(No Model.) 6 Sheets—Sheet 1.

A. JOHNSTON.

APPARATUS FOR GRINDING CUTLERY.

No. 504,387. Patented Sept. 5, 1893.

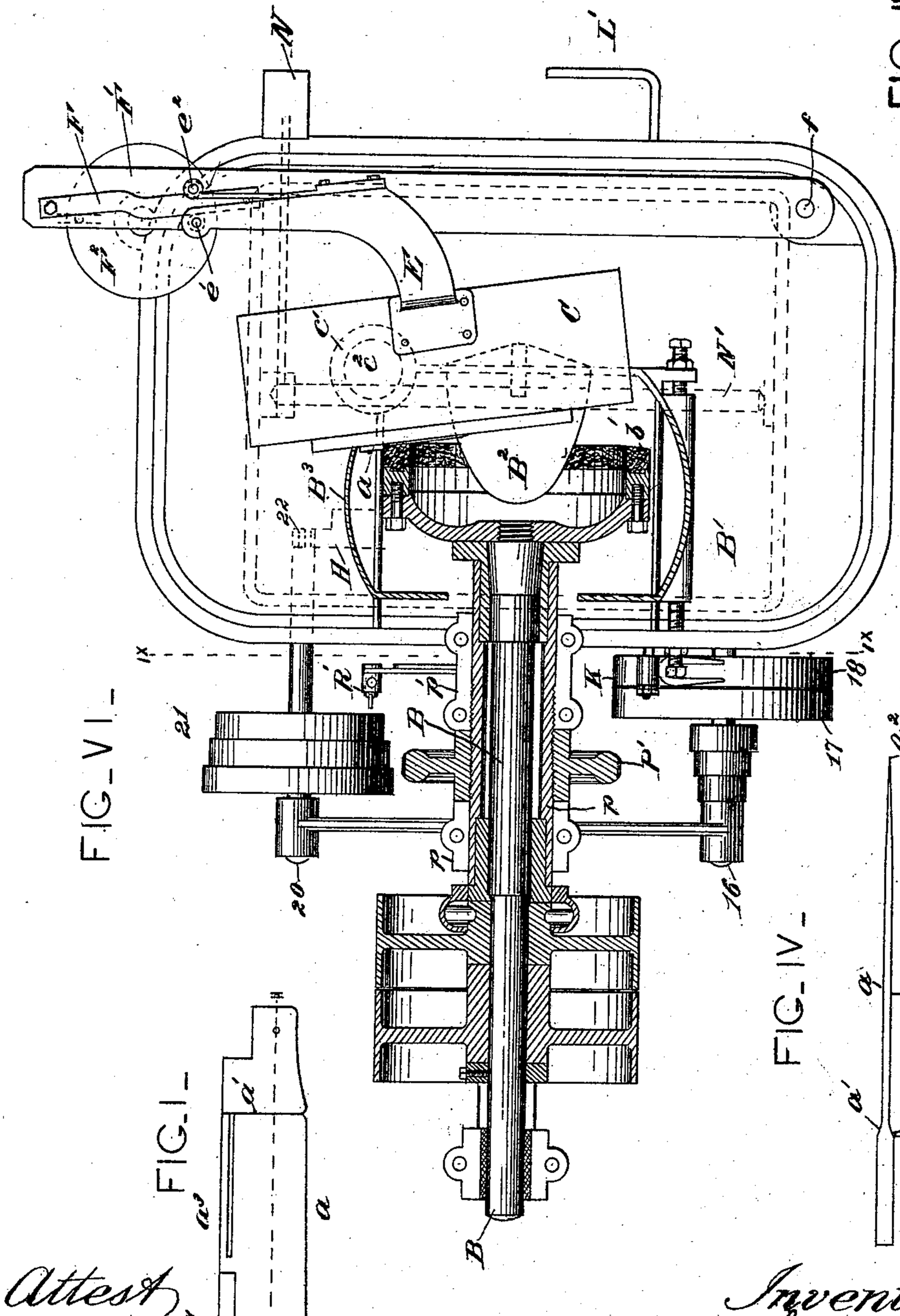

FIG. VI.

FIG. II.

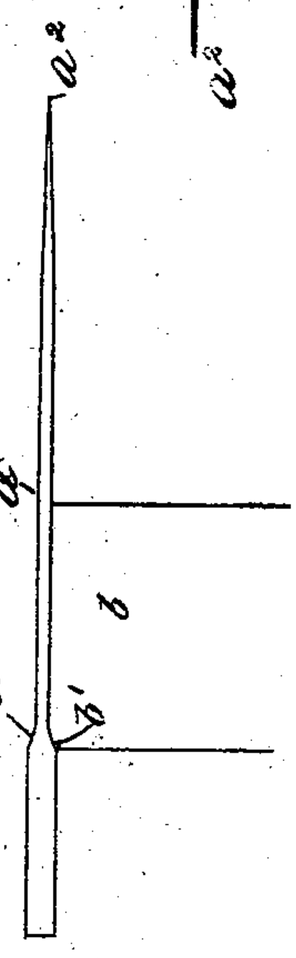

FIG. IV.

FIG. I.

FIG. III.

Attest

Arthur A. Ebb.

Geo. Lewis.

Inventor:
Allen Johnston,
by Howson & Sawyer,
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(No Model.) 6 Sheets—Sheet 2.

A. JOHNSTON.

APPARATUS FOR GRINDING CUTLERY.

No. 504,387. Patented Sept. 5, 1893.

FIG. VIII.

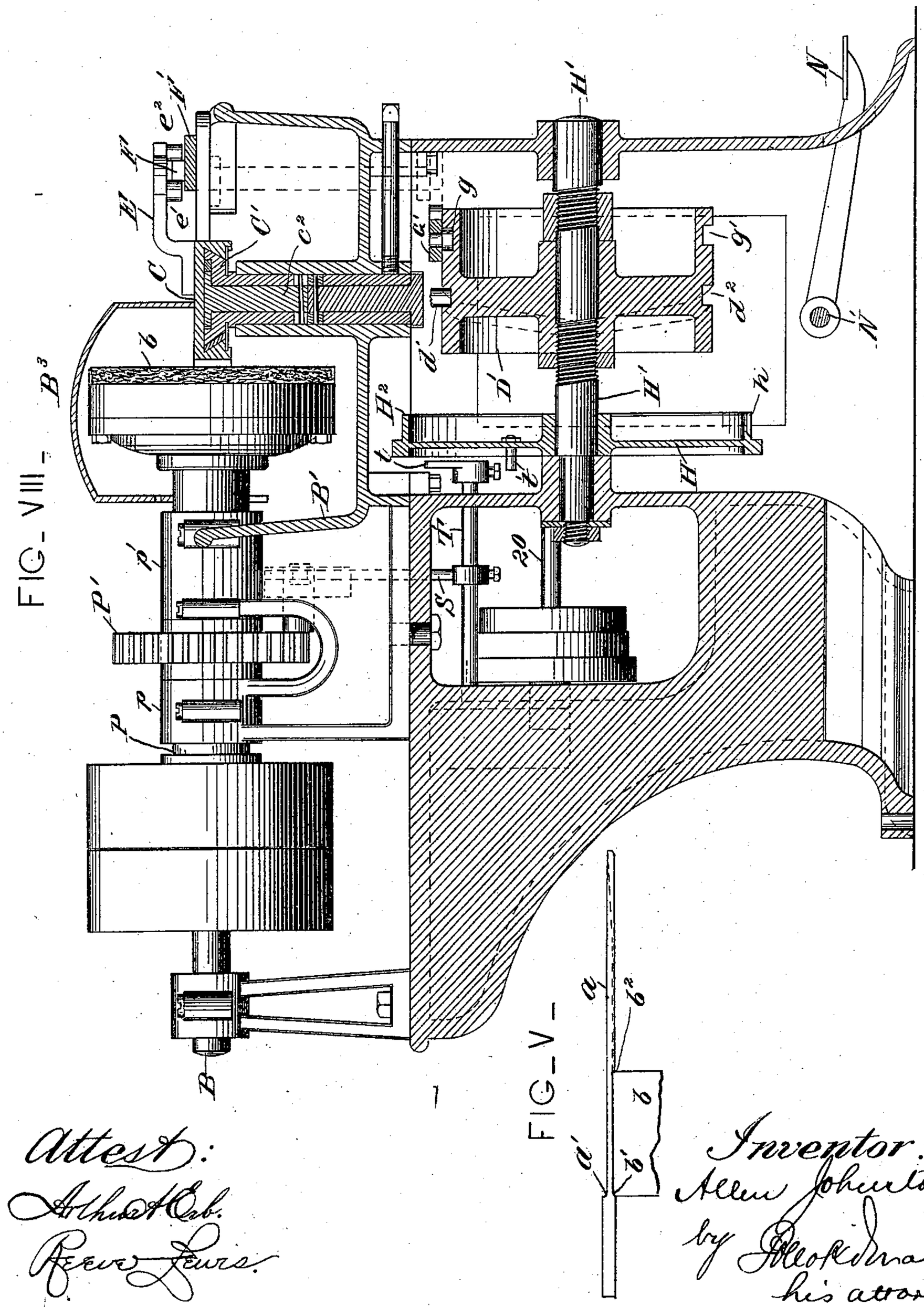

FIG. V.

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(No Model.) 6 Sheets—Sheet 3.

A. JOHNSTON.

APPARATUS FOR GRINDING CUTLERY.

No. 504,387. Patented Sept. 5, 1893.

FIG. XVI.

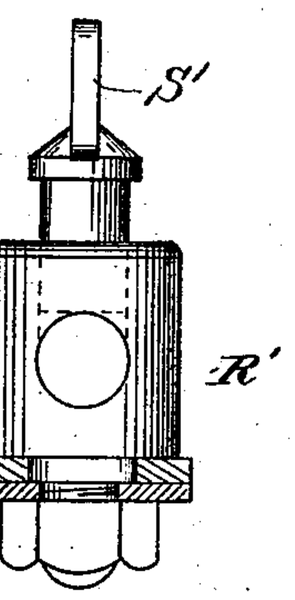
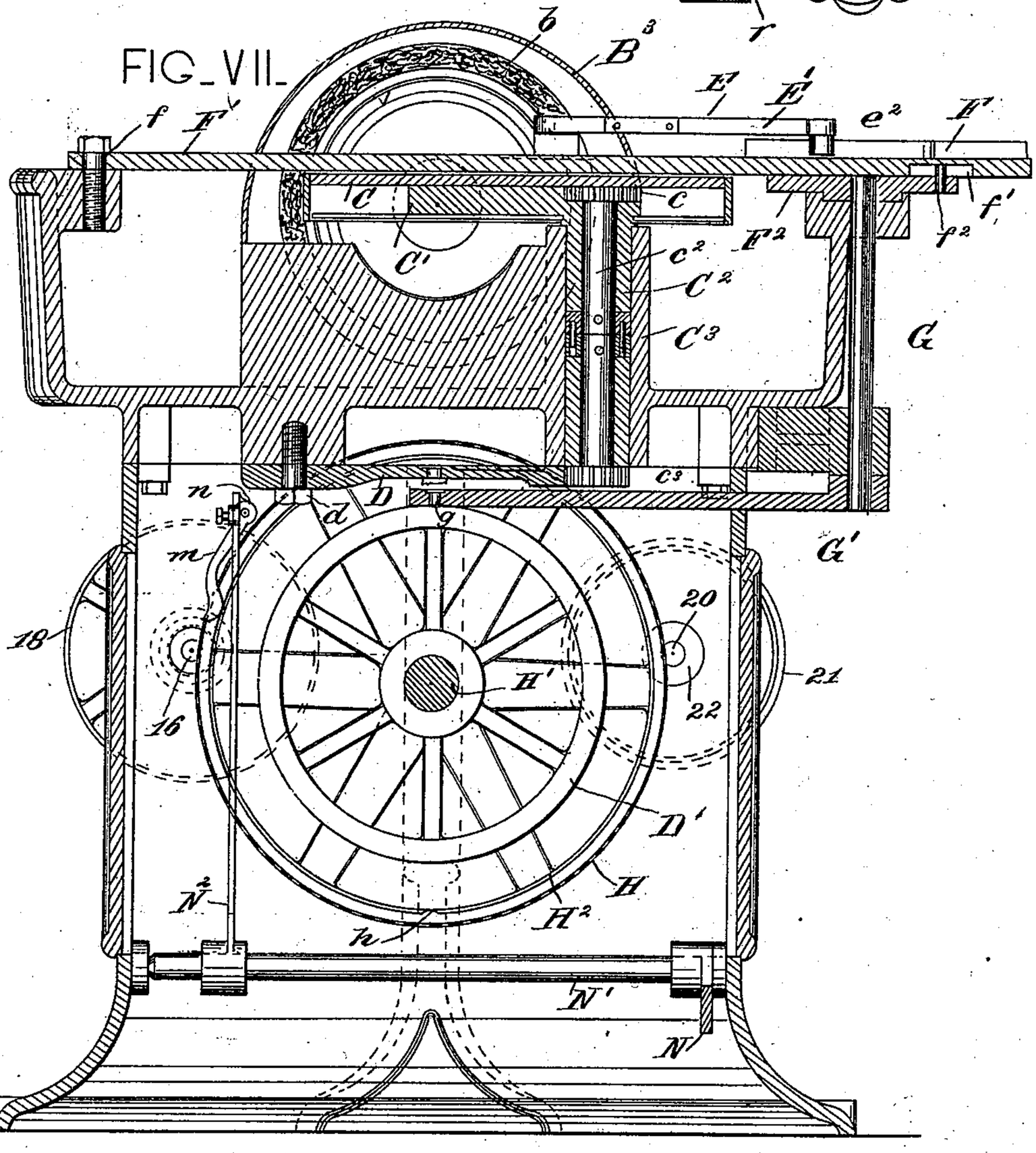


FIG. VII.



Attest:
Arthur A. Eby.
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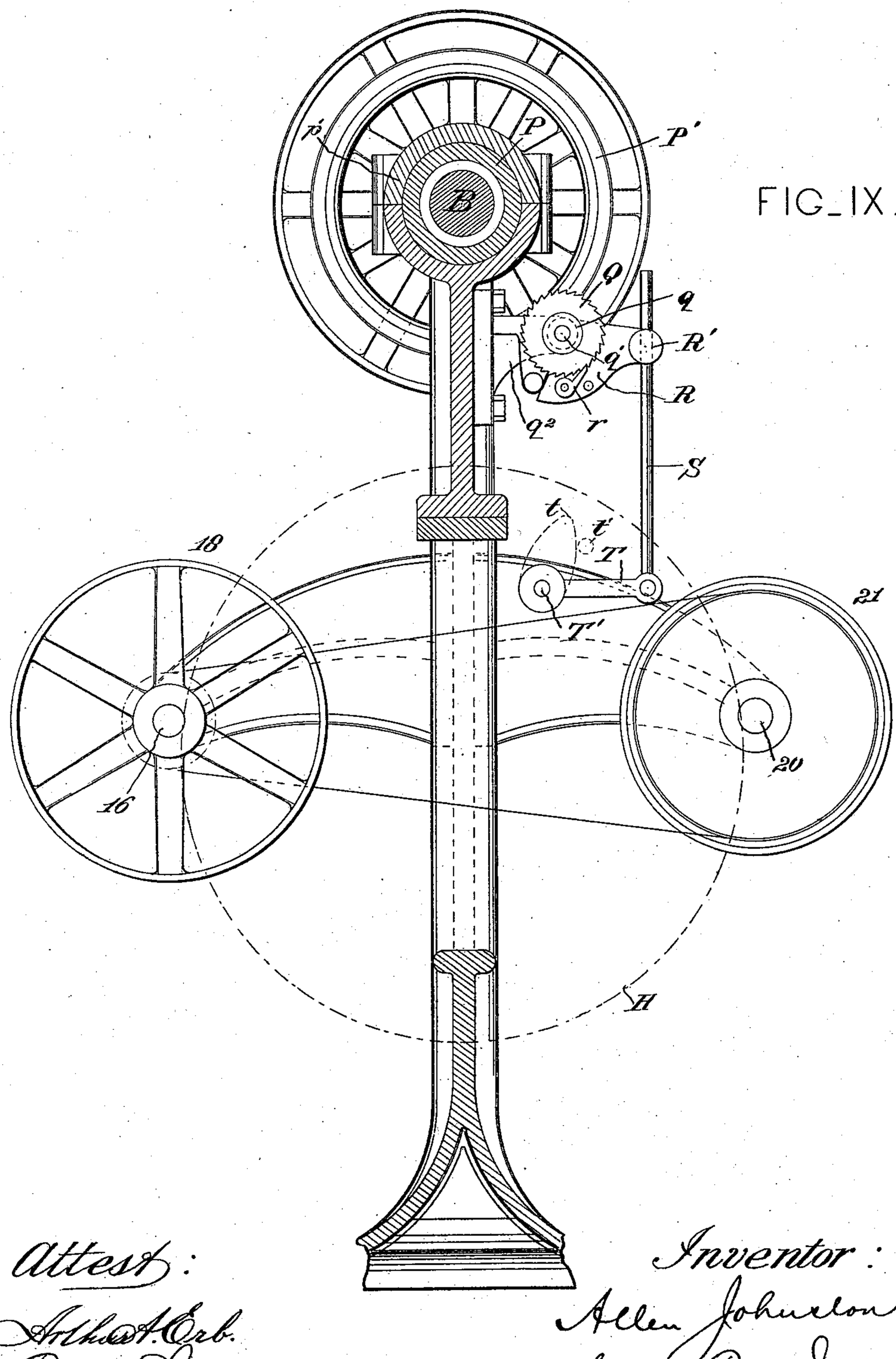
(No Model.) 6 Sheets—Sheet 4.

A. JOHNSTON.

APPARATUS FOR GRINDING CUTLERY.

No. 504,387. Patented Sept. 5, 1893.



FIG_IX_

Attest:
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(No Model.) 6 Sheets—Sheet 5.

A. JOHNSTON.

APPARATUS FOR GRINDING CUTLERY.

No. 504,387. Patented Sept. 5, 1893.

FIG. XIV.

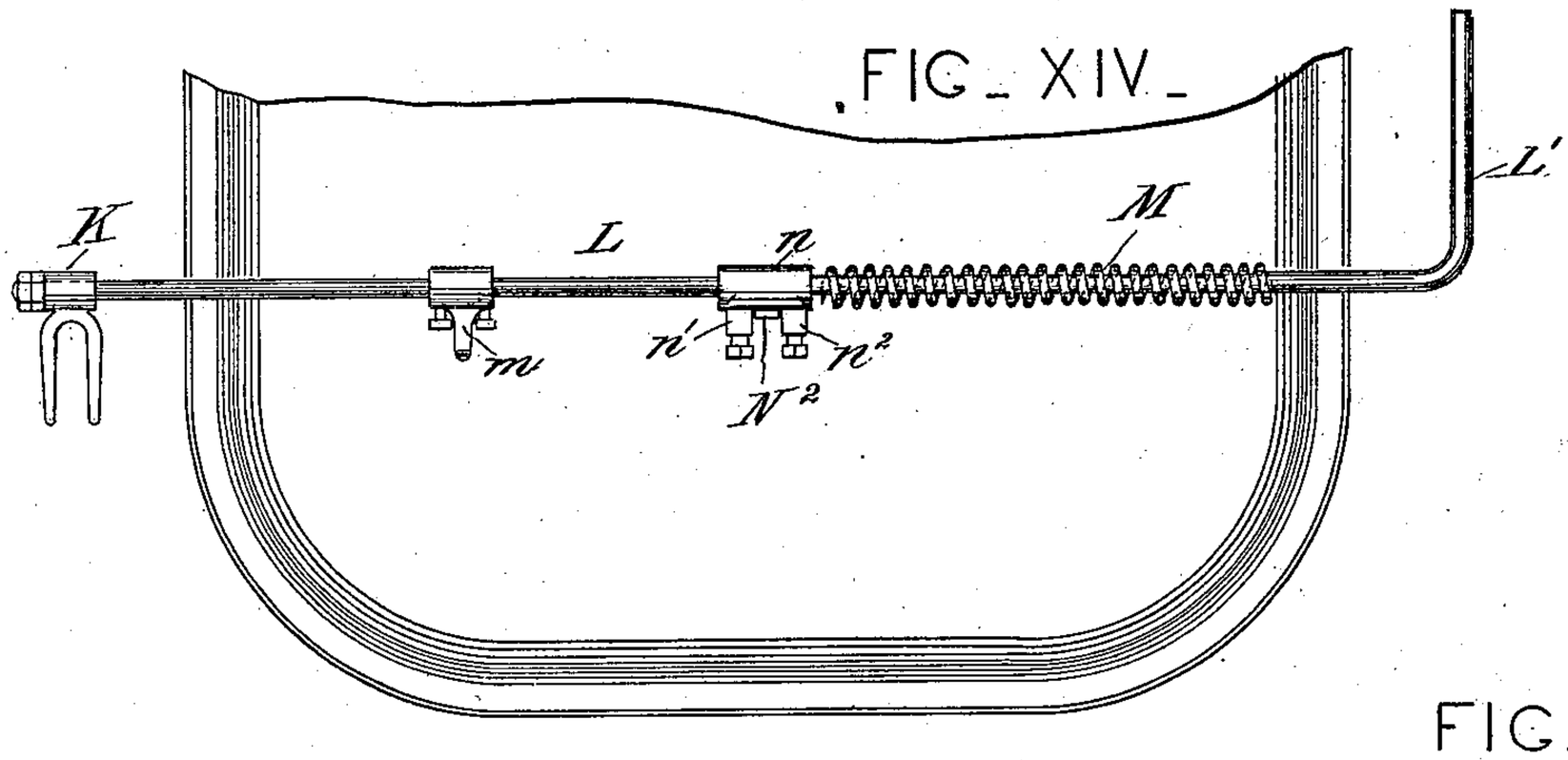


FIG. X.

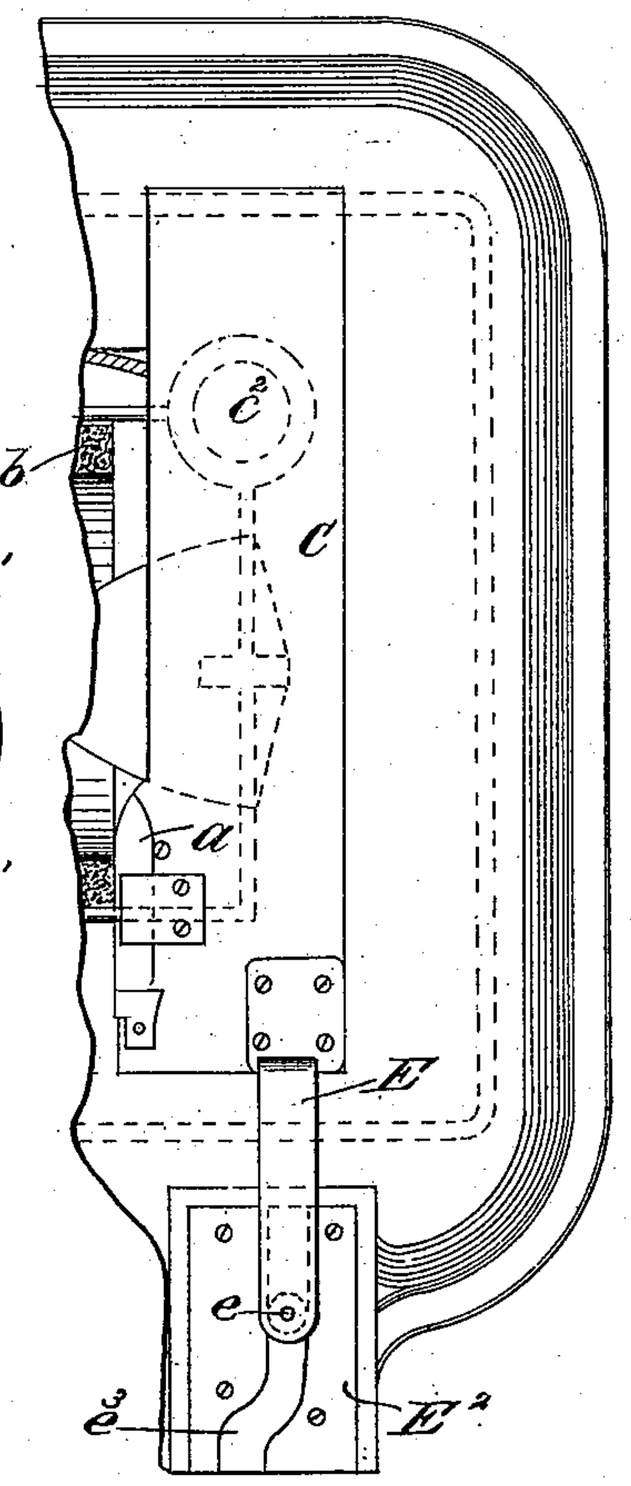
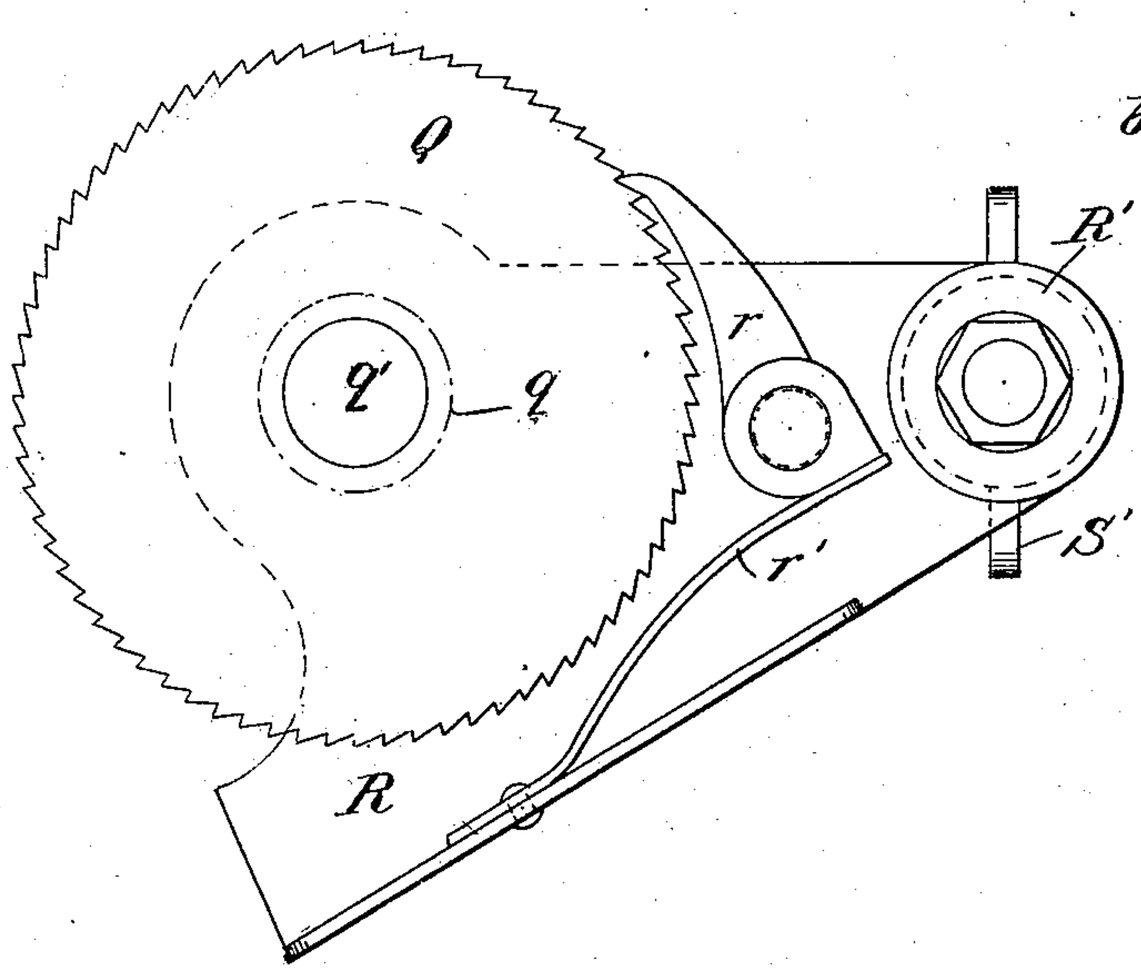


FIG. XV.



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(No Model.) 6 Sheets—Sheet 6.

A. JOHNSTON.

APPARATUS FOR GRINDING CUTLERY.

No. 504,387. Patented Sept. 5, 1893.

FIG. XI.

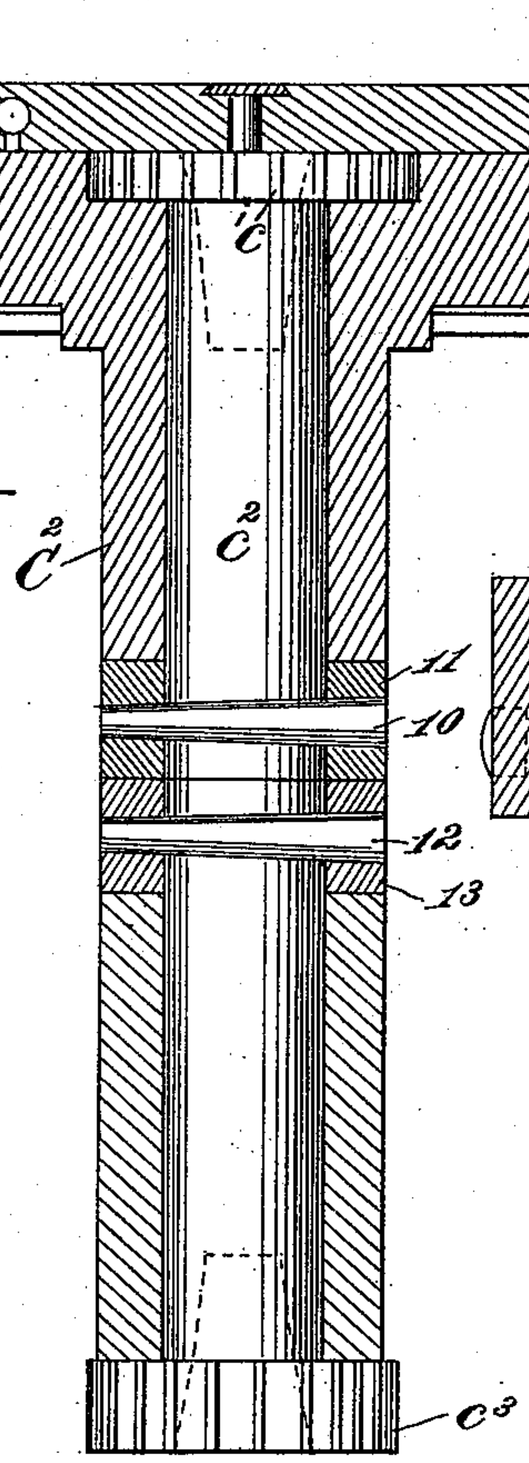


FIG. XII.

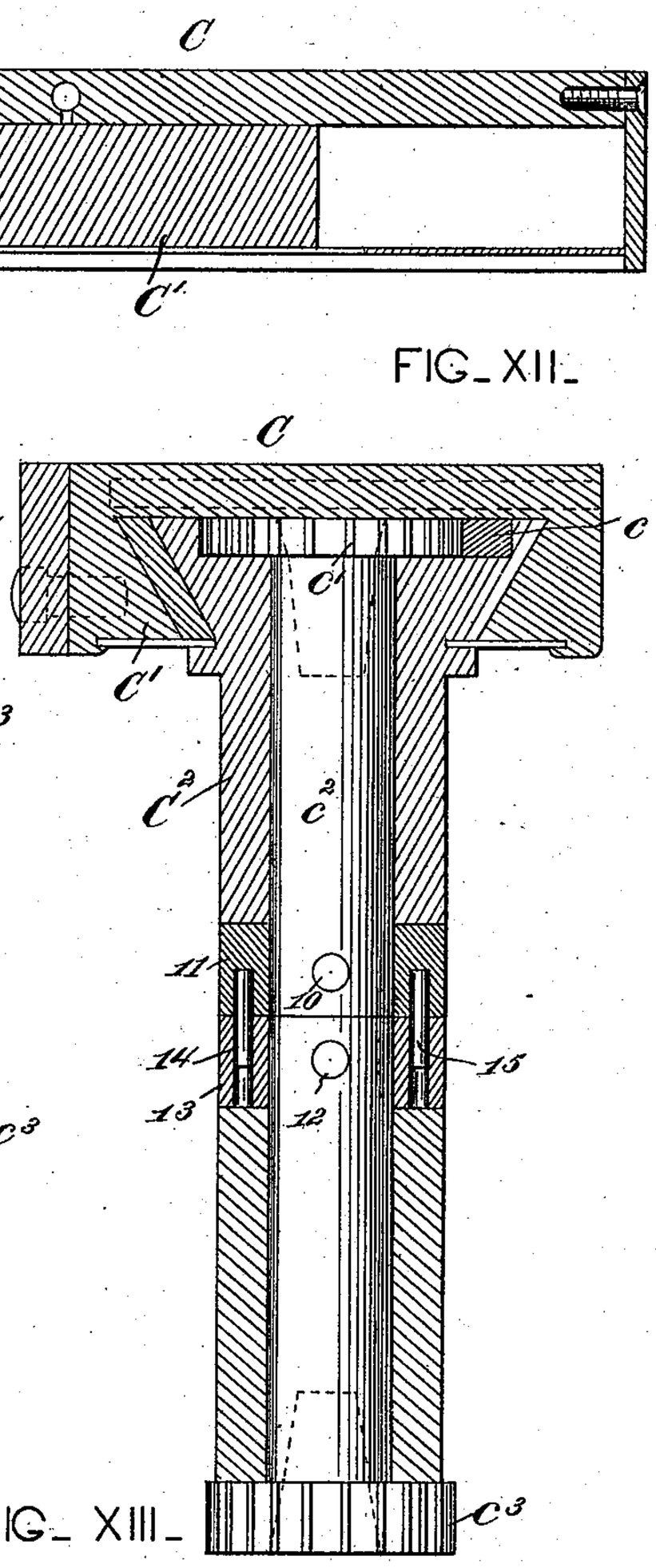
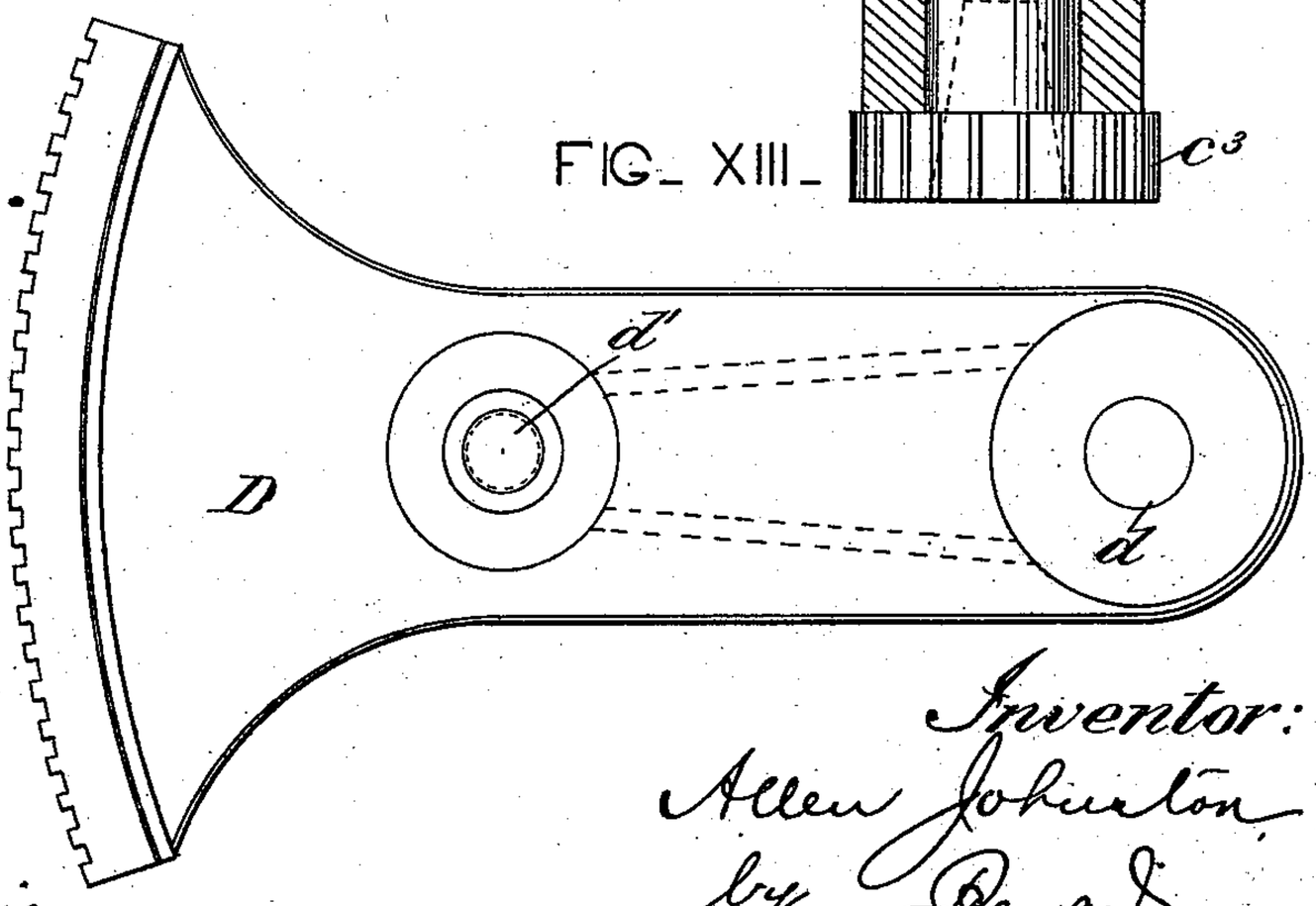


FIG. XIII.



Attest:
Arthur St. Orb.
Reeve Lewis.

Inventor:
Allen Johnston,
by Edwd J. Mauro
his attorneys.

UNITED STATES PATENT OFFICE.

ALLEN JOHNSTON, OF OTTUMWA, IOWA.

APPARATUS FOR GRINDING CUTLERY.

SPECIFICATION forming part of Letters Patent No. 504,387, dated September 5, 1893.

Application filed October 18, 1892. Serial No. 449,249. (No model.)

To all whom it may concern:

Be it known that I, ALLEN JOHNSTON, of Ottumwa, in the county of Wapello and State of Iowa, have invented a new and useful Improvement in Apparatus for Grinding Cutlery, which is fully set forth in the following specification.

The present invention relates to the art of cutlery grinding, and particularly to the grinding of articles of various sorts upon which an irregular surface is to be produced by the grinding operation, necessitating an irregular feed, in contradistinction to operations that may be termed "regular," as grinding the flat surfaces of disks, case knives, &c., or the curved surfaces of mandrels, spindles, &c.

The blades of pocket knives may be taken as an illustration of the class of articles to which this invention has more particular reference. To bring such a knife-blade to its true shape by grinding it must be ground flat on the side for a greater part of its length, and then gradually rounded off toward the point. The back is also to be ground flat for the greater part of its length and then rounded toward the point. When the blade is chamfered on one side, as usual with large blades, there is a third operation involving an irregular feed.

One object of my invention is to effect the grinding of these, and similar irregular surfaces, by means of automatic feeding devices. At present (unless the work is held and guided by hand) the sides of pocket knife blades are usually ground by being fed and held against a rotating grinder of greater thickness than the length of the blade. This simply grinds a flat surface leaving the rounding of the blade toward the point to be finished by hand. It has, however, been proposed to employ an annular grinder, and to feed the knife blade across the same, the grinding beginning at the point of the knife.

Another operation in the fashioning of pocket knife blades consists in forming a shoulder near the end which is attached to the handle. In the manner in which such blades, (and other articles having a similar shoulder) are ground, the shoulder cannot be properly cut by grinding, and must be finished by hand, the reason being that the corner of the wheel which forms this shoulder is continually wearing away and becoming rounded, the greatest amount of wear being directly on this corner.

One feature of the present invention consists in feeding the blade flatwise against the wheel, grinding this shoulder first, and then feeding the blade lengthwise across the grinding edge until the point of the blade is reached. By this method the corner of the wheel which grinds the shoulder has nothing else to do, and the wear of the face of the wheel tends constantly to keep this corner sharp.

The invention includes mechanism whereby the operation indicated above may be accomplished. The automatic feeding and work holding mechanism comprises a slide by which the work is carried and which is capable of moving in any direction in one plane, actuating mechanism for reciprocating the slide to grind the flat surface, and a cam or former (whose shape will depend on the particular contour to be given to the work) for deflecting the slide to grind the irregular or curved portion of its surface. In moving laterally toward and from the grinding surface the slide may swing on a center, or move bodily in guides. The specific motions of the slide are, of course, relative to the grinding wheel, and it is immaterial which of these devices is relatively movable. Special improvements included in this part of the invention will be fully described hereinafter.

The invention further comprises automatic means for adjusting the wheel with reference to the work holder. The arbor of the grinding-wheel has heretofore been made adjustable lengthwise by means of a hand wheel.

According to the present invention the wheel is moved forward intermittently by automatic devices, the amount of motion being sufficient to compensate for wear. Inasmuch as the amount of wear will vary with the hardness of the steel acted upon, as well as with the composition of the wheel itself, the invention includes means for regulating the amplitude of motion given to the wheel at each automatic adjustment. The required amount of motion being ascertained and the adjusting mechanism regulated accordingly, the workman has no further concern with

the adjustment of the wheel. Preferably the mechanism is so constructed as to effect an adjustment at the end of each complete movement of the work holding slide, and it is also preferred to provide the machine with an automatic stop to arrest the feed mechanism at the end of each movement. This is desirable because one workman in practice supervises several of these machines, and unless very watchful he would not always be ready to stop the machine and remove the work at the proper moment.

In order that the invention, and the best mode in which I now contemplate applying the principle thereof, may be fully understood, I will explain the same more in detail, reference being had to the accompanying drawings, which illustrate the construction of a machine having work-holding and feeding mechanism designed for grinding the blades of pocket knives.

Figure I, shows in side view a knife blade after grinding in accordance with this invention. Fig. II, is a longitudinal section on line II and Fig. III a transverse section on line III of Fig. I. Fig. IV, illustrates the present mode of grinding the shoulder on the blade. Fig. V, illustrates the improved mode of forming the shoulder wholly by grinding. Fig. VI, is a horizontal section of a machine constructed in accordance with the invention, the section being through the axis of the grinder and the work holding devices being shown in plan. Fig. VII is a front elevation partly in vertical section. Fig. VIII is a central vertical longitudinal section, the grinding wheel and its arbor being shown in side elevation. Fig. IX, is a vertical cross-section on line IX (Fig. VI) looking to the rear. Fig. X, is a partial plan view of the work holding devices arranged to grind the back of the knife. Figs. XI and XII are details in longitudinal vertical section and transverse section respectively of the work-holding slide and accessory parts. Fig. XIII is a detail of the oscillating segment for conveying motion to the slide. Fig. XIV, is a detail in plan of the automatic stop mechanism for arresting the feed slide at the end of its stroke. Figs. XV and XVI are details illustrating part of the automatic adjusting mechanism for the grinding wheel.

Referring to Figs. I to V, a represents a knife blade ground to proper shape. From the shoulder a', which should be nearly square, to the dotted line III the blade is flat, and from that line to the point a^2 it is curved or tapered as shown in Fig. II. If ground straight to the end in the ordinary way the blade would have the same thickness at the point a^2 as at the other points along the section of Fig. II, and the curved part of the cutting edge would have to be formed by a separate operation. The back a^3 of the blade is ground flat from the right hand end to the dotted line III, and from that line is rounded or curved to the point a^2. The chamfered portion a^4 presents the same features as the side of the blade, that is to say, it has a square shoulder and is flat to about the dotted line III, and then curved to the point a^2.

In grinding the side of the blade, if the point is first brought in contact with the wheel, and then fed along until the rear end of the surface to be ground reaches the wheel, (as is done in grinding table knives, &c.) the effect will be as shown in Fig. IV, in which b represents part of the grinding wheel. In that method the greater part of the wear occurs at the corner b' of the wheel which acts first upon every part of the blade, the wear on the grinding face increasing in degree toward this corner and gradually rounding it, as indicated in the drawings. Consequently, except upon the first few articles ground, the required shoulder cannot be cut by the wheel, rendering another operation necessary.

The improved method is illustrated in Fig. V. According to this plan the blade a is first fed directly against the wheel extending across and beyond the grinding face as shown. The shoulder is thus cut by the sharp corner, and the blade then fed away from this corner (instead of toward it) until the point of the blade is ground. In practicing this method it will be readily seen that the wear on the face of the wheel diminishes toward the corner b', by which the shoulder is cut, it being the opposite corner b^2, which sustains the maximum wear; and that the effect of the abrasion of the wheel in this case is to keep the corner b' sharp.

Referring now to the other drawings, the grinding wheel b is of the ring or cup form described in Letters Patent No. 377,201, granted to me January 31, 1888, and is mounted on a horizontal arbor B, suitably supported in bearings, and provided with the usual fast and loose pulleys. The wheel turns in a trough B' adapted to contain water and to supply it by a spout B^2 to the interior of the wheel, and the latter is partly inclosed by a guard or casing B^3, all substantially as in machines described in previous patents. The work holding slide C rests on a dovetailed support C' (Figs. XI and XII) and can reciprocate thereon. This support has a tubular portion C^2 which is pivoted in a socket C^3 in the frame (Fig. VII). Consequently the slide C, by the rotary movement of support C', and by its own independent reciprocating movement, is capable of universal motion in a horizontal plane. It can therefore (when properly guided) be moved in, or parallel with the plane of rotation of the grinder, then toward the latter to bring blade a against it, to begin the operation of grinding at the shoulder (this being the position of the parts as shown in Fig. VI), then back in a right line, grinding the flat portion of the blade, and then in a curved line, compounded of its own motion and the axial motion of the support C', grinding the curved portion of the blade.

The devices for reciprocating the work-

holding slide are in some respects such as have heretofore been used. The novel features of this part of the construction reside mainly, in the automatic guiding of the slide in irregular lines, and in the means for starting and stopping the same. Slide C has on its under side a rack *c* which engages a pinion *c'* on the end of an upright shaft c^2, which has a similar pinion c^3 on its lower end. Pinion c^3 is engaged and actuated by a segmental arm D (Figs. VII and XIII) which is pivoted at *d* to the frame and is oscillated by means of a pin *d'* attached to the arm D and entering a cam groove d^2 in the drum or cam wheel D' (see Fig. VIII). This gives the slide C a reciprocating motion transversely to the axis of the grinder. Shaft c^2 is made in two parts for convenience in removing the slide and its support when desired. The upper part is fastened by a pin 10 to a ring 11, and the lower part similarly fastened by a pin 12 to a ring 13. The two rings are coupled by upright pins 14, 15, which are fast in one of the rings (the lower) and fit loosely in holes in the upper. Thus the upper part of the shaft may be readily uncoupled from the lower. This, of course, is merely a convenient arrangement, and not an essential feature of the construction.

To grind the side of a blade as in Fig. VI, the slide C must have a motion toward the wheel in the direction of the axis thereof. To this end a guide arm E is detachably secured by screws or otherwise to slide C. At its free end this arm has two pins or rollers *e'*, e^2, the latter being carried on the end of a spring E' which presses it toward the roller *e'*. Between these rollers or pins is a guide bar or former F, which controls the positions of the slide C axially as it is reciprocated back and forth. It will be obvious from inspection of the drawings that as the rollers *e'*, e^2 follow the guide bar F the slide C, while moving lengthwise, will be turned on the axis of shaft c^2 as a center when the contour of said bar deviates from a line parallel with the plane of rotation of the grinder, and by giving to the guide-bar or former a suitable outline the work-holding slide may be turned in either direction, and to any desired extent, within certain limits.

Special importance is not attached to the particular devices described for guiding the work-holder, as these may obviously be modified, or replaced by other devices capable of performing substantially the same functions. The essential feature or principle of this part of the invention consists in providing automatic means for giving the work-holder an irregular movement.

As shown in Fig. VI the guide, cam, or former F, is secured rigidly to the long lever F' pivoted to the frame at *f* and capable of horizontal oscillation. The function of this lever is to swing the work-holder toward the wheel so that the corner *b'* may strike the blade at the point where the shoulder is to be cut, as already explained. This motion is communicated to lever F' in the following way: Said lever has on its under side a recess *f'* which is entered by a wrist-pin f^2 on a disk F^2. Disk F^2 is carried by an upright spindle G suitably supported in bearings in the frame, and having at its lower end an arm G' which extends horizontally toward the cam wheel D' and has a pin *g* which enters a second cam groove *g'* in the periphery of said wheel (Figs. VII and VIII). Through these connections the lever F' is at the proper moment turned in the proper direction to throw the knife blade into contact with the wheel. The shape of the cam grooves d^2 *g'* will, of course, depend upon the character of the work to be done. As shown in Fig. X the lever F' and its actuating mechanism are not always essential. In that figure the grinding of the back of the knife blade is illustrated. In this instance the guide arm E is provided with a single pin or roller *e* entering a cam groove e^3 in a stationary guide plate E^2. This groove is straight for a certain distance and then curved, so that the slide C will travel in a line parallel with the plane of the grinding surface until the curve in the back of the knife blade is reached, and then be deflected so as to keep the curved part of the blade against the wheel. The cam groove here is the obvious equivalent of the cam bar in the other figures.

The means for starting and stopping the feed movement will next be described. Power is transmitted from the shaft 16, having the loose pulley 17, and fast pulley 18, to the shaft 20, having band pulleys 21 (Figs. VI and IX), the speed of the latter shaft being much less than that of the former. On the inner end of shaft 20 is a small pinion 22 (Figs. VI and VII) which engages and drives a large toothed wheel H which is on the shaft H' carrying the cam wheel D'. Shaft H' is thus driven at a low rate of speed. The belt which drives shaft 16, from which the feed-movement is derived, is controlled by a belt shipper K (Figs. VI and XIV) carried by a rod L, extending backward from the front of the frame, and having at its forward end an elbow or bend L^2 for manipulation by hand, as hereinafter explained. Rod L is surrounded by a spiral compression spring M, which bears at its forward end against the frame, and tends to push the rod backward, or in the direction to throw the belt from the fast pulley 18 to the loose pulley 17. Consequently, whenever the rod is released it at once arrests the feed-movement. Rod L may be moved in the opposite direction to start the feed by means of a treadle N, rock-shaft N' and upright arm N^2 (Figs. VII and VIII). The upper end of arm N^2 lies between two bosses n' n^2 on a collar *n* which is screwed fast to rod L. Arm N^2 is also springy and presses against the collar *n* which has a flat surface on the side adjacent to said arm, as seen in Fig. VII. Rod L also carries a finger or detent *m*, screwed fast to the rod so

as to follow it in either a longitudinal or an axial movement. When the belt is on the loose pulley this detent or finger *m* bears with slight pressure on the rim H^2 of wheel H, the pressure being due to the resiliency of arm N^2 bearing as already explained against the collar *n*, which at this time is tilted at a slight angle to said arm. To start the feed, the operator puts his foot on treadle N swinging arm N^2 forward, moving rod L lengthwise in the same direction, and shifting the belt to the fast pulley. This movement of rod L carries finger *m* past the rim H^2 of wheel H, and the pressure of arm N^2 on collar *n* turns the rod L slightly until the flat face of said collar is parallel with the said arm as shown in Fig. VII. This slight rotary movement of rod L is just sufficient to carry finger *m* inward so that its free end is caught and held by the edge of rim H^2. Consequently, though the operator immediately removes his foot from the treadle, rod L is retained in this position against the pressure of its spring M, and the work-feed continues in operation. Rim H^2 is provided at one point with a depression or notch *h* (Figs. VII and VIII). When this notch comes opposite detent *m*, the latter is no longer held, and spring M at once acts, pushing rod L back and shifting the belt to the loose pulley. This notch is in such position that the feed is arrested at the moment when work-slide C reaches the end of its return movement (to the right in Fig. VII). When now the operator inserts a new piece of work into the holder he puts his foot on the treadle and shaft H′ begins to rotate, cam groove d^2 begins to oscillate arm D and slide C moves toward the axis of the wheel bringing the work opposite the grinding face of the latter. Pin *d′* now travels for a while in a straight part of groove d^2, during which time groove *g′* swings arm G′ and lever F′, as explained above, bringing the blade up against the wheel until the shoulder is cut. When this movement is completed groove d^2 swings arm D in the opposite direction, and slide C begins to retreat keeping the blade in contact with the grinder. The movement is at first in a right line, grinding a flat surface on the blade, but as the slide nears the end of its travel it is deflected by the action of the guide-arm E and the curved part of guide-bar or former F, thus moving in a line which is the resultant of its rectilinear and rotary movements, grinding the curved part of the blade terminating at its point. At this moment the reciprocating movement of slide C ends, and cam groove *g′* causes it to turn away from the wheel, and on the completion of this movement the releasing notch *h* comes opposite detent *m*, and the feed is automatically arrested.

In case of any accident necessitating the stoppage of the feed before it completes its movement this can be effected by slightly depressing the bent end L′ of rod L, turning the latter far enough to release detent *m* from engagement with rim H^2, and permitting spring M to shift the belt from the fast pulley.

The special construction and disposition of parts for effecting the starting and stopping of the feed movement, while advantageous, admit of much modification, the broad novel features of this part of the invention residing in the starting of the feed movement by means of a foot treadle, and the automatic stoppage thereof at the completion of each movement.

The mechanism for automatically adjusting the grinding wheel at intervals to compensate for wear will now be described. The arbor B of the wheel is surrounded by a sleeve P having bearings in the frame in which it can move longitudinally without turning. Sleeve P is screw threaded externally (Fig. VI) for a portion of its length and engaged by an adjusting wheel P′ whose hub is threaded interiorly, and which is held from endwise movement by two collars *p p′*, which form the bearings of sleeve P. Wheel P′ has a threaded rim which is engaged by a small pinion *q* (shown in dotted lines Figs. IX and XV) on a short shaft *q′* which has bearings in a bracket q^2. This shaft also carries a ratchet wheel Q with which engages a pawl *r*, pivoted on a plate R which swings freely on shaft *q′*. Pawl *r* is held in engagement with ratchet Q by a spring *r′* (Fig. XV). Plate R receives motion from an upright rod S which passes through a hole in boss R′ of said plate and is secured by a set screw S′. The lower end of the rod S is jointed to an arm T projecting from a rock shaft T′ (Fig. IX). The forward end of this shaft carries a lug *t* which lies in the path of a pin *t′* projecting from the rear of wheel H, (Figs. VIII and IX.) This pin makes contact with lug *t* once in each rotation of wheel H, depressing it and giving an upward thrust to rod S, this motion being transmitted by the pawl *r*, ratchet Q and pinion *q*, to the adjusting wheel P′. The grinding-wheel is thus moved a short distance toward the work holder. It is obviously desirable that this adjustment should be capable of regulation to meet varying conditions of work. This may be effected by loosening the set screw S′ and moving the rod S downward to lengthen the stroke of the pawl *r*, or upward to shorten its stroke.

Many departures may be made from the details of construction herein described and shown without departing from the spirit of the invention, and some of the elements of the machine may be replaced by devices equivalent in function. For example, I may substitute for a shifting belt and fast and loose pulleys, other well known means for starting and stopping a shaft.

Having now fully described my said invention, what I claim, and desire to secure by Letters Patent, is—

1. In a machine for grinding articles having an irregular surface, the combination with a grinding wheel, of a work-holder capable of

universal motion in one plane, and an irregular guide for controlling the movements of said work holder, substantially as described.

2. In a machine for grinding articles having an irregular surface, the combination with a grinding wheel, of a work-holding slide supported so as to be capable of universal motion in one plane, means for reciprocating said slide in line with the grinding surface of said wheel, and a guide of irregular outline for deflecting said slide from the line of its reciprocating movement, substantially as described.

3. The combination with the grinding wheel, of a work-holder, a swiveled support therefor, means for reciprocating said slide on its support, a guide for changing the positions of said support and slide while the latter is reciprocating on the former, a movable support or lever carrying said guide, and means for moving said support or lever toward and from the grinding surface of said wheel, substantially as described.

4. The combination with the grinding-wheel, of a work-holder, a swiveled support therefor, a pinion on a shaft concentric with the axis of said support and engaging a rack on said work-holder, means for oscillating said shaft, and a guide controlling the movements of said support on its axis, substantially as described.

5. In a grinding machine for grinding knife blades and other articles having a shoulder thereon, the combination with the grinding-wheel, of a work-holder capable of moving transversely to the grinding surface and also parallel therewith, means for feeding said work-holder toward the grinding surface so as to present the article flatwise against the wheel and first grind the shoulder by the corner of the wheel, and means for subsequently traversing the work-holder with the article in contact with said wheel, across the grinding face thereof and in the direction away from the said corner, substantially as described.

6. In a grinding machine, the combination with the grinding wheel, of the automatic feed-mechanism for moving the work to, against, and away from the grinding wheel, a starting and stopping device such as a belt-shipper, a spring tending constantly to actuate said device in the direction to arrest the feed, a detent for holding said spring during the feed-movement, and means for automatically releasing said spring and putting the stopping device into operation at the completion of the feed movement when the work is away from the wheel, substantially as described.

7. In a grinding machine, the combination with the wheel, of the feed-slide, driving mechanism for moving said slide toward and from the wheel, a spring-actuated rod for disconnecting the said driving mechanism and arresting the feed, a treadle or lever for withdrawing said rod against the pressure of said spring and thus starting the feed, a catch or detent engaging and holding said rod when retracted by said lever or treadle, and means for releasing said catch or detent at the end of the movement of the feed-slide, substantially as described.

8. The combination with the grinding wheel and automatic feed mechanism, of a starting and stopping device such as a belt-shipper, an actuating rod therefor, a treadle for shifting said rod in the direction to start the feed, a detent for holding the rod in this position, and means for releasing the detent automatically at a predetermined moment, substantially as described.

9. In a grinding machine, the combination with work-holding devices, of a rotary grinder, an adjusting wheel for moving the grinder in the direction of the work-holder, and means for intermittently actuating said wheel, substantially as described.

10. The combination with the work holding devices, of a rotary grinder, a wheel for adjusting said grinder with respect to said work-holding devices, and gearing connected with a moving part of the machine for actuating said adjusting wheel intermittently, substantially as described.

11. In a grinding machine, the combination with the work-holder and its actuating devices, of a rotary grinder, intermittently operating mechanism for moving said grinder toward said work-holder to compensate for wear, and means for regulating the amount of such motion at each adjustment, substantially as described.

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

ALLEN JOHNSTON.

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