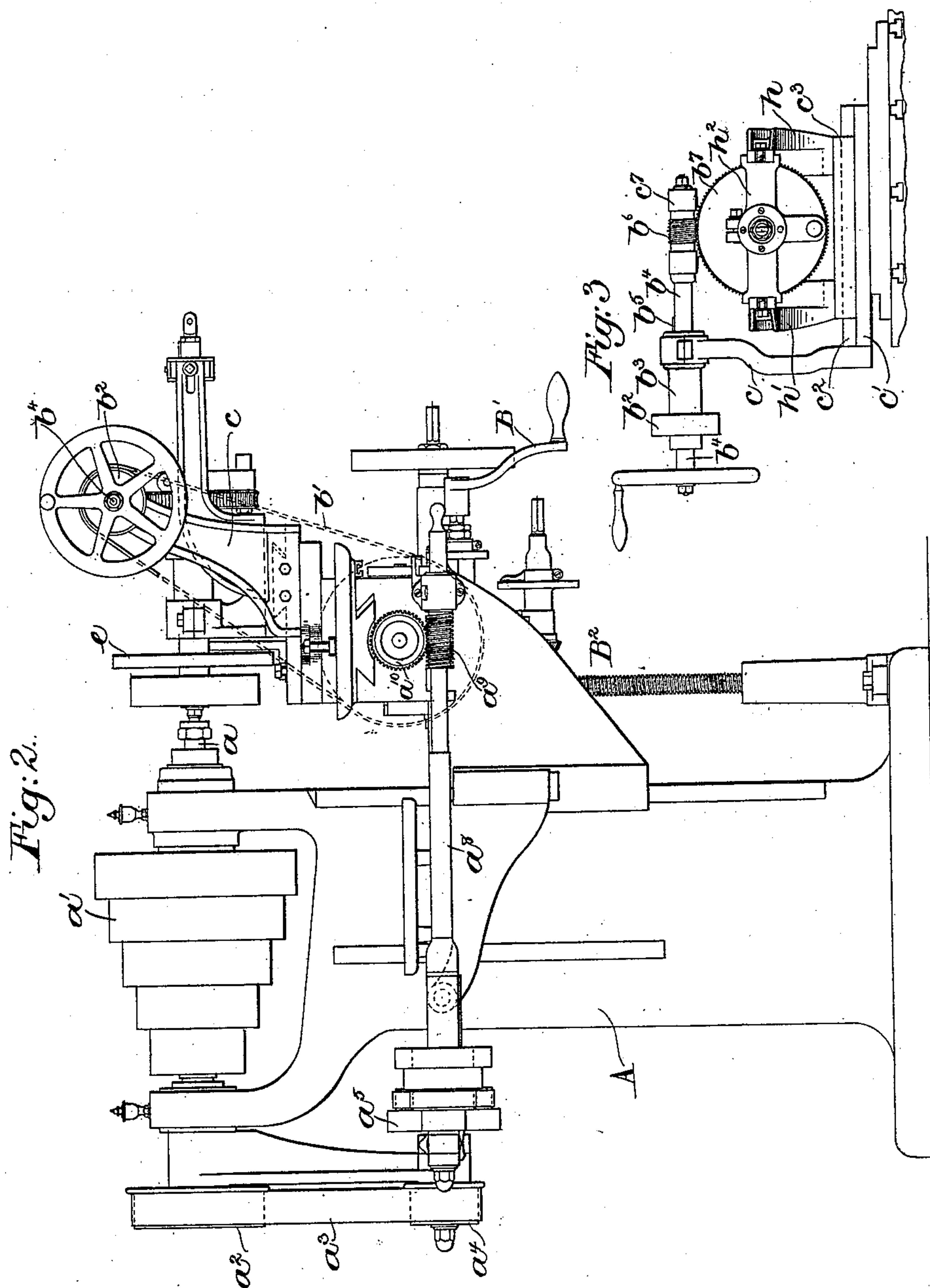


4 Sheets—Sheet 2.

No. 471,381.

Patented Mar. 22, 1892.



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Edward F. Allen

Inventors.
Zachary T. French
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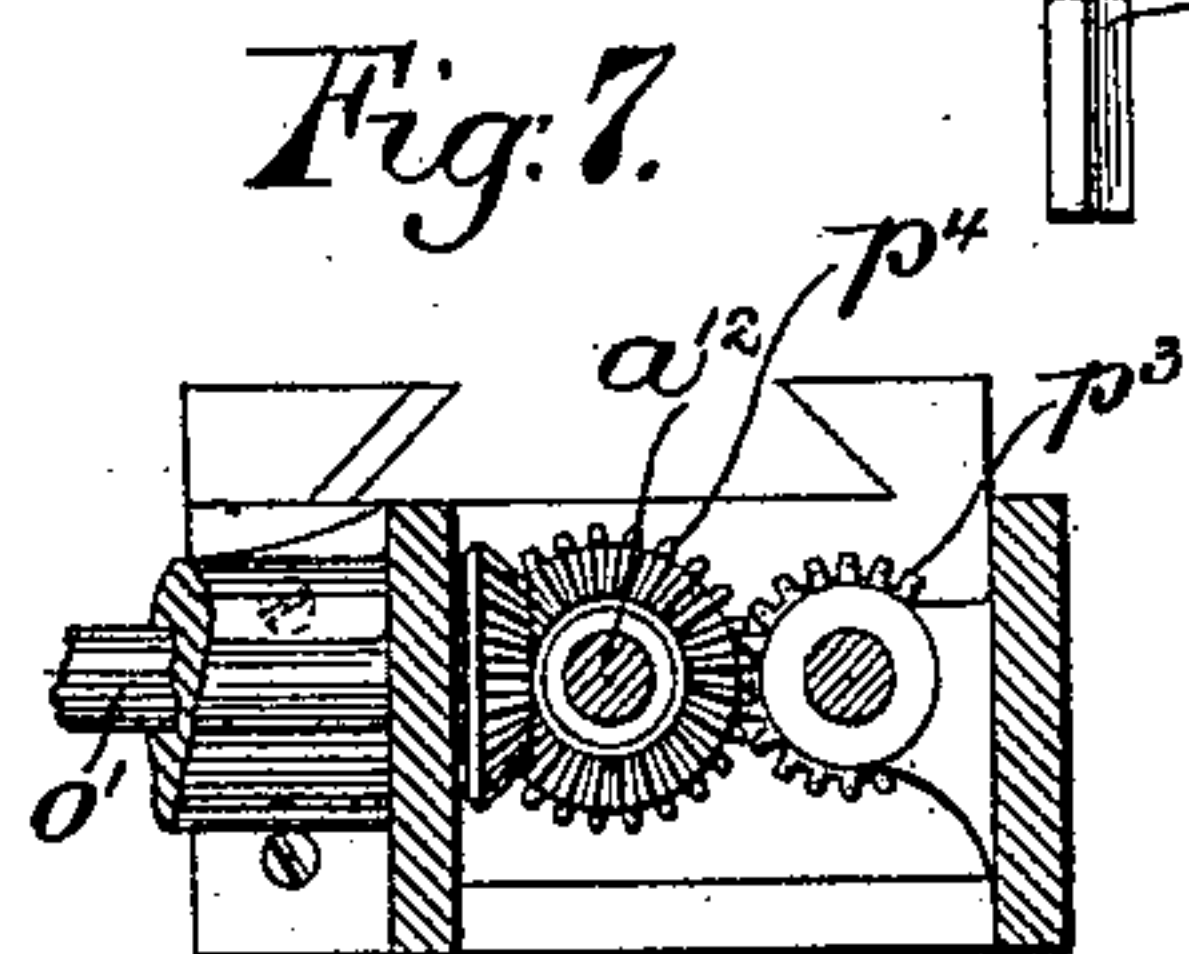
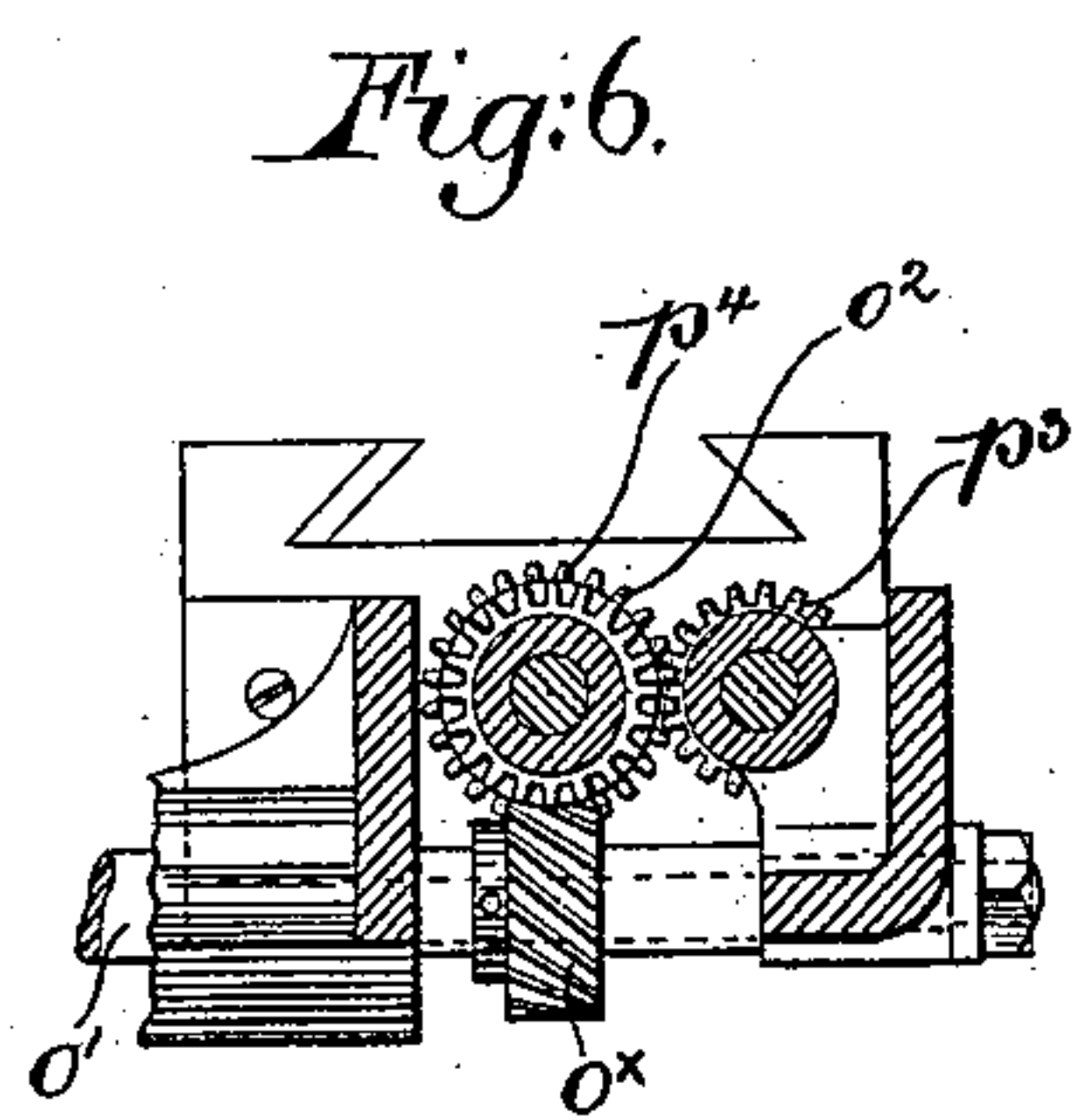
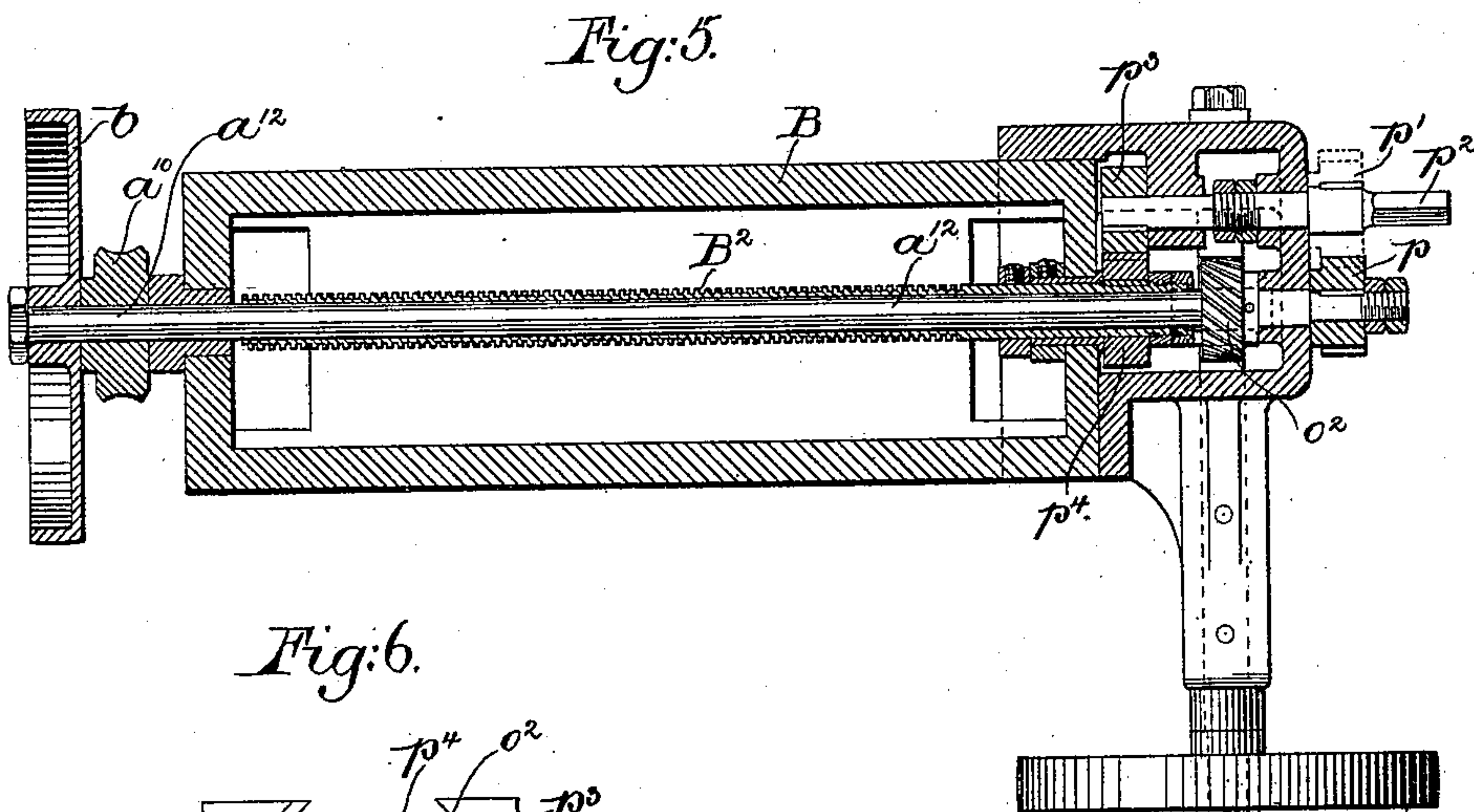
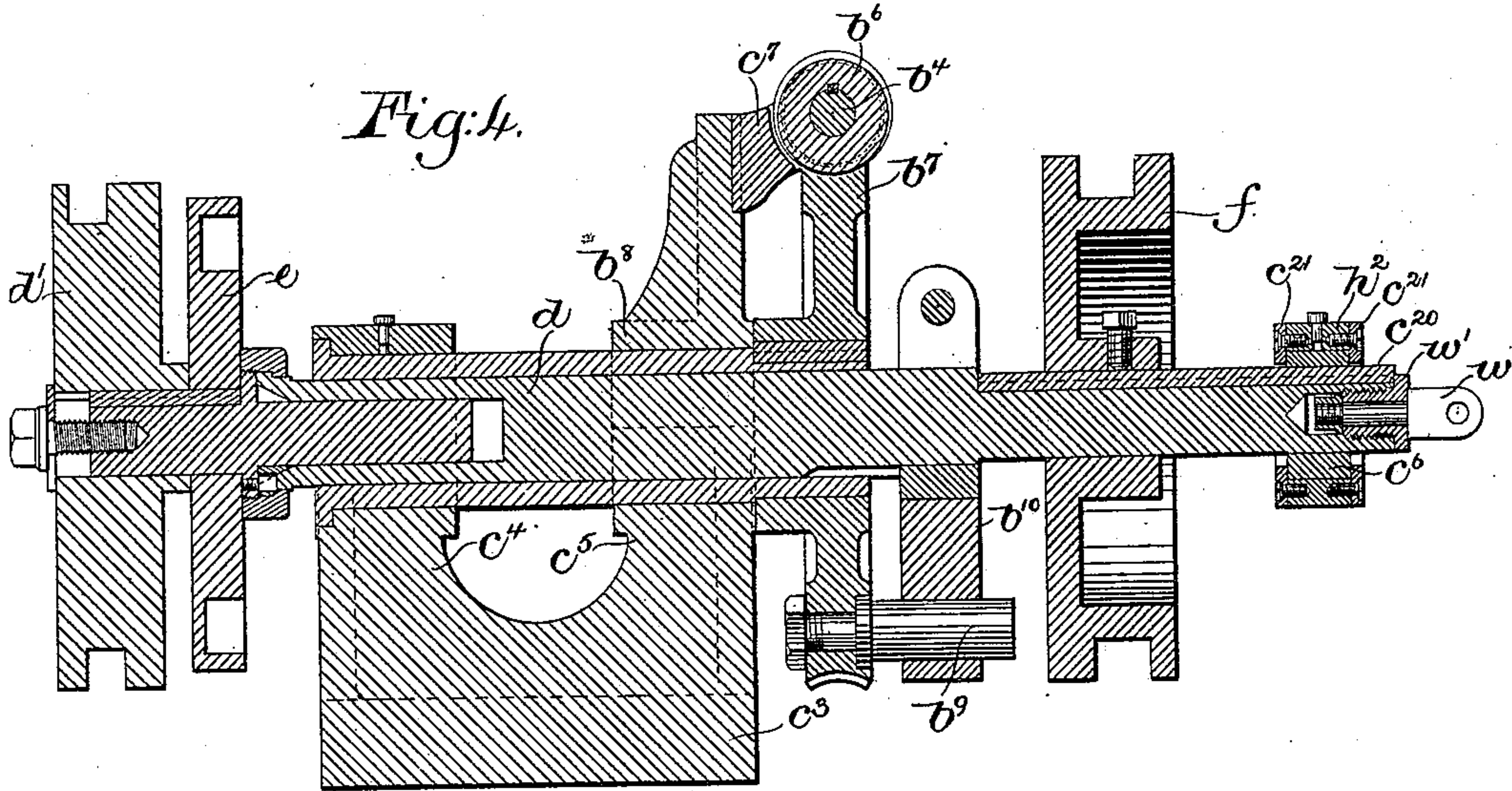
(No Model.)

4 Sheets—Sheet 3.

Z. T. FRENCH & W. C. MEYER.
CAM CUTTER.

No. 471,381.

Patented Mar. 22, 1892.



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4 Sheets—Sheet 4.

No. 471,381.

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Fig: 8.

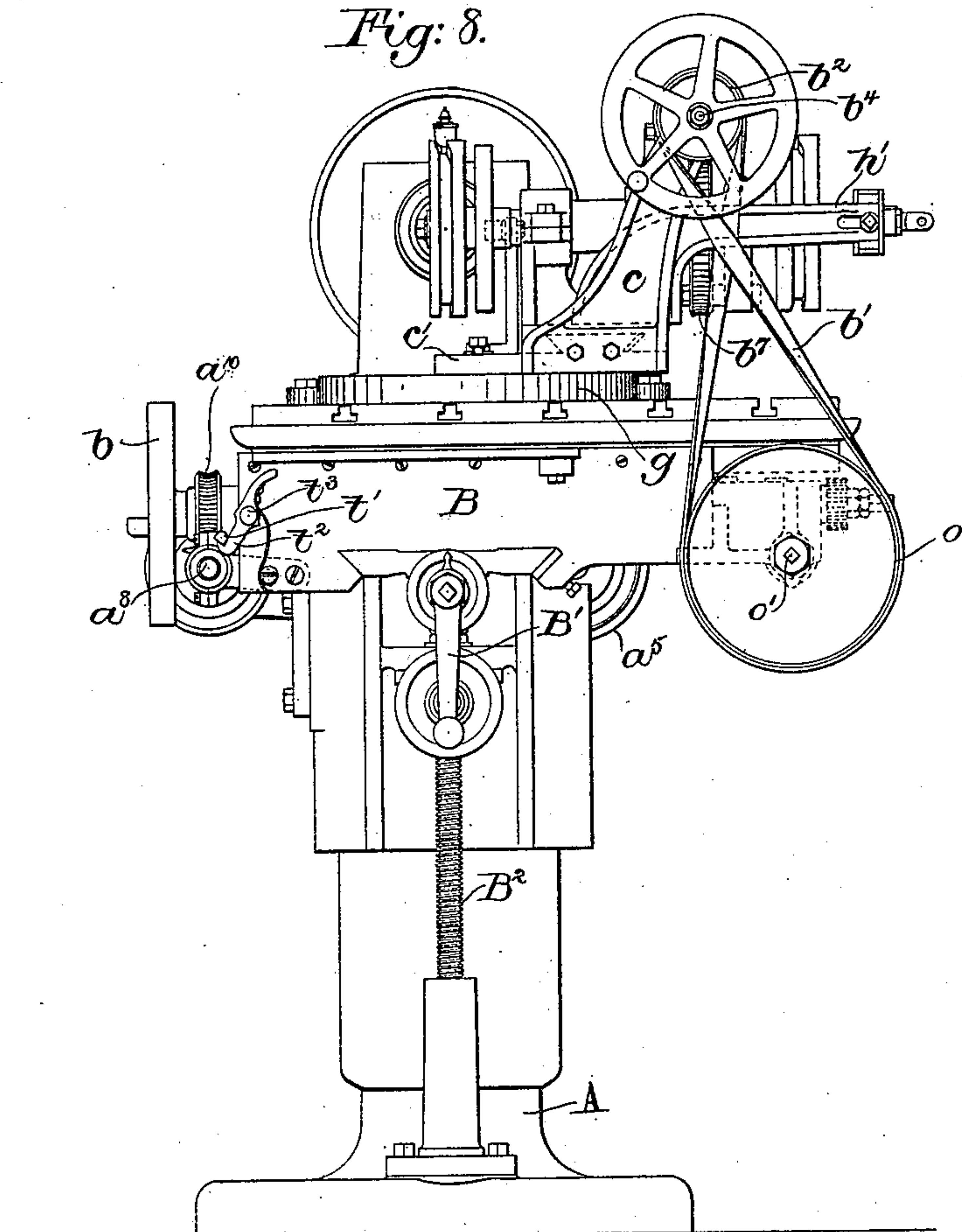
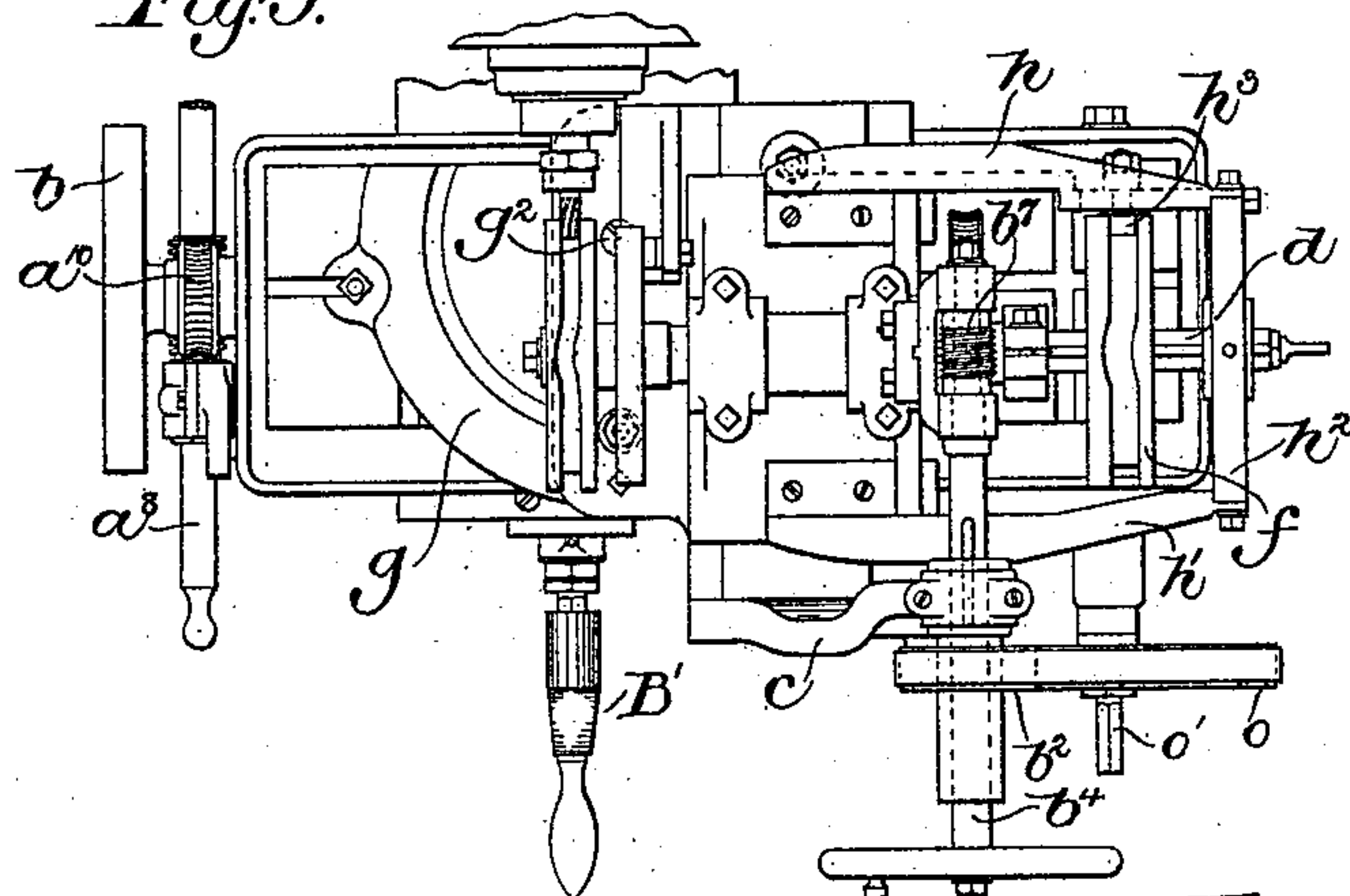


Fig. 9.



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UNITED STATES PATENT OFFICE.

ZACHARY T. FRENCH AND WILLIAM C. MEYER, OF BOSTON, MASSACHUSETTS.

CAM-CUTTER.

SPECIFICATION forming part of Letters Patent No. 471,381, dated March 22, 1892.

Application filed May 21, 1891. Serial No. 393,620. (No model.)

To all whom it may concern:

Be it known that we, ZACHARY T. FRENCH and WILLIAM C. MEYER, both of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Cam-Cutters, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention has for its object to construct a cam-cutter adapted for cutting face or peripheral cams, or both.

In accordance with this invention the tool-carrying spindle, having suitable means for operating it, is held in proper bearings, and a rotatable pattern-cam-carrying shaft is provided, upon which the cam to be cut is placed, said shaft being adapted to receive upon it either a pattern face-cam or a pattern peripheral cam, or both, as desired, and if a pattern peripheral cam is employed the said shaft is made longitudinally movable, and if a pattern face-cam is employed said shaft is made transversely movable with relation to the cutting-tool. An automatic feeding mechanism is provided for the pattern-cam-carrying shaft, which is operated by any power-driven shaft.

The cam-cutting devices are herein shown as applied to a milling-machine of ordinary construction, and said machine is in accordance with this invention adapted for cam-cutting, and also, by the removal of certain parts, for milling.

Our invention also comprehends many details of construction to be hereinafter referred to, and claimed at the end of this specification.

Figure 1 shows in plan view a cam-cutting machine embodying this invention, it being represented as adapted to cut face-cams; Fig. 2, a front elevation of a machine shown in Fig. 1; Fig. 3, a side view of the essential parts of the automatic feeding mechanism for the pattern-cam-carrying shaft; Fig. 4, an enlarged vertical longitudinal section of the pattern-cam-carrying shaft shown in Fig. 1, taken on the dotted line *x*, having thereon in addition a pattern peripheral cam; Fig. 5, a horizontal section of the bed supporting the parts carrying the cam to be cut; Fig. 6, a detail to be referred to; Fig. 7, a modification to be referred to; Figs. 8 and 9, side and plan

views of the cam-cutting devices shown in Fig. 1, placed in proper position to cut a peripheral cam.

The main frame-work *A* is of suitable construction to support the operating parts. The tool-carrying spindle *a* has its bearings in the frame-work and has mounted on it the belt-pulleys *a'*, by which said spindle is rotated, and also has fixed to it a belt-pulley *a²*, over which passes a belt *a³*, which belt also passes over a pulley *a⁴*, secured to a shaft carrying the pulleys *a⁵*, over one of which the belt *a⁶* passes, which also passes over a pulley *a⁷* of a set of pulleys secured to a shaft *a⁸*, carrying a worm *a⁹*, which engages a worm-wheel *a¹⁰*, secured to a shaft *a¹²*, arranged at right angles with relation to the shaft *a⁸*, said shaft *a¹²* having its bearings in the box-like frame or bed *B* on the main frame-work. The shaft *a¹²* has fixed to it a belt-pulley *b*, over which passes a belt *b'*, which passes over another belt-pulley *b²*, secured to a sleeve *b³*, having its bearings in a stand or support *c*, and in said sleeve *b³* the shaft *b⁴* is held by means of a spline *b⁵*, that it may be rotated by the sleeve *b³*, but may be moved longitudinally in said sleeve. The stand *c* is secured to a plate *c'*, having on it a dovetailed projection *c²*, on which slides a saddle *c³*, having uprights *c⁴* *c⁵* *c⁶* for the shaft *d*, which carries the cam to be cut. (Herein represented as at *d'*.) On the upright *c⁵* the bearing-block *c⁷* is secured, which affords a good and sufficient bearing for the shaft *b⁴*, which shaft carries the worm *b⁶*. Below the worm *b⁶* a worm-wheel *b⁷* is located, which is secured to a sleeve *b⁸* on the shaft *d*, and said worm-wheel carries a pin or stud *b⁹*, which passes freely through a hole in the crank-arm *b¹⁰*, secured to the shaft *d*, so that as the worm-wheel is revolved the shaft *d* will also be revolved.

The shaft *d* is adapted to receive upon it the former or pattern face-cam *e* and the former or pattern peripheral cam *f*. A stand *e'* is erected on the plate *c'*, which has a stud which enters the groove of the former or pattern cam *e*, and as said stand *e'* is stationary and the saddle carrying the cam-shaft *d* movable transversely on the slide *c²* said saddle will be moved as the cam-shaft is revolved in accordance with the shape of the cam-groove of the former or pattern cam *e*.

The bed B is arranged to be moved toward and from the cutting-tool by a screw-rod rotated by a hand-crank B', as shown in Figs. 2 and 7, and as usual in milling-machines, and, also, the bed B can be raised and lowered by the screw-rod B²⁰, turned by suitable beveled gears or otherwise, as usual in milling-machines.

The machine thus far described is adapted for cutting irregular grooves in the face of a disk to make a face-cam, and the operation is as follows: The former or pattern cam *e* of the particular shape desired is secured to the shaft *d*, the stud on the stationary stand *e'* entering the groove in said cam, a disk, such as *d'*, is placed on said shaft *d*, and the plate *c'*, supporting the saddle and carrying the shaft *d*, is moved toward the cutting-tool, which acts on the disk to cut or form the groove, and while the said cutting-tool is acting the disk *d'* is revolved slowly by the shaft *d*, and said disk is also moved transversely, according to the irregularities of the groove in the former or pattern cam *e*. On the bed B the plate *g* is secured, which has a circular slot or groove T-shaped in cross-section, as *g'*, and the plate *c'* is pivoted at *g*² to said plate *g*, and bolts 2 2 are utilized to secure the plate *c'* firmly in position on the grooved plate *g*, and to insure its correct position a pin 3 is provided, which enters a hole made in said plate *g* at the desired point or points.

When desired, the bolts 2 2 may be loosened and the pin 3 withdrawn, and the plate *c'*, with its saddle supported on it, swung around on the pivot *g*² into a position at an angle with relation to the cutting-tool, as shown in Figs. 7 and 8. When the parts are in this position, they are utilized to cut a peripheral cam, and to accomplish such results the former or pattern cam *f* on the shaft *d* is utilized.

Two stands *h h'* are erected on and secured to the saddle-plate *c*³, which stands support at their outer ends a cross-head or connecting-piece *h*², having a hole through it for an annular bearing-block *c*⁶, placed on the shaft *d* and recessed to receive a spline *c*²⁰ on said shaft. The annular bearing-block *c*⁶ is held in place by two flat rings *c*²¹ *c*²¹, secured to the cross or connecting piece *h*², one at each side, as best shown in Fig. 4, overlapping the said block *c*⁶. This bearing-block permits the shaft *d* to be moved freely longitudinally within it and rotates with said shaft. An eye *w* is swiveled to a screw-cap *w'*, which is screwed into the end of the shaft *d*, the flange of said cap preventing the removal of the spline *c*²⁰. A stud *h*³ is secured to the stand *h*, which enters the peripheral groove in the former or pattern cam *f*. As the shaft *d* is rotated by means of the worm-wheel *b*⁷, it will be moved longitudinally, following the irregularities of the peripheral groove in the pattern-cam *f*. When the saddle is turned into this position, the belt-pulley *b*² will be connected with the belt-pulley *o* by a short belt, as shown in Figs. 7 and 8. The belt-pulley *o*

is secured to a shaft *o'*, carrying a spiral gear *o*^x, which is engaged by a spiral gear *o*², secured to that end of the shaft *a*¹² opposite the worm-wheel *a*¹⁰, (see Fig. 5,) so that as the shaft *a*¹² is revolved the shaft *o'* will be revolved to rotate the shaft *b*⁴. Hence it will be seen that in each of the positions shown, whether for cutting face or peripheral cams, the feeding is automatic and is also accomplished by the employment of substantially the same mechanism.

When the machine is used for cutting face-cams, the shaft *d* will be in alignment with the tool-cutting shaft, and the belt-pulley *o* will at such time be useless and may be removed, and when the machine is used for cutting peripheral cams the shaft *d* will be at right angles with relation to the tool-cutting shaft and the belt-pulley *b* will be useless.

The machine is also arranged for ordinary milling, and the bed B is hence mounted on and adapted to be moved by the screw-rod B², which is herein represented as a sleeve, and as a means for rotating said screw-rod when it is desired to utilize it to move the bed B we have secured to the shaft *a*¹² a toothed gear, (see Fig. 5,) which engages the pinion *p*¹, secured to a shaft *p*², having its bearings in the frame-work, said shaft having fixed to it a pinion *p*³, which engages a pinion *p*⁴ on said screw-rod B². As the shaft *a*¹² revolves, the said screw-rod B², connected with it by the gearing, as described, will be revolved. When it is not desired to utilize the screw-rod B², we prefer that it shall remain at rest, and hence we remove the pinion *p*¹. Instead of employing the spiral gears *o*² *o*^x, bevel-gears may be employed, as represented in Fig. 7. The shaft *a*⁸, carrying the worm-wheel *a*⁹, is held in a bearing *t*, pivoted to the main frame-work, and said shaft has at its outer end a projection *t'*, which is engaged and held by a hook *t*², pivoted at *t*³ up into position for the worm to engage the worm-wheel. By moving the hook *t*² to release the projection *t'* the shaft will drop so that its worm will disengage the worm-wheel, and when in such position the shaft *a*¹² may be rotated rapidly by a hand-wheel to thereby facilitate presenting the cam to be cut to the cutting-tool.

We claim—

1. In a cam-cutter, the following instrumentalities, viz: a tool-carrying spindle, means for operating it, a rotatable and transversely-movable pattern-cam-carrying shaft, and automatic feed mechanism for said shaft, substantially as described.

2. In a cam-cutter, the tool-carrying spindle and means for operating it, and the rotatable and transversely-movable pattern-cam-carrying shaft, combined with feeding mechanism for said pattern-cam-carrying shaft, and a belt or equivalent connecting said feeding mechanism with a power-driven shaft, substantially as described.

3. In a cam-cutter, the tool-carrying spindle and means for operating it, and the rotatable

and transversely-movable pattern-cam-carrying shaft and a worm-wheel thereon, combined with a rotating and longitudinally-movable worm-shaft having a worm, and a belt or equivalent connecting said worm-shaft with a power-driven shaft, substantially as described.

4. In a cam-cutter, the tool-carrying spindle and means for operating it, and the rotatable and transversely-movable pattern-cam-carrying shaft, combined with a worm-wheel on said shaft, a worm engaging therewith, a rotatable and longitudinally-movable shaft bearing said worm, a shaft, as a^{12} , a belt or equivalent connecting said shaft with the worm-shaft, a worm-wheel on said shaft a^{12} , a worm engaging said worm-wheel, and a shaft bearing it adapted to be connected by a belt or equivalent with a power-driven shaft, substantially as described.

5. In a cam-cutter, a tool-carrying spindle and a rotatable and longitudinally-movable pattern-cam-carrying shaft, combined with an automatic feeding mechanism for said shaft, substantially as described.

6. In a cam-cutter, a tool-carrying spindle and a rotatable and longitudinally-movable pattern-cam-carrying shaft, combined with a feeding mechanism for said shaft, and a belt or equivalent connecting it with a power-driven shaft, substantially as described.

7. In a cam-cutter, a tool-carrying spindle and a rotatable and longitudinally-movable pattern-cam-carrying shaft, combined with a sleeve on said shaft, a worm-wheel on said sleeve, a worm engaging said worm-wheel, a shaft bearing said worm, and a belt connecting said worm-shaft with a power driven shaft, substantially as described.

8. In a cam-cutter, a tool-carrying spindle and means for operating it, and a rotatable and longitudinally-movable pattern-cam-carrying shaft, combined with a sleeve on said shaft and a worm-wheel on it, a worm engaging said worm-wheel, a shaft bearing it, a power-driven shaft, as a^{12} , the shaft o' , operated by it, and a belt or equivalent connecting the shaft o' with the worm-shaft, substantially as described.

9. In a cam-cutter, a tool-carrying spindle and means for operating it, and a rotatable, transversely, and longitudinally movable pattern-cam-carrying shaft, combined with a sleeve on said shaft, a worm-wheel secured to said sleeve, a longitudinally-movable and rotating shaft having a worm engaging said worm-wheel, and a belt or equivalent connecting said worm-shaft with a power-driven shaft, substantially as described.

10. In a cam-cutter, a tool-carrying spindle, a pattern-cam-carrying shaft, a pivoted support for said shaft, a plate to which said support is pivoted, and a bed supporting said plate, substantially as described.

11. In a cam-cutter, a tool-carrying spindle,

a pattern-cam-carrying shaft, a pivoted support for said shaft, a plate to which said support is pivoted, a bed supporting said plate, feeding mechanism for the said pattern-cam-carrying shaft, comprising a worm-wheel and worm, a belt-pulley on the worm-shaft, combined with a power-driven shaft, as a^{12} , a belt-pulley at one end and a gear at the other end, and a short shaft, as o' , a gear on it at one end, and a belt-pulley at the other end, substantially as described.

12. The tool-carrying spindle and means for operating it, and the bed B and screw-rod for moving it, combined with the power-driven shaft a^{12} , gear p on it, removable gear p' , shaft p^2 , gear p^3 , and gear p^4 , secured to said screw-rod, substantially as described.

13. The tool-carrying spindle and means for operating it, the bed B, and screw-rod B^2 , having a hole through it from end to end, combined with a power-driven shaft a^{12} , passing through the hole in said screw-rod, the gear p on said shaft, the removable gear p' , shaft p^2 bearing it, the gear p^3 on said shaft, and the gear p^4 , secured to the screw-rod, substantially as described.

14. In a cam-cutter, the rotatable and longitudinally-movable pattern-cam-carrying shaft, combined with a collar c^6 splined to it, a cross-piece having a hole through it in which said collar is placed, and means to hold the collar in the cross-piece that the shaft may be moved independently of it, substantially as described.

15. In a cam-cutter, the rotatable and longitudinally-movable pattern-cam-carrying shaft, the sleeve on it, the worm-wheel constituting a part of the feeding mechanism secured to said sleeve, the pin b^9 , carried by said worm-wheel, the arm b^{10} , secured to the shaft and having a hole through it in which said pin b^9 is freely movable, substantially as described.

16. In a cam-cutter, the pattern-cam-carrying shaft and automatic feeding mechanism for it, comprising the shaft a^{12} and worm-wheel on it, and the worm-shaft a^8 and movable bearing for it, and a locking device for holding said shaft a^8 in position, whereby its worm may engage the worm-wheel on the shaft a^{12} , substantially as described.

17. The tool-carrying spindle and means for operating it, the bed B, screw-rod B^2 , and gear on it, combined with another gear engaging the gear on the screw-rod, and a rotatable shaft carrying said gear, substantially as described.

18. The tool-carrying spindle and means for operating it, the bed B, and screw-rod B^2 , combined with a power-driven shaft arranged parallel to the screw-rod for transmitting the power from one to the other end of the bed, substantially as described.

19. In a cam-cutter, the rotatable and longitudinally-movable pattern-cam-carrying

shaft, combined with a collar *c*⁶ splined to it, a cross-piece having a hole through it in which said collar is placed, means to hold the collar in the cross-piece that the shaft may
5 be moved independently of it, and arms supporting said cross-piece, substantially as described.

In testimony whereof we have signed our

names to this specification in the presence of two subscribing witnesses.

ZACHARY T. FRENCH.
WILLIAM C. MEYER.

Witnesses:

GEO. W. GREGORY,
EDWARD F. ALLEN.