

Oct. 24, 1961

V. C. D. DAWSON ET AL

3,005,573

BLOWOUT DIAPHRAGM

Filed Oct. 8, 1959

FIG.1.

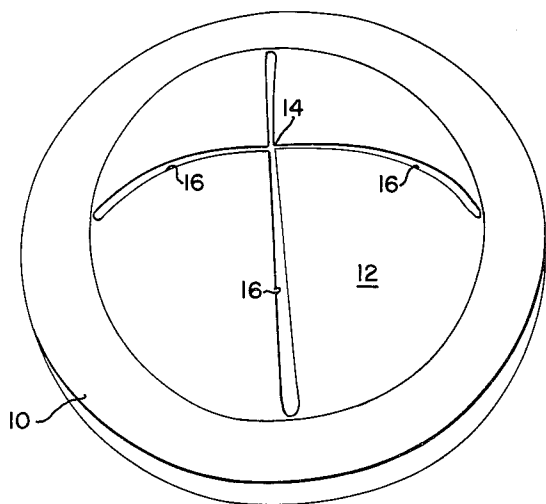


FIG.4.

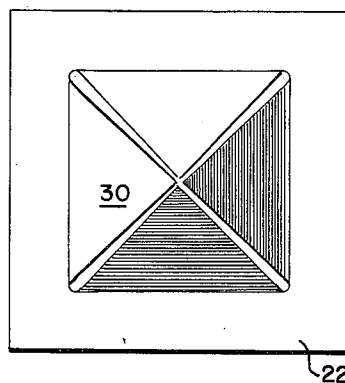


FIG.2.

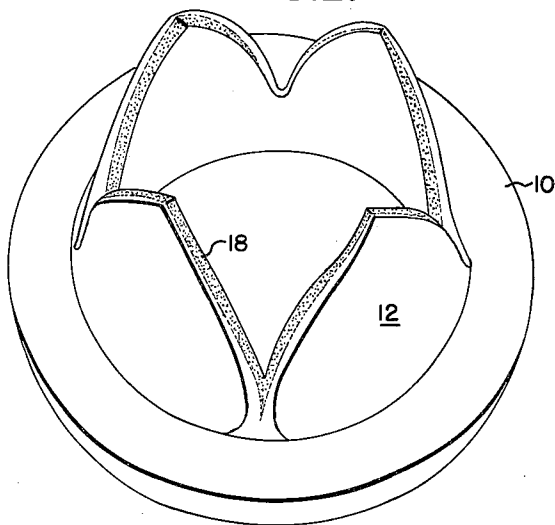
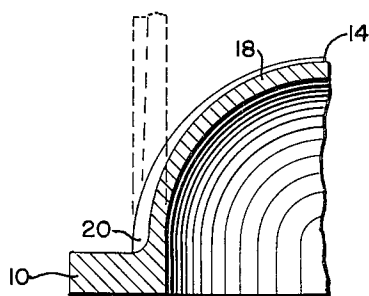


FIG.3.



INVENTORS
VICTOR C. D. DAWSON
ARNOLD E. SEIGEL

BY

Q. I. Baxter Warner
P. J. Hodges
ATTORNEYS.

1

3,005,573

BLOWOUT DIAPHRAGM

Victor C. D. Dawson, Silver Spring, and Arnold E. Seigel, Chevy Chase, Md., assignors to the United States of America as represented by the Secretary of the Navy
Filed Oct. 8, 1959, Ser. No. 845,296

2 Claims. (Cl. 220-89)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to a valve of the rupturable diaphragm type which is designed to open under a predetermined pressure and which cannot be closed or reused.

In the study of aerodynamic forces at supersonic speeds, it is the practice to suspend models in a wind tunnel and pass air at very high velocity past the models, taking pictures at the instant the model is buffeted by the air or gaseous medium. One method of obtaining the velocity of gas desired is to explode a mixture of gases in a gun barrel and by means of a rupturable diaphragm type valve admit the explosive gases into the tunnel. In order to be sure the velocity of the gases are as desired, a valve which will change from completely closed to completely open instantly is needed. Also the parts of the valve must not set up currents in the onrushing air which would be different from that encountered by a missile in flight. The valve must be rugged to withstand the high velocity gases passing from the explosive chamber to the wind tunnel and must be designed with no parts which might tear loose so that no solid particles enter the wind tunnel with the onrushing gases.

An object of the present invention is to provide a valve of the rupturable diaphragm type which will open instantly from a completely closed position to a completely open position.

Another object of the present invention is to provide a valve of the rupturable diaphragm type which will completely open at a calculable pressure and remain completely closed until it is subjected to that calculated pressure or a higher pressure.

Still another object is the provision of a valve having a circular rim and formed with a central hemispherical rupturable diaphragm scored to open along certain predetermined lines, all of the scored sections being retained by the disc upon opening.

A further object of the invention is the provision of scored sections which vary in thickness along the score mark to insure retention of all the parts of the valve when the valve opens.

A still further object is the provision of a valve formed with a hemispherical diaphragm scored to be ruptured into spherical quadrants when subjected to a predetermined pressure, the thickness of the diaphragm at the lines of rupture being uniform, the thickness of the metal of the diaphragm varying from the center to the circumference to insure retention of all the parts after rupture.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

2

FIG. 1 is a perspective view of the valve closed;

FIG. 2 is a perspective view of the valve open;

FIG. 3 is a cross-sectional view along the score lines of a single quadrant; and

FIG. 4 is a plan view of a modification of the valve shown in FIG. 1.

Referring to the drawing wherein like parts are designated by like numerals throughout the several figures, the diaphragm valve shown on FIG. 1 is hemispherical in shape with a heavy flat integral rim 10. The inner wall of the rim continues from the base of the hemisphere in cylindrical form so that the blast enters the hemisphere along a tangential line. The valve is stamped or otherwise formed into the hemispherical shape from a flat disc and scored with sections of great circle lines which cross at right angles to each other and divide the hemispherical portion into four equal spherical quadrants 12.

When the diaphragm is ruptured the spherical quadrants must not be torn loose from the rim and must open fully so that no part of the quadrants is in the direct path of the blast. Should any part of the quadrants be in the path of the blast, disturbing air currents would be set up in the wind tunnel and the results of the test would not be accurate. The entire hemisphere is thicker adjacent the rim and decreases in thickness as it approaches the juncture 14 of the score lines 16. The thickness of the metal along the lines on which it is ruptured is the same at the rim as at the juncture of the score lines to make it possible to calculate the bursting pressure and to insure substantially instantaneous rupture, and this uniform thickness is shown at 18. The difference in thickness is clearly shown in the depth of the score lines, being deeper at 20 adjacent the rim than at 14, the juncture of the score lines. This carefully designed rupturable diaphragm will assume the position shown in dashed outline in FIG. 3 when subjected to a pressure of approximately 60,000 p.s.i., from any suitable source such as, for example, a gas gun. The valve is used between an explosion chamber and a wind tunnel. A mixture of gases under pressures approximately 8,000 p.s.i. are ignited and the resultant explosion ruptures the diaphragm as shown in FIG. 2, to permit the gas to enter the wind tunnel.

FIG. 4 illustrates a modified form of the hemispherical valve. The valve shown in this figure is pyramid shaped with a square rim 22. The triangular sides 30 of the pyramid are formed similar to the spherical quadrants 12, the metal varying in thickness from the base to the apex. The triangular shaped sides open similarly to the quadrants of FIG. 2. This type is generally used with lower pressures and smaller wind tunnels.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A rupturable diaphragm valve comprising a hemispherical body portion of a decreasing thickness and tapering uniformly from the base to the dome, said body portion being divided into segments by score lines of decreasing depth, said score lines decreasing in depth from the base to a common juncture at the dome, the body portion remaining along said score lines being of

3

equal thickness throughout the extent of said score lines, and an integral rim portion, the interior wall of the rim being normal to the diametric plane of the hemispherical body portion, said wall being an extension of the inner wall of the hemispherical body portion at its base, said rim being of a thickness greater than the hemispherical body portion at its greatest thickness.

2. A rupturable diaphragm valve according to claim 1 wherein the score lines divide the hemispherical body portion into quadrants.

5

10

589,944
2,131,809
2,656,950
2,952,383

774,812

4

References Cited in the file of this patent

UNITED STATES PATENTS

Greengrass ----- Sept. 14, 1897
Killen ----- Oct. 4, 1938
Coffman ----- Oct. 27, 1953
Paxton et al. ----- Sept. 13, 1960

FOREIGN PATENTS

Great Britain ----- May 15, 1957