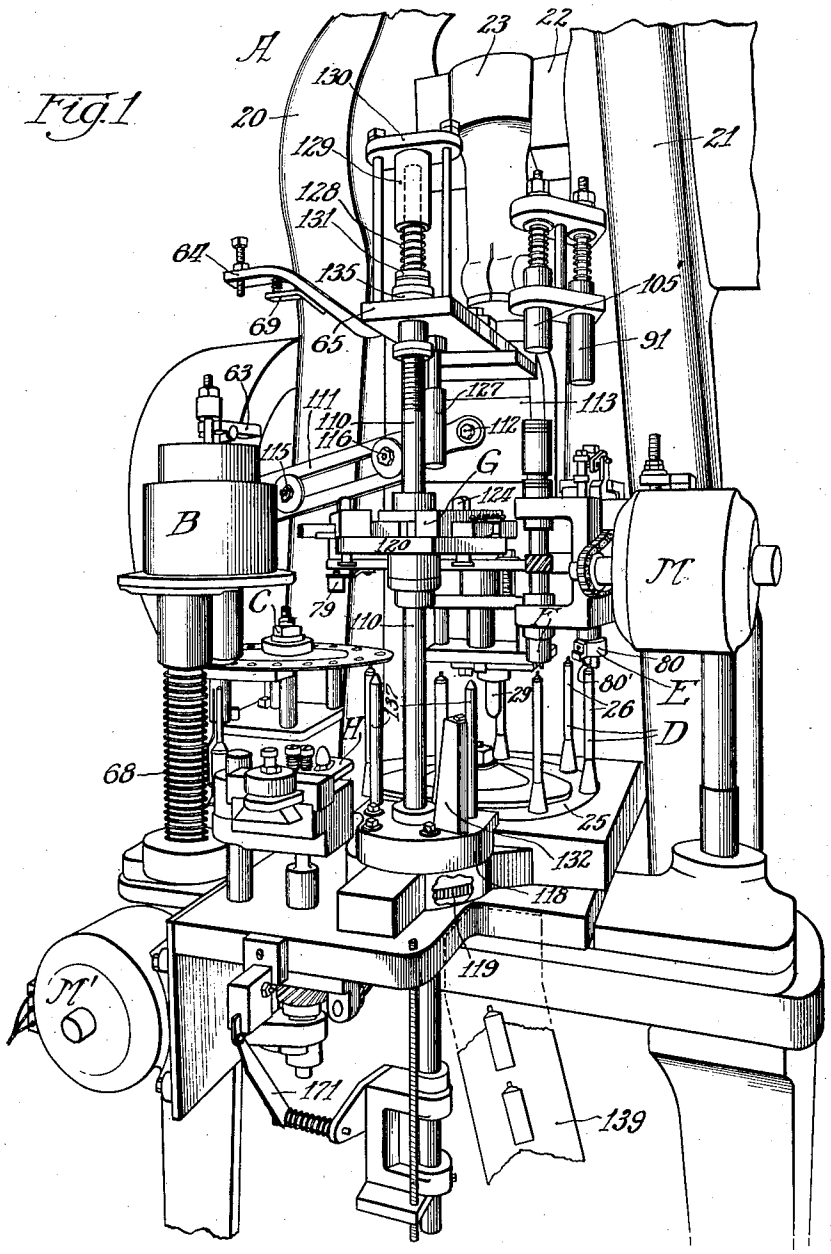
Sept. 24, 1929. J. HORAK 1,729,257

COLLAPSIBLE TUBE MAKING MACHINE

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Fig. 1



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COLLAPSIBLE TUBE MAKING MACHINE

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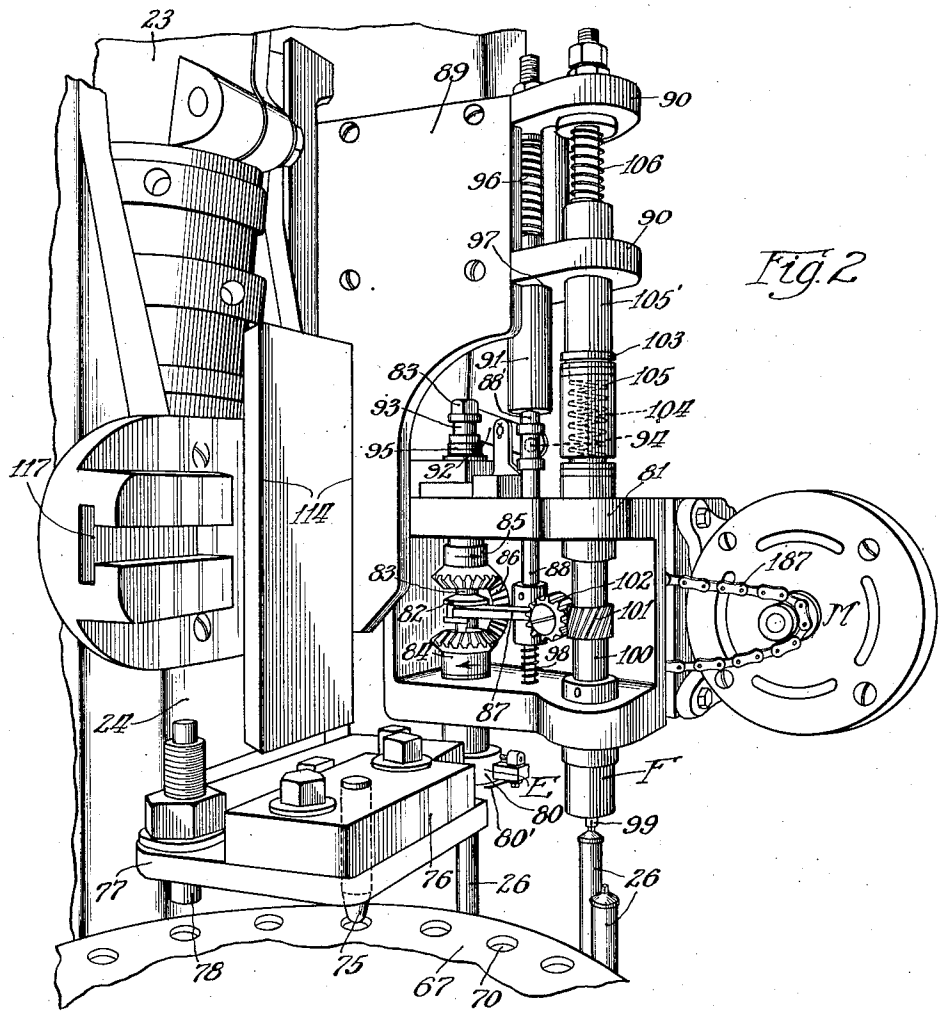


Fig. 2

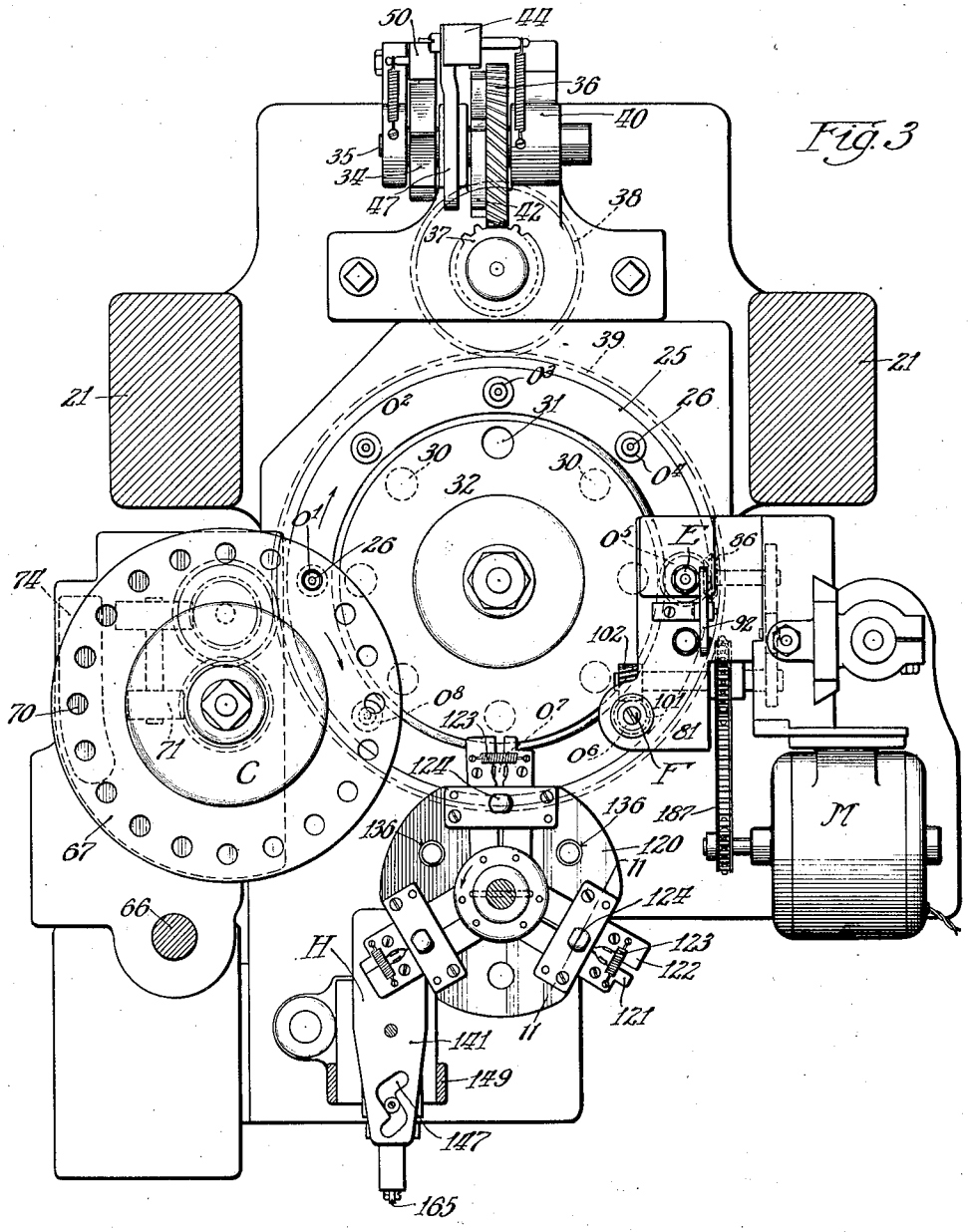
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COLLAPSIBLE TUBE MAKING MACHINE

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Fig. 3



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COLLAPSIBLE TUBE MAKING MACHINE

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Fig. 4

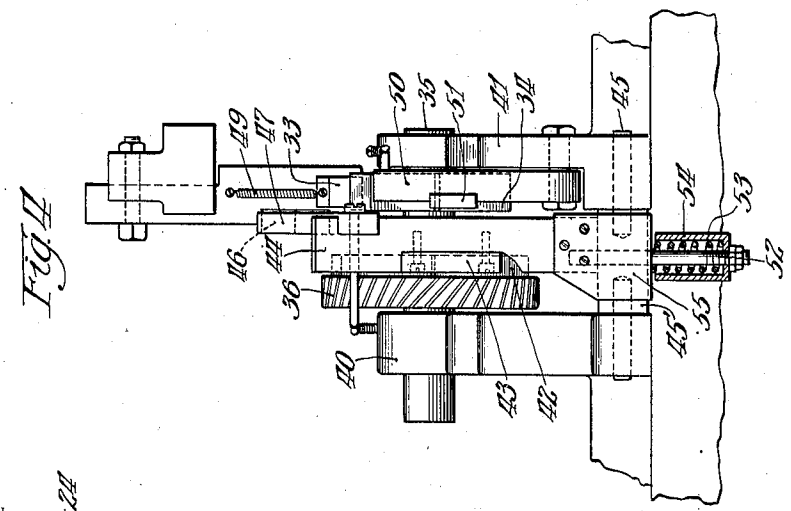
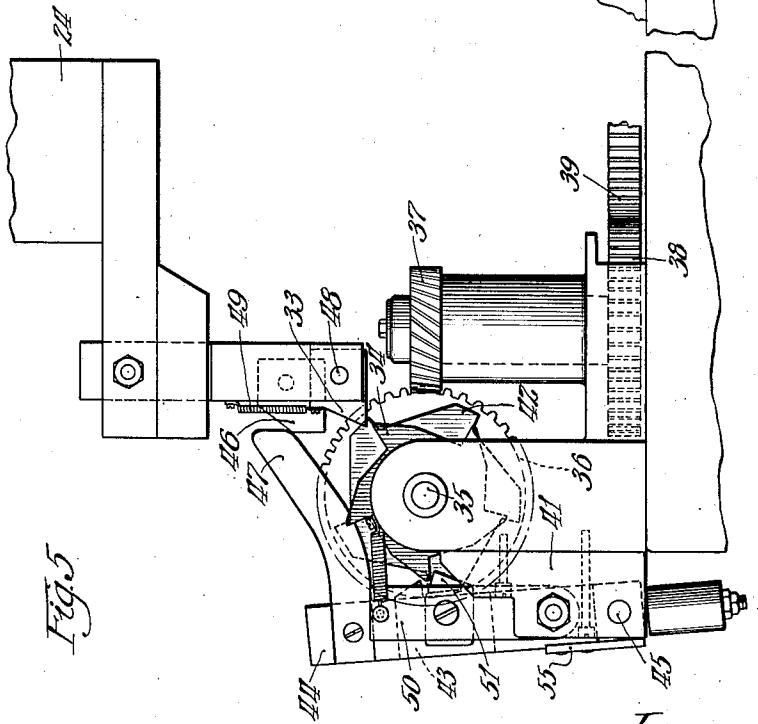


Fig. 5

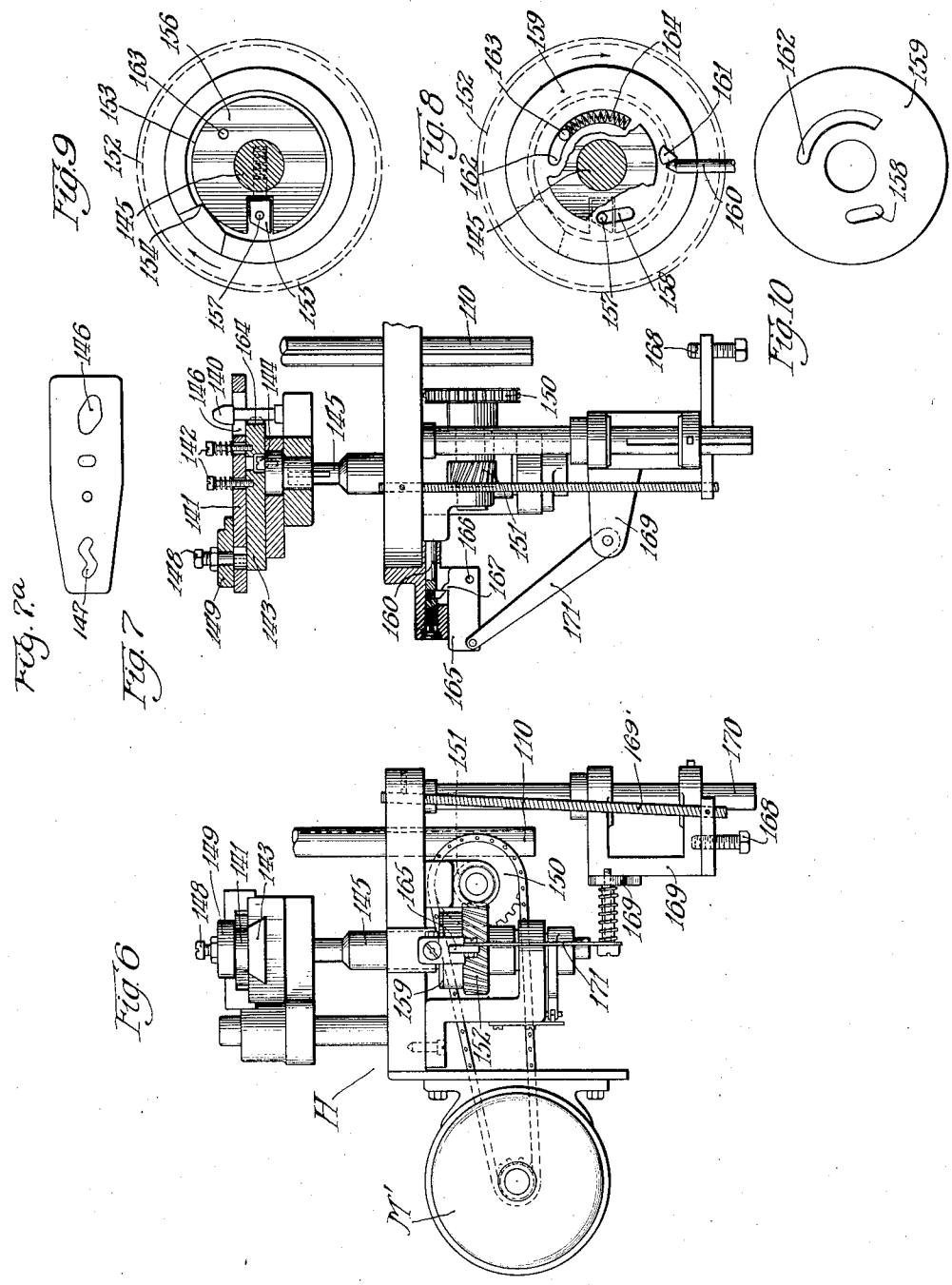


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COLLAPSIBLE TUBE MAKING MACHINE

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COLLAPSIBLE TUBE MAKING MACHINE

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Fig. 12

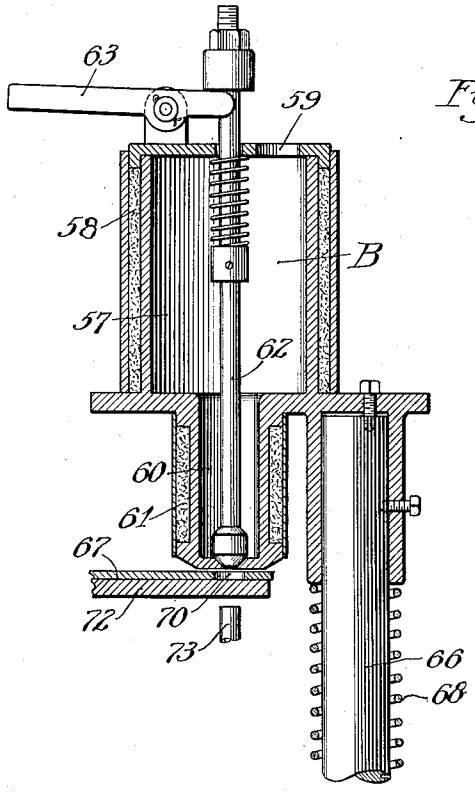
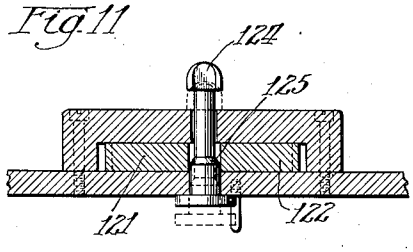


Fig. 11



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COLLAPSIBLE TUBE MAKING MACHINE

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Fig.14 Fig.15 Fig.16 Fig.17 Fig.18 Fig.19 Fig.20

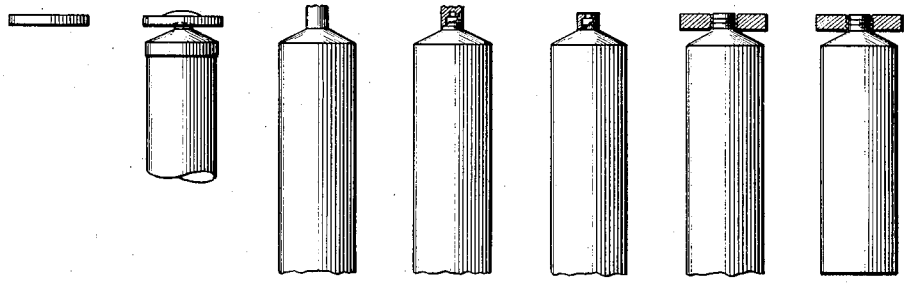


Fig.13

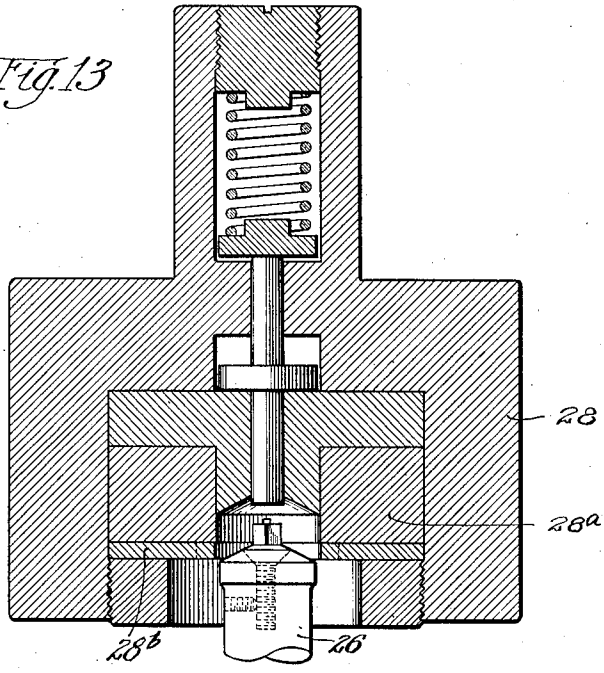
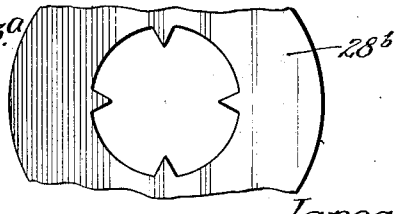


Fig. 13a



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UNITED STATES PATENT OFFICE

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COLLAPSIBLE-TUBE-MAKING MACHINE

Application filed July 24, 1922. Serial No. 577,060.

My invention relates to collapsible tube making machines, an object being to provide an improved and simplified machine of this character and although I refer to collapsible tubes my invention, as illustrated herein although particularly constructed for this purpose is not limited thereto, as it is just as well adapted for other devices of a similar character, such as soft metal caps for bottles, etc. One of the features of my invention is the provision of a machine for making the complete tube from the raw material, that is, melting the metal, feeding the molten metal to a feed plate wherein blank buttons are automatically made and successively fed to a press actuated extruding die where the tube is formed, and then passed along into successive positions where it is automatically acted upon to thread the neck, face it off and then trim the tube into the appropriate length.

Another feature of my invention is the provision of a new and improved method of making collapsible tubes wherein the metal is taken from the raw state automatically through the various steps to a complete tube.

Another feature of my invention is the provision of increased motion mechanism added to an ordinary standard punch press wherein a short stroke of the press completes the tube by the extrusion method and the tube is then lifted off a long forming spindle by lifting and carrying mechanism having a stroke greater than the stroke of the press but driven thereby and by which the tube is carried around into another position to be operated on, such as in the trimming thereof to bring it to the appropriate length.

Another feature of my invention is the provision of an automatic feeding melting pot operated with each stroke of the press to feed the molten metal to the button forming mold or feed plate, although punched buttons may be fed, if desired.

Another feature of my invention is the provision of automatically operated threading and facing devices which act upon the tube during various steps as it is intermittently moved forward toward completion.

There are other features of my invention but these will be more particularly pointed out in the ensuing part of the specification and appended claims.

For a better understanding of my invention, reference is to be had to the accompanying drawings in which

Fig. 1 is a perspective view of the preferred form of my invention, but with the lower portion of the legs and the upper and rear portions of the press frame broken away;

Fig. 2 is a perspective view of a portion of the mechanism showing more particularly the threading and facing mechanism;

Fig. 3 is a plan view in the nature of a transverse section, looking downwardly on the various elements of the machine;

Fig. 4 is a rear elevation of the driving mechanism shown at the rear of Fig. 3;

Fig. 5 is a right side elevation of Fig. 4;

Fig. 6 is a front elevation of the tube trimming mechanism and driving mechanism therefor;

Fig. 7 is a right side elevation of Fig. 6 with some of the parts in section;

Fig. 7ª is a plan view of the detail 141, that is the shearing blade;

Fig. 8 is a plan view or cross section through the driving shaft 145 of the trimmer, taken immediately above the plate 159 in Fig. 6 and showing more in detail the clutch mechanism with the shaft 145 to operate the trimmer;

Fig. 9 is a view of the mechanism of Fig. 8, but with the plate 159 removed;

Fig. 10 is a detail view of the plate;

Fig. 11 is a sectional view through the tube lifting fingers along the line 11—11 of Fig. 3;

Fig. 12 is a vertical cross section through the melting pot;

Fig. 13 is a cross sectional view of the extruding die including the die and forming spindle;

Fig. 13ª is a bottom view of the notching plate 28ᵇ of Fig. 13;

Figs. 14 to 20 show the various steps of operation including the blank button, feeding the button to the die spindle, forming the tube by extrusion of the button, threading the neck of the tube, facing the top of the neck, lifting the tube from the spindle, and trimming the

lower end of the tube to the appropriate length, respectively.

Referring now more in detail to my invention as illustrated, it is preferably applied to or includes a press, the one illustrated being of the vertical reciprocating type A having the usual slide or die carrying head, said press supporting the various mechanisms which successively act to complete the tube from the molten metal to the finished product, and includes the melting pot B for feeding the molten metal, such as pure tin, etc., as commonly used, to the forming and feeding plate mechanism C where it is carried to the spindle mechanism D of the extrusion die and then successively fed along to a threading spindle E and facing spindle F, after which the tubes are lifted off the spindle by the tube removing mechanism G and placed into operative relation with the trimming mechanism H, where they are trimmed to their appropriate length and then released and deposited in an appropriate receptacle.

Now, as to the press A, this, of course, may be of any suitable type but the one illustrated has sides 20—21 between which the crank shaft 22 is supported for driving the connecting rod 23 which extends to the press slide 24 at the lower end where the extruding die of Fig. 13 is suitably supported.

Now as to the extrusion die mechanism, I preferably provide a single die adapted to cooperate with a plurality of forming spindles 26 which are successively moved past the die member and to this end I preferably mount these spindles 26 upon a rotatable plate 25 which is intermittently advanced so as to bring the spindles successively beneath the die, one for each operation or reciprocation of the press. These spindles 26 have irregular tips 27, (see Fig. 13) preferably squared so that as the blank or button is forced thereon and successively operated upon, the blank and tube are held against rotation upon the forming spindle as when it is extruded, threaded and faced. As to the die (Fig. 13), this comprises the usual holder 28 carrying appropriate means for trimming the blank and extruding or forming the tube over the forming spindle 26. The former 28^a also acts to trim the blank to the appropriate diameter should it be oversize, by cutting a ring of metal off. This would drop down over the spindle and in time clog the die but to prevent this I use a notching plate 28^b, (shown in detail in Fig. 13^a) so that the blank is notched into a point on the appropriate diameter before it is trimmed. Then when the former die 28^a trims the blank, the trimmed off part drops down in sections around the spindle and is easily carried away. In order to center the forming spindles 26 beneath the die I provide a centering pin 29 (Fig. 1) adapted to enter holes 30 in the spindle carrying plate 25 shown in dotted lines in Fig. 3, the centering pin 29 cutting down through a clearing opening 31 in the stationary plate 32 which is mounted above the rotatable spindle plate 25.

In order to drive the spindle plate 25 I provide mechanism adapted to advance the plate from one spindle to the next for each operation or reciprocation of the press slide, this movement being performed during the preliminary downward motion of the slide before the extrusion begins. To this end I provide mechanism shown more clearly at the top of Fig. 3 and in Figs. 4 and 5, which mechanism is driven by a pawl carried by the press slide as it descends.

In general, this mechanism comprises an adjustable pawl 33 adapted to engage a tooth of the ratchet wheel 34 upon each downward movement of the press, which ratchet is fastened to a shaft 35 carrying a spiral gear 36 in mesh with a spiral gear 37 connected to a spur gear 38 in mesh with a larger gear 39 secured to and travelling with the spindle plate 25. The parts are so proportioned that the spindle plate 25 is moved the distance between spindles for each reciprocation of the press, but said movement is completed by the preliminary motion of the press slide and before the extrusion process begins.

As the pawl 33 travels downwardly it slides past the engaged tooth of the ratchet wheel 34 as soon as a sufficient feeding movement has been effected so that the press slide may continue in its downward travel and allow the other parts to remain inert during the final movement thereof. The ratchet wheel 34 and its shaft 35 are supported between uprights 40—41, said mechanism also being provided with means to prevent over-running due to the momentum imparted thereto by the stroke of the press. To this end I provide an oppositely disposed ratchet 42 adapted to be engaged by the pawl 43 carried by an arm 44 pivotally supported at 45 so that the said arm 44 and stop pawl 43 carried thereby may be moved back away from the stop ratchet 42 by the upward movement of the press slide. This is brought about by the cam plate 46 which engages the arm 47 during the upward movement of the press head to force the arm 44 and the pawl 43 back from the holding ratchet 42. It is to be noted that in Figs. 4 and 5 the press slide 24 is shown beneath its normal or uppermost position and in the act of being moved upwardly. During this upward movement of the press the pawl 33 slides over the teeth of the ratchet wheel 34 being pivoted at 48, but held by a spring 49. In order to prevent this upward movement of the pawl from causing a backward movement of the ratchet wheel 34, I provide a spring pressed arm or lever 50 carrying a holding tooth 51 shown in engagement with one of the teeth of the ratchet wheel 34.

It is also to be noted that the arm 44 is yieldingly held in the block 45′ which block is pivoted at 45, this yielding mounting consisting of a shaft 52 extending downwardly from the arm 44 through the block 45′ and held by a spring 53 incased in the tube 54. Thus, the spring 53 tends to hold the arm 44 yieldingly against the block 45′ and I apply a plate 55 thereto to keep the arm 44 from turning, the said plate being fastened to the arm 44 by three screws and slidable against the outside of the block 45′. It is also to be noted that the tubular casing 54 acts as the final stop for the stop pawl 43, there being a slight play between the tube 54 and the block 45′ as shown in both Figs. 4 and 5. Thus as the press slide comes down and the pawl 33 engages and rotates ratchet 34, the stop ratchet 42 engages the stop pawl 43 just before the completion of the advancing ratchet movement and just as the pawl 33 slides past its engaged tooth 34 at the downward movement of the stroke, the stop mechanism comes into play but in a yielding manner so as to prevent a sudden stoppage to the parts. At this time the sleeve 54 is up against block 45′ and remains there until the press slide moves upwardly to release the arm 44 so that as the arm is pushed back its stop pawl 43 upon disengaging from the engaged stop tooth 42 snaps downwardly to the limit of the play as indicated between the sleeve 54 and block 45 so that the stop pawl 43 cannot prevent a subsequent rotation of the ratchet 34 when the block 46 has moved away from the releasing arm 47. That is, as the pawl 43 is pushed out clear of the ratchet 42 it snaps downwardly the distance of the plate and then after the arm 47 is disengaged by the cam 46, the pawl 43 rests against the outside or peripheral edge of the tooth 42 so as to leave it free to be advanced by the next stroke of the press.

Now as to the blank casting and feeding mechanism, I preferably mold the blanks to feed them to the machine and to this end I use a melting pot B shown more in detail in Fig. 12, which feeds the molten metal to the feed plate mechanism C. The melting pot B is preferably electrically heated and comprises an upper reservoir 57 wound with an electric heating element 58 so as to maintain the upper portion of the pot at a temperature sufficient to melt the material used, which may be pure tin, lead composition, etc. The metal may be dropped into the pot through the opening 59 in the cover thereof. A lower portion or smaller pot 60 is provided which is also surrounded by an electric heating element 61 adapted to maintain the lower pot at the proper temperature to permit a free flow of the metal, the lower pot carrying less metal and thus being more easily maintained at a flowing temperature. Valve mechanism is provided for feeding the metal and to this end I provide a valve stem 62 seating at the bottom of the lower pot and adapted to be lifted by the lever 63. This lever 63 is actuated by an arm 64, actuated upon each stroke of the press. This arm 64 is carried by the bracket 65 which is a part of the increased stroke mechanism and moves up and down with each operation of the press. The melting pot B is carried upon a standard 66 and normally held clear of the feed and molding plate 67 by a spring 68, the nozzle of the pot being first pressed down against the plate 67 by the spring pressed member 69 before the valve is opened. I thus maintain the pot clear of the plate 67 except while the plate is being fed so that the pot does not interfere with the free feeding movement of the plate.

The holding and feeding plate mechanism C comprises a rotatable plate 67 having a plurality of opening 70 therein adapted to receive the molten metal from the melting pot so as to form the blank buttons from which the tubes are formed. This plate 67 is driven the distance between holes for each stroke of the press, being preferably connected through the gearing 71 indicated by the dotted lines in Fig. 3 to the larger gear 39 connected with the spindle plate 25. Thus, as the spindle plate is driven upon each downward stroke of the press, the feeding plate 67 is also driven in the direction of of the arrow indicated thereon, the distance between holes 70 so as to feed successive blanks to the forming spindles 26. In Fig 3 a spindle is shown directly beneath one of the holes 70. The plate 67 rests upon a plate 72 and I provide a Bunsen burner 73 directly beneath the plate 72 at the point where the molten metal is deposited so as to keep this at the proper temperature, and thus more positively fill the molding openings 70. As the plate 67 rotates, however, the filled molding holes pass over a cooling portion in the plate indicated by the dotted lines 74 in Fig. 3, this cooler being supplied with oil or water circulating therethrough. In order to properly center the feeding plate above the forming spindle 26 I provide a centering pin 75 (Fig. 2) which is held in an adjustable block 76. This pin travels with the press slide and is supported on a plate 77 extending out from the press slide 24. In order to press the molded blank out of the feeding plate as it is moved above a forming spindle 26, the plunger and former 78 (Fig. 2) enters the registering mold opening 70 and forces the blank down over the small tip 27 on the end of the forming spindle. The blank is thus held on the spindle when the spindle is moved from the feeding position to the extruding or forming position, which by the way is two steps as will be seen from Fig. 3. In the intermediate step between the feeding position O^1 and the forming po-

sition O^3 no operation is performed upon the blank at position O^2, although at this time other operations take place upon the tube as will be hereinafter referred to. Upon each stroke of the mechanism a button blank 70 is oiled after it is molded and to this end I provide an oiling device in the form of an oil fed piece of felt 79 (Fig. 1) which is applied over one of the openings 70 as the pressed slide comes down.

In the operation of the feeding plate the plate is moved with the down stroke of the press being connected to the spindle plate, but this movement, of course, takes place during a preliminary or non-extruding portion of the operation of the press and the plate comes to rest above the spindle before the blank is driven out of it onto the spindle tip. The plate then, of course, remains stationary until the press slide returns to its upper position and comes down again on its next stroke.

The tube having been advanced to the forming or extruding position O^3 is then stepped along to position O^4 where no operation is performed upon it, although operations are taking place at other positions. It is then stepped to position O^5 where it is threaded. Simultaneous with the threading operation a facing operation occurs upon the tube at position O^6. The threading and facing mechanisms E and F respectively are preferably operated by a continuously driven source of power as the motor M, but, of course, it is to be understood that my invention is not limited in this way.

As to threading mechanism E, this includes a die 80 carried upon a vertical shaft 83 extending up through the stationary frame 81 and carrying a clutch 82 at the center thereof secured fast to the shaft. The die 80 carries a spring 80′ (Fig. 1) in the form of a flat yielding finger pressing down against the top of the tube so as to hold it on the spindle as the die rotates. Otherwise the die might draw the tube up off the spindle. Loosely rotatable upon the clutch shaft 83 are two gears 84 and 85 rotating in opposite directions as indicated by the arrows thereon, being driven by the gear 86 which is driven by the chain 187 from the motor M. The clutch 82 is normally clear of the two driving gears 84—85 being held in its central position by the arm 87 extending from the vertical shaft 88, which shaft has a longitudinal motion being pressed downwardly initially to start the threading operation when the press slide comes down.

The press slide which includes the main portion 24 and the forwardly extending plate 89 carries the frame 90 having the spring held plunger 91 adapted to strike the top of the shaft 88 at 88′. In Fig. 2 the press slide is shown in a partly depressed position for convenience of illustration, but it is to be understood that when it is in its upper or normal position the plunger 91 is up away and clear of the shaft top 88′. As shown in this figure, the slide is not fully down, for with the slide in its lowermost position the plunger 91 will press the shaft 88 downwardly so as to bring the clutch 82 against the lower or threading gear 84.

Assuming that the slide has continued down farther than shown so as to bring the clutch 82 in engagement with the gear 84, the threading die 80 is rotated on the shaft 83. This threading rotation is only a predetermined number of revolutions and the device is arranged so that it will then automatically stop the threading rotation at which time the shaft and die remain inert until the press slide starts its upward travel. This is brought about by the reversing mechanism shown at the top of shaft 83 consisting of a link 92, which link is pivoted at its center on the bracket and carries a roller at the left end tarvelling in the groove 93 in shaft 83 so that the shaft is free to rotate. The right end of the link carries a roller travelling in the groove 94 in the shaft 88, this roller being indicated in dotted lines and clear of the edges of the groove 94. This clearance is to allow the shaft 88 to be normally pressed downwardly to start the threading operation.

Assuming that the threading rotation has started and shaft 83 is rotated in a clock-wise direction, it is drawn downwardly by reason of the threads 95 thereon. Therefore, due to this downward travel of the shaft 83, the corresponding end of the link 92 is drawn downwardly so that the right end of link 92 moves upwardly and the roller carried at the right end engaging the upper face of the groove 94 lifts the shaft 88 upwardly until the clutch 82 and gear 84 disengage, stopping further rotation of the die shaft 83. It is to be noted that the plunger 91 which presses the starting shaft downwardly is held by a spring 96 and there is sufficient clearance at 97 between the frame 90 and plunger 91 when the shaft 88 is moved upwardly by the downward travel of threading shaft 83. The threading mechanism now remains inert until the upward movement of the press slide. When the press slide starts upwardly the plunger 91, of course, moves upwardly permitting the shaft 88 to be pressed upwardly by the spring 98 at the lower end thereof. This causes the arm 87 carried thereby to press the clutch 82 up against the upper or retrieving gear 85 thus causing a reverse operation of the threading shaft 83 and unscrewing the die from the tube neck. In order to stop this returning or retrieving movement of the shaft 83 the link 92 again comes into play, this time having its left end pushed upwardly due to the upward travel of shaft 93 as the thread 95 unscrews, thereby driving the right end of the link downwardly and causing its roller to

engage the lower edge of slot 94, driving the shaft 88 downwardly to unlock clutch 82 from gear 85. The threading mechanism then remains inert until the next subsequent operation of the press. It is to be noted that the threading die 80 and controlling mechanism therefor, are interchangeable and adjustable for different sizes of tubes.

The facing mechanism F, which is also preferably driven by the motor M consists of a suitable facing tool preferably in the form of a facing milling cutter 99 carried at the bottom of shaft 100, which is rotated by means of the spiral gears 101—102 operated by the chain 187 of the motor. The vertical driving shaft for the facing mechanism comprises an outer sleeve 100 which carries the gear 101 and an inner shaft keyed to the outer shaft 100 but longitudinally slidable therein and carrying the cutter 99 and its chuck at the lower end and extending up to its head plate 103 which is the upper end of the shaft. The shaft is held in its upper position by the spring 104 shown inside the sleeve 105 so as to hold the cutter 99 normally above the upper end of the tube whereby it may be pressed downwardly to a predetermined point to properly face off the top of the threaded neck of the tube. For the purpose of pressing the facing shaft downwardly the plunger 105′ is provided being carried in the frame 90 and pressed downwardly by the spring 106 and adjustable for different lengths of tubes. In Fig. 2 the press slide is shown in almost its lowermost position but in Fig. 1 it is shown in its uppermost position with the plungers 91 and 105′ disengaged from the threading and facing mechanism.

In connection with the tubes it is to be noted that various sizes of tubes may be made and the mechanism is so adjustable as to work upon different tubes, either as to diameter or length. To this end the forming spindles 26 are also removable so that the desired spindle may be threaded down into the spindle carrying plate.

It will be noted that the threading and facing spindles are above two different forming spindles 26 so that each device operates upon a separate tube, one doing the threading and the other the facing, simultaneously.

Having described the casting, extruding or forming, threading and facing mechanisms, the mechanism G for removing the tubes from the forming spindles and advancing them to the trimming mechanism H and then releasing them, will be described.

The tube after having been faced at mechanism F, that is position O^6 of the spindle plate, is advanced to position O^7 upon the next subsequent operation of the press, at which time the removing mechanism G is actuated so that one of its gripping fingers will grasp the tube, lift it off the spindle, rotate to deposit it or place it over the shearing post of the trimming mechanism H, and then rotate to a third position and release the tube.

The lifting mechanism is mounted upon a rotatable and longitudinally movable shaft 110, which shaft is rotatably mounted in the bracket 65 but only slightly longitudinally movable therein. This bracket 65 travels up and down as the press slide travels, but at an increased stroke and to this end I provide increased stroke mechanism in the form of a lever 111 pivotally secured at 112 to the slide 113 carrying the bracket 65, which slide is carried upon the way 114 of the main press slide 24. Thus, the auxiliary slide 113 is free to move up and down on the way 114 of the main slide 24. As to the lever 111, this is also pivoted at its left end at 115 to the side frame 20 of the press, and a pivot 116 extends through the lever into the T-slot 117 of the main slide 24. The lever 111 is slidable on both pivots 115 and 116 but due to the driving fulcrum being between the two outside pivots 115 and 112 it will be seen that the auxiliary slide 113 travels with a greater stroke than the main slide. By adjusting the middle fulcrum 116 in the T-slot 117, this stroke may be varied so as to take care of different lengths of tubes.

Referring again to shaft 110 which is carried with the auxiliary slide, this shaft extends down through a casing 118 having a gear 119 therein in which the shaft 110 is slidably keyed. Gear 119 is in mesh with the large gear carried with the forming spindle plate so that as the press slide comes down and drives the spindle plate, gear 119 is also rotated to rotate shaft 110 through 120°. While this shaft 110 is being thus rotated it is also being carried downwardly due to the connection with bracket 65 so that it carries the gripping finger plate 120 down and around whereby a pair of gripping fingers will come down over the spindle in position O^7 to grasp the tube thereon, the next pair of gripping fingers which have already grasped the preceding tube deposit their tube over the shearing or trimming mechanism H, while the third set of gripping fingers automatically release the completed tube which they hold.

These gripping fingers each comprise a pair of bars 121—122 pivoted at their inner ends and connected by a spring 123 at their outer ends which spring acts to pull the fingers together at the proper time to grip the tube by the threads at the neck. In order to open and close these fingers I provide a cam operating post 124 shown more clearly in Fig. 11. This post 124 has a cam portion 125 shown in full lines up in the position in which it holds the fingers 121, 122 apart as in position O^7 of Fig. 3. To release the fingers so that they may grasp the tube at position O^7 the post 124 is pressed downwardly at the finish of the rotary and downward movement of the

lifting mechanism, which, of course, is before the downward stroke of the press is completed, but after the rotary motion of the gripping plate 120 and its shaft 110 has ceased. This operation of the cam post 124 is brought about by the post 127 extending downwardly from the bracket 65. As previously stated, the shaft 110 is not fixedly carried against longitudinal motion in the bracket 65 but extends up through the bracket 65, spring 128, and sleeve 129, which sleeve is held by the bridge plate 130. The end of the shaft 110 does not extend all the way up in the sleeve 129 as indicated by the dotted lines, but its initial downward movement is brought about with the spring 128 interposed between the collar 131 on the shaft 110 and bridge plate 130. Thus the shaft 110 is being moved downwardly by the bracket 65 of the auxiliary slide until further downward movement of the shaft 110 is prevented by the upwardly extending stop post 132 engaging the lower end of one of the cam posts 124. However, the press slide is still continuing its downward movement at this time so that although shaft 110 is stopped against downward movement the auxiliary slide and bracket 65 continues downwardly a slight distance further causing the stud 127 carried by the bracket 65 to strike the upper end of the cam post 124 opposite the position O^7 of the spindle plate. This drives the post 124 downwardly until the cam 125 clears the lower edge of the fingers 121—122 at which time they snap inwardly due to the action of spring 123 to grip the threaded neck of the tube by the correspondingly threaded jaws as indicated at each of the gripping fingers in Fig. 3.

The downward travel of the press having been completed, the slide again starts upwardly, the bracket 65 first moving up again slightly on the shaft 110 until the stop collars 135 are engaged after which the shaft is carried up with the bracket to the limit of the stroke. It is also to be noted that at the time the gripping mechanism was driven downwardly the finger carrying plate 120 is positively centered before the work is commenced upon the tubes, by means of centering holes 136 in this plate embracing the centering spindles 137 shown more clearly in Fig. 1. This is to more positively line up the apparatus before the work upon the tubes commences.

In the description of the lifting mechanism as just given, I referred only to one of the three operations performed thereby during each stroke of the press as it is to be noted that not only does it grasp the tube at position O^7 and lift it off the spindle during the upward travel, but during the rotary and downward travel of the plate 120 the tube which was last lifted off a forming spindle is carried around to the position over the trimming mechanism H, and the tube which was just operated upon at the trimming mechanism H is carried around to the next position and released to be deposited in a suitable receptacle beneath the press along the chute 139.

As to the operation in carrying the tube from the spindle 107 around to the trimming mechanism, assuming that the lifting mechanism is in its uppermost position as indicated in Fig. 1, with a tube held in each one of the jaws of the gripping fingers, upon the downward stroke of the press the gripping mechanism is, of course, carried down and around moving a tube from position O^7 to the trimming mechanism H and placing it over the shearing stud 140 thereof. This shearing mechanism is shown more particularly in Figs. 6 to 10 where the power driving mechanism therefor and trigger mechanism is also detailed.

In connection with this device I preferably employ a continuously operating source of power in the form of a motor driving gearing which is normally disconnected from the shearing device, but which upon actuation of the trigger mechanism by the down stroke of the press connects the driving shaft with the shear to effect but a single operation thereof, means being provided to prevent more than such a single operation.

The shearing device consists of a flat plate 141, a plan view of this plate being shown in Fig. 7ª. The plate is yieldingly held by springs and screws 142 against a slide 143, which slide is reciprocated in its ways by a roller 144 eccentrically mounted upon the end of the driving shaft 145 so as this shaft 145 rotates the roller 144 moves the slide 143 and a single rotation of the shaft causes a single complete reciprocation of the slide. The plate 141 has a peculiar shaped shearing slit 146 surrounding the shearing stud or post 140 and the plate 141 has a peculiar motion imparted to it by the operation of the slide 143 due to the peculiar slot 147 therein which embraces a roller on the lower end of the screw 148 carried in the bridge piece 149. By the arrangement shown the plate is given a movement whereby it shears around the circumference of the tube inwardly at all points so as to prevent burring the tube as it is trimmed off. The upper face of the plate 141 around the slot 146 is forced under the overhanging or shearing edge of the post 140 when it is operated.

Now as to the power mechanism and tripping mechanism for operating the shear, a motor M′ is provided driving a sprocket wheel 150 connected through a shaft with a spiral gear 151 for driving the larger spiral gear 152, these parts being preferably in continuous motion. The driven gear 152 is normally disconnected from the shaft 145 and is adapted to be connected therewith by

the clutch mechanism shown more in detail in Figs. 8, 9 and 10. The gear 152 is hollowed out at 153 and has a hardened clutch tooth 154 extending into the opening and adapted to be engaged by the dog 155 but which is normally held in the block 156 free of the tooth 154. The block 156 is fastened to the shaft 145 so that when the dog 155 is released it is engaged by the tooth 154 of the gear so as to carry the shear operating shaft 145 around a single revolution at which time the dog 155 is forced back away from the tooth 154 to prevent more than a single revolution of the shaft. The dog 155 has a spring tending to press it outwardly but the dog is held in its non-operative position by means of a pin 157 extending upwardly therefrom into a slot 158 in the plate 159. This plate is loose on the shaft 145 and rests against the top of the gear 152 as indicated in Fig. 6. The plate 159 is normally held against rotation by means of a bolt 160 resting against the side of an upwardly extending stud 161 carried by the plate. The plate has a second slot 162 through which extends a pin 163 carried by the block 156. Between this pin 163 and the end of the slot is a spring 164 normally pressing the plate so that its stud 161 is held against the bolt 160. The slot 158 is tangential and its lower end is further away from the axis than the upper end viewed as in Fig. 8. It will thus be apparent that if the bolt 160 is withdrawn away from the stop pin 161 the action of the spring pressing the dog 157 outwardly, and the action of the spring 164 pressing the plate 159 around in a clock-wise direction will permit or force the dog 156 out into the path of the gear pawl 154 so that as the gear comes around it will engage the pawl 154 and carry the pawl, and thus also the block 156 and shaft 145 around, plate 159 also traveling therewith.

Now if the bolt 160 were held out the rotation of the parts would continue but I have provided a trigger mechanism whereby the bolt 160 is snapped out very quickly, simply permitting the pin 161 to release to start the rotation after which the bolt 160 snaps back to the rear side of the pin 161. Therefore, as the mechanism completes one revolution the stop pin 161 again strikes the bolt 160 preventing further rotation of plate 159. However, tooth 154 and dog 155 are still in engagement and the rotation of the gear and block 156 continues. But plate 159 being held stationary, the pin 157 on the dog 155 rides in the slot 158, toward the axis of the shaft, drawing the dog 157 inwardly out of engagement with the tooth 154 and stop block 156.

Now as to the trigger mechanism for operating the bolt 160, this is shown more clearly in Fig. 7. A trigger 165 is provided pivoted at 166, and having a tooth 167 normally engaging a spring pressed tooth carried by the bolt 160. The bolt is pressed inwardly by a spring at its left end as shown. It will be apparent that if trigger 165 is pulled downwardly at its left end, tooth 167 carried thereby forces the bolt 160 outwardly and thus frees it from the stop pin 161 (Fig. 8). But as the trigger is drawn downwardly as stated, the tooth 167 snaps past the tooth carried by bolt 160 so that the bolt may immediately snap back into its holding position but not before the pin 161 has been released. Thus, by the actuation of the trigger 165 but a single cutting operation of the shears is effected. As soon as the trigger 165 is released its tooth 167 snaps up past the spring-pressed pin in the bolt 160 into its normal position as shown in Fig. 7, due to the upward pull of the spring 169′.

Now as to the actuation of the trigger mechanism to permit the operation of the shears, this preferably takes place after the tube has been deposited over the shearing bolt 140, and by the final downward movement of shaft 110. That is, the bottom end of the shaft engages the adjustable screw 168 thereby moving the frame 169 downwardly on the shaft 170. This frame 169 is connected with the trigger 165 by a link 171.

Thus in the operation of the shearing mechanism as downward motion of the press is completed and the shaft 110 of the lifting mechanism driven into its lowermost position, the trigger of the clutch mechanism is actuated so that the shear receives a single cutting operation and no more. This cuts or trims off a ring of metal at the lower end of the tube which drops down around the shearing post 140. In order to prevent these rings of metal from accumulating on this post and clogging up the mechanism I provide a cutter 164 on the end of the slide 143, which cutter engages a vertical shearing edge on the post 140, as indicated in Fig. 7, so as to cut up the rings as they drop down whereby they readily drop off and clear the device.

The operations upon the tube having been completed, the tube is lifted up off the shearing post by the upward travel of the lifting mechanism and upon the next actuation of the press the lifting mechanism is rotated again carrying the finished tube around into the third position of the lifting mechanism and as it is driven downwardly the cam post 124 corresponding to the fingers which are carrying the finished tube is engaged by the upwardly extending stop 132 (Fig. 1) driving the post upwardly to separate the fingers so as to drop the completed tube down into the chute 139 where it is carried away. The lifting mechanism then is carried upwardly to the limit of its upward stroke and the fingers which just released the completed tube are ready upon the next operation of the

press to be driven around to take another tube off of the spindle at position O^7.

I claim:

1. A collapsible tube making machine including extruding mechanism comprising a plurality of blank receiving spindles, a press head carrying an extruding die, and means responsive to each operation of the press head to feed a blank to a spindle, move a fed spindle beneath the extruding die, and form the tube on the last said spindle.

2. A collapsible tube making machine including extruding mechanism comprising a plurality of blank receiving spindles, a press head carrying an extruding die, and means responsive to each operation of the press head to feed a blank to a spindle, move a fed spindle beneath the extruding die, form the tube on the last said spindle, and thread the tube on one end to receive a cap, said operations being simultaneous but upon successive blanks.

3. A collapsible tube making machine including extruding mechanism comprising a plurality of blank receiving spindles, a press head carrying an extruding die, and means responsive to each operation of the press head to feed a blank to a spindle, move a fed spindle beneath the extruding die, form the tube on the last said spindle, thread the tube on one end to receive a cap and face off the threaded end of the tube, said operations being simultaneous but upon successive blanks.

4. A collapsible tube making machine including extruding mechanism comprising a plurality of blank receiving spindles, a press head carrying an extruding die, and means responsive to each operation of the press head to feed a blank to a spindle, move a fed spindle beneath the extruding die, form the tube on the last said spindle, thread the tube on one end to receive a cap, face off the threaded end of the tube and trim off the tube to a desired length, said operations being simultaneous but upon successive blanks.

5. A collapsible tube making machine including extruding mechanism comprising a plurality of blank receiving spindles, a press head carrying an extruding die, and means responsive to each operation of the press head to feed a blank to a spindle, move a fed spindle beneath the extruding die, form the tube on the last said spindle, thread the tube on one end to receive a cap, face off the threaded end of the tube, trim off the tube to a desired length and lift a completed tube off a spindle, said operations being simultaneous but upon successive blanks.

6. A collapsible tube making machine including extruding mechanism comprising a movable plate, a plurality of blank receiving spindles carried by said plate, a press head carrying an extruding die, and means responsive to each operation of the press head to feed a blank to a spindle, move a fed spindle beneath the extruding die, and form the tube on the last said spindle.

7. A collapsible tube making machine comprising a forming mechanism for forming the tube from blank buttons including a die and forming spindle, a molding feeder plate having a plurality of openings therein, a melting pot for feeding the metal to successive openings to provide blank buttons, said feeder plate being movable to place successive blanks over the spindle, threading and facing mechanism, and means for automatically feeding the plate and spindle and moving the fed spindle to be successively operated on to form, thread and face the tube.

8. A collapsible tube making machine comprising a rotatable plate carrying a plurality of forming spindles, a press head carrying an extrusion die for cooperation with the spindles, a rotatable feeder plate having a plurality of button receptacles therein adapted to be successively adjusted over successive spindles, and means for so operating said spindle and feeder plates for each operation of the press head.

9. A collapsible tube making machine comprising a blank button feeding device, an extrusion die, a threading device, a facing device, a trimming device, and means whereby successive operations of the extrusion die will feed a blank and form, thread, face and trim the tube.

10. A collapsible tube making machine comprising a melting pot, a plate having a plurality of blank receiving openings therein, an extruding die, and means for operating the melting pot to feed the plate and operate the plate to feed the die for each operation of the die.

11. A collapsible tube making machine comprising a tube extruding die including a forming spindle and die, a plate having a plurality of blank receiving openings therein, a melting pot for feeding molten metal to the plate openings, and means responsive to each operation of the die to operate the melting pot to feed a plate opening, and operate the plate to feed a spindle.

12. A collapsible tube making machine including a feeding melting pot comprising an upper reservoir and a connected lower reservoir having independent heating means whereby the lower reservoir is maintained at a higher melting temperature than the upper reservoir, and tube making mechanism including means for automatically feeding it from said lower reservoir.

13. A collapsible tube making machine including a feeding melting pot comprising an upper reservoir and a connected lower reservoir having independent heating means whereby the lower reservoir is maintained at a higher melting temperature than the upper reservoir, the lower reservoir being of

a smaller cross sectional area than the upper one, and tube making mechanism including means for automatically feeding it from said lower reservoir.

14. A collapsible tube making machine including a feeding melting pot comprising an upper reservoir and a connected lower reservoir having independent heating means whereby the lower reservoir is maintained at a higher melting temperature than the upper reservoir, the lower reservoir being of a smaller cross sectional area than the upper one, a valve for the lower reservoir for controlling a feeding opening in the bottom thereof, and tube making mechanism including means for automatically feeding it from said lower reservoir.

15. A collapsible tube making machine comprising a press, a forming mechanism comprising a die and forming spindle operated vertically by the press slide, a vertically operated tube lifting device having a longer stroke than the press slide, and increased motion mechanism connecting the slide and said device to operate the latter.

16. A collapsible tube making machine comprising a press, a forming mechanism comprising a die and forming spindle operated vertically by the press slide, a vertically operated tube lifting device having a longer stroke than the press slide, and increased motion mechanism connecting the slide and said device to operate the latter, by a non-extruding part of the movement of the slide.

17. A collapsible tube making machine comprising a press, a forming mechanism comprising a die and forming spindle operated vertically by the press slide, a vertically operated tube lifting device having a longer stroke than the press slide, and increased motion mechanism connecting the slide and said device to operate the latter by a preliminary downward movement of the slide.

18. A collapsible tube making machine comprising an extrusion die including a forming spindle having means to prevent turning of the tube when formed on the spindle.

19. A collapsible tube making machine comprising an extrusion die including a forming spindle, means for threading the formed tube while on the spindle, and means for preventing the tube from turning on the spindle while being threaded.

20. A collapsible tube making machine including an extrusion die spindle having an irregular shaped tip on which the neck of the tube is formed and whereby turning of the tube on the spindle is prevented.

21. A collapsible tube making machine comprising an extrusion die including a plurality of successively fed forming spindles, and lifting mechanism for removing the tubes from the spindles including a vertically movable device carrying a plurality of sets of gripping fingers whereby the tubes are lifted from the spindles by successive sets of fingers, and means for rotating the device when a set of gripping fingers have lifted a tube to deposit the tube away from the spindle.

22. A collapsible tube making machine comprising an extrusion die including a forming spindle, means for lifting a tube from the spindle including a pair of vertically reciprocable clutch fingers and a cam for operating the fingers to clutch the tube to lift it from the spindle and thereafter operate the fingers to release the tube therefrom, and means for moving the fingers with a tube to one side of the spindle before releasing the tube.

23. In a collapsible tube making machine, trimming mechanism for shearing the formed tube comprising a shearing post over which the tube is placed, a shearing knife having a shearing opening surrounding the tube, and means for operating the knife so as to shear the tube inwardly around the circumference thereof.

24. In a collapsible tube making machine, trimming mechanism for shearing the formed tube comprising a shearing post over which the tube is placed, a shearing knife having a shearing opening surrounding the tube, continuously driven means for operating the knife but normally disconnected therefrom, and means for connecting the driven means to the knife including mechanism to prevent more than a single shearing operation thereof.

25. In a collapsible tube making machine, trimming mechanism for shearing the formed tube comprising a shearing post over which the tube is placed, a shearing knife having a shearing opening surrounding the tube, means for operating the knife so as to shear the tube around the circumference thereof whereby a ring of the tube material drops down on the post, and a cutter for shearing the ring whereby it may be removed from the post.

26. In a collapsible tube making machine, a press and extrusion die including a vertical forming spindle, a die for threading the tubes while on the spindle after forming thereof, continuously driven operating means for the die, means responsive to a downward travel of the press slide for connecting the driven means to the die for effecting only a predetermined number of cutting revolutions thereof, and means whereby the next upward movement of the press slide will effect a reversal of the die to relieve it of the tube.

27. In a collapsible tube making machine, a press and extrusion die including a plurality of forming spindles therefor, means for feeding blanks to the spindles and succesively forming tubes thereon upon each stroke of the press, a threading die and a facing cutter

each one adapted to operate on a tube for each stroke of the press, and means for advancing the filled spindles along beneath the die and cutter to successively operate upon the tubes.

28. In a collapsible tube making machine, a press and extrusion die including a plurality of forming spindles therefor, means for feeding blanks to the spindles and successively forming tubes thereon, upon each stroke of the press, a continuously rotating facing cutter for facing off the tops of the tubes but normally out of operative relation with the tubes, and means for moving the cutter to face a tube on a spindle for each operation of the press.

29. In a collapsible tube making machine, a forming mechanism for operating upon blanks comprising a forming spindle, a die for pressing the blank against the top of the spindle to form the tube, said die first trimming the blank to the appropriate diameter if over size, and a notching member for notching the blank to points on the appropriate diameter before it is trimmed whereby the trimmed portion drops down in sections around the spindle.

30. In the method of forming articles by extrusion, the steps consisting in casting a slug of non-ferrous metal of the dimensions required for the formation of a single article, placing the slug on an imperforate surface, and then subjecting the slug after it has set but before it has completely cooled to extruding pressure to cause the metal to flow upwardly from said surface.

31. In the method of forming articles by extrusion, the steps consisting in individually forming slugs in synchronism with the operation of the extrusion press, and then individually operating on said slugs to form articles therefrom by extrusion.

32. In a collapsible tube making machine, a die, a plunger, means for producing relative movement between said die and plunger, means for individually forming slugs adapted for the formation of a single article, and means for delivering said slugs to said die.

33. In an extrusion press, a die, a plunger, a molding apparatus, means for operating said molding apparatus in timed relation to the operation of the plunger to form individual slugs, and means for delivering said slugs to said die.

In witness whereof, I hereunto subscribe my name this 14th day of July, A. D. 1922.

JAROSLAV HORAK.