Jan. 26, 1943. G. E. FRANCK 2,309,181

APPARATUS FOR FORMING CLOSED TUBES

Filed Nov. 12, 1940

Fig. 1.

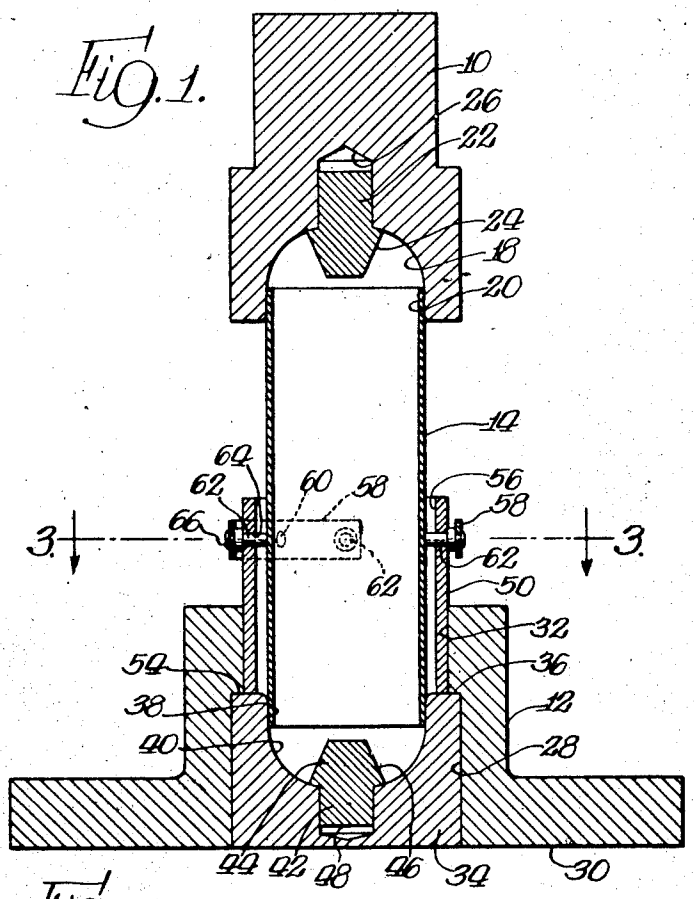


Fig. 2.

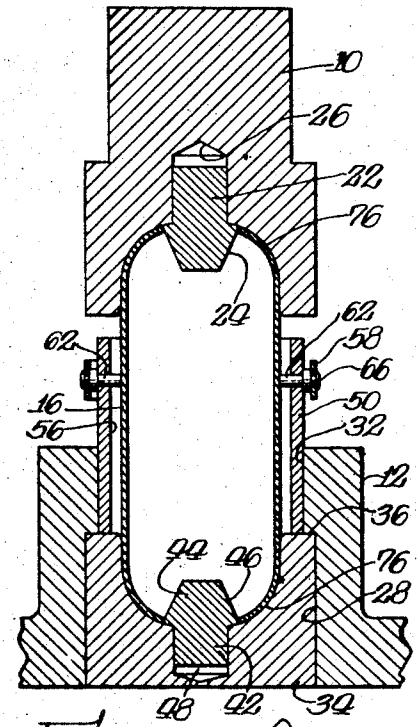


Fig. 3.

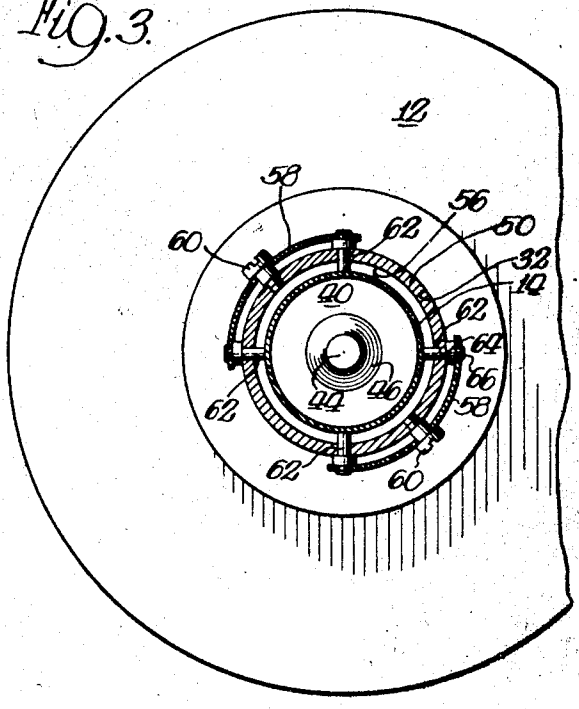
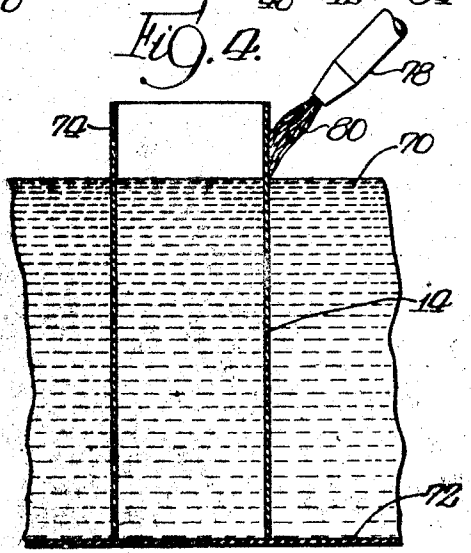


Fig. 4.



INVENTOR.
George E. Franck.
BY Bair & Freeman
Attys.

Patented Jan. 26, 1943

2,309,181

UNITED STATES PATENT OFFICE

2,309,181

APPARATUS FOR FORMING CLOSED TUBES

George E. Franck, Riverside, Ill., assignor to The Imperial Brass Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application November 12, 1940, Serial No. 365,313

5 Claims. (Cl. 113—49)

My invention relates to containers or devices made of metal and formed from a single length of stock into tubes substantially closed at both ends and suitable forming apparatus such as dies and appurtenances thereto for forming such containers.

Among the objects of my invention is to provide a new and improved apparatus for forming a substantially cylindrical container having substantially closed ends by operation upon a length of metallic cylindrical tubing stock.

A further object is to provide an apparatus consisting of dies and a centering means cooperable with the dies which are adapted to receive a piece of tubular stock centered properly within the dies and then compress the stock at one or at both ends simultaneously into the closed form of container desired and then open so that the container thus formed might be removed without it being necessary to break apart any parts of the separate coacting die platens.

It is further among the objects to provide platens and centering mechanism cooperable therewith which is adapted to correctly center stock of a predetermined size which may be slightly over or under size or which may in addition have irregularities on the surface.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various steps of my method together with parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawing, in which:

Figure 1 is an elevational view in section showing upper and lower die platens and a length of stock in place prior to the forming operation.

Figure 2 is a vertical sectional view similar to Figure 1, showing the die platens in compressed position.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 1.

Figure 4 shows a method of heat treating the end of the tubular stock which is to be formed.

It has previously been the custom to use tubular stock for devices such as filters, dehydrators, strainers, scale traps, etc., which are often used in liquid and gas lines where the liquid or gas is under considerable pressure or which may be of such a nature as to enable it to leak out wherever even a very slight leak might occur.

It has likewise been the practice when making such devices to close the ends of the tubular stock either by providing threaded caps or when especially high pressures are encountered by attaching thereto flanges which are bolted together. Such constructions are relatively expensive and entail a large number of manufacturing operations. Moreover, even when so designed, the capped and threaded stock is unsuitable for very high pressures.

Metallic bodies having curved closed ends have frequently been found in the past to have great strength in proportion to the gauge of the metal formed into such rounded shapes. However, in providing a method for forming tubes of relatively small diameter into such shapes having rounded ends a difficult problem is presented since all of the work must be performed upon the stock from the outside and no backing or supporting structure can be effectively positioned within the tube while the forming operation takes place.

This method and the apparatus, therefore, is directed to the provision of a means whereby tube stock of relatively small diameter may be cut and formed into containers comprising a single piece having rounded ends and which by reason of such construction have relatively great strength in proportion to the gauge of the metal forming the tubular stock.

One embodiment of my invention directed to the provision of such an apparatus for practicing my method is shown on the drawing where an upper platen 10 is shown opposed to a lower platen 12 wherein each are provided with suitable recesses for positioning and compressing a length of tubular stock 14, as shown in Figure 1, into a desired form 16, shown in Figure 2.

The upper platen 10 has a recess comprising an annular curved portion 18 and a cylindrical portion 20. The cylindrical portion has a diameter substantially equal to the outer diameter of the tube stock 14 so that the stock may slide easily into the recess. At the center of the recess is a plug 22 having a conical end 24 extending into the recess and centered with respect thereto.

It will be noted that the conical surface 24 at its point of contact with the curved portion of the recess 18 is approximately at right angles thereto. An aperture 26 is provided in the platen for the reception of the plug, which plug might be provided with conical ends of various sizes.

The lower platen 12 has a cylindrical hole 28 extending inwardly from a bottom edge 30 and a cylindrical aperture 32 on the upper side smaller than the hole 28 and communicating there-

with. Within the hole 28 is an insert 34 forming a part of the lower platen, with its lower surface flush with the surface 30 of the platen and an upper edge abutting a shoulder 36. The insert has a recess comprising a cylindrical portion 38 having a diameter substantially equal to the outer diameter of the tube stock 14 and an annular inwardly curved recess portion 40 similar to the recess portion 18 of the upper platen.

Likewise there is provided a plug 42 having an upper conical portion 44 extending centerably within the recess with the conical surface 46 at its point of contact with the curved portion 40 at substantially a right angle. The recess 48 is supplied for receiving the plug 42.

In the aperture 32 of the platen 12 a sleeve 50 is inserted until it abuts an upper annular rim 54 of the insert 34. The sleeve is designed to fit snugly within the aperture but has an inner diameter 56 substantially greater than the outside diameter of the tube stock 14. Opposed centering devices comprising spring members 58 are secured to the sleeve by means of screws 60. These spring members are normally arcuate in shape as shown in Figure 3, and of resilient material such as spring steel. These are secured to the sleeve in horizontal position.

At each end of each of the spring members there is provided a hole or slot within which is positioned a pin 62. The pin extends through a hole 64 in the sleeve within which it has a free sliding fit and has a cap 66 securing it to the end of the spring member.

In the form of my invention shown, four pins are provided positioned in pairs and opposed to each other. The pins are permitted to move longitudinally with respect to their axes and are normally spring pressed into the position shown in Figure 3 by the spring members 58.

In Figure 4 there is shown a body 70 of relatively cool liquid such as water held in a container 72 and having a depth slightly less than the length of the tubular stock 14 permitting an end 74 to extend above the surface of the water. The length of the end 74 is substantially equal to the portion of the tube which is to be formed into a rounded closed end 76 as seen in Figure 2.

In the particular embodiment shown in Figure 4, there is provided a torch 78 designed to impel a heat stream 80 against the exposed portion of the tubular stock. It is contemplated, however, and within the scope of my invention to provide a shallow bath of liquid such as lead heated to the temperature necessary for annealing the tubular stock in order that the stock might be dipped in it to the depth desired for forming the closed end 76.

Should pure lead not be available then the end to be dipped might be coated with grease or some similar substance in order to keep it clean during the heat or annealing operation. Similarly, electric means might be abutted against the tubular stock in order to properly heat it.

In operation a length of tubular stock is first measured to the proper size allowing for portions of it to be turned inwardly, then cut and the end edges properly squared. Next, using one of the forms of my method the stock is placed in a bath of relatively cool liquid to a depth such that the end protruding above the surface of the liquid is no longer than the length of the tubing stock desired to be heated and annealed.

The protruding end can then be readily heated by a torch as shown in Figure 4 or by some suitable similar means to a temperature preferably between 800° F. and 1200° F. The liquid bath prevents heat from passing to the central portion of the tubular stock. As soon as the stock has been heated to the proper temperature it can be quickly cooled as by tipping the stock over into the liquid or by dousing it in some acceptable manner by a cooling fluid. Next, where both ends of the tube are to be closed, the stock is inverted in the liquid bath and the opposite end heated and doused.

After this has been done the stock is placed in the cylindrical portion 38 of the recess in the lower platen as shown in Figure 1 by slipping it downwardly through the sleeve 50. When in this position the lower cylindrical portion 38 holds the bottom end and the pins 62 bearing against the side walls of the stock centered properly with respect to the recess and the conical end 44 of the plug 42. Next, the upper platen is lowered by suitable power machinery to the position shown in Figure 1, wherein the cylindrical portion 20 of the recess surrounds the upper annealed end of the tubular stock.

Then the platens 10 and 12 are forced together by power means and while being so forced together, the tubular stock is forced into the form 16, shown in Figure 2, while remaining in a carefully adjusted center position by the centering pins. During the compressing stroke the ends of the stock which have been annealed are formed over into the curved ends 76 lying flat against the annular curved portions 18 and 40, respectively, of the recesses. The end edges of the stock are driven inwardly into the recesses until they make edgewise contact with the conical surfaces 24 and 46 of the respective plugs 22 and 42.

When this operation has been completed, the platens can be readily separated one from another and the conical surfaces of the plugs withdrawn from the container thus formed. The container can then be readily lifted out of the lower platen and due to their resilient mounting the centering pins 62 will permit the withdrawal without obstruction. The apparatus is then ready for the next container forming operation.

In the meantime, the container 16 thus shaped may be further machined by reaming the ends formed by the plugs to size in preparation for the insertion of a standard fitting.

There has thus been provided a method and apparatus for making a single piece of tubular stock into a high-duty closed container which when equipped with the necessary fittings is suitable for use in high-pressure gas and liquid lines without danger of leaks and with a relatively minimum necessity for adjustment and repair.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure, or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. A device for forming a cylindrical length of tubing stock into a chamber having rounded, relatively closed ends comprising a platen having an aperture therein including a cylindrical portion for receiving said stock, an inwardly curved annular wall forming a bottom for said aperture and a centering element extending into the recess at the center of said bottom, a second platen having an annular curved recess therein complementary to said first recess having a limited reciprocal movement relative to the first

platen to and from a compressed position, a centering element in said second recess, and a sleeve secured to the first platen and extending outwardly beyond the surface thereof to a position spaced from the compressed position of said other platen, and a plurality of opposed centering devices in the sleeve, each comprising a spring pressed, laterally reciprocable element secured to the sleeve extending through the sleeve wall to a point of contact with the wall of said stock and releasably held in said positions.

2. A device for forming a cylindrical length of tubing stock into a chamber having rounded, relatively closed ends comprising a platen having an aperture therein including a cylindrical portion greater in diameter than said stock, a shoulder beneath said cylindrical portion and an inwardly curved annular wall forming a bottom for said aperture, a plug extending into the recess at the center of said bottom, a second platen having an annular curved recess therein complementary to said first recess having a limited reciprocal movement relative to the first platen to and from a compressed position, a central plug in said second recess, a sleeve fitting within the aperture of the first platen positioned against said shoulder and extending outwardly beyond the surface to a position spaced from the compressed position of said other platen, and a plurality of opposed centering devices in the sleeve, each comprising a spring pressed laterally reciprocable element secured to the sleeve extending through the sleeve wall to a point of contact with the wall of said stock and releasably held in said positions for centering the tube stock relative to the plugs.

3. A device for forming a cylindrical length of tubing stock into a chamber having rounded, relatively closed ends comprising a platen having an aperture therein including a cylindrical portion greater in diameter than said stock, a shoulder beneath said cylindrical portion and an inwardly curved annular wall forming the bottom for said aperture, a second platen having an annular curved recess therein complementary to said first recess having a limited reciprocal movement relative to the first platen to and from a compressed position, a sleeve fitting within the aperture of the first platen positioned against said shoulder and extending outwardly beyond the surface to a position spaced from the compressed position of said other platen, and opposed transverse centering devices in the sleeve, each comprising an arcuate spring element surrounding a portion of the circumference of the sleeve in transverse position, a screw securing the center of said element to the sleeve and reciprocably mounted pins secured one at each end of each said element extending through the sleeve wall to points of contact with the wall of said stock and releasably held in said positions by said spring element.

4. A device for forming a cylindrical length of tubing stock into a chamber having rounded, relatively closed ends comprising a platen having an outer member including a cylindrical aperture therein greater in diameter than said stock and a base therefor, a cylindrical hollow inner member within the aperture, said inner member having a recess including a cylindrical side wall portion having a depth substantially equal to the length of said stock adapted to be formed into one of said closed ends and equal in diameter to the diameter of said stock, a shoulder at the top of said recess beneath said aperture and an inwardly curved annular wall forming the bottom of said recess and a plug extending into the recess at the center of said bottom, a second platen having an annular curved recess therein complementary to said first recess and having a limited reciprocal movement relative to the first platen to and from a compressed position, a central plug at the bottom of said second recess, and a sleeve fitting within the aperture of the first platen positioned against said shoulder and extending outwardly beyond the surface to a position spaced from the compressed position of said other platen, and opposed transverse centering devices in the sleeve, each comprising an arcuate spring element surrounding a portion of the circumference of the sleeve in transverse position, a screw securing the center of said element to the sleeve and reciprocably mounted pins secured one at each end of each said element extending through the sleeve wall to points of contact with the wall of said stock and releasably held in said positions by said spring element.

5. A device for forming a relatively long cylindrical length of tubing stock into a chamber having the mid portion thereof possessed of the same cylindrical shape as said tubular stock and having rounded, relatively closed ends comprising, a platen having an aperture therein including a short cylindrical section having the same internal diameter as the external diameter of said stock adapted to fit around the end of said stock, an inwardly curved annular wall forming a bottom for said aperture, a second platen having an annular curved recess therein complementary to said first recess including a short cylindrical section having the same diameter as the external diameter of said stock adapted to fit around the other end of said tubular stock, said platens having an initial open position for insertion of the tubular stock, and having a limited relative reciprocating movement to and from compressed positions, an initial compressed position wherein each end of the tubular stock is held within the respective short cylindrical section and a final compressed position wherein the cylindrical portion of the stock remains out of contact with said platens throughout a substantial portion of its length and wherein the tube contacting portions and the faces of the platens remain at a substantial distance from each other, the ends of said stock being in contact with the respective curved annular recess, with the end edges thereof directed edgewise toward a central aperture of size relatively smaller than the initial diameter of the tubular stock.

GEORGE E. FRANCK.