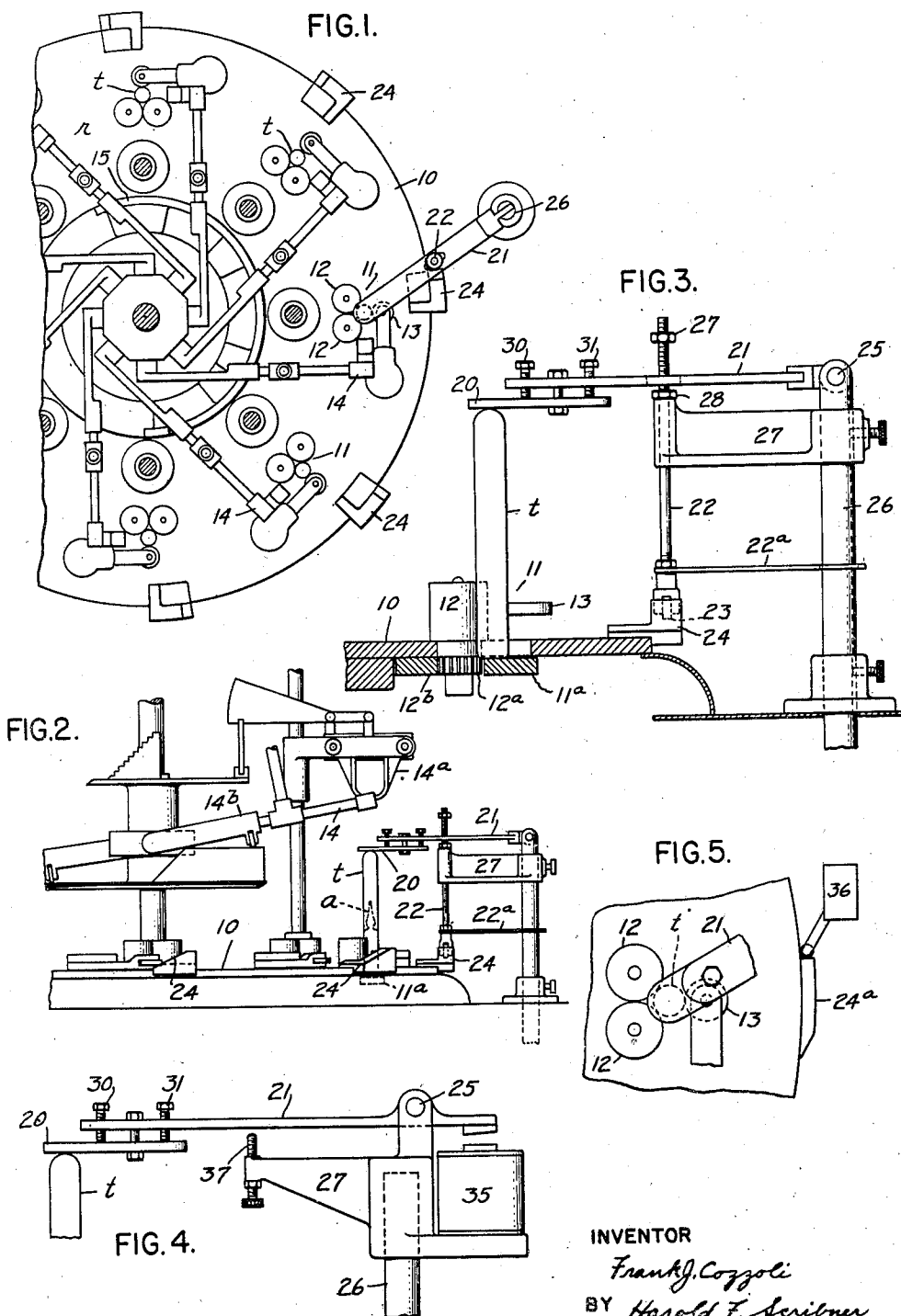


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TUBE TESTING MEANS
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TUBE TESTING MEANS

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This invention relates to improvements in the art of sealing glass tubes and containers and is concerned more particularly with a method and means of determining whether the container and its seal is secure and adequately strong for the purposes.

A primary aim of the invention is to insure against the passing, inadvertently or otherwise, of inherently weak or defectively sealed containers and to discover and weed out beforehand, the unsecure or improperly sealed containers.

Frequently an improper or weak seal shows up only after the container has been packaged or shipped to the consumer. Evaporation, spoilage and loss of valuable pharmaceutical preparations has been occasioned due to the latent defects in the container or in the seal, and the present invention undertakes to render available a simple but effective means for determining, before additional processing or handling takes place, whether the container has been securely sealed and possesses the strength to withstand the further handling and abuse met with in shipment and in the hands of consumers.

Tube sealing machines have been developed to replace hand sealing and while such machines increase the rate of production and produce, as a rule, uniformly perfect and secure seals, there occasionally occurs an imperfect seal or container. The cause of the defect or imperfection may be attributed to any one or a number of reasons, such as variations in wall thickness of the tubes, or variations in their sizes, a variation in the quality of the glass, incorrect timing or duration of the heating and sealing period on a given tube, too fast a chilling of a given tube which may set up strains in the glass causing a mild explosion when jarred at a later time, entrapment of relatively high gas pressures, and a number of other factors.

A seal may look strong and secure, when in fact it is not and the only practical way of determining the strength of the sealed container is to subject the container to a rigid and severe shock of a magnitude greater than is to be expected under any normal or usual condition met with in subsequent handling or in the field.

Heretofore the conventional practice has been to have one or more attendants engaged in bodily lifting and inverting each tube or container as it came from the sealing machine and rapping the sealed end sharply against a metal plate. Such manual handling, however, introduced still another time consuming operation in addition to requiring extra operators and, moreover, depended

upon the skill of each operator to strike each tube with neither too severe or too delicate a blow. Frequently, tubes were broken and their contents lost by excessive blows, and on the other hand, relatively weak tubes were passed without being subjected adequately to the required test. The present invention aims to render manual testing of the containers and their seals unnecessary and expeditiously to insure adequate and uniform testing of each tube automatically during its progress from one station to another without removing the tube from a machine, conveyor, or other transporting medium.

Still a further aim of the invention is to render available a testing apparatus that may be used as an adjunct or an attachment to an existing container processing machine and operated by or in time with the container moving devices of the machine so that after each container completes the processing cycle it automatically is subjected to a relatively severe test. If the container is inherently weak or has had a weak seal formed thereon, the testing will reveal the fact by producing a definite fracture, and in some instances container collapse, and so render the container definitely unfit for further processing or handling.

Another objective of the invention is to provide a simple testing device having the capacity to subject any of a wide range of sizes and classes of glass tubes and containers to positive and severe tests using forces of preselected magnitudes best calculated to represent the maximum shocking forces the containers would be expected to receive and to have the ability to withstand during normal handling or use.

To achieve the objectives of this invention it is proposed to construct a device embodying adjustable means for applying a force of a predetermined value, to the container preferably at or in the region of the seal, thereby to test the strength of the seal as well as the strength of the entire container. With modern methods of sealing, labeling and packaging hermetically sealed glass containers it is usually the practice to employ one or more mechanically driven devices in transporting the containers during or between the successive processing stages and the present invention undertakes to provide a testing unit or attachment whose operation is automatically controlled by the movements imparted to such existing carrier mechanisms. By so devising and arranging the tester, additional attendants and additional sources of manual or mechanical power are not required and once the testing unit is

properly related to the cycle and adjusted for the containers undergoing processing its functioning is automatically synchronized with container movements and automatically subjects each to the requisite test.

Other objects and advantages will be in part indicated in the following description and in part rendered apparent therefrom in connection with the annexed drawing.

To enable others skilled in the art so fully to apprehend the underlying features hereof that they may embody the same in the various ways contemplated by this invention, a drawing depicting a preferred typical construction has been annexed as a part of this disclosure and, in such drawing, like characters of reference denote corresponding parts throughout all the views, of which:

Figures 1 and 2 of the drawing illustrate plan and side views respectively of a portion of a sealing machine embodying this invention.

Fig. 3 is a side view on an enlarged scale of the testing device illustrated in Fig. 1.

Figs. 4 and 5 are fragmentary views of a variant form of testing apparatus.

With reference to Figures 1 and 2 of the drawing, the mechanism at the left of the figures represents a portion of a sealing machine in which the tubes *t* to be processed are progressively carried through loading, glass softening, sealing, and cooling stages and thereafter discharged from the machine. Mechanisms of such character are known in the art and need not, it is believed, be explained in detail. Suffice it to say that the reference to a sealing machine herein is for the purpose of illustrating a form of tube conveying device in which all of the tubes undergoing treatment are carried progressively past a given point, whereat, in accordance with this invention tube testing synchronized with the tube movements, may take place.

The referred to sealing machine comprises a power rotated table member 10, which carries a plurality of tube holders 11. Each tube holder consists of a group of rollers, arranged generally at the points of a triangle, including a pair of driven rolls 12 and an idler roll 13 that normally is urged toward the V between the driven rolls. An underlying annular plate 11^a supports the bottoms of the tubes. At the loading station, the idler roller 13 is mechanically retracted to permit insertion of the tube to be sealed in the triangular space defined by the peripheries of the three rolls. After loading, the third roller presses the tube against the driven rolls 12 whereby the tube is rotated about its axis as the table 10 revolves about the central axis. Gears 12^a, secured to each roller 12, mesh with a stationary ring gear 12^b, and effect the aforesaid rotation.

At a certain region in the angular travel of the tube, a traveling burner 14 lowers and plays a flame on the rotating tube at the zone required to soften the glass. A little further along, gripper elements 14^a take hold of the portion of the tube above the softened zone and stretches and severs the tube, effecting thereby a partial sealing of the drawn out end of the body. The flame continues to play on the end of the tube, completing the seal by fusing over the end of the glass. As the sealing is completed the flame is removed and the sealed tube cools during the remaining part of its travel to the discharge chute. In the present disclosure the removal of the flame occurs at the region marked *r*, in Fig. 1, and is effected by a stationary cam member 15 that co-

acts with a roller on the traveling burner arm 14^b to elevate the burner considerably above the sealed end of the tube. A sealing cycle similar to the above is set forth in greater detail in my prior Patent No. 2,258,498, and in my copending application Serial No. 446,523, filed June 10, 1942.

Uniformly perfect seals are as a rule, produced by the above method. Occasionally, however, an imperfect seal is produced, and where the imperfection is obvious from inspection, the imperfect tube is withdrawn. The real difficulty found to exist, however, lies in the fact that during the sealing operation an imperfect tube or seal is produced as to which the defect is not obvious or noticeable, and the tube is passed for further processing or packaging and only then or at a still later date do the consequences of the defect appear in the form of evaporation, spoilage of the product, or collapse of the tube.

While one strives to obtain and maintain a high degree of uniformity in the tube sizes, wall thickness, and quality of glass, variations have and do occur. A slightly thinner wall contains a less volume of glass for a given diameter than a tube of normal wall thickness, and a machine set for the normal tube will more quickly heat or overheat the thin tube. Moreover, a thin tube will contain less material to be stretched over its end to make the seal, and if closure is complete, the seal is likely to be weak and delicate.

In the case of liquid filled tubes, a small variation in inside diameter will cause a change in the liquid level and bring it closer or further away from the zone of heating, and consequently, produce an abnormal condition. Likewise, a slight variation in the quality of the glass will present an abnormal condition and result in an imperfect seal or a seal that later proves to have been defective, much to the annoyance of the consumer, who, in some cases may have depended upon and needed the product badly.

To guard against possibilities of this kind, this invention proposes a mechanism for weeding out the weak tubes by subjecting each tube to a physical test intended to produce an obvious fracture or collapse, in respect to such tubes that are inherently weak or have had a weak seal produced thereon.

A preferred form of device for the purpose is illustrated in the accompanying drawing and consists of a member 20 of a predetermined weight value that is permitted to fall through a predetermined distance, upon the end of a sealed tube or other container to be tested. In the embodiment illustrated the weight 20 is removably and adjustably mounted to the free end of a pivoted lever 21. Midway the ends of the lever, a rod 22, having a roller 23 of small radius at its lower end, is adapted operatively to engage the lever and a traveling cam element 24, to effect a lifting and a sudden dropping of the weight 20 when the tube to be tested arrives at a position directly under the weight.

The lever 21 is pivoted at 25 preferably to the top of a vertically adjustable supporting post 26, positioned a suitable distance away from the edge of the tube carrier 10, as illustrated in Fig. 3, or to the post end of a guide bracket 27 as illustrated in the Fig. 4 modification.

The outer end of the guide bracket is broached or milled to receive the vertically extending actuating rod 22 which may be square, splined, or otherwise formed whereby it is constrained against turning about its axis. In the embodi-

ment illustrated in Figs. 2 and 3, a guide brace 22^a secured at one end to the rod 22, straddles the post 26 and serves as a means for maintaining the rod 22 and its roller 23 in proper angular position. The upper end of the actuating rod is threaded to receive two sets of check nuts 27^a and 28^a, one at either side of the lever, and the under set in conjunction with the vertically movable bracket 27 serving as an adjustable limit stop for controlling the limit of fall of the lever and its weight.

The upward movement of the lever and the distance through which the weight 20 may fall is controlled in this instance by the cam members 24 attached to the tube carrier in proper positions with relation to the tube receptacles so that as each tube reaches the testing zone, the leading edge or incline of the associated cam will lift the rod 22, lever 21 and weight 20, to permit passage thereunder of the tube. When the tube is directly under the weight, the roller 23 drops quickly off the trailing end of the cam 24, allowing the weight to fall on the tube. If the seal or the main body of the tube is inherently weak or defective, the shock imparted by the falling weight will cause a definite fracture or complete collapse of the tube.

The device is accommodated to tubes of different lengths by adjusting the post 26 vertically or by adjusting the guide bracket 27 vertically on the post. If the adjustment be such that the weight 20 slants at too great an angle from the horizontal, correction is made by adjusting the bolts 30 and 31 whereby the position and alignment of the contacting face of the weight 20 relative to the tube end may be altered to suit the needs. Fig. 2 illustrates the device adjusted to a suture tube *t*, and in dotted lines an ampule *a* is illustrated to which the testing device may also be adjusted.

The severity of the shock and force of the weight on the tube may be varied by changing the weight 20 for a heavier or lighter one, and fine adjustments effected by over setting the effective stroke so that the weight may fall through only a fraction of the normal distance before reacting upon the tube end.

In the variant form disclosed in Figs. 4 and 5, an electro magnet 35 is provided for lifting the weight. With this modified form, cam elements 24^a function to close the switch 36 and its circuit to the magnet 35 before the tube arrives at a position under the weight and then, when the tube is directly under, to open the switch to allow the weight to fall. An adjustable stop 37, carried by the bracket 27 limits the distance of fall. In other respects the form illustrated in Figs. 4 and 5 conforms in details and function to the forms described above.

With either form of tester there is no danger of inadvertently passing an inherently weak or improperly sealed tube for as each tube passes along on the carrier it automatically is thoroughly tested for strength of seal and its ability to withstand considerable abuse. The relatively weak tubes are, by this invention, detected immediately and removed, and the tubes that pass the test can safely be relied upon to preserve the products in their original sterile condition and safely to withstand further handling and abuse. Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various utilizations by retaining one or more of the features that, from the standpoint

of the prior art, fairly constitute essential characteristics of either the generic or specific aspects of this invention and, therefore, such adaptations should be, and are intended to be, comprehended within the meaning and range of equivalency of the following claims.

Having thus revealed this invention, I claim as new and desire to secure the following combinations and elements, or equivalents thereof, by Letters Patent of the United States:

1. A mechanism for shock testing a glass tube comprising, a tube carrying means movable in a predetermined path, a weighted lever pivoted to a support located to one side of said path of movement so that the free end of the lever overextends the path of movement of the tube carrying means, means for lifting the free end of said lever a predetermined distance, means for propelling said carrying means in said path, and trip means timed and controlled by the movement of said carrying means for releasing said lever to thereby allow same to fall, said trip means operating when the glass tube to be tested reaches a point directly under the free end of the said lever to receive the impact thereof.

2. The combination set forth in claim 1 including means at the said free end of said lever to vary the angle of the plane of its tube striking face relative to the tube end.

3. A means for testing a glass tube comprising, a tube support, a weighted lever pivoted to a support located to one side of said tube support so that the free end of the lever overextends the tube support, means for lifting the free end of said lever a predetermined distance, means for positioning a tube to be tested under said weighted lever, and trip means timed and controlled by the said positioning means for releasing said lever to thereby allow same to fall, said trip means operating when the glass tube to be tested is in position to be struck by the falling lever.

4. A device for shock testing a glass tube comprising a tube carrying means movable in a predetermined path, a weighted lever pivoted to a support located to one side of said path of movement so that the free end of the lever extends generally horizontally over the path of movement of the tube carrying means, magnetic means for actuating said lever about its pivot, means for propelling said carrying means in said path, control means for said magnetic means timed and controlled by the movement of said carrying means for effecting movement of said lever in synchronism, said control means operating as the glass tube to be tested approaches a position to be struck by the free end of the said lever.

5. A device for testing the strength of the seal of a glass tube sealed by fusion combining a movable carrier, a series of tube holding means carried thereby, a weighted element positioned above said tube holding means in position to react against a sealed glass tube in the region of its seal on movement of the tube carried by said tube holding means to a position thereunder; means for propelling said tube holding means in a predetermined path thereby to carry the tube holding means and tubes therein successively from a position ahead of said weighted element to testing position under the latter and then past said element, and means operated in synchronism with the carrier movement for successively effecting such relative movement between the tubes carried in said holding means and said weighted element as each tube arrives in testing position, said weighted element operating suc-

cessively to exert a compression force upon the sealed end of the respective tubes sufficient to fracture the tubes if the tubes or their seals are relatively weak.

6. Means for subjecting a glass tube to a strength test combining tube transporting means including a receptacle adapted to support and carry tubes in a predetermined path, a force applying member positioned in the path of travel of the tubes and adapted successively to engage and apply a compression force to the end of the tube sufficient to fracture a relatively weak tube, means for propelling said transporting means and the tube carried thereby in said path; and means controlled by the movement of said transporting means for rendering said force applying member effective when the tube and said member are in testing position relative to each other.

7. A device for testing the strength of the seals of glass tubes sealed by fusion combining bodily shiftable tube holding means, an element movable in a plane which includes the longitudinal axis of a tube when the tube is in testing position positioned above said tube holding means in position to react upon the sealed end of a tube on bodily movement of the latter to a position

thereunder, means for effecting such relative shifting movement between tubes in said holding means and said element thereby successively to effect transportation of tubes from an ineffective position to an effective position with respect to said element and means consequent upon said shifting movement to effect said reaction thereby to fracture the tube if the seal is relatively weak, and means for varying the effective force of said movable element to suit tubes of a different strength factor.

8. A device for testing the strength of hermetically sealed tubes comprising bodily movable tube receptacles for receiving and transporting tubes to be tested, a weight member normally suspended a predetermined distance above the receptacles at a relatively fixed point along the path of movement of the receptacles, magnetic means for raising said weight a given distance, and control means for said magnetic means actuated by the movement of the receptacles operative to effect release of the weight member as the tube carried by the respective receptacles reaches a position thereunder to allow the member to fall said predetermined distance upon the tube.

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