

Sept. 18, 1923.

1,468,092

W. M. TOWNE
METHOD AND APPARATUS FOR FORMING TUBULAR METAL ARTICLES, SOCKETED
TERMINAL LUGS, AND THE LIKE

Filed May 10, 1923 . 2 Sheets-Sheet 1

Fig. 1.

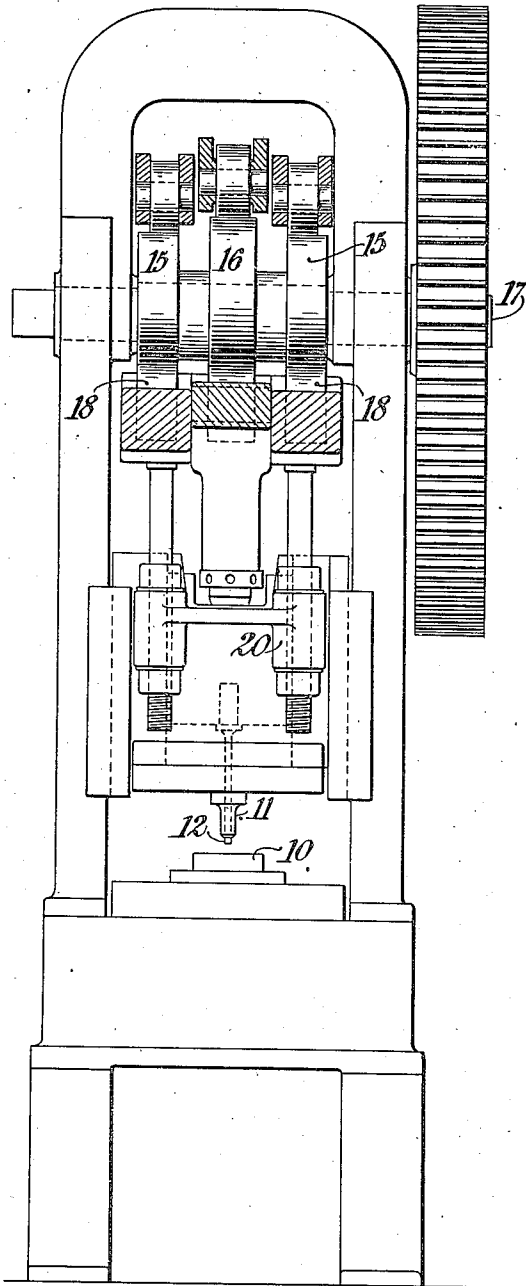
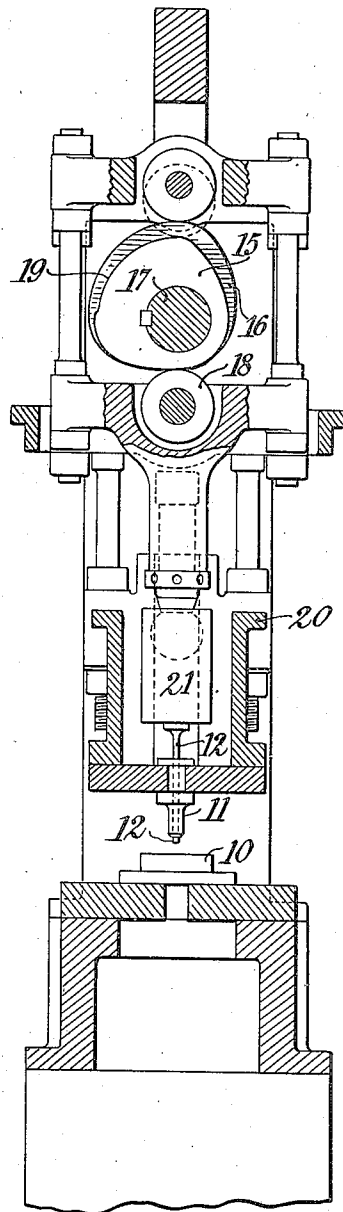


Fig. 2.



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Fig. 3.

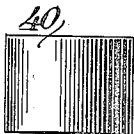


Fig. 4.

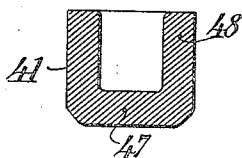


Fig. 5.

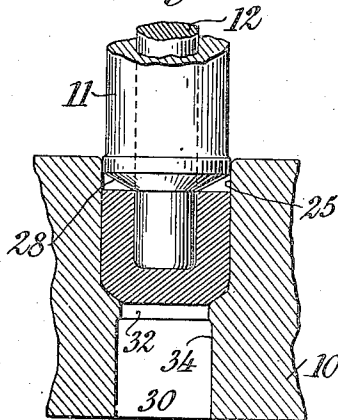


Fig. 7.

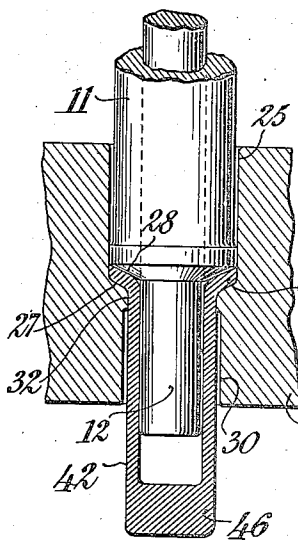


Fig. 8.

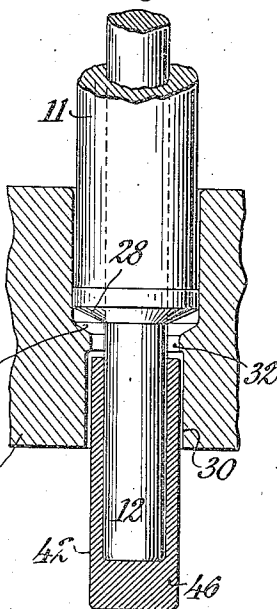


Fig. 6.

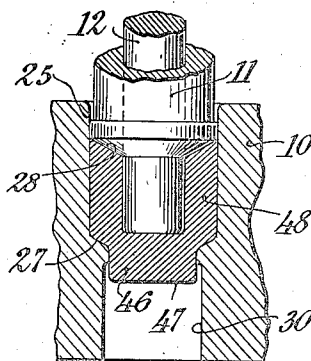


Fig. 10.

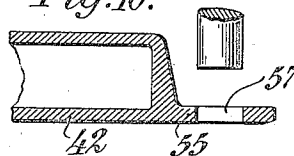


Fig. 9.

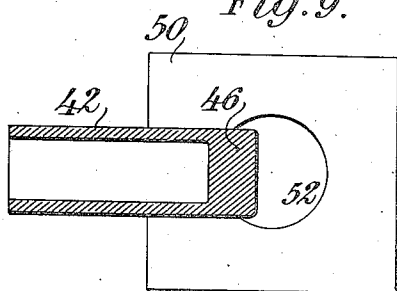
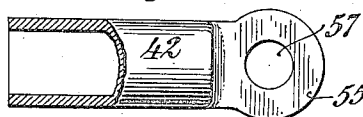


Fig. 11.



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UNITED STATES PATENT OFFICE.

WALTER M. TOWNE, OF NEW YORK, N. Y., ASSIGNOR TO E. W. BLISS CO., OF BROOKLYN,
NEW YORK, A CORPORATION OF WEST VIRGINIA.

METHOD AND APPARATUS FOR FORMING TUBULAR METAL ARTICLES, SOCKETED TERMINAL LUGS, AND THE LIKE.

Application filed May 10, 1923. Serial No. 638,097.

To all whom it may concern:

Be it known that I, WALTER M. TOWNE, a citizen of the United States of America, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Methods and Apparatus for Forming Tubular Metal Articles, Socketed Terminal Lugs, and the like, of which the following is a specification.

This invention relates to a method and apparatus for forming tubular metal articles, socketed terminal lugs, and the like, and aims to provide improvements therein. The method combines the steps of extruding and drawing metal in one die and in substantially one operation.

In the Hooker process (see Patent No. 922,585, May 25, 1909) and certain variations thereof or analogous processes, a fin, surrounding and attached to the extruded tube is left after the extruding operation. In the practical use of the said Hooker process, the fin is severed in the die from the extruded tube and the tube and detached fin removed from the die.

It has, however, been proposed to remove the extruded tube with the fin attached and to thereafter draw the fin into tubular form but with what success it is not known. According to the present invention a flange of substantial thickness is left at the end of the extruding operation and this flange is not detached from the extruded tube, but is drawn into tubular form substantially as a continuation of the extrusion, the extrusion and drawing being performed substantially as a continuous operation.

The invention further provides a method and apparatus for forming by extrusion and drawing, as above set forth, an article having a socket of uniform diameter, and which may also have an end mass of metal adapted for flattening and eye-holing.

The invention further provides a method and apparatus whereby the metal of the blank which is forced toward the extrusion opening in the extrusion die, is first caused to fill the extrusion opening and thereby take the form of a thickened solid part and thereafter the remaining part of the blank extruded in the form of a tube.

The invention further provides a novel

method of making terminal lugs for electrical conductors.

An apparatus embodying the invention is shown in the accompanying drawing. The drawing also comprises illustrations for aiding the description of the process.

Referring to said drawings:

Figure 1 is a front view and Fig. 2 is a vertical section of a combined extrusion and drawing press;

Figs. 3 and 4 are views of blanks prepared for the extrusion operation:

Figs. 5, 6, 7 and 8 show the blank and tubular article to be formed therefrom, and the forming parts at different steps of the process;

Figs. 9 and 10 are views showing subsequent operations on the article produced by the forming steps shown in Figs. 5-8, and Fig. 11 shows a complete terminal lug for electrical conductors produced by the operations shown in Figs. 5-10.

Referring to said drawings, numeral 10 designates a die, 11 an extrusion punch, and 12 a drawing punch mounted in said extrusion punch. The die 10 is ordinarily supported on the fixed bed of the press, and the punches 11 and 12 are driven toward said die by suitable means, as cams 15 and 16 on a rotary shaft 17 bearing on rollers 18 on slides 20 and 21 to which said punches 11 and 12 are attached. The cams are so timed that the cam 16 drives the punch 12 to perform its drawing action, as the cam 15 ceases to drive the punch 11 to perform the extruding action, so that the operations of extruding and drawing are substantially one continuous operation of the press.

Instead, however, of having the two punches 11 and 12 combined, as shown herein, these punches may be formed separately and adapted to act successively on the blank in the same die by an arrangement similar to that shown and described in the Hooker Patent No. 1,352,194, dated September 7, 1920.

The die 10 is formed with a recess (Figs. 5-8) in which the blank is received and laterally confined, a shoulder 27 between which and the end 28 of the punch 11 the said blank is compressed, and 30 a central opening through which the extruded metal flows. The opening 30 has a throat portion

32 into which the extruded metal immediately flows, and is preferably of slightly enlarged diameter below the throat, as indicated at 34 (Fig. 5) to reduce the frictional resistance of the tube in the die.

In the formation of tubes having a uniform internal diameter, the drawing punch 12 is arranged to project beyond the end of the extrusion punch 11 in such manner as to enter the opening 30 in said die and limit the inward flow of the metal in the throat 32 during the extrusion of that part of the metal which forms the tube.

In carrying out the process a blank 40 of suitable and desired form is chosen. Where a tube having a uniform inside diameter is to be formed, the blank is cupped, as indicated at 41, Fig. 4, the said blank being preliminarily formed by punching a piece of bar stock, shown in Fig. 3. The cupped blank 41, Fig. 4, is then placed in the recess 25 of the die 10 (or carried therein by the punch, as shown in Fig. 5) and the extrusion punch 11 driven to compress the blank between the shoulder 27 of the die and end face 28 of the punch, extruding the metal through the throat 32 of the die into the central opening 30 in the form of a closed end tube 42, as shown in Fig. 7. The drawing punch 12 follows the extrusion punch 11 into the die, and thereafter limits the inward flow of the metal at the throat during the extrusion, whereby the internal diameter of the extruded tube is maintained uniform.

At the end of the extrusion operation, a flange 44 (Fig. 7) of substantial thickness is left between the extrusion punch and the shoulder 27. According to the present invention, the approach of the extrusion punch 11 to said shoulder 27 is so controlled that the thickness of said flange 44 is substantial, and not a mere fin, corresponding substantially to the thickness of the wall of the tube 42, and as soon as the extrusion action of the punch 11 has been completed, the drawing punch 12 is driven toward the bottom of the extruded tube, and draws the flange 44 through the throat 32 of the die, thereby drawing said flange 44 into tubular form and forming a continuation or extension of the extruded tubular portion of the tube 42. The extrusion punch 11 may if necessary be held against the flange 44 during the drawing action of the punch 12 and thereby acts as a blank holder, but as the thickness of the flange 44 is substantial, this will usually not be necessary, and the contour of the cam 15 is therefore given a slight fall beyond its high point, as indicated at 19, to allow the shoulder 28 of punch 11 to free the said flange 44. Moreover, to facilitate the flange 44 being drawn inward by the action of the drawing punch 12, the face of the shoulder 27 and the end face 28 of the punch 11 are made so as to slightly di-

verge inwardly, toward the axis of the die opening 30, as may be seen from an inspection of Figs. 7 and 8. The part 34 of the die of enlarged diameter also facilitates the action of the drawing punch 12, by avoiding friction between the tube 42 and this part of the die.

Moreover, by beginning the drawing of the flange 44 immediately following the action of the extrusion punch, the metal is still hot and in a favorable condition for the molecular rearrangement effected by the drawing operation.

The drawing may, however, as indicated above, be effected in the die 10 by a separate punch 12 which acts after the extrusion punch has been removed from the die.

To form a tube with a mass 46 of metal at one end, the blank 40 is formed of considerable thickness at that part 47 which lies under the drawing punch 12. Or, the extrusion punch 11 may be arranged to build up the thickness of the part 47 of the blank under the punch 12, by forcing some of the metal from the sides 48 of the blank into the opening 30 in such manner that a part of this extruded metal from the sides 48 of the blank is extruded in the form of a solid or rod (see Fig. 6), the remaining metal of the sides 48 of the blank being extruded in the form of a tube 42 (Figs. 7 and 8). This extrusion of a part of the blank in solid form may be effected by arranging the extrusion punch 11 and the punch 12 in such manner that the punch 11 begins the extrusion of the metal before the bottom of the punch 12 reaches a position immediately above the upper level of the throat 32 of the die opening 30 (Fig. 6). As a result of the original thickness of the part 47 of the blank, or as the result of the building up of the part 47 by extrusion in solid section, the extruded tube 42 has been formed on its end the mass of metal 46.

To form a terminal lug for electrical conductors, the tube 42 is placed in a die 50 (Fig. 9), with its end mass 46 projecting into the recess 52 and said end 46 flattened out by a punch into the form shown in Fig. 10. The flattened end 55 is then punched to provide an eye-hole 57 as shown in Fig. 8, through which eye-hole 57 a bolt may be passed for making said terminal lug fast to a piece of electrical apparatus, as usual with such terminal lugs. The tubular part 42 receives the end of an electrical conductor or cable, which is usually fastened therein by solder. In making the terminal lugs, instead of drawing the flange 44 on the extruded tube into the tube, this may be severed, though it is preferred, as disclosed herein, to draw said flange.

The invention, as regards the apparatus, may receive other embodiments than that

herein specifically illustrated and described, and as regards the method, may be carried out by other procedures than those specifically disclosed.

5 I claim as my invention:

1. A method of forming tubular articles comprising compressing the marginal portion of a blank to extrude metal through a central opening in a die, leaving thereon a flange of substantial thickness, and thereupon drawing the flange into tubular form in said die through said die-opening.

2. A method of forming tubular articles comprising compressing the marginal portion of a blank to extrude metal through a central opening in a die, limiting the inward flow of the extruded metal toward the axis of said central opening whereby a tube of uniform internal diameter is formed, leaving on said blank a flange of substantial thickness, and thereupon drawing the flange into tubular form in said die through said die-opening.

3. A method of forming tubular articles with a mass of metal at one end of said tube, comprising compressing the marginal portion of a thick cupped blank to extrude metal through a central opening in a die, leaving thereon a flange of substantial thickness, and thereupon drawing the flange into tubular form in said die through said die-opening.

4. An apparatus for forming tubular articles, comprising an extrusion punch and die, said die having a central extrusion opening, and said extrusion punch having a drawing punch therein, and means for driving said drawing punch into an extruded tube through the opening in said die to draw on said die the flange on an extruded tube into tubular form.

5. An apparatus for forming tubular articles, comprising an extrusion punch and die, said die having a central extrusion opening, and said extrusion punch having a drawing punch therein, and means for driving said drawing punch into an extruded tube through the opening of said die, to draw on said die the flange on an extruded tube into tubular form, and means for holding said extruding punch against the flange during the drawing thereof.

6. An apparatus for forming tubular arti-

cles, comprising an extrusion punch and die, said die having a central extrusion opening and said extrusion punch having a drawing punch therein, and means for driving said drawing punch into an extruded tube through the opening in said die, to draw on said die the flange on an extruded tube into tubular form, said drawing punch being adapted to project beyond the end of said extruding punch into said die during the extruding operation to limit the inward flow of the metal at the throat of said die.

7. An apparatus for forming tubular articles, comprising an extrusion punch and die, said die having a central extrusion opening, and said extrusion punch having a drawing punch therein, and means for driving said drawing punch into an extruded tube through the opening in said die, to draw on said die the flange on an extruded tube into tubular form, said extrusion punch and die having slightly inwardly divergent contiguous faces.

8. An apparatus for forming tubular articles, comprising an extrusion punch and die, said die having a central extrusion opening, and said extrusion punch having a drawing punch therein, and means for driving said drawing punch into an extruded tube, through the opening in said die, to draw on said die the flange on an extruded tube into tubular form, said die opening having a throat and being slightly enlarged below said throat to lessen the frictional resistance of said shell against said die to the action of said drawing punch.

9. A method of extrusion comprising first extruding metal from the sides of a blank through a die opening in solid form, and thereafter extruding metal from said sides of the blank in tubular form.

10. A method of extrusion comprising first extruding metal from the sides of a blank through a die opening in solid form, and thereafter extruding metal from said sides of the blank in tubular form and thereafter drawing on the same die the flange on said blank remaining at the end of the extrusion operation.

In witness whereof, I have hereunto signed my name.

WALTER M. TOWNE.