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The invention relates to a signalling horn, more particularly one for motor vehicles, comprising a diaphragm which is moved by a drive and operates on a pressure chamber, a funnel-shaped tube which follows on from the pressure chamber, is coiled parallel to the diaphragm and ends in a trumpet, and comprising further means for connecting part of the signalling horn to the surrounding air.

One such signalling horn is known from DE-AS 12 56 115. There a passage is provided to vent a space containing the electromagnetic drive for the diaphragm, in order to prevent the diaphragm from being pretensioned by a closed space.

This known signalling horn does, however, have its drawbacks, for no measures are indicated as to how to eliminate water from the funnel-shaped tube of the signalling horn, water that may form in the funnel-shaped tube either as a result of condensation or when a flood of water, e.g. caused by the motor vehicle travelling through driving rain, allows water to get through the trumpet and into the funnel-shaped tube. However, water in the funnel-shaped tube impedes the transformation of sound by the funnel-shaped tube and can thus conspire with tone distortion to produce a note of weakened volume, or may even cause the signalling horn to fail altogether.

Although a signalling horn incorporating drainage openings is known from DE-OS 25 01 584, these drainage openings are used to drain the space accommodating the pneumatic drive for the diaphragm. No means are provided here either for draining the funnel-shaped tube.

From GB-A-1 036 715 a signalling horn is already known which incorporates a funnel-shaped tube. At the bottommost point when the signalling horn is in a prespecified fitting position, the funnel-shaped tube has a substantially downward-pointing opening which is adjoined by a passage. However, the funnel-shaped tube of this prior art signalling horn is not coiled parallel to the diaphragm. The passage provided therein does not point downwards when the horn is in the specified fitting position.

EP 0 302 258 A1, which has an earlier filing date but not an earlier publication date, describes a signalling horn, more particularly one for motor vehicles, which has a diaphragm which is moved by a drive and which operates on a pressure chamber. Following on from the diaphragm is a funnel-shaped tube which is coiled parallel to the diaphragm and ends in a trumpet. However, no measures are described in connection with said signalling horn for preventing the tone emitted from becoming impaired as a result of water in the funnel-shaped tube.

From FR-A-1 060 678 there is already known a signalling horn for motor vehicles which is equipped with a funnel-shaped tube coiled parallel to the diaphragm. Apart from the trumpet, however, this prior art highlights no other means of connecting part of the signalling horn to the surrounding air.

It is the object of this invention to create a signalling horn that prevents water in the funnel-shaped tube from impairing the tone emitted.

This object is achieved in accordance with the invention by the fact that in addition to the trumpet, on one winding which is bottommost when the signalling horn is in a prespecified fitting position, the funnel-shaped tube has a substantially downward-pointing additional opening which is adjoined by a substantially downward-pointing passage leading to the air surrounding the signalling horn, in that the length of the passage is so constituted that the resonant frequencies of the passage which are governed by said length do not coincide in frequency with the harmonics generated by the signalling horn which determine the sound level, and in that the passage extends from the bottommost winding as far as the trumpet.

Because on one winding which is bottommost when the signalling horn is in a prespecified fitting position the funnel-shaped tube has a substantially downward-pointing opening, the water lying in the bottommost winding, more particularly from a flood of water, is able to flow out of the funnel-shaped tube. The use of this measure alone would, however, impair the tone and acoustic pressure of the signalling horn due to the resulting disruption to the function of the funnel-shaped tube. The invention therefore further provides for a substantially downward-pointing passage which follows on from the opening. The passage is an open tube, which in acoustic terms is only semi-"open" in respect of its resonant frequencies, yet acts as an acoustic closure in respect of the intermediate frequency ranges. In these intermediate ranges there is thus no appreciable attenuation of the frequency components being conducted within the funnel-shaped tube.

Therefore in accordance with the invention the length of the passage is dependent on the frequency position of the harmonics generated by the signalling horn. As is known, the tone of the signalling horn is made up of a number of harmonics.

The lowest harmonic is known as the fundamental, or keynote, and the frequencies of the higher harmonics are in each case an exact multiple of the fundamental. Accordingly the length of the passage can be chosen depending on the position of these frequencies. This exploits the fact that the passage exhibits the acoustic

properties of an open tube which in its resonant frequencies takes vibration energy from the funnel-shaped tube, but blocks this transfer of energy in the intermediate frequency ranges.

The invention utilises this fact and in advantageous manner the length of the passage is chosen so that the resonant frequencies of the tube do not coincide in frequency with the harmonics generated by the signalling horn, but are situated therebetween, though preferably above the harmonic that determines the volume.

Particularly in the case of signalling horns whose trumpets are situated more or less parallel to the diaphragm and which are attached to the motor vehicle in such a way that the trumpet points perpendicular to the direction of travel, it is advantageous for the passage to extend from the bottommost winding as far as the trumpet, because in the case of the signalling horns in standard use in motor vehicles the length of the passage is then within the advantageous range of around 2 to 6 cm.

The signalling horn according to the invention thus has the advantage over conventional horns that water lying in the funnel-shaped tube is able to run out of the funnel-shaped tube via the opening and the passage, thereby avoiding the sound being adversely affected by water in the funnel-shaped tube.

At the same time, thanks to the passage it is possible to stop the adverse effects on the tone of the signalling horn due to the opening in certain frequency ranges. The only extra part necessary is a passage, thereby enabling the signalling horn according to the invention, incorporating the acoustic advantages indicated above, to be constructed in a straightforward and inexpensive manner.

Practical embodiments and refinements of the signalling horn according to the invention can be taken from the subsidiary claims.

For use in motor vehicles, signalling horns with funnel-shaped tubes are employed whose volume-determining harmonics lie in the 1000 to 3000 Hz range. In the case of such signalling horns it has been shown to be particularly advantageous if the length of the passage is approximately 2 to 6 cm. This applies especially to passages with cross-sectional areas of 3 to 9 square millimetres.

To prevent the opening or passage from becoming clogged with foreign particles and particles of dirt, it is advantageous if the cross-sectional area of the opening is bigger than 3 square millimetres. Although cross-sections of increasing size ensure that the water runs out of the funnel-shaped tube more quickly, this does reduce the

effective acoustic efficiency of the passage owing to phenomena at the mouth of the opening. Practice has shown that a cross-sectional area of not more than 9 square millimetres represents the upper limit.

To simplify the production process it is advantageous if the cross-sectional area of the passage is approximately the same as the cross-sectional area of the opening and if the passage and/or opening have a round cross-section.

To further simplify the production process and thus reduce production costs it is, lastly, particularly advantageous to injection-mould the funnel-shaped tube and the passage together as one piece from plastic. Plastics injection-moulded funnel-shaped tubes are quite common nowadays. The increased engineering outlay entailed in providing the measure according to the invention then only consists in fitting the injection moulding die with suitable recesses for the outer wall of the passage and in providing a needle which delimits the inner wall of the passage.

The drawing illustrates one example of embodiment of the signalling horn according to the invention, and this will now be explained in detail with reference to the drawing.

The single figure shows a signalling horn according to the invention, which is fastened to the motor vehicle with the plane of the diaphragm perpendicular to the direction of travel and with its trumpet arranged parallel to the plane of the diaphragm. The trumpet (5) thus hangs down and points to the road surface along which the motor vehicle is being propelled. The figure shows a funnel-shaped tube (1), which follows on from a pressure chamber situated behind the funnel-shaped tube (not visible in the drawing). Also behind the funnel-shaped tube, and approximately parallel to the plane of the drawing, is the diaphragm (likewise not shown). The drive for the signalling horn according to the invention is likewise concealed by the funnel-shaped tube (1).

The funnel-shaped tube (1) opens out in a trumpet (5) and incorporates a downward-pointing, bottommost winding (2) which incorporates a substantially downward-pointing opening (3).

The opening (3) merges into a substantially downward-pointing passage (4), which is so disposed that the passage (4) extends from the bottommost winding (2) as far as the trumpet (5). The signalling horn according to the invention is attached by a fixing lug (6) to the bodyshell of the motor vehicle, which is not illustrated in the drawing.

As the motor vehicle is travelling, spray and driving rain in particular are likely to pass through the trumpet (5)

into the funnel-shaped tube (1) and trickle along the funnel turn shown at the top of the drawing into the bottommost winding (2), where it would collect if the opening (3) and the passage (4) were not provided. Since, however, the opening (3) and the passage (4) are provided in accordance with the invention, the water in the winding (2) is able to run out of the winding (2) through the opening (3) and the passage (4), and thence out of the funnel-shaped tube (1).

The measure provided under the invention therefore safely prevents water in the funnel-shaped tube (1) from distorting the tone emitted by the signalling horn according to the invention.



Claims

1. Signalling horn, more particularly one for motor vehicles, comprising a diaphragm which is moved by a drive and operates on a pressure chamber, a funnel-shaped tube (1) which follows on from the pressure chamber, is coiled parallel to the diaphragm and ends in a trumpet (5), and further comprising means for connecting part of the signalling horn to the surrounding air, characterised in that in addition to the trumpet (5), on one winding (2) which is bottommost when the signalling horn is in a prespecified fitting position, the funnel-shaped tube (1) has a substantially downward-pointing additional opening (3) which is adjoined by a substantially downward-pointing passage (4) leading to the air surrounding the signalling horn, in that the length of the passage (4) is so constituted that the resonant frequencies of the passage (4) which are governed by said length do not coincide in frequency with the harmonics generated by the signalling horn which determine the sound level, and in that the passage (4) extends from the bottommost winding (2) as far as the trumpet (5).
2. Signalling horn according to claim 1, characterised in that the passage (4) and/or the opening (3) have a round cross-section.
3. Signalling horn according to claim 1, characterised in that the cross-sectional area of the passage (4) is the same as the cross-sectional area of the opening (3).
4. Signalling horn according to claim 1, characterised in that the length of the passage (4) is approximately 2 to 6 cm.
5. Signalling horn according to claim 4, characterised in that the length of the passage (4) is approximately 3.5 cm.
6. Signalling horn according to claim 1, characterised in that the cross-sectional area of the opening (3) is approximately 3 to 9 square millimetres.
7. Signalling horn according to claim 1, characterised in that the funnel-shaped tube (1) and the passage (4) are injection-moulded from plastic together as one piece.