No. 617,408. Patented Jan. 10, 1899.

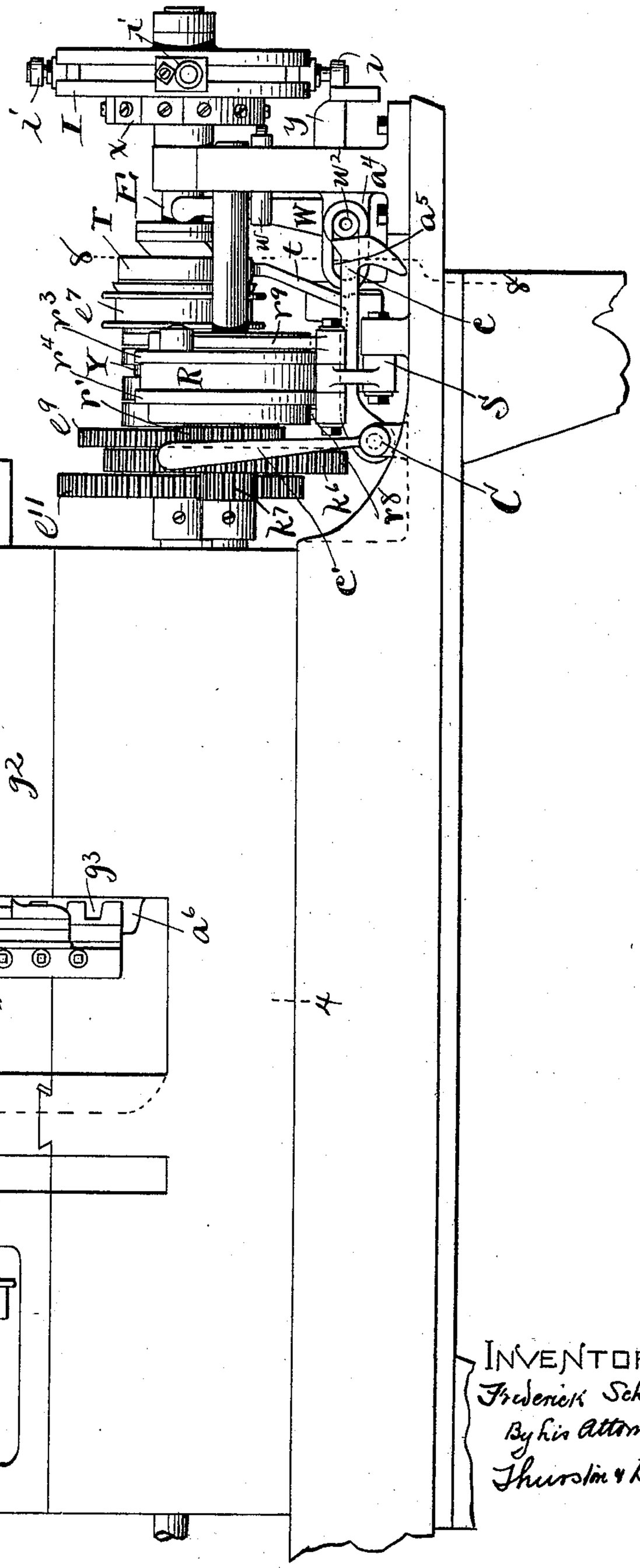
F. SCHULZE.

METAL TURNING MACHINE.

(Application filed Aug. 14, 1897.)

(No Model.) 7 Sheets—Sheet 1.

Fig. 1.



WITNESSES.
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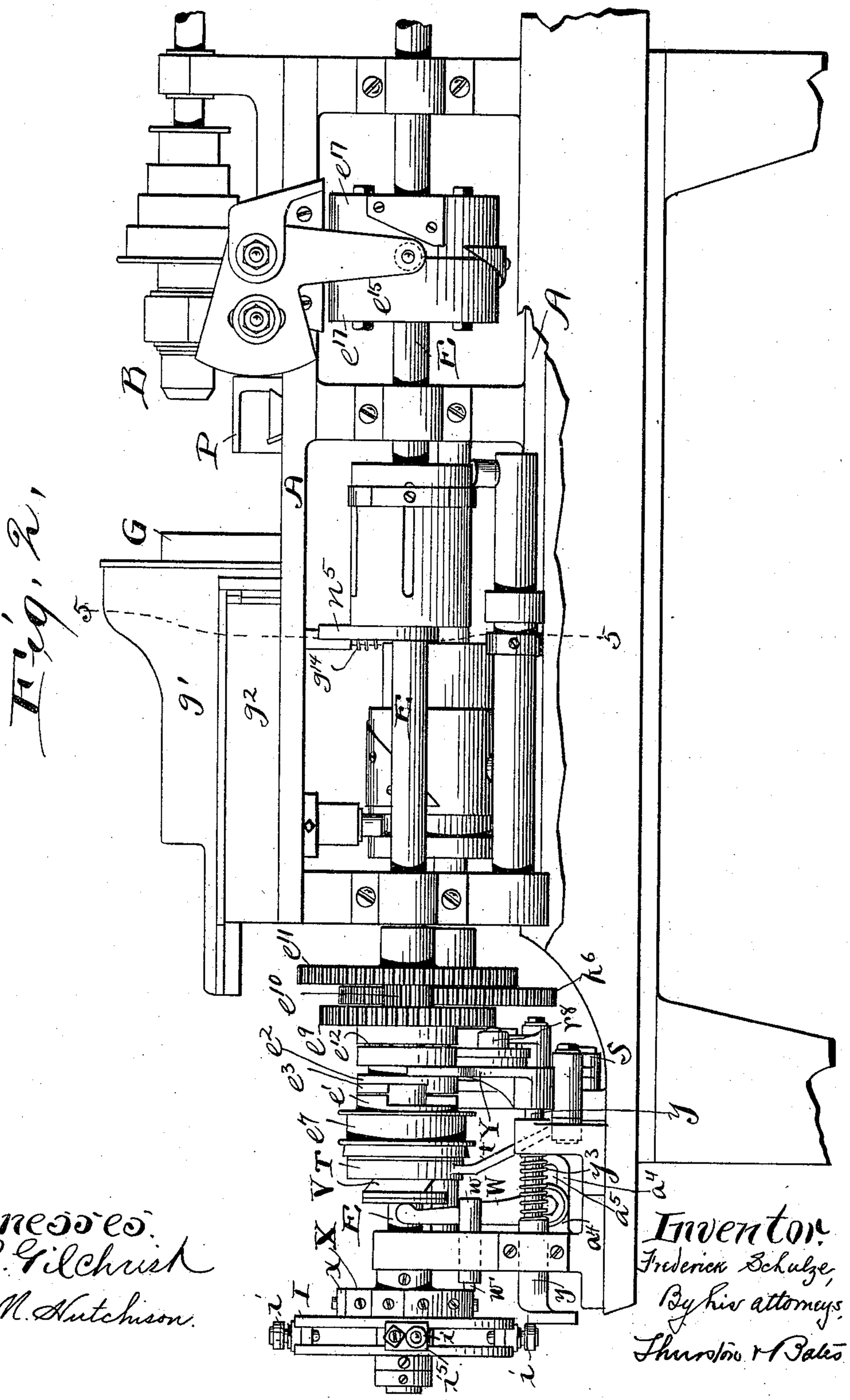

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(No Model.) 7 Sheets—Sheet 3.

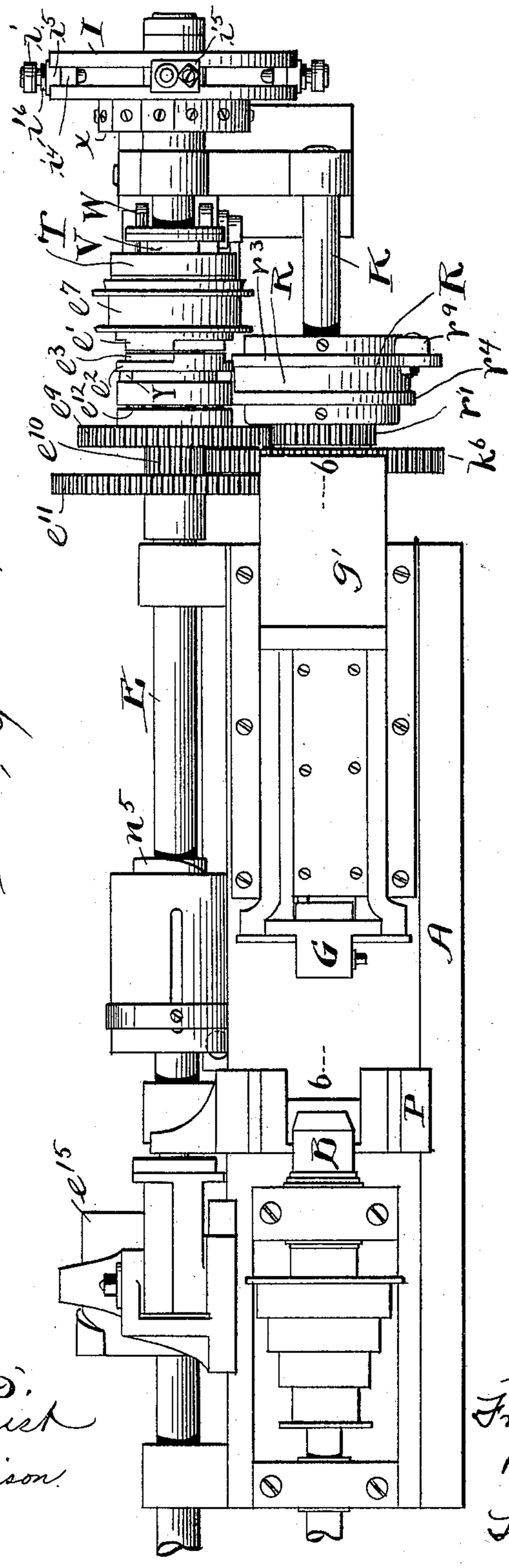

Fig. 3.

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(No Model.) 7 Sheets—Sheet 4.

Fig. 3.

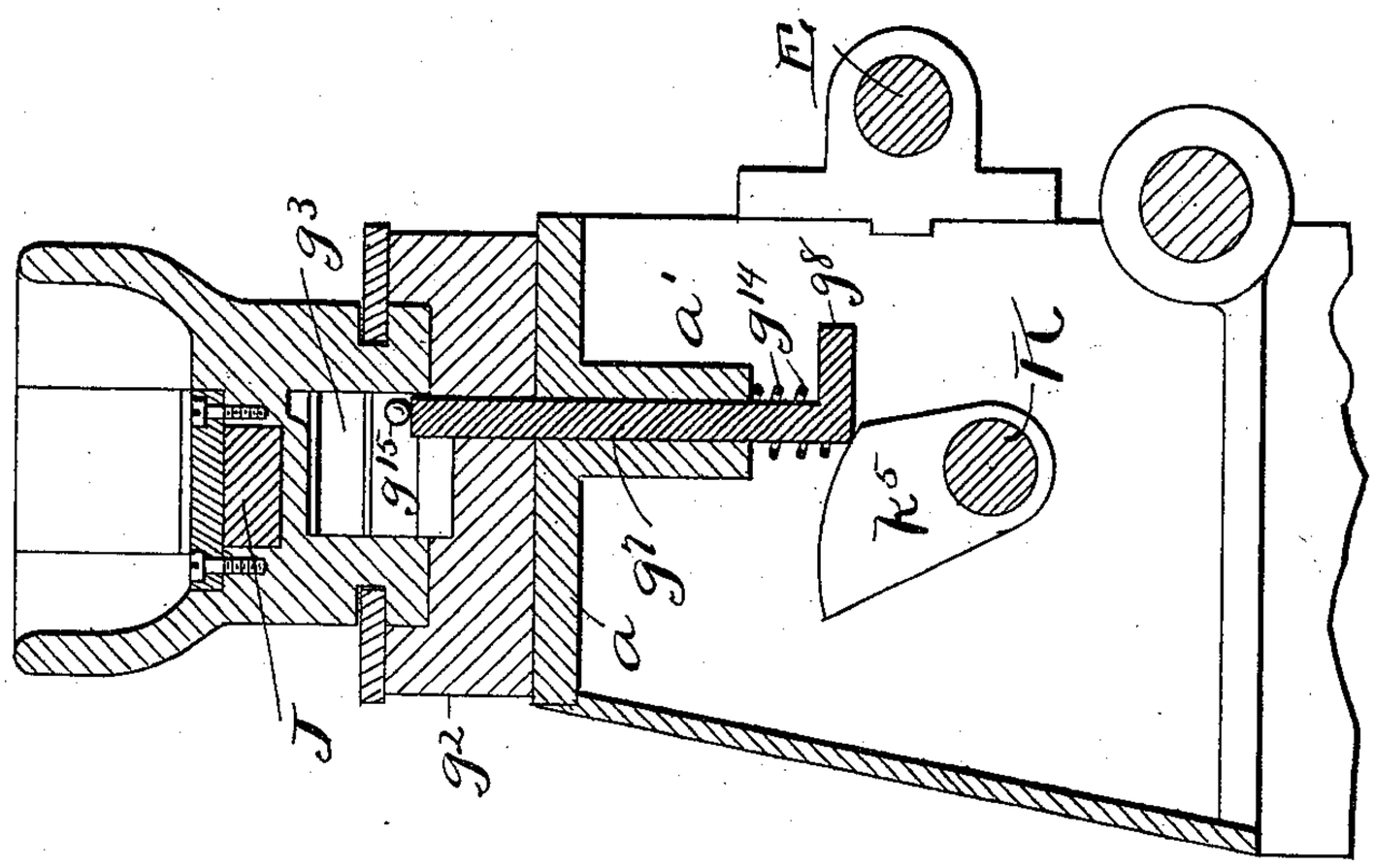
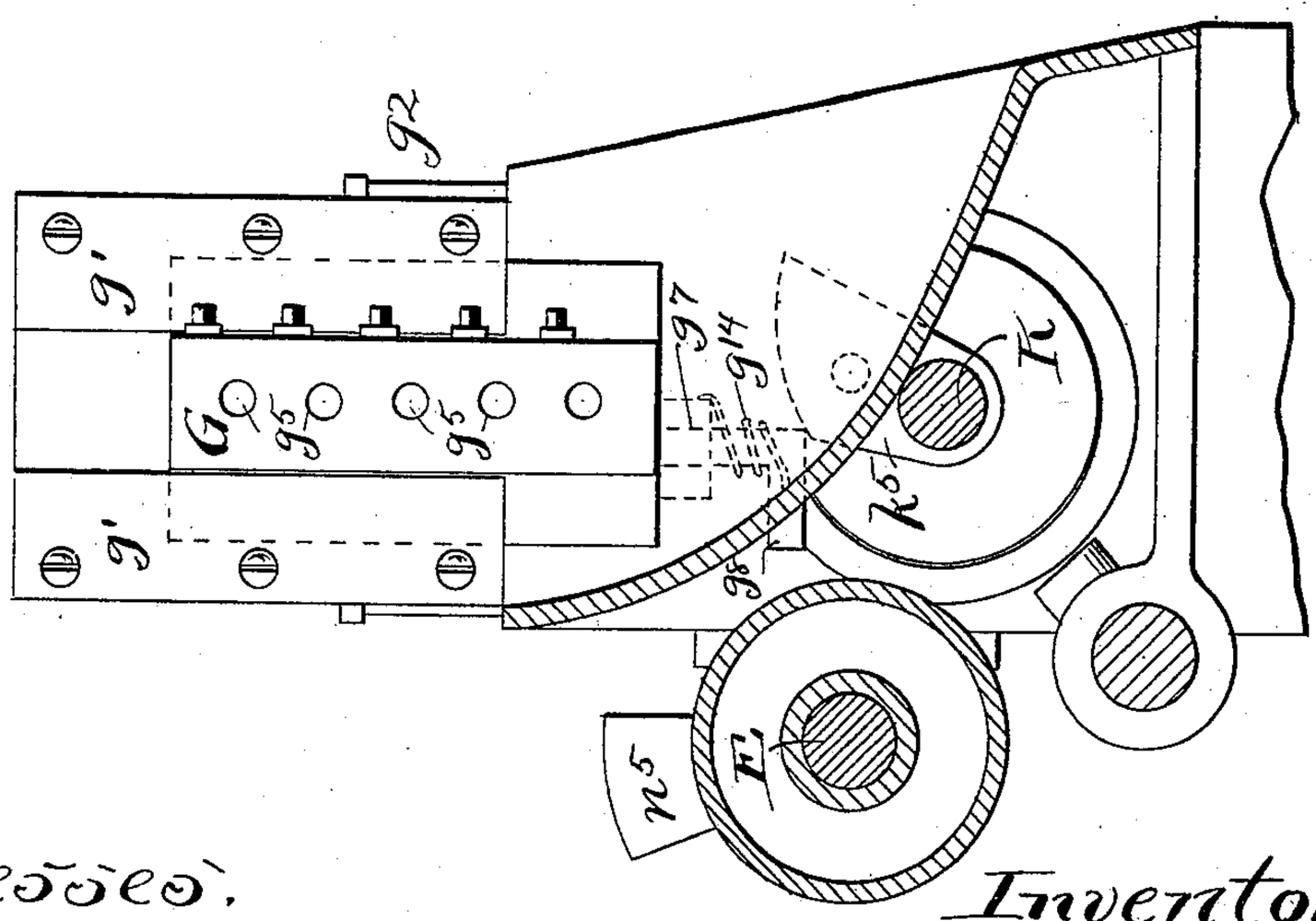


Fig. 4.



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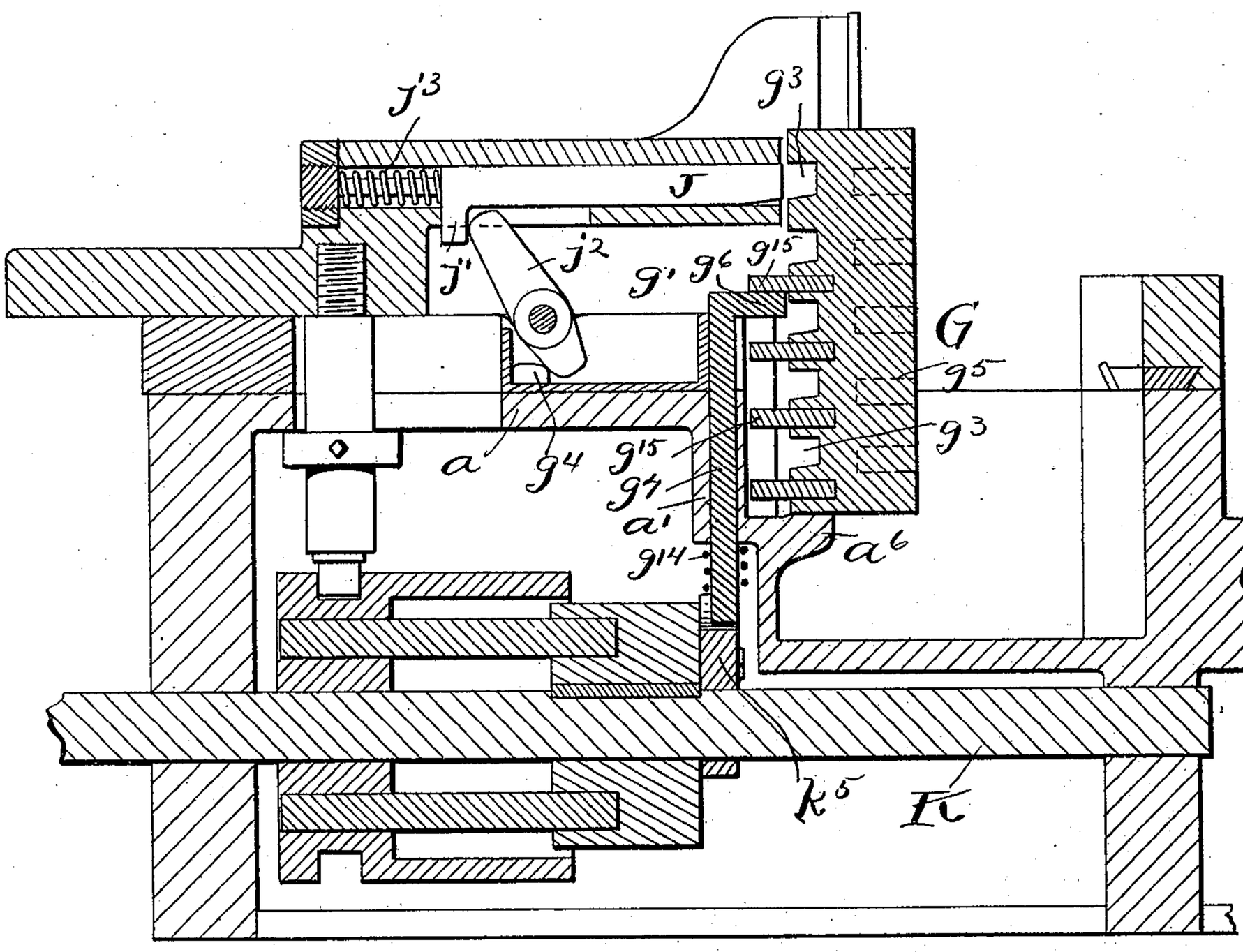

Fig. 6.

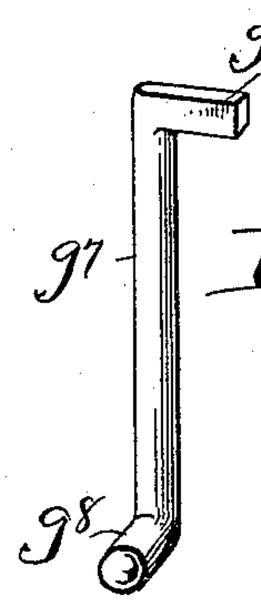

Fig. 7.

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Fig. 8.

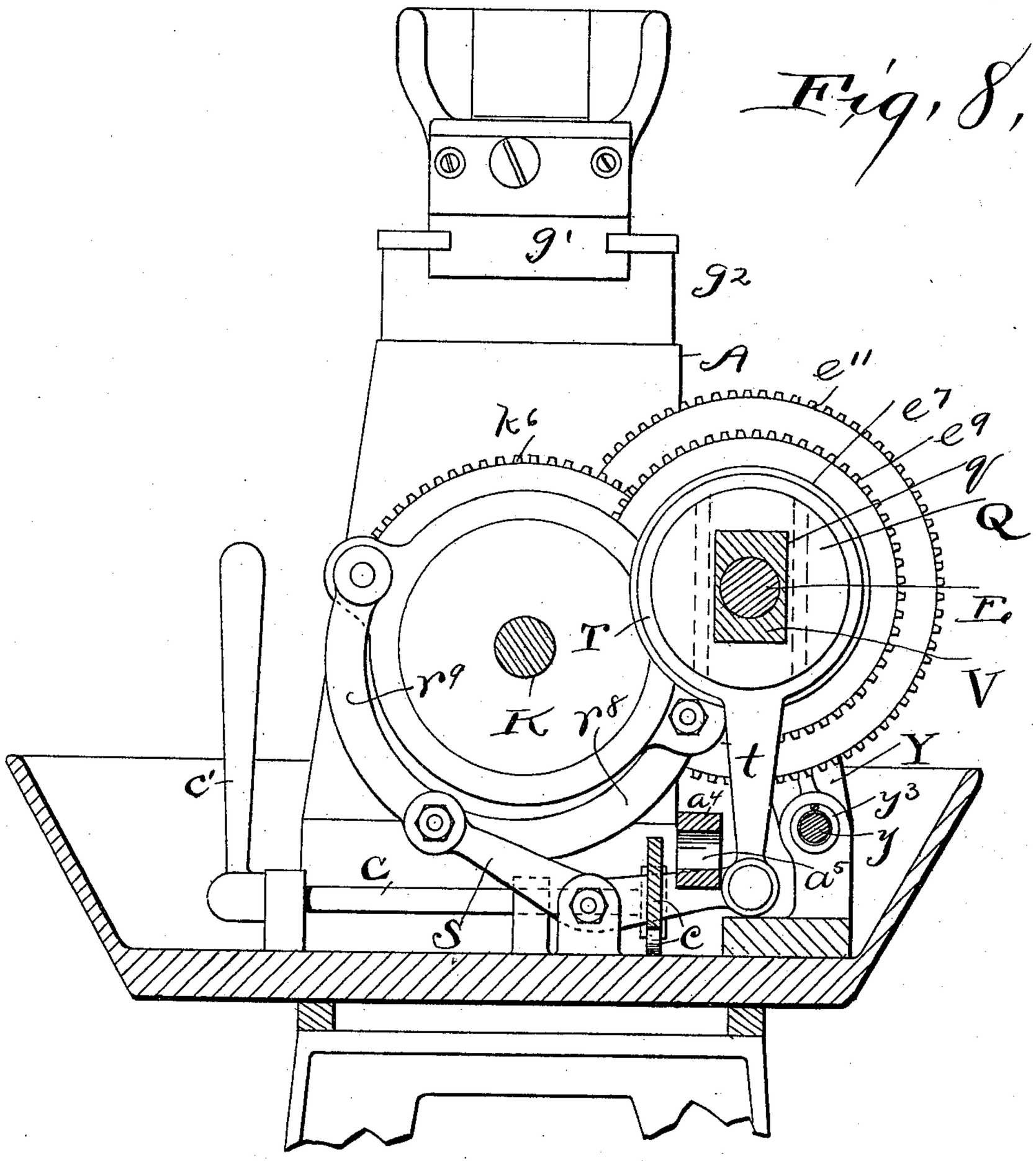


Fig. 10.

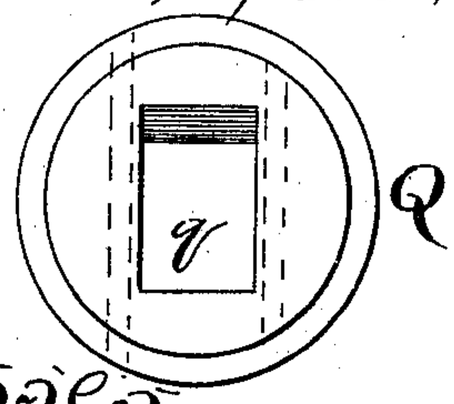
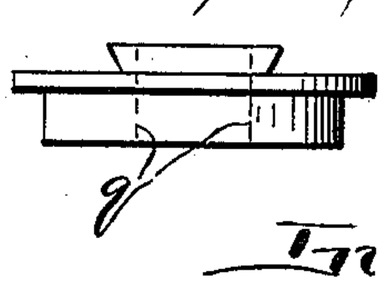


Fig. 9.



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(No Model.)

7 Sheets—Sheet 7.

Fig. 13,

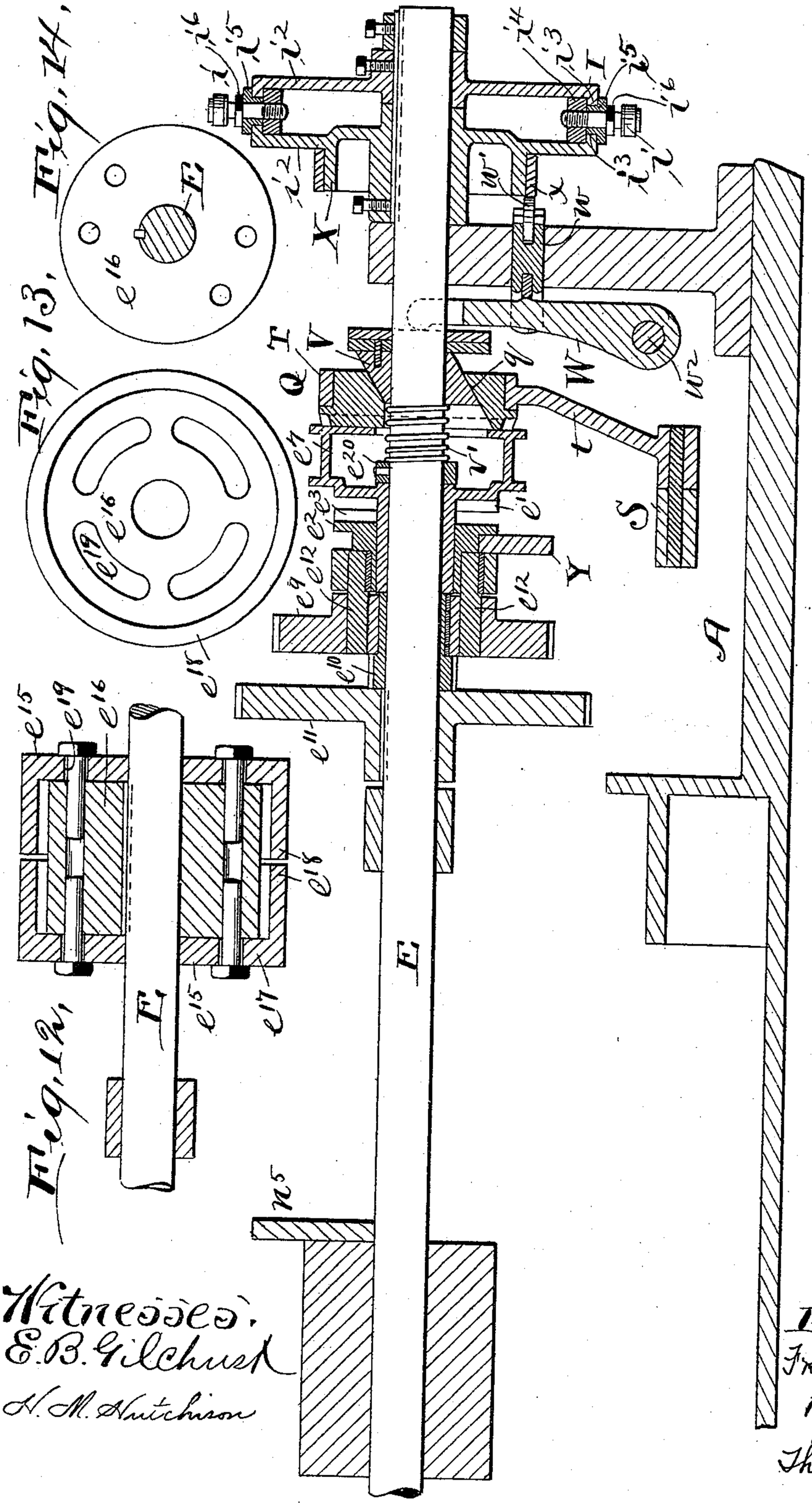

Fig. 11,

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UNITED STATES PATENT OFFICE.

FREDERICK SCHULZE, OF CLEVELAND, OHIO.

METAL-TURNING MACHINE.

SPECIFICATION forming part of Letters Patent No. 617,408, dated January 10, 1899.

Application filed August 14, 1897. Serial No. 648,197. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK SCHULZE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Metal-Turning Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention is in a sense an improvement upon the machine described and claimed in Letters Patent No. 578,777, granted to me March 16, 1897, although the machine as shown is not, strictly speaking, a screw-machine, simply because no means are shown for reversing the motion of the live-spindle. The mere substitution, however, of the live-spindle-operating mechanism shown in said prior patent or any other analogous mechanism for the corresponding mechanism shown in the present drawings will make a screw-machine out of it, and obviously such substitution may be made by any skilled mechanic.

The object of the present invention is to increase the capacity of metal-turning machines whether the live-spindle is capable of rotation in one or both directions.

The invention relates, first, to a movable tool-head which is used in lieu of the tool-holding turret commonly found in machines of this character, and also to the mechanism whereby this tool-head is automatically operated to bring the different tools into proper relation with the work, and this part of the invention is not limited in its use to a lathe having its other mechanism constructed in any particular manner.

The invention also relates to means for quickly changing from the fast to the slow motion, and vice versa, also to certain mechanism for stopping the cutting of the work at any time without necessarily stopping the machine, and also to certain other changes in and modifications of the mechanism shown and described in said prior patent in the nature of improvements thereon.

The machine shown and containing my present invention is in many respects, and except as hereinafter specified and fully described, substantially like the machine shown and described in said prior patent, to which patent reference is made for a more complete description of the old parts of the machine.

In the drawings, Figure 1 is a front elevation of my improved machine. Fig. 2 is a rear elevation. Fig. 3 is a plan view. Fig. 4 is a sectional end elevation on line 4 4 of Fig. 1. Fig. 5 is a sectional end elevation on line 5 5 of Fig. 2. Fig. 6 is a sectional rear view of the tool-head slide and associated mechanism on line 6 6 of Fig. 3. Fig. 7 is a detached perspective view of the rod g^7. Fig. 8 is a sectional end view on line 8 8 of Fig. 1. Fig. 9 is a top view of the eccentric disk Q, and Fig. 10 is an end view of said disk. Fig. 11 is a longitudinal vertical sectional view of certain mechanism on shaft E. Fig. 12 is a similar view of a drum secured on shaft E. Fig. 13 is an end view of one of the disks e^{15}, and Fig. 14 is an end view of the inclosed drum e^{16}.

Referring to the parts by letters, A represents the framework of the machine.

B represents the tubular live-spindle.

E represents the main driving-shaft, and K a supplemental driving-shaft.

The usual tool-holding turret is not found in the present machine. In its place is a sliding tool-head G, which is movable in a path transverse to the axis of the live-spindle. As shown, this head moves vertically; but this is a matter of preference. The head is provided with a plurality of tool-sockets g^5, arranged with their centers in a vertical plane which passes through the axis of the live-spindle. Five of these sockets are shown, but less or more may be provided, as desired, and one, two, or more of these sockets may be utilized for any job. If, for example, only two tools are needed for a job, they are placed in the two upper sockets, and after they have been successively used the head may be dropped to its normal position preparatory to using them again. It is not necessary as it is with a turret-machine that the tool-holding device be moved through its entire path of possible travel after it has been started and before it can return to its starting-point. In automatic turret-lathes as commonly constructed one piece of work is finished for each complete revolution of the main shaft,

because the turret must make a complete rotation before the first tool can be in place for the succeeding operation, while in my machine, owing to the capacity of the tool-head to move back to the starting-point from any position, much time may be saved when some of the tools are not used. Thus, for example, if but two tools are used, as is frequently the case, there may be a saving of substantially three-fifths of the time or more if the tool-head has more that five tool-sockets. This obviously results in a great saving of time, wherefore the machine has a greater capacity than a turret-machine can have, and this increased capacity of the machine is due to the fact that when a piece of work is finished the tool-head may be dropped to its starting-point immediately.

The tool-head is mounted in suitable guideways on the face of the tool-head slide g', which is movable horizontally toward and from the live-spindle in suitable guides in the saddle g^2. This saddle is secured to the bed of the machine in any well-known manner. The sliding tool-head is held in the different positions necessary to maintain the different tools in proper relation to the work by a spring-bolt J, which is mounted in the slide g' directly behind the tool-head. Its end, which is slightly tapered, enters correspondingly-shaped bolt-sockets g^8 in the rear side of the tool-head, the spring j^3 acting to force said bolt into said sockets. The bolt is withdrawn by a lever j^2, which is pivoted to the slide g', its upper end engaging with a lug j' on the bolt. Its lower end, when the slide g' is moved backward, strikes a fixed lug g^4 on the saddle, whereby said lever is rocked, with the result of withdrawing the bolt J from the bolt-socket g^3. The tool-head is moved upward step by step and is held up while the bolt J is not in service for this purpose by a cylindrical rod g^7, which rod is vertically movable through a hole in the saddle and in a boss a' on the bed a. A finger g^6 projects at right angles from the upper end of the rod and is adapted to engage beneath any one of the pins g^{15}, which project horizontally one above another from the rear side of the tool-head. This rod is held so that the finger is in line with the pins by a coil-spring g^{14}, which surrounds its lower end, one end of said coil-spring being secured to the boss a', while the other end is connected with the rod g^7. The action of the spring is to turn the rod in its socket until the finger g^6 strikes the side of the slide, at which time the finger is in the same vertical plane with the fingers upon the tool-head. This rod is moved upward periodically by a cam k^5, secured to the shaft K. The rod is turned upon its axis, so as to draw its upper finger to one side of the line of fingers on the tool-head by means of a cam n^5, which is rigidly connected with the shaft E. The tool-head slide is moved toward and from the live-spindle by substantially the same mechanism which is fully described in the prior patent named for moving the turret-slide.

The part of the mechanism which is above described operates as follows: Supposing that at the beginning of the operation the parts are in the relative position shown in Figs. 1 and 6, the tool-slide is moved forward to bring the tool in the upper tool-socket into engagement with the work. As it begins this movement the spring-bolt J is released from the retractile action of the lever j^2 and is moved forward by its spring entering the socket g^3 in the tool-head before the upper pin g^{15} passes off of the finger g^6. When the tool has done its work, the slide is moved backward. The cam k^5 strikes the lower end of the rod g^7, lifting the same, and it lifts the tool-head and holds it up until the tool-head slide again moves forward and the spring-bolt enters the second bolt-socket g^3 in the tool-head. The cam k^5 passing from under the rod permits the rod to fall, wherefore when the tool-head slide again returns to the position shown the second pin g^{15} on the tool-head is above the finger g^6 on the rod. These operations are repeated until the several tools have acted upon the work. Then the cam n^5, which is beveled on one side, as shown in Fig. 3, strikes an arm on the lower end of said rod, turning the rod in its socket, and thereby moving the finger g^6 out of line with the pins g^{15}. The tool-head thereupon drops to its original position, its lower end resting on a fixed support a^6. More than one of the cams n^5 may be secured to the shaft E in such position that during one revolution of the shaft E the rod may be turned two or more times, as desired, with the result of allowing the tool-head to drop an equal number of times to its original position.

In a machine of this class it is necessary in order to work the machine to its full capacity that every motion except the actual cutting motions shall be done quickly, the cutting motions being necessarily slow. In order to do this, the change from the fast to the slow motion, and vice versa, should be very quickly accomplished. There should be no stoppage between motions, for this is liable to bring about inaccurate timing, and as a result the tool might jam into the work. To accomplish this desirable result, I have provided mechanism in which the slow motion is constantly running, but is overtaken, so to say, at the proper time by the fast motion. The slow motion of both of the shafts E and K is effected by mechanism which is substantially like that shown and described in said prior patent. Some parts of its mechanism it is necessary to here describe in order that my improvement relating to this part of the machine may be fully understood.

e^7 is a pulley which is loosely mounted upon the shaft E and is constantly driven by a belt, which is not shown. Mounted upon one face of this pulley in dovetail guides which extend transversely of the shaft is the adjustable

eccentric disk Q, the function of which is the same as the adjustable eccentric disk shown in the prior patent. The eccentricity of this disk is varied by means of a rectangular block V, the upper and lower faces of which are parallel and inclined from the front to the rear face of said block, which block is loosely mounted upon shaft E and passes through a rectangular opening q in the eccentric disk, the upper and lower faces of which are inclined from the front to the rear face of said disk. When this block is moved to the left, as shown in Fig. 11, the eccentricity of the disk is increased, and it is moved to the left by mechanism substantially the same as is shown in said prior patent—to wit, a lever W and its operating mechanism—and it is moved to the right to decrease the eccentricity by a spring v', inclosed within said loose pulley e^7, surrounding the shaft and thrusting endwise against a collar e^{20}, fastened to the shaft, and against the said block. On the opposite face of this loose pulley is the fixed member of a clutch, consisting of one or more clutch-jaws e'. Mounted loosely upon the hub of this pulley is the movable clutch member e^2, having jaws e^3, adapted to engage with the jaws on the pulley.

e^9 and e^{10} represent two gears which are likewise mounted loosely on the shaft E, but are rigidly connected with each other. Laterally-projecting pins e^{12}, secured to the movable clutch member e^2, enter holes in the gear e^9, whereby said member and gears are compelled to revolve together, although the clutch member is permitted to move longitudinally upon the shaft.

e^{11} represents a gear which is keyed to the shaft E.

r' represents a gear formed on a sleeve which is rigid with the disk R, which disk is part of the "silent-feed" mechanism shown and described in said prior patent, which sleeve and disk are loose upon the shaft K. k^6 and k^7 are respectively gear and pinion, which are keyed to the shaft K and mesh, respectively, with the gears e^{10} and e^{11}. It will be understood by those familiar with the construction of this silent-feed mechanism that the disk R, to which the gear r' is made fast, is capable of being moved forward faster than it could be by the other parts of the silent feed—in other words, that the parts of the silent-feed mechanism by which the gear r' is rotated do not prevent it from rotating faster. When, therefore, by the operation of the clutch the gears e^9 e^{10} are connected directly to the pulley e^7, fast motion is transmitted from the said pulley to the shafts through the gears e^{10}, k^6, k^7, and e^{11}. In this case, although the silent feed continues to operate, the disk R and gear r' are moved along by gear e^9 faster than they would otherwise be moved. When by the operation of the clutch said gears e^9 e^{10} are disconnected from the pulley e^7, then slow motion is transmitted to the shafts through the silent-feed mechanism and the entire train of gears r', e^9, e^{10}, k^6, k^7, and e^{11}. There is therefore no stopping of the motion of the shafts which might disarrange the timing of the moving parts. When the fast-moving mechanism is thrown in, it overtakes the slow-moving mechanism, and the shafts are therefore driven at the faster speed by less than the entire train of gears. When the fast-moving mechanism is thrown out, the speed of the shafts slackens until it corresponds with the speed at which said shafts will be driven by the slow mechanism, whereupon said slow mechanism (including the entire train of gears) continues to rotate the shafts at this rate. This mode of operation is possible, because the slow-moving mechanism contains a part near the shaft—viz., disk R and connected gear r'—which may move forward faster than the other parts between it and the pulley—viz., the other parts of the so-called "silent feed." The movable clutch member is moved, so as to cause the engagement and disengagement of it with the loose pulley by substantially the same mechanism which is shown in the prior patent as the means for operating the belt-shipper therein necessarily employed. This mechanism consists of a fork Y, secured to a sliding bar y, a coil-spring y^3 surrounding said bar and tending to move it in the direction which will cause the clutching of the movable clutch member. This bar is moved in the contrary direction by dogs i, adjustably secured to the edge of a drum I, which drum is rigidly secured to the shaft E. This so-called "drum" I is of novel form, which greatly facilitates the fastening of the dogs thereto at any desired point. This drum consists of two disks i^2 i^2, both fast to the shaft and having at their outer edges, respectively, cylindrical flanges i^3, which extend toward each other. One plate i^4 lies between the disks and inside of and in contact with said flange. Another plate i^5, in contact with the outer peripheries of said disks, is fastened to the inner block by a screw-bolt i^6. These two plates and bolt form a clamp and there may be as many of these clamps as desired. The dogs i are secured to the outer clamp-plate i^5.

The lever W, which, as before stated, operates the block V, has a bar w secured to it, which passes through a guide-hole in the frame, and a roller w' on its outer end engages with the dogs x, secured to a flange X on the drum I. These dogs may be of any shape and may be arranged in such manner as to cause the bar w to be moved at the proper times and to the extent desired to vary the eccentricity of disk Q, substantially as shown in said prior patent. The lower end of the lever W instead of being pivoted to a fixed point is provided with a pivot-pin w^2, which lies in a horizontal slot a^5 in a fixed plate a^4. This pivot is normally prevented from movement by the end of a lever c, which holds said pivot in the end of said slot. This lever is

rigidly secured to a transverse rock-shaft C, having an operating-handle c' within easy reach of the operator. The end of said lever is cam-shaped, substantially as shown, whereby it will as it is moved down move the pivot back to the end of the slot a^5, which, as stated, is the position in which lever W is operative for the described purpose. When this lever end is raised, the lever W will no longer press the block V forward, but, on the contrary, the spring v' is permitted to act to push the block in the contrary direction, whereupon the disk Q comes into a position concentric with the shaft. When in this position, it has no effect upon the silent-feed mechanism, and therefore all of the feed movements of the various parts stop, (provided the fast movement is not connected up by the clutch e^2.) Since the fast movement is not intended to be connected up when the machine is cutting, the operation of lever c' to release the pivot of lever W causes the cutting action of the machine to stop.

Another improvement embodied in the machine relates to the construction of the drum upon which the adjustable dogs are secured. The drum e^{15}, which carries the dogs for operating the cutting-off tool-slide P, is constructed according to my improvement. It consists of an internal drum e^{16}, which is to be keyed to the shaft E, and two disks e^{17}, loose on the shaft, each having a cylindrical flange e^{18}. These disks are placed at opposite ends of the drum e^{16}, with the flanges embracing said drum, and the disks in which the segment-shaped slots e^{19} are formed are bolted to the drum e^{16} in any desired relation to it and to each other.

The two disks r^3 r^4 of the silent-feed mechanism are oscillated in the manner and with the results described in said prior patent by two links r^8 r^9, the lever S, and an eccentric-strap T, which embraces the eccentric disk Q, an arm t, which is rigidly connected with said strap, being connected with the opposite end of the lever S, to which the said links are connected.

When the pulley is not connected by the described clutch e^2 to the gears e^9 e^{10}, the silent feed is working alone and the slow motion of the parts is going on; but when the said pulley is clutched to the said gears the mechanism for the fast motion is thrown in—that is to say, the gears e^9 e^{10} are connected with the driving-pulley e^7 and the fast motion ensues, overtaking, as it were, the slow-motion mechanism, which, nevertheless, continues to act. When the parts are unclutched, the fast motion stops; but the parts are moved along without any stop by the slow-motion mechanism.

Having described my invention, I claim—

1. In a metal-turning machine, in combination, a tool-head slide, a sliding tool-head mounted upon said slide and having a plurality of tool-sockets in its outer face and a plurality of corresponding bolt-sockets in another face, a spring-bolt carried by the slide for engagement in said bolt-sockets, and means operated by the backward movement of the slide for withdrawing said bolt, substantially as specified.

2. In a metal-turning machine, a tool-head slide, a sliding tool-head mounted on the front end thereof, and movable in a path transverse to the path of the tool-head slide, said tool-head having a plurality of tool-sockets and corresponding bolt-sockets, a spring-lock bolt for engagement in said bolt-sockets, a lever pivoted to the slide for moving said bolt, and a lug for engaging with the lever when the slide is moved backward, substantially as specified.

3. In a metal-turning machine, in combination, a tool-head slide, a sliding tool-head mounted upon one end thereof and having a plurality of tool-sockets and corresponding projecting pins, with a reciprocating rod for engaging with said pins, mechanism for operating said rod, and a locking device for holding said tool-head in the various positions to which it is moved, substantially as specified.

4. In a metal-turning machine, in combination, a tool-head slide, a sliding tool-head mounted upon one end thereof and having a plurality of tool-sockets and also a plurality of corresponding pins, a rod adapted to move longitudinally upon its axis and having two fingers projecting laterally therefrom, one of said fingers being adapted to engage with the pins upon the tool-head, a cam for periodically moving said rod endwise, and a device engaging with the other finger on said rod for periodically turning the rod upon its axis, substantially as described.

5. In a metal-turning machine, in combination, a tool-head slide, a sliding tool-head mounted upon one end thereof and having a plurality of tool-sockets and also a plurality of corresponding pins, a rod adapted to move longitudinally upon its axis and having two fingers projecting laterally therefrom, one of said fingers being adapted to engage with the pins upon the tool-head, a cam for periodically moving said rod endwise, and a device engaging with the other finger on said rod for periodically turning the rod upon its axis, and a locking-bolt for holding the tool-head in its various positions, substantially as specified.

6. In a metal-turning machine, in combination, the live-spindle, a tool-head slide movable toward and from it, a tool-head mounted and adapted to slide up and down upon the front end of said slide and having a plurality of tool-sockets in its front face, one above another, a plurality of corresponding bolt-sockets, and a plurality of corresponding horizontal pins, a spring-lock bolt, a device for retracting the same when the slide is drawn backward, a vertically-movable rod having two laterally-projecting fingers, one of which is adapted to engage with the pins upon the

tool-head, the main shaft, and a supplemental shaft, a device carried by the latter shaft for periodically moving the rod endwise, and a device on the main shaft for engaging with one of the fingers on said rod to turn said rod upon its axis, and a spring for turning said rod backward when released by the last-named device, substantially as specified.

7. In a metal-turning machine, in combination, a main shaft, a supplemental shaft, a single loose driven pulley, mechanism which is permanently connected with said pulley for imparting a slow movement to said shafts, mechanism for imparting a fast movement to said shafts, and a clutch for connecting and disconnecting the last-named mechanism to and from the pulley, the slow-moving mechanism containing a part near the shafts which may move forward faster than the other parts nearer the pulley, whereby the shafts may be turned by the mechanism for transmitting the faster movement without disconnecting the mechanism for transmitting the slower movement, substantially as specified.

8. In a metal-turning machine, in combination, a main shaft, a supplemental shaft, a single loose driven pulley, a silent feed operated by and permanently connected with said pulley, the driven part of which may be moved forward faster than the driving part, mechanism operated by the driven part of said silent feed for turning said shafts, and a clutch adapted to connect the last-named mechanism directly with said loose pulley without disconnecting the silent-feed mechanism, substantially as specified.

9. In a metal-turning machine, in combination, a shaft, a loose pulley, an eccentric disk mounted on one face of said pulley and adapted to slide thereon transversely of its axis, a wedge-block movable longitudinally of said shaft and adapted by such movement to vary the eccentricity of said disk, a spring for moving said block in one direction, a lever for moving it in the opposite direction, and a movable pivot for said lever, substantially as specified.

10. In a metal-turning machine, in combination, a shaft, a loose pulley, an eccentric disk mounted on one face of said pulley and adapted to slide thereon transversely of its axis, a wedge-block movable longitudinally of said shaft and adapted by such movement to vary the eccentricity of said disk, a spring for moving said block in one direction, a lever for moving it in the opposite direction, a pivot-pin for said lever, a slot in which said pin is movable, and a device for temporarily preventing such movement, substantially as specified.

11. In a metal-turning machine, in combination, a shaft, a loose pulley, an eccentric disk mounted on one face of said pulley and adapted to slide thereon transversely of its axis, a wedge-block movable longitudinally of said shaft and adapted by such movement to vary the eccentricity of said disk, a spring for moving said block in one direction, a lever for moving it in the opposite direction, a pivot-pin for said lever, a slot in which said pin is movable, and a lever having an eccentric end for moving said pivot-pin to and holding it in the desired position, substantially as specified.

12. In a metal-turning machine, in combination, a shaft, a block fixed to the shaft, two disks loose on the shaft and having cylindrical flanges which surround said block, cams on the outer peripheries of said flanges, said disks having segmental slots, and screws passing through said slots and screwing into the block for adjustably connecting the disks and block, substantially as specified.

13. In a metal-turning machine, in combination, two disks i^2 i^2 secured thereto having cylindrical flanges i^3 i^3 which extend toward each other, clamps consisting of the plates i^4 i^5 which engage respectively with the inner and outer peripheries of said flanges, the screw-bolts i^6 and dogs secured to the outer clamping-plates, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

FREDERICK SCHULZE.

Witnesses:
PAUL SCHNEIDER,
HENRY TRENKAMP.