

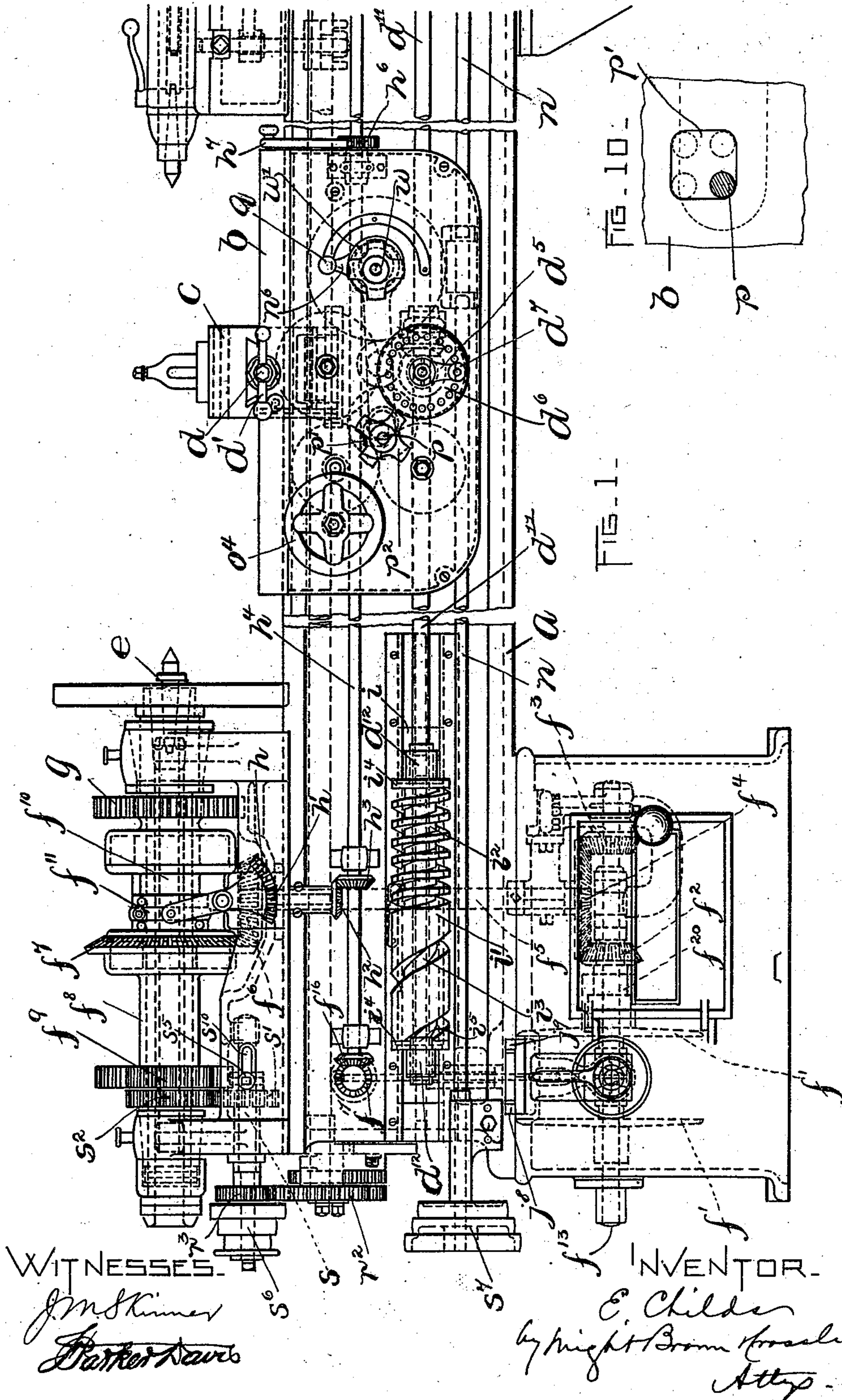
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E. CHILDS.  
LATHE.

No. 550,439.

Patented Nov. 26, 1895.



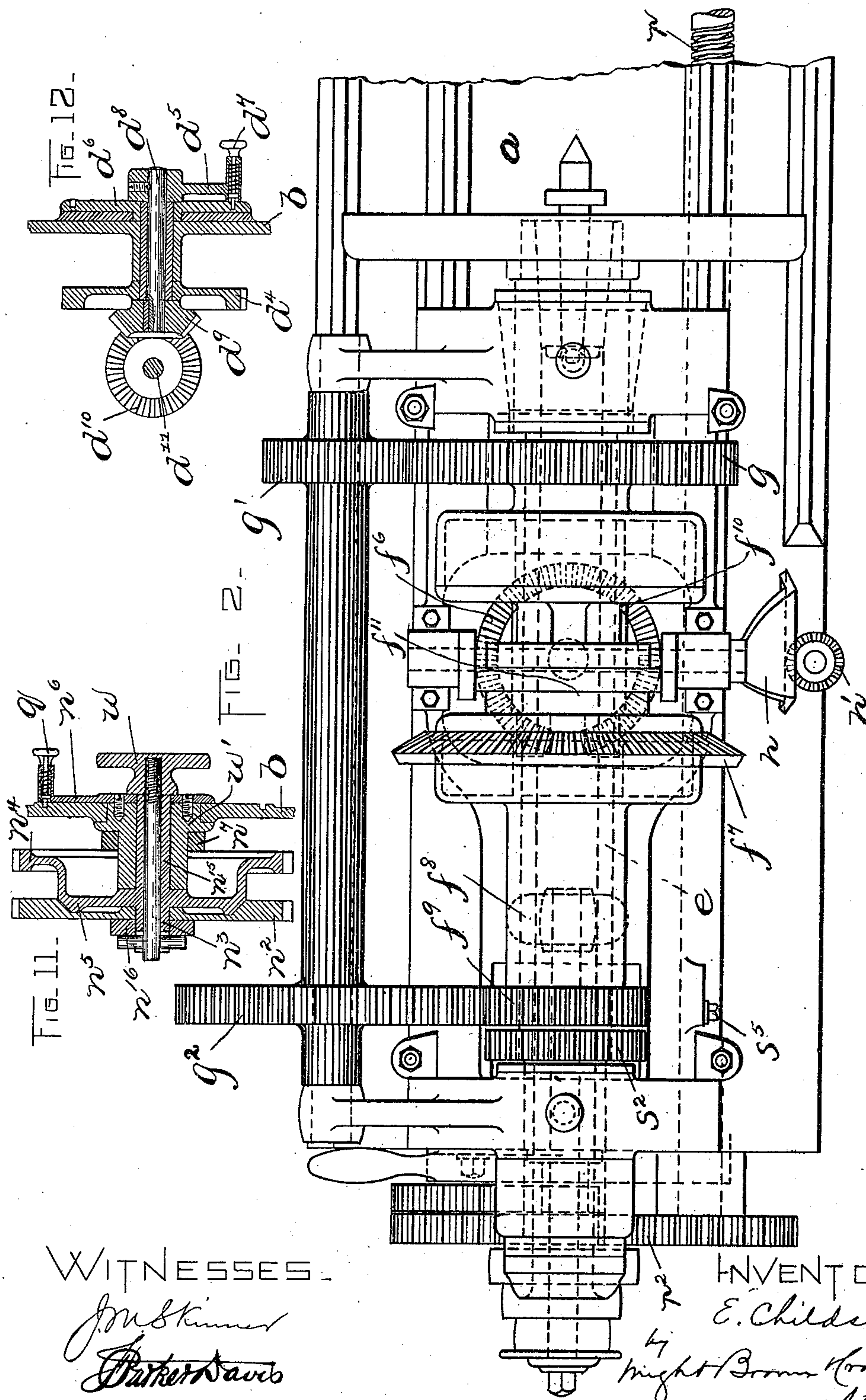
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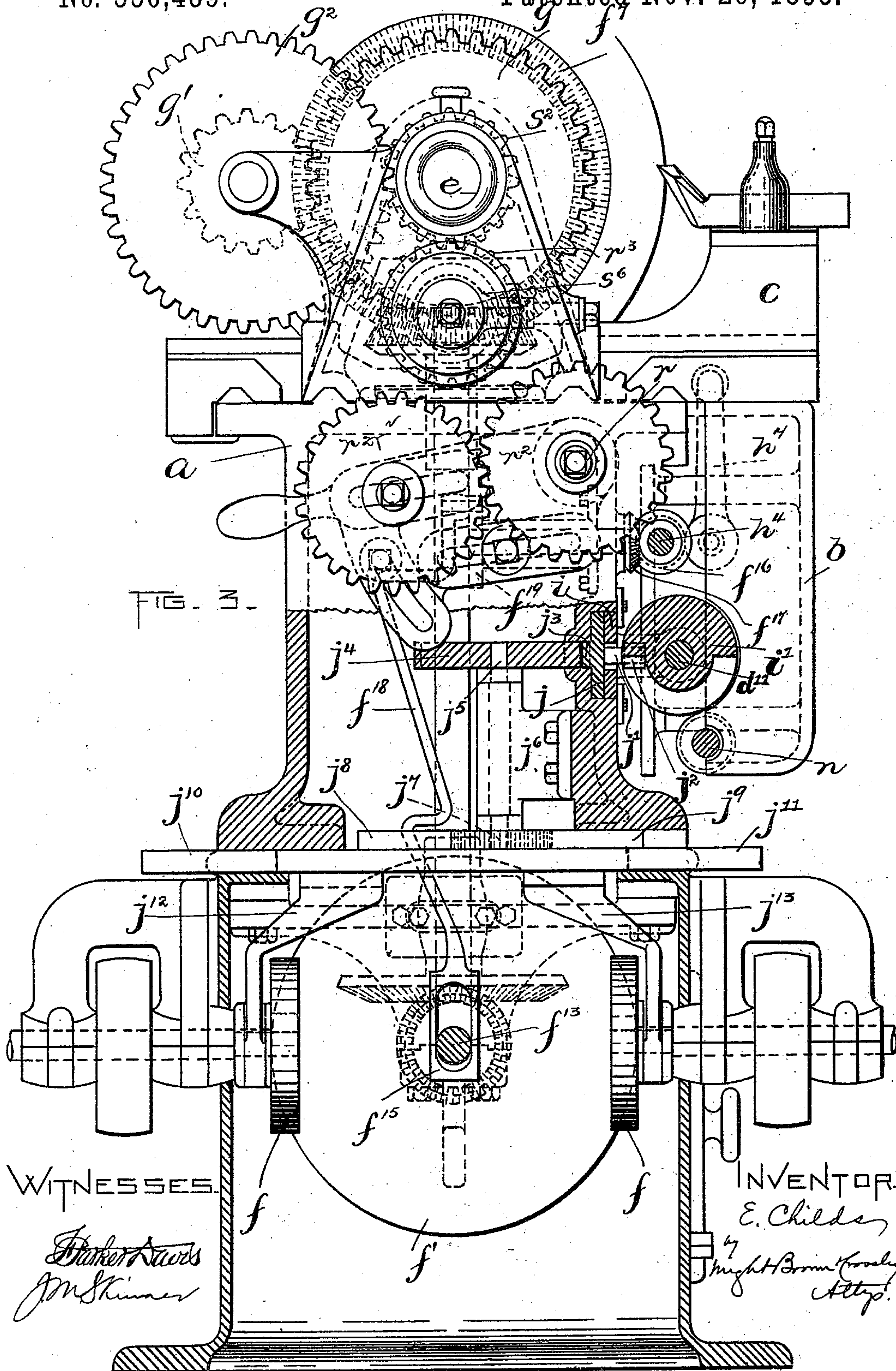
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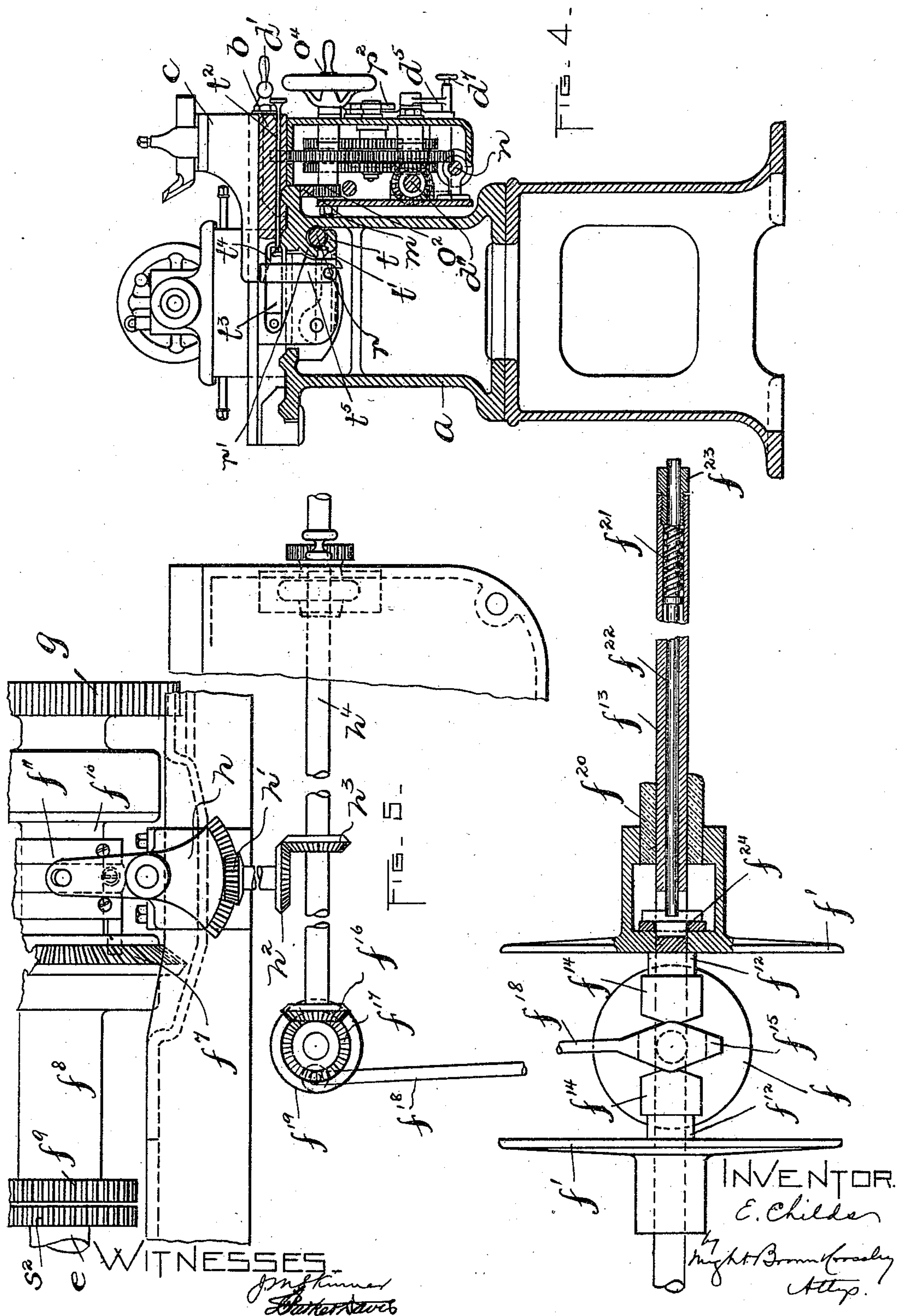
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6 Sheets—Sheet 4.

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Patented Nov. 26, 1895.



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



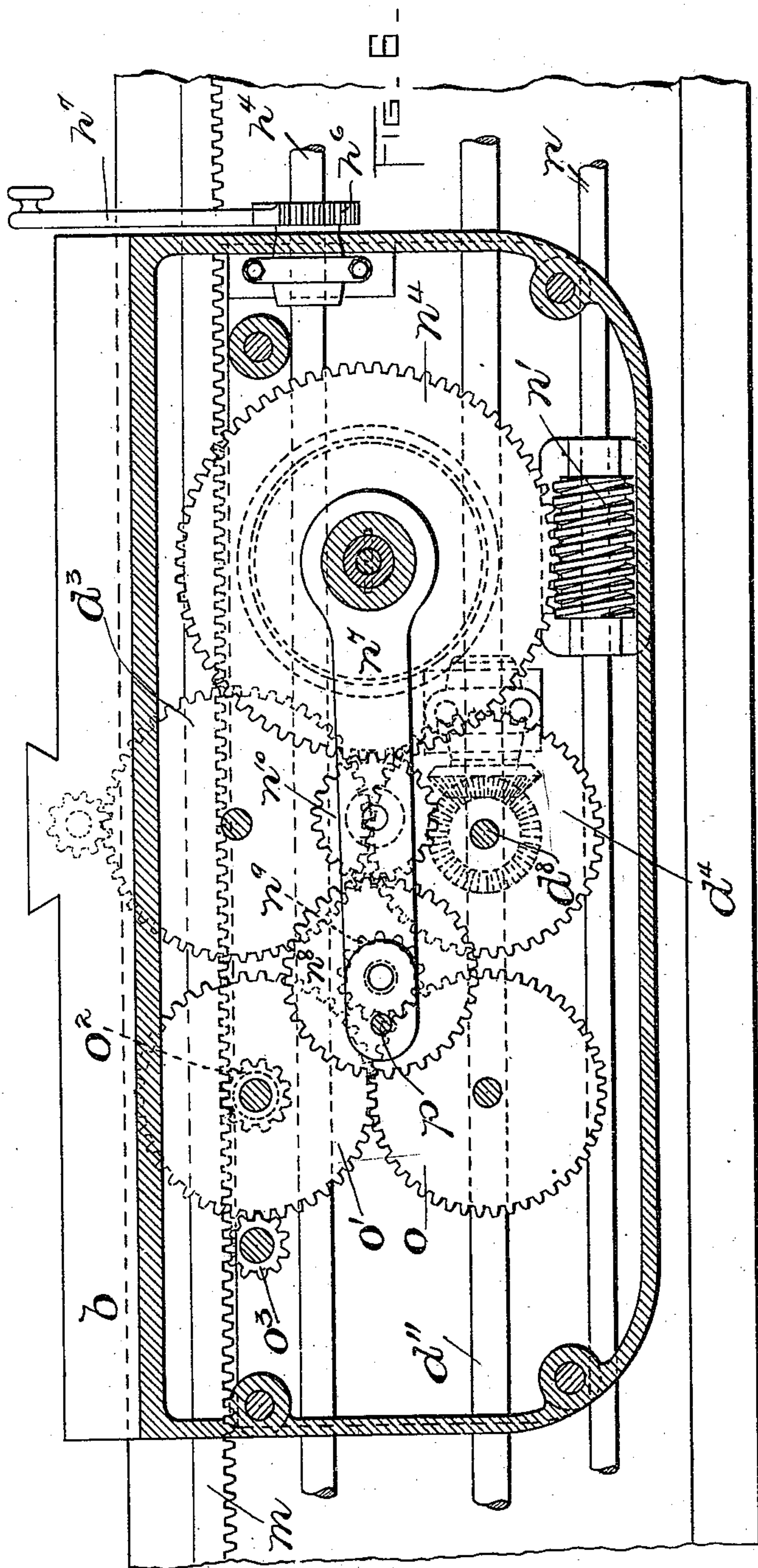
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E. CHILDS.  
LATHE.

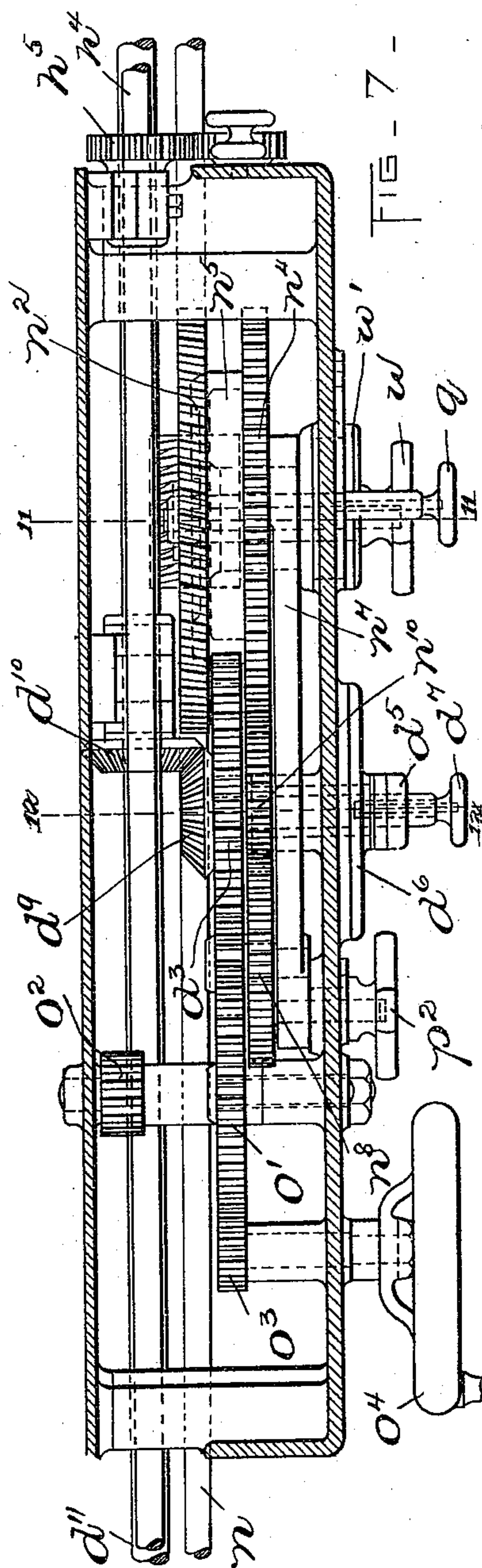
No. 550,439.

Patented Nov. 26, 1895.



WITNESSES.

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*Barker Davis*



INVENTOR.

*E. Childs*  
*by Knight Brown & Co. Atty.*



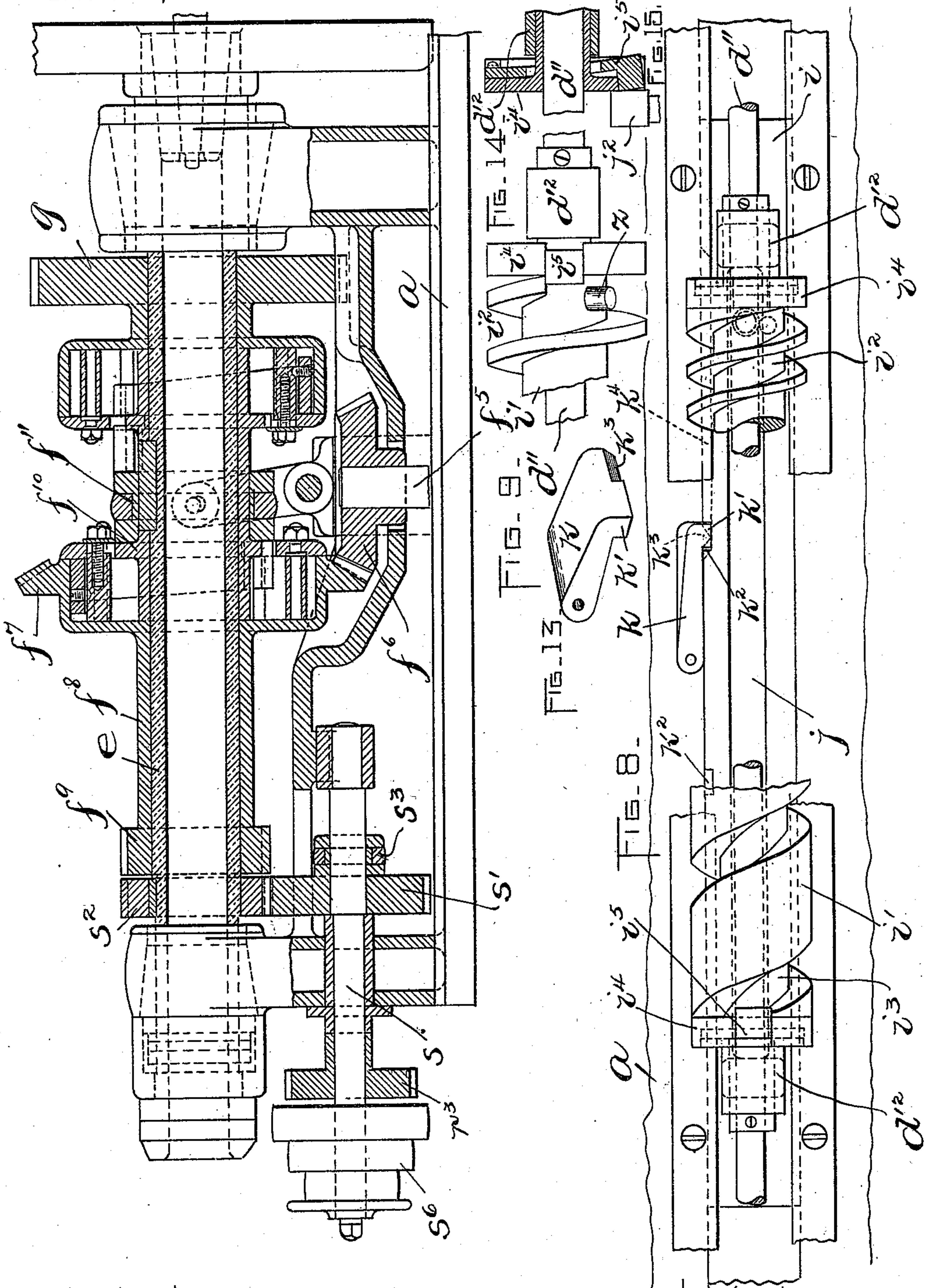
(No Model.)

6 Sheets—Sheet 6.

E. CHILDS.  
LATHE.

No. 550,439.

Patented Nov. 26, 1895.



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# UNITED STATES PATENT OFFICE.

EUGENE CHILDS, OF DOVER, NEW HAMPSHIRE, ASSIGNOR TO THE AUTOMATIC RAPID LATHE COMPANY, OF BOSTON, MASSACHUSETTS.

## LATHE.

SPECIFICATION forming part of Letters Patent No. 550,439, dated November 26, 1895.

Application filed August 21, 1893. Serial No. 483,653. (No model.)

*To all whom it may concern:*

Be it known that I, EUGENE CHILDS, of Dover, in the county of Strafford and State of New Hampshire, have invented certain new and useful Improvements in Lathes, of which the following is a specification.

This invention relates to certain improvements applicable to lathes and cut-off machines which employ a cross-feed whereby the cutting-tool is advanced and withdrawn in a plane at right angles to the center line of the lathe, and also applicable to screw-machines. Reference may be had to my prior patents, No. 461,401, granted October 13, 1891, and No. 490,426, granted January 24, 1893, which show structures of a similar character.

The principal objects of the present invention are as follows: to provide variable-speed-changing means for controlling the changing of speed of the spindle, whereby the scope of work of the lathe is greatly increased; to render the lathe capable of a greater variety of adjustments than any heretofore produced; to provide improved means for shifting the feed from the cross-feed screw to the parallel feed, and vice versa, and for reversing the feed-motion; to provide improved means for throwing the back gears in and out and for throwing the machine completely out of action without shifting a belt.

To the above ends the invention consists in the novel features of construction and combination of parts, which will be described hereinafter and pointed out in the claims.

Referring to the accompanying drawings, which illustrate the invention, Figure 1 shows a side elevation of a sufficient portion of a lathe to show my improvements. Fig. 2 shows a top plan of one end of the lathe. Fig. 3 shows an end elevation with some parts broken away and others shown in section. Fig. 4 shows a cross-section of the tool-carriage and lathe-bed, showing the lead-screw and means for engaging the same with and disengaging it from the carriage. Fig. 5 shows a detail of the means for throwing the back gears in and out of operative connection with the spindle and for throwing the whole machine out of operation without shifting the driving-belt. Fig. 6 shows a longitudinal vertical section of the tool-carriage and

apron. Fig. 7 shows a horizontal section of the same. Fig. 8 shows an enlarged detail of the variable-speed-changing screw and appurtenances. Fig. 9 shows a sectional view of the spindle and appurtenances. Fig. 10 shows a fragment of the apron and illustrates different positions an adjusting-stud is adapted to occupy. Fig. 11 shows a section on line 11 of Fig. 7. Fig. 12 shows a section on line 12 of Fig. 7. Fig. 13 shows a detail perspective view of a latch. Fig. 14 shows a detail of one end of the variable-speed-regulating screw and parts coacting therewith. Fig. 15 shows a sectional detail of parts appearing in Figs. 8 and 14.

The letter *a* designates the lathe-bed; *b*, the tool-carriage, suitably supported on said bed, so as to move longitudinally on the same; *c*, the cross-feed tool-carriage fitting a slideway on the carriage *b*; *d*, the cross-feed screw supported in bearings in the carriage *b* and engaging the carriage *c* and provided with a handle *d'*, by which to turn the cross-feed screw, and *e* the work-rotating spindle.

The change of speed of the spindle as the diameter of the work decreases is accomplished by moving friction-wheels *f* radially with respect to disks *f'*, with which said wheels make frictional connection. The said wheels rotate continuously and impart motion to the disks. One of said disks is affixed on a sleeve *f<sup>20</sup>*, which carries a bevel-pinion *f<sup>2</sup>*, and the other is affixed on a shaft *f<sup>13</sup>*, which carries another bevel-pinion *f<sup>3</sup>*. The two pinions *f<sup>2</sup>* and *f<sup>3</sup>* both mesh with a bevel-gear *f<sup>4</sup>*, and they have position diametrically opposite each other with relation to said gear, whereby in rotating oppositely they drive the bevel-gear in one direction. Said bevel-gear is carried on the lower end of a shaft *f<sup>5</sup>*, which carries a bevel-gear *f<sup>6</sup>* at its upper end in mesh with a bevel-gear *f<sup>7</sup>*, carried by a sleeve *f<sup>8</sup>*, which is mounted loosely on the spindle *e*, and also carries a small spur-gear *f<sup>9</sup>*.

A collar *f<sup>10</sup>* is fixed to the spindle *e*, and a double clutch *f<sup>11</sup>* is splined on said collar and adapted to connect the same with the bevel-gear *f<sup>7</sup>* or with a large gear *g*, also loose on the spindle and connected through back gears *g'* and *g<sup>2</sup>*, mounted on a counter-shaft with the gear *f<sup>9</sup>*. By shifting the clutch *f<sup>11</sup>* the



spindle may be operatively connected with the gear  $f^7$ , so as to be driven directly thereby, or with the gear  $g$ , so as to be driven indirectly by the gear  $f^7$  through the back gears, according to the class or condition of work in the machine.

The clutch is shifted through the following means: A segment  $h$  engages the clutch and is pivoted to the lathe-bed, and said segment engages a bevel-pinion  $h^1$  on a short shaft which carries another bevel-pinion  $h^2$  in mesh with a pinion  $h^3$  on a horizontal shaft  $h^4$ , extending through the carriage  $b$ . A spur-gear  $h^5$ , mounted on the carriage, is splined to the shaft, and a second spur-gear  $h^6$ , also mounted on the carriage, meshes with said spur  $h^5$  and has a handle  $h^7$ , by which it may be turned. By turning this handle the clutch is shifted through the connections described. The advantage of this arrangement is that the shifting-handle is carried by the tool-carriage, and this will be found of special value in long lathes in view of the greater convenience.

The means for throwing the machine out of action without throwing off the driving-belts are as follows: The sleeve  $f^{20}$  and the shaft  $f^{13}$ , which carry the friction-disks  $f'$ , may slide in their bearings and are actuated toward each other by a spring  $f^{21}$ , inclosed within the shaft  $f^{13}$ , which is hollow, and said spring is carried on a spindle  $f^{22}$  and bears at one end against a shoulder on said spindle and at the other end against a nut  $f^{23}$ , which screws in the end of the shaft. A key  $f^{24}$  passes through a slot in shaft  $f^{13}$  and is pressed against a shoulder in disk  $f'$  by spindle  $f^{22}$ , the slot in the shaft being long enough to admit of sufficient endwise movement. Collars  $f^{12}$  are fitted loosely on the shaft  $f^{13}$  and abut the confronting faces of the disks  $f'$ . Said collars have heads  $f^{14}$  with double-beveled confronting faces. A double-ended wedge  $f^{15}$  straddles the shaft  $f^{13}$  between the two heads  $f^{14}$ . By bringing the central wide part of the wedge into engagement with the apexes of the faces of the heads  $f^{14}$  the collars  $f^{12}$  are moved apart and the disks  $f'$  spread sufficiently to clear them of the friction-wheels, as shown in Fig. 5. When either small end of the wedge is brought to a central position between the heads  $f^{14}$ , the spring  $f^{21}$  throws the disks into frictional engagement with the wheels. The wedge is actuated from the shaft  $h^4$  through a bevel-pinion  $f^{16}$  on the end of said shaft, a pinion  $f^{17}$  on a shaft supported in the lathe-bed and in mesh with said pinion  $f^{16}$ , and a rod  $f^{18}$ , connecting a crank-disk  $f^{19}$  on said shaft with the wedge. This rod is best shown in Fig. 3. It extends rearwardly from the crank-disk, is formed into a coil, and then extends downwardly to the wedge, having an offset at one point. The rod is formed in this manner simply to clear gear-wheels, which would prevent its extending straight down from the crank-disk to the wedge.

As has been before stated, the turning of the handle  $h^7$  shifts the clutch  $f^{11}$  to connect

the spindle with the bevel-gear  $f^7$ , or with the back gears. When this handle is extending vertically upward, the clutch is thrown into the gear  $f^7$  and the lower end of the wedge  $f^{15}$  is brought to a central position between the heads  $f^{14}$ , the crank-pin of the disk  $f^{19}$  being at the upper side of said disk, and the disks  $f'$  are in frictional engagement with the wheels  $f$ , and when the handle is extending straight downward the clutch is thrown into the gear  $g$  and the upper end of the wedge is brought into a central position between the heads  $f^{14}$ , the crank-pin of the disk  $f^{19}$  being then at the lower side of the disk, and the disks  $f'$  and wheels  $f$  are in frictional engagement; but when said handle is brought to a horizontal position, as shown in Fig. 5, the clutch is in an intermediate position, engaged with neither of the gears, the crank-pin of the disk  $f^{19}$  is at the middle of its throw, and the middle or wide part of the wedge is brought to a central position between the heads  $f^{14}$  and is holding the disks  $f'$  out of contact with the friction-wheels  $f$ . It will be observed that with the double-ended wedge and double-inclined faces of the heads  $f^{14}$  the friction-disks will be spread apart under either direction of movement of the clutch.

The arrangement whereby the speed of the work-rotating spindle is increased as the diameter of the work decreases will next be described. The cross-feed screw  $d$  carries a spur-gear which meshes with a larger gear  $d^3$ , supported in the carriage  $b$ , and said gear  $d^3$  meshes with another gear  $d^4$ , mounted on a sleeve fitted to revolve in a bearing in the apron and supporting a shaft  $d^8$ . A perforated disk  $d^6$  on the exterior of the apron is fast on the sleeve with the gear  $d^4$  and loose on the shaft  $d^8$ , and a crank-handle  $d^5$  is fixed to the shaft  $d^8$  and works over the face of said disk, having a spring-pressed bolt  $d^7$  for engagement with the perforations thereof. When the said bolt is engaged with a perforation in the disk, it will be seen that by turning the crank-handle the disk will then be rotated and with it the gear  $d^4$ . The shaft  $d^8$  carries affixed to it a bevel-pinion  $d^9$ , which meshes with a bevel-pinion  $d^{10}$ , supported in a bearing on the carriage  $b$  and splined to a shaft  $d^{11}$ , extending through the carriage and supported in bearings  $d^{12}$  on a slide  $i$ , fitted to a slideway in the lathe-bed. A screw  $i^1$  is fitted loosely on the shaft  $d^{11}$  between the two bearings  $d^{12}$ , and the thread of this screw has a variable pitch. Throughout approximately one-half of its length the pitch is uniform, as shown at  $i^2$ , and throughout the remainder of its length the pitch is much coarser, as shown at  $i^3$ . The connection of the shaft  $d^{11}$  with the screw is effected through heads  $i^4$ , affixed to the shaft and carrying spring-held dogs or pawls  $i^5$ , the springs being flat plates fitting cavities in the heads and secured at one side to the heads. These dogs or pawls are projected by their springs into the paths of shoulders at the ends of the screw-thread, and un-



der one direction of rotation of the shaft one pawl drives the screw, while under the other direction of rotation of said shaft the other pawl drives the screw. The pawls project beyond the shoulders of the screw against which they act for a purpose which will hereinafter appear. A second slide  $j$  has position behind the slide  $i$  and carries a pin  $j'$ , which projects through a slot in the slide  $i$  and into the channel of the screw  $i'$ , where it carries a roller  $j^2$  for engagement with the sides of said channel. The slide  $j$  has a rack  $j^3$  on its rear side meshing with a horizontal gear  $j^4$ , fixed on the upper end of a shaft  $j^5$  and supported by a fixed bearing  $j^6$ , through which the shaft extends. Said shaft carries a gear  $j^7$  on its lower end, which meshes with two racks  $j^8$  and  $j^9$  on opposite sides of the gear and arranged to slide in the lathe-bed. These racks are fastened on slides  $j^{10}$   $j^{11}$ , which support hangers  $j^{12}$   $j^{13}$ , carrying the friction-wheels  $f$ .

A latch  $k$  is pivoted to the lathe-bed above the slides  $i$  and  $j$  and its free end extends across both slides, and part of it is made square, as shown at  $k'$ , for engagement with correspondingly-formed notches  $k^2$  in the outer slide  $i$ , while part is beveled, as shown at  $k^3$ , for engagement with beveled ends of a channel  $k^4$ , formed in the upper side of the back slide  $j$ . While the beveled portion of the latch is in the channel of the back slide, the square portion of said catch may engage one of the square notches  $k^2$  of the front slide and hold the latter stationary. It is with the parts in this adjustment and with the pin  $j'$  at the right-hand end of the screw and the friction-wheels  $f$  at the farthest outward position that the work is started, and it will be observed that as the cross-feed tool-carriage travels inward the screw  $i'$  will be revolved through the connections described, and this revolution of the screw moves the back slide through the engagement of the pin  $j'$  with the channel of the screw. The movement of the back slide causes the friction-wheels  $f$  to be gradually moved toward the center of the friction-disks through the connection described—viz., the gears  $j^4$  and  $j^7$  and the slides  $j^{10}$  and  $j^{11}$ , the revolution of the gear  $j^7$  moving the said slides in opposite directions and carrying the friction-wheels  $f$  toward the center of the friction-disks.

It is desirable that some provision be made for preventing the friction-wheels being moved toward each other beyond a certain limit to avoid injury to the machine, and this is one reason for providing the latch  $k$  and arranging it as desired, for when the friction-wheels have reached the limit of their inward movement the inclined end of the channel in the back slide strikes the beveled part of the latch and throws it out of engagement with the front slide. The front slide being no longer held fixed by the latch, the back slide will be no longer moved under rotation of the screw, but continued rotation of the latter after the latch has been thrown out will cause

the screw and front slide to be moved to the right until the end of the thread-channel is reached. Here the pawl  $i^5$  encounters the pin  $j'$  and is moved thereby out of the path of the shoulder on the screw, thereby disconnecting the screw from the head  $i^4$ , which drives it. Further rotation of the shaft  $d^{11}$  in the same direction produces no motion of the screw. Upon withdrawing the cross-feed the screw  $i'$  will be moved back to its normal position, and then the latch will again drop into the square notch in the front slide and hold the latch so that continued backward rotation of the screw will bring the back slide to its normal position and the friction-wheels  $f$  again to their outward position, where they are most remote from the center of the disks  $f'$ . When the pin  $j'$  reaches the right-hand end of the screw, it trips the pawl  $i^5$  at this end out of engagement with the screw, so that further turning of the shaft  $d^{11}$  produces no movement of the screw. This is done to prevent the pin binding in the end of the screw-channel. A rigid stop-pin  $z$  stands at the end of the screw-channel for the traveling pin  $j'$  to abut.

The object of the varying degree of pitch in the screw  $i'$  is to obtain a movement of the friction-wheels  $f$  proportional to the advance of the cutting-tool, whether the back gears are in or not. If it were practical to use friction-disks large enough and to carry the friction-wheels to the center thereof, there would be no necessity of varying the pitch of the screw and the back gears could be dispensed with; but it is not practical to employ such a construction, and hence in operating upon work of greater diameter than provided for in the size of the disks when the friction-wheels reach the center of the disks there still remains a portion of the work to be acted upon. Now the speed of the spindle is the same with the back gears in and the friction-wheels at the middle of the disks as it is with the back gears thrown out and the friction-wheels at the outside of the disks. So with my improved arrangement when the friction-wheels reach the center of the disks and there still remains a portion of the work to be acted upon the back gears are thrown out and the friction-wheels moved to their outward position as follows:

The operator grasps the projecting end of the shaft  $d^{11}$  and draws it to the right, which causes both slides to move together to the right until the latch  $k$  drops into the left-hand notch  $k^2$  in the front slide. When the friction-wheels reach the limit of their inward movement and the back gears are thrown out, the latch  $k$  is disengaged from the front slide by the incline of the back slide. By this operation the cross-feed has not been affected in the least and stands ready to continue across. The friction-wheels have, however, been moved to their outward position. Upon continuing the cross-feed the back slide will be moved to the left by the engagement



of the pin  $j'$  in the coarse pitch of the screw, and the friction-wheels will be moved much more rapidly toward the center of the disks than in the first instance by reason of the increased coarseness of the thread-channel, and the full movement of the friction-wheels will be obtained during the remainder of the cross-feed, which is considerably shorter than the first cross-feed. When the end of the screw-channel is reached, the latch is tripped out, as before, by the engagement therewith of the inclined end of the channel in the back slide. This coarse pitch of the screw is for use at all times when the back gears are disengaged to vary the speed.

The perforated disk  $d^6$  and handle  $d^5$  provide means of adjustment whereby the back slide may be moved to any part of the screw-thread desired without affecting the cross-feed. By this adjustment the work can be started in at any speed desired.

Thus far the description has related mainly to the cross-feed. The mechanism employed to effect the parallel feed will now be described and incidentally the means for making the cross-feed automatic.

The bed  $a$  is provided with a rack  $m$ , as usual. A spline-shaft  $n$  extends through the carriage, and a worm  $n'$  is mounted on said shaft and meshes with a worm-gear  $n^2$ , which is loosely mounted on the hub  $n^{15}$  of a gear  $n^4$ , said hub being elongated and supported eccentrically in a circular block  $w'$ , fitting a bore in the apron and adapted to turn therein. The gear  $n^4$  is formed with a friction-clutch member  $n^5$  for engagement with a corresponding part of the gear  $n^2$ , and these gears may be rotatively connected by means of a T-headed bolt  $n^3$ , extending through the hub  $n^{15}$ , its T-head extending over a collar  $n^{16}$ , which fits against the gear  $n^2$ , and its outward end being screw-threaded to receive a hand-nut  $w$ , adapted to bear against the hub of the gear  $n^4$ . By tightening the said hand-nut the gear  $n^2$  is drawn into engagement with the gear  $n^4$ . A hub of the block  $w'$ , concentric with the hub  $n^5$ , carries an arm  $n^7$  on the inner side of the apron, and said arm carries a large and a small gear  $n^8$   $n^9$ , joined together on the same center at its outer free end, and an intermediate gear  $n^{10}$ , connecting the large gear  $n^8$  with the gear  $n^4$ . Two intermeshing gears  $o$  and  $o'$  are supported one above the other in the carriage, and the upper one is fast with a small spur  $o^2$ , which is in mesh with the rack  $m$ . Another spur  $o^3$  is supported on a stud in the carriage and intermeshes with the gear  $o'$ , and said latter spur is controlled by a hand-wheel  $o^4$  on the exterior of the apron. The spur  $n^9$  has position between the four gears  $d^3$ ,  $d^4$ ,  $o$ , and  $o'$  and is adapted to mesh with each separately under the different adjustments of which the gears are capable. These adjustments will next be explained. When the handle  $n^6$  is in a vertical position, as shown in the drawings, Fig. 1, the eccentric block

$w'$  is in a position to bring the hub of gear  $n^4$ , which it supports at the forward or left-hand end of its throw, and the arm  $n^7$  is therefore carried in the same direction and the small gear  $n^9$  is in position to mesh either with the gear  $o$  or the gear  $o'$ . A stud  $p$ , fastened in the free end of said swinging arm, projects through an opening  $p'$  in the apron of sufficient extent to allow for up-and-down and forward-and-back play of the stud. When the parts are at the adjustment just described, the stud is at the front end of the said opening. By means of a hand-nut  $p^2$ , screwing onto the stud, the arm  $n^7$  may be raised or lowered to bring the spur  $n^9$  into mesh with either the gear  $o$  or  $o'$  and locked at the desired adjustment by tightening the said hand-nut. These gears are brought into play when an automatic parallel feed is used, and with the spur  $n^9$  in mesh with the lower gear  $o$  the carriage will be fed forward. By loosening the hand-nut  $p^2$  and raising the spur  $n^9$  into mesh with the upper gear  $o'$  it will be apparent that the parallel feed is reversed and the carriage run back. When the handle  $n^6$ , Fig. 1, is brought to a horizontal position, the eccentric is at the middle of its throw and the spur  $n^9$  is in an intermediate position, where it intermeshes with no one of the gears, and under this adjustment the parallel feed and the cross-feed can only be operated by hand—the parallel feed by the crank-wheel  $o^4$  and the cross-feed by the handle  $d'$ —which obviates all chance of feeds becoming engaged while screw-cutting is being done and thereby causing a breakdown.

To throw in the automatic cross-feed, the handle  $n^6$  is turned until it extends straight down and the eccentric is in a position which brings the hub of gear  $n^4$  at the right-hand or rearward end of its movement and the spur  $n^9$  in position to mesh with either the gear  $d^3$  or the gear  $d^4$ . By manipulating the hand-nut  $p^2$  in the same manner as before described the said spur may be brought into mesh with either of the said gears and locked. When in mesh with the lower gear, the feed is forward, and consequently when in mesh with the upper gear the feed is backward. The handle  $n^6$  carries a spring-pressed bolt  $q$ , which works over a curved plate on the apron and is adapted to be projected into a hole in said plate at each of its three positions described.

The shaft  $n$  is driven through the following connections with the spindle: A shaft  $s$ , supported below the spindle, carries a shiftable gear  $s'$ , adapted to mesh either with a spur  $s^2$  on the spindle or with the spur  $f^9$ . The said shiftable spur slides on the shaft and may be shifted and locked in mesh with either of the spurs named by means of a yoke  $s^3$ , straddling the hub of the spur and engaging a groove therein, and having a screw-threaded shank projecting through a slot  $s^{10}$  in the lathe-head, and a nut  $s^5$  on said shank and adapted to be clamped against the exte-



rior of the lathe-head. The shaft  $s$  carries a three-step cone-pulley  $s^6$ , which is connected by a belt with a cone-pulley  $s^7$  on the shaft  $n$ .

A lead-screw  $r$  for cutting screw-threads is supported in bearings inside the hollow bed of the lathe, under a portion  $r'$  of said bed which overhangs the said screw and forms a roof which protects it from falling dirt, said overhanging portion being hollowed out to conform to the contour of the screw and closely cover the same. The said lead-screw is operatively connected with the spindle through the usual change-gears  $r^2$ , meshing with a spur  $r^3$  on the shaft  $s$ .

The lead-screw feeds the carriage along through the following means: A half-nut  $t$  is carried at the end of an arm  $t'$ , pivoted to a portion of the carriage extending down into the hollow bed. Said arm carries the half-nut under the lead-screw, and said half-nut is adapted to be thrown into and out of engagement with the lead-screw by the movement of said pivoted arm. The latter is worked by a rod  $t^2$ , projecting through the front of the carriage and connected at its inner end with a slide-block  $t^3$ , having an inclined side  $t^4$ . A link  $t^5$ , joined to the arm  $t'$ , has a lug which projects over the inclined side  $t^4$  of the slide-block and itself has a corresponding incline. It will be seen that by drawing the rod  $t^2$  out the half-nut will be brought into engagement with the lead-screw, and by pushing said rod in said half-nut is allowed to drop out of engagement with the lead-screw.

It will be seen that by means of the shiftable gear  $s'$  the lathe is allowed a much greater range in thread-cutting, for by throwing said gear into mesh with the spur  $s^2$  when the back gears are driving the spindle the relative slow speed of the gear  $s^2$  permits the finest thread to be cut, whereas by shifting the spur  $s'$  into mesh with the gear  $f^9$  the greatly-increased speed transmitted thereby allows the cutting of the very coarsest thread. Of course the change-gear will be arranged according to the degree of pitch desired in the usual way. The shiftable gear thus allows more adjustments for thread-cutting.

It is evident variations may be made in the structure here shown without departing from the spirit and scope of the invention.

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

1. A lathe comprising in its construction a cross-feed screw, a shaft in gear therewith, a screw on said shaft and having a thread of one pitch throughout a portion of its length and a thread of a coarser pitch throughout the remainder of its length, said screw being capable of longitudinal movement and speed controlling mechanism governed by the pitch of the screw.

2. A lathe comprising in its construction a cross-feed screw, a shaft in gear therewith, a screw on said shaft and having a thread of

uniform pitch for a portion of its length and of a greater or coarser pitch for the remainder of its length, said screw being capable of longitudinal movement, speed controlling mechanism governed by the thread of said screw, and means for automatically rendering the speed-changing mechanism inoperative when the end of the thread of smaller or finer pitch of the screw is reached.

3. A lathe comprising in its construction a cross-feed screw, a shaft in gear therewith and supported in bearings on a slide, a screw on said shaft and having a thread of variable pitch, a back-slide carrying a part engaging the thread-channel of the variable screw, a latch engaging the front slide and holding it stationary, said latch adapted to be tripped out of engagement with said slide by the back-slide at a certain period of the latter's movement, and speed-changing mechanism operatively connected with the back-slide.

4. A lathe comprising in its construction a cross-feed screw, a shaft in gear therewith, a screw on said shaft, a slide having a part engaging the channel of said screw, and a rack, a gear in mesh with the rack and carrying a second gear, racks on opposite sides of said second gear and in mesh therewith, friction wheels carried by said racks, and friction disks on opposite sides of said wheels.

5. A lathe comprising in its construction a cross-feed screw, a shaft in gear therewith and carrying a head having a spring-pressed driving pawl, a screw mounted loosely on the shaft and having a shoulder which the pawl abuts, a slide having a part engaging the thread-channel of the screw and adapted to retract the pawl, and speed-changing mechanism operatively connected with the slide.

6. A lathe comprising in its construction a tool-carriage and apron, a cross-feed screw, a shaft carrying a screw which controls the speed of the spindle, suitable connections between the said shaft and the cross-feed screw whereby they may be caused to operate together, and means for rendering the connection inoperative and for operating the shaft independent of the cross-feed screw for purposes of adjustment, substantially as described.

7. A lathe comprising in its construction a tool-carriage and apron, a cross-feed screw, a shaft carrying a screw which controls the speed of the spindle through suitable connections, a crank on the apron and geared to the said shaft, and provided with a spring-pressed bolt, a perforated disk for engagement of said bolt, and a gear fast with said disk and connected with the cross-feed screw.

8. A lathe comprising in its construction the work-rotating spindle, a double clutch splined thereon, a sleeve loose on the spindle and carrying a bevel gear which is positively connected with the driving power, and a spur, a collar loose on the spindle on the opposite side of the clutch and carrying a gear, back-gears connecting the spur on the sleeve with



the last-named gear, and a handle carried on the tool-carriage and controlling the clutch through suitable connections.

9. A lathe comprising in its construction  
5 the work-rotating spindle, a double clutch splined thereon, a sleeve loose on the spindle and carrying a bevel gear which is positively connected with the driving power, and a spur,  
10 a gear loose on the spindle on the opposite side of the clutch, back-gears connecting the spur on the sleeve with the last-named gear, a segment controlling the clutch, a shaft in gear with said segment and extending through the tool-carriage, a gear supported on the  
15 carriage and splined to said shaft, and another gear in mesh with said splined gear and having a handle.

10. A lathe comprising in its construction frictional driving wheels, friction disks spring-  
20 pressed into engagement with said wheels, a double-ended wedge for spreading the said disks, a work-rotating spindle, a double clutch splined thereon, a sleeve loose on the spindle and carrying a bevel gear which is operatively  
25 connected with the friction-disks, and a spur, a gear loose on the spindle on the opposite side of the clutch, back-gears connecting the spur on the sleeve and the last-named gear, and a handle carried on the tool-carriage and  
30 controlling the clutch through suitable connections and also the double-ended wedge.

11. A lathe comprising in its construction frictional driving wheels, friction disks spring-  
35 pressed into engagement with said wheels, a double-ended wedge for spreading the said disks, a work-rotating spindle, a double clutch splined thereon, a sleeve loose on the spindle and carrying a bevel gear which is operatively connected with the friction disks, and a spur,  
40 a gear loose on the spindle on the opposite

side of the clutch, back-gears connecting the spur on the sleeve and the last-named gear, a segment controlling the clutch, a shaft in gear with said segment and extending through the tool-carriage, a crank geared to said shaft, 45 a rod connecting the crank with the double-ended wedge, and a handle carried by the tool-carriage and operating said shaft.

12. The combination of a hollow lathe bed having an interior overhanging part with a 50 semi-cylindrical cavity in its under side; a lead screw occupying said cavity; a carriage having a pendent part in the hollow lathe-bed; an arm pivoted to said pendent part and extending under the lead screw where it carries 55 a half-nut for engagement with said screw; and suitable means for manipulating said arm from the front of the lathe to engage said half-nut with or disengage it from the lead screw. 60

13. A lathe comprising in its construction a rack on the bed, a tool-carriage and apron carrying a cross-feed screw, a shaft extending through the carriage and having a worm, a worm gear engaging the latter and loosely 65 mounted on the hub of another gear, an eccentric block in the apron and supporting said hub, an arm mounted on the hub of said block, means for connecting the said gears, and gears carried by said arm and adapted 70 to connect with the rack and the cross-feed screw under different adjustments of the arm.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 28th day of 75 July, A. D. 1893.

EUGENE CHILDS.

Witnesses:

C. S. HANSON,

A. G. WHITTEMORE.