

April 29, 1952

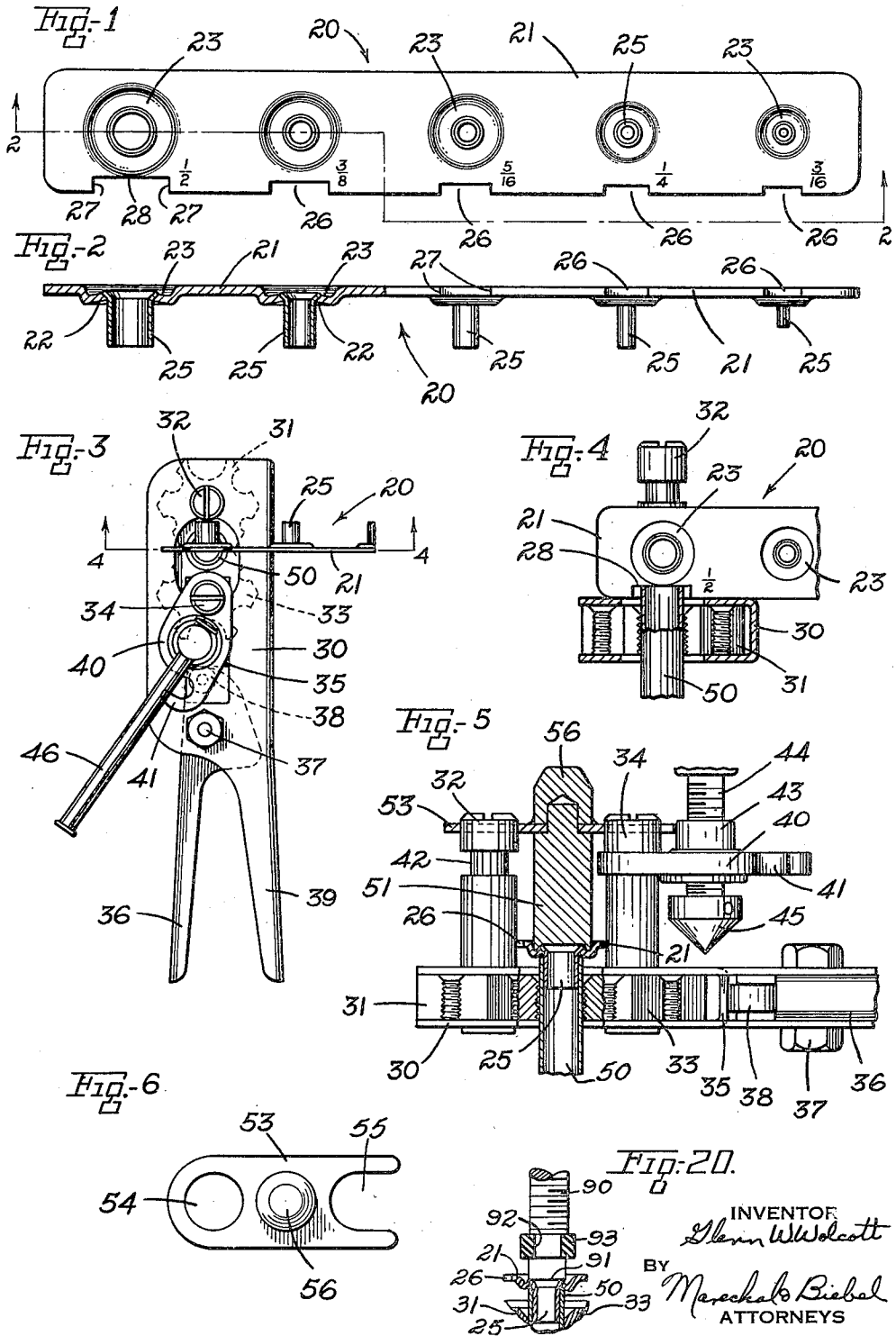
G. W. WOLCOTT

2,595,036

APPARATUS FOR DOUBLE FLARING TUBES

Filed June 26, 1948

3 Sheets-Sheet 1



INVENTOR
Glen W. Wolcott
BY
Marshall Biebel
ATTORNEYS

April 29, 1952

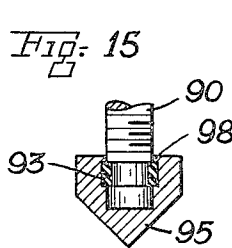
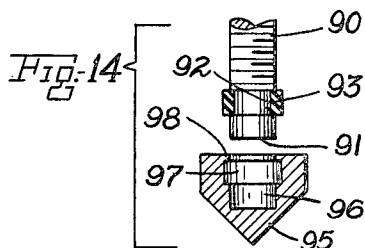
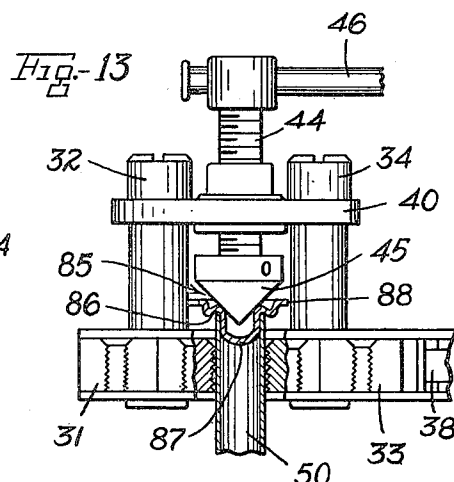
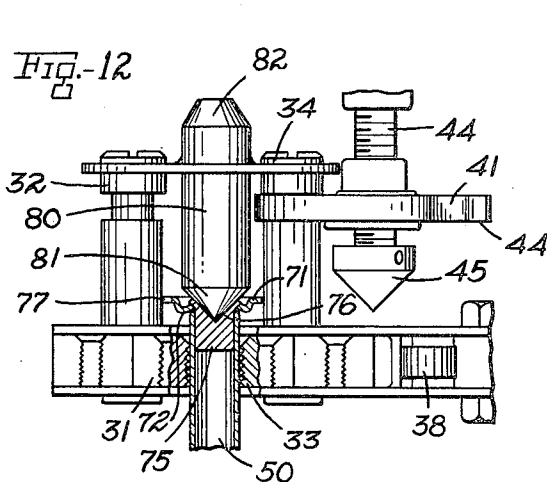
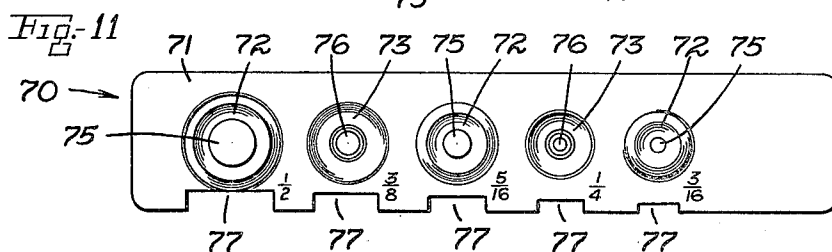
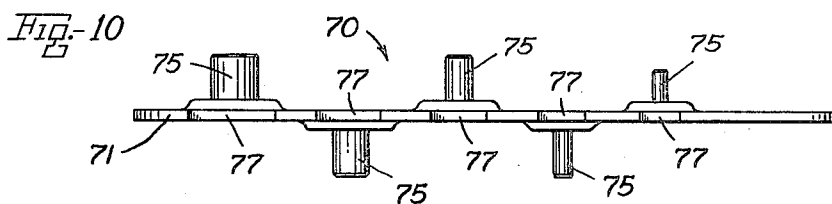
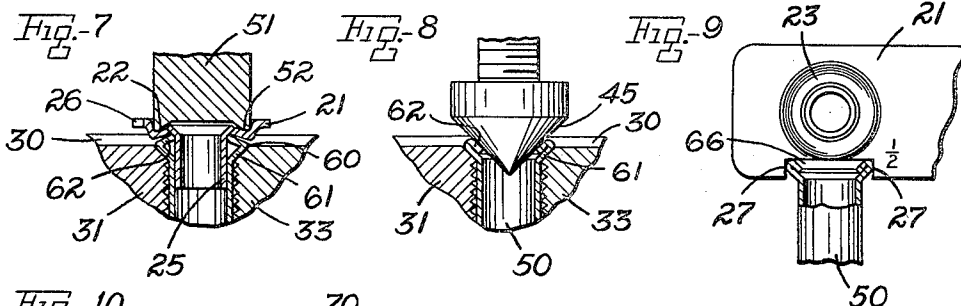
G. W. WOLCOTT

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APPARATUS FOR DOUBLE FLARING TUBES

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3 Sheets-Sheet 2



INVENTOR
Glen W. Wolcott
BY
Marshall Bichel
ATTORNEYS

April 29, 1952

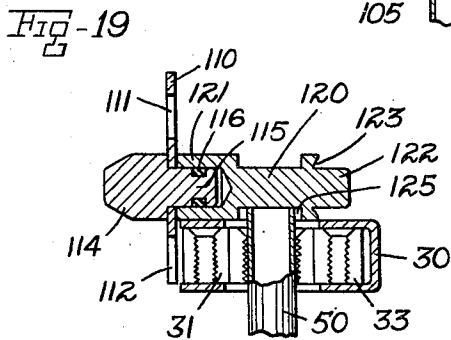
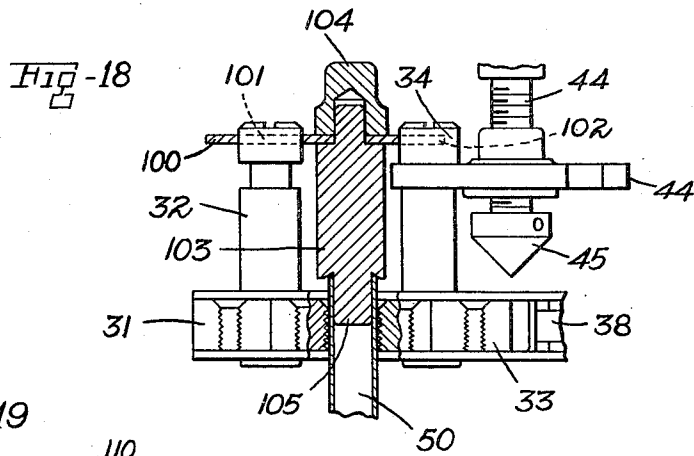
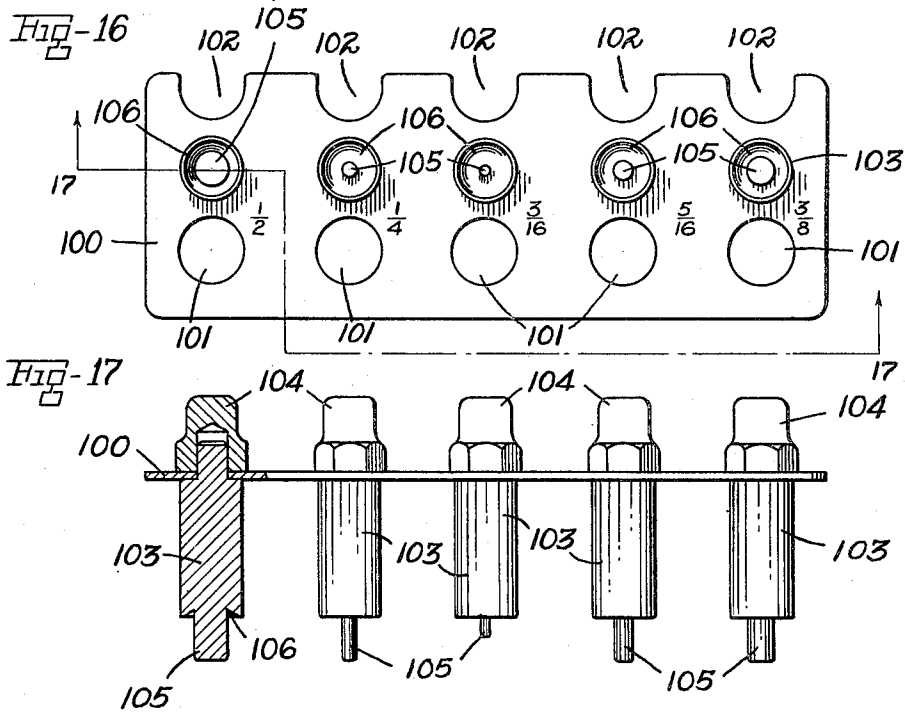
G. W. WOLCOTT

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APPARATUS FOR DOUBLE FLARING TUBES

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3 Sheets-Sheet 3



INVENTOR
Glenn W. Wolcott
BY Marshall Biebel
ATTORNEYS

UNITED STATES PATENT OFFICE

2,595,036

APPARATUS FOR DOUBLE FLARING TUBES

Glenn W. Wolcott, Dayton, Ohio, assignor to
Penn Aircraft Products, Inc., Dayton, Ohio, a
corporation of Ohio

Application June 26, 1948, Serial No. 35,363

5 Claims. (Cl. 153-79)

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This invention relates to tools for flaring tubing and the like, and more particularly to tools for use in forming double flares on such tubing.

A double flare in which the end of the tubing is folded inwardly to provide a double thickness in the flared portion of the tubing may be conveniently produced in two forming operations. In the first step, the end of the tubing is compressed axially to form a circumferential rib having the general configuration in cross section of a reverse flare. In the second step, the end section of this rib is crimped or folded inwardly of the tubing to complete the double flare. This second step is readily performed by a conical flaring member such as used to form single flares, and one of the principal objects of the present invention is to provide a tool of simple and lightweight construction for effectively executing the initial forming step in a double flaring operation to provide the tubing with a circumferential rib of predetermined dimensions and configuration such that the completed double flare will be of the proper dimensions.

Another object is to provide a double flaring tool which includes a working face and a guide portion of predetermined dimensions for operation on the tube to be flared, and which also includes a gauge portion calibrated in accordance with the tube size for cooperation with clamping jaws in which the tubing is gripped during double flaring to locate the end of the tubing in such position beyond the jaws that the rib formed thereon will be of proper size for incorporation in a double flare.

An additional object is to provide a double flaring tool which includes a gauge portion calibrated in accordance with the size of tubing on which the associated working parts of the tool are intended to operate and which is effective both to gauge the proper position of the tube for the initial double flaring step and also to gauge whether the finished double flare is of proper size for such given size of tube.

Among other objects of the invention are to provide a double flaring tool which includes multiple working parts of different dimensions on a single main body portion for operating on tubes of different sizes, and further to provide such a multiple unit double flaring tool which includes gauge portions calibrated in accordance with each of the working parts to facilitate the production of double flares of the proper dimensions on a substantial range of tube sizes.

It is also an object of the invention to provide a double flaring tool which is adapted for ready

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use in cooperation with available tools for forming single flares and which may be actuated either by the flaring cone of the single flaring tool or by a separate actuating member.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings:

Fig. 1 is a top view of a double flaring tool in accordance with the invention;

Fig. 2 is a view of the tool partly in side elevation and partly in longitudinal section as indicated by the line 2-2 of Fig. 1.

Fig. 3 is a plan view of the first or gauging step in a double flaring operation with the tool of Figs. 1 and 2 in conjunction with a single flaring tool;

Fig. 4 is a view on the line 4-4 of Fig. 3;

Fig. 5 is a view illustrating the position of the ram used in the double flaring operation, the view being taken at right angles to Fig. 4 and being partly in side elevation and being partly broken away in vertical section;

Fig. 6 is a detail top view of the actuating member or ram shown in Fig. 5;

Fig. 7 is an enlarged fragmentary view showing the parts upon completion of the initial forming step of the double flaring operation;

Fig. 8 is a view similar to Fig. 7 illustrating the completion of the second step of the double flaring operation;

Fig. 9 is a fragmentary view illustrating the gauging of the finished double flare by means of the tool of Figs. 1 and 2;

Fig. 10 is a view in side elevation of a modified form of double flaring tool;

Fig. 11 is a top view of the tool of Fig. 10;

Fig. 12 is a view similar to Fig. 5 showing the operation of the tool of Figs. 10 and 11 with a modified construction of actuating member or ram;

Fig. 13 is a view similar to Fig. 12 showing a further modified flaring tool operating in conjunction with the flaring cone of the single flaring tool;

Figs. 14 and 15 are sectional views illustrating a modified construction of flaring cone and compression screw therefor, Fig. 14 showing the parts disassembled and Fig. 15 showing the parts in assembled relation;

Fig. 16 is a view of the under side of a further modified form of double flaring tool;

Fig. 17 is a view partly in side elevation and partly in section on the line 17-17 of Fig. 16;

Fig. 13 is a view similar to Fig. 5 showing the operation of the double flaring tool of Figs. 16 and 17;

Fig. 19 is a view similar to Fig. 4 illustrating a further modified form of double flaring tool; and

Fig. 20 is a fragmentary view illustrating the operation of the device of Figs. 14 and 15 in the initial forming step of a double flaring operation.

Referring to the drawings, which illustrate preferred embodiments of the present invention, in the double flaring tool 20 shown in Figs. 1 to 5, the main body portion is an elongated flat metal plate 21. This plate is formed at a plurality of spaced positions thereon to provide a corresponding plurality of concave, frusto-conical working faces 22 along one surface thereof, leaving a similar plurality of recesses 23 along its other surface, and these working faces and recesses are of progressively different diameters lengthwise of plate 21. The centers of these portions 22 and 23 are punched out, and a cylindrical tube 25 is mounted in each of the resulting apertures and extends generally normally from the plate in concentric relation with its associated working face 22. A connection of adequate strength between each tube 25 and the plate 21 is readily obtained by staking the end of the tube in the corresponding recess 23 and reinforcing this joint by brazing. The tubes or guide portions 25 of the tool are graduated in outer diameter to fit in close telescoping relation within tubing of different sizes to be double flared, and the working faces 22 are thus similarly graduated in size.

Along one edge of plate 21 is a series of open, generally channelled slots 26, one for each of the working units 22 to 25 and each having sides 27 and a bottom 28. Each of slots 26 is of different depth and width in accordance with the size of tubing on which its associated working unit is intended to operate, and these slots serve as gauges for accurately positioning the end of a piece of tubing to be double flared in the clamping portion of a flaring tool and also for checking the final dimensions of the completed double flare. Accordingly, one surface of the tool 20 may be provided with suitable indicia identifying the size of tubing to be operated on by each working unit and its associated slot 26, Fig. 1 showing the tool as calibrated for tubing of five sizes ranging from $\frac{3}{8}$ to $\frac{1}{2}$ inch in diameter.

Figs. 3 to 6 illustrate the operation of this double flaring tool in conjunction with a single flaring tool of the construction shown in the application of Karl W. Wilks, Jr. and Glenn W. Wolcott, Serial No. 680,108, filed June 28, 1946, now Patent No. 2,563,088, issued August 7, 1951, and assigned the same assignee as this application. This tool includes a main body 30 of channelled construction in which a multi-jaw clamp member 31 is pivotally mounted on the lower portion of a post 32 extending above body 30. A complementary clamping member 33 is similarly pivotally mounted on the lower part of a similar post 34 carried by a yoke 35 mounted for sliding movement lengthwise of body 30. A lever 36 is pivotally mounted in body 30 on a bolt 37 and carries a roller 38 which engages the end of yoke 35 to urge the latter into a position wherein the clamp members 31 and 33 are in clamping relation, the lever 36 cooperating with a handle portion 39 of body 30 to form plier-like handles.

A strap 40 is pivotally mounted at one end on the upper part of post 34 and is provided at its other end with a hook portion 41 for releasable locking engagement in a circumferential groove

42 adjacent the upper end of post 32 when the clamp members 31 and 33 are in clamping relation. A shaft 44 is threaded in a central boss portion 43 of strap 40 and carries a flaring cone 45 at its lower end for flaring engagement with tubing clamped in members 31 and 33, and an operating handle 46 is provided at the upper end of shaft 44. The strap 40 can thus be swung about post 34 to carry the shaft 44 and cone 45 away from the clamping members 31 and 33 as shown in Fig. 3, but when the hook portion 41 of strap 40 is locked on post 32, the shaft and flaring cone are in accurately centered relation with tubing clamped in the clamping members of the tool, this position of these parts being shown in Fig. 13.

Figs. 3 and 4 show the first step in the double flaring operation, in which the tool 20 is used to gauge the proper position in the jaws of the flaring tool for the end of a piece of tubing 50 to be double flared. As shown, the tool 20 is arranged with plate portion 21 in edgewise relation with the upper surface of the channelled body 30 and with a selected slot 26 of the proper size facing and in line with tubing 50, the operation being illustrated in connection with $\frac{1}{2}$ inch tubing. With the parts held in these relative positions, the tube 50 is pushed through the jaws of clamp members 31 and 33 until its end is in contact with the bottom 28 of the slot, and the handles of the flaring tool are then forced together to effect clamping of the tubing, this position of the parts being shown in Fig. 3.

Figs. 5 to 7 illustrate the first forming step of the double flaring operation, in which tool 20 is actuated by a ram member 51 having its end recessed to provide an annular working face 52 for contact with the recess 23 of tool 20. A guide plate 53 is carried by the upper end of the ram 51 the plate having a hole 54 at one end and an open slot 55 adjacent the other end thereof to receive the posts 32 and 34 respectively, with the slot 55 straddling the boss 43 on strap 40. A cap nut 56 is secured to the upper end of the ram and plate 53 co-axially with the ram to form a hammer pad, and these parts are suitably brazed or otherwise secured together to give a rigid structure.

To carry out the first forming step, the parts are arranged in the relative positions shown in Fig. 5, with the guide portion 25 of the proper size received within the tube and the shaping portion 22 abutting the end of the tube. The hammer pad 56 is struck with a hammer or like tool, and the resulting movement of the ram 51 is guided in a straight line both by co-operation of the guide plate 53 with posts 32 and 34 and also by the telescoping engagement of the guide 25 in the tubing and the engagement of the end of the ram in recess 23. Fig. 7 shows the relative positions of the parts at the completion of this step, and it will be seen that the end of tube 50 is shaped or formed in a circumferential rib 60 composed of a lower or inner portion 61 flared outwardly in the tapered portion of the clamping jaws of 31 and 33 and upper or outer portion 62 which is flared inwardly from the portion 61, this portion 62 being preferably inclined at an angle somewhat nearer normal to the axis of the tubing than the portion 61.

The final forming step is shown in Fig. 8 as carried out by the flaring cone 45 after removal of tool 20 and ram 51, and in this step the portion 62 of rib 60 is folded inwardly of the tubing

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substantially parallel with and flat against the portion 61 and in overlying relation therewith. Thereafter, the tool 20 is again used to check the final dimensions of the completed double flare 66. As shown in Fig. 9, the double flare is inserted in the same slot 26 as was previously employed in the gauging step shown in Fig. 4, but in this step the width of the slot is employed to gauge whether the outer diameter of the double flare is within maximum permissible limits. That is to say, the width of each slot 26 is predetermined to be substantially equal to the maximum permissible outer diameter for a double flare on tubing of a particular size, in this case $\frac{1}{2}$ inch tubing. Thus if the double flare will pass through slot 26 laterally as shown in Fig. 9, it is of the proper size, but if it fails to pass through the slot, it is too big. Conversely, if the double flare has too great lateral clearance in slot 26 in the position shown in Fig. 9, as may be readily judged by observation, it is too small.

It will thus be seen that the tool 20 provides a single unit combining simple and efficient means not only for effecting the initial forming step in a double flaring operation but also for quickly and accurately gauging both the proper length of tubing for incorporation in the double flare and also the final dimensions of the completed double flare, the final gauging step thus providing a check on the accuracy of the initial positioning of the tubing. The tool is light in weight as well as of convenient size and shape for handling, and it has the further advantage of combining in a single device a plurality of working units for operating on tubing of different sizes. It will also be noted that the tool is not limited to use with the flaring tool of the above-referred to application, but is equally applicable to other types of such tools as may be desired, the relative spacing of the working faces 22 and guide portions 25 lengthwise of the tool being predetermined to leave adequate clearance for the body of a single flaring tool at either side of the unit 22—25 being used during the first forming step.

Figs. 10 to 12 show a double flaring tool 70 of somewhat modified construction. It includes a main plate or body portion 71 in which concave working faces 72 similar to the working faces 22 are formed on alternate surfaces lengthwise of the plate, leaving recesses 73 correspondingly on alternate surfaces of the plate. Each working face 72 is provided with a guide portion 75 similar to the guide portions 25, but as shown in Fig. 12, each portion 75 is solid in cross section except for a conical recess 76 in the upper end thereof (which is secured to plate 71). Plate 71 is provided with a series of gauge slots 77 along one edge corresponding with each of the working units 72—75. It will also be noted that this arrangement of working units alternately on opposite sides of the main plate provides for the same number of units as the tool 20 on a plate 71 of lesser length than plate 21.

The double flaring operation with the tool 70 is substantially the same as that already described in connection with Figs. 1 to 9 and may be similarly carried out with a ram of the construction shown in Figs. 5 and 6. Fig. 12 shows this operation with a ram 80 having a conical tip 81 for engagement in the conical recess 76 to cause the desired engagement of the tool 70 with tubing 50, this ram being otherwise of the same construction as the ram shown in Figs. 5 and 6 and having a hammer pad 82. The final step corresponding with Fig. 8 may be carried out with the flaring cone 45, or the ram 80 may

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be employed for this step in the same manner as shown in Fig. 12 but with tool 70 removed.

Fig. 13 shows the initial forming step of a double flaring operation carried out with the flaring cone 45 instead of a separate ram member, and in Fig. 13 a further modified construction of double flaring tool 85 is shown in which the working face 86 and guide portion 87 are both integrally formed with the body of plate 88, the tool being otherwise similar to tool 70. In the arrangement shown in Fig. 13, the threaded shaft 44 is tightened down to force cone 45 and tool 85 against the end of tube 50 and thus to form the desired circumferential rib thereon. The shaft 44 is then backed off sufficiently to remove tool 85, and the operation is repeated to complete the double flare. It should also be noted that the same procedure may be followed with either of tools 20 and 70 without requiring the use of a separate ram.

Figs. 14 and 15 show a modified construction of flaring cone and screw shaft adapted for use with flaring tool such as that shown in the above-referred-to application Serial No. 680,108 for performing double flaring operations. The screw shaft 90 corresponds with the screw shaft 44 already described but has a flat end portion 91, and a circumferential groove 92 is formed therein at a position adjacent but spaced axially from the end 91. A resilient rubber ring 93 is mounted in groove 92 and held in place by the walls thereof. The cone 95 has a central bore 96 adapted to receive the end of screw shaft 90, and this bore is enlarged at 97 to substantially the same diameter as the outer diameter of rubber ring 93, leaving an annular rib or shoulder 98 at the upper end of the cone. This construction and arrangement provides for readily coupling and uncoupling the parts 90 and 95 by relative axial movement thereof as shown in Fig. 14, the rubber ring 93 holding the parts in assembled relation but permitting relative rotational movement of the cone on the screw shaft.

The flaring cone arrangement of Figs. 14 and 15 may be readily used with any of the double flaring tools 20, 70 and 85, as illustrated in Fig. 20 in connection with the double flaring tool 20. In the first forming step with any of these tools, the cone 95 is removed from shaft 90 as shown in Fig. 14, and the shaft is then operated to bring its lower end 91 into working engagement with the upper face of the double flaring tool, thus forming the desired circumferential rib in the manner shown in Fig. 20. The shaft 90 is then backed off sufficiently to remove the double flaring tool and replace the cone 95 in the position shown in Fig. 15, and the operation is repeated to complete the double flare in the same manner as shown in Fig. 8, the preliminary and final gauging steps being carried out in the same manner as already described.

Figs. 16 to 18 illustrate another modified construction of double flaring tool in which the functions of the ram and tool are combined. In this tool, a main body plate 100 is provided with a series of holes 101 and notches 102 for receiving the posts 32 and 34 in operation. The plate 100 carries a series of ram members 103 arranged in spaced relation longitudinally thereof, and the upper end of each ram is provided with a cap nut 104 to serve as a hammer pad. The lower end of each ram 103 is of reduced diameter to provide a guide portion 105, these guide portions being of different diameter for close telescoping engagement within tubing of correspondingly dif-

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ferent sizes. Each ram 103 is also provided with a concave frusto-conical working face 106 concentric with the guide portion 105 thereon.

Fig. 18 shows this form of double flaring tool in operation with a flaring tool. The ram 103 which has its guide portion 105 of the proper size for the tubing 50 is mounted with its associated hole 101 and notches 102 receiving the posts 32 and 34. The hammer pad 104 on this ram is then struck with a hammer or mallet to carry out the first forming step. The double flaring tool is then withdrawn and the second forming step carried out as with the flaring cone 45 as already described. It will also be apparent that the plate 100 may readily be provided with gauge slots similar to slots 25 and operating in similar manner, and further that the plate may be subdivided to give a series of units each having its own guide plate as with the ram shown in Figs. 5 and 6 and each adapted for use in double flaring a different size of tubing.

Fig. 19 shows a still further modified construction of double flaring tool in which a single actuating member or ram is provided with a series of working members or adapters for double flaring tubing of different sizes. The guide plate 110 is similar to the plate 53 in Figs. 5 and 6 and includes a hole 111 and notches 112 similar to those described above. The actuating member is brazed or otherwise secured to plate 110 and includes a hammer pad 114 and a stem portion 115 extending through plate 110 and provided with a circumferential groove receiving a resilient rubber ring 116 of slightly greater outer diameter than the stem 115. The adapter 120 includes a socket portion 121 adapted to receive the stem portion 115 slidably therein so that the rubber ring 116 will hold these parts in assembled relation as shown. The opposite end of adapter 120 is formed with a guide portion 122 and a frusto-conical working face 123 concentric therewith.

The guide portion 122 of adapter 120 is of predetermined diameter in accordance with the size of tubing to be operated on. Thus a series of such adapters may be provided each having its guide portion and working face of a different size to fit a correspondingly different size of tubing, and any of such adapters may be selectively used with a single actuating member. In addition, each adapter is provided with a circumferential groove 125 similar in function to the slots 25 in Figs. 1 and 2 and similarly related in depth and width to the guide portion 122 and the size of tubing which this guide portion is intended to fit.

Fig. 19 shows this form of tool in the initial gauging step for a double flaring operation, in which the adapter 120 is laid across the clamping members 31 and 33 and the depth of groove 125 is used to position the end of tubing 50 in the clamping members. The initial forming step with this tool is substantially the same as described in connection with Fig. 18, and in this step the tool is turned up vertically with its guide portion 122 fitting down into the end of tube 50, the hole 111 and the notch 112 being received over the two posts of the flaring tool. The second forming step may be performed with a flaring cone or conical ram and thereafter the width of groove 125 is employed to check the dimensions of the finished double flare.

It will be seen that with this form of tool as shown in Fig. 19, an adapter 120 of the proper size to fit a piece of tubing to be double flared

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may be quickly and easily coupled to the actuating member for the double flaring operation, and the gauging groove on each adapter facilitates desired uniform results. It should also be noted that this composite tool may be formed integrally with similar results, and further that the ram members of the other tools disclosed may be similarly provided with gauge grooves if desired for similar operation in double flaring operations.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A tool of the character described for use in combination with clamping jaws and a pressure member to form a double flare at the end of a tube of predetermined diameter held in said clamping jaws and projecting therefrom, comprising a flat body portion, a guide portion extending from a surface of said body portion and having a predetermined diameter to be received within a tube of said predetermined diameter, a concave frusto-conical working face on said body portion concentric with said guide portion for engagement with an end of said tube to form a circumferential rib thereon upon relative movement toward said tube, and said body portion having a pressure face thereon opposite said guide portion for pressure engagement with said pressure member to effect said shaping operation.

2. A tool of the character described for use in combination with clamping jaws and a pressure member having an annular working end to form a double flare at the end of a tube of predetermined diameter held in said clamping jaws and projecting therefrom, comprising a generally flat plate having a portion formed out of the plane of the main portion thereof to provide an annular working face on one side of said plate and an annular recess on the opposite side thereof adapted to receive said annular end of said pressure member, and a guide portion projecting from said plate in concentric relation with said working face, said guide portion being of predetermined diameter for reception within a tube of said predetermined diameter to guide said working face into engagement with the end of said tube for forming a circumferential rib thereon upon relative movement towards said tube.

3. A tool of the character described for use in combination with clamping jaws and a pressure member to form a double flare at the end of a tube of predetermined size held in said clamping jaws and projecting therefrom, comprising a generally flat plate having a portion thereof formed to provide an annular working face on one side of said plate, a guide portion projecting from said plate in concentric relation with said working face, said guide portion being of predetermined diameter for reception within a tube of said predetermined size to guide said working face into engagement with the end of said tube for forming a circumferential rib thereon upon relative movement towards said tube, and said plate having a pressure face thereon opposite said guide portion for pressure engagement with said pressure member to effect said forming operation.

4. A tool of the character described for use in combination with clamping jaws and a conical

pressure member to form a double flare at the end of a tube of predetermined size held by said clamping jaws and projecting therefrom comprising a flat body portion, a guide portion extending generally normally from a surface of said body portion and having a predetermined diameter for reception within a tube of said predetermined size to be double flared, an annular working face on said body portion concentric with said guide portion for engagement with an end of said tube to form a circumferential rib thereon upon relative movement toward said tube, and said guide portion being shaped to receive said conical actuating member from the side of said body portion opposite said working face, and said clamping jaws to receive the end of said tube and measure the proper length thereof for projection beyond said jaws to form said rib, and said slot being of predetermined width in accordance with said predetermined size of tube.

5. A double flaring tool for use in combination with clamping jaws and a pressure member to form double flares on the ends of tubes of a plurality of different predetermined diameters held by said clamping jaws and projecting therefrom, comprising an elongated flat plate, a plurality of guide portions projecting from said plate and of different predetermined size in accordance with said predetermined diameters of tubes for insertion in supporting relation within a tube of corresponding diameter to be double flared, means on said plate adjacent each said guide portion for effecting a shaping operation on the

ends of said tubes in preparation for the double flares, and said plate having a pressure face thereon opposite each said guide portion for pressure engagement with said pressure member to effect said shaping operation.

GLEN W. WOLCOTT.

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