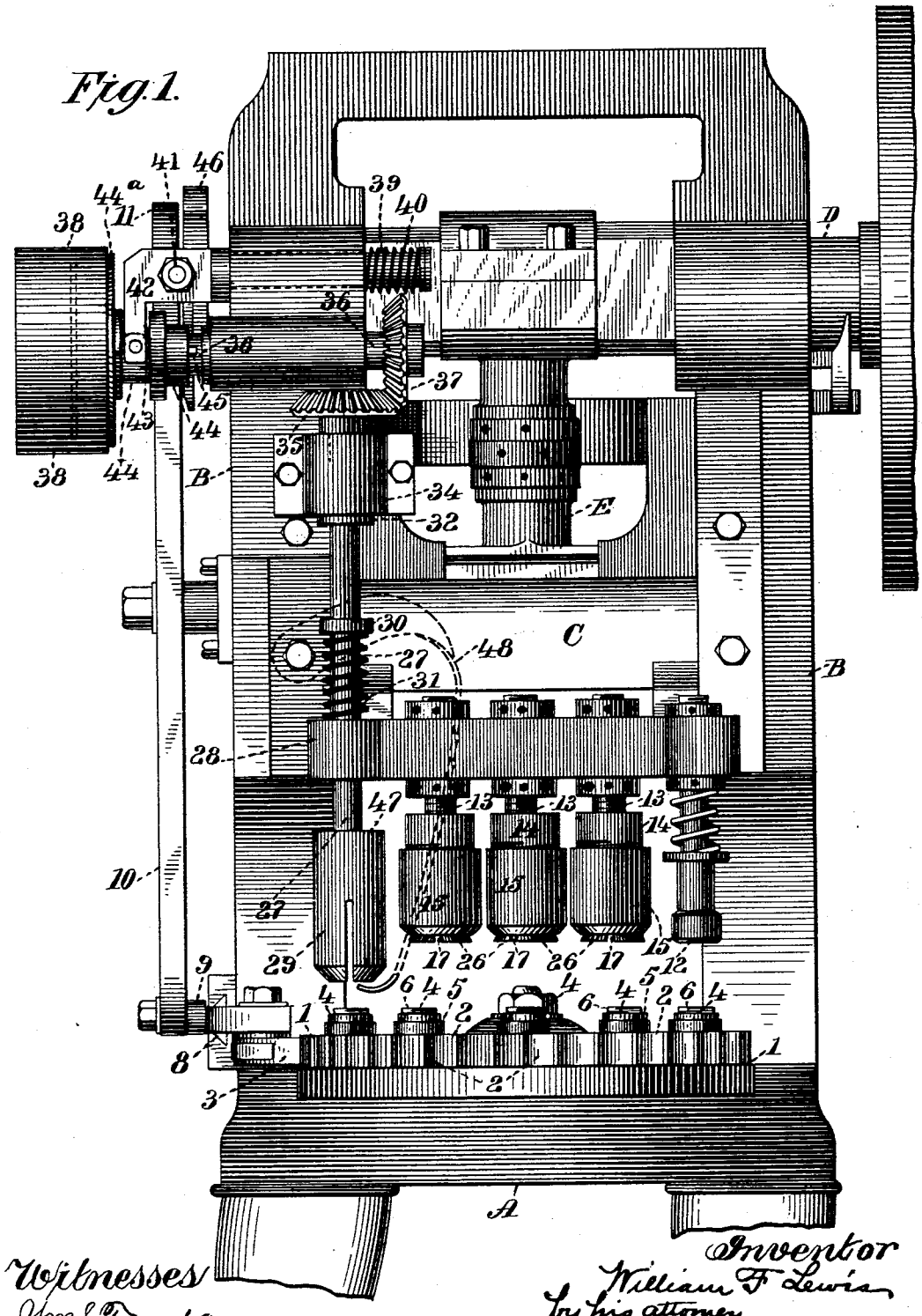
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W. F. LEWIS.

MACHINE FOR FORMING SCREW THREADS ON ARTICLES OF SHEET METAL.

No. 411,156. Patented Sept. 17, 1889.

Fig. 1.



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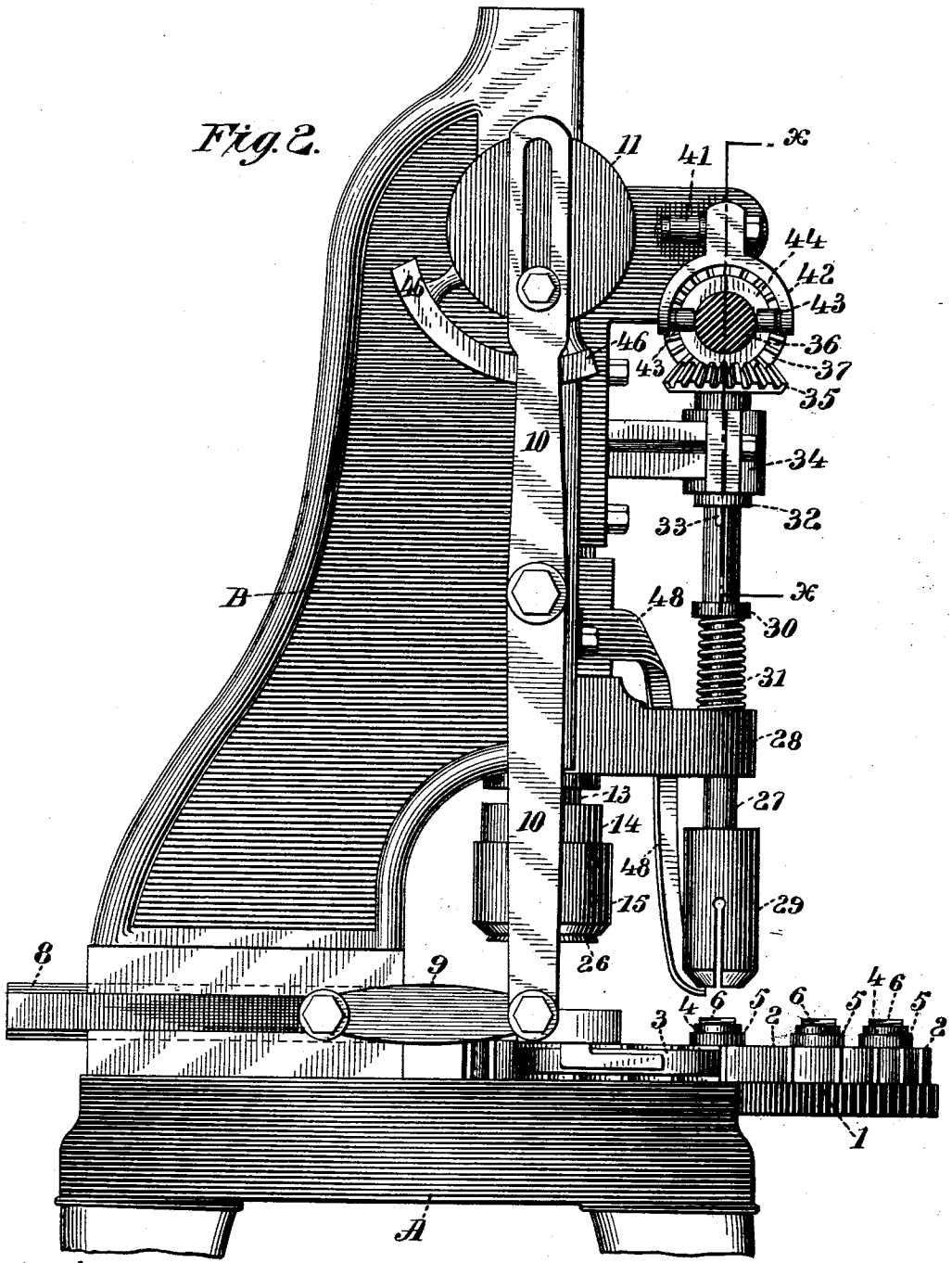
(No Model.) 5 Sheets—Sheet 2.

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MACHINE FOR FORMING SCREW THREADS ON ARTICLES OF SHEET METAL.

No. 411,156. Patented Sept. 17, 1889.

Fig. 2.



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MACHINE FOR FORMING SCREW THREADS ON ARTICLES OF SHEET METAL.

No. 411,156. Patented Sept. 17, 1889.

Fig. 3.

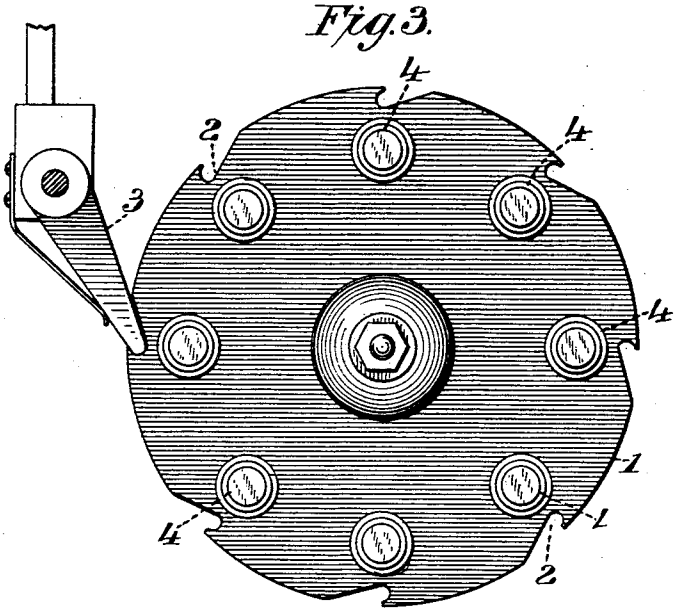
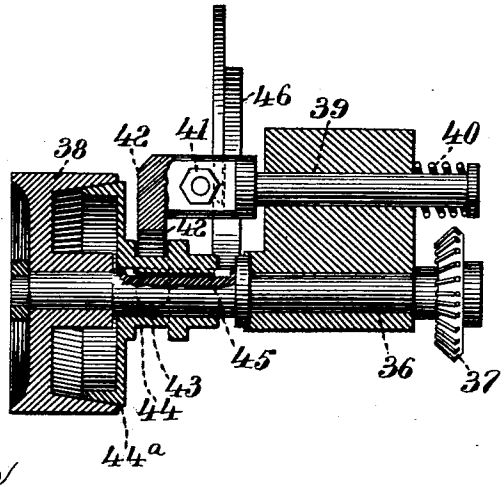


Fig. 4.



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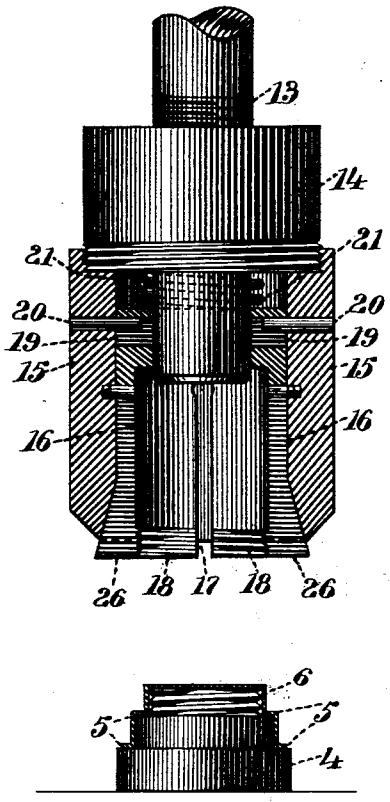
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Fig. 5.



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MACHINE FOR FORMING SCREW THREADS ON ARTICLES OF SHEET METAL.

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Fig. 6.

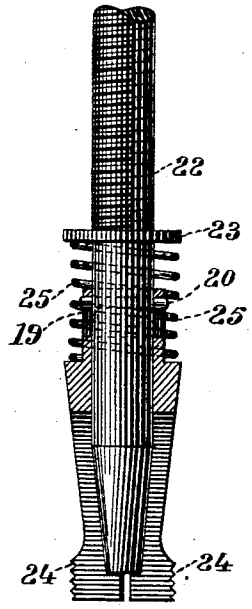


Fig. 7.

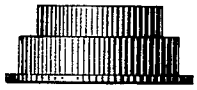
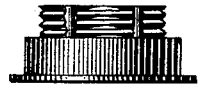


Fig. 8.



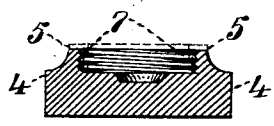


Fig. 9.



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UNITED STATES PATENT OFFICE.

WILLIAM F. LEWIS, OF WATERBURY, CONNECTICUT, ASSIGNOR TO THE PLUME & ATWOOD MANUFACTURING COMPANY, OF SAME PLACE.

MACHINE FOR FORMING SCREW-THREADS ON ARTICLES OF SHEET METAL.

SPECIFICATION forming part of Letters Patent No. 411,156, dated September 17, 1889.

Application filed April 24, 1889. Serial No. 308,430. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. LEWIS, a citizen of the United States, residing at Waterbury, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Machines for Forming Screw-Threads upon Articles of Sheet Metal; 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.

My invention relates to certain new and useful improvements in machines for forming screw-threads upon articles of sheet metal—such, for instance, as parts of oil-cans, gas-burners, and the like; and the objects of my invention are, first, to form the screw-threads in the metal by pressure instead of by knurling or tapping, as heretofore practiced, and that whether the threads are to be on the interior or exterior of the article, or both; second, to provide means for retaining the article to be threaded securely in position for the performance of the threading operation; third, to provide means for the presentation of the article to be operated upon to the successive tools adapted to act upon it; fourth, to provide means for the extraction and ejection of the finished work; and, fifth, to provide a machine embodying the operative parts hereinbefore set forth, which shall be simple in construction and positive in operation.

With these ends in view my invention consists in the means for impressing the threads upon the work and for stripping and ejecting the latter, and in the construction and combination of elements hereinafter set forth, and then recited in the claims hereunto annexed.

In order that those skilled in the art to which my invention appertains may fully understand the construction and method of operation thereof, I will describe the same in detail, reference being had to the accompanying drawings, which form a part of this specification, and in which—

Figure 1 is a front elevation of a press provided with my improvement; Fig. 2, a side elevation thereof; Fig. 3, a detail plan view of the feeding-plate and its operating-pawl; Fig. 4, a detail section on the line *x x* of Fig. 2; Fig. 5, a detail section showing a pair of dies adapted for external threading; Fig. 6, a similar view of dies for internal threading; Fig. 7, a detail elevation of a blank before threading; Fig. 8, a similar view of a threaded cup or shell; Fig. 9, a similar view showing the shell after having been operated upon by a single pair only of the dies.

Similar letters and figures denote the same parts in all the views of the drawings.

A represents the bed of an ordinary press such as is used for stamping sheet metal.

B are the vertical standards mounted upon said bed, and C is the reciprocatory gate, which is mounted and moves in ways in the standards.

D is the main shaft, and E is the pitman operated by said shaft and actuating the gate.

Secured by a central pivot upon the bed of the press, so that its periphery is beneath the gate, is a circular turn-table or feeding-plate 1, having upon its edge a series of teeth 2, with which a reciprocating pawl 3 is adapted to engage and so turn the plate intermittently. (See Fig. 3.)

4 are hubs, to any suitable number, secured in a circle upon the surface of the plate. Each of these hubs has its upper portion conformed to the shape of the threaded article to be produced, and forms a lower die. For instance, if a cup-shaped article, threaded exteriorly, is to be produced, each of said hubs will, as seen at Fig. 5, be formed in the shape of the inside of the threaded product, having shoulders 5 and a male screw-threaded portion 6. If, upon the other hand, an interiorly-threaded article—as a collar or the like—is to be made, each of said hubs will be cup-shaped and provided with an interior female thread 7, as seen at Fig. 6.

The pawl whereby the circular plate is operated step by step about its center receives its motion from a slide 8, which latter is actuated through a link 9 by a lever 10. Said lever is operated about its pivotal point by a crank-disk 11 on the end of the main shaft. By this means the plate is moved one step at each revolution of the main shaft, so that the hubs are presented seriatim for the operation of the tools upon the gate. The first of these

tools consists of a spring-cushioned presser-block 12, carried upon the gate and adapted to seat the unthreaded blank firmly upon the hub. Next are secured to the gate two or more threading-dies. I have shown three; but two may be employed, or, if desired, a greater number than three. If these dies are adapted for exterior threading, they consist, as seen at Fig. 5, of the threaded rod 13 for attachment to the gate, a collar 14 on said rod, a hollow sleeve 15, having its upper end secured to the lower end of the collar and internally tapered at its lower extremity, and the operating-die 16, arranged around the end of the rod and externally conformed to the interior contour of the sleeve. This die has a tapered surface corresponding to the internal taper of the sleeve, and is slotted from its lower end upward for a considerable portion of its length, as seen at 17. These slots are for the purpose of imparting spring quality to the die, and there may be two, three, four, or more of said slots, according to the size and thickness of material of which said die is made. Said die is internally screw-threaded at its lower extremity, as seen at 18. Near its upper end said die has two or more guide-slots 19, which are engaged by pins 20, projecting inward from the sleeve. These pins serve to hold the die in the sleeve and to prevent any axial movement thereof, while at the same time they permit a limited movement to said die relative to the sleeve and in the direction of its length. Around the rod, and bearing respectively upon the under surface of the collar 14 and the top surface of the die, is a coiled spring 21, whose function is to keep the said die ejected from the sleeve to the limit allowed by the pins 20, except when said die is forced upward relative to said sleeve, as will hereinafter be fully set forth. If, upon the other hand, said dies are to be used for interior threading, they consist, as seen at Fig. 6, of a threaded rod 22 for attachment to the gate, said rod being tapered at its lower end, an abutment-collar 23, secured upon said rod, a shouldered, internally-tapered, and vertically-slotted die arranged around said rod and externally screw-threaded, as at 24, a slot-and-pin attachment between the rod and the die similar in action to that heretofore described, and a spiral spring 25, interposed between the shoulder on the die and the abutment-collar.

The two dies hereinbefore described have each, in connection with the shape of the die upon the hub which is designed to be used therewith, substantially the same mode of operation.

In the die for exterior threading the normal position thereof is as shown at Fig. 5, with its interior diameter large enough to admit the entrance of the lower die with the blank to be threaded upon it. When said upper die descends over the blank, the bottom plane face of said die 26 strikes the shoulder 5 on the lower die, and the slight continued downward movement of the rod, gate, and sleeve serves to drive the die upward within the tapered sleeve, and thereby to compress the sections of said die which are formed by the vertical slots therein inward upon the lower die and the sheet-metal blank which is arranged thereon. Thereby the impress of the threads upon the two dies is imparted to the sheet metal. The upward movement of the sleeve with the gate allows the die to slide out of the sleeve and to expand, so that it may lift freely with the gate.

In the die for interior threading the bottom of the hollow lower die arrests the downward movement of the upper die, and the continued downward movement of the tapered rod in the tapered and slotted die expands the screw-threaded lower end of the latter, so as to operate upon the blank to be worked, as in the other die heretofore described, but outward instead of inward.

There remains to be described the device whereby the finished work is removed from the dies upon the feeding-plate and the means whereby it is operated.

27 is a vertical shaft having a bearing in the gate, as at 28. Upon its lower end is mounted a vertically-slotted gripper 29, which is of such internal diameter that it may be forced downward over and caused, by its spring quality, to grasp a piece of the finished work upon one of the lower dies. Upon the shaft 27 is an abutment-collar 30. A spring 31 is disposed around said shaft between said collar and the gate, and the upper end of said shaft extends within a short hollow shaft 32, to which it is connected by a spline 33 in such manner that the shaft 27 may receive rotary motion from said hollow shaft, but may at the same time have a vertical motion independent thereof, the reason for which will be presently apparent.

The hollow shaft just referred to is journaled in a bracket 34 on the face of one of the standards B, and carries upon its upper end a beveled gear 35.

36 is a horizontally-disposed shaft journaled in an outward extension from the standard. Upon its inner end it carries a gear 37, meshing with the gear 35.

Journaled loosely upon the end of the shaft 36 is a pulley 38, interiorly coned at its inner end (see Fig. 4) and continuously driven independent of the main shaft by a belt.

39 is a slide-rod arranged in the frame immediately above the shaft 36 and parallel thereto, and said rod is normally retained at its inward limit of movement by a spring 40. Near the outer end of this rod is a projecting roller-stud 41, and at the extremity said rod carries a downwardly-projecting fork 42, which has roller-studs 43 engaging a grooved collar 44. Said collar carries a coned friction-disk 44^a, and is arranged around and connected by a spline 45 to the shaft 36. Upon the crank-disk whereby the step-by-step rotation of the circular feed-plate is accom-

plished through the lever and pawl is arranged a sectoral wedge 46, whose plane of rotation is just inside the plane of the center of the roller-stud 41 on the slide-rod 39. The action of this wedge is to force the slide-rod outward against the action of its spring, and thereby through the fork and collar to engage the coned friction-disk with the constantly-rotating pulley 38. By this means rotation is imparted to the transverse shaft, and thence through the beveled gears to the vertical shaft 27 for such a proportion of each revolution of the main shaft as the length of the sectoral wedge bears to the entire circumference of the disk on which said wedge is mounted. By reference to Fig. 2 this is seen to be about one-quarter, so that the vertical shaft revolves during one-quarter of the time occupied by the main shaft in making one turn, and is idle during the other three-quarters by the friction-disk being drawn out of engagement with the coned pulley by the spring 40. The wedge is so timed as to throw the disk into engagement with the coned pulley at the time the gate commences its upward movement, and this engagement and the rotation of the vertical shaft continues during substantially one-half of the upward stroke of said gate.

It will be observed that the length of stroke of the gripper and of the vertical shaft is not as great as the stroke of the gate and the tools attached directly thereto and carried thereby.

When the gate descends, it slides on the vertical shaft until it abuts against the top surface of the gripper designated by 47. For the balance of its stroke it carries said gripper with it, the shaft sliding downward within the hollow shaft to which it is splined. When so carried downward, the gripper is forced over and grasps the completed article on the die beneath it, and as the gate ascends the gripper is caused to rotate, and thereby the screw-threaded sheet-metal article is removed out of engagement with the die. When the gate ascends, it raises the shaft on its spline connection, the spiral spring forming a cushion, and the article of work is disengaged from the gripper by means of a spring-arm 48, which is displaced by the downward stroke of the gripper, but which slides across its beveled lower surface on the ascending stroke and throws out the work.

Having hereinbefore set forth the method of operation of the several parts of my invention, I will now describe the working of the machine as a whole.

An operator, as the feeding-plate revolves, places upon the dies upon said plate seriatim as they come before her the blanks to be operated upon. A blank after having been so placed over the die is first pressed firmly downward thereon by the presser-block carried on the gate. Then, as the plate turns, the blank is presented at the next downward stroke of the gate to the first of the slotted threading-dies which presses into the metal the shape of the screw-threads which it carries. As the die is slotted to give it resiliency, the blank after the first threading operation will appear as shown at Fig. 8—that is, with blank spaces on its periphery corresponding to the slotted portions of the die. Having been turned a third step, the blank is operated upon by a duplicate of the first threading-die, but which is arranged with its slots out of coincidence with those of the first die, so that the blank spaces left by said first die will receive their appropriate thread. At the next step a third die, like the two preceding, acts upon the blank. This is merely as a finishing operation, and is not essential to the production of good work. At the next step the gripper is forced over the now-finished blank and the latter is stripped from the lower die by the combined upward and rotary motion of the gripper, which unscrews the work from the threads, and immediately thereafter, by means of the spring-arm 48, the work is released from the gripper and thrown into any convenient receptacle.

The thread impressed upon the work by means of laterally-moving dies, as hereinbefore set forth, possesses numerous advantages over the knurled or rolled threads heretofore produced.

Knurled or rolled threads which are uniform in size are very difficult to produce on account of the pressure of the knurl or roll upon the metal, which latter may vary in thickness or ductility. Thereby the finished articles may differ in size. This cannot happen in threads impressed upon the work as heretofore set forth, because the metal is compressed against a die to whose operative surface the metal must conform. Furthermore, in the pressed thread the metal of the product is worked less than in the rolled thread.

In this my invention I do not wish to be confined to the exact details of construction which I have herein shown and described, since many minor changes both in the construction of the operative parts and in their application to the press, which changes are entirely within the province of mechanical skill, may be made without departing from the spirit of my invention, as is set forth in the clauses of claims now to follow.

I claim—

1. In a machine of the character described, the combination, with the plurality of lower dies each having thereon the configuration to be imparted to the finished article, and means for moving said dies step by step beneath the upper dies, of the press-gate, the upper dies, secured thereon, carried thereby and having interrupted operative surfaces complementary to those upon the lower dies and out of coincidence in the successive dies, and wedges moving with and adapted to actuate the sections of said upper dies, substantially as specified.

2. In a machine of the character described,

the combination, with a plurality of lower dies each conformed to the shape of the finished article to be produced, and a rotating plate whereby said lower dies are presented seriatim to the upper dies, of a plurality of radially expansible and contractible upper dies, the gate for vertically reciprocating said dies, wedges for imparting the radial expansion and contraction thereunto, and a gripper properly timed relative to said upper dies and adapted to remove the finished work from the lower dies, substantially as and for the purpose set forth.

3. In a machine of the character described, the combination, with the lower dies and the plate whereby they are presented seriatim to said dies, of the plurality of radially expansible and contractible upper dies and means for operating their jaws toward and from the work, a cushioned pressure-block operating one or more steps in advance of the said upper dies, and a gripper carried by the gate and operating subsequent to the said upper dies and adapted to remove the finished work from the lower dies, substantially as set forth.

4. The combination, in a machine of the character described, with the lower dies and means whereby they are successively presented to the tools, of the plurality of upper threading-dies, the same being radially expansible and contractible, and the gate whereon they are mounted, the pressure-block upon the gate whereby the blanks are seated in advance of their presentation to the threading-dies, and the vertically-reciprocated and intermittently-rotated gripper operating subsequent to the threading-dies, and whereby the work is removed from off the lower dies, substantially as set forth.

5. In a machine of the character described, the combination, with the intermittently-operated feeding-plate and the lower dies arranged in a circle upon said plate, each of said dies conformed to the shape of the article to be produced, of the reciprocating gate, the plurality of expansible and contractible threading-dies mounted upon and reciprocating with said gate, the gripper vertically operated by said gate, and means independent of said gate whereby an intermittent rotation is imparted to said gripper in addition to its vertical movement, substantially as and for the purpose specified.

6. The combination, in a machine of the character described, with the lower dies and the rotary plate whereon they are mounted, of the gate and a plurality of threading-dies arranged thereon, each of said dies being slotted vertically as to its operative surface, whereby a radial expansibility is imparted thereto, and having an inclined surface, an inclined surface secured upon the gate and engaging said inclined surface on the dies, and a spring for retaining the parts in their normal relative positions except when operated by the descent of the gate, substantially as and for the purpose set forth.

7. In a machine of the character described, the combination, with the lower dies and the means for operating them, of the dies upon the reciprocating gate, each die having a series of slots therein whereby an expansive and contractile action is imparted thereto, a wedge for effecting the radial action of the die-jaws, and a rotating and vertically-movable gripper for the removal of the work subsequent to the action of the dies, substantially as specified.

8. In a machine of the character described, the combination, with the reciprocating gate, the tools secured thereon, and the lower dies mounted beneath said gate, of the gripper and a vertical shaft upon which it is secured, a transverse shaft geared to said vertical shaft, a constantly-rotating band-wheel, and a clutch for connecting said transverse shaft with said band-wheel, substantially as set forth.

9. In a machine of the character described, the combination, with the reciprocating gate, the dies carried thereby, and the lower dies arranged beneath the gate, of the vertical shaft and the gripper arranged thereon, a short hollow shaft splined to said vertical shaft, a transverse shaft geared to said hollow shaft, a constantly-rotating band-wheel, a clutch splined to said transverse shaft, and a wedge operated independent of the band-wheel and in proper time with the gate, whereby intermittent engagement is effected between said band-wheel and the transverse shaft, as set forth.

10. The combination, in a machine of the character described, with the reciprocating gate and dies and the lower dies arranged beneath the gate, of the vertically and axially movable gripper-shaft and the gripper carried thereby, an independently-operated band-wheel, a clutch whereby the motion of the said band-wheel may be imparted to the gripper-shaft, and means operated in time with the gate and independent of the gripper-shaft, whereby the latter is intermittently engaged with the band-wheel, so as to be operated thereby, substantially as specified.

11. The combination, in a machine of the character described, with the main shaft, of the gate connected thereto and driven thereby, the dies upon the gate, the wedges whereby the radial movement is imparted to said dies, and the lower dies arranged beneath said gate, of the circular rack-plate whereon said lower dies are mounted, a reciprocating pawl adapted to engage and turn said plate step by step, a pivoted lever driven by the main shaft and adapted to actuate said pawl, and a rotary gripper operating in time with the dies, and whereby the finished work is removed, substantially as specified.

12. In a machine of the character described, the combination, with the gripper, its shaft, and the gate for imparting thereto a properly-timed vertical movement, of a hollow shaft splined to the gripper-shaft, a transverse shaft

geared to the hollow shaft, an independently-rotated band-wheel, a clutch splined to said transverse shaft and carrying a friction-disk, and a sectoral wedge operated from the main shaft, and whereby the clutch is moved into engagement with the band-wheel, substantially as set forth.

13. The combination, in a machine of the character described, with the rotating feed-plate, the lower dies mounted thereon, and means for imparting properly-timed step-by-step rotation to the plate, of the reciprocating press-gate, a plurality of vertically-slotted dies whose operative surfaces are out of coincidence relative to the work movably arranged upon said gate, and wedges arranged in said dies and secured to the gate, whereby a radial movement may be imparted to their operative faces, in connection with the downward stroke of the gate, substantially as set forth.

14. The combination, in a machine of the character described, with the centrally-pivoted feeding-plate and its dies and the ratchet-and-pawl mechanism, whereby a step-by-step movement is imparted thereto, of the reciprocating press-gate, a plurality of vertically-slotted dies arranged and carried thereon and movable relative thereto, and means for imparting to the sections of said dies a radial movement, a spring-cushioned presser-block, also carried by said gate, a gripper adapted to be operated by said gate, and means disconnected from said gate, whereby in addition to its vertical movement an intermittent axial rotation is imparted thereto, substantially as set forth.

15. In a machine of the character described, the combination, with a plurality of lower dies, each having a surface conformed to the shape of the finished article, and means for moving said dies step by step for presentation to the upper dies, of a reciprocating gate and a series of expansible and contractible dies mounted thereon, said dies being arranged with the interruptions between their operative surfaces out of coincidence, substantially as and for the purpose specified.

16. In a machine of the character described, the combination, with a plurality of lower dies, each having an operative surface conformed to the shape of the article to be produced, of a gate and means for reciprocating it relative to the said lower dies, an upper die having an interrupted operative surface, and means for imparting to said die an expansive and contractile movement, and a second upper die, also having radial movement, both said upper dies being carried on the gate, and the interruptions between the operative surfaces of the last-named upper die being out of coincidence with the interruptions between the surfaces of the first-mentioned upper die, whereby work having a continuous finished surface may be produced, substantially as specified.

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

WILLIAM F. LEWIS.

Witnesses:
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