United States Patent [19]

Van Nederveen

[11] **3,926,306**

[45] **Dec. 16, 1975**

[54] **METHOD FOR SEALING A FILLED CONTAINER UNDER VACUUM, AND VACUUM-SEALED FILLED CONTAINERS**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **206/84;** 53/7; 53/22 R; 53/25; 53/86; 156/69; 156/73; 206/525

[51] **Int. Cl.**[2] **B65D 81/00;** B65B 31/02

[58] **Field of Search** ..... 53/4–8, 22 R, 53/24, 25; 206/84, 525; 156/69, 73, 272

[56] **References Cited**

UNITED STATES PATENTS

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Primary Examiner—Travis S. McGehee
Attorney, Agent, or Firm—Daniel M. Rosen

[57] **ABSTRACT**

A method for the manufacture of a closed casing, in which material is stored at a pressure of less than 10^{-1} torr, characterized in that the casing is sealed in a space in which the pressure is at least equal to the pressure mentioned above.

16 Claims, 5 Drawing Figures

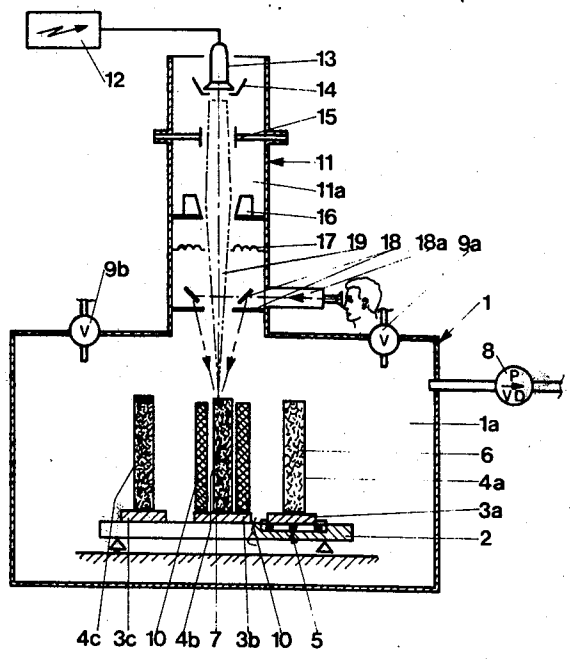

FIG.1

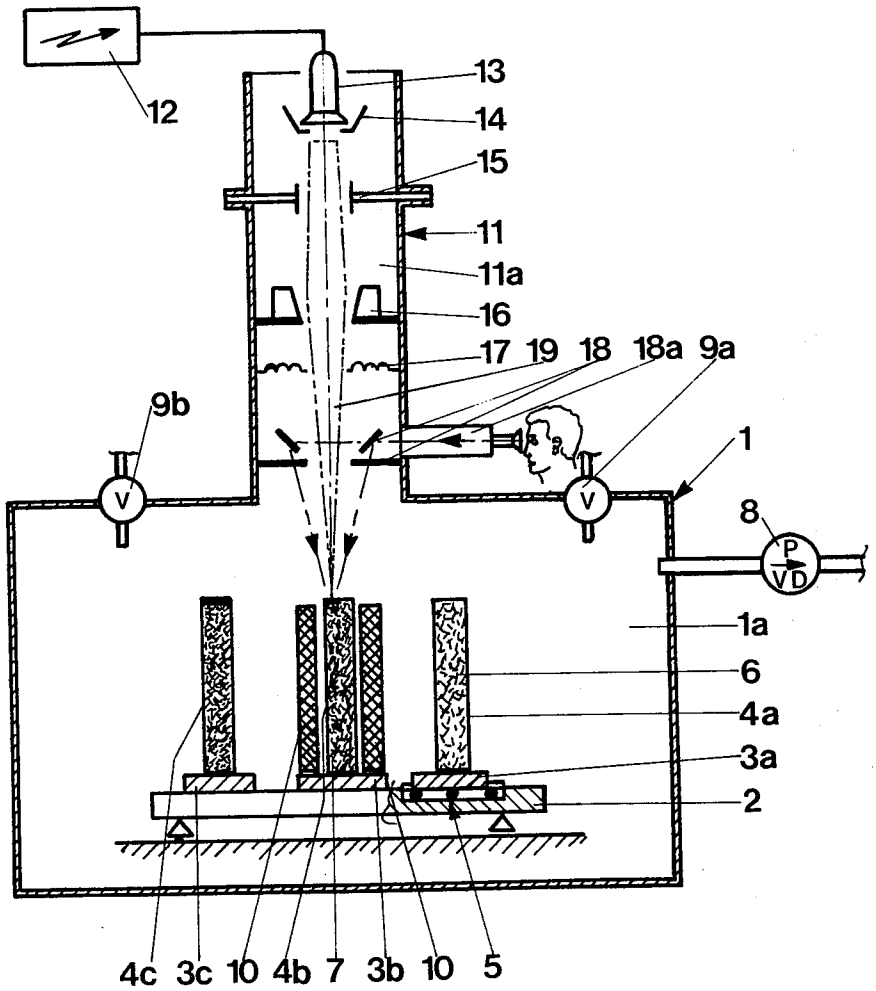
12
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FIG.2a

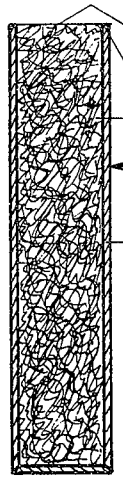


FIG.2b

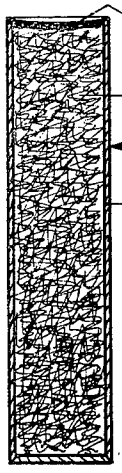


FIG.3a

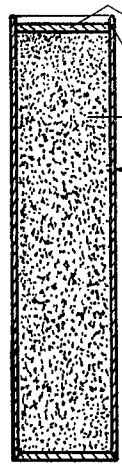


FIG.3b

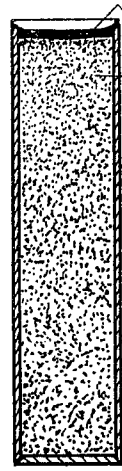


FIG.4a

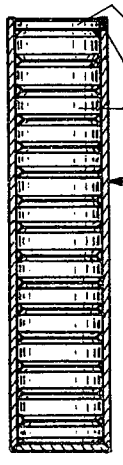


FIG.4b

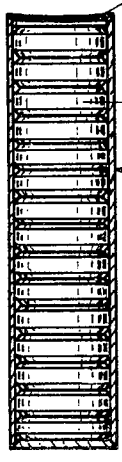


FIG.5a

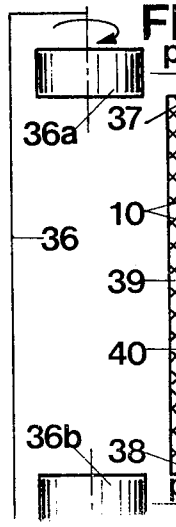
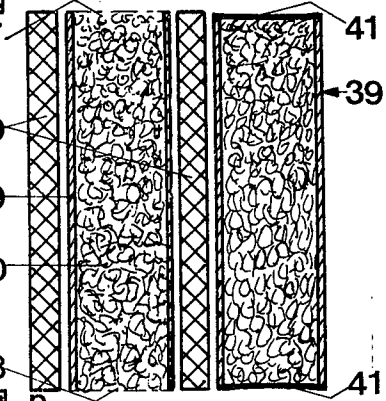


FIG.5b



METHOD FOR SEALING A FILLED CONTAINER UNDER VACUUM, AND VACUUM-SEALED FILLED CONTAINERS

BACKGROUND OF THE INVENTION

The invention relates to a method of manufacturing a sealed casing in which material is stored at a pressure of less than 10^{-1} torr.

A method is known whereby objects are obtained which are particularly suited for processing in an extruding device. These objects usually take the shape of a round bar, a tube or similar section, and comprise primarily a casing, called container, in which powdered or granular material is usually stored, and a closure (lid). The material is made into a relatively dense mass by a compacting process, after which the container is evacuated, i.e. air and moisture are withdrawn from the container until the pressure in the container has reached a value between 10^{-1} and 10^{-4}. This method of removing air, moisture and such like substances has so far been effected with the aid of a tube connected to the container and to which a pumping installation is connected. After the desired pressure in the container has been reached with the aid of the pump, the connecting tube between the container and the pumping installation is cut and sealed at the same time.

SUMMARY OF THE INVENTION

The invention introduces a method which considerably reduces the operations described in the foregoing and used by the known method. The method in accordance with the invention is therefore characterised in that the casing is sealed in a space in which the pressure is at least equal to that mentioned above. The invention will be further explained by reference to the drawing; advantages and other features will become evident from this.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic view of a device provided with a space or chamber in which the method is applied.

FIGS. 2*a*, 2*b*, 3*a*, 3*b*, 4*a* and 4*b* show longitudinal sections of embodiments of casings or containers employed by the method in accordance with the invention.

FIGS. 5*a* and 5*b* is a diagrammatic view of a welding device with the aid of which a container can be welded.

DESCRIPTION OF PREFERRED EMBODIMENT

According to the view of FIG. 1 the device (with which the method in accordance with the invention can preferably be applied) comprises a space or chamber **1a** with a work table **2**, comprising interconnected movable assembly tracks 3*a*, 3*b* and 3*c*, on which containers 4*a*, 4*b* and 4*c* are placed. Assembly track **3a** is connected with a compacting device **5**, for example a vibrating mechanism. Content **6** (powdered or granular material or otherwise) is densified there to a compact mass **7** by the compacting device **5**. The containers 4*b* containing a compacted mass are thereupon passed on to track 3*b*, on which the actual evacuating and sealing of the container take place. To this end, space **1***a* is put under a pressure of at least 10^{-1} torr in accordance with the invention, which is effected with the aid of an air pump **8**, the required pressure in space **1***a* being

maintained in conjunction with valve mechanisms **9***a* and **9***b*. During evacuation of air, moisture and similar substances from containers **4***b*, these are surrounded by means **10**, which ensure that the densified masses **7** remain fixed or stabilized in the containers. In this embodiment, means **10** consist of magnet coils, whose magnetic field is controllable; the strength is made dependent on the magnetic properties of the material **6,7** for instance. It is evident that other means for fixing or stabilizing the material, such as a suction device or other known mechanical fixing devices, can be used. Thereupon each container **4***b* is sealed at least on one side by means of a specific sealing device, for which the method in accordance with the invention advantageously uses an "electron-beam-welding" device **11**, of which vacuum chamber **1***a* actually forms part. This welding device **11** to be employed preferably comprises, in brief, one high-tension unit **12**, a filament cathode **13** with control electrode **14**, and an anode **15** at some distance from it. At the lower end of column **11***a* an electromagnetic focusing lens **16** as well as beam deflection coils **17** are fitted. Column **11***a* furthermore carries a reading an inspection viewer **18***a* with mirrors **18**, with the aid of which the strength and direction of welding beam **19** can be influenced. With the device described in the foregoing a sharp, very accurately operating welding beam can be obtained, which can be controlled outside the device and which is capable of favorably and quickly sealing the evacuated container. It will be clear that this welding method, particularly because the welding takes place in a vacuum chamber and further because a welding beam controllable in every respect is applied, offers considerable advantages, especially if the container to be sealed has a geometrically intricate shape.

The method in accordance with the invention also has the advantage that the number of "rejects" among the containers to be extruded is very small. With containers made in accordance by the known method, whereby it is necessary to cut the tube connecting the pump and container and seal it, leakages are no rare occurrence, but this effect is very slight in containers manufactured in accordance with the invention.

Subsequently, after sealing of one or more sides of the container, the latter is fed on to belt 3*c*, after normal pressure has been reached in space **1***a* through control of valve mechanism **9**, container 4*c* is carried from the space, if necessary directly to an extruding device (not further shown).

In accordance with the invention, the sealing of a container **4***a* is advantageously effected through the filled material itself functioning as sealing material.

FIG. 2*a* represents the longitudinal section through a container **20** which comprises a casing **21** made of relatively thin metal, in which a powdered or granular material **22** is stored. It is observed that the casing need not specially be made of metal; a plastic material, for instance, (P.V.C.) with sufficient hardness with respect to the processing temperatures concerned is likewise suitable as casing material or container. In this embodiment, container **20** is filled up to the edge of the container wall with the powdered or granular material after the compaction process. In accordance with the invention the upper layer **23** of material **22** is caused to melt with the aid of welding beam **19**, in such a way that this melted layer is fused with the upper edge **21***a* of the container into a seal **25** (FIG. 2*b*). This sealed container comprises a generally flat top surface with no

projecting parts, i.e. an unobstructed surface. It will be clear that in this embodiment the granular or powdered material **22** is particularly suited to shape a well-sealing fused layer. It will furthermore be clear that with the aid of the device in accordance with the invention the seal need not be formed especially at the upper edge, but that the formation of the seal can also be effected at a different level.

FIG. 3*a* represents a container **26,** whose contents **27** consist of a non-meltable, at least not readily meltable substance. Generally, this consists of a filling material not suitable as sealing material for the container, as well as material which is difficult to check as to complete air-tightness or which is not reliable in this respect. A favorable solution in accordance with the invention is characterised in that after the compacting process and the evacuation at the top of the compacted mass **27,** a readily meltable layer **28** to be fused with the wall of the container is provided, which is fused with upper edge **26***a* to form seal **29** (see FIG. 3*b*).

It is observed that filling a container in vacuum chamber **1***a* has the advantage of (powdered or granular) material not being lost but being always reusable on account of the specific conditions in the chamber. Furthermore, it is observed that the upper layer **28** (FIG. 3*a*), for instance, may have the same chemical composition as the actual filling material, but then has different physical properties to aid effective sealing. Contents **27** of container **26** may consist of powdered material, for instance, and the upper layer **28,** serving as sealant, of granular material, with otherwise the same properties as the filling material. Also the layer to be fused may be substantially the same material as the casing.

FIG. 4*a* shows a longitudinal section through an extrudable container **30,** whose contents, instead of granular or powdered material, consists of tablets **31.** The tablets, which are usually made of powdered material possess in themselves a greater density than the basic material, so that the treatment of compacting the contents of a container can be dispensed with, or at least need be less intensive than in the case where only powdered or granular material is used. In this preferred embodiment a layer **32** of the top tablet is fused with the edge of container **30** by means of welding beam **19,** so that an (air-tight) seal **33** (see FIG. 4*b*) is obtained. It will be clear that the entire tablet **31** can also be melted into a seal. If, however, the tablet material is not suited for fusing with the edge **30***a* of casing **30** the top tablet **34** (see FIG. 4*c*) is provided, in accordance with a favorable embodiment, with a suitable layer **35** which is then fused with the edge **30***a* of container **30** to form seal **33** (see FIG. 4*b*).

FIG. **5** gives a diagrammatic view of an embodiment of a welding device **36,** with the aid of which the terminal parts **37** and **38** of the container can be sealed. In this embodiment the filling material **40** is readily weldable, at least there is readily weldable material near the terminal parts **37** and **38** of container **39.** Briefly, this specific sealing device **36** works as follows: relatively heavy discs **36***a* and **36***b* made of specially suited material rotate at high speed in the vacuum space and at the same time move in the direction indicated by arrows p, i.e. perpendicularly to the center line of container **39.** Where the container wall **39** and fusible layers **37** and **38** meet an intensive exchange of energy takes place, in such a way that these layers and the terminal edges of container **39** are fused into seals **41** (see FIG. **5***b*). This welding method has the advantage of being economical as regards initial expenditure and maintenance, while it can also be favorably be effected into a space where the pressure is at least 10^{-1}, by a method controllable from outside.

I claim

1. A closed and sealed container containing a stored material at a pressure less than 10^{-1} torr within said container, the container comprising a plurality of walls which surround and define an enclosure, one of said walls comprising a solid and generally flat outer layer of said stored material fused and sealed to adjacent walls of said remaining walls.

2. A method for closing and sealing a container which contains a material therein to be stored at a pressure less than 10^{-1} torr, said container formed by walls having edges which define an opening of the container to be closed and sealed, and said material therein having a top layer adjacent said opening, the method comprising the steps of placing said container with said material therein in a chamber, reducing the pressure within said chamber to less than 10^{-1} torr and, while at said pressure, fusing and subsequently solidifying said top layer of the material thus forming said layer into a top wall of said container, and fusing said top wall of said edges to close and seal said opening.

3. A method according to claim **2** wherein fusing said top layer comprises directing onto said top layer the beam of an electron beam welding device which is within said chamber and operating under said pressure of less than 10^{-1} torr.

4. A method according to claim **2** wherein said material comprises a fusible substance as said top layer thereof and a non-fusible substance as the remainder below said top layer.

5. A method according to claim **2** wherein said top layer has substantially the same composition as said container.

6. A method according to claim **2** wherein said container has at least one additional opening similar to said first opening, comprising the further steps of closing and sealing said additional opening similarly to said first opening.

7. A method according to claim **2** wherein said material is present in powdered form.

8. A method according to claim **7** comprising the further step of fixing said powdered material in said container prior to said fusing of same.

9. A method according to claim **8** wherein said material is magnetizable, and wherein fixing said material comprises applying a magnetic field thereto.

10. A method according to claim **2** comprising the further step of forming said material into tablet-shaped elements prior to placing same in said container.

11. A method according to claim **7** comprising the further step of vibrating said container and material therein prior to said fusing.

12. A method according to claim **2** wherein said fusing comprises directing a laser beam onto said top layer.

13. A method according to claim **2** wherein said fusing comprises providing heat with a friction welding device.

14. A closed container sealed according to the method of claim **2,** and containing a stored material at a pressure within said container less than 10^{-1} torr, said container comprising a plurality of walls which surround and define an enclosure, one of said walls com-

prising said fused top layer of said stored material, said top layer being generally flat and unobstructed and sealed to adjacent walls of said remaining walls.

15. A closed container according to claim **14** wherein said top layer and said container comprise substantially the same composition.

16. A closed container according to claim **14** wherein said stored material comprises a fusible substance as said top layer thereof and a non-fusible substance as the remainder below said top layer.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,926,306

DATED : December 16, 1975

INVENTOR(S) : Hans Bertil Van Nederveen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The Priority Document date should be --June 26, 1972--.

Column 1, line 33, after "and" insert --as--.

Column 4, line 3, after "favorably" delete "be";

line 25, after "said top wall" delete "of" and substitute --to--.

Signed and Sealed this

Second Day of November 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks