

Nov. 19, 1968

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3,411,338

TUBE FLARING APPARATUS

Filed Aug. 2, 1965

5 Sheets-Sheet 1

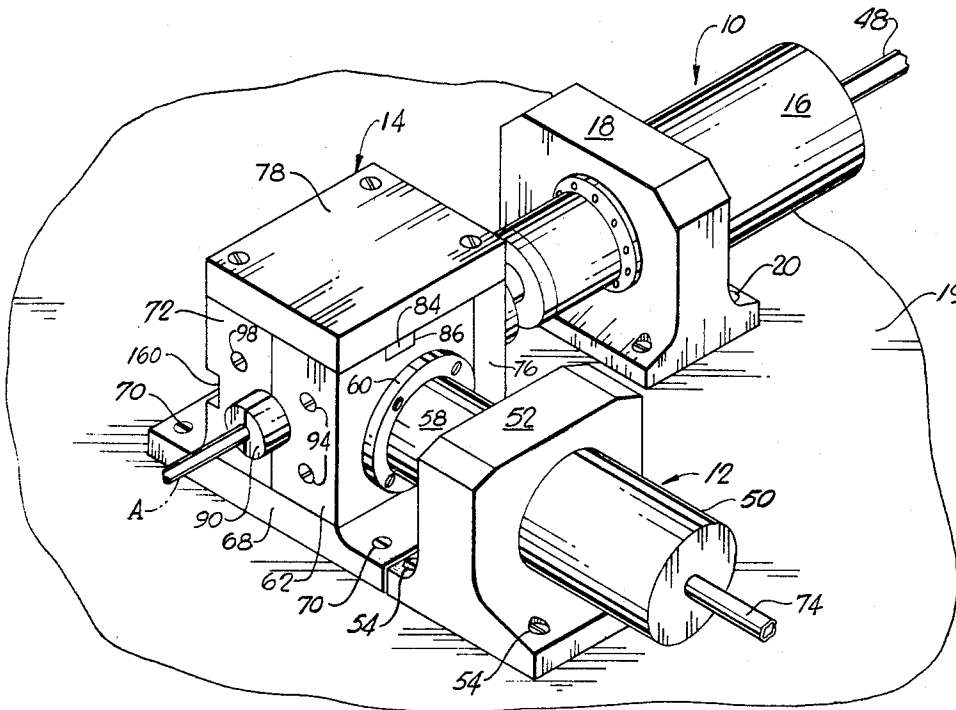


FIG 1

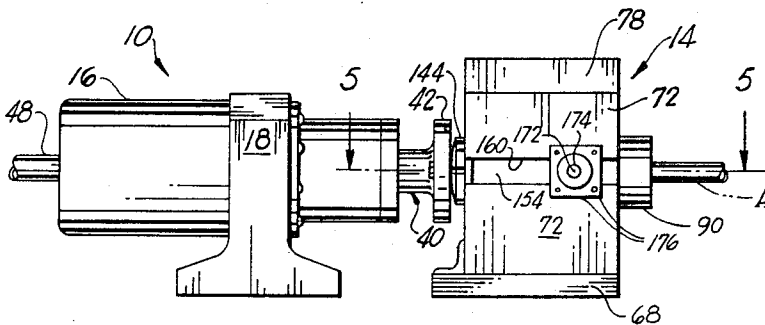


FIG 2

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5 Sheets-Sheet 2

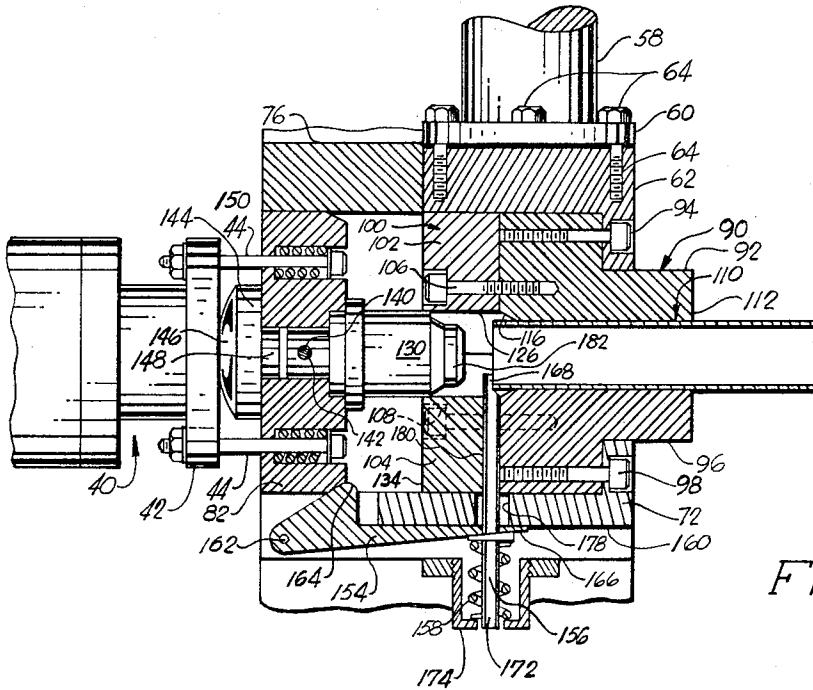


FIG 5

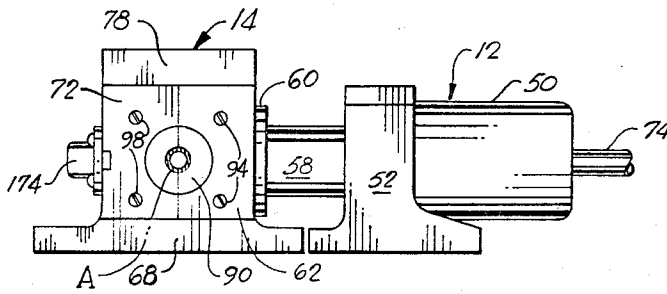


FIG 3

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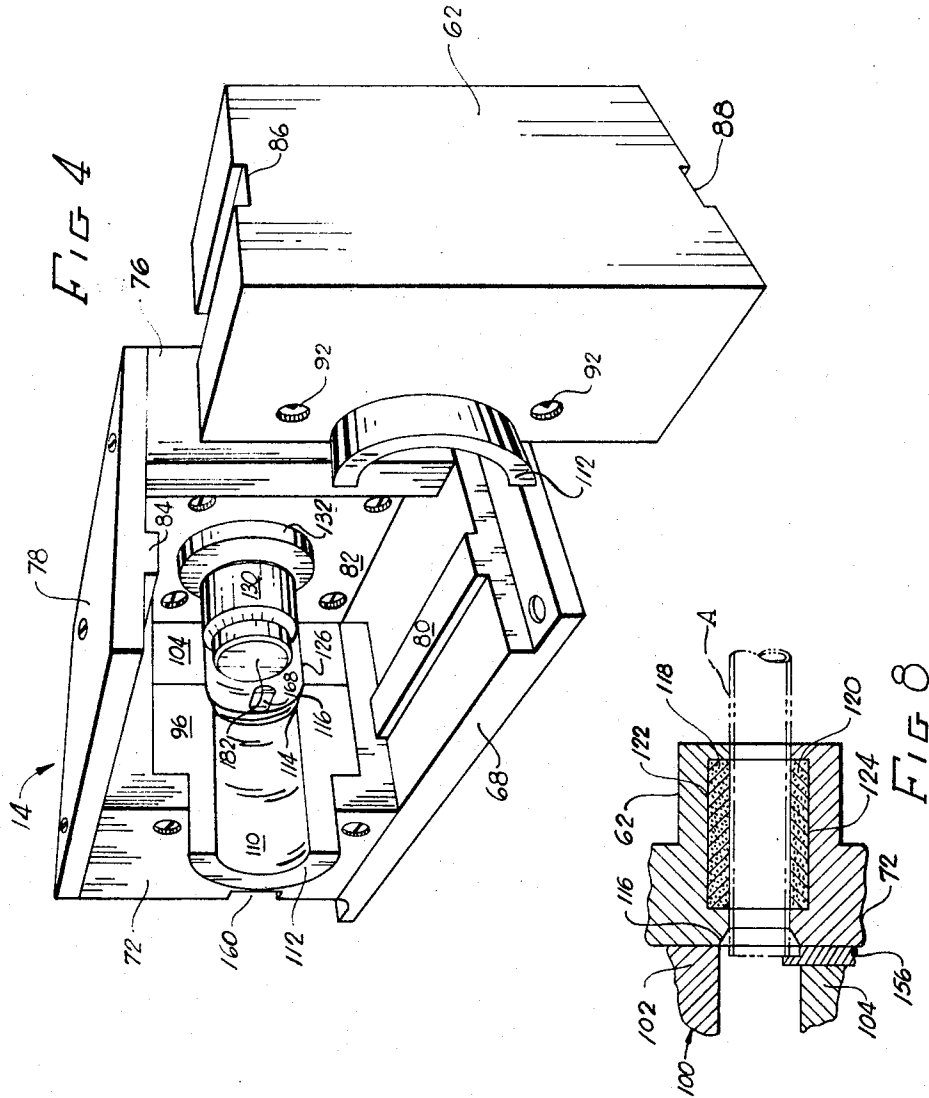
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TUBE FLARING APPARATUS

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5 Sheets-Sheet 3



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TUBE FLARING APPARATUS

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5 Sheets-Sheet 4

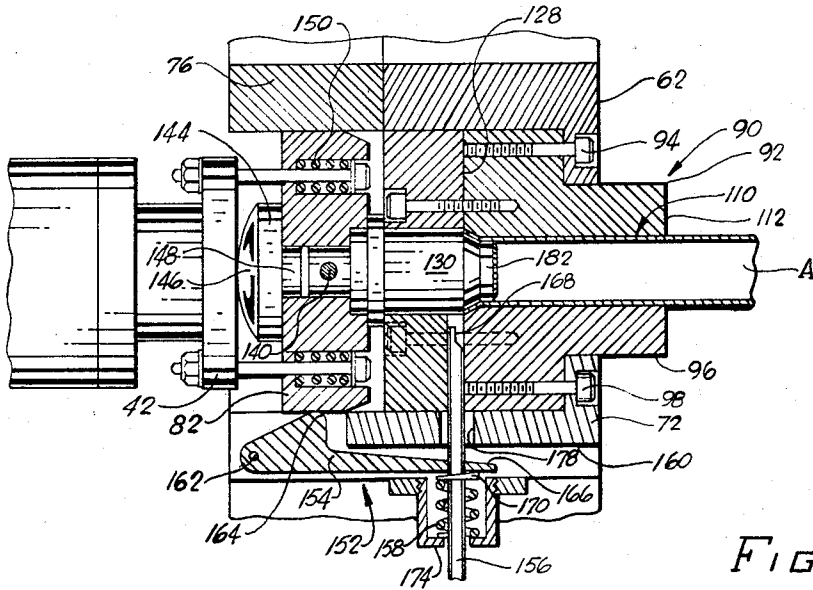


FIG 6

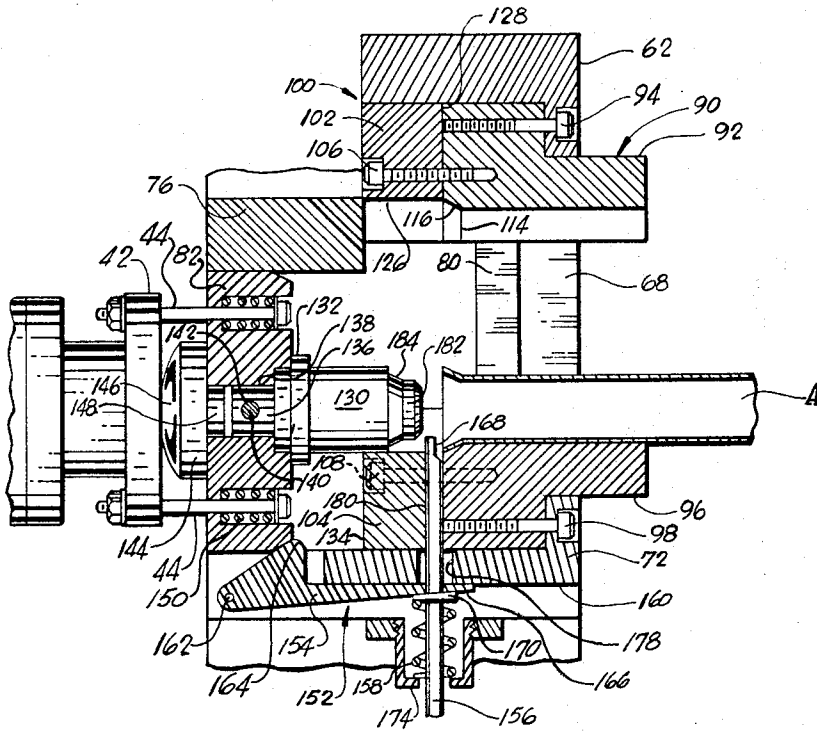


FIG 7

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TUBE FLARING APPARATUS

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5 Sheets-Sheet 5

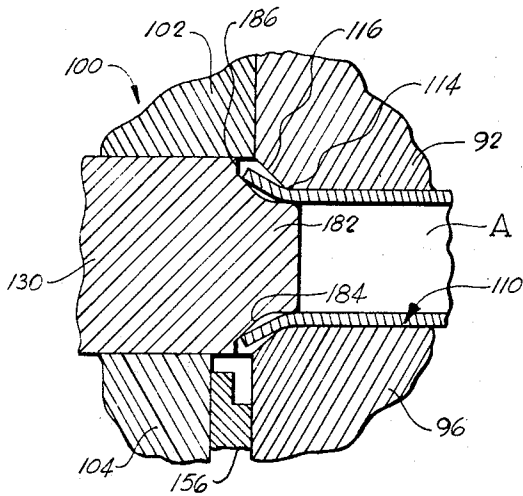


FIG 9

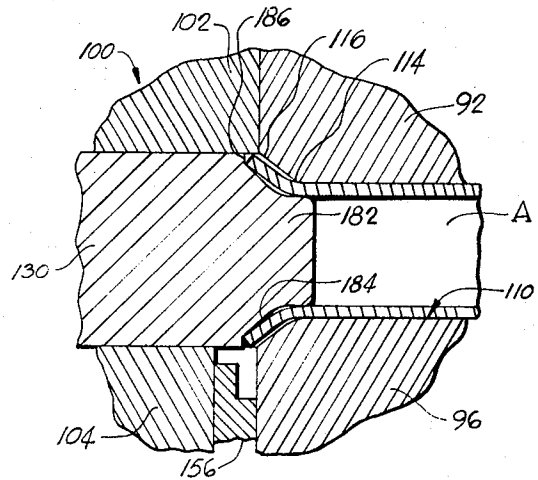


FIG 10

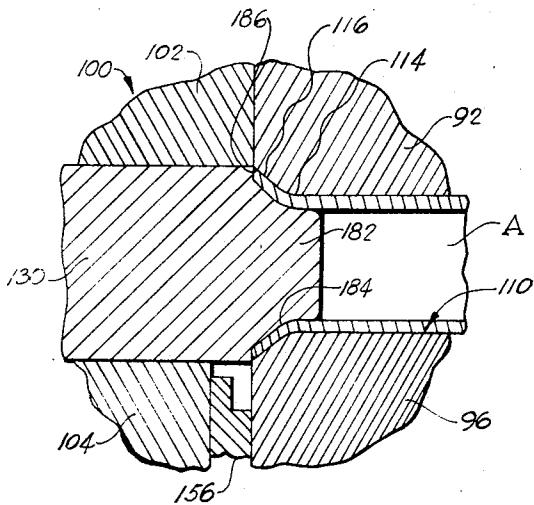


FIG 11

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3,411,338

TUBE FLARING APPARATUS

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13 Claims. (Cl. 72-293)

ABSTRACT OF THE DISCLOSURE

A tube flaring apparatus having a male die mounted on the plunger of an actuating cylinder for reciprocal movement toward and away from a female die. The female die has a plunger guide fixed thereto to maintain precise alignment of the male die axis with the female die axis. The female die together with the plunger guide is split along the axis of its bore to allow for separation for insertion of tubing. A locator pin acts as a stop to control the longitudinal positioning of the tubing with respect to the female die flare. Locator pin is automatically retracted out of the path of the male die plunger by initial movement of the plunger. Tubing is restrained against movement in the female die by interference fit with the tapered bore or by an abrasive insert secured in the bore of the die segments.

The present invention relates to apparatus for shaping the ends of tubes and more particularly to apparatus for forming a flare on the ends of tubes.

It has been the practice in the tube flaring art to flare tubes by the use of spinning mandrels, rotating cams or spools, or various types of tools actuated by hand or fluid power against the tube end while the tube is restrained against movement. Certain disadvantages are apparent in the use of such devices. Amongst these is the inability of the devices to repeatedly form a precise tube flare of the particular angles desired. In addition, prior methods consumed considerable forming time as a result of utilizing manual power for certain phases of the tube flaring operation. Consequently, the end product embodied flares that were not only dimensionally inaccurate but were replete in the structural imperfections inherent in the basic tubing or basic tubing material.

Moreover, conventional tube forming methods and devices fail to take into consideration dimensional variances of the tube per se, such as out-of-roundness and irregularities in the tube wall thickness each of which adversely affect the accuracy of the flared tube end. Additionally, usual tube forming methods and devices re-distribute the material of the tube embodying the above mentioned variances causing these inaccuracies to appear in the flared tube end. Thus the formed ends of the tubes may be unsatisfactory in respect to the accuracy of the angle of flare, wall thickness, concentricity, and roundness, which in turn may result in leakage at joints or connections when subjected to the pressures of the particular system involved.

The apparatus of the present invention eliminates the aforementioned deficiencies of the prior devices and provides a means whereby the end portions of tubes are repeatedly formed to precise flare shapes by means of controlled trap displacement of material with controlled force and stroke.

Accordingly, it is an object of this invention to provide apparatus which will form the end portions of tubes accurately and economically.

Another object of the present invention is to provide apparatus which will shape the ends of tubes to precision forms by controlling displacement of tube material during application of forming pressure.

Still another object of the invention is to provide tube

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flaring apparatus which flares the ends of tubes to accurate angles.

Another object of this invention is to provide tube flaring apparatus which will produce perfectly round and concentric flares on tube ends.

It is yet another object of this invention to provide tube flaring apparatus which clamps the tube to be formed, preventing movement thereof during the forming operation whereby accurate forming of the tube end is achieved.

Other objects and advantages of this invention will further become apparent hereinafter in the drawings, in which:

FIGURE 1 is a perspective view of the tube flaring apparatus of the present invention.

FIGURE 2 is a front elevational view of the male actuator assembly and die assembly with portions broken away and in section to facilitate the illustration.

FIGURE 3 is an end elevational view of the die assembly and die assembly actuator with portions broken away and in section to expose the interior construction thereof.

FIGURE 4 is a perspective view of the die assembly with the movable portion thereof shown in open position for receiving tubing to be flared.

FIGURE 5 is an enlarged cross-sectional view taken on the line 5-5 of FIGURE 2 showing the positions of the various components of the die assembly immediately prior to the flaring operation.

FIGURE 6 is a view taken in the same plane as FIGURE 5 showing the positions of the various components of the die assembly upon completion of the flaring operation.

FIGURE 7 is a view similar to FIGURE 6 showing the die assembly in open position for removal of the flared tube.

FIGURE 8 is a fragmentary sectional view illustrating a modified form of the tube clamping die.

FIGURE 9 is an enlarged fragmentary sectional view showing the beginning of the flaring operation as the male die enters the tubing.

FIGURE 10 is a view similar to FIGURE 9 showing the male die further advanced into the tubing, and

FIGURE 11 is a view similar to FIGURES 9 and 10 showing the final position of the male die at the completion of the flaring operation.

The tube flaring apparatus of the present invention comprises generally of a male die and a female die, the latter being of split construction to permit removal of the flared tube from the female die cavity. The female die assembly includes means to restrain the tubing against axial movement within the die cavity during the flaring operation. The male die is cantilevered from a carriage which is reciprocated toward and away from the female die by a hydraulic actuator. In order to assure precision alignment of the cantilevered male die with the axis of the female die, a guide member secured to the female die supports the male die immediately adjacent the flaring end thereof. The guide member together with the male die carriage and the split female die assembly are positioned within a housing. The housing serves as a means to direct the movement of the male die carriage in addition to directing the movement of the movable half of the split female die and guide member. Thus the movable members of the tube flaring apparatus are maintained in precise alignment with the stationary members through their being positioned within a housing common to both.

In order to form a tube flare of precise configuration and dimensions, it is necessary to accurately control the position of the end of the unflared tube with respect to the flare seat of the female die. A locator or stop pin serves this function by forming an abutment against which the end of the tube is engaged when it is properly

positioned within the cavity of the female die. The spring-biased locator pin is automatically withdrawn out of the path of the male die by the initial movement of the male die carriage towards the closed female die assembly. As the male die advances towards the female die, the pilot portion thereof enters the tubing bore whereafter the tubing is flared as the flare portion of the male die progresses towards the female die seat. Subsequently, the flare is completed and the male die is returned to its starting position by its hydraulic actuator. A similar hydraulic actuator is suitably coupled to the movable portion of the female die and guide member assembly whereby the assembly is moved away from the stationary portion thereof to allow for the removal of the completed flared tube.

Referring to the drawings and in particular to FIGURES 1, 2 and 3, there is shown the tube flaring apparatus of the present invention generally consisting of a forming actuator assembly 10, a clamping actuator assembly 12, and a die assembly 14.

The forming actuator assembly 10 is shown as having a cylinder 16 suitably secured to a mount or cylinder support 18 as by engagement of external threads of the cylinder mating with internal threads of the mount. The mount 18 is secured to a suitable table or support 19 as by bolts 20.

The actuator assemblies 10 and 12 are of a usual construction each comprising a cylinder 16 and 50 respectively in which a spring biased piston (not shown) is reciprocated in one direction by hydraulic action and in the opposite direction by spring action.

An adapter 40 secured to the free end of the piston rod of actuator assembly 10 is provided with a flange portion 42 for coupling to a plunger carriage 82 as by bolts and nuts 44. Conduits 48 and 74 connect the cylinders 6 and 50 respectively with a suitable hydraulic pressure source (not shown).

The cylinder 50 of the actuator assembly 12 is secured to a support or mounting member 52 by threaded engagement therewith (not shown) in a manner similar to the attachment of the cylinder 16 to the amount 18 of the actuator assembly 10. Bolts or screws 54 fixedly secure the support 52 to the table 19. A piston rod 58 extending through an end wall of the cylinder 50 is provided with a flanged portion 60 which serves to secure the piston rod 58 to a movable die holder 62 of the die assembly 14 as by bolts 64.

The die assembly 14 comprises a base plate member 68 secured to the table 19 by bolts 70, a stationary die holder member 72, movable die holder 62, a wall member 76 and a cover member 78.

Rails 80 and 84 fixed to the base plate member 68 and cover member 78 respectively are slidably received in upper and lower recesses 86 and 88 in the movable die holder 62. A female die assembly 90 comprises die components 92 and 96. Die component 92 secures to the movable die holder 62 by bolts or screws 94. Die component 96 secures to the stationary die holder member 72 by bolts or screws 98. A plunger guide 100 is similarly divided into two components 102 and 104. Guide component 102 is secured to die component 92 by bolts or screws 106. Guide component 104 is secured to die component 96 by bolts or screws 108. When die components 92 and 96 together with their associated plunger guide components 102 and 104 are in the clamped or closed position as shown in FIGURES 1, 3, 5, 6, 9, 10 and 11, they define a precision bore generally designated by the numeral 110. Bore 110 is preferably tapered, having a diameter at the outside face 112 of the female die assembly 90 slightly less than the diameter at the transition 114 with the female flare die seat 116. The tapered bore 110 serves as a means to exert a clamping force on the workpiece or tubing A as a result of the smallest diameter thereof being slightly smaller than the outside diameter of the tube A. Thus the tubing A is restrained

against axial and rotational movement during the flaring operation.

FIGURE 8 illustrates a modified form of clamping arrangement wherein inserts 118 and 120 are positioned within recess 122 and 124 of movable die holder 62 and stationary die holder 72 respectively. Inserts 118 and 120 are preferably fabricated from epoxy material having granules of abrasive material or the like suspended therein. The friction afforded by these abrasive granules is sufficient to prevent axial and rotational movement of the tubing A during the flaring operation.

The plunger guide components 102 and 104 when in closed position (FIGURES 1, 3, 5, 6, 9, 10 and 11), define a bore 126. The axis of bore 126 is precisely aligned with the axis of bore 110 of the female die assembly 90. A plunger or male die 130 carried by the plunger carriage 82 is slidably received in the bore 126 of the plunger guide 100. In addition to serving as a guide for the plunger 130, the guide 100 further serves to limit the travel of the plunger toward the flare die seat 116. This is achieved through engagement of an enlarged base portion 132 of the plunger 130 with the inside face 134 of the plunger guide 100.

Plunger 130 is removably secured to the plunger carriage 82. Adjacent its base portion 132, plunger 130 is provided with a shank portion 136 which projects into a bore 138 in the plunger carriage 82. A pin 140 extends through an aperture in the carriage 82 (not shown) and through an opening 142 in the shank 136 to secure the plunger 130 to the carriage 82. An anvil 144 having a convex head 146 mounts on the carriage 82 with its shank end 148 projecting into the bore 138 thereof opposite the shank 136 of the plunger 130. The convex head 146 engages the flat face of the flange 42 of the piston adapter 40. In order that the carriage 82 may be freely reciprocated within the die assembly housing 14 without binding, the bolts and nuts 44 which couple the carriage 82 to the piston adapter 40 are preloaded by compression springs 150 interposed between the bolt heads and the carriage. Thus a slight misalignment condition between the axis of the actuator cylinder 16 and die assembly housing 14 may be tolerated as a result of the flexible connection afforded by the spring loaded bolt connection and the point contact afforded by the engagement of the convex anvil with the flat flange of the piston adapter.

An automatic tube indexing mechanism generally designated by the numeral 152, provides means whereby the tubing A is precisely located within the bore of the female die assembly 90 relative to the face 128 thereof. Tube indexing assembly 152 comprises a trip lever 154, a stop or locator pin 156, and a compression spring 158. The stationary die holder member 72 is provided with a groove or recess 160 in which the trip lever 154 is positioned. A pivot pin 162 pivotally secures the trip lever 154 to the die holder member 72. A node 164 projecting from the trip lever 154 extends through an opening in the wall of the die holder member 72 and into the path of travel of the plunger carriage 82. The end 166 of the trip lever 154 opposite its pivotal connection with the die holder member 72 is bifurcated to receive the stop pin 156. Stop pin 156 is a rod-like member having a flattened end 168 against which the tubing A rests prior to its being flared. Intermediate opposite ends of the stop pin 156, a collar or flange 170 is provided which engages the bifurcated end 166 of the trip lever 154. The end 172 opposite the flattened end 168 projects through an opening in a cap member 174 which is fixed to the die holder member 72 as by screws 176. The compression spring 158 positioned about the stop pin 156 is interposed between the collar 170 thereof and the inside surface of the cap member 174.

As hereinbefore described, the female die assembly 90 and the plunger guide 100 are secured to one another by bolts 106 and 108. In preparation for flaring tubing of apperticular diameter, matched die sets are selected

commensurate with the diameter of the tubing. The male die or punch 130 is positioned in the bore 138 of the carriage 82 and the pin 140 is inserted in the opening in the carriage and punch to thereby secure the punch to the carriage. The die assembly 90 together with its plunger guide 100 is bolted to the movable die holder 62 and stationary die holder member 72 by bolts 94 and 98 respectively. The locator pin 156 may next be inserted through the hole 178 in the wall of the stationary die holder member 72 and into the opening 180 of the plunger guide component 104. Spring 158 is then placed over the end 172 of the locator pin 156 and the cap member 174 is positioned over the spring and secured to the stationary die holder member 72 by the screws 176.

With the movable die holder 62 set in open position as shown in FIGURE 4, the tubing A is positioned in the half bore of the female die component 96 with the end to be flared resting against the flat 168 of the locator pin 156. Subsequently, the clamping cylinder 50 is energized, moving the movable die holder 62 on the rails 80 and 84 of base plate 68 and cover member 78 respectively to its closed position as shown in FIGURE 5. Hydraulic pressure is maintained on the piston of the cylinder 50 to apply sufficient clamping pressure on the tubing A during the flaring process to prevent its being moved. It will thus be apparent that the locator pin 156 serves to precisely gauge the length of tubing projecting beyond the flare die seat 116 as required to form a perfect flare while the tubing is positively clamped against movement in the female die assembly 90.

Upon closing of the female die components about the tubing A, the cylinder 16 is energized whereupon movement of the ram thereof transmits motion to the carriage 82 through the anvil 144 and flange 42 of the adapter 40. The carriage 82, upon initial movement thereof, strikes the node 164 of the trip lever 154 pivoting it about the axis of its pivot pin 162. The bifurcated end 166 of the trip lever 154 in contact with the collar 170, moves the locator pin 156 against the bias of the spring 158 clear of the bore 126 of the plunger guide 100. As the plunger 130 carried by the carriage 82 and guided by the plunger guide 100, advances towards the tubing A, the pilot portion 182 thereof enters the bore of the tubing A. Subsequently, the end of the tubing is engaged by the flare portion 184 of the plunger 130, FIGURE 9, whereupon the tubing is radially stretched as the flare is being formed. FIGURE 10 shows the tube flared to its maximum diameter and the end surface thereof engaging the shoulder portion 186 of the plunger 130. FIGURES 6 and 11 show the flare completely formed as the plunger 130 reaches the end of its stroke. In this position the base 132 of the plunger 130 is engaged with the face 134 of the plunger guide 100 whereby positive stroke control is achieved. It will be apparent from the illustrations of FIGURES 10 and 11 that the male and female dies as combined with the plunger guide, completely trap the end of the tubing as it is being flared, displacing the material and increasing the thickness of the wall of the flared end of the tubing.

To complete the cycle, the plunger 130 and plunger carriage 82 are returned to the starting position by release of the hydraulic pressure from within the cylinder 16. Gage pin 156 is reciprocated by bias of the spring 158 projecting the flattened end 168 thereof into the bore 126 of the plunger guide 100 as the carriage 82 passes beyond the node 164 of the trip lever 154. As shown in FIGURE 7, the movable portion of the female die assembly 90 is then separated from pressure contact with the stationary die component 96 by release of hydraulic pressure from within the cylinder 50. Removal of the flared tube is thus made possible by the spaced apart attitude of the female die components.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will

be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

I claim:

1. A tube flaring apparatus comprising:
 - a female die assembly,
 - means defining a bore in said female die assembly, said bore having a flare seat portion,
 - said female die assembly having a movable and a stationary portion,
 - said movable portion being separable from said stationary portion of said female die assembly from a closed to an open position,
 - said bore being separated along its longitudinal axis when said female die assembly is in open position,
 - plunger means having a flare portion movable toward and away from said flare seat portion of said bore of said female die assembly,
 - guide means connected to said female die assembly,
 - means defining a bore in said guide means,
 - said bore of said guide means being coextensive with and axially aligned with the bore of said female die assembly,
 - said plunger means being slidably positioned in said bore of said guide means,
 - said plunger means being engageable with a tubular workpiece positioned in the bore of said female die assembly,
 - and said plunger means when moved toward said flare seat portion of said female die assembly, displacing the material of said tubular workpiece to conform with the flare portion of said plunger and the flare seat portion of said female die assembly.
2. A tube flaring apparatus comprising:
 - a female die assembly,
 - means defining a bore in said female die assembly, said bore having a flare seat portion,
 - said female die assembly having a movable and a stationary portion,
 - said movable portion being separable from said stationary portion of said female die assembly from a closed to an open position,
 - said bore being separated along its longitudinal axis when said female die assembly is in open position,
 - plunger means having a flare portion movable toward and away from said flare seat portion of said bore of said female die assembly,
 - guide means connected to said female die assembly,
 - means defining a bore in said guide means,
 - said bore of said guide means being coextensive with and axially aligned with the bore of said female die assembly,
 - said plunger means being slidably positioned in said bore of said guide means,
 - said plunger means being engageable with a tubular workpiece positioned in the bore of said female die assembly,
 - said plunger means having a base portion in intimate contact with said guide means in its maximum moved position towards said flare seat portion of said female die assembly, and
 - said plunger means when moved toward said flare seat portion of said female die assembly, displacing the material of said tubular workpiece to conform with the flare portion of said plunger and the flare seat portion of said female die assembly.
3. A tube flaring apparatus comprising:
 - a female die assembly,
 - means defining a bore in said female die assembly, said bore having a flare seat portion,
 - said female die assembly having a movable and a stationary portion,
 - said movable portion being separable from said stationary portion of said female die assembly from a closed to an open position,

said bore being separated along its longitudinal axis when said female die assembly is in open position, plunger means having a flare portion movable toward and away from said flare seat portion of said bore of said female die assembly, 5
 guide means connected to said female die assembly, means defining a bore in said guide means, said bore of said guide means being coextensive with and axially aligned with the bore of said female die assembly, 10
 gage means movable in and out of said guide means bore for positioning a tubular workpiece in the bore of said female die assembly, said plunger means being slidably positioned in said bore of said guide means, 15
 said plunger means being engageable with said tubular workpiece, said plunger means when moved toward said flare seat portion of said female die assembly, displacing the material of said tubular workpiece to conform with the flare portion of said plunger and the flare seat portion of said female die assembly. 20
4. A tube flaring apparatus comprising:
 a female die assembly, means defining a bore in said female die assembly, 25
 said bore having a flare seat portion, said female die assembly having a movable and a stationary portion, said movable portion being separable from said stationary portion of said female die assembly from 30
 a closed to an open position, said bore being separated along its longitudinal axis when said female die assembly is in open position, a carriage movable toward and away from said flare seat portion of the bore of said female die assembly, 35
 plunger means carried on said carriage, guide means connected to said female die assembly, means defining a bore in said guide means, said bore of said guide means being coextensive with and axially aligned with the bore of said female die, 40
 said plunger means being slidably positioned in said bore of said guide means, said plunger means being engageable with a tubular workpiece positioned in the bore of said female die, and 45
 said plunger means when moved toward said flare seat portion of said female die assembly, displacing the material of said tubular workpiece to conform with the flare portion of said plunger and the flare seat portion of said female die assembly. 50
5. A tube flaring apparatus comprising:
 a female die assembly, means defining a bore in said female die assembly, said bore having a flare seat portion, said female die assembly having a movable and a stationary portion, 55
 said movable portion being separable from said stationary portion of said female die assembly from a closed to an open position, said bore being separated along its longitudinal axis when said female die assembly is in open position, a carriage movable toward and away from said flare seat portion of the bore of said female die assembly, trip lever means engaging said gage means, 60
 a node or said trip lever means engaging said carriage, plunger means carried on said carriage, guide means connected to said female die assembly, means defining a bore in said guide means, said bore of said guide means being coextensive with and axially aligned with the bore of said female die, 70
 gage means movable in and out of the bore of said guide means for positioning a tubular workpiece in the bore of said female die assembly, said plunger means being slidably positioned in said bore of said guide means, 75

said plunger means being engageable with a tubular workpiece, said plunger means having a base portion in intimate contact with said guide means in its maximum moved position towards said flare seat portion of said female die assembly, 5
 said plunger means when moved toward said flare seat portion of said female die assembly, displacing the material of said tubular workpiece to conform with the flare portion of said plunger and the flare seat portion of said female die assembly.
6. A male and female die assembly for a tube flaring apparatus comprising:
 a female die assembly, means defining a bore in said female die assembly, said bore having a flare seat portion, said female die assembly having a movable and a stationary portion, said movable portion being separable from said stationary portion of said female die assembly from a closed to an open position, said bore being separated along its longitudinal axis when said female die assembly is in open position, guide means fixed to said female die assembly, means defining a bore in said guide means, said bore of said guide means being coextensive with and axially aligned with the bore of said female die assembly, said bore of said guide means being substantially equal in diameter to the major diameter of said flare seat, a male die plunger having a flare portion positioned intermediate a shoulder portion and a pilot portion, said male die plunger having a body portion slidably received in the bore of said guide means, and said pilot portion of said male die plunger being movable into and out of the bore of said female die assembly.
7. A male and female die assembly for a tube flaring apparatus comprising:
 a female die assembly, means defining a tapered bore in said female die assembly, said bore having a flare seat portion, said tapered bore at its smallest end being of a dimension slightly less than the outside dimension of a tubular workpiece to be flared, said female die assembly having a movable and a stationary portion, said movable portion being separable from said stationary portion of said female die assembly from a closed to an open position, said bore being separated along its longitudinal axis when said female die assembly is in open position, guide means fixed to said female die assembly, means defining a bore in said guide means, said bore of said guide means being coextensive with and axially aligned with the bore of said female die assembly, said bore of said guide means being substantially equal in diameter to the major diameter of said flare seat, a male die plunger having a flare portion positioned intermediate a shoulder portion and a pilot portion, said male die plunger having a body portion slidably received in the bore of said guide means, and said pilot portion of said male die plunger being movable into and out of the bore of said female die assembly.
8. A tube flaring apparatus comprising:
 a die assembly positioned in a housing having a base plate, wall members, and a cover member, upper and lower rails secured to said cover member and said base plate respectively, one of said wall members being slidably positioned on said upper and lower rails, an actuator connected to said slidable wall member,

said slidable wall member being movable by said actuator toward and away from a stationary wall member, a female die, said female die having a component fixedly secured to said slidable wall member and a component fixedly secured to said stationary wall member, said female die components having faces in intimate contact with one another when in closed position, said faces being spaced from one another when said female die components are in open position, means defining a bore through said female die components, said bore having its axis coincident with said faces of said female die components when in closed position, said bore being of tapered configuration, said tapered bore having its smallest dimension slightly less than the outside dimension of a tubular workpiece to be flared, a flared seat coextensive and axially aligned with said bore, said flare seat intersecting said tapered bore at its largest diameter, a plunger guide fixedly secured to said female die, means defining a bore in said plunger guide, said bore having its axis coextensive and aligned with said bore of said female die components, a plunger slidably received in said bore of said plunger guide, said plunger having a flare portion intermediate a shoulder portion and a pilot portion, said plunger having a base portion engaging said plunger guide upon maximum positioning thereof towards said female die, said pilot portion of said plunger being of substantially like configuration and dimension to the interior of the tubular workpiece to be flared, and said shoulder portion of said plunger displacing the material of the tubular workpiece flare into said female die flare seat upon engaging of the base portion of said plunger with said plunger guide.

9. A tube flaring apparatus comprising: a die assembly positioned in a housing having a base plate, wall members, and a cover member, upper and lower rails secured to said cover member and said base plate respectively, one of said wall members being slidably positioned on said upper and lower rails, an actuator connected to said slidable wall member, said slidable wall member being movable by said actuator toward and away from a stationary wall member, a female die, said female die having a component fixedly secured to said slidable wall member and a component fixedly secured to said stationary wall member, said female die components having faces in intimate contact with one another when in closed position, said faces being spaced from one another when said female die components are in open position, means defining a bore through said female die components, said bore having its axis coincident with said faces of said female die components when in closed position, said bore being of tapered configuration, said tapered bore having its smallest dimension slightly less than the outside dimension of a tubular workpiece to be flared, a flare seat coextensive and axially aligned with said bore, said flare seat intersecting said tapered bore at its largest diameter, a plunger guide, said plunger guide having a component fixedly secured to said female die component connected to said slidable wall member, said plunger guide having a component fixedly secured to said female die component connected to said stationary wall member, means defining a bore in said plunger guide, said bore having its axis coextensive and aligned with said bore of said female die components, a carriage slidably mounted within said housing, an actuator flexibly linked to said carriage, said carriage being movable toward and away from said plunger guide by said actuator, a plunger carried on said carriage, said plunger being slidably received in said bore of said plunger guide, said plunger having a flare portion intermediate a shoulder portion and a pilot portion, said plunger having a base portion engaging said plunger

to said female die component connected to said stationary wall member, means defining a bore in said plunger guide, said bore having its axis coextensive and aligned with said bore of said female die components, a carriage slidably mounted within said housing, an actuator flexibly linked to said carriage, said carriage being movable toward and away from said plunger guide by said actuator, a plunger carried on said carriage, said plunger being slidably received in said bore of said plunger guide, said plunger having a flare portion intermediate a shoulder portion and a pilot portion, said plunger having a base portion engaging said plunger guide upon maximum positioning thereof towards said female die, said pilot portion of said plunger being of substantially like configuration and dimension to the interior of the tubular workpiece to be flared, and said shoulder portion of said plunger displacing the material of the tubular workpiece flare into said female die flare seat upon engaging of the base portion of said plunger with said plunger guide.

10. A tube flaring apparatus comprising: a die assembly positioned in a housing having a base plate, wall members, and a cover member, upper and lower rails secured to said cover member and said base plate respectively, one of said wall members being slidably positioned on said upper and lower rails, an actuator connected to said slidable wall member, said slidable wall member being movable by said actuator toward and away from a stationary wall member, a female die, said female die having a component fixedly secured to said slidable wall member and a component fixedly secured to said stationary wall member, said female die components having faces in intimate contact with one another when in closed position, said faces being spaced from one another when said female die components are in open position, means defining a bore through said female die components, said bore having its axis coincident with said faces of said female die components when in closed position, said bore being of tapered configuration, said tapered bore having its smallest dimension slightly less than the outside dimension of a tubular workpiece to be flared, a flare seat coextensive and axially aligned with said bore, said flare seat intersecting said tapered bore at its largest diameter, a plunger guide, said plunger guide having a component fixedly secured to said female die component connected to said slidable wall member, said plunger guide having a component fixedly secured to said female die component connected to said stationary wall member, means defining a bore in said plunger guide, said bore having its axis coextensive and aligned with said bore of said female die components, a carriage slidably mounted within said housing, an actuator flexibly linked to said carriage, said carriage being movable toward and away from said plunger guide by said actuator, a plunger carried on said carriage, said plunger being slidably received in said bore of said plunger guide, said plunger having a flare portion intermediate a shoulder portion and a pilot portion, said plunger having a base portion engaging said plunger

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guide upon maximum positioning thereof towards said female die,
 a gage pin movable in and out of the bore of said plunger guide for longitudinally positioning said tubular workpiece in the bore of said female die,
 said pilot portion of said plunger being of substantially like configuration and dimension to the interior of the tubular workpiece to be flared, and
 said shoulder portion of said plunger displacing the material of the tubular workpiece flare into said female die flare seat upon engaging of the base portion of said plunger with said plunger guide.

11. A tube flaring apparatus comprising:

a die assembly positioned in a housing having a base plate, wall members, and a cover member,
 one of said wall members being slidably positioned in said housing,
 an actuator connected to said slidable wall member, said slidable wall member being movable by said actuator toward and away from a stationary wall member, a female die,
 said female die having a component fixedly secured to said slidable wall member and a component fixedly secured to said stationary wall member,
 said female die components having faces in intimate contact with one another when in closed position, said faces being spaced from one another when said female die components are in open position,
 means defining a bore through said female die components,
 said bore having its axis coincident with said faces of said female die components when in closed position, said bore being of tapered configuration,
 said tapered bore having its smallest dimension slightly less than the outside dimension of a tubular piece to be flared,
 a flare seat coextensive and axially aligned with said bore,
 said flare seat intersecting said tapered bore at its largest diameter,
 a plunger guide,
 said plunger guide having a component fixedly secured to said female die component connected to said slidable wall member,
 said plunger guide having a component fixedly secured to said female die component connected to said stationary wall member,
 means defining a bore in said plunger guide,
 said bore having its axis coextensive and aligned with said bore of said female die components,
 a carriage slidably mounted within said housing,
 an actuator flexibly linked to said carriage,
 said carriage being movable toward and away from said plunger guide by said actuator,
 a plunger carried on said carriage,
 said plunger being slidably received in said bore of said plunger guide,
 said plunger having a flare portion intermediate a shoulder portion and a pilot portion,
 said plunger having a base portion engaging said plunger guide upon maximum positioning thereof towards said female die,
 a gage pin movable in and out of the bore of said plunger guide for longitudinally positioning said tubular workpiece in the bore of said female die,
 said pilot portion of said plunger being of substantially like configuration and dimension to the interior of the tubular workpiece to be flared, and
 said shoulder portion of said plunger displacing the material of the tubular workpiece flare into said female die flare seat upon engaging of the base portion of said plunger with said plunger guide.

12. A tube flaring apparatus comprising:

a die assembly positioned in a housing having a base plate, wall members, and a cover member,

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one of said wall members being slidably positioned in said housing,
 an actuator connected to said slidable wall member, said slidable wall member being movable by said actuator toward and away from a stationary wall member, a female die,
 said female die having a component fixedly secured to said slidable wall member and a component fixedly secured to said stationary wall member,
 said female die components having faces in intimate contact with one another when in closed position, said faces being spaced from one another when said female die components are in open position,
 means defining a bore through said female die components,
 said bore having its axis coincident with said faces of said female die components when in closed position, said bore being of tapered configuration,
 said tapered bore having its smallest dimension slightly less than the outside dimension of a tubular workpiece to be flared,
 a flare seat coextensive and axially aligned with said bore,
 said flare seat intersecting said tapered bore at its largest diameter,
 a plunger guide,
 said plunger guide having a component fixedly secured to said female die component connected to said slidable wall member,
 said plunger guide having a component fixedly secured to said female die component connected to said stationary wall member,
 means defining a bore in said plunger guide,
 said bore having its axis coextensive and aligned with said bore of said female die components,
 a carriage slidably mounted within said housing,
 an actuator flexibly linked to said carriage,
 said carriage being movable toward and away from said plunger guide by said actuator,
 a plunger carried on said carriage,
 said plunger being slidably received in said bore of said plunger guide,
 said plunger having a flare portion intermediate a shoulder portion and a pilot portion,
 said plunger having a base portion engaging said plunger guide upon maximum positioning thereof towards said female die,
 said pilot portion of said plunger being of substantially like configuration and dimension to the interior of the tubular workpiece to be flared, and
 said shoulder portion of said plunger displacing the material of the tubular workpiece flare into said female die flare seat upon engaging of the base portion of said plunger with said plunger guide.

13. A tube flaring apparatus comprising:
 a die assembly positioned in a housing having a base plate, wall members, and a cover member,
 upper and lower rails secured to said cover member and said base plate respectively,
 one of said wall members being slidably positioned on said upper and lower rails,
 an actuator connected to said slidable wall member, said slidable wall member being movable by said actuator toward and away from a stationary wall member, a female die,
 said female die having a component fixedly secured to said slidable wall member and a component fixedly secured to said stationary wall member,
 said female die components having faces in intimate contact with one another when in closed position, said faces being spaced from one another when said female die components are in open position,
 means defining a bore through said female die components,
 said bore having its axis coincident with said faces of

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said female die components when in closed position,
 said bore being of tapered configuration,
 said tapered bore having its smallest dimension slightly
 less than the outside dimension of a tubular work-
 piece to be flared, 5
 a flare seat coextensive and axially aligned with said
 bore,
 said flare seat intersecting said tapered bore at its larg-
 est diameter,
 a plunger guide, 10
 said plunger guide having a component fixedly secured
 to said female die component connected to said
 slidable wall member,
 said plunger guide having a component fixedly secured
 to said female die component connected to said station- 15
 ary wall member,
 means defining a bore in said plunger guide,
 said bore having its axis coextensive and aligned with
 said bore of said female die components,
 a carriage slidably mounted within said housing, 20
 an actuator flexibly linked to said carriage,
 said carriage being movable toward and away from
 said plunger guide by said actuator,
 a plunger carried on said carriage,
 said plunger being slidably received in said bore of said 25
 plunger guide,
 said plunger having a flare portion intermediate a
 shoulder portion and a pilot portion,
 said plunger having a base portion engaging said plung- 30
 er guide upon maximum positioning thereof to-
 wards said female die,

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a trip lever having one end thereof pivotally secured
 to said stationary wall member,
 said trip lever having its opposite end in contact with
 a gage pin,
 a node projecting from said trip lever extending into
 the path of travel of said slidable carriage,
 said gage pin being slidable in a bore of the stationary
 component of said plunger guide,
 a spring normally biasing one end of said gage pin into
 the bore of said plunger guide,
 said trip lever moving said gage pin clear of said plung-
 er guide bore upon initial movement of said carri-
 age,
 said pilot portion of said plunger being of substantially
 like configuration and dimension to the interior of
 the tubular workpiece to be flared, and
 said shoulder portion of said plunger displacing the
 material of the tubular workpiece flare into said fe-
 male die flare seat upon engaging of the base por-
 tion of said plunger with said plunger guide.

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