(No Model.)

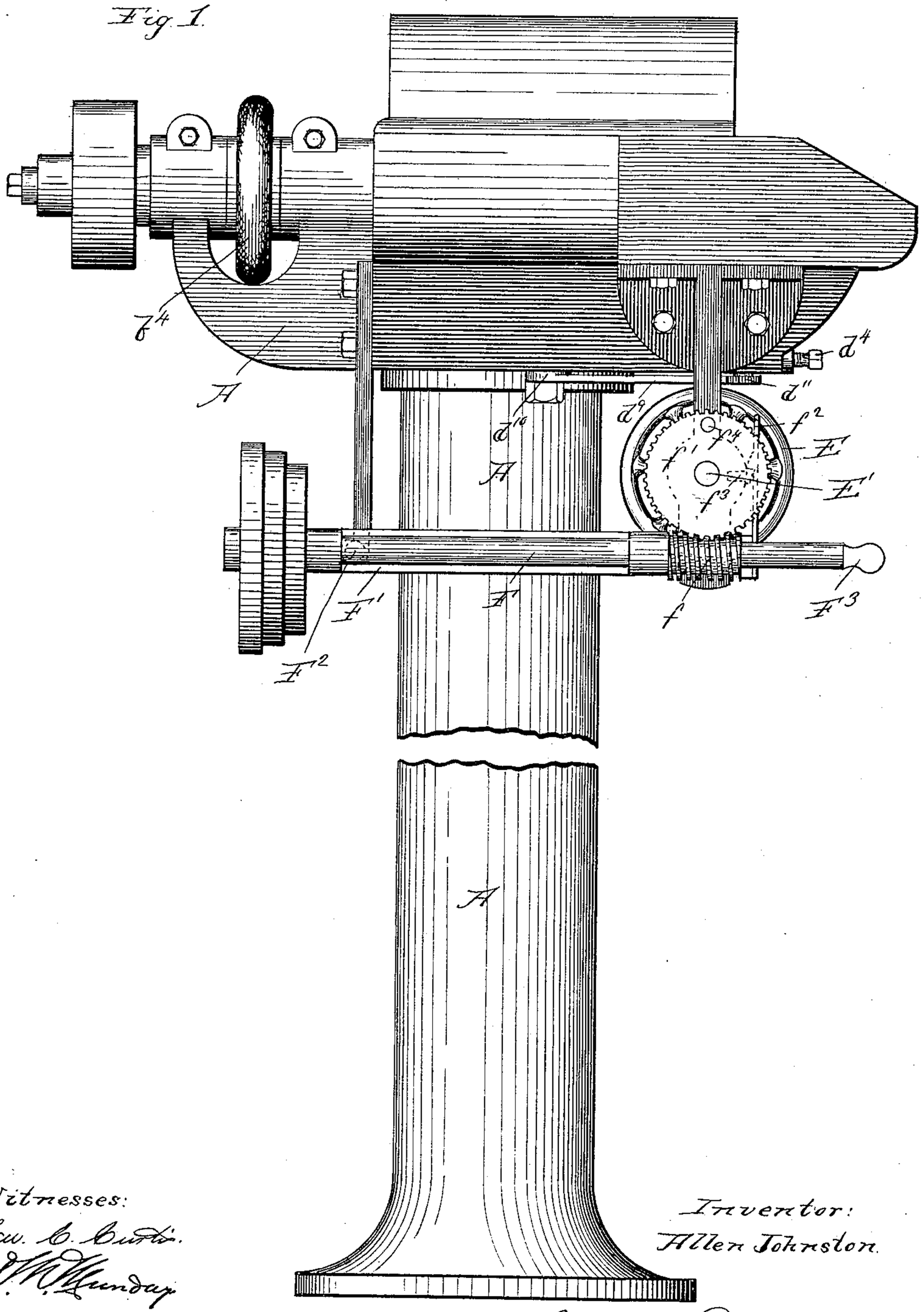
4 Sheets—Sheet 1.

A. JOHNSTON.

ART OF GRINDING CUTLERY.

No. 377,202. Patented Jan. 31, 1888.

Fig. 1.



Witnesses:
Sam. C. Curtis.
H. N. Munday

Inventor:
Allen Johnston.

By Munday, Evarts & Adcock

his Attorneys.

(No Model.)

4 Sheets—Sheet 2.

A. JOHNSTON.

ART OF GRINDING CUTLERY.

No. 377,202. Patented Jan. 31, 1888.

Fig. 2.

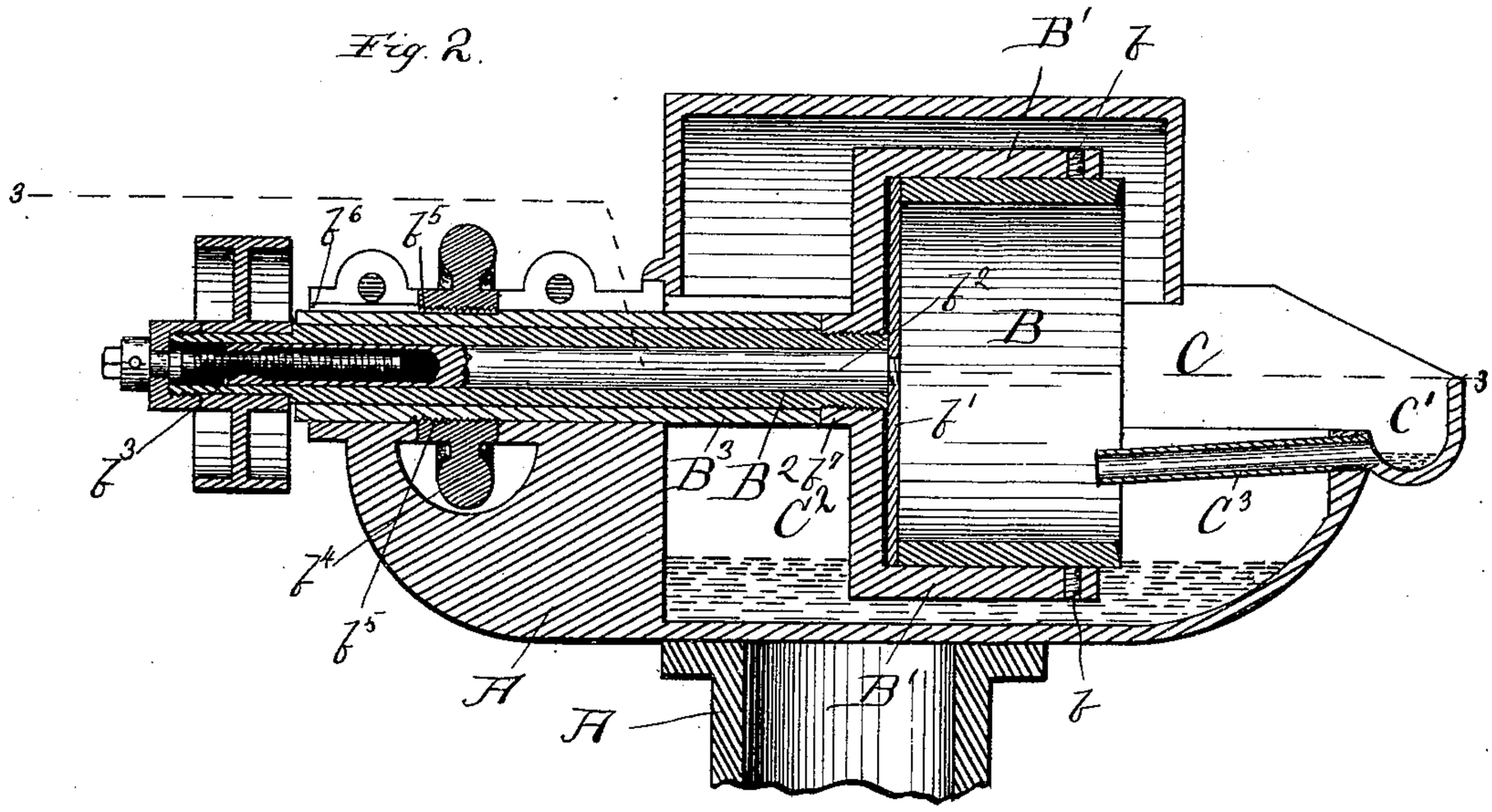
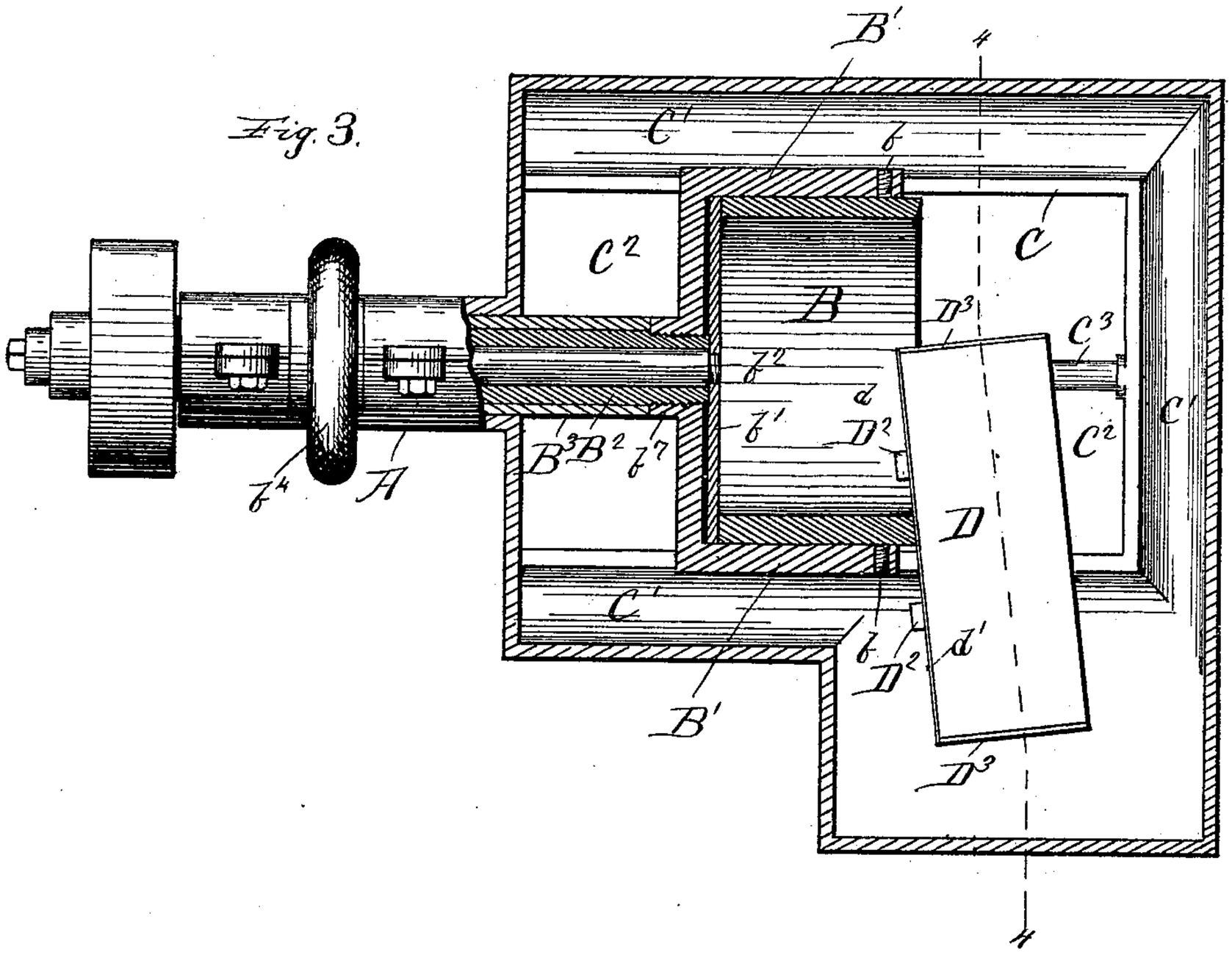


Fig. 3.



Witnesses:
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his Attorneys:

(No Model.) 4 Sheets—Sheet 3.

A. JOHNSTON.

ART OF GRINDING CUTLERY.

No. 377,202. Patented Jan. 31, 1888.

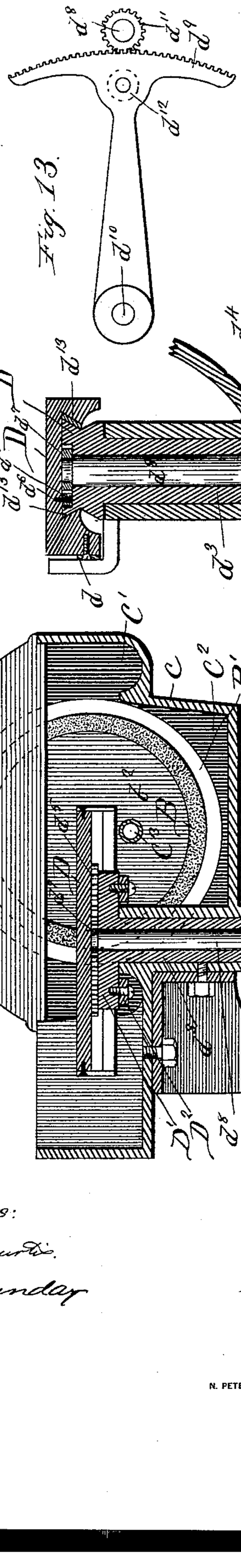

Fig. 1.

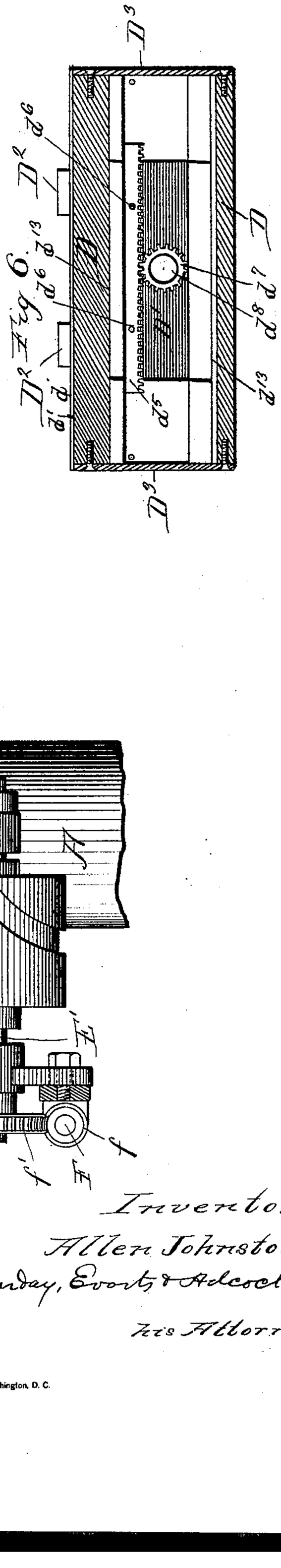

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses:
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Inventor:
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His Attorneys:

(No Model.) 4 Sheets—Sheet 4.

A. JOHNSTON.

ART OF GRINDING CUTLERY.

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Fig. 9.

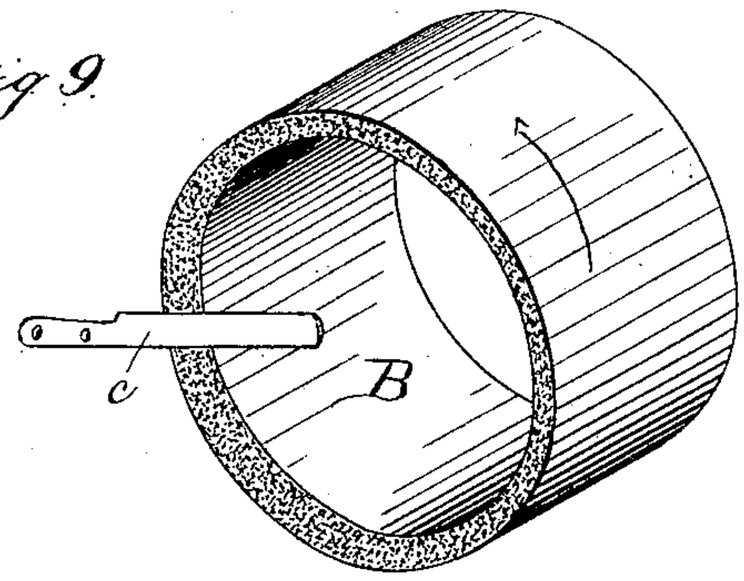


Fig. 5.

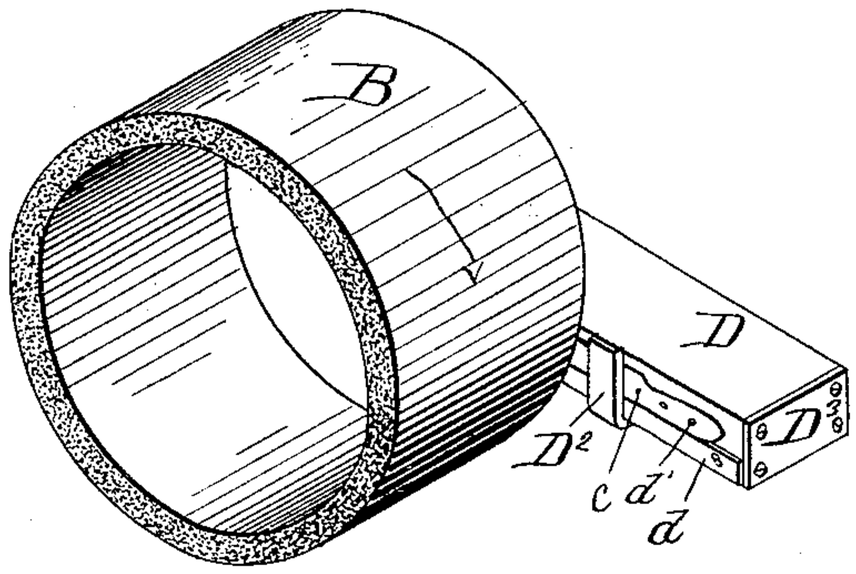


Fig 7.

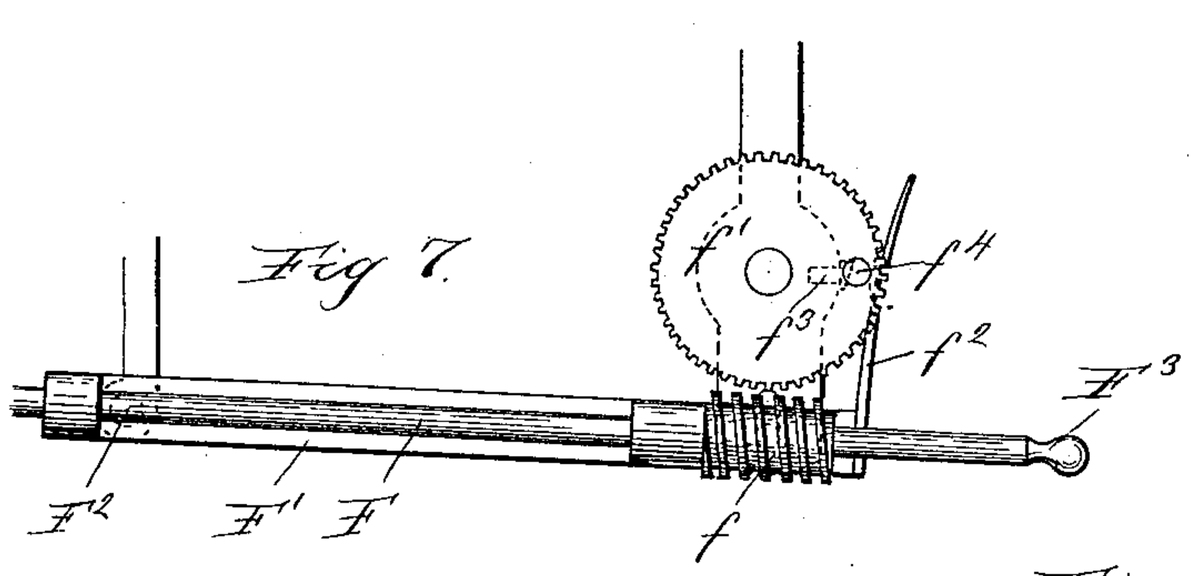
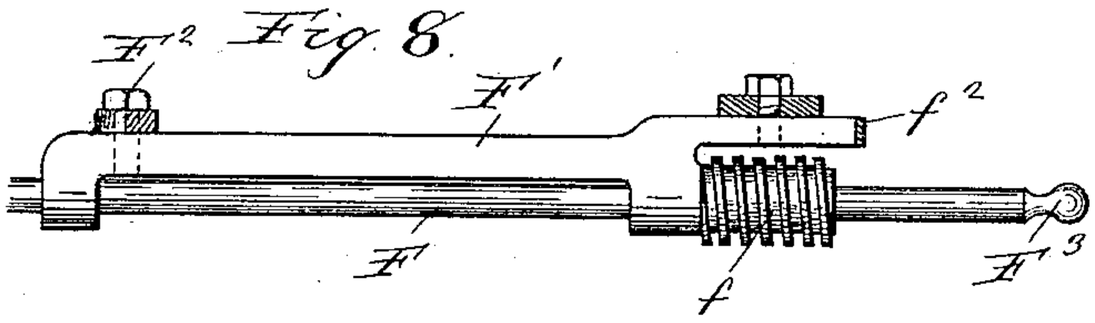
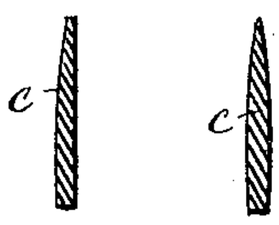


Fig 8.



Figs. 11 + 12.



Witnesses:
Lew. C. Curtis.
A. M. Munday

Inventor:
Allen Johnston.
By Munday, Evarts & Adcock
His Attorneys.

UNITED STATES PATENT OFFICE.

ALLEN JOHNSTON, OF OTTUMWA, IOWA.

ART OF GRINDING CUTLERY.

SPECIFICATION forming part of Letters Patent No. 377,202, dated January 31, 1888.

Original application filed July 28, 1887, Serial No. 245,473. Divided and this application filed December 30, 1887. Serial No. 259,387. (No model.)

To all whom it may concern:

Be it known that I, ALLEN JOHNSTON, a citizen of the United States, residing in Ottumwa, in the county of Wapello and State of Iowa, have invented a new and useful Improvement in the Art of Grinding Cutlery, of which the following is a specification.

My invention relates to improvements in the art of grinding cutlery or other articles which require to have a convex surface.

The blades of table-knives are usually and preferably ground with convex curved instead of flat or plane surfaced sides. Heretofore these knives have usually been ground upon the outside cylindrical surface of a grindstone or emery-wheel the thickness or width of which is equal or about equal to the length of the knife-blade, the knife being held by the workman about parallel to the axis of the stone, and the convexity being given to the side of the knife by the workman continually rocking the same on the stone as it is being ground. In this method of grinding the knife is and can be given little if any reciprocating movement across the face of the stone, and as a consequence, owing to the inequalities in the hardness, &c., of the stone at different parts and the varying amount of grinding required at different points along the length of the knife, the stone or emery will soon wear uneven and its periphery become more or less wavy or made up of a series of high and low bands. In practice, therefore, the workman is required to stop grinding every hour or two and dress his stone by chopping or hacking its peripheral surface all over with a suitable instrument, and thus filling it with a series of transverse grooves, cavities, or hackles, the hackles being made closer and deeper in the high parts of the stone and fewer and lighter in the low parts, so that the stone may again receive an approximately true cylindrical surface. This method of grinding is not only comparatively slow, laborious, and expensive, requiring skilled labor, but it also results in quite a proportion of the stone being wasted, hacked, or chopped away instead of utilized.

The object of my improvement is to provide an improved method or process of grinding knives or other articles with a convex surface and an automatic machine for practicing the same.

My invention consists in grinding knives or other articles with a convex surface by feeding the knife or article across the inside conical surface of a revolving annular or ring grinder. The degree of convexity given to the surface of the article may be varied or regulated by varying the inclination at which the knife is held to the axis of the annular stone. If the article is held parallel to the axis of the stone, it will have the full convexity of the inside curved surface of the annular stone. If it is held at right angles to the axis of the stone, it will of course be ground on a plane or flat surface, and at intermediate inclinations the degree of convexity will be inversely proportioned to the angle. The knife or article may be reciprocated or fed across the internal edge of the cylindrical revolving grinder by hand or by suitable machinery. In practicing my improved process I prefer, however, to employ an automatic machine or device for feeding the knife or article across the internal edge of the hollow cylindrical grinder, as the work may be thus done not only with greater rapidity, but also with greater uniformity.

To more fully illustrate and explain my invention, I have shown in the accompanying drawings, which form a part of this specification, a machine suitable for use in practicing my invention.

In said drawings, Figure 1 is a side elevation of such machine. Fig. 2 is a central vertical longitudinal section. Fig. 3 is a horizontal section on line 3 3 of Fig. 2. Fig. 4 is a vertical cross-section on line 4 4 of Fig. 3. Fig. 5 is a detail perspective view of the hollow stone and inclined reciprocating work-holder. Fig. 6 is a detail horizontal sectional view showing the work-holder and the means for reciprocating the same. Figs. 7 and 8 are detail views illustrating the operation of the work-holder-reciprocating mechanism. Fig. 9 is a detail perspective view of the hollow grinder and the knife being ground thereon. Fig. 10 is a cross-section of the reciprocating work-holder and its guideway. Figs. 11 and 12 are cross-sections of the knife, the former showing one side ground and the latter both. The de-

gree of convexity is exaggerated. Fig. 13 is a detail plan view of the segment and gear for operating the knife-feed slide.

In said drawings, A represents the frame of the machine, which may be of any suitable construction.

B is a hollow ring, rim, or cup-shaped grinder. This grinder may be made of stone, emery, or other suitable material. The grinder may, if desired, have one end or head, in which case the grinder will be cup-shaped; but I preferably make the grinder in the form of an annulus or ring.

B′ is a revolving holder in which the hollow grinder B fits, and is secured by the set-screws *b*. The stone or emery holder B′ is preferably made cup-shaped, or with a closed end, and is secured, by screw-threads or otherwise, upon a hollow revolving shaft, B^2, which is journaled in a sleeve, B^3, mounted upon the frame of the machine. The annular grinder B is adjusted or pushed out of its holder B′ as it wears away by means of a follower-disk, *b*′, which fits against the back end or edge of the grinder, and is secured upon the adjustable rod b^2, which fits in the hollow shaft B^2, and is adjusted by means of the set-screw b^3, which works in the hollow threaded end of said rod. The sleeve B^3 also has a slight sliding movement in its bearing on the frame of the machine for the purpose of adjusting the pressure of the grinder against the work or article being ground. This adjustment is effected by means of the threaded hand-wheel b^4, the threads of which work in threads b^5 cut upon the sleeve B^3. The sleeve B^3 is kept from revolving by a key, b^6, or other suitable means. The emery-holder B′ is furnished with a hub, b^7, of the same exterior diameter as the sleeve B^3, and fits snugly against the end of said sleeve. The interior of this hub is threaded closely upon the hollow shaft B^2, so that the grit or grindings worn from the stone cannot get into the bearing or journal of the shaft B^2. The follower *b*′ and its rod b^2 close the end of the hollow shaft B^2, and prevent the grit to any appreciable extent working its way through the same, and, moreover, the centrifugal action tends to throw such particles away from the axis.

C represents the hollow case which incloses the grinder B and its holder B′, and also constitutes the upper and lower water receptacles or troughs, C′ C^2. The water in the lower receptacle, C^2, is maintained at such depth that the outer periphery of the grinder B or its holder B′ will turn in the water, and by its centrifugal action throw or carry the water up so that it will strike upon the inside of the case C and fill the water receptacle or trough C′. A spout or conductor, C^3, leads from this upper trough, C′, and delivers the water upon the interior peripheral surface of the hollow or cup-shaped wheel B. As the water is thus delivered upon the inside of the grinder, the centrifugal force of the revolving grinder tends to spread it in a thin film over the inside surface of the wheel, and to cause it to flow out in an annular sheet over the grinding edge or rim of the annular stone, and thus supply the water continuously and evenly to the stone at the very point where the work is being done. By this means I am enabled to effectually prevent the heating of the article being ground, however rapidly the stone may revolve, and also to facilitate the work.

It is obvious that if the knife or article, *c*, being ground were to be held against the inside surface of the revolving stone, and about parallel to the axis of the stone, the convexity given to the ground surface of the knife would be the same as the curve of the stone. In grinding cutlery I in practice usually employ a hollow stone about a foot in diameter. Such a stone would give much too great a degree of convexity to the knife if the knife should be held parallel or nearly parallel to the axis of the stone, and if the article were so held the annular stone would wear thinner and thinner, and it would be difficult to utilize all or nearly all of the material of the stone. By holding and reciprocating the knife or article at a greater or less inclination across the rim or edge of the stone, any degree of convexity desired may be given to the face of the article ground from the full curve of the stone to a flat or plane surface. By grinding the article upon the inclined or conical surfaced end or edge of the annular stone nearly the whole material of the stone may be utilized.

D represents the inclined reciprocating work-holder upon which the work—knife or other article—being ground is held and supported, and by which it is reciprocated across the conical surface of the annular stone. This work-holder, as shown in the drawings, is specially adapted for holding table cutlery or knives. The holder, however, may be readily adapted to hold other articles. The holder is provided with a longitudinal ledge, *d*, against which the back of the knife rests, and with a pin or lug, *d*′, to enter one of the handle-holes in the handle of the knife. The holder is further provided with a hook or clamp, D^2, to prevent the knife falling off the ledge when not being pressed against the grinder. The work-holder D is mounted and reciprocates upon a suitable guide, D′. The guide D′ is mounted adjustably or pivotally upon the frame of the machine by means of its hollow pivot d^3 and set-screw d^4, so that the inclination of the guide to the axis of the revolving grinder may be varied or adjusted as desired. The work-holder D is reciprocated upon its guide D′ by means of a rack, d^5, secured to said holder by screws d^6 and a gear, d^7, on the shaft d^8, which meshes with said rack. The shaft d^8 is revolved by means of a segment, d^9, pivoted at d^{10} to the frame of the machine, and which meshes with a gear, d^{11}, on the shaft d^8. The pivoted segment d^9 is furnished with a pin or friction-roller, d^{12}, and is oscillated back and forth by a grooved cam, E, on the shaft

E'. The shaft E' is driven by a worm, *f*, on the shaft F, which meshes with a gear, *f'*, on the shaft E'. The shaft F is journaled in a sleeve, F', pivoted at F^2 to the frame of the machine. The shaft F is furnished with a driving-pulley on its end and is driven by a belt. The sleeve F' is furnished with a handle, F^3, at its outer end, by which the worm may be raised into engagement with the gear *f'*. The sleeve F' is further provided with a spring pawl or catch, f^2, which engages a corresponding pawl or notch, f^3, upon the frame of the machine, and serves to hold the worm *f* and gear *f'* in engagement until the gear *f'* has made one complete revolution. At each complete revolution of the gear *f'* a pin or lug, f^4, thereon strikes the spring-pawl f^2 and disengages said pawl from the catch f^3, and thus permits the worm *f* to drop out of engagement with its gear *f'*. At each complete revolution of the gear *f'* the cam E of course makes one revolution, and the knife-holder is reciprocated back and forth across the beveled rim or edge of the hollow or cup-shaped grinder B.

If desired, the mechanism may be readily arranged to cause the knife-holder to make two or more or any desired number of reciprocations across the hollow grinder by simply changing the shape of the cam-groove E. In grinding cutlery or table-knives, however, I have found one complete reciprocation of the knife and knife-holder to be ordinarily sufficient for each knife. As soon as the worm *f* is thus disengaged from the gear *f'*, the knife-holder ceases to reciprocate, and while it is thus stationary the operator removes the knife, one side of which has been ground, and places another knife in the holder, and then by lifting on the handle F^3 he raises the worm *f* into engagment with its worm-gear *f'*.

It will be observed from the arrows that the stone revolves in the direction to press or force the back of the knife against the longitudinal ledge *d* on the holder D. If the stone were to revolve in the opposite direction, it would tend to raise or throw the knife out of its holder, and as it is also desirable to grind the knife with its edge forward in respect to direction of motion of the stone, I in practice grind one side of the knife upon one machine, and the other or opposite side of the knife upon another machine, the two machines being duplicates of each other, excepting that the knife-holders are arranged at the opposite ends of the annular stone.

For the purpose of protecting the guide or slide way D' of the reciprocating work-holder D and its rack d^5 and gear d^7, I make the guide groove or way d^{13} in the under face of said holder and of a dovetail shape, as indicated clearly in Fig. 10, thus giving the holder D an inverted-box shape, the ends of which are also closed by plates D^3 D^3. The rack d^5 and d^7 are thus also protected and covered by the box form of the sliding holder D, the gear d^7 being inclosed between the slide and its guide D'.

An angle-arm, D^2, is secured to the frame of the machine, and serves in a measure to hold the knife or work in place on its holder D. The ledge *d*, upon which the knife rests, should be made of hardened steel and separate from the knife holder slide, being secured thereto by screws, as indicated in the drawings.

In practice I usually employ hollow cylindrical emery-grinders, the same being cast or made in the form of hollow cylinders with square ends. The end of the same upon which the grinding is done will soon assume a bevel or conical surface, corresponding to the inclination at which the knife-holder and knife thereon are held and reciprocated in respect to the axis of the grinder. It is not necessary, however, that the grinder be made in the form of a hollow cylinder. It may be in the form of a hollow cone or dish shape. In such case, however, it is obvious that as the grinder wears away and the diameter of its bevel grinding-surface becomes less and less the inclination at which the work is held to the axis of the grinder will need to be varied if it is desired to give the same degree of convexity to the ground surface. If the grinder is made in the form of a hollow cup, the annular rim or ring holder B' will not be required, as in such case the stone may be secured in the ordinary manner upon the revolving shaft. If the disk or follower *b'* (indicated in Fig. 2) were made integral with the stone B, it would represent the head or bottom of a cup-shaped grinder.

I do not herein claim the machine which I have shown and described for the purpose of better explaining my invention, as that forms the subject-matter of my original application No. 245,473, filed July 28, 1887. This application is filed as a division of said application.

I claim—

1. The process or improvement in the art of grinding cutlery or other articles with a convex surface, consisting in feeding the article across the internal edge of a cylindrical revolving grinder, substantially as specified.

2. The process or improvement in the art of grinding cutlery or other articles with a convex surface, consisting in feeding the article across the internal edge of a cylindrical revolving grinder and adjusting the degree of convexity of the ground surface by adjusting the inclination of the line of feed of the article relative to the axis of the grinder, substantially as specified.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALLEN JOHNSTON.

Witnesses:
J. T. HACKNORTH,
A. G. HARROW.