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[54] **DIAPHRAGM VALVE SOUND TRANSMITTERS OPERATING ON GASEOUS PRESSURE MEDIUM**
5 Claims, 2 Drawing Figs.

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[50] **Field of Search** ..... 116/137, 70, 142, 142 FP, 142 VFP, 59, 140

[56] **References Cited**

UNITED STATES PATENTS

2,273,968	2/1942	Lewis	116/142
2,281,539	4/1942	Grover	116/142
2,281,611	5/1942	Williams	116/142
2,671,426	3/1954	Woody	116/142
2,789,529	4/1957	Broden	116/142
2,944,509	7/1960	Shintako	116/142

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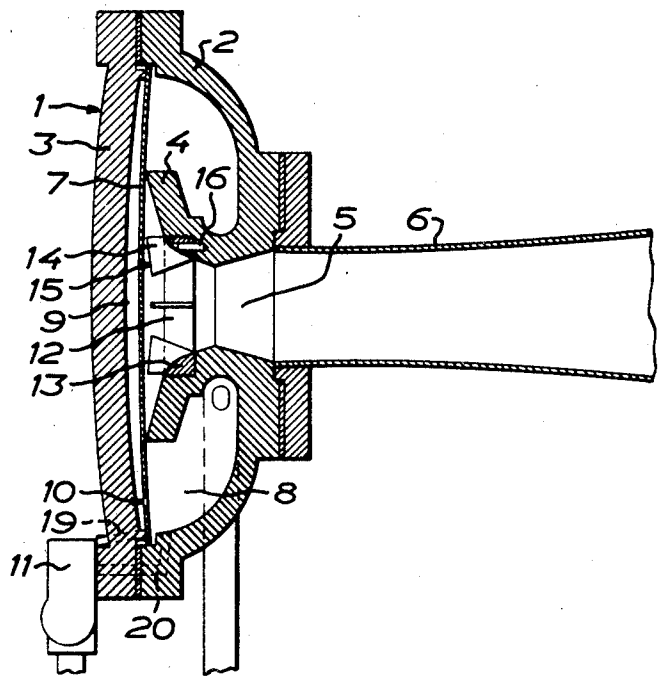
ABSTRACT: In a diaphragm valve sound transmitter operating on gaseous pressure driving medium and having a diaphragm which, when no signal is to be generated, is blocked against a seat at the inlet end of a horn outlet passage under the action of the pressure of the driving medium in a back pressure chamber located behind the diaphragm, undue stresses in the diaphragm due to the pressure in the back pressure chamber are avoided by a support member in the horn outlet passage. The support member surface facing the diaphragm is spaced from the diaphragm a distance greater than the deflection of the diaphragm towards the support member during oscillation but smaller than the maximum diaphragm deflection permissible in view of the stresses.



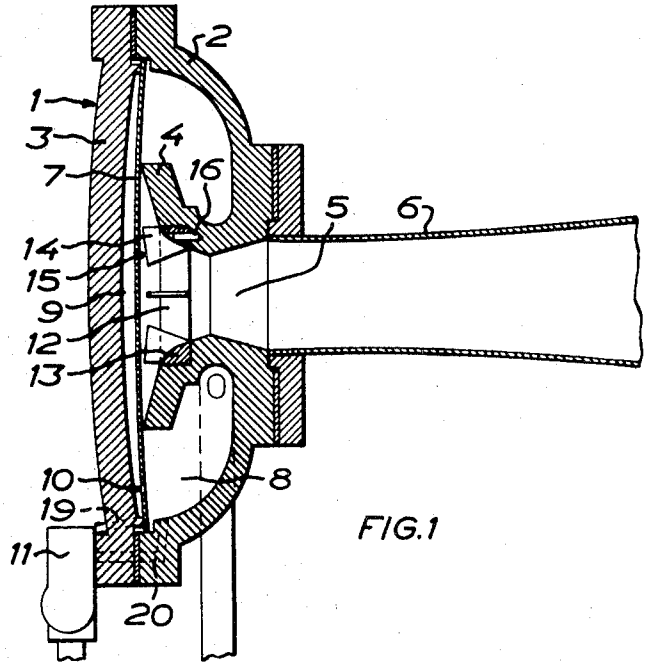


FIG.1

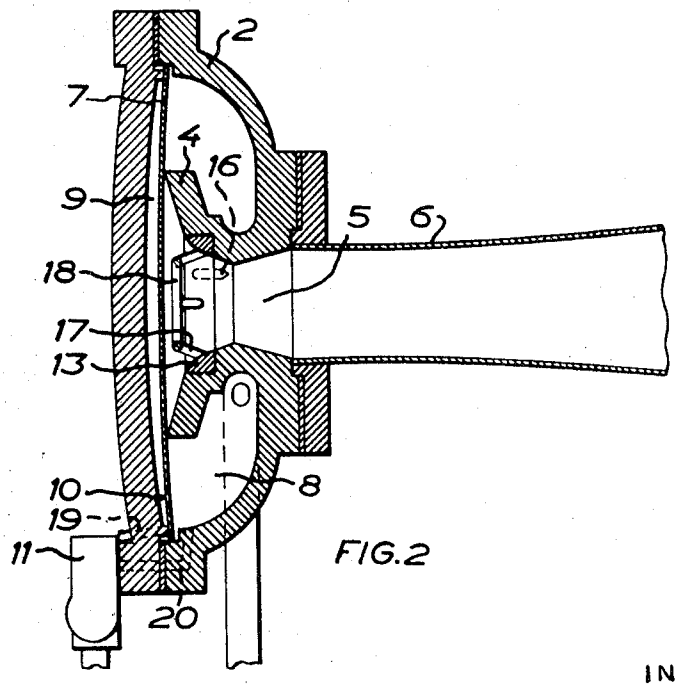


FIG.2

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DIAPHRAGM VALVE SOUND TRANSMITTERS OPERATING ON GASEOUS PRESSURE MEDIUM

This invention relates to diaphragm valve sound transmitters operating on gaseous driving medium and having a diaphragm which during signalling oscillates relative to a seat and periodically opens and closes the communication between a pressure medium inlet passage and an outlet passage opening into a resonance horn but which, when no signal is to be generated, is blocked against the seat under the action of the pressure of the driving medium in a back pressure chamber located behind the diaphragm.

A consequence of this per se known method of operating diaphragm valve sound transmitters, which often is termed back pressure operation, is that the blocking pressure, i.e. the pressure prevailing in the back pressure chamber when no signal is to be generated, will cause the diaphragm to deflect towards the outlet passage in which ambient pressure prevails. It may occur that the static forces become so large that the diaphragm is deformed, thereby jeopardizing the function of the sound transmitter. This is a serious problem, especially in sound transmitters having large diaphragm surfaces and/or using high pressures for the pressure medium, as is often the case in diaphragm valve sound transmitters for ships where steam or compressed air from the existing steam or compressed air system is used as driving medium. For instance, the pressure in the steam system may be in the order of 12—16 kg/cm.^{2}, and as it may also occur that all equipment connected in the system is tested with the double working pressure, it will be appreciated that the risk of damage to the diaphragm in the sound transmitters can be very great.

To eliminate these disadvantages of the diaphragm valve sound transmitters of the type indicated, the present invention suggests an arrangement which is essentially characterized in that it has a support member provided in the outlet passage adjacent the diaphragm, the support member surface facing the diaphragm being spaced from the diaphragm a distance greater than the deflection of the diaphragm towards the support member during oscillation, but smaller than the maximum diaphragm deflection permissible in view of the stresses.

The invention will now be described in the following with reference to the accompanying drawing in which,

FIG. 1 shows a longitudinal section through a diaphragm valve sound transmitter according to the invention, and

FIG. 2 illustrates a modified embodiment.

The diaphragm valve sound transmitter illustrated in the drawing comprises a diaphragm housing 1 which consists of a body member 2 and a cover 3 secured thereto. The body member 2 is formed in conventional manner with a hollow mushroom seat 4, the interior of which merges into an outlet passage 5 extending through a resonance horn 6 attached to the body member. A diaphragm 7 is clamped in the diaphragm housing by means of the cover 3, whereby it is held in resilient engagement with the seat 4. The housing has an inlet passage in the form of an inlet chamber 8 surrounding the seat 4, means being provided for connecting a pipe line for supplying driving medium to the inlet chamber. The inside of the cover 3 defines together with the diaphragm 7 a space 9 which usually is termed back pressure chamber. The back pressure chamber 9 communicates through a small hole 10 provided in the diaphragm 7 with the inlet chamber 8 and through a passage 19 provided in the diaphragm housing with an operating or control valve 11 adapted to place the back pressure chamber in communication either with the surrounding atmosphere or, through a passage 20 in the diaphragm housing, with the inlet chamber 8. When no signal is to be generated, the valve 11 maintains the back pressure chamber 9 in communication with the inlet chamber 8 through the passages 19, 20 so that the pressure in the back pressure chamber blocks the diaphragm 7 against the seat 4. For signalling, the valve 11 is caused to place the back pressure chamber 9 in communication with the surrounding atmosphere so that the pressure medium in the inlet chamber in known manner can cause the diaphragm 7 to oscillate towards and away from the seat 4 for delivering a signal.

According to the invention, a diaphragm support member 12 is provided in the outlet passage 5 adjacent the diaphragm 7.

In the embodiment according to FIG. 1, the support member 12 is an externally threaded ring 13 screwed into a threaded recess in the outlet passage 5 where the latter merges into the mushroom seat 4, the ring 13 having a number of cams 14 projecting towards the diaphragm, and the cam surfaces 15 facing the diaphragm forming support surfaces for the diaphragm. In order to interfere as little as possible with the flow in the outlet passage, the inner surface of the ring has been formed with a curvature closely following the curvature of the inlet passage in the region of the ring. For the same reason, the cams 14 have been made as thin as possible in a direction transverse to the direction of flow. To prevent the ring 13 from shaking loose due to vibrations, it is locked against rotation by means of a pin 16 extending through a hole provided in the ring and the seat. The support surfaces 15 are spaced from the diaphragm a distance greater than the deflection of the diaphragm towards the support member during oscillation, but smaller than the maximum diaphragm deflection permissible in view of the stresses. According to a preferred embodiment, the support surfaces 15 have been formed with a curvature substantially conforming to the curvature of the diaphragm at the moment when the diaphragm is moved into engagement with the support member under the action of the blocking pressure in the back pressure chamber.

In the modified embodiment according to FIG. 2, the support member, like in the embodiment according to FIG. 1, comprises an externally threaded ring 13 which is screwed into a threaded recess in the outlet passage 5 and locked against rotation by means of a locking pin 16. A number of support elements in the form of support legs 17, each of preferably circular cross section, extend from the ring 13 towards the diaphragm 7. The support legs 17 carry a support ring 18 concentric with the diaphragm 7 and also of preferably circular cross section. The surface of the support ring 18, which faces the diaphragm 7, is spaced from the diaphragm a distance greater than the deflection of the diaphragm towards the support member during oscillation, but smaller than the maximum diaphragm deflection permissible in view of the stresses. The cross-sectional dimensions of the support legs 17 and the support ring 18 and also the shape of the inner surface of the ring 13 have been chosen so as to interfere as little as possible with the flow in the outlet passage 5.

When the operating valve has been set for blocking, i.e. when no signal is to be generated, the pressure in the back pressure chamber 9 is the same as in the inlet chamber 8. The diaphragm 7 is urged against the seat 4 and thereby deflected within the area inside the sealing edge of the seat 4. However, due to the location of the support member according to the invention, this deflection will not be so great that the resulting stresses in the diaphragm material exceed permissible values. Before these values are reached, the diaphragm thus has been moved into engagement with the support surfaces 15 and the support ring 18, respectively. By forming the support surfaces, in accordance with the embodiment illustrated in FIG. 1, with a curvature substantially corresponding to the curvature of the diaphragm at the moment of engagement, the load will be relatively uniformly distributed, which contributes towards reducing the risk of local stress concentrations in the diaphragm.

For signalling, the operating valve is set to signalling position, whereby the back pressure in the back pressure chamber is relieved. The diaphragm 7 is lifted from the seat 4 by the pressure in the inlet chamber 8, thereby causing a flow of pressure medium through the gap between the diaphragm and the seat edge to the outlet passage 5. The resulting rapid pressure changes cause the diaphragm to swing back resiliently towards the seat and then to be unseated again under the action of the pressure in the inlet chamber 8 and the pressure wave reflected from the resonance horn 6 so that the diaphragm will oscillate with respect to the seat 4. The periodic pressure shocks produced in the outlet passage and thus in the

resonance horn **6** cause the sound transmitter to deliver a signal. For interrupting the signal, the operating valve is set to a position in which the communication of the back pressure chamber with the atmosphere is interrupted, simultaneously as the pressure in the inlet passage **8** is permitted to act also in the back pressure chamber **9**, thereby urging the diaphragm **7** into uninterrupted engagement with the sealing edge of the seat **4** and, depending upon the size of the pressure, also with the support surfaces **51** of the support member **12**.

The invention is not limited to the above-described embodiments and can be modified in several ways within the scope of the appended claims. Thus, the invention is applicable also to such diaphragm valve sound transmitters where the inlet passage opens centrally, i.e. in the center of the diaphragm, and the support member may then consist of a number of thin walls connecting the outer surface of the inlet passage with the inner surface of the housing. The support member may also be formed integrally with the seat, for instance during injection moulding of the body member of the diaphragm housing.

What I claim and desire to secure by Letters Patent is:

1. A gaseous pressure medium operated diaphragm valve sound transmitter comprising a housing, a diaphragm in said housing dividing the interior of said housing into an inlet chamber and a back pressure chamber, first inlet means for introducing gaseous pressure medium into the inlet chamber of said housing, second inlet means for introducing gaseous pressure medium into the back pressure chamber of said housing, control means for controlling the pressure of the gaseous pressure medium in the back pressure chamber of said housing resonance horn means connected to said housing, outlet passage means having one end positioned in said housing and merging at the other end into said resonance horn means, a valve seat at said one end of said outlet passage means in said housing, said diaphragm being blocked in abutment against said valve seat when said control means maintain full pressure of the gaseous pressure medium in the back pressure chamber, and oscillating towards and away from said valve seat when said control means are adjusted to maintain lower than full pressure of the gaseous pressure medium in the back pressure chamber, and support means in said outlet passage means adjacent said valve seat, said support means being spaced from said diaphragm a distance greater than the deflection of said diaphragm towards said support means during oscillation but smaller than the maximum diaphragm deflection permissible in view of stresses.

2. A sound transmitter according to claim **1** in which said support means comprise a number of support elements projecting from the walls of said outlet passage means towards said diaphragm and being of slight extension transversely of the direction of flow of the gaseous pressure medium in said outlet passage means.

3. A sound transmitter according to claim **1** in which support surfaces on said support means facing said diaphragm are formed with a curvature substantially corresponding to the curvature of said diaphragm at the moment it engages said support surfaces.

4. A sound transmitter according to claim **1** in which said support means comprise a ring, mounted in said outlet passage means, and diaphragm support elements in the form of cams projecting from said ring in radial planes towards said diaphragm.

5. A sound transmitter according to claim **2**, in which a support ring is carried by said support elements concentrically with said diaphragm.