May 30, 1933. J. H. TAYLOR 1,911,653

METHOD OF MAKING PIPE TEES

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Fig. 1.

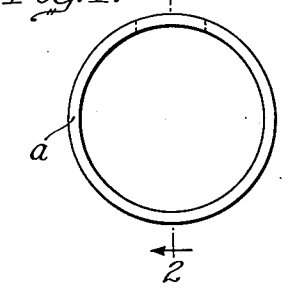


Fig. 2.

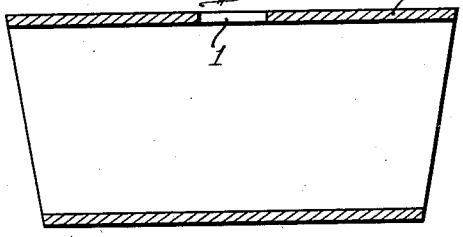


Fig. 3.

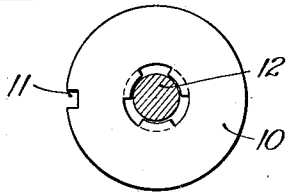
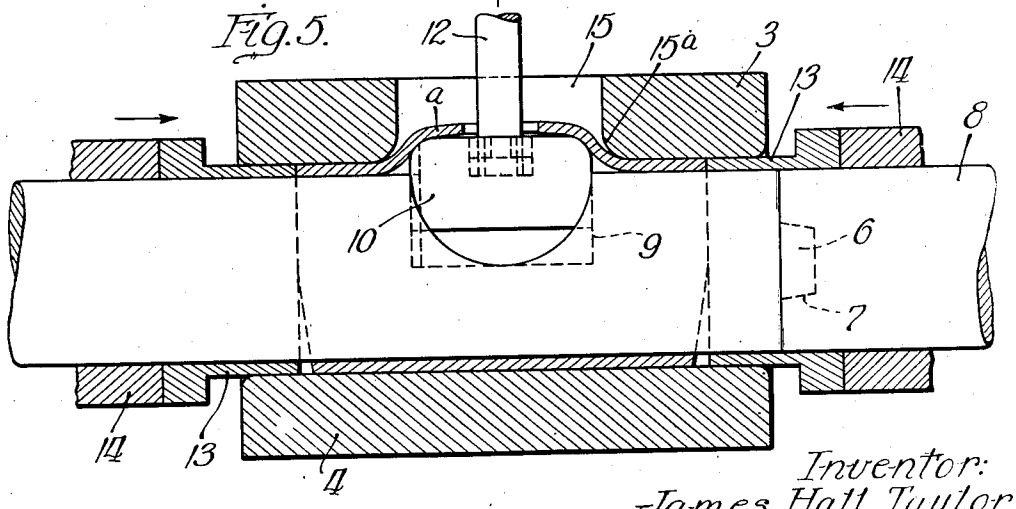


Fig. 4.

Fig. 5.



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Fig. 6.

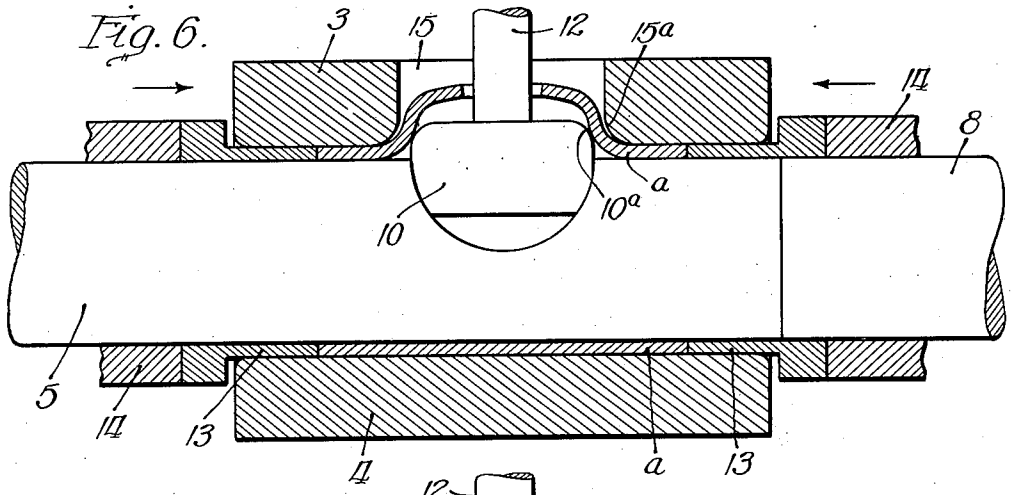


Fig. 7.

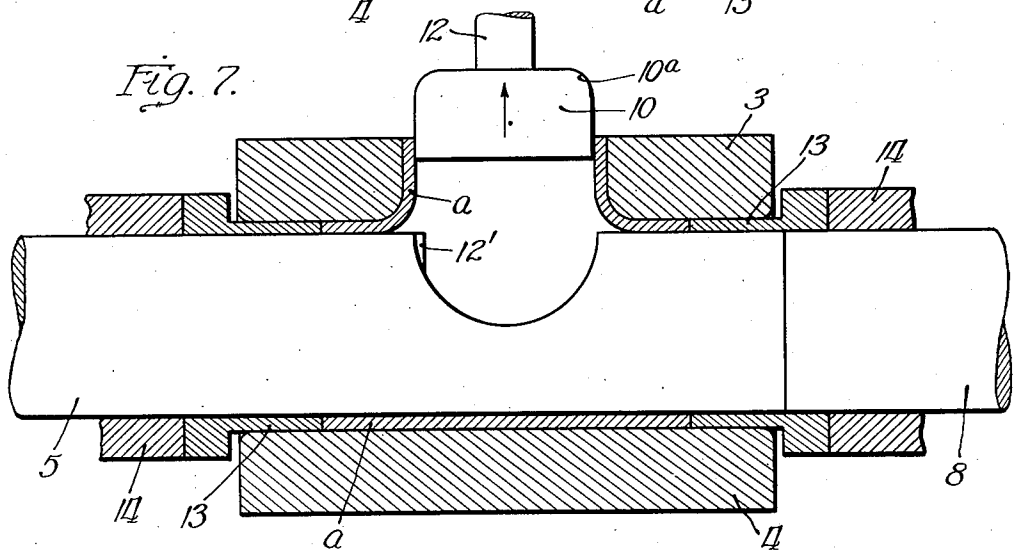
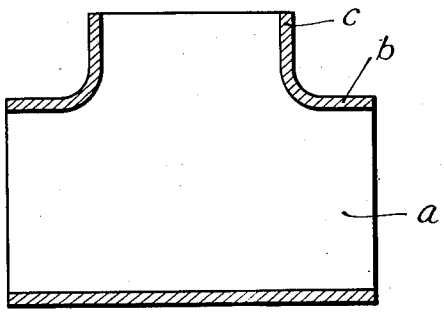


Fig. 8.



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Fig. 9.

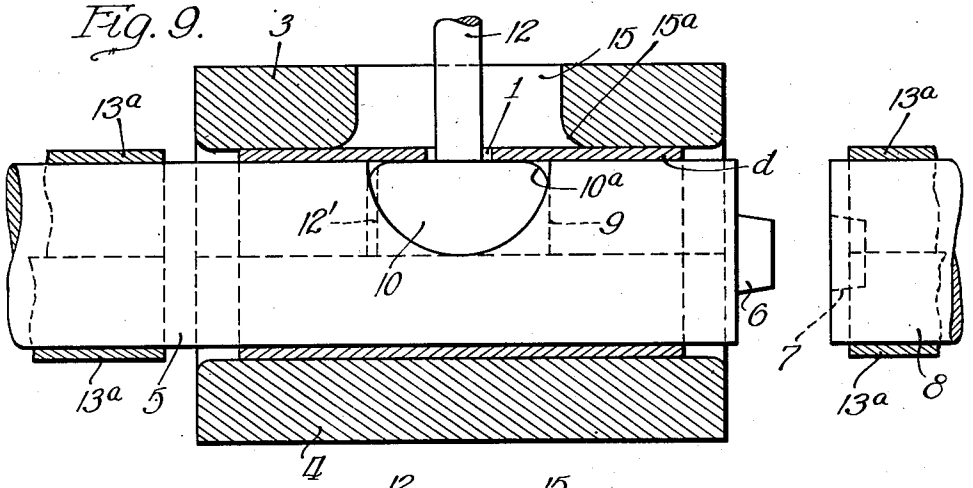


Fig. 10.

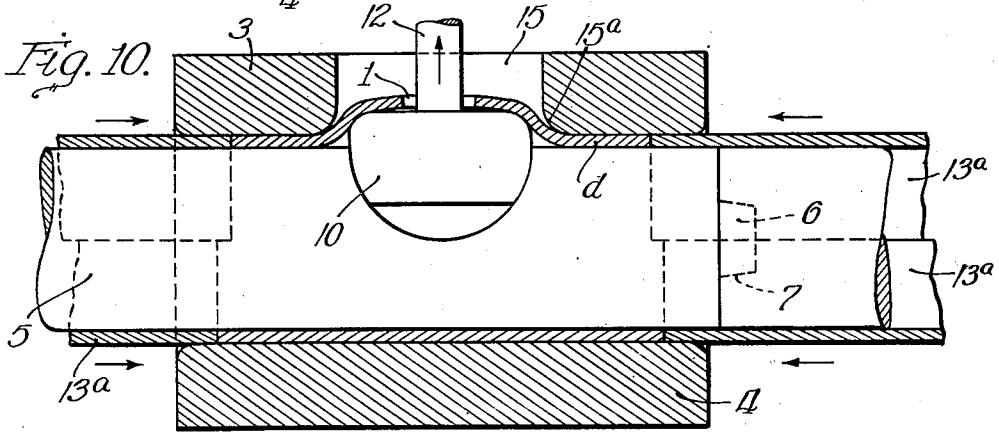


Fig. 11.

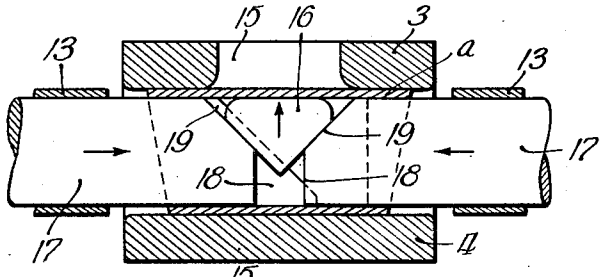
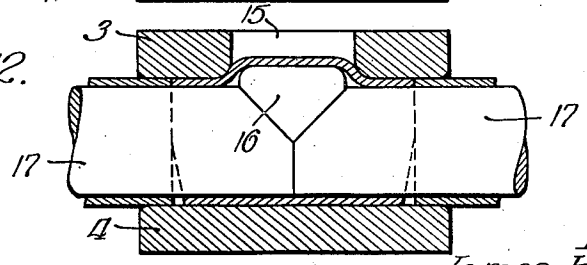


Fig. 12.



Inventor:
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Patented May 30, 1933 1,911,653

UNITED STATES PATENT OFFICE

JAMES HALL TAYLOR, OF OAK PARK, ILLINOIS

METHOD OF MAKING PIPE T'S

Application filed June 8, 1931. Serial No. 542,840.

My invention relates to the production of pipe T's and analogous fittings, and has to do more particularly with an improved method for making such articles.

The primary object of my invention is to provide an improved method for making pipe T's and analogous fittings from tubular stock. Further objects and advantages of my invention will appear from the detailed description.

In the drawings:

Figure 1 is an end view of a tubular blank used in producing pipe T's and like articles in accordance with my method;

Figure 2 is a section taken substantially on line 2—2 of Figure 1;

Figure 3 is a plan view of the former for shaping the extension or neck of the T;

Figure 4 is a vertical sectional view taken lengthwise through the holding and forming dies and associated parts, illustrating the first step of my invention, parts being shown in elevation;

Figure 5 is a view similar to Figure 4 but illustrating the second step of my method;

Figure 6 is a view similar to Figure 4 but illustrating the third step of my method;

Figure 7 is a view similar to Figure 4 but illustrating the fourth and last step of my invention;

Figure 8 is a central vertical sectional view taken lengthwise through a T produced by my method;

Figure 9 is a view similar to Figure 4 but illustrating a modification of my invention;

Figure 10 is a view similar to Figure 5 but illustrating the second step of the modified form of my method illustrated in Figure 9;

Figures 11 and 12 are sectional views taken lengthwise through the dies and associated structures illustrating the first and second steps, respectively, of a second modified form of my method, parts being shown in elevation.

In producing T's and analogous fittings in accordance with my method, I employ blanks formed from suitable lengths of wrought metal tubing. Such a blank is illustrated in Figures 1 and 2, and is designated by the reference character *a*. The ends of this blank are cut on transverse planes which converge toward the shorter side of the tubing, as viewed in Figure 2. At the central portion of the upper or longer side of the tubing, I provide a circular opening 1. The blanks *a* are conveniently cut from lengths of tubing of approximately the same interior and exterior diameter as the desired interior and exterior diameter of the trunk or body of the fitting or T to be produced.

The blank *a* is heated to a suitable flowing temperature, and is then placed in the cavity defined by upper and lower holding dies 3 and 4, respectively, which may be moved toward and away from each other in a suitable manner. These dies, when closed, define a cylindrical die recess which receives the blank *a* and confines it against outward radial spreading movement while not exerting appreciable pressure upon the blank. The function of these dies is to hold the blank without causing deformation thereof. The blank *a* is placed upon a suitable mandrel 5 corresponding in diameter to the interior diameter of the blank and the dies 3 and 4, when closed, are disposed in concentric relation to the mandrel. The mandrel 5 may be stationary, or it may have endwise movement imparted thereto in any suitable or preferred manner. The dies 3 and 4 are somewhat greater in length than the greatest length of blank *a* and mandrel 5 is provided, at one end thereof, with a tapered stud 6 adapted to fit into a corresponding recess 7 in a supplemental mandrel 8 movable toward and away from mandrel 5. When the mandrels 5 and 8 are in endwise contact they provide, in effect, a continuous mandrel, as in Figure 5.

Mandrel 5 is provided with a cylindrical recess 9 extending from the upper portion thereof and adapted to receive a cylindrical former 10 which is provided with a recess 11 extending lengthwise thereof and adapted for reception of the rib 12 of man-

drel 5, projecting into recess 9, for holding the former 10 against turning movement. The blank *a* is so disposed upon mandrel 5 that opening 1 is concentric with recess 9. This opening accommodates a pull rod 12 the lower end of which fits into a corresponding recess in former 10, the former being provided with bayonet slots and the rod 12 being provided with cooperating lugs, whereby the rod can readily be attached to the former for withdrawing it from the recess 9. This type of connection is known and need not be illustrated nor described in detail. The rod 12, after being attached to the former, may be moved upwardly, as indicated, in any suitable or preferred manner known in the art.

Pressure dies 13, in the form of flanged collars or sleeves, are slidably mounted upon the mandrels 5 and 8 for movement lengthwise thereof. The dies 13 may be forced toward each other in any suitable manner, as by means of followers 14 of sleevelike construction, which followers are slidable upon the mandrels and may be subjected to hydraulic or other pressure for forcing the dies 13 inwardly of the cavity defined by the dies 3 and 4, as indicated by the arrows in Figure 5.

The upper holding die 3 is provided with an opening 15 concentric with recess 9 of mandrel 5. This opening is of slightly greater diameter than the former 10, this difference in diameter being such that, when the former is raised into opening 15, an annular space between the former and the surrounding walls of opening 15 is provided, of a thickness corresponding to the desired thickness of the wall of the neck or projection to be produced in forming the T. It will also be noted that the upper end of the former 10 is rounded at the edge portion thereof, at 10*a*.

After the blank *a* has been disposed in the dies as in Figure 4, the pressure applying dies 13 are moved inwardly as in Figure 5. This inward movement of the dies 13 displaces and redistributes the metal at the upper portion of the blank *a*. The blank is radially confined at all portions thereof except at such portion as lies beneath the opening 15, and there the metal of the blank may flow outwardly. This outward flow is guided by the former 10 which is raised, as shown. The metal entering the opening 15 is deflected upwardly between the rounded shoulder at the upper end of former 10 and the rounded shoulder 15*a* at the lower end of opening 15. By cutting the ends of the blank on planes which converge toward the shorter side thereof, I provide at each end of the blank an excess quantity of metal which is available for displacement and redistribution in the manner set forth. The inward movement of dies 13 continues until the ends of the blank are normal to the longer axis thereof, as in Figure 6, at which time this movement may be stopped, though inward movement of the pressure applying dies may be continued beyond this point if necessary or desirable. The former 10 may be moved upwardly continuously during the inward movement of the dies 13, if desired, though this is not necessary. Conveniently, the former 10 is raised into the position shown in Figure 5, in which position it may remain until after the dies 13 have been moved inwardly to their innermost positions, as in Figure 6. The former 10 may then be completely withdrawn and, during its upward movement, this former serves to spread the metal which has been projected into the opening 15 outward radially into contact with the surrounding wall of this opening. This radial spreading of the projected metal serves to expand radially the opening 1 initially provided in the blank to the diameter of the neck or projection of the T. This final step in my method is illustrated in Figure 7 from which it will be noted that the former 10 has shaped the metal projected radially of the body of the blank, as in Figure 6, to the opening 15 so as to produce from the blank the T of Figure 8, this T comprising the body portion *b* from which extends the neck or projection *c*.

In the modified form of my invention illustrated in Figures 9 and 10, the ends of the blank *d* are normal to the longer axis thereof. The pressure applying dies 13 are replaced by dies comprising two semi-circular sections mounted for relative sliding movement upon the mandrels. After the blank has been properly positioned in the dies, it is subjected to endwise pressure by the dies 13*a* and, under certain conditions, the upper sections of these dies may be moved inwardly beyond the lower sections thereof, as in Figure 10, to produce the desired amount of projection of metal into the opening 15. This is desirable since it may be difficult to compress the blank endwise, at both the upper and the lower portions thereof, to produce the desired radial projection of the metal, since the metal is displaced more easily from the upper portion of the blank, when confined within the dies 3 and 4 and about the mandrel 5, than from the lower portion of the blank. After the proper amount of metal has been projected into opening 15, the former 10 is withdrawn through this opening so as to complete forming of the neck or projection of the T, in the same manner as in Figure 7. The ends of the T thus produced may then be subjected to further treatment or finished, if found desirable or necessary.

In the modification illustrated in Figures 11 and 12, I provide a former 16 the lower portion of which is of wedge shape. Two

mandrels 17 are oppositely movable into and out of the blank *a*, these mandrels having, at their inner ends, overlapping extensions 18 the upper surfaces of which are inclined downwardly and inwardly to provide wedging surfaces 19 which coact with the inclined surfaces of former 16. Pressure applying dies 13 are slidable upon the mandrels 17 and are forced toward each other for subjecting the blank to endwise pressure and projecting a portion thereof radially into opening 15 of the upper holding die 3. As the dies 13 move inwardly and subject the ends of the blank *a* to pressure, the mandrels 17 are also moved inwardly so as to force the former 16 upwardly thus causing the projected metal to flow outwardly into the opening 15. This movement of the mandrels 17 toward each other continues until the inner ends of these mandrels are in abutment, the space between the inner upper portions of the mandrels being filled by the lower portion of the former 16. Continued inward movement of the dies 13 increases the projection of the metal into the opening 15. When dies 13 have been moved inwardly to their innermost position, these dies and the mandrels 17 may be withdrawn, after which a suitable opening is provided centrally of the projection extending into the opening 15, and which is to constitute the neck or projection of the T. After this has been done, the forming of the neck of the T may be completed by forcing a ball of proper diameter through the opening in the projection extending into opening 15 of the upper die 3, this being accomplished by a wedge member forced through the blank *a* lengthwise thereof so as to exert outward radial pressure upon the ball. This method and means for spreading and shaping wrought metal is known in the art and need not be described or illustrated here in greater detail.

I have illustrated my invention, by way of example and for convenience, as applied to the production of T connections. It will be readily apparent to those skilled in the art, however, that my invention is equally applicable to connections, such as crosses having two or more projecting elements extending substantially radially from the body or trunk portion of the connection or fitting. I do not, therefore, limit my invention to the production of T connections since, in its broader aspects, it is applicable to all connections or fittings of the general type referred to.

What I claim is:

1. The method of making a pipe T from a tubular metal blank, which comprises confining the blank between an interior mandrel extending the full length of the blank and an external die structure having an opening extending from the outer face of the blank and thereby restraining the blank against radial deformation except as to the portion thereof corresponding to the die opening, subjecting the blank to endwise pressure applied to the ends of the blank and thereby displacing the metal thereof and flowing the displaced metal into said opening and producing an angular extension upon the blank, and then forming said extension to final size and shape.

2. The method of making a pipe T from a tubular metal blank having its ends cut on planes converging toward the shorter side of the blank, which comprises subjecting the blank to endwise pressure while restraining the entire blank except a restricted area at the longer side thereof against radial deformation and thereby reshaping the ends of the blank so as to be normal thereto while displacing more metal at the longer side of the blank than at the shorter side thereof, flowing the displaced metal outwardly of the blank over said restricted area at the longer side thereof and producing an angular extension upon the blank, and forming said extension to final size and shape.

3. The method of making a pipe T from a tubular metal blank, which comprises engaging the blank between an exterior die with an opening and a continuous interior mandrel extending the full length of the blank and provided with a protrusion toward said opening, and subjecting said blank to endwise pressure applied to the ends of the blank and thereby displacing the metal of the blank and causing the displaced metal to flow outwardly of the blank into said opening guided by said protrusion.

4. The method of making a fitting having an angularly projecting element, which comprises restraining a tubular metal blank against radial extension except for a selected area thereof corresponding to the desired angularly projecting element, subjecting the blank to endwise pressure applied to the ends of the blank and thereby displacing from the region of the blank adjacent said selected area a greater amount of metal than is displaced at any other region of the blank, flowing the displaced metal outwardly of the blank at said selected area producing an angular extension of the blank, and then forming said extension to final size and shape.

5. The method of making a pipe T, which comprises subjecting to endwise pressure applied to the ends thereof a metal blank of greater length at one portion than the remainder of the blank while restraining the blank against radial extension except at a selected area of the longer portion thereof, thereby displacing a greater amount of metal at the longer portion of the blank

than at the remainder thereof, flowing the displaced metal outwardly at said selected area and producing an extension of the blank, and then forming said extension to final size and shape.

6. The method of making a pipe T, which comprises subjecting to endwise pressure applied to the ends thereof a metal blank having its ends cut on planes converging toward the shorter side of the blank while restraining the blank against radial extension except at a selected area of the longer side of the blank, thereby displacing a greater amount of metal at the longer side of the blank than at the shorter side thereof, flowing the displaced metal outwardly at said selected area and producing an extension of the blank, and then forming said extension to final size and shape.

7. The method of making a pipe T, which comprises positioning a tubular blank between an inner mandrel and an outer die having an opening therethrough corresponding to the cross-area of the desired neck of the T, the mandrel and the die being otherwise continuous throughout the full length and circumference of the blank and restraining the latter against radial extension except at said opening, subjecting the blank to endwise pressure applied to the ends thereof and thereby displacing the metal of the blank and flowing the displaced metal outwardly through the opening and providing a protuberance at one side of the blank, and forming said protuberance to final size and shape to provide the neck of the T.

8. The method of making a pipe T, which comprises restraining a tubular blank against radial displacement throughout its entire area except for a restricted area at one side of the blank and corresponding to the cross-area of the neck of the desired T, subjecting the blank while so restrained to endwise pressure applied to the ends of the blank and thereby displacing the metal of the blank and flowing the displaced metal outwardly of the blank at said restricted area and producing a protuberance at said side of the blank, and forming said protuberance to final size and shape to produce the neck of the T.

9. The method of making a pipe T, which comprises positioning a tubular blank between an inner mandrel and an outer die having an opening therethrough corresponding to the cross-area of the neck of the desired T, the mandrel having a protrusion toward the opening and defining therewith an annular passage, the mandrel and the die being otherwise continuous throughout the full length and circumference of the blank and restraining the latter against radial extension except at said opening, subjecting the blank to endwise pressure applied to the ends thereof and thereby displacing the metal of the blank and flowing the displaced metal outwardly through said passage into the opening and providing an extension at one side of the blank, and forming said extension to final size and shape to provide the neck of the T.

10. The method of making a pipe T, which comprises positioning a tubular blank between an inner mandrel and an outer die having an opening therethrough corresponding to the cross-area of the neck of the desired T, the mandrel comprising a former constituting a protrusion toward the opening and defining therewith an annular passage, the mandrel and the die being otherwise continuous throughout the full length and circumference of the blank and restraining the latter against radial extension except at said opening, subjecting the blank to endwise pressure applied to the ends thereof and thereby displacing the metal of the blank and flowing the displaced metal outwardly through said passage into the opening and providing an extension at one side of the blank, and moving the former outwardly through said opening and thereby forming said extension between the former and the surrounding wall of the opening to final size and shape to provide the neck of the T.

In witness whereof, I hereunto subscribe my name this 4th day of June, 1931.

JAMES HALL TAYLOR.