No. 808,887.

PATENTED JAN. 2, 1906.

H. P. TRUEMAN & E. D. CLEGHORN.

SCREW MAKING AND METAL TURNING LATHE.

APPLICATION FILED DEC. 29, 1902.

11 SHEETS—SHEET 1.

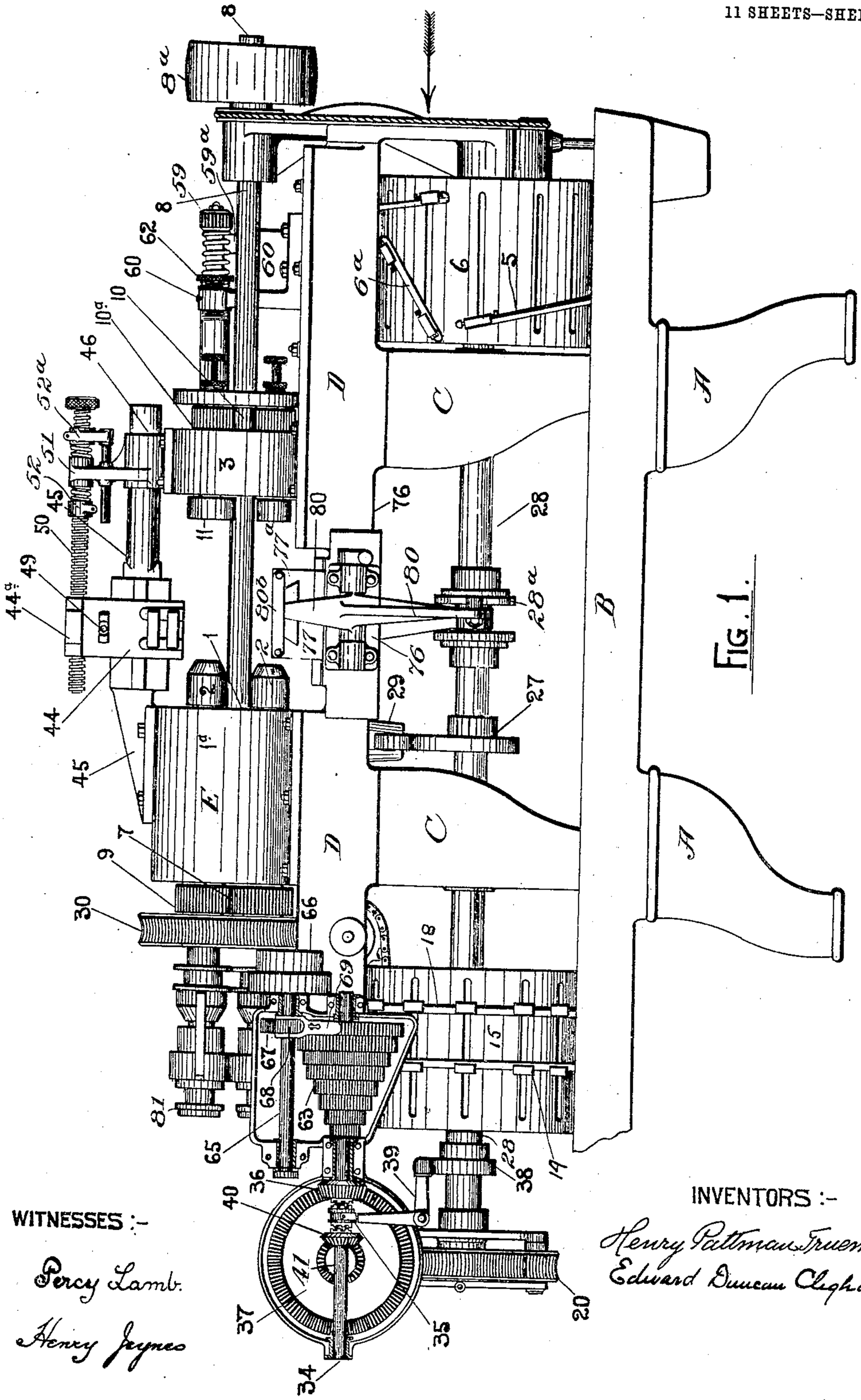

FIG. 1.

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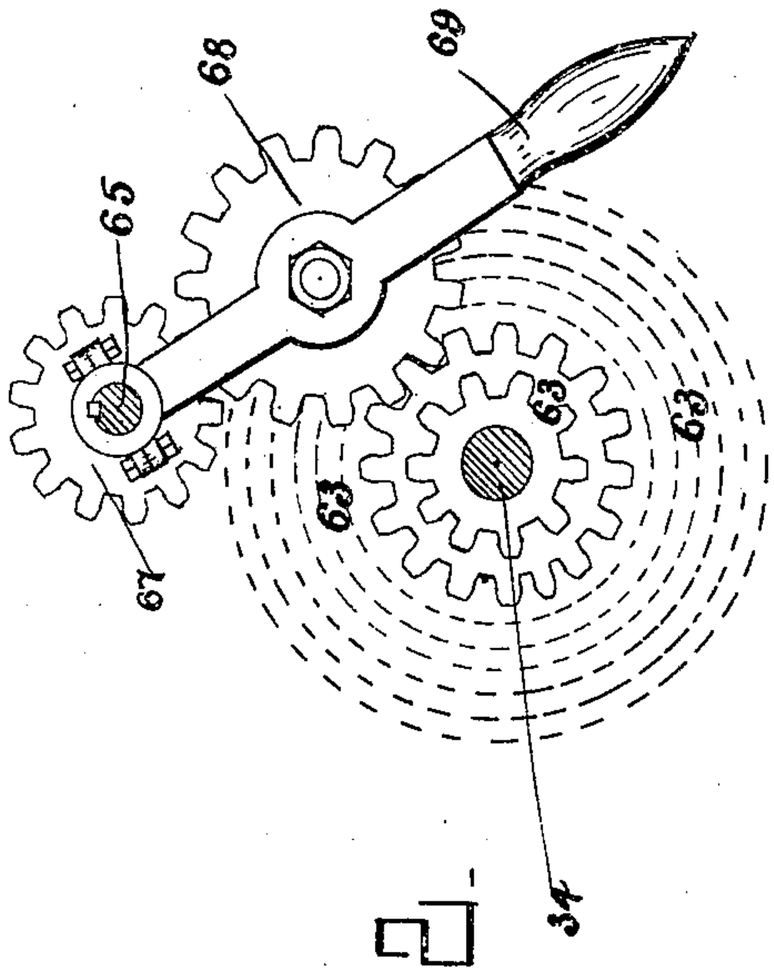

FIG. 2.

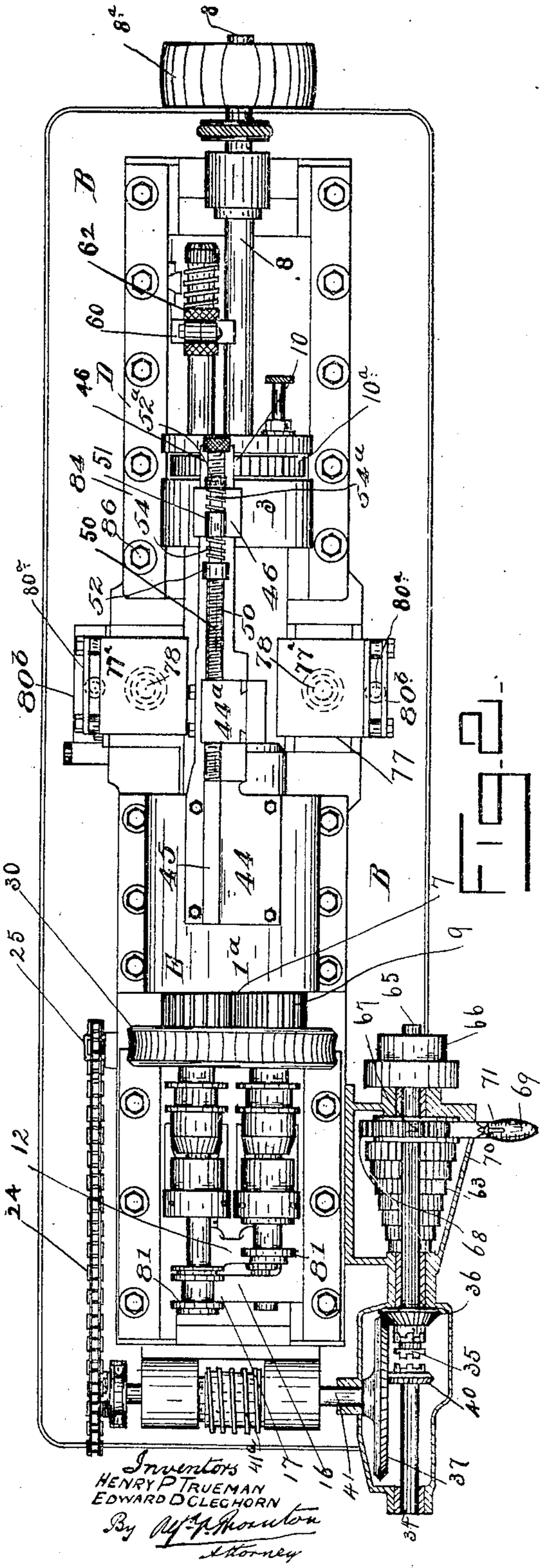

FIG. 1.

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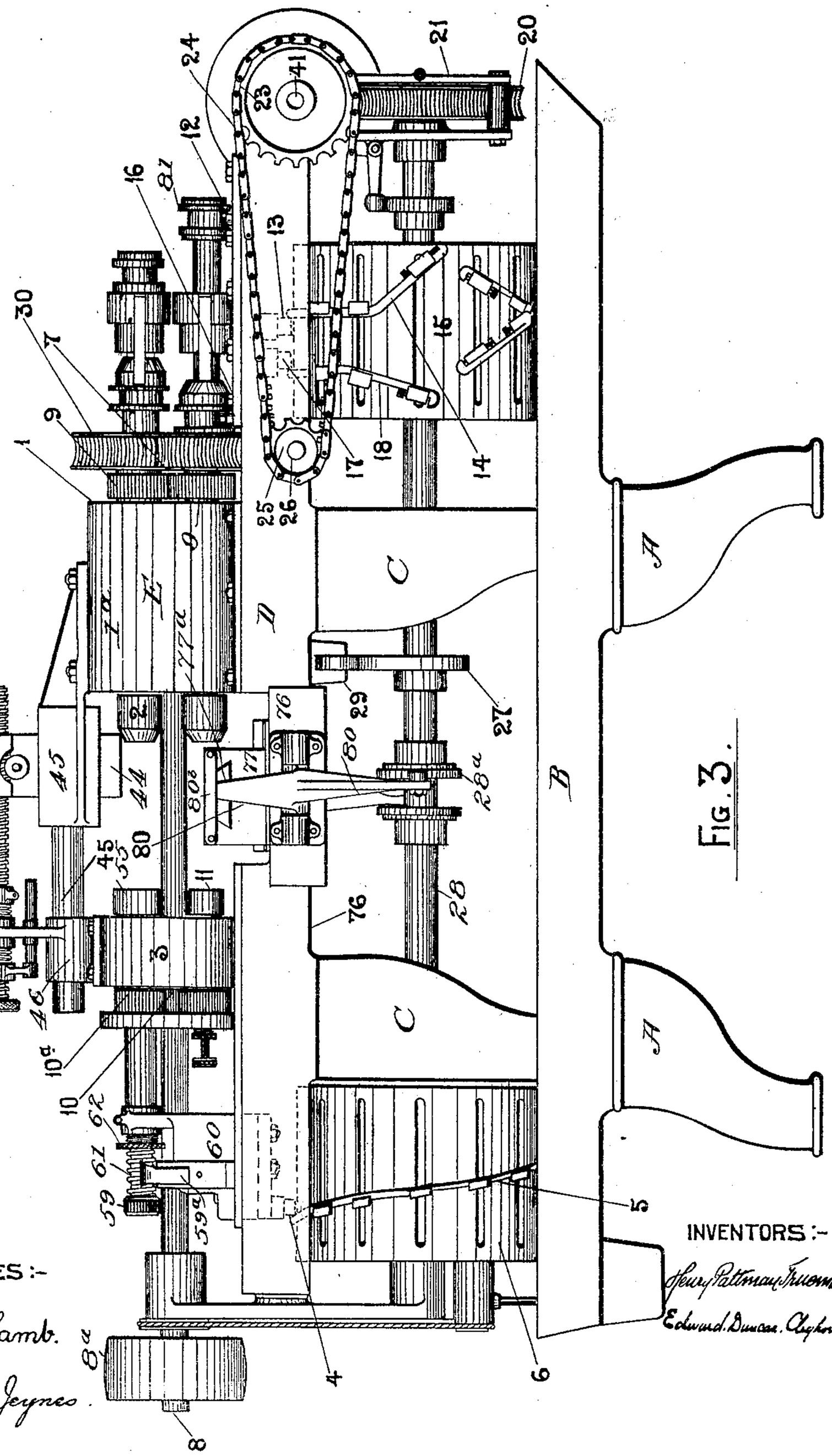

FIG. 3.

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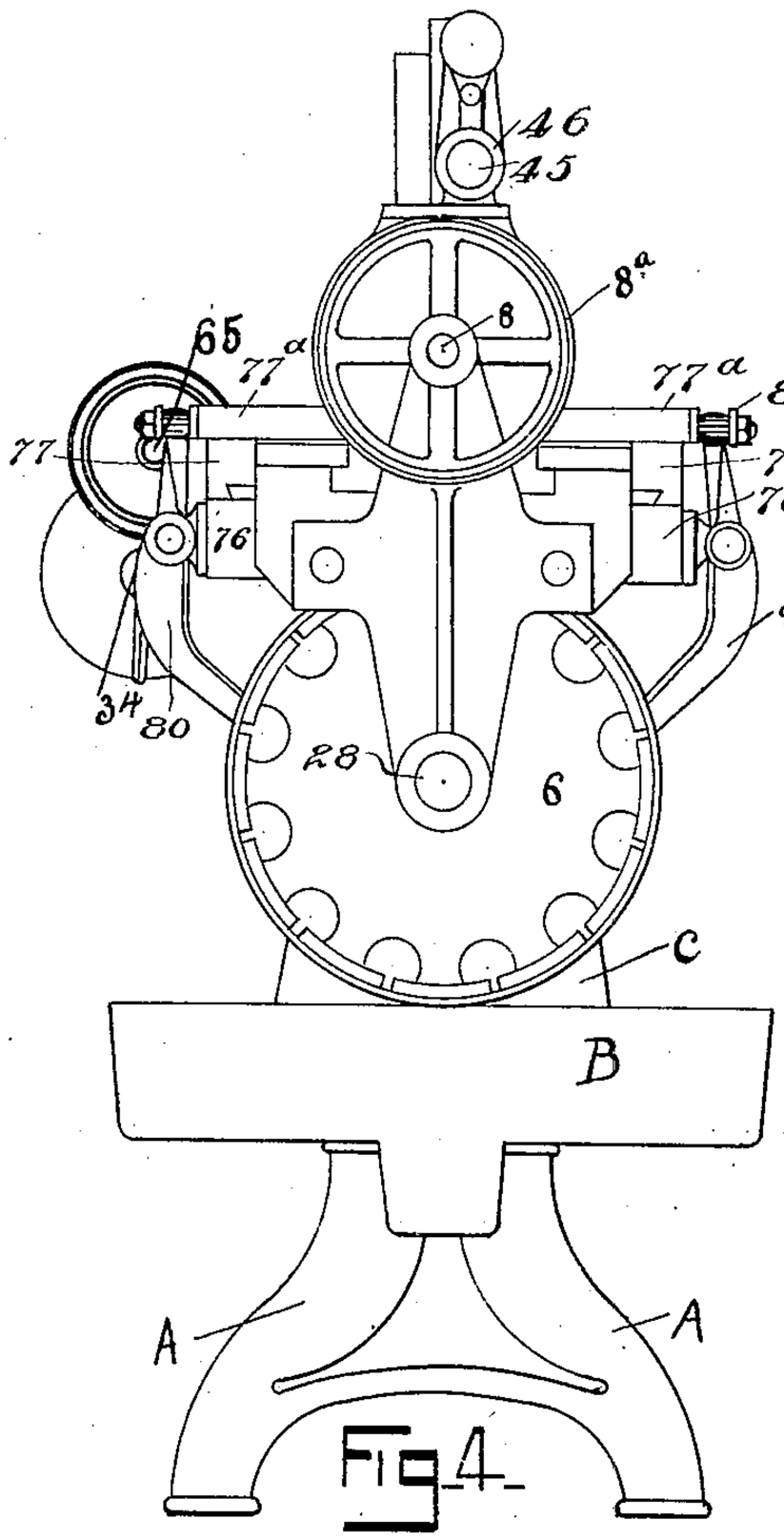


Fig. 4.

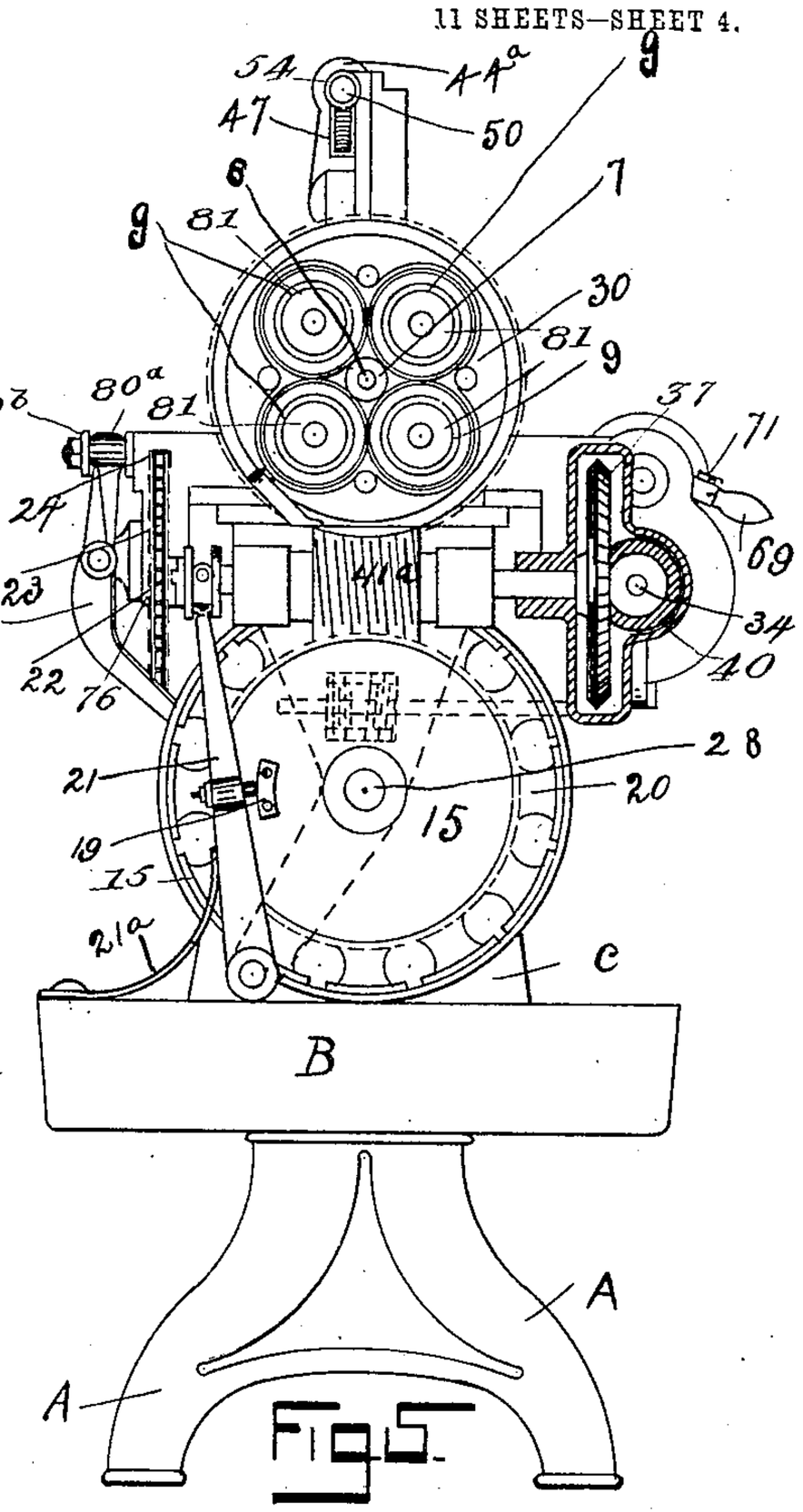
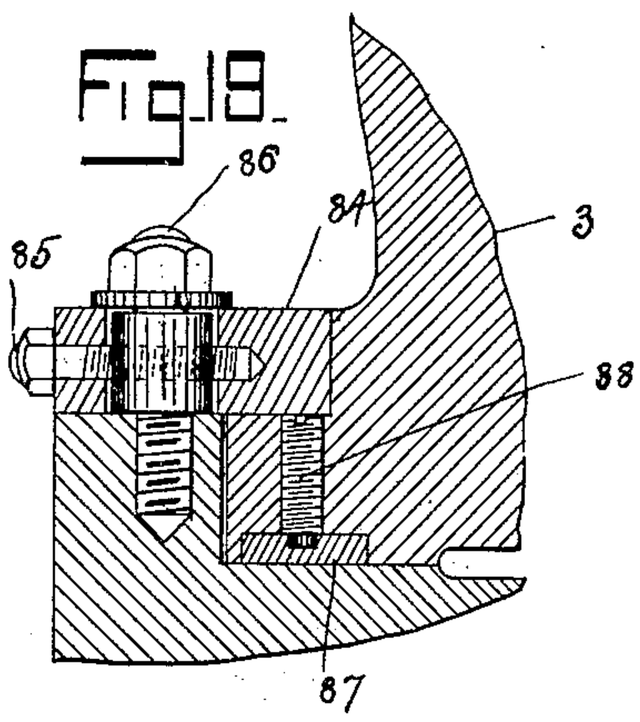


Fig. 5.

Fig. 18.



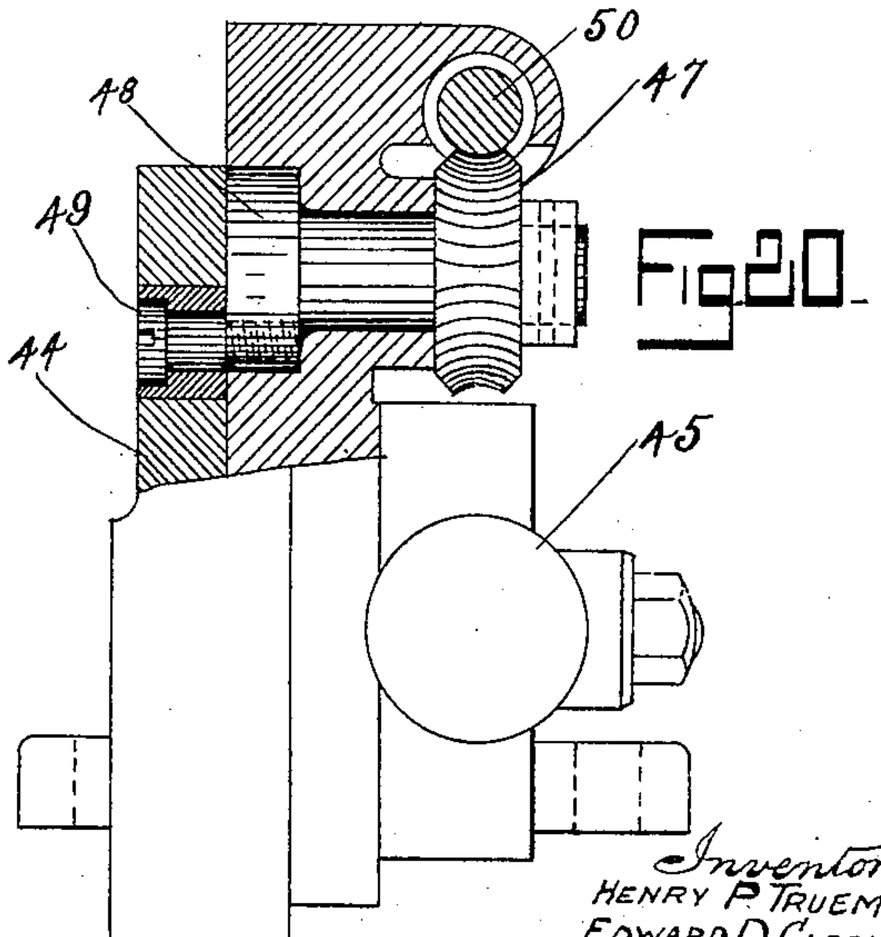


Fig. 20.

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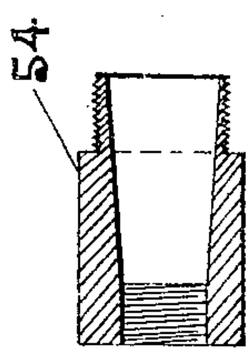

FIG. 9.

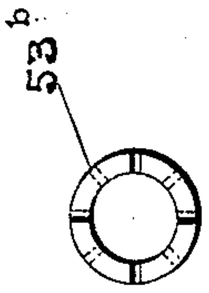

FIG. 8.

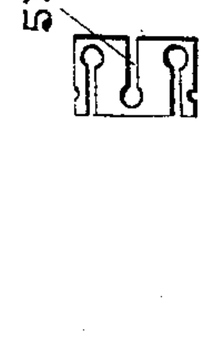

FIG. 7.

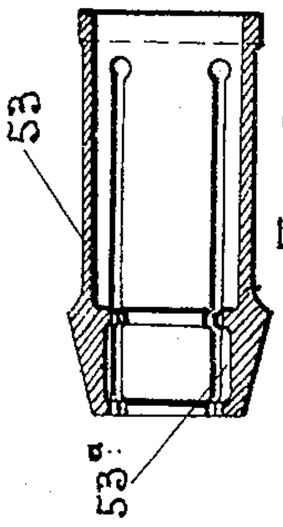

FIG. 6.

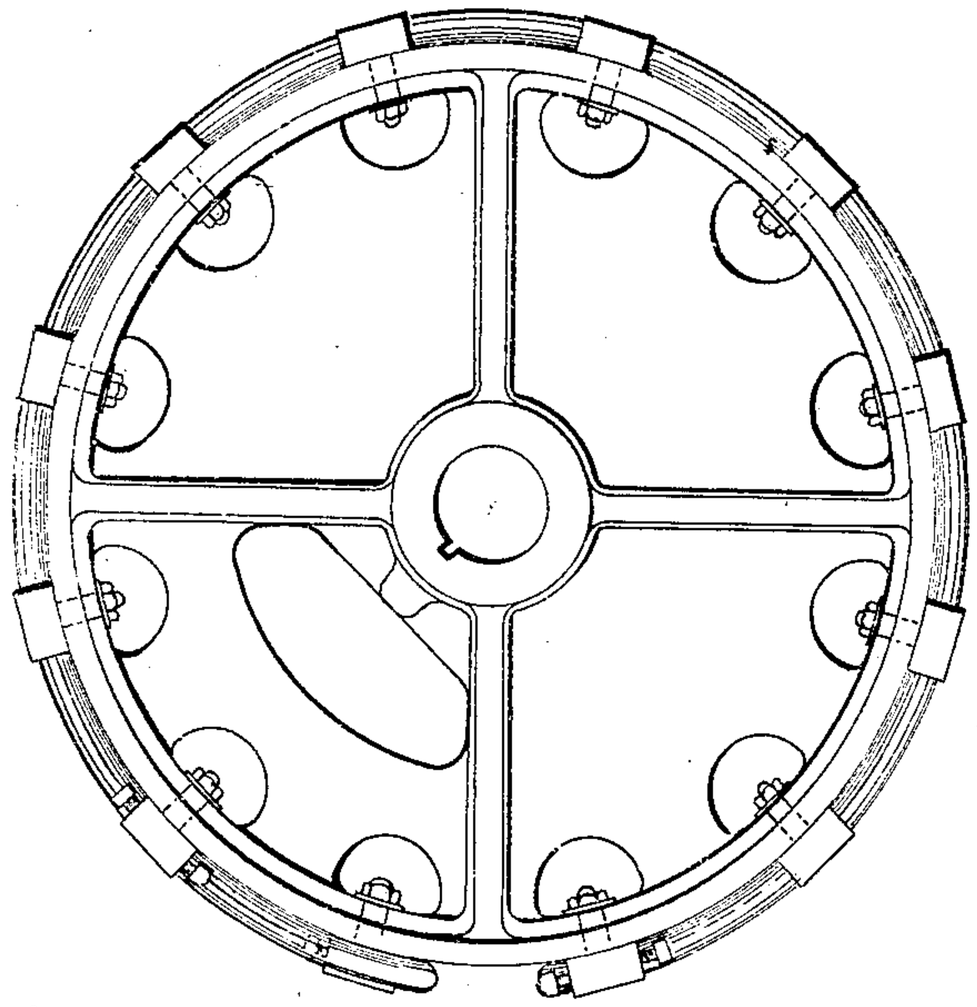

FIG. 11.

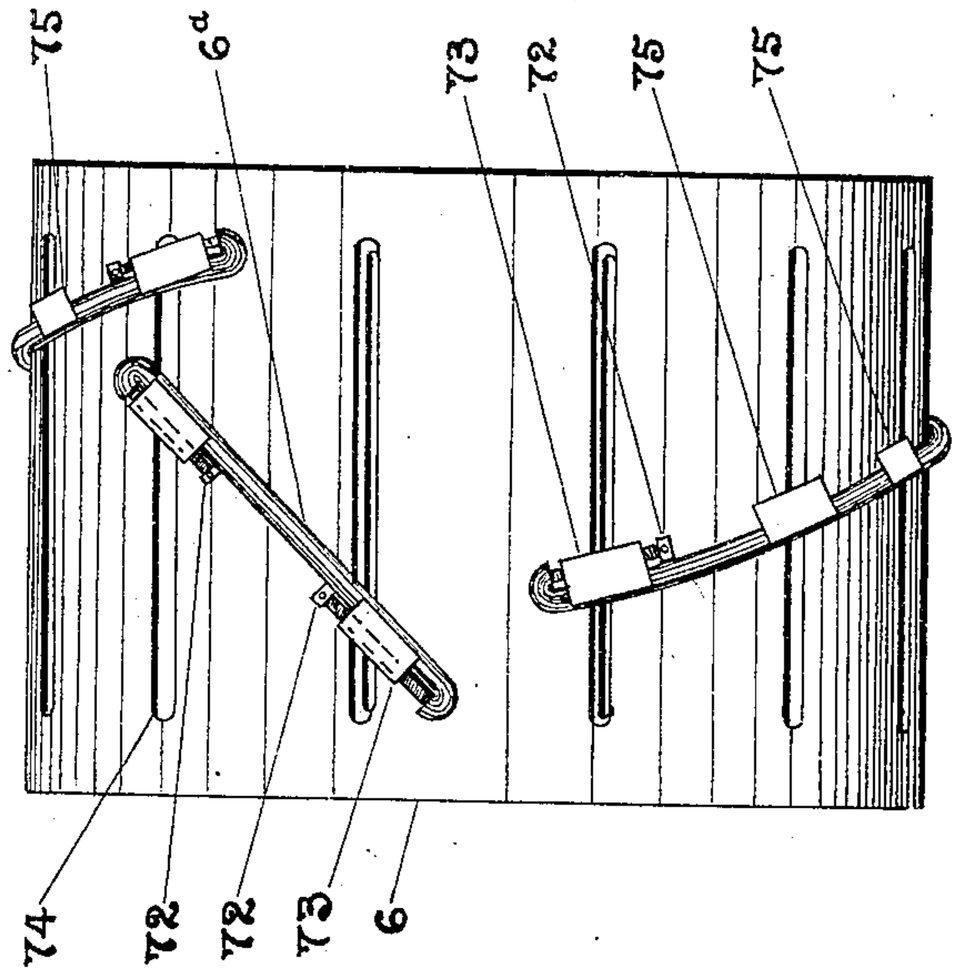

FIG. 10.

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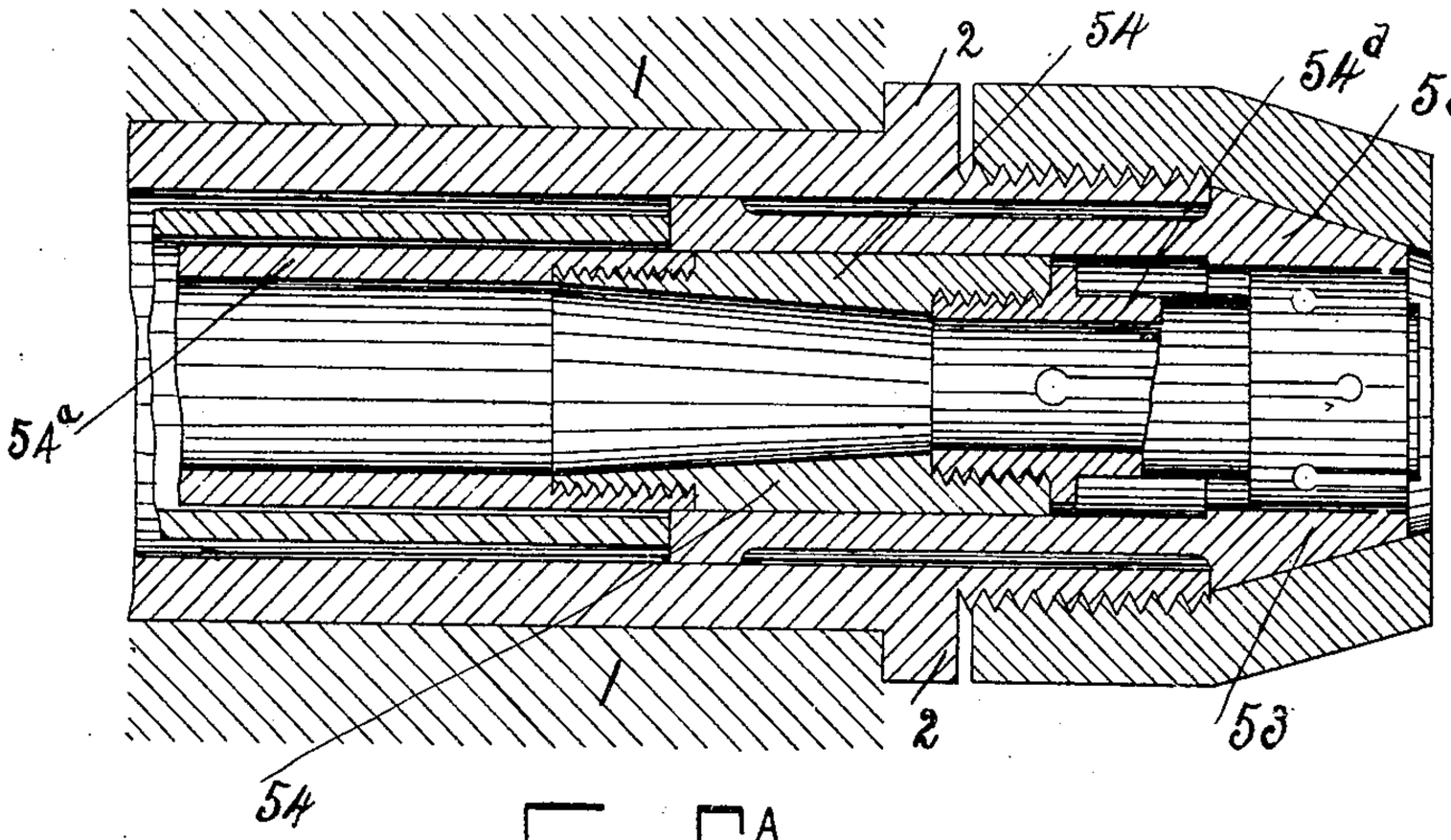

Fig. 6A

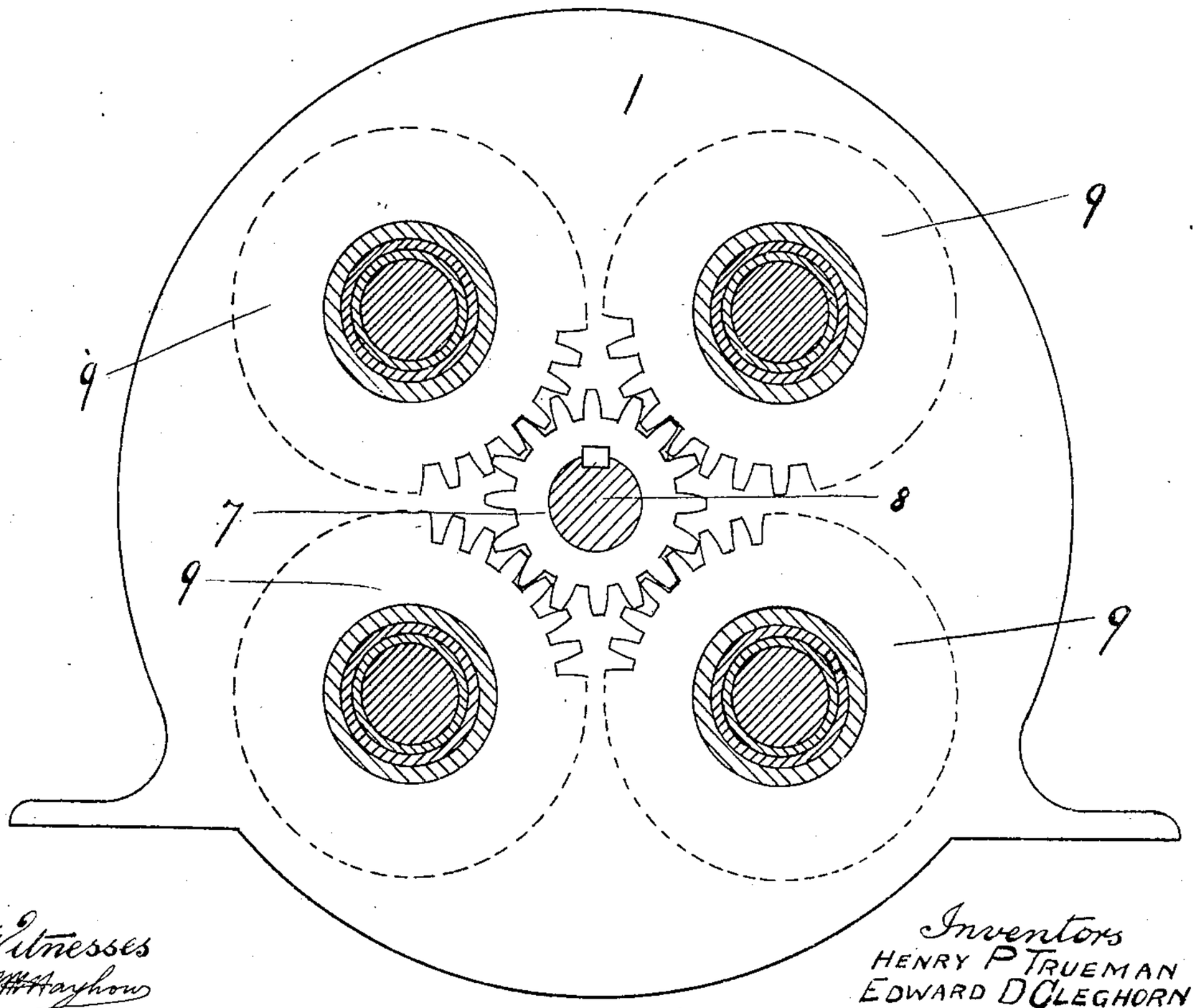

Fig. 2A

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11 SHEETS—SHEET 7.

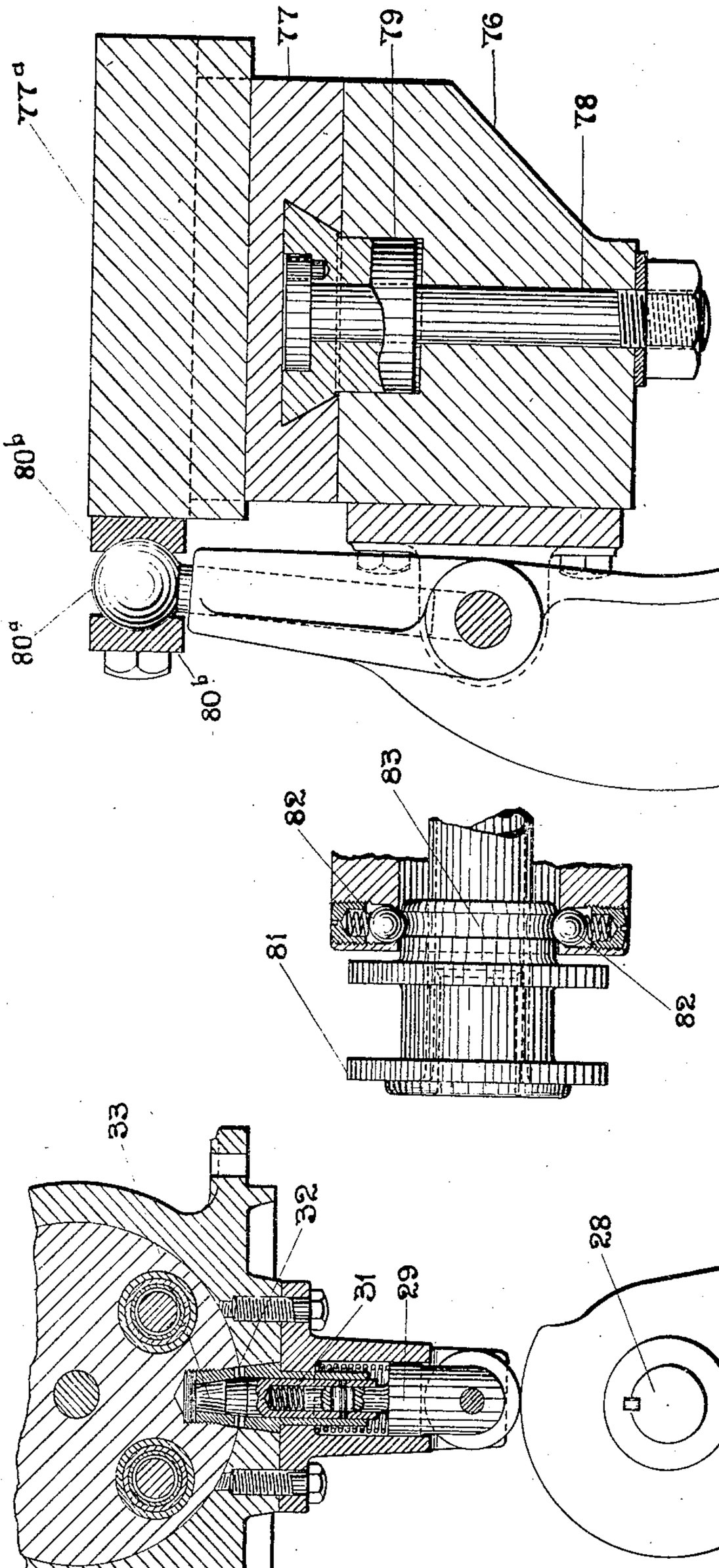

FIG. 18.

FIG. 13.

FIG. 12.

WITNESSES :-
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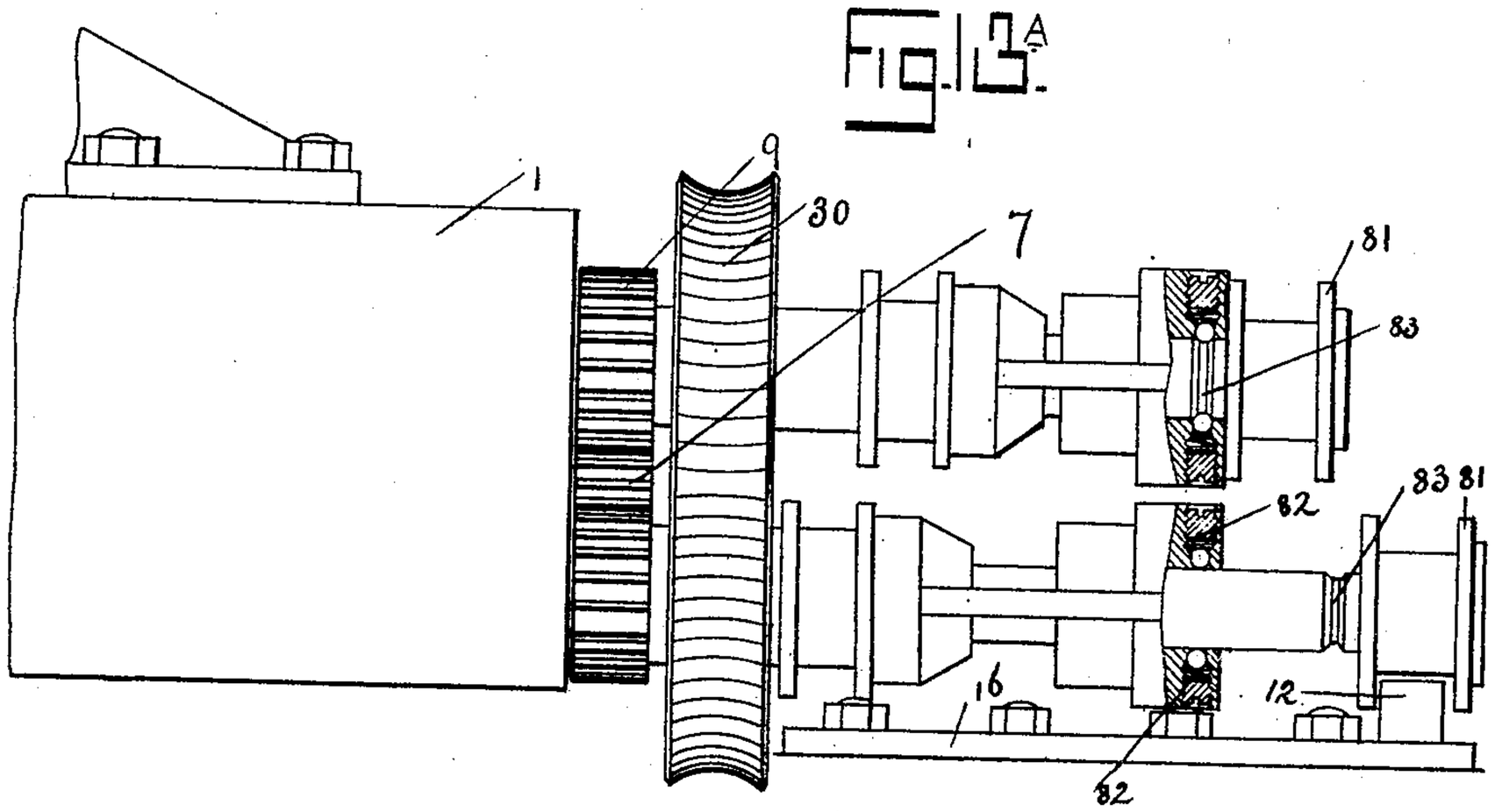
11 SHEETS—SHEET 8.

Fig. 13A



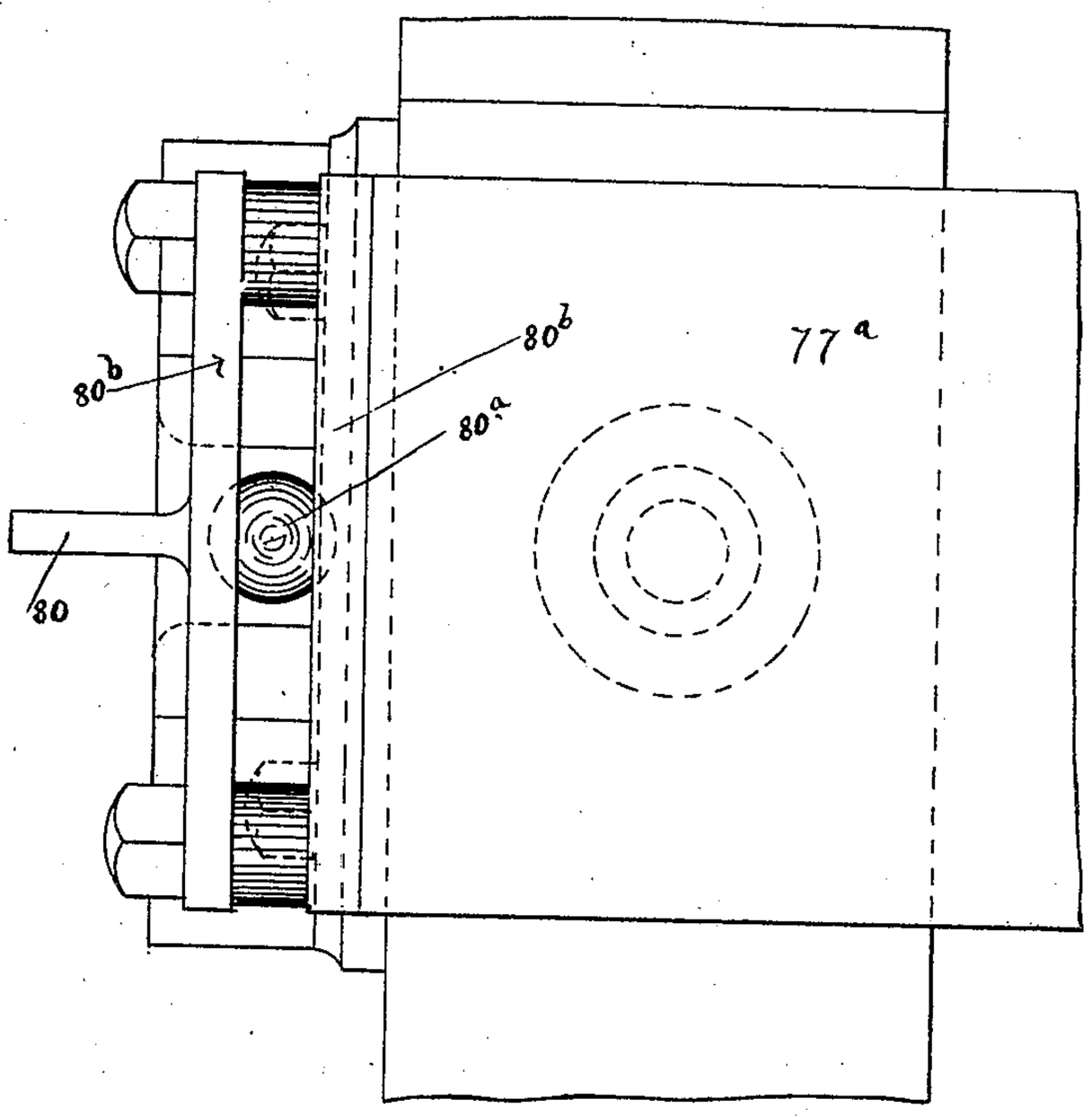


Fig. 13A

Witnesses
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SCREW MAKING AND METAL TURNING LATHE.

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11 SHEETS—SHEET 9.

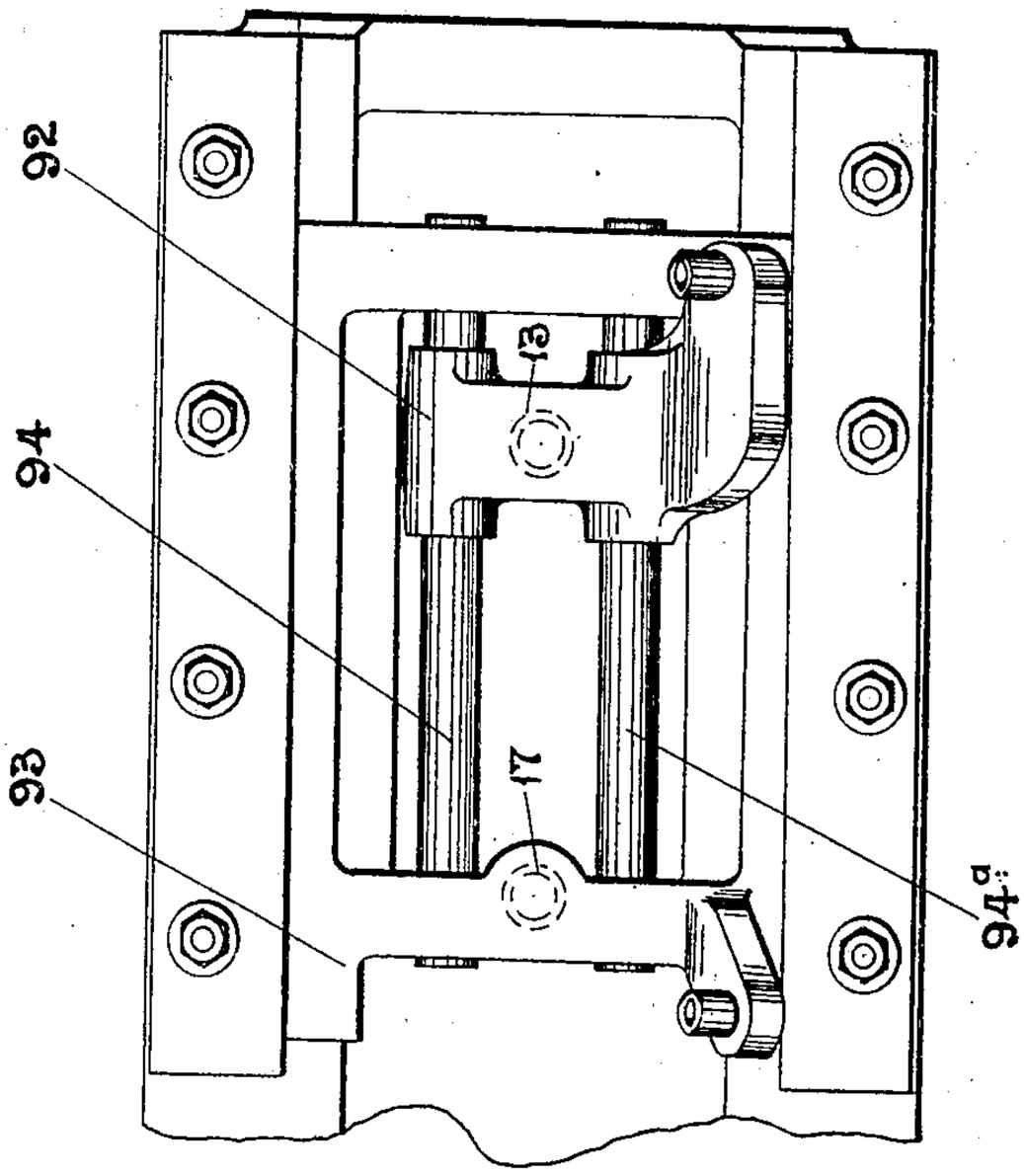

FIG. 14.

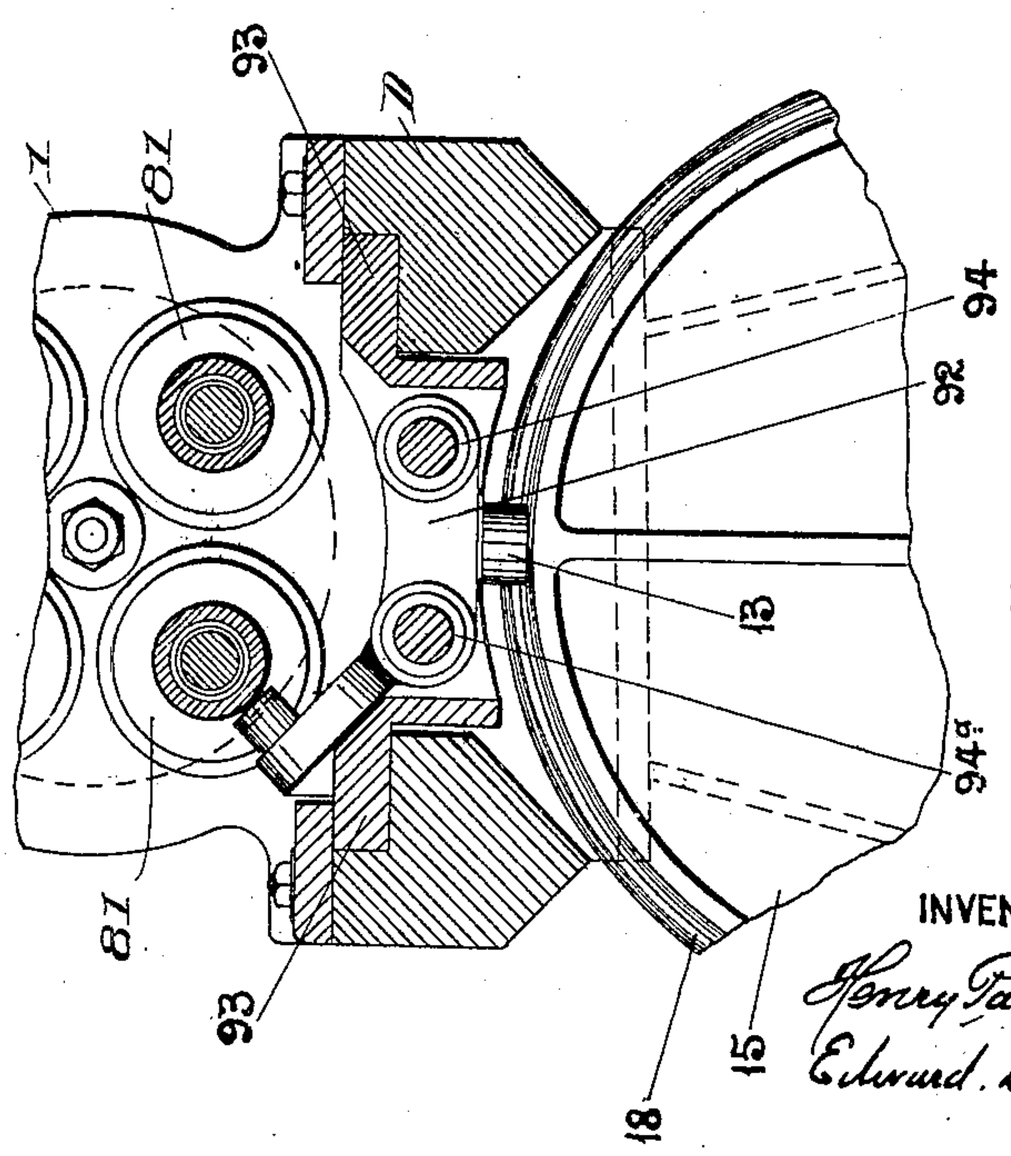

FIG. 15.

WITNESSES :-

Percy Lamb.

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No. 808,887. PATENTED JAN. 2, 1906.

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SCREW MAKING AND METAL TURNING LATHE.

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11 SHEETS—SHEET 10.

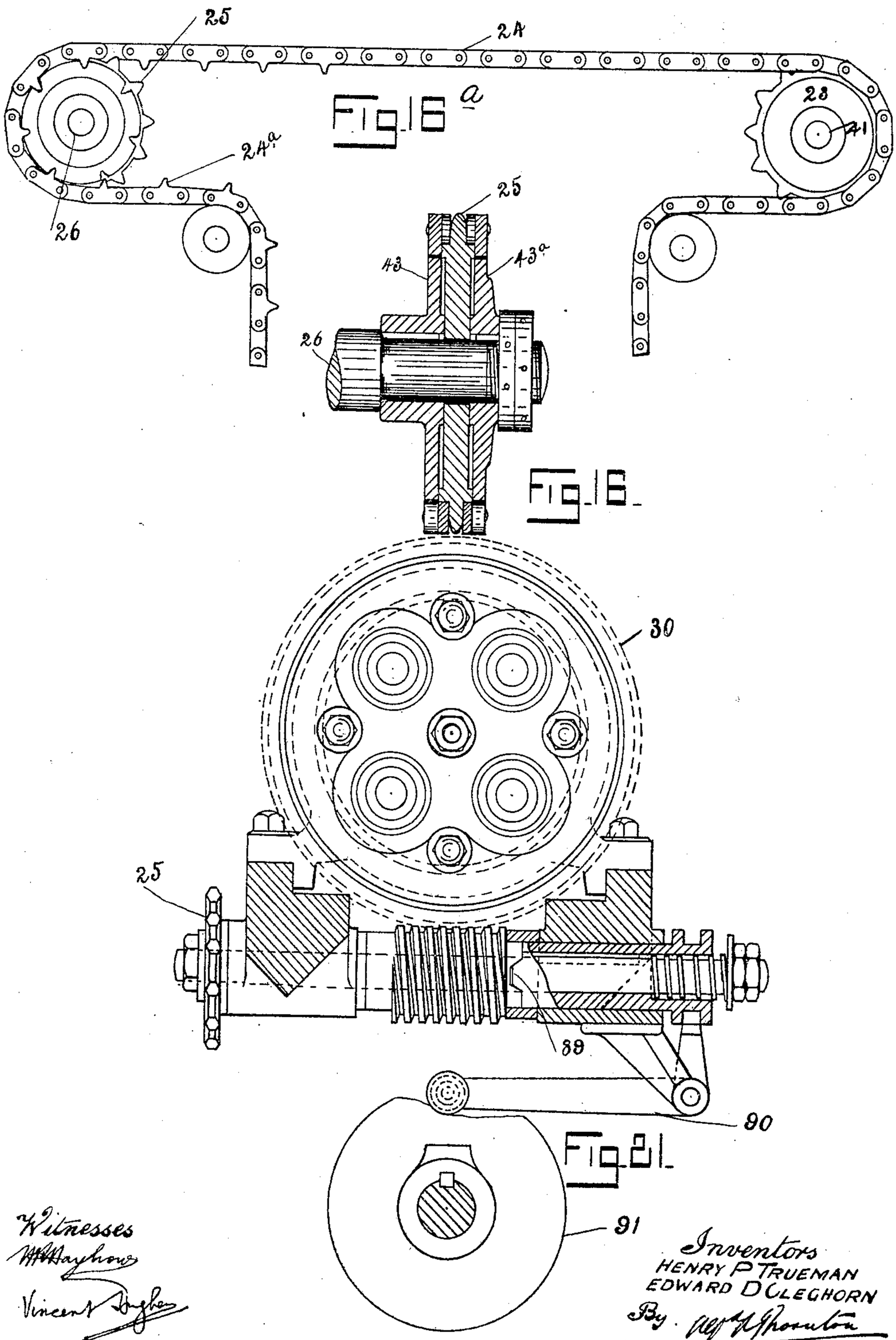

Fig. 16a

Fig. 16.

Fig. 21.

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SCREW MAKING AND METAL TURNING LATHE.

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11 SHEETS—SHEET 11.

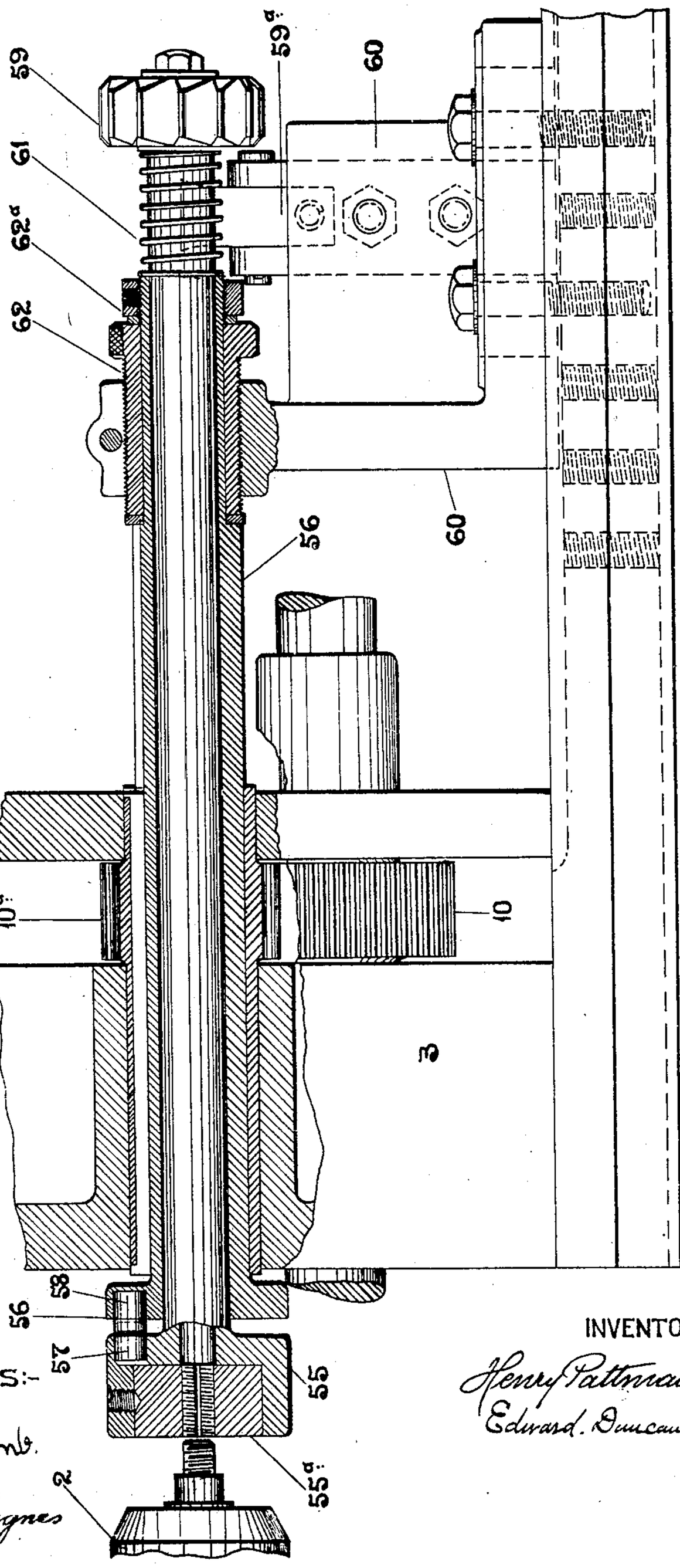

Fig. 17.

WITNESSES:-

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UNITED STATES PATENT OFFICE.

HENRY PATTMAN TRUEMAN AND EDWARD DUNCAN CLEGHORN, OF WORCESTER, ENGLAND.

SCREW-MAKING AND METAL-TURNING LATHE.

No. 803,887. Specification of Letters Patent. Patented Jan. 2, 1906.

Application filed December 29, 1902. Serial No. 136,880½.

To all whom it may concern:

Be it known that we, HENRY PATTMAN TRUEMAN, residing at Plynlimon, Rainbow Hill, Worcester, and EDWARD DUNCAN CLEGHORN, residing at Conway Villa, Stanley Road, Worcester, in the county of Worcester, England, subjects of the King of Great Britain, have invented certain new and useful Improvements in Screw-Making and Metal-Turning Lathes, of which the following is a specification.

This invention relates to improvements in screw-making and metal-turning machines, and particularly to that class of machines known as "multispindle" machines, which machines are characterized by having a multiplicity of rods or bars under the action of the operating-tools at one and the same time. By this means one complete piece necessitating several distinct operations upon it is completed at each revolution of the main cam-shaft. The number of spindles and tool-holders we preferably employ is four. These said spindles and tool-holders are utilized in conjunction with tools held in slides, the said slides being supported upon the framework of the machine.

By this our invention we also provide improved means for moving the spindle-carrying head through a predetermined arc of movement and for securely locking the same in any desired position, an advantage of our improvement being the facility with which heavier weights can be moved than was heretofore possible in machines of this class.

Another important object of this invention is to so construct and arrange the machine as a whole that the operator can vary the feed of the cutting-tools, according as they are dull or sharp, without requiring to remove and refix the gearing.

Another object of this invention is to so construct and arrange the feed-slide cams that the operator can adjust the same cam to various angles, thus avoiding loss of time in setting the machine for new work. With the same object of enabling the operator to quickly set up the machine for new work we construct the cut-off slides to swivel at various angles.

The feed-tubes have interchangeable reducing-sockets, and the spools of the feed-tubes are held in position when empty by spring-pressed bolts, which offer no obstruction to the operator when filling rods of material into the tubes.

Another important object of this invention is to so construct the screwing-die that end adjustment can be made readily by the operator when cutting screw-threads to a definite length.

Other improvements consist in so constructing the supplemental tool-slide usual to this class of machine that it is more firmly supported and more readily adjusted to a fresh setting and in constructing the main tool-slide with adjusting-blocks to maintain alinement.

We also so construct the feed and clamp slides that one is carried by or upon the other, thus economizing space.

The general disposition of the various parts is similar to existing machines of this class, the framework of which varies according to the purpose for which it is designed.

In order that this our invention may be more readily understood and carried into practical effect, reference is hereby made to the accompanying sheets of illustrative drawings, wherein—

Figure 1 is a front elevational view of a screw-making and metal-turning machine constructed in accordance with this our invention. Fig. 2 is a plan view thereof. Fig. 3 is a rear elevational view thereof. Fig. 4 is an end elevational view thereof looking in the direction of the arrow, Fig. 1. Fig. 5 is a similar view from the other end. Figs. 6 and 6ª are sectional views, to an enlarged scale, showing the gripping portion of the chuck we employ. Figs. 7 and 8 are side elevational and end views, respectively, of our flexible or expansible bush used in conjunction with a chuck, as shown in Fig. 6ª. Fig. 9 is a sectional view showing the arrangement of the reducing-sockets we employ in the manner shown in Fig 6ª. Figs. 10 and 11 are front and end elevational views showing the details of the flexible cam we employ. Fig. 12 is a sectional elevational view illustrating the means we employ for locking the intermittently-rotating work cylinder or turret. Figs. 13 and 13ª are views serving to show the manner in which we retain the feed-tubes in their closed position when empty. Fig. 14 is a plan view showing the construction of the clamping and feed slides used in this machine. Fig. 15 is a sectional view of the

clamp and feed slides. Fig. 16 shows a convenient means for rotating the turret. Fig. 16[a] illustrates the form of chain we employ in connection with the device illustrated by Fig. 16. Fig. 17 is an enlarged view of the end adjustment for the screw-threading device. Fig. 18 is an enlarged view showing angular adjustment to cut-off slides. Fig. 18[a] is a plan view thereof. Fig. 19 is an enlarged view showing the means for adjusting to correct wear of tool-slides. Fig. 20 is an enlarged view showing the means for supporting and actuating the supplementary tool-slides. Fig. 21 shows a modified form of mechanism for intermittently moving the work-carrying turret through a determined arc. Fig. 21[a] illustrates the gearing for rotating the stock-spindles and tools, and Fig. 22 is a view showing the change-speed gearing we employ.

Referring to the drawings, in which like characters of reference indicate corresponding parts wherever occurring, the framework of the machine is designated by the letters A, B, C, D, and E, A A indicating the lower legs; B, the pan; C C, the upper legs; D, the bed, and E the work-cylinder case or frame.

Motion is communicated to the top shaft 8 by a power-driven band applied to a pulley 8[a]. A spur-gear 10 drives the four gears 10[a] so as to rotate the four tool-spindles 11, which tool-spindles are carried by the tool-head 3. At the end of the shaft 8 remote from the pulley 8[a] a gear 7 is fixed, which gear drives four wheels 9, which four wheels 9 are keyed upon the four work-spindles 2, so that the tool-spindles 11 and the work-spindles 2, carried by the turret 1, can be revolved from the shaft 8. The lower shaft 28 carries cam-drums and cams for operating various parts of the machine, as will hereinafter appear. Motion is indirectly applied from the pulley 8[a] to the shaft 65 by means of a driving-belt passing around a step-pulley upon a supplemental shaft and a second driving-belt passing from the pulley on the supplemental shaft to the step-pulley 66 on said shaft 65. The motion thus transmitted from the shaft 8 to the shaft 65 is communicated to the shaft 34 by means of the gear 68, which derives its motion from the pinion 67, carried upon the shaft 65 and keyed thereon in such a way that it must rotate at the same rate as the shaft, but is capable of being moved longitudinally along the shaft upon the lever 69, the said lever 69 being located upon the shaft 65 and capable of sliding thereon, so that the gear 68 upon said lever 69 may be brought into mesh with any one of the gear-wheels 63 upon the shaft 34 in order that said shaft 34 may be rotated at any desired speed. The forward end of the lever 69 is provided with a spring-catch 70, which is adapted to engage with holes or notches formed in the gear-case cover. The gear-wheels 63 can be engaged and motion communicated to the shaft 34. Bevel-gears 36 and 40 on the shaft 34 engage with the bevel-wheel 37, which is fixed to the shaft 41. The latter, carrying a worm 41[a], engages the worm-wheel 20, which, being fixed on the shaft 28, gives motion to the same. The cam-strips 14 on the drum 15, keyed upon the shaft 28, engage with the roller 13, fixed upon the feed-slide 12, and move the said feed-slide 12, and the cam-strip 18 on the said drum 15 engages with the roller 17, fixed upon the clamp-slide 16, and moves the said clamp-slide 16. The cam-strip 5 on the drum 6, keyed upon the shaft 28, engages with the roller 4, fixed upon the tool-slide 3, and moves the said tool-slide 3 toward the work-spindles 2, the tool-slide 3 being returned by another cam-strip 6[a] on the drum 6.

The tool-carrying head 3 is retracted at an accelerated speed, and the turret 1 is revolved during this acceleration by the shaft 34 revolving at a determined speed, the clutch 35 upon the shaft 34 being engaged with the pinion 36, which pinion 36 engages with the outer circle of teeth on the bevel-wheel 37. At a given point, determined by the cam 38, fixed upon the shaft 28, the clutch 35 is moved by the bell-crank lever 39, so that the said clutch 35 engages the pinion 40, which now drives the bevel-wheel 37 by means of the inner circle of teeth, consequently increasing the speed of rotation of the bevel-wheel 37, and consequently the worm-shaft 41, upon which the bevel-wheel 37 is keyed.

The worm-shaft 41 drives the worm-wheel 20 and also the chain-wheel 23, keyed upon the end of the worm-shaft 41, at an accelerated speed, (thus accelerating the rotation of the turret 1,) the rotation of the shaft 34 remaining at the predetermined constant speed. The chain-wheel 23 aforesaid will, it is obvious, be revolved continuously, and the chain 24 is provided at intervals with projections 24[a]. The chain-wheel 25 revolves loosely upon the worm-shaft 26, and on each side of the said chain-wheel 25 is fixed a toothed wheel 43 and 43[a]. For convenience of illustration the wheel 43[a] and the projections 24[a] on the chain 24, which are clearly shown in Figs. 16 and 16[a], are not shown in Fig. 3. These toothed wheels 43 and 43[a] are adapted to engage with the projecting teeth 24[a] of the chain 24. It will now be understood that the said chain 24 will revolve the loose chain-wheel 25 without rotating the worm-shaft 26. When, however, the projecting teeth 24[a] on the chain 24 arrive at the toothed wheels 43 and 43[a], the teeth will engage with the said toothed wheels 43 and 43[a], and thus drive the worm-shaft 26, upon which said toothed wheels are keyed. It will be understood that the worm-shaft 26, meshing with the worm-wheel 30 of the turret 1, drives the said turret. The number of projecting teeth 24[a] is directly proportional to the number of revolutions required to be made

by the worm-shaft 26 when operating to revolve the turret 1 through any desired arc. Another means of moving the turret through a determined arc is clearly illustrated in Fig. 5. In this device the cam-plate 19 upon worm-wheel 20 engages a pin or projection on the lever 21. This lever moves the clutch 22 into engagement with the chain-wheel 23, which then imparts motion through the chain 24 to the smaller chain-wheel 25. This chain-wheel 25 is connected to the worm-shaft 26, which shaft is under torsion before the cam 27, Fig. 12, on the shaft 28 allows the lock-bolt 29 to be withdrawn from engagement with the turret 1. When the bolt 29 is withdrawn from engagement with the turret 1, the worm on the worm-shaft 26, Fig. 3, operates in conjunction with the worm-wheel 30, fixed to the turret, moving the said turret on its axis. When the said turret has accomplished nearly one-fourth of a revolution, the cam 27 on shaft 28 presses the lock-bolt 29 into contact with the turret 1. The spring 31 allows the taper end 32 of the lock-bolt 29 to remain in contact with the surface of the turret 1. When, however, the bushed cavity or socket 33 in the turret comes opposite the taper end 32 of the lock-bolt 29, the spring 31 causes the bolt to enter the said bushed cavity, and thus arrest the further rotation of the turret. At this moment the cam-plate 19 on worm-wheel 20 allows the spring-controlled lever 21 to move the clutch 22 out of engagement with the chain-wheel 23, and the spring 21[a], bearing against the lever 21, acts to move said lever in order to throw the clutch 22 out of engagement.

The form of flexible adjustable cam we employ for operating the tool and feed slides is particularly illustrated in Figs. 10 and 11. The cam is formed by fixing metal strips 5 and 6[a], preferably of circular section, around the surface of a cam-drum 6. Both ends of the cam-strips 5 and 6[a] are preferably hooked and adapted to engage with screws 72, carried by sliding blocks 73, which blocks can be moved longitudinally in slots 74, formed in the cam-drum 6. The screws 72 enable the cam-strips to be put in tension after setting to any desired angle. After setting the cam-strip to any desired lead we provide a series of supporting-blocks 75, arranged to slide in the slots 74 and capable of being clamped in position, so that the said blocks can be fixed in contact with the flexible strips 5 and 6[a], and thus reinforce and strengthen the cam to resist the pressure of the rollers 4, 13, and 17, Fig. 3, which operate in conjunction with the said flexible adjustable cam-strips.

The cutting-off slide which we employ in connection with this our invention is illustrated particularly by Fig. 18. The angularly-adjustable cutting-off slideways 77 are carried upon the main frame or bed 76 by a clamping-bolt 78 and carry cutting-off tools. The circular neck 79 of the bolt 78 fits in a recess in the bed 76 and permits of the slideways 77 being set at varying angles and also at right angles to the work-spindles 2. In order that this adjustment may be effected, the levers 80, which operate the slideways when they themselves are operated by the cams 28[a], carried by the shaft 28, are provided with ball-joints 80[a], having telescopic necks. The said ball-joints 80[a] are retained by grooved plates 80[b], attached to the tool-slides 77[a]. These devices enable the slides 77 to move at an angle differing from the right-angle plane of movement which is constant with regard to the levers 80.

In order to enable various thicknesses of work to be operated upon, we employ the "reducing-socket" 54, so called on account of its tapered formation. (Illustrated by Figs. 6[a] and 9.) As will be seen, one end of the reducing-socket 54 is provided with a screw-thread on its outer periphery, thus enabling it to be screwed into the feed-tube 54[a], located within the hollow work-spindle, while the other end is screw-threaded interiorly, so as to adapt it to receive the screwed end of the feed-shell 54[d]. The spring-chuck 53 is carried by the reducing-socket 54, and the flexible bushing 53[d] of such chuck is arranged to grip the work.

In order to retain the feed-spools in their closed position when empty, we preferably employ spring-actuated balls 82, which are adapted to engage in a groove 83, formed on the outer end of the spool 81 aforesaid for that purpose.

In Figs. 2 and 3 one spool is shown in its forward position and the other in its retracted position, close to the work-spindle. The balls 82 in the end of the work-spindle act as spring-actuated pawls and snap into the grooves 83 in the periphery of the spool and hold the spool from slipping endwise until forcibly operated upon by the bowl or projection on the feed-slide, which projection engages the flanged end 81 of the feed-spool.

Referring particularly to Fig. 17, the drawings illustrate the devices we employ in constructing a screw-threading device according to this invention. For convenience of illustration the section has been arranged to pass through the centers of both of the overlapping pegs 57 and 58. The screwing-die 55[a] or tap is secured to the special tool-holder 55. This tool-holder is or may be revolved in the same direction as the work rotated by the spindle 2. The tool-holder 55 revolves at a greater speed than the work. The die-tool holder 55 is supported within the sleeve 56 and is capable of end motion with respect to the said sleeve 56. A projecting peg 57 is provided at the rear of the tool-carrying collar. A similar peg 58 is fixed at the front end of the sleeve 56. The sleeve 56 is constantly rotated by the gear-wheels 10 and 10[a]. At

the rear end of the tool-holder 55 is fixed a ratchet-wheel 59, adapted to engage with a pawl 59[a], fixed on the bracket 60. A spring 61 is placed, as shown, upon the tool-holder 55. The operation of the parts is as follows: The tool-carrying head 3 advances toward the work carried by spindle 2. When the die 55[a] comes in contact with the work, the peg 57 engages with the peg 58. The die 55[a] is now driven at the same rate as the sleeve, which rate of rotation being greater than the work-spindle 2 causes the die to screw itself upon the work. If the tendency of the die is to screw upon the work with a greater longitudinal movement than the forward movement of the head 3, the pegs 57 and 58 lose contact with each other and the die ceases to screw upon the work. When the head 3 continues its advance, the pegs 57 and 58 again engage and the die screws upon the work. When the head 3 reaches the end of its travel forward, the screwed portion of the work will be completed. Upon the return of the head 3 the pegs 57 and 58 are drawn apart from each other and the die revolves with the work. When the ratchet-wheel 59 upon the end of the die-tool holder 55 engages with the pawl 59[a], fixed upon the bracket 60, the pegs 57 and 58, carried by the die-tool holder 55 and the sleeve 56, respectively, are separated, and the tool-holder 55 and die 55[a] are prevented from revolving, and the work-spindle by its continued revolution runs the die off the work. The exact length of screw to be formed upon the work is secured by moving the sleeve 56 longitudinally in relation to the bracket 60, fixed on the tool-head 3. A fine-thread screw-nut 62, screwed in the bracket 60 and gartered to the sleeve 56 by the collar 62[a], enables fine adjustment to be made, coarse adjustments being obtained by moving the bracket 60 upon the base of tool-head 3.

A combination feed-change and disengaging gear constructed according to this our invention consists of the following devices, (shown clearly in Figs. 1 and 2:) In connection with the turret 1 we provide a supplemental tool-carrying slide 44, Figs. 1 and 5. This said tool-slide 44 is carried by an arm 45 and is provided with the usual clamps for holding the tool. The arm 45 is preferably fixed upon the turret-case 1[a], and the tool-carrying head 3 has rigidly attached to it a sleeve or bearing 46, adapted to slide upon an extension of the arm 45. The tool-slide 44 is operated in a vertical plane to and from the work carried by the work-spindle by the following devices: The arm 45 carries the base portion of slide 44. An extension 44[a] of the tool-slide 44 carries a worm-wheel 47. (Shown clearly in Fig. 20.) This worm-wheel actuates a crank-disk 48, having a crank-pin 49 working in a slot formed in tool-slide 44. A worm-shaft 50 passes through bearings and is held in engagement with the teeth of the worm-wheel 47. The outer end of the worm-shaft 50 passes through a bearing 51, carried on the sleeve 46. On each side of the bearing 51 the worm-shaft 50 carries pinch blocks or nuts 52 and 52[a]. (See particularly Fig. 3.)

The tool-slide 44 can now be moved by turning the worm-shaft 50 on its axis, and this device is used for purposes of adjustment. The tool-slide 44 is automatically operated by moving the worm-shaft longitudinally. This end movement is caused by the bearing 51, carried on the tool-slide 3, engaging with the nuts 52 52[a], in which case the worm-shaft acts as a rack to move the worm-wheel 47. If the tool-slide 44 is required to be pressed forward against the material to be operated upon, springs 54[b] 54[c] are interposed between the bearings 51 and the nuts 52 52[a], and it will be seen that the springs allow of continued longitudinal movement of the bearing 51 after the tool carried by the slide 44 has come in contact with the work.

In Fig. 19 we have shown how we propose to provide for adjustment to compensate for wear and tear of the tool-slide 3. Adjusting-strips 84, adjusting-screws 85, and clamp-bolts 86 are provided. These devices permit of lateral adjustment for the tool-slide 3. Vertical adjustment is provided for by means of the blocks 87, fitted into slots on the under side of the slide 3. By means of the adjusting-screws 88 vertical adjustment of the tool-slide is secured. If lateral adjustment is required, the clamp-bolts 86 are withdrawn and the position of the fitting-strip 84 is adjusted by means of the screw 85, when the clamp-bolts 86 are again replaced. If, however, the bottom of the tool-slide 3 becomes worn and it is desired to adjust vertically, the strip 84 is removed and the fitting-strip 87 adjusted by means of the screw 88.

The feed and clamp slides constructed according to this our invention are shown distinctly by Figs. 14 and 15. The feed-slide 92, which operates in the usual manner to push the material endwise through the chuck 53, is carried by bars or rods 94 and 94[a], these rods being fixed to or carried by the clamp-slide 93. The clamp-slide, whose function is to operate the usual jaw-levers which clamp the material and hold it while it is being operated upon by the tools, is operated by a roller 17 engaging with cam 18 on a drum, such as 15, as before described. The feed-slide is also operated by its own roller 13, which engages with a similar cam 14 on the drum 15.

Referring particularly to Figs. 6, 7, and 8, 53 designates the gripping portion of the spring-chuck commonly used in machines of this kind. According to our invention the gripping portion of the chuck 53 is provided with a recess or cavity 53[a], which said cavity is adapted to receive the bushing illustrated by Figs. 7 and 8, such bushing being slit in

one or more places, as shown at 53[h], so as to render it capable of closing upon the work to be held.

What we claim as our invention, and desire to secure by Letters Patent of the United States, is—

1. In screw-making and metal-turning lathes, the means for enabling various thicknesses of work to be operated upon, consisting in the combination of a work-spindle, a feed-tube carried within said work-spindle, and having an interior screw-thread at one end, a feed-shell having an exterior screw-thread at its inner end, and a reducing-socket having one end screw-threaded internally and adapted to receive the externally-screw-threaded end of the feed-shell and having its other end screw-threaded externally and adapted to screw into the feed-tube, substantially as specified.

2. In screw-making and metal-turning lathes, in which a supplemental tool-carrier is employed; means for imparting a sliding movement to said tool-carrier, said means comprising a shaft having a worm-wheel and crank for actuating said tool-carrier, a worm-shaft to actuate said worm-wheel; a bearing-bracket upon the main tool-slide for supporting said shaft; an arm for supporting said tool-carrier, and an extension on said arm, the bearing-bracket for the worm-shaft having an opening or guide through which said extension slides; in combination with stops and springs for automatically operating said tool-carrier, said stops being rigidly carried upon said worm-shaft, one on each side of said bearing-bracket, and said springs being interposed between said stops and said bearing-bracket, substantially as specified.

3. In screw-making and metal-turning lathes, the cutting-off slideways held upon the main frame and capable of angular adjustment; the actuating-lever of said cutting-off slideways; the telescoping ball-joints of said actuating-lever; and the grooved guides along which the ball-joints of said actuating-lever operate, said grooved guides being attached to the tool-slides, substantially as specified.

4. In stock-feeding mechanism for screw-making and metal-turning lathes the combination with the feed-slides and the feed-spools operated by said feed-slides; of means for retaining said feed-spools in their retracted positions, said means consisting of balls arranged to lie in a groove in the feed-spool; recesses in the end of the feed-tube, in which are located said balls; and springs located in said recesses and arranged to exert a pressure on said balls, substantially as specified.

5. In screw-making and metal-turning lathes of the multispindle type, means for enabling the tool-slides to be adjusted to compensate for wear, said means comprising the combination with side strips, capable of adjustment to compensate for the wear on the sides of the tool-slide; of screw and clamp bolts for adjustment; and blocks fitted in spaces; and the spaces formed in the under side of the tool-slide, said blocks being capable of vertical adjustment to compensate for wear on the bottom of the tool-slide; and the set-screws for adjusting vertically, substantially as specified.

6. In screw-making and metal-turning lathes, means for operating the feed-spools, said means comprising a clamp-slide; a feed-slide arranged to slide upon said clamp-slide; a cam-pin upon said clamp-slide and a cam-pin upon said feed-slide, said pins being arranged to be operated by cam-strips upon a cam-drum; and the said cam-drum and the said cam-strips upon said cam-drum, substantially as specified.

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Witnesses:
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