Jan. 29, 1963 R. B. STANLEY 3,075,331

CRIMPING APPARATUS FOR SEALING CAPS TO CONTAINERS

Filed Aug. 19, 1960

FIG.1

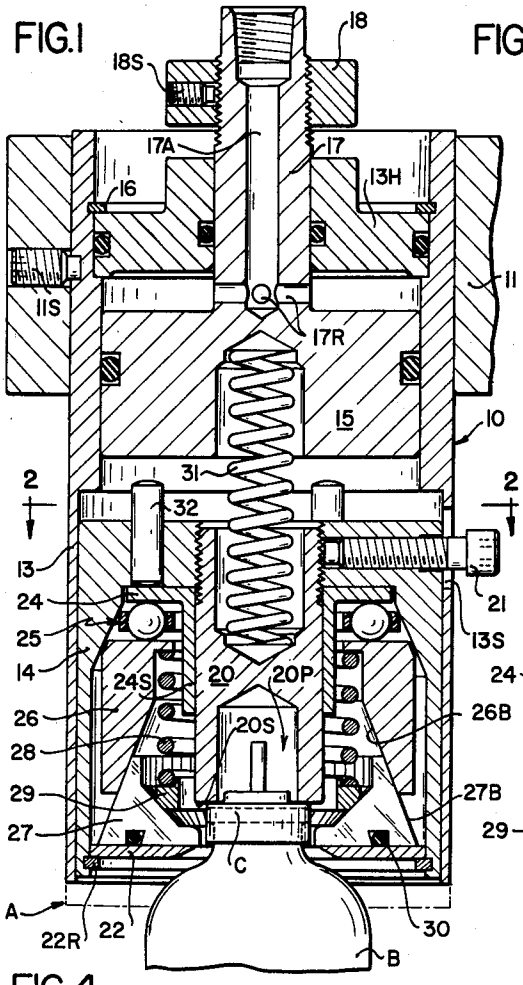


FIG.2

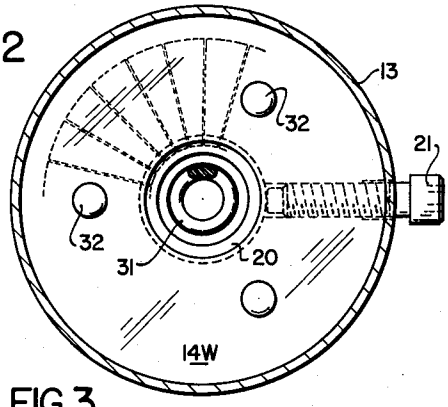


FIG.3

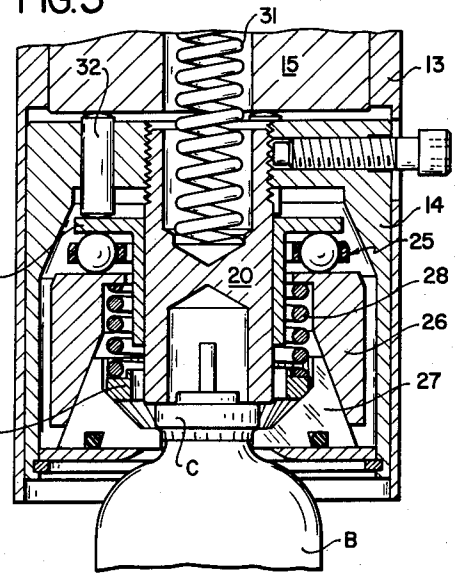


FIG.4

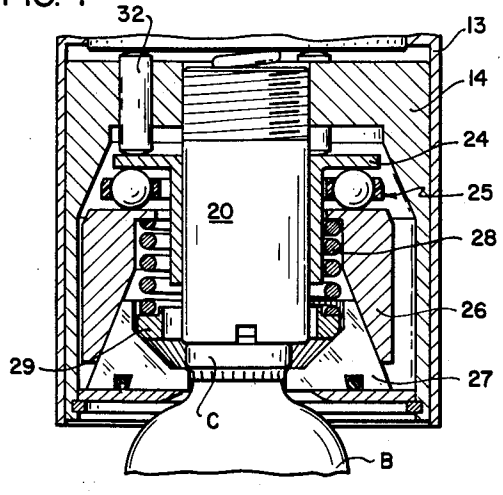
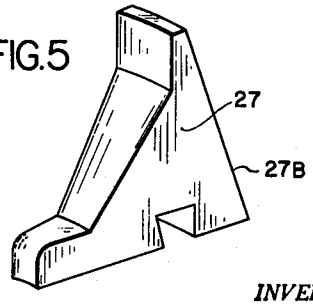


FIG.5



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CRIMPING APPARATUS FOR SEALING CAPS TO CONTAINERS

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This invention relates to apparatus for crimping a closure cap into sealed relation across the open top or mouth of a container and, more particularly, is concerned with crimping apparatus for applying a closure cap to a bottle of the type used in the packaging of pressure-dispensed products.

Crimping apparatus of the general type with which the present invention is concerned is normally used in production line setups and therefore must be capable of efficiently and reliably sealing a closure cap to a bottle or other container. Furthermore, it must be long lived and durable to minimize maintenance and eliminate production line stoppages. It is also important that the crimping apparatus be readily adjustable to adapt the unit for operation over a range of crimp depths and crimp diameters of the mouths of the bottles that are to be handled. It is also important that the unit be capable of receiving and handling bottles even though they may arrive with some degree of misalignment. Finally, the crimping apparatus arrangement should accommodate differences in bottle height for preventing the development of bottle-crushing forces.

The principal object of the invention is to provide a closure cap-crimping apparatus having the above features.

Another object of the invention is to provide a crimping apparatus arrangement having externally engageable facilities for making convenient crimp depth and crimp diameter adjustments.

Still another object of the invention is to provide a crimping apparatus having a floating collet mechanism that adjusts automatically to receive misaligned bottles and that is automatically recentered after each operation.

A further object of the invention is to provide crimping apparatus having yieldable preload means operable for initially pressing the closure cap into sealed relation across the container mouth and thus eliminating solid cap preloading members that might deliver crushing forces to the containers.

Briefly, in accordance with this invention, there is provided a crimper head for crimping closure caps in sealed relation about the mouth of a container, the crimper head comprising an outer shell forming a mounting pocket for a cage that is spring-biased towards one end of the shell, means for moving the shell to bring the cage into engagement with a closure cap to preload the closure cap against the container, a crimping mechanism mounted for lateral floating movement within the cage to adjust automatically for containers that are slightly misaligned, and means in the shell movable relative to the cage for actuating the crimping mechanism to crimp the cap in sealed relation about the container.

The crimping mechanism is actuated by a piston slideable in the upper end of the outer shell under the power of hydraulic fluid under pressure. A spring reacting between the piston and the cage applies the preloading forces prior to and during crimping and returns the piston after the crimping operation.

The construction accommodates convenient adjustment for selecting the desired crimp depth and crimp diameter.

Other objects and advantages will become apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same:

FIG. 1 is a vertical sectional view through a crimper head illustrating the position of its parts during initial engagement of the head against a container;

FIG. 2 is a detailed horizontal sectional view and is taken on the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary vertical sectional view through the lower end of the crimper head and illustrates the position of its parts during crimping;

FIG. 4 is a fragmentary vertical sectional view corresponding to that of FIG. 3 but illustrating the action of the crimper head when the container with which it coacts is slightly off-center; and

FIG. 5 is an enlarged perspective view of a crimping jaw that is utilized in the crimper head.

Referring now to the drawings, for purposes of illustrative disclosure a crimper head constructed in accordance with this invention is shown in its entirety in FIG. 1 wherein, as designated generally at **10**, it is provided with a mounting bracket **11** which is fixed to the head by a lock screw **11S**. It will be understood that the mounting bracket connects the head to a vertically reciprocable operating post (not shown) for raising and lowering the head in a predetermined, controlled manner.

The head is shown engaged over a container B, which may be assumed to have already been filled with product and which is also shown provided with a valve-in-cap type closure C seated loosely over the open top or mouth of the container. In the arrangement illustrated herein for purposes of disclosure, the container B will be recognized as a familiar type of glass bottle used in aerosol packaging; and the closure cap C, which is also standard, includes a depending skirt that encircles the bottle rim or mouth for sealing to the bottle by a crimping operation during which the skirt is pressed tightly around the lip of the bottle.

The crimper head has a tubular main housing or shell **13** to which the bracket **11** is fixed. At its lower end the shell **13** provides a mounting pocket for receiving a cup-shaped cage **14** that houses the crimping mechanism. At its upper end the shell provides an operating cylinder for a reciprocably slideable piston **15**, with a cylinder head **13H** being fixed within the top of the shell by a suitable lock ring **16**. The piston **15** is provided with an integrally formed, axially extending piston rod **17** that projects in slideable relation through the cylinder head **13H**. A stop nut **18** is threaded onto the outer end of the piston rod and fixed at a predetermined location thereon by a set screw **18S** for abutment against the cylinder head in regulating the length of travel of the piston. The piston rod **17** may be formed with an axial bore **17A** leading through a plurality of internal radial bores **17R** to supply hydraulic fluid under pressure to a clearance space provided between the adjacent faces of the piston and the cylinder head. Preferably the face of the cylinder head has an annular recess to establish a minimum clearance space for insuring initial entry of the hydraulic fluid.

The cage **14** for housing the crimping mechanism has its upper end wall formed with an internally threaded central socket to receive a locator **20** that has a downwardly opening pocket **20P** bordered at its lower end by a cap-engaging annular shoulder or surface **20S**. The locator pocket is large enough to accommodate the valve of the closure cap, and it may also be shaped to serve as a socket for engagement by a wrench, for a purpose to be explained hereinafter. The locator is fixed in predetermined position in the cage by a cap screw **21** that extends through a lengthwise slot **13S** provided in the vertical wall of the tubular housing **13**. The cage **14**

and locator 20 are capable of axial sliding movement within the shell 13 within the range provided by the length of the slot 13S. A ring disc 22 is fixed within the bottom end of the cage 14 by a lock ring 22R to form a bottom wall for the cage. The ring disc 22 is provided with a central opening of somewhat greater diameter than the caps that are to be crimped to allow clearance for bottles that may be misaligned as they are delivered to the crimper head.

In accordance with the present invention, the cage houses a crimping mechanism that comprises a thrust washer 24 having an integrally depending sleeve section 24S in slideable guided engagement over the locator 20, a floating thrust bearing loosely surrounding the sleeve section 24S and preferably being of an antifriction type which, as designated generally at 25, may comprise a ball-retainer ring and a plurality of steel balls, a collet sleeve 26 loosely surrounding the locator for limited lateral floating movement within the cage, a floating assembly of collet jaws 27, each of which may be of the type shown in FIG. 5, and a return spring 28 and pressure ring 29 loosely encircling the locator and reacting axially between the collet sleeve 26 and the assembly of collet jaws 27 to yieldably urge the same into spaced apart relation within the cage.

The collet sleeve and collet jaws have complementary bevelled surfaces 26B and 27B, respectively, that are interengageable in response to relative axial movement of the sleeve towards the jaws 27 to move the jaws radially inwardly into crimping engagement with the depending skirt of a cap that is engaged with the locator. Contracting movement of the collet jaws is resisted by the pressure ring 29 and its associated coil spring 28, and these parts are then active, after removal of the crimping forces, to expand the collet jaws and free them from engagement with the closure cap.

In the arrangement illustrated herein for purposes of disclosure, the collet jaws are formed as separate elements, and for convenience in assembly, each of them is provided with a tapered notch on its bottom surface for force-fit engagement in circular array about a common O-ring 30 that establishes and maintains their initial positions.

At their adjacent ends, the piston 15 and the locator 20 are provided with corresponding openings or sockets that receive the opposite ends of a preload and return spring 31 which is initially compressed to transmit preload forces to the locator for the purpose of tightly compressing the cap into sealed relation on its container before the actual crimping operation is carried out and to act in expansion for returning the piston 15 at the end of each crimping operation. The upper wall of the cage has a set of guide passages opening lengthwise therethrough to receive a set of dowels 32 that are longer than these passages to project therebeyond for compressional engagement between the piston 15 and the thrust collar 24 in transmitting piston travel to the collet sleeve 26. Even during such compression loading, the floating thrust bearing 25 easily accommodates necessary lateral movement of the floating crimping mechanism within the cage 14.

In operation, a bottle B having a closure cap C seated loosely thereon may be delivered automatically into predetermined alignment beneath the crimper head 10 and, as is apparent in FIG. 1, the post-mounted bracket 11 and the outer shell 13 move down in unison to engage the shoulder 20S at the lower end of the locator 20 in compressing relation upon the top of a closure cap C seated loosely on the bottle B. This position of initial engagement against the cap C is shown in FIG. 1. Continued downward movement of the shell 13 to bring its lower end to the phantom line indicated by the arrow A at the bottom of FIG. 1 is yieldably resisted by the preload spring 31 which thus becomes compressed between

the stationary locator 20 and the piston 15 that is movable downwardly jointly with the shell.

The preloading force which is thus applied to the closure cap through the spring 31 causes a desirable initial flowing of a gasket provided within the cap, and this assures more perfect sealing. The travel imparted to the shell by the operating post (not shown) is selected to bring the piston into position for contact with the dowels 32.

After the shell has been lowered to the line A to preload the closure cap and to bring the piston into approximate engagement with the dowel pins 32, liquid under pressure is supplied through the bore 17A of the piston rod to enter the clearance space at the top of the piston. As pressure builds up, the piston is forced downwardly through the shell to drive the dowel pins 32 downwardly through the upper wall of the cage 14 and correspondingly to force the collet sleeve downwardly through the cage 14 for contracting the collet jaws 27 into crimping engagement around the closure cap.

This final, or crimping, position of the parts is shown in FIG. 3 wherein it will be noted that the piston 15 does not go solid against the cage, and this avoids the application of crushing forces to the bottle. The bottle is subjected to only those forces which are transmitted through the preload spring 31, and this spring is selected with characteristics consistent with the strength of the bottle constructions. The piston rod stop nut shown at 18 in FIG. 1 is set to engage the upper end of the cylinder head 13H before the piston face engages the cage 14.

The floating arrangement of the crimping mechanism located within the cage 14 has the important advantage that it automatically adapts itself to bottles that are slightly misaligned or off-center with respect to the center line of the crimper head. The fragmentary view of FIG. 4 illustrates the operation of the crimper head when sealing a bottle that has been inadvertently supplied in slightly off-center relation. The center line of the bottle is shown displaced from the center line of the locator 20 which, of course, together with the cage 14 and the shell 13, is fixed against lateral displacement. It will be apparent that as the crimper head is lowered onto the bottle, the particular collet jaws 27 around one side of the cap conflict with the cap and are forced sidewards to accommodate the entrance into the cage of the cap and the mouth of the bottle. As these particular jaws are moved sidewards, they correspondingly urge the collet sleeve 26 sidewards and it readily follows, due to the anti-friction characteristics of the floating thrust bearing 25. During this sideward shifting movement, the collet sleeve, together with the spring-loaded pressure ring 29, maintains the stability of the loose assembly of collet jaws. As is apparent from FIG. 4, the crimping mechanism has shifted to the left to accommodate an off-center bottle, and the crimping action of the jaws upon the bottle is identical and is in no way affected by the misalignment.

Both the crimp depth and the crimp diameter of the present crimper head may be readily varied to adapt the head for optimum engagement with caps and bottles of various dimensions.

The crimp depth is determined by the dimension between the abutment surface 20S at the lower end of the locator 20 and the actual crimping surfaces of the collet jaws 27, which are maintained adjacent the bottom wall 22 of the cage. This dimension may be adjusted by loosening the cap screw 21 to free the locator 20, which is then threaded inwardly or outwardly through the cage and locked in a selected new position by retightening the cap screw 21. This adjustment also changes the particular preloading force developed by the spring 31, but this is not significant. Preferably, the locator pocket 20P is shaped to receive an adjustment wrench for facilitating external adjustment of the crimp depth.

The crimp diameter is determined by the diameter of the collet jaws at their final contracted position; and this, in turn, is dependent upon the length of travel of the collet sleeve **26** and, hence, upon the length of travel of the piston. As indicated previously, the piston travel is regulated by adjusting the position of the stop collar **18** along the piston rod **17**.

The foregoing description and the drawings are given merely to explain and illustrate the invention and the manner in which it may be performed, and the invention is not to be limited thereto except insofar as the appended claims are so limited, since those skilled in the art who have this disclosure before them will be able to make modifications and variations therein without departing from the scope and spirit of the invention.

I claim:

1. A crimper head for sealing a closure cap around the open mouth of a container and comprising a shell providing a mounting pocket at one end thereof, a cage slidably retained in said mounting pocket extending substantially to the outermost end thereof and carrying a cap-engaging locator centrally therein without lost motion, therebetween, crimping mechanism floatingly mounted in said cage for limited lateral shifting movement relative to the principal axis thereof and including a set of radially movable collet jaws adjacent said one end of said pocket for engagement around a closure cap and a jaw actuator operable for moving the jaws into crimping engagement with a cap, means for providing relative movement between said shell and a container to bring said locator into engagement against a closure cap disposed on a container, and means movable through said shell for operating said actuator to move said jaws into crimping engagement with said cap.

2. A crimper head for sealing a closure cap around the open mouth of a container and comprising a shell providing a mounting pocket at one end thereof, a cage slideably retained in said mounting pocket extending substantially to the outermost end thereof and carrying a cap-engaging locator centrally therein without lost motion therebetween, a spring in said shell biasing said locator and cage towards said one end of the shell, crimping mechanism floatingly mounted in said cage for limited lateral shifting movement relative to the principal axis thereof and including a set of radially movable collet jaws arranged for engagement around a closure cap and a jaw actuator slideable in said cage to engage said jaws for moving the same into crimping engagement with a cap, means for providing relative movement between said shell and a container to apply force through said spring for preloading said locator against a closure cap disposed on a container, and means for moving said actuator member through said shell to move said jaws into crimping engagement with said cap.

3. A crimper head for sealing a closure cap around the open mouth of a container and comprising a shell providing a mounting pocket at one end thereof, a cage slideably retained in said mounting pocket and carrying a cap-engaging locator in lengthwise adjustable fixed position centrally therein, a spring in said shell biasing said locator and cage towards said one end thereof, crimping mechanism mounted in said cage and including a set of radially movable collet jaws arranged for engagement around a closure cap and a jaw actuator slideable in said cage to engage said jaws for moving the same into crimping engagement with a cap, means for providing relative movement between said shell and a container to apply force through said spring for preloading said locator against a closure cap disposed on a container, with the selected position of said locator with respect to said cage determining the crimp depth, and means for moving said jaw actuator member through said shell to move said jaws into crimping engagement with said cap at the selected crimp depth.

4. A crimper head for sealing a closure cap around the open mouth of a container and comprising a shell providing a cylinder at one end and a mounting pocket at the other end, a piston slideable in said cylinder, a cylinder head at said one end of said shell, a cage slideably retained in said mounting pocket and having an interiorly arranged, fixedly mounted cap-engaging locator structure, resilient means reacting between said piston and locator structure to bias the same apart, crimping mechanism mounted in said cage and including an annular set of collet jaws for radial movement into engagement with a cap to seal the cap around a container and a jaw actuator slideable in said cage to engage said jws for moving the same into crimping engagement with a cap, thrust means movable through said cage for transmitting force from said piston to said actuator, means for moving said shell to bring said locator structure into engagement against a closure cap disposed on a container, with said resilient means being compressed upon continued movement of said shell to bias said locator structure for preloading engagement against the closure cap on a container, and means for moving said piston through said cylinder to further compress said resilient means and to simultaneously transmit motion through said thrust means for driving said jaw actuator into engagement with said jaws for moving the jaws into crimping engagement with the cap.

5. The crimper head arrangement of claim 4 wherein said piston has a piston rod projecting in slideable relation through and beyond said cylinder head and an adjustable stop collar is secured externally on said rod to abut said head for limiting piston travel.

6. A crimper head for sealing a closure cap around the open mouth of a container and comprising a shell providing a mounting pocket at one end thereof, a cage slidably retained in said mounting pocket extending substantially to the outermost end thereof and having a cap-engaging locator supported therein, without lost motion therebetween, crimping mechanism floatingly mounted in said cage for limited lateral shifting movement relative to the principal axis thereof and including a set of radially movable collet jaws for engagement around a closure cap, a jaw actuator operable for moving the jaws radially into crimping engagement with a cap, and bias means normally urging the jaw actuator and the set of jaws to opposite ends of the cage, means for providing relative movement between said shell and a container to bring said locator into engagement against a closure cap disposed on a container, and means movable through said shell for operating said actuator to move said jaws into crimping engagement with said cap.

7. A crimper head for sealing a closure cap around the open mouth of a container and comprising a shell providing a mounting pocket at one end thereof, a cage slidably retained in said mounting pocket extending substantially to the outermost end thereof and having a cap-engaging locator mounted therein without lost motion therebetween, crimping mechanism floatingly mounted in said cage for limited lateral shifting movement relative to the principal axis thereof and including a set of radially movable collet jaws for contracting engagement around a closure cap, said jaws having bevelled surfaces on their radially outermost edges, a collet sleeve having a complementary bevelled surface about its interior for cooperating engagement with said jaw surfaces to contract said jaws radially inwardly into crimping engagement with a cap in response to movement of said sleeve theretoward and bias means normally urging the sleeve and the set of jaws to opposite ends of the cage for spreading said jaws apart radially, means for providing relative movement between said shell and a container to bring said locator into engagement against a closure cap disposed on a container, and means movable through

said shell for operating said actuator to move said jaws into crimping engagement with said cap.

8. In a crimper head for sealing a crimpable closure cap on the open mouth of a container, in combination, a set of radially movable collet jaws arranged for crimping engagement around a closure cap said jaws having downwardly and outwardly diverging outer cam surfaces and downwardly and inwardly converging inner cam surfaces, a collet sleeve fitting telescopically over said jaws and having an inner cam surface engaging with said outer cam surfaces for contracting said collets together when said sleeve is moved downwardly with respect to said jaws, a pressure ring fitting within said set of collets in camming engagement with said inner cam surfaces thereof to exert a spreading action on said jaws,

and a spring retained in compression between said pressure ring at the bottom and said collet sleeve at the top for normally biasing said set of collet jaws and said collet sleeve apart in opposed axial directions.

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