Aug. 9, 1932. J. V. GIESLER 1,870,902

EXPANSION ABSORBER

Filed Dec. 17, 1927

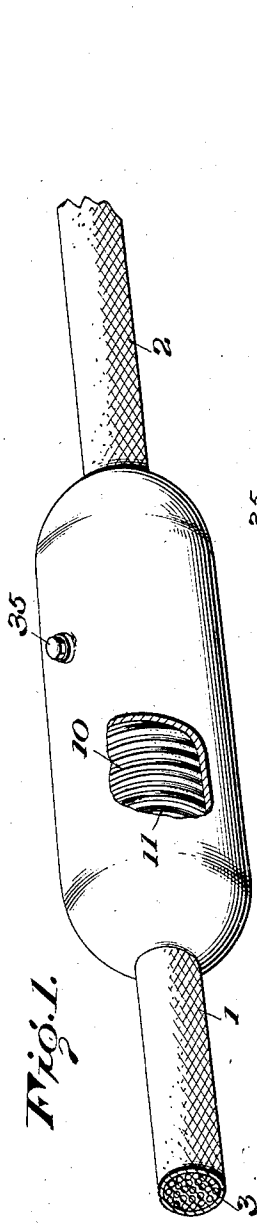

Fig. 1.

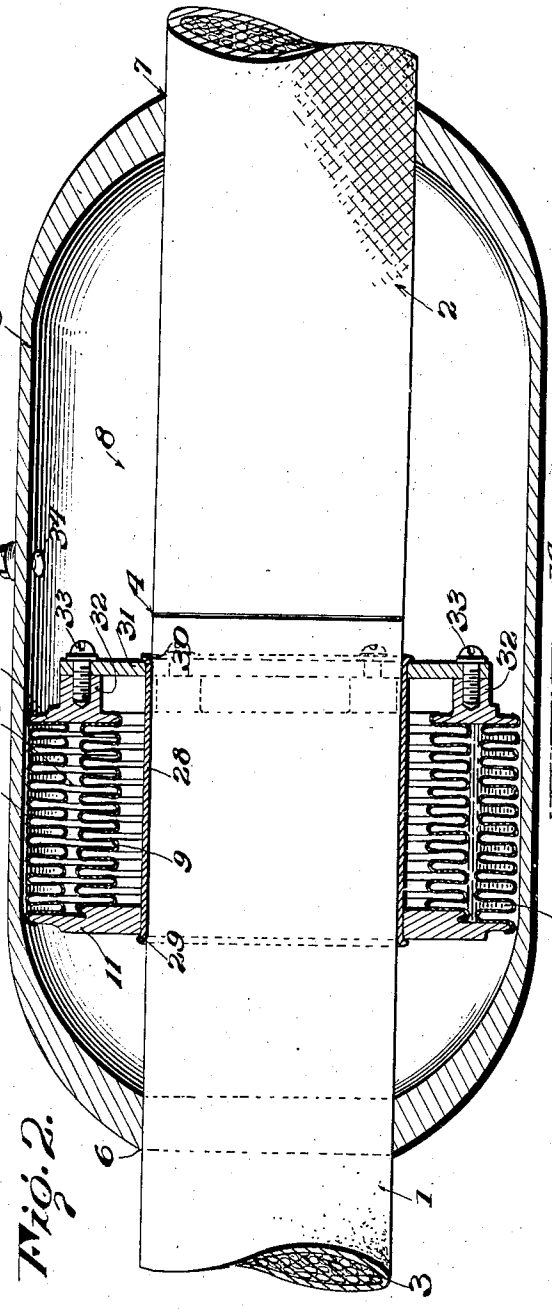

Fig. 2.

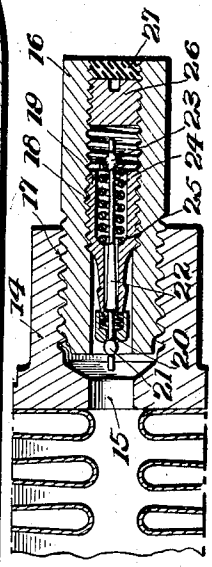

Fig. 3.

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UNITED STATES PATENT OFFICE

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EXPANSION ABSORBER

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This invention relates to a method and means for maintaining pressure within a container within predetermined limits.

Where it is desired to maintain a certain pressure within a container for substantial periods, considerable difficulties have heretofore been encountered due to gradual losses of pressure from leakage, absorption, changes in temperature, and the like. For example, in high tension cable installations, where the ends of two adjoining cable sections are connected, it has been customary to insulate the joint by attaching a sheath to the cables on either side of the joint and to fill the same with heavy oil or other suitable insulating medium under considerable pressure. It has been found in practice that in time the leakage losses, absorption losses, and the like, will so reduce the pressure of the insulating medium that the insulating effect thereof is seriously impaired and when subjected to high tensions the joint may break down. The same difficulties are also encountered in many other cases wherein closed containers, filled with some substance or substances, are required to be maintained at or above a certain predetermined pressure.

It has been proposed heretofore to overcome these disadvantages by exerting on the substance under pressure a substantially constant external force by the provision of suitable external means such as a weighted piston and the like adapted to exert a pressure on the medium within the container. Such means are, however, objectionable for many reasons. The integrity and strength of the container are inevitably impaired, and the possibilities of leakage, fracture of the container, etc., are greatly increased. Furthermore, where considerable pressure must be maintained, the method of maintaining the pressure by the use of weights and the like as external pressure exerting means becomes impracticable, since many difficulties are involved in providing an efficient apparatus to supply the pressure required. Moreover, where the medium under pressure is a gas or relatively freely flowing liquid, it is almost impossible to construct a piston or other sliding member with a sufficiently tight fit to prevent leakage of such medium over substantial periods of time. In any case, the use of means external to the container may be objectionable due to requirements of space and location of the container, particularly since any gravity actuated means is operative only in a vertical direction.

One of the objects of the present invention is to obviate the above disadvantages and to provide a novel method and means for maintaining a desired pressure within a container which is efficient, reliable and economical.

Another object is to provide a method of maintaining pressure within a container by utilizing the pressure itself to create an internal expanding force which is of the order of said pressure and compensates for losses of said pressure.

Another object is to provide means which may be entirely enclosed within a container for maintaining the pressure therein within predetermined limits.

A further object is to provide expansible means which may be subjected to initial compression within the container, whereby the expansion of such means compensates for variations of pressure normally occurring within said container.

Other objects will appear as the description of the invention proceeds.

With the above objects in view, the invention, broadly stated, includes the combination with a suitable container of any desired size or type having therein a fluid medium under pressure, of an expansible and collapsible member placed entirely within said container and subjected to an initial compression by the pressure of said fluid medium. Any suitable or desired type of expansible and collapsible means may be employed for this purpose. Preferably, such means takes the form of an expansible and collapsible vessel, which is maintained in a normal state of expansion by a gaseous medium contained therein. When such a vessel is placed in a closed container and subjected to a pressure greater than the pressure of the gaseous medium contained within the vessel, it will be compressed until the pressure within the vessel equals the pressure without the vessel.

If the external pressure is now decreased or fluctuates due to any cause whatsoever, the tendency of the vessel to expand to its normal state immediately in an effort to compensate for the loss thus maintains a pressure within the container which is equal to or greater than the pressure within the vessel in its normally expanded state.

For purposes of exemplification, the accompanying drawing illustrates the invention as applied to a high tension cable joint, but since many other applications of the invention will be readily apparent to those skilled in the art, and the invention may receive a variety of embodiments, it is to be expressly understood that the invention is not limited to the application or embodiment shown, or otherwise than by the terms of the appended claims.

In the drawing, Fig. 1 is a perspective view showing the arrangement and assembly of the parts constituting the joint; Fig. 2 is an enlarged longitudinal sectional view of Fig. 1; and Fig. 3 is an enlarged detail of a filling valve for the vessel shown in Fig. 2.

In the drawing, wherein like reference numerals indicate like parts throughout the several views, the adjoining ends of two cable sections 1 and 2, each of which may be suitably armored as at 3, are joined or spliced together at 4 to constitute a cable joint. For the purpose of insulating said joint, the ends of the two cable sections are enclosed by a sheath 5 of metal or any other suitable material, which is joined to said sections at 6 and 7, on either side of the joint 4, by any suitable means such as sweating or soldering. The sheath 5 thereby encloses a space 8 so as to constitute a fluid-tight container which may be filled with an insulating medium such as heavy oil or grease.

In practice it is necessary that the space 8 be placed and maintained under considerable pressure, and to this end suitable means are provided which will compensate for any loss of pressure, such means comprising an expansible and collapsible vessel placed within the space 8. In the form shown said vessel comprises two deeply corrugated, expansible and collapsible walls 9 and 10, preferably of resilient metal, the ends of each of said walls being attached to two annular heads 11 and 12 in any suitable manner, as by soldering or brazing. An annular space 13 is thereby formed which constitutes a completely sealed, fluid-tight vessel.

The space 13 is preferably filled with any suitable medium such as gas, under an initial pressure determined by the requirements hereinafter set forth. To this end the head 12 is provided with a boss 14, having an opening 15 (Fig. 3) communicating with the interior of the vessel, in which is inserted a suitable filling valve 16. The valve 16 may be of any suitable type, and in the form shown, comprises a tubular body threaded at 17 into the boss 14. The tubular bore of said body is interiorly threaded and engages at 18 a tubular valve member 19 having a valve seat 20 formed on its inner end.

A ball valve 21 cooperates with the valve seat 20, and is carried on a valve stem 22 extending through the tubular valve member 19. An enlargement 23 on the outer end of the valve stem serves as a seat for one end of a coil spring 24, the other end of which is seated in a recess 25 formed in the valve member 19. The spring 24 normally maintains the valve 21 closed. When it is desired to charge the vessel 13, the outer end of valve stem 22 is depressed, thereby opening the valve 21, while the fluid is being forced into the vessel, and as soon as the stem 22 is released, the spring 24 will close the valve to prevent escape of the fluid from the vessel. When charged, the body 16 may be permanently closed by means of a plug 26 and a suitable sealing medium 27, such as solder, wax, paraffin, etc.

It is desirable to prevent undue expansion of the vessel in certain cases, as for example when the vessel is charged with a pressure above atmospheric pressure, and before its installation in the container. For this purpose the vessel is provided with any suitable means for limiting its expansion to a desired amount, and in the form shown such means comprise a tubular member 28, surrounding the cable 1, and having a flared end 29 which engages the head 11 and a flared end 30 which may, for example, engage a ring 31 suitably secured to the bosses 32 as by means of screws 33.

In practice, when it is desired to maintain the pressure within the space 8 above a certain predetermined amount, the vessel 13 is first charged with a suitable gas or other medium at a pressure equal to the minimum pressure desired within the space 8. The charging of the vessel is accomplished as above described by means of the filling valve, and the vessel is then sealed by means of the plug 26 and seal 27. The vessel is then placed within the sheath 5, and the latter is slid over one end of the cable, while the splice is being made. When the splice is completed, the sheath 5 is placed in position and preferably sweated or soldered to the cables 1 and 2. The space 8 is then filled with any desired medium such as heavy oil through an opening 34 in the sheath 5, which opening is then sealed by means of a plug 35. The pressure within the sheath may be raised to any desired maximum, and as soon as it increases above the desired minimum pressure, to which the vessel 13 is charged, the latter will be compressed so that the pressure within the vessel will be always maintained equal to the pressure in the space 8. It will be apparent that if any loss of pressure in space 8 occurs,

the vessel 13 will immediately expand until the pressures are again equalized, and the loss will thereby be compensated and a pressure maintained which is always above the predetermined minimum.

The particular pressure characteristic of the variation between the maximum and minimum values may be regulated by properly proportioning the initial volume of gas in the vessel to the final volume of gas therein. This may readily be done by inserting in the vessel 13, preliminary to charging it with gas, a certain amount of any substantially non-compressible substance, which may be either solid, semi-solid or liquid. This substance is shown by way of example as a liquid, indicated at 36.

While the invention has been described with particular reference to a cable joint, it will be readily apparent that it is equally applicable to any container wherein it is desired to maintain a certain definite minimum pressure. As has been seen, the means employed may be entirely enclosed within the container, and thus requires no additional space and interferes in no way with the normal installation and operation of the container itself. Once installed, the device is entirely self-operative, and requires absolutely no attention. At the same time, it will function over long periods of time, maintaining an accurate and well-defined minimum pressure within the container in spite of temperature variations, leakage, absorption, or any other cause tending to reduce the pressure therein. While in the examples given, relatively small pressures will be encountered, the invention is just as serviceable and efficient for high pressures, the only requirements being that the size and strength of the collapsible vessel be properly proportioned in view of the use to which it is to be put.

Another advantage of the invention is that the expansive force is created by the pressure which is to be maintained, and may therefore be made of the order of such pressure without difficulty. For example, if external pressure-exerting means are employed, it is almost impossible to provide suitable operating means which will exert large pressures steadily and constantly over long periods of time and without care or attention. On the other hand, where the force desired is created by the initial pressure placed upon the medium to be maintained under pressure, this difficulty is entirely avoided. At the same time all packed joints and sliding fits as between cylinders and pistons are eliminated and the chances of leakage losses thereby greatly reduced. The invention is moreover extremely simple in construction and design, is reliable and efficient in operation, and is economical and inexpensive to construct.

While the invention has been illustrated and described with considerable particularity, for the purposes of proper explanation, it will readily be apparent that the invention is not limited to the embodiments shown, but that other embodiments will now readily occur to those skilled in the art, and that changes in the construction, arrangement, and assembly of the parts may be made without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. The combination with a cable joint, of a sheath enclosing said joint, a pair of tubular corrugated walls surrounding said cable and constituting a collapsible and expansible vessel, the space between said walls being charged with a fluid medium under superatmospheric pressure and said sheath being charged with an insulating medium under pressure, and means associated with said walls to limit expansion thereof.

2. The combination with a cable joint of a sheath enclosing said joint charged with insulating medium under pressure, a pair of annular heads surrounding said cable within said sheath, and inner and outer tubular, corrugated walls operatively connected with said heads to constitute a fluid-tight vessel, a tubular supporting member for said vessel extending through said heads and having flanged ends, said supporting member being adapted to be slipped on said cable, said vessel containing a fluid medium normally under superatmospheric pressure and partially collapsed by the pressure in said sheath but tending to expand and compensate for losses of pressure in said sheath.

3. An expansible and contractible unit for maintaining the pressure of a fluid in a container comprising an annular flexible vessel containing an expansible fluid, a tubular supporting member having flared ends and an annular head at each end of the vessel surrounding the tubular supporting member, said flared ends of the tubular member limiting the expansion of said vessel.

4. In apparatus of the class described, the combination of a container adapted to hold a fluid under pressure, means within the container for maintaining the fluid pressure comprising an expansible and contractible vessel containing an expansible fluid, a tubular supporting member having flared ends, and an annular head at each end of the vessel surrounding the tubular supporting member, said flared ends of the tubular member limiting the expansion of said vessel.

5. In apparatus of the class described, the combination of a container adapted to hold a fluid under pressure, means within the container for maintaining the fluid pressure comprising a vessel containing an expansible fluid and formed by a pair of cylindrical corrugated walls joined at the ends by annular

heads, and a tubular supporting member extending through the annular heads and having flared ends for limiting the expansion of said vessel.

6. In combination with a cable joint, a sheath enclosing said joint and containing an insulating medium, and an expansible and contractible unit for maintaining the fluid in the sheath under pressure comprising an annular flexible vessel within said sheath containing an expansible fluid under pressure, a tubular supporting member having flared ends, and an annular head at each end of the vessel surrounding the tubular supporting member, said unit adapted to be first slipped over the end of the cable in advance of the insulating fluid being forced into the sheath under pressure and partially collapsing the vessel, the expanding fluid within the vessel at all times maintaining the pressure of the insulating fluid above a predetermined minimum.

7. In combination with a cable joint, a sheath enclosing said joint and containing an insulating medium, and an expansible and contractible unit for maintaining the fluid in the sheath under pressure comprising a vessel containing an expansible fluid formed by a pair of cylindrical corrugated walls joined at the ends by annular heads, and a tubular supporting member extending through the annular heads and having flared ends for limiting the expansion of said vessel, said unit being adapted to be slipped on said cable end after which the insulating fluid may be forced into the sheath under pressure and partially collapsing the vessel, the expanding fluid within the vessel at all times maintaining the pressure of the insulating fluid above a predetermined minimum.

In testimony whereof I have signed this specification.

JEAN V. GIESLER.