Dec. 27, 1955 D. M. ROCKWELL, JR 2,728,135

METHOD FOR USE IN CONNECTION WITH THE MAKING OF PROTECTOR CAPS FOR COMPRESSED GAS CYLINDERS

Filed March 31, 1952 2 Sheets-Sheet 1

Fig. 1.

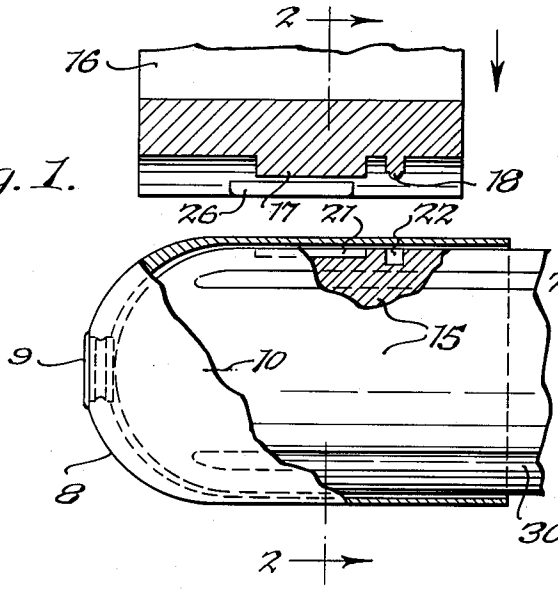


Fig. 2.

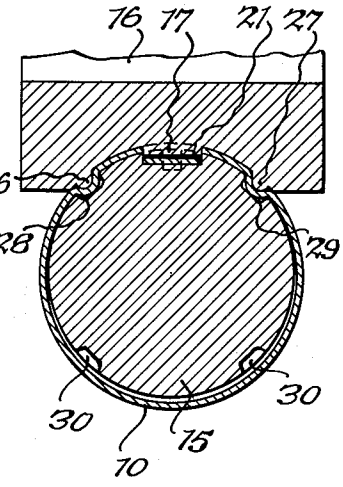
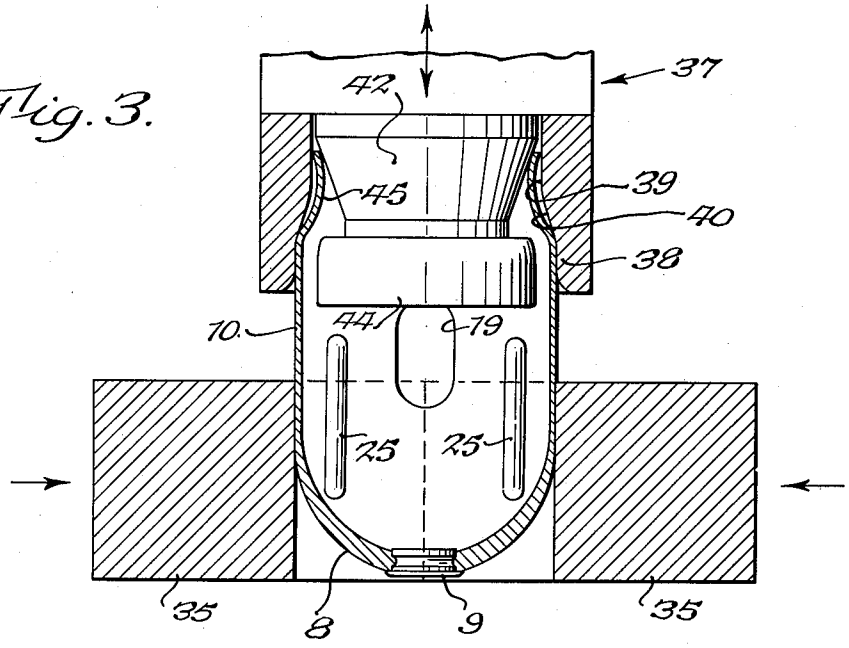


Fig. 3.



INVENTOR.
Dean M. Rockwell, Jr.
BY
Parker, Prichard, Hayes
Attorneys.

Dec. 27, 1955 D. M. ROCKWELL, JR 2,728,135

METHOD FOR USE IN CONNECTION WITH THE MAKING OF PROTECTOR CAPS FOR COMPRESSED GAS CYLINDERS

Filed March 31, 1952 2 Sheets-Sheet 2

Fig. 4.

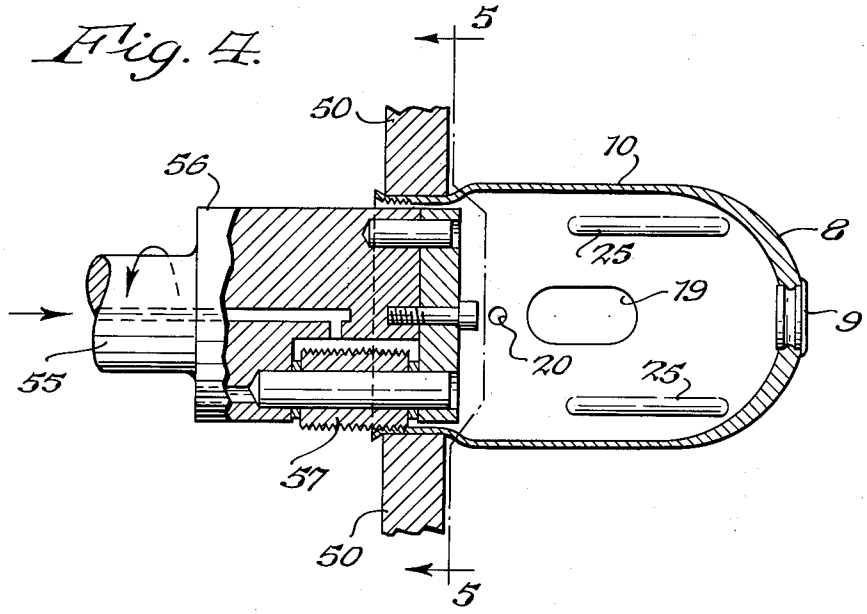
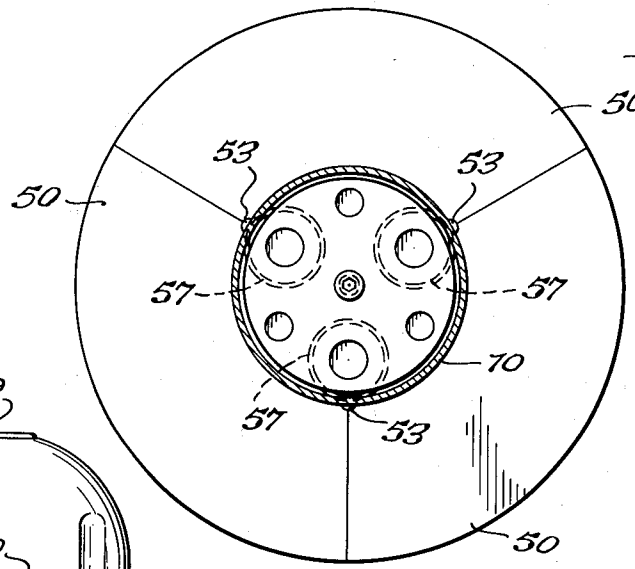


Fig. 5.



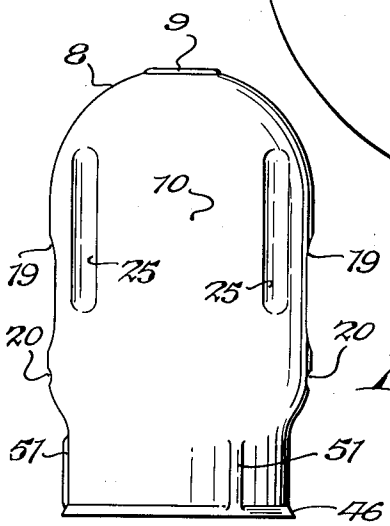


Fig. 6.

INVENTOR.
Dean M. Rockwell, Jr.,
BY
Parker, Prichard & Parker,
Attorneys.

United States Patent Office 2,728,135 Patented Dec. 27, 1955

2,728,135

METHOD FOR USE IN CONNECTION WITH THE MAKING OF PROTECTOR CAPS FOR COMPRESSED GAS CYLINDERS

Dean M. Rockwell, Jr., Buffalo, N. Y.

Application March 31, 1952, Serial No. 279,587

2 Claims. (Cl. 29—157.1)

This invention relates to improvements in methods and apparatus for use in making protector caps of the type commonly used on the ends of compressed gas cylinders to protect the valve or valves mounted on the upper ends of the cylinders.

One of the objects of this invention is to provide a method and apparatus for facilitating the manufacture of protector caps of this kind and to produce protector caps of improved and simplified construction.

Another object is to provide method apparatus by means of which the protector caps may be provided with neck portions of improved and strengthened construction.

Another object is to provide a method and apparatus for contracting one end of a protector cap to form a neck portion thereof.

It is also an object of this invention to provide apparatus whereby the neck portion may be formed of uniform diameter throughout the larger portion of the length thereof and with an outwardly flaring outer end.

A further object is to provide method and apparatus for producing a protector cap with a neck portion having an internal thread of improved construction formed therein in such a manner as to increase the strength of the neck portion of the cap.

A further object is to provide a method and apparatus for forming reinforcing beads or ribs integral with the neck portion.

It is also an object of this invention to provide a method and apparatus whereby the reinforcing ribs or beads on the neck portion may be formed simultaneously with the rolling of the threads on the interior of the neck portions.

Other objects and advantages will be apparent from the following description of some embodiments of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:

Fig. 1 is a longitudinal view, partly in section, showing a protector cap in operative relation to a punch and die for punching holes or windows in the sides of a protector cap and simultaneously forming longitudinally extending grooves or channels in the side of the protector

Fig. 2 is a transverse sectional elevation thereof on line 2—2, Fig. 1.

Fig. 3 is a central, sectional elevation of a protector cap and mechanism for swaging an end of the protector cap and forming an outwardly flaring end portion thereon.

Fig. 4 is a central, sectional view of a protector cap and of thread rolling mechanism in operative relation thereto for use in forming internal threads in the neck portion thereof.

Fig. 5 is a transverse sectional view thereof on line 5—5, Fig. 4.

Fig. 6 is a side elevation of a protector cap having incorporated therein the improvements produced by means of the method and apparatus herein described.

Protector caps in connection with which the method and apparatus herein described are used may be of any suitable or desired type or construction, but preferably the method and apparatus are employed in connection with caps of this type as disclosed in my copending application Serial Number 280,749 filed April 5, 1952. These protector caps are each preferably made from a suitable length of metal tubing, one end of which is contracted by means of a spinning operation to form a crown 8, and the axial portion of the crown of the cap is closed by means of a plug 9 in any suitable or desired manner. The side portions 10 of the cap are preferably of approximately the same thickness and diameter as the original tubing from which the cap is made This diameter and thickness of metal is maintained to the ends of the caps opposite to the crown 8 thereof when the caps are initially subjected to the method and apparatus herein disclosed. In Fig. 1 there is shown a cap as it appears before it is acted upon by the method and apparatus forming the subject matter of this application.

These partly finished caps are first provided with the necessary windows or openings in the caps, and certain longitudinal reinforcing grooves or channels are also formed in the sides of the caps. This may be accomplished in any suitable or desired manner, and in the construction shown, a die 15 is provided over the end of which the cap is telescoped so that it is in proper relation to a reciprocatory plunger 16 movable toward and from the die 15. This plunger is preferably provided with one or more cutting punches, two such punches being shown in the construction illustrated, the larger punch 17 serving to cut an opening or window 19, Fig. 6, in a side of the cap, and the smaller punch 18 serving to punch a hole 20 into a side of the cap. These punches 17 and 18 cooperate with recesses 21 and 22 in the die 15.

In order to provide the longitudinal grooves or channels 25, Fig. 6 in the cap, the plunger 16 is also provided with a pair of projections or ribs 26 and 27 arranged at opposite sides of the punches 17 and 18 and formed to cooperate with grooves or recesses 28 and 29 in the die 15. These projections or ribs are so positioned on the plunger 16 as to form the reinforcing grooves or channels 25, Fig. 6 in the metal of the cap while the cutting operation is performed by means of the punches 17 and 18.

In the particular construction shown, the windows and grooves or channels are formed in one side of the cap at a time, and after the windows and recesses are formed in one side of the cap, the cap is reversed and again positioned on the die so as to present the other side of the cap to the cutting and forming operations of the plunger 16. In order to facilitate the correct positioning of the caps on the die, the undersurface of the die is preferably provided with grooves or recesses 30 similar to the grooves or recesses 28 and 29 on the upper face of the die. Consequently, when a cap is reversed, the reinforcing grooves or channels 25 of the cap will enter into the grooves 30 of the die, and thus position the cap in correct relation to the die and plunger so that windows 19, an aperture 20 and the grooves or channels 25 are formed on the other side of the cap in a position directly opposite to the windows and grooves formed in the initial stamping and pressing operation.

After a cap has been subjected to the apparatus shown in Figs. 1 and 2, it is then ready to be subjected to the operations of forming the neck thereof. This neck is of reduced diameter and is preferably formed by a swaging operation, as illustrated in Fig. 3. Preparatory to the swaging operation the cap is securely clamped in a holding or gripping device which, in the construction shown by way of example, includes two jaws 35 mov-

able toward each other to clamp the portion of the cap adjacent to the crown 8 thereof. The jaws 35 are so positioned that the cap will also be located in correct operative relation to an annular swaging die 37 which preferably includes a portion 38 having an internal diameter very slightly larger than the external diameter of the body portion of the cap, so that this part of the die can telescope about the cap. This swaging die also includes a part having an inner face 39 of a lesser diameter, the parts 38 and 39 being connected by an annular tapering or approximately frusto-conical portion 40. When the swaging die moves downwardly into engagement with the end of the cap which is opposite to the crown thereof, the metal of the upper end of the cap will be pressed inwardly into reduced diameter by the frusto-conical portion 40 of the swaging die.

In order to limit the extent to which the neck portion of the cap is deformed by this portion of the die, an additional die is provided in the interior of the swaging die, this inner die being provided with a substantially frusto-conical or flaring exterior surface 42 with which the inwardly flaring end of the cap may engage to prevent excessive distortion of this portion of the neck and to force the free end or edge of the neck portion outwardly, thus assisting in the forming of an outwardly flaring end of the neck portion.

The inner die 42 terminates at its end in a sizing die 44. The inward swaging of the neck portion by the die part 40 does not produce a truly cylindrical neck portion on the cap and some of the metal is forced inwardly to a greater extent than desired, as shown in Fig. 3. Consequently the sizing die 44 is provided so that when the swaging die 37 moves away from the holding jaws 35, the sizing die will be drawn through the interior of the part 45 of the cap and thus force this part of the cap outwardly into cylindrical form. During this outward drawing of the sizing die 44, the extreme end portion of the cap, which was forced outwardly by the flaring surface 42, will be left in an outwardly flaring condition, as indicated at 46 in Fig. 6. This flaring end of the cap is necessary for the forming of the screw threads on the neck portion of the cap and for guiding these screw threads of the cap into correct relation to the external threads formed on the cylinder. By means of the method and apparatus described, this flaring part 46 is formed without requiring any seperate operation on the cap.

By contracting the diameter of a part of the cap to form the neck portion thereof, it will be obvious that this swaging operation also results in increasing the thickness of the metal at the neck, which is very desirable to prevent breakage of the caps at the necks thereof.

The caps, when leaving the apparatus, as shown in Fig. 3, are then ready for the internal threading operation by means of method and apparatus illustrated in Figs. 4 and 5. In the apparatus shown in these figures, the neck portion of the cap is firmly gripped in any desired manner, for example, between jaw members 50, three of these jaw members being shown in the construction illustrated by way of example. These jaw members are formed to securely hold the neck portion in such a manner that this neck portion will not expand, due to external radial pressure applied to the neck portion during the rolling of the threads. It is also desired to provide the exterior of the neck portion with reinforcing ribs 51, shown in Fig. 6, and in order to provide these reinforcing ribs simultaneously with the rolling of the screw threads on the interior of the neck portion, the jaws 50 are so formed as to provide recesses therein into which some of the metal of the neck may be pressed during the rolling of the threads. In the construction shown by way of example, the jaws are so formed as to engage the major portion of the periphery of the neck and to be out of engagement with minor portions thereof, the parts of the jaws not contacting with the neck forming recesses into which metal may flow to form the reinforcing ribs 51.

For this purpose, in the construction illustrated, the jaws 50 are provided with cut-away portions or grooves 53, those shown being arranged at the ends of the jaws 50, so that two of these grooves together form a recess to receive the metal forming a reinforcing rib 51.

The mechanism for producing the internal threads on the neck portion of the device may be of any usual or suitable type, that shown including a stem or arbor 55 which is provided with an enlarged head 56 on which are mounted a plurality of rolls 57 having screw threaded peripheral surfaces, three of these rolls being shown in the construction illustrated. These rolls are arranged in such relation to each other that the threads of each of the rolls will track in the threads pressed into the interior of the neck portion. It will, of course, be understood that the arbor and head are advanced, while rotating, into the neck portion to the desired extent and are then rotated in the reverse direction while being withdrawn from the neck portion.

The threaded rolls 57 are also so set with relation to the neck of the cap as to roll some of the metal of the neck portion of the cap ahead of them, and by providing the recesses or grooves 53 in the clamping jaws 50, this excess metal is forced little by little into these recesses in the jaws, thus forming the reinforcing ribs 51. Furthermore, the provision of the grooves 53 to accommodate excess metal greatly facilitates the rolling of the threads in the cap. Consequently, by means of a single operation, threads are formed in the neck portion of the cap and the reinforcing ribs are formed on the exterior thereof.

By means of the rolling of threads on the interior of the neck, none of the metal of the neck is removed, as would be the case if the threads were cut. The rolling of the threads actually increases the strength of the neck since the rolling of the threads increases the overall thickness of the metal at the neck portion. This, with the increase in thickness of the metal of the neck portion resulting from the swaging operation, as shown in Fig. 3, produces necks on the caps which are of ample strength to avoid breaking when the caps are subjected to blows or impacts laterally of the axes of the caps.

It will be understood that various changes in the details, materials and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention may be made by those skilled in the art, within the principle and scope of the invention as expressed in the appended claims.

I claim as my invention:

1. A method for use in forming a protector cap for a compressed gas cylinder from a piece of steel tubing of substantially uniform diameter, which includes the steps of reducing the diameter of one end of the tubing by swaging to form a neck portion of reduced diameter and greater wall thickness, gripping the exterior of said neck portion about the major portion of the periphery thereof, and leaving ungripped certain longitudinal portions thereof at intervals about said periphery, and rolling screw threads on the interior of said neck portion and simultaneously forcing some of the metal of said neck outwardly into said ungripped portions by the outward pressure exerted on the neck portion by said thread rolling operation to form reinforcing ribs on the exterior of said neck.

2. A method for use in forming a protector cap for a compressed gas cylinder from a piece of steel tubing of substantially uniform diameter, which includes the steps of reducing the diameter of one end of the tubing by swaging to form a neck portion of a diameter less than that ultimately desired while an inner die is within said neck portion to limit the reduction in diameter of said neck portion, expanding the swaged end of the neck portion to the diameter desired by drawing said inner die out of said neck portion and simultaneously forming a flare on the outer end of said neck portion, and

rolling screw threads on the interior of said neck portion while the exterior thereof is held against excessive expansion.

References Cited in the file of this patent

UNITED STATES PATENTS

151,960	Dangerfield	June 16, 1874
1,672,082	Oakley	June 5, 1928
1,696,229	Fantz	Dec. 25, 1928
1,711,795	Kinney	May 7, 1929
1,744,549	Hopkins	Jan. 21, 1930
1,812,023	Seavey	June 30, 1931
1,877,370	Streit	Sept. 13, 1932
2,005,215	Batie	June 18, 1935
2,168,641	Arbogast	Aug. 8, 1939
2,246,096	Hogg	June 17, 1941
2,268,246	Dooley	Dec. 30, 1941
2,344,285	Carmode	Mar. 14, 1944
2,349,863	Hallberg	May 30, 1944
2,372,011	Remington	Mar. 20, 1945
2,373,901	Lowery	Apr. 17, 1945
2,383,584	Beishline	Aug. 28, 1945