CONTAINER NECKING MECHANISM AND METHOD

Inventor: John Hardy Maytag, Denver, Colo.
Assignee: Coors Porcelain Company, Golden, Colo.
Filed: March 19, 1971
Appl. No.: 126,138

U.S. Cl. 113/120 R, 113/1 G, 72/354, 72/370
Int. Cl. B21d 51/00, B21b 17/02, B21d 22/00
Field of Search 113/1 G, 120 H, 120 M, 113/120 AA, 120 R; 72/94, 343, 354, 358, 370; 29/1-3

References Cited
UNIVERSAL PATENTS
3,600,927 8/1971 Wahler .................113/120 AA
3,468,153 9/1969 Patarini .................113/120 AA
2,013,654 9/1935 Hothersall ..............113/1 G
865,257 9/1907 Kohl .................113/120 H
1,698,999 1/1929 Hothersall .................72/370

Primary Examiner—Charles W. Lanham
Assistant Examiner—Michael J. Keenan
Attorney—Bertha L. Macgregor

ABSTRACT
Container necking mechanism comprising a stationary necking die and reciprocatory punch and push plate members, each of said punch and push plate members being controlled by a rotated cam, said cams causing the punch or push plate member to exert pressure in the direction against the container at predetermined times during the cam rotations to move the container toward and from an annular space between the stationary die and punch member, and said cams having complemen tal working faces on parts of their peripheries which cooperate during part of the necking operation to move a container into necking position in the die by simultaneous movements of both punch and push plate members in the same direction whereby frictional resistance between the punch and the container is eliminated during movement of the container with the punch.

4 Claims, 3 Drawing Figures
CONTAINER NECKING MECHANISM AND METHOD

This invention relates to container necking mechanism and method of necking containers such as cylindrical cans. Necking is a procedure which reduces the diameter of a can adjacent its open end, preparatory to flanging the circumferential edge and applying a cover thereon to close the can. In a 12 fluid ounces can, approximately 5/8 inches tall, the necked portion extends inwardly five sixteenths of an inch from the circumferential edge of the container. The reduction in the diameter of the can adjacent its top, produced by the necking procedure, is quite small, approximately 5/8 inch, but sufficient to provide space within the outer diameter of the body of the can for the rim or chime formed on the outer side of the top edge when the cover is applied to the container. When necking is omitted, the chime protrudes radially outwardly beyond the container body and interferes with the efficient packaging of the containers wherein it is desirable to have the container bodies in close contact with each other without the spacing caused by the protruding rims.

When prior art necking mechanisms and methods have been employed for necking thin walled cans, such as aluminum containers, the cylindrical bodies have become wrinkled or buckled in operation due to pressure applied simultaneously in opposite directions to the top and bottom ends of the cans. It has been customary to move a container end to be necked into an annular space between a reciprocatory punch and a stationary die, where the necking takes place, by applying pressure to the container bottom by means of a push plate, the punch having previously been fully retracted and being maintained stationary relatively to the die meanwhile. The frictional resistance encountered by the can end due to frictional resistance simultaneously with the stationary die and punch while being forced into the space between them exceeds the column strength of the can, causing wrinkling and buckling of the can body.

The main object of this invention is to perform the necking of thin walled containers without injury to the containers, and in an efficient and dependable manner. This object is achieved by eliminating resistance heretofore imposed by the knock out punch on the container adjacent its open end as the container meets the necking mechanism, by providing means for moving both the punch and the bottom push plate members, and consequently the container, in the same direction during the necking contact between container and punch member while within the annular space in the stationary die.

IN THE DRAWINGS:

FIG. 1 is a longitudinal vertical sectional view, partly in elevation, of a container necking machine embodying my invention, the drive mechanism for the main shaft being omitted.

FIG. 2 is a diagrammatic view illustrating the operation of the mechanism of FIG. 1, showing a container to be necked by the stationary necking die and cam actuated knock out punch at the lower left of the drawing cooperating with the cam actuated necking ram and push plate at the lower right of the drawing, and showing also the progressive movements of the parts at designated time intervals.

FIG. 3 is a view similar to FIG. 2 illustrating the operation of corresponding parts in prior art necking machines.

In the embodiment of the invention shown in FIG. 1, the container to be necked is a conventional seamless cylindrical thin walled can 10 having side walls 11, bottom 12 and an open top edge 13. In FIGS. 2 and 3, the can 10 is shown at the bottom of the drawings as it appears before having been necked, and at the top of the drawings as it appears after having been necked at 14.

Referring to FIG. 1, containers 10 are deposited from a delivery chute (not shown) into the pockets of a pair of star wheels 15 which include a spacer 16. The wheels 15 are mounted on a rotatable shaft 17 in such position that the cans 10 carried by the rotated star wheel are in axial alignment with a knock out punch which is part of the necking mechanism comprising a knock out cam 18, cam support 19, knock out ram 20, bushing 21, retaining nut 22, lock gasket 23, knock out punch 24 and stationary necking die 25, all located at the left of the container 10 in FIG. 1. The containers 10 are also aligned with a push plate for contacting the bottom of the can 10, part of the necking mechanism including the necking cam support 26, necking cam 27, necking ram 28, bushing 29 and push plate 30, all located at the right of the container 10 in FIG. 1.

A plurality of the necking dies 25 and knock out mechanisms 20–24 is mounted in the knock out rams block 35, and a registering number of the necking push plates 30 and mechanisms 26–29 is mounted in the necking rams block 36. Other designated parts of the mechanism are a key 40, air collar 41, wear plate 42, air manifold 43, air manifold standoff 44 and air manifold reaction plate 45. The operation of the cans 18 and 27 and the parts actuated thereby will be understood by reference to FIG. 2.

In FIG. 2, the un-necked container 10 is shown at the bottom of the view in axial alignment with the stationary necking die 25 and knock out punch 24, at the left, and with the necking push plate 30 at the right, the plate 30 being adjacent the can bottom 12 at the beginning of the necking cycle indicated at 101 on the cans 18 and 27. The knock out cam 18 and the necking cam 27 are rotated in unison. Their contours or working faces differ from each other in certain areas which impart movements to the containers 10. Time intervals in the rotation of the cans 18 and 27 are designated 101–118 inclusive.

As the cans 18 and 27 rotate during the interval 101–104, the ram 28 and push plate 30 are gradually moved toward the punch 24 and stationary die 25 due to the contour of the cam 27 contacting the ram 28, consequently moving the can 10 toward the annular space between the punch 24 and die 25. As indicated in the interval 105–109, the knock out cam 18 has a contour which corresponds approximately with that of cam 27, causing the container 10 to be moved to the left by the push plate 30 into contact with the inner surface of the stationary die 25 and at the same time the knock out ram 20 and punch 24 are relieved of pressure from punch cam 18 and are free to move in the same direction as the container at approximately the same speed. The simultaneous movement of the push plate 30 and punch 24 in the same direction during the interval 105–109, while the can edge 13 is moving into the annular space within the die 25, eliminates frictional
3,687,098

resistance which would be encountered at this stage of the necking operation if the punch 24 were held stationary by the cam 18 or were forced toward the right in this interval.

The completion of the necking which reduces the diameter of the wall 11 adjacent the edge 13, as indicated at 14, is performed between the stationary die 25 and punch 24 while the latter is moving in the same direction as the container and push plate 30 in the interval indicated at 108–109 on the cams when the push plate 30 in exerting pressure on the bottom of the container. During this interval, the cam 18 permits the punch 24 to move with the container and thus relieves the container of bearing pressure opposed to that exerted by the plate 30.

During the interval 110–118, the push plate 30 is being moved away from the bottom of the container, leaving the necked container free to move in response to pressure exerted by the knock out punch 24 which travels in the path defined by the cam 18.

FIG. 3 illustrates necking operations heretofore performed by prior art mechanism and methods. The container 10, stationary die 25 and punch 24, as well as the push plate 30 and ram 28 are similar to parts so designated in FIG. 2, but a knock out cam 50 and necking cam 51 differ from the cams 18 and 27 which have replaced them. The contours of the cams 50 and 51 differ from each other and also from the cams 18 and 27, respectively. Time intervals corresponding to the rotations of the cams 50 and 51 are designated 201–218. During this time indicated approximately by 205–209, the cams 50 and 51 exert pressures in opposite directions toward each other on the punch 24 and push plate 30, respectively, and thus on opposite ends of the container 10 between them, causing injury to thin walled bodies due to the resistance imposed by the punch member 24 bearing against the container area adjacent the edge 13 while that part of the container is within the annular space between die 25 and punch 24 and plate 30 is bearing on the bottom of the can. In the prior art procedure illustrated in FIG. 3, the pressure on the can which is generated by pressure from the push plate opposed by friction with the stationary punch is additive to that caused by the pressure of the push plate opposed by friction with the necking die.

The advantages obtained by the use of the cams 18 and 27 for actuating the knock out punch 24 and push plate 30 are apparent from FIG. 2, where a can is pushed by the plate 30 to the left while the can is spaced from the punch 24; the necked can is moved by the punch 24 toward the right while the can is spaced from the push plate 30 in movement out of necking position; and intermediate these two movements of the can, in the time interval indicated approximately at 105–109, the cams 18 and 27 rotate in unison to present a pressure exerting face against the push plate member and a cooperating substantially complementary non-pressure exerting face toward the punch 24, producing movement simultaneously in the same direction of the container, punch and push plate members, thereby preventing injury to the container because frictional resistance has been eliminated between the punch and container as they move together in the same direction.

1. Container necking mechanism comprising:
   a. a stationary necking die,
   b. a reciprocable punch movable in the die and separated from the die by an annular necking space,
   c. a reciprocable push plate spaced in axial direction from the punch,
   d. rotated supporting means supporting a container having an open end to be necked in axial alignment with the necking die, punch and push plate,
   e. a rotated push plate cam operatively connected to the push plate, said cam including means to actuate the push plate to contact the container and move the container gradually toward the punch into necking contact with the punch and stationary die in the annular space between them and including means to withdraw the push plate from the container, and
   f. a rotated punch cam operatively connected to the punch, said cam including means to actuate the punch to space the punch from the open end of the container while the push plate moves the container gradually toward the punch, including means to actuate the punch to engage the container and to move in the same direction with the container while the push plate is pushing the container into said annular space, and including means for moving the punch and container out of the said space by actuating the punch to bear on the container necked end while the push plate is out of contact with the container.

2. The mechanism defined by claim 1, in which the cams are contoured to have substantially complementary working faces on corresponding parts of their peripheral surfaces which actuate the push plate to push the container and simultaneously actuate the punch to engage the container and to move the container and push in the same direction.

3. The method of necking an open end container which comprises the steps of moving the container toward a stationary necking die and reciprocable punch by exerting pressure against the container end while the opposite end is free of pressure, moving the punch and container simultaneously in the same direction to position the container end between the punch and die in necking engagement therewith, and exerting pressure on the necked end to free the container from the punch and die while the bottom of the container is free of pressure, whereby pressure caused by friction between can and punch and consequent injury to the container are eliminated.

4. The method of necking a container having a closed end and an open end, which comprises the steps of moving the container toward necking mechanism by imposing pressure against the closed end of the container in axial direction while the open end is free from pressure, moving the container by pressure against the closed end into necking position and simultaneously engaging the open end by necking mechanism moving in the same direction as that imposed on the container closed end, and moving the necked container away from the necking mechanism by imposing pressure against the open end while the closed end of the container is free from pressure, whereby pressure caused by friction between can and punch and consequent injury to the container are eliminated.