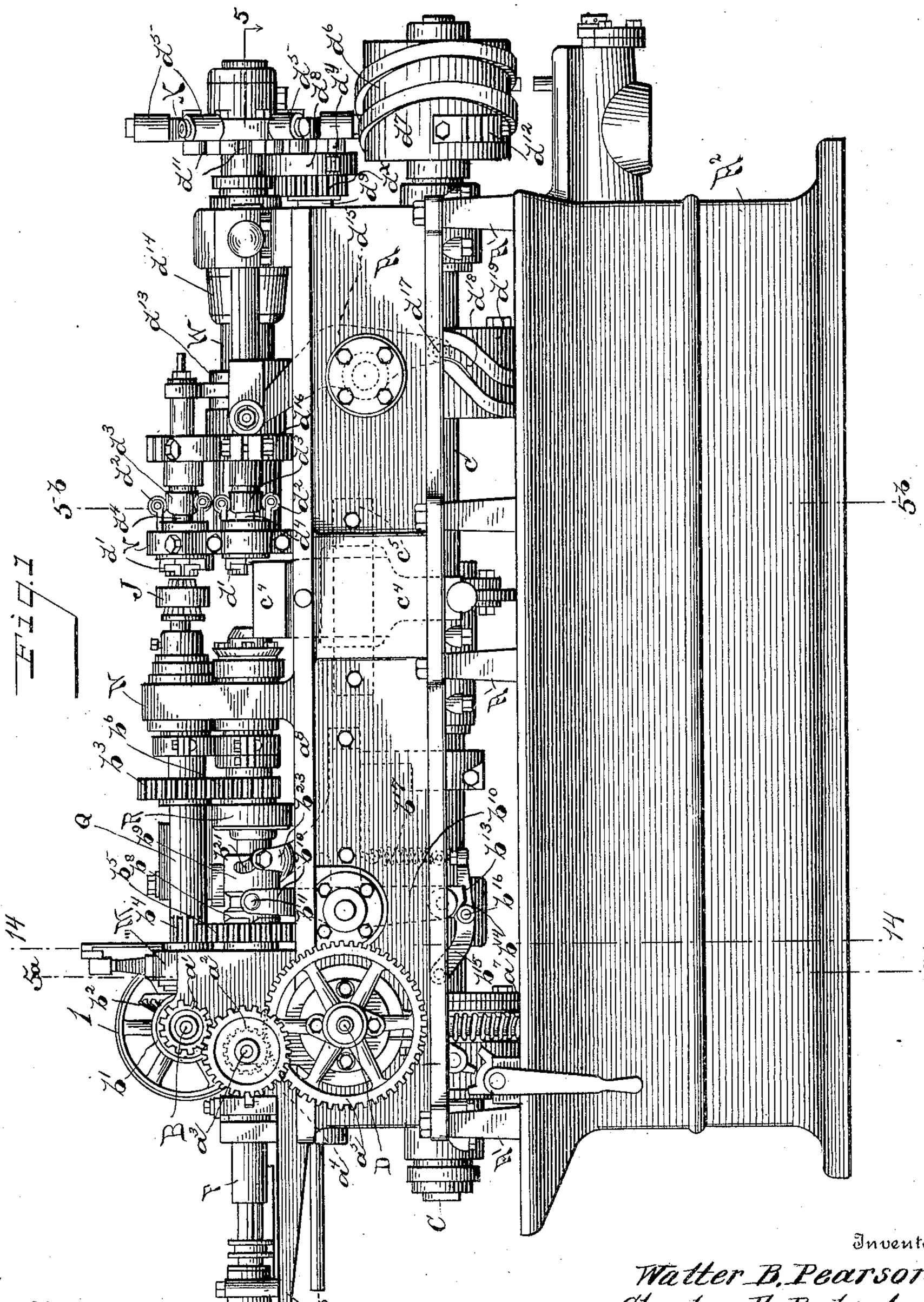
No. 827,659. PATENTED JULY 31, 1906.

W. B. PEARSON & C. E. ROBERTS.

SCREW MACHINE.

APPLICATION FILED SEPT. 9, 1904.

6 SHEETS—SHEET 1.



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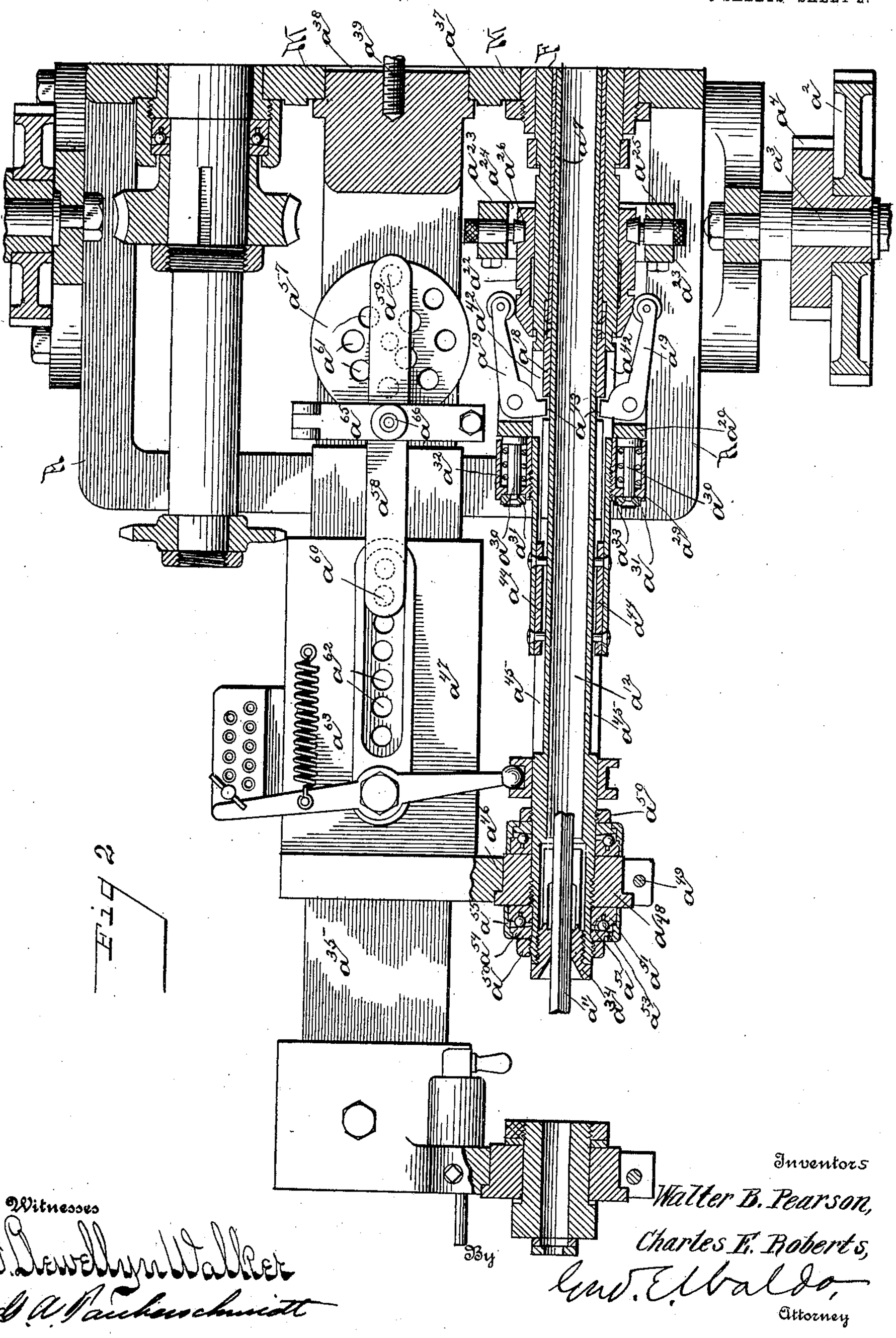

Fig 2

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6 SHEETS—SHEET 3.

Fig 3

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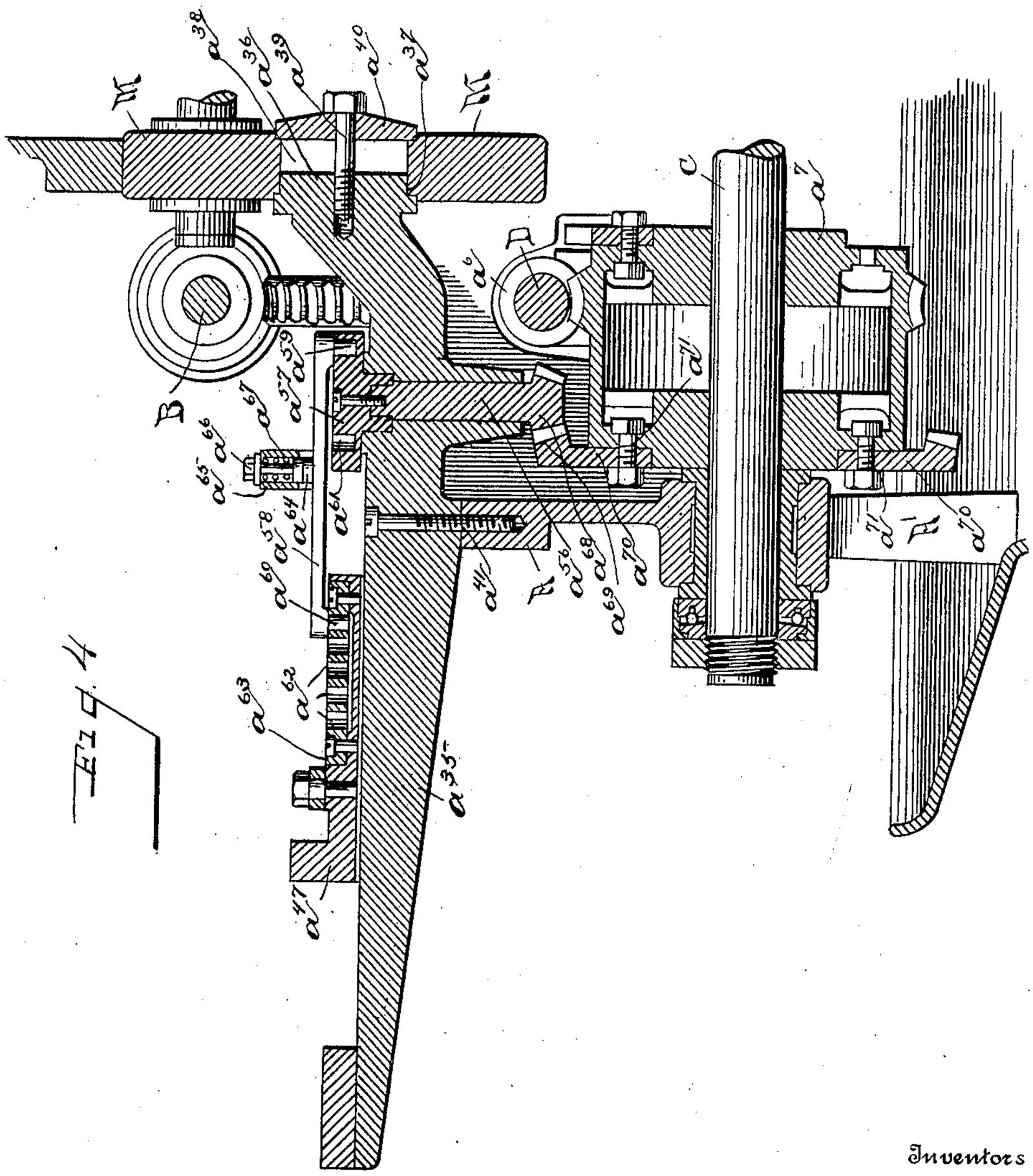

Fig. 4.

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Fig. 5.

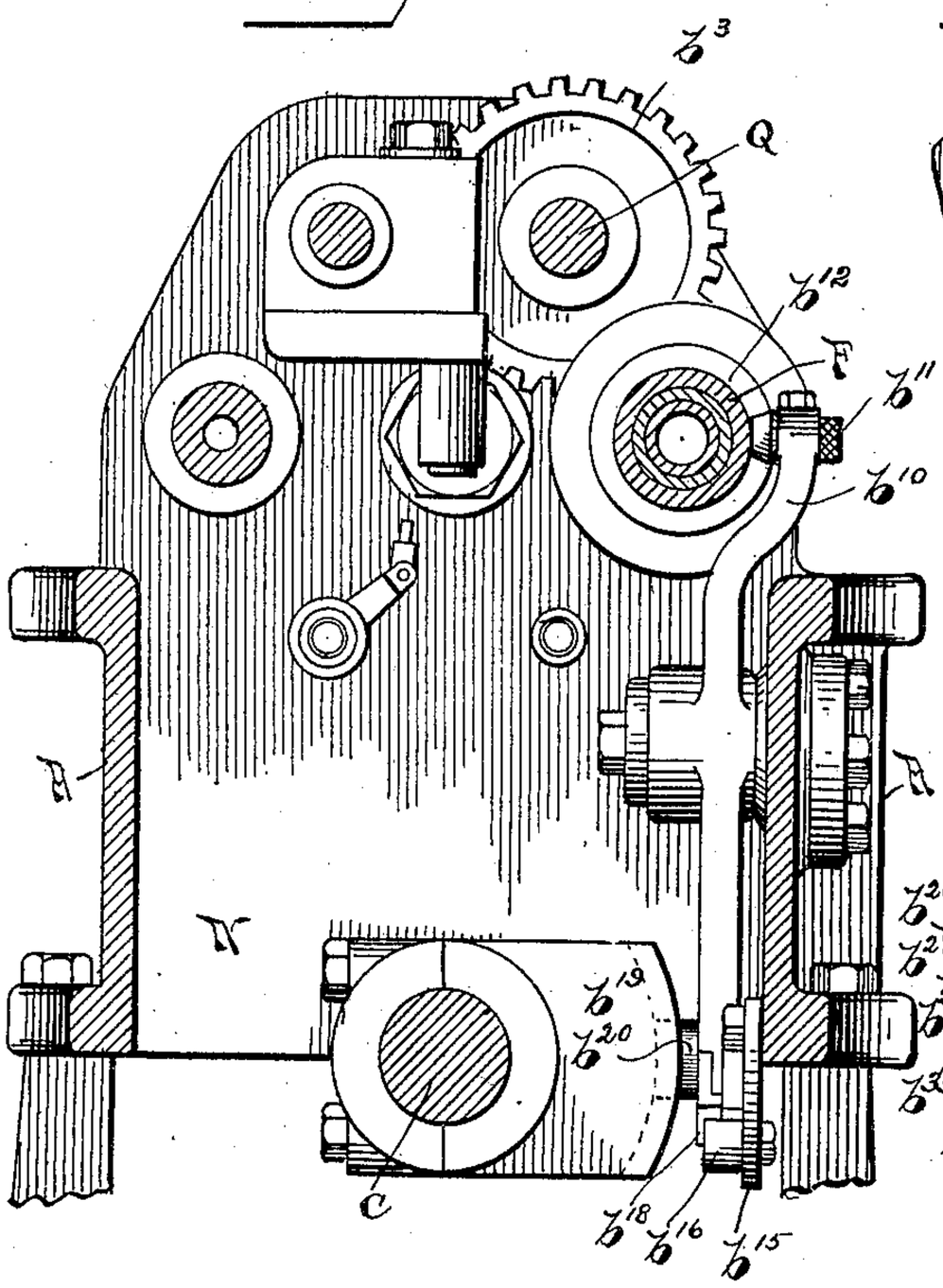
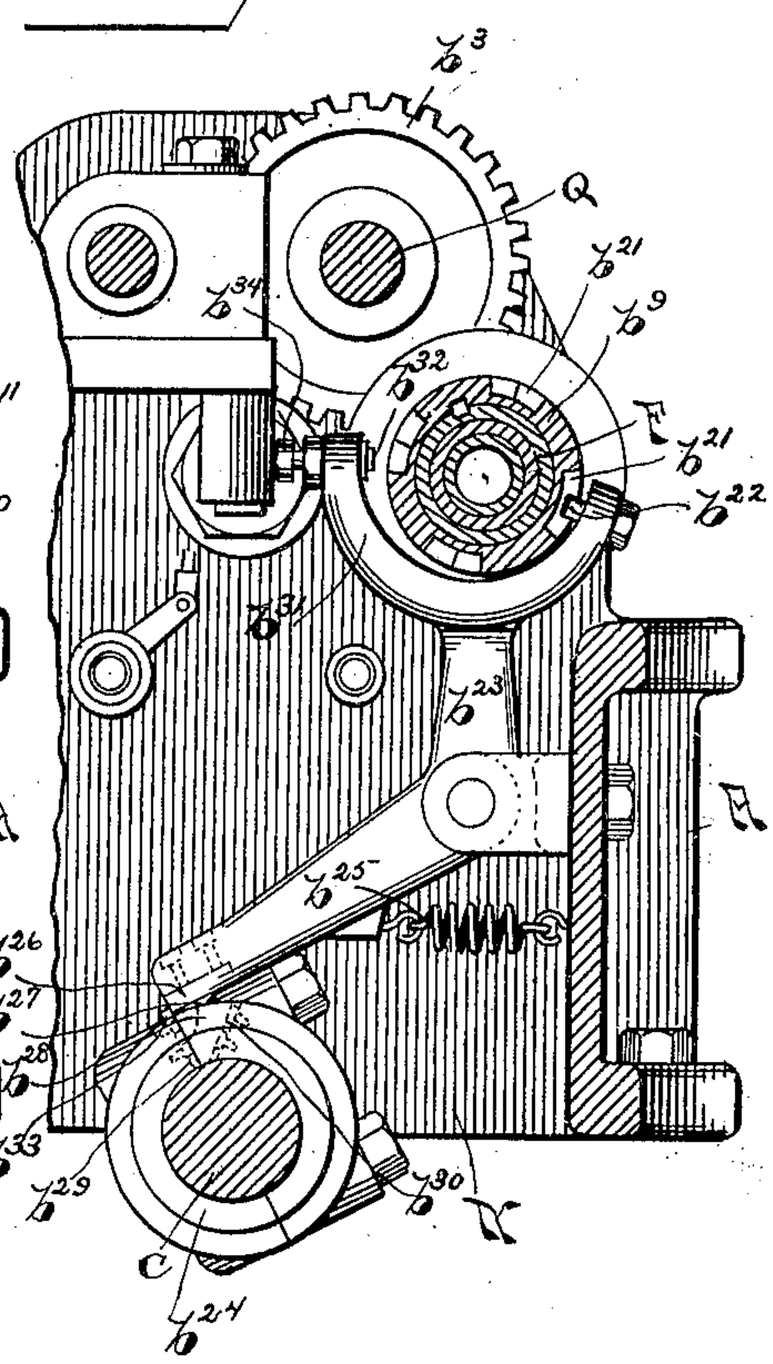


Fig. 6.



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SCREW MACHINE.

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6 SHEETS—SHEET 6.

Fig. 7.

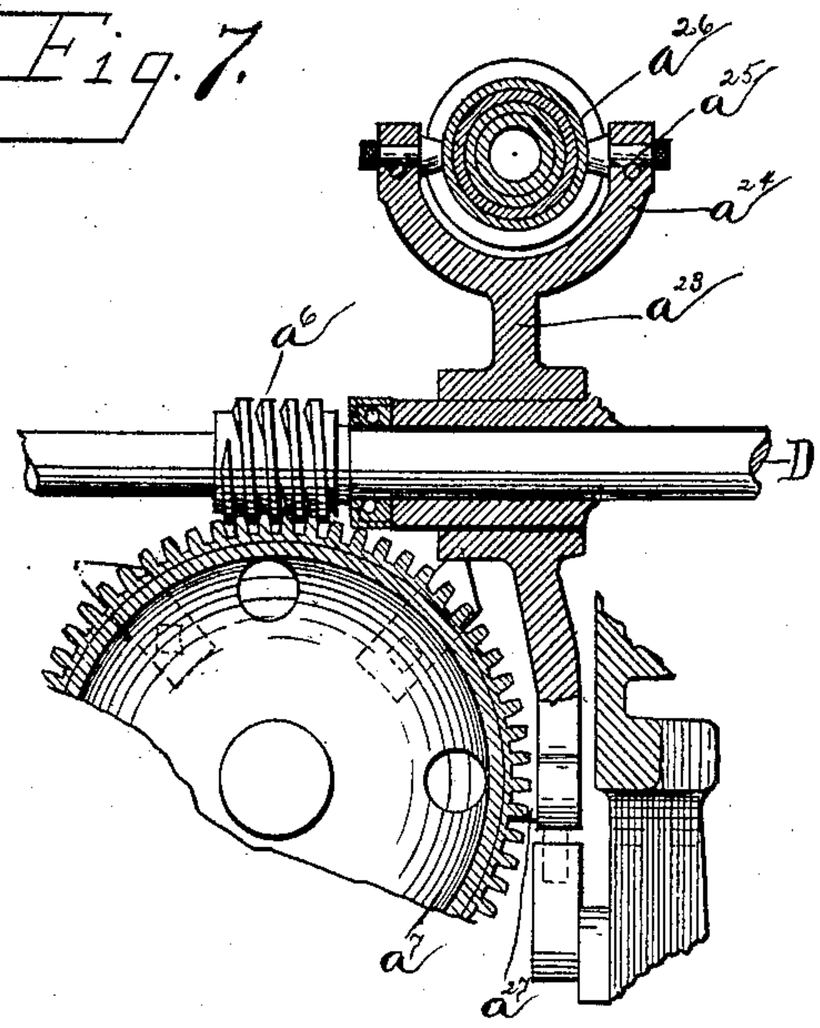


Fig. 8.

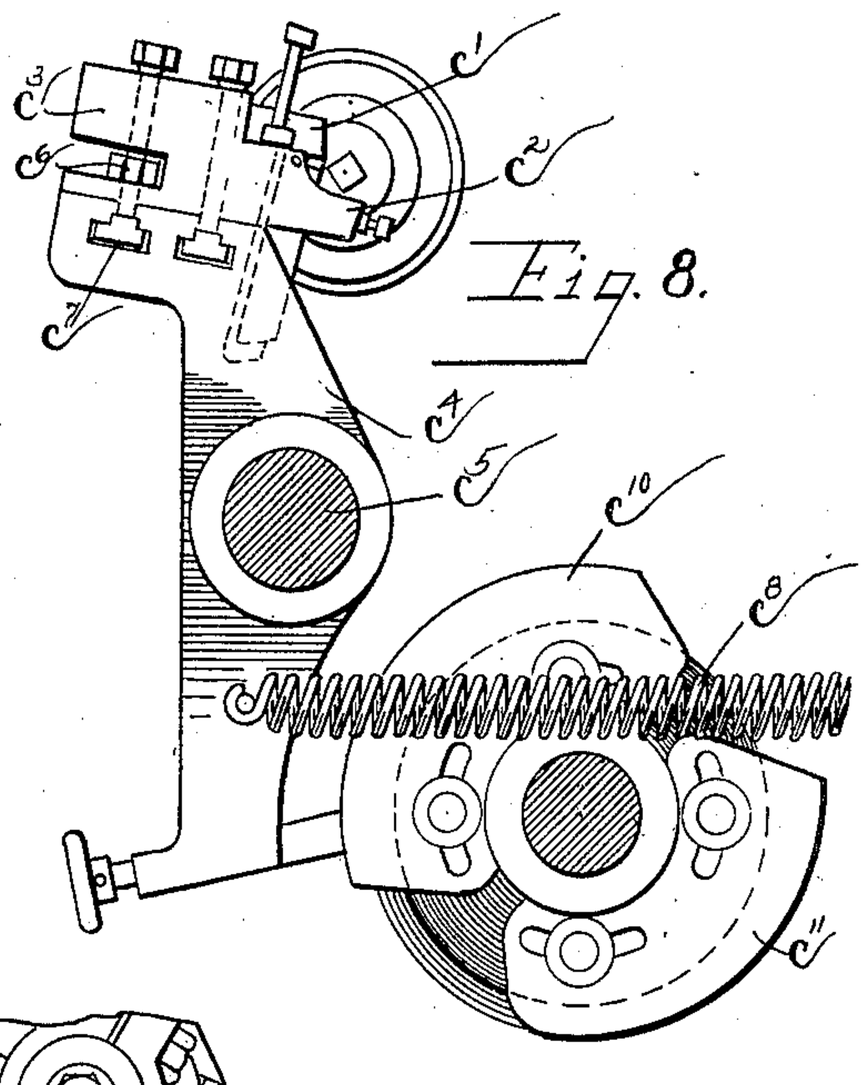
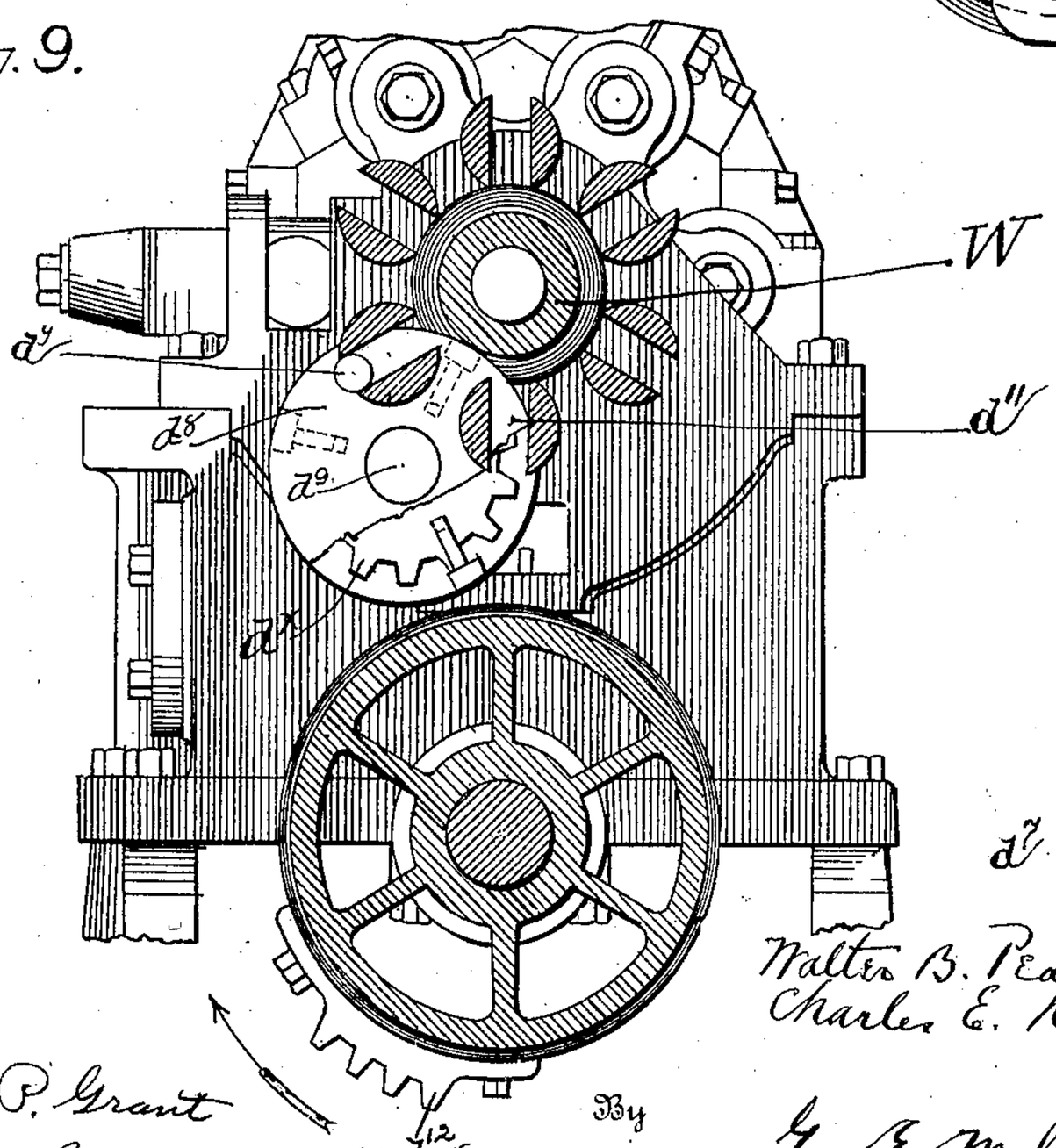


Fig. 9.



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UNITED STATES PATENT OFFICE.

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SCREW-MACHINE.

No. 827,659. Specification of Letters Patent. Patented July 31, 1906.

Original application filed May 9, 1902, Serial No. 106,620. Divided and this application filed September 9, 1904. Serial No. 223,881.

To all whom it may concern:

Be it known that we, WALTER B. PEARSON, a resident of Detroit, Wayne county, Michigan, and CHARLES E. ROBERTS, a resident of Oak Park, Cook county, Illinois, citizens of the United States, have invented certain new and useful Improvements in Screw-Machines, of which the following is a complete specification.

This invention relates to screw-machines, and particularly to machines for making metal screws, such as set-screws and cap-screws, being a division of our prior application, Serial No. 106,620, filed May 9, 1902.

The primary object of the invention is to provide a screw-machine which will effect a saving in the material from which the screw is made and in the time of making the screw.

To avoid waste of stock in severing blanks, the invention consists of means for partially severing the blank from the bar of stock by cutting a V-shaped groove in the bar of stock at the desired point of severance and thereafter turning the bar of stock upon its axis while employing means to operate upon one end of said bar of stock to change the speed of rotation of that end relatively to the other end.

The process itself of severing blanks from a bar of stock, consisting in first partially severing the blank from the stock by grooving said bar at the desired point of severance, the groove of the bar being angular or V-shaped, and then turning the sections of said bar upon their common axis relatively to each other, has been mentioned in Patent No. 732,218, dated June 30, 1903, and issued to us as patentees.

The machine we describe herein discloses mechanism for turning the bar of stock on its axis until it reaches a position where the cutting-tool operates on it, and during its continued rotation the cutting-tool partially severs the bar of stock. A substantial part of the diameter of the bar of stock is left uncut, and in actual practice by means of the V-shaped cutting-knife we sever only about one-half the diameter, thereby causing a considerable saving in material and time. Means are then provided for engaging the end of the partially-severed stock, and by retarding the subsequent rotation of the bar of stock on one side of the point one end of the stock is twisted off from the bar of stock. In the preferred form of construction which we have illustrated there is shown means for stopping the turning of the bar of stock after it is partially severed until holding means have engaged the end of the bar of stock to hold it against further rotation. When the bar of stock is subsequently rotated and the end near the point of severance is held, the end of the stock is twisted. In the machine disclosed the bar of stock is completely stopped from rotary movement before the holding means operates, and as it may be possible to engage the end of the stock while being rotated we therefore do not desire to limit ourselves to this particular form of mechanism.

In the drawings, Figure 1 is a side elevation view of our machine. Fig. 2 is a transverse sectional view along the line 5 5 of Fig. 1. Fig. 3 is a longitudinal sectional view between the points indicated by 5^a and 5^b in Fig. 1. Fig. 4 is a vertical section through the part of the machine to the left of the line 14 in Fig. 1. Figs. 5 and 6 are detail views of parts of the stopping mechanism. Figs. 7, 8, and 9 are detail views of parts of the machine.

Like characters of reference indicate like parts in the different views.

The frame of the machine consists of a bed A, Fig. 1, supported on posts or pillars A′, which extend upwardly from the base A^2, the sides and bottom of which are inclosed, having a downwardly-projecting flange around the upper edge, thus forming a pan adapted to receive the oil which runs off the tools and chips formed thereby.

The operating parts of the machine are driven from a transverse shaft B, Figs. 1 and 4, and a longitudinal shaft C, of which the shaft B is driven from a suitable source of power by means of a belt (not shown) applied to the driving-pulley 1, secured to said shaft. The shaft C is driven by means of a suitable driving connection with the shaft B. We have shown and claimed a novel arrangement of tools and blank-supporting head in the original application and many other novel features in the original application of which this is a division, and we therefore do not in this divisional application make any claims upon them. Any suitable form of driving connection may be made between the trans-

verse shaft B and the longitudinal shaft C. As indicated, there is secured to said shaft B a gear a', which gears with an intermediate gear a^2, revolubly mounted on a stud a^3, supported by the frame A of the machine. This gear is connected with a smaller gear a^4, which gears with a large gear-wheel a^5, connected to the transverse shaft D, which extends below the shaft B. The shaft D is formed near its center with a worm-gear a^6, which meshes with a gear formed on a drum a^7, secured to the shaft C, which shaft is located near the bottom of the machine.

The stock-spindle of the machine is indicated by F. This stock-spindle is secured to its bearings (see Figs. 1 and 3) by means of nuts a^8 threaded thereto, hardened-steel washers a^9 being inserted between said nuts and the ends of the bearing-boxes of said spindle. In the preferable construction shown said nuts a^8 are threaded directly to the bodies of said spindles, said nuts being split to provide for engaging them with the threads on said spindles, the sections thereof being secured together by clamping-screws a^{10}. Said screws a^{10} also provide convenient means for clamping said nuts in any desired longitudinal adjustment on said spindles.

The stock-spindle F, Figs. 2 and 3, is hollow, and the bar of stock of angular shape (partially shown at a^{11}, Fig. 2) is delivered to the machine therethrough by means of a "wire-feed" which, as regards its general features, is of a familiar type, comprising a feed-tube a^{12} and spring-jaws a^{13} on the front end of said feed-tube adapted to grip the bar of stock with sufficient force to impart movement thereto with said feed-tube, and said bar of stock is free to move therewith. The stock-spindle F is also provided with a stock-chuck adapted to secure the bar of stock therein against movement. As shown, said chuck is of the type comprising a chuck-body a^{14}, secured to the ends of the spindle, and a split collet a^{15}, preferably secured against rotation relatively to the chuck-body a^{14} by a key a^{16}, a plunger a^{17}, a butt-ring a^{18}, Fig. 2, secured to the rear end of said plunger, bell-levers a^{19}, pivoted in a collar a^{20} on the stock-spindle, the short arms of which bear against the rear end of the butt-ring a^{18} and a wedge a^{22}, which is longitudinally movable on the stock-spindle and is adapted to force the long arms of the bell-levers a^{19} outwardly and thereby force the plunger a^{17} forward, which will in turn force the chuck-collet a^{15} into the taper of the chuck-ring a^{14} and clamp said collet upon the bar of stock. To facilitate changing the chuck-bodies and to insure register of the opening therein with the holding mechanism hereinafter mentioned, said chuck-body a^{14} instead of being threaded to the end of the stock-spindle is bolted to a ring a^{21}, Fig. 3, threaded to the end of said spindle in fixed adjustment. If the length of the chuck-body a^{14} is varied, the length of the chuck-collet a^{15} will also have to be varied correspondingly.

Movement longitudinally of the spindle F to lock and release the bell-levers a^{19} at desired predetermined intervals is imparted to the wedge a^{22} by means of a lever a^{23} in the following manner, (see Figs. 2 and 7:) The lever a^{23} is pivoted upon an extension in the bearing-box of the shaft D. Formed on the upper end of said lever is a yoke a^{24}, secured in which are pins a^{25}, the inner ends of which engage a groove a^{26}, formed in the surface of said wedge a^{22}. Secured to the lower end of said lever a^{23} is a lateral projection a^{27}, which engages a cam formed on the drum a^7, adapted to impart movement to said lever a^{23}, and thus to the wedge a^{22} in opposite directions in the desired manner.

Instead of being rigidly secured to the spindle F the collar a^{20} is supported in yielding adjustment thereon in the following manner, (see Fig. 2:) Threaded to said spindle F in the rear of said collar a^{20} is a ring a^{29}, in which are mounted spring-plungers a^{30}, the forward ends of which project beyond the face of said ring and abut against the rear face of the collar a^{28}. As shown, said plungers a^{30} are fitted to and are longitudinally movable in holes or sockets a^{31}, formed in said ring a^{29}, and coiled springs a^{32} are inserted between the heads of said plungers and the rear ends of said holes or sockets surrounding the shanks of said plungers as guides. As shown also, the rear ends of the shanks of said plungers a^{30} project through holes or openings in the rear side of said ring a^{29}, and secured thereto are washers a^{33}, which limit the movement of said plungers under the influence of the springs a^{32}. The springs a^{32} are sufficiently strong to insure the desired operation of the bell-levers a^{19} and adjunctive parts under normal conditions. If, however, excessive resistance is offered to the movement of the parts actuated by the bell-levers a^{19}, as should the bar of stock run uneven, being larger in some parts than in others, or should chips become lodged between the engaging surfaces of the chuck-body a^{14} and of the chuck-collet a^{15}, either of which might prevent the desired operation of the machine or might even subject parts thereof to a strain which would break them, said springs will be compressed, allowing the machine to go through a regular cycle without undue strain on any of its parts and without blocking the machine.

The relation and adjustment of parts are such that the chuck-collet a^{15} will be closed when the feed-tube a^{12} is retracted and will be open when the feed-tube is advanced. The bar of stock will thus be held against rearward movement with said feed-tube and will be fed forward by and with said feed-tube.

In the preferable construction shown also spring-jaws a^{34}, Fig. 2, substantially like and

adapted to grip the bar of stock in the same manner as the jaws a^{13} on the forward end of the feed-tube a^{12}, are secured to the rear end of said feed-tube. These jaws are for the purpose of feeding the bar of stock before it reaches said jaws a^{13}, thus providing for starting a bar of stock into the machine as soon as the rear end of the bar on which the machine is operating passes said jaws a^{34}.

The rearward extension a^{35} on the machine-frame preferably consists of a bracket removably secured thereto. As shown, Fig. 4, said bracket is secured in position on the bed of the machine-frame in the following manner: Formed on the forward end of said bracket is a circular projection a^{36}, at the base of which is a shoulder a^{37}. The projection a^{36} is fitted to an opening a^{38}, formed in the bridge M on the frame A, and said projection is firmly secured in said hole or opening a^{38} by means of a bolt a^{39}, threaded into the end of said bracket, the head of which bears against a plate a^{40}, which extends across the opening a^{38} on the front side of the bridge M. Between its ends said bracket a^{35} rests upon the bed A and is rigidly secured thereto by means of a bolt a^{41}.

The plunger a^{17} is connected to the stock-spindle F, so as to rotate therewith, by means of the bell-levers a^{19}, (see Fig. 2,) the short arms of which extend through slots a^{42} in said stock-spindle and engage slots a^{43}, formed in the rear end of the butt-ring a^{18}. The feed-tube a^{12} is connected to the stock-spindle F, so as to rotate therewith, by means of keys a^{44}, secured to said stock-spindle, which engage grooves a^{45}, formed longitudinally in the feed-tube.

The feed-tube a^{12} may be reciprocated to feed the bar of stock by any suitable means. As shown, Fig. 2, said tube is revolubly secured against longitudinal movement in an arm a^{46} on a slide or saddle a^{47}, fitted to and longitudinally movable on suitable guides or ways formed on the brackets a^{35}. As shown, the bearing for said feed-tube in said arm a^{46} is formed in a bushing a^{48}, secured in said arm a^{46}, the arm a^{46} being split at the outer side of the opening therein to receive said bushing and being adapted to be clamped upon said bushing by means of a clamping-screw a^{49}. As shown also, said feed-tube is secured in fixed longitudinal adjustment in said bushing by means of nuts a^{50}, threaded to said feed-tube on opposite sides of said bushing. As shown also, ball-bearings are provided on both sides of said bushing. As shown, said ball-bearings consist of rings a^{51}, which bear against the sides of said bushing, in which are formed V-shaped ball-races a^{52}. The balls a^{53} are confined in said ball-races a^{52} by means of disks a^{54}, adapted to be forced against said balls with desired pressure by means of nuts a^{50}, which bear against the outer sides thereof. Preferably, also, thimbles a^{55} inclose the members of said ball-bearings at their edges, said thimbles being snugly fitted to the rings a^{51}, whereby said thimbles a^{55} will be secured in position and being loosely fitted to the disks a^{54} to allow said disks to rotate freely with the feed-tube.

Revolubly mounted in a suitable bearing in the bracket, Fig. 4, is a stub-shaft a^{56}, to the upper end of which is secured a disk a^{57}, which is connected to the slide or saddle a^{47} by means of a connecting-link a^{58}, one end of which is pivoted to the disk a^{57} eccentrically to its axis of rotation and the opposite end of which is pivoted to the slide or saddle a^{47}. With this construction it is obvious that rotation of the disk a^{57} will impart a reciprocating movement to the slide or saddle a^{47} and that the eccentricity of the point of attachment of the link a^{58} to said disk a^{57} will determine the travel of said slide or saddle, and thus the feeding of stock to the machine. As preferably constructed, means are provided for changing the feed of the machine by varying the eccentricity of the point of attachment of the connecting-link a^{58} to the disk a^{57}. As shown, this is effected in the following manner: Secured to the connecting-link a^{58} are pins a^{59} and a^{60}, of which the pin a^{59} is interchangeable in a series of holes a^{61}, Fig. 2, formed in the disk a^{57} at different distances from its axis of rotation, and the pin a^{60} is interchangeable in a series of holes a^{62}, formed in the saddle a^{47}, the holes a^{62} in the saddle being preferably formed in a plate a^{63}, removably secured in said slide or saddle, (see Fig. 4,) thus providing for hardening said plate. The pins a^{59} and a^{60} are secured in engagement with the holes which they respectively engage by means of a spring-pressed shoe a^{64}, supported in a bar a^{65}, which passes over said connecting-link a^{58}. As shown, Fig. 2, the bar a^{65} is hinged to the bracket a^{35} at one side of said connecting rod or link and is bolted to said bracket a^{35} at the other side of said connecting rod or link, thus making provision for quickly removing the bar when it is desired to change the feed of the machine. As shown also, the shoe a^{64} is maintained in position in the bar a^{65} against the pressure of the spring applied thereto by means of a nut a^{66}, threaded to the projecting end of the shank a^{67} of said shoe. Intermittent rotary motion through one hundred and eighty degrees is imparted to the stub-shaft a^{56} and to the disk a^{57}, carried thereon, in the following manner: Formed on or secured to the lower end of said stub-shaft a^{56} is a bevel-gear a^{68}, Fig. 4, which is adapted to be engaged by segmental gears a^{69} on the shaft C, the relation of parts being such that each of said segmental gears will rotate said bevel-gear a^{68} through one hundred and eighty degrees, or one-half of a revolution, and will leave the teeth of said bevel-gear a^{68} in proper position to be engaged by the teeth of the following

segmental gear a^{69}. As heretofore explained, however, when it is desired to reset the machine to make a longer or shorter screw than that which it is making at a given time the feed must be varied in such manner that the blank, long or short, will be fed to the same point through the stock-spindle; but when the pin a^{59} is changed from one hole a^{61} to another the travel of the saddle a^{47} will be varied symmetrically on both sides of a central point. Thus to bring said slide or saddle to the same forward limit of travel it will be necessary to change the pin a^{60} from the hole a^{62} with which it is in engagement at the time to one farther forward when it is desired to increase the feed or to one farther back when it is desired to decrease the feed. As shown, there are ten holes a^{61} in the disk a^{57} and only five in the saddle a^{47}, the holes in said slide or saddle corresponding to alternate holes in said crank or disk. This is due to the fact that with desired fineness of feed the holes a^{62} in said saddle would run into each other if a hole a^{62} were provided for each hole a^{61}. In practice, therefore, we have used two bars a^{58} of different lengths, one of said bars being longer than the other by an amount equal to one-half the distance between the adjacent holes a^{62}.

As shown, the segmental gears a^{69} are formed on plates or arms a^{70}, the inner ends of which are fitted to a circular shoulder formed on the drum a^{7} and which are secured to said drum by means of bolts a^{71}, which engage a T-slot formed in said drum. Provision is thus made for adjusting said segmental gears circumferentially of the shaft C to vary the times of actuating the stub-shaft a^{56} and the parts controlled thereby to cause the same to work in desired relation to other parts operating in combination therewith.

Rotary movement is imparted to the stock-spindle F in the following manner, (see Figs. 1 and 3:) Revolubly mounted in the bridges M and N of the machine-frame there is a shaft Q, which is driven directly from the shaft B by means of bevel-gears b' and b^2, rigidly secured to the shafts B and Q, respectively. Relatively large and small back gears or pinions b^3 and b^4 on the shaft Q respectively engage relatively small and large gears b^5 and b^6, loosely mounted on the stock-spindle F, which are adapted to be secured to said spindle at desired predetermined intervals, preferably by means of suitable clutches. As shown, the gear b^6 is adapted to be secured to said shaft by means of a friction-clutch, (indicated as a whole by R.) The gear b^5 is adapted to be secured to said stock-spindle F by means of clutch-teeth b^7, Fig. 3, thereon, which are adapted to be engaged by corresponding clutch-teeth b^8, formed on a sleeve b^9, Figs. 1 and 3, splined to said stock-spindle. As shown, the sleeve b^9 is mounted between the gear b^5 and the clutch R, and the wedge which controls said clutch R is formed on said sleeve, the relation and adjustment of parts being such that movement of said sleeve to lock the clutch will disengage the clutch-teeth b^7 and b^8, and vice versa, and such also that during a portion of the travel of said sleeve both clutches will be disengaged from said stock-spindle. Movement longitudinally of the stock-spindle is imparted to the sleeve b^9 to secure the gears b^5 and b^6 to said stock-spindle and to release said gears therefrom by means of a lever b^{10}, pivoted upon the machine-frame, Fig. 3, a projection b^{11} on the upper end of which engages a groove b^{12}, formed in said sleeve b^9. Formed on the lower end of the lever b^{10}, Fig. 1, is a cam-surface comprising sections b^{13} and b^{14}, of which the section b^{13} is substantially concentric with the pivotal axis of said lever and the section b^{14} is upwardly inclined. Pivoted at one end upon the machine-frame is a lever b^{15}, Fig. 1, having a pin b^{16}, which is held yieldingly in engagement with the cam-surfaces b^{13} and b^{14} by means of a spring b^{17}, (in dotted lines,) applied to the free end of said lever b^{15}. With this construction it is obvious that when the pin or stud b^{16} is in engagement with the cam-surface b^{13} the lever b^{15} will be unaffected thereby, and when in engagement with the cam-surface b^{14} the tension of the spring b^{17} will tend to throw the lever to effect engagement of the clutch-teeth b^7 b^8, and thus to secure the slow-driving gear b^5 to the stock-spindle. The strength of the spring b^{17} is such that when the sleeve b^9 is free to move under its influence it will throw said sleeve to effect engagement of the clutch-teeth b^7 b^8. The relation of parts is such that when the sleeve b^9 is in position to lock the clutch R the pin b^{16} will be in engagement with the cam-surface b^{13}.

The cam-surfaces b^{13} b^{14} are preferably formed on a hardened-steel plate b^{18}, Fig. 5, secured to the end of the lever b^{15}.

Pivotal movement is imparted to the lever b^{10} to lock and disengage the clutch R at desired predetermined intervals by means of suitable surfaces on a cam b^{19} on the shaft C, which are adapted to engage a stud b^{20}, secured in the lower end of said lever b^{10}, said stud being preferably provided with an anti-friction-roller.

In order that the screw-blank carried on the end of the bar of stock may be stationary when the chuck-jaws, hereinafter to be described, are closed upon the same, means are provided for stopping the stock-spindle at the time said chuck-jaws are closed and in proper position for the chuck-jaws to grasp the same in the desired manner. As shown, the means for so stopping said spindle are as follows, (see Figs. 1 and 6:) Formed in the sleeve b^9 are stop-slots b^{21}, which are adapted to be engaged by a pin or projection b^{22}, which projects inwardly from a lever b^{23}, piv-

oted upon the machine-frame, the opposite end of which projects into the path of travel of a cam b^{24} on the shaft C, a spring b^{25} applied to said lever being adapted to move the lever b^{23} pivotally to effect engagement of the pin b^{22} with the stop-slots b^{21}. As shown, the lever b^{23} has a hardened-steel shoe b^{26} secured to its free end, which is provided with a tongue or projection b^{27}, which engages the cam-surface on the cam b^{24}.

During all of the time that the clutch R is locked and during most of the time that the clutch-teeth b^7 b^8 are in engagement the tongue or projection b^{27} on the lever b^{23} rides on a substantially cylindrical section of the cam b^{24}, in which position the pin b^{22} will be held out of engagement with the slots b^{21} and the stock-spindle F will be free to rotate. When it is desired to stop said stock-spindle, however, the tongue or projection b^{27} drops into a recess or notch b^{28} in said cam b^{24}, thus allowing the spring b^{25} to move the lever b^{23} pivotally to effect engagement of the pin b^{22} with one of the slots b^{21}, the position of said recess or notch b^{28} and its dimension circumferentially of the cam b^{24} being such that the stock-spindle will be held stationary during the time that the blank-supporting chucks are being closed. Secured to the sides of the notch or recess b^{28} are hardened-steel plates b^{29} b^{30}, which receive the wear due to the action of the tongue or projection b^{27}. The relation of parts is such also that the stock-spindle F will be stopped almost immediately after the sleeve b^9 has been moved to disengage the clutch R and to effect engagement of the clutch-teeth b^7 b^8, which form an effective brake adapted to check the speed of said stock-spindle, as each time the teeth b^8 on the sleeve b^9 "run over" the teeth b^7 on the gear b^5 it will necessitate stretching the spring b^{17} through the medium of the projection b^{16} on the lever b^{15} acting on the cam b^{14}. Before stopping said stock-spindle F it will thus be necessary to disengage the clutch-teeth b^7 b^8. In the preferable construction shown this is effected by forming the slots b^{21} on an incline toward said teeth and disposing the pin or stud b^{22} so that it will engage said slots adjacent to their forward ends, the relation being such that said pin or stud b^{22}, acting on the inclined front side of the slot b^{21}, which it engages, will move the sleeve b^9 longitudinally of the stock-spindle to disengage the clutch-teeth b^7 b^8 before said pin or stud reaches the end of said slot b^{21}. A great advantage of throwing the clutch-teeth b^7 b^8 into engagement when the clutch b^9 is disengaged and before stopping the stock-spindle is that said stock-spindle will be positively rotated at a slower speed until it reaches the position in which it is designed to be stopped by the pin or stud b^{22}—that is, with the opening in the chuck-collet a^{15} in register with the blank-supporting jaws without relying on the momentum of said stock-spindle, which might not always operate as intended. The relation and adjustment of parts are such also that during the time the stock-spindle is held stationary by the pin or stud b^{22} the stud or projection b^{16} on the lever b^{15} will bear on the inclined cam-surface b^{14} on the lever b^{10}. Thus as soon as the pin or stud b^{22} is disengaged from said slot b^{21} the spring b^{17} will at once throw the clutch-teeth b^7 b^8 into engagement and rotate the stock-spindle positively at its slow speed and with great power, thereby twisting a blank which has been previously partially severed from the bar of stock off from said bar of stock.

In order to eliminate as much as possible the noise caused by the clutch-teeth b^7 b^8 running over each other, we prefer to provide means independent of said clutch-teeth for braking or checking the speed of the stock-spindle when the clutch R is disengaged. In the preferable construction shown said means consist of an arm b^{31} on the lever b^{23}, which extends up on the rear side of the stock-spindle F. Secured in said arm is a plug b^{32}, of hard wood or other suitable material. Just before the clutch R is disengaged pivotal movement is imparted to the lever b^{23} to advance said plug b^{32} into engagement with the surface of the sleeve b^9 with sufficient pressure to "brake" or check the stock-spindle. As shown, this is accomplished by providing a projection b^{33} on the surface of the cam b^{24}, which will engage the projection b^{27} on the lever b^{23} just before said projection b^{27} drops into the notch or recess b^{28}, the height of said projection b^{33} being such that the lever b^{23} will be moved pivotally thereby sufficiently to depress the plug b^{32} into frictional engagement with the surface of said sleeve b^9 in the desired manner. A convenient manner, as shown, for forming the projection b^{33} consists in extending the plate b^{30}, secured to a side of the notch or recess b^{28}, above the cylindrical section of the cam b^{24}. In the preferable construction shown also the plug b^{32} is adapted to be adjusted outwardly by means of a screw b^{34}, threaded into the lever-arm b^{31}, which bears against the end of said plug.

The screw-blanks are necked between the head and the body thereof and are partially severed from the bar of stock while in the stock-spindle F by suitable tools which are fed toward and from the bar of stock in any desired manner. As shown, the tool which partially severs the screw-blanks from the bar of stock is adapted to rough-point one screw-blank and to face off the end and finish the head of the next succeeding screw-blank. In the preferable construction shown, Figs. 3 and 8, the necking-tool c' and the cut-off tool c^2 are secured in a tool-holder c^3, so as to be adjustable toward and from the bar of stock. The tool-holder is supported upon

the upper end of a lever c^4, pivoted between its ends upon a bar c^5, secured against rotation to the machine-frame in proper position. The tool-holder c^3 is preferably secured to the lever c^4 by means of bolts c^6, the heads of which engage T-slots c^7, formed in said lever in a familiar manner. Provision is thus made for adjusting the tools longitudinally of a bar of stock supported in the stock-spindle F. The tools c' c^2 are maintained normally retracted from the bar of stock by means of a spring c^8, applied to the lower end of the lever c^4, one end of which is secured to a pin in said lever and the opposite end of which in an eyebolt secured in the machine-frame or other rigid support. Movement of the lever c^4 under the influence of the spring c^8 may be limited by means of a suitable stop. Pivotal movement is imparted to the lever c^4 to feed the tools c' c^2 into the bar of stock by means of cams c^{10} c^{11} on the shaft C.

The operative surfaces of the cams c^{10} c^{11} being separated by intervening spaces, as shown, it is obvious that the tools c' c^2 will be fed toward and retracted from the bar of stock twice during each revolution of the shaft C, the cam c^{11}, being the lower, operating to neck and partially sever the screw-blank from the bar of stock and the cam c^{10}, being the higher, operating to finish or face off the ends of the screw-heads. During one of the intervals in which the lever c^4 is out of engagement with said cams c^{10} c^{11} the screw-blank is twisted off from the bar of stock at the point of partial severance therefrom in a manner hereinafter to be described, and during the other interval when said lever is out of engagement with said cams the bar of stock is fed forward.

The head (indicated as a whole by V) on which the screw-blanks are supported during the operation of the machine is rigidly secured to a shaft W, revolubly mounted in suitable bearings in the machine-frame. Chuck-jaws d', Fig. 1, are supported by said head V and are adapted to grip the heads of the screw-blanks delivered through the stock-spindle F. As shown, the chuck-jaws d' are formed on levers d^2, pivoted in the head V, there being a plurality of sets of chuck-jaws. As shown in Fig. 1, when there is a set of chuck-jaws in position for receiving the blank from the stock-spindle F there is a corresponding set of chuck-jaws opposite the tool J carried on the tool-spindle Q. The specific arrangement of the chuck-jaws and the operation of same are fully described in our divisional application, Serial No. 229,035, for wedges.

The chuck-jaws are normally open and maintained open by springs or by the weight of the free ends of the levers d^2. They are of angular shape, adapted to be closed to grip the screw-blanks by wedges d^3, fitted to and longitudinally movable on the shanks d^4 as guides, which wedges are adapted to separate the ends of the levers d^2 opposite to those on which said chuck-jaws are carried, thereby closing said chuck-jaws in the desired manner. These chuck-jaws are moved up to proper position for grasping the blanks. The jaws during the time the blank is held prior to its complete severance remain stationary and hold one end of said blanks immovable after the sides of said blanks are firmly grasped by said jaws.

Reciprocating movement toward and from the tools is imparted to the head V through the agency of the disk or head X, provided with radial projections d^5, preferably provided with antifriction-rollers, which engage a camway d^6, formed on the drum d^7, rigidly secured to the shaft C. The disk X may be secured in any usual manner to said shaft W, it being necessary that it be secured to said shaft without relative longitudinal movement.

Intermittent rotary movement is imparted to the shaft W, and thus to the head V, through the agency of the disk d^8, revolubly mounted upon a stud d^9, secured in the end of the machine-frame. The pin d^y, Fig. 9, secured in said disk d^8, is adapted to engage radial slots d^{11}, formed in projections from the head X. The head X may be called the "indexing-head" and the disk d^8 the "converter." Secured to said converter d^8, so as to rotate therewith, is a gear d^x, the teeth of which are adapted to be engaged by a segmental gear d^{12} on the drum d^7. The segmental gear is adapted to engage gear d^x to rotate the shaft W and the parts carried thereon when said shaft is at the rearward limit of its movement, thus insuring that the screw-blanks carried in the chuck-jaws d' will be fully retracted from the tools. We have shown formed on said shaft W a ring d^{13}, which, in coöperation with a bearing-box d^{14} for said shaft W, obviously will hold said shaft against too great endwise movement, thereby preventing the projections d^5 being thrown out of register with the camways d^6.

Movement is imparted to the wedges d^3 to close and open the chuck-jaws d' at desired predetermined times in the following manner, Fig. 1: Pivoted upon the machine-frame is a lever d^{15}, (shown in dotted lines,) one end of which extends upwardly on the side of a head d^{16} remote from said wedges d^3 when the chuck-jaws are in register with the stock-spindle F, said jaws being open to receive the screw-blank from said stock-spindle F. A pin d^{17} on the lower end of the lever d^{15} engages a camway d^{18} on a drum d^{19}, rigidly secured to the shaft C. The upper end of said lever d^{15} will be out of contact with the head d^{16} while said head V is being moved toward the tools by the cam, the shape of the cam d^{18}

being such, preferably, that the upper end of the lever d^{15} will strike the head d^{16} and move the same so as to force the wedge d^3, carried thereby, between the ends of the lever d^2, thus closing the chuck-jaws just at the time the head V is in position of nearest approach to the spindle F and Q. The relation of parts is such also that the lever b^{23} will be moved pivotally to bring the pin b^{22}, carried therein, into engagement with a slot b^{21} in the sleeve b^9 on the stock-spindle F to stop said stock-spindle just before the chuck-jaws are closed.

The purpose and operation of the shoe a^{64} and its associated parts are fully explained in our divisional application for mechanism for feeding a bar of stock, as also are the purpose and function of the holes a^{61}.

The relation of parts might be such that the chuck-jaws would not be closed until after the stock-spindle had been stopped, and just as said stock-spindle was being started by the slow gear b^4 b^5 the said chuck-jaws could be closed, operating thereby to retard or check the rotation of the end of the stock engaged thereby. The relation, as shown, is such that when the stock-spindle F is held stationary by the pin b^{22} in engagement with the slot b^{21} the opening in the chuck-collet a^{15}, and thus the screw-blank on the end of a bar of stock secured therein, will register with the chuck-jaws d' when closed, so that said jaws will grip the head of said screw-blank in the desired manner.

The general operation of our machine is as follows: Beginning immediately after the severing of a blank, at which time the blank-carrying head is fully advanced and the stock-spindle rotating at its slow speed, the sequence of operation is as follows: Immediately after a blank is severed the fast driving-gear is thrown into train with the stock-spindle, causing it to rotate at high speed. The blank-carrying head is retracted and indexed, and at the same time the severing-tool is fed forward to finish the end of the head, and the necking-tool passes over the screw-blank between the head and body, thus finishing the neck. After the severing and necking tools are retracted and the previously-severed blank is out of the way the bar of stock is fed forward with the stock-spindle still rotating at its high speed. The severing (and necking) tools are then fed forward to partially sever a blank and to rough out the neck and again retracted, immediately after which the fast driving-gear is thrown out of train with the stock-spindle and the clutch of the slow driving-train thrown in, which, as heretofore explained, will operate to brake the stock-spindle and reduce its speed. The lever b^{23} is then moved pivotally to cause the pin b^{22} therein to engage one of the cam-slots b^{21} in the sleeve b^9, whereby the clutch-teeth b^7 b^8 will first be disengaged and then the spindle stopped. In the meantime the blank-carrying head has been advanced with a pair of empty chuck-jaws in register with the screw-blank in the stock-spindle and into position to grip the head of the partially-severed screw-blank on the bar of stock. Immediately after the stock-spindle is stopped the chuck-jaws opposite the blank are closed upon the head of the partially-severed screw-blank, after which the pin b^{22} is withdrawn from the slot b^{21} to release the stock-spindle and the clutch-teeth b^7 b^8 thrown into engagement, causing the stock-spindle to rotate at its slow speed, which will twist off the partially-severed blank, the head of which is held in the clutch-jaws on the blank-carrying head, thus severing the blank. The sleeve b^9 is then moved longitudinally of the stock-spindle to disengage the clutch-teeth b^7 b^8 and to lock the clutch R, causing the stock-spindle to rotate at its fast speed.

Having thus described our invention, we claim—

1. In a screw-machine, the combination of a revoluble stock-holder and means for rotating the same, a cutting device for partially severing a bar of stock secured in said revoluble stock-holder, a second stock-holder for seizing the end of said partially-severed bar of stock and holding the same stationary, means for intermittently stopping said revoluble stock-holder, and means to cause said second stock-holder to grasp the end of said partially-severed bar of stock when said revoluble stock-holder is in positions of rest, substantially as described.

2. In a screw-machine, the combination of a revoluble stock-holder and means for rotating the same at relatively fast and slow speeds, a cutting device for partially severing a bar of stock secured in said revoluble stock-holder, a second stock-holder for seizing the end of said partially-severed bar of stock and holding the same stationary, means for intermittently stopping said revoluble stock-holder, and means to cause said second stock-holder to grasp the end of said partially-severed bar of stock when said revoluble stock-holder is in positions of rest, substantially as described.

3. In a screw-machine, the combination of a stock-spindle, a movable holding device adapted to be brought into register with said stock-spindle to seize one end of the bar of stock, a cutting device for partially severing a bar of stock secured in said stock-spindle, mechanism for rotating said stock-spindle, means for intermittently stopping the rotation of said stock-spindle, and means to cause the holding device to approach and seize the stock during intervals of rest of the stock-spindle, substantially as described.

4. In a screw-machine, means for rotating a bar of stock, a change-of-speed device for

said rotating means, a cutting device for partially severing said stock, means for holding stationary one end of said bar, means to operate the change-of-speed device whereby there will be a change from fast to slow speed, and then to inoperative position before the end of the bar is seized by the holding device, means for operating the change-of-speed device subsequent thereto and after the partial severance of said stock, for the purpose specified.

5. In a screw-machine, a main operating device, a stock-spindle and a stock-holder connected therewith for an annular bar of stock, a clutch for connecting said operating device with said spindle, a stop device for said clutch and spindle, and a second stock-holder adapted to coöperate with said angular bar, when at rest for clamping same to said stock-holder, means for operating said stop device arranged first to disengage said clutch from said operating device, and immediately thereafter hold said clutch and spindle stationary in proper predetermined position to insure the proper registery of the second holding device and bar of stock, and subsequently to release said stop device, and means for effecting reëngagement of said clutch for the purpose of twisting the bar on its axis.

6. In a screw-machine, a main operating device, a stock-spindle and a stock-holder for an angular-shaped bar of stock, a clutch for connecting the operating device with said spindle for rotating same, a stop device for said spindle, a second stock-holder, angular-shaped jaws thereon, means for moving the stop device to disengage said clutch from the main operating device and hold said bar of stock and said spindle at a predetermined point of rotation, means for operating the jaws of the second stock-holder while said spindle is held by said stop device, and means for releasing said stop device subsequent to the operation of said jaws, for the purpose specified.

In testimony that we claim the foregoing as our invention we affix our signatures, in presence of two subscribing witnesses, this 7th day of September, A. D. 1903.

WALTER B. PEARSON.
CHARLES E. ROBERTS.

Witnesses:
M. P. FURR,
K. A. COSTELLO.