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in accordance with Art. 76 EPC: 0 019 394(71) Applicant: THE CONTINENTAL GROUP, INC.
1 Harbor Plaza
Stamford Connecticut 06904(US)(72) Inventor: Walter, John
9815 S. Artesian Avenue
Evergreen Park Illinois(US)(74) Representative: Madgwick, Paul Roland et al,
Ladas & Parry Isartorplatz 5
D-8000 München 2(DE)

(54) Apparatus for assembling container halves.

(57) Apparatus for assembling a pair of thin-walled metal container counterparts which are brought together axially, are rounded and one inserted into the other substantially without deformation of either of the pair of counterparts so that the inner part is allowed to expand, after insertion, radially and both parts at their juncture are stressed in hoop tension for tightly embracing an adhesive interposed therebetween and thereby insure a good bond at the seam.

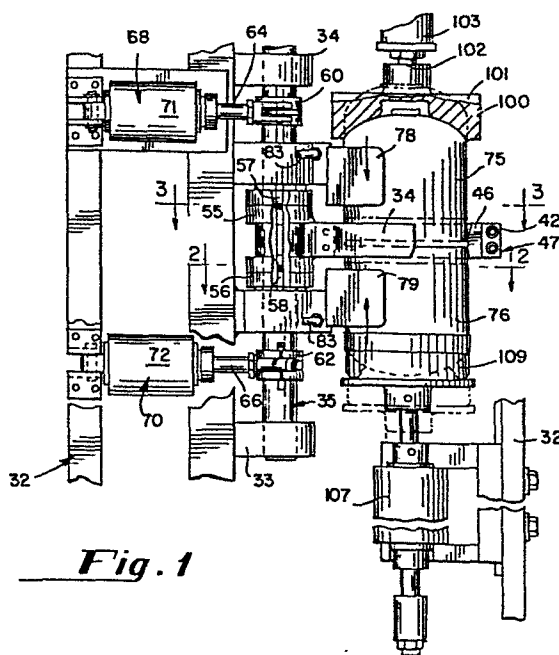


Fig. 1

- 1 -

The invention is directed to an apparatus for assembling thin-walled container halves.

Attempts at assembling thin-walled container halves by conventional methods have failed in that
5 even if one of the halves is necked in prior to attempts at assembly, the flimsy nature of the side walls prevents their retaining a cylindrical shape and thus great difficulty has been experienced in rounding the parts and then axially pushing them to-
10 gether.

In French Patent No. 1,224,793, a container is formed of thick-walled cylinder halves, one of which is necked out and the second necked in, the second half being telescoped into the first and the halve
15 are then welded together. This may be effective for thick-walled containers which retain their shape after reforming, but thin-walled containers, particularly if made from relatively soft metal such as aluminum, are very unstable in retaining their shape and thus are
20 difficult to assemble and in forming the edges, are hard to control. This is especially significant for high-speed production of 400-1000 units per minute.

In the prior art, the bonding of telescoped container halves usually involves a welding or brazing
25 of the metal parts. Adhesive bonding as heretofore has been tried but has been found wanting.

Various problems occur in obtaining an adequate sealing using adhesive bonding. Attempts have been made by merely coating the exterior edge portion of the inner

- 2 -

container portion or the interior edge portion of the outer container portion. The two halves then are telescoped. However, during the insertion movements the edge of the uncoated portion would scrape off the coating from the coated portion and the residue remaining would not in each instance be sufficient to provide a bond of required integrity.

The object of this invention is to provide a novel apparatus for assembling the container halves which overcome the foregoing problems.

Accordingly, the present invention provides an apparatus for assembling a pair of thin-walled cup-shaped container sections adapted to be assembled end to end and each section comprising a cylindrical body wall having an open end defined by an end portion of the body wall which normally assumes an out of round shape; comprising a support; means for mounting said sections in axially spaced aligned relation and the end portion of each opposing the other; a die assembly mounted on the support in a position to receive one of the container sections at one side thereof and the other container section at the opposite side thereof; said die assembly comprising an opening there through; outer guide means at opposite sides thereof for guiding the end portions of respective container sections into said opening; said opening being defined at one side of the die assembly by a cylindrical surface disposed inwardly as said guide means as a continuation thereof and of a diameter to snugly engage the external side of a container section insertable therein to shape and hold the same round; said guide means on the other side of said guide assembly extending through said shoulder and defining an inner edge thereof; said shoulder having a radial extent slightly greater than the thickness of the body wall of the container inserted into said cylindrical sur -

- 3 -

face area, and means for advancing said container sections toward one another and telescoping the end portion of one container end portion into the other.

In use of the apparatus of the invention,
5 the first and second container halves are advanced toward each other at opposite sides of the die and the second half is forced through the necking surface and is slightly necked in while the first half is disposed in receiving position. Thus, as the second half is
10 being necked in, it also wedges into the first half. These operations are concurrent. Before the halves are fitted one into the other, the second or entering half has a coating of adhesive applied thereto along its entering edge, although it will be understood
15 the adhesive may be applied within the outer (first) container half at its juncture edge portion.

The outer container is held round (squared) in the die assembly. The entering portion of the inner container is slightly necked in while relatively
20 advancing the two halves toward each other and while holding them under control so that the inner container portion easily enters the open end of the outer portion. The inner portion is under compression and after release from the die, springs outwardly and produces a hoop tension in the outer portion.
25

The adhesive preferably is a vinyl plastisol material which solidifies on being heated after the container sections are mated. The container sections are released when telescoped and the inner section
30 expands and compresses the trapped adhesive and thus maintains intimate pressed contact between the parts so that they adequately bond with the adhesive as it cures or sets. Suitable adhesive materials for bonding the two container sections together can be any known
35 materials having adhesive properties including vinyl

plastisols, thermosetting epoxy resins and thermoplastic resins such as polyethylene, polypropylene. Other adhesive materials include vinyl plastisol formulations, carboxylated polyolefin resins and especially carboxylated polypropylene resins of the type disclosed in U.S. Patent 3,616,047.

These and other features and advantages of the invention will become more apparent from the specification and the drawings, wherein:

10 Fig. 1 is a side elevational view partly in axial section of apparatus of the invention;

 Fig. 2 is a cross-sectional view taken substantially on line 2-2 of Figure 1;

 Fig. 3 is an enlarged cross-sectional view
15 taken substantially on line 3-3 of Figure 1;

 Fig. 4 is an enlarged fragmentary view of a portion of the die member in cross-section showing the can parts in position preparatory to entering the die; and

20 Fig. 5 is a fragmentary axial vertical section taken substantially on line 5-5 of Figure 3 showing the can parts in assembled position.

 The preferred apparatus of the invention is illustrated in Figures 1-5. With reference to these
25 Figures, the apparatus 31 comprises a support frame 32 which has a plurality of vertically aligned bearings 33 and 34 mounted thereon in which an operating shaft assembly 35 is journaled.

 The shaft assembly is split into two counter-
30 rotary sections 38 and 40.

 Shaft section 38 is connected to one jaw or clamp holder 42 and the shaft section 40 is connected to jaw or clamp holder 44 of a die 45. The jaw sections each carry a half section segment 46 of a die ring 47.
35 Each section 46 has a tongue 48 fitted into a groove 50, in the associated jaw or clamp holder 42 or 44. In addition, there is provided an end stop 52 at each end of

segment 46 abutting the end of the same, the stop being attached by screws 54, 54 threaded into the associated end portion of the jaw section 42 or 14.

Jaws 42, 44 have arms 55, 56 respectively at one of
5 their ends keyed by keys 57, 58 to the respective shaft sections 38 and 40.

The shaft sections 38 and 40 are connected to pistons 64, 66 of air or hydraulic motors 68, 70, the pistons operating in cylinders 72, 74.

10 Thus, the clamps and their associated die sections are opened and closed by reversely turning the respective shaft sections in order to admit cup-shaped container halves or cups 75, 76 which are made of metal, preferably aluminum of about 6-10 mils in thickness.

15 Associated delivery and discharge mechanism is used to bring the cups to the assembly apparatus 31 and to remove the assembled container but are of no concern as to the present invention.

As best seen in Figure 1 and 2, the assembly
20 apparatus is provided with vacuum holders 78, 79 which are mounted on the frame and each have an arcuately shaped pocket with a vacuum slot 81 connected with an associated vacuum line 83.

The holders 78, 79 releasably hold the upper
25 and lower halves 75, 76 of the container with the open end portions 85, 86 (Fig. 4) thereof facing each other. The clamps are then closed about these open end portions as seen in the right half of Fig. 4. If desired, the clamps may first be closed and the halves advanced to-
30 ward each other and entered into the upper and lower ends of the die 47. It will be noted that the upper and lower end portions 88, 90 of the dies are provided with truncated conical guide surfaces 93., 92 which flare downwardly and upwardly respectively and at their outer
35 ends are of a diameter greater than that of the body portions 93, 94 of the upper and lower cup sections.

Thus, the edge portions 85, 86 of the body portions 93, 94 are easily guided into the center portion of the die.

The center portion of the die has an upper
5 cylindrical die portion with a surface 97, which is equal to substantially the outside diameter of the upper cup. The upper cup is advanced into the surface 93 which rounds the lower edge portion of the upper cup by an upper pusher 100 which has a cap 101 at the lower
10 end of rod 102 of a piston which operates in an air cylinder 103 carried by the frame.

The upper cup slips along the holder 78 and is guided into the cylindrical die surface 97 until the lower edge 105 of the upper cup seats upon the
15 shoulder 106 at the bottom of the squaring surface 107. Simultaneously, with the upper cup being inserted into the cylindrical section 107, the lower cup is pushed upwardly by an air or hydraulic cylinder 107 which has a base pad 108 bearing against the bottom or base 109
20 of the lower or male cup. The edge portion 86 of the lower cup has been previously coated with an appropriate adhesive 109. The edge portion 86 of the lower cup is very slightly necked-in but not deformed as it moves past the shoulder 106. The inner edge of the shoulder
25 106 is of a diameter slightly less than the inner diameter of the upper cup, and the shoulder 106 has a radial dimension slightly larger than the thickness of the metal of the body wall of the upper cup.

It has been found that the fit of the lower
30 cup edge portion into the upper edge portion merely springs the metal of the lower cup very slightly without permanent deformation and that upon release from the die, the hoop compressive forces on the edge portion 56 are slightly relieved and tensile hoop stresses
35 develop in the edge portion 85. Thus, a tight fit is insured between the two halves and the adhesive which is preferably thermoplastic polyolefin resins such as

- 7 -

carboxylated polypropylene or polyethylene as well as thermosetting resins such as epoxy resins. These resins, when heated, will distribute and bond in shear the opposing outer surface 112 of the inner portion 86 to the inner surface 113 of the outer portion 85. It will be noted that no inner support is required to telescope the two cups into each other and no wrinkling occurs at the juncture so that a good, leak-proof bond is developed which resists separation of the two halves in shear. It will be understood that any cold adhesive or thermoplastic adhesives may be used to bond the two halves.

After the two cup halves are assembled, the die is opened and the upper and lower pushers separated and a vacuum withdrawn from the holders and the assembled unit is withdrawn or drops out and the following two halves are entered into the apparatus at opposite sides of the die and assembled in a continuous process.

- 8 -

CLAIMS

1. An apparatus for assembling a pair of thin-walled cup-shaped container sections adapted to be assembled end to end and each section comprising a cylindrical body wall having an open end defined by an end portion of the body wall which normally assumes an out of round shape; characterized by a support; means for mounting said sections in axially spaced aligned relation and the end portion of each opposing the other; a die assembly mounted on the support in a position to receive one of the container sections at one side thereof and the other container section at the opposite side thereof; said die assembly comprising an opening there through; outer guide means at opposite sides thereof for guiding the end portions of respective container sections into said opening; said opening being defined at one side of the die assembly by a cylindrical surface disposed inwardly as said guide means as a continuation thereof and of a diameter to snugly engage the external side of a container section insertable therein to shape and hold the same round; said guide means on the other side of said guide assembly extending through said shoulder and defining an inner edge thereof; said shoulder having a radial extent slightly greater than the thickness of the body wall of the container inserted into said cylindrical surface area, and means for advancing said container sections toward one another and telescoping the end portion of one container end portion into the other.

2. The apparatus according to claim 1, characterized by mounting means comprising a pair of vacuum cups disposed at opposite sides of the die assembly releasably supporting the respective container sections for movements toward each other.

3. The apparatus according to claim 1 or 2, characterized by means for moving said container sections toward each other.

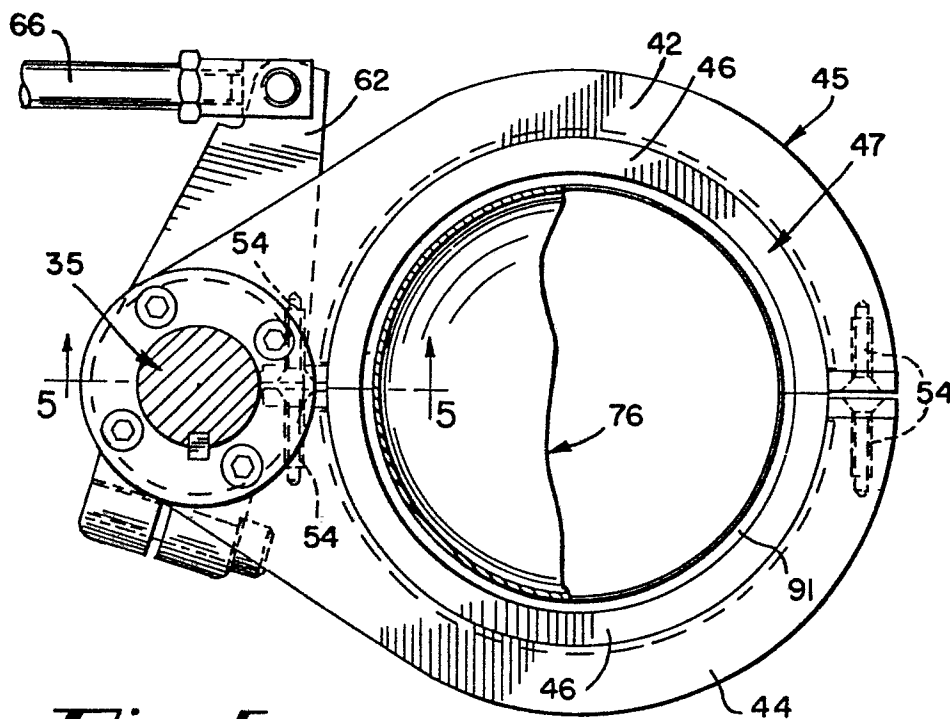
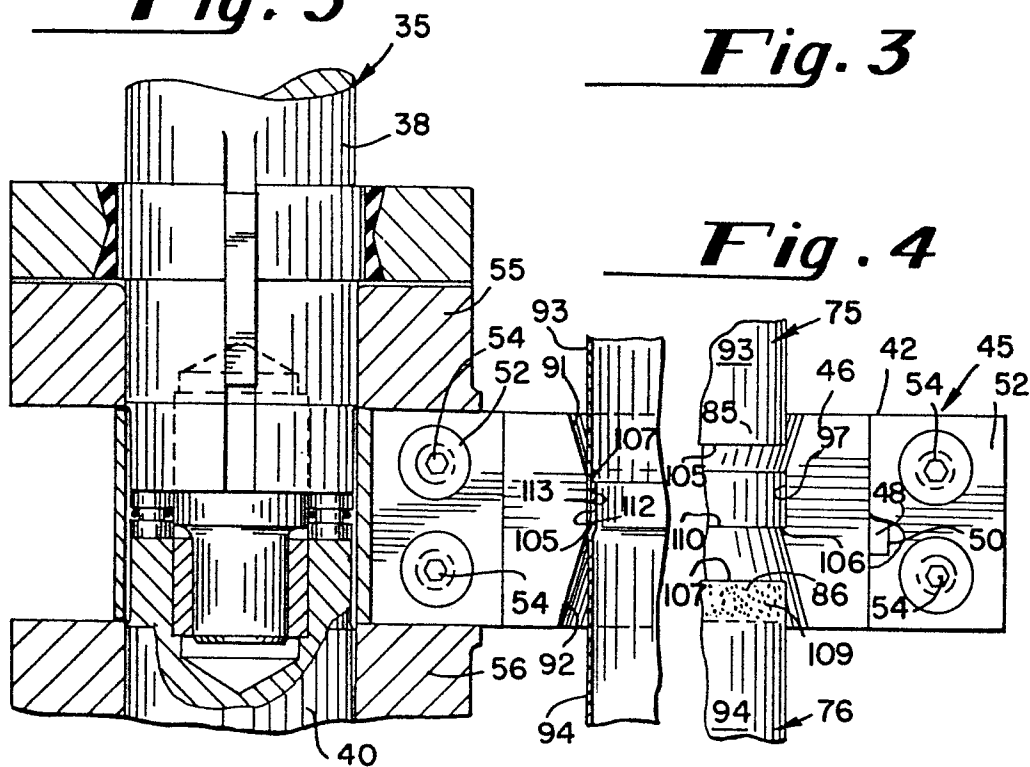
4. The apparatus according to claim 1, 2 or 3, characterized by said die assembly comprising a pair of complementary segments, and means for closing said segments preparatory to assembly of said container sections and separable to release the assembled containers.

5. The apparatus according to claim 4, characterized by said support comprising a pair of counter-rotating shafts, and said die assembly comprising a pair of radially separable and closable segments connected to respective shafts, and means programmed to close and open the die segments to respectively dispose the die in assembly position and in release position.

6. The apparatus according to any of claims 1 to 5, characterized by said die assembly comprising a die ring having a frusto-conical guide surface tapered toward the die center and forming a through opening therein; a cylindrical squaring surface extending from the inner end of one of said guide surfaces; and a stop shoulder at the end of said cylindrical surface remote from said one guide surface, said shoulder having a radial width substantially equal to or slightly larger than the thickness of the metal wall of a cup adapted to be inserted therein; the other of said guide surfaces extending through said shoulder and forming the inner marginal edge thereof.

7. The apparatus according to claim 6, characterized by said die ring being split diametrically into two halves and a holder for each half having a tongue and groove interlock therewith, and means on each holder for securing the related ring half thereto.

Fig. 1

**Fig. 5****Fig. 3****Fig. 4**