METHOD OF TESTING THE SEALS OF FOOD CONTAINERS AND CONTAINERS SUITABLE THEREFOR

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Filed: June 28, 1972

Appl. No.: 266,939

Foreign Application Priority Data
July 1, 1971 Netherlands 7109071

U.S. Cl. 324/65 R, 53/78, 73/52, 324/65 P

Int. Cl. G01r 27/02

Field of Search 324/65 R, 65 P; 73/52; 53/78

ABSTRACT

A thin-walled flexible container containing sterilised foodstuff is tested by measuring the electrical conductivity of a path from the interior of the container through the seal to the outside. A container which can be so tested non-destructively is described.

2 Claims, 3 Drawing Figures
METHOD OF TESTING THE SEALS OF FOOD CONTAINERS AND CONTAINERS SUITABLE THEREFOR

This invention relates to the control of packaging, particularly for foodstuffs in sealed containers, and specifically to checking the seals of such containers. Semi-rigid and flexible containers are being used more and more for the packaging of products, particularly foodstuffs which have been preserved by sterilisation. These semi-rigid or flexible containers, manufactured from materials such as metal (e.g., aluminium) coated on one or both sides with plastic or optionally made entirely of plastic, give good protection as regards tightness with respect to the surroundings as long as no damage occurs, for example as a result of rough handling. However, a source of trouble is provided by the seals for which it is not possible to guarantee tightness in 100 percent of cases, no matter what method of sealing is used, for example heat-sealing, electric or acoustic welding, etc. It will be realised that if a sterilised food container has a leak in its seal, the contents rapidly become contaminated.

Therefore, during the packaging of foodstuffs according to the above mentioned method, random testing of the tightness of the seals is regularly carried out by the industry during production. Not only are these random tests extremely time consuming with the methods used up to now (e.g., a biological test), but they also generally have the disadvantage that they must be carried out in a manner which is wholly destructive for the containers which have been filled with the product, closed and possibly thereafter sterilised.

A quick and non-destructive method was sought according to which all the containers, if necessary, could be subjected to an effective control of the imperviousness to leakage as they leave the production line. We have realised that measurement of electric resistance across the seal yields favourable and reproducible results. Although electrical resistance testing is known from the prior art for other purposes, e.g., for rubber articles (Austrian patent specification No. 147,124), it cannot be used for the purpose aimed at here without the necessary adjustment.

Accordingly the invention provides a sealed container containing a product and incorporating an electrode which provides an electrically conductive path between the product and the exterior of the container, said electrode being electrically insulated in such a manner as to enable conductivity between the product and the exterior of the container to be measured when at least the seal of the container is immersed in an electrolyte.

The conductivity (or resistance) can be measured in conventional manner by measurement of the current flow produced by a constant potential between the electrolyte and electrode while the container is suitably immersed, and this provides a measure of the effectiveness of the seal.

It should be realised that the invention is only applicable to the measurement of containers containing a product which is electrically conductive. This applies to most sterilised foodstuffs.

The electrode may be incorporated in the container permanently during formation of the container or during the sealing of its lid, or may be only temporarily incorporated during the testing operation.

A particularly convenient form of the former makes use of a strip of foil, or wire which passes through the container seal, i.e., it is sandwiched between the mating sealed surfaces at the seal, from outside the container to the product inside.

Desirably the wire or strip at points outside the container should have an insulating coating to prevent risk of direct electrical contact between the wire or strip and the electrolyte, and there should be no electrical contact with the walls of the container if the latter includes a layer of metal foil.

A method according to the invention comprises incorporating an electrode in said container which provides an electrically conductive path between the product and the exterior of the container immersing the container in an electrolyte, making an electrical connection to the exterior of said container while maintaining electrical insulation between said electrode and the electrolyte, measuring the conductivity between said electrical connection and the electrolyte, and removing the container from said electrolyte and from the electrical connection.

In a particularly convenient form where the electrode is only temporarily incorporated in the container, said electrode is a conductive needle which is injected through a point in the walls of the container and is subsequently removed, and the method further comprises resealing the container at said point in its walls.

A convenient apparatus for carrying out this form of the process according to the invention incorporates both a conductive needle electrode and means for provision of a drop of molten plastic to re-seal the hole formed by the needle.

This latter method is particularly suitable for containers manufactured entirely from plastic.

In certain cases however this method could also be useful for semi-rigid made of metal. It is then necessary that, at least during the measuring, the product cannot come into contact with the cut edge caused in the metal by the conductive probe needle, or alternatively that the needle is insulated from the metal.

The device for carrying out the method according to the invention is provided with a bath filled with electro-conductive and satisfactorily moistening liquid (electrolyte) in which the containers, and at least the part of them that is to be controlled, can be partially or wholly immersed, and further with a measuring device comprising a voltage source, a micro-ammeter and two electrodes, one of which sticks into the electrolyte and one of which is intended for contact with the product present in the container to be immersed in the bath. The second electrode may simply be the wall of the bath if it is electrically conductive.

For this we preferably make use of containers provided with a conductor which is electrically insulated from the wall of the container. This can be provided in the wall previously or can be inserted right through the seal during the sealing operation.

In another embodiment the electrode intended for contact with the product consists, according to the invention, of a conductive probe needle which is provided with a driving device for limited longitudinal movement of the needle between a measuring position and a withdrawn resting position, while means are present for dosing a measured amount of liquid plastic after each measuring operation. Except for the part at and
near the extremity, the conductive probe needle can be provided with an insulating coating.

Containers which have been controlled according to the methods indicated are easy to identify either because of the plugging of the control hole in their bottom wall or because of the presence of an electrode.

The invention will be further explained with reference to the drawings. In this:

FIG. 1 is a sketch showing the principle involved in carrying out a measuring on a container provided with a plate electrode;

FIG. 2 shows, on an enlarged scale, the arrangement with a container provided with a tape electrode;

FIG. 3 shows schematically an apparatus for measuring the imperviousness to leakage, more particularly intended for containers made entirely from plastic.

In the figures an electrolyte bath is indicated by 1, containers to be investigated by 2 and a product present in the containers by 3.

In FIG. 1 is represented schematically a measuring operation on a container which has previously been provided with a plate electrode which at 4 on the bottom, electrically isolated from the metal outer side of the container, can be connected to the measuring system. The latter is only very schematically illustrated in the drawing and consists of a voltage source and a μ-ammeter connected to it in series.

In FIG. 2 a more easily realised tape or wire electrode 5 is shown which can be welded within the seal when the latter is being affected. This can be carried out with standard containers in the production line, irrespective of the kind of container. In FIG 2 a container with an outside of metal (e.g., aluminium) is shown; the tape or wire electrode can, however, also be applied to containers made entirely of plastic. The electrode carries an external insulating coating to provide electrical insulation from the electrolyte.

Finally, in FIG. 3 an apparatus is shown which is preferably intended for measuring the imperviousness to leakage of containers made entirely of plastic, e.g., polypropene. Herein a conductive probe needle 6 is carried by a driving device 7 and moved manually from a withdrawn resting position to the measuring position, as shown in the figure. In doing so, the bottom wall of the container 2 is pierced and the needle is caused to extend into the conductive product. The conductivity measurement is then made.

On the upper side of the needle, a piston 8 is attached which, when the needle is subsequently withdrawn, is forced down by the driving device 7 (a form of screw jack) and pushes in front of it a measured amount of liquid plastic, in the present case also polypropene, which is present in the reservoir 9. The plastic is kept at the right temperature by the heating spiral 10 which surrounds the reservoir 9.

The liquid plastic flows on to the bottom wall of the container, whereby the hole that has been made in the bottom is closed.

As has already been mentioned in the introduction to the description, it is possible to use the aforementioned apparatus for metallic semi-rigids but only, however, if the cut edge is sufficiently insulated electrically from the product and/or the needle.

What is claimed is:

1. A method of testing the effectiveness of the seal of a free-standing thin-walled container containing therein an electrically conductive food product said container providing an electrically insulated barrier between the food product and the exterior of the container comprising the steps of inserting an electrode in a wall of the container, the electrode being in electrical contact at one portion thereof with the food product and in electrical contact at another portion thereof with a point outside of the container while being electrically insulated from the container immersing the container in an electrolyte, connecting the portion of the electrode outside of the container with a source of electrical current while maintaining electrical insulation between said electrode and the electrolyte, removing the container from the electrolyte and removing the electrode from the wall of the container.

2. A method according to claim 1 in which said electrode is a conductive needle which is injected through a point in the walls of the container and is subsequently removed, and the method further comprises resealing the container at said point in its walls.