May 23, 1950 F. GARTNER 2,509,056

TAPPING MACHINE

Filed Dec. 4, 1947 2 Sheets-Sheet 1

Fig. 1

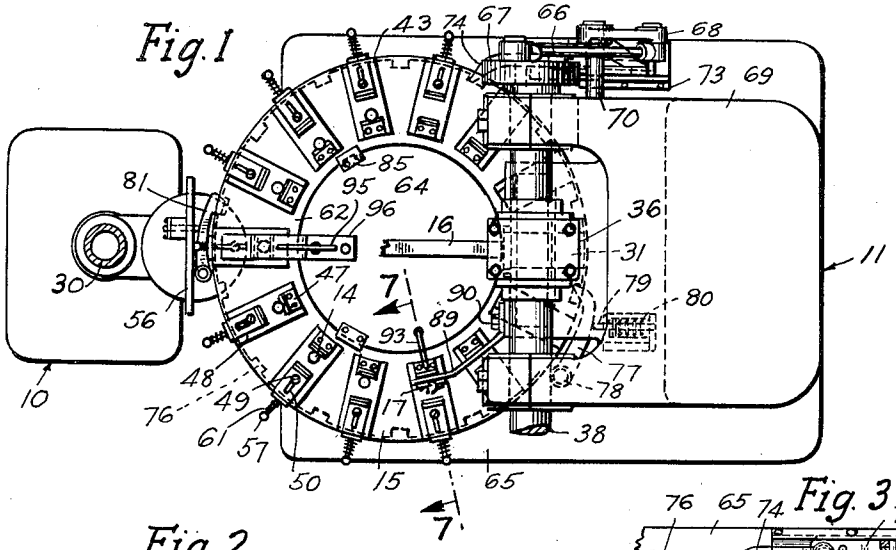


Fig. 2

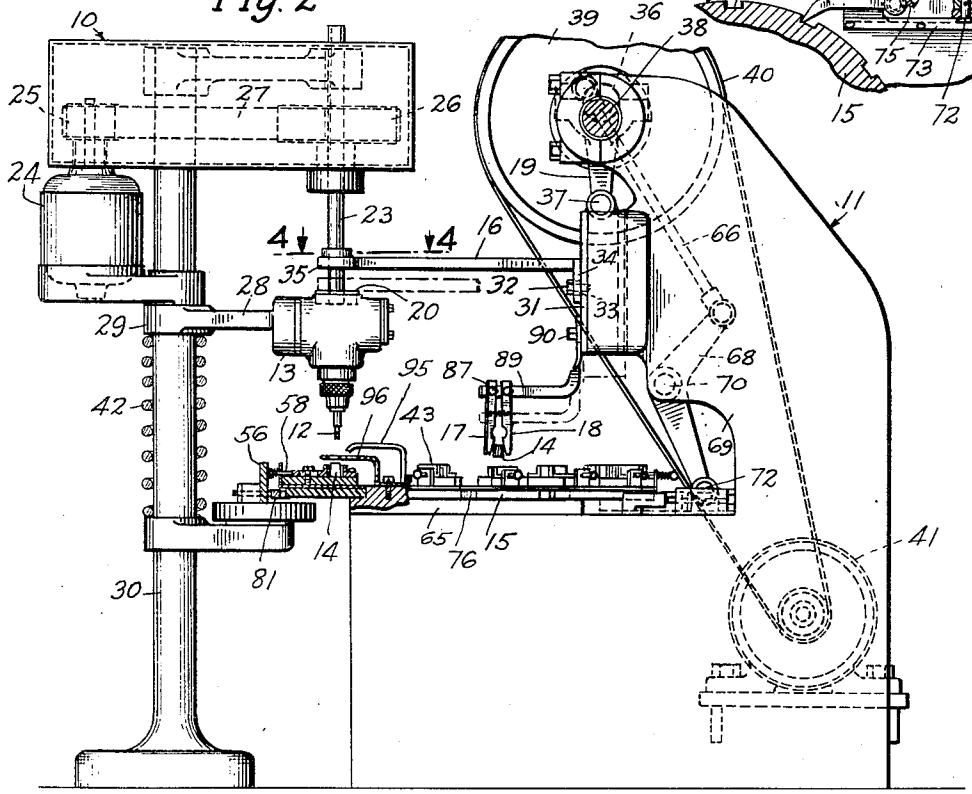
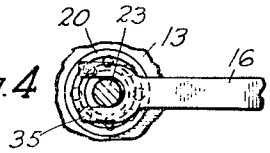


Fig. 3

Fig. 4



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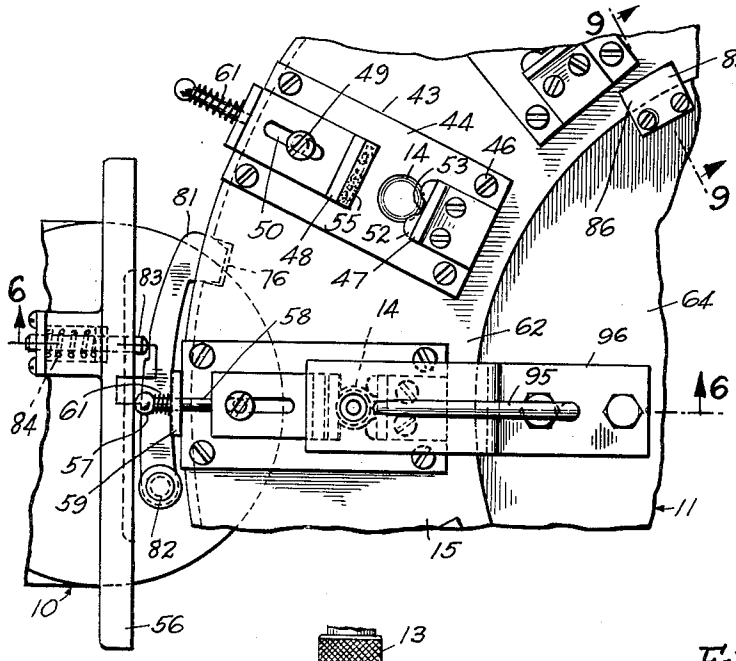


Fig. 5

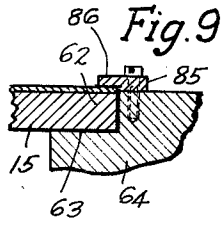


Fig. 9

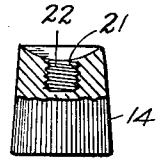


Fig. 10

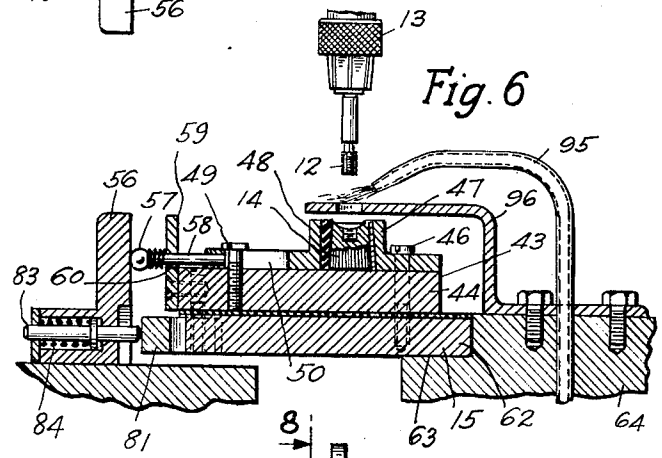


Fig. 6

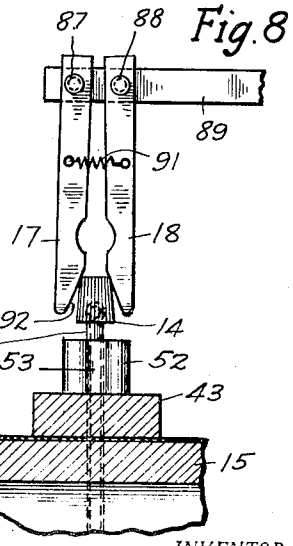


Fig. 8

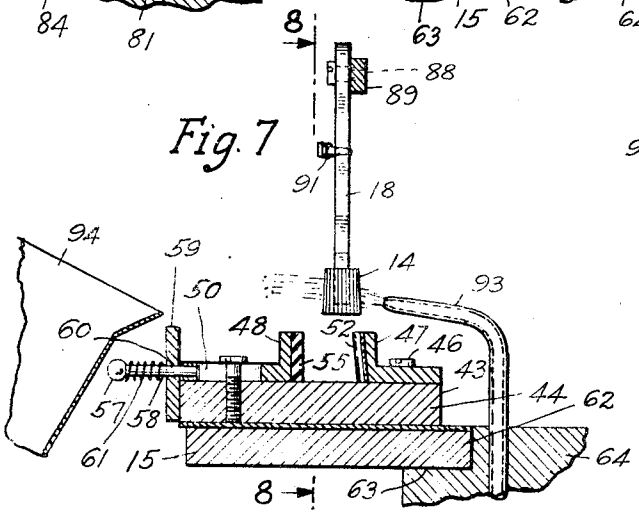


Fig. 7

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2,509,056

TAPPING MACHINE

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Application December 4, 1947, Serial No. 789,654

6 Claims. (Cl. 10—129)

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This invention relates to screw thread tapping machines and particularly to that type intended to tap blind holes in thermosetting plastic articles such as bottle caps.

The invention contemplates the provision of a tapping machine wherein a conventional tapping attachment such as that disclosed for example in Patent No. 2,012,340 is automatically reciprocated through the proper stroke required for the tapping of the hole in the work, and wherein the work is automatically fed to the tapping station and there adequately held during the tapping operation, and then automatically discharged from the machine.

The invention further contemplates the provision of a machine utilizing a suitable well known tapping attachment, for automatically tapping blind holes in articles brought automatically to the attachment, and for discharging the tapped articles by a blast, the machine being readily constructed by combining selected parts of a drill press with parts of a dial press.

The invention further contemplates the combination of a drill press, a dial press and a tapping attachment into a single properly functioning tapping machine, to which the work to be tapped is manually or otherwise fed, and the remaining operations are automatically performed.

The various objects of the invention will be clear from the description which follows and from the drawings, in which

Fig. 1 is a top plan view of the tapping machine partly in section, certain of the parts being broken away.

Fig. 2 is a side elevational view of the machine.

Fig. 3 is a fragmentary top plan view, partly in section, of a portion of the means for intermittently rotating the dial and work holders.

Fig. 4 is a fragmentary horizontal sectional view, taken on the line 4—4 of Fig. 2, of the arm of the dial press employed for imparting the operative downward stroke to the tapping attachment and to the tap thereof.

Fig. 5 is a fragmentary enlarged top plan view similar to Fig. 1 of the dial and work holders, showing the means for closing the jaws of the work holders.

Fig. 6 is a fragmentary vertical sectional view of a work holder, taken on the line 6—6 of Fig. 5.

Fig. 7 is a fragmentary vertical sectional view of the work discharge means taken on the line 7—7 of Fig. 1.

Fig. 8 is a similar sectional view taken on the line 8—8 of Fig. 7.

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Fig. 9 is a fragmentary vertical sectional view of the dial support and guide taken on the line 9—9 of Fig. 5.

Fig. 10 is an elevational view partly in section of a bottle cap suitable for tapping by the machine.

In the practical embodiment of the invention shown by way of example, the various rotating and reciprocating movements of the work-feeding, tapping and discharge mechanisms are imparted thereto by the typical drill press 10 and the typical dial press 11 for purposes of economy, though it will be understood that an equivalent special machine usable only for tapping may readily be designed having the same movements and operating in the same manner to perform and attain the same results. The mechanism of the drill press rotates the top 12 carried by the conventional tapping attachment 13, which reverses the direction of rotation of the tap after the screw thread has been completely formed in the hole of the article 14. The dial press 11 not only causes intermittent rotation of the dial or turntable 15 in a horizontal plane, but also reciprocates the arm 16 which controls the downward operative or feeding movement of the tapping attachment and reciprocates the work-gripping discharge fingers 17 and 18.

The attachment 13 may be of any well known form such as that shown for example in Patent No. 2,012,340, designed for connection to the revoluble drill shaft of a drill press and to have its tap 12 rotated thereby first in one direction to form the thread 21 in the hole 22 of the work 14 on the downward movement of the tap, and then in the opposite direction to remove the tap from the work during the upward movement of the attachment. The vertical drill shaft 23 of the drill press is connected to the attachment 13 in the usual manner and is continuously rotated by the usual connections to the drill press motor 24, such as the motor pulley 25 (Fig. 2), the shaft pulley 26 and the belt 27, the shaft 23 being supported for vertical reciprocatory movement through the pulley 26 as by a key and slot connection thereto. An arm 28 fixed at one end to the attachment 13 and at its other end terminating in a ring 29 slidable on the column 30 of the drill press, guides the attachment during its vertical movement.

Means are provided for moving the arm 16 into pressing contact with the tapping attachment to lower the attachment the exact required distance to thread the hole in the work. In the form of the invention shown, said arm 16 is

adjustably attached to the ram 31 of the dial press, since such dial presses already are provided with means for vertically reciprocating the rams thereof. The bolt 32 passing through the slot 33 in the base 34 at one end of the arm and into the ram secures said arm in its exact adjusted position wherein the lowermost positions of the arm and the ram correspond to the lowermost position of the tap in the hole 22 of the work. At its other end, the arm 16 is bifurcated to form the fork 35, the rotating drill shaft 23 being received between the branches of the fork. Preferably, a suitable anti-friction bearing as 20 is interposed between the under side of the fork 35 and the top of the attachment 13 in order to permit the shaft 23 to rotate freely while the fork presses downwardly upon the outer race of the bearing and thereby halts the rotation of said outer race without interference with the rotation of the inner race and while adequately transmitting downward pressure to the attachment. The ram 31 is reciprocated in the usual manner by means of the connecting rod 19 pivoted at one end at 37 to the ram and pivoted at its other end to the crank 36 on the shaft 38, said shaft being the main shaft of the dial press and being rotated continuously as by the pulley 39 thereon through the belt 40 and the dial press motor 41.

After the tap 12 has completed the tapping operation, the ram 31 begins its upward stroke and the arm 16 moving with the ram releases the downward pressure on the tapping attachment. The spring 42 around the drill press column 30, then becomes effective to raise the arm 28, the attachment 13 and the drill shaft 23 to begin the withdrawal of the tap from the work. Such withdrawal causes reversal of the direction of rotation of the tap, due to the operation of the clutch (not shown) which forms part of the tapping attachment as is well understood. Release of the tap from the work permits the tap to be again rotated in the initial tapping direction ready for the repetition of the operation.

The work pieces 14 being in the form shown, bottle caps, are manually fed to the work holders 43 on the dial 15 of the dial press. Each of said holders, as best seen in Figs. 5 to 7, comprises a base 44 suitably secured to the annular dial 15 as by the screws 46, a fixed jaw 47 secured to the base and a radially slidable jaw 48 secured to the base as by means of the bolt 49 passing through the radial slot 50 and into the base. The upstanding portion of the fixed jaw is lined with suitable material 52 shaped to fit and to grip the article 14. Said article being shown as a conical cap, the jaw lining is provided with a tapered recess 33 to receive a tapered part of the cap thereby to assist in aligning the cap at the tapping station and to retain the cap in centered position even after it has been released by the movable jaw of the work holder. Said movable jaw 48 has its upstanding inner end portion lined with yieldable and resilient material 55 such as rubber to prevent injury to the work when the jaws are forced together with the work therebetween. To close the jaws, a fixed cam plate as 56 is interposed in the path of the outer rounded end 57 of the jaw operating rod 58, the other end of which is secured to the movable jaw 48. Interposed between the end 57 and the fixed upstanding guide plate 59, through the opening 60 of which the rod 58 passes and is guided, is the spring 61 urging said rod end 57 outwardly toward the cam plate 56 which may be fixed to the bed plate of the drill press. As the work holder approaches its rest position at the tapping station, the rod 58 is forced inwardly by the plate 56 against the action of the spring 61 to close the jaw 48 upon the work and to force the work into the recess 53 of the fixed jaw lining, thereby centering and aligning the work, which remains and is retained in the recess after the jaws open. Opening of the movable jaw occurs under the influence of the spring 61 when the rod 58 passes the cam plate.

The dial 15 may be of any suitable type, but as shown, is of annular form, with its inner peripheral portion 62 slidably resting on the ledge 63 of the dial support 64 upstanding from the bed 65 of the dial press. To rotate the dial intermittently enough to carry the work holders 43 successively to the tapping station, the connecting rod 66 (Figs. 1 and 2) is provided at its upper end with a pivotal connection to the crank 67 on the shaft 38, and at its other end is pivoted to the bell crank lever 68, which is pivotally mounted on the frame 69 as at 70. The lower end of the lever 68 is pivoted to the slide 71 (Fig. 3) as by the pin 72, said slide sliding in a suitable fixed guideway 73 and carrying the dial-operating pawl 74, the free end of which is urged by the spring 75 into one of the notches 76 in the outer periphery of the dial. One of said notches is provided for each work holder, both being spaced apart equally around the circumference of the dial. On each rotation of the shaft 38, the slide 71 is reciprocated causing the pawl 74 to advance the dial one notch and to carry the next work holder to the tapping station while the tapping attachment is in its raised position. The work holder remains at rest while the pawl 74 is being retracted and the ram 31 completes its descent and moves upwardly enough to withdraw the tap from the work.

To prevent excess movement of the dial under the action of the pawl 74 and to insure exact positioning of the work holders and of the work therein at the tapping station, a pair of pivoted spring-pressed holding pawls are provided to enter spaced apart selected peripheral notches 76. One of the pawls as 77 (Fig. 1) is pivoted to the bed plate of the dial press as at 78 and is urged by the rod 79, pressed by the spring 80 toward the periphery of the dial and into one of the notches 76. The other holding pawl 81 may be pivoted to the bed plate of the drill press as at 82 and is similarly pressed (Figs. 5 and 6) by the rod 83 and the spring 84 toward the periphery of the dial and into one of the notches, the ends of the pawls being suitably shaped to prevent overrunning of the dial and to accomplish the registration desired. The dial is maintained at its proper height and positioned by the clamps 85 (Fig. 9) each removably secured to the dial support 64 and having an outer part 86 thereof overhanging the inner peripheral portion of the dial.

After the work 14 has been tapped as above described, it is released by the movable jaw of the work holder and is carried while resting in the recess 53 of the movable jaw, to a discharge station where it is removed from the work holder and discharged from the machine by a blast. For lifting the work from the work holder, the pair of fingers 17, 18 are each pivoted at the upper end thereof as at 87, 88 respectively, to the bracket 89 adjustably secured to the ram 31 as by the bolt 90 passing through a suitable upright slot in the end part of the bracket whereby the bracket may be raised or lowered as required. The fingers are drawn toward each other by a light spring as 91, and each terminates in a slightly roughened inner

edge portion as 92 which is inclined to the vertical (Fig. 8) so that said edge portions of the fingers converge upwardly.

As the ram 31 descends, the upper corner part of the work 14 enters the space between the inclined edges 92 of the fingers and is gripped thereby, the gripping action being aided by the spring 91. As the ram 31 rises, the work is withdrawn from the recess 53 of the work holder into the range of the blast of air emerging from the pipe 93 leading to a suitable source of compressed air (not shown) and which blows the lightly held article from between the discharge fingers 17, 18 and into a suitable receptacle as 94, Fig. 7. A branch pipe 95 (Fig. 6) terminates at the tapping station and discharges an air blast to remove the dust or waste generated by the tapping operation to prevent interference with the operation of the machine. To hold the tapped article against rising excessively out of the jaws of the work holder with the rising tap 12 when the tap is removed from the work, a suitable guard as 96 perforated for the passage of the tap may be arranged at the tapping station, the work being stripped by the guard should it rise out of the jaws with the tap.

It will be seen that there is hereby provided a relatively simple, efficient and economical automatic tapping machine for articles which require careful handling such as the relatively brittle bottle caps made of thermosetting material shown herein, that the machine may be readily and economically constructed by combining existing and readily available machines having the proper reciprocating and rotary movements, that the accuracy required for tapping blind holes in relatively brittle material may readily be attained by the invention to limit the tapping operation to the exact length required and thereby prevent damage to or spoilage of the work, and that the invention is well designed to carry out its intended purposes.

While a certain specific embodiment of the invention has herein been shown and described, it will now be understood and obvious that various changes may be made therein without departing from the spirit of the invention defined in the appended claims.

I claim:

1. A machine for tapping the hole in a conical drilled article comprising the combination with a tapping attachment for a drill press, said attachment being provided with a tap rotatable in one direction to tap a hole in the article and rotatable in the other direction on withdrawal of the tap from the article, of a horizontal annular rotatable article-holding dial, a dial support slidably engaging the inner peripheral edge of the dial, article holders on the dial, said holders having upwardly and inwardly tapering flanges to grip the conical article therebetween, the dial being intermittently rotatable to carry the holders successively to a tapping station aligned vertically with the tap, means including a reciprocating arm engaging and urging the attachment downwardly and a spring urging the attachment upwardly for reciprocating the attachment and the tap thereof toward and from the holders at the tapping station while the dial is at rest, spring-pressed pivoted fingers connected to and movable as a unit with the arm and having inclined downwardly diverging article-gripping edges adapted to spread apart and to grip the tapped article between the fingers on the downward movement of the fingers into engagement with the upper edge of the article and to lift the article from the holder while the dial is at rest, and a pipe having a terminal portion arranged transversely of and adjacent the paths of the fingers and adapted to deliver a blast to the article lifted by the fingers clear of the holder to blow the article from between the fingers out of the machine.

2. The combination of a tapping attachment provided with a tap and a drive shaft, of means in operative engagement with the shaft for rotating the tap, an intermittently rotatable horizontal work-holding dial, work holders on the dial each comprising an inner fixed jaw and a slotted outer movable jaw, a bolt passing through the slot of the movable jaw and into the dial and an extension on the outer end of the movable jaw, means for closing the movable jaw on an article of work as the work holder approaches the tap comprising a fixed cam arranged to engage the extension and to move the extension inwardly, means for reciprocating the attachment to tap the work comprising a reciprocating member having a bifurcated end straddling the drive shaft, work-lifting fingers above the dial each pivotally mounted at one end and having an inclined work-gripping edge at the other end, a spring secured to the fingers and urging the fingers toward each other, a connection between the fingers and the reciprocating member to reciprocate the fingers toward and from the workholders thereby to receive the work between the inclined edges and to lift the work out of the jaws on the upward movement of the fingers, the upper corner edge of the work being relatively lightly gripped by the fingers, and a blast delivery pipe arranged transversely of the inclined edges and terminating adjacent a selected point in the path thereof.

3. The combination with a device having a tap rotatable in one direction to tap an internal screw thread in the wall of a hole in an article of work and rotatable in the other direction to withdraw the tap from the work, the work having a substantially conical lateral surface, of a horizontally rotatable work-supporting table below and in the path of the tap and in position to carry the work articles successively to a tapping station under the lower end of and in vertical alignment with the tap, said table comprising a rotatable ring, an inner fixed member having an outer ledge engaging and supporting the ring and ratchet means engaging the periphery of and intermittently rotating the ring around the fixed member, an upright rotatable and vertically reciprocable shaft operatively secured to the attachment and adapted to rotate the tap, work holders on the ring each adapted to engage the lateral surface of the work and to secure the work to the ring in position for tapping, work-lifting mechanism above the work holders and in circumferential spaced relation to the tap, said mechanism comprising a pair of transversely spaced similar fingers each having the lower part of the inner edge thereof inclined downwardly and outwardly, a pivot for the upper end of each finger, a transverse spring across the fingers and secured at the respective ends thereof to the respective fingers thereby to urge the tapering lower edges of the fingers toward each other, said lower edges being sufficiently divergent and spaced apart at the lowermost points thereof to receive and to grip the uppermost part of the lateral conical surface of the work therebetween when the fingers are lowered on to the work held by an aligned work holder, the fingers spreading apart against the action of the spring as said edges engage and move downwardly past the uppermost

corner edge of the work, and a reciprocable member having a part carrying the pivots of the fingers and having another part engaging the shaft to lower the shaft and thereby to cause the fingers to grip lightly and to lift the work off the table while the tap is removed from another article of work, and a compressed-air-carrying pipe having a terminal portion arranged laterally of the fingers and provided with a discharge opening adjacent the path of the tapered lower edges of the fingers to direct a blast of compressed air toward and laterally past the area between said tapered edges when the fingers approach the uppermost positions thereof, thereby to remove the work from between the fingers and to forward the work out of the machine.

4. The combination of claim 3, each of the work holders comprising a base secured to the ring, a fixed jaw secured to the base and having an upstanding flange at its outer edge, a lining on the flange provided with a tapered recess, a slotted jaw slidable on the base radially of the fixed jaw and having an upstanding inclined inner flange, a resilient and yieldable lining on and inwardly of the inner flange, a bolt passing through the slot of the slotted jaw and into the base, an extension projecting from the slotted jaw radially and outwardly, a spring on the extension urging the slotted jaw away from the fixed jaw, and a fixed cam in the path of the extension adapted to engage the extension and to close the jaws upon a conical article arranged therebetween.

5. The combination of claim 4, the reciprocating member supporting the pivots being bifurcated at the end thereof engaging the shaft to straddle the shaft and a spring operatively connected to the tapping device and urging the device upwardly.

6. A tapping machine comprising a reciprocating and rotating tap, means underneath the tap for intermittently feeding articles into vertical alignment with the tap and for holding the article against movement when so aligned, tap-holding and operating means for reciprocating the tap into and out of the article to tap the article, means reciprocating vertically above the feeding and holding means for lifting the tapped article out of the feeding and holding means comprising a pair of spaced apart fingers in spaced relation to the tap, each of the fingers being pivotally mounted at its upper end and having an inclined work gripping edge at its lower end, the inclined edges of the fingers diverging downwardly, a spring extending across the fingers and secured thereto intermediate the ends thereof to permit the fingers to spread as the inclined edges are forced downwardly over the upper corner edge of an article to grip the article lightly, and an operative connection between the tap reciprocating means and the fingers to reciprocate the fingers vertically and bodily as a unit, and a pipe having a substantially horizontal terminal portion terminating adjacent the paths of the inclined edges and conducting air under pressure to direct a blast at the article lifted by the fingers to blow the article out of the machine.

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