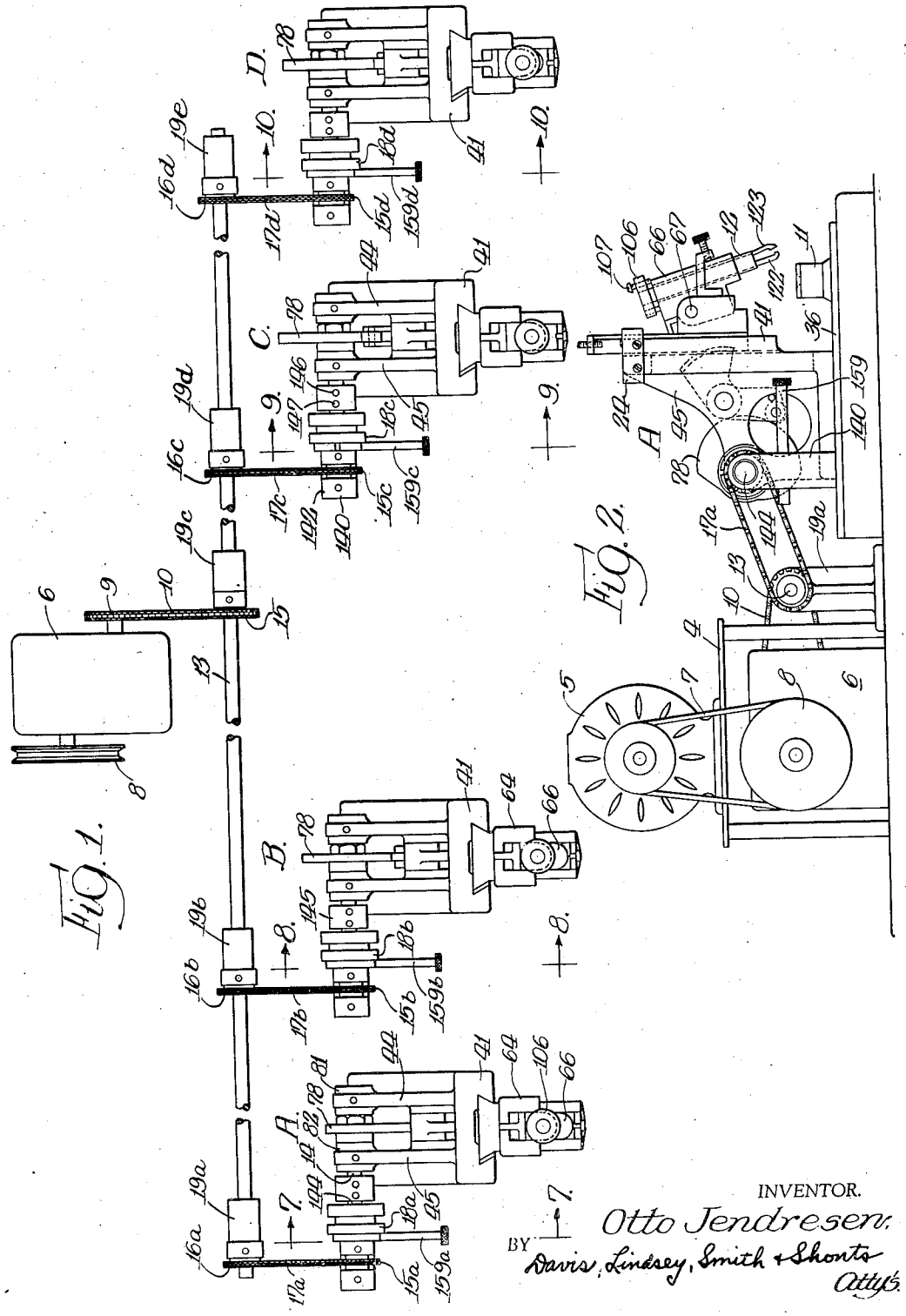
Jan. 11, 1944. O. JENDRESEN 2,339,079

APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

Filed Dec. 15, 1941 5 Sheets-Sheet 1



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APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

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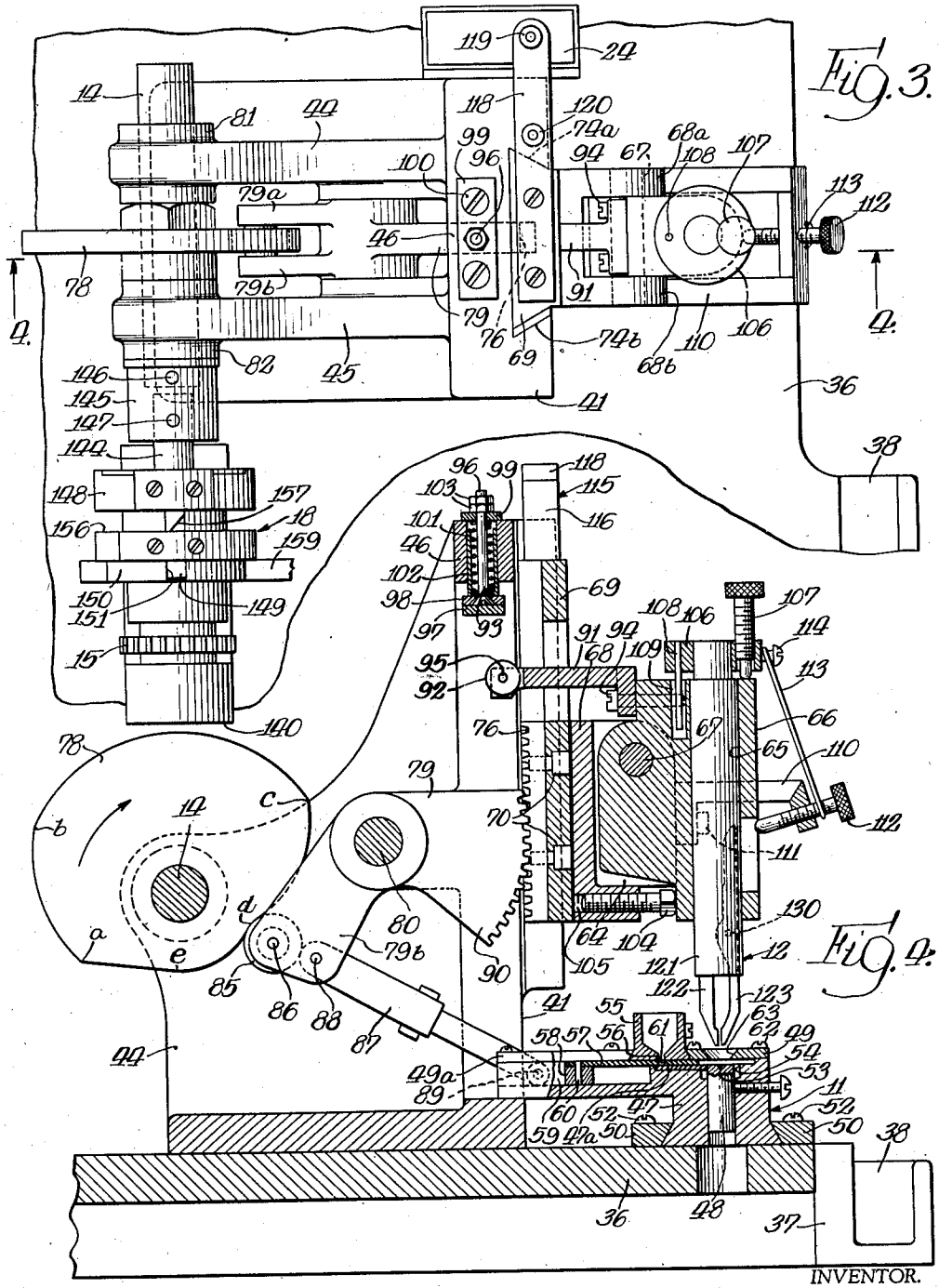

Fig. 3.

Fig. 4.

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APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

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Fig. 5.

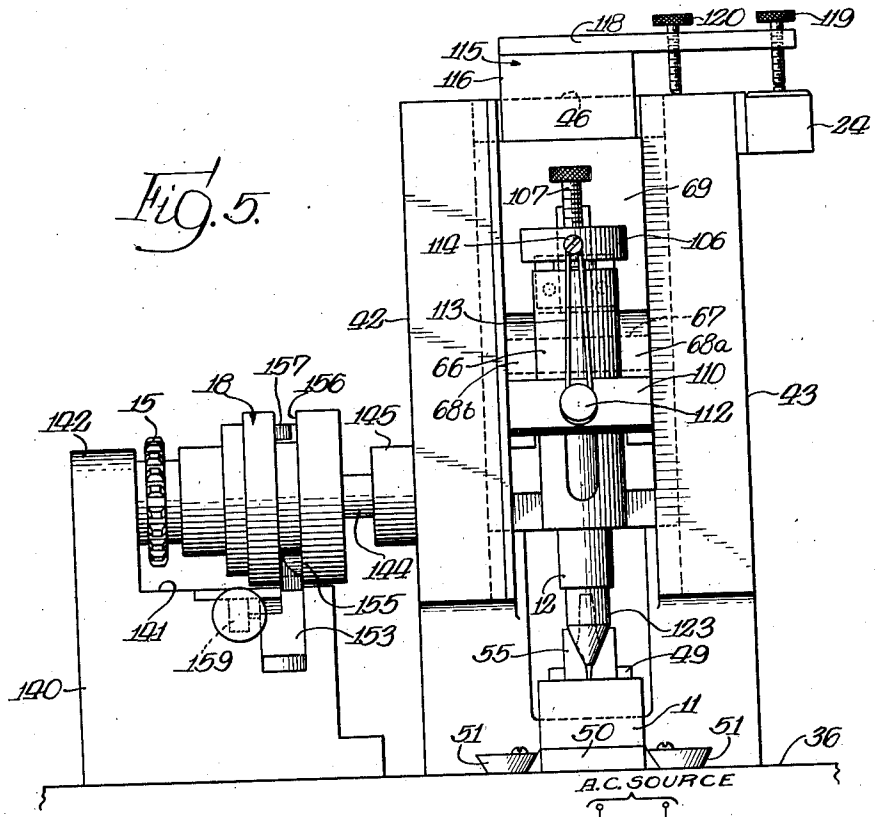
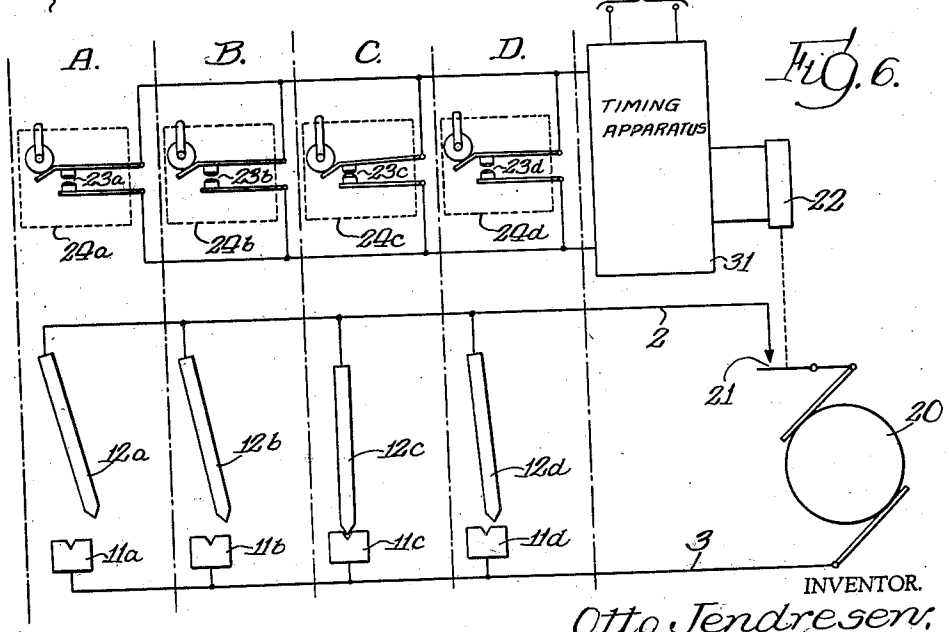


Fig. 6.



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APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

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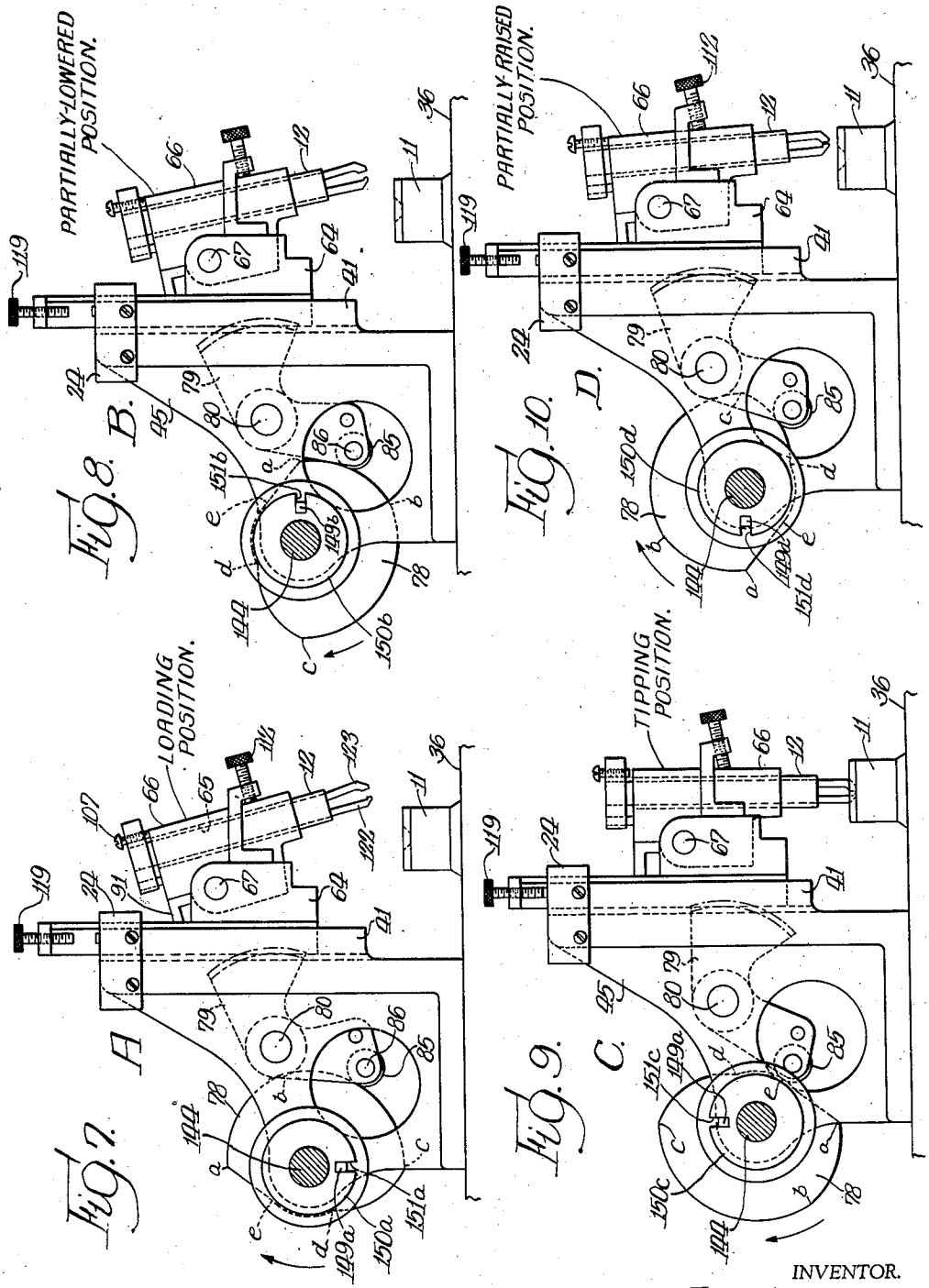

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APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

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Fig. 11.

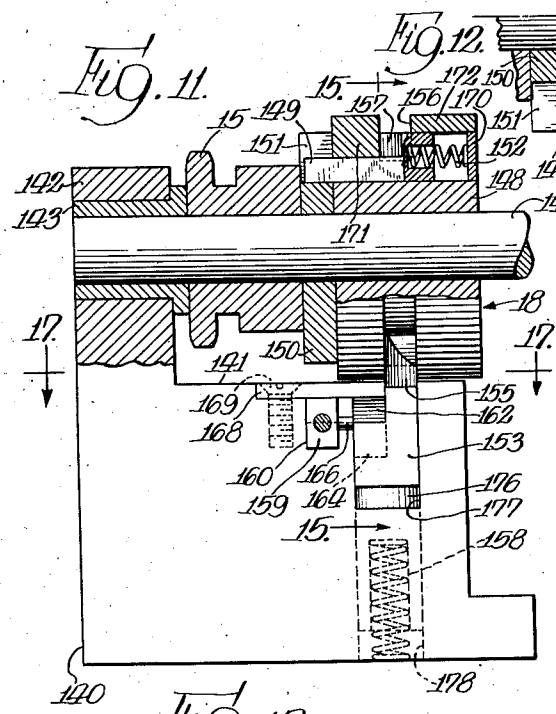


Fig. 12.

Fig. 13.

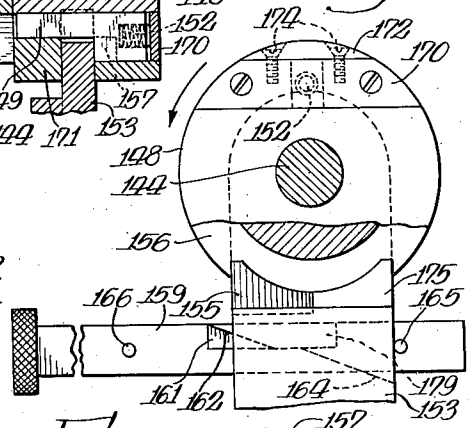


Fig. 14.

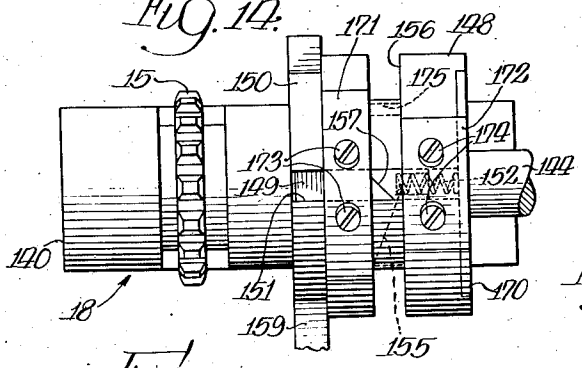


Fig. 15.

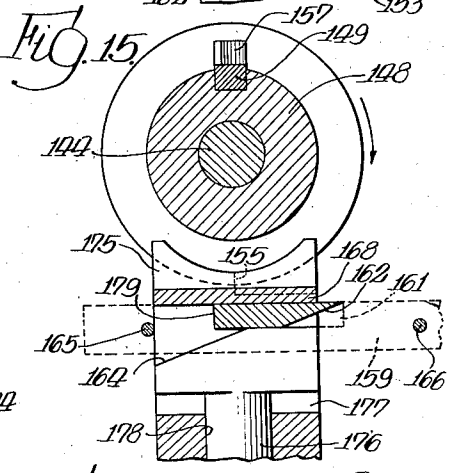


Fig. 16.

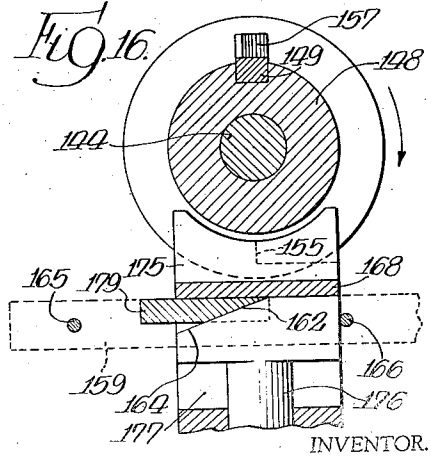
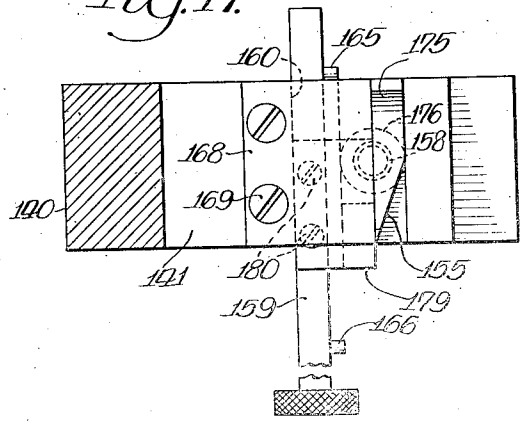


Fig. 17.



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Patented Jan. 11, 1944 2,339,079

UNITED STATES PATENT OFFICE

2,339,079

APPARATUS FOR TIPPING METAL BASES WITH METAL TIPS

Otto Jendresen, Milton, Wis., assignor to The Parker Pen Company, Janesville, Wis., a corporation of Wisconsin

Application December 15, 1941, Serial No. 423,057

15 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.

It is an object of the present invention to provide improved apparatus of the character described, which is simple in arrangement, positive and reliable in operation, and is capable of being operated at relatively high speeds to produce in production quantities, tipped bases which are uniformly free from structural defects.

It is another object of the invention to provide improved apparatus of the character described, wherein a plurality of tipping machines are operated in multiple and a minimum of auxiliary equipment is required.

It is another object of the invention to provide improved apparatus of the character described, which is so arranged that a single timing device, common to the tipping machines, is used for measuring the welding intervals for all of the machines.

In accordance with another object of the invention, provisions are made whereby a single welding current source, having a current rating equal only to the current requirements of a single tipping machine, and a single welding current circuit, are used to deliver welding current to all of the machines.

According to another object of the invention, provisions are made for staggering or maintaining a predetermined phase displacement between the operating cycles of the different machines, whereby the movable base holders thereof are non-concurrently operated to occupy their respective tipping positions.

In accordance with still another object of the invention, the movable base holders of the machines are driven by a common driving means, and facilities are provided for selectively cutting any machine into and out of service without disturbing the operation of the other machines.

According to a still further object of the invention, provisions are made in the apparatus for preventing the operation of the base holder of any machine from being arrested when it occupies its tipping position.

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:

Fig. 1 is a plan view illustrating the mechanical arrangement of improved tipping apparatus characterized by the features of the invention briefly referred to above;

Fig. 2 is an end view of the tipping apparatus shown in Fig. 1, and additionally discloses the arrangement for driving the plurality of tipping machines shown in Fig. 1;

Fig. 3 is a plan view of one of the tipping machines forming a part of the apparatus shown in Figs. 1 and 2;

Fig. 4 is a side sectional view, taken along the line 4—4 of Fig. 3, which illustrates the machine with the nib holder thereof in its tipping position;

Fig. 5 is a front view of the machine shown in Figs. 3 and 4;

Fig. 6 is a circuit diagram illustrating the manner in which the control equipment for the machines is electrically connected;

Figs. 7, 8, 9 and 10 are side views which, taken together, illustrate the relative positions of the operating mechanisms for the four machines shown in Fig. 1 when the driving equipment for these machines occupies a particular position;

Fig. 11 is a side view, partially in section, illustrating the details of the clutch which is included in the driving connection between each of the machines and the associated driving equipment;

Fig. 12 is a detail view illustrating the structural relationship between certain of the parts of the clutch shown in Fig. 11 when this clutch is disengaged;

Fig. 13 is a view, partially in section, illustrating the clutch shown in Fig. 11 as viewed from the right end thereof;

Fig. 14 is a plan view of the clutch;

Figs. 15 and 16 are end sectional views of the clutch mechanism as shown in Fig. 11; and

Fig. 17 is a top sectional view taken along the lines 17—17 of Fig. 11, illustrating the control mechanism of the clutch.

Referring now to the drawings, and more particularly to Figs. 1 and 2 thereof, the improved tipping apparatus there illustrated comprises four tipping machines A, B, C and D, which are of identical construction and are arranged to be driven by a common driving motor 5 through driving connections which commonly include a speed reducing gearbox 6 and a line shaft 13. More specifically, the motor 5 is mounted upon a platform 4 and is connected to impart rotary movement to the driving pulley 8 of the gearbox through a belt 7. The gearbox is provided with driven sprocket 9 which is connected to rotate the shaft 13 through a connection comprising the chain 10 and a sprocket 15 which is rigidly mounted upon the shaft 13. The line shaft 13 is journaled in bearings which are carried by the five spaced-apart bearing supports 19a, 19b, 19c, 19d and 19e, each support being mounted upon a suitable base and being disposed adjacent a drive sprocket. The driving connections between the common shaft 13 and the four tipping machines A, B, C and D

respectively include clutch mechanisms 18a, 18b, 18c and 18d which respectively comprise the drive sprockets 15a, 15b, 15c and 15d. These sprockets are chain-connected by means of the chains 17a, 17b, 17c and 17d to the driving sprockets 16a, 16b, 16c and 16d, which are all rigidly mounted upon the shaft 13.

Each of the four illustrated tipping machines is of the improved form disclosed and claimed in applicant's copending application Serial No. 386,095, filed March 31, 1941. Briefly considered, and as best shown in Figs. 3, 4 and 5 of the drawings, each machine 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. 3, to provide an opening into which a shallow drawer may be inserted, and the front of the top wall of the base 36 is cut back along this opening so that tipped nibs ejected from the nib holder of the machine may be dropped into the drawer.

The base 36 carries a stationary tip holder 11 and a frame 41 which supports the major portion of the moving parts of the machine. More specifically, this frame 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.

In brief, 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 fiber cover plate 49. The lower edges of the 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 base holder 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 maintained 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 47 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. This plate 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. Preferably, the cover plate 49 is formed of insulating material to prevent possible shocks to the operator handling the machine, and the flared opening through this plate is of such size as to concentrate the hydrogen stream in the welding zone.

As best shown in Fig. 4 of the drawings, the frame 41 of the machine supports, for reciprocating movement in a vertical direction, a carriage 64 upon which the nib holder 12 of the machine is rotatably mounted. 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 the carriage member 68. This carriage member is mounted upon a slide 69 by means of assembly screws, not shown, and is suitably insulated therefrom. The edges of the slide 69 are flared to form guides which mate with tapered guideways 74a and 74b milled in the oppositely disposed inner walls of the frame members 42 and 43, and the inner wall thereof is channeled to receive a rack 76 which is mounted upon the slide 69 by means of assembly screws 70. 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 suitable insulating means, not shown.

For the purpose of imparting reciprocating movement to the carriage 64, an operating mechanism is provided which includes a drive shaft 14, 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 are also provided with bearings 81 and 82 in which the shaft 14 is journaled.

The lever 79 carries at the left 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 79. Reciprocating movement of the slide 57 between its loading and discharge positions is imparted thereto through the provision of a yielding 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 the forked ends of the operating plunger 58. The latter end of the connection 87 is connected to the op-

erating 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 connection 87.

The right 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 by the cam 78. In order to rotate the head 66 relative to the carriage 64 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 101 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 98, 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 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.

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 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 Fig. 4 of the drawings, the nib holder 12 comprises a sleeve 121 which houses a stationary jaw 122 and a movable jaw 123. This sleeve is telescoped within the barrel 65 of the head 66 and is freely slidable therethrough. More specifically, the movable jaw 123 is pivotally mounted on the stationary jaw 122 by means of a pivot pin 130, and the tail end of the movable jaw is arranged to be engaged by the end of the micrometer screw 112 through openings provided in the head 66 and the sleeve 121 each time the nib holder is operated into its loading position. The movable jaw 123 is normally spring-biased to engage the stationary jaw 122 and a nib ejector is provided between these two jaws for ejecting nibs held therebetween. This ejector is actuated by a camming connection which is operated incident to the movement of the jaw 123 to its open position.

As best shown in Fig. 6 of the drawings, the electrical control equipment for the four machines shown in Figs. 1, 7, 8, 9 and 10 of the drawings, comprises a welding current generator 20, which is arranged to deliver current to the parallel-connected nib and tip holders of the four machines A, B, C and D over a circuit which includes the contacts 21 of a contactor type of relay 22, and the welding circuit conductors 2 and 3. More specifically, welding current is passed over this circuit each time the nib holder 12 of any one of the four machines is operated to its tipping position wherein a nib held thereby is positioned to engage a tip held by the associated tip holder 11. For the purpose of measuring the duration of each welding interval the circuit for energizing the operating winding of the contactor 22 is arranged to be controlled by timing apparatus 31, which may, in turn, be tripped to energize the winding of the contactor 22 for a measured time interval in response to

operation of any one of the micrometer switches 24a, 24b, 24c and 24d. The timing apparatus 31 may, if desired, comprise a conventional alternating current cycle counter of the thermionic type, which is so arranged that when its trip circuit is closed, it functions to energize the winding of the relay 22 for a given time interval, and to then deenergize this relay regardless of the opened or closed circuit condition of its trip circuit. Operating current for the timing apparatus 31 and for the winding of the contactor 22 is supplied from a commercial alternating current source schematically indicated by the bracketed terminals shown in Fig. 6 of the drawings.

In considering the operation of the nib tipping machine, briefly described above, it is pointed out that the hopper 55 is first filled with a suitable 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 machine is initiated. To this end the operator inserts the base of a nib between the jaws 122 and 123 of the nib holder. 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 envelops 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. Assuming that the illustrated tipping machine is the first machine A of the battery of machines shown in Fig. 1 of the drawings, that the motor 5 is operating to rotate the shaft 13 and that the clutch 18 is engaged, rotary movement is imparted to the cam 78 through the belt 7, the gearbox 6, the chain 10, the shaft 13, the sprocket 16a, the chain 17a, the sprocket 15a, the clutch 18a and the shaft 14. The direction of movement of this driving connection is such that the cam 78 is rotated in a clockwise direction as viewed in Fig. 4 of the drawings.

Assuming that the parts of the illustrated tipping machine occupy a position such that the nib holder 12 is in its raised or loading position at the time the operation of the machine is initiated, the cam roller 85 first 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 to its tipping position as illustrated in Fig. 4 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 its 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 engages a stop provided within the nib holder assembly. 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 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 includes 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. In this regard it will be understood that immediately the contact springs 23 of the switch 24 are moved into engagement to close the trip circuit of the timing apparatus 31, this apparatus func-

tions to energize the operating winding of the contactor 22. When thus energized the contactor 22 closes its contacts 21 to complete a circuit including the conductors 2 and 3 for passing current from the welding generator 20 through the engaged tip and nib held by the tip and nib holders 11 and 12, respectively. 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 force 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 time interval measured by operation of the timing apparatus 31, the contactor 22 is deenergized and opens its contacts 21 to interrupt the welding circuit, whereby the flow of current through the engaged nib and tip is arrested. Shortly after the welding circuit is opened by the contactor 22, 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 tail end of the movable jaw 123 engages the end of the stop screw 112 and is operated to disengage the tipped nib. This relative movement between the jaws 122 and 123 causes the ejector of the nib holder assembly to eject the tipped nib from the holder. 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.

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 its tip discharge position. 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 counter-clockwise 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.

From a consideration of the control circuit as illustrated in Fig. 6 of the drawings, it will be understood that the output current rating of the generator 20 is determined by the manner in which the four machines A, B, C and D are operated. If the operating cycles of these machines are synchronized so that the nib holders thereof are concurrently operated to their respective tipping positions and the welding intervals over-

lap, a welding generator 20 having a current rating substantially four times that required for any one of the machines must be provided. Under these circumstances it would also be desirable, if not necessary, to provide four sets of timing apparatus for separately controlling the welding intervals of each machine, which sets of timing apparatus would be independently controlled by the four micrometer switches 24a, 24b, 24c and 24d. In order to avoid such unnecessary duplication of the timing apparatus and to avoid using a welding generator having an unnecessarily large current rating, the clutches 18, which are provided in the driving connections between the four machines A, B, C and D and the shaft 13, are so constructed and arranged that the operating cycles of the four machines are staggered. More specifically, the operating cycles of the four machines are so displaced in phase that, for a particular angular position of the shaft 13, the nib holder of the machine A occupies its loading position as illustrated in Fig. 7 of the drawings, the nib holder of the machine B occupies the partially lowered position illustrated in Fig. 8 of the drawings, the nib holder of the machine C occupies its tipping position as illustrated in Fig. 9 of the drawings, and the nib holder of the machine D occupies its half-raised position as illustrated in Fig. 10 of the drawings. Correspondingly different positions of the nib holders of the four machines are maintained for any other angular position of the drive shaft 13. This is accomplished by utilizing the positive chain and sprocket connections between the common drive shaft 13 and each of the clutches 15, and by using clutches of improved arrangement which are of the positive or positional clutching type.

The structure and arrangement of the four clutches is identical and will best be understood from a consideration of the clutch 18, the details of which are illustrated in Figs. 11 to 17, inclusive, of the drawings. In brief this clutch comprises a stepped support 140 which is suitably mounted upon the base member 36 of the machine in the manner shown in Figs. 3 and 5 of the drawings. This support is provided with an upper surface 141 from which extends a bracket portion 142 having a sleeve bearing member 143 extending therethrough. This bearing journals one end of a shaft 144, the other end of which is rigidly connected to the shaft 14 of the tipping machine, shown in Figs. 3, 4 and 5 of the drawings. A collar 145 which receives the adjacent ends of the two shafts 144 and 14 is used for this purpose. Set screws 146 and 147 are threaded through the collar 145 in order rigidly to secure this collar to the ends of the shafts 14 and 144, respectively. By using this type of rigid connection between the two shafts, the bearing supports for the shaft 14 also function as bearing supports for the otherwise unsupported end of the shaft 144. The shaft 144 has rigidly mounted thereon a driven member 148 which is arranged to be clutched and declutched from the driving sprocket 15 by means of a clutch bolt 149. More specifically, the driving sprocket 15 is rigidly secured to a friction plate 150, and the unit thus formed is rotatably mounted upon the shaft 144 with the friction face of the plate 150 loosely engaging an associated friction face of the driven member 148. The plate 150 is provided with a slot 151 extending radially inward from the circumferential surface thereof, into which the clutch bolt 149 is adapted to be urged by a coil spring 152 at any time when the left end of the bolt 149 registers with this slot and the bolt is not restrained in its retracted or declutched position.

For the purpose of selectively operating the clutch bolt 149 between its clutching and retracted positions, a cam plunger 153 is provided which is arranged to be reciprocated vertically in an opening provided in the support 140. More specifically, this plunger is provided with a head 175 which is of rectangular cross section and lies within a channel 177 milled transversely through the support 140, and with a shank 176 which extends into an opening 178 drilled downward from the bottom of the channel 177 through the support 140. The head 175 is provided with an upper camming finger 155 which, when the plunger occupies its raised position, is adapted to extend into an annular recess 156 extending radially inward from the outer surface of the driven member 148, so that it may engage the cam finger 157 of the clutch bolt 149. A coil spring 158 is provided for biasing the plunger 153 toward its raised position wherein the camming finger 155 thereof is positioned within the recess 156 in the path of movement of the cam finger 157. One end of this coil spring extends into a hole drilled into the lower end of the plunger shank 176 and the other end thereof rests upon the upper surface of the base member 36.

For the purpose of determining the raised position of the plunger 153 and the additional purpose of retracting this plunger so that the cam finger 155 thereof is out of the path of movement of the clutch bolt 149, the mechanism is equipped with an operating plunger 159 which is slidably mounted on the support 140 for movement along a line normal to the axis of the shaft 144. More specifically, this operating plunger is of rectangular cross-section and is disposed in a channel 160 milled transversely through the support 140. A flat cam plate 179 is mounted, by means of assembly screws 180, in a recess cut in the upper surface of the plunger 159. This plate extends laterally from the body of the plunger 159 and is cut away at 161 to provide a camming surface 162 which is arranged to coact with a camming surface 164 formed by appropriately cutting away the left side of the cam plunger 153. These surfaces are so arranged that as the operating plunger 159 is reciprocated between its two positions, the cam plunger 153 is operated between its retracted and non-retracted positions. For the purpose of limiting the longitudinal movement of the operating plunger 159, pins 165 and 166 are driven through openings provided therein on either side of the support 140. This prevents the operating plunger 159 from being pulled out of the mechanism when it is being operated to retract the cam plunger 153, and from being pushed through the mechanism during operation thereof to release the cam plunger 153. From a consideration of Fig. 15 of the drawings it will be noted that the upper surface of the cut away portion of the cam plunger 153 not only includes the camming surface 164, but also includes a flat upper surface which is adapted to engage the flat under surface of the laterally extending finger 161 when the cam plunger 153 is retracted. Thus the vertical position of the plunger 153 is at all times determined by the position of the operating plunger 159. The mounting assembly for the two plungers 153 and 159 comprises a flat plate 168 which is positioned in a transversely extending recess provided in the

upper surface 141 of the support 140. This plate, which is secured in position by means of assembly screws 169 threaded into the support 140, is coextensive with and overlies the upper surface of the laterally extending plate 179 to provide an extended bearing surface for receiving the upward thrust exerted on the plate 179 by the biasing spring 158. By virtue of this arrangement the operating plunger 159 is prevented from binding in the channel 160 of the support 140.

As best illustrated in Figs. 11, 13 and 14 of the drawings, the assembly for mounting the clutch bolt 149 and the coil spring 152 on the driven member 148 comprises a side plate 170 and two top plates 171 and 172. More specifically, this assembly is formed by cutting away the outer surface of the member 148 to different radial depths in order to provide flat surfaces upon which the two cover plates 171 and 172 may be mounted. The right end surface of the driven member 148 is also cut away to provide a recess for receiving the side plate 170. Further, this member is milled along its longitudinal axis to a radial depth greater than the radial depth of the recess 156 in order to provide a channel therein for receiving the clutch bolt 149. The two cover plates 171 and 172 are mounted upon the flat surfaces of the driven member 148 to maintain the side plate 170, the coil spring 152, and the clutch bolt 149 in assembled relation by means of assembly screws 173 and 174.

In considering the operation of the clutch, it may be assumed that the operating plunger 159 occupies its pulled out position wherein the flat under surface of the cam plate 179 engages the flat upper surface of the plunger head 175 to maintain the plunger 153 in its retracted position as shown in Fig. 15 of the drawings. It may further be assumed that the clutch bolt 149 occupies its extended position wherein it is positioned within the slot 151 to provide a rigid drive connection between the sprocket 15 and the shaft 144 through the driven member 148. With the parts of the mechanism occupying the indicated positions, the camming finger 155 of the plunger 153 is disposed out of the path of movement of the camming surface 157 of the clutch bolt 149. Accordingly, the clutch bolt remains in its extended position to provide a driving connection between the sprocket 15 and the shaft 144 so long as the position of the two plungers 159 and 153 is not altered.

In order to declutch the shaft 144 from the sprocket 15 the plunger 159 is pushed backward through the recess 160 from the position shown in Fig. 15 of the drawings. Incident to this movement of the plunger 159, the camming surface 162 is slid backward over the camming surface 164 of the plunger head 175, permitting the plunger 153 to be elevated vertically under the influence of the coil spring 158 until the cam finger 155 thereof is positioned to engage the camming surface 157 of the clutch bolt 149. After the operating plunger 159 has been pushed back to its retracted position the relative positions of this plunger and the cam plunger 153 are as illustrated in Fig. 16 of the drawings. When the cam finger 155 is moved into the path of movement of the clutch bolt 149 and the camming surfaces of these two elements are brought into engagement through continued rotation of the sprocket 15, the clutch bolt 149 is moved to the right from the position illustrated in Fig. 11 of the drawings, until it is withdrawn from the slot 151 to occupy the position shown in Fig. 12 of the drawings. When the bolt 149 is fully withdrawn from the slot 151 the sprocket 15 is completely declutched from the shaft 144 so that further rotation thereof may continue without imparting rotary movement to the driven member 148 and the shaft 144.

In order to again clutch the shaft 144 to the sprocket 15, the operating plunger 159 is pulled from the position shown in Fig. 16 of the drawings to the position shown in Fig. 15 of the drawings. Incident to this movement of the plunger 159, the camming surface 162 of the plate 179 coacts with the camming surface 164 of the plunger head 175 to move the plunger 153 against the biasing force of the spring 158 until it occupies its retracted position wherein the cam finger 155 is disengaged from the camming surface 157 of the clutch bolt 149. When thus released, the left end of the bolt 149, as viewed in Fig. 11 of the drawings, is pressed against the bearing surface of the plate 150 by the spring 152. As the sprocket 15 continues to rotate, the slot 151 is brought into registry with the end of the bolt 149 and this bolt is shot into the slot under the influence of the spring 152. Thus a driving connection is again established between the sprocket 15 and the shaft 144.

From the above explanation with reference to the details of the clutch mechanism as illustrated in Figs. 11 to 17, inclusive, of the drawings, it will be understood that by selectively operating the plungers 159*a*, 159*b*, 159*c* and 159*d* of the clutch mechanisms 18*a*, 18*b*, 18*c* and 18*d*, respectively, an operator of the illustrated tipping apparatus may selectively cut any one of the tipping machines A, B, C and D into and out of service. In this regard it will be understood that when the operating plunger 159 of any one of the four clutches is operated to declutch the associated tipping machine from the drive shaft 13, the shaft 144 of the clutch mechanism will be stopped in a position which is determined by the engagement of the camming surfaces 157 and 155 thereof. This angular position of the shaft 144 at which movement of the shaft is arrested, determines the position in which the associated nib holder is held after the movement thereof is stopped. The arrangement of the four clutch mechanisms and the shafts 14 to which they are connected is such that each time one of the machines is cut out of service, movement of the tip holder thereof is arrested with the tip holder occupying its loading position. This is accomplished by suitably adjusting the relative angular positions of the shafts 144 and 14 so that engagement of the camming surfaces 157 and 155 occurs, to declutch the shaft 144 from the drive sprocket 15, when the cam 78 of the associated tipping machine occupies a position such that the roller 85 is riding on the sector *b*—*c* of the cam. More specifically, the arrangement is such that each time a machine is cut out of service the movement of the nib holder thereof will be arrested when the roller 85 engages a predetermined point along the sector *b*—*c* of the cam 78. This point is the same for all four of the machines and can readily be attained by suitably adjusting the clutch shafts 144 relative to the tipping machine shafts 14 so that they bear the same angular relationship with respect to each other.

The purpose of the above-described arrangement, whereby the operation of any one of the tipping machines can only be arrested when the

nib holder thereof occupies its loading position, is to prevent the welding current source 20 from being short-circuited through any one of the machines. In this regard it will be noted that if operation of any one of the machines is arrested with the nib holder of the machine occupying its tipping position, a connection may easily be established through engagement of the nib and tip holders of the machine, thereby to provide an unbroken low resistance path shunting the welding circuit conductors 2 and 3. Moreover, with the nib holder of the machine in its tipping position, the contacts 23 of the micrometer switch 24 provided therein would interfere with the operation of the timing apparatus 31 common to the four machines.

As pointed out previously, another feature of the invention relates to the arrangement of the equipment whereby the operating cycles of the four tipping machines are staggered. More specifically, a 90° phase displacement is maintained between the operating cycles of each adjacent pair of machines. To this end, the slot 151*b* as provided in the clutch plate 150*b* of the clutch 18*b* trails by 90°, the slot 151*a* as provided in the clutch plate 150*a* of the clutch 18*a*. Similarly, the slot 151*c* as provided in the clutch plate 150*c*, lags the slot 151*b* of the clutch plate 150*b* by 90°. Finally, the slot 151*d* provided in the clutch plate 150*d* trails the slot 151*c* of the clutch plate 150*c* by 90°. By virtue of this arrangement, and the positive drive connection between the shaft 13 and each of the four drive sprockets 15*a*, 15*b*, 15*c* and 15*d*, the cams 78*a*, 78*b*, 78*c* and 78*d* are angularly displaced in steps of 90°. Accordingly when all four of the machines are in service, the operating cycles thereof are so staggered that the nib holders of the four machines are successively operated into their respective tipping and loading positions and no two of the nib holders ever concurrently occupy their tipping positions. Moreover, this arrangement positively precludes a machine which has been removed from service from being cut back into service except at the exact instant when the desired phase relationship between the operating cycle thereof and the operating cycles of the other three machines is reestablished. In this regard it will be apparent from the above explanation that the only point at which the sprocket 15 can be clutched to the driven member 148 to provide a driving connection between the two shafts 13 and 144, is that point at which the slot 151 is brought into registry with the end of the clutch bolt 149. It will be understood, therefore, that since the slots 151*a*, 151*b*, 151*c* and 151*d* are angularly 90° apart, the desired phase relationship between the operating cycles of the machines cannot be disturbed as the machines are cut into and out of service.

The purpose of staggering the operating cycles of the four machines is to permit a single set of timing equipment 31 and a single welding current source 20, of low current rating, to be used. In this regard it will be understood that when the 90° phase displacement between the operating cycles of the four machines is maintained, the nib holders of the four machines are successively operated to their respective tipping positions, and incident thereto the micrometer switches 24 are successively operated to trip the timing apparatus 31. Each time the trip circuit of this apparatus is closed, the contactor 22 is operated for a measured time interval to pass current through the engaged nib and tip of the machine in which the operated micrometer switch 24 is included, all in the manner previously explained.

While one embodiment of the invention has been disclosed, it will be understood that various modifications may be made therein which are within the true spirit and scope of the invention.

What is claimed is:

1. In apparatus for tipping metal bases with metal tips, a plurality of tipping machines each including a tip holder and a base holder which is cyclically operative between a loading position and a tipping position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, driving means common to said machines, driving connections between said base holders and said driving means, and means included in said driving connections for selectively cutting any one of said machines out of service without disturbing the operation of the other machines.

2. In apparatus for tipping metal bases with metal tips, a plurality of tipping machines each including a tip holder and a base holder which is cyclically operative between a loading position and a tipping position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, driving means common to said machines, driving connections between said base holders and said driving means, clutches included in said driving connections for selectively cutting said machines into and out of service, and means included in said clutches for providing a phase displacement between the operating cycles of said base holders.

3. In apparatus for tipping metal bases with metal tips, a plurality of tipping machines each including a tip holder and a base holder which is cyclically operative between a loading position and a tipping position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, driving means common to said machines, driving connections between said base holders and said driving means, clutches included in said driving connections for selectively cutting said machines into and out of service, and means included in said clutches for maintaining a phase difference between the operating cycles of said base holders such that said base holders nonconcurrently occupy their tipping positions.

4. In apparatus for tipping metal bases with metal tips, a plurality of tipping machines each including a tip holder and a base holder which is cyclically operative between a loading position and a tipping position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, driving means common to said machines, driving connections between said base holders and said driving means, clutches included in said driving connections for selectively arresting the operation of said base holders, and means included in said clutches for preventing the operation of any base holder from being arrested while it occupies its tipping position.

5. In apparatus for tipping metal bases with metal tips, a plurality of tip holders, base holders individual to said tip holders and each operative between a tipping position and a loading position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, means for driving said base holders, means for selectively arresting the operation of said base holders, and means for preventing the operation of any base holder from being arrested while it occupies its tipping position.

6. In apparatus for tipping metal bases with metal tips, a plurality of tip holders, base holders individual to said tip holders and each cyclically operative between a loading position and a tipping position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, means for successively operating said base holders into their tipping positions, a source of welding current common to said holders, and means comprising a timing device which is commonly associated with said holders and is successively controlled in accordance with the operation of the different base holders for passing current from said source through the engaged bases and tips as said base holders are successively operated to their tipping positions.

7. In apparatus for tipping metal bases with metal tips, a plurality of tip holders, base holders individual to said tip holders and each cyclically operative between a loading position and a tipping position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, means for successively operating said base holders into their tipping positions, a source of welding current common to said holders, and means comprising a timing device which is common to said holders and is actuated each time one of said base holders is moved into its tipping position for passing current from said source through each engaged tip and base as said base holders successively occupy their tipping positions.

8. In apparatus for tipping metal bases with metal tips, a plurality of tip holders, cyclically operative means for successively moving bases into engagement with tips held by said tip holders, a welding circuit common to said holders and operative to pass current through each tip which is engaged by a base, and means comprising a timing device which is repeatedly actuated during each cycle of operation of said first-named means for completing said circuit for a predetermined interval of each period when each tip is engaged by a base.

9. In apparatus for tipping metal bases with metal tips, a plurality of tip holders, base holders individual to said tip holders and each operative between a loading position and a tipping position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, means for successively operating said base holders into their tipping positions, switches individual to said base holders and each operated in response to movement of the associated base holder into its tipping position, means for passing welding current through each base when it is moved to engage a tip held by one of said tip holders, and means comprising a timing device common to said holders and sequentially controlled by said switches for limiting the duration of each welding period to a fixed time interval.

10. In apparatus for tipping metal bases with metal tips, a plurality of tip holders, base holders individual to said tip holders and each operative between a loading position and a tipping position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, means for successively operating said base holders into their tipping positions, switches individual to said base holders and each operated in response to movement of the associated base holder into its tipping position, a welding circuit common to said holders and operative to pass current through each base when it is moved to engage a tip held by one of said tip holders, and means comprising a timing device common to said holders and sequentially controlled by said switches for limiting the duration of each welding period to a fixed time interval.

11. In apparatus for tipping metal bases with metal tips, a plurality of tip holders, base holders individual to said tip holders and each operative between a tipping position and a loading position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, means for driving said base holders, a welding circuit common to said holders, means for closing said circuit each time one of said base holders is operated to its tipping position, means for selectively arresting the operation of said base holders, and means for preventing the operation of any base holder from being arrested while it occupies its tipping position.

12. In apparatus for tipping metal bases with metal tips, a plurality of tip holders, base holders individual to said tip holders and each operative between a tipping position and a loading position wherein a base held thereby is positioned to engage a tip held by the associated tip holder, means for driving said base holders, a welding circuit common to said holders, means comprising a timing device common to said holders and controlled in accordance with the movement of said base holders for closing said circuit for a fixed interval of each period when one of said base holders occupies its tipping position, means for selectively arresting the operation of said base holders, and means for preventing the operation of any base holder from being arrested while it occupies its tipping position.

13. In apparatus for tipping metal bases with metal tips, a plurality of tipping machines each including a base holder and a tip holder, means for operating said holders so the tips and bases respectively held thereby are successively moved into engagement, and means comprising a timing device common to said holders and successively actuated by the different machines for passing welding current through the successively engaged tips and nibs for a predetermined interval of each period of engagement therebetween.

14. In apparatus for tipping metal bases with metal tips, a plurality of tipping machines each including a tip holder and a base holder, driving apparatus common to said machines and including means for operating said holders so that the tips and bases held by the holders of the different machines are successively moved into engagement, and disengaging means for selectively cutting any one of said machines out of service without disturbing the operation of the other machines.

15. In apparatus for tipping metal bases with metal tips, a plurality of tipping machines each including a tip holder and a base holder, driving apparatus common to said machines and including means for operating said holders so that the tips and bases held by the holders of the different machines are successively moved into engagement, a welding circuit common to said machines, means including said circuit for passing welding current through the successively engaged tips and nibs for a predetermined interval of each period of engagement therebetween, means for selectively arresting the operation of said machines, and means for preventing the operation of any machine from being arrested when the holders thereof are relatively positioned to permit engagement between a tip and a nib respectively held thereby.

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