

Feb. 19, 1924.

1,484,141

H. C. MALLORY

EXPANSIBLE COLLAPSIBLE ELEMENT

Original Filed April 22, 1914

Fig. 1.

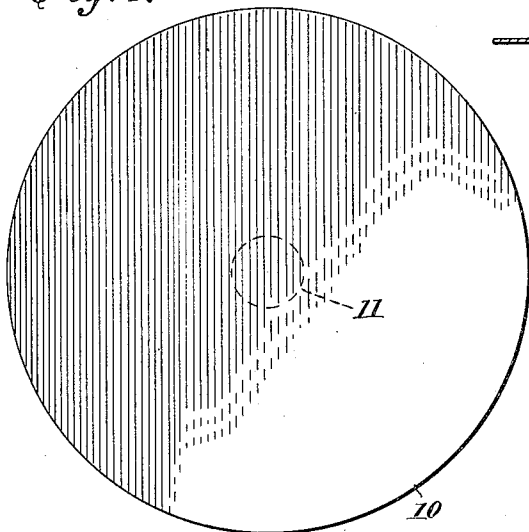


Fig. 2.

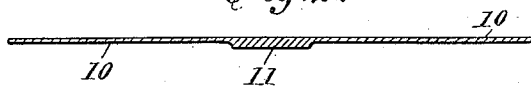


Fig. 3.

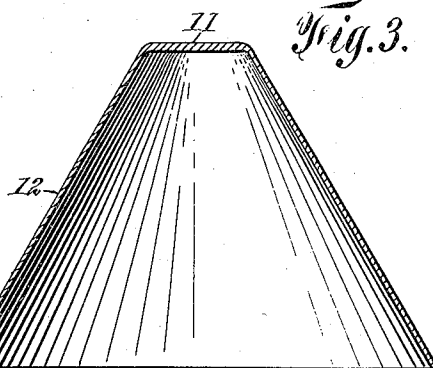


Fig. 4.

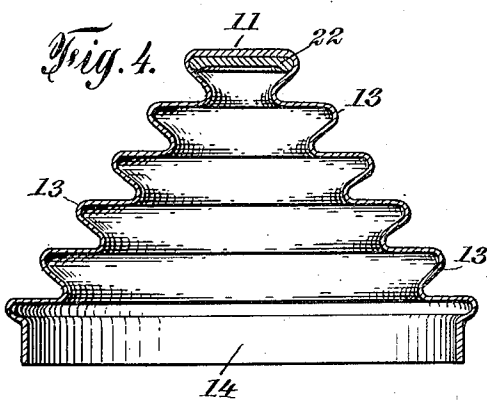


Fig. 5.

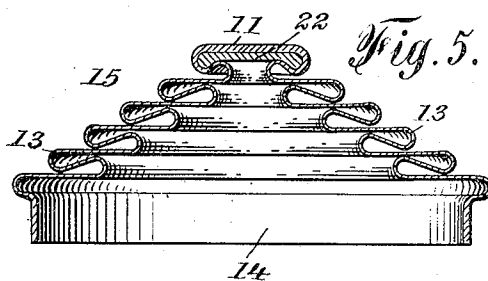


Fig. 6.

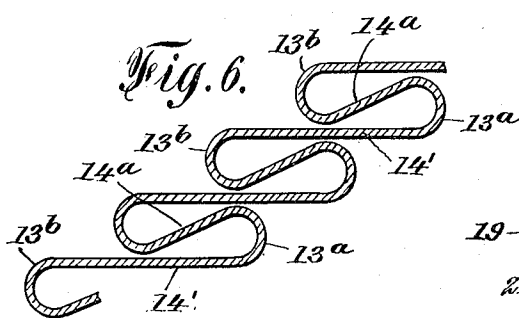
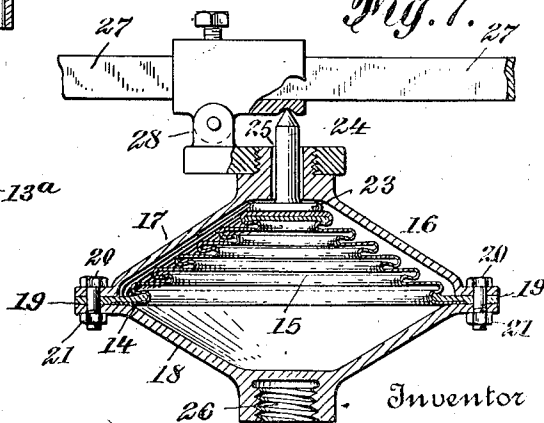


Fig. 7.



Inventor

Harry C. Mallory

Conrad A. Dittich
his Attorney

234

UNITED STATES PATENT OFFICE.

HARRY C. MALLORY, OF BELLPORT, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AMERICAN RADIATOR COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF NEW JERSEY.

EXPANSIBLE COLLAPSIBLE ELEMENT.

Original application filed April 22, 1914, Serial No. 833,593. Renewed December 5, 1919. Divided and this application filed August 31, 1920. Serial No. 407,212.

To all whom it may concern:

Be it known that I, HARRY C. MALLORY, a citizen of the United States, residing at Bellport, Suffolk County, in the State of New York, have invented certain new and useful Improvements in Expansible Collapsible Elements, of which the following is the full, clear, and exact specification.

My invention relates to improvements in expansible-collapsible elements adapted for use in connection with thermosensitive or pressure sensitive devices, and for other purposes, and the same has for its object to provide an element of the diaphragm type which while readily responsive to slight temperature or pressure variations, is not apt to fracture or other impairment as a result of use.

Further, said invention has for its object to provide an elastic or flexible element of the diaphragm type having a corrugated portion, the folds or bends of which are adapted to contact within the limit of the elasticity of the metal when the diaphragm or element is collapsed to its full extent.

Further, said invention has for its object to provide an expansible-collapsible element if the diaphragm type which is conical in form and capable of extended movement in response to pressure or temperature variations without liability of becoming fractured or impaired as the result of repeated expansion and contraction.

Further, said invention has for its object to provide an expansible-collapsible element of conical form having its body portion circumferentially corrugated, and the inner and outer rounded end portions or bends of said corrugations connected by alternately long and short lateral portions.

Other objects will in part be obvious, and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends my invention consists in the novel details of construction, and in the combination, connection and arrangement of parts, and in the several steps constituting the method hereinafter more fully described, and then pointed out in the claims.

In the accompanying drawings forming part of this specification wherein like numerals of reference indicate like parts;

Figure 1 is a face view showing a blank from which an expansible-collapsible element embodying my invention may be made;

Fig. 2 is a central sectional view thereof;

Fig. 3 is a central sectional view showing the first step of my process in which the flat blank is rolled, pressed or spun in conical form;

Fig. 4 is a similar view showing the blank as the same appears after it has been subjected to the action of suitable dies and circumferentially corrugated to a certain extent;

Fig. 5 is a similar view showing the blank with the corrugations fully developed therein, and provided at its open end with an annular flange or end;

Fig. 6 is an enlarged detail sectional view showing the construction and arrangement of the corrugations, and

Fig. 7 is a detail central sectional view showing an expansible-collapsible diaphragm embodying my invention applied to a damper regulator for steam or hot water boilers, etc.

In producing an expansible-collapsible diaphragm I first produce from a sheet of metal a flat, circular disk 10 having a thicker central portion 11 to form a reinforced closed end for the element. The said disk 10 is then rolled pressed or spun into conical form 12, as shown in Fig. 3, and successively subjected to the action of suitable dies whereby a series of circumferential corrugations 13 are produced therein, as shown at Fig. 4. By subjecting the blank 12 to the action of additional dies the bends or folds of the corrugations 13 are deepened as shown in Fig. 5, and a tubular flange 14 produced at the open end of the structure. By preference the flange 14 is made of greater thickness than the wall of the corrugated portion in order to form a substantial connecting portion whereby the diaphragm 15 may be conveniently secured to a suitable support.

In order to prevent the metal of the diaphragm 15 being strained beyond its elastic limit at approximately the center of the annular connecting portions when the diaphragm is collapsed to its full extent, the

corrugations 13 are formed with rounded inner bends 13^a, and similar outer bends 13^b, and the ends of said outer bends 13^b connected to, or united with one end of each of the inner bends 13^a next above and below said outer bend 13^b by a wide annular member 14', and a narrow member 14^a, respectively.

At Fig. 7 is shown an expansible-collapsible element of the diaphragm type, as hereinabove described, incorporated in a damper regulator for boilers. In said construction the diaphragm 15 has its open, larger end secured to a casing 16 at the junction of the two sections 17, 18 by means of an annular member or flat ring 19 which embraces the lowermost corrugation adjoining in the flange 14, and is secured in said casing by bolts 20 and nuts 21.

In the interior of the closed, smaller end of the diaphragm is secured a disk 22 which serves to reinforce said smaller closed-end which is adapted to engage with the head 23 of the stem 24 which extends through an opening 25 in the upper end of the casing 16.

When the pressure in the boiler increases it will be communicated through the opening 26 in the base of the casing 16 to the interior of the diaphragm 15, and cause the same to expand and in so doing raise the stem 24, which in turn will act upon the under side of a lever 27 pivotally supported in bearings 28 provided upon the top of the casing 16. The free end of the lever 27 may be suitably connected to the damper in order to control the operation thereof.

The diaphragm 15 has its sides formed at such angle and the annular members 14', 14^a of each corrugation formed of such length that the outer bends 13^b, and the inner bends 13^a overlap, whereby when the diaphragm 15 is collapsed the upper sides of the under annular members 14' will contact with the lower or under sides of the outer bends 13^b and the under sides of said under members 14' will contact with the inner, upper faces of the inner bends 13^a, and thereby form a stop and prevent the metal in the convolutions bending beyond the limit of its elasticity. This construction is particularly important in view of the fact that the corrugation having the greatest area, in this case shown at the bottom, is most flexible,—the flexibility decreasing in direct proportion as the area decreases. The corrugation having the greatest area will consequently collapse first when the diaphragm is subjected to pressure from above, and it is therefore necessary that each corrugation should be so formed as to make a stop within the limit of elasticity of the metal in order to prevent rupture of the diaphragm in said under annular connecting members 14', 14^a.

This application is a division of my earlier application, Serial No. 833,593, filed

April 22, 1914, renewed December 5, 1919, Serial No. 342,802, and patented January 25, 1921, No. 1,366,473.

In this case no claim is made for the process of producing the article herein shown, described and claimed, as said process constitutes the subject-matter of a divisional application, filed January 16, 1924, Serial No. 686,500.

Having thus described my said invention, what I claim and desire to secure by Letters Patent is:—

1. An expansible-collapsible element comprising a portion having circumferential corrugations therein whose inner and outer bends are united by alternately narrow and wide annular connecting members, substantially as specified.

2. An expansible-collapsible element comprising a portion having circumferential corrugations therein composed of rounded inner and outer bends, and annular members connecting said bends; the outer bend of one corrugation overlapping the inner bend of the adjoining corrugation, substantially as specified.

3. An expansible-collapsible element comprising a portion having circumferential corrugations therein whose inner and outer bends are united by narrow and wide annular connecting members, and a flange extending from one end of said corrugated portion, substantially as specified.

4. An expansible-collapsible element comprising a portion having circumferential corrugations therein whose inner and outer bends are united by narrow and wide annular connecting members, and a flange of greater thickness than said corrugated portion extending therefrom, substantially as specified.

5. An expansible-collapsible element comprising a portion having circumferential corrugations therein whose inner and outer bends are united by narrow and wide annular connecting members, and a tubular flange extending from one end of said corrugated portion, substantially as specified.

6. An expansible-collapsible element comprising a portion having circumferential corrugations therein whose inner and outer bends are united by narrow and wide annular connecting members, and a tubular flange of greater thickness than said corrugated portion extending therefrom, substantially as specified.

7. An expansible-collapsible element comprising a portion having circumferential corrugations therein, whose alternate inner and outer ends overlie whereby said bends and the annular connecting portions will contact within the limit of elasticity of the metal when said element has collapsed to its full extent, substantially as specified.

8. An expansible-collapsible element com-

prising a portion having circumferential corrugations therein composed of rounded inner and outer bends, and annular members connecting said bends; the outer bend of one corrugation overlying the inner bend of the adjoining corrugation, substantially as specified.

9. An expansible-collapsible element comprising a portion having circumferential corrugations therein composed of rounded inner and outer bends, alternately narrow and wide annular members connecting said inner and outer bends, and said wide annular members adapted to be engaged between the outer bend of one corrugation, and the inner fold of another corrugation when said expansible-collapsible element is fully collapsed, substantially as specified.

10. An expansible-collapsible element comprising a body portion having circumferential corrugations therein arranged in stepped formation, and a tubular flange extending from one end of said corrugated portion, substantially as specified.

11. An expansible-collapsible element comprising a conical body portion having circumferential corrugations therein, composed of rounded inner and outer bends, and alternate annular horizontal members and annular inclined members uniting said bends, substantially as specified.

12. An expansible-collapsible element comprising a conical body portion having circumferential corrugations therein composed of rounded inner and outer bends, horizontal annular members, and inclined narrower annular members uniting said bends, substantially as specified.

13. An expansible-collapsible element comprising a conical body portion having a flat top, and circumferential corrugations

in said body portion, said circumferential corrugations comprising rounded inner and outer bends, and annular members uniting the ends of one bend with the ends of the adjoining bends, substantially as specified.

14. An expansible-collapsible element comprising a conical body portion having a reinforced top, and circumferential corrugations in said body portion, said circumferential corrugations comprising rounded inner and outer bends, and annular members uniting the ends of one bend with the ends of the adjoining bends, substantially as specified.

15. An expansible-collapsible element comprising a conical body portion having a reinforced flat top, and circumferential corrugations in said body portion, said circumferential corrugations comprising rounded inner and outer bends, and annular members uniting the ends of one bend with the ends of the adjoining bends, substantially as specified.

16. An expansible-collapsible element comprising a conical body portion, a flat, reinforced closed end, and circumferential corrugations in said body portion, said circumferential corrugations comprising rounded inner and outer bends, and annular members uniting said inner and outer ends, and the outer bends of one corrugation overlying the inner bend of the next succeeding corrugation, substantially as specified.

Signed at the city of New York, New York County, in the State of New York, this first day of June, one thousand nine hundred and twenty.

HARRY C. MALLORY.

Witnesses:

CONARD A. DEITERICH,
IRENE V. BANNIN.