No. 672,557.

Patented Apr. 23, 1901.

A. JOHNSTON.

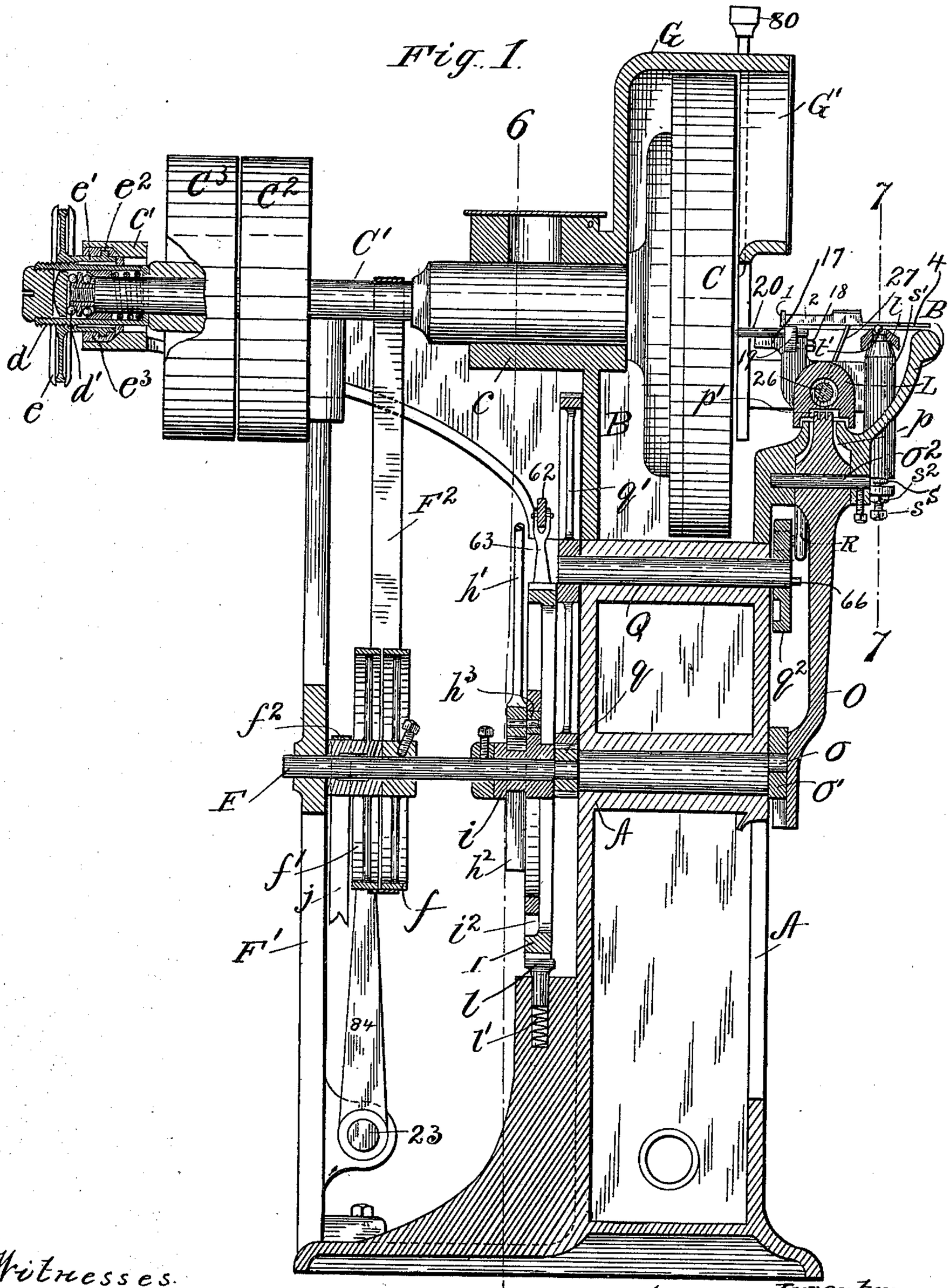
GRINDING MACHINE.

(Application filed Jan. 22, 1900.)

(No Model.)

7 Sheets—Sheet 1.

Fig. 1.



Witnesses.
W. R. Edelen
Herbert Lewis

Inventor.
Allen Johnston
by Philip Mauro
his Atty.

6

No. 672,557.

Patented Apr. 23, 1901.

A. JOHNSTON.

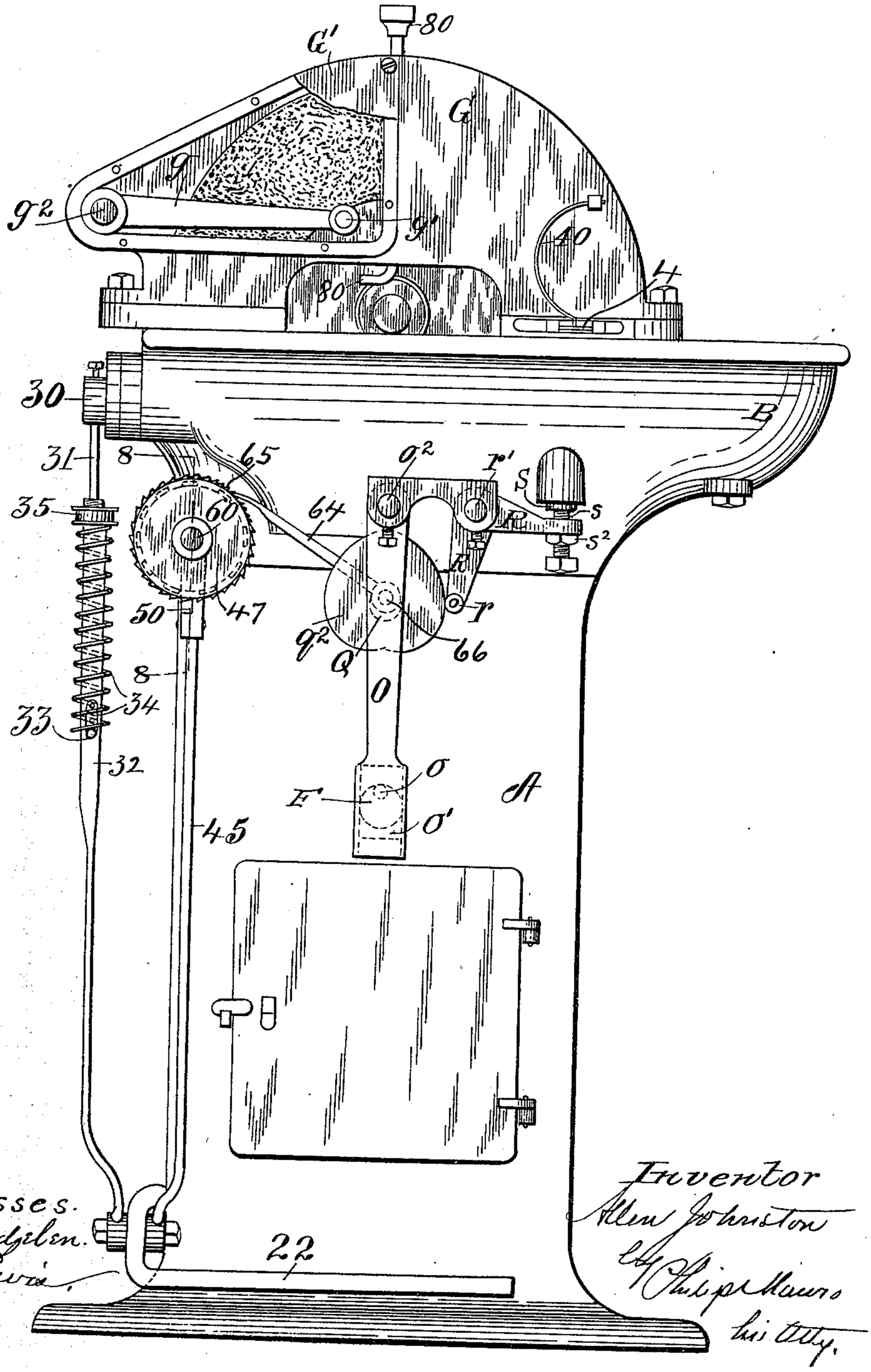
GRINDING MACHINE.

(Application filed Jan. 22, 1900.)

(No Model.)

7 Sheets—Sheet 2.

Fig 2.



Witnesses.
W. B. Edgerton.
Geo. Tweed.

Inventor
Allen Johnston
by Philip Mauro
his Atty.

No. 672,557.

Patented Apr. 23, 1901.

A. JOHNSTON.

GRINDING MACHINE.

(Application filed Jan. 22, 1900.)

(No Model.)

7 Sheets—Sheet 3.

Fig. 3.

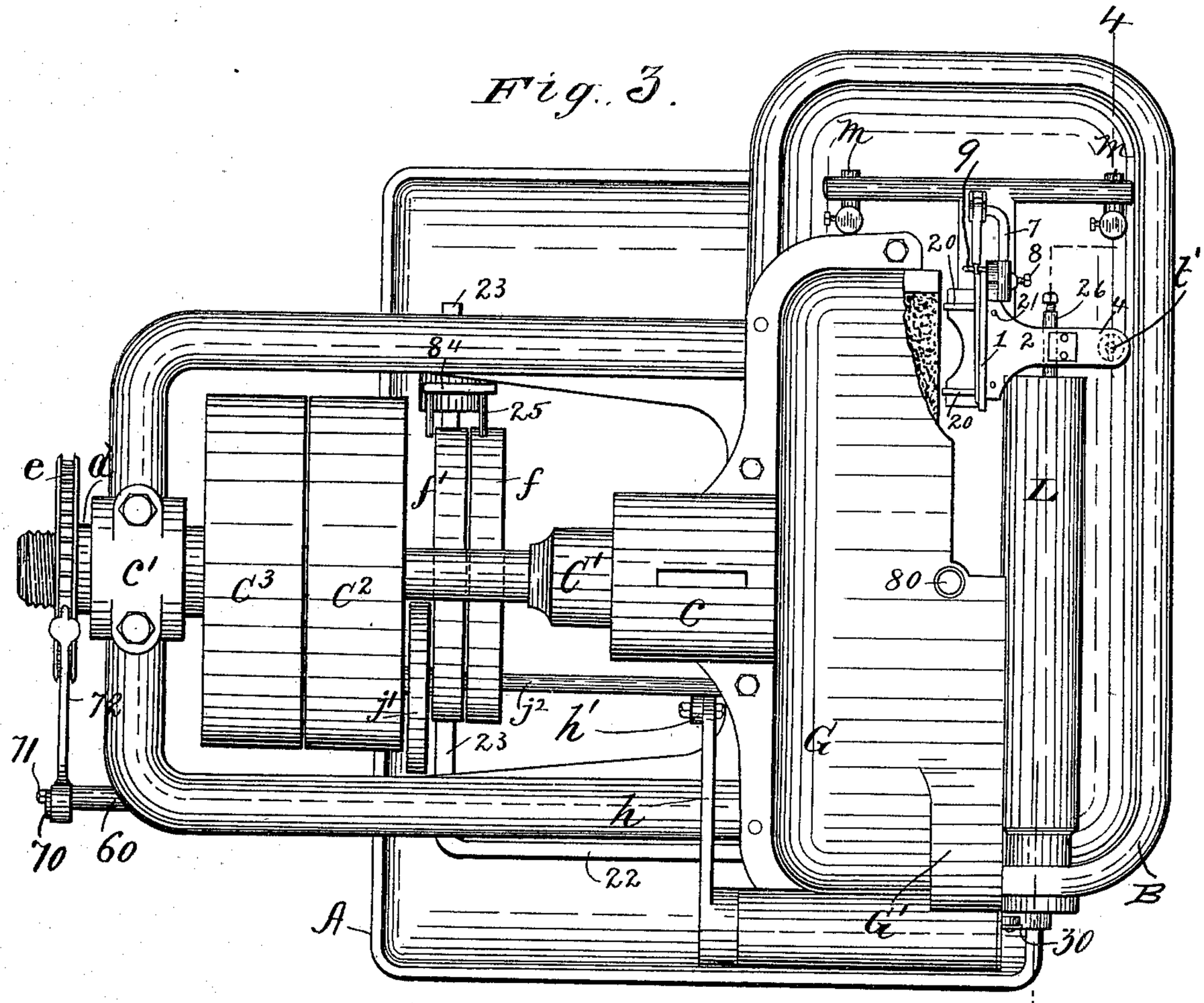
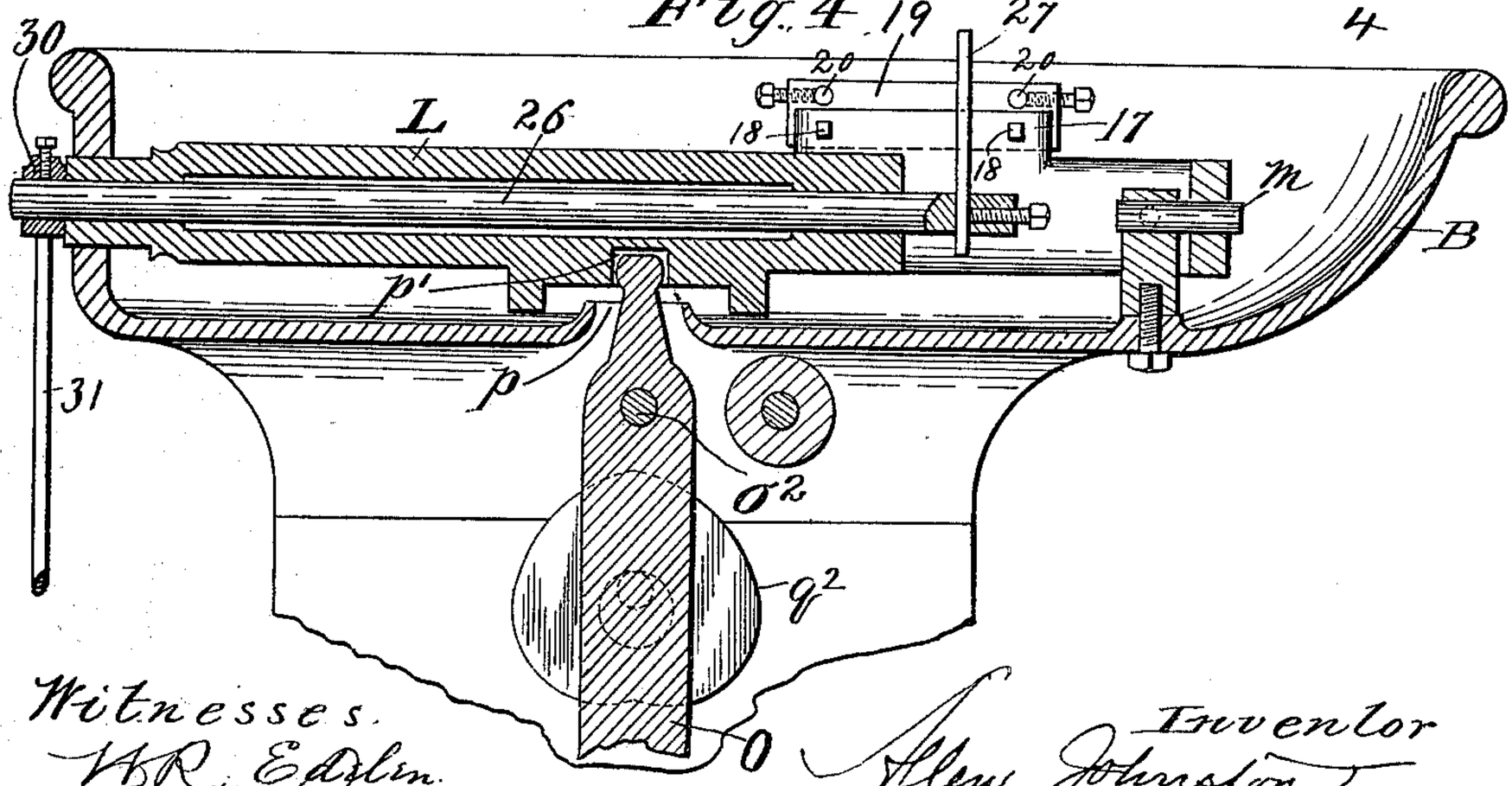


Fig. 4.



Witnesses.
J. R. Edelin.
Thos. Tweed.

Inventor
Allen Johnston
by Philip C. Mauro
his Atty.

No. 672,557. Patented Apr. 23, 1901.

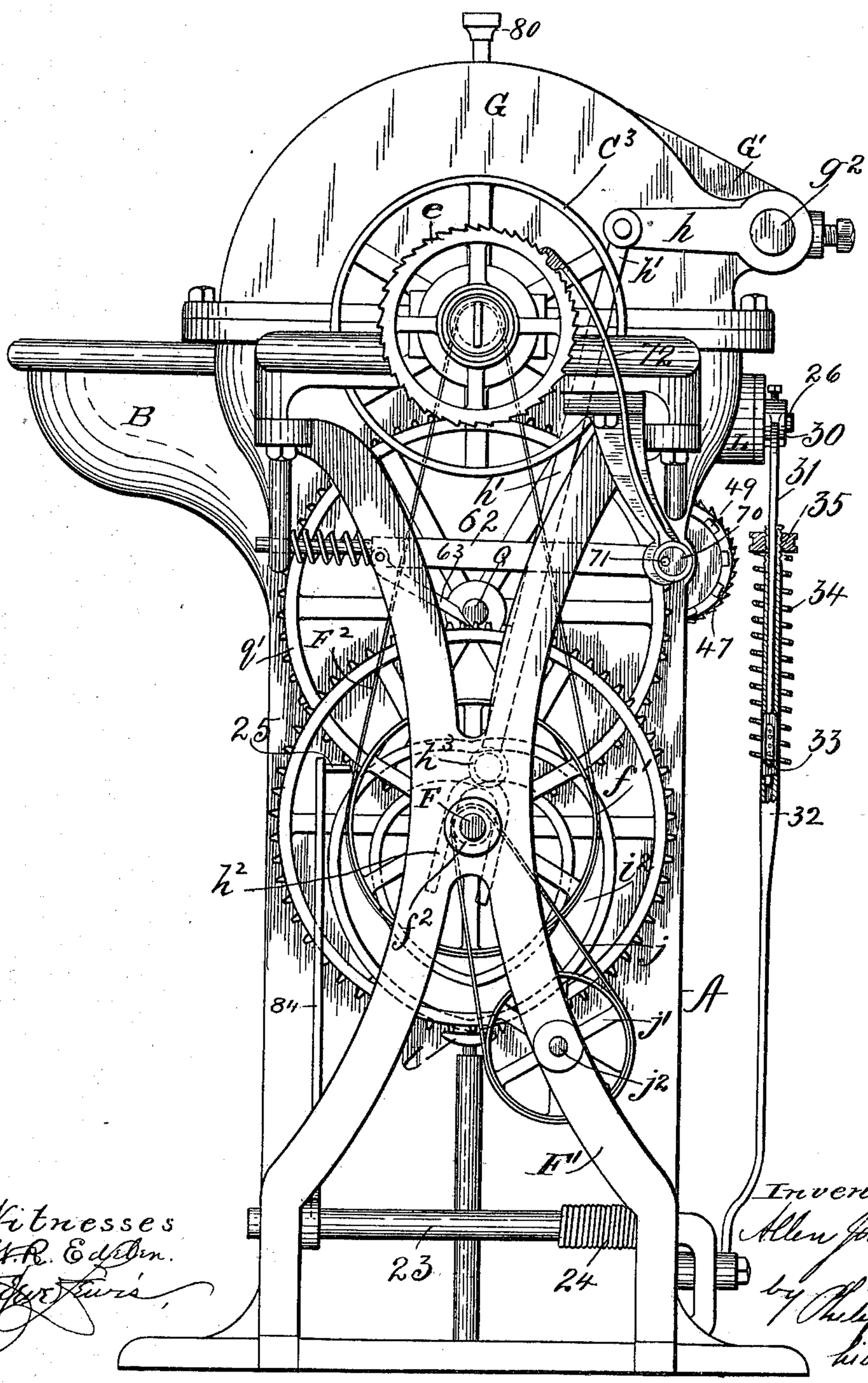
A. JOHNSTON.

GRINDING MACHINE.

(Application filed Jan. 22, 1900.)

(No Model.) 7 Sheets—Sheet 4.

Fig. 5.



Witnesses
W. R. Edson.
Jas. F. Lewis,

Inventor
Allen Johnston
by Philipp Bros.
his Attys.

No. 672,557. Patented Apr. 23, 1901.

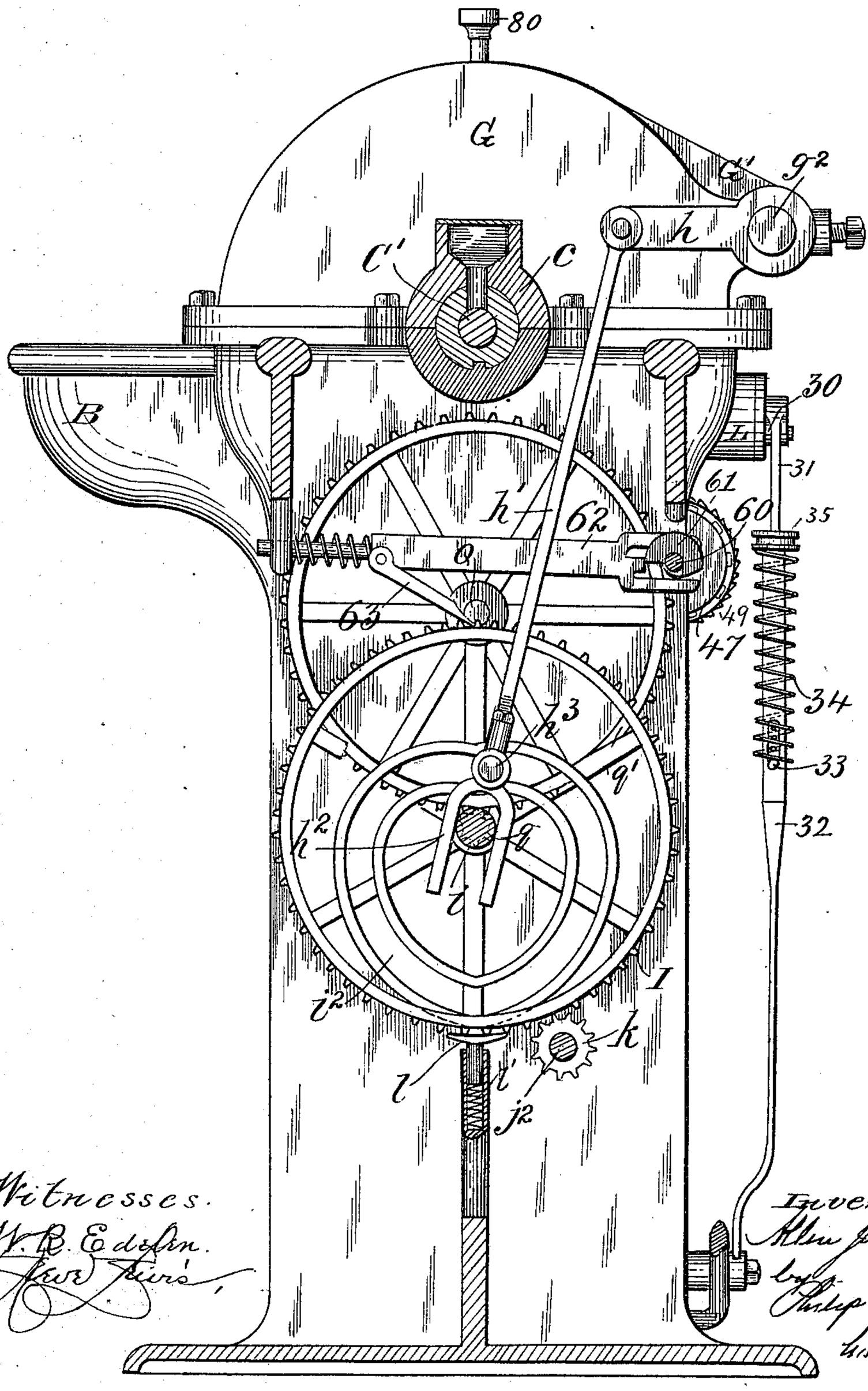
A. JOHNSTON.

GRINDING MACHINE.

(Application filed Jan. 22, 1900.)

(No Model.) 7 Sheets—Sheet 5.

Fig. 6



Witnesses.
W. R. Edson.
Geo. Geis,

Inventor,
Allen Johnston
by Philip Mauro
his Atty.

No. 672,557. Patented Apr. 23, 1901.

A. JOHNSTON.

GRINDING MACHINE.

(Application filed Jan. 22, 1900.)

(No Model.) 7 Sheets—Sheet 6.

Fig. 7.

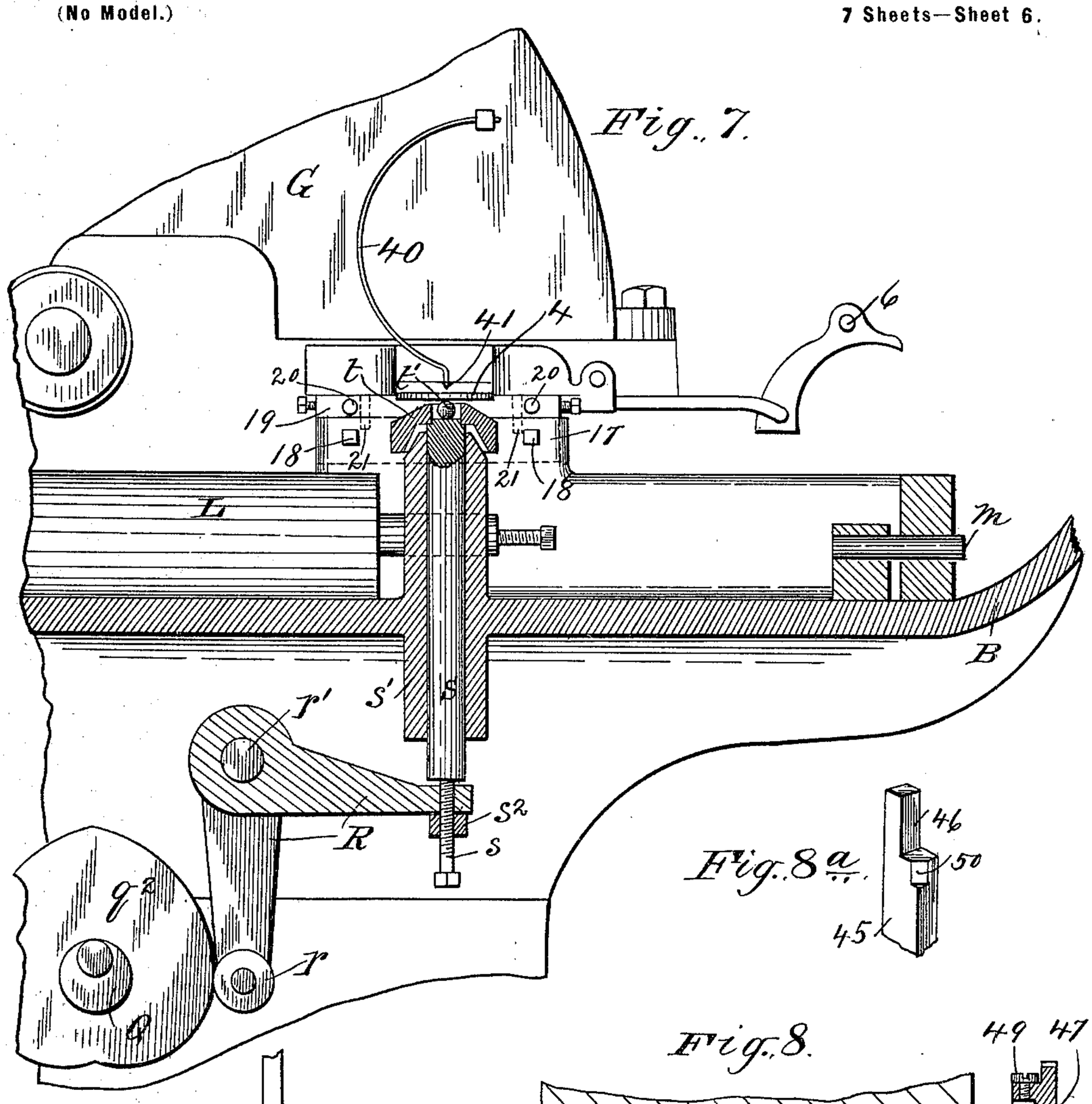
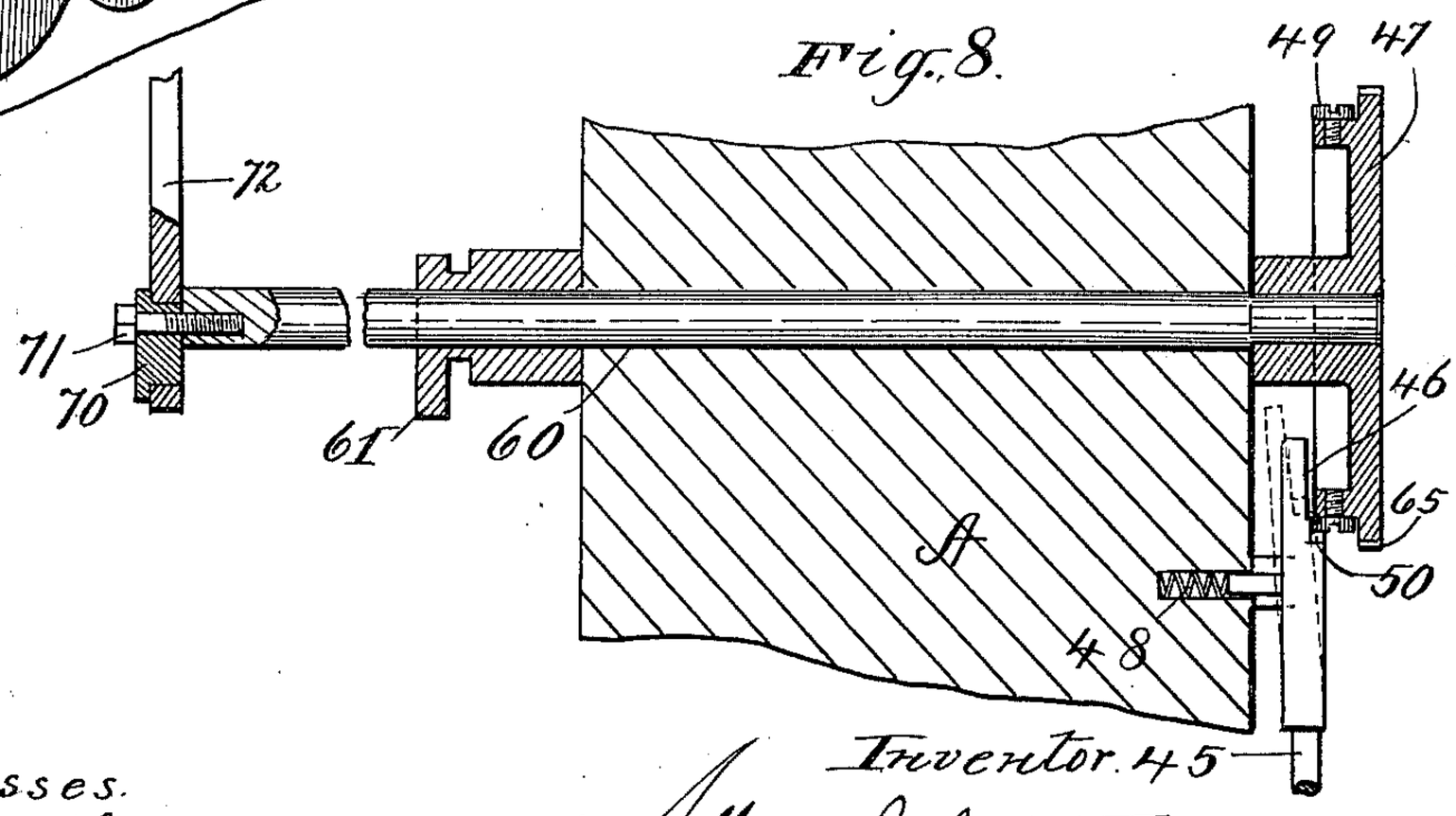


Fig. 8a.

Fig. 8.



Witnesses.
W. B. Edelen.
Geo. Unger

Inventor. 45
Allen Johnston
by Philip Mauro
his Atty.

No. 672,557. Patented Apr. 23, 1901.

A. JOHNSTON.

GRINDING MACHINE.

(Application filed Jan. 22, 1900.)

(No Model.) 7 Sheets—Sheet 7.

Fig. 9.

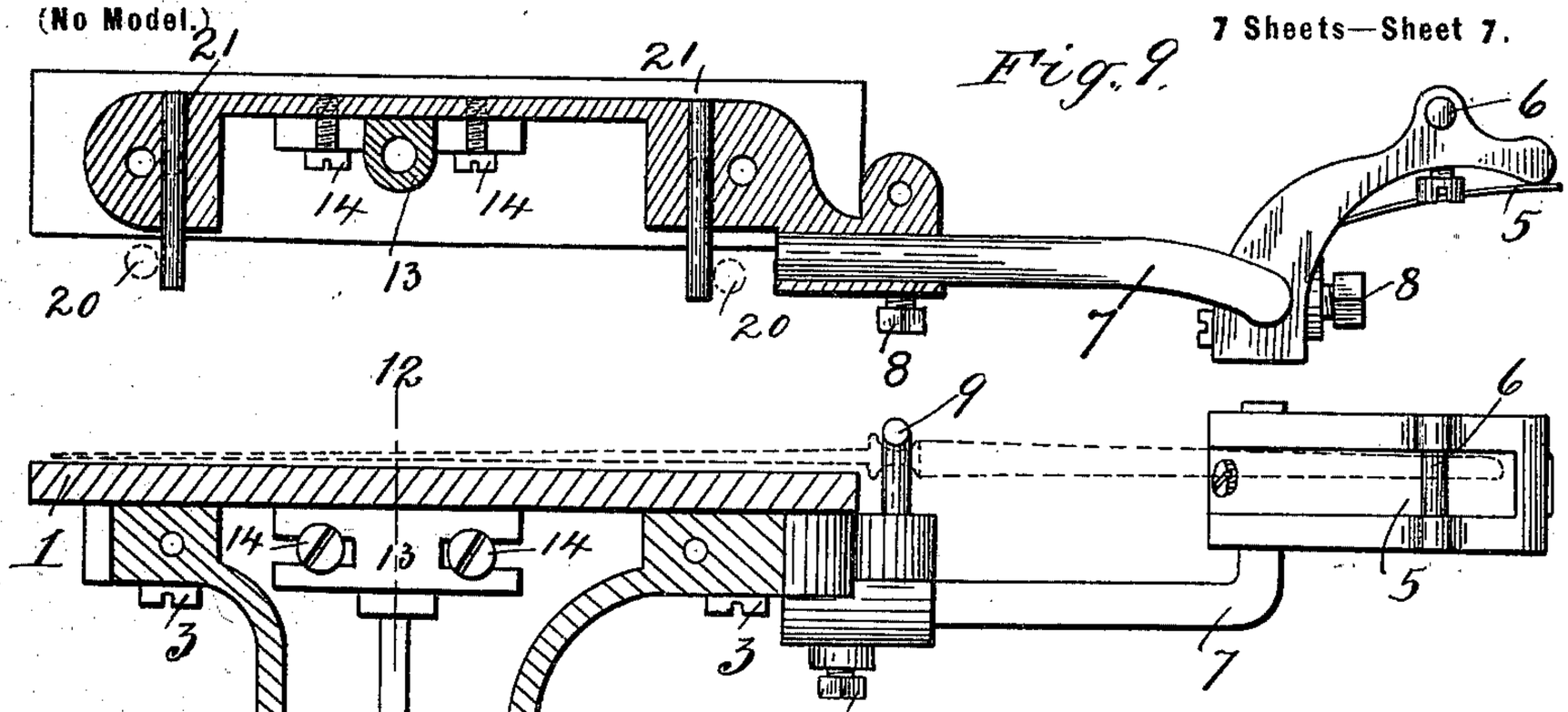


Fig. 10.

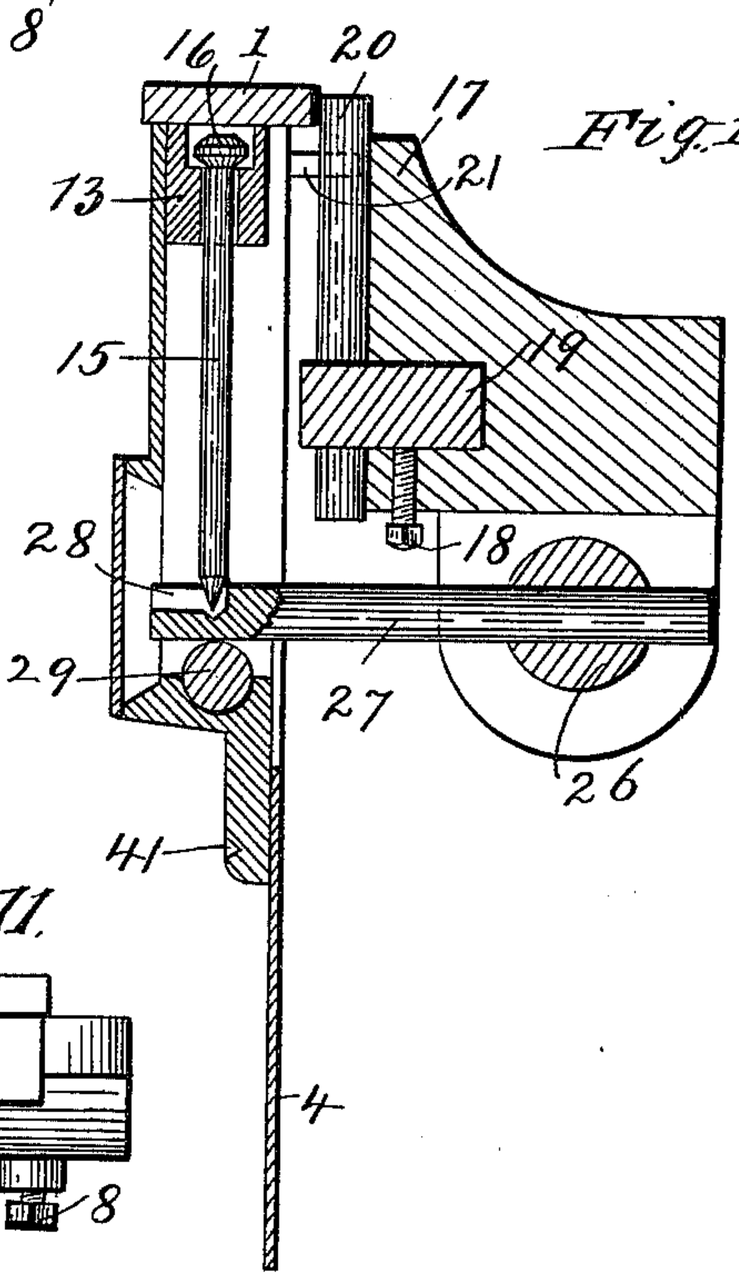
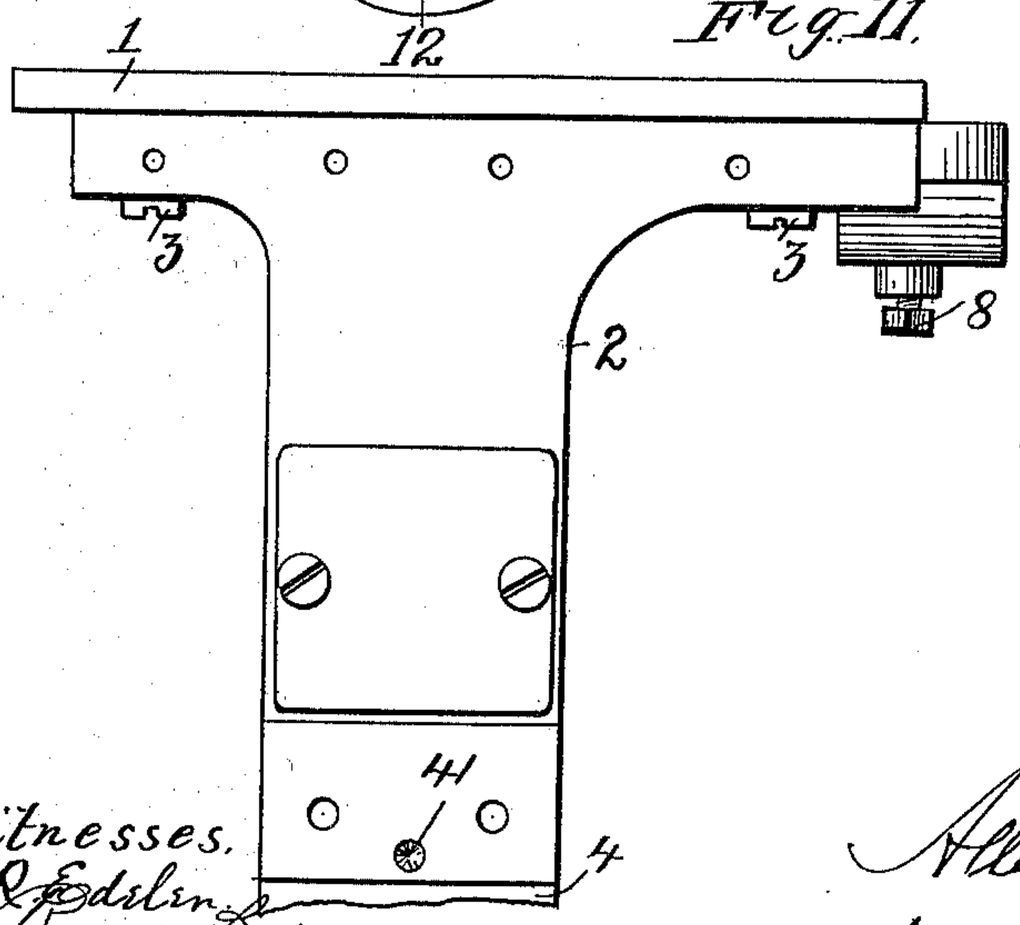


Fig. 12.

Fig. 11.



Witnesses,
W. R. Edelin.
Fred Fairs

Inventor
Allen Johnston
by Philip Mauro
his Attorney.

UNITED STATES PATENT OFFICE.

ALLEN JOHNSTON, OF OTTUMWA, IOWA.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 672,557, dated April 23, 1901.

Application filed January 22, 1900. Serial No. 2,370. (No model.)

To all whom it may concern:

Be it known that I, ALLEN JOHNSTON, a resident of Ottumwa, Iowa, have invented a new and useful Improvement in Grinding-Machines, which invention is fully set forth in the following specification.

This invention has reference to improvements in grinding and polishing machines, particularly to such as are employed in the finishing or whitening of the blades of table-knives.

My present invention consists in certain improvements upon the machine of my Patent No. 557,825, dated April 7, 1896, the principal features of said improvements being the provision of mechanism operated automatically at predetermined intervals for truing the acting surface of the grinding-wheel and for advancing said wheel to compensate for wear on its acting surface, and, furthermore, to so locate and construct the parts of the mechanism that wear generally, and particularly that due to the loose grinding material (from the surface of the grinding-wheel) coming in contact with bearing-surfaces, will be avoided, or at least reduced to a minimum.

My invention also embraces other important features, all of which will be best understood by reference to the accompanying drawings, wherein—

Figure 1 is a vertical sectional view. Fig. 2 is a front elevation. Fig. 3 is a top plan view. Fig. 4 is a vertical sectional view through the basin of the frame and the reciprocating carriage on line 4 4 of Fig. 3. Fig. 5 is a rear elevation. Fig. 6 is a sectional view on line 6 6 of Fig. 1 looking to the left. Fig. 7 is a vertical sectional view on line 7 7 of Fig. 1. Fig. 8 is a sectional view on line 8 8 of Fig. 2. Fig 8^a is a detail perspective view of the upper end of rod 45. Fig. 9 is a vertical longitudinal sectional view through the knife-holder, which is mounted on the carriage. Fig. 10 is a horizontal longitudinal sectional view through the knife-holder. Fig. 11 is a plan view of the knife-holder, partly broken away and with other parts omitted. Fig. 12 is a sectional view on line 12 12 of Fig. 10.

A brief explanation of the scheme of operation of the machine as illustrated will lead to a quick understanding of the functions and *modus operandi* of the parts about to be more fully explained in the detailed description. The knife to be ground is placed by the operator in a knife-holder, Figs. 9 to 12, which slides transversely on a carriage to bring the blade of the knife into contact with the surface of the grinding-wheel. The carriage is given a limited longitudinal reciprocatory movement, so as to present different parts of the surface of the knife-blade to different parts of the grinding-surface and prevent uneven grinding or grooving due to imperfections in said grinding-surface. By pressing on a treadle the operator advances the knife-holder to the grinding-surface and places under tension a spring which acts on the holder to hold the knife in contact with the grinding-surface with yielding pressure. The same operation throws into gear the means for reciprocating the carriage, and after the knife has been acted upon for a predetermined period of time the reciprocation ceases, the knife-holder is withdrawn from its advanced position, and the operator puts in another knife. Upon depression of the treadle these operations are repeated. After the machine has been thus started and automatically stopped a predetermined number of times—in the present case ten—or, in other words, after ten knives (or both sides of five knives) have been acted upon—means are automatically brought into operation for truing the grinding-surface. Means are also provided for automatically advancing the grinding-wheel to compensate for the wear on the grinding-surface.

Referring to the drawings, A represents the base of the frame, upon which is mounted the basin B.

C is a grinding-wheel, of annular or ring form, carried by a shaft C′, which is mounted in bearings *c c′*. At its outer end and within bearings *c′* the shaft is surrounded by a sleeve *d*, within which are located ball-bearings *d′ d′*, which receive the end thrust of the shaft. At its outer end sleeve *d* is provided with exterior screw-threads which are engaged by interior screw-threads on a ratchet-wheel *e*, said wheel having a hub *e′* projecting into the bearing *c′* and having a flange e^2 thereabout projecting into a corresponding groove in a filling e^3 of Babbitt metal within the bearing, whereby the ratchet-wheel is permitted to ro-

tate, but longitudinal movement thereof prevented. By turning the ratchet-wheel in the proper direction the shaft C′, and with it the grinding-wheel C, may be advanced toward the front of the machine to compensate for wear on the grinding-surface. Means for automatically rotating the ratchet-wheel will be described hereinafter.

The shaft C′ carries fast and loose pulleys C^2 and C^3, respectively, by the former of which it is driven from any suitable source of power.

F is a shaft having a bearing at one end in the base A and at its other end in a spider F′, extending upwardly from the foot of said base to the under side of the basin B. This shaft carries a fast pulley *f* and a loose pulley *f*′, having an elongated hub f^2. A belt F^2 (see Figs. 1 and 5, not shown in Fig. 3) passes from shaft C′ over the pulleys *f f*′, said belt being of such width as to at all times partially overlap the rim of the loose pulley, even when the belt is shifted to such position as to drive the fixed pulley, and with it the shaft F. In this manner while the pulley *f* is driven only when the belt is shifted thereon, as shown in Fig. 1, the loose pulley is continuously rotated.

The device for truing the grinding-surface and the means for automatically operating the same may be most clearly understood by reference to Figs. 1, 2, 3, 5, and 6. G is a cap or cover which fits over the grinding-wheel and is secured to the basin B. Said cap is enlarged at G′ to permit the necessary movement of the swinging arm *g*, which carries the diamond or other hard point *g*′, which is adapted to be moved laterally across and act upon the surface of the grinding-wheel to true the same. The arm *g* is secured to a shaft g^2, bearing in one side of the cap or cover G and carrying at its rear projecting end a crank-arm *h*, through which said shaft is adapted to receive its oscillatory movement for imparting the translatory movement to the truing-point *g*′. Arm *h* receives its movement from a pitman *h*′, which has a forked lower end h^2, embracing the hub *i* of gear-wheel I, loosely mounted on the shaft F. Said gear-wheel is provided with a heart-shaped cam-groove i^2, engaged by a roller h^3 on the pitman *h*′. It will thus be apparent that upon rotation of the gear-wheel I the heart-shaped cam will act to impart to the pitman *h*′ a longitudinal reciprocatory movement, which through the intermediary of the arm *h* will be transformed into oscillatory movement in the shaft g^2. As it is not necessary that the truing device should be continuously in operation, means are provided whereby it is brought into action intermittently. To this end the gear-wheel I is adapted to be driven by a belt *j*, passing from the hub of loose pulley f^2 over a pulley *j*′, carried by a shaft j^2, said shaft bearing at one end in the spider F′ and at its other end in the base A and carrying a pinion *k*, adapted to engage said gear I. At one point on its periphery, however, the teeth of the gear-wheel I are omitted, and when this part of the gear-wheel comes opposite the pinion *k* its movement is arrested, a brake-shoe *l*, actuated by a spring *l*′, (see Fig. 1,) bearing against the teeth of the gear-wheel I with sufficient friction to prevent movement thereof due to momentum, but at the same time allowing the same to be rotated when the teeth of the pinion *k* are in actual engagement with the teeth on the gear-wheel. It will thus be seen that after the truing-point has been traversed across the grinding-surface and back again it is arrested until the gear-wheel I is moved a sufficient distance to again bring the teeth thereof into engagement with the pinion *k*, which latter is continuously rotated by the pulley *f*′, as will be clearly understood. The means for effecting the movement of the gear-weeel I for the purpose of again engaging the teeth thereof with the pinion will be described later.

Referring now to Figs. 1, 3, 4, and 7, L represents a reciprocatory carriage which carries the knife-holder, to be described hereinafter. This carriage consists of a hollow elongated part at one end and of a T-shaped extension at the other end. The extremity of the elongated end passes through and is adapted to slide in a suitable opening in the vertical wall of the basin B, while the extremities of the arms of the T-shaped ends of the carriage have projections therethrough which are engaged by horizontal pins *m m*, which are supported by suitable uprights from the bottom of the basin B, Fig. 7.

The carriage L receives its longitudinal reciprocation through the following mechanism: At its forward extremity the shaft F (see Figs. 1 and 2) is provided with an eccentric-pin *o*, which engages an opening in the rectangular block *o*′, which latter is adapted to slide vertically in a suitable way formed in the lower end of a vertically-disposed lever O, said lever being pivoted at o^2 and its upper end projecting through a vertical opening *p* in the bottom of basin B and engaging a recess *p*′ in the under side of the carriage L. It will be obvious that the oscillatory movement imparted to the lever O by the eccentric-pin *o* and the block *o*′ will in turn impart a corresponding movement to the carriage L.

In order to grind the surface of the knife-blade to the proper convexity, it is necessary to impart to the holder whereby the knife is presented to the grinding-wheel a tilting or rocking movement simultaneously with its longitudinal reciprocation. The means for accomplishing this will now be described, referring particularly to Figs. 1, 2, and 7. The shaft F carries a pinion *q*, engaging a gear-wheel *q*′, secured to the inner extremity of a shaft Q, passing through a horizontal bearing in the upper part of base A just below the basin B, said shaft bearing at its outer extremity a heart-shaped cam q^2, against which bears a roller *r*, carried by one arm of a bell-crank lever R, pivoted to the under side of

basin B at r'. A screw-threaded bolt s passes through a corresponding opening in the extremity of the horizontal arm on the bell-crank lever and at its upper end supports a vertically-movable bar S, which passes upwardly through a sleeve s', formed on the bottom of the basin B. A set-nut s^2 serves to secure the bolt s in any desired position of adjustment. At its upper extremity bar S supports a cap t, having a central opening in which is located a bearing-ball t', said ball resting against the end surface of the bar, but being confined in its movement by the wall of the opening through the cap. The tail-piece or extremity of the knife-holder (to be more fully described hereinafter) bears against the ball t' during the longitudinal reciprocation of said knife-holder with the carriage L. From the foregoing description it will be understood that the rotation of the heart-shaped cam q^2 acts through bell-crank lever R to slowly raise and lower the bar S and that the knife-holder following this movement of the bar will be gradually tilted in conformity with the convexity which it is desired to impart to the surface of the knife-blade.

The knife-holder is most clearly shown in Figs. 9 to 12 of the drawings. It consists of a plate 1, to one side of which is secured the hollow frame 2 by the screws 3 3. From the under side of the frame 2 projects a tailpiece 4, which, when the knife-holder is in place on the carriage, rests against ball t', as already described. When placed in the holder the blade of the knife rests against the flat face of the plate 1, while the handle thereof engages between a spring 5 and a cross-pin 6, constituting parts of the extension 7 of the holder, which is adjustably secured to the frame 2 by means of a set-bolt 8. A hook 9 on the holder closely engages the groove of the bolster of the knife to hold the latter tightly in place, as clearly shown in Fig. 10 of the drawings. To the under side of the forward end of the frame 2, contiguous to the plate 1, is secured a recessed block 13. This block is held in place by screws 14 14 (see Figs. 9 and 10) engaging through slots therein, which slots permit the desired adjustment of said block. Pin 15, the function of which will be more fully described hereinafter, has a head 16 engaging in the recess of the block 13, as clearly shown in Fig. 12, the stem of said pin projecting rearwardly loosely through an opening in said block.

On the T-shaped part of the carriage L is an elevated part 17, (see Figs. 1, 4, 7, and 12,) having a longitudinal recess therein, in which is a plate 19, secured by set-bolts 18. This plate has two openings therethrough, in which are adjustably secured rods 20, projecting forwardly toward the acting face of the grinding-wheel, as most clearly shown in Fig. 1. These rods constitute the bearing for the forward end of the knife-holder in its movements toward and from the grinding-wheel, the under edge of the plate 1 resting directly on the upper surface of said rods. To prevent lateral movement of the holder on these rods, I provide vertical pins 21, engaging against the inner faces of the rods 20 20, respectively, as clearly shown in Figs. 7, 9, and 12.

For advancing the knife-holder and holding the knife in contact with the grinding-wheel with yielding pressure and for automatically withdrawing the same after the knife has been subjected to the grinding action for a predetermined period and for arresting the reciprocatory movement of the carriage I provide the following mechanism: A treadle 22 extends forwardly to the front of base A from a shaft 23, mounted in bearings on the inner face of the spider F'. A coiled spring 24 about the shaft 23 acts to raise the treadle when the same is released in a manner about to be described. A belt-shifting arm 84, projecting upwardly from shaft 23, has pins 25 25 at its upper extremity engaging on opposite sides of the belt F^2, as most clearly shown in Fig. 3.

As clearly shown in Figs. 1 and 4, a shaft 26 extends longitudinally through the hollow part of the carriage L. The projecting inner end of the shaft is provided with a lateral opening therethrough, in which is adjustably secured a pin or finger 27, (see Figs. 1, 4, and 12,) having a recess 28 in its upper extremity, in which the pointed end of the pin 15, heretofore referred to, engages, as most clearly shown in Fig. 12. The rear side of the finger bears against the cylindrical surface 29 of a rod secured in the frame 2. The other end of the shaft 26 projects through the end of carriage L, bearing in the vertical wall of the basin B, and carries a crank-arm 30, which pivotally connects with the upper end of the rod 31, which telescopes into the hollow end of the rod 32, the latter being pivoted at its lower end to the treadle 22. The rod 31 has a series of openings through its lower end, in any one of which may be engaged a pin 33, which projects at opposite ends through slots in the wall of the hollow upper end of the rod 32. A coiled spring 34 rests at its lower end against the projecting ends of the pin 33, and its upper end bears against the under side of a nut 35, screw-threaded onto the rod 32. With the parts as thus described it will be seen that when the operator depresses the treadle 22 the spring 34 will, when placed under sufficient tension, move the rod 31 downwardly and through the crank-arm 30 rotate the shaft 26, causing the finger 27, through its connection with the knife-holder by means of the pin 15, to advance said holder until the surface of the knife-blade is brought in contact with the grinding-wheel. There is sufficient freedom of movement between the pin 15 and the knife-holder, on the one hand, and the pin 15 and the finger 27, on the other hand, to enable the knife-holder to be thus advanced without lifting the same from the rods 20 or the bearing-ball t'. In order to

hold the tailpiece of the holder firmly in contact with its bearing-ball, I provide a spring 40, (see Fig. 7,) secured at its upper end to the cover G and at its lower end bearing in a conical recess 41 in the upper surface of the frame 2, forming a part of the knife-holder, said recess being most clearly shown in Figs. 10, 11, and 12 of the drawings. The knife-holder, of course, has such freedom of movement as to permit the flat face of the knife carried thereby to automatically aline itself with the flat grinding-surface when advanced to contact therewith. It will be understood that upon depression of the treadle in the manner above referred to the belt-shifter acts to move the belt F^2 onto the fast pulley *f*, thus throwing into operation the mechanism for reciprocating the carriage and for tilting the knife-holder during its reciprocation with the carriage. To maintain the treadle in its depressed condition for a length of time sufficient to accomplish the desired grinding of the surface of the knife-blade, I provide a vertically-disposed rod 45, pivotally connected at its lower end to the treadle 22 (see Fig. 2) and at its upper end formed with a notch 46, the horizontal shoulder of which upon depression is adapted to engage under the peripheral edge of a wheel 47, a spring 48, located in a recess in the base A, acting against a pin bearing on the rod 45 to force the upper end of said rod outwardly, so that its notch will engage the wheel 47 in the manner described. (See Fig. 8.) Arranged equidistant about the periphery of the wheel 47 are screws 49, the heads of which project from said wall and are adapted to act on the inclined surface 50, just below the notch 46 in the upper end of the bar 45, to force the horizontal shoulder of said bar out of engagement with the wheel, and thus permit the treadle 22 to be raised through the action of the coiled springs 24 and 34, already referred to. When the treadle is raised, the bar 45 is moved upwardly to the position shown in dotted lines in Fig. 8, the belt F^2 is shifted from the fast pulley *f*, the shaft 26 is rotated, moving the finger 27, and the knife-holder S is moved to the position shown in Fig. 1. Another knife is now inserted by the operator, who again depresses the treadle, and the operations as above described are repeated. As has already been explained, after ten knives are thus ground the truing device is brought into action and from time to time the grinding-wheel is advanced to compensate for wear thereon. The means for operating the truing device have already been described to the point where that part of the surface of the gear-wheel I having no teeth thereon is brought to a position opposite the pinion *k*, and it only remains to be explained how this gear-wheel is advanced to bring the teeth thereof into engagement with the pinion. The wheel 47, already described, is secured to one end of shaft 60, which has bearings in the base A. (See Figs. 2, 6, and 8). On the shaft is also mounted a cam 61, which bears against one end of a spring-actuated slide 62. (See Figs. 5 and 6.) This slide carries a pawl 63 in engagement with the teeth of gear-wheel I. For every knife ground the wheel 47 is moved a distance equal to the space between two of the screws 49 thereon, or, in other words, one-tenth of a rotation. This movement of wheel 47 is effected by a pawl 64 (see Fig. 2) engaging the ratchet-teeth 65, which extend entirely around one side of the periphery of said wheel, as clearly shown in Fig. 8, said pawl being actuated by an eccentric-pin 66, (see Figs. 1 and 2, the pawl 64 being omitted from the former figure,) projecting from the face of cam q^2. The shaft 60, and consequently the cam 61, carried thereby, is given a similar movement, and it will therefore be seen that ten knives will be acted upon during the time required to impart a complete rotation to said cam. During this time the cam intermittently moves the slide 62 to the left, Fig. 6, until said slide drops off of the highest part of the cam-surface and under the action of its spring is moved to the right. In this movement the pawl 63 moves the gear-wheel I a distance sufficient to engage the teeth thereon with the constantly-rotating pinion *k*, and the mechanism for moving the truing device is thus caused to operate in the manner already set forth.

The shaft 60 carries at its rear extremity an eccentric 70, secured to the shaft by a screw 71 and engaging an opening eccentrically located in the end thereof. Upon loosening this screw 71 the eccentric may be adjusted on the shaft to vary its throw. The eccentric 70 actuates a pawl 72, which engages a ratchet-wheel *e*, heretofore referred to, turning the same from time to time to move shaft C′ longitudinally in its bearings to compensate for wear on the grinding-surface.

80 is a pipe through which water may be fed to the grinding-surface.

The complete cycle of operation of the machine will, it is thought, be readily understood from the description above given.

Grinding and polishing being analogous operations, all references to the former will be understood to apply also to the latter.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a grinding-machine, the combination with a grinding-wheel, of a movable work-holder, means for rocking the work-holder to laterally oscillate the article being ground, means for reciprocating the work-holder longitudinally to move the article being ground along the grinding-surface a swinging arm the outer end of which is adapted to be given a translatory movement across the grinding-surface, a truing-point carried by said arm and adapted to act upon said surface to true the same, and mechanism for actuating

said arm automatically and intermittently after certain predetermined movements of the work-holder.

2. In a grinding-machine, the combination with a grinding-wheel having a flat grinding-surface, of a movable work-holder, means for rocking the work-holder to laterally oscillate the article being ground, means for reciprocating the work-holder longitudinally to move the article being ground along the grinding-surface, a swinging arm mounted to move in a plane parallel with the grinding-surface, and carrying a truing-point which is adapted to traverse and act upon the grinding-surface to true the same, and mechanism actuating said arm operated automatically and intermittently after certain predetermined movements of the work-holder.

3. In combination, a grinding-wheel, a movable work-holder, means for rocking the work-holder to laterally oscillate the article being ground, means for reciprocating the work-holder longitudinally to move the article being ground along the grinding-surface, a truing device adapted to be moved across and in contact with the grinding-surface to true the same, gearing and connections for transmitting motion to said truing device, means for automatically throwing said gearing out of operative relation with the driving parts of the machine after the truing device has operated for a predetermined period of time, and means for automatically throwing the same into such operative relation when the machine is operated for a predetermined period.

4. The combination with a grinding-wheel, of a movable work-holder, means for rocking the work-holder to laterally oscillate the article being ground, means for reciprocating the work-holder longitudinally to move the article being ground along the grinding-surface, a truing device for the grinding-wheel, actuating mechanism for the truing device, and mechanism for automatically and intermittently throwing said actuating mechanism into gear with the driving parts of the machine.

5. In combination, a grinding-wheel, a movable work-holder and mechanism for imparting movement thereto to present the work to the grinding-surface, a truing device for said wheel, a driving-pinion for the truing device and means for rotating the same, a gear-wheel meshing with said pinion, the teeth of said wheel being omitted at one point whereby rotation of the wheel is arrested when this point comes opposite to the pinion, and means operating automatically to move the gear-wheel to bring the teeth thereof into engagement with the teeth of the pinion after the grinding-wheel has done a predetermined amount of work.

6. In a grinding-machine, a grinding-wheel, a truing device for said wheel, a driving-pinion for the truing device and means for rotating the same, a gear-wheel meshing with said pinion, the teeth of said wheel being omitted at one point whereby rotation of the wheel is arrested when this point comes opposite to the pinion, a carriage, a holder on said carriage for the article to be ground, mechanism for reciprocating the carriage, means for throwing said mechanism into operation, means for automatically throwing said mechanism out of operation, and means operating automatically to move the gear-wheel into engagement with the teeth of the pinion after the mechanism for reciprocating the carriage has been thrown into and out of operation a predetermined number of times.

7. In a grinding-machine, a grinding-wheel, a movable work-holder and mechanism for operating the same to present the work to the grinding-surface, a shaft for the grinding-wheel, and means actuated automatically during the operation of the machine for moving said shaft longitudinally in its bearings to advance the wheel to compensate for wear on its grinding-surface.

8. In a grinding-machine, a basin in which the grinding-wheel operates, a reciprocatory carriage mounted in said basin in front of the grinding-wheel, an arm for reciprocating said carriage projecting upwardly through an opening in the bottom of the basin beneath the carriage and mechanism for actuating said arm.

9. In a grinding-machine, a basin in which the grinding-wheel operates, a reciprocating carriage and means for operating the same, a work-holder mounted to move laterally on the carriage to present the work to and withdraw it from the grinding-surface, means for imparting such lateral movement to the work-holder, means mounted in the basin and projecting through the bottom thereof for supporting the outer end of the work-holder and raising and lowering the same to rock the work-holder and thereby grind the work to the desired convexity of surface, and mechanism exterior to the basin for operating said means.

10. In a grinding-machine, a basin in which the grinding-wheel operates, a reciprocating carriage and means for operating the same, a work-holder mounted to move laterally on the carriage to present the work to and withdraw it from the grinding-surface, means for imparting such lateral movement to the work-holder, a vertically-disposed rod mounted in a suitable bearing on the bottom of the basin and depending outside of the same, an anti-friction-bearing at the upper end of said rod on which the outer end of the work-holder is supported, and mechanism outside of the basin operating upon the lower depending end of the arm to raise and lower the same to rock the work-holder, thereby imparting to the work the desired convexity of grind.

11. In a grinding-machine, a basin in which the grinding-wheel rotates, a carriage mounted in the basin in front of the grinding-wheel and means for reciprocating the same, said

carriage having a longitudinal passage therethrough, a shaft extending through said opening, means connected with the outer end of the shaft for oscillating the same, a work-holder movable laterally on the carriage, and a pin or finger on the projecting inner end of said shaft engaging the work-holder to move the latter as the shaft is oscillated.

12. In a grinding-machine, the combination with a grinding-wheel, of a movable work-holder, mechanism for rocking the work-holder to laterally oscillate the article being ground and for reciprocating the work-holder longitudinally to move the article being ground along the grinding-surface, said mechanism being adapted to be thrown into operation by the operator and to be automatically thrown out of operation, a truing device for the grinding-wheel, and automatically-operated mechanism for actuating the truing device after the work-holder has been thrown into and out of operation a predetermined number of times.

13. In a grinding-machine, the combination with a grinding-wheel, of a movable work-holder, mechanism for rocking the work-holder to laterally oscillate the article being ground and for reciprocating the work-holder longitudinally to move the article being ground along the grinding-surface, said mechanism being adapted to be thrown into operation by the operator and to be automatically thrown out of operation, a truing device for the grinding-wheel, automatically-operated mechanism for actuating the truing device after the work-holder has been thrown into and out of operation a predetermined number of times, and automatically-operated means for advancing the grinding-wheel to compensate for wear on its grinding-surface.

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

ALLEN JOHNSTON.

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