Oct. 6, 1931. F. H. LANDRUM 1,825,744

METHOD OF TESTING SEALED CONTAINERS

Filed Aug. 31, 1927 2 Sheets-Sheet 1

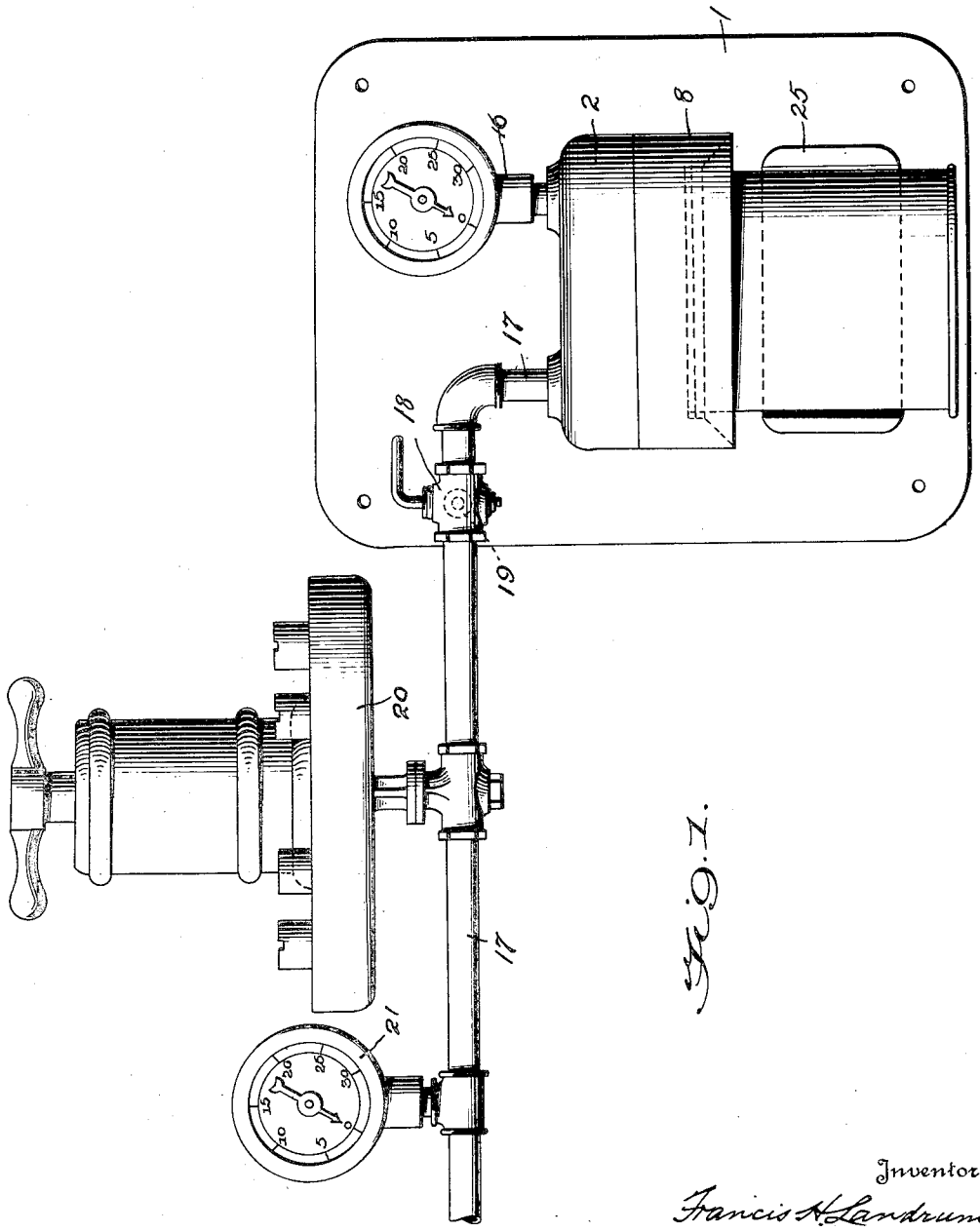


Fig. 1.

Inventor
Francis H. Landrum

By O'Neill & Bunn

Attorneys

Oct. 6, 1931. F. H. LANDRUM 1,825,744

METHOD OF TESTING SEALED CONTAINERS

Filed Aug. 31, 1927 2 Sheets-Sheet 2

Fig. 3.

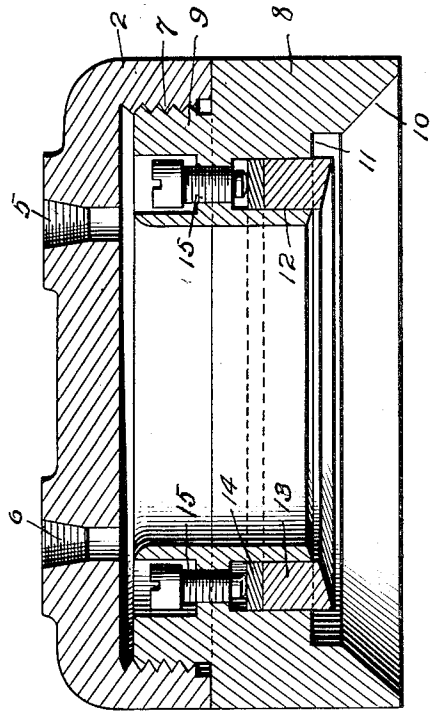
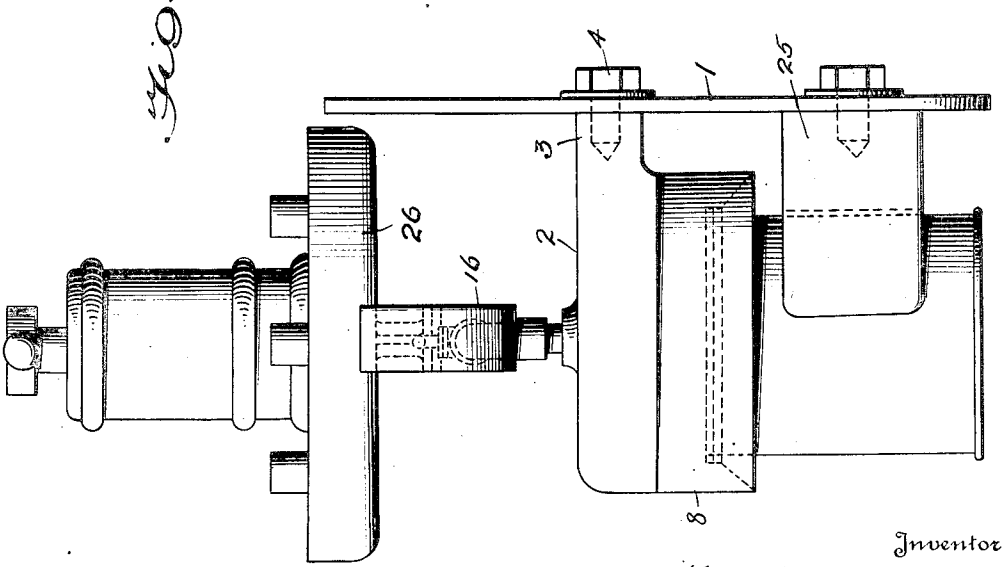


Fig. 2.



Inventor

Francis H. Landrum

By O'Neill & Bunn

Attorneys

Patented Oct. 6, 1931 1,825,744

UNITED STATES PATENT OFFICE

FRANCIS H. LANDRUM, OF HONOLULU, TERRITORY OF HAWAII

METHOD OF TESTING SEALED CONTAINERS

Application filed August 31, 1927. Serial No. 216,660.

The invention relates to a novel method for testing sealed containers of foodstuffs and other commodities, such as containers consisting of the usual metal cans with sealed flexible end closures, which containers may be of the various sizes and shapes employed for this purpose, the testing operation involving the application of a force externally of the flexible sections of the containers of a character to cause said sections to move outwardly and produce an audible sound, when internal pressure within the containers exceeds a predetermined amount, or when vacuum deficiencies exist within the containers, the emitted or audible sound serving as an index by means of which the defective containers may be segregated or separated from the containers in which the internal pressure or vacuum conditions are normal. The method depends upon the characteristic tendency of a flexible section of a container, usually the closure element, to move, bulge, or convex outwardly, when the fluid pressure within the container exceeds the external pressure, such as a reduced air pressure applied to the flexible section. In the preferred application of the method, reduced air pressure is applied to the exterior of a container or a portion of a container wall which will move or bulge outwardly with a flipping action when the predominant pressure is on the inside of the container, and so regulating the reduction of the external pressure that the defective containers will be evidenced by the movement of the wall sections thereof, which movement is accompanied by a distinctive audible sound, the applied external pressure being ineffective to produce any movement of the walls of containers in which the internal pressure or degree of vacuum is normal, so that the defective containers may be instantly recognized and properly segregated.

The invention is illustrated in the accompanying drawings, in which:—

Fig. 1 is a front elevation of a simple form of apparatus for carrying out the method.

Fig. 2 is an end elevation thereof.

Fig. 3 is a sectional elevation through the vacuum chamber.

Referring to the drawings, 1 indicates a panel or support upon which the apparatus is mounted, said support, preferably, being secured in vertical or upright position, with the various elements of the mechanism used to carry out the method secured to or adjacent the front face of the panel. A component element of the vacuum chamber, comprising a casting 2 provided with a rearwardly extending flange 3, by means of which the casting is secured to the support 1 by bolts 4, is finished with an internal screw thread 7 by means of which the complementary section of the vacuum chamber is attached thereto. This complementary section is so constructed and arranged as to provide means for effecting a sealing joint between the flexible portion of a container wall to be tested, usually the closure element, and the vacuum chamber. As indicated in Fig. 3, the assembled vacuum chamber is adapted to receive for testing, containers of the form of cylindrical metallic cans having sealed closure elements as indicated in Figs. 1 and 2. The purpose of constructing the vacuum chamber of two sections is to permit complementary sections of different shapes and sizes to accommodate different types of containers to be interchangeably applied to the main supporting section 2. In the specific form of the apparatus shown, the complementary section includes an annular casting 8 having a screw threaded neck 9, which engages the screw threads 7 on the interior of section 2, the lower rim or edge of the section 8 being provided with a bevel 10 terminating in an annular shoulder 11, the bevel serving to guide and center the containers with respect to the vacuum chamber. The inner portion of the lower face of section 8 adjacent the shoulder 11 has formed therein an annular recess 12 in which is fitted a sealing ring or gasket 13 of rubber or the like, which is adapted to engage the closure element of the container and effect a fluid-tight seal between said closure and the vacuum chamber. The gasket is backed up by a follower ring 14, which

may be accurately adjusted by set screws 15 engaging threaded openings in the body of section 8, as clearly shown in Fig. 3. As indicated, the complementary section 8 and the sealing ring or gasket 13 carried thereby are so proportioned that the sealing edge of the gasket engages the closure of the container as near the peripheral edge of the closure as possible, whereby a relatively large area of the closure top will be exposed to fluid pressure induced in the vacuum chamber, when the container is in sealed relation with the latter.

The top of the vacuum chamber section 2 is provided with tapped openings 5 and 6, in the former of which is mounted a suitable pressure gauge 16, which serves to indicate the reduced pressure or degree of vacuum induced in the vacuum chamber during the testing operations. The other opening 6 receives the end of a pipe line 17, which leads to a suitable source of reduced pneumatic pressure, such as an air pump, or a tank from which the air is partially exhausted by a pump or other suitable apparatus, and interposed in the air line or pipe 17 is a compound valve 18 adapted to connect the vacuum chamber with the source of reduced air pressure, or with the atmosphere, according to the position of the valve. The valve may be of the usual three way type, including a lateral air vent 19, which opens up communication between the vacuum chamber and the external air, when the valve is moved to cut off the air line 17. Also interposed in the air line 17 is a pressure reducing and regulating valve 20, which may be adjusted to impose the desired and predetermined reduction of the air pressure within the vacuum chamber during the testting operations. A second pressure gauge or vacuum gauge 21 is preferably interposed in the air line beyond the pressure regulating valve 20 and serves to indicate the extent of the reduction of pressure maintained in the air line.

As a matter of convenience, a convexed faced container guide 25 is removably secured to the front face of the support 1, which serves to facilitate engagement of the container with the centering bevel edge 10 of the vacuum chamber. The guide is removably applied in order that it may be substituted by others to accommodate containers of different shapes and sizes, as will be understood.

In carrying out the method, which constitutes the present invention, it may be assumed that a normal container of the type indicated has an internal vacuum equivalent to six inches or more of mercury on a standard vacuum gauge, and that about four inches of applied vacuum to the exterior of the container wall, to wit, the end closure, is necessary to cause the flexible section or end closure to move or "flip" from a normal relation to one of exterior convexity. During this movement or "flip", there is produced a characteristic audible sound, which may be readily heard and distinguished by the operator, or, if the latter's hearing is defective, will be manifested by a resultant vibration communicated to the apparatus and through the walls thereof to the hand of the operator, so that the "flip" will be evident to the sense of touch by contact of the hand with the container or the vacuum chamber. The most pronounced audible sound or physical vibration is produced by a flexible section of the container, usually the closure, which is normally concaved by atmospheric pressure, at the instant the section of a container passes from an intermediate plane relation to one of convexity. If the external fluid pressure is reduced gradually, the flexible section slowly moves from its position of concavity to that of a horizontal plane in unstable equilibrium, and, as the movement of the section progresses, there is a position just external of the plane position in which the flexible section rapidly "flips" or assumes a convexed form, at which instant a characteristic click is produced. Naturally, the sound waves thus produced vary in quality of tone depending upon various factors, such as the size and shape of the container, the material, contour, and treatment in manufacture of the flexible section, the height of the fill in the container and the contents of the latter. Similarly, characteristic sounds are produced by containers which have flexible sections normally designed to have a lesser movement under the action of differential internal and external fluid pressures, such as the movement from a concave to a plane or flat position, or from a plane or flat position to a convex position. If a container, instead of having a vacuum therein equal to six inches of mercury, had zero vacuum or atmospheric pressure, the flexible section will move outwardly or "flip" when a reduced internal pressure represented by four inches or more of mercury were applied to said section, the pressure represented by the four inches of vacuum being that necessary to distort the metal of the section; therefore, the normal flexible section, usually the end closure, should move outwardly or "flip" at four plus six or ten inches of externally applied vacuum or reduced pressure. If it is desired to select from a series of containers normally having six inches of internal vacuum, containers having relatively zero vacuum or "leakers", meaning those that have taken in some atmospheric pressure and reduced the internal vacuum of the container and produced substantially atmospheric pressure therein, usually about two or three inches of vacuum is allowed for variation in the material of the flexible

sections of the containers. In order to separate the containers having zero vacuum, the degree of vacuum induced in the vacuum chamber of the apparatus should be that represented by four plus three or seven inches of mercury. The actual force required to "flip" the flexible portion of the container, more particularly the closure element, depends upon several factors, such as the thickness and kind of material, whether the same has been heat treated or not, the contour markings on its surface, the effect of the impact of the contour marking dies, etc. Simple experimental tests are required to determine the amount of force or applied reduced fluid pressure to "flip" each type of flexible section on a container having zero vacuum therein. On the aforesaid assumption, containers of the type hereinbefore referred to will require thirteen inches of externally applied vacuum to "flip" the flexible section, to wit, the end closure, of a container having a six inch normal internal vacuum.

In carrying out the method as described, each container is engaged with the guide member 25 and then moved upwardly until the peripheral edge of the top engages the centering bevel 10 on the lower edge of the vacuum chamber, so that the rim of the container passes between the outer edge of the sealing gasket 13 and the interior wall of the vacuum chamber, and the lower edge of the sealing ring engages the top closure of the container near the peripheral edge of the latter and effects a fluid-tight joint between the container and the vacuum chamber. When this sealed engagement has been effected, the valve 18 is moved to open position, with the handle in the position shown in Fig. 1, thereby establishing communication between the vacuum chamber and the source of reduced pressure through the air line 17, the exact amount of reduced air pressure applied to the vacuum chamber being determined by the pressure regulating valve 20, which, as hereinbefore indicated, may be of any approved type. This reduced air pressure is applied directly to the flexible section of the closure of the container in sealed engagement with the vacuum chamber. Obviously, the predetermined or desired degree of reduction of the air pressure so applied to the vacuum chamber and the flexible section of the container will depend upon the permissive limits of the internal pressure within the containers. For example, if no material variation in the normal vacuum of six inches is allowed, the induced reduced pressure will be equal approximately to that represented by twelve inches of mercury. If, however, a lower degree of vacuum in the containers were permissible, the pressure regulating valve 20 would be adjusted to apply a reduced air pressure of a commensurately higher degree to the vacuum chamber. If, under the conditions heretofore stated, the container being tested has a vacuum of six inches or more, no movement of the flexible section of the container, to wit, the closure, is effected and consequently no sound or vibration is produced by the apparatus and the container and its contents are accepted as normal or up to standard requirements. If, however, the container has a zero internal vacuum or is a "leaker", the flexible section or closure moves outwardly or "flips" or changes from a normally concaved or relatively flat position to a convex position, producing thereby the characteristic sound as hereinbefore explained, which is audible to the human ear or is manifested through vibrations which may be felt by contact with the wall of the vacuum chamber or the walls of the container, the sound or vibration indicating that the container is defective and is, therefore, to be discarded. After each container is thus tested, 2 the handle of valve 18 is moved to shut off communication between the vacuum chamber and the source of reduced air pressure and at the same time open up communication with the vacuum chamber through the vent port 19 of said valve 18, thereby restoring the pressure within the vacuum chamber to that of the atmosphere and permitting the container to be withdrawn from engagement with the vacuum chamber. As indicated, the apparatus as illustrated is merely typical or exemplary as applicable to carrying out the method with containers of the specific type stated and, obviously, is susceptible of various changes and modifications to accommodate containers of different types and forms without departing from the spirit of the invention. By providing the machine with interchangeable complementary vacuum chamber sections, of which section 8 is a type, the machine will accommodate containers of as many and different types as there are complementary sections available, the latter being so constructed and arranged as to provide a sealing engagement with the particular sections of the flexible walls of the containers to be tested.

Preferably the testing of the containers is effected under normal atmospheric temperature conditions, or an average temperature of sixty-five degrees F. or under of the containers and contents thereof, and the tests may be made immediately after the containers are processed and cooled, in the case of products which require heat treatment, or at any time after the containers are hermetically sealed and a definite time period allowed to permit any seepage of air which might occur because of the defects in the containers. Likewise, the tests may be effected prior to or subsequent to the labelling

of the containers, or previous to storage and shipment, or just prior to delivery of the containers to the ultimate consumer.

What I claim is:

1. The method of testing sealed containers having flexible sections capable of outward movement under excessive internal pressure, which comprises locally reducing the extraneous pressure on said sections to an extent sufficient to cause the sections to move outwardly and produce an audible sound when the internal pressure is excessive, and segregating those containers emitting such sound.

2. The method of testing sealed containers having flexible closures capable of outward movement under excessive internal pressure, which comprises locally reducing the extraneous pressure on said closures to an extent sufficient to cause the closures to move outwardly and produce an audible sound when the internal pressure is excessive, and segregating those containers emitting such sound.

3. The method of testing the vacuum in sealed containers having flexible sections, which comprises locally reducing the exterior air pressure on said sections to an extent sufficient to cause the flexible sections of containers having vacuum deficiencies to move outwardly and emit an audible sound, and segregating the containers emitting such sound.

4. The method of testing the vacuum in sealed containers having flexible closures, which comprises locally reducing the exterior air pressure on said closures to an extent sufficient to cause the flexible closures of containers having vacuum deficiencies to move outwardly and emit an audible sound, and segregating the containers emitting such sound.

In testimony whereof I affix my signature.

FRANCIS H. LANDRUM.