April 15, 1941. E. S. CORNELL, JR 2,238,212

METHOD AND APPARATUS FOR PRODUCING LATERAL-PROVIDED FITTINGS

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Fig. 1.

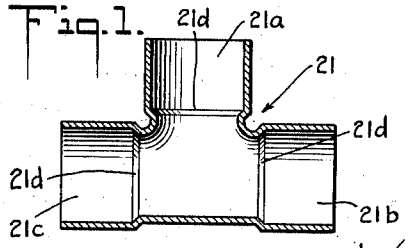


Fig. 2.

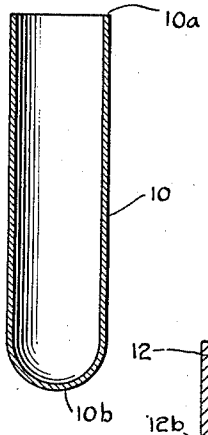


Fig. 3.

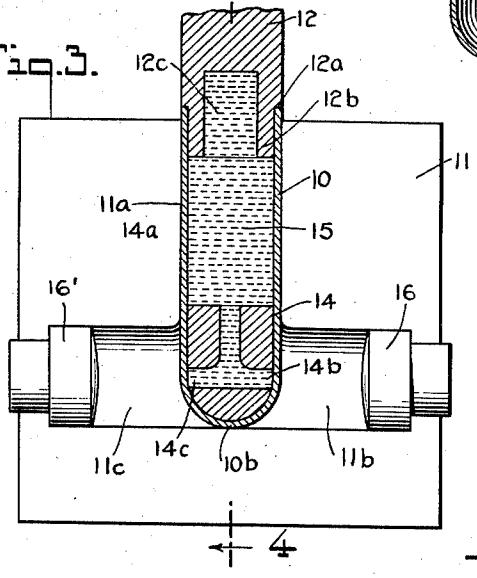


Fig. 4.

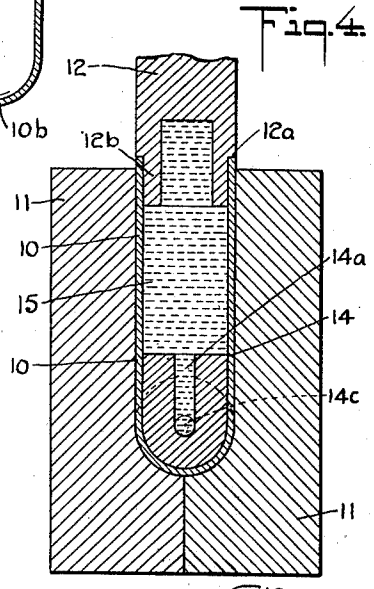


Fig. 5.

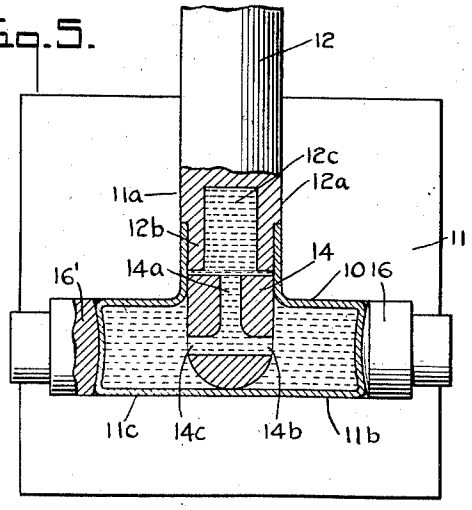


Fig. 6.

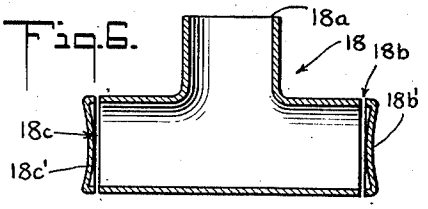
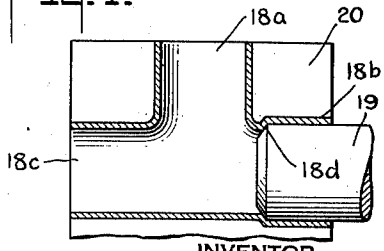


Fig. 7.



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Fig. 8.

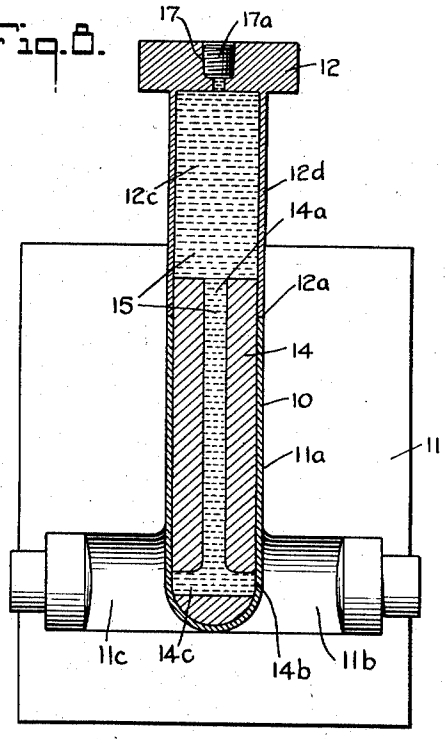


Fig. 9.

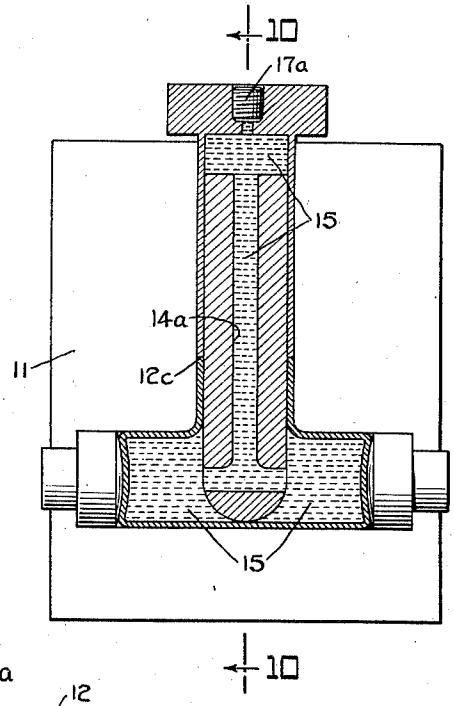
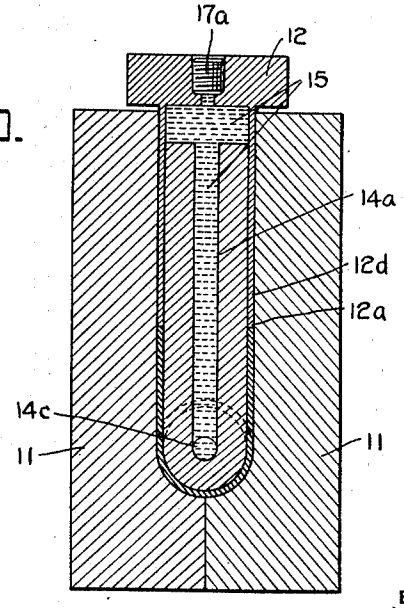


Fig. 10.



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UNITED STATES PATENT OFFICE

2,238,212

METHOD AND APPARATUS FOR PRODUCING LATERAL-PROVIDED FITTINGS

Edward S. Cornell, Jr., Larchmont, N. Y.

Application January 24, 1939, Serial No. 252,515

2 Claims. (Cl. 113—44)

The invention is directed to the production of T's and other lateral-provided fittings of cold wrought integral metal.

The invention is of particular utility for the production of T's and other lateral-provided fittings by the cold working of material of the nature of copper, which is defined as including commercially pure, i. e., 99% or above, copper or other metal or alloy or like metallic constituency which under the condition of heat supplied thereto in advance of operation pursuant to the invention gives rise to the formation of cuprous or other oxid or other deleterious condition.

Pursuant to the instant invention, a shell, i. e., tubular blank having a closed end, in the absence of supplied heat, is suitably positioned in a suitable die, the die having apertures conforming to the configuration of the T or other lateral-provided fitting desired to be produced. In the instance of a T formed from such shell, the shell may be positioned within the lateral, i. e. neck member, aperture of the die, a suitable pressure exerting medium such as oil, water, plastic or the like being placed within the shell, and suitable means such as a press having or connected to a suitably shouldered plunger serving as a male die arranged to engage the material of the shell and subject the same to suitable mechanical pressure simultaneously with pressure internally of the shell engendered in the pressure exerting medium, whereby the material of the shell at and adjacent its closed end is caused to flow into and along the face of the remaining apertures of the die, thereby forming the desired T or other lateral-provided fitting. Such pressure within the pressure-exerting medium may be engendered by the male die contacting such medium, or by piped connection with a suitable source of such medium under pressure.

It is desirable to support the material of the shell where unprotected by the faces of the die, against deformation either externally and/or internally. For internal support, I prefer suitable means of rigid material having an outer contour closely approximating the contour of the inner wall of the shell, such rigid means being apertured to provide paths of flow of the pressure medium therethrough. Most advantageously, such apertured rigid means is located within the shell at or within the juncture of the die branch apertures, the apertures through said rigid means extending to the material of the shell in directions toward the hollow interiors of the die branch apertures.

It is also advantageous to employ stop lugs for limiting the extent of flow into a die aperture of the material of the shell. Such stop plugs, most desirably, are provided with suitable facial configuration at their effective faces for imparting suitable contour at the termini of the flowed metal, for facilitating suitable severing thereat, minimizing waste of metal severed, and the like.

In certain instances of carrying out the present invention, the shouldered plunger may have a nose projecting into and engaging the inner faces of the shell, thereby serving to support the material of the shell against inward deformation. In certain instances of employment of the present invention, such elongated nose for the plunger may be hollow to provide for sufficient volume of the pressure medium to effect the desired extent of flow of the material of the shell into the branch apertures of the die.

If it is desired to provide a relatively large area of contact between the apertured rigid element and the inner wall of the shell, the volume of the hollow interior of the plunger is correspondingly increased.

Further features and objects of the invention will be more fully understood from the following detail description and the accompanying drawings in which:

Fig. 1 is a central sectional elevation of a T, typical of a lateral-provided fitting producible pursuant to the present invention.

Fig. 2 is a central sectional elevation of a shell from which the T shown in Fig. 1 may be produced.

Fig. 3 is a central sectional elevation; Fig. 4 is a sectional elevation on line 4—4 of Fig. 3, illustrating one method and suitable instrumentalities therefor for carrying out one form of the invention. Figs. 3 and 4 show such method at a preliminary stage thereof; and Fig. 5 is a central sectional elevation corresponding to Fig. 3, but showing a subsequent or final stage of the method.

Fig. 6 is a central sectional elevation of the product derived from my method such as pursuant to Figs. 3, 4 and 5. In Fig. 6 the right-hand and left-hand terminal portions of the material of the product are shown severed.

Fig. 7 illustrates in central sectional elevation a method of belling and providing abutment stops for one or more openings of the product shown in Fig. 6.

Fig. 8 is a central sectional elevation illustrating another form of my method for carrying

out the invention; the parts here illustrated represent an initial stage of the operation.

Fig. 9 illustrates a subsequent or final stage of the operation initiated in Fig. 8.

Fig. 10 is a central sectional elevation taken on line 10—10 of Fig. 9.

Referring to Figs. 2 through 5, of the drawings, an unheated, suitable shell of material of the nature of copper, above defined, such as the shell 10 having an open end 10*a* and closed end 10*b*, as illustrated in Fig. 2, is positioned in a suitable die 11, the lateral aperture of which is indicated at 11*a* and branch apertures are indicated at 11*b* and 11*c*. For the formation of a T, such shell 10 is advantageously positioned in the lateral aperture 11*a* of the die 11, the closed end 10*b* of the shell resting on a die face at the juncture of the die apertures. A shouldered plunger is indicated at 12, its shoulder at 12*a*, and having a relatively short nose, see 12*b*.

In the procedure illustrated in Figs. 3, 4, and 5, the shell 10 is of a length exceeding the length of the lateral aperture 11*a* of the die, and the nose 12*b* is of relatively short length, and accordingly it is advantageous to employ a ring 13 of rigid material, having an inner diameter substantially equal to the outer diameter of the material of the shell.

As appears from Figs. 3, 4, and 5, suitable mandrel means, indicated at 14, may be employed for precluding deformation of the material of the shell at the location at and adjacent the juncture of the lateral aperture 11*a* with the branch aperture 11*b*, 11*c* of the die; an advantageous type of such deformation preventing means 14, as shown in Figs. 3, 4, and 5, is in the form of a hollow shell, the outer periphery of which closely proximates the inner periphery of the shell 10, having suitable apertures to provide a longitudinally extending passage 14*a* and therewith communicating transverse outlets 14*b*, 14*c*, the latter respectively extending toward and preferably in substantial alignment with the axis of the branch apertures 11*b* and 11*c* of the die.

Advantageously, plugs 16, 16' are employed at the termini of the branch apertures 11*b*, 11*c* of the die. The plugs and shanks thereof approximate but not closely the peripheries of the adjacent faces of the die, to afford channels of flow for air therethrough, incident to the flow of the metal into the branch apertures 11*b*, 11*c*, which is now more particularly described.

Upon the stroke of the plunger 12, downwardly as appears from Figs. 3, 4, and 5, from its position as illustrated in Figs. 3 and 4 to its position as illustrated in Fig. 5, the material of the shell 10 is subjected to mechanical pressure exerted by contact of the shoulder 12*a* of the plunger 12 at the open end of the shell 10, simultaneously with pressure imparted by the face of the plunger to and upon the pressure medium 15, and effective upon the material of the shell. Such conjoint mechanical pressure and internal fluid pressure causes flow of the material of the shell in sliding contact with the face of the lateral aperture 11*a* of the die toward the region of the juncture of the lateral aperture 11*a* with the branch apertures 11*b*, 11*c* and into the respective branch apertures 11*b*, 11*c* until the material of the shell has been caused to flow from its initial position indicated in Figs. 3 and 4 to its subsequent or final position, indicated in Fig. 5, and thereby produce the general T configuration, as indicated.

The employment of the apertured hollow rigid element 14 is of advantage during the stage of flow of the material of the shell adjacent the juncture of the lateral aperture 11*a* with the branch apertures 11*b*, 11*c* of the die, by reason of the apertured hollow rigid element 14 having its outer periphery closely approximating the inner periphery of the shell and extending from locations remote from the juncture of the die branch apertures to and within the juncture, thus positively preventing deformation of the material of the shell at all stages of the operation.

Pursuant to the procedure illustrated in Figs. 8, 9 and 10, the apertured hollow rigid mandrel 14 has a relatively greater area of contact with the inner walls of the shell 10, and correspondingly longer longitudinal passage 14*a*, which communicates with the transverse outlets 14*b*, 14*c*. The plunger 12 has a correspondingly greater hollow interior 12*c* at its effective face communicating with the interior of the shell, the mechanically-exerting portion 12*d* of the plunger simulating the formation of a shell.

As appears from Fig. 8, the hollow rigid mandrel 14, when initially placed within the shell 10, may extend beyond the confines of the shell 10, that is to say, as viewed in Fig. 8, above the plane of engagement of the shoulder 12*a* with the upper open end of the shell 10.

As appears from Fig. 8, the height of the lateral die aperture 11*a* may be greater than the length of the shell 10, thus affording engagement of the shoulder 12*a* of the plunger within the confines of the lateral die aperture.

The product derived by the above or equivalent procedure, in the instance of a T fitting, has the general T configuration 18 indicated in Fig. 6, namely having an open end at 18*a*, corresponding to the open end 10*a* of the shell 10, see Fig. 2, and closed at the respective ends 18*b*, 18*c*; in Fig. 6, the end terminal portions 18*b*' and 18*c*' are indicated as severed, as by means of a suitable saw.

It will be observed that the convex configuration of the respective stops 16, 16' gives rise to a concave formation at the central portion of the terminal portions 18*b*', 18*c*', which, predicated upon practical experience, insures full attainment of the desired configuration at the terminal portions, imparts rigidity thereat, effective during the severing operation, and other advantages.

The resulting general T product, having three open ends, may then be completed to commercial finish as may be desired. Usually, each end is provided with an abutment serving as a stop, indicated at 18*d*, for gauging the telescopic insertion of the end of a pipe or the like. The production of such stop 18*c* is advantageously carried out simultaneously with belling the ends of the T, as by means of a suitable expanding tool indicated at 19, in cooperation with a suitable two-part holding die 20. It is understood that, whereas Fig. 7 indicates but one end, i. e., 18*b*, expanded, either or both of the remaining ends 18*a*, 18*c* may be similarly treated.

The resulting T, see 21, Fig. 1, illustrating a T fitting of conventional internal and external configurations, is adapted for connection with the end of a pipe or other fitting or the like, either by sweat-jointing, pursuant to conventional practice, or by threading, in which latter instance the wall thickness of each end is sufficient to bear the necessary threading.

It is a characteristic of the present invention that my method, pursuant to any of the proce-

dures hereinabove set forth, or equivalent, gives rise to an eventual T, the wall thickness of the respective ends of which, see 21*a*, 21*b*, 21*c*, is substantially uniform. In the embodiment illustrated in Fig. 1, the T is provided with abutments 21*d* in each of its connection openings 21*a*, 21*b*, 21*c*.

From the above variant forms of my method and the instrumentalities of the character above set forth, including suitable die means having branched apertures contoured to impart the desired configuration of the eventual fitting and including also a shouldered plunger, a T or other lateral-provided fitting is fabricated from a shell or equivalent of material of the nature of copper, as above defined, in the absence of supplied heat, that is to say, by sole cold working of the material effected by pressure mechanically applied to the material of such shell conjointly with pressure applied interiorly of the material of such shell through the intermediation of a suitable pressure-exerting medium, the resulting cold-flow of the material being guided by the aperture faces of such die means, deformation of the material of such shell being at all times precluded by the provision of an apertured hollow element and/or suitable elongation of the nose of such shouldered plunger.

More particularly, my present invention contemplates disposing such shell to position its closed end in abutting relation with a face of the die within the region of a juncture of branch apertures of the die.

Whereas the shell 10, see Fig. 2, is shown having a hemispherical configuration, it is apparent that a flat or substantially flat configuration of its closed end is applicable in carrying out my invention.

When it is desired to impart pressure to the pressure-exerting medium independently or concomitantly with the pressure engendered by contact of the effective faces of the plunger directly with the pressure-exerting medium, the plunger is suitably bored and suitable piping connected with the inlet of such bore, leading to a suitable source of pressure-applied medium, preferably controllable in degree of pressure, as will be understood by those skilled in the art.

As appears from Figs. 8, 9 and 10, the bore 17 of the plunger 12 may be closed by means of a suitable closure plug 17*a*, which may be inserted and sealingly locked by mating screw-threading.

Whereas I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. The method of forming a hollow branch fitting, which includes placing a shell blank having an open end and a closed end in close contacting relationship with the walls of a recess in a die, the die having at least one other recess intersecting with said first-mentioned recess, abutting the closed end of said shell blank against a wall of said intersecting recess, inserting within said shell blank a closed-ended hollow rigid mandrel having an external configuration matching the internal configuration of the shell blank, the closed end of said mandrel engaging the closed end of the shell blank, said mandrel having a centrally arranged passage communicating with the open end of said shell and having side outlets communicating with said centrally arranged passage adjacent the closed end of said mandrel, said mandrel having its wall surface in contact with the wall of the shell blank over an area including and extending beyond the area of intersection of said die recesses, filling said shell blank and said mandrel passages with liquid, and subjecting the shell blank to mechanical pressure exerted at the open end of said shell blank and in a direction axially thereof to cause mechanical movement of the material of the shell blank toward the juncture of said branches and laterally therefrom into said intersecting branch, while concomitantly exerting an internal fluid pressure to bear initially concentratedly against the wall of said shell blank at the location of the side outlets in said mandrel.

2. Apparatus for the manufacture of hollow lateral branch fittings, comprising, in combination, a female die means having an internal longitudinal branch and an internal lateral branch intersecting therewith, one of said branches having an opening for receiving a closed-ended tubular shell blank for positioning within said branch with its closed end in abutment with a wall of said intersecting branch, and a hollow mandrel having an open end and a closed end, said mandrel having a side outlet disposed adjacent the closed end thereof; said mandrel having an outside diameter permitting the snugly slidable insertion thereof into the shell blank with its closed end in engagement with the closed end of the shell blank, and a length extending substantially above the intersection of the branches of the die, and the said branch of the die having a diameter permitting the snugly slidable insertion of the shell blank therein, with the outside wall of the shell blank in contact with the wall of said die branch.

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