Jan. 19, 1943. O. JENDRESEN 2,308,659

APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

Original Filed March 31, 1941 5 Sheets-Sheet 1

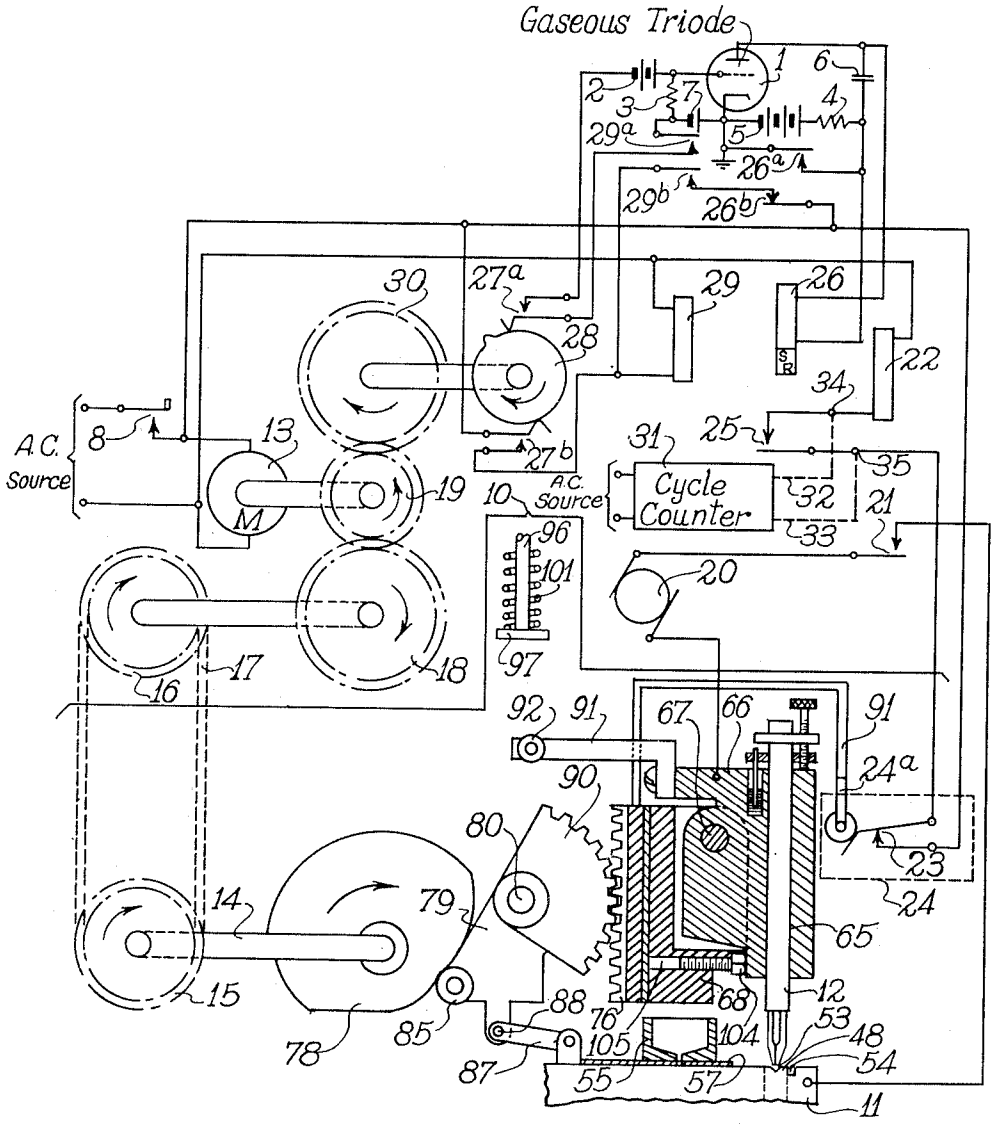


Fig. 1

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Original Filed March 31, 1941 5 Sheets-Sheet 2

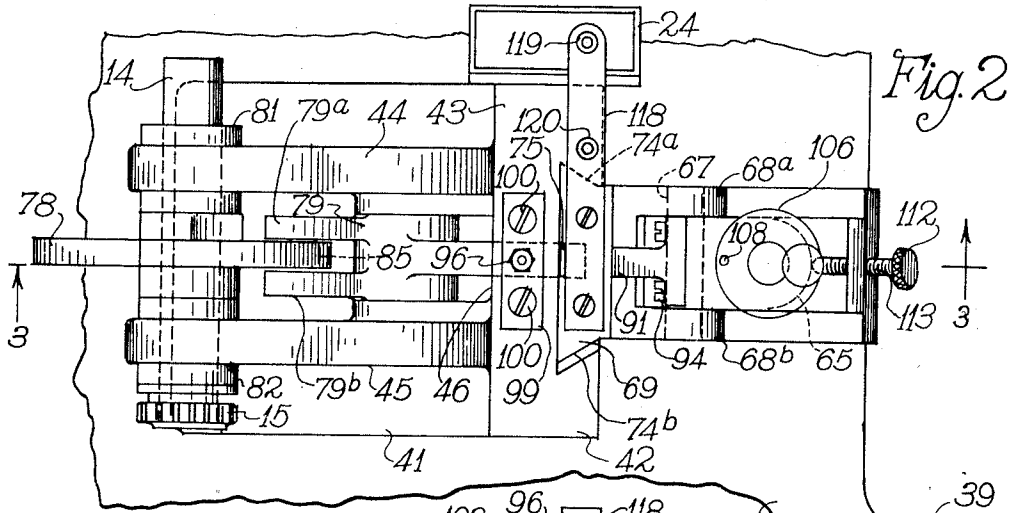


Fig. 2

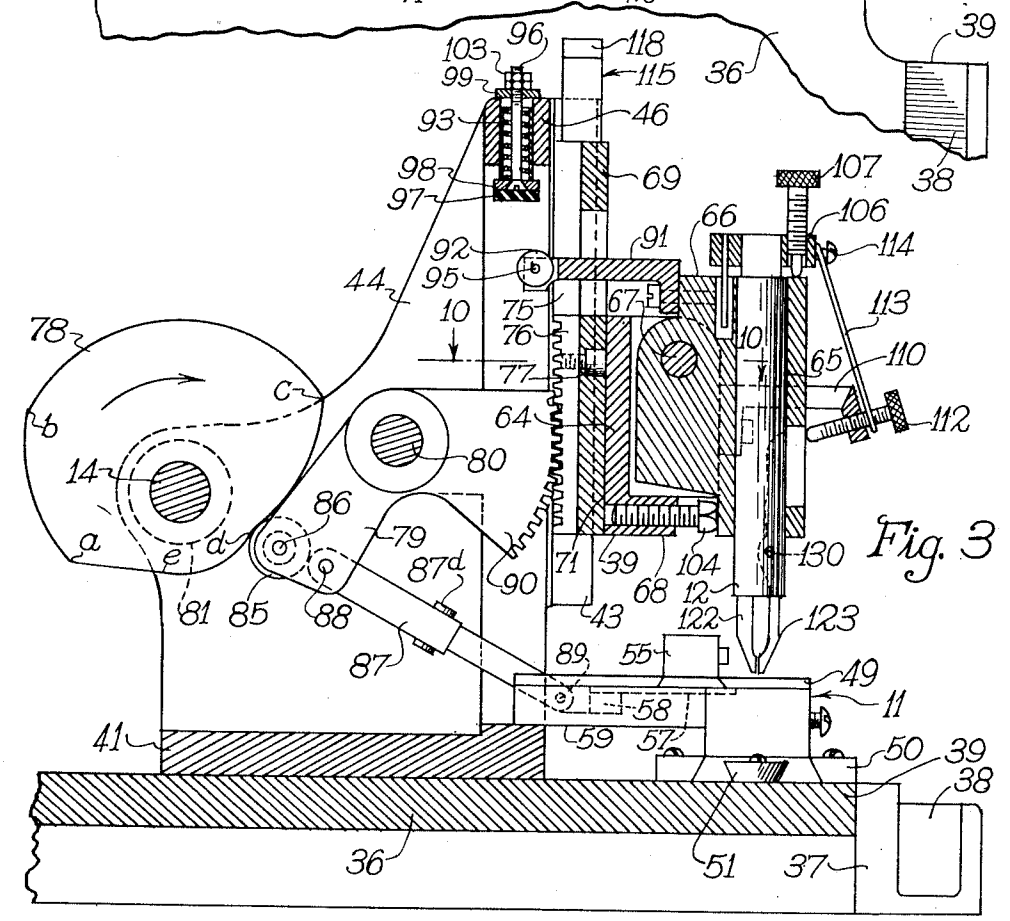


Fig. 3

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APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

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Fig. 5

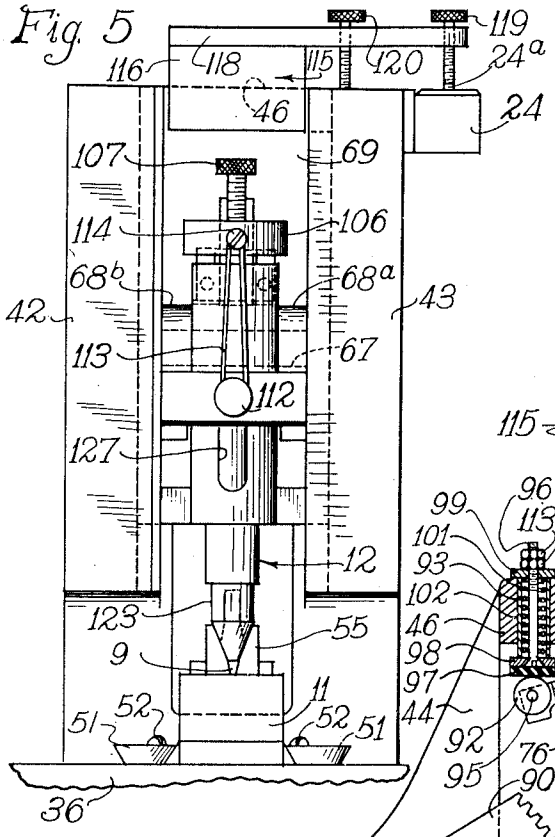


Fig. 3A.

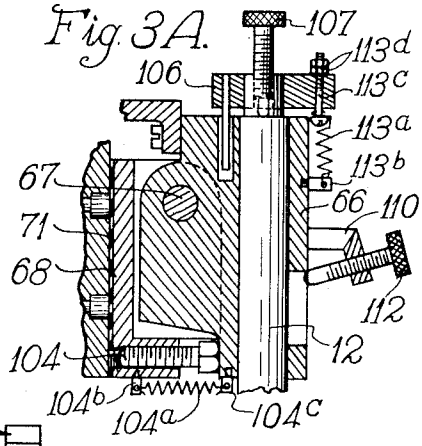
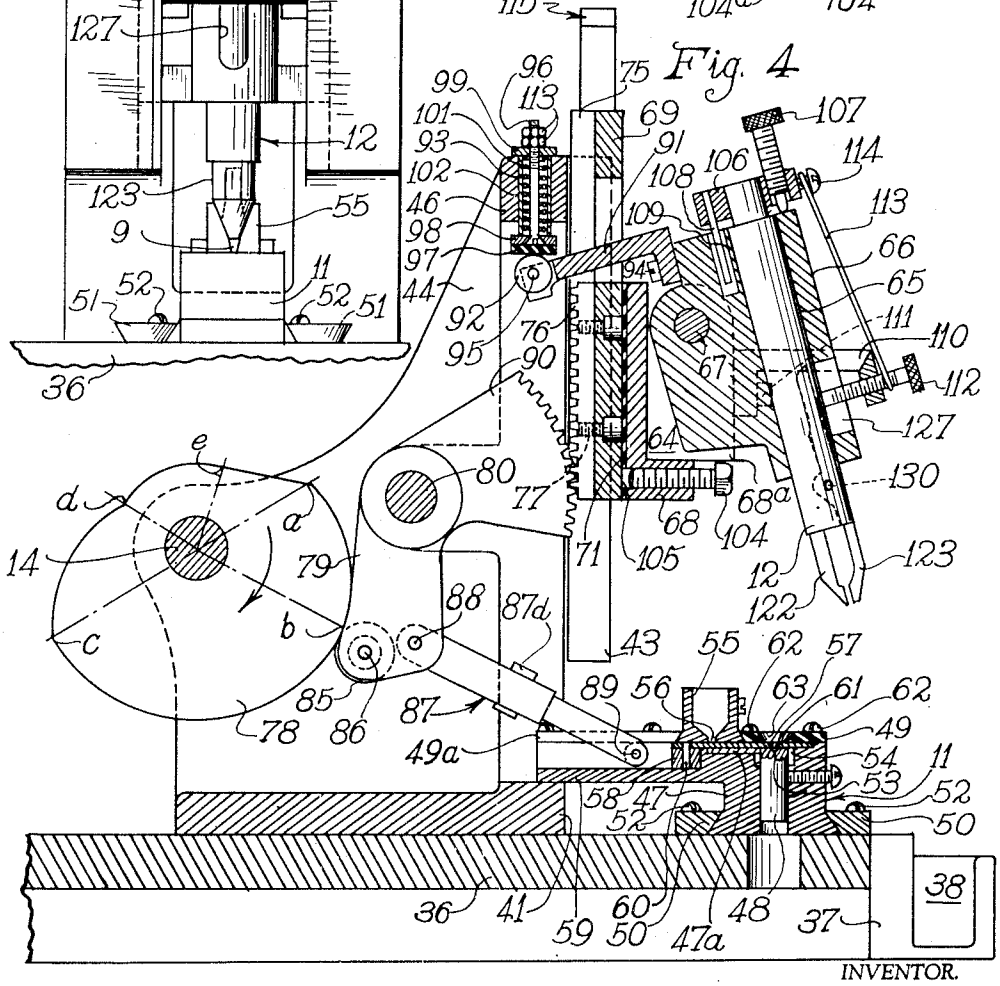


Fig. 4



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APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

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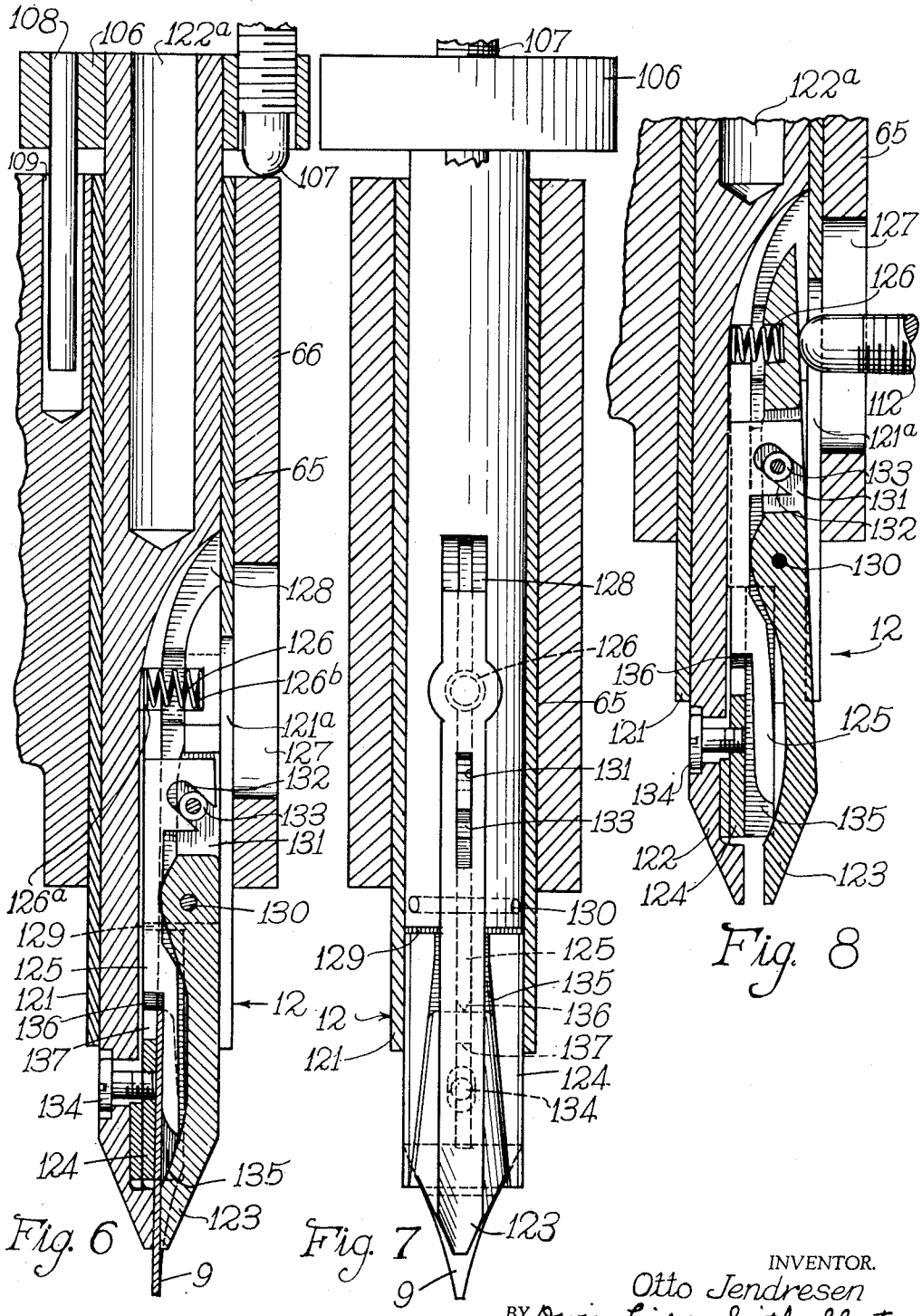


Fig. 6

Fig. 7

Fig. 8

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APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

Original Filed March 31, 1941 5 Sheets-Sheet 5

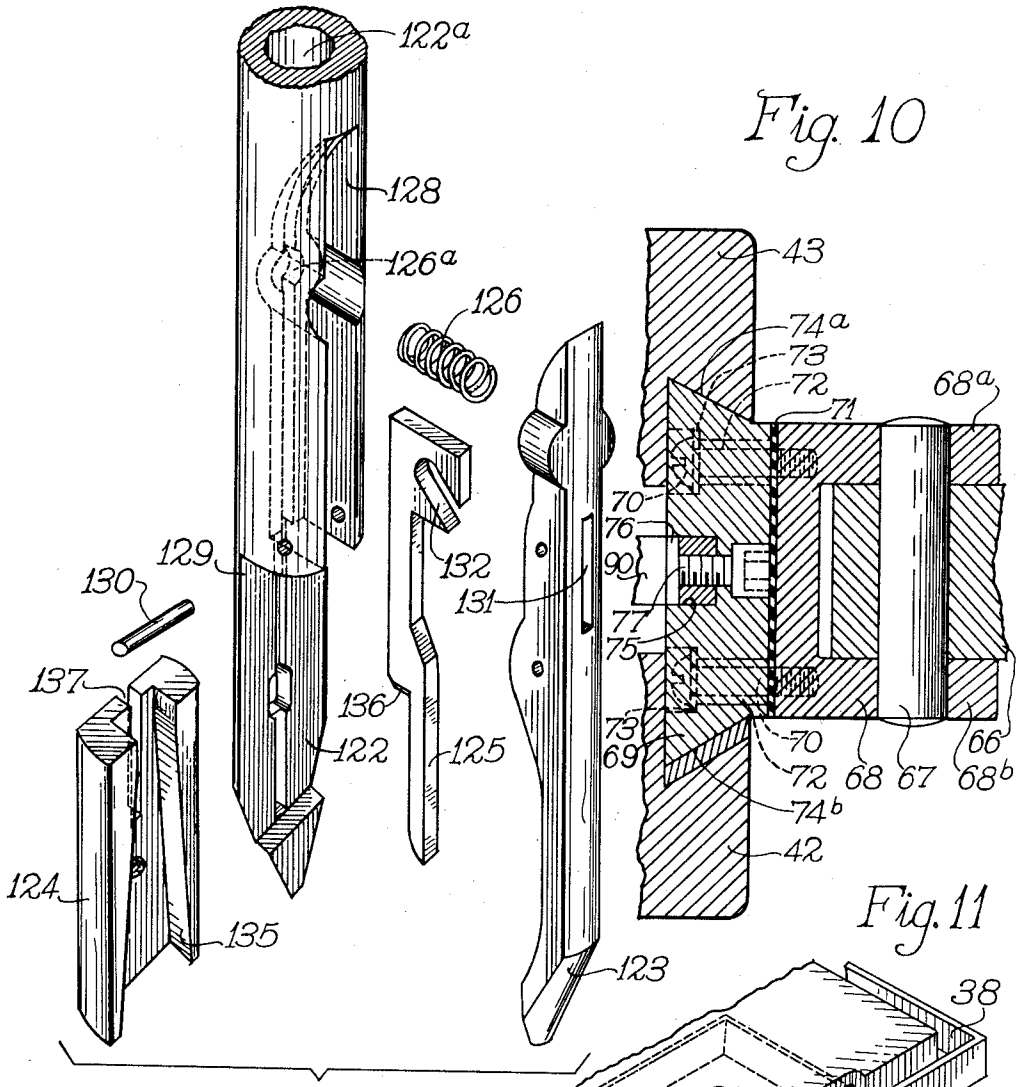


Fig. 10

Fig. 11

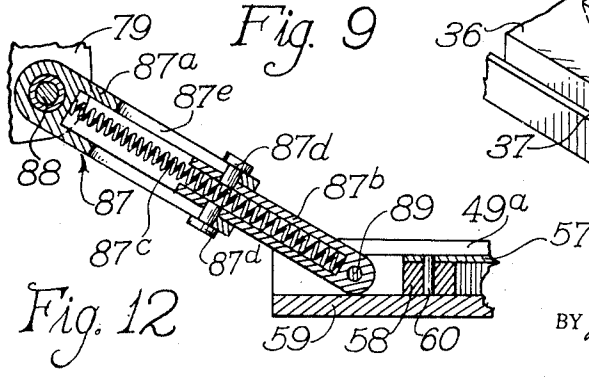
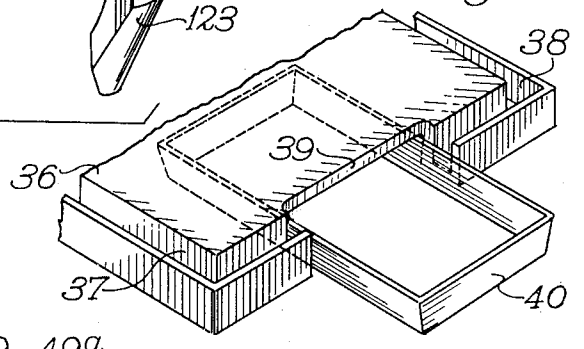


Fig. 12

Fig. 9



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UNITED STATES PATENT OFFICE

2,308,659

APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

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Original application March 31, 1941, Serial No. 386,095. Divided and this application September 24, 1941, Serial No. 412,098

7 Claims. (Cl. 219—4)

The present invention relates to apparatus for tipping metal bases with metal tips and, more particularly to improvements in apparatus for welding precious metal tips to pen nibs. This application is a division of copending application Serial No. 386,095, filed March 31, 1941.

It is an object of the present invention to provide, in a machine of the character described, an improved and exceedingly simple device for automatically feeding tipping material to the tip holder of the apparatus in timed relationship with the movement of a continuously operated base holder.

It is another object of the invention to provide an improved device for feeding the tipping material in pellet form to the tip holder, which device may be quickly adapted to handle pellets of different sizes with but a few easily accomplished substitutions of parts.

The novel features believed to be characteristic of the invention are set forth with particularity in the appended claims. The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in connection with the accompanying drawings in which:

Figure 1 is a view illustrating in partially schematic form the mechanical arrangement and circuit wiring of improved tipping apparatus embodying the features of the present invention;

Fig. 2 is a plan view of the tipping machine schematically illustrated in Fig. 1;

Fig. 3 is a side sectional view, taken along the line 3—3 of Fig. 2, which illustrates the machine with the nib holder thereof in its tipping position;

Fig. 3A illustrates a slightly modified arrangement of the nib holder and carriage therefor;

Fig. 4 is a side sectional view illustrating the machine with the nib holder in its raised or loading position;

Fig. 5 is a front view of the machine;

Figs. 6, 7 and 8 are sectional views illustrating the details of the nib holder;

Fig. 9 is an exploded view illustrating the nib holder assembly;

Fig. 10 is a sectional view taken along the lines 10—10 of the mechanism as shown in Fig. 3;

Fig. 11 is a fragmentary detail view of the base of the machine; and

Fig. 12 illustrates certain details of the connection through which the tip feeding device is operated.

Referring now to the drawings, and more particularly to Fig. 1 thereof, the improved tipping apparatus there illustrated comprises a tipping machine 10 which is provided with a stationary tip holder 11 and a movable nib or base holder 12. The base holder 12 is arranged to be operated by a driving motor 13 through a driving connection which includes a shaft 14, chain sprockets 15 and 16, interconnected by an endless chain 17, and a pair of meshing gears 18 and 19. Preferably, the motor 13 is of the adjustable speed type, so that the tipping speed at which the machine 10 is operated may be varied at will by an operator. This may be accomplished by providing an adjustable speed changing device, not shown, in series with the circuit breaker 8 in the input circuit of the motor. For the purpose of passing current through an engaged nib and tip held by the holders 12 and 11, respectively, to produce a fused metal connection therebetween, a welding circuit is provided which includes a six volt, direct-current welding generator 20 and the contacts 21 of an electromagnetically controlled contactor 22. The contactor 22 is operated in timed relationship with the movement of the nib holder 12 through the provision of a control circuit which includes the contacts 23 of a carriage actuated switch 24, and the contacts 25 of a slow-to-release relay 26. The relay 26 is energized in timed relationship with the movement of the nib holder 12 by an impulsing device which includes a three electrode gaseous discharge tube 1, a second control relay 29 and two sets of contacts 27a and 27b which are actuated by a pulsing cam 28. The cam 28 is arranged to be driven from the driving gear 19 through a gear 30 which is of the same size as the gear 18. The control grid of the tube 1 is normally biased negatively substantially beyond the space current cut-off point by means of a battery 7 which is bridged across the input electrodes of the tube in series with a resistor 3. In order to impress an ionizing voltage across the input electrodes of the tube 1, thereby to render the tube conductive, a source of direct current 2 of correct voltage is provided. A second source of direct current 5 is provided in the output circuit of the tube 1 in series with a current limiting resistor 4 and the winding of the relay 26, in order to energize this relay when the tube 1 is rendered conductive. The slow-to-release period of the relay 26 is enhanced by the action of a condenser 6 connected in shunt therewith. If desired, a conventional alternating current cycle counter 31 of the thermionic type may be used in lieu of the timing relay 26 and its associated equipment for controlling the contactor 22. In such case the output or timing leads 32

and 33 of the cycle counter 31 are respectively connected to the terminals 34 and 35, and the relay 26 and its associated control equipment are omitted from the apparatus.

Briefly described, and as best shown in Figs. 2, 3, 4 and 5 of the drawings, the tipping machine 10 comprises a base 36 having around its outer edge a downwardly extending portion 37, the bottom surface of which is adapted to rest upon a table or bench, and the upper side of which is recessed to provide a trough 38 for catching waste material. The front side of the base portion 37 is interrupted, as shown in Fig. 11, to provide an opening 39 into which a shallow drawer 40 may be inserted. The front of the top wall of the base 36 is cut back along the opening 39 so that tipped nibs ejected from the holder 12 are dropped into the drawer 40.

The base 36 carries a frame 41 which supports the major portion of the moving parts of the machine. More specifically, the frame 41 is provided with upwardly extending side members 42 and 43 and rearwardly extending shaft supporting members 44 and 45. The frame 41 also includes a top member 46 which extends between and is set back from the front wall of the side members 42 and 43.

The base member 36 also carries the tip holder 11. More specifically, the tip holder assembly comprises a base 47, a tip holding anvil 48, a pair of guide plates 49a, a slide plate 47a, and a fibre cover plate 49. The lower edges of the holder base 47 are flared to mate with the tapered edges of adjustable locking plates 50 and 51 which are clamped to the base 36 by means of assembly screws 52. Preferably, the assembly plates 51 are eccentrically mounted in order to permit slight lateral adjustment of the tip holder assembly across the front of the base member 36. The cylindrical anvil 48 extends through an opening provided in the holder base 11 and registers with an enlarged opening in the machine base member 36 through which it may be removed. At its upper end the anvil 48 is provided with a recess 53 which constitutes a tip receiving pocket. A chamber 54 is provided around the upper end of the anvil 48, into which hydrogen may be introduced through any suitable inlet conduit, not shown, during the operation of the machine. The slide plate 47a is secured in a shallow channel milled in the upper side of the base member 47, and the right end thereof abuts the side of the anvil 48. The upper surfaces of the plate 47a and the anvil 48 are substantially flush so that an unbroken surface is presented over which the pellets may be slid into the pocket 53. The base member 11 also supports a tip hopper 55, having a discharge opening 56 in the lower wall thereof, and a tip feeding device which comprises a slide 57 and an actuating plunger 58. More specifically, a centrally disposed, longitudinally extending channel is provided in the upper wall of the base member 11 which receives the slide 57. This member is also provided with a rearwardly extending portion 59 which is channeled to receive the operating plunger 58, the two elements 57 and 58 being secured together by means of a pin 60. In order to convey tips from the discharge opening 56 of the hopper 55 to the receiving pocket 53 of the anvil 48, the slide 57 is provided with a conveying pocket 61 which alternately registers with the opening 56 and the pocket 53 during the operation of the machine. The two elements 57 and 58 of the feed mechanism are held in assembled relationship by means of the guide plates 49a which are secured to the base 47 by assembly screws. The cover plate 49 and the guide plates 49a are provided with oppositely disposed inwardly tapered edges which coact with the flared bottom of the hopper 55 to provide a guideway for lateral movement of the hopper and to provide a means for securing the hopper to the top of the base 47. The assembly plate 49 is also provided with a flared opening 63 which registers with the upper end of the anvil 48 and through which the point of a nib held by the nib holder 12 may be moved to engage a tip held by the tip receiving pocket 53. This cover plate is formed of insulating material to prevent possible shocks to the operator handling the machine. The flared opening through this plate is of such size as to concentrate the hydrogen stream in the welding zone. By substituting slide plates 47a and slides 57 of different thicknesses and properly adjusting the height of the anvil 48 as each change is made the feeding device just described may be adapted to convey pellets of different sizes from the pellet hopper to the receiving pocket of the anvil. For example, an exceedingly thin slide 57 and a relatively thick slide plate 47a are used in feeding pellets of .026 inch diameter to the receiving pocket of the anvil. On the other hand, a relatively thick slide 57 and a relatively thin slide plate 47a are used in feeding pellets of .052 inch diameter to the receiving pocket of the anvil.

The frame 41 of the machine supports, for reciprocating movement in a vertical direction, a carriage 64 upon which the nib holder 12 is supported. More specifically, the nib holder 12 is slidably supported in the barrel 65 of a retaining head 66 which is mounted for pivotal movement with a spindle 67 between the side flanges 68a and 68b of a carriage member 68. As best shown in Fig. 10 of the drawings, the carriage member 68 is mounted upon a slide 69 by means of assembly screws 70 and is insulated therefrom through the provision of a sheet of insulating material 71, fiber sleeves 72 which surround the assembly screws 70, and insulating washers 73 which separate the screw heads from the slide. The edges of the slide 69 are flared to form guides which mate with the tapered guideways 74a and 74b milled in the oppositely disposed inner walls of the frame members 42 and 43. The inner wall of the slide 69 is provided with a channel 75 for receiving a rack 76 which is mounted upon the slide 69 by means of assembly screws 77. From the above explanation it will be understood that the carriage member 68 and the head 66 are mounted for reciprocating movement with the slide 69 and are insulated from the frame and base by means of the insulating sheet 71, the insulating sleeves 72 and the insulating washers 73.

For the purpose of imparting reciprocating movement to the carriage 64, in response to rotation of the drive shaft 14, a driving connection is provided therebetween which includes a cam 78 mounted for clockwise rotation with the shaft 14, and a reciprocating lever 79. The lever 79 is mounted for rotation about a stub shaft 80, the two ends of which are supported in openings provided in the rearwardly extending frame members 44 and 45. These frame members 44 and 45 are also provided with bearings 81 and 82 in which the drive shaft 14 is journaled. The chain sprocket 15 is rigidly mounted upon the end of the main shaft 14.

The lever 79 carries at one end thereof a cam roller 85 which is mounted for rotation with a

pin 86 journaled in bearings provided in the forked ends 79a and 79b of the lever. Reciprocating movement of the slide 57 between its loading and discharge positions is imparted thereto through the provision of a connection 87, one end of which is secured between the ends 79a and 79b of the lever 79 by means of a pin 88, and the other end of which extends between the guide plates 49a and between the forked ends of the operating plunger 58. As best shown in Fig. 12 of the drawings, the drive connection 87 comprises two interfitting parts 87a and 87b with a coil spring 87c providing a yielding connection therebetween. More specifically, the adjacent ends of the two parts 87a and 87b are bored out to receive the coil spring 87c which is held under compressive tension by means of a pin and slot connection between the two parts. This pin and slot connection comprises a pair of pins 87d which are secured to the walls of the part 87b on opposite sides thereof and extend through slots 87e cut longitudinally along opposite sides of the walls defining the bore hole of the part 87a. The part 87b is connected to the operating plunger 58 by means of a pin 89 which extends through registering openings provided in the forked ends of the plunger 58 and the lower end of the part 87b.

The opposite end of the lever 79 is in the form of a gear sector 90 having teeth which mesh with the teeth of the rack 76 so that up and down reciprocating movement is imparted to the carriage 64 as the lever 79 is rocked about the shaft 80 through rotation of the cam 78. In order to rotate the head 66 relative to the carriage 23 so that the nib holder 12 is tilted outward as it is operated from its tipping position to its loading position, the head 66 is provided with an arm 91 which carries a roller 92 arranged to coact with a spring cushioned stop assembly 93. More specifically, the arm 91 is mounted upon the head 66 by means of assembly screws 94, and the roller 92 is rotatable with a pin 95 having ends journaled in the forked ends of the arm 91. The cushioned stop assembly 93 is supported by the cross member 46 of the frame 41. Briefly described, this assembly comprises an elongated screw 96 having its head secured between a bearing plate 97 and an assembly plate 98 and its shank extending through an enlarged opening drilled vertically through the cross member 46, and a registering opening provided in a top assembly plate 99. The roller bearing plate 97 is formed of fiber or other insulating material in order to insulate the head 66 and the holder 12 from the frame 41. The top plate 99 is secured to the cross member 46 by means of assembly screws 100. In order to bias the bearing plate 97 toward its downward position, a spiral spring 101 is provided which is telescoped over the screw 96 and lies within the side walls of a sleeve 102. One end of the biasing spring 93 abuts the under side of the assembly plate 99 and the opposite end thereof abuts the flanged end of the sleeve 102. This sleeve is journaled for sliding movement in the opening provided in the cross member 46. For the purpose of limiting the downward movement of the bearing plate 97, stop nuts 103 are provided which are adjustable along the threaded shank of the screw 96 to any desired position.

Clockwise rotation of the head 66 relative to the carriage member 68 during movement of the nib holder 12 from its loading position to its tipping position is limited by an adjustable stop screw 104 which is threaded into a tapped drill hole 105 provided in the carriage member 68. Downward movement of the nib holder 12 through the barrel 65 of the retaining head 66, after the holder is lowered to bring the point of a nib held thereby into engagement with a tip held by the tip holder 11 and during a welding operation, is limited through the provision of a stop assembly which comprises a collar 106 suitably mounted upon the upper end of the holder 12 and having threaded therethrough an adjustable micrometer screw 107, the lower end of which bears against the upper surface of the head 66. The collar 106 also carries a copper pin 108, the lower end of which extends within and is displaced from the walls of a mercury receiving cup 109. The purpose of providing the mercury filled cup 109 and the contacting pin 108 is to ensure an unbroken electrical connection between the nib holder 12 and the head 66, thereby to prevent sparking between the engaged surfaces of these two elements. An additional stop assembly is provided for operating the nib holder 12 automatically to eject a nib held therein as the nib holder is moved to its loading position. This assembly comprises a U-shaped bracket 110 having legs which straddle the head 66 and which are secured to the carriage member 68 by means of assembly screws 111. The base of this U-shaped member 110 is angularly disposed to lie in a plane parallel to the longitudinal axis of the holder when the holder occupies its loading position, and is provided with a centrally disposed tapped opening which is adapted to receive the threaded shank of an adjustable micrometer screw 112. In order to ensure positive rotation of the head 66 relative to the carriage member 68 during downward movement of the carriage 64, an elastic band 113 is provided which encircles the shank of the micrometer screw 112 and the shank of a screw 114 which is threaded into the collar 106.

As an alternative to the arrangement of the carriage assembly illustrated in Figs. 3 and 4 of the drawings, that shown in Fig. 3A may be used. In this alternative arrangement the nib holder assembly is biased normally to maintain the stop screw 107 in engagement with the upper surface of the head 66 by means of a coil spring 113a. This spring is anchored at its lower end to a screw 113b which is threaded into a tapped opening provided in the front wall of the head 66. At its upper end, the spring 113a is secured to the head of a screw 113c which extends through a hole drilled through the collar 106 and is held in place by a pair of nuts 113d. It will be understood that by adjusting the nuts 113d along the shank of the screw 113c, the biasing force exerted on the nib holder assembly may be adjusted as desired. In the arrangement shown in Fig. 3A, the micrometer screw 107 is threaded through the collar 106 at a point about half way between the front and back of the collar in order to provide adequate space for securing the screw 113c to the collar. A coil spring 104a is also provided in the Fig. 3A arrangement for biasing the head 66 toward the carriage member 68. This spring is anchored at its opposite ends to lugs 104b and 104c which are respectively carried by the carriage member 68 and the head 66. The modified arrangement just described and shown in Fig. 3A is quite desirable when the machine is to be operated at high speeds, since the action of the springs 113a and 104a insures positive relative movement between the parts of the carriage 64 at

the proper points in the operation of the machine. Moreover, the action of the spring 104a serves to minimize any tendency of the head 66 to bounce when it is rotated to engage the stop screw 104.

The machine also includes a combination switch actuating and stop assembly 115 which is fixedly mounted upon the upper end of the slide 69 in any suitable manner. This assembly includes a spacing block 116 and a laterally extending arm 118. The arm 118 is provided with spaced-apart drill holes which are tapped to receive a pair of adjustable micrometer screws 119 and 120. The micrometer screw 119 coacts with the operating plunger 24a of the switch 24 to operate this switch between its open and closed circuit positions as reciprocating movement is imparted to the carriage 64. The micrometer screw 120, on the other hand, is arranged to engage the upper surface of the frame 41 and serves to determine the position in which the carriage 64 is brought to rest during its downward movement.

As best shown in Figs. 6, 7, 8 and 9 of the drawings, the nib holder 12 comprises a sleeve 121, a stationary jaw 122, a movable jaw 123, a nib shoe 124, a nib ejecting finger 125, and a spiral spring 126 for biasing the jaws 122 and 123 to grip a nib 9 inserted therebetween. More specifically, the sleeve 121 is telescoped within the barrel 65 of the head 66 in tight-fitting relationship therewith, and is provided with a channel 121a in the outer side wall thereof, within which the movable jaw 123 is free to operate. The upper end of this channel registers with an enlarged opening 127 provided in the barrel 65 of the head 66, and these registering openings are disposed to receive the end of the micrometer screw 112 when the holder 12 is operated to its loading position. The biasing spring 126 is interposed between the upper or operating end of the movable jaw 123 and the adjacent portion of the other jaw 122, opposide ends of this spring being disposed in recesses 126a and 126b formed in the jaws 122 and 123, respectively. The upper end of the jaw 122 is drilled out to provide a shot receiving pocket 122a, and the lower end thereof is provided with a channel 128 to receive the rectangular-shaped movable jaw 123 and with a cut-away portion 129 for receiving the nib shoe 124. A key and slot connection is provided between the nib shoe 124 and the jaw 122 in order to accurately position the shoe on this jaw. The movable jaw 123 is pivotally mounted within the channel 128 of the stationary jaw 122 by means of a pivot pin 130 which extends through the walls defining the channel. The stationary jaw 122 is further channeled to receive the base portion of the ejecting finger 125 which is formed of flat stock. The enlarged upper end of this finger extends within an elongated slot 131 cut through the movable jaw 123, and is provided with an inclined slot 132. The sides of this inclined slot form camming surfaces which coact with a roller 133 mounted within the slot 131 of the jaw 123, to reciprocate the finger 125 between its ejecting and loading positions in response to relative movement between the two jaws.

As indicated above, the nib shoe 124 is disposed within the cut-away portion 129 of the stationary jaw 122. This shoe is secured to the stationary jaw 122 by means of an assembly screw 134 and is provided with a nib receiving channel 135 which is tapered and shaped to conform to the configuration of the base of a pen nib of a specific size. The ejecting finger 125 is cut away at 136 so that the lower portion thereof may overlie the base of a nib inserted in the nib receiving channel 135 of the shoe 124. The upper edge of this cut-away portion of the finger 125 is V-shaped and is arranged to be projected into a slot 137 cut into the nib shoe 124 at a point along the upper edge thereof.

In operating the nib tipping apparatus described above, the hopper 55 is first filled with tipping material. This material is preferably sintered osmiridium which is crushed and compressed into pellets of such size that each pellet may be used for tipping one pen nib. If desired, the nib holder 12 may be loaded before operation of the apparatus is initiated. To this end, the operator inserts the base of a nib between the jaws 122 and 123 of the nib holder where it is held in the channel 135 of the nib shoe 124. Before the operation of the apparatus is started the hydrogen inlet valve, not shown, is operated to pass hydrogen into the chamber 54 of the tip holder 11. The hydrogen, which envelopes the engaged tip and nib during each welding operation, precludes the formation of oxidation products which may lead to a defective union between the engaged tip and nib. The operation of the apparatus is initiated by actuating the switch 8 to close the input circuit to the driving motor 13. With this motor operating, rotary movement is imparted to the cam 78 through the meshing gears 19 and 18, the gear sprocket 16, the chain 17, the gear sprocket 15 and the shaft 14, the direction of movement of this shaft being such that the cam 78 is rotated in a clockwise direction as viewed in Figs. 1, 3 and 4 of the drawings. Rotary movement is also imparted to the pulsing cam 28 through the meshing gears 19 and 30.

Each time the cam 28 is operated to bring the lobe thereof into engagement with the cam-follower portion of the upper contact spring 27b an obvious circuit is completed for energizing the relay 29. This relay, in operating, locks up in a circuit including its contacts 29b and the contacts 26b, and closes its contacts 29a to prepare the input circuit to the tube 1. Thereafter, the springs 27b are opened to interrupt the operating circuit for the relay 29, but this relay remains energized in its locking circuit. As the cam 28 continues to rotate, the lobe thereof momentarily closes the contact springs 27a. This occurs an instant after the nib holder 12 is lowered to its tipping position during each cycle of operation of the machine. When the contact springs 27a are moved into engagement, the voltage of the source 2 is positively applied to the control grid of the tube 1 across the resistor 3 to lower the negative potential of this grid. The tube 1 now fires or becomes ionized to permit space current flow therethrough. Accordingly, the slow-to-release relay 26 is energized from the source 5 over a circuit which includes the resistor 4 and the space current path of the tube 1. In operating, the relay 26 closes its contacts 25 to complete the prepared operating circuit for the contactor 22 in the manner explained hereinafter. At its contacts 26b, the relay 26 opens the locking circuit for the relay 29, causing the latter relay to restore. At its contacts 26a, the relay 26 short-circuits the source 5 in series with the resistor 4, thereby to bring the anode and cathode of the tube 1 to the same potential for the purpose of extinguishing the space current flow therebetween. In this connection it will be understood that the tube 1 is of the type which is grid controlled for starting purposes only, i. e., after a discharge

therethrough is established the grid loses control. The relay 29, in releasing, opens its contacts 29b further to interrupt its locking circuit. At its contacts 29a the relay 29 opens the input or firing circuit of the tube 1. This circuit may or may not have been previously opened at the contact springs 27a by the cam 28, depending upon the speed at which the machine is operating. In any event, this circuit cannot be recompleted until the cam 28 is driven through another revolution.

As indicated above, when the relay 26 operates, the contacts 26a thereof are closed to extinguish the space current flow through the tube 1 and thus restore the control of the space current flow to the negatively biased control grid of the tube. The charged condenser 6 now discharges through the winding of the relay 26 to retain this relay operated for the required welding interval. At the end of this interval, the relay 26 releases to open its contacts 25 and thus interrupt the welding circuit in the manner explained below. At its contacts 26a, the relay 26 opens the short-circuit across the series-connected source 5 and resistor 4. At its contacts 26b, the relay 26 reprepares the locking circuit for the relay 29. As the cam 28 continues to rotate, the cycle of operations just described is repeated during each revolution thereof.

From the above explanation it will be understood that the cams 28 and 78 are operated at the same speed and that the cam 28 is angularly disposed to close the contacts 27a at exactly the same point in each revolution of the cam 78. It will also be understood that the period during which the relay 26 is operated during each revolution of the cam 28 is entirely independent of the speed at which the machine is operated. Thus if the cam 28 is rotated to close the contact springs 27a and stops in this position, the relay 26 will be operated for exactly the same interval as when the cam 28 is being driven at maximum speed. Moreover, by adjusting the capacitance value of the condenser 6, this interval may be changed as desired. If desired, the relay 26 may be of the adjustable dashpot type in order to provide the necessary welding interval.

Assuming that the parts of the tipping machine 10 occupy the positions illustrated in Fig. 4 of the drawings at the time the operation of the machine is initiated, the cam roller 85 traverses the surface of the operating sector *b*—*e* of the cam, which sector is of decreasing radius. During such relative movement between the cam 78 and the roller 85, the carriage 64 is, by the gravitational force exerted thereon, moved from its loading position as illustrated in Fig. 4 of the drawings, to its tipping position as illustrated in Fig. 3 of the drawings. This downward movement of the carriage 64 and the head 66 carried thereby serves to rotate the lever 79 in a clockwise direction through the meshing engagement of the gear sector 90 with the rack 76. The extent to which the lever 79 is rocked in a clockwise direction is, of course, limited by the engagement of the roller 85 with the surface of the cam sector *b*—*e*. As the initial downward movement of the carriage 64 proceeds, the elastic band 113, acting in conjunction with the gravitational pull exerted on the eccentrically mounted head 66, serves to rotate the head and the nib holder 12 in a clockwise direction relative to the carriage 64. During this rotation and translation of the head 66 and the nib holder 12, the roller 92 carried by the arm 91 engages the bearing plate 97 but the spring 101 is of sufficient stiffness to maintain the stop assembly in the illustrated lowered position. It will be noted that the lower end of the nib holder 12 is caused to follow a curvilinear path so long as the roller 92 carried by the arm 91 engages the bearing plate 97. During continued downward movement of the carriage 64 the lower end of the barrel 65 thereof engages the stop screw 104 to prevent further rotation of the head 66 relative to the carriage member 68. It will be noted that the primary section *b*—*a* of the cam operating or lowering sector *b*—*e* is of slowly decreasing radius. Accordingly, the initial downward movement of the carriage 64 is relatively slow and the head 66 is rotated into engagement with the stop screw 104 at a slow speed which prevents the head from bouncing or oscillating during continued downward movement thereof. The continued downward movement of the carriage occurs while the surface of the cam sector *a*—*e* is traversing the roller 85. After the head 66 and the stop screw 104 are brought into engagement, the lower end of the nib holder 12 is moved in an exact straight line until the tipping position thereof is reached. In this regard it will be understood that by adjusting the stop screw 104 the nib holder 12 may accurately be positioned to bring the point of a nib carried thereby squarely into engagement with a tip held in the receiving pocket 53 of the tip holder 11. It will also be noted that after the stop screw 104 is engaged by the barrel 65 of the head 66, and during continued downward movement of the carriage 64, the roller 92 is moved away from the bearing plate 97.

When the cam 78 is rotated so that the point *e* along the surface thereof engages the roller 85, the nib holder 12 occupies its tipping position. In this regard it is pointed out that during the final downward movement of the carriage 68 the point of the nib held between the jaws of the nib holder 12 engages the tip deposited in the receiving pocket 53 of the tip holder 11. Thereafter, and as the head 66 continues to move downwardly, the nib base is thrust upward within the jaws of the holder 12 thereof until the nib base is properly positioned in the nib shoe 124, at which time the upper edge of the nib base may engage the V-shaped lower edge of the ejecting finger 125. During further downward movement of the head 66, the holder assembly comprising the two jaws 122 and 123 is held stationary with the end of the nib base engaging the tip and the sleeve 121 is telescoped downward over the jaws 122 and 123 against the force exerted thereon by the elastic band 113, whereby the end of the stop screw 107 is disengaged from the upper surface of the head 66. Also incident to the final downward movement of the carriage 64, the end of the micrometer screw 119 engages the operating plunger 24a of the switch 24 so that the contacts 23 thereof are moved into engagement. Thereafter the end of the stop screw 120 engages the upper surface of the frame member 43 to arrest the downward movement of the carriage 64.

Following the operations just described, and during the movement of the cam wherein the surface of the tipping sector *e*—*d* thereof, of constant radius, engages the roller 85, no further movement of the carriage 64 occurs. The period required for such movement of the cam 78 measures a time interval during which the tip deposited in the receiving pocket 53 of the tip holder 11 is welded to the nib engaged thereby and held between the jaws of the nib holder 12. Immediately after the contact springs 23 of the

switch 24 are moved into engagement to prepare the circuit for energizing the operating winding of the contactor 22 is completed, this circuit is completed at the contacts 25 of the relay 26 in the manner explained above. When thus energized, the contactor 22 closes its contacts 21 to complete a circuit for passing current through the engaged tip and nib held by the tip and nib holders 11 and 12, respectively. This welding circuit extends from the lower terminal of the direct current generator 20 by way of the head 66, the mercury column in the cup 109, the pin 108, the collar 106, the jaws 122 and 123 of the nib holder, the nib held between the jaws of the nib holder, the tip disposed in the receiving pocket 53 of the tip holder, the frame of the machine 10, and the contacts 21 to the upper terminal of the generator 20. The current traversing this circuit causes the engaged tip and nib to be fused at the points of contact therebetween. Incident to the formation of this fused connection, the contacting zones of the engaged tip and nib are momentarily heated to a temperature exceeding the melting points thereof and hence assume a fluid state. When the restraining forces exerted on the nib holder assembly is thus removed, the elastic band 113, coacting with the gravitational force exerted on the nib holder assembly, pulls this assembly downward until the lower end of the stop screw 107 engages the upper surface of the head 66. The extent of this movement is exceedingly small and the movement is only permitted to ensure a perfect bond between the engaged tip and nib.

At the end of the welding interval, as measured by the release period of the relay 26, this relay restores and opens its contacts 25 to interrupt the circuit for energizing the operating winding of the contactor 22. The contactor 22 now releases and opens its contacts 21 to interrupt the above-traced welding circuit, whereby the flow of current through the engaged nib and tip is arrested. In this regard it is pointed out that the operation of the camming element 28 is so timed, through operation of the gears 19 and 30, that the contacts 27a are moved into engagement to cause the operation of the relay 26 immediately after the switch 24 is operated by the screw 119 to close the contacts 23. Hence the welding period is in each instance determined by the release period of the slow-to-release relay 26, and this is true regardless of the speed at which the apparatus is operated.

Shortly after the welding circuit is opened by the contactor 22 in the manner explained above, and during continued rotation of the cam 78, the roller 85 engages the surface of the retracting sector *d*—*c* of the cam. This surface is of rapidly increasing radius and, accordingly, the lever 79 is rocked in a counterclockwise direction to raise the carriage 64. During the initial upward movement of the carriage 64 to move the tipped nib out of engagement with the tip holder 11, the head 66 retains its lowered position. As the cam 78 continues to rotate, the carriage 64 is elevated to a position such that the roller 92 engages the bearing plate 97 of the stop assembly 93. During the continued upward movement of the carriage 64, vertical movement of the roller 92 is arrested so that the head 66 is rotated in a counterclockwise direction relative to the carriage member 68. Thus, during the final portion of the period when the surface of the cam sector *d*—*c* traverses the roller 85 the head 66 is rocked to bring the nib holder 12 back to its loading position. Incident to the final movement of the head 66 the operating end of the movable jaw 123 engages the end of the stop screw 112 to eject the nib held between the jaws of the holder 12 in the manner explained immediately below. As the cam 78 continues to rotate, the surface of the loading sector *c*—*b* thereof, which is of constant radius, traverses the cam roller 85. During such rotation of the cam the carriage remains in its raised position and the nib holder 12 is held in its loading position. It will be noted that the extent of the sector *c*—*b* of the cam 78 determines the period during which the nib holder 12 is held in its loading position. Consequently, this sector is made of sufficient size that, when the machine is operated at its maximum speed, the holder 12 is retained in its loading position for an adequate time interval to permit easy insertion of a pen nib between the jaws thereof. From this point on the operations just described are cyclically repeated during each revolution of the cam 78.

From the above explanation it will be understood that during the initial movement of the carriage 64 to lower the nib holder 12 from its tipping position to its loading position, the shock of the engagement of the head 66 with the stationary parts of the frame 41 is minimized through the action of the cam 78 to lower the carriage 64 at a slow speed, thereby to prevent any tendency for the head 66 to bounce or oscillate as the tip holder 12 is moved into its tipping position. It will further be apparent that by suitable adjustment of the micrometer screws 107 and 120 the downward movement of the carriage 64 may be accurately adjusted so that the movement of the nib holder 12 which occurs after the welding operation is started is limited to a fixed predetermined value which may be varied for nibs and tips of different sizes. Moreover the provision of the adjustable stop screw 112 enables the movement of the jaw 123, which occurs incident to the final retracting movement of the holder 12, accurately to be adjusted.

As indicated in the above description, the movable parts of the cushioned stop assembly 93 are normally maintained in the illustrated lowered positions thereof during the operation of the machine. If, however, the head 66 and the carriage member 68 should inadvertently be locked against relative movement, or the movement of the head toward its loading position should accidentally be blocked, the movable elements 96, 97, 98, 102 and 103 of this assembly are moved upward with the carriage 64 as the carriage is elevated to its raised position. Careless handling of the machine may cause the movement of the head 66 to be blocked in the manner just referred to. Thus, the nib holder assembly comprising the two jaws 122 and 123 may inadvertently be telescoped upward through the sleeve 121 to bring the pivot point 130 opposite the end of the stop screw 112 during final movement of the head 66 toward its loading position. Should this occur, the rotation of the head 66 relative to the carriage member 68 is blocked by the screw 112 before completion and with the free end of the arm 91 in a slightly elevated position. In such case, however, the travel permitted between the moving parts of the cushioned stop assembly 93 and the frame of the machine, permits the upward movement of the carriage 64 to be completed without exerting any excessive strain on any part of the machine. Thus, the cushioned stop assembly acts to safeguard the machine

against breakage or bending of the parts occasioned by careless handling.

Referring now more specifically to the manner in which the nib holder 12 is loaded and the nibs inserted therein are automatically ejected, it will be noted that when the holder occupies its loading position, as illustrated in Fig. 8 of the drawings, the nib ejecting finger 125 occupies its downward or ejecting position and the jaws 122 and 123 are open. With the nib holder in this position the triangular-shaped base of a nib 9 may be inserted between the jaws in the channel 135 of the nib shoe 124 until the upper edge thereof engages the V-shaped edge of the finger 125. The nib is held between the angularly extending sides of the nib shoe by the machine operator until the jaws 122 and 123 are closed to grip the nib, at which time the nib may be released by the machine operator. With the nib inserted in the nib shoe, the movable jaw 123 is operated to clamp the nib 9 against the jaw 122 during the initial movement of the holder 12 away from its loading position. Thus, during the initial downward movement of the carriage 64, the head 66 is tilted inward in the manner explained above, so that the end of the stop screw 112 is gradually disengaged from the operating end of the movable jaw 123. As this occurs, the spring 126 operates to close the jaw 123 until the nib 9 is firmly gripped between this jaw and the stationary jaw 122. During this relative movement between the jaws 122 and 123 the roller 133 coacts with the upper camming surface of the slot 132 to translate the ejecting finger 125 upwardly so that the lower V-shaped edge thereof is moved out of engagement with the upper edge of the base of the nib 9. The parts of the nib holder 12 remain in this position until the nib holder 12 approaches its tipping position to bring the point of the nib 9 into engagement with the tip pellet disposed in the receiving pocket 53 of the tip holder 11. When this occurs, the movement of the nib 9 is stopped but the weight of the nib holder assembly causes the downward movement of this assembly to continue so that the nib 9 is forced upward in the channel 135 of the nib shoe 124 in the manner explained above. The parts of the nib holder and the nib 9 remain in this position until the nib holder is again retracted to its loading position. During the final portion of the retracting movement, the operating end of the movable jaw 123 is again moved into engagement with the end of the stop screw 112 so that this jaw is rocked about its pivot pin 130 against the bias of the spring 126 to open the two jaws and thus release the nib 9 from the gripping force exerted by the jaws. Incident to this relative movement between the two jaws, the cam roller 133, operating in conjunction with the lower surface of the inclined slot 132, forces the ejecting finger 125 downward. Since the lower V-shaped edge of this finger is at this time in engagement with the upper base edge of the nib 9 the nib is forcibly ejected from the channel 135 of the nib shoe 124 and is expelled into the nib receiving drawer 40 of the machine. Thus it will be seen that the only operation required on the part of the operator is that of feeding nibs to the nib holder 12, such nibs being automatically ejected from the holder after the tipping operation is completed.

In adapting the machine 10 for use in tipping pen nibs of different sizes, the only required changes in the machines are the substitution of ejecting fingers 125 and nib shoes 124 of different sizes. These elements are made up in sets, the sizes thereof varying in certain dimensions according to the size of the nibs with which they are to be used. Thus, for a large nib having a relatively wide base portion and of relatively long length, the nib shoe 124 used for receiving the nib is provided with a relatively wide nib receiving channel 135, and the length of the cut-out portion 136 of the ejecting finger 125 is proportioned to accommodate the length of the nib. For a short nib, on the other hand, the shoe 124 provided to receive the nib base is provided with a nib receiving channel 135 of correspondingly smaller dimensions and the length of the cut-out portion 136 of the ejecting finger 125 is correspondingly reduced to accommodate the decreased length of the nib. The different ejecting finger and nib shoe sets are changed by withdrawing the nib holder assembly from the sleeve 121 and knocking out the pivot pin 130 to remove the jaw 123. After this is done, the substitution may readily be effected, after which the assembly is rebuilt and again inserted in the sleeve 121. From the above explanation, it will be apparent that by using nib shoes and ejecting fingers in sets the nib holder 12 may be altered at will to receive nibs and accommodate nibs of different sizes. In order to adjust the weight of the nib holder assembly, as supplemented by the action of the elastic band 113, to the tipping of nibs of different sizes, the pocket 122a may be loaded with shot to provide the required compressive force on a tip engaged by the point of a nib held between the jaws of the nib holder 12.

It is pointed out above that the tip pellets are automatically fed to the tip receiving pocket 53 of the tip holder 11 from the hopper 55 in timed relationship with the movement of the nib holder 12. In this regard it will be noted that during the portion of each revolution of the cam 78 when the surface of the operating sector *b*—*e* of the cam traverses the roller 85 to permit the lever 79 to be rocked in a clockwise direction, the connection 87 pulls the operating plunger 58 of the tip feeding device to the left, so that the slide 57 is withdrawn from the tip discharge position illustrated in Fig. 4 of the drawings. The extent of this movement is such that the conveying pocket 61 of the slide 57 is moved into registry with the discharge opening 56 of the hopper 55 coincident with the movement of the cam 78 to bring the surface point *e* thereof into engagement with the cam roller 85. Thus, the conveying pocket 61 is loaded with a pellet through the opening 56 in the base of the hopper 55 during the portion of the cam movement when the surface of the sector *e*—*d* engages the roller 85. During continued movement of the cam 78, and while the surface of the retracting sector *d*—*c* of the cam engages the roller 85, the lever 79 is rocked in a counterclockwise direction to move the nib holder 12 from its tipping position to its loading position, in the manner explained above. Incident to this movement, the lever 79, acting through the connection 87, operates the plunger 58 and connected slide 57 to the right, so that the discharge opening 56 of the hopper 55 is closed. The pellet disposed in the conveying pocket 61 of the slide 57 is slid over the upper surface of the base 47 until it is brought into registry with the tip receiving pocket 53 of the anvil 48. This occurs slightly before the surface point *c* of the cam 78 is moved to engage the roller 85, i. e., shortly before the nib holder 12 is moved to its loading position. When these

two pockets are brought into registry the pellet disposed in the conveying pocket 61 is discharged by gravity into the pocket 53 of the anvil 48. In this regard it is pointed out that the size of the anvil pocket 53 is preferably such that it will not accommodate more than one tip pellet. Accordingly, if the pocket 53 is already loaded, the pellet held in the conveying pocket 61 is retained therein during continued operation of the machine until the deposited pellet is used in tipping a nib. During continued rotation of the cam 78 pellets are automatically fed one by one to the receiving pocket 53 of the anvil 48, in a manner clearly apparent from the above explanation. From this explanation it will be noted that the movement of the slide 57 is synchronized with the movement of the nib holder 12 so that the receiving pocket 53 is loaded while the nib holder 12 occupies its loading position, and the end of the slide 57 is retracted from its tip loading position as the nib holder 12 is brought downward into its tipping position. Moreover, this synchronous relationship between the movement of the nib holder 12 and the loading slide 57 is not disturbed by changes in the operating speed of the machine, as will be apparent from a consideration of the mechanical linkages utilized to correlate the movements of the two elements.

The purpose of providing the yielding connection 87 between the lever 79 and the plunger 88 is substantially apparent from the above explanation. In this regard it will be understood that if the slide 57 should be locked against movement relative to the base member 47, or the movement of the slide toward its discharge position should partially be blocked, the part 87*a* is telescoped over the part 87*b* of the connection 87 against the action of the spring 87*c* to permit the continued rotation of the cam 78. In other words, the motion of the arm 79 which cannot be used in moving the slide 57 is taken up in the yielding connection 87 without unduly straining the parts of the machine. The pellet feeding device and the other parts of the machine are thus further safeguarded against breakage.

As will appear from the preceding description, the operation of the various parts of the apparatus, including the control relays of the circuit equipment, are so correlated that the tipping of nibs may be accomplished at different speeds without disturbing the synchronous relationship between the various parts of the apparatus. In this connection it is also indicated above that the cycle counter 31 may be used in lieu of the slow-to-release relay 26 and the cam controlled interrupter springs 27, for the purpose of controlling the contactor 22 to close and open the welding circuit. This cycle counter is provided with a control relay, not shown, having contacts which connect the conductors 32 and 33 together at spaced intervals, and for periods of uniform duration. Preferably, the counter is of the type which counts a predetermined number of cycles of the alternating voltage impressed upon the input terminals thereof to measure a spacing interval; energizes the control relay to connect the two conductors 32 and 33 together; counts an additional predetermined number of cycles to measure a welding interval; and deenergizes the control relay to disconnect the two conductors 32 and 33 from each other. This operating cycle is continuously repeated under the control of the thyratron tubes conventionally embodied in the counter. Provisions are made for manually controlling the circuit constants of the counter, so that the spacing periods during which the control relay of the counter is restored, as well as the extent of each welding period when the control relay is operated, may be varied at will. Provisions are also made whereby the entire cycle pattern followed by the control relay may be shifted along a time axis through manual adjustment of the circuit constants of the counter. This latter adjustment permits the relay operations to be synchronized with the movement of the head 66 to close the contacts 23 of the switch 24. By virtue of this arrangement, the contactor 22 may be made to operate immediately after the nib holder 12 is operated to its tipping position, and the extent of the welding period may be fixed at any desired value which is independent of movement of the nib holder 12. It will be understood from the above explanation that when the cycle counter 31 is used, certain manual adjustments are required in order to synchronize the operation of the contactor 22 with the movement of the nib holder 12, each time the operating speed of the tipping machine 10 is changed. This may readily be accomplished by observing the operation of the machine.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is contemplated to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

I claim:

1. In a machine for tipping metal bases with metal tips, a tip holder provided with a tip receiving pocket of such dimensions that it will only accommodate one tip of a given size, a hopper for receiving tipping material and provided with a discharge opening, a slide normally closing said opening and provided with a conveying pocket, the thickness of said slide being such that said conveying pocket will only accommodate one tip of said given size, and means for moving said slide to bring said conveying pocket alternately into register with said discharge opening and said tip receiving pocket.

2. In a machine for tipping metal bases with metal tips, a tip holder provided with a tip receiving pocket of such dimensions that it will only accommodate one tip of a given size, a hopper for receiving tipping material and provided with a discharge opening, a conveyor normally closing said opening and provided with a conveying pocket, the thickness of said conveyor being such that said conveying pocket will only accommodate one tip of said given size, and means for operating said conveyor to bring said conveying pocket alternately into register with said discharge opening and said tip receiving pocket.

3. In a machine for tipping metal bases with metal tips, a support, a tip holder carried by said support and provided with an end having a tip receiving pocket therein, said tip receiving pocket being of such dimensions that only one tip of a given size may be deposited therein, a hopper for receiving tipping material and provided with a discharge opening, a slide plate mounted on said support and including a sliding surface disposed substantially flush with the tip receiving end of said holder, a slide supported for reciprocating movement over said surface and normally closing said discharge opening, said slide being provided with a conveying pocket, the thickness of said slide being such that said

conveying pocket will only accommodate one tip of said given size, and means for reciprocating the slide to bring the conveying pocket thereof alternately into register with said discharge opening and said tip receiving pocket.

4. In a machine for tipping metal bases with metal tips, a support, a tip holder carried by said support and provided with an end having a tip receiving pocket therein, a hopper for receiving tipping material and provided with a discharge opening, a slide plate mounted on said support and including a sliding surface disposed substantially flush with the tip receiving end of said holder, a slide supported for reciprocating movement over said surface and normally closing said discharge opening, said slide being provided with a conveying pocket, the slides and slide plates used in said machine being interchangeable in pairs each having the same combined thickness but comprising elements having different relative thicknesses, means for holding said tip holder in different positions in order to maintain the flush relationship between the tip receiving end thereof and the sliding surface of the slide plate regardless of the thickness of the slide plate in use, and means for reciprocating the slide in use to bring the conveying pocket thereof alternately into register with said discharge opening and said tip receiving pocket.

5. In a machine for tipping metal bases with metal tips, a support provided with an opening extending vertically therethrough and a slide channel of given depth extending transversely therealong and communicating with the upper end of said opening, a tip holder supported within said opening and provided at its upper end with a pocket for receiving pellets of tipping material, a pellet hopper carried by said support above said channel and provided with a discharge opening in the bottom wall thereof, a slide plate disposed in the bottom of said channel and having an upper sliding surface disposed substantially flush with the upper end of said holder, a slide supported for reciprocating movement over said surface and normally closing said discharge opening, said slide being provided with a pellet conveying pocket extending through the thickness thereof, and means for reciprocating the slide to bring the conveying pocket alternately into register with said discharge opening and said tip receiving pocket.

6. In a machine for tipping metal bases with metal tips, a support provided with an opening extending vertically therethrough and a slide channel of given depth extending transversely therealong and communicating with the upper end of said opening, a tip holder supported within said opening and provided at its upper end with a pocket for receiving pellets of tipping material, a pellet hopper carried by said support above said channel and provided with a discharge opening in the bottom wall thereof, a slide plate disposed in the bottom of said channel and having an upper sliding surface disposed substantially flush with the upper end of said holder, a slide supported for reciprocating movement over said surface and normally closing said discharge opening, said slide being provided with a pellet conveying pocket extending through the thickness thereof, the slide and slide plates used in said machine being interchangeable in pairs each having the same combined thickness which is slightly less than the depth of said channel and each comprising elements of different relative thicknesses, thereby to adapt said machine to handle pellets of different sizes, means for holding said tip holder in said first-named opening in different vertical positions in order to maintain the flush relationship between the tip receiving end thereof and the sliding surface of the slide plate regardless of the thickness of the slide plate in use, and means for reciprocating the slide in use to bring the conveying pocket thereof alternately into register with said discharge opening and said tip receiving pocket.

7. In a machine for tipping metal bases with metal tips, a tip feeding mechanism comprising a support, a tip holder carried by said support, a tip hopper carried by said support, said tip hopper being disposed above and laterally offset with respect to said tip holder, a laterally disposed channel formed in said support and extending between the bottom of said tip hopper and the top of said tip holder, a slide arranged in said channel and having a tip conveying pocket formed therein, said slide having a retracted position wherein said tip conveying pocket is disposed in registry with the bottom of said tip hopper and an extended position wherein said tip conveying pocket is disposed in registry with said tip holder, said tip conveying pocket being adapted to receive a single tip fed by gravity thereto from said tip hopper when said slide occupies its retracted position, said tip holder being adapted to receive a tip fed by gravity thereto from said tip conveying pocket when said slide occupies its extended position, and means for reciprocating said slide between its two positions.

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