

March 2, 1937.

D. E. LINDQUIST

2,072,591

MANUFACTURE OF FITTINGS

Original Filed Dec. 26, 1934 3 Sheets-Sheet 1

FIG. 1.

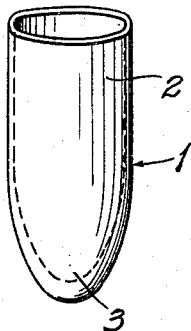


FIG. 2.

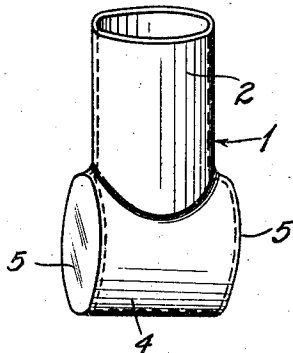


FIG. 3.

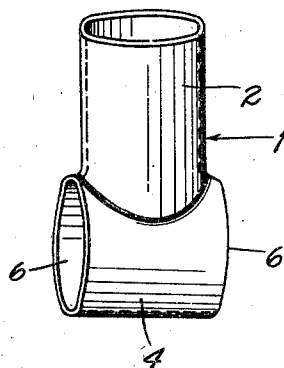


FIG. 4.

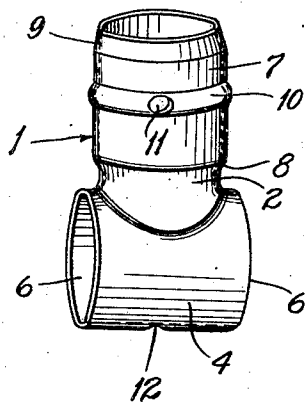


FIG. 5.

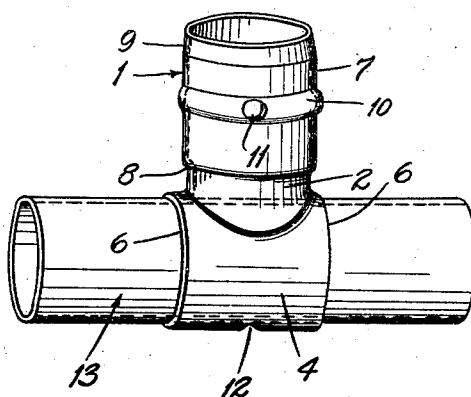
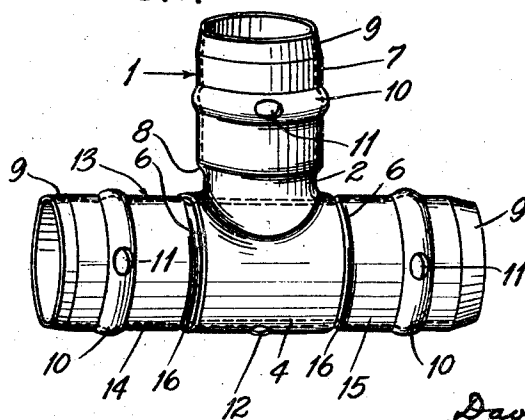


FIG. 6.



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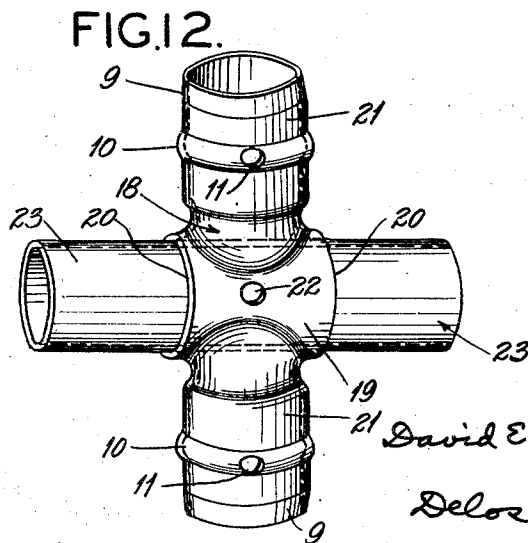
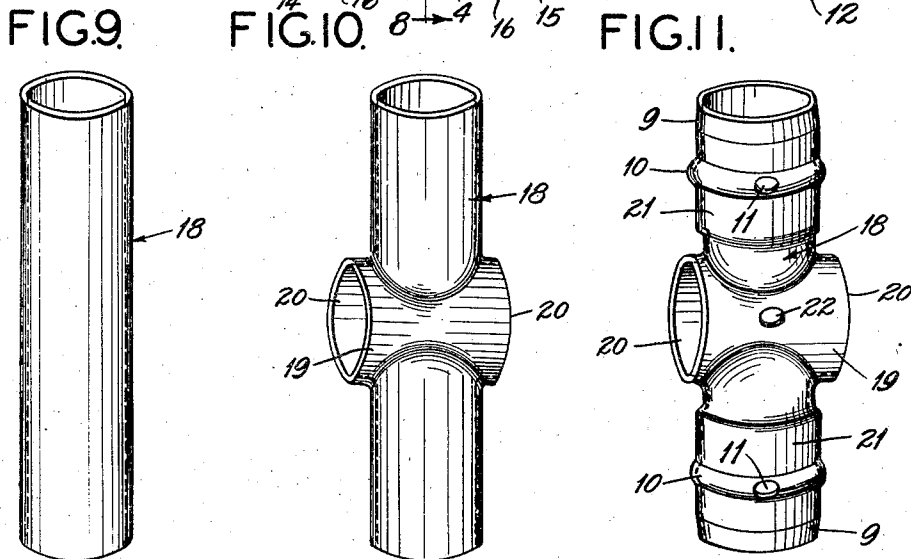
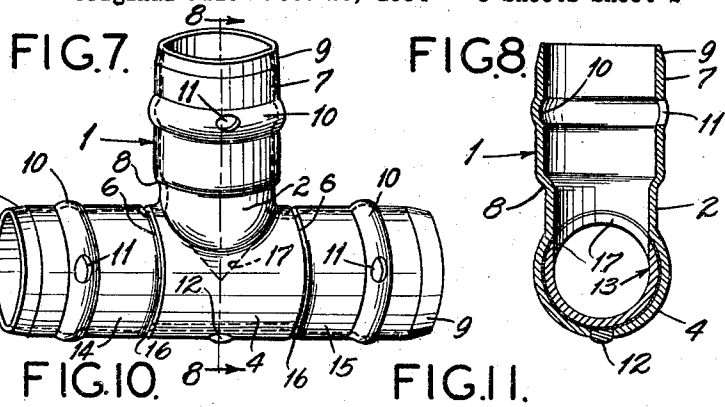
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MANUFACTURE OF FITTINGS

Original Filed Dec. 26, 1934 3 Sheets-Sheet 2



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MANUFACTURE OF FITTINGS

Original Filed Dec. 26, 1934

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FIG.13.

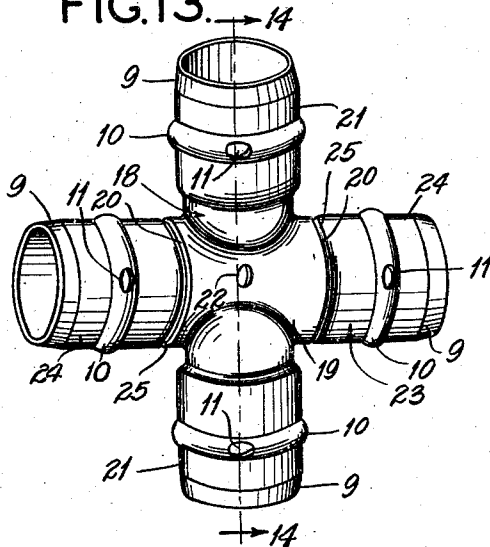


FIG.14.

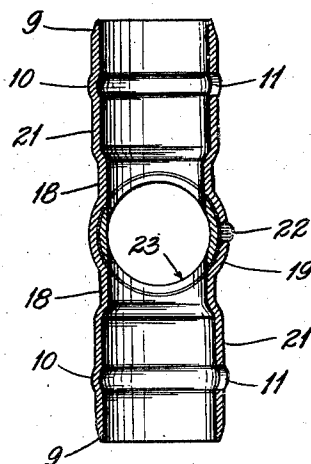


FIG.15.

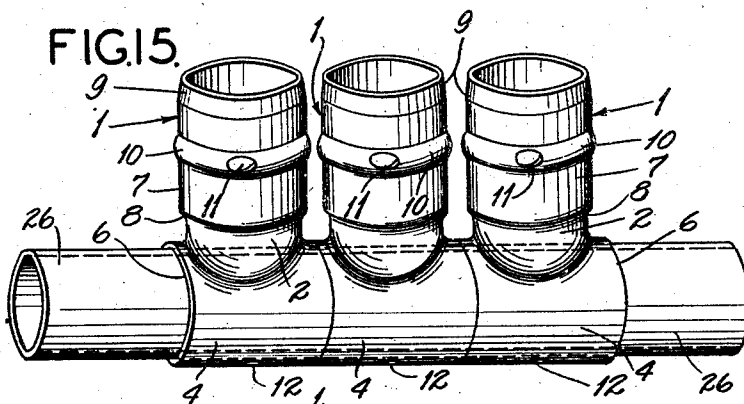
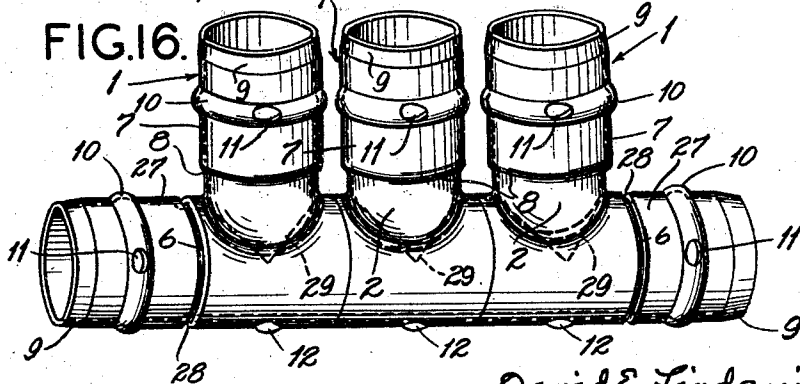


FIG.16.



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UNITED STATES PATENT OFFICE

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MANUFACTURE OF FITTINGS

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Original application December 26, 1934, Serial No. 759,217. Patent No. 2,039,542 dated May 5, 1936. Divided and this application July 31, 1935, Serial No. 33,931

5 Claims. (Cl. 29—157)

This invention relates to the manufacture of fittings, and with regard to certain more specific features, to the manufacture of threadless wrought metal fittings. This application is a division of my application Serial No. 759,217, filed December 26, 1934, entitled "Fittings".

Among the several objects of the invention may be noted the provision of a method of manufacturing fittings of the class described for pipe, rods, and the like which are relatively simple in construction, but which are rigid and serviceable in use; the provision of a method of manufacturing fittings of the class described which, while assembled from a plurality of pieces, are so constructed that there is substantially no likelihood of their coming apart while in use; the provision of a method of manufacturing fittings of the class described particularly adapted for making joints of the capillary soldered type; the provision of a method of manufacturing fittings of the class described which is carried through with maximum simplicity and a minimum of complicated apparatus; and the provision of a method of the class described which is economical in its use of material. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the steps and sequence of steps, and arrangements of operation, which will be exemplified in the methods hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are illustrated several of various possible embodiments of the invention,

Fig. 1 is a perspective view of a blank;

Fig. 2 is a perspective view of the blank of Fig. 1 after an initial operation thereon;

Fig. 3 is a perspective view of the blank of Fig. 1 after a second operation thereon;

Fig. 4 is a perspective view of the blank of Fig. 1 after a third operation thereon;

Fig. 5 is a perspective view showing the initial assembly of the blank of Fig. 4 with a tube length;

Fig. 6 is a perspective view showing the assembly after a first operation thereon;

Fig. 7 is a perspective view of a completed T fitting embodying the present invention;

Fig. 8 is a vertical cross section taken substantially along line 8—8 of Fig. 7;

Fig. 9 is a perspective view of a blank adapted for the production of a second embodiment of the invention;

Fig. 10 is a perspective view of the blank of Fig. 9 after the completion of certain operations thereon;

Fig. 11 is a perspective view of the blank of Fig. 9 after the completion of certain additional operations thereon;

Fig. 12 is a perspective view showing the initial assembly of the blank of Fig. 11 with a tube length;

Fig. 13 is a perspective view of a completed cross fitting embodying the present invention;

Fig. 14 is a vertical cross section taken substantially along line 14—14 of Fig. 13;

Fig. 15 is a perspective view of an assembly adapted to be constituted into a further embodiment of the invention; and,

Fig. 16 is a perspective view of a header fitting embodying the present invention.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Fig. 1, numeral 1 indicates a cup-shaped blank, which may be formed by extrusion or a similar process, and is adapted for the production of a T fitting in which all three outlets are to receive pipe ends of equal diameter. The material of the blank 1 is the material of which the fitting is to be made, which is usually wrought copper, although other metals may similarly be used. The diameter of the cylindrical portion 2 of the blank 1 is desirably equal to the exterior diameter of the tube or rod it is desired that the fitting be suited to accommodate. The wall thickness of the cylindrical portion 2 is suitable to withstand the forming operations hereinafter described and present a finished fitting of practicable wall thickness. For example, with an outer diameter of one inch, the wall thickness may well be of the order of .064 inch. The cup end 3 of the blank 1 is desirably formed with greater wall thickness than the cylindrical portion 2, as illustrated, because in the operations to follow, it is expanded into a greater area and such additional thickness is needed to provide the ultimate expanded portions with substantially the same wall thickness as the portions derived from the cylindrical region 2, which is to be desired.

The first operation on the blank 1 is to bring it into the conformation illustrated in Fig. 2. A suitable method of accomplishing this is by use of split or book dies and the application of hydraulic pressure inside the blank. This procedure may normally be carried out in a series of steps, with intermediate annealings of the blank. As

shown in Fig. 2, the cup portion 3 of the blank 1 after this operation is expanded into a cylindrical portion 4, which is at right angles to the cylindrical section 2 of the original blank. The ends 5 of the cylindrical section 4 are closed by portions 5. The outer diameter of the cylindrical section 4 is preferably made equal to the outer diameter of cylindrical section 2, plus two wall thicknesses, (this making the inner diameter of the section 4 equal to the outer diameter of the section 2). The excess thickness of the cup portion 3 of the blank of Fig. 1 has now been distributed into the cylindrical portion 4 in such manner that the wall thickness is substantially uniform throughout the blank.

The next step, as illustrated in Fig. 3, comprises cutting off the closed ends 5 of the blank of Fig. 2. The blank has now assumed the general conformation of a T, having two outlets 6 at the region formerly occupied by the ends 5 and a side outlet formed by the cylindrical portion 2. The length of the cylindrical section 4, however, is insufficient for the blank to be considered a practicable T fitting.

The next operation is illustrated in Fig. 4, and comprises, broadly, expanding or sizing the cylindrical portion 2 to form a side or lateral outlet or socket adapted to receive a pipe end to make a joint. This expanding or sizing operation may be performed with tools of the type shown in Rader Patent 1,938,194. The resulting socket is indicated by numeral 7 in Fig. 4. The socket 7 terminates with a shoulder 8, which is desirably so formed that it presents an inward taper inside the socket, down to the diameter of the short remaining section of the original cylindrical section 2. This taper serves to exert a centering action upon an entering pipe and is in accordance with the teachings of Lindquist Patent 1,890,998. It is likewise desirable, at the extreme end of the fitting, to provide an outside taper 9. The purpose of this outside taper 9 is to permit the cooling of solder at the extreme end of the fitting in the making of a joint, prior to the cooling of the solder inside the joint, in accordance with the teachings of Gresley et al. Patent 1,776,502.

After the formation of the socket 7, it is desirable that a bead 10 be outwardly rolled in the central region of the socket 7, and that this bead 10 be provided with a solder feed hole or sprue 11. The bead 10, in the making of a joint, acts as a distributing channel for solder introduced through the feed hole 11. A similar solder feed hole 12 is drilled in some region of the cylindrical portion 4; the optimum location has been found to be substantially opposite the projecting cylindrical portion 2.

For reference purposes, the blank 1 as prepared up to this stage will hereinafter be referred to as the side outlet section of the T.

The next step in manufacturing the T is indicated in Fig. 5. Here it will be seen that a cylindrical pipe or tube length 13 has been inserted into the cylindrical portion 4 of the side outlet section, passing through the open ends thereof. For the present, the tube 13 is completely cylindrical, without any deformation, throughout its length. When the tube 13 is in centralized position, and after suitable cleaning and fluxing operations have been performed, it is soldered in position by heating the assembly with a blow torch or the like and feeding solder throughout the feed hole 12. With proper cleaning and fluxing, the solder introduced at the hole 12 may be

made to spread and occupy the entire interfacial region between the pipe 13 and the cylindrical section 4 of the side outlet section 1. This, in effect, means that the pipe 13 is soldered to the side outlet section 1 at all regions of the section 4 with the exception of the circular opening or interval left by the intersection of the section 2 with the section 4.

As an alternative to soldering in the manner described, the side outlet section 1 may be spot welded, arc welded, or otherwise autogenously joined to the tube 13. Soldering, however, is usually to be preferred, inasmuch as it is more likely to make a fluid-tight joint between the two sections.

Care must be used in selecting the solder for joining the side outlet section 1 and the tube 13, because the fitting being constructed is one that will later be used to make a joint with pipe ends by a similar soldering procedure. Accordingly, if the fitting is to go into usual service, wherein soft solder melting at a low temperature is used to make the joint, then it is desirable that the side outlet section 1 be soldered to the tube 13 with a high melting point solder, such as silver solder. This precaution is taken in order to prevent the assembly itself from coming loose when it is made into a joint in later use.

The next step in making the fitting comprises expanding or belling the two ends of the tube 13 into sockets 14 and 15 of the same relative conformations as the socket 7 of the blank 1. This stage is illustrated in Fig. 6. In expanding the ends of tube 13, there are formed shoulders 16, similar in shape to the shoulder 8 hereinbefore mentioned. These shoulders 16 are positioned to abut the ends 6 of the cylindrical portion 4 of the side outlet section 1, to lock the tube section 13 against sliding movement in the side outlet section 1. This arrangement, in addition to the soldering operation described, makes the fitting quite rigid and incapable of coming apart in service. Further, if the fitting, when in use, is subjected to so high a temperature as to melt the solder holding the side outlet section 1 and tube section 13 together (as, for example, in case of a fire) the shoulders 16 still serve to lock the fitting in assembly and permit it to continue to serve a useful purpose, even though it may be somewhat leaky. If the shoulders 16 are formed sufficiently tightly against the ends 6, the fitting will be found to be leak-proof even though no solder is used to join the assembly.

The shape of the sockets 14 and 15 at the ends of the tube section 13 is substantially the same as that of the socket 7 of the cylindrical portion 2 of the side outlet section 1; hence, the same index characters are used, and the above description of socket 7 likewise applies to sockets 14 and 15. Sockets 14 and 15, like socket 7, may be made with tools of the type shown in Rader Patent 1,938,194.

An advantage of using such a Rader patent tool is that the working of the metal thereby effected is done in the cold, and such cold-working tends to harden the metal of the sockets, which may previously have been softened or annealed by the soldering or welding procedure described.

The next and final stage in manufacturing the T fitting comprises introducing a drill through the socket 7 of the side outlet section 1 and drilling a hole 17 in the tube 13 in order to establish communication between the tube 13 and the side outlet section of the T, as illustrated in Fig. 7.

The drill is usually of the same diameter as the diameter of the restricted portion 2 beneath the shoulder 8. The T is now completed and ready for use in making a joint.

5 The manner of making a joint with the T as shown in Fig. 7 is substantially the same as that described in Hill Patent 1,770,852. This comprises, briefly, cleaning and fluxing the inner surfaces of the three sockets 7, 14, and 15, similarly
10 cleaning and fluxing the ends of the pipes to be joined, telescoping said pipe into the sockets until they rest against the shoulders 8 and 16, respectively, heating the entire assembly with a blow torch or the like, and feeding solder, preferably in wire form, through the feed holes 11
15 in such a manner that the solder spreads by capillary attraction throughout the regions of engagement of the sockets and the tube ends. When the solder cools, effective, rigid joints are
20 provided between the fitting and the three pipe ends.

The invention as thus far described has been concerned with the production of a T fitting. The principles of the invention likewise apply to
25 the formation of other types of fittings in which there are three or more outlets. Figures 9 through 14, for example, illustrate the formation of a cross fitting involving four outlets. The method of manufacturing this fitting is substantially as follows:

30 Fig. 9 illustrates a blank 18 which comprises a simple length of cylindrical tubing. The first operation on this blank, which corresponds to the blank 1 of Fig. 1, comprises placing it in a split or book die and hydraulically forming a cylindrical portion 19 (Fig. 8) at right angles to the
35 axis of the tube, in the middle portion of the tube. In order to do this, when the blank 18 is placed in the dies, one end of it needs to be plugged.

40 In Fig. 10, the blank is shown with the ends of the cylindrical portion 19 already cut off, forming openings 20. It will be understood that as the blank comes from the dies, the ends 20 are closed and in a subsequent operation these ends are cut off, as was the case between the stages illustrated in Figures 2 and 3 for the blank 1.

The next operation on the blank 18 comprises expanding the two tube ends thereof into pipe-receiving sockets 21, as illustrated in Fig. 11. The
45 sockets 21 are similar to the sockets 7, 14, and 15, heretofore described in connection with the T fitting. A solder feed hole 22 is also now provided in the cylindrical portion 19.

50 The next step, as illustrated in Fig. 12, comprises inserting a straight length of tube 23 through the cylindrical portion 19, and soldering it in position therein. Thereafter, the ends of the tube 23 are expanded into sockets 24 (Fig. 13) similar to the sockets 21. This expansion of the
55 sockets 24 forms shoulders 25 which lock the tube 23 in the cylindrical portion 19, in the same manner as in the T embodiment. Thereafter, a drill is passed through the length of the blank 18, thus
60 establishing holes for communication between both sockets 21 and the tube 23. The cross fitting as thus finished is illustrated in Figures 13 and 14.

70 Figures 15 and 16 illustrate the formation, by the principles of the present invention, of a multiple-outlet header fitting. In the present instance, this is accomplished by providing a plurality of side outlet sections 1 in the stage of their manufacturing illustrated in Fig. 4, and
75 positioning said sections in a side-by-side rela-

tion on a length of tube 26. While Figures 15 and 16 show the outlet sections all in a similar angular position on the tube 26, it will readily be seen that each one may occupy a different angular position. After the outlet sections have
5 been soldered in position on the tube 26 in the manner heretofore described, the ends of the tube 26 are expanded into sockets 27 (Fig. 16) providing shoulders 28 holding the assembly rigidly together. Thereafter holes 29 are drilled, one for
10 each outlet, and the fitting is thus completed.

It will readily be seen that, instead of using the side outlet sections as shown in Fig. 4 for making this header-type fitting, the sections as illustrated in Fig. 11 may be used; or, a combination of Fig. 4 sections and Fig. 11 sections may
15 be used in one header.

It will be seen that the several embodiments of the invention are related in their common principle of construction. For example, each embodiment comprises a side outlet section of seamless character including at least one socket portion and a cylindrical portion at right angles to
20 said socket portion, and a main tube portion fitting through the cylindrical portion of the side outlet section, having sockets formed on its ends whereby it is locked to the socket portion.

The fittings described herein are claimed in the parent application of this application, Serial No. 759,217, filed December 26, 1934.

30 In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions and processes without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not
40 in a limiting sense.

I claim:

1. The method of manufacturing fittings which comprises providing a substantially cylindrical blank, forming from said blank a cylindrical
45 portion at an angle to the axis of said blank, fitting a tube through said cylindrical portion, and expanding the opposite ends of said tube whereby to lock it against longitudinal movement in said cylindrical portion.

2. The method of manufacturing T fittings
50 which comprises providing a cupped, cylindrical blank, forming the cupped end of the blank into an open-ended cylindrical portion the axis of which is at right angles to the axis of the blank proper, fitting a tube through said cylindrical
55 portion, and expanding the opposite ends of the tube forming shoulders abutting the ends of said cylindrical portion and thereby locking said tube against longitudinal movement in said cylindrical portion.

3. The method of manufacturing T fittings which comprises providing a cupped, cylindrical blank, hydraulically pressing the cupped end of said blank into a cylindrical portion the axis of which is at right angles to the axis of the blank
65 proper, cutting off the ends of said cylindrical portion, expanding the blank proper into a socket adapted to receive a pipe end, closely fitting a tube length into said cylindrical portion and sealing it there in position, and expanding the
70 ends of said tube into sockets adapted to receive pipe ends and inwardly terminating as shoulders abutting the ends of said cylindrical portion, whereby to lock said tube against longitudinal movement in said cylindrical portion, and drill- 75

ing a hole through said tube in the region of its intersection with the blank proper, whereby the socket of the blank proper forms the side outlet of the T.

- 5 4. The method of manufacturing cross fittings which comprises providing a tubular blank, hydraulically pressing the central portion of said blank into a cylindrical portion, the axis of which is at right angles to the axis of the blank proper, 5
10 cutting off the ends of said cylindrical portion, expanding the ends of said tubular blank into sockets adapted to receive pipe ends, closely fitting a tube length into said cylindrical portion and sealing it there in position, and expanding 10
15 the ends of said tube length into sockets adapted to receive pipe ends and inwardly terminating as shoulders abutting the ends of said cylindrical portion, whereby to lock said tube length against longitudinal movement in said cylindrical portion, and drilling holes through said tube length 20
20 in the region of its intersection with the sockets of the original blank, thereby to establish communication between all four sockets of the fitting.
25 5. The method of manufacturing header fittings which comprises providing a plurality of

cupped, cylindrical blanks, hydraulically pressing the cup end of each of said blanks into a cylindrical portion, the axis of which is at right angles to the axis of the blank proper, cutting off the ends of said cylindrical portions, expanding the blanks proper into sockets adapted to receive pipe ends, closely fitting a tube length into said cylindrical portions in such manner that the ends of adjacent cylindrical portions abut each other and the tube length extends at each end beyond the outermost cylindrical portion, sealing said tube length in position on each of said cylindrical portions, and expanding the ends of said tube length into sockets adapted to receive pipe ends and inwardly terminating as shoulders abutting the outermost ends of the outermost cylindrical portions, whereby to lock said tube length against longitudinal movement in said cylindrical portions, and drilling holes through said tube length in the region of its intersection with each of the sockets of the original blanks, whereby communication is established between the tube length and all of the sockets of the original blanks.

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