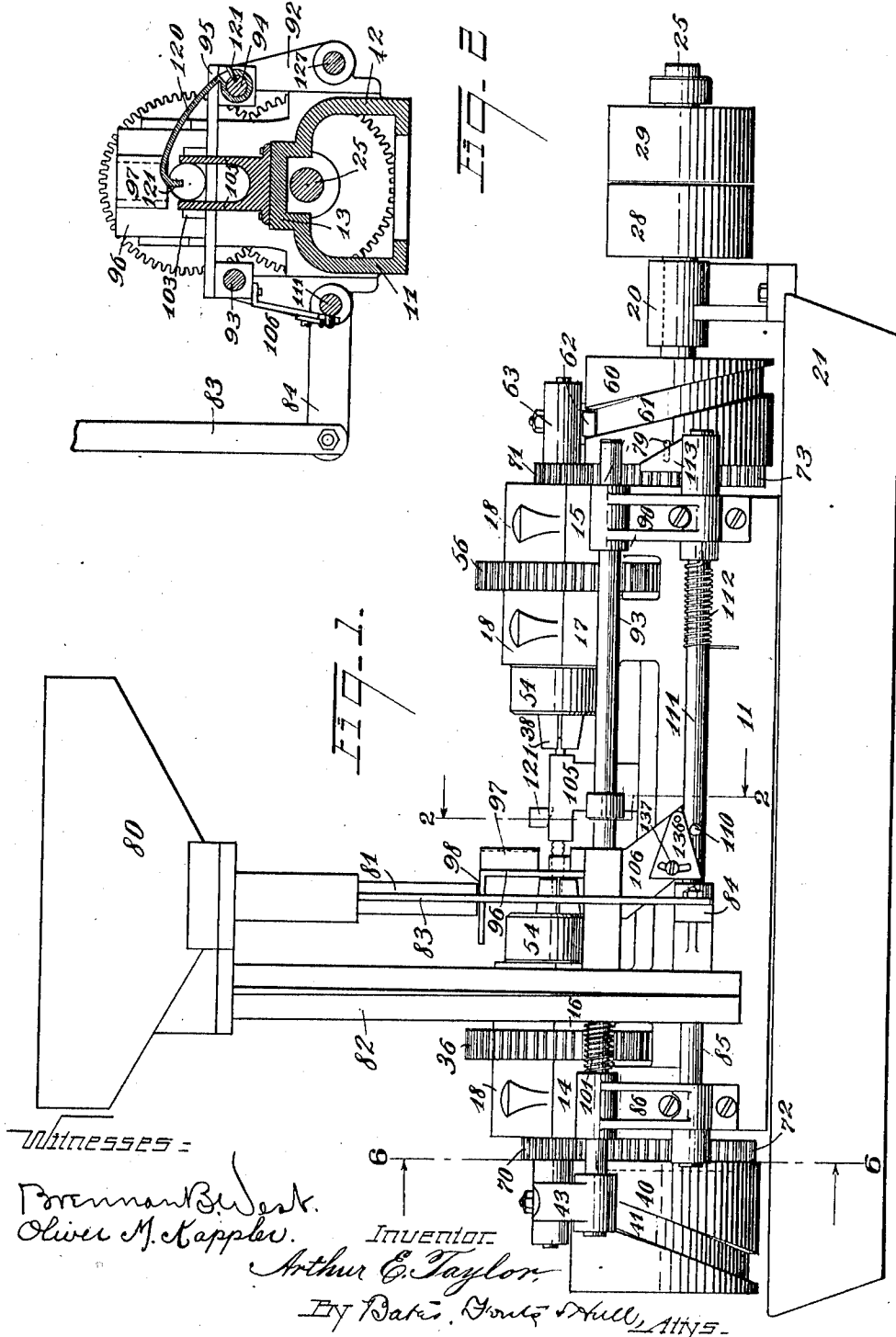


A. E. TAYLOR.
NUT TAPPING MACHINE.
APPLICATION FILED NOV. 29, 1909.

1,012,294.

Patented Dec. 19, 1911.

3 SHEETS-SHEET 1.

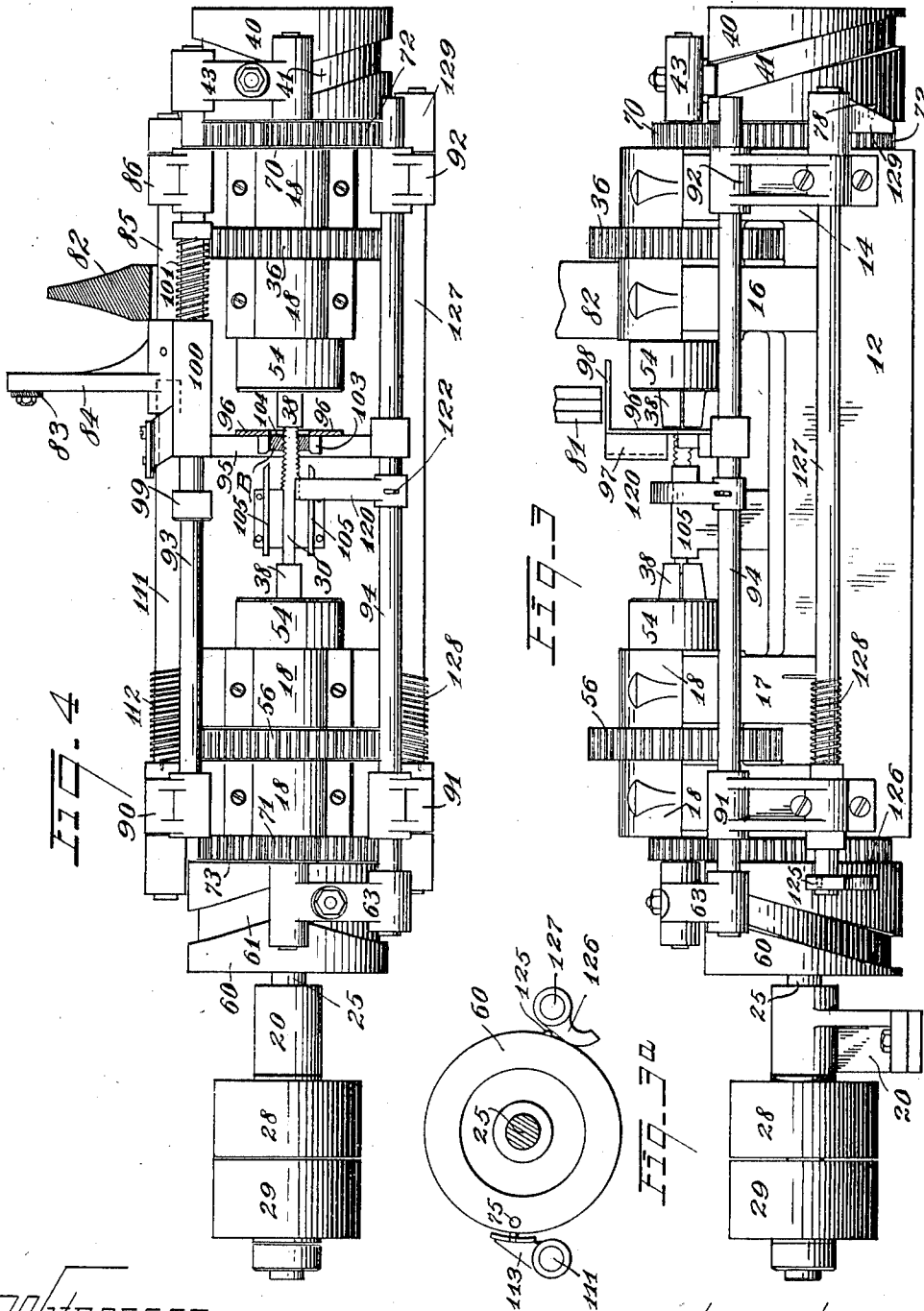


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Witnesses
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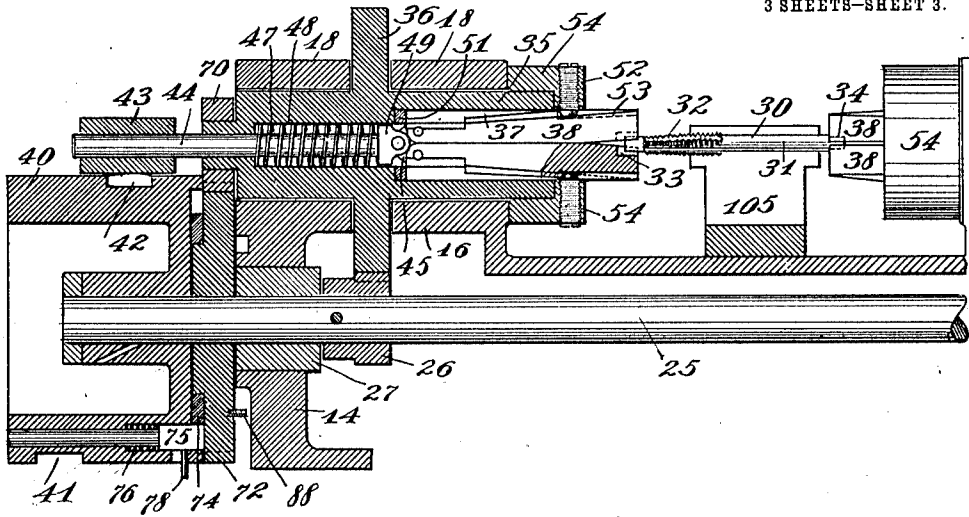


Fig. 7.

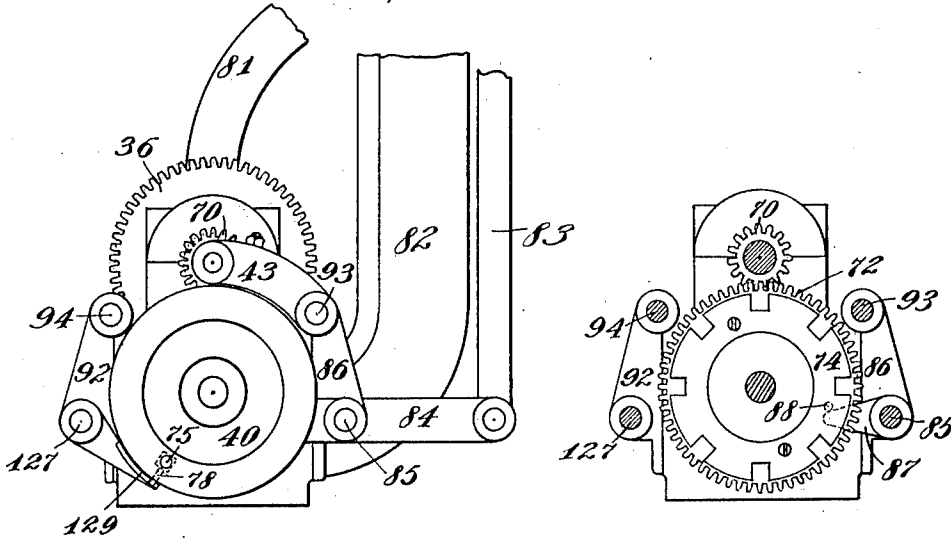
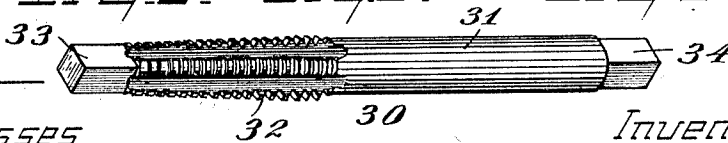


Fig. 5. Fig. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

ARTHUR E. TAYLOR, OF ELYRIA, OHIO.

NUT-TAPPING MACHINE.

1,012,294.

Specification of Letters Patent.

Patented Dec. 19, 1911.

Application filed November 29, 1909. Serial No. 530,296.

To all whom it may concern:

Be it known that I, ARTHUR E. TAYLOR, a citizen of the United States, residing at Elyria, in the county of Lorain and State

of Ohio, have invented a certain new and useful Improvement in Nut-Tapping Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to a machine for tapping threads in nuts, and has for its object the production of a device of this character in which the tap may be turned continuously in one direction by power applied simultaneously to both ends thereof. The ends are alternately released to allow the unthreaded blank to pass onto the tap and the threaded nut to pass off of it. The devices for grasping and driving the tap are of such character that they may not only effectively engage the tap even though the driving torsion twists the tap end out of position, but also operate to bring the tap back into proper axial position, relieving the torsional strain.

My mechanism not only increases the rapidity of tapping the nut because no time is wasted in screwing the tap out of the nut, but furthermore, by reason of the tap being grasped and driven at both ends when it is cutting, the strain on the tap is only half as great as ordinarily, and the capacity of the tap is correspondingly increased.

My invention comprises the means employed for carrying out the above features, and other auxiliary features, all of which is more fully hereinafter explained.

The drawings illustrate my invention in an organized machine.

Figure 1 is a side elevation of such machine looking at what may be called the front side; Fig. 2 is a vertical section of the same substantially on the line 2—2 of Fig. 1; Fig. 3 is a rear elevation of the machine; Fig. 3^a is an end elevation of the cam drum shown at the left end of Fig. 3—this view showing also the rock shaft which releases the drum and the rock shaft which is actuated by it; Fig. 4 is a plan; Fig. 5 is an end view looking from the left hand end of Fig. 1, which is the right hand end of Figs. 3 and 4; Fig. 6 is a vertical section as indicated by the lines 6—6 of Fig. 1; Fig. 7 is a longitudinal central vertical section through one

of the jaws and adjacent mechanism; Fig. 8 is a perspective of the tap itself.

Designating the parts shown by reference numerals, the bed of the machine is shown as made of a hollow box-like member having a front plate 11, back plate 12, top plate 13, and end members 14 and 15. The walls of the front and back plates extend upwardly near the ends intermediate of the portions 14 and 15, as shown at 16 and 17, such upward extensions and end portions leaving spaces between them for gears hereinafter described. The frame also includes caps 18 over the various portions 14, 15, 16 and 17 and a pedestal 20 for the main driving shaft. A suitable stationary trough 21 may be provided as shown in Fig. 1, to catch the nuts, drippings, etc.

Suitably mounted in the end members 14 and 15 of the bed is the main driving shaft 25. As this shaft carries pinions 26 within the bed, it is convenient to mount the shaft in bushings 27 larger than the pinions so that the shaft, bushings and pinions may be easily installed and drawn out endwise when desired. At one end of the machine this main shaft 25 extends outwardly beyond the bearing 20 and carries the usual tight and loose pulleys 28 and 29.

The tap, designated 30, may be of the form shown in Fig. 8. It has a shank 31, threaded portion 32 and squared ends 33 and 34. To properly grasp and drive these ends, I provide a pair of similar mechanisms, one of which is shown in Fig. 7, and which I will now describe.

Mounted in the bearings provided by the bed members 14 and 16 and the caps 18, is a rotating barrel 35 which has intermediately projecting from it a gear 36 meshing with the pinion 26 on the driving shaft. Within the barrel 35 is an axial recess 37 occupied by a pair of jaws 38. These jaws are not only longitudinally slidable within the recess, but are movable with regard to each other so as to cause their free ends to approach or recede. In Fig. 7 the jaws are shown in intermediate position after they have freed the tap and before they have been withdrawn into the socket. Withdrawal is effected by a drum 40 on the main shaft 25, this drum having a cam groove 41 in which rides a roller 42 on a cross head 43 in which is rigidly mounted a rod 44, the

inner end of which is connected by toggle links 45 with the jaws 38. Accordingly, when the cam groove 41 pulls the roller 42 outwardly, the jaws are pulled back into the socket 37. When the returning portion 5 of the groove returns the rod 44, it forces the rod with the jaws inwardly to cause the jaws to take over the end of the tap. I provide a spring 47 about the rod, bearing at one end against the base of a reduced portion 10 48 of the socket, and at the other end against a head 49 on the rod. This spring assists the action of the cam in causing the jaws in closing to perform the work of torsionally righting the tap, and furthermore the spring relieves the pressure of the roller against the cam groove when the jaws are in engagement. As the jaws come into their inner position their rear ends become free 15 by passing in front of a washer 51 which lies at the base of the recess 37, and thereafter the continued inward movement of the rod 44 through the toggle links forces the rear ends of the jaws outwardly, which 20 forces inwardly the front ends by reason of the jaws being fulcrumed by pins 52 occupying grooves 53 in the jaws, these pins being carried by a cap 54 on the barrel 35. The grooves are of such length that just as the rear ends of the jaws clear the washer 30 51, the end walls of the grooves about the pins 52, preventing further outward movement of the jaws; then, as the rod 44 continues to move, the toggle links force the rear ends of the jaws outwardly until the 35 toggle knuckle has moved slightly past the center, this operation causing the jaws to effectively engage and lock the tap. When the jaws have grasped the tap, their outer ends abut the face of the washer 51 which 40 makes a positive stop to receive the thrust on the jaws caused by the drag, the blank being threaded, whereby such thrust cannot back the jaws into the socket. The washer 45 is hardened, as are also the jaws, to prevent wear. The screw pins 52 and 53 which form the fulcrums provide means for adjusting the grasp of the jaws to compensate for variations in different taps.

50 I have described the mechanism for engaging and rotating the tap with reference to the left hand end of the machine. The mechanism at the right hand end is identical, its gear 56 meshing with a pinion on 55 the main driving shaft and its cam roller 62 on a cross head 63 engaging the groove 61 of a cam 60 on the shaft.

While the cams 40 and 60 are mounted on the driving shaft, they are not rigid therewith, but are loose thereon, having a different speed, as will be presently explained. This I effect by mounting pinions 70 and 71 60 on the two barrels 35, these pinions meshing with gears 72 and 73 loose on the driving 65 shaft. Each gear has a series of notches as

illustrated in Fig. 6, these notches being preferably made in a ring 74 secured to the gear. Each cam is provided with a plunger 75 adapted to occupy any of the notches. The plunger is pressed in engaging direction by a spring 76, and is held out of engagement by pins 78 and 79 occupying slots 70 in the respective cams 40 and 60. The release of either pin locks the corresponding cam drum to the corresponding gear which 75 is constantly rotated by the train of gearing mentioned. The locking and releasing of the two cams is in accordance with the sequence of operations, which will be more fully described hereinafter. 80

The blanks which my machine is adapted to tap have the desired angular exterior and a central hole, as is usual. These blanks are placed in a hopper of any suitable construction and fed to the machine by gravity 85 or otherwise, as desired. Fig. 1 shows at 80 a usual type of hopper from, which a chute 81 leads downwardly. This hopper is shown as carried by a bracket 82 mounted on the frame. The blanks in the hopper 90 may be agitated to insure their proper feeding by a bar 83 guided alongside of the bracket and projecting into the hopper, this bar being pivotally mounted at its lower end on a rock arm 84 which is rigid on a 95 rock shaft 85. This shaft is mounted in the bracket 82 and the bracket 86 on the frame, and carries a tappet arm 87 which is periodically engaged by a pin 88 on the gear 72. The result is that the bar 83 periodically agitates the hopper contents and 100 insures the blanks being fed down the chute.

Mounted in the four brackets carried on the two sides of the frame, (of which one has already been referred to as 86 and the 105 others are designated 90, 91 and 92 respectively) are two rock shafts 93 and 94. Mounted on these rock shafts is a cross head 95. This cross head provides a shelf on which the blank may rest alining with the 110 tap. Secured to the cross head also is an upright bracket or plate 96 carrying a hollow guide 97 and having a horizontal shelf 98 adapted to stand beneath the chute 81 and prevent exit therefrom. When the cam 115 drum 40 acts to draw the cross head 43 outwardly to release the tap at that end as heretofore described, such movement draws outwardly also the shaft 93, and the collar 99 thereon engaging the cross head 95, slides 120 the same endwise to carry the shelf 98 away from the exit of the chute, and this allows the blanks in the chute to drop down the guideway provided, wherefore the blank may pass onto the shelf 95 alining with the 125 spindle, the blank then standing between guiding lugs 103 and in front of a round hole 104 through the plate 96. Fig. 4 shows a blank, designated B, in this position. As shown in the drawings, when one blank is 130

on the shelf alining with the spindle, two blanks may stand one above the other within the vertical passageway provided by the guide 97. The cross head 95 has an elongated bearing 100 on the shaft 93 which enables the cross head to be pulled outwardly at one side without skewing it. As the groove 41 on the drum 40 is returning the shaft 93, a spring 101 surrounding that shaft and acting against the elongated bearing 100, forces the cross head inwardly, pressing the nut onto the tap until the thread of the tap takes hold sufficiently to itself feed the nut. When the nut has so far been fed onto the tap that the tap will feed it, it comes between a pair of stationary guides 105 which engage the opposite edges of the nut and prevent its rotating. The entrance edges of these guides are shown in Fig. 4 as tapered, so that the guides 103 on the cross head may make close connection with the stationary guides. As the cross head is advanced by the spring 101, a depending arm 106 on the elongated bearing 100, having an inclined lower face, acts on a pin 110 projecting from a rock shaft 111. This rock shaft is mounted in the bracket 90, heretofore referred to, and, at its other end, is freely socketed in the hub of the arm 84. A coiled spring 112 surrounding the rock shaft 111 tends to keep it in normal position. When, however, the shaft is rocked by the advancing cross head, an arm 113 on the right hand end of the shaft (Fig. 1) is thereby withdrawn from the pin 79, heretofore referred to, whereby the clutch plunger of the cam 60 springs into action and clutches that cam to the gear 73, causing the outward movement of the cross head 63 and the withdrawal of the jaws engaging the right hand end of the tap, after the manner of the mechanism already described with reference to Fig. 7. As the cam 60 is acting on the roller 62 to draw outwardly the cross head 63 to release the jaws, it simultaneously draws outwardly the shaft 94, slidable in the brackets 91 and 92 and secured to that cross head. On this shaft 94 is an arm 120 having a downwardly projecting free end 121, Fig. 2, which is adapted to engage a finished nut on the blank, the result being that as the jaws are withdrawn from the exit end of the tap, the arm 120 shoves along all the nuts on the shank of the tap so that the foremost drops off the end onto the bed surface 13 and passes down into the tank 20, or is otherwise taken care of as desired. It will be noticed that the arm 120, while compelled to move longitudinally with the shaft 94, may rock independently of that shaft by reason of a pin-and-slot engagement 122, Fig. 4. It will also be seen from Fig. 1, that the lower face of the tongue 121 of this arm is inclined upwardly toward the receiving end of the tap.

The result is that as the nut is screwed along the tap it slides under the arm 120 and cams it upwardly, until, after the tapping is completed, the tongue on the arm drops down behind it ready to feed it forward when the arm is moved longitudinally. Now after the jaws have released the shank end of the tap and moved away from it to allow the foremost of the finished nuts to be fed off the tap, the cam groove 61 and the corresponding spring 47 returns the jaws to position, causing them to reengage the tap. After such reengagement has taken place, a lug 125 (Figs. 3 and 3^a) on the cam drum 60 engages a tappet arm 126 rigid on the rock shaft 127 which is mounted in brackets 91 and 92. This rock shaft is held in normal position by the coiled spring 128, but when it is rocked by the lug 125, the arm 129 on the shaft is withdrawn from the pin 78, whereby the spring 76 (Fig. 7) acting on that pin, causes it to clutch the cam drum 40 to the gear 72. This initiates the outward movement of the cross head 43 and the consequent withdrawal of the jaws 38 and the feeding on of a new blank, as heretofore explained. As soon as the lug 125 has rocked the shaft 127 to cause the engagement of the cam drum 40, the cam drum 60 has fulfilled its function, and immediately thereafter the pin 79 on the drum 60 engages the incline of the arm 113 and thereby forces itself toward the right, Fig. 1, withdrawing the clutch plunger and releasing and stopping the cam drum 60. After the cam drum 40 has performed its function and is completing its rotation, the pin 78 thereon rides onto the incline of the arm 129 and withdraws the clutch plunger 75, thus terminating the rotation of the cam drum 40. Then the threading progresses until the arm 106 on the cross head, by its incline, rocks the shaft 111 to release the cam drum 60, when the same sequence of operations is repeated.

From the above description it will be seen that my machine is entirely automatic. The main shaft 25 is continuously rotated and this continuously rotates the two chucks, which continuously rotate the tap, this tap being in driving engagement at all times with one or the other chuck. With such continuous rotation, the periodic operation of the machine may be summarized as follows: The hopper and hopper chute being loaded with blanks, the movement of the chute closure 98 releases the blank and allows it to drop into the guide 97, the bottom blank in that guide dropping onto the shelf 95 and between the lugs 103, this operation being caused by the outward movement of the cross head 43 under the influence of the cam 40. This same outward movement releases the chuck at the entrance end of this tap. Then the cam groove 41, re-

turning the cross head 43, feeds the blank onto the tap and causes the reengagement of the chuck with the tap end. The feed is then continued by the spring 101 moving the cross head until the blank passes between the stationary guides 105 and under the nose 121 and the arm 120. When the blank has reached a point on the tap where the hardest cutting work has been completed the cam arm 106 rocks the shaft 111 to release the pin 79, initiating the rotation of the cam drum 60. The rotation of this drum moves outwardly the cross head 63, opening and withdrawing the chuck at the shank end of the tap and moving in that direction the arm 120 which shoves any previously completed nuts along the tap shank until the foremost passes off the tap. Then the cam groove 61 returns the cross head 63, the chuck reengaging the shank end of the tap. Just after this movement is completed the lug 125 on the cam drum 60 rocks the shaft 127 to initiate the movement of the cam drum 40 and thereupon the cam drum 60 comes to rest. The cam drum 40 then takes up the operation of withdrawing the chuck at the entrance end and feeding a new blank onto the tap, this new blank being fed on as the previous blank is about completed.

It should be noted that the timing of the release and engagement of the chucks is dependent upon the progress of a blank being tapped, instead of at predetermined intervals. This is an important feature as it insures the proper distribution of the blanks on the tap irrespective of variations in the size of the hole in the blank. If the timing were positive, a blank with a hole large enough to pass idle over the tap for example, would waste time; while if the hole were too small sufficient time would not be allowed to tap it, and successive nuts might become jammed at one place on the tap and result in its breakage.

While either end of the tap is disengaged, the tap is, of course, driven only at one end, but this is while the tap is doing its lighter work, either finishing a nearly tapped nut or starting a fresh one or both. The number of nuts on the tap at any one time may be more or less than two as desired. This may be regulated, for example, by adjusting the incline of the active edge of the cam plate 106. Such adjustment is shown in Fig. 1 where the active edge is on a plate 136 pivoted to the plate 106 and adjustably locked by a clamping bolt 137 in a slot.

From the above description it will be seen that with my machine there is the minimum of lost time. While one or more nuts are being tapped, the exit chuck may be opened to allow the removal of the nut, then immediately returned, and the entrance chuck opened and a fresh blank placed on the entrance end of the tap and that chuck re-

turned, the tapping operation going on continuously, and with the nuts spaced as desired on the tap. When the tap is doing its greatest cutting work it is held and driven from both ends so that the strain on the tap is greatly reduced over the ordinary form, where it is driven from one end.

The torsional strain which the blank and the driving chuck exert on the tap in this machine, at the times when one end is free, while reduced from the ordinary torsion by reason of the light work the tap is doing at that time, is sufficient to give the tap a material twist. Now when the pair of jaws of either chuck in this machine come inwardly to engage the squared end of the tap, they exert a camming action on that squared end, thereby at once taking the twist out of the tap and holding it in proper position. This action of the jaws is important, for I have found that the twist is so great that a socket fitting the end of the tap and designed to register with it will not register when the tap is in action. Accordingly, I consider the openable camming jaws to be an important feature in the present machine.

Having thus described my invention, what I claim is:

1. In a machine of the character described, the combination of a tap having angular extensions at each end, and a pair of rotatable chucks adapted to engage said extensions respectively, each of said chucks having jaws adapted to exert a camming action on the corresponding extension if out of registration with the jaws.

2. In a machine of the character described, the combination of a tap having angular extensions at each end, and a pair of rotatable chucks adapted to engage said extensions respectively, each of said chucks having jaws which may exert a camming action on the corresponding extension and means for automatically and alternately moving said chucks longitudinally.

3. In a tapping mechanism, a tap having an angular portion at each of its ends, a chuck for each end of the tap, each chuck having a pair of jaws with cooperating angular seats, said chucks being adapted to normally engage their respective ends of the tap, means for simultaneously turning the said chucks in the same direction, means for holding the nut blank from rotation during the tapping operation, and means for disconnecting the chucks from the tap alternately whereby the tap is driven first from one end, then from both ends, and finally from its other end.

4. In a tapping mechanism, a tap having two angular ends, two pairs of separate jaws having angular seats adapted to engage the respective ends of the tap and thus furnish means for driving the tap from either of its ends, said means being adapted to continu-

ously rotate the tap in the same direction, and means for applying the nut blanks to the tap at one end of the latter and for releasing the blanks from the other end thereof.

5 5. In a tapping mechanism, a tap, a driving chuck for engaging each end of the tap, a gear wheel for driving each chuck, the chucks having jaws adapted to open and close and longitudinally movable, means including a spring for normally holding the jaws in active position, and means for forcing the jaws against the tension of the springs for disengaging the chucks from the tap.

15 6. In a tapping mechanism, a tap, a pair of jaws for engaging each end of the tap, gear wheels having socketed hubs into which the jaws respectively project, the jaws being adapted to be driven by the gear wheels, but being longitudinally movable therein, and mechanism for moving the jaws in the sockets, and means whereby such movement opens and closes the jaws.

25 7. The combination, with a double-ended tap, of a pair of rotatable chucks openable and closable to engage and disengage the end portions of the tap respectively, means for simultaneously rotating both chucks, automatic means for causing said chucks to disengage the ends of the tap alternately, and means whereby the disengagement and reengagement of one end initiates the disengagement and reengagement of the other.

35 8. The combination of a tap, a pair of rotatable members adapted to engage the two ends of the tap respectively, means for moving said members longitudinally to disengage and reengage the ends of the tap respectively, and means whereby one reengaging movement feeds a blank on the tap, and the other disengaging causes mechanism to engage and feed a threaded nut off the tap.

40 9. The combination, with means for driving a tap, of means controlled by the progress of a blank on the tap for disconnecting the driving means.

50 10. The combination of a tap engageable at both ends, a pair of mechanisms for so engaging the tap and driving it, means for releasing the hold on the tap at one end, and mechanism controlled by the progress of the blank being tapped for actuating said means.

55 11. The combination of a tap engageable at both ends, a pair of mechanisms for so engaging the tap and driving it, means for releasing the hold on the tap at the exit end, mechanism controlled by the progress of the blank being threaded for actuating said means, and mechanism actuated by said means for releasing the tap at the receiving end.

60 12. The combination of a tap engageable at both ends, a pair of mechanisms for so engaging the tap and rotating it simulta-

neously, a pair of cams for causing disengagement and reengagement of said mechanisms respectively, and mechanism actuated by the progress of the blank for throwing said cams into action.

70 13. The combination of a tap engageable at both ends, a pair of mechanisms for so engaging the tap and rotating it simultaneously, a pair of cams for causing disengagement and reengagement of said mechanisms respectively, and mechanism operated by one of said cams for throwing the other into action.

75 14. The combination of a tap engageable at both ends, a pair of mechanisms for so engaging the tap and rotating it simultaneously, a pair of cams for causing disengagement and reengagement of said mechanisms respectively, and mechanism operated by the progress of the blank being tapped for throwing one of said cams into action, and mechanism operated by said cam for throwing the other cam into action.

80 15. The combination of a tap engageable at both ends, a pair of mechanisms for so engaging the tap and rotating it simultaneously, a pair of cams for causing disengagement and reengagement of said mechanisms respectively, and mechanism throwing said cams into action, and mechanism whereby each cam throws itself out of action.

85 16. The combination of a tap, a pair of chucks for engaging the same, each chuck being mounted in a rotatable spindle and having a pair of jaws, a pair of cams for withdrawing and returning said jaws, and means whereby each cam automatically releases itself at the end of a predetermined movement.

90 17. The combination of a tap, a pair of chucks for engaging the same, each chuck being mounted in a rotatable spindle, a main driving shaft geared with both of said spindles, a pair of cams for engaging and disengaging said chucks, and means whereby each cam automatically releases itself at the end of a predetermined movement.

95 18. In a tapping machine, the combination of a tap, a pair of rotatable members each having means for engaging the corresponding end of the tap, mechanism for causing said means to alternately release the tap, and a pair of single rotation cams for operating said mechanisms.

100 19. In a tapping machine, the combination of a tap, a pair of rotatable members each having means for engaging the corresponding end of the tap, mechanism for causing said means to alternately release the tap, cams for operating said mechanism, and clutches for controlling said cams.

105 20. The combination of a pair of chucks each consisting of a rotatable barrel and longitudinally slidable jaws within each

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barrel, a double ended tap adapted to be engaged by both chucks, a pair of cams adapted alternately to open and close the respective chucks, and a pair of clutches for
5 controlling said cams respectively.

21. The combination of a pair of chucks each consisting of a rotatable barrel with longitudinally slidable jaws therein, a double ended tap adapted to be engaged by both
10 chucks, a driving shaft geared to rotate the two chucks simultaneously, a pair of cams adapted alternately to open and close the respective chucks, a pair of clutches for controlling said cams respectively, and means
15 whereby said clutches are automatically engaged and released.

22. The combination of a double-ended tap, two sets of jaws for driving the two ends simultaneously, means for separating
20 either set of jaws and then withdrawing them from the tap, and means for returning said jaws over the tap and thereafter causing them to engage the same.

23. The combination with a double-ended
25 tap of two alined drivers therefor each consisting of a rotatable barrel, a pair of jaws therein, means for forcing the rear ends of said jaws apart to cause the forward ends to assume engaging position, and a thrust
30 abutment for the spread ends of the jaws.

24. In a tapping machine, the combination of two drivers each consisting of a rotatable barrel, a pair of jaws therein adapted to engage the tap, means for forcing said
35 jaws apart to free the tap and drawing them into the barrel with their engaging portions apart, means for each driver for causing said jaws to close on the tap and a positive thrust abutment in front of which said jaws
40 come in such operation, and mechanism for actuating the last mentioned means successively.

25. The combination with a double-ended tap of two alined drivers therefor each consisting of a rotatable barrel, a pair of jaws
45 mounted in a recess therein, intermediate fulcrums for said jaws, mechanism for forcing the rear ends of said jaws apart and thereby closing the forward ends, and a seat
50 in the recess forming a thrust abutment for the jaws.

26. The combination with a double-ended tap of two alined drivers therefor each consisting of a rotatable barrel, a pair of jaws
55 mounted therein, intermediate fulcrums for said jaws, toggle links and a rod for forcing the rear ends of said jaws apart and thereby closing the forward ends, and a washer in the barrel surrounding said rod and forming
60 a thrust bearing for the jaws.

27. The combination with a double-ended tap of two alined drivers therefor each consisting of a rotatable barrel, a pair of jaws
65 therein adapted to have longitudinal movement, means for forcing said jaws apart,

and intermediate fulcrums for the jaws consisting of stop screws whose points occupy grooves in the jaws.

28. The combination with a double-ended tap of two alined drivers therefor each consisting of a rotatable barrel, a pair of jaws
70 therein adapted to slide in a socket in the barrel, stationary fulcrums for said jaws with which they have a sliding engagement, means for projecting the jaws forwardly,
75 means for stopping the forward movement, and means for forcing the rear ends of the jaws apart to cause the forward ends to clamp.

29. In a tapping machine, the combination of two drivers each consisting of a rotatable barrel, a pair of jaws therein adapted to slide in a socket in the barrel, fulcrums for said jaws, and a cam and a spring
80 for each driver for first projecting the jaws toward the tap and then forcing the rear ends of the jaws apart to cause the forward ends to clamp the tap, and means for actuating the two cams successively.
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30. The combination with a double-ended tap of two alined drivers therefor each consisting of a rotatable barrel, a pair of jaws
90 mounted in a socket in the barrel, a cam for withdrawing the jaws into the barrel and spreading their forward ends, and a spring coacting with the cam for returning the
95 jaws and closing them.

31. The combination with a double-ended tap of two alined drivers therefor each consisting of a rotatable barrel, a pair of jaws
100 therein, fulcrums for said jaws intermediate of their ends, toggle links for spreading the rear ends of the jaws, a rod connected to the toggle knuckle, and means for operating the
105 rod.

32. The combination with a double-ended tap of two alined drivers therefor each consisting of a rotatable barrel, a pair of jaws
110 therein, fulcrums for said jaws intermediate of their ends, toggle links for spreading the rear ends of the jaws, and a thrust abutment for the spread ends.

33. In a tapping machine, the combination of two drivers each consisting of a rotatable barrel, a pair of jaws mounted in a
115 socket in the barrel, a cam and mechanism operated thereby for separating the engaging portions of the jaws and then withdrawing the jaws into the barrel, and a cam and a spring for each driver for returning the
120 jaws and then closing them, and means for actuating the two cams successively.

34. The combination with a double-ended tap, of a pair of rotatable chucks openable and closable to engage and disengage the
125 end portions of the tap respectively, means for simultaneously rotating both chucks, automatic means for moving the jaws of said chucks longitudinally to disengage the ends
130 of the tap alternately, and an automatic

feed for fresh blanks controlled according to one of such longitudinal movements.

35. The combination of a rotatable chuck openable and closable to engage and disengage the tap, a feeding chute, a cut-off therefor, and a cam simultaneously moving the jaws of the chuck and the cut-off.

36. The combination with a double-ended tap, of a pair of rotatable chucks openable and closable to engage and disengage the end portions of the tap respectively, means for simultaneously rotating both chucks, a feed chute for the blanks, a cut-off therefor, means for removing tapped nuts, automatic means for causing said chucks to disengage the ends of the tap alternately, a cam for so moving one of the chucks and also the cut-off to feed a blank, and a cam for so moving the other chuck and also the nut remover to discharge a nut.

37. The combination of a pair of chucks, means for simultaneously rotating them, a pair of cams, means whereby each cam may open the corresponding chuck, a pair of rock shafts for actuating the cams respectively, means controlled by the progress of the work for rocking one shaft, and means controlled in accordance with the movement of the cam thus actuated for rocking the other shaft to actuate the other cam.

38. The combination of a pair of chucks, means for simultaneously rotating them, a pair of cams, means whereby said cams operate said chucks while rotating, a pair of clutches for the respective cams, means actuated according to the progress of the work for causing one of said clutches to engage, and means actuated at a predetermined time after such engagement to cause the other clutch to engage.

39. The combination of a tap, mechanisms for engaging and driving both ends thereof, mechanism controlled by the progress of the nut for causing the withdrawal of one of the driving mechanisms, and mechanism operating at a predetermined time thereafter for causing the withdrawal of the other driving mechanism.

40. The combination of a pair of rotatable

chucks in alinement, a main driving shaft geared with both chucks, a pair of cams, connecting mechanism between each cam and the jaws of the corresponding chuck, and clutches and gearing between each cam and the main driving shaft.

41. The combination of a pair of alined rotatable chucks, a main driving shaft parallel therewith, gearing between each chuck and the driving shaft, two cams loose on the driving shaft, two gears loose on the shaft and geared therewith, clutches adapted to lock the cams to the two gears respectively, and mechanism connecting each cam with the jaws of the corresponding chuck and adapted to move such jaws longitudinally.

42. The combination of two rotatable chucks in alinement, two axial rods to operate the jaws of the respective chucks, two parallel longitudinally movable rods (each rod being connected with one of the axial rods mentioned) a blank feeding mechanism operatively connected with one of said rods, a nut discharging mechanism operatively connected with the other of said parallel rods.

43. The combination of two rotatable chucks in alinement, two axial rods adapted to operate the jaws of the respective chucks, two parallel longitudinally movable rods (each rod being connected with one of the axial rods mentioned) a blank feeding mechanism operatively connected with one of said parallel rods, and a nut discharging mechanism operatively connected with the other of said parallel rods, a pair of cams for alternately actuating one set of axial and parallel rods and then the other set, means for continuously rotating the chucks, and means for intermittently rotating the cams.

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

ARTHUR E. TAYLOR.

Witnesses:

ALBERT H. BATES,
BRENNAN B. WEST.