

The invention relates to a signalling horn, in particular for motor vehicles, having a diaphragm which is moved by a drive, and which acts on a pressure chamber, having a funnel which is connected to the pressure chamber, the funnel consisting of a first section of constant cross-sectional area, a conically enlarging second section and an exponentially enlarging third section, terminating in a sound outlet opening, such that the first section and the second section are coiled parallel to the plane of the diaphragm, and such that the sound outlet opening is arranged essentially parallel to the plane of the diaphragm.

Such a signalling horn is already known from French Patent Application 2,400,744, in which the first section of constant cross-sectional area and the second section of conically enlarging cross-sectional area are coiled parallel to the plane of the diaphragm. The exponentially enlarging third section is arranged perpendicular to the plane of the diaphragm, so that the sound outlet opening is arranged essentially parallel to the plane of the diaphragm.

However, the already known signalling horn has disadvantages. As a result of the coiling of the first section and the second section parallel to the plane of the diaphragm, it is possible to produce large funnel lengths with the first section and the second section. However, as a result of the third section being arranged perpendicular to the plane of the diaphragm, this already known signalling horn has a large spatial expansion in the direction of the sound emission direction, that is to say, in the direction perpendicular to the plane of the diaphragm. This large spatial expansion can make it impossible to instal the already known signalling horn, for example, in a confined engine bay of a motor vehicle, since there is insufficient space available in such an engine bay for the installation of the already known signalling horn.

As a result of the bend in the funnel of the already known signalling horn at the transition from the

second section to the third section it is possible that the high frequency sound components in particular, of the tone produced by the signalling horn, cannot follow the deflection by approximately 90° , which can lead to a dull tone, to a loss of sound level and hence finally to a poor signalling effect of the already known signalling horn.

Finally, the exponentially enlarging third section is constructed independently from the rest of the funnel, so that the production of the already known signalling horn can be costly, since, for the assembly of the already known signalling horn, the third section must be connected to the other sections of the funnel in an additional work operation.

The invention has the object of producing a signalling horn which has as high a sound pressure level as possible and which occupies as little space as possible.

This object is achieved according to the invention in that the third section is coiled essentially parallel to the plane of the diaphragm and in that the third section has a planar reflecting surface at the end of the funnel, which is turned outwards from the plane of the diaphragm in the direction of the sound outlet opening and whose one boundary line forms a boundary line of the sound outlet opening.

As a result of the third section being coiled essentially parallel to the plane of the diaphragm and the main emission direction of the signalling horn according to the invention being located essentially perpendicular to the plane of the diaphragm, the signalling horn according to the invention has a shorter length in the main emission direction. This means that the signalling horn according to the invention, unlike those which are already known, can be accommodated, for example, in the engine bay of the motor vehicle with the sound outlet opening in the direction of travel, the signalling horn according to the invention at the same time having a smaller space requirement in the direction

of travel. The signalling horn according to the invention can thus also be used more frequently in the confined engine bays of motor vehicles.

5 However, trials have shown that by applying this measure according to the invention on its own, the tone of the signalling horn according to the invention becomes dull. The reason for this is that the high harmonics which determine the sound pressure cannot follow the curvature of the funnel in the exponential region. In the
10 regions of the funnel in which the diameter is comparable to the wavelength of the harmonics produced, partial reflections of the higher-frequency sound components can occur on the curved surfaces. Instead of the desired concentration of the higher frequency sound components,
15 a severe scattering of the harmonics occurs, as a result of which the tone becomes dull and quiet.

 In order avoid this disadvantage, according to the invention the third section has at the end of the funnel a planar reflecting surface, which is turned
20 outwards from the plane of the diaphragm in the direction of the sound outlet opening and whose one boundary line forms a boundary line of the sound outlet opening. In the funnel, there thus results a planar reflecting surface, whose dimensions are greater than or comparable to one
25 third of the wavelength of the higher-frequency harmonics which determine the level. As a consequence of this, these sound components are at least partially reflected once on this surface and are then emitted through the sound outlet opening. In essence, multiple reflections
30 from the funnel walls do not occur. The tone remains clear and loud.

 The signalling horn according to the invention, compared with that which is already known, has the advantage that, in particular as a result of the design
35 of the third section of the funnel and of the sound outlet opening, less space is required, for example for fitment in the engine bays of motor vehicles. Furthermore, the signalling horn according to the invention has the advantage that it has a high sound pressure level

despite the advantageous space-saving shape, so that a major warning effect can be achieved with the signalling horn according to the invention.

5 Advantageous refinements and further developments of the object of the invention result from the sub-claims.

10 It is advantageous to turn the planar reflecting surface outwards only by up to 60° from the plane of the diaphragm, since in this way a reverberation of sound components in the funnel is avoided. Such reflections could lead to a reduction of the sound pressure level and to a dull tone of the signalling horn according to the invention.

15 In this connection, it is particularly advantageous to turn the planar reflecting surface outwards by 45° from the plane of the diaphragm, since in this way the high-frequency harmonics are reflected outwards on average by 90° from the plane of the diaphragm and emerge from the sound outlet opening. The sound pressure of the signalling horn according to the invention is then particularly great in the direction of travel.

20 Precise investigations have shown that it is advantageous if the dimensional size of the boundary line of the planar reflecting surface is approximately equal to one third of the wavelength of the frequency band in which it is intended that the harmonics having the highest sound pressures will be emitted.

25 The planar reflecting surface can be designed with a trapezoidal shape and, in particular, the short parallel can be selected to be approximately equal to double the height of the trapezoid. This simple shaping of the surface boundaries permits simple matching to the reflection conditions.

30 For determining the effective funnel length for the mechanical and acoustic conditions, the end of the funnel can be assumed to occur at the point of intersection of the centre line of the funnel with the planar reflecting surface.

35 In order that the planar reflecting surface does

not detract from the effect of the funnel as an acoustic transformer, it is furthermore advantageous to shape the remaining funnel wall of the third section such that the funnel cross-sectional area enlarges along the centre axis, which is now bent.

As a drive, an electromagnetic drive can advantageously be used.

It is particularly advantageous if the funnel and the third section are constructed together, as one piece, since in this way there is no additional cost for the assembly of the third section onto the funnel and the production of the signalling horn according to the invention is thus shortened and made cheaper.

An exemplary embodiment of the object of the invention is shown in the drawings and is explained in more detail in the following text:

The single figure shows a perspective view of a signalling horn according to the invention.

The signalling horn (1) according to the invention is shown in a perspective view, such that the funnel (2) with its third, exponentially enlarging section (3) is identifiable and allows a view through the sound outlet opening (4) onto the planar reflecting surface (5). The third section (3) and the rest of the funnel (4) are extruded together, as one piece, from plastic.

The other sections of the signalling horn according to the invention, not shown in the figure, correspond for example to the electromagnetic signalling horn of French Patent Application 2,400,744, the plane of the diaphragm being arranged parallel to the edge (11) of the signalling horn (1).

The termination of the third section of the funnel (2) is turned outwards from the plane of the diaphragm in such a manner that the sound outlet opening (4) is arranged parallel to the plane of the diaphragm. The turning outwards of the termination from the plane of the diaphragm results essentially from the planar reflecting surface (5), which is incorporated in the third section (3) of the funnel (2). The planar reflecting

surface (5) is in this case turned outwards by 45° from the plane of the diaphragm.

Because of the essentially rectangular design of the funnel cross-sectional area, a planar reflecting surface (5) advantageously results which is trapezoidal. The first boundary line of the trapezoid, or its long parallel (6), form, a boundary line of the sound outlet opening (4). The second boundary line, or short parallel (7), is arranged parallel to the first boundary line (6) of the planar surface (5).

The preferred installation position of the signalling horn according to the invention, for example in the engine bay of a motor vehicle, is with the plane of the sound outlet opening (4) perpendicular to the direction of travel, so that the main emission direction of the signalling horn according to the invention is perpendicular to the sound outlet opening (4) and is thus parallel to the direction of travel. In this way, the space required for the signalling horn according to the invention is no longer determined by the diameter of the signalling horn, as in the case of the already known signalling horn, but by the height of the funnel (2) and of the casing located beneath the funnel (2), not shown in the figure. In the case of usual modern signalling horns, this height is significantly less than the diameter of the signalling horn, so that in the direction of travel of the motor vehicle, in the case of the arrangement of the signalling horn according to the invention, in the engine bay, a significantly smaller space requirement results, compared with that for the already known signalling horn. In this case, the diameter of the signalling horn according to the invention is not significantly greater than that of the already known signalling horn.

For matching the funnel length to the stated mechanical characteristics and the desired acoustic characteristics, it is appropriate to define the point of intersection (9) of the centre line (8) of the funnel (2) with the planar reflecting surface (5) as the end of the

The centre axis (10) of the funnel (2) is now bent outwards from the plane of the diaphragm because of the third section (3) of the funnel (2) being turned outwards from the plane of the diaphragm and because of the arrangement of the planar reflecting surface (5). In order that these measures according to the invention do not detract from the characteristics of the funnel (2) as an acoustic transformer, it is advantageous to shape the funnel wall of the third section (3) remaining the planar reflecting surface (5) in such a way that the funnel cross-sectional area enlarges along the centre axis (10), which is now bent.

An electromagnetic drive can be used, as is presented in French Patent Application 2,400,744, as the drive of the signalling horn (1) according to the invention, in accordance with the figure. Such electromagnetic drives have the advantage that they can be supplied with electrical power in a simple manner from the motor vehicle on-board power supply.

For other applications, it can be quite advantageous to select as the drive, for example, pneumatic, that is to say compressed-air operated, drives.



Patent Claims:

1. Signalling horn, in particular for motor vehicles, having a diaphragm which is moved by a drive, and which acts on a pressure chamber, having a funnel which is connected to the pressure chamber, the funnel consisting of a first section of constant cross-sectional area, a conically enlarging second section and an exponentially enlarging third section, terminating in a sound outlet opening, such that the first section and the second section are coiled parallel to the plane of the diaphragm, and such that the sound outlet opening is arranged essentially parallel to the plane of the diaphragm, characterised in that the third section (3) is coiled essentially parallel to the plane of the diaphragm and in that the third section (3) has a planar reflecting surface (5) at the end of the funnel (2), which is turned outwards from the plane of the diaphragm in the direction of the sound outlet opening (4), directed in such a manner that no sound is reflected back into the horn, and whose one boundary line (6) forms a boundary line of the sound outlet opening (4).
2. Signalling horn according to Claim 1, characterised in that the planar reflecting surface (5) is turned outwards by up to 60° from the plane of the diaphragm.
3. Signalling horn according to Claim 2, characterised in that the planar reflecting surface (5) is turned outwards by 45° from the plane of the diaphragm.
4. Signalling horn according to Claim 1, characterised in that the dimensions of the boundary line (6) of the planar reflecting surface (5) are approximately equal to one third of the wavelength of the frequency band in which it is intended that the harmonics having the highest sound pressures will be emitted.
5. Signalling horn according to Claim 1, characterised in that the planar reflecting surface (5) has a trapezoidal shape, and in that, in particular, the short parallel (7) is approximately equal to double the height of the trapezoid.



6. Signalling horn according to Claim 5, characterised in that the length of the short parallel (7) is greater than 40 mm.
- 5 7. Signalling horn according to Claim 1, characterised in that the effective length of the funnel at the mouth of the funnel is determined approximately by the point of intersection (9) of the centre line (8) of the funnel with the planar reflecting surface (5).
- 10 8. Signalling horn according to Claim 1, characterised in that the remaining wall of the third section (3) of the funnel is shaped such that the funnel cross-sectional area enlarges along the bent centre axis (10).
9. Signalling horn according to Claim 1, characterised in that the drive is an electromagnetic drive.
- 15 10. Signalling horn according to Claim 1, characterised in that the funnel (2) and the third section (3) are constructed together, as one piece.