(No Model.) 3 Sheets—Sheet 1.

# C. D. ROGERS.

## SCREW SWAGING MACHINE.

No. 408,673. Patented Aug. 6, 1889.

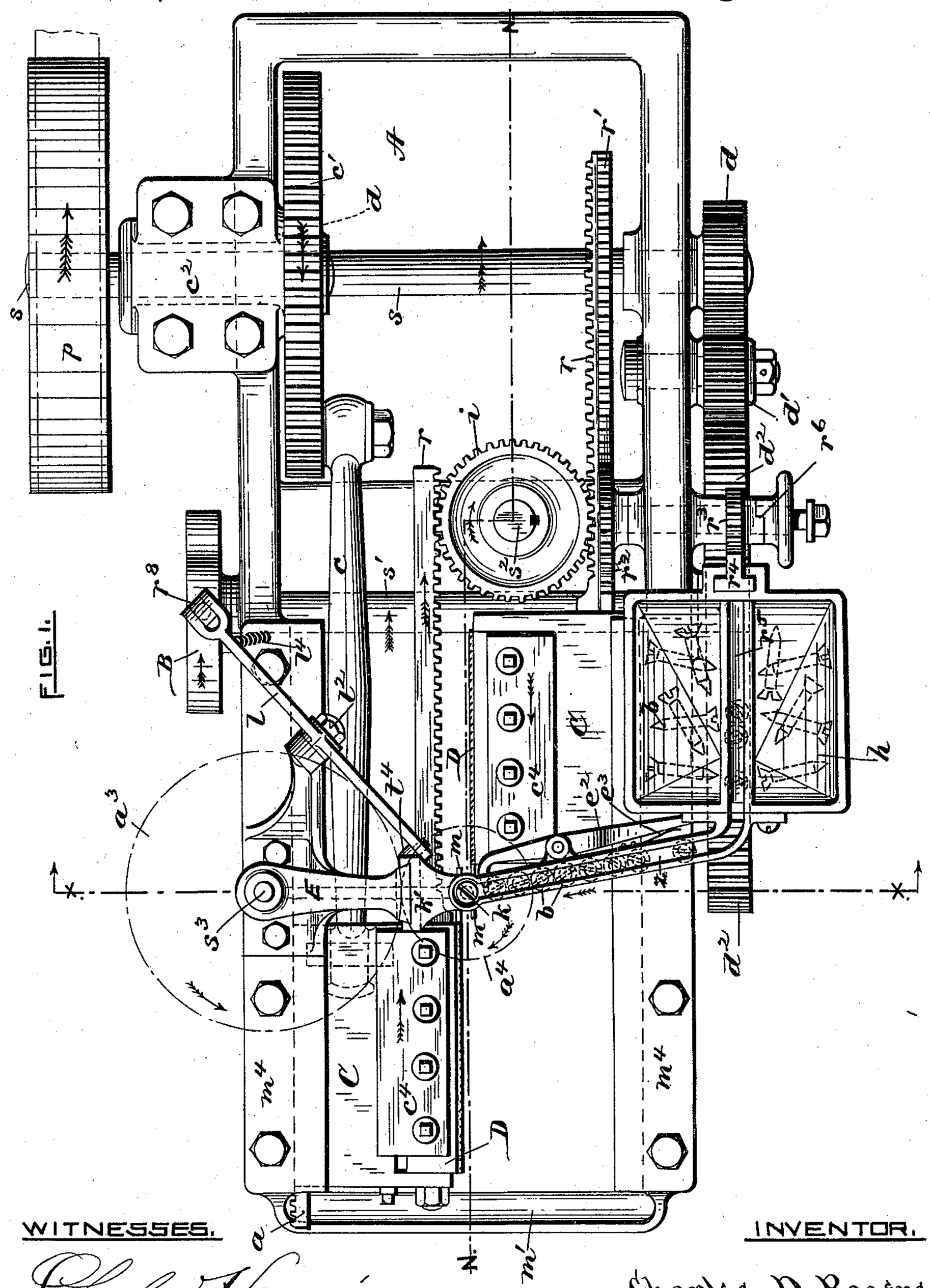

FIG. 1.

WITNESSES.

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## SCREW SWAGING MACHINE.

No. 408,673. Patented Aug. 6, 1889.

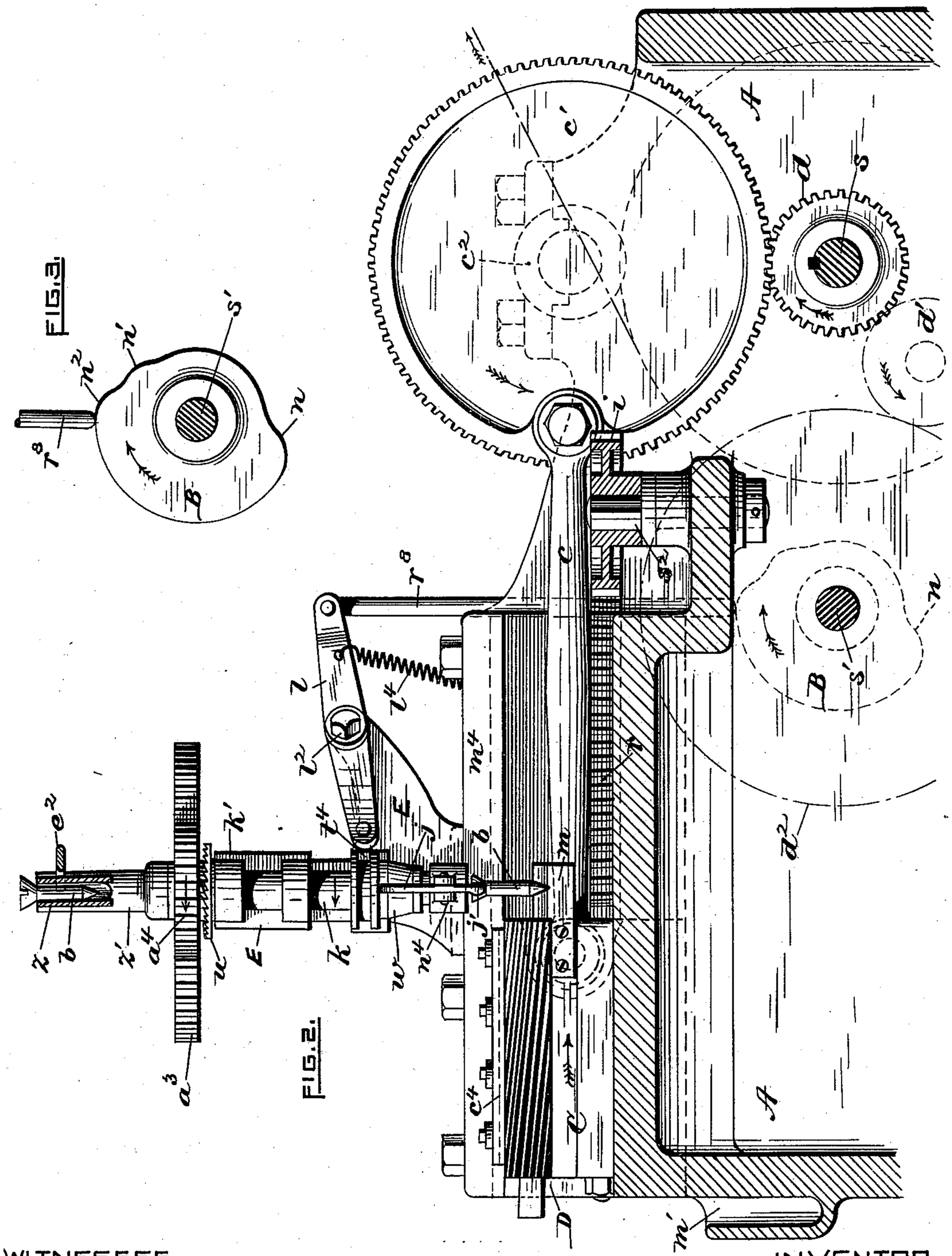

FIG. 2.



FIG. 3.

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(No Model.) 3 Sheets—Sheet 3.

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## SCREW SWAGING MACHINE.

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FIG. 7.

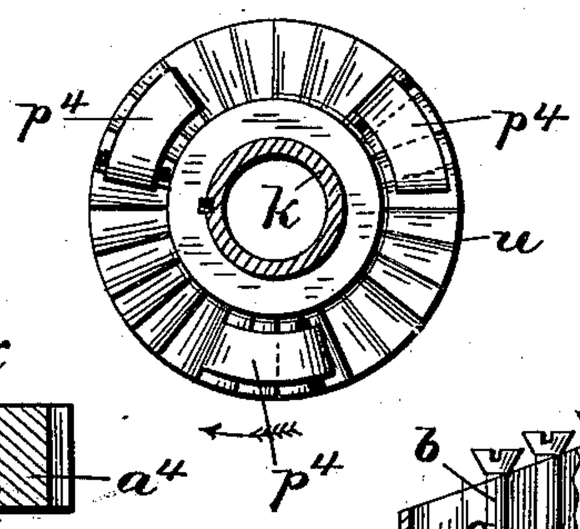


FIG. 6.







FIG. 5.

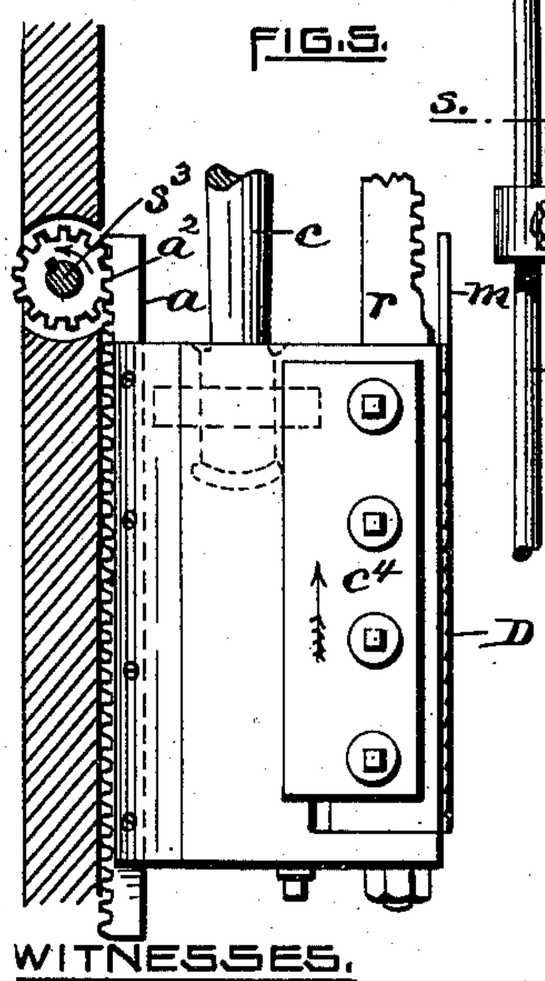


FIG. 4.

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# UNITED STATES PATENT OFFICE.

CHARLES D. ROGERS, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO THE AMERICAN SCREW COMPANY, OF SAME PLACE.

## SCREW-SWAGING MACHINE.

SPECIFICATION forming part of Letters Patent No. 408,673, dated August 6, 1889.

Application filed December 11, 1888. Serial No. 293,269. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES D. ROGERS, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Screw-Threading Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

In the operation of forming screw-threads upon wood-screws by the rolling process, as heretofore practiced—that is, by means of traveling threading-dies having oblique grooves formed in their working-faces—it occasionally happens that the blanks, while being acted upon by the threading-dies, fail to turn properly upon their axes—that is, in unison with the traveling dies—the screws in such case being imperfect, if not altogether worthless. In some instances the blanks fail to continue to turn after the first revolution or two, thereby choking the dies. Besides the objection just named (*i. e.*, a lack of means for positively revolving the blanks) the dies themselves are, by reason of such lack of revolving device, subject to excessive strains, which sometimes produce fractures. At the same time the work or power necessary to actuate the machine is greatly augmented. The object I have in view is to overcome the disadvantages and objection to such former methods, whereby the product of the machine will be practically uniform in quality, while the quantity of screws turned out by a machine possessing my improvement will be greatly increased.

Another feature to be considered in rolling screws, particularly when the threads are produced wholly by a lateral outward flow of the metal instead of by elongation, is that the surface of the blank while being acted upon by the threading-dies must, as the rolling progresses and the thread enlarges, revolve more slowly, owing to the gradually-increasing diameter of the thread, which, when completed, considerably exceeds the normal size of the wire—that is to say, in a screw of this character, suppose the same to have ten threads per inch, the normal circumference of the blank being one inch and the outer circumference of the blank when threaded being one and one-tenth inch. In the production of such a screw, wherein both swaging-dies travel to and fro simultaneously or at the same rate of movement, it is evident that whereas the dies in the first inch of their travel will revolve the blank (assuming it does not slip) one complete turn or one inch circumferentially, the last inch of the dies will produce only a partial revolution of the screw, owing to the increased diameter of the raised screw-threads.

As before stated, the object of my present improvements is to provide means for insuring the turning of a screw-blank without slipping during its passage through the dies. If the screws to be produced are to have threads raised above the normal surface of the blank—that is, screw-threads whose diameter exceeds that of the blank itself before threading—I proportion the blank holding and revolving mechanism so that it will revolve the blank at a minimum rate of speed, the same corresponding to that due to the action of the dies at the completion of their work. From this it will be seen that the mechanism for holding and revolving the blank in no wise prevents the reciprocating dies from acting freely upon the blank throughout the stroke, it being understood that the dies themselves act to revolve the blank slightly in advance of the action of the said blank-holding mechanism, this mechanism being employed solely to insure the rotary movement of the blank, and it is not called into play unless the blank becomes momentarily retarded in its axial movement. In some cases this characteristic of the gradual enlargement of the screw-thread and the consequent diminishing rate in the revolution of the blanks during the operation of rolling screw-threads on them is not apparent, or, at least, only in a slight degree, when the reduction of the blank laterally is transferred to a longitudinal direction.

My improvements consist, essentially, of an automatically-operating clamping or gripping device, which seizes the blanks singly and positively revolves them while being threaded during their passage between the dies, the rate of travel of the surface of the screw being nearly or quite coincident with that of the threading-dies. In case the screws are to have threads which exceed the normal size of the wire or unthreaded portion of the screw, I provide the gripping mechanism with a ratchet-like arrangement, which not only insures a positive rotary movement to the screw, but also permits the screw, &c., to revolve independently of the driving arrangement before and as the metal commences to flow radially beyond the normal size of the wire.

In the annexed three sheets of drawings, illustrating my invention, Figure 1, Sheet 1, represents a plan view of a machine adapted to produce threads upon wood-screws by the rolling process and embodying my present improvements. Fig. 2, Sheet 2, is a longitudinal sectional view taken on the irregular line N N of Fig. 1. Fig. 3 is a detail view of a cam adapted to actuate the blank-holding jaws. Fig. 4, Sheet 3, is a transverse sectional view taken on line *x x* of Fig. 1. Fig. 5 is a horizontal sectional view taken on the plane of *s s*, Fig. 4, showing an arrangement for revolving the holding-jaws. Fig. 6 is an enlarged vertical sectional view showing some of the spindle-driving mechanism more in detail; and Fig. 7 is a cross-sectional view of the hollow spindle, to which is secured a ratchet-plate. It also shows the driving-pawls detached from the loosely-mounted driving-gear.

The following is a more detailed description of my improved machine:

In the drawings, A designates the frame or bed in which the several parts of the machine are mounted.

D D indicate the screw-threading dies, the same having a series of oblique grooves and ribs formed in the working-face thereof, arranged to produce threads upon the surface of the screw-blanks *b*. The dies are oppositely arranged and secured in die-holders or cross-heads C, mounted to reciprocate in ways formed in the bed A. The mechanism or driving arrangement for simultaneously operating the dies, as shown in the drawings, is substantially the same as described and claimed in United States Patent No. 389,168, granted to me September 4, 1888. The arrangement, briefly stated, is as follows: To the main driving-shaft *s* is secured a small gear *d*, which engages a large gear *c'*, secured to a shaft mounted in a bearing $c^2$. To the gear *c'* is jointed a connecting-rod *c*, jointed in turn to the cross-head C, by means of which the latter is given a reciprocating movement. By means of a rack *r*, secured to and extending from the front end of each cross-head, and the loosely-mounted gear-wheel *i*, engaging both of said racks, (see Fig. 1,) the two dies are forced to simultaneously travel in opposite directions.

The feeding device is substantially like that shown in the patent above referred to— that is, one of the rack-rods *r* is provided on its top with another series of teeth *r'*, which mesh into a wheel $r^2$, secured to a short shaft, on which is also mounted a clutch-gear $r^3$, meshing into the vertically-guided rod $r^4$, having a pick-up blade $r^5$ secured thereto and fitted to travel up and down in the stationary blank-carrying hopper *h*, from which, by means of a track or runway Z, (see Fig. 1, &c.,) the blanks are conducted to the hollow spindle *k*, &c., about to be described.

The essential feature of my present invention resides in positively revolving the blank while the screw-thread is being formed on its surface, thereby preventing the blank from sliding. A means for thus revolving the blanks is shown in the annexed drawings, a description of which is as follows:

A hollow spindle *k* is vertically mounted to revolve directly over the center of the space formed by the separation of the dies, Fig. 1, the same being supported in bearings *k'*, adjustably secured to an upright frame E, secured to the bed of the machine. The upper end of the spindle is fitted into the lower end of the runway Z, the latter at this point being tubular and coinciding with the mouth of the spindle. Intermediate of the upper bearing *k'* and said portion of the runway the spindle is provided with a loosely-mounted gear-wheel $a^4$, which is driven by a larger gear $a^3$, secured to the upper end of a vertically-mounted shaft $s^3$, having a pinion $a^2$ secured to its lower end, which in turn is actuated by a rack *a*, attached to a cross-head C, (see Figs. 4 and 5,) the relative proportion of the gearing being such as to revolve the blank one turn while each of the dies is traveling a distance equal to the circumference of the blank, or, in other words, the rate of travel of the surfaces of the screw and dies is the same.

In addition to the loosely-mounted gear $a^4$ the spindle is provided with a ratchet-toothed plate *u*, keyed thereon in proximity to the gear. The latter is recessed to receive a series of pivoted pawls $p^4$, (three being shown in the drawings,) which engage the teeth of said plate *u*, the pawls being so arranged that only a very slight angular movement of the gear will insure the contact of one or another of them with a ratchet-tooth. By this arrangement it is apparent that the spindle is revolved only during the forward travel of the die, the pawls upon the return-stroke passing over the ratchet-teeth. Springs $p^5$, Fig. 6, assist in dropping the pawls. Another advantage resulting from said arrangements is that the axial movement of the screw while being properly acted upon by and between the dies causes the hollow spindle to revolve independently and in advance of the said driving-gear $a^4$.

To the lower end of the hollow spindle is secured a head $w^2$, having oppositely-arranged ears or projections $n^4$, to which are pivoted the holding-jaws $j$, the latter having the lower portions $j'$, adapted to seize a blank by its head and firmly retain it between them while the blank is being subjected to the action of the threading-dies. The upper ends of the jaws engage the surface of a cone-shaped clutch $w$, which is fitted to move up and down on the spindle. The clutch is made to revolve in unison with the spindle by means of a feather or key fitted into the spindle. A cam B, secured to the driven shaft $s'$, in connection with a rod $r^8$ and the pivoted clutch-lever $l$, jointed to the rod, affords means for automatically opening and closing the jaws at regular intervals, the shape of the cam and its position on the shaft being so timed that the jaws are first opened to release the screw, followed by their partial closing to receive a blank from the runway, the cam then finally acting to cause the jaws to firmly grip the blank.

The checking device as drawn, Fig. 4, consists of a pivoted lever $e^2$, having one end thereof in engagement with a cam-shaped extension $r^7$, secured to the pick-up blade mounted in the hopper $h$. The other end of the lever is bent and passes through the side of the runway near the entrance to the tubular outlet $z'$. The bent end of the lever holds the column of blanks in check; but at the proper time, by reason of the traveling cam $r^7$, the lever is withdrawn from the blanks, thereby permitting one of them to pass into the spindle $k$ by gravity, there to be received by the jaws, as just stated. A spring $e^3$, Fig. 1, acts to quickly return the lever to its normal position.

Now, assuming the dies D to be suitably mounted, the joint operation of the several mechanisms in screw-threading a blank $b$ is substantially as follows: The blank is first discharged from the column, from whence it drops down through the now stationary spindle $k$ and past the ends $j'$ of the jaws until arrested by them under its head, and at the point also by the oppositely-beveled supporting guide-plates $m$, secured to the front ends of the dies, Figs. 2 and 4, the threading-dies then being near the end of the back-stroke. The blank is next firmly clamped in the jaws by the movement of the cam-surface $n^2$ immediately preceding the termination of the back-stroke. As the dies begin to advance toward each other, the rack $a$ causes the spindle (and with it the blank) to revolve substantially in unison with the die movement. The dies upon reaching the blank immediately commence to act upon it to form the screw-thread, the blank meanwhile being positively revolved, and so continuing throughout the entire stroke. If, however, the radial enlargement of the thread when finished extends much beyond the wire or unthreaded portion of the screw, the blank at the commencement of the stroke will seek to travel correspondingly faster than the spindle, which is driven at the rate of revolution of the blank when its threads are formed, the rate of axial travel of the blank gradually decreasing from the commencement of the enlargement of the thread to its completion. This feature of the rolling operation is mainly provided for and accomplished by means of the loosely-mounted pawl-carrying gear $a^4$ and the ratchet-disk $u$, keyed to the spindle.

I would state here that in order to produce screws of this kind—that is, screws having enlarged screw-threads—I prefer to make the proportion of the gear-train which actuates the spindle $k$ such that the latter will be revolved at a rate of speed corresponding to the decreased or minimum rotation of the blank, as just stated, or, in other words, the spindle is geared to revolve at a little less speed than the dies would impart. By this arrangement the work of the dies D in threading the screw not only revolves the blank upon its axis, but with it also the spindle, which latter for the time being travels in advance of the revolving gear $a^4$, the relative speeds of the blank and gear becoming coincident just preceding the end of the threading-stroke.

In case the blank in its passage through the dies should become momentarily retarded from any cause, a pawl $p^4$ of the continuously-revolving gear acts instantly to correct the error or irregularity in the blank's movement by causing the movement of the gear and spindle to become coincident for the time being.

Just before the termination of the forward or threading stroke the cam B in its revolution carries the portion $n$ thereof around to engage the end of the rod $r^8$, which, in connection with the spring $l^4$, acts to elevate the clutch $w$, thereby opening the jaws and releasing the now threaded screw, which then falls through an opening $o^2$ formed in the bed (see Fig. 4) into any receptacle placed beneath. The dies complete the forward stroke and return to the normal position ready to again advance to thread a screw, the jaws meanwhile remaining open. Just prior to the end of said return-stroke, and as the dies pass each other, the checking-lever $e^2$ releases a blank $b$ from the track or runway $z$. If desired, the runway may be provided with a stop actuated by said lever, arranged to be inserted transversely at the rear of the forward blank simultaneously with the withdrawal of the end of the lever $e^2$ from the front of the blank, thereby holding the column of blanks in check until the released blank is discharged from the runway and the checking-lever $e^2$ again returns to its normal position, when the blank immediately falls through the vertical hollow spindle, the point of the blank engaging and resting upon the inclined edges of the bars $m$, secured to the dies. The cam-surface $n^2$ causes the complete closing of the jaws upon the head of the blank at about

the same time that the dies reach the end of the stroke.

In order to effect a positive movement of the clutch-lever *l*, the cam B may be provided with a cam-shaped groove adapted to receive a truck-roll mounted on the end of the rod $r^8$.

In case the screws to be produced are to have the screw-thread of substantially the same diameter as the wire or unthreaded portion, the ratchet-plate *u* and pawls $p^4$ may be dispensed with and the small gear $a^4$ be directly secured to the hollow spindle *k*. In this event it is obvious that the screws elongate somewhat during the threading operation. To provide for the lengthening of the screws, the spindle and its parts may be fitted somewhat loosely, so as to permit of a corresponding vertical movement.

I claim as my invention—

1. The combination, with reciprocating swaging-dies which roll threads upon a screw-blank by rotating it between them and expanding the metal radially, of a revolving blank-carrying spindle and mechanism, substantially as described, which permits the spindle to be independently revolved by the action of said swaging-dies upon the blank, substantially as hereinbefore set forth.

2. In a screw-swaging machine, the combination, with swaging-dies for rolling threads upon a screw-blank, of a revolving blank-carrying spindle provided with a pawl-and-ratchet gearing which permits the spindle to be revolved by the action of said swaging-dies upon the blank at a greater speed than that which is normally due to the gearing, but which comes into action to compel the spindle to rotate the blank if the engagement of the dies with the blank fails to insure its rotation at the required rate, substantially as hereinbefore set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

CHARLES D. ROGERS.

Witnesses:
CHARLES HANNIGAN,
GEO. H. REMINGTON.