(No Model.) 5 Sheets—Sheet 1.

R. HAKEWESSELL.

SCREW MAKING MACHINE.

No. 530,179. Patented Dec. 4, 1894.

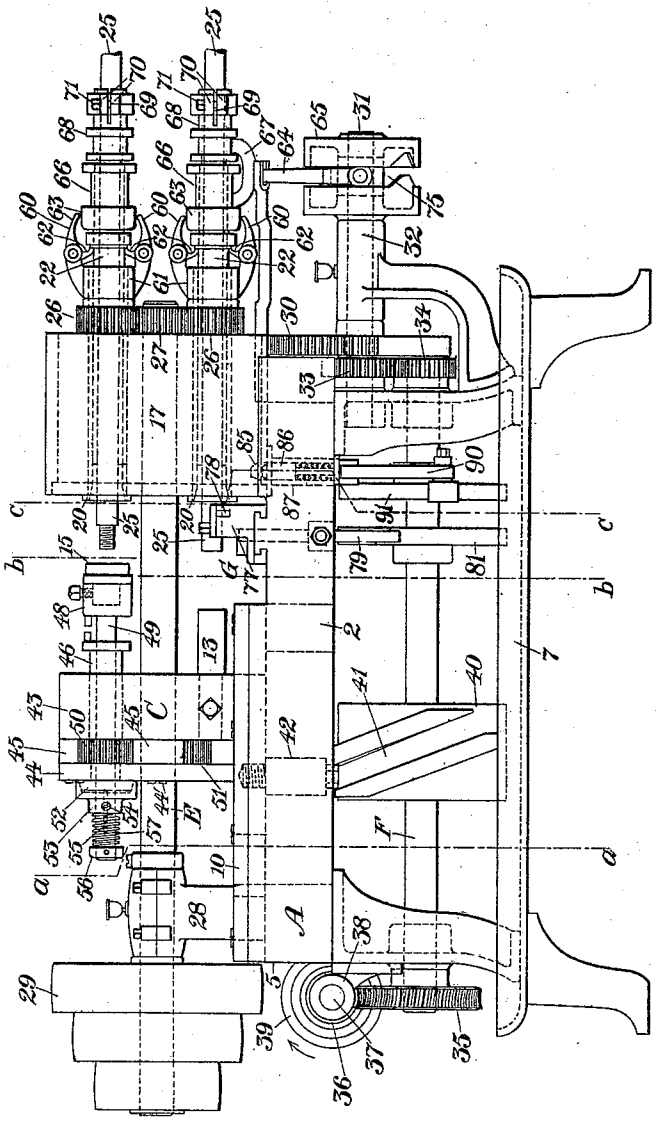

Fig. 1.

Witnesses:
John L. Edwards Jr.
Fred. J. Dole.

Inventor:
Reinhold Hakewessell.
By his Attorney,
F. A. Richards

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(No Model.) 5 Sheets—Sheet 2.

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SCREW MAKING MACHINE.

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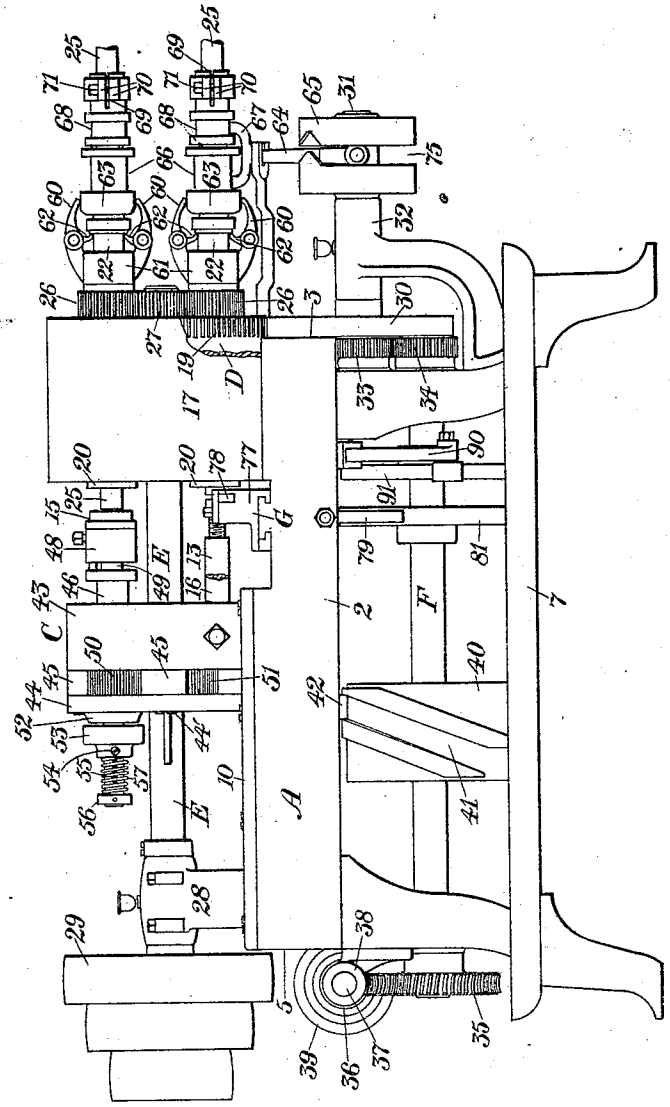

Fig. 2.

Witnesses:
John L. Edwards Jr.
Fred. J. Dole.

Inventor:
Reinhold Hakewessell.
By his Attorney,
F. H. Richards

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

(No Model.) 5 Sheets—Sheet 3.

R. HAKEWESSELL.

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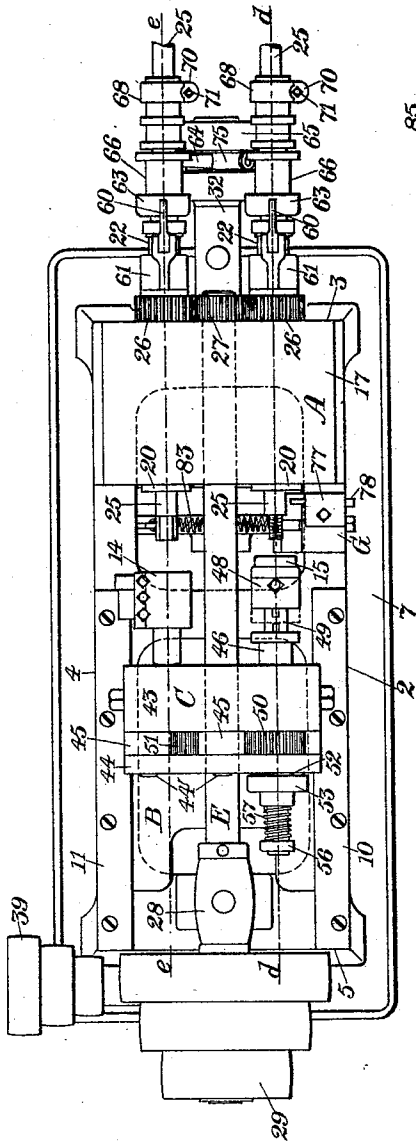


Fig. 3.

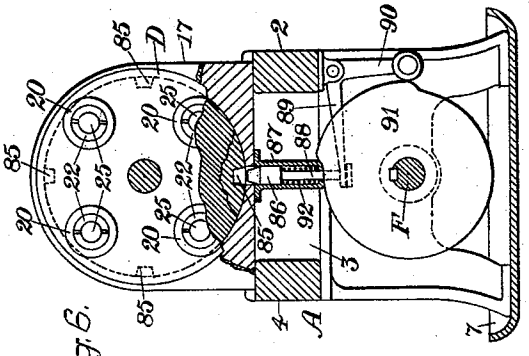


Fig. 6.

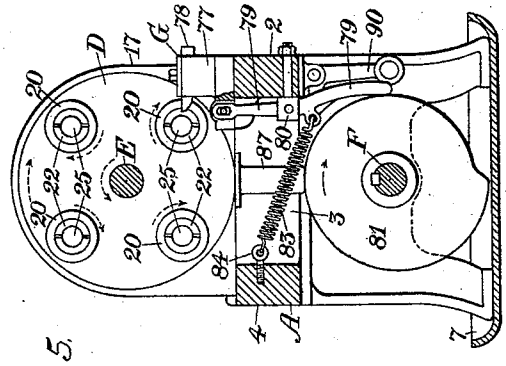


Fig. 5.

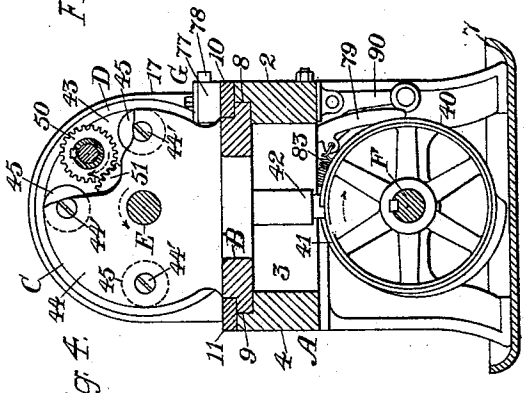


Fig. 4.

Witnesssss:
John L. Edwards Jr.
Fred. J. Dole.

Inventor:
Reinhold Hakewessell.
By his Attorney,
F. H. Richards

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

(No Model.) 5 Sheets—Sheet 4.

R. HAKEWESSELL.

SCREW MAKING MACHINE.

No. 530,179. Patented Dec. 4, 1894.

Fig. 8.

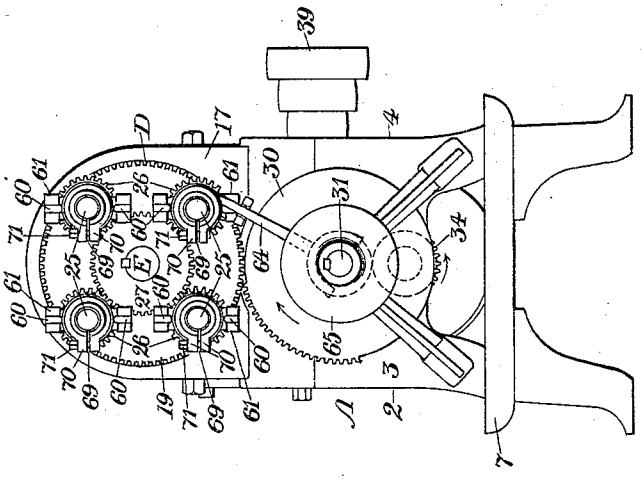
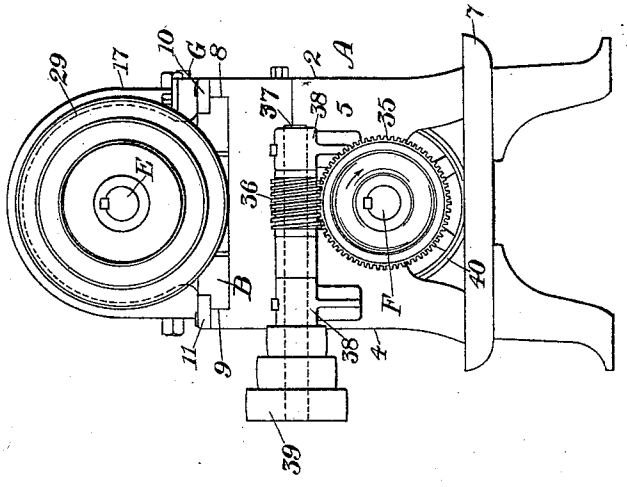


Fig. 7.



Witnesses:
John L. Edwards Jr.
Fred. J. Dole.

Inventor:
Reinhold Hakewessell.
By his Attorney,
F. A. Richards

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(No Model.)

5 Sheets—Sheet 5.

R. HAKEWESSELL.

SCREW MAKING MACHINE.

No. 530,179. Patented Dec. 4, 1894.

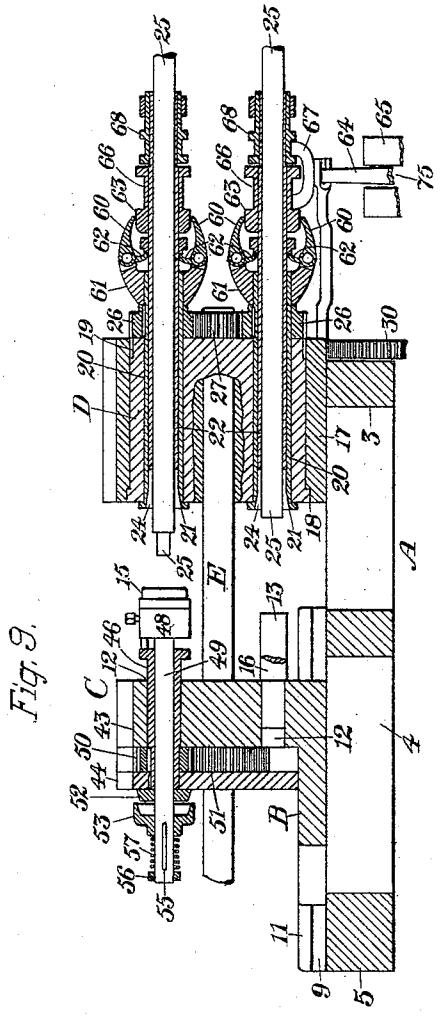

Fig. 9.

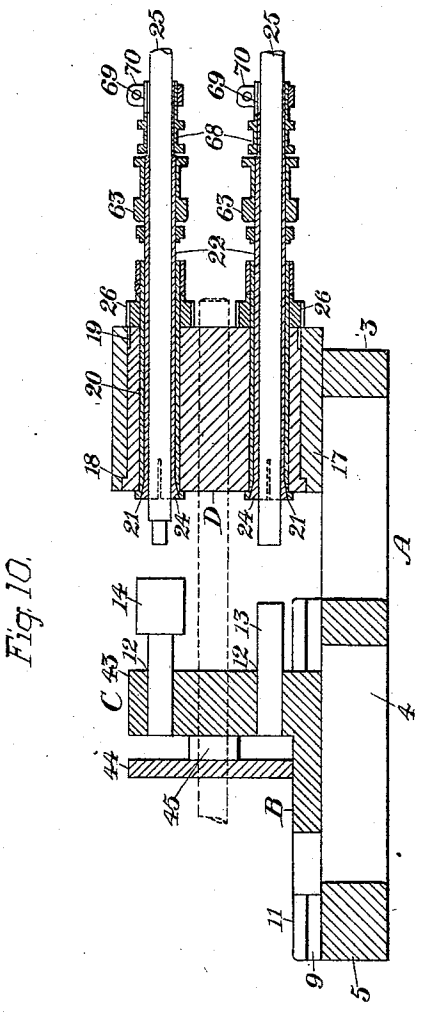

Fig. 10.

Witnesses:
John L. Edwards Jr.
Fred. J. Dole.

Inventor:
Reinhold Hakewessell,
By his Attorney,
F. H. Richards

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

UNITED STATES PATENT OFFICE.

REINHOLD HAKEWESSELL, OF HARTFORD, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO HIMSELF AND HORACE S. FULLER, NATHAN F. MILLER, AND WILLIAM J. GABB, OF SAME PLACE, AND EDWIN C. HENN, OF BLOOMFIELD, CONNECTICUT.

SCREW-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 530,179, dated December 4, 1894.

Application filed November 18, 1893. Serial No. 491,317. (No model.)

To all whom it may concern:

Be it known that I, REINHOLD HAKEWESSELL, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Screw-Making Machines, of which the following is a specification.

This invention relates to improvements in screw-making machines, the object of the invention being to produce a screw-making machine which will be automatic in its operation and of such construction and organization that a series of screw-rods may be operated upon simultaneously, but independently, by tools performing separate and distinct functions; also to provide means for automatically feeding or presenting each screw-rod of the series (after it has been operated upon by one tool) to the next adjacent tool and, successively, to the remaining tools of the series, whereby a plurality of screw-rods may be under-going separate and distinct operations simultaneously, and by such successive operations one screw be completed by each operation or complete movement of the machine.

Another important object of my present invention is to so construct the screw-threading die-mechanism that the screw-threading die may be screwed upon, and withdrawn from, the screw-rod, in the operation of cutting the thread without reversing or interrupting the movements of the driving-mechanism, or of the rod-carrying spindles, and thereby avoid the loss of time common to machines of ordinary construction wherein it is customary to cut the thread upon the screw-rod by a movement in one direction, and withdraw the screw-rod by unscrewing the same in the opposite direction, necessitating a reversal of the driving mechanism and requiring the same length of time to withdraw the cutting-die as to cut the thread.

With these objects in view, the invention consists in the organization of mechanism, and in the special construction of the several parts of the screw-making machine, as hereinafter more fully described and set forth in the claims.

In the drawings accompanying and forming a part of this specification, Figure 1 shows in side elevation, a screw-making machine embodying my present invention, said figure showing the parts in their normal or inactive position. Fig. 2 is a view similar to Fig. 1, showing the parts in the position they occupy when the screw-rods are being acted upon. Fig. 3 is a plan view of the machine, the several parts thereof being in the relative positions shown in Fig. 1. Figs. 4, 5 and 6 are vertical cross-sectional views of the machine taken in dotted lines *a*—*a*, *b*—*b* and *c*—*c*, respectively, Fig. 1, as seen from the left-hand in said figure, the legs of the machine being omitted. Fig. 7 is an end elevation of the machine as seen from the left-hand in Fig. 1. Fig. 8 is an end elevation of the machine, as seen from the right-hand in Fig. 1. Figs. 9 and 10 are vertical longitudinal sections of a portion of the machine taken in dotted lines *d*—*d* and *e*—*e*, respectively, Fig. 3.

Similar characters designate like parts in all the figures.

In the organization of this improved screw-making machine there are seven principal elements, namely—first, a sliding tool-carrier adapted for carrying a plurality of tools, one or more of which are revoluble therein; second, means for automatically feeding said tool-carriage and limiting the movement thereof with relation to the work, and for independently rotating one or more of said tools; third, an intermittently revoluble work-spindle-carrying head or turret having a series of longitudinally disposed spindle-holding sockets formed therein; fourth, a series of work-holding spindles or chucks revolubly supported in said turret; fifth, mechanism for imparting an intermittent rotary movement to said turret; sixth, means for independently rotating the work-holding spindles and the screw-rods held therein, and, seventh, for feeding mechanism for automatically feeding forward the screw-rods which are to be operated upon successively by the various tools of the machine.

The framework of the machine, which is designated in a general way by A, may be of

any form and construction suitable for carrying the several details of the mechanism. In the form thereof herein shown, it consists, essentially, of a bed comprising two side rails, 2 and 4, and end rails, 3 and 5, supported upon suitable legs; and the usual oil-pan, 7, located underneath the working parts of the machine, it being shown in the drawings as forming the base portion of the machine.

Formed in the side rails 2 and 4 of the machine, are longitudinal slide-ways, 8 and 9, fitted to which, and held in place by the usual straps, 10 and 11, is the longitudinally sliding tool-carriage B, having a tool-carrying head, C, at or near its forward end, as shown in Fig. 1. This head has formed therein a series of tool-carrying sockets, 12, arranged equi-distantly about a common center, and in which are supported (either fixedly or revolubly as will be hereinafter described) a series of screw-forming tools herein shown as four in number, and designated by 13, 14, 15, and 16, respectively.

The work-spindle-carrying head or "turret" D is revolubly supported in an upright bearing, 17, formed preferably integral with the bed of the machine near its forward end. This chuck-carrying head is flanged at its rear end as shown at 18 to fit an annular groove at the rear end of the bearing and prevent longitudinal displacement, and has secured to or formed upon its forward end concentric to the axis thereof, a spur, or driving-wheel, 19. Formed longitudinally through said turret D, are a series of sockets or bearings, in each of which sockets is journaled a tubular shaft, 20, which projects somewhat beyond the forward end thereof. This shaft is conically bored at its rear end, as shown at 21, and has loosely journaled therein a split chuck-sleeve or work-carrying spindle, 22, having its rearward end flared or conically flanged as shown at 24, to coincide with the conical bore 21 of the said tubular shaft 20. Through these spindles 22, are extended the screw-rods, 25, to be operated upon.

Keyed to each of the tubular shafts 20, as most clearly shown in Figs. 1, 2, and 8, is a pinion, 26, the axes of which pinions are equidistantly disposed with relation to a common center and are driven simultaneously by means of a gear-wheel, 27, secured to the forward end of the main driving shaft, E, of the machine; which shaft is journaled at its forward end in the work-carrying head or turret D, and at its rear end in a bearing, 28, secured to, or forming a part of the frame of the machine. Said shaft extends through the tool-carrying head as shown in the drawings, and is provided at its rear end with the usual driving pulley, 29.

In the construction of the spindle-carrying head D, the same may be adapted for carrying an indefinite number of work-spindles, and the tool-carrying head may be likewise constructed to carry an equal number of tools to operate upon the screw-rods carried by the said spindles. The number of work-carrying spindles and tools provided, will, of course, depend upon the form of screw it is desired to make. In the present instance, as shown in the drawings, the work-carrying head is provided with four screw-rod-holding spindles, which are adapted for independent rotation through the medium of the usual gearing shown, consisting of wheels 26, one for each spindle-chuck and a central wheel 27 upon the main shaft of the machine.

Through mechanism as hereinafter described, the work-carrying spindles have not only a rotary movement about their individual axes, but also have an intermittent rotary movement about a common axis. This intermittent orbital motion is imparted to the series of work-carrying spindles for the purpose of bringing the screw-rods carried by said spindles successively into axial alignment with, and in position for being operated upon by, the tools upon the tool-carrying head C. As a means for securing this intermittent orbital rotary motion to the work-carrying spindles about a common axis, a segmental gear-wheel, 30, is provided, which, as shown in the drawings, is carried upon the center shaft, 31, journaled in a bracketed bearing, 32, formed upon or secured to the lower portion of the frame of the machine. This segmental gear-wheel meshes with a spur-wheel 19 upon and intermittently rotates the work-carrying head D. The toothed segment or portion of said segmental wheel is of sufficient length to rotate the spur-wheel 19 and the connected head D approximately one-fourth of one revolution, and to allow said head to remain stationary the proper length of time for the tools to complete their operation upon the ends of the screw-rods. An ordinary locking-device will be provided, as hereinafter described, for engaging and locking the turret or work-carrying head in its successive operative positions. The extent of rotation of the turret head D and the length of time intervening between movements thereof will depend, as hereinbefore stated, upon the number of work-carrying spindles and tools employed.

Secured to the shaft 31, upon which the segmental gear-wheel is mounted, is a pinion, 33, which meshes with a gear-wheel, 34, upon the forward end of a cam-shaft, F. This cam-shaft is journaled in bearings at its either end in the framework, as shown in the drawings, and has at its rear end a worm-wheel, 35, which meshes with, and is driven by, a worm 36, upon a transverse worm-shaft, 37, journaled in bearings, 38, upon the rear end of the frame of the machine; said shaft 37 being provided with a suitable driving-pulley, 39, at one end thereof, whereby the cam-shaft may be actuated.

As a means for actuating and governing the movement of the sliding tool-carriage, a cam-wheel, 40, is provided which is secured to the cam-shaft F and has a cam-groove, 41,

formed in its periphery as shown. A stud, 42, secured at its upper end in the tool-carriage B, is provided to secure an operative connection between said cam and tool-carriage, which stud will preferably be provided with a friction roller at its lower end to enter the cam-groove 41 of the cam-wheel 40. This cam-wheel may be of any desired construction to give the required forward and return movements to the tool-carriage.

As shown in the drawings, the tool-head, in my present machine, will preferably be constructed in two pieces, *i. e.*—the forward or main portion, 43, secured to or formed a part integral with the tool-carriage, and the back-plate, 44, secured to the tool-head by means of suitable screws, a series of blocks, 45, being interposed between said plate and tool-head to leave sufficient space between said head and back plate for the interposition of tool-driving mechanism. These spacing-blocks 45 are herein shown as three in number, they being held in place by means of the screws 44′ as shown.

To accomplish one of the chief objects of my present invention, which is to provide for the release of the screw-cutting die from the end of the screw-rod after the thread has been cut and without reversing the operation of the driving-mechanism or other parts, I have provided means for rotating the screw-cutting die, (or dies, if more than one be employed) as well as means for rotating the screw-rod being operated upon by said die. For this purpose I have provided a sleeve or tubular shaft, 46, which is supported in the socket in the tool-carrying head and extends through both parts 43 and 44, respectively. This shaft is provided at its forward end with one member of a "pull-off" or pin clutch-device to engage the other member of a like clutch-device upon the die-carrying head, 48; which die-carrying head is secured to a die-spindle, 49, revolubly supported in the said sleeve or shaft 46. Secured to the spindle-driving shaft 46, between the front and back plates 43 and 44 of the tool-carrying head, is a pinion, 50, which meshes with and is driven from the gear wheel 51, splined to the main shaft E of the machine, as most clearly shown in Figs. 2 and 9. Said splined connection between the gear-wheel 51 and shaft E permits said gear-wheel to be revolved with the shaft and also permits a movement longitudinally of said shaft during the reciprocation of the tool-carriage B. Secured to, or formed upon, the rear face of the back-plate 44, of the tool-head, concentric to the tool-carrying spindle, is a bevel-face annular projection, 52, which constitutes one member of a friction-clutch or brake, the other member of which consists of a collar, 53, conically bored at its forward end to correspond with and fit the brake-member 52. This brake-member 53 is secured to the spindle 49 preferably by means of a pin 54, extended through an elongated slot, 55, formed longitudinally in said spindle near its rear end, and is adapted for longitudinal movement upon said spindle, the pin 54 and slot limiting the movement thereof. Screwed upon the rear end of the spindle is a nut, 56, and interposed between said nut and brake-member 53 is a spiral spring, 57, the function of which spring is to throw the brake-member 53 forward upon the spindle in position to engage the brake-member 52 during the backward movement of the tool-carriage, thus "breaking" the die-spindle against rotation, which, in consequence of the continued rotation of the screw-rod it is acting upon, will cause said die to be unscrewed therefrom, as will be hereinafter more clearly described. Instead of this friction-brake or -clutch, a toothed clutch may if preferred be employed. This organization and construction of the die-actuating mechanism accomplishes a result of material importance in machines of this class, in that it permits the unscrewing of the screw-cutting die from the shank of the screw without reversing the driving mechanism, it simply being necessary to rotate the screw-rods at one speed and the die at a greater speed in the same direction.

With my machine, in practice, the screw-rod to be operated upon by the screw-cutting die will be rotated by means of the gearing before described in the direction of the arrow shown in Fig. 5, and the die-carrying spindle 49 which is to operate upon the end of said rod, is rotated by means of its gearing in the same direction as shown by the arrow in Fig. 5, but at considerably greater speed than the screw-rod. The difference between these two speeds constitutes the effective cutting speed of the die, which may by this means be made very slow, as required for making steel screws.

In the operation of the machine, the screw-cutting die will be so set with relation to the work and with relation of the movement of the tool-carriage, that in cutting the thread the die-carrying head 48 will be released or "drawn off" from the tubular shaft by the retractive movement of the carriage B at the completion of the cutting of the screw, which will bring the two clutch-members 52 and 53 at the rear end of the spindle into frictional engagement, (or locking engagement, as the case may be) thus stopping the rotation of the die, which, in consequence of the rectracting stress of the spring 57, will be unscrewed from the rod and will resume its operative engagement with the shaft 46, whereby it is rotated, the parts at this time assuming the position shown in Fig. 9.

It is not desired to limit this invention to the exact construction and organization of tool-mechanism or rod-carrying mechanism shown in the drawings, as for instance, it might sometimes be desirable to hold the rods fixedly with relation to the tools operating thereon, as when making rivets and similar articles, in which case it might be desirable

to rotate all of the series of tools instead of one as hereinbefore described.

In the drawings I have illustrated one form of clutch-mechanism for operating the work-holding chucking-spindles to grasp the rods, and means for automatically feeding the wires into position to be operated upon by the several tools. Briefly stated, this mechanism consists of a set of elbow-levers, 60, 60, pivoted upon a collar, 61, secured to the forward end of the tubular shaft 20 journaled in the turret head D. These levers have two inwardly extending arms, 62, 62, so disposed with relation to the levers 60 as to be thrown forward as said levers are pressed outward. These arms 62, 62, bear at their inner ends against the rear face of a flange upon the rear end of the chuck-sleeve or work-spindle 22 and are adapted, (as the levers 60 are thrown outward) to move the spindle forward, bringing its inclined or conical-faced rearward end against the conically bored rearward end of the tubular shaft which compresses the spindle and grasps the screw-rod therein, as will be clearly apparent by reference to Figs. 9 and 10 of the drawings. As a means for spreading the levers 60 of the clutch to actuate the spindle and grasp the rod, a frustro-conical hub, 63, is loosely journaled upon the forward end of the work-spindle 22 slightly in advance of said levers, which hub is moved endwise upon said spindle at the proper time for releasing from and engaging with the spindle and the screw-rod, by means of the shipper-lever, 64, which is actuated by a cam, 65, secured to the counter-shaft 31 as will be hereinafter more fully explained. The hub 63 has an annular groove, 66, of sufficient length to receive and permit free longitudinal movement of one arm of the bifurcated or forked end, 67, of the shipper-lever 64, for the purpose hereinafter set forth. Secured to the extreme rear end of the work-spindle 22 is a grooved collar, 68, having its end divided longitudinally as shown at 69, and adapted to be compressed to impinge the spindle 22, which being slit at this end, will in turn impinge the screw-rod. This collet has projections, 70, at one side through which is extended a lag-screw or bolt, 71, by means of which the impinging pressure of the spindle upon the screw-rod may be regulated. The forked shipper-lever has one of its arms extended into the annular groove of the collar 68 and is adapted to move the same longitudinally upon the spindle, as and for the purpose hereinafter set forth. The operation of this clutch-mechanism is as follows: After the finished screw has been cut off by means of the cutter hereinafter described, and at the time the work-carrying head D has been revolved to the position to bring the next adjacent rod to the action of the cutter, and while said cutter is acting upon the next adjacent rod, the shipper-rod is shifted to the right hand which first acts upon the collar 68 to shift the collar longitudinally upon the rod a short distance without disturbing the position of the work-spindle or rod impinged thereby. After the shipper-rod has been moved to the right-hand the length of the annular groove in the hub 63, it then acts upon the forward flange of said hub, withdrawing the same from between the levers 60 which releases the spindle from impingement with the rod at the rear end and permits the said rod upon the reverse motion of the shipper-lever to be fed rearward the requisite distance, and in position to be operated upon by the successive tools, the retractive movement of said shipper-lever first acting to feed the screw-rod as described, and after the said rod has reached its proper position, to shift the hub 63 to the position shown in Fig. 9, spreading the levers 60 of the clutch which throws the clutch-sleeve backward and again impinges the screw-rod at its rear end.

In the drawings, the cam 65 for operating the shipper-lever, is shown as having the cam-groove, 75, in which the lower end of the shipper-lever travels, said shipper-lever being preferably bifurcated at this end as shown in dotted lines in Fig. 8. It is obvious that any suitable device might be employed for operating this clutch-mechanism just described without departing from my invention.

In the drawings I have shown one form of cut-off device designated in a general way by G, it consisting of a transversely sliding tool-carrier, 77, supported on ways secured to or formed upon the bed of the machine, and a cutting-tool, 78, adjustably secured in said tool-carrier, as most clearly shown in Fig. 5. As a means for automatically feeding said cut-off tool to the work, I have provided a lever, 79, fulcrumed intermediate to its ends to a stud, 80, secured to the side-rail of the bed of the machine. The upper end of this rod is longitudinally slotted and engages a projection or pin upon the inner end of the tool-carrier, the lower end of said lever 79 engaging the cam-face of a cam, 81, secured to the cam-shaft F, which cam-shaft is of a construction to throw the upper end of the lever 79 inward at the proper time to feed the cut-off tool to the work, a spiral spring, 83, being provided as clearly shown in Fig. 5, to retain the lower end of the tool-slide actuating-lever in contact with said cam, the said spring being connected at one end to the lever below its fulcrum point, and at its opposite end to a pin 84 or other suitable device secured to the opposite side of the frame.

The turret or work-carrying head D has formed in its periphery a series of lock-notches, 85, adapted to be engaged by a lock-bolt, 86, to lock the said head in its successive positions and with its screw-rods in position to be operated upon by the several tools. This locking mechanism consists preferably of the bolt 86 carried in a sleeve or barrel, 87, secured to the under side of the

bearing 17 as shown most clearly in Fig. 6. This sliding bolt 86 has a reduced extension, or shank, 88, which extends through the sleeve 87 and has a flange at its lower end to be engaged by the arm, 89, of a bell-cranked lever, pivoted to the framework of the machine. The opposite arm, 90, of said lever will preferably be provided with a friction roller at its extreme end which engages the cam-face of a lock-bolt-actuating-cam, 91, secured to the cam-shaft F. A spring, 92, is interposed between the lower face of the lock-bolt and the bottom wall of the sleeve and acts to retain the friction roller of the bell-crank arm 90 in engagement with the cam 91.

It will be understood that the lock-bolt actuating cam and cut-off cam will be of such construction and so timed in their movements with relation to the movements of the work-carrying head D as to lock the said head in its successive positions at the proper time and to throw the cut-off tool into operation while said turret head is so locked, also that the cam which actuates the clutch-mechanism to cause the releasing, feeding and re-grasping of the screw-rod will also be timed in its movements with relation to the work-carrying head-actuating mechanism as to feed the rod into position to be acted upon by the different tools immediately after the said rod has been cut off by the cutting-off tool.

The general operation of my screw-making machine is as follows: The rods 25 having been inserted into and through the work-carrying spindles 22, and said spindles having been firmly clamped thereto at the rear ends thereof by means of the clutch-device as hereinbefore described, and the several parts of the machine being in the position shown in Fig. 2 of the drawings, power is applied to pulleys 29 and 39 of the main shaft E and cam-shaft F, respectively, to cause said shafts to revolve at the proper relative speeds. The cam 91 first acts to disengage the lock-bolt 86 from the lock-bolt-notch in the work-carrying head D, after which the segmental gear-wheel 30 in mesh with the spur-wheel 19 upon the said head D, acts to revolve said head in the direction indicated by arrow in Fig. 5, the main shaft E in the meantime rotating the work-carrying spindles and the screw-threading die independently about their individual axes at their proper relative speeds in the same direction as indicated by the arrows in Figs. 4 and 5, the said head being in this operation rotated about its axis a distance equal to the angular distance between two of the rod-carrying spindles. When this motion is completed, the lock-bolt is immediately thrown upward into the notch 85 through the medium of the lock-bolt actuating-lever, its spring and cam, which locks the head D against further movement about its axis until the shaft F has rotated the cam-wheel 91 sufficiently far to bring its eccentric portion into engagement with said lock-actuating lever. This rotation of the work-carrying head D brings one of the screw-rods in position to be fed forward by means of the clutch-mechanism a distance equal to the length of screw it is desired to make, the cam 65 acting at this time to shift the shipper-rod 64 which as before described, slides the hub 63 and sleeve of the clutch-mechanism toward the right, and then toward the left to release the rod, feed forward and re-grasp the same as hereinbefore set forth, leaving the rod projecting the proper distance beyond the rear face of the turret-head to be acted upon by the successive tools of the machine during the successive movements of the said head. After the rod has been positioned, the segmental gear-wheel again acts to rotate the work-carrying head to bring the rod so positioned into alignment with the next adjacent tool, which in this instance will be the shaping-tool. After the rod has reached this position, the tool carriage is fed forward through the medium of its cam which brings the tools into engagement with the several rods carried by the head D.

In practice, the majority of the tools will have a slight "lead" over, or extend slightly in advance, of the screw-threading die, which lead will practically be the distance of movement of the die-head necessary for disengaging or "drawing-off" said head from its driving shaft which may be more or less according to the clutch-devices employed therewith. The object of this is to permit the screw-threading die, which rotates in the same direction as the screw-rod, but with an increased speed, to continue its cutting-movement a short period after the tool-carrying head-actuating-cam has reversed the movement of the tool-carriage, the reverse or backward movement of said carriage carrying the die-shaft with it, releasing the die-head from operative engagement with said shaft, and at the same time bringing the brake-members upon the spindle into frictional engagement and at once stopping the rotary movement of the die-head, which will then be withdrawn or unscrewed from the screw-rod in consequence of the continued rotation of the screw-rod, backward movement of the tool-slide, and inactivity of said die-head; this action taking place without reversing the driving-mechanism and during the time the tool-carriage is assuming its former or normal position.

It will be seen that by the use of my improvement, material advantages are attained, in that a series of screw-rods are successively operated upon to complete the screw by a series of successive tools, simultaneously, obviating the necessity of several distinct and independent operations upon a single screw as heretofore common in screw-making machines of ordinary construction.

Having thus described my invention, I claim—

1. In a screw-making machine, the combina-

tion with the frame-work, of the revoluble chuck-carrying head supported in a bearing at one end of the frame, the main shaft revolubly-supported at one end in said head and at its opposite end in a bearing upon the frame, a series of work-carrying spindles revolubly-supported in tubular shafts in said head, means for intermittently rotating the head upon the shaft, means for simultaneously rotating the spindles upon their own axes, a tool-carrier constructed and adapted to be moved toward the work-carrying spindles alternately with each intermittent movement of the revoluble head, a die-carrying spindle revolubly supported and adapted for longitudinal movement in a tubular shaft journaled in the tool-carrier, mechanism for continuously rotating the die carrier shaft, and two oppositely-operable clutch-devices located at opposite ends of the die-spindle and adapted for alternate operation whereby upon the advancing movement of the tool-carrier the die-spindle is rotated with its shaft and upon the retractive movement of said tool-carrier the die-spindle is locked against rotation, substantially as described and for the purpose set forth.

2. In a screw-making machine, in combination, a revoluble spindle-carrying head supported in a suitable bearing, a gear-wheel secured to, or formed a part of said head, a series of work-carrying spindles revolubly mounted in said head, mechanism for simultaneously rotating said spindles, a gear-segment meshing with the gear-wheel of said head and adapted for intermittently rotating the same to bring the spindles thereof successively into alignment with the screw-forming tools of the tool-carrier, mechanism for driving said gear-segment, a locking-device for intermittently locking and releasing said head between successive rotations, a sliding tool-carrier carrying a series of screw-forming tools in position for engagement with the work carried by the spindles, means for moving said tool-carrier toward and from the spindle-carrying head, and means for rotating one of said tools in the tool-carrier, substantially as described and for the purpose set forth.

3. In a screw-making machine, the combination with framework, of the revoluble chuck-carrying head D supported in a bearing at one end of the frame, the main shaft E revolubly supported at one end in said head and at its opposite end in a bearing upon the frame, work-carrying spindles revolubly supported in tubular shafts journaled in the work-carrying head; pinions secured to said shafts which mesh with a gear-wheel secured to the main shaft, means for intermittently rotating the work-supporting head about its axis, a locking-device therefor, a sliding tool-carrying head intermediate to the two bearings of the main shaft, a die-carrying spindle revolubly supported in a tubular shaft journaled in said carrier, a pinion secured to said spindle-carrying shaft, a driving-wheel therefor secured to and adapted for longitudinal movement upon the main shaft, means for moving the tool-carrier toward and from the head D and for locking the die-carrying spindle against rotation during the backward movement of said carrier, substantially as and for the purpose set forth.

4. In a screw-making machine, the combination with the intermittently revoluble work-spindle head D having a series of work-carrying spindles revolubly supported therein and having a peripherally disposed gear-wheel and peripheral lock-notches, of the gear-segment 30 meshing with the gear-wheel of the said head and constructed for intermittently rotating said head about its axis, substantially as described, mechanism for rotating said gear-segment, and a spring-actuated lock-bolt adapted to engage the lock-notches in the said head to lock the same against rotation, and a cam for intermittently and automatically actuating said lock-bolt, substantially as and for the purpose set forth.

5. In a screw-making machine, the combination with the framework, of the main horizontal shaft E supported at its ends as described, the cam-shaft F, the sliding tool-carriage having the vertical tool-head, a series of tools carried by said tool-head, mechanism for imparting a forward and return movement to said tool-carriage, a revoluble work-carrying head having remotely disposed peripheral lock-notches therein, and having a gear-wheel fixed thereto or formed a part thereof, substantially as set forth, the gear-segment 30 in mesh with said gear-wheel and adapted for intermittently rotating said wheel, a lock-bolt adapted to engage the notches of the work-carrying head, a lock-bolt-actuator and a cam secured to the cam-shaft and engaging said actuator to operate the bolt, a series of work-carrying spindles revolubly supported in the work-carrying head, gearing connecting said spindles with the main shaft for rotating the same, and work-feeding and holding devices in engagement with said spindles all constructed and arranged, substantially as and for the purpose set forth.

6. In a screw-making machine, the combination of a sliding tool-carrier head and a revoluble work-carrying head adjustable one with relation to the other, a longitudinally movable and intermittently revoluble die or tap-carrying spindle carried in a tubular shaft revolubly supported in said head, a main shaft, gearing connecting said main shaft with, and adapted for rotating said tubular shaft and spindle, a pin-clutch interposed between the spindle-head and tubular shaft, mechanism for sliding the tool-carrying head toward and from the work-carrying head, a brake-device connected with the die-spindle operative to lock said spindle against rotation during the backward movement of the head,

a series of work-carrying spindles revolubly supported in the work-carrying head, mechanism for rotating said spindles through the action of the main shaft, a gear-wheel connected with the work-carrying head, a gear-segment in mesh with said gear-wheel and adapted for intermittently rotating said head, a cam-actuated lock-bolt adapted to engage and lock the head in its successive positions, a lock-bolt-actuator and a cam secured upon the cam-shaft journaled in the frame, which cam-shaft engages said bolt-actuator and intermittently retracts the bolt from its locked-engagement with the work-carrying head, substantially as and for the purpose described.

REINHOLD HAKEWESSELL.

Witnesses:
FRED. J. DOLE,
JOHN L. EDWARDS, Jr.