

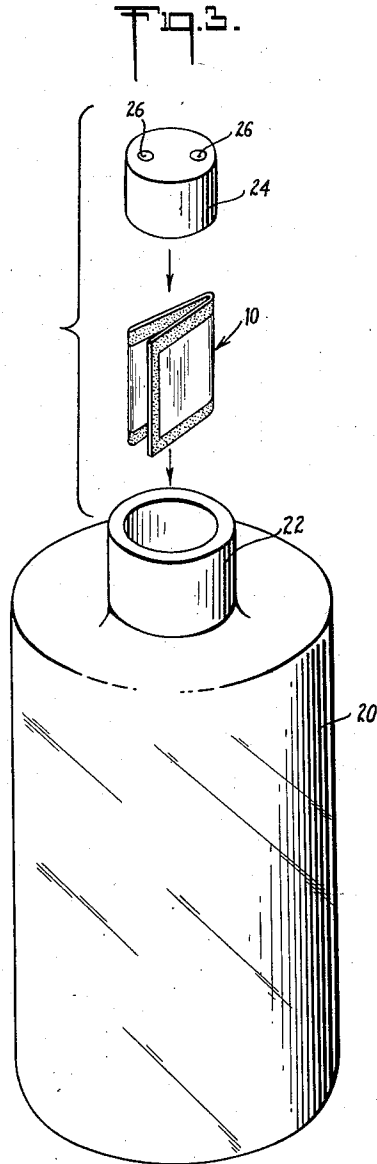
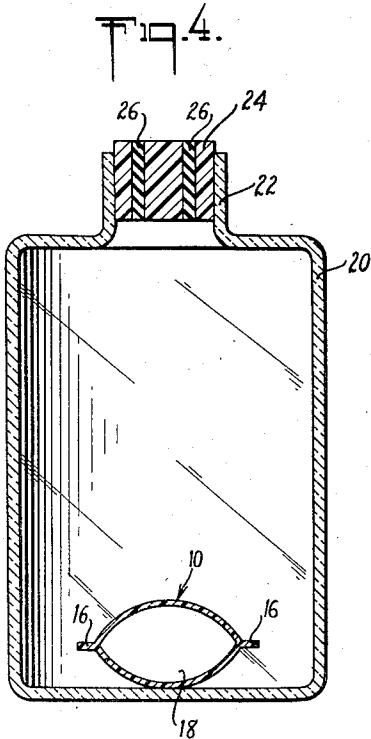
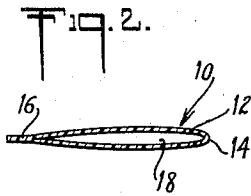
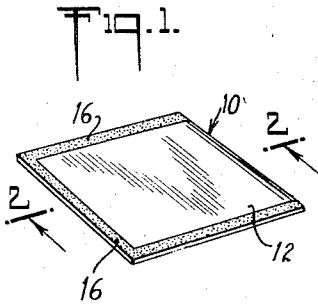
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R. W. CARVER

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PRESSURE INDICATOR

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INVENTOR  
ROBERT W. CARVER

BY  
*Joseph A. Schaines*  
ATTORNEY

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## PRESSURE INDICATOR

Robert W. Carver, Chatham, N. J.

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1 Claim. (Cl. 116—114)

This invention relates to pressure indicating apparatus and more specifically to a simplified, inexpensive pressure indicator that may be used to indicate the presence and degree of positive and negative pressures within closed conduits, vessels and the like.

While it will become apparent that this invention is of general utility, it is particularly useful for detecting the presence of a vacuum in sealed transparent containers as for example vacuum bottles used to withdraw blood. At the present time, bottles to be used to store blood in blood banks are first sterilized and then sealed under a vacuum in order to insure maintenance of the sterility of the bottle as well as to withdraw blood from a donor. In many cases the vacuum in the bottle lost because of an improper seal not only upsets the blood transfusion process but also indicates the possibility of contamination of the container.

One object of the invention, therefore, resides in the provision of a low cost, dependable vacuum indicator for bottles that will immediately and positively indicate the presence and amount of vacuum within a container. While the invention is particularly useful for containers, it is also adaptable for use in any application wherein the indicator can be observed within the depressurized space.

Another object of the invention resides in the provision of an improved, disposable pressure indicator that is characterized by its low cost and ease of manufacture, and that may be readily inserted in a container or other space to be tested.

The above and other objects and advantages of the invention will become more apparent from the following description and accompanying drawings forming part of this application.

In the drawings:

Fig. 1 is a perspective view of an indicator in accordance with the invention;

Fig. 2 is a cross-sectional view of Fig. 1 taken along the line 2—2 thereof;

Fig. 3 is a perspective view of a container with the indicator of Fig. 1 being inserted therein; and

Fig. 4 is a cross-sectional view of the container of Fig. 3 showing the indicator in the presence of a vacuum.

The embodiment of the invention now to be described is particularly desirable for use in connection with transparent containers such as vacuum bottles of the type employed in withdrawal of blood for blood banks. In this case one of the difficulties heretofore encountered has been the loss of vacuum within the container prior to its connection with the donor by reason of a poor or imperfect seal. This condition not only results in considerable inconvenience to the donor but delays the entire process and utilizes valuable time and facilities. Through the employment of a vacuum indicator in accordance with the invention these difficulties are completely avoided and at the same time negligible space is occupied by the indicator when the container is filled.

Referring now to Figs. 1 and 2, the indicator 10 is

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formed of a material 12 impervious to air and other fluid as for instance a relatively thin plastic material having substantial flexibility and some degree of elasticity. While most of the plastic and rubber materials are satisfactory for this purpose, it is, of course, important that it be resistant to any gases or liquids that it may contact.

The indicator 10 shown in the figures is fabricated of a thin transparent plastic material folded upon itself along the line 14 to form a substantially rectangular device. The meeting edges 16 of the folded material 12 are sealed in any suitable manner to form a pocket having a relatively thin chamber 18 therein. Now with a quantity of air or other gas trapped within the pocket or chamber 18 at a predetermined pressure as for example atmospheric pressure and then the indicator is subjected to more negative ambient pressures it will expand an amount proportional to such pressures. On the other hand if the indicator 10 is filled with a gas under pressure and then subjected to a positive ambient pressure, it will collapse an amount proportional to such ambient pressure. Thus the indicator 10 will readily function as both a positive or negative pressure indicator depending upon the manner in which the compartment or chamber 18 is filled.

In the case of the vacuum indicator for use in glass containers for receiving blood, the compartment 18 is filled preferably at atmospheric pressure and sealed in a sterile atmosphere. The completed indicator 10 is then sterilized preparatory to insertion in the bottle.

Fig. 3 illustrates a conventional transparent bottle 20 of the type generally used in blood banks and having a relatively narrow neck 22 adapted to receive a rubber "cork" or closure 24. These bottles 20 are sterilized and sealed under a vacuum and means in the form of a pair of sealed openings 26 are provided in the closure 24 for receiving a suitable tube or tubes for attachment to a donor. While a vacuum is essential to the use of the jar or bottle 20, its presence will not be assured until the bottle is actually placed in use and this difficulty cannot be avoided by known testing apparatus as it is not only inconvenient and difficult to use but is time consuming and will result in at least a partial loss of vacuum.

According to the invention, the indicator 10 is inserted within the container 20 prior to sealing and evacuation of the container as previously described. In view of the flexibility of the indicator 10 it can be rolled or folded to facilitate its insertion into the opening 22 of the container, and its resiliency will cause it to automatically unfold when within the container.

After the container opening 22 has been closed by the closure 24 as shown in Fig. 4 of the drawing, it is then evacuated prior to final sealing and preparation for use. When the container is evacuated, the air or other gas disposed within the compartment 18 of the indicator 10 will of course expand, causing the enclosing walls of the indicator 10 to bulge outwardly as shown in cross-section of Fig. 4, and form in effect a bubble. The extent of the enlargement of the indicator 10 is an indication of the degree of vacuum within the container, and since the latter is usually of a transparent material, the pressure condition within the container will be readily observable. If the indicator 10 is in the enlarged condition it is, therefore, known that sufficient vacuum exists within the container for the purpose intended. On the other hand, should the indicator 10 be in a flattened condition, it is known that the vacuum within the container has been lost. When the container is filled the vacuum within it no longer exists and the indicator will flatten out. As a result the indicator occupies little or negligible volume within the container and remains in place until after the contents are utilized and the container is again sterilized or sealed. If desired the indicator 10 may be either reused

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or merely thrown away and a new indicator provided in its place.

It is apparent that an indicator 10 may also be used to provide means for checking the pressure within a vessel in which case, of course, the chamber 18 within the indicator 10 would be filled at a pressure above atmospheric and will collapse in the presence of a positive ambient pressure. In cases where extremely high vacuums are to be checked by an indicator in accordance with the invention, it may be desirable to fabricate the indicator so that a partial vacuum exists within the compartment 18. In this way high stresses are not placed on the indicator walls when subjected to high negative pressures.

Although only one embodiment of the invention has been shown and described, it is apparent that the indicator 10 may assume any suitable size or shape that will adapt it more readily to a specific application. Moreover, other modifications, alterations and changes may be made without departure from the true scope and spirit of the invention.

What I claim is:

The combination with a rigid transparent container

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adapted to be sealed with a vacuum therein of indicating means within the container for indicating the presence and magnitude of the vacuum comprising a packet formed of at least two layers of a flexible fluid-impervious material sealed about the edges to provide an air tight chamber between the layers and an expandable gas between said layers and having a pressure approximately equal to atmospheric pressure, said packet upon evacuation of the container expanding to increase its size and modify its shape to indicate the presence and general magnitude of the vacuum within the container.

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