(No Model.)

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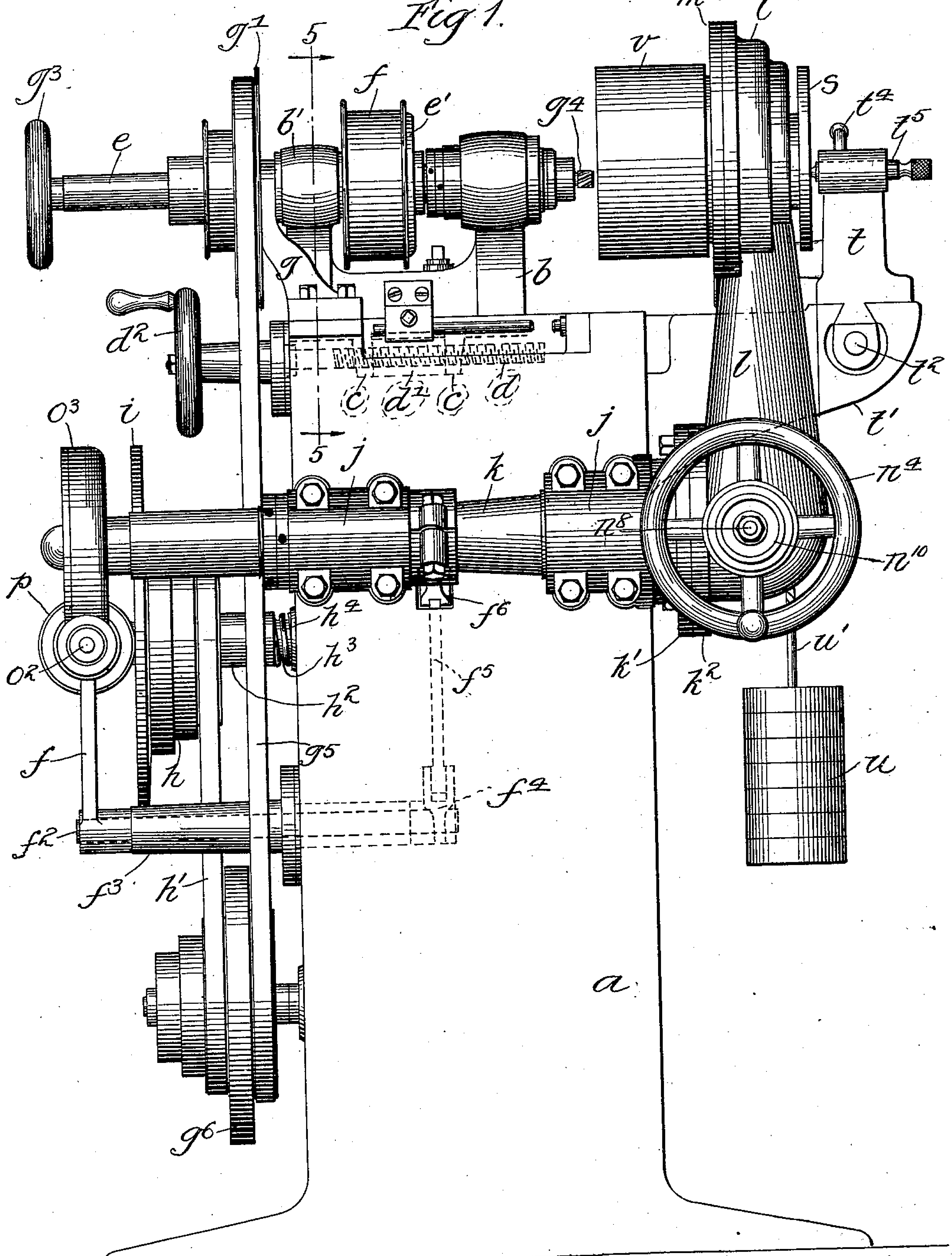
C. E. DAVIS & C. L. GROHMANN.

PROFILING MACHINE.

No. 560,347. Patented May 19, 1896.

Fig. 1.



Witnesses
Wm. F. Henning
Thos. M. Rheem

Inventors
Charles E. Davis,
Carl L. Grohmann
By David H. Fletcher, atty.

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

(No Model.) 6 Sheets—Sheet 2.

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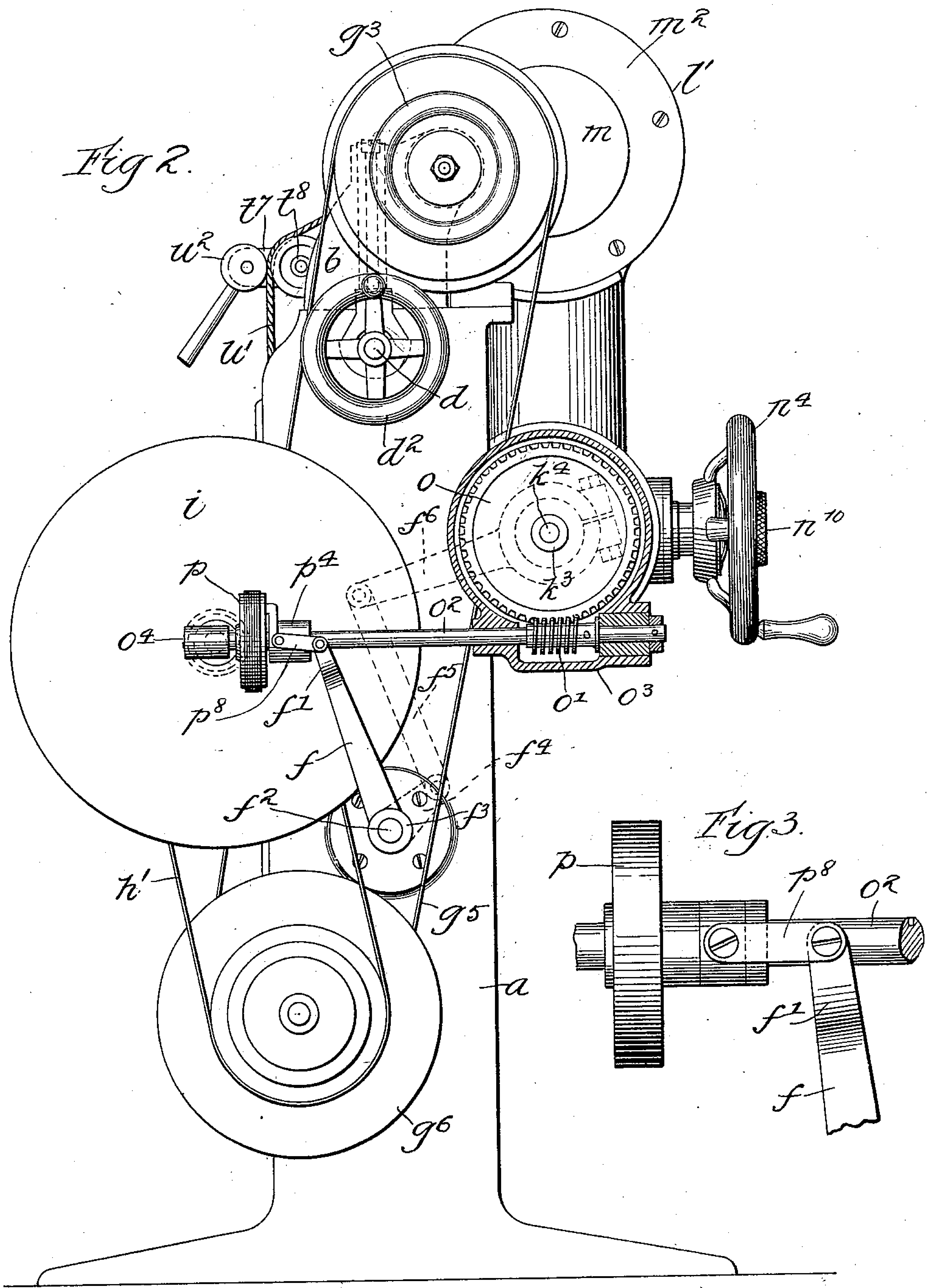
Fig. 2.

Fig. 3.



Witnesses
Wm F. Henning
Jno. M. Rheem.

Inventors
Charles E. Davis.
Carl L. Grohmann.
By David H. Fletcher, Atty.

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

(No Model.)

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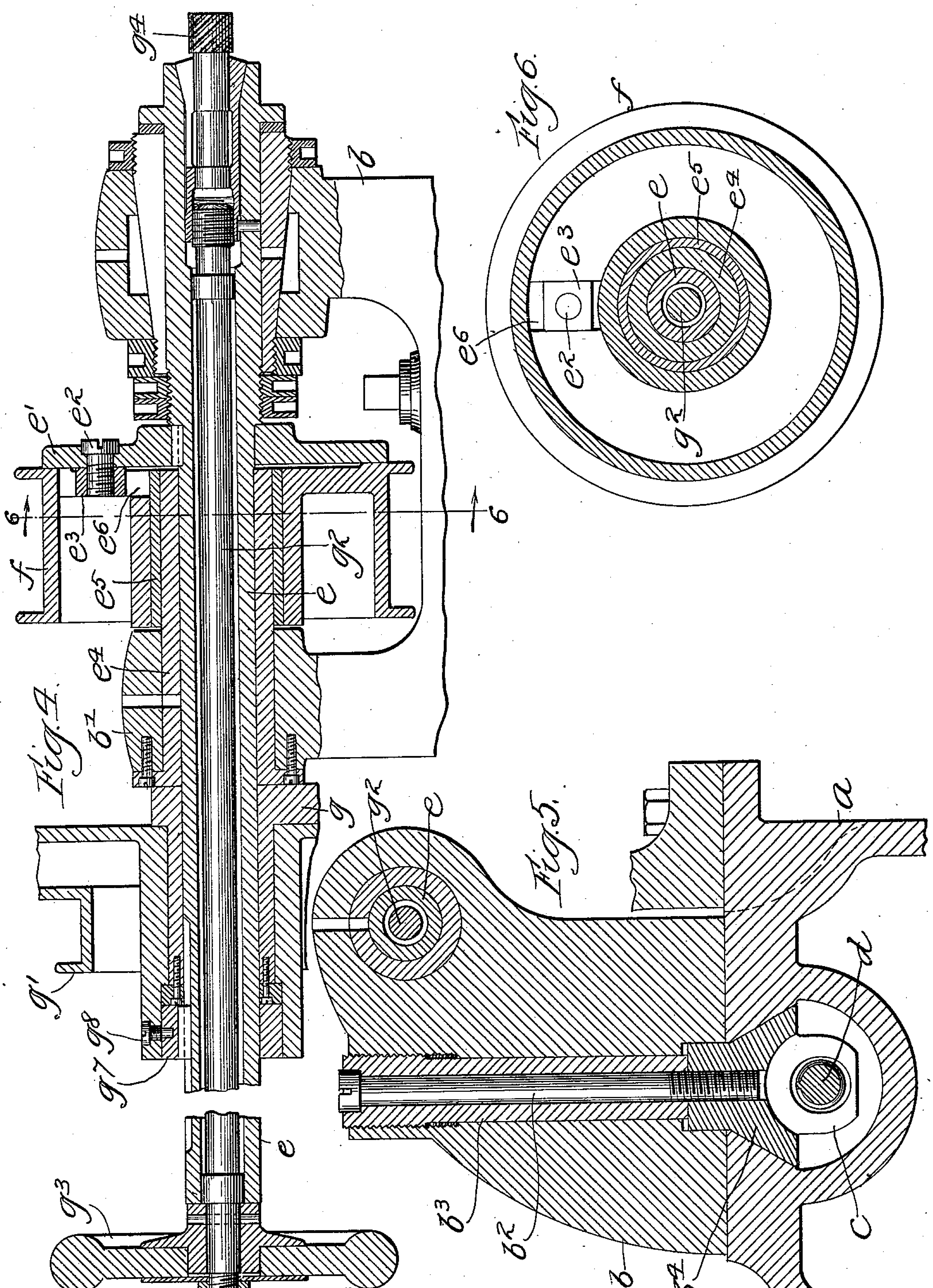

Witnesses
Wm. J. Henning
Jno. M. Rheem.

Inventors.
Charles E. Davis
Carl L. Grohmann.
By David H. Fletcher, Atty.

(No Model.)

6 Sheets—Sheet 4.

C. E. DAVIS & C. L. GROHMANN.

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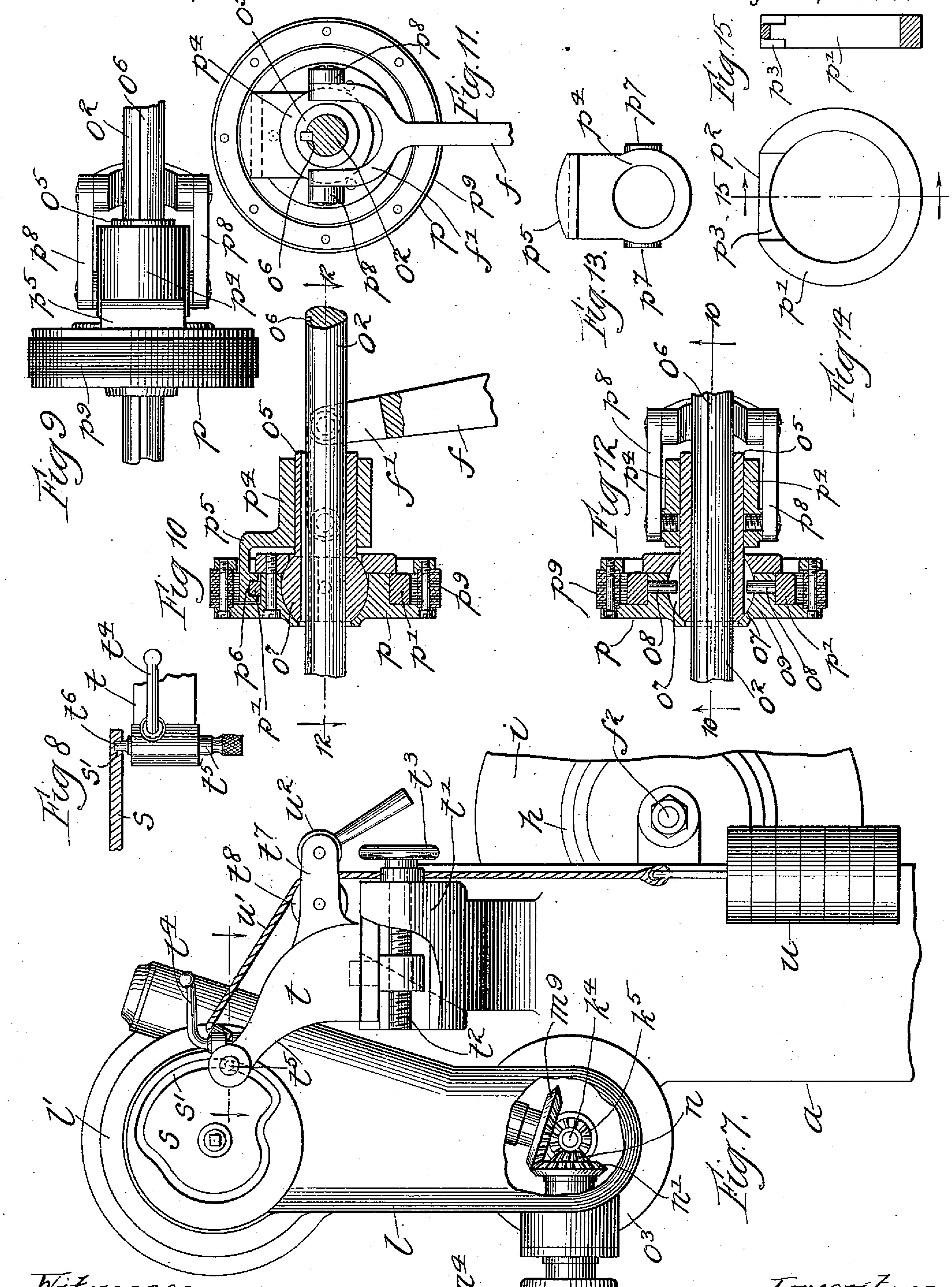

Witnesses
Wm. J. Henning
Wm. M. Rheem

Inventors
Charles E. Davis.
Carl L. Grohmann.
By David H. Fletcher,
Atty.

(No Model.)

6 Sheets—Sheet 5.

C. E. DAVIS & C. L. GROHMANN.

PROFILING MACHINE.

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Fig. 16.

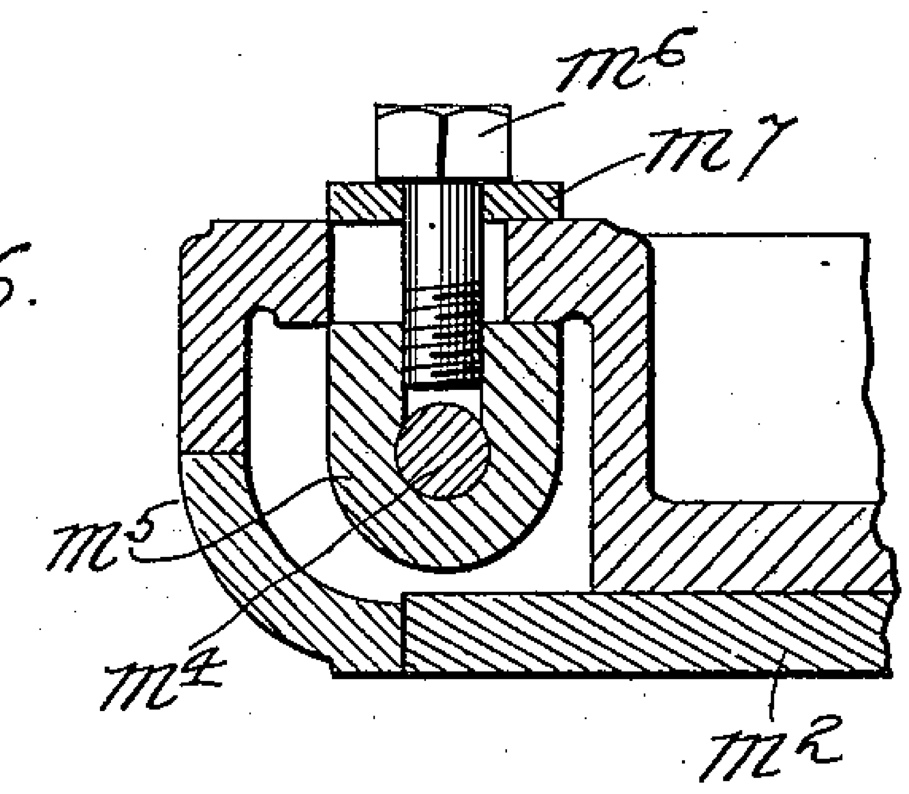


Fig. 17.

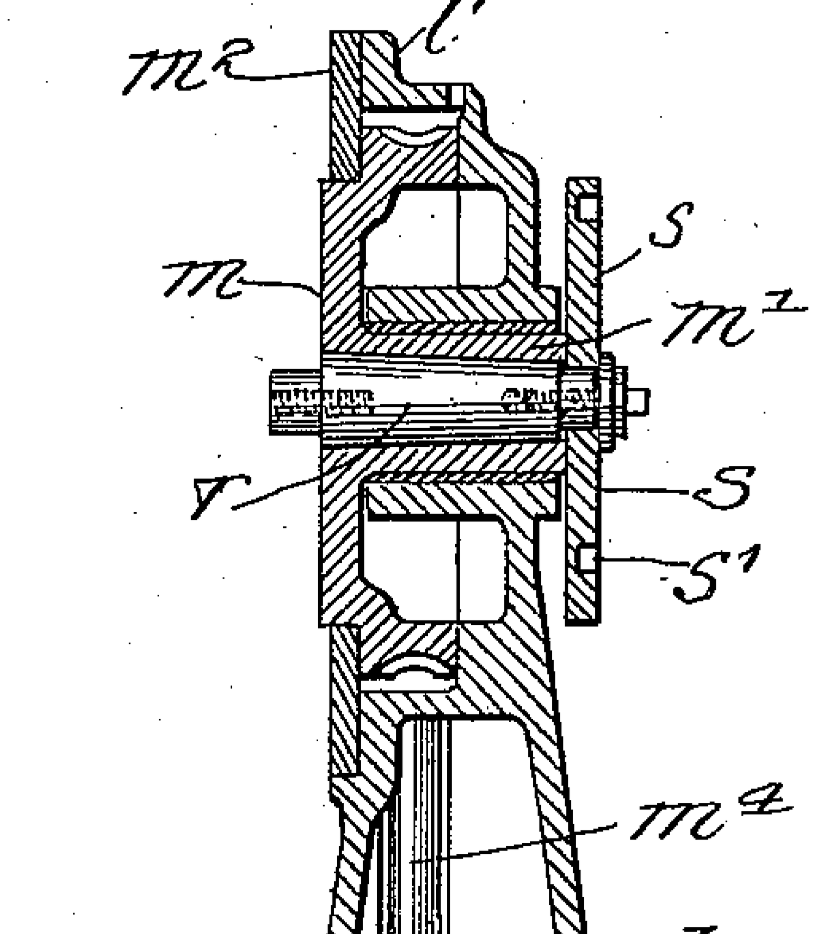
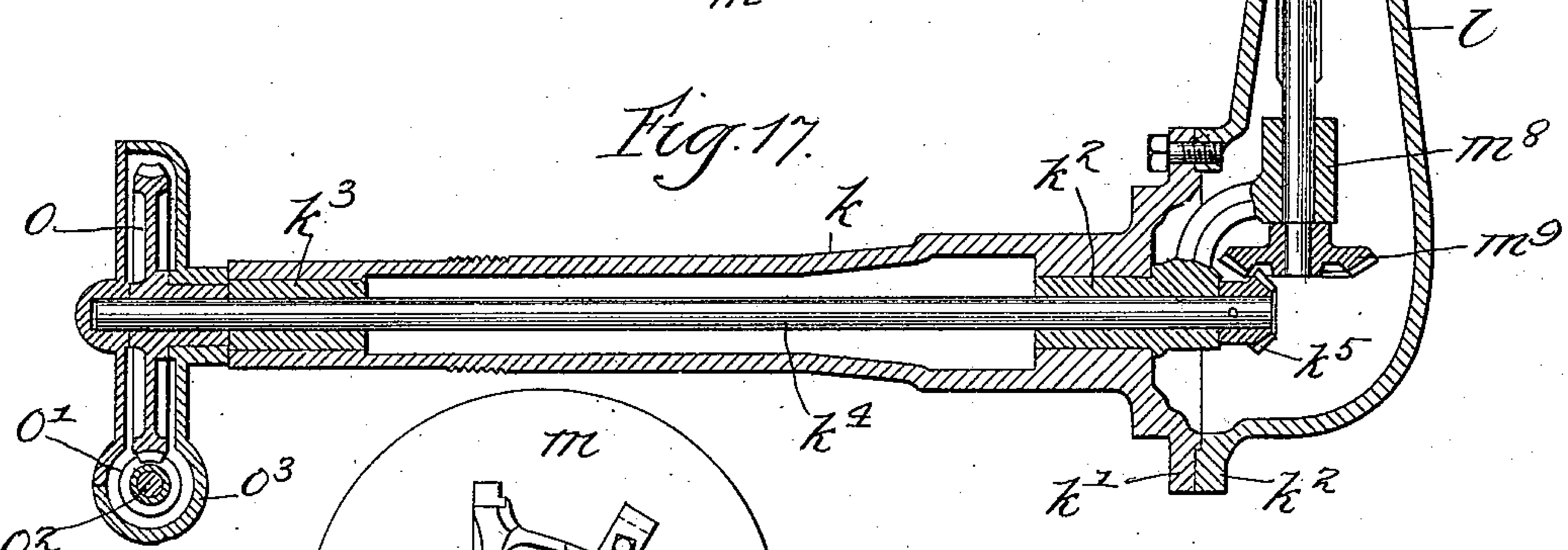



Fig 18

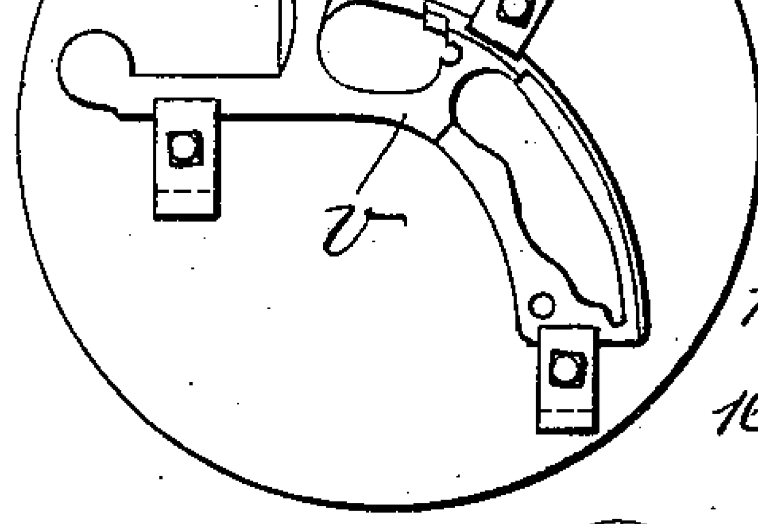


Fig. 19.

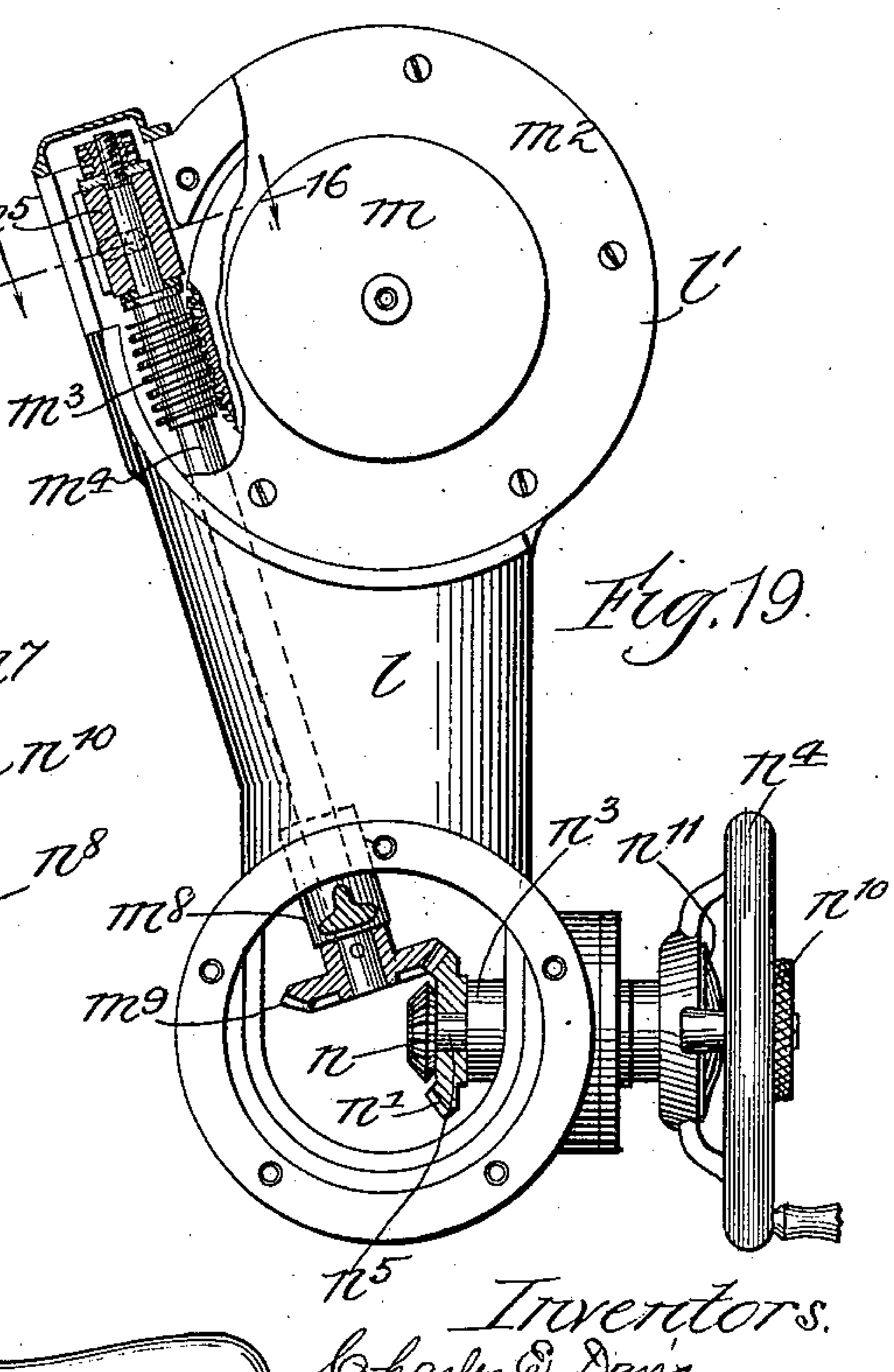
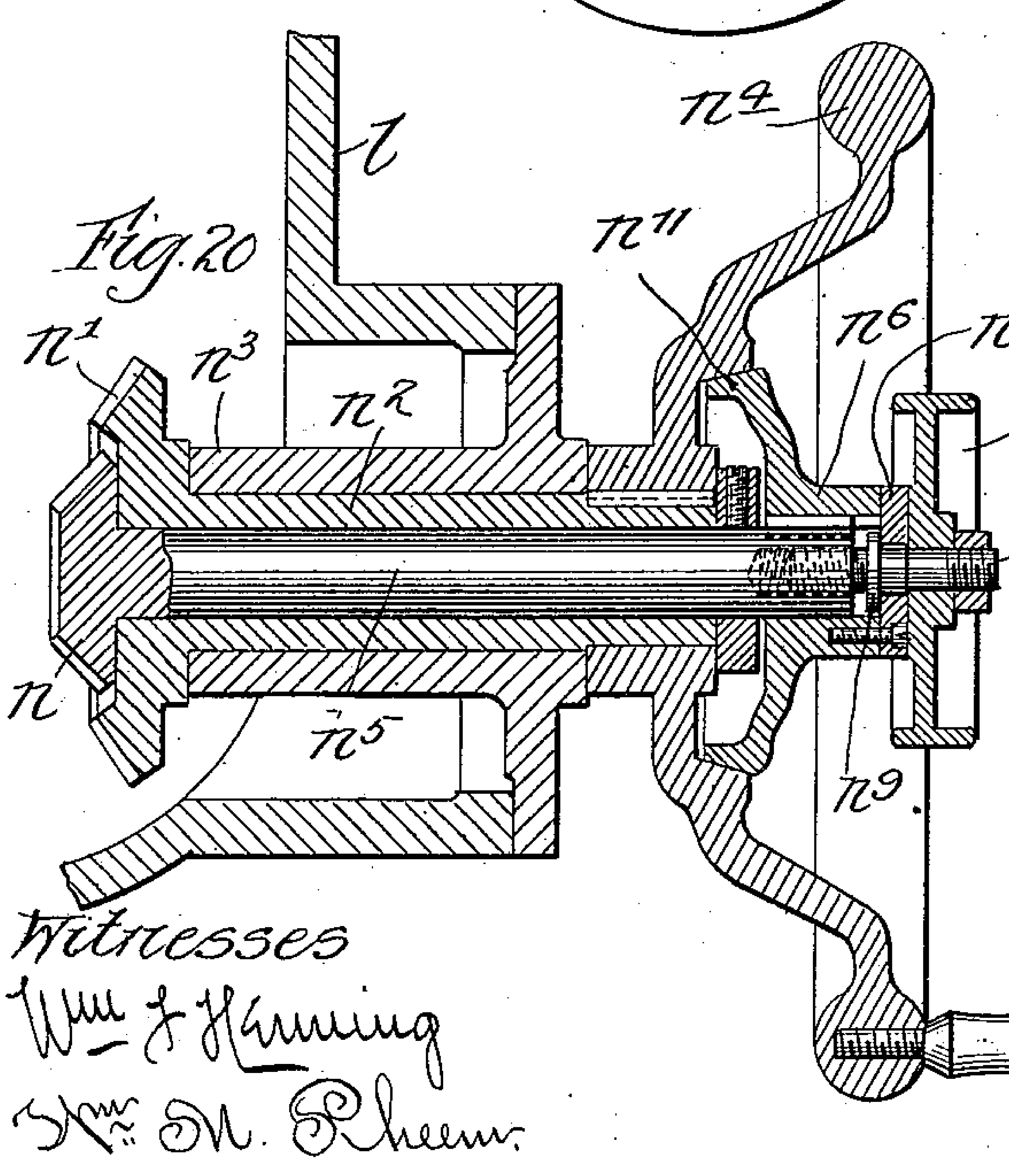


Fig. 20



Witnesses
Wm. J. Henning
Wm. M. Rheem.

Inventors.
Charles E. Davis
Carl L. Grohmann,
By David H. Fletcher
atty.

(No Model.) 6 Sheets—Sheet 6.

C. E. DAVIS & C. L. GROHMANN.

PROFILING MACHINE.

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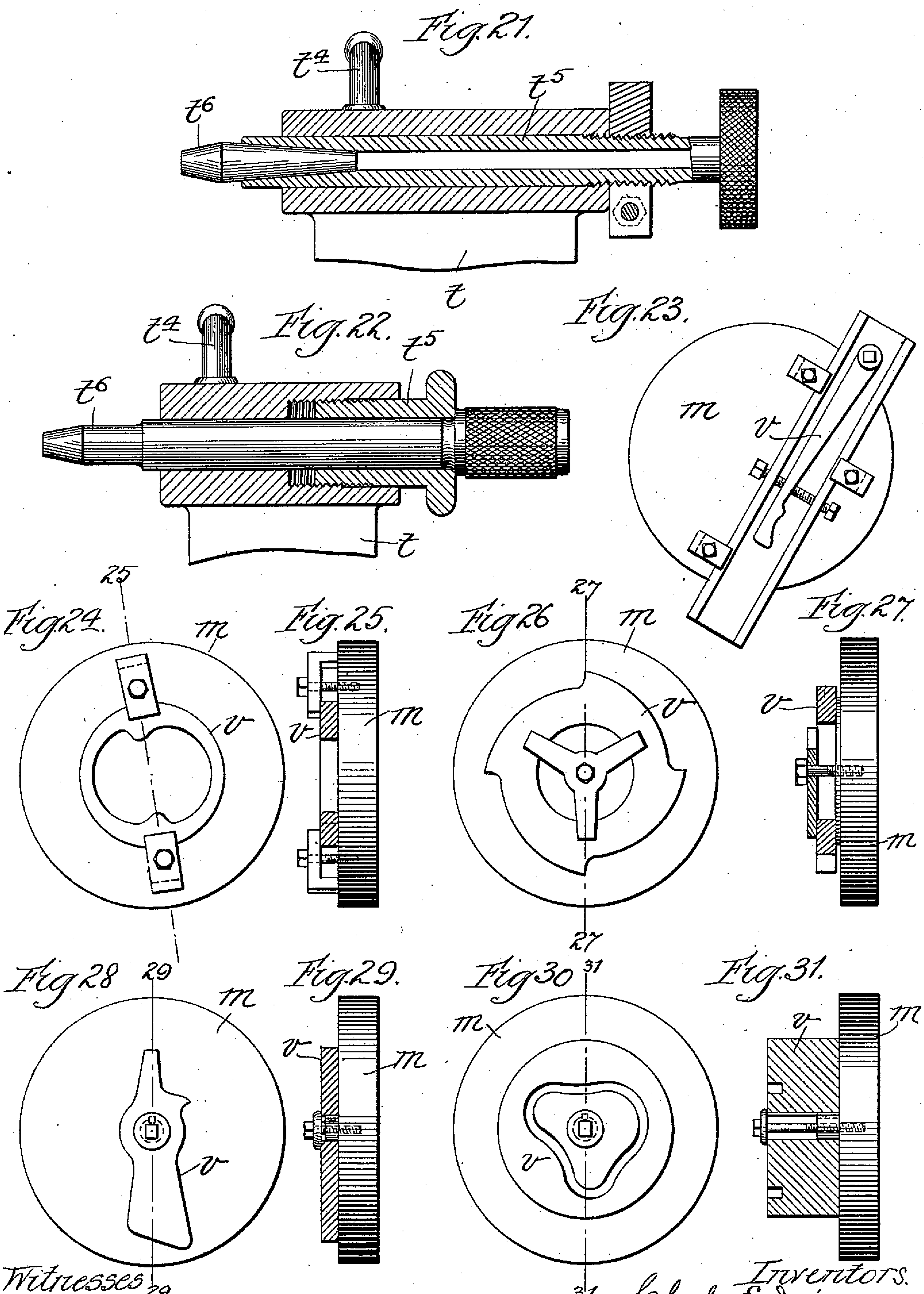

Witnesses
Wm. F. Hanning
Jas. M. Rheem

Inventors.
Charles E. Davis.
Carl L. Grohmann.
By David H. Fletcher,
Atty.

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

UNITED STATES PATENT OFFICE.

CHARLES E. DAVIS AND CARL L. GROHMANN, OF CHICAGO, ILLINOIS.

PROFILING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 560,347, dated May 19, 1896.

Application filed October 20, 1894. Serial No. 526,513. (No model.)

To all whom it may concern:

Be it known that we, CHARLES E. DAVIS and CARL L. GROHMANN, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Profiling-Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in which corresponding letters of reference in the different figures indicate like parts.

The object of our invention is to provide a profiling-machine which shall be so constructed as to permit of the automatic shaping by means of a suitable cutter or tool of an indefinite variety of forms conforming in contour, respectively, with formers of varying shape. To this end our purpose, among other things, is to provide a profiling-machine in which the strain of the driving and feed belts shall be removed from the spindle in order to permit the attainment of high speed in the latter and the consequent satisfactory use of small cutters; further, to provide a novel feed mechanism for the machine, whereby the lineal feed of the work is rendered uniform in speed regardless of the distance of the tool at any given time from the axis of the face-plate upon which the work is held; further, to enable a former to be employed which is larger than the size of the article to be formed. Again, we desire by means of novel and simple adjustments to cut cams or other forms of a steeper pitch than has heretofore been done by profiling-machines, while at the same time the friction upon the working parts may be greatly lessened.

In addition to the foregoing it is our purpose to so construct our improved machine as to permit of the use of plain cutters of small cost and to provide for wear or decrease in the size thereof by means of a tapering former-pin, thus insuring exact work and enabling all of the special forms to be made by the use of plain cutters in lieu of a variety of cutters of special and costly shapes. Moreover, it is our purpose to provide certain novel devices with relation to the feeding mechanism whereby it may be controlled either by hand or power.

To these ends our invention consists in the combination of elements hereinafter more particularly described, and definitely pointed out in the claims.

In the drawings, Figure 1 is a front elevation of our improved machine. Fig. 2 is the side view thereof. Fig. 3 is an enlarged view in detail of a friction-wheel, being a modified construction. Fig. 4 is a central longitudinal sectional view in detail of the spindle-head. Fig. 5 is a sectional view thereof, taken upon the line 5, Fig. 1, viewed in the direction of the arrows there shown. Fig. 6 is a sectional view taken upon the line 6, Fig. 4. Fig. 7 is a side view of the machine, taken from an opposite direction from that shown in Fig. 2. Fig. 8 is plan view in detail of the former-pin head, together with a sectional view of the former, intended to coact therewith. Fig. 9 is the plan view in detail of our improved friction-wheel. Fig. 10 is a vertical sectional view of the friction-wheel shown in Fig. 9. Fig. 11 is an end view of said friction-wheel as seen from the front of the machine. Fig. 12 is a central horizontal sectional view of said friction-wheel. Fig. 13 is a detail view of the tilting arm for tilting the friction-wheel. Fig. 14 is a detail view of the ring for connecting the tilting arm with the wheel. Fig. 15 is a sectional view taken upon the line 15, Fig. 14. Fig. 16 is a vertical sectional view upon the line 16, Fig. 19. Fig. 17 is a longitudinal sectional view in detail of the oscillating face-plate-holding arm and the shafts and gearing mounted therein. Fig. 18 is a face view in detail of the face-plate, showing work of an irregular form clamped therein. Fig. 19 is a detail view of the oscillating arm, looking toward the face-plate, said arm being detached from the horizontal portion by which it is supported. Fig. 20 is an enlarged vertical sectional view in detail of the hand feeding-crank and its connections. Fig. 21 is an enlarged longitudinal sectional view of the former-pin head. Fig. 22 is a like view showing a modification thereof. Fig. 23 is a front view of the face-plate, showing the clamping device for holding the work. Figs. 24, 26, 28, and 30 are like face views; and Figs. 25, 27, 29, and 31 are edge views of a face-plate, showing clamping devices with varying kinds of work therein.

Referring to the drawings, *a* represents the frame of our improved machine, which consists of an upright of cast metal of such proportions as to render it thoroughly rigid. Attached to the top of the frame *a* is sliding head *b*, Figs. 1, 2, 4, and 5, which is connected with the frame *a* by means of the dovetailed block b^4, arranged in a suitable guideway in said frame, as clearly shown in Fig. 5. Bolts b^2, one of which is shown in said last-named figure, serve to attach the block b^4 to hollow adjusting screw-bolts b^3, tapped into the head *b*, by which the wear in the slide may be taken up when desired. Lugs *c c* are formed upon the block b^4, through which is loosely passed a feeding-screw *d*. (Indicated in dotted lines in Fig. 1 and shown in Figs. 2 and 5.) A nut d' (indicated in dotted lines in Fig. 1) is formed upon the screw *d* and interposed between the lugs *c c*. The screw *d* is held from longitudinal movement in the frame, as indicated, so that when turned by means of a hand-wheel d^2 thereon the head *b* may be caused to slide longitudinally for the purpose of adjusting the cutting-tool to the work or of removing it therefrom, as hereinafter stated.

Mounted in suitable bearings in the head *b*, as clearly shown in Fig. 4, is a hollow spindle *e*, to which is keyed a disk e', Figs. 4 and 5, to which is attached by means of a screw e^2 a square block e^3. A stationary sleeve e^4, through which the hollow spindle is passed, is rigidly attached to a bracket or arm b' of the head *b*. A secondary sleeve e^5 is loosely mounted upon the sleeve e^4, upon which sleeve is in turn loosely mounted the hub of a main driving-pulley *f*, of which said sleeve forms the bearing. A slot e^6 is formed in the web of said pulley, into which is loosely inserted the block e^3, thus indirectly connecting the pulley *f* with the hollow spindle, so that as the former is rotated it will cause the rotation of the latter. It will be observed that this construction enables the hollow spindle to be entirely relieved from the strain of the belt, and hence it may be rotated at a high rate of speed without danger of heating. Moreover, it permits the use of a small and inexpensive cutter where otherwise a large one would need to be employed to accomplish a satisfactory amount of work.

A bracket *g*, provided with a sleeve integral therewith, is rigidly attached to the frame, and serves as a support for a secondary pulley g', which is attached to a ring g^7 by means of a screw g^8, which is in turn splined to the hollow spindle. Thus the outer end of the spindle is supported while the strain of the pulley g' is entirely removed therefrom.

A draw-in spindle g^2 is placed within the hollow spindle *e* and is provided with a hand-wheel g^3, by which it is operated. The other end is tapped into the usual cone-chuck, as shown, for the purpose of holding the tool g^4. The pulley g' is connected by means of a belt g^5, Figs. 1 and 2, to a cone-pulley g^6, mounted upon a bearing attached to the frame, which pulley is connected to a secondary cone-pulley *h* by means of a belt h', said pulley being mounted upon a stud h^3, rigidly attached to the frame. A spiral spring h^4 is interposed between the pulley and frame for the purpose hereinafter stated. Rigidly attached to the pulley h^2 is a friction-disk *i*, which is intended to rotate continuously and is designed to automatically regulate the feed, as hereinafter specified.

We will first describe our improved means for giving an oscillatory movement to the face-plate, whereby the position of the cutting-tool is accommodated to the contour of the work, after which we will describe our improved automatic feeding device.

Mounted in horizontal bearings *j*, Fig. 1, is a hollow rock-shaft *k*. Shown in section in Fig. 17. Said hollow shaft is provided with a flange k', to which is detachably secured by means of a like flange k^2, bolted thereto, a hollow upright arm *l*, upon the upper end of which is formed a head l', within which is mounted a revoluble face-plate *m*. A hub m', Fig. 17, is preferably formed upon the face-plate, which hub is secured in a suitable bearing in the head or upper part of the arm *l*. A ring m^2, fitted within an offset in the face-plate, as clearly shown in Fig. 17, is bolted to a flange upon the head and serves to retain the face-plate in position while permitting it to be rotated.

Formed upon the periphery of the face-plate within the head are gear-teeth, as shown, adapted to engage with a worm m^3, Fig. 19, upon a shaft m^4, located within the arm *l*. The upper end of the shaft m^4 is secured in a bearing m^5, Figs. 16 and 19, which is rendered laterally adjustable by means of the set-screw m^6 and adjusting-plate m^7, which enables any desired adjustment to be made. The lower end of the shaft m^4 is supported within a bearing m^8, which is rigidly connected, as shown in Fig. 17, with a similar bearing k^2, detachably secured within the hollow rock-shaft *k*. The bearing k^2, together with a suitable bearing k^3, supported in the opposite end of the rock-shaft, serves to support a shaft k^4 within the rock-shaft *k*, the former of which is connected with the shaft m^4 by means of four peculiarly-arranged beveled gears k^5, *n*, n', and m^9, Figs. 7, 17, 19, and 20. The gear n' is mounted upon a short hollow shaft n^2, Fig. 20, which is secured within a bearing n^3 at the base of the arm *l*, thus enabling the shaft to extend outwardly toward the front of the machine. Keyed rigidly to the outer end of the shaft n^2 is a hand-wheel n^4, Figs. 1, 2, 7, 19, and 20, by which the shaft m^4 may be operated by hand, when desired, through the gear n'. Within the hollow shaft n^2, which forms a bearing therefor, is placed a shaft n^5, to which the gear *n* is attached. Splined to the outer end of the shaft n^5 is a hub n^6, which extends beyond said outer end, as shown in Fig. 20, and is adapted to be moved longitudinally thereon, while required to rotate therewith. A plate n^7 is rigidly attached to the outer end of the hub. A screw n^8, having a shoulder n^9 thereon, is tapped into the shaft n^5 and is provided with a hand-wheel n^{10}, which, when turned, serves to impart a longitudinal movement to the hub. The hub is provided with a cone-shaped flange n^{11}, adapted to fit within a corresponding recess formed in the hub of the hand-wheel n^4. Thus by means of the hand-wheel n^{10} the cone-shaped rim n^{11} may be forced into said recess, thereby clutching the hub n^6 and hand-wheel n^4 together by frictional contact and causing the shafts n^2 n^5 to rotate as one. The shaft k^4 (see Figs. 7 and 17) is connected by means of intermediate mechanism, hereinafter described, with a source of power for the purpose of rotating the face-plate. When, therefore, the friction-clutch just described is set, as shown in Fig. 20, the gear k^5, meshing into the gear n, drives the latter, and with it the gear n', which in turn engages with the gear m^9, thus driving the shaft m^4 and imparting motion to the face-plate m through the worm m^3. Upon reversing the hand-wheel n^{10} and loosening the friction-clutch the gears k^5 n continue to rotate, but the shaft n^2 remains stationary, and hence no motion is imparted to the face-plate; but should it be desirable to feed the work by hand this may be accomplished by turning the hand-wheel n^4. Thus it will be seen that the machine may be adjusted at will so that the face-plate may be rotated by power automatically or by hand by merely clutching or unclutching the shafts n^2 n^5.

Attached to the left-hand end of the shaft k^4, Figs. 2 and 17, is a gear-wheel o in engagement with a worm o' upon a shaft o^2. One end of the latter is supported in bearings formed in a casing o^3, which covers the gear o. The other end of said shaft is supported in a bearing o^4, Fig. 2, upon the outer end of the stud h^3, (shown in Fig. 1 and indicated in dotted lines in Fig. 2,) said stud extending through a central opening in the friction-disk i.

Loosely mounted upon the shaft o^2 is a sleeve o^5, Figs. 9, 10, 11, and 12, which is splined into the groove o^6, so as to permit a longitudinal movement upon said shaft while rotating therewith. Upon one end of said sleeve is formed a ball o^7, which serves as a bearing for a wheel p. Pins o^8 o^8, Fig. 12, are projected from the body of the wheel into grooves o^9 in such manner as to permit the wheel to tilt laterally upon its axis while causing the rotation of the sleeve o^5 and shaft o^2. The body of the wheel p is made in two parts bolted together, as indicated, to enable it to be placed upon the ball. Between the sections is preferably secured a ring p^9, of rubber or other suitable material, having a friction-surface adapted to engage in frictional contact with the surface of the friction-wheel i. Placed loosely within a groove or recess formed between two sections of the wheel p is a ring p', Figs. 9, 10, 11, 12, 14, and 15, which is cut away, as shown at p^2, and notched at the sides, as shown at p^3 p^3. A collar p^4 is loosely mounted upon the sleeve o^5, said collar having an arm p^5, with a notch p^6 formed upon its under side, which is in operative connection with the cut-away portion of the ring p'. Trunnions p^7 p^7 are formed upon the collar and are connected by means of links p^8 p^8 to the respective branches f f' of an arm q, which is rigidly attached to the rock-shaft f^2, Figs. 1 and 2, sustained in a bearing within a hollow stud f^3, which is rigidly attached to the frame. The inner end of the shaft f^2 has an arm f^4, (indicated in dotted lines,) which is connected by means of a link f^5 to an arm f^6, which is rigidly attached to the rock-shaft k. By this means the oscillation of the rock-shaft is communicated to the sleeve p^4, thereby actuating the latter and moving the friction-wheel p either toward or away from the center of the disk i, according to the direction of the movement of the rock-shaft. In order to save power and prevent undue wear of the friction-surfaces upon the wheel p and disk i, which would occur as a result of forcibly sliding the former upon the latter, we provide the means described for tilting the wheel p obliquely to the shaft o^2, which causes it to roll to or from the center, according to the direction in which it is tilted. The relative distance of the wheel from the center of the disk i governs its speed, which varies in exact proportion to said distance, and hence varies the speed of the face-plate m through the shafts o^2 k^4 m^4. The object of this device will be more clearly understood in connection with the construction and operation of the former with reference to the cutting-tool, which will now be described.

Secured in the hollow hub m' of the face-plate m is a tapered pin r, to the outer end of which is attached by means of a suitable nut a former s, Figs. 1, 7, and 17. A bracket t', Figs. 1 and 7, is formed upon the frame, which is provided with a dovetailed groove, in which is fitted an arm t, adapted to slide thereon. A screw t^2, having a hand-wheel t^3, is tapped into a depending lug secured to the arm t. By turning the hand-wheel the arm may be moved backward or forward to any desired position.

Secured in the upper end of the arm t by means of a hand tightening-screw t^4, Figs. 1, 7, 8, 21, and 22, is a former-pin holder t^5, which may be adjusted longitudinally by means of a screw-thread thereon, as shown, and is preferably made hollow, so as to receive a former-pin t^6 therein. The former-pin is adjusted so as to engage with the former, whatever its character or contour may be. If a cam, as shown in Figs. 7 and 8, the end of the former-pin is placed in the groove s' thereof, in which case we prefer to employ a straight former-pin, as shown in Fig. 8. In case a different former is used upon work requiring profile-cutting only, we prefer to employ a tapered former-pin, as shown in Figs.

21 and 22. In such case the former-pin holder t^5, which is tapped into the head of the part t, may be adjusted longitudinally, so as to permit the tapered portion of the pin to bear upon the former in such a way as to compensate for the wear of the cutter. Thus it is obvious that not only a cutter of very small diameter may be employed, but it may be permitted to wear indefinitely and yet insure accurate work. A great advantage of this construction which permits the use of a small cutter is that it enables every variety of work to be speedily, accurately, and cheaply done that has heretofore required the use of special and expensive cutters. The means for adjusting and aiding in the manipulation of the parts referred to are the following: An arm t^7, Figs. 2 and 7, is formed upon the arm t, upon which is mounted a sheave t^8, over which is trained a cord u', having a weight u thereon. An eccentric hand-clamp u^2 (better shown in Fig. 2) enables the cord to be clamped at will. The end of the cord is attached to the head l' of the arm l, and the constant tendency of the weight is to draw the arm forward and hold the former against the former-pin.

The "work" v, varying indefinitely in form, as indicated in Figs. 18 and 23 to 31, inclusive, is clamped upon the face-plate m, and a former s of the desired contour is attached to the oscillating head in the manner described. The former-pin is adjusted in contact with the former and the cord t^8 unclutched, so as to permit the weight to act and hold the former against the former-pin as the former is rotated. The cutter or tool g^4 is then placed in the chuck and adjusted to the work by turning the hand-wheel d^2. Power being applied to the machine, the friction-wheel i is rotated in the manner described, and being pressed by the action of the spring h^4 against the friction-wheel p the motion of the latter is imparted in the manner specified to the face-plate. Assuming that the work to be done is the cutting of a groove in a cam v, Fig. 1, the contour of which is like that shown at s', Fig. 7, as the face-plate is rotated the arm l is oscillated to conform to the variations in the former. Assuming the former to be in the position shown in Fig. 7, the friction-wheel p, Fig. 2, as a result of the position of the rock-shaft, will be very near the center of the disk i, and consequently will be rotated at a minimum rate of speed, thereby rotating the face-plate slowly, so as to feed the work to the cutter g^4 at no greater speed than if the cutter were nearer to the axis of the cam. As the face-plate is further rotated so as to bring the former-pin in that part of the groove nearest to the center of the former, the wheel p is moved farther from the center of the disk i and is thereby caused to rotate at a proportionately higher rate of speed, thus rotating the face-plate faster when the cutter is nearest to the center. By this means the lineal feed to the cutter is always automatically maintained at a uniform rate, regardless of the shape of the former, the speed of rotation of the face-plate being always in proportion to the distance of the former-pin from the center of the former.

In lieu of the tilting wheel, which automatically accommodates itself to the desired direction of movement of the sleeve o^5 upon the shaft o^2, an ordinary wheel may be used, as shown in Fig. 3; but the power required to shift it would be much greater.

Aside from the advantage incident to an automatic and uniform lineal feed, which is the direct result of the employment of the rock-shaft k and the oscillating face-plate, this construction enables a much larger former to be employed and allows profile work to be done of a much steeper pitch than can be done upon ordinary machines, while the friction incident to the work is greatly decreased. Moreover, the automatic feed described enables the tool to cut with greater smoothness than if the feed were varied, as it necessarily would be when controlled by hand.

It is obvious that the conditions described may be reversed and that the cutting-tool and former-pin instead of being stationary may be made to oscillate in harmony with the contour of the former by which it may be controlled, and that the work and former may be placed upon the stationary axis and rotated to conform in its lineal feed to the contour of the former without departing from the principle involved in our invention; but we prefer the construction hereinbefore set forth.

Having thus described our invention, we claim—

1. The combination in a profiling-machine of an oscillating arm, a revoluble former mounted thereon, for determining the contour of the work to be formed an adjustable former-pin, means for securing the same in a stationary position, a work-holding face-plate in operative connection with said former, a cutting-tool, means for feeding the work thereto, a source of power for actuating said former and cutting-tool, and means such as a weighted cord and pulley for holding the former in engagement with the former-pin with a yielding pressure, whereby all "play" is taken up and the exact contour of the former is followed in the work, substantially as described.

2. In a profiling-machine, the combination of an oscillating arm mounted upon a rock-shaft, a revoluble former mounted upon said arm, means for holding said former in operative contact with a stationary pin, a revoluble face-plate, a cutting-tool, a source of power in operative connection with said face-plate and cutting-tool, an automatic feeding device and means in operative connection with said rock-shaft whereby the lineal feed may be controlled by the relative position of the rock-shaft as it is caused to oscillate by the former, substantially as described.

3. In a profiling-machine, the combination of an oscillatory arm mounted upon a rock-shaft, a revoluble former mounted upon said

arm, means for holding said former in operative contact with a stationary pin, a revoluble face-plate, a cutting-tool, a source of power in operative connection with said face-plate and cutting-tool, a friction-disk, a laterally-movable friction-wheel connected with the feeding mechanism to drive the same, and means, in operative connection with said rock-shaft for moving said friction-wheel away from or toward the center of said friction-disk as said arm is oscillated by the former, substantially as described.

4. In a profiling-machine, the combination of an oscillatory arm mounted upon a rock-shaft, a revoluble former mounted upon said arm, means for holding said former in operative contact with a stationary pin, a revoluble face-plate, a cutting-tool, a source of power in operative connection with said face-plate and cutting-tool, a friction-disk, a laterally-tilting friction-wheel connected by means of suitable shafting and gears with the face-plate and means, in operative connection with said rock-shaft for laterally tilting said friction-wheel in harmony with the movement of said rock-shaft, substantially as described.

5. In a profiling-machine, the combination of a revoluble former mounted upon an oscillatory arm, a revoluble face-plate a cutting-tool, a source of power in operative connection with said face-plate and cutting-tool, a feeding device, a former-pin having a tapered end adapted to be brought into engagement with the former, means for adjusting said former-pin longitudinally, means for also adjusting the same at varying distances from the axis of the former and means for holding said former in operative contact with said former-pin, substantially as described.

6. The combination in a profiling-machine, of a revoluble former, a former-pin having a tapering end adapted to engage with the former, and means for adjusting said former-pin longitudinally, whereby the wear of the tool may be compensated for, substantially as described.

7. The combination in a profiling-machine of a revoluble former mounted upon a rock-shaft, a work-holding face-plate in operative connection therewith, feeding mechanism, a friction-disk in operative connection with the driving-power for actuating the feeding mechanism, a friction-wheel adapted to be tilted obliquely to its axis and in frictional contact with said disk and interposed means in operative connection with said rock-shaft for tilting said friction-wheel in harmony with the oscillation of the face-plate, substantially as described.

8. The combination with the friction-disk i of the laterally-movable tilting wheel p in operative connection with the feed mechanism, substantially as described.

9. The combination with a revoluble oscillatory former, of the shaft o^2 in operative connection with the feed mechanism, disk i, tilting wheel p, lever q and means for automatically oscillating said lever in harmony with the oscillation of the former, substantially as described.

10. In a profiling-machine, the combination of an oscillatory arm, a revoluble former mounted thereon for determining the contour of the work to be formed, a former-pin, means for securing the same in a stationary position, means for holding the former in engagement therewith, a cutting-tool, means for feeding the work thereto, a source of power for actuating said former and cutting-tool, and means for receiving the belt pull, whereby the cutting-tool may be relieved from friction, substantially as described.

11. In a profiling-machine, the combination of a spindle for holding the cutting-tool, a driving-pulley mounted upon a bearing independent of the spindle, and a disk splined or otherwise secured to the spindle and connected with said pulley by means of a sliding or yielding connection, whereby rotary motion may be imparted to the disk while said disk is wholly relieved from the belt strain, substantially as described.

In testimony whereof we have signed this specification, in the presence of two subscribing witnesses, this 13th day of July, 1894.

CHARLES E. DAVIS.
CARL L. GROHMANN.

Witnesses:
D. H. FLETCHER,
W. H. CHAMBERLIN.