

March 20, 1945.

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2,371,949

ACOUSTIC ALARM DEVICE

Filed Nov. 4, 1941

3 Sheets-Sheet 1

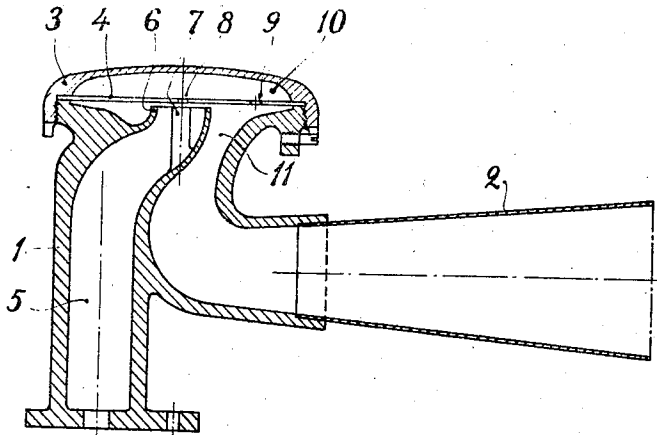


Fig. 1

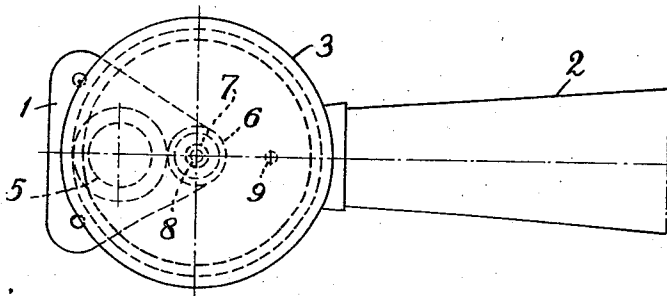


Fig. 1a

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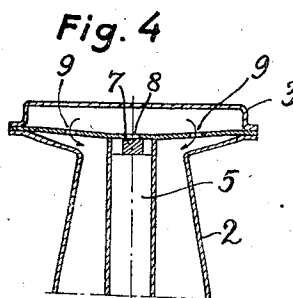
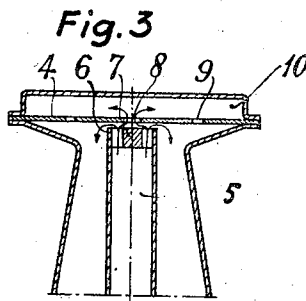
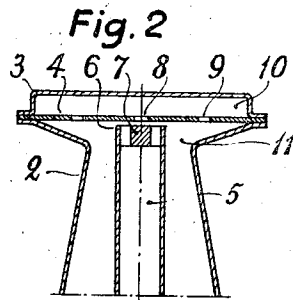
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Fig. 5

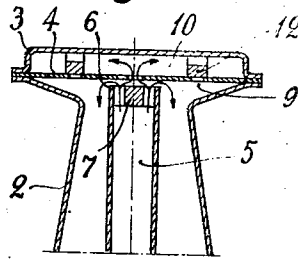


Fig. 6

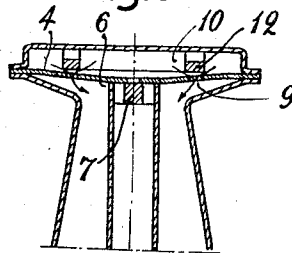


Fig. 7

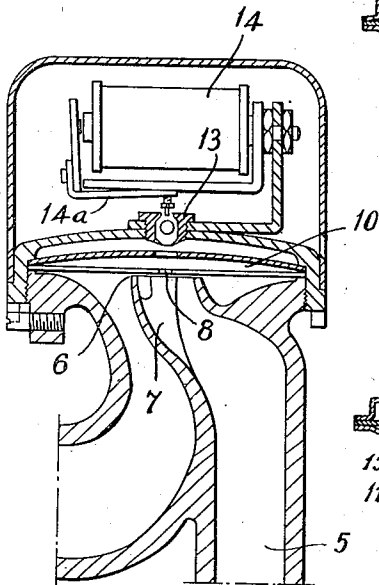
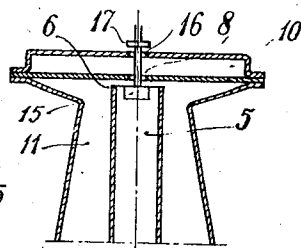


Fig. 8

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UNITED STATES PATENT OFFICE

2,371,949

ACOUSTIC ALARM DEVICE

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In Sweden February 13, 1940

6 Claims. (Cl. 177-7)

The present invention refers to an acoustic alarm device. Such alarm devices are known and their function is based on the principle that a diaphragm against which a strong air current or a current of some other gaseous medium is directed, under certain conditions begins to vibrate, thus producing a loud sound. In order to obtain the sound in the alarm device according to the principle in question it is necessary that the diaphragm be arranged at a certain distance from the mouth piece from which the air flows and that a horn is provided, in which certain oscillations dependent on the frequency conditions may be produced. Known acoustic alarm devices are usually constructed in such a manner, that an air current is directed against the centre of the diaphragm, passing on to the horn. The acoustic alarm device according to this construction, however, presents a problem as regards the regulation of the distance between the mouth of the tube and the diaphragm, the degree of flexibility of the diaphragm having further a great influence upon the air pressure required. It is therefore very difficult and in some cases impossible to start such an acoustic alarm device, if the said distance is much greater or smaller than correct or if the obtainable air pressure approaches the limit for the lowest possible pressure for operating the acoustic alarm device. The tension in the stretched diaphragm being dependent on the temperature, the pressure necessary for starting the acoustic alarm device will vary considerably with changes in temperature.

The aim of the invention is to construct an acoustic alarm device with good starting qualities so that at low air pressures, it starts to produce sound, and which also at these pressures attains a maximal emission of sound after a very short interval.

Through the device according to the invention such forces are produced on the oscillating diaphragm when an air current is directed against the same that the distance between the diaphragm and the mouth piece of the air inlet tube automatically will be corrected at the same time as the diaphragm is forced to perform the oscillations desired.

The invention shall be described with reference to the accompanying drawings, in which five embodiments are shown. Fig. 1 shows a vertical section and Fig. 1a a horizontal projection of the acoustic alarm device according to the first embodiment. The Figures 2, 3 and 4 show a second embodiment.

The Figures 5 and 6 show vertical sections of

a part of an acoustic alarm device according to another embodiment of the invention.

Figures 7 and 8 show vertical sectional parts of an acoustic alarm device according to the fourth and fifth embodiments of the invention.

In Figures 1 and 1a, 1 is the housing of the acoustic alarm device, which at the bottom is provided with a device for the attachment of the alarm device. The housing carries a horn 2 and at the upper end a cover 3 with the diaphragm 4. In the housing 1 there is a channel 5 for the incoming air. The mouth of this channel at the upper end is formed as a plane ring-like seat 6 which in the centre is provided with a plug 7. The upper surfaces of the seat and the plug are located in the same plane. The diaphragm 4 is located between the housing 1 and the cover 3 in a plane above the seat 6. One hole 8 is arranged at the centre of the diaphragm in front of the plug 7, the diameter of the hole being smaller than that of the plug. At least one other hole 9 is formed nearer the edge of the diaphragm ends into the funnel. The part of the housing against which the rim of the diaphragm rests, is made as a planely ground edge, concentrically placed around the seat 6 and the plug 7. The cover 3, by means of which the diaphragm is fixed in its position, forms a chamber 10 above the diaphragm. This chamber communicates through the hole 8 with the supplying channel 5 and through the opening 9 with the outlet passage 11 under the diaphragm. The passage 11 opens into the horn 2.

In Figures 1 and 1a the outlet passage 11 is of such shape that the horn 2 is disposed angularly with respect to the inlet channel 5 while in Figures 2 to 4 the horn is in parallel relation to and surrounds the inlet channel. In all other respects these two horns of the invention are the same.

When the acoustic alarm device is to give signals, air is supplied to the supplying channel 5.

Air thereby will flow out between the diaphragm 4 and the seat 6 through the passage 11 and horn 2. Simultaneously the air will flow through the hole 8 of the diaphragm into the chamber 10 (see Fig. 3). The air pressure above the diaphragm thereby will increase, thus pressing the latter against the seat 6. The plug 7 in the supplying channel 5 now completely covers the hole 8 in the diaphragm. Consequently the air will be prevented from flowing further into the chamber 10 and thus the pressure in the same will decrease, as air is coming out through the hole 9 of the diaphragm. When the total

pressure on the upper side of the diaphragm becomes equal to or less than the total pressure of the air, which is flowing in through the channel 5 on the lower side of the diaphragm, the latter returns to its initial position. Air now will pass into the outlet passage 11 and the horn 2 again, and the above described working will be repeated. In this way the air flowing out intermittently into the horn 2 thereby will produce a characteristic sound.

The embodiment of the acoustic alarm device shown in Figures 5 and 6 differs from the previous embodiments only in that, when the diaphragm is at rest, the openings 9 therein are closed by a ring 12 secured to the cover 3. Since the ring 12 covers the openings 9 in the diaphragm, the pressure in the air chamber 10 will increase more rapidly according to this embodiment than according to those first mentioned, where the holes 9 are constantly open so that the air may be blown out through them. When the alarm device is to produce sounds, air is blown in through the channel 5, as described above. Air will then partly issue into the horn 2 and partly enter into the room 10 above the diaphragm 4 and thus effect an increase of pressure in the said room. The pressure on the upper side of the diaphragm now presses the same down against the seat 6 thereby uncovering the openings 9 through which air is discharged and the pressure in the chamber 10 will decrease. For the rest the operation of this embodiment is analogous to the one described in connection with the first embodiments.

Figure 7 shows another embodiment of the acoustic alarm device. According to this embodiment the holes 9 which let out the air in the chamber 10 are not arranged in the diaphragm itself but between the chamber and the outer atmosphere as indicated at 16. The effect of the alarm device on the whole is the same as in the embodiment according to the Fig. 2, but further the advantage is obtained that the air passing through the hole 16 arranged between the chamber and the outer atmosphere may easily be controlled from the outside. As a consequence under certain conditions the diaphragm may also be used as a valve for closing the air supply to the alarm device, thus dispensing with the valve which otherwise had to be connected with the inlet channel as already has been described in connection with the embodiments shown. If the opening 16 is closed between chamber 10 and the outer atmosphere by means of a valve 17, the diaphragm will be pressed against the mouth piece 6 of the supplying channel 5 due to the entrance of air through the opening 8 of the diaphragm and thereby the further passage of air is prevented. This effect may further be intensified by replacing the plug 7 of the embodiment above described by a piston 15 which is removed from the diaphragm at the same time as the hole 16 between the chamber and the outer atmosphere is closed, thereby permitting the air pressure in the supplying channel 5 to continue to act upon the upper surface of the diaphragm in the chamber 10. It is advisable to arrange the piston 15 on a valve spindle which also carries the valve 17 provided for the closing of the hole 16.

In Figure 8 an embodiment of an acoustic alarm device according to the invention is shown according to which the alarm device is governed by an electric relay 14, the armature 14a of which acts upon the valve 13 between the chamber 10

and the outer atmosphere. When this valve 13 is closed the diaphragm is pressed against the mouth 6 on the supplying channel.

The functioning of the acoustic alarm device according to the embodiment shown in Figures 7 and 8 is the following.

When the acoustic alarm device is connected to a pipe for air pressure the air will pass through the channel 5. Air will then pass into the passage 11 and through the hole 8 in the diaphragm 4. This will cause an increase of the pressure in the chamber 10 above the diaphragm. The valves 16, 17 Figure 7 or 13 Figure 8 respectively are closed on this occasion. The diaphragm is now pressed down against the seat so firmly that the air is prevented from penetrating further between the diaphragm and the seat. On account of the inclination of the diaphragm around the seat a small elevation will be produced in the centre of the diaphragm right in front of the plug 7, thus forming a small air passage through the hole 8. The object of this feeble air current is to provide for the replacement of the air which through leakage for instance on the periphery of the diaphragm might cause a decrease of pressure in the chamber 10.

When the acoustic alarm device shall give signal the valves 16, 17 Figures 7 or 13 Figure 8 is opened. This is effected in the embodiment according to the Figure 8 by the electric magnet 14. When the valve in either Figure 7 or 8 has been opened the air from the chamber 10 begins to flow out through this valve and a decrease of pressure in the chamber 10 is obtained, which enables the air pressure from the channel 5 to lift the diaphragm 4 again. Air from the channel now issues between the diaphragm and the seat into the passage 11 and through the hole 8 in the diaphragm into the chamber 10. The pressure in the chamber will now increase, and at this the diaphragm will be pressed down against the seat, so that the piston 15 or the plug 7 covers the hole 8 and the mode of operation described earlier in connection with the Figures 2-4 will be repeated. If the valve 16, 17 or 13 is closed, the air which at every vibration enters through the opening 8 into the diaphragm 4, will remain in the chamber 10 and cause an increase of pressure there. When the pressure in this chamber 10 has become sufficient the diaphragm 4 is pressed down against the seat 6 and is retained in this position.

The air from the channel 5 is again prevented by the diaphragm from passing into the funnel. The sound of the acoustic alarm device has ceased and the diaphragm has closed the opening in the channel 5.

I claim:

1. An acoustic alarm device comprising a housing with a cover, an inlet channel for a fluid medium pressure arranged within the housing, an outlet passage surrounding the inlet channel, a vibrating diaphragm having one side normally disposed in closely spaced relation to the mouth of the inlet channel and periodically engageable with said mouth to close communication between said inlet channel and said outlet passage, an air chamber on the other side of the diaphragm between the diaphragm and the cover of the housing, said diaphragm having an aperture normally connecting the air chamber with the channel, and a member in front of the aperture interrupting the passage of the fluid from the inlet channel to the air chamber, at the same time when

communication between the inlet channel and the outlet passage is closed.

2. An alarm as claimed in claim 1 in which the diaphragm is provided with an opening for exhausting fluid from the air chamber to the outlet passage.

3. An alarm device as claimed in claim 1 in which said member is constituted by a plug located in the inlet channel and terminating in the plane of the inlet channel mouth.

4. An alarm device as claimed in claim 1, wherein the diaphragm is provided with an opening connecting the air chamber with the outlet

passage and means coacting with said opening for controlling the passage of fluid therethrough.

5. An alarm device as claimed in claim 1 in which said cover is provided with an exhaust opening, a valve member controlling passage through said opening, and an electric relay controlling said valve member.

6. An alarm device as claimed in claim 1, in which the diaphragm is provided with an exhaust opening connecting the air chamber with the outlet passage, and a valve member carried by said cover and normally closing said opening.

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