

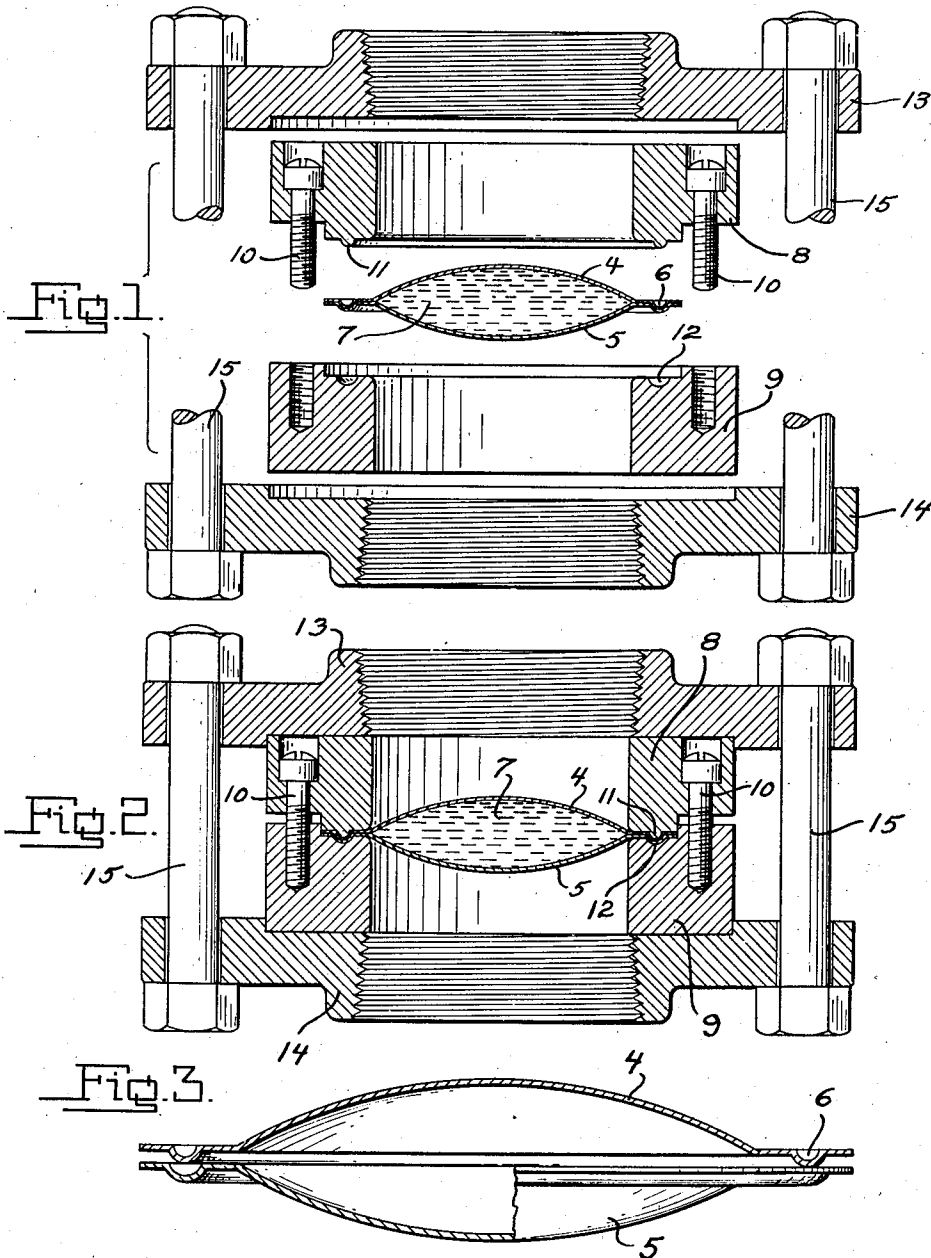
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SAFETY PRESSURE RELIEF DEVICE

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SAFETY PRESSURE RELIEF DEVICE

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This invention relates to a pressure relief device for a container in which pressure may be produced sufficient to burst the container. More particularly the invention relates to that type of safety device for pressure relief commonly known as a frangible disc. It is an object of the invention to provide an improved device of this nature which will function more accurately under varied conditions than pressure relief means of a comparable sort previously used and known. Other objects will be pointed out in the description of the invention or will be apparent therefrom. A full understanding of our invention by which these objects are accomplished may be had from the accompanying drawing, and the description which follows:

Referring to the drawing which forms a part of this specification, Fig. I shows a vertical central sectional view involving a preferred embodiment of our invention and Fig. II shows a similar view except that the relief device and supporting members are in assembled position ready for use. Figure III is a central cross sectional view of the pressure relief device alone.

For conveniently describing the safety device it will be referred to as a hydraulic capsule. In the different figures of the drawing like parts are designated by like numerals. The opposed concavo-convex discs which form the walls of the hydraulic capsule of applicants' invention are designated respectively by numerals 4 and 5. A circular groove in the marginal area of the frangible discs is indicated by 6. The number 7 refers to the liquid filling agent of the hydraulic capsule. Numbers 8 and 9 designate, respectively, the two parts of a suitable ring-form holder or support for the hydraulic capsule of Fig. III. Number 10 represents retaining screws for holding together the two parts of the hydraulic capsule support. A male annular seating projection on the sealing face of ring 8 is numbered 11, and 12 designates an annular female sealing groove in ring 9.

Flanges 13 and 14 and flange-retaining bolts 15 illustrate a suitable means for retaining the hydraulic capsule in a pressure line.

Having identified the various details in the drawing, we will proceed with the description of the invention.

Frangible discs 4 and 5 provide pressure relief by rupturing when excessive pressure develops. They are readily replaceable and may be made of any material having sufficiently uniform and otherwise suitable physical properties. Ordinarily metals will be used, such as nickel, copper,

aluminum, silver, platinum, gold and lead. The nature of the corrosive action, if any, of vapors to which the hydraulic capsule is exposed, pressures to be retained, temperature of operation and size of vent are all factors on which the choice of a suitable material for the frangible discs depends.

The frangible discs 4 and 5 are cut from sheet stock which may be flat or may have been previously bulged. In the event that the discs are made from flat stock, they must be placed between the hydraulic capsule holders 8 and 9 one by one and bulged to a perfect spherical segment. Pressure is applied from the under side to bulge disc 4 and from the upper side to bulge disc 5. The magnitude of pressure used is comparatively unimportant provided it is in excess of that formed by vacuum and sufficiently below the bursting pressure of the disc to allow additional expansion due to temperature change. For example, a disc designed to burst at 50 pounds per square inch has proved satisfactory when hydraulically bulged at 35 pounds per square inch.

To fill and assemble applicants' hydraulic capsule for use, one may proceed as follows: the hydraulic capsule holder composed of rings 8 and 9 and retaining screws 10, is submerged in a container filled with the hydraulic medium 6 to a depth to provide a slight pressure such as 1 lb. per square inch. The holder is then manipulated and rubbed to free it of bubbles and the frangible discs 4 and 5 are submerged, freed from adhering bubbles, if any, and placed in their respective positions in the holder, with concave faces toward each other. The retaining screws 10 of the holder are then tightened to seal the liquid inside the capsule. The sealing is facilitated by the sealing ridge 11 of holder 8 which forces metal of the frangible discs into the receiving circular groove 12 of holder 9.

Liquid filling medium for the hydraulic capsule may be any substantially non-compressible fluid suited to the particular operation in which the device is to be used: for example, water, glycerine, mineral oil and animal and vegetable oils.

It is to be understood that various methods of forming and filling the hydraulic capsule may be resorted to and such are no part of the invention. Applicants desire protection only for the frangible disc hydraulic capsule and its use regardless of the methods employed to form and fill it.

After the hydraulic capsule is filled and assembled with the holder, the whole may be fastened between pipe flanges 13 and 14 by tight-

ening bolts 15. Flanges 13 and 14 are shown in the drawing as having a pipe tap to accommodate threaded pipes leading from a pressure vessel to the safety device and thence to a discharge area or receiving tank or header. Naturally various modifications are optional for particular service. For example, one flange may be integrally formed with the pressure vessel, and where the discharge is not obnoxious and without value, a discharge pipe may be dispensed with.

Although the hydraulic capsule is conveniently formed, filled, and mounted in a holder, as explained above, it may be independently filled and inserted between flanges in a pressure line. When a holder is not used, the capsule may be filled by submerging it and sealing it under the liquid with a suitable tool. For example, one disc may be made slightly greater in diameter and an upturned rim on the larger disc may be folded over and crimped on the rim of the other disc. Appropriate grooves made in the pipe flanges will accommodate the bead on the rim of the hydraulic capsule when this procedure is employed. When the filling liquid is sufficiently viscous and the hydraulic capsule is to be inserted without delay between flanges in a pressure line, the natural adherence of the wet disc flanges is all that is necessary to prevent ingress of air.

In the drawing and thus far in the description applicants' hydraulic capsule has been represented as having the component frangible discs mounted rim to rim. It should be understood, however, that by suitable modification of the holder or otherwise the pair of discs may be mounted with some intervening space between their rims and still function satisfactorily. This is a highly distinguishing feature between applicants' hydraulic capsule containing a substantially non-compressible fluid and a pair of similar frangible discs enclosing air or any easily compressible gas.

The hydraulic capsule, as described herein, is particularly applicable where a safety bursting between 25 and 200 pounds pressure is required. It is known that the action of a given pressure on a convex surface exerts considerably greater stress than on a concave surface. For this reason frangible discs of the type under consideration designed to burst within the above mentioned range collapse prematurely under vacuum or back pressure from a common discharge header. The hydraulic capsule of the present invention obviates this trouble, since the stress, due to reversal of pressure, is transmitted through the practically incompressible liquid to the stronger concave section. In other words, the bursting point of applicants' hydraulic capsule is the same regardless of the direction from which the pressure is applied, thus effectively protecting

against premature rupture on reversal of pressure. For example, if a 2" diameter .003" thick aluminum disc is employed, it is calculated to rupture at 43 pounds positive pressure. In the form of applicants' hydraulic capsule this occurs no matter from which side the pressure comes. Vacuum cannot exceed 14.7 pounds per square inch so it can have no effect on the hydraulic capsule, but if a single disc is substituted, it will still require 43 pounds positive pressure to rupture it, but only 7½ pounds (approximately 15" of mercury) reversed or negative pressure. The 7½ lbs. of negative pressure is not necessarily the rupture pressure, but is the point at which the disc will reverse its contour and break the metal at the edge of the disc.

Having thus described our invention and application of the same, what we claim as new and desire to protect by Letters Patent of the United States, is:

1. An excess pressure releasing device comprising a supporting member having a discharge passage for excessive pressure therethrough and a pair of concavo-convex frangible discs mounted to normally close the passage, said frangible discs being arranged with their concave faces toward each other and having the sealed intervening space between the discs filled with a substantially incompressible fluid.

2. An excess pressure releasing device comprising a supporting member having a discharge passage for excessive pressure therethrough, a ring-shaped holder in which is mounted a pair of concavo-convex frangible discs with concave faces toward each other and having the sealed intervening space between the discs filled with a substantially incompressible fluid, said supporting member and annular holder maintaining the frangible discs and their liquid content in a position to normally close the discharge passage.

3. An excess pressure releasing device comprising a supporting member having a discharge passage for excess pressure therethrough and a pair of concavo-convex metal frangible discs fixed to normally close the passage, said metal frangible discs being arranged with their concave faces toward each other and having the sealed intervening space between the discs filled with a substantially incompressible fluid.

4. An excess pressure releasing device consisting of a pressure discharge outlet normally closed by a pair of concavo-convex frangible discs arranged with their concave faces toward each other and having the sealed intervening space between the discs filled with a substantially incompressible fluid.

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