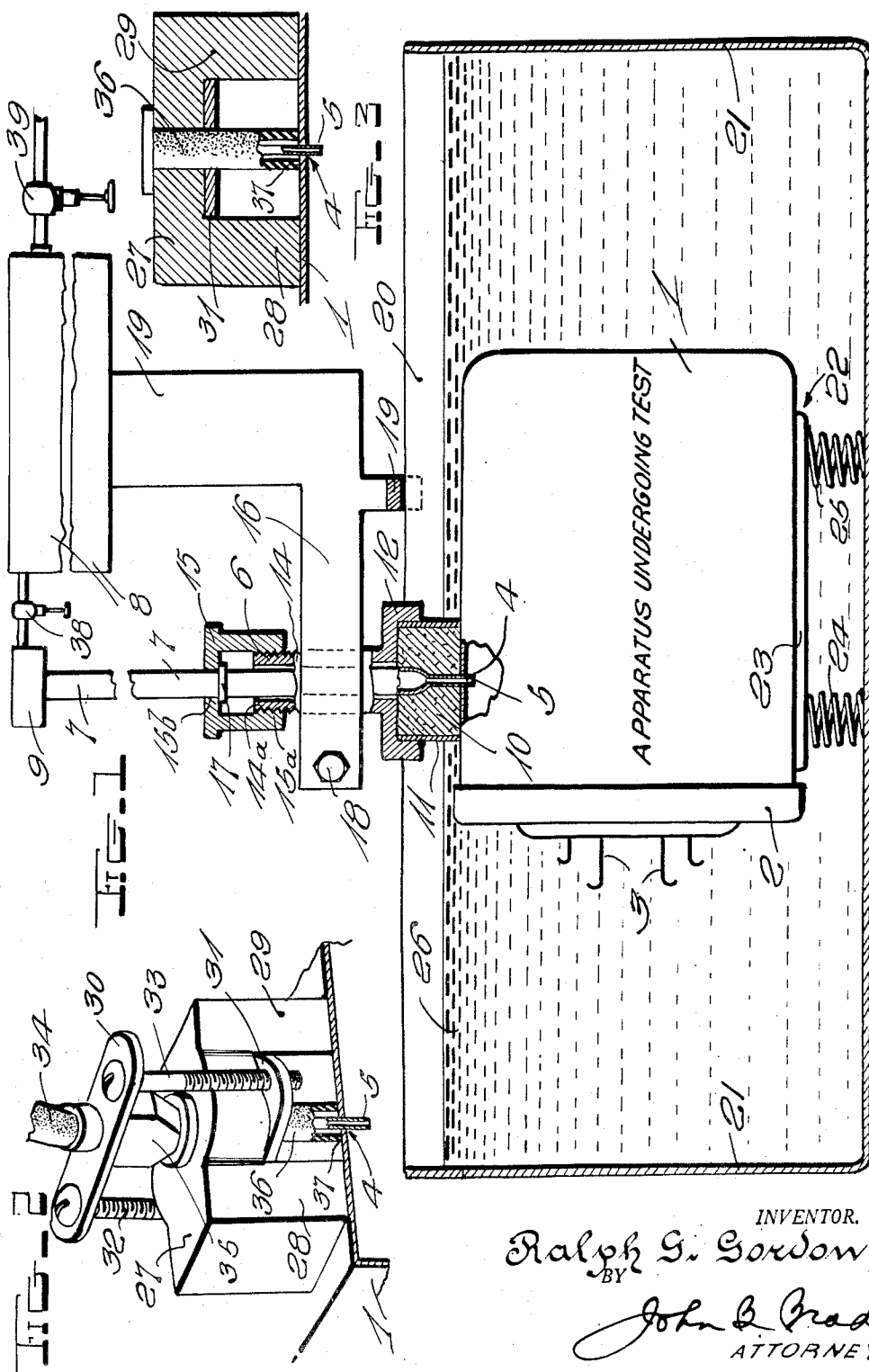


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 APPARATUS FOR TESTING AND HERMETICALLY SEALING
 MECHANICAL AND ELECTRICAL EQUIPMENT
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APPARATUS FOR TESTING AND HERMETICALLY SEALING MECHANICAL AND ELECTRICAL EQUIPMENT

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My invention relates broadly to apparatus for testing and hermetically sealing apparatus in containers.

One of the objects of my invention is to provide apparatus for sealing mechanical and electrical devices in containers, degasifying such containers and testing the containers for the security of the sealing.

Still another object of my invention is to provide an improved apparatus for facilitating the sealing of mechanical and electrical apparatus in containers and the baking of such apparatus over a time period, for evacuating the container for insuring the operation of the mechanism and electrical apparatus within the container at high efficiency independently of atmospheric and ambient conditions.

Still another object of my invention is to provide an arrangement of injector device for application through the wall of a container containing mechanical and/or electrical equipment being sealed and wherein the injector device is maintained in position with respect to the container by magnetic attachment means and the injector aperture in the container sealed automatically by gasket means maintained under compression by the magnetic adherence of the magnetic attachment means to the exterior wall of the container.

Still another object of my invention is to provide an improved testing apparatus for evacuating and sealing containers for electrical and mechanical apparatus as set forth more fully in the specification hereinafter following by reference to the accompanying drawings in which:

Figure 1 is a schematic view showing one form of apparatus used in my invention applied in the testing of the condition of the seal of an electric relay within a container; Fig. 2 is a perspective view of a modified form of magnetically attached applicator for the injector needle which is projected through one side of the container enclosing the electrical or mechanical apparatus to be sealed; Fig. 3 is a transverse sectional view showing the coaction of the magnetic attachment means, the injector needle and the pressure seal which is rendered effective by the compression of the gasket around the aperture in the wall of the casing to which the magnetic attachment means adheres.

With the requirements of the armed services for operating sensitive electrical and mechanical apparatus under conditions encountered anywhere in the world, the sealing of such sensitive apparatus against the variable influences of atmospheric and ambient conditions has become essential. The apparatus of my invention has proven highly efficient in the protection of sensitive electrical and mechanical apparatus against changes in conditions of temperature, humidity and barometric pressure encountered in various locations of the world and in insuring long and effective life for the operation of the equipment. I have illustrated my invention in the testing of sealed electric relays but it will be understood that my invention is applicable to all types of mechanical and electrical attachments and that the application to electric relays shown herein is merely to be considered in the illustrative sense.

My invention is applicable to all hermetically sealed apparatus and devices where complete dehydration and removal of any volatile solvents is required to attain maximum insulation and contact life and to insure efficient operation under the rigid requirements of military and other important applications.

While my invention is described in connection with electric relays, it will be understood that other electrical

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equipments are intended to be included by this term as all such equipments have in common materials and parts which are capable of liberating gassy fumes or which become subject to changes in dimensions with changes in temperature. It is first necessary to process these equipments under heat and vacuum until all such materials and parts are free of gases and stabilized to a condition where no dimensional changes will occur.

The container in which the equipments, such as an electric relay, are sealed, together with the cover are first treated with a suitable preparation so that no foreign material, dirt or any trace of rust is present. Such container, cover or accompanying header may be provided with a suitable breather or vent for the purpose of evacuation. Whenever the header or the cover is provided with a vent then the container will be without vent. A minute hole in the container is the generally accepted method for providing a vent. However, a tube, preferably in the cover or header, is sometimes employed for a vent, particularly when specifications require an enclosure to be pressurized with an approved gas. Therefore, my invention is directed to two devices for sealing: (A) for equipments having a container or cover provided with a breather or vent hole, (B) for equipments in which the container is provided with a breather or vent tube.

Referring to the drawings in more detail reference character 1 designates the container for an electric relay having a header 2 which supports the terminal connections in spaced insulated relation and indicated generally at 3. After sealing the container 1 and header 2, but prior to sealing the breather hole 4 which is provided in the side wall of the container, each electric relay is tested as follows: a leak test fixture of the type shown in Figure 1 or of the magnetic type shown in Figs. 2 and 3 is applied to the side wall of the container 1 with the injector needle 5 extending through the breather hole 4 in the side wall of the container 1. The injector needle 5 connects through a coupling tube 6 with an air line 7 through which filtered dry air or an inert gas is forced from a pressure source indicated at 8 through the filter 9 for injecting the filtered dry air or inert gas at approximately 17 pounds per square inch into the interior of the container 1. Provision is made for the sealing of the injector needle 5 with respect to the aperture 4 by a suitable pad 10 which is confined by a cylindrical member 11 confined by the flanged header 12 from which the tubular stem 14 extends surrounding the coupling tube 6. The end of the stem 14 is screw threaded as indicated at 14a and is engaged by interior screw threads 15a of the cap 15. Coupling tube 6 is provided with an annular flange 17 against which the inside surface of cap 15 abuts. The air line 7 which is attached to coupling tube 6 extends through the central aperture 15b in cap 15. The leak test fixture includes a supporting arm 16 which carries the stem 14 and which is secured therearound by a suitable bolt 18. The supporting arm 16 also provides means 19 for mounting the pressure source cylinder 8 for supplying the air under pressure through filter 9 to the air line 7 leading to injector needle 5. The supporting arm 16 is provided with a suitable yoke indicated generally at 19 adapted to set over and embrace the side walls 20 of the fluid tank 21. The leak test fixture including the air pressure source and injector needle is accordingly readily attachable over the side walls of the fluid tank 21 in such a position that injector needle 5 may readily be centered through breather hole 4 in the side wall of container 1. To insure the proper alignment, a spring supported table 22 is provided in fluid tank 21 including a horizontally extending support 23 spaced from the bottom of fluid tank 21 by springs 24 and 25. The fluid tank 21 is filled with water to the level indicated at 26.

The electrical equipment such as an electric relay which is subjected to test is mounted on the horizontally extending support 23 in a position whereby injector needle 5 extends through aperture 4 in the side wall of container 1 and in a position to inject air or gas under pressure of approximately 17 pounds per square inch into the container 1. The container 1 is submerged in the water 26 and a test observation made to determine

whether or not there are any air bubbles present showing leakage from the interior of container 1. If no air bubbles appear then the apparatus is ready for processing.

In the event that container 1 has a breather tube thereon modification is made in the test rig to attach a small flexible hose connection to the breather tube extending from the container 1 for introducing air under pressure into container 1.

I have mentioned herein a pressure of 17 pounds per square inch because this simulates an altitude of approximately 50,000 feet. The pressure may, therefore, be varied to meet specific requirements. This pressure test insures 100 per cent inspection in a production process.

After application of the foregoing test, but prior to sealing the breather hole, the apparatus and the enclosing casing are placed in an autoclave and heat and vacuum applied. Heat can be allowed to reach 100° C., and the vacuum may be increased to 30", and held for a period of two hours. At the end of approximately two hours under the foregoing conditions the vacuum pump and the heat are shut off and dry air, approved inert gas or liquid introduced into the autoclave. The apparatus and the enclosing casing are maintained in the autoclave until atmospheric pressure and ambient temperature is reached, after which they can be taken out and the breather hole sealed.

In another application of my invention, after completely sealing the apparatus assembly in the container and prior to the sealing of the breather tube, the container enclosed apparatus is placed on a heat rack and a vacuum hose connected to the breather tube for applying 30" vacuum. When the container heat is up to 100° C. it is held for approximately two hours and then the vacuum hose is shut off by closing a vacuum hose valve.

The vacuum gage forming part of the test set-up in series with the evacuation tube is then observed to determine the degree of vacuum drop. The observation is continued for approximately one minute, and if there is no appreciable vacuum drop, then the reverse process is employed by introducing dry air or inert gas or an approved liquid through a manifold connected to the vacuum line provided for that purpose. During the above procedure, the vacuum gage should be observed and when the gage registers the given pressure, then the breather tube is pinched tight and the connecting tube withdrawn and the aperture 4 sealed immediately.

Tests are carried out for checking leaks in the breather tube after vacuum processing and sealing by submerging the sealed container in a fluid bath brought up to 100° C. The containers are thus inspected for possible appearance of bubbles in the fluid bath. Where specifications require the use of an approved inert gas, or should a radioactive gas be employed, leaks in the sealed container may also be detected by using an electrical or a mechanical detector.

Engineering tests are carried out on the sealed equipment after sealing the breather hole or tube by placing the sealed containers in a vat filled with a suitable liquid which submerges the containers at least one-half inch above the highest part of the containers. A bell jar is then positioned over the vat and pumped out to apply a vacuum of approximately 30". Close observation is made for bubbles. Containers showing any indication of bubbles are rejected.

My invention is particularly adaptable in the sealing of apparatus in containers of magnetic material. The magnetic type of leak test fixture is shown in Figs. 2 and 3 as including permanent magnet 27 having magnetic poles 28 and 29 of substantially horse shoe construction adapted to bridge the breather hole 4 in the side wall of the container 1 by magnetic attraction and adhesion of the magnetic fixture with respect to the magnetic side wall of the container. The permanent magnet is gripped by the central clamp formed by plates 30 and 31 secured together by screws 32 and 33. An air hose 34 is supported by plate 30 and connects with coupling tube 35 that connects with resilient tube 36 extending between magnet poles 28 and 29 and having a resilient end portion forming a sealing connection at 37 with the wall of the casing 1 around the injector needle 5 that passes through breather hole 4 in the wall of container 1. Thus a tight seal is provided between the injector needle 5 and the container 1 when applying pressure through the injector needle 5 to the interior of the container or when evacuating the container through the needle 1.

I have illustrated in Fig. 1 the manner of controlling the supply of air or gas from cylinder 8 to filter 9 by valve 38. The cylinder 8 is supplied with air or gas under pressure from a main generating or storage source through valve 39.

In either of the forms of my invention the breather aperture 4 is sealed around injector needle 5 either by pad 10 (Fig. 1) or gasket 36 (Figs. 2 and 3).

My invention is applicable in the hermetic sealing of a wide variety of apparatus and devices requiring protection, such as the sealing of transformers and other electrical components in meeting the wide variations encountered in atmospheric conditions from the Tropics to the Frigid Zones.

While I have described my invention in certain of these preferred embodiments, I realize that modifications may be made and I desire that it be understood that no limitations upon my invention are intended other than those imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A device for applying an injector needle through a breather aperture in the wall of a container formed from magnetic material and having a solid closure on one end and a sealed closure on the other end which comprises a permanent magnet having a pair of spaced pole pieces operative to magnetically engage the magnetic wall of a container on opposite sides of the breather aperture therein and intermediate the solid closure on one end and the sealed closure on the other end, an injector needle having a fluid passage therein carried by said permanent magnet and disposed in a position adapted to extend through the breather aperture in the magnetic wall of the container and a sealing gasket surrounding said needle and adapted to be maintained under compression around the needle by said permanent magnet whereby fluid injected through said needle into said container is confined to a path directed into the container.

2. A device for magnetically maintaining an injector needle through an apertured magnetic wall of a container having a solid end closure on one end and a sealed end closure on the opposite end which comprises a permanent magnet having a pair of spaced magnetic poles adapted to engage the magnetic wall of a container on opposite sides of the aperture therein intermediate a solid end closure at one end of the container and a sealed closure at the other end of the container, a clamp extending between the magnetic poles of said permanent magnet, an injector needle having a fluid passage therein and connected with a fluid pressure source, said needle being carried by said clamp and directed through the apertured magnetic wall of the container and a tubular resilient gasket extending between said clamp and the apertured magnetic wall of the container and surrounding the injector needle for maintaining a seal around the injector needle adjacent the entry thereof through the apertured wall of the container.

3. A magnetic device for applying an injector needle through a breather aperture in the wall of a container formed from magnetizable material, comprising a permanent magnet having a pair of spaced pole pieces operative to magnetically engage the wall of a container on opposite sides of the breather aperture, a clamping plate extending between the spaced pole pieces and centrally apertured for the passage of a resilient tube, said resilient tube extending through the permanent magnet, a coupling tube establishing connection with said resilient tube, a second clamping plate aligned with the aforesaid clamping plate, said second clamping plate being centrally apertured for engaging the end of said coupling tube, means interconnecting the aligned ends of said clamping plates for maintaining said permanent magnet, said resilient tube and said coupling tube in assembled relation, a flexible air hose extending through said coupling tube and into said resilient tube, an air injector needle connected with said air hose and extending through the breather aperture in the apertured wall of the container while said resilient tube forms a sealing gasket around said apertured wall and the injector needle passing therethrough, whereby air may be forced into the interior of the container.

4. A magnetic device for applying an injector needle through a breather aperture in the wall of a container formed from magnetizable material as set forth in claim 3

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in which the means interconnecting the ends of said clamping plates are adjustable screws which may be adjusted for varying the pressure exerted against said coupling tube for establishing connection with said resilient tube.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
900,324	Swangren	Oct. 6, 1908 10

Number
1,207,814
1,371,484
1,539,937
2,391,351
2,442,587
2,478,754

6

Name	Date
Stocton	Dec. 12, 1916
Howard	Mar. 15, 1921
Cochrane	June 2, 1925
Schmidt	Dec. 18, 1945
Coggeshall et al.	June 1, 1948
Dubilier et al.	Aug. 9, 1949