

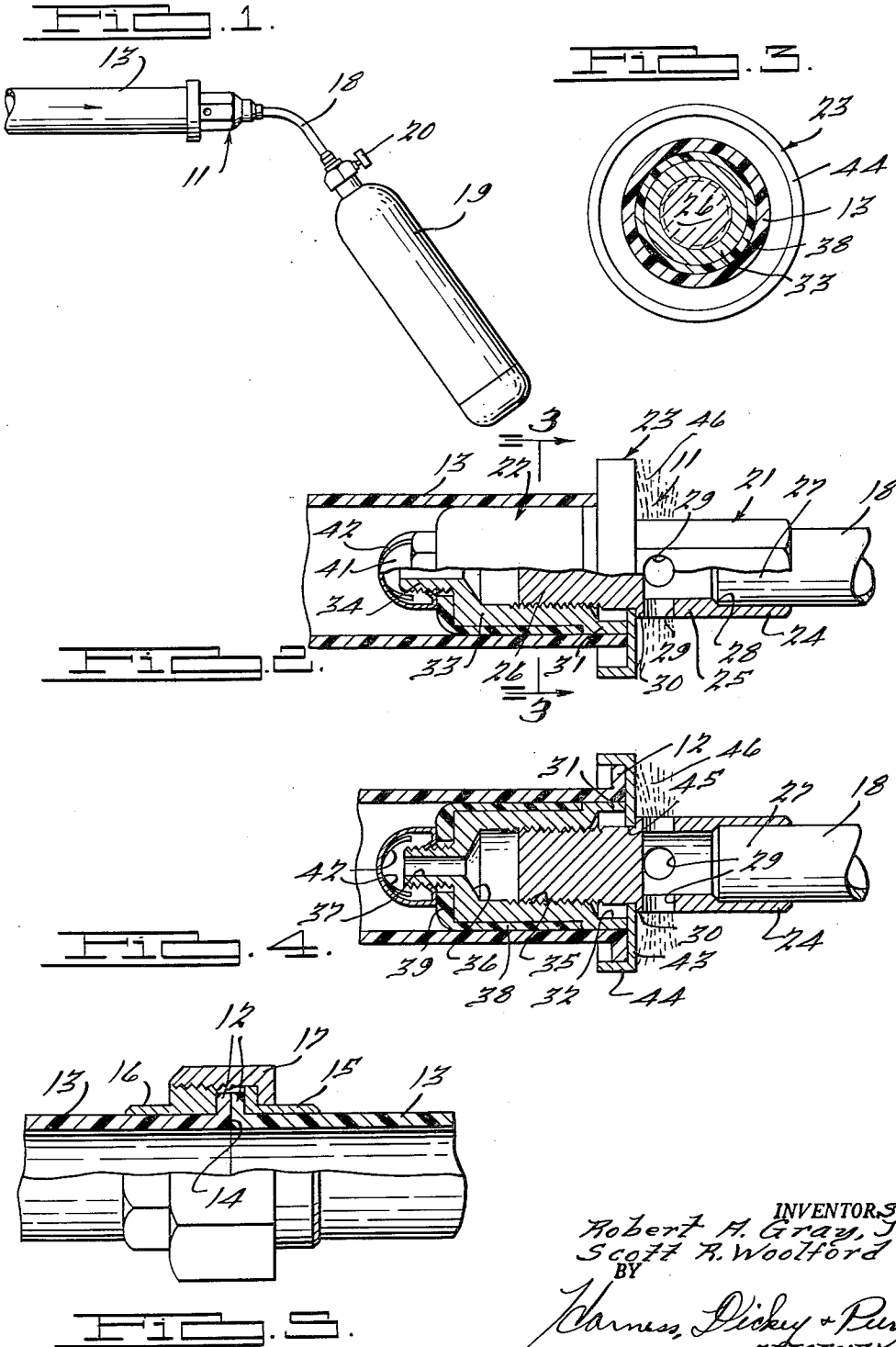
July 10, 1962

R. A. GRAY, JR., ETAL

3,042,965

FORMING TOOL FOR PLASTIC PIPE

Filed Oct. 19, 1959



INVENTORS
Robert H. Gray, Jr.
Scott R. Woolford
BY
Karnes, Dickey & Purdie.
ATTORNEYS.

1

3,042,965

FORMING TOOL FOR PLASTIC PIPE

Robert A. Gray, Jr., and Scott R. Woolford, Port Huron, Mich., assignors to Mueller Brass Co., Port Huron, Mich., a corporation of Michigan

Filed Oct. 19, 1959, Ser. No. 847,116

7 Claims. (Cl. 18—1)

This invention relates to forming tools, and more particularly to devices for forming flanges or other shapes on the ends of plastic tubing for joining purposes.

The increasingly widespread use of plastic tubing for industrial and home purposes has emphasized the necessity of providing means and methods for connecting tubing lengths to each other or to other fittings, in such a manner as to minimize interference with fluid flow, while providing a fluid-type joint which will resist deterioration. Past solutions for this problem, especially those used in the field, have had important disadvantages because of undesired diameter reductions at the connection, or the use of materials dissimilar to the plastic which might be subject to attack from fluids carried by the tubing.

It is an object of the present invention to provide a novel and improved forming tool for use in conjunction with plastic tubing of the thermoplastic type which enables end flanges or other shapes to be quickly formed on the tubing in such a manner that the tubing may be connected to another member without reduction in diameter of the fluid flow path, or contact of any extraneous material with the fluid.

It is another object to provide an improved forming device of this nature which is especially adapted for field use and may be used in conjunction with a conventional torch for heating the tubing end prior to forming, without the necessity of subjecting the tubing material to direct flame.

It is a further object to provide an improved tube forming device of this character which enables the accurate and uniform formation of flanges or other shapes on tubing ends without unnecessarily heating or softening the adjacent length of tubing.

It is also an object to provide an improved tube forming apparatus of the above nature which permits quick cooling of the formed tube flange by water quenching, while minimizing the possibility of malformation of subsequent flanges by the formation of steam from residual water in the device.

It is another object to provide a novel and improved flange forming tube having the above characteristics, which is of a portable nature and is so constructed as to facilitate its production in large quantities.

Other objects, features, and advantages of the present invention will become apparent from the subsequent description, taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is a side elevational view of the novel forming tool shown in conjunction with a length of plastic tubing and a portable torch;

FIGURE 2 is a side elevational view in cross-section of the forming device itself, shown with the tube in its initial position;

FIGURE 3 is a cross-sectional view taken along the line 3—3 of FIGURE 2 and showing the configuration of the mandrel which supports the work as well as the mold which forms the flange;

FIGURE 4 is a view similar to FIGURE 2 showing the tube in its formed position; and

FIGURE 5 is a side elevational view partially in cross-section showing the manner in which two sections of plastic tubing having flanges formed thereon may be

2

joined without reducing the flow diameter or permitting contact of extraneous material with the fluid.

In general terms, the invention comprises an elongated assembly of elements having an adapter portion at one end for receiving the nozzle or outlet of a heater such as a portable torch, and a mandrel at the opposite end adapted to be inserted in one end of a length of plastic tubing. A mold of annular shape is mounted at an intermediate portion of the device. The adapter portion of the device includes means for applying heat to the mold from the flame emitted by the torch, so that the end of the plastic tubing engaging the mold will be heated. The main portion of the mandrel has a cover of heat insulative material so that a minimum amount of heat will be transferred to the tubing beyond that portion which is to be formed into a flange.

As the tubing end is heated, the tubing is pushed on the mandrel toward the flange so that the softened plastic will spread outwardly and fill the mold cavity. The tubing end may then be cooled by dipping it, together with the forming device, into water, and the tubing is then removed from the device. The assembly is preferably fabricated of two separate threadably connected parts so as to facilitate mass production, with the mold being held between the two parts. Means are provided in the form of appropriate passageways and vent means for preventing steam which may be formed during successive quenching and forming operations from being forced between the mold and softened tube end in such a manner as might cause malformation of the flange.

Referring more particularly to the drawings, the flange forming device is generally indicated at 11 and is adapted to form an outwardly directed flange 12 on a tube 13 formed of a thermoplastic material such as a polyethylene resin. FIGURE 5 illustrates the use of tubing having these flanges which are joined together in such a manner as to preserve the original tube diameter and keep substances other than the plastic itself from coming into contact with the fluid. For illustrative purposes, flange 12 is shown as being of rectangular cross-sectional shape with an outer surface 14 in a radial plane, so that flanges may be mated in flush relation. The flanges are united by slipping a flange collar 15 on one tube and a threaded collar 16 on the other tube, with an internally threaded coupling member 17 being slipped over collar 15 and threaded onto collar 16 to draw the flanges together. It will be understood that end shapes other than that of flange 12 could be formed by applicant's novel device within the principles of the invention.

As shown in FIGURE 1, device 11 is adapted to be mounted on the outer end of a tube 18 extending from a portable torch 19 of a conventional type which emits a flame from the tip of tube 18 and is controlled by a valve 20. Although this construction adapts unit 11 for field use where, for example, lengths of tubing coils are cut and flanged as required, the invention in its broader sense contemplates the provision of other heat sources.

Unit 11 comprises a body generally indicated at 21, a mandrel generally indicated at 22 threadably mounted on the body, and a mold generally indicated at 23 which is mounted on the body and is secured thereto by mandrel 22. Body 21 is of elongated shape and includes a tubular adapter portion 24 at one end thereof, a tubular flame diverting portion 25 and a mandrel supporting portion 26. Adapter portion 24 has an internal diameter which is preferably such as to enable it to fit over the tip 27 of burner tube 18, with the end of the burner tube engaging a shoulder 28. Flame diverting portion 25 has a slightly smaller diameter than portion 24, and is provided with a plurality of radially extending ports 29 adjacent a shoulder 30 at the inner portion thereof. Mandrel supporting portion 26 is of reduced diameter compared

with the diameter of portion 25 and is externally threaded along a major portion of its length. Both body 21 and mandrel 22 are fabricated of a heat conducting material such as brass. Mandrel 22 is of somewhat larger diameter than the main portion of body 21 and has a tubular inner portion 31 with a bore 32 and a main portion 33 having a slightly reduced outside diameter. An externally threaded extension 34 is formed on the outer end of mandrel 33, this extension being of smaller diameter than the other portions of the mandrel. The mandrel has an internally threaded portion 35 extending from portion 31, and the bore having this thread is connected by a transitional passage 36 with an axial bore 37 in extension 34.

A tubular insulating member 38 is mounted on portion 33 of mandrel 22, this insulating member being fabricated of a rigid heat resistant material such as certain known plastics. An inwardly directed shoulder 39 is formed at one end of member 38, this shoulder engaging the shoulder formed between portion 33 and extension 34 of mandrel 22. A nut 41 is threaded on extension 34 and holds insulating member 38 in place. The nut is preferably of a sheet metal type having openings or slots 42 so that steam emitted from passage 37 may easily escape therethrough. The outside diameter of insulating member 38 as well as that of mandrel portion 31 is preferably such that these surfaces are flush and will slide snugly into the end of tubing 13.

Mold 23 is shown as being of annular shape, with a radial wall portion 43 and an axially extending outer portion 44. The internal diameter 45 of mold 23 is such that it will fit onto mandrel supporting portion 26 of body 21 and engage shoulder 30. The size and diameter of outer portion 44 of the mold are such that the annular space between portion 31 of the mandrel and portion 44 of the mold will be equal to the desired size of the flange to be formed on tubing 13.

In assembling unit 11, insulating member 38 will be slipped onto mandrel 22 and held in place by nut 41. Mold 23 will be mounted on body 21 against shoulder 30 and mandrel 22 may then be threaded onto portion 26 of body 21 until portion 31 of the mandrel engages the inside of the mold to hold it securely in place against shoulder 30. It will be observed that both body 21 and mandrel 22 are in heat conducting relation with each other and with mold 23, the latter also being fabricated of a heat conducting material. The area of contact of mandrel portion 31 with wall 43 of the mold is relatively small due to bore 32, so that good contact between the mold and mandrel for heat transfer purposes will be facilitated.

The assembled unit may then be mounted on tip 27 of burner tube 18 and the burner ignited. The flame directed into portion 25 of body 21 will be diverted radially outwardly through ports 29, these flame jets being indicated at 46. Combustion supply air may flow through any annular space between tip 27 and adapter portion 24, as well as around flame jets 46 as they issue from apertures 29. The flame jets will play against wall 43 of mold 23, thus heating the mold and mandrel portion 31 as well as the end portion of tubing 13 in contact therewith.

As the tubing is softened in this manner, it may be pushed against wall 43 of mold 23, the softened portions of the tubing flowing outwardly and filling the annular mold cavity. A flange 12 will thus be formed on the end of tubing 13 as indicated in FIGURE 4, the operative surfaces of this flange being sharply delineated as it fills the mold cavity. Mandrel 22 will maintain the tubular shape of the adjacent portion of tubing 13 as the flange formation takes place, and insulative sleeve 38 will prevent undue heating of the tubing beyond the portion being formed into a flange. It should be noted that at no time will the flame come into direct contact with the material of the tubing, thus preventing the possibility

of unwanted effects on the tubing material which might result from such direct flame contact.

After flange 12 has been formed, unit 11 and the tubing will be separated from burner 19. The tubing, together with unit 11 may then be dipped in a coolant such as water, to hasten hardening of the tubing flange. The tubing may then be slipped off the unit which will then be ready for another operation.

During the quenching step of the process, water may collect in parts of the tubing, and more particularly in the vicinity of mold 23, such as in the annular cavity within mandrel portion 31. Upon the next application of heat to mold 23, this water will form steam. In order to prevent the expansion of such steam into the mold cavity which might cause malformation of flange 12, the steam is permitted to escape past the mating threads of members 21 and 22, through passages 36 and 37 and through interstices 42 of nut 41 to the atmosphere. The threads will of course have a normal fit such as provides a passage therethrough. In this manner, any steam built up in the annular chamber within mandrel portion 31 can escape to the atmosphere without harm.

It will thus be seen that an improved flange forming tool for plastic tubing has been provided which combines the flange mold, tube support and heat applying means for the mold in an integral unit, especially adapted for mounting on portable torches. The device prevents direct flame from being applied to the plastic tubing, confines the heat to the section of tubing to be formed, and includes means for preventing steam from adversely affecting the flange shape. The unit is of simple and sturdy construction and may be produced in large quantities at low cost.

While it will be apparent that the preferred embodiment of the invention disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In an outward flange forming device for plastic tubing or the like, an annular mold having a radial wall portion and an axially extending outer portion, a mandrel extending coaxially from the inside of said mold and adapted to fit within the tubing, and a tubular heat applying element secured to said mold and extending from the other side thereof, said heat applying element being adapted to receive a burner tip and having means for applying heat to said radial wall portion of the mold.

2. In an outward flange forming device for plastic tubing or the like, an annular mold having a radial wall portion and an axially extending outer portion, a mandrel secured to said mold and extending coaxially from one side thereof, a tubular element extending from the other side of said mold and adapted to receive a burner tip, and a plurality of radial passages in said tubular element adjacent said mold whereby flame jets may be applied to the radial wall portion of said mold.

3. In a device for forming flanges on plastic tubing or the like, a mold of heat conductive material comprising a centrally apertured radial wall portion and an axially extending annular outer wall portion, a body of heat conductive material disposed on the outside of said mold and having a heat applying portion adapted to apply heat to the outside mold surface, a mandrel extending coaxially from the inside of said mold, a portion of said mandrel being fabricated of heat conductive material and being in spaced parallel relation with said outer mold portion to form an annular cavity therewith, and means securing together said mold, body and mandrel as an integral unit.

4. In a device for forming flanges on plastic tubing or the like, an annular mold of heat conductive material, a heat applying member secured to and extending from one side of said mold, a mandrel secured to and extending from the other side of said mold in coaxial relation therewith, said mandrel having an annular portion of heat con-

5

ductive material in spaced relation with a portion of said mold to form a mold cavity therewith, and an annular portion on said mandrel of insulative material extending from said first-mentioned portion in a direction away from said mold.

5. In a device for forming flanges on plastic tubing or the like, a cup-shaped annular mold of heat conductive material, a body extending axially from the outside of said mold and having a heat applying portion adapted to supply heat to the outer mold surface, a mandrel extending axially from the inside of said mold, means securing said mandrel to said body and said mold, said mandrel comprising an annular heat conductive portion in spaced relation with a portion of said mold to form a cavity therewith, a tubular sleeve of insulative material extending from said first mandrel portion, said first mandrel portion and sleeve having a diameter such as to support a length of tubing adjacent the end to be formed, and means fastening the outer end portion of said sleeve to said mandrel.

6. The combination according to claim 5, said mandrel having a threaded extension, said sleeve fastening means comprising a nut on said extension engageable with said sleeve, and passageway means in said mandrel for permitting the escape of steam from the vicinity of said mold.

7. In a device of the class described, a body having an adapter portion adapted to receive a burner tip, a shoulder at an intermediate portion of said body, a plurality of

6

radial portions adjacent said shoulder for directing flame jets from said burner tip in an outward direction, a mold having a centrally apertured radial wall engaging said shoulder and an axially extending outer wall, a mandrel having a first portion engageable with the inside of said mold, threaded portions connecting said body and mandrel, the body, mold and mandrel being of heat conductive material, a sleeve of insulative material on said mandrel extending outwardly from said first portion, and passageway means in said mandrel for permitting the escape of steam from the vicinity of said mold.

References Cited in the file of this patent

UNITED STATES PATENTS

758,145	Nordenskjold	Apr. 26, 1904
2,265,111	Brown	Dec. 2, 1941
2,312,579	O'Brien	Mar. 2, 1943
2,340,784	Westin et al.	Feb. 1, 1944
2,386,498	Ostrander	Oct. 9, 1945
2,485,885	Hoopes	Oct. 25, 1949
2,686,337	Kaufman	Aug. 17, 1954
2,788,544	Voumard et al.	Apr. 16, 1957

FOREIGN PATENTS

459,060	Canada	Aug. 23, 1949
639,997	Great Britain	July 12, 1950