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METHOD AND APPARATUS FOR CLOSING CONTAINERS WITH  
CLOSURES SIMILAR TO BOTTLE CAPS  
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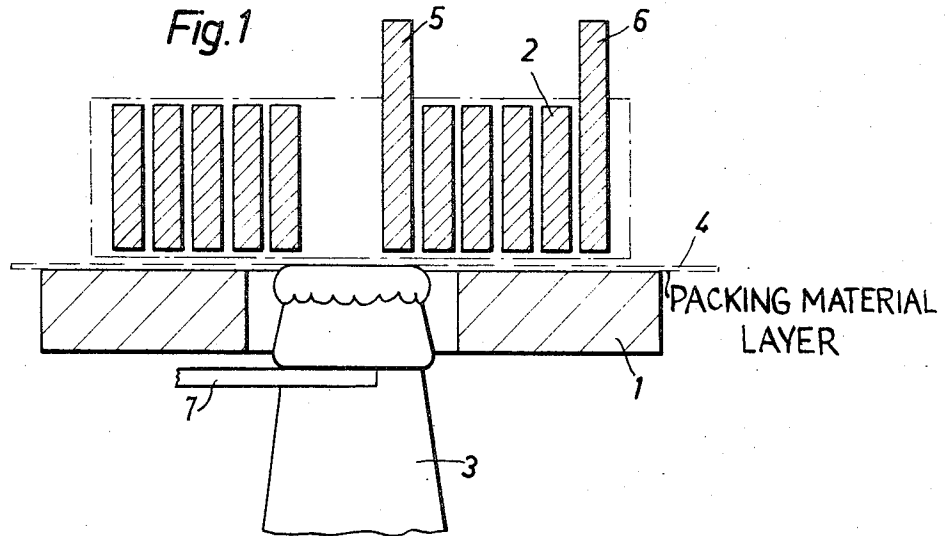
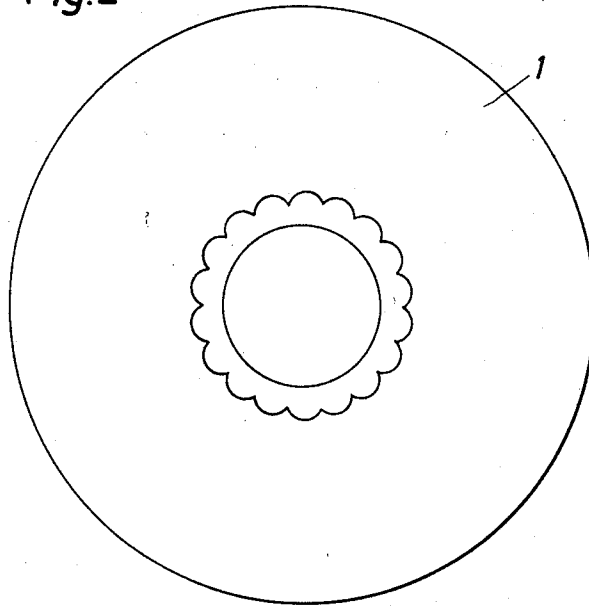


Fig. 2



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**METHOD AND APPARATUS FOR CLOSING  
CONTAINERS WITH CLOSURES SIMILAR  
TO BOTTLE CAPS**

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5 Claims

**ABSTRACT OF THE DISCLOSURE**

Method of closing containers such as bottles with closures similar to bottle caps include the steps of punching a closure blank out of a metal band and simultaneously pressing the closure blank onto the container so as to close an opening thereof in one operating step by passing a shock current discharge through an induction coil whereby a pressure wave is exerted on the closure blank. Container-closing apparatus for carrying out the above method includes a shock current induction coil having a single-layer spiral winding disposed in a given plane, a punch die having an opening with a profile corresponding to an opening of the container that is to be closed, the punch die being disposed in a plane underlying and spaced from said given plane a given distance so as to provide clearance for the insertion of a metal band therebetween, and means for inserting the container in the opening of the punch die.

Our invention relates to method and apparatus for closing containers, such as bottles, for example, with closures similar to bottle caps.

In heretofore known container-closing machines, such as bottle-capping apparatus, a series of manufacturing steps are necessary for closing the container. Thus, for example in German Pat. 693,458, there is disclosed how a crown-shaped bottle cap is supplied by a guide chute to a location above the mouth of a bottle and then pressed thereon. For the coordination of the individual operating steps, many mechanically movable parts are required which must, moreover, operate accurately with respect to one another so that the individual steps beginning with the introduction of the caps and the bottles and ending with the capping of the bottles will take place in correct sequence. Care must also be taken in order to provide a fluid-tight closure so that predetermined dimensions of the caps and the bottle openings are maintained as accurately as possible. In general, due to the complex mechanical construction of the conventional bottle-capping machine it is not readily possible to use different caps for capping different types of bottles. Container-closing or bottle-capping machines, because of the often necessary exchangeable parts, are quite expensive. Furthermore, for each different type of bottle corresponding caps must be kept in stock, which even further increases the expense of operating such bottle-capping machines.

It is accordingly an object of our invention to provide method and apparatus for closing containers with closures similar to bottle-caps which avoids the foregoing disadvantages of the heretofore known methods and apparatus of this type.

More specifically, it is an object of our invention to provide an improved method and apparatus which simplifies the closing of different types of containers and reduces the cost thereof.

It is another object of our invention to provide such

method and apparatus which obviates the necessity for stocking large quantities of bottle caps of different sizes and shapes.

With the foregoing and other objects in view we accordingly provide method of closing containers such as bottles with closures similar to bottle caps, comprising the steps of punching a closure blank out of a metal band and simultaneously pressing the closure blank onto the container so as to close an opening thereof in one operating step by passing a shock current discharge through an induction coil whereby a pressure wave is exerted on the closure blank. When the containers are bottles having a beaded rim surrounding the bottle opening, the pressure wave produced by the shock current discharge is applied so that the closure blank is pressed around the beaded rim.

Our invention is based on the fact that electric currents are induced in metals by rapidly varying magnetic fields and, due to the interaction of the alternately flowing current with the varying magnetic fields, deforming shock waves are produced in a surrounding medium such as air and water or the like. In German published application No. 1,122,188, there is described how workpieces are deformed by means of such shock wave forces or, for example, how two telescoping pipes are joined thereby to one another. In the invention of this application, use is made of the same shock wave forces for fluid-tightly or liquid-tightly closing containers such as bottles with closures similar to bottle caps. We therefore provide, in accordance with our invention in a container-closing apparatus for closing containers such as bottles with closures similar to bottle caps, a shock current induction coil having a single-layer spiral winding disposed in a given plane, a punch die having an opening with a profile corresponding to an opening of the container that is to be closed, said punch die being disposed in a plane underlying and spaced from said given plane a given distance so as to provide clearance for the insertion of a metal band therebetween, and means for inserting the container in said opening of said punch die.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as method and apparatus for closing containers with closures similar to bottle caps, it is nevertheless not intended to be limited to the details shown, since various modifications may be made in the method and structural changes in the apparatus without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction of the apparatus and the steps of the method of the invention, however, together with additional objects and advantages thereof will be best understood from the following description when read in connection with the accompanying drawing, wherein:

FIG. 1 is an elevational view, partly in section of the apparatus of the invention; and

FIG. 2 is a top plan view of the punch die forming part of the apparatus of FIG. 1.

Referring now to the drawing, there are shown in FIG. 1 only those parts of the container-closing apparatus that are essential for comprehending the invention of this application. A punch die 1 is provided, extending in a given plane, and a shock current coil 2 having a single-layer spiral winding is located in a plane thereabove, as shown in FIG. 1, and spaced a given distance therefrom. The spacing between the coil 2 and the punch die 1 is of such dimension as to provide clearance for the passage of a metal band 4 therebetween.

At the beginning of the container-closing method of our invention, the metal band 4 lies on top of the punch

die 1, as shown in FIG. 1 and is engaged by the mouth of the bottle 3 or other container which is to be closed. The cleaned and filled bottle 3 or other container is moved upwardly, as shown in FIG. 1 by conventional means such as the illustrated clamp 7, so that the opening thereof extends into the die opening which has a scalloped profile. At the same instant that the bottle 3 is inserted into the die opening, a shock current of relatively short duration is supplied to the coil 2 through the leads 5 and 6 thereof by a conventional non-illustrated shock current source, thereby producing a rapidly varying magnetic field at the location of the metal band 4. This magnetic field, in turn, induces electrical currents in the metal band 4 which interact with the magnetic field to produce a pressure wave or force which causes a bottle-cap blank, of shape and size determined by the shape and size of the die opening, to be punched out of the metal band 4. The ring-shaped zone which is formed between the edge of the die defining the die opening and the neck of the bottle 3 is of such dimension that the scalloped edge of the cap blank is pressed around the annular bead at the mouth of the bottle 3 so that the fully formed cap is firmly secured thereon and tightly closes the opening of the bottle. The closed bottle 3 is thereafter removed from the die opening by actuating suitable conventional mechanism which, for example, moves the clamp 7 in a downward direction, as viewed in FIG. 1, and the bottle is then carried away to another location at which it may be further processed. As the next succeeding bottle 3 or other container is inserted in the die opening, the metal band is simultaneously advanced so that an unbroken surface thereof overlies the die opening. In addition, ignition pulse can be applied simultaneously to the aforementioned non-illustrated shock current source through a delay line so that the entire container-closing operation can be completed rhythmically with a single pulse. In this way, the greatest possible production of closed containers can be achieved. The metal band 4, when desirable, may be provided with a layer of sealing or packing material, such as a suitable plastic material, which adds to the sealing effect of the cap blank punched from the metal band 4. The packing material may be coated on the metal band 4 directly or may be in the form of a loose foil strip interposed between the metal band 4 and the die 1 and can be supplied from a non-illustrated roll thereof. In addition to adding to the sealing effect of the ultimate bottle cap, the layer of packing material serves as a protection for the container or bottle against being struck directly by the metallic cap blank punched from the metal band 4.

Due to the method of the invention in this application, the dimensions of the individual bottle openings can vary without producing any danger that the cap or closure will have a liquid-tight fit. Moreover, maintenance of a large stock of different types of caps or closures is thereby obviated. In addition, the heretofore practice of separately fabricating the caps and then transporting them to the location at which they are pressed onto the container is now dispensed with because, in accordance with our invention, the metal band 4, of which the caps are formed, can be located on spools within the container-closing machine proper. Also, hygienic requirements can be better met for a metal band, as in the invention of this applica-

tion, than for completed container closure which must be stored and then transported to the location at which the containers are closed.

In accordance with the method of our invention, all types of containers with beaded edges about the openings thereof can be closed, even when the openings are rectangular, for example. The material of which the container is made is furthermore inconsequential. The closure can also be pressed over a shaped component which is similar to the beaded edge. For this purpose, the edge is flanged, for example, or in the case of a cylindrical metal container, is expanded or widened so that the cross section thereof is provided with a trapeziform profile.

Since accurately deformed members of sheet metal can be produced by the method and apparatus of our invention, we can also produce therewith membranes, for example. Accordingly, instead of a container, a tool can be employed wherein the blank punched from the metal band can be deformed. Thus, in a single step, i.e. with one energy shock, a stamping or punching operation and a deforming operation are simultaneously performed.

We claim:

1. In a method of closing containers such as bottles with closures similar to bottle caps, the steps of punching a closure blank out of a metal band and simultaneously pressing the closure blank onto the container so as to close an opening thereof in one operating step by passing a shock current discharge through an induction coil where-by a pressure wave is exerted on the closure blank.

2. Method according to claim 1, wherein the container is of the type having an opening surrounded by a beaded edge, and the closure blank is placed across the opening and is pressed around the beaded edge.

3. Method according to claim 1, which includes coating one side of the metal band with packing material so as to seal the closed opening of the container.

4. Method according to claim 1, which includes inserting packing material in the form of a foil strip between the metal band and the container opening and simultaneously punching a blank from the metal band and from the packing material and pressing them on the container.

5. In a container closing apparatus for closing containers such as bottles with closures similar to bottle caps, a shock current induction coil having a single-layer spiral winding disposed in a given plane, a punch die having an opening with a profile corresponding to an opening of the container that is to be closed, said punch die being disposed in a plane underlying and spaced from said given plane a given distance so as to provide clearance for the insertion of a metal band therebetween, and means for inserting the container in said opening of said punch die.

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U.S. Cl. X.R.

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