No. 732,453. PATENTED JUNE 30, 1903.

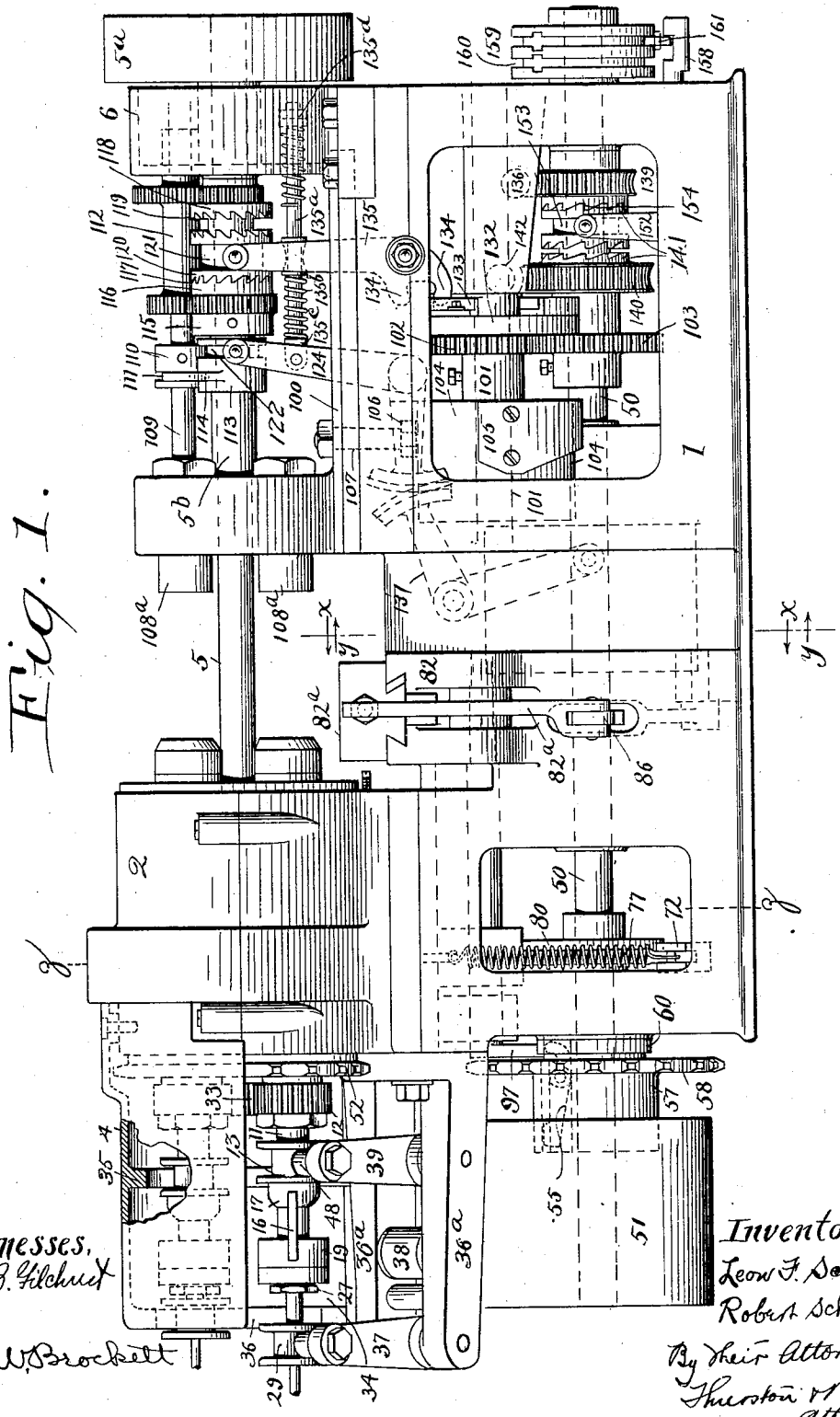
L. F. & R. SCHULZE.

METAL WORKING MACHINE.

APPLICATION FILED NOV. 11, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

Fig. 1.



Witnesses,
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B. W. Brockett

Inventors,
Leon F. Schulze
Robert Schulze
By their Attorneys,
Thurston & Bates
Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 732,453. PATENTED JUNE 30, 1903.

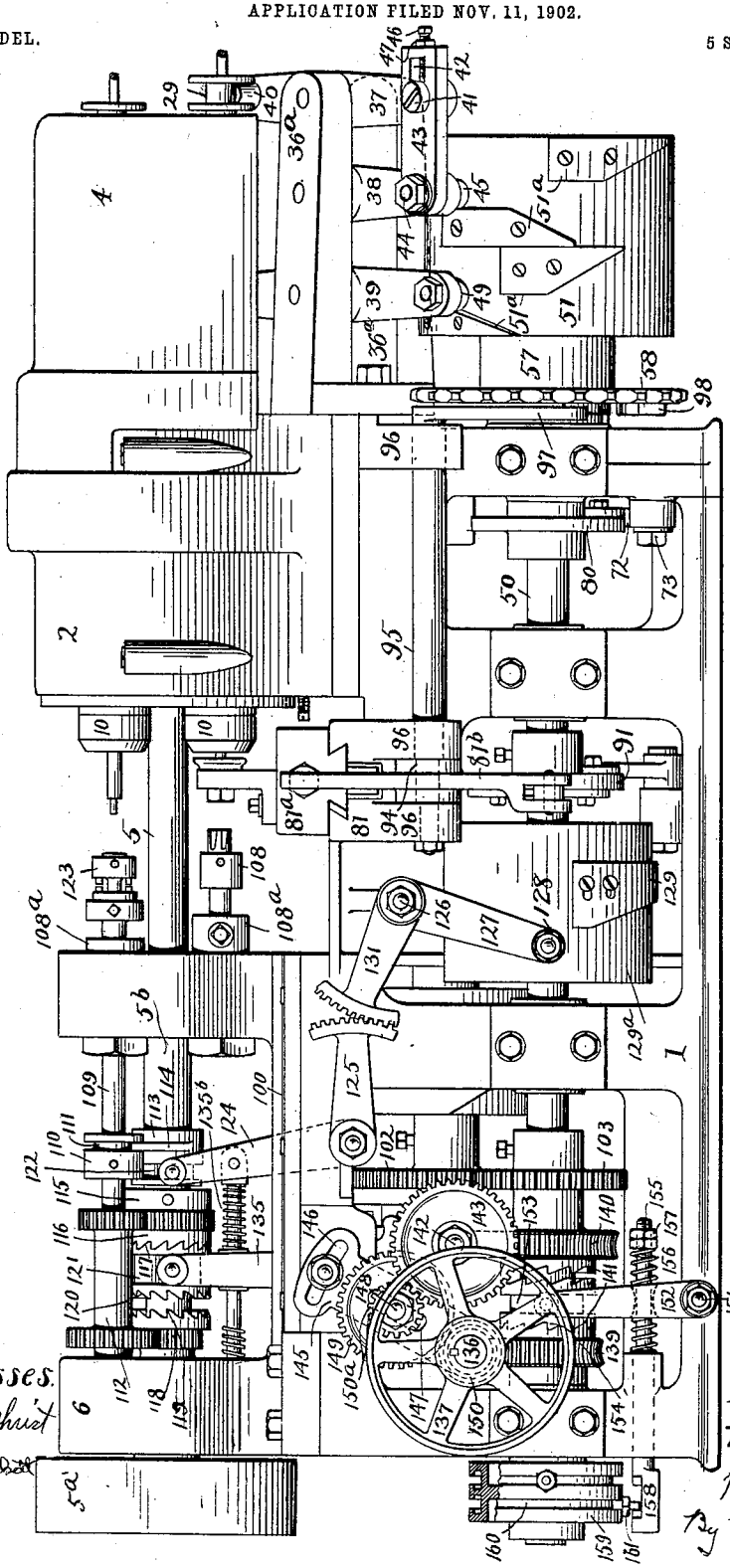
L. F. & R. SCHULZE.

METAL WORKING MACHINE.

APPLICATION FILED NOV. 11, 1902.

NO MODEL. 5 SHEETS—SHEET 2.

Fig. 2.



Witnesses.
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METAL WORKING MACHINE.

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NO MODEL. 5 SHEETS—SHEET 3.

Fig. 3,

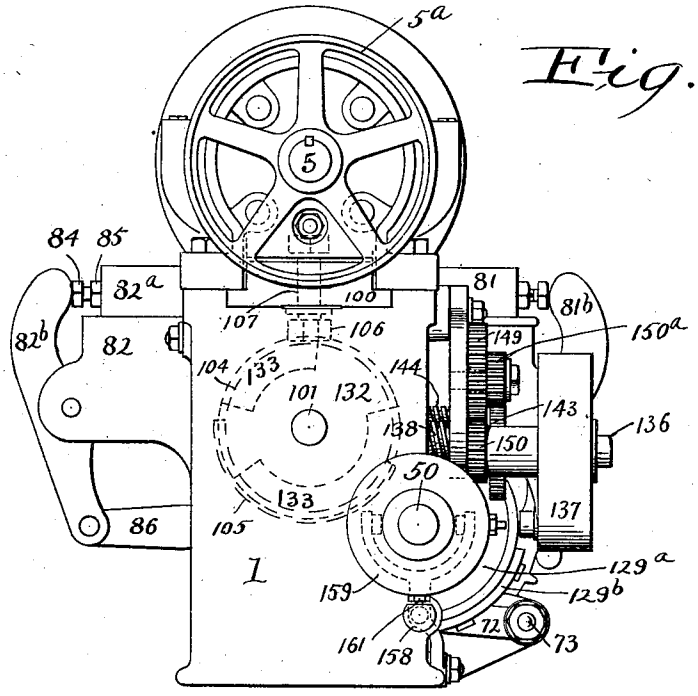
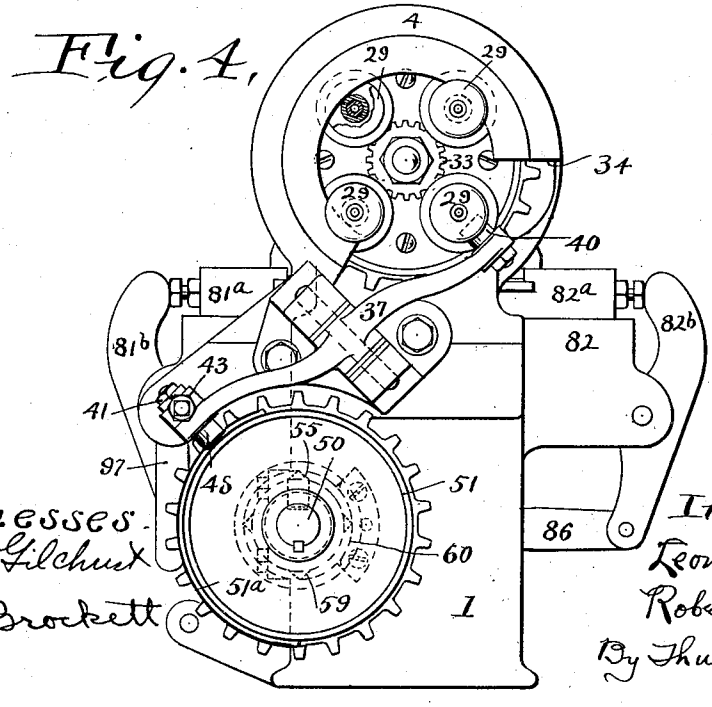


Fig. 4,



Witnesses.
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METAL WORKING MACHINE.

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NO MODEL. 5 SHEETS—SHEET 4.

Fig. 5,

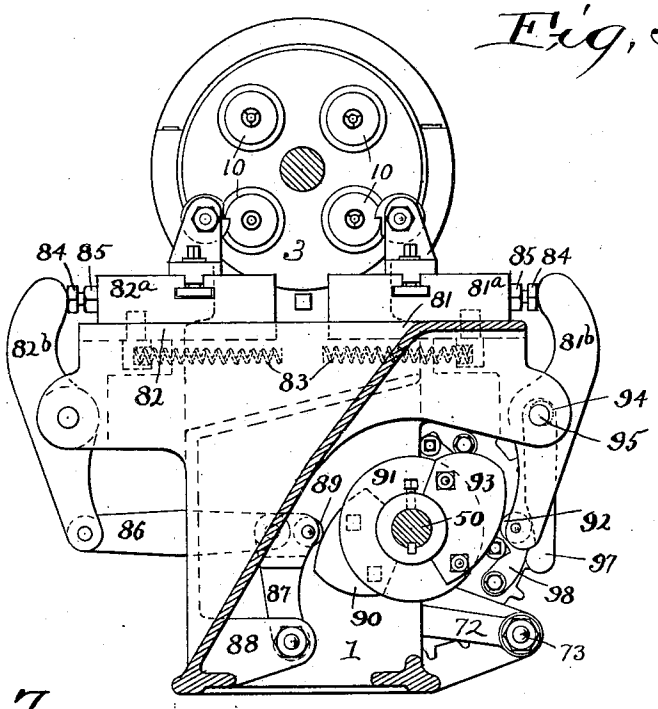


Fig. 7,

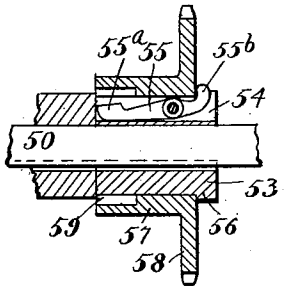
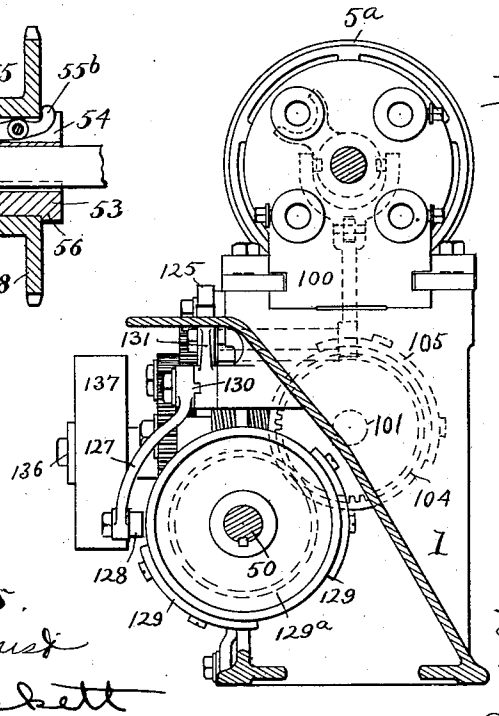


Fig. 6,



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 732,453. PATENTED JUNE 30, 1903.

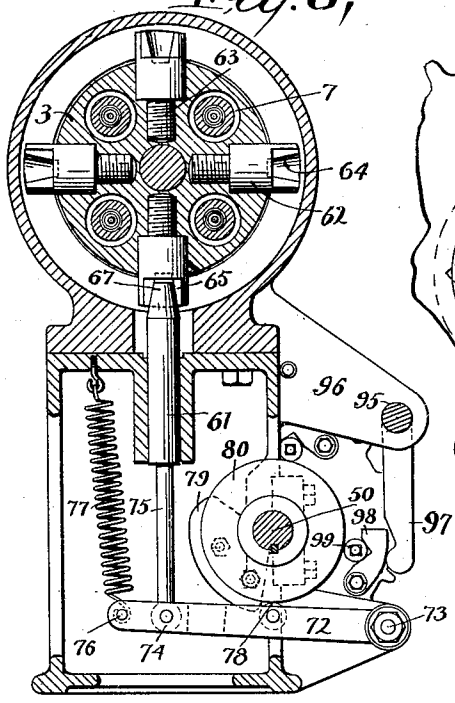
L. F. & R. SCHULZE.

METAL WORKING MACHINE.

APPLICATION FILED NOV. 11, 1902.

NO MODEL. 5 SHEETS—SHEET 5.

Fig. 8,



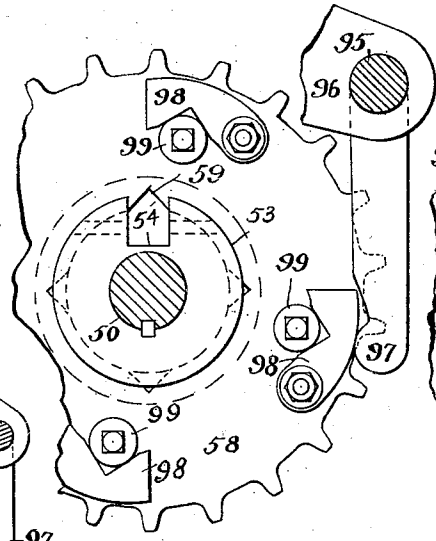


Fig. 9,

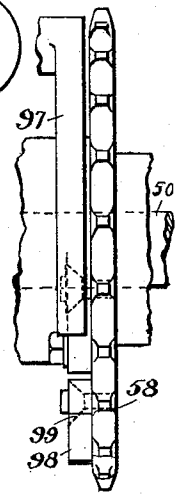


Fig. 10,

Fig. 11,

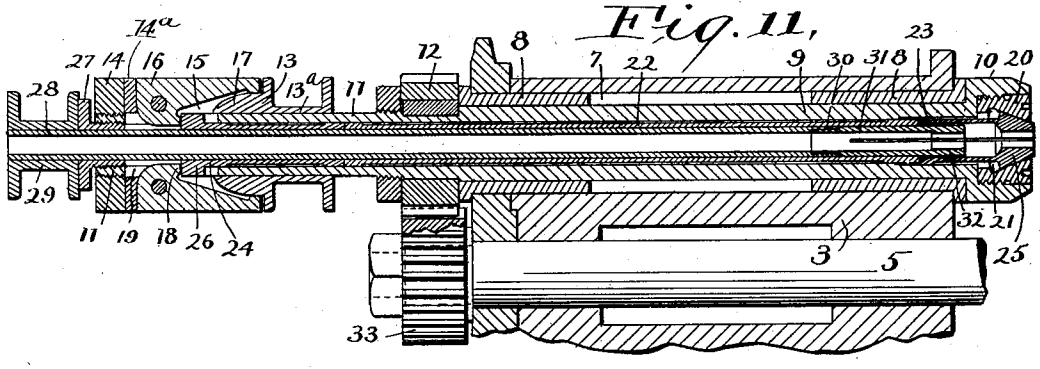
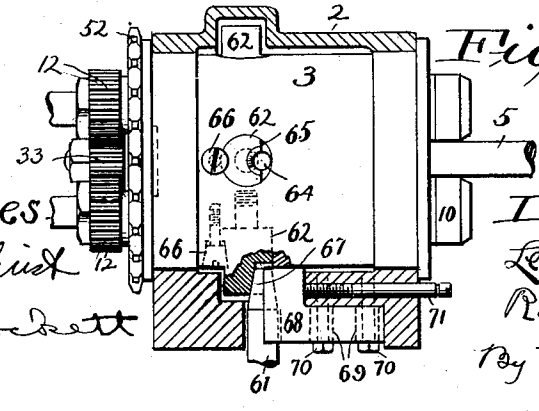


Fig. 12



Witnesses
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No. 732,453. Patented June 30, 1903.

UNITED STATES PATENT OFFICE.

LEON E. SCHULZE AND ROBERT SCHULZE, OF CLEVELAND, OHIO.

METAL-WORKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 732,453, dated June 30, 1903.

Application filed November 11, 1902. Serial No. 130,878. (No model.)

To all whom it may concern:

Be it known that we, LEON F. SCHULZE and ROBERT SCHULZE, citizens of the United States, both residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Metal-Working Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

In metal-working machines wherein several operations automatically result in definite sequence it is necessary for efficiency not only that the various operations be carried on at just the proper time, but that each device should do no more nor no less than is required of it and should do it as rapidly as possible. Certain difficulties have been experienced from machines of this class by reason of the locking device, which is provided to hold the stock-carrying head from movement, not being of such a character as will insure firmly holding said head during the several operations, such locking devices generally becoming inefficient with wear; also, because the different parts by reason of the wear and tear and inaccurate construction in the machine fail to efficiently perform their several functions; also, because the die which cuts the thread is not thrown into and out of operation in such a way that time will be saved; further, that the cutting of thread is done too rapidly and that running off of thread is done in such manner as to subject machines to undue strains, and also that general cutting motion of cam-shaft and driving mechanism cannot be changed without changing speed of return or idle motions; also, that different-pitch threads cannot be followed up by dies.

The object of our invention, therefore, is to obviate the numerous difficulties noted above and to provide a locking device which at all times, irrespective of the wear and tear in the machine, will firmly hold the head against movement during the different operations of the tools; to provide means for adjusting the tools so as to compensate for the wear and tear of the chucks; to operate the die in such a way that time will be saved thereby and without reversing the motion of any of the parts; to provide for slow running on a thread in cutting a screw or in cutting internal threads in such manner as not to subject the machine to unnecessary strains; to provide means for changing speed of cam-shaft for cutting operations without changing it for return or idle motions; to provide means for cutting threads of various pitches and to let the die follow at the proper rate of speed, and, lastly, to provide in connection with the several movements of the machine certain devices which will aid in performing their different functions.

The invention may be best summarized as consisting of the means we employ for these ends, or any of them, as hereinafter more fully explained and summed up in the claims.

Referring to the drawings, Figure 1 is a side elevation of a machine constructed according to our invention. Fig. 2 is an elevation from the opposite side. Figs. 3 and 4 are end views of the machine, Fig. 3 showing the end of what we call the "tool" portion of the machine—that is, the right-hand end of Fig. 1—and Fig. 4 being an end view of the chuck portion of the machine—that is, from the left-hand end of Fig. 1. Figs. 5 and 6 are vertical cross-sections through the middle of the machine, looking in opposite directions, Fig. 5 looking toward the chuck portion of the machine, as indicated by the arrows marked *x* in Fig. 1, and Fig. 6 looking toward the tool portion, as indicated by the arrows marked *y* in Fig. 1. Fig. 7 is a detail view, in longitudinal section, of the pawl construction for throwing the sprocket-wheel into action. Fig. 8 is a vertical section of the machine, being taken on the line *z z* of Fig. 1, looking toward the left. Fig. 9 is a detail view of a sprocket-wheel which carries dogs for operating the lever which adjusts the tool-carriers. Fig. 10 is a view looking at the periphery of said sprocket-wheel. Fig. 11 is a detail view, in longitudinal section, of one of the chucking devices and its operating mechanism. Fig. 12 is a detail view, in sectional side elevation, of the chuck-head and its locking devices.

Referring to the parts by numerals, 1 is the frame of the machine, of suitable construction for carrying the several mechanisms which are mounted upon it, and having a casing 2 secured thereto for containing the chuck-head 3. This casing 2 is open in the front to permit the forward or engaging end of the

chuck-head to project therefrom and is also open in the rear to permit the rear end of the chuck-head to project out into a supplemental casing 4.

The chuck-head 3 is cylindrical in form and has its bearing in the frame 1 and casing 2 and furnishes one bearing for a main driving-shaft 5, which passes through the same and extends across the machine to the opposite end, where it is mounted in a suitable bearing 6. Four cavities 7 are provided in the chuck-head 3 for receiving the several chucks and feeding devices. The chucks and their corresponding feeding devices are in this case four in number, but may be increased or decreased, according to the different operations the machine is required to perform, and since all of them are alike in construction a description of one will suffice for all. Secured in each of the cavities 7 in the chuck-head 3 are shouldered sleeves 8, which are secured therein in any suitable manner and serve as bearings for the several chucks. Each chuck is composed of a tubular portion 9, having a head 10 at the forward end and a suitable reduced protion 11 for receiving a pinion 12 and also for a chuck-operating sleeve 13, which is provided with an annular groove 13^a and a conical portion 17. Upon the outer end of this reduced portion 11 is secured, by means of screw-threads or otherwise, a chuck-operating head 14^a, which is provided with radial slots 15, in which are pivoted operating-pawls 16, and has a collar 14 for adjusting the same. The pawls, as shown in Fig. 11, have tail portions which extend to a point adjacent to the conical portion 17 of said sleeve 13 and also shoulders 18, which project through slots 19 in said reduced portion 11 of the chuck-tube 9.

In the chuck-head 10 is a ring 20, which screws into said head and has a central tapering opening 21 therein, as shown in Fig. 11. Within the chuck-tube 9 is a long sleeve 22, which engages the jawed sleeve 23 at the forward end of said tube 9 and a sleeve 24 at the rear end of the same. The jawed sleeve 23 is provided with a tapered enlarged portion 25, which is split to form the jaws and operates in the tapered opening 21 in the ring 20, carried by the chuck-head 10. The sleeve 24 is provided with lugs 26, projecting into the slots 19 in the chuck-tube 9 in such a position that they will be engaged by the shoulders 18 of the pawls 16.

Secured in the extreme rearward end of the chuck-tube 9 is a ring 27, which serves as a bearing for a friction feed-operating sleeve 28 and also clamps the collar 14 in position, the threaded portions of the chuck-tube 9 and the collar 27 being slightly tapered. This sleeve 28 is provided with an annularly-grooved hub 29 upon one end and extends through said sleeves 24 and 22. The bore of the sleeve 28 is slightly larger than the size of the stock metal from which the screws are made and at the inner end is provided with an enlarged screw-threaded portion to receive a screw-threaded reduced portion 30 of a friction-chuck 31. This chuck 31 is tubular in form and is slit longitudinally, so as to form spring-jaws 32.

The operation of the foregoing chuck mechanism is as follows: Stock metal is inserted into the sleeve 28 until it is caught by the friction-chuck 31, and as the chuck is rotated and the screw is formed and completed the operating device, which will be hereinafter described, for said chuck and feed mechanism come into operative position, and as the stock metal is to be fed forward the sleeve 13 is moved forward, so as to allow the tail portions of the pawls 16 to move inward, thus relieving the pressure upon the jaws 25 and releasing the stock metal to the action of the friction-chuck 31, when by the cycle of movement the sleeve 29 is operated and the stock metal is fed forward a distance equal to the length of a screw. The sleeve 13 is then forced back into its normal position and the pawls will through their shoulders 18 and the sleeve 22 force the jaws 25 in upon the stock metal and firmly hold the same during the several operations of the machine. After jaws 25 have again gripped the stock metal the collar 29 is brought back to its original position, the friction-jaws 32 slipping over the stock metal. Rotary motion is conveyed to each of the chucks from the shaft 5 through the pinions 33 and 12.

Having described the construction of the chucks and the feed mechanism, we will now proceed to describe the mechanism for operating the same step by step and for holding them in the several positions during the rotation of the head. The casing 4, above referred to, is cylindrical in form and extends around the rear ends of said chucks, with the exception of an open space 34, as shown in Fig. 4, and is provided with internal annular projections 35 and 36, which are arranged to engage in the annular grooves of said sleeves 13 and the hubs 29 for the purpose of preventing their movement longitudinally during the time when they are not passing the opening in said casing 4.

Mounted in suitable brackets 36^a, carried by the frame of the machine, are three levers 37, 38, and 39. The lever 37 is provided at one end with a friction-roller 40 for engaging the annular groove in the hub 29, and at the other end is provided with a bolt 41, which passes through a slot 42 in a link 43, which in turn is pivoted to the lever 38, near the end thereof, by a bolt 44, which carries upon its lower end a friction-roller 45. In the end of the link 43 is a set-screw 46 and a check-nut 47, which serves as a means for adjusting the movement of the lever 37, and therefore adjusting the feed of the stock metal. The lever 39 has a friction-roller 48 for engaging in the annular groove 13^a of the sleeve 13 and at the other end has a friction-roller 49. Mounted in suitable bearings, carried by the

frame 1, is a cam-shaft 50, having upon one end thereof, adjacent to the levers 37, 38, and 39, a drum 51, which is provided upon its periphery with suitable cams 51^a for engaging the friction-rollers 45 and 49 on said levers.

The parts which convey the intermittent rotation to the head will now be described. Secured to the head at any suitable point is a sprocket-wheel 52. In line with this sprocket-wheel and keyed to the cam-shaft 50 is a boss 53, having a radial slot 54 therein, in which is pivoted a pawl 55. This boss 53 is provided with a shoulder 56, and around a long cylindrical part thereof is a hub 57 of a sprocket-wheel 58, which is of the same diameter as the sprocket-wheel 52, secured to the chuck-head. The hub 57 is provided with internal grooves 59, corresponding in number to the number of chucks in the chuck-head. These grooves 59 are V-shaped in cross-section and register at times with a projection 55^a upon the pawl 55. Secured to the side of the frame adjacent to the shoulder 56 and in the path of the projection 55^b of the pawl is an arc-shaped cam 60, which is inversely proportional in size to the number of grooves in the hub 57, in this instance being one-fourth of the circumference of a circle described by the arc of the cam, since there are four grooves in said hub.

It will be seen from the foregoing description that as the shaft 50, and consequently the boss 53, which is keyed to the same, rotates the projection 55^b of the pawl 55 will engage the cam 60, whereupon the opposite end 55^a will be forced up into one of the grooves 59 and rotary motion will be conveyed to the sprocket-wheel 58 through its hub 57 until the pawl passes from the end of the cam 60. Since the cam 60 was made to correspond to one-fourth of a circle the sprocket-wheel 58 will be rotated one-fourth of a turn, and since it is connected by a chain with the equal sprocket-wheel 52 on the chuck-head the chuck-head will be rotated one-fourth of a turn also.

The head 3, during the time when it is stationary, is locked against movement by means of a bolt 61, mounted in a suitable guideway in the frame. This bolt 61 engages at different times during the rotation of the head four sockets 62, which are secured therein by means of threaded stems 63. These sockets are substantially of the form shown in Figs. 8 and 12, having in the end thereof a tapered recess 64, which is eccentric to the axis of each of the sockets. Each socket is cut away at 65 and is held in place against rotation by means of a screw 66. The end 67 of the bolt 61 is tapered to correspond with the recess 64 in the socket. Secured to the frame 1 in the path of the cut-away portion of the sockets 62 is a block 68, which is provided with longitudinal slots 69, through which pass bolts 70, securing said block to the frame. In the face of this block 68 and in line with the bolt 61 is a groove having near its upper end a tapered portion corresponding to the end 67 of said bolt and forming, with the recess 64 in said sockets, a complete tapered opening for receiving that bolt. This block 68 is capable of adjustment to and from the sockets by a set-screw 71. Up-and-down motion is conveyed to the bolt 61 through a lever 72, which is pivoted at 73 to the frame and at 74 to the stem 75 of the bolt and is connected at 76 to a helical spring 77, which in turn is secured to the frame. This spring pulls upward on the lever and the bolt. At a suitable point the said lever 72 is provided with a friction-roller 78, which lies in the path of the cam 79, carried by a cam-wheel 80 upon the cam-shaft 50. The cam 79 is so located on the cam-wheel 80 that the bolt 61 will be operated thereby to unlock the chuck-head at the proper time and will remain in an unlocked position until the chuck-head is revolved to its next position, the spring 77 thereafter operating to relock it. By having the taper-bolt 61 lock the head directly to a stationary taper looseness of the bolt in its bearing becomes immaterial and the locking continues to be positive, notwithstanding wear of the parts. This is an important feature of our invention.

Mounted in suitable guideways 81 and 82 are the transversely-operating carriages 81^a and 82^a, which carry the lateral cutting-tools. Upon the sides of the frame are mounted two levers, 81^b and 82^b, which are adapted to engage at one end their respective carriages, which are held against said levers by means of coiled springs 83 and are adjusted with respect to said levers by means of set-screws 84 and check-nuts 85. The lever 82^b is connected by a link 86 with a link 87, pivoted to an ear 88, integral with the frame, and has a friction-roller 89 mounted on it. This roller normally remains in the path of a cam 90, carried by a cam-wheel 91. The other lever 81^b has at its lower end a friction-roller 92, which normally lies in the path of a cam 93, mounted upon the opposite side of the cam-wheel 91. It will be seen from the construction just described of the levers 81^b and 82^b that the carriages 81^a and 82^a will be moved to and from the work by means of these cams 93 and 90, mounted on the same cam-wheel 91, carried by the cam-shaft 50.

The lever 81^b is mounted upon an eccentric portion 94 of a shaft 95, mounted in the bearings 96 and having upon the opposite end an arm 97. This arm 97 lies in the path of dogs 98, pivotally mounted upon the side of the sprocket-wheel 58 and is operated more or less about said shaft 95 as a pivot, according to the adjustment of the dogs 98, which adjustment is brought about by means of the tapered heads of the screws 99. There are as many of these dogs as there are chucks in the chuck-head. The object of this construction of eccentric mounting of the lever 81^b and the operation of the same is as follows: Should any of the chucks become worn, so

that they are loose in the chuck-head, or should their construction not be absolutely accurate, or should the revolving of the head bring it in slightly-different relative position to the lateral tools, it is then necessary to compensate for such wear, inaccurate construction, or different relative positions by setting the transverse tools so that they will account for such emergencies during their operation. This is brought about by these dogs 98, which are adjusted whenever necessary, so that they will throw the arm 97 more or less distance, according to such wear, inaccuracy of construction of the chuck corresponding, and this throw of the arm 97 will rotate the shaft 95, which movement, through the eccentric portion 94, will throw the lever in, and thus shift the tool toward or from the work.

The fine adjustment just described to vary the position of the tool according to the individual wear of the chucks is another important feature of the invention. It enables very accurate work to be done. The same adjustment could be provided for the other carriage and its tool, if desired.

The parts which operate in connection with the stock metal and also the parts which operate the transverse tools have been described, and the description will now be confined to those parts which work in connection with the tools mounted upon the longitudinally-movable carriage 100.

Mounted in suitable bearings in the framework of the machine is a supplemental cam-shaft 101, which receives its motion through two spur-gears 102 and 103 of like size, so that the supplemental cam-shaft operates in unison with the main cam-shaft 50. Upon this supplemental cam-shaft 101 is mounted a cam-wheel 104, upon which are mounted suitable cams 105 for engagement with a friction-roller 106, carried by a stud 107, secured to the longitudinally-movable carriage 100. These cams 105 operate the carriage 100 at proper intervals to bring the several tools 108 into operation. Three of these tools ordinarily move with the carriage 100. The fourth tool-socket 108^a may remain open, and a shaft 109 passes therethrough to a position just out of line of the stock metal operated upon. The shaft 109, which we call the "die-shaft," is mounted in a suitable bearing in the block 6 and has pinned thereto a collar 110, having an annular groove 111. A compound gear 112 is also splined upon this shaft 109, but having a shaft longitudinally movable therein, and upon a sleeve 5^b, rigid with the carriage 100 and surrounding the main drive-shaft 5 of the machine is mounted a loose collar 113, having a forked arm 114 extending therefrom and engaging in the annular groove 111 in the collar 110. Upon the shaft 5 is a collar 115, rigidly secured thereto, which serves as an abutment for a pinion 116, which has upon its inner face radial clutch-teeth 117. This pinion 116 is loose upon the shaft 5. Another pinion 118 is also loose upon the shaft 5 and has radial clutch-teeth 119 upon its inner face also. These teeth are adapted to be engaged at different times by a toothed collar 120, which is splined to the shaft 5 and has an annular groove 121 in the periphery thereof. The collar 113 is also provided with an annular groove 122.

It will be seen from the foregoing that by shifting the collar 113 longitudinally upon the sleeve 5^b on the shaft 5 the shaft 109 will be slid forward or backward in its tool-socket, and the die carried by its forward end will be brought into engagement with the work, or vice versa. It will also be seen that should the collar 120 be operated in either direction one or the other of the pinions 116 and 118 will be thrown into connection with the drive-shaft 5, and hence the compound gear 112 will be operated at a greater or less speed according to this connection. It is also apparent that should it be desirable to change the die-shaft from one tool-socket to another it may be so changed, and the driving mechanism just described may be turned about the main drive-shaft 5 and still retain its operative connection with the said die-shaft.

The mechanism for bringing about a longitudinal movement of the collar 113 consists of a rock-arm 124, mounted upon a cross-shaft journaled in the frame and having upon its outer end a toothed segment 125, removably secured thereto. This rock-arm 124 has a fork at its upper end for engagement in the groove 122 of said collar. Mounted upon a suitable stud 126 upon the side of the frame is a rock-arm 127, having upon one end a friction-roller 128, which is adapted to engage the adjustable cams 129, carried by a cam-wheel 129^a upon the cam-shaft 50. At the other end this arm is provided with a key 130, which engages a suitable keyway in a toothed segment 131, also mounted upon said stud, whereby the arm and segment are locked together. During the rotation of a cam-wheel 129^a on the cam-shaft 50 the arm 127 will be operated upon its pivot by cams 129, and through the medium of the toothed segments 131 and 125 the arm 124 will shift the collar 113 in a longitudinal direction, which in turn shifts the collar 110 also in a longitudinal direction, and thereby moves the die 123, carried by its shaft 109, forward to engage the work. It will be seen that the size of the segments 131 and 125 will determine the speed at which the link 124 is thrown in one direction or the other, and the adjustment of the cams 129 will determine the amount of that throw. Therefore it will be seen that by a change of the die and the segments a change in pitch can be obtained and by a change in the adjustment of the cam 129 the amount of thread cut upon the stock can be determined. If instead of a die a threading-tool is used, then a change in pitch may be obtained by only changing the segmental gears.

Mounted upon the supplemental cam-shaft

101 is a cam-wheel 132, carrying upon one of its faces stop-cams 133, which are angular in cross-section and whose arcs are concentric with said cam-wheel 132. These cams operate between the jaws 134 of a bell-crank lever 135, which has a fork at its upper end for engagement in the annular groove 121 of the collar 120, and hold said lever 135 against movement until a pressure is created upon the same to throw the collar 120 into engagement with the pinions 116 or 118. The device for creating such pressure and for bringing the toothed collar 120, heretofore referred to, into engagement with one or the other of the two pinions 118 and 116 as rapidly as possible consists of a rod 135^a, pivoted to the rock-arm 124 and passing through a suitable opening in the lever 135. Springs 135^b are arranged on either side of said lever upon this rod 135^a between a shoulder 135^c and a nut 135^d, screwed upon the end of the same, so that when said lever is released from the stop-cam 133 it will be quickly shifted into engagement with the opposite pinion.

The lever 135 and the springs for operating the same, taken in connection with the pinions 116 and 118, and also the compound gear 112, which is splined upon the shaft 109, constitute the mechanism which controls the running off and the running on of the die. The clutch-teeth between the collar 120 and one of the two pinions 116 and 118 are thrown into engagement, so that the speed of the shaft 109 will be reduced in comparison with the speed at which the stock metal is rotated. Thus it will be seen that as the die is moved forward by the mechanism just described for that purpose the threads will be cut a predetermined distance and at a proper pitch. Then the lever 135 is operated so as to throw the collar 120 into engagement with opposite pinion, which will throw in the gears in such a way that the shaft 109 will be rotated at a higher speed than the stock metal, thus running off the die from the screw.

The object of the die-operating mechanism just described is to facilitate the cutting of the threads upon the stock metal at a comparatively very slow speed, also to save time in the operation and save the multiplication of parts, and, further, to prevent the reversing or stopping of any of the parts associated with the die or with the stock metal, which operation would necessarily cause a jar upon the parts affected by it and rack the mechanism in that part of the machine to an undue extent.

Motion is conveyed to the cam-shaft 50 through the following mechanism: A shaft 136 is mounted in suitable bearings in the frame 1 at right angles to the line of the cam-shaft 50. This shaft 136 has on the outside of the machine a driving-pulley 137 and on the inside of the frame a worm 138, which in turn meshes with a worm-wheel 139, loose upon the cam-shaft 50. Another worm-wheel 140 is also mounted loose upon the cam-shaft 50, and the faces of the hubs of both of said worm-wheels are provided with clutch-teeth 141. Secured to the frame and parallel to the shaft 136 is a short shaft 142, carrying at one end a spur-gear 143, while at the other it carries a worm 144, which meshes with the worm-wheel 140. Pivoted upon the shaft 136 is a plate 145, provided with a segmental slot 146 and a radial slot 147. Through the slot 146 projects a bolt for adjusting the relative position of said plate. Adjustably mounted in the slot 147 is a stud 148, carrying a gear 149 and a pinion 150^a, rigid with each other. The pinion 150^a meshes with the gear 143, while the gear 149 meshes with a pinion 150, carried by the shaft 136. The pinion 150, the gear 149, the pinion 150^a, and the gear 143 constitute a reduction-gearing between the shaft 136 and the shaft 142. The gear 149 and pinion 150^a may be replaced by gears of different sizes in order to change the speed of the shaft 50 when driven by the worm 144.

Pivoted to a stud 151 in the framework is a rock-arm 152, having a fork at its upper end for engagement in an annular groove 153 of a toothed collar 154, which is splined to the shaft 50. This link 152 is operated upon its pivot by means of a rod 155, mounted in the frame and passing through said rock-arm. Upon the rod 155 on each side of the rock-arm 152 are coiled springs 156, so arranged that said arm 152 is held between the ends of the same. Suitable nuts 157 are provided upon the end of the rod 155 for the purpose of adjusting the pressure of said springs. On the opposite end of this rod 155 is a cam-plate 158, rigidly secured thereto and extending out from the end of the machine. The upper side of this plate is provided with a recess the sides of which taper toward each other in a transverse direction. Mounted upon the end of the cam-shaft 50 is a wheel 159, having annular T-shaped grooves 160 therein for the purpose of receiving the studs 161, which are arranged to engage the tapering sides of the groove in the cam-plate 158.

From the foregoing it will be obvious that as the cam-shaft 50 rotates one of the studs 161 will be brought into contact with one of the sides of the groove in the cam-plate 158. This will shift the rod 155, which in turn will exert a pressure upon the link 152 and throw the teeth of the collar 154 into engagement with one or the other worm-gears on either side thereof, and when the other one of the studs 161 comes in contact with the side of the cam-plate 158 the rod 155 will be shifted in the opposite direction and pressure will be exerted upon the opposite side of the arm 152 and the collar 154 will be thrown into engagement with the worm-gear upon the opposite side. The springs 156 prevent any injury if the points of the teeth hit and insure engagement as soon as the parts are in position for it.

Through the different arrangements of gearing just described the cam-shaft will be oper-

ated from the pulley 137 at different speeds at various times in the cycle of movement of the machine, according to whether the machine is cutting or working idle, and thus the greatest economy of speed will be attained.

While we have here described a specific way of performing different operations and arriving at various improvements sought, we do not intend to limit ourselves thereby, but mean to cover all similar means.

Having described our invention, we claim—

1. In a screw-machine, the combination with a movable head, a locking-pin for the same, and a socket for said pin divided on its longitudinal axis, one part of said socket being carried by the movable head and the other part carried by a relatively stationary frame.

2. In a screw-machine, the combination of a movable head having an open-sided recess, a relatively stationary member carrying a corresponding open-sided recess, and a pin adapted to occupy both of said recesses when in juxtaposition and lock said head and said member together.

3. In a screw-machine, the combination with a movable head having a tapered open-sided recess, a relatively stationary adjustable block having a tapered open-sided recess adapted to form a substantially complete socket with the recess in the head, a tapered pin slidably mounted in the frame and adapted to occupy such socket or be withdrawn therefrom, and mechanism for operating said pin.

4. In a screw-machine, the combination with the head having a plurality of chucks mounted therein, of a locking-pin, and a socket for said pin composed of any one of a number of partial recesses carried by said head, and a common recess carried by the frame.

5. In a screw-machine, the combination with a movable head having a plurality of tapered open-sided recesses, a relatively stationary block having a correspondingly-tapered open-sided recess, and a tapered pin adapted to lock the head in various positions by engaging the socket formed by any of the recesses in the head and the recess in the block when in juxtaposition.

6. In a screw-machine, the combination of a rotatable head carrying a plurality of chucks, a tool, and means for adjusting the position of the tool so as to correspond to each particular chuck.

7. In a screw-machine, in combination with a rotatable head having a plurality of chucks mounted therein, means for locking said head against rotation, a transversely-movable tool and means for adjusting its position during the rotation of the head to compensate for wear and position of an individual chuck of the head.

8. In a screw-machine, in combination with a rotatable head having a plurality of chucks mounted therein, a transversely-movable carriage, a tool carried thereby and a series of adjustable dogs for adjusting said transversely-movable carriage so as to correspond to each particular chuck.

9. In a screw-machine, in combination with a rotatable head having a plurality of chucks mounted therein, means for locking said head against rotation, a transversely-guided tool-carriage, means for moving said carriage back and forth across the machine, an eccentric having connections between it and the tool-carriage, and means for operating said eccentric during the rotation of the head so as to set up the tools an amount which will compensate for the wear of any chuck in said head.

10. In a screw-machine, in combination with a rotatable head having a plurality of chucks mounted therein, means for locking said head against rotation, a tool-carriage, levers pivoted to the framework for reciprocating said tool-carriage, and an eccentric operating in connection with one of said levers for shifting the same, whereby said carriage may be set up a sufficient distance to compensate for the wear and position of each chuck in said head.

11. In a screw-machine, in combination with a rotatable head, a plurality of chucks mounted in said head, feeding devices within each of said chucks, a lever for operating said feeding devices successively, a pivoted arm, a link connecting said arm and lever, means for adjusting the relation between said lever and said link, and means for operating said arm.

12. In a screw-machine, the combination with the frame, of a rotary head having a plurality of chucks mounted therein, a shaft, a boss rigid therewith and having a longitudinal slot therein, a pawl mounted in said slot, a gear-wheel having a sleeve surrounding said boss, said sleeve being provided with a number of internal recesses adapted for engagement by said pawl, gearing between said gear-wheel and said head, and means for operating said pawl, substantially as described.

13. In a screw-machine, the combination with the frame, of a rotatable head having a plurality of chucks mounted therein, a shaft, a boss rigid therewith and having a longitudinal slot therein, a pawl pivotally mounted in said slot and having a portion extending beyond the same, a gear-wheel provided with a sleeve surrounding said boss, internal recesses within said sleeve for engagement by said pawl, gearing between said gear-wheel and said head and a cam for engaging said extended portion of said pawl, substantially as described.

14. In a screw-machine, in combination with a rotatable head having a plurality of chucks, a pin for locking said head against rotation, sockets rigid with said head and provided with open-sided recesses for engagement by said pin, a relatively stationary socket secured to the frame and having an open-sided recess adapted also for engage-

ment by said pin, a slot in said relatively stationary socket, and a bolt passing through said slot for clamping said stationary socket in any adjusted position.

15. In a screw-machine, the combination with the frame, of a rotatable head having a plurality of chucks mounted therein, transversely-guided tool-carriages, levers for reciprocating said carriages, suitable cams for operating said levers, one of said levers being pivoted upon an eccentric portion of a shaft mounted in the frame, and means for automatically rocking said shaft a greater or less degree according to the chuck then in operative position with respect to that tool-carriage affected by the operation of said shaft.

16. In a screw-machine, the combination with the frame, of a rotatable head having a plurality of chucks mounted therein, transversely-guided tool-carriages, levers for reciprocating said carriages, suitable cams for operating said levers, one of said levers being pivoted upon an eccentric portion of a shaft mounted in the frame, an arm rigidly secured to said shaft, dogs engaging said arm, thereby rocking said shaft and setting up one of said levers an amount corresponding to the throw of said dog, and means for adjusting said dogs.

17. In a screw-machine, the combination of a chuck, a die slidably mounted, and adapted to operate upon the stock metal carried by said chuck, an arm for shifting said die longitudinally, another arm adapted to be suitably operated, a segmental gear carried by said second arm, another segmental gear adapted to coöperate with said first-mentioned segmental gear and means for operating said second segmental gear.

18. In a screw-machine, in combination with the frame, a chuck, a die slidably mounted and adapted to operate upon the stock metal carried by said chuck, a pivoted arm for shifting said die longitudinally, a segmental gear removably secured to said arm and adapted to operate the same, another arm pivoted to the frame, a segmental gear removably secured to said second arm and adapted to cooperate with said first-mentioned segmental gear and means for operating said second-mentioned arm, said segmental gears being adapted to be replaced by others of different radii for varying the throw of said first-mentioned arm.

19. In a screw-machine, in combination with the frame, a chuck, a die-shaft, a die carried by said shaft, a collar rigid with said shaft and having an annular groove, an operating-arm having a fork engaging said groove, a gear-segment removably secured to said arm for operating the same, another pivoted arm, a gear-segment removably secured thereto and coöperating with said first-mentioned gear-segment and means for operating said second-mentioned arm.

20. In a screw-machine, in combination, a chuck, a die-shaft, means for reciprocating said shaft, a clutch-sleeve splined to a driving-shaft and adapted in either extreme position to drive said die-shaft, a lever for shifting said clutch-sleeve, cams for holding said lever, springs operating upon either side of said lever for quickly shifting said clutch-sleeve, and means for increasing the pressure upon one of said springs according to the position of the die-shaft.

21. In a screw-machine, in combination, a chuck, a die-shaft, mechanism for reciprocating said shaft, a compound gear splined to said shaft, a main driving-shaft, two pinions loose upon the main driving-shaft, said pinions being adapted to operate in connection with the gears of said compound gear, a clutch-sleeve splined to said driving-shaft, a lever for shifting said clutch-sleeve, cams for holding said lever, springs operating upon either side of said lever for quickly shifting said clutch-sleeve into contact with either of said pinions, and means for compressing either of said springs by the mechanism for reciprocating the die-shaft.

In testimony whereof we hereunto affix our signatures in the presence of two witnesses.

LEON F. SCHULZE.
ROBERT SCHULZE.

Witnesses:
E. B. GILCHRIST,
B. W. BROCKETT.