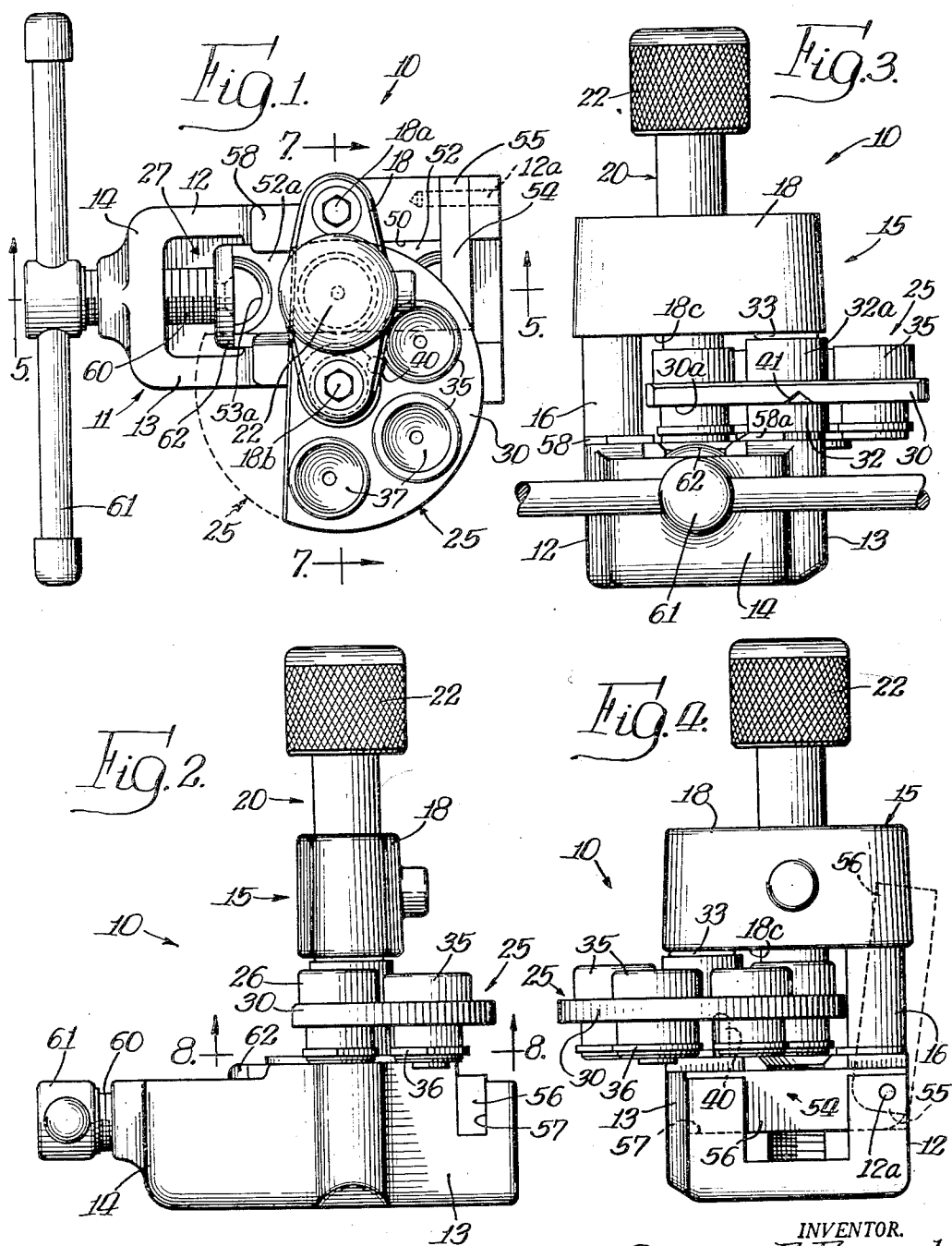


G. E. FRANCK
FLARING TOOL

3 Sheets-Sheet 1

Filed May 4, 1953



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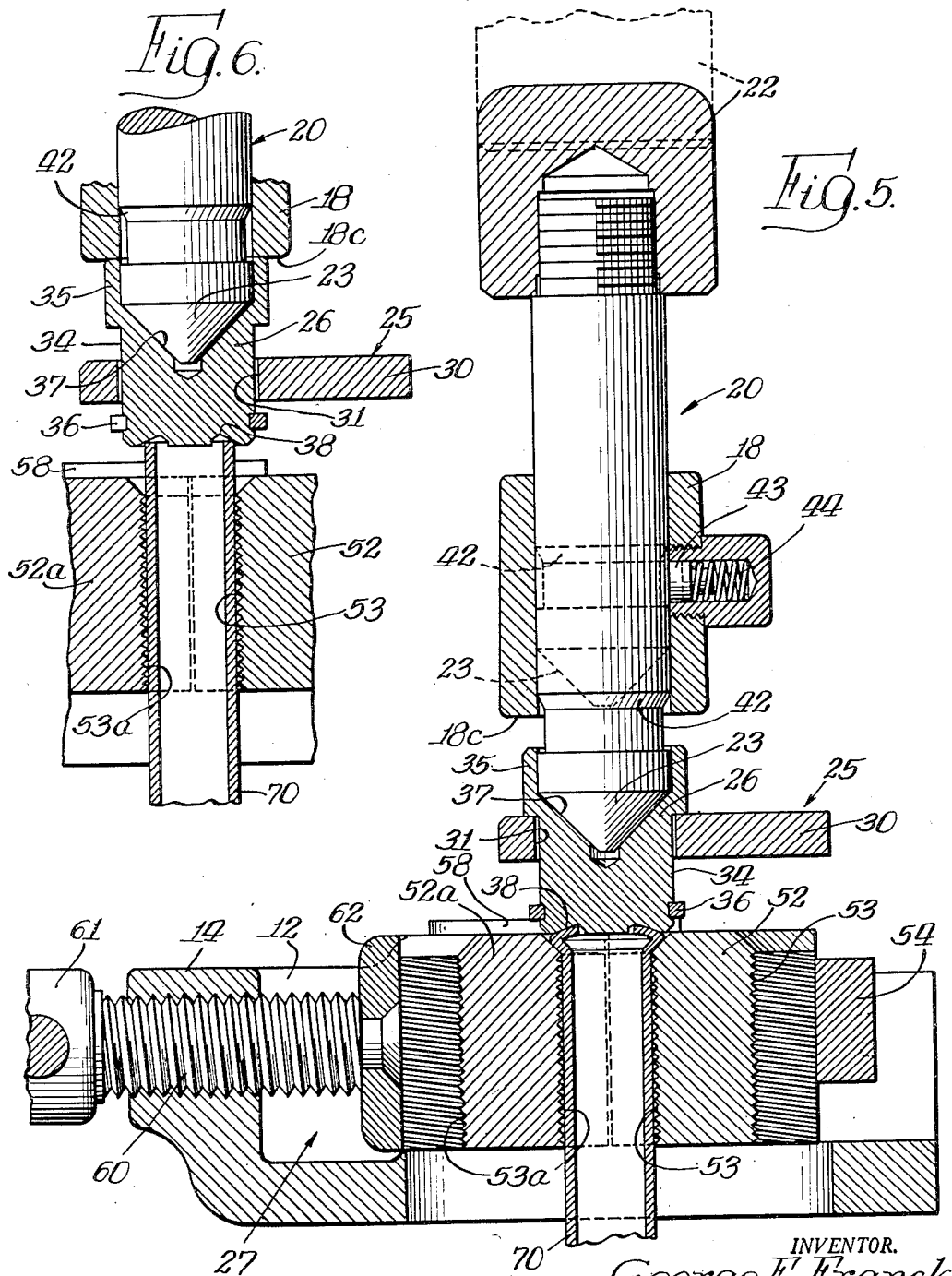
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FLARING TOOL

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3 Sheets-Sheet 2



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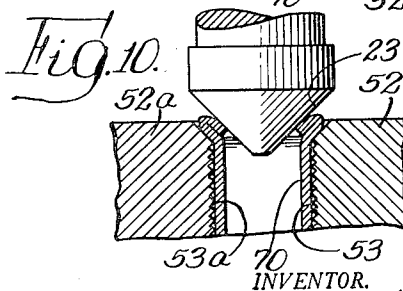
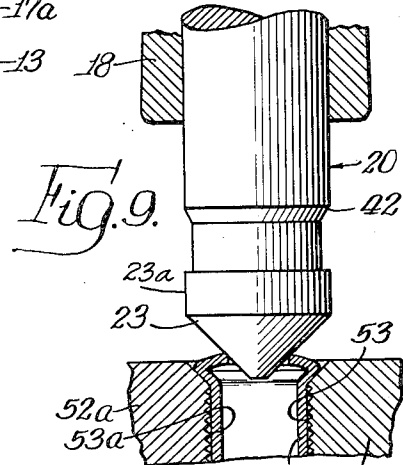
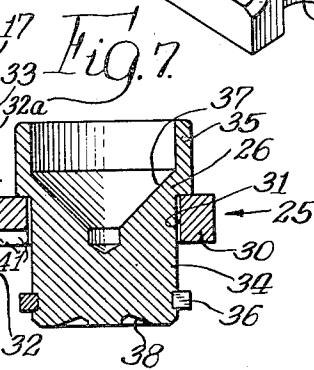
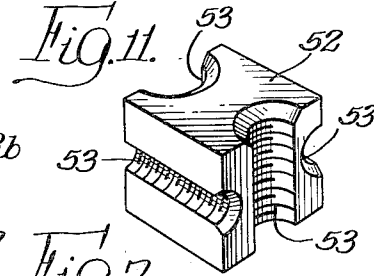
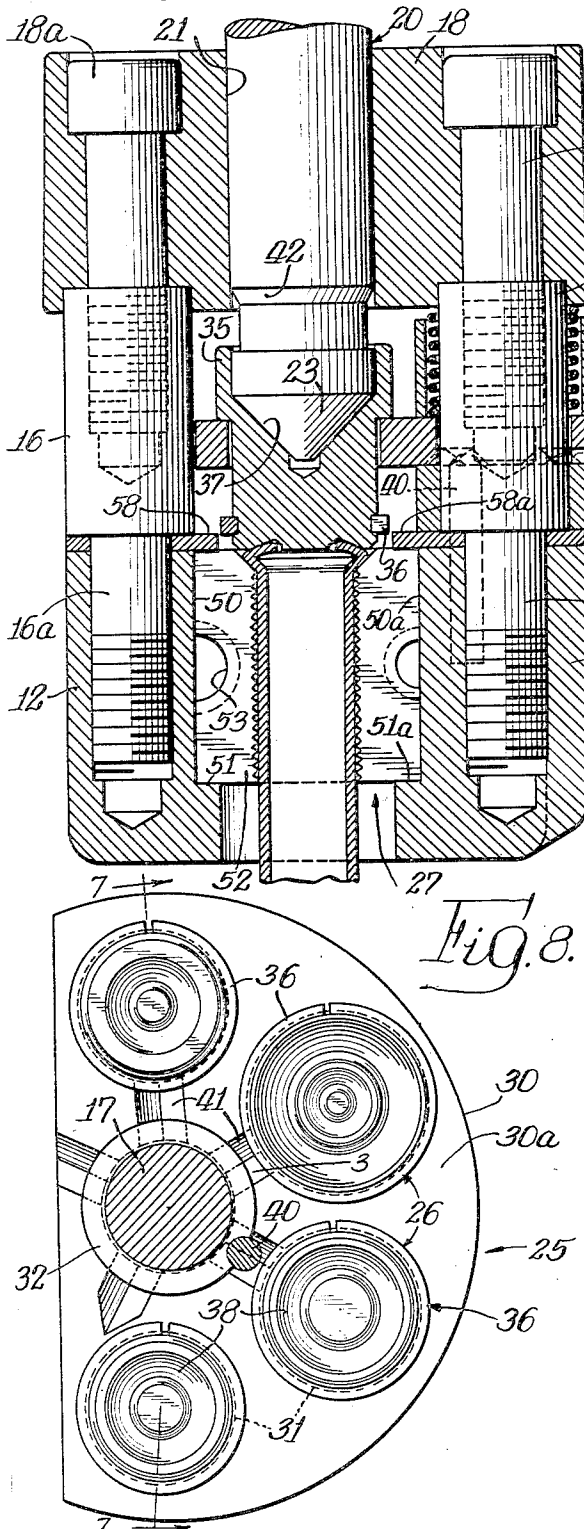
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G. E. FRANCK
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2,774,408

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3 Sheets-Sheet 3



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1

2,774,408

FLARING TOOL

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Application May 4, 1953, Serial No. 352,929

6 Claims. (Cl. 153—79)

This invention relates to a flaring tool and more particularly to a tube flaring tool.

It is the general object of this invention to produce a new and improved tool of the type described.

A principal feature of the invention is the provision of a new and improved double flaring tool having at least one adapter member adapted for producing a primary flare on the end of the tube, and a force applying member arranged to cause said adapted member to produce the primary flare, and to produce directly a secondary flare on the end of a tube, said members being cooperatively arranged to have accurate tube engaging alignment.

Another feature is that the adapters are mounted to be selectively interposed between the force applying member and the end of the tube to receive the force exerted by the force applying member and to transmit it to the tube end to produce the primary flare, with the mounting of each adapter being loose in a plane normal to the direction of its movement against the tube end during the flaring operation, whereby the selected adapter is aligned with the tube end by action of the force applying member.

A further feature of the invention is the provision of such a tool wherein the adapters are mounted on a movable carrier plate and are each provided with a recess accurately complementary to the flaring portion of the force applying member so that the adapters may be accurately aligned with the tube end by contact with the force applying member.

Other and further features of the invention will be readily apparent from the following description and drawings, in which:

Fig. 1 is a top elevational view of an impact type double flaring tool embodying the invention;

Fig. 2 is a side elevation of the apparatus of Fig. 1;

Fig. 3 is an end elevational view of the tool of Fig. 1;

Fig. 4 is an elevational view of the opposite end of the apparatus of Fig. 3;

Fig. 5 is a vertical sectional view taken along line 5—5 of Fig. 1;

Fig. 6 is an enlarged detailed view showing a flaring adapter immediately prior to its operation;

Fig. 7 is a vertical sectional view taken along line 7—7 of Fig. 1;

Fig. 8 is a view of the underside of the carrier for the adapters;

Fig. 9 is a view of the punch positioned to produce the secondary flare on a tube;

Fig. 10 is a view like Fig. 9 showing the operation of the punch upon completion of the secondary flare; and

Fig. 11 is an isometric view of one of the clamping blocks.

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and will herein be described in detail one specific embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

While it will be readily apparent to those skilled in the art that certain of the features and advantages of the present invention may be utilized in various forms of

2

tube working tools, they are herein, for the purpose of exemplary embodiment, shown as incorporated in an impact type double flaring tool. As is known in the art, this type of tool is used to produce a primary flare on the end of a tube to shape the same generally as shown in Fig. 9, that is to produce an inturned flare on the end of a tube. The tool is then subsequently used to produce an outturned flare to bend the tube into the position shown in Fig. 10 so as to produce a flare on the end of a tube, with the portions of the tube which are flared being of double thickness. To produce the primary flare an adapter is interposed between the force applying member and the tube and is driven against the end of a tube as illustrated in Fig. 6. The adapter is then moved out of the way and the force applying member is used directly to produce the secondary flare. It is of course important that the adapter be properly aligned with the tube during the production of the primary flare. Heretofore this has required extremely accurate and expensive machining and even such accurate machining did not eliminate the possibility that the adapter might become misaligned with the tube and punch during hard usage. Should the adapter become misaligned it is clear that an improper flare will be produced and this difficulty is particularly evident where the tubes to be flared are brazed tubes and thus tubes with unequal degrees of hardness throughout their circumference.

The foregoing difficulties have been overcome in the tool of the invention by mounting the adapters loosely in a suitable carrier so that the adapter is free to move from side to side, that is in planes normal to its movement against the tube during the primary flaring operation. To assure proper alignment of the adapter and tube the same is provided with a recess complementary in shape to the force applying member and adapted to receive the same. As the force applying member accurately fits into the recess, the force applying member itself serves to align the adapter properly with the tube and thus correct alignment is assured over a long period of time and without the necessity of expensive machine operations to produce a tool.

Referring now to the drawings, the apparatus comprises a tool 10 including a first U-shaped frame portion 11 having a pair of legs 12 and 13 each integrally secured at one end to the base 14 of the U, and a second U-shaped frame portion 15 having a pair of legs 16 and 17. The legs 16 and 17 are each provided with integral screw portions 16a and 16b, respectively, which are received in suitably threaded openings provided in the legs 12 and 13. At their upper ends the legs 16 and 17 are secured to the base 18 of the U-shaped portion 15 through the medium of a pair of screws 18a and 18b as shown in Fig. 7.

A force-applying member, here in the form of a punch 20, is reciprocally carried in an opening 21 provided in the base portion 18. As seen in the drawings, particularly Figs. 5 and 7, base portion 18 is made relatively thick so that opening 21 therein is axially elongated. The punch 20 has a head 22 adapted to receive the impact of a tool such as a hammer and a generally conical punch portion 23 so shaped as to provide a secondary flare on the tube. Contiguous with conical portion 23 is a cylindrical portion 23a.

A carrier 25 is provided to carry a plurality of adapters 26 utilized to produce a primary flare. Mounted between the legs 12 and 13 of the U-shaped portion 11 is a tube clamping means generally indicated at 27 for holding a tube in axial alignment with the punch.

The carrier 25 comprises a plate 30 rotatably mounted on the leg 17 and provided with a plurality of circular holes 31, the centers of each of which are equally spaced from the axis of rotation of the plate. The plate 30 is

3

spaced above the leg 13 by means of a collar 32 which surrounds the leg 17 and contacts the undersurface 30a of the plate. Contacting the upper surface of the plate is a second collar 32a also surrounding the leg 17, with the collar 32a having a height less than the distance between the upper surface of the plate and the undersurface of the base 18. A spring 33 is provided to urge the plate downwardly against the collar 32, it being clear from the construction described that the plate may be moved upwardly against the tension of the spring 33 a distance equal to the spacing between the collar 32a and the underside of the base 18.

Loosely mounted in each of the holes 31 is one of the adapters 26. Each adapter has a generally cylindrical exterior portion 34 smaller in diameter than the hole in which it is located, with each adapter having an integral collar portion 35 at its upper end larger in diameter than the hole and a snap ring 36 at its lower end. Thus, each adapter is loosely retained in each of the holes.

Each adapter is provided with a recess 37 at its upper end complementary in shape to the shape of the punch portions 23 and 23a. It is preferable that the recesses 37 each be very accurately formed so as to mate with the punch portion as it is this mating connection that serves properly to align the adapter axially with a tube held in the clamping means 27. On the underside of each adapter there is formed a groove 38 shaped to provide the turned or primary flare on the end of the tube. Each adapter is provided with a groove 38 of different size on its lower portion so as to accommodate tubes of varying diameter.

Means are provided for slightly elevating the carrier as the same is rotated so as to insure that the adapters will clear the clamping means during such rotation. For this purpose there is provided a detent pin 40 which contacts the undersurface 30a of the plate to lift the same the distance permitted by the spacing of the collar 32a previously mentioned. At approximately the location of each of the adapters the undersurface of the plate is provided with radial grooves 41 so as to approximately locate the adapter in axial alignment with a tube. As previously noted, this location is only approximate inasmuch as accurate alignment is accomplished by the punch as the same is moved downwardly into the recesses 37. The punch 20 is provided with an annular groove 42 (Fig. 5) engageable by a detent pin 43 urged into the groove by a spring 44 to hold the punch in retracted position during rotation of the carrier so that no interference between the punch portion 23 and the adapter is encountered during such rotation.

The legs 12 and 13 on the first U-shaped portion 11 are provided with opposite parallel side faces 50 and 50a which are shaped to form an integral step portion 51 and 51a at their lower portions to provide spaced parallel guideways slidably supporting a pair of tube clamping blocks 52 and 52a. The blocks are cubical in shape and each is provided with a plurality of hemicylindrical grooves 53 and 53a, with the grooves being of different radius of curvature so as to accommodate tubes of different sizes. It will be noted from an examination of Fig. 11 that each groove extends from end to end of the block. In the particular embodiment shown, grooves are formed in four of the six faces of each block. The open end of the U-shaped portion, and thus the open end of the parallel guideways, may be closed by a gate 54 pivoted at one end 55 about pin 12a held by the leg 12, with the opposite end 56 of the gate being receivable into the notch 57 formed in the leg 13. To change the clamping means to accommodate a different sized tube, the gate 54 is merely pivoted to open position, the blocks slid along the guideways and out of the portion 11 and then rotated so as to bring the proper sized groove 53 and 53a into mating relationship so as to form a generally cylindrical tube receiving opening. The blocks are then

4

replaced in the guideways and the gate closed. To retain the blocks in the guideways there is provided a pair of parallel plates 58 and 58a secured to the upper surfaces of the legs 12 and 13, respectively, and overlying at least in part the space between the guideways 50 and 50a. These plates 58 and 58a cooperate with the step portions 51 and 51a to retain the blocks in the guideways.

Means are provided for forcing the blocks together to clamp a tube in the cylindrical opening formed by cooperating recesses in the blocks, with said means including a screw 60 threaded into the base portion 14 and having a handle 61 at its outer end. At its inner end the screw 60 is provided with a thrust washer 62 which bears against the adjacent face of the block 52a to force the block against the other block. The clamping force exerted serves not only to hold a tube in the cylindrical opening formed by the grooves in the two blocks, but also, by exerting a force against the gate 54, serves to hold the gate in closed position.

In operation the blocks may be removed from the guideway and oriented so as to bring matching grooves 53 and 53a together to form a cylindrical opening corresponding to the diameter of the tube to be worked upon. The blocks are then replaced in the guideways and the gate 54 closed. The proper adapter 26 is then brought into approximate position in axial alignment with the tube by rotation of the carrier 25. With the proper adapter in position and before the screw 60 is tightened against the adjacent face of the block 52a, the tube 70 is inserted as far as possible through the opening, against the undersurface of the positioned adapter and such motion is continued to lift the adapter until the collar 35 strikes the undersurface 18c of the base 18. This position is illustrated in Fig. 6 and the adapters are so proportioned from end to end that when the tube has been moved to this position it extends a distance above the upper face of the clamping blocks sufficient to produce the desired flare on the tube. In other words, the adapters serve, as an additional purpose, as gauges properly to position a tube in the clamping means. During the foregoing operations, the punch is in retracted position with the detent pin 43 engaging the groove 42 so as not to interfere with the rotation of the carrier and the proper positioning of the tube.

With the tube properly positioned in the clamping means, the handle 61 is rotated to exert a clamping force thereon to prevent movement of the tube during the flaring operations which are to follow. The punch 20 is then forced downwardly as by striking the head 22 with a hammer so as to drive the punch portion 23 into the recess 37 and to move the adapter downwardly to force the upper end of the tube to bend into the groove 38 as shown in Fig. 5. During the downward movement of the adapter it is axially aligned with the tube because of the close fit between the punch portion 23 and recess 37. With the primary flare illustrated in Fig. 5 now existing on the end of the tube, the carrier 25 is rotated so as to remove all of the adapters from the path of movement of the punch, the plate 30 being properly shaped so as to permit such positioning of the adapters. The punch 20 is again driven downwardly in the same manner as before but without the intervention of the adapters and thus strikes the end of the tube in the manner illustrated in Fig. 9 and carried downwardly to produce the secondary flare illustrated in Fig. 10. Upon completion of this operation the screw 60 may be loosened, the blocks separated slightly and the tube withdrawn, with the tube of course having a double flare of the desired thickness and configuration at one end.

I claim:

1. A tube flaring tool comprising a frame, a force applying member reciprocally mounted on the frame, tube clamping means on the frame for holding a tube in axial alignment with said member, a carrier movably mounted on the frame, a plurality of adapters each loosely mounted

on the carrier, each of said adapters having a recess at one end complementary to the shape of said member and each adapter having its other end shaped to produce an inturned flare on a different one of a plurality of differently sized tubes, with said carrier being movable from a first position wherein a selected adapter is positioned intermediate said member and a tube in the clamping means to transmit a force exerted on said member to the tube, to a second position wherein all of the adapters are removed from the path of movement of said member, and with each of said adapters being proportioned to space said other end thereof a predetermined distance from the clamping means when the carrier is in said first position whereby a tube inserted into the clamping means and moved into contact with said other end of the adapter is positioned to produce a desired flare, detent means on the frame for retaining said member spaced from the adapters during movement of the carrier, and cam means on the frame and cooperating means on the carrier to move the carrier away from the clamping means as the carrier is moved from said first position.

2. A tube flaring tool comprising a frame, a force applying member reciprocally mounted on the frame, tube clamping means on the frame for holding a tube in axial alignment with said member, a carrier including a plate rotatably mounted on the frame about an axis parallel to and spaced from the path of movement of said member and being provided with a plurality of holes, the centers of each of which are spaced from the rotational axis of the plate, an adapter mounted in each of said holes, each of the adapters having spaced portions larger in diameter than and located on opposite sides of the hole and a portion substantially smaller in diameter than the hole intermediate said larger portions whereby to retain each adapter in its hole while allowing substantial lateral movement of the adapter relative to said plate, each of said adapters having a recess at one end complementary to the shape of the punch and each adapter having its other end shaped to produce a flare on a different one of a plurality of differently sized tubes, which said carrier being movable from a first position wherein a selected adapter is roughly aligned with said member and a tube in the clamping means to transmit a force exerted on said member to the tube, to a second position wherein the adapter is removed from the path of movement of said member.

3. A tube flaring tool comprising a frame having a first U-shaped portion and a second U-shaped portion with the ends of the legs of the second portion being secured to an intermediate portion of opposite legs of the first portion rigidly to secure said U-shaped portions together at substantially right angles to each other, an opening in the base of the second U-shaped portion, a force applying member reciprocally mounted in said opening, tube clamping means mounted on the legs of the first U-shaped portion for holding a tube in axial alignment with said opening, a carrier including a plate rotatably mounted on one of the legs of the second U-shaped portion and being provided with a plurality of holes, the centers of each of which are spaced from the rotational axis of the plate, an adapter mounted in each of said holes, each of the adapters having spaced portions larger in diameter than and located on opposite sides of the hole and a portion smaller in diameter than the hole intermediate said larger portions whereby loosely to retain each adapter in its hole and allow substantial movement of the adapter laterally of said plate, each of said adapters having a recess at one end complementary to the shape of said member and each adapter having its other end shaped to produce an inturned flare on a different one of a plurality of differently sized tubes, with said carrier being movable from a first position wherein a selected adapter is positioned intermediate said member and a tube in the clamping means to transmit a force exerted on said member to the tube, to a second position wherein all of the adapters are removed from the path of movement of said member, said adapters being

movable in said holes toward and into contact with said base of the second U-shaped portion by a tube inserted in said clamping means to position the tube to produce a desired flare.

4. The flaring tool of claim 2, wherein the adapter spaced portion on the side of the hole adjacent said member is an integral collar and said spaced portion on the side of the hole adjacent said clamping means is a removable ring, and the positioning of said collar and ring is predetermined to gauge the axial positioning of the tube in the clamping means and to permit axial movement of the adapter to produce a proper flare.

5. A tube flaring tool comprising a frame including means providing an axially elongated opening, a force applying member mounted in said opening and accurately guided thereby for axial movement, said force applying member terminating at one end in a flaring cone head, tube clamping means rigid with said frame for holding a tube to be flared in axial alignment with said force applying member, a carrier movably mounted on said frame and a flare forming adapter loosely carried by the carrier for movement relative to said carrier in the direction of movement of said force applying member and limitedly in a plane normal to its own direction of movement during the primary tube flaring operation, said adapter at one end being shaped to produce a flare on a tube in the clamping means when forced against the tube by said force applying member and at the other end having a recess complementary to the shape of and receiving the head of said force applying member with a close fit therein to be thereby placed and held in accurate alignment with the tube to be flared and said force applying member.

6. A tube flaring tool comprising a frame including means providing an axially elongated opening, a force applying member mounted in said opening and accurately guided thereby for axial movement, said force applying member terminating at one end in a flaring cone head having a conical tip and a cylindrical portion adjacent the base of the conical portion, tube clamping means rigid with said frame for holding a tube to be flared in axial alignment with said force applying member, a carrier movably mounted on said frame and a flare forming adapter loosely carried by the carrier for movement relative to said carrier in the direction of movement of said force applying member and limitedly in a plane normal to its own direction of movement during the primary tube flaring operation, said adapter at one end being shaped to produce a flare on a tube in the clamping means when forced against the tube by said force applying member and at the other end having a recess having a conical portion and a cylindrical portion to be complementary to the shape of said flaring cone head and receiving said head including the cylindrical portion thereof with a close fit therein to be thereby placed and held in accurate alignment with the tube to be flared and said force applying member.

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