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(54) **ELECTROACOUSTIC TRANSDUCER COMPRISING A CLOSING MEMBER FOR CLOSING THE REAR VOLUME OF THE TRANSDUCER**

ELEKTROAKUSTISCHER WANDLER MIT EINEM VERSCHLUSSTEIL ZUM VERSCHLIESSEN
VOM RÜCKVOLUMEN DES WANDLERS

TRANSDUCTEUR ELECTROACOUSTIQUE COMPORTANT UN ELEMENT OBTURATEUR POUR
FERMER SON VOLUME ARRIERE

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Description

[0001] The invention relates to an electroacoustic transducer comprising a diaphragm which is substantially centro-symmetrical with respect to a transducer axis and which is capable of vibrating in the direction of the transducer axis, and comprising a voice coil connected to the diaphragm in the area of the rear volume of the transducer, and comprising a magnet system which is substantially centro-symmetrical with respect to the transducer axis, which magnet system is accommodated in a housing of the transducer and comprises a magnet, a cover disc adjoining the magnet, and a substantially pot-shaped yoke comprising a core disc, which also adjoins the magnet, and a hollow cylindrical yoke portion which projects from the core disc in a direction parallel to the transducer axis, and which forms an annular air gap between the cover disc and the hollow cylindrical yoke portion, in which air gap the voice coil is arranged, and comprising a substantially annular closing member adapted to close the rear volume, which closing member has a contact surface which extends parallel to a circle which is concentric with the transducer axis, which contact surface faces a contact portion of a part of the transducer, which part also bounds the rear volume, and which closing member has at least one passage which terminates in its contact surface, for realizing an acoustic friction between the rear volume and the acoustic free space surrounding the transducer.

[0002] An electroacoustic transducer of the type defined in the opening paragraph is commercially available from the Applicant under the type designation WD 00917 and is known therefrom. The known transducer comprises a substantially cylindrical magnet system which comprises a circular cover disc, a round disc-shaped magnet and a pot-shaped yoke which comprises a round disc-shaped base from which a hollow cylindrical yoke portion projects at the location of its perimeter, which portion changes into peripheral pot wall which extends transversely to the transducer axis. In the known transducer this magnet system is accommodated in a plastic transducer housing. In the known transducer the closing member for closing the rear volume of the known transducer is formed by a ring-like closing cap, which is also made of a plastic and which comprises a hollow cylindrical closing wall, which extends parallel to the transducer axis, and an annular closing disc, which is connected to this closing wall and which has a circular opening. The ring-like closing cap provided as the closing member is connected to the transducer housing with its hollow cylindrical closing wall, i.e. with the peripheral face of this wall, by ultrasonic welding in a mechanically rigid and acoustically sealed manner. With its opening the annular closing disc is slid onto the pot-shaped yoke of the magnet system, i.e. onto the hollow cylindrical yoke portion, thus forming a contact surface of the closing cap, which contact surface is formed by the bounding surface of the opening, is concentric

with and extends parallel to the transducer axis of the known transducer, and engages with a contact portion of the hollow cylindrical yoke portion of the yoke of the magnet system, which contact portion also extends parallel to the transducer axis. In the known transducer it is thus necessary to connect the closing member, i.e. the closing cap, to the transducer housing in a mechanically rigid as well as acoustically sealed manner and, in addition, to adapt the inner diameter of the annular closing disc of the closing cap and the outer diameter of the hollow cylindrical yoke portion of the yoke system accurately to one another. Both the acoustically sealed connection to the housing of the transducer and said adaptation of the diameters constitute an additional operation, which makes the transducer more expensive and should therefore be avoided.

[0003] It is an object of the invention to eliminate the above-mentioned problems and to provide an improved transducer in a simple manner and with simple means.

[0004] To this end the invention is characterized in that the magnet system is substantially hollow cylindrical and comprises an annular magnet and an annular cover disc as well as a hollow cylindrical yoke having an annular core disc from which the hollow cylindrical yoke portion projects in the area of its inner diameter, and the closing member comprises an annular body having an annular contact surface which extends transversely to the transducer axis and with which it faces the contact portion of said part of the transducer, which contact portion also extends transversely to the transducer axis, and a ring projection, which projects obliquely from the annular body along its entire circumference and is movable against spring action, by means of which ring projection an acoustic sealing with a mating surface can be achieved, and the at least one passage terminates in the annular contact surface of the annular body, which surface extends transversely to the transducer axis.

[0005] In this way it is achieved that the closing member can initially be connected to the transducer without an acoustically sealed connection being made between the annular body of the closing member and the transducer portion adapted to cooperate with the annular body, and that an acoustically sealed connection between the ring projection and the mating surface and an acoustically sealed connection between the annular contact surface of the annular body of the closing member and the annular contact portion of the transducer part adapted to cooperate with the annular body is not formed until the transducer is mounted in an electroacoustic device, the ring projection of the closing member then being resiliently urged against a mating surface of the electroacoustic device, while at the same time the acoustic impedance between the rear volume of the transducer and the acoustic free space surrounding the transducer is formed by means of the at least one passage, which acoustic impedance is required in order to obtain a desired acoustic characteristic of the transducer. In addition, the closing member in the transducer in

accordance with the invention has both a positioning function and a fixing function because by means of the closing member the transducer is held in a desired operating position in an electroacoustic device in a stable manner after the transducer has been mounted into this device. A further additional function of the closing member in the transducer in accordance with the invention is that by means of the closing member, i.e. by means of the ring projection of the closing member, it is possible to compensate for mounting height tolerances.

[0006] In a transducer in accordance with the invention the ring projection can project obliquely from the annular body towards the transducer axis. It has proved to be particularly advantageous if the ring projection of the closing member projects from the annular body of the closing member in a direction away from the transducer axis. Thus, a comparatively large diameter of the ring projection is obtained, which has proved to be advantageous because in this way a gentle spring action can be achieved by means of the ring projection.

[0007] In a transducer in accordance with the invention it has further proved to be advantageous if a plurality of stabilizing projections, which are spaced at equal angles from one another, project obliquely from the annular body of the closing member in directions with respect to the transducer axis which are opposite to that of the ring projection. This ensures that in the built-in condition of the transducer the annular contact surface of the annular body of the closing member always closely engages with the contact portion of the transducer part adapted to cooperate with the annular body, thereby guaranteeing a proper acoustically sealed connection between the contact surface and the contact portion.

[0008] In a transducer as defined in the preceding paragraph it has proved to be very advantageous if the stabilizing projections project from the annular body of the closing member at substantially the same angle as the ring projection. This is advantageous in order to achieve that the spring forces applied by the ring projection and the stabilizing projections are distributed as uniformly as possible.

[0009] In a transducer having stabilizing projections it has proved to be particularly advantageous if the closing member comprises a given number of stabilizing projections and an equal number of passages, and each stabilizing projection and each passage is disposed symmetrically with respect to a radial direction. This results in a close and relatively large-area engagement of the contact surface of the annular body of the closing member and the contact portion of a transducer part adapted to cooperate with the annular body.

[0010] In all the above-mentioned variants of a transducer in accordance with the invention it has proved to be advantageous if a plurality of angularly equispaced projections, which extend substantially in the direction of the transducer axis, are connected to the annular body of the closing member, by means of which projections the closing member can be connected to the a part

of the transducer in order to retain the closing member. Such a construction is advantageous for a simple connection of the closing member to a transducer part.

[0011] In all the above-mentioned variants of a transducer in accordance with the invention it has further proved to be very advantageous if the closing member is made of a plastic, preferably polyacetal. In practice, such a construction has proved to be particularly favorable because particularly polyacetal has satisfactory spring characteristics and a high temperature stability.

[0012] In all the above-mentioned variants of a transducer in accordance with the invention it has further proved to be particularly advantageous if the transducer can be provided with differently constructed closing members which differ from one another with respect to the implementation of the passages provided in order to realize acoustic frictions and which consequently result in different acoustic characteristics of the transducer. As a result of this, a plurality of variants of a transducer in accordance with the invention, which differ from one another with respect to their acoustic characteristics, can be realized in a simple manner and substantially without additional expense.

[0013] The above-mentioned as well as further aspects of the invention will become apparent from the embodiments described hereinafter by way of examples and will be elucidated by means of these embodiments.

[0014] The invention will now be described in more detail with reference to the drawing, which shows two embodiments to which the invention is not limited.

[0015] Figure 1 is an underneath view taken at the arrow I in Figure 2 and showing a basic unit of an electrodynamic transducer in accordance with a first embodiment of the invention, to which unit a closing member can be connected.

[0016] Figure 2 shows the basic unit in a side view taken at the arrow II-II in Figure 1 and partly in sectional view.

[0017] Figure 3 shows the basic unit of Figures 1 and 2 in a plan view taken at the arrow III in Figure 2.

[0018] Figure 4, similarly to Figure 2, shows the electroacoustic transducer in accordance with the first embodiment of the invention, the basic unit and the closing member of the transducer being connected to one another.

[0019] Figure 5 shows the closing member of the transducer of Figure 4 in a cross-sectional view taken on the line V-V in Figure 6.

[0020] Figure 6 shows the closing member of Figure 5 in a plan view taken at the arrow VI in Figure 5.

[0021] Figure 7 shows a part of the closing member of Figures 5 and 6 in a sectional view taken on the line VII-VII in Figure 6 and to an enlarged scale in comparison with Figure 6.

[0022] Figure 8 shows diagrammatically a part of a portable telephone including an electroacoustic transducer in accordance with a second embodiment of the invention.

[0023] Figures 1 to 3 show a basic unit B of an electrodynamic transducer 1 in a first embodiment of the invention, which is shown as a whole in Figure 4 and which has a transducer axis 2. To accommodate and hold the individual parts of the transducer 1 the latter comprises a plastic housing 3. The housing 3 essentially comprises a hollow cylindrical circumferential wall 4, which changes into a narrow annular bounding wall 5 at the top and which has three mounting projections 6, 7 and 8 at the bottom, which are spaced at equal angles from one another. Prior to assembly of the transducer 1 the mounting projections 6, 7 and 8 project from the circumferential wall 4 in axial directions and after all the parts of the transducer 1 have been mounted in the housing 3 said projections are bent by means of an ultrasonic process.

[0024] The transducer 1 comprises a substantially hollow cylindrical magnet system 9, which is substantially centro-symmetrical with respect to the transducer axis 2 and whose construction is apparent from Figure 2. The magnet system 9 is accommodated in the housing 3 and comprises an annular magnet 10, also referred to as the ring magnet 10, which is adjoined by an annular cover disc 11 at its upper side and by an annular core disc 12 of a hollow cylindrical yoke 13 at its lower side. The yoke 13 comprises the annular core disc 12 and a hollow cylindrical yoke portion 14, which projects from said disc in a direction parallel to the transducer axis 2 and whose end which is remote from the core disc 12 extends into the area of the cover disc 11, namely in such a manner that an annular air gap 15 is formed between the cover disc 11 and the yoke portion 14.

[0025] A voice coil 16 wound from coil wire is arranged in the air gap 15 and is shown only diagrammatically in Figure 2 because such a construction of a coil wound from coil wire is generally known. In known manner the voice coil 16 is secured to a diaphragm 17 by means of an adhesive joint, which diaphragm is centro-symmetrical with respect to the transducer axis 2 and can perform excursions in the direction of the transducer axis 2. The voice coil 16 is disposed in the rear volume HV of the transducer 1. The diaphragm 17 comprises a curved central portion 18 and an annular peripheral portion 19 which is connected to the cover disc 11 by an adhesive with its edge zone 8, which lies between the narrow annular bounding wall 5 of the housing 3 and the cover disc 11.

[0026] In the transducer 1 shown in Figures 1 to 3 the cover disc 11, the ring magnet 10, the core disc 12 of the yoke 13 and the diaphragm 17 all have the same outer diameter, which is adapted accurately to the inner diameter of the circumferential wall 4 of the housing 3 in such a manner that the core disc 12 of the yoke 13, the ring magnet 10 as well as the cover disc 11 and, consequently, also the diaphragm 17 are positioned exactly with respect to the transducer axis 2 by means of the circumferential wall 4 of the housing 3. This also results in an exact positioning of the voice coil 16 in the air gap 15, so that always an unimpeded vibration of the

voice coil 16 is guaranteed.

[0027] The voice coil 16 made of coil wire has two coil leads 20, of which only one lead 20 is shown in Figure 2. The transducer 1 further has two contact terminals, which are both shown in Figure 1, but only one of these contact terminals is visible in Figure 2. Each of the two contact terminals is electrically connected to one coil lead, preferably by soldering but clamping is also possible. Viewed in the direction of the transducer axis, the two contact terminals are disposed inside the substantially hollow cylindrical magnet system 9.

[0028] As is apparent from Figure 2, the contact terminals in the transducer shown in Figures 1 to 3 are preferably formed by substantially U-shaped spring contacts 21 and 22 having limbs 23 and 24, which extend transversely to the transducer axis 2 and of which a first limb 23 is mechanically connected to a part of the transducer 1 and of which a second limb 24 has contact faces 25 for cooperation with mating contacts, which contact faces 25 are movable substantially parallel to the transducer axis 2. The contact faces 25 are each formed by a spring contact portion bent away from the second limb 24. Suitably, the two contact faces 25 of the two spring contacts 21 and 22 are situated at different radial distances from the transducer axis 2, as is clearly shown in Figure 1.

[0029] As stated hereinbefore, the first limb 23 of each of the two spring contacts 21 and 22 is mechanically connected to a part of the transducer 1. This part of the transducer 1 for mounting the two spring contacts 21 and 22 is formed by a substantially pot-shaped contact holder 26. The first limbs 23 of the two U-shaped spring contacts 21 and 22 are mechanically connected to a bottom wall 27 of the pot-shaped contact holder 26. By means of its hollow cylindrical circumferential wall 28 the pot-shaped contact holder 26 is mounted in the hollow cylindrical yoke portion 14 of the yoke 13 of the magnet system 9.

[0030] At the location of its free end the first limb 23 of each of the two U-shaped spring contacts 21 and 22 has a terminal lug 29, which is inclined relative to said limb and which extends through the bottom wall 27 of the pot-shaped contact holder 26 and is connected to a respective coil lead 20. In this way the two terminal lugs 29 provide an electrical connection between, on the one hand, the coil leads 20 and, consequently, the voice coil 16 and, on the other hand, the two U-shaped spring contact 21 and 22.

[0031] As also stated hereinbefore, the U-shaped spring contacts 21 and 22 are situated inside the substantially hollow cylindrical magnet system 9, viewed in the direction of the transducer axis 2. As is apparent from Figure 2, the two U-shaped spring contacts 21 and 22 of the transducer 1 as shown in Figures 1 to 3 are disposed at least for the greater part inside the substantially hollow cylindrical magnet system 9, also viewed in a direction transverse to the transducer axis 2. Viewed in a direction transverse to the transducer axis 2, only

the contact faces 25 of the two U-shaped spring contacts 21 and 22 are situated outside the substantially hollow cylindrical magnet system 9.

[0032] As regards the electrodynamic transducer 1 of Figures 1 to 3 it is to be noted that this transducer 1 is shown to an enlarged scale, i.e. approximately five times full scale. At full scale of the transducer 1 the value of the outer diameter D of the transducer 1 indicated in Figure 3 has a nominal value of 13.2 mm. The transducer 1 is therefore particularly compact and is therefore very suitable for use in telecommunication devices, such as portable telephones and the like.

[0033] The transducer 1, as can be seen in Figure 1, further comprises a substantially annular closing member 30 for closing the rear volume HV. This closing member 30 is shown separately in Figures 5, 6 and 7.

[0034] The closing member 30 as shown in Figures 5 to 7 is made of a plastic, preferably polyacetal because this synthetic material has suitable spring characteristics and a high temperature stability.

[0035] With a contact surface 32, which extends parallel to a circle 31 which is concentric with the transducer axis 2, the closing member 30 lies against a contact portion 33 of a part of the transducer 1, which portion is shown diagrammatically in dash-dot lines in Figure 1, which part of the transducer 1 in the present case is formed by the yoke 13 of the magnet system 9, i.e. by the annular core disc 12 of the yoke 13 of the magnet system 9. In the present case the closing member 30 has a total of four passages 34, 35, 36 and 37 which open into its contact surface 32 and which serve to obtain an acoustic friction between the rear volume HV of the transducer 1 and the acoustic free space surrounding the transducer 1. By providing such passages, in order to obtain an acoustic friction, the acoustic characteristics of such an electroacoustic transducer can be influenced and defined in known manner.

[0036] As can be seen in Figures 5 to 7, the closing member 30 comprises an annular body 38 whose annular contact surface 32, which in the present case extends transversely to the transducer axis 2, faces the contact portion 33 of said part of the transducer 1, i.e. the contact portion 33 of the yoke 13, which also extends transversely to the transducer axis 2, and further comprises a ring projection 39, which projects obliquely from the annular body 38 along its entire circumference and is movable against spring action. In the present case the spring action is mainly provided by means of an annular thinner portion Z between the annular body 38 and the ring projection 39. An acoustic sealing with the ring projection 39 can be achieved with a mating surface 40. Such a mating surface 40 is shown diagrammatically in Figure 4. The mating surface 40 has been provided on a supporting wall 41, shown in dash-dot lines in Figure 4, of an electroacoustic device, which is not shown any further in Figure 4. Thus, in the transducer 1 in accordance with the invention shown in Figure 4 the supporting wall 41 serves for closing the rear volume HV of the

transducer 1.

[0037] In the closing member 30 as shown in Figures 5 to 7 each of the passages 34, 35, 36 and 37 terminates in the annular contact surface 32 of the annular body 38, which surface extends transversely to the transducer axis 2.

[0038] In the closing member 30 as shown in Figures 5 to 7 the ring projection 39 advantageously projects from the annular body 38 in a direction away from the transducer axis 2. In the present case the closing member 30 has four stabilizing projections 42, 43, 44 and 45 spaced at equal angles from one another. The four stabilizing projections 42, 43, 44 and 45 project obliquely from the annular body 38 of the closing member 30 in directions with respect to the transducer axis 2 which are opposite to that of the ring projection 39. In the present case, the four stabilizing projections 42, 43, 44 and 45 thus point towards the transducer axis 2.

[0039] As is clearly shown for the stabilizing projection 43 in Figure 7, the four stabilizing projections 42, 43, 44 and 45 of the closing member 30 project from the annular body 38 of the closing member 30 at substantially the same angle as the ring projection 39.

[0040] The transducer 1 as shown in Figure 4 thus comprises a closing member 30 having a given number of stabilizing projections, i.e. four stabilizing projections 42, 43, 44 and 45, and an equal number of passages, i.e. four passages 34, 35, 36 and 37. Each of the stabilizing projections 42, 43, 44 and 45 and each of the passages 34, 35, 36 and 37 are disposed symmetrically with respect to radial directions 46, 47, 48 and 49, respectively.

[0041] As regards the closing member 30 it is to be noted that in this closing member 30 four angularly equispaced projections 50, 51, 52 and 53, which extend substantially in the direction of the transducer axis 2, are connected to the annular body 38 of this transducer, by means of which projections the closing member 30 can be connected to the yoke 13 of the transducer 1 in order to retain the closing member 30. The projections 50, 51, 52 and 53 each have a slot 54, 55, 56 and 57 so that the projections are cross-sectionally U-shaped, the limb portions of the of the projections 50, 51, 52 and 53 being resiliently movable towards one another when the projections 50, 51, 52 and 53 are inserted or introduced into the holes 58, 59, 60 and 61 provided for this purpose in the yoke 13. Thus, the closing member is secured to the yoke 13 of the transducer 1 by means of the resilient action of the projections 50, 51, 52 and 53.

[0042] The transducer 1 shown in Figure 4 has been provided with the closing member 30 as shown in Figures 5 to 7, which closing member has passages 34, 35, 36 and 37 of substantially rectangular cross-sectional shape. It is to be noted that the basic unit B of the transducer 1 can be connected to differently constructed closing members, i.e. that a transducer can be provided with differently constructed closing members 30, which differ from one another with respect to the shapes of the

passages provided in order to obtain acoustic frictions and which consequently give rise to different acoustic characteristics of the transducer. For example, closing member whose construction differs from that of the closing member 30 as shown in Figures 5 to 7 can have cross-sectionally rectangular passages whose sides have greater or smaller lengths or it can have cross-sectionally semicircular or wedge-shaped passages. Thus, by the use of differently constructed closing members it is achieved in a simple manner that by means of a basic unit which is common to all transducer variants a multitude of variants of a transducer in accordance with the invention can be realized which differ from one another with respect to their acoustic characteristics, so that it is always possible in a simple manner to realize a transducer which is optimized for different electroacoustic devices.

[0043] With the transducer 1 described with reference to Figures 1 to 7 it is achieved in an advantageous manner that the closing member 30 can initially be connected to the transducer without an acoustically sealed connection being made between the annular body 38 of the closing member 30 and the yoke 13 of the magnet system 9 of the transducer 1, which yoke is adapted to cooperate with the annular body 38, and that an acoustically sealed connection between the ring projection 39 and the mating surface 40 and an acoustically sealed connection between the annular contact surface 32 of the annular body 38 of the closing member 30 and the annular contact portion 33 of the yoke 13 of the magnet system 9 of the transducer 1, which yoke is adapted to cooperate with the annular body 38, is not formed until the transducer 1 is mounted in an electroacoustic device, the ring projection 39 of the closing member 30 then being resiliently urged against a mating surface 40 of the electroacoustic device, while at the same time the acoustic impedance between the rear volume HV of the transducer 1 and the acoustic free space surrounding the transducer 1 is formed by means of the four passages 34, 35, 36 and 37, which acoustic impedance is required in order to obtain a desired acoustic characteristic of the transducer 1. In addition, the closing member 30 in the transducer 1 has both a positioning function and a fixing function because by means of the closing member 30 the transducer 1 is held in a desired operating position in an electroacoustic device in a stable manner after the transducer 1 has been mounted into this electroacoustic device, which is achieved mainly owing to the resilient action of the ring projection 39 of the closing member 30. A further advantage of the closing member 30 is that by means of the closing member, i.e. by means of the ring projection 39 of the closing member, it is possible to compensate for mounting height tolerances. Since the ring projection 39 projects outwardly from the ring projection 38 a gentle spring action is achieved by means of the ring projection. The provision of the stabilizing projections 42, 43, 44 and 45 guarantees that the contact surface 32 of the annular

body 38 is always acoustically sealed with respect to the contact portion 33 of the yoke 13, even when in view of the available space the annular body 38 is comparatively narrow and is therefore dimensionally less stable.

[0044] Figure 8 shows a part of a portable telephone 62 having a housing 63 which accommodates a support 64 carrying a printed circuit board 65.

[0045] The telephone 62 includes an electroacoustic transducer 1 in accordance with a second embodiment of the invention. The electroacoustic transducer 1 bears with its narrow annular bounding wall 5 on a positioning cylinder 66, which is also annular, the transducer 1 being urged against the positioning cylinder 66 by the resilient action of the ring projection 39, so that the transducer 1 is properly positioned and held in its operating position.

[0046] The closing member 30 of the transducer 1 shown in Figure 8 does not comprise any stabilizing projections. In order to ensure that in spite of the absence of the stabilizing projections the contact surface 32 of the annular body 38 and the contact portion 33 of the part, not indicated in Figure 8, of the transducer 1 always reliably engage against each other, the annular body 38 of the transducer 1 shown in Figure 1 is constructed so as to have a suitable dimensional stability. In Figure 8 two passages 34 and 36 of the closing member 30 are indicated by means of broken lines.

[0047] The invention is not limited to the two embodiments described above by way of examples. For example, the ring projection of a closing member can be connected to the annular body without a thinner portion and can in itself be elastically deformable as a whole and can consequently be movable against spring action.

Claims

1. An electroacoustic transducer comprising a diaphragm which is substantially centro-symmetrical with respect to a transducer axis and which is capable of vibrating in the direction of the transducer axis and comprising a voice coil connected to the diaphragm in the area of the rear volume of the transducer and comprising a magnet system which is substantially centro-symmetrical with respect to the transducer axis, which magnet system is accommodated in a housing of the transducer and comprises a magnet, a cover disc adjoining the magnet, and a substantially pot-shaped yoke comprising a core disc, which also adjoins the magnet, and a hollow cylindrical yoke portion which projects from the core disc in a direction parallel to the transducer axis, and which forms an annular air gap between the cover disc and the hollow cylindrical yoke portion, in which air gap the voice coil is arranged, and comprising a substantially annular closing member adapted to close the rear volume, which

closing member has a contact surface which extends parallel to a circle which is concentric with the transducer axis, which contact surface faces a contact portion of a part of the transducer, which part also bounds the rear volume,
and which closing member has at least one passage which terminates in its contact surface, for realizing an acoustic friction between the rear volume and the acoustic free space surrounding the transducer,

characterized in that

the magnet system is substantially hollow cylindrical and comprises an annular magnet and an annular cover disc as well as a hollow cylindrical yoke having an annular core disc from which the hollow cylindrical yoke portion projects in the area of its inner diameter,

and the closing member

comprises an annular body having an annular contact surface which extends transversely to the transducer axis and with which it faces the contact portion of said part of the transducer, which contact portion also extends transversely to the transducer axis,

and a ring projection, which projects obliquely from the annular body along its entire circumference and is movable against spring action, by means of which ring projection an acoustic sealing with a mating surface can be achieved,

and the at least one passage terminates in the annular contact surface of the annular body, which surface extends transversely to the transducer axis.

2. A transducer as claimed in Claim 1, **characterized in that** the ring projection of the closing member projects from the annular body of the closing member in a direction away from the transducer axis.
3. A transducer as claimed in Claim 1 or 2, **characterized in that** a plurality of stabilizing projections, which are spaced at equal angles from one another, project obliquely from the annular body of the closing member in directions with respect to the transducer axis which are opposite to that of the ring projection.
4. A transducer as claimed in Claim 3, **characterized in that** the stabilizing projections project from the annular body of the closing member at substantially the same angle as the ring projection.
5. A transducer as claimed in Claim 3 or 4, **characterized in that** the closing member comprises a given number of stabilizing projections and an equal number of passages, and each stabilizing projection and each passage is disposed symmetrically with respect to a radial direction.

6. A transducer as claimed in any one of the preceding Claims,

characterized in that a plurality of angularly equispaced projections, which extend substantially in the direction of the transducer axis, are connected to the annular body of the closing member, by means of which projections the closing member can be connected to the a part of the transducer in order to retain the closing member.

7. A transducer as claimed in any one of the preceding Claims,

characterized in that the closing member is made of a plastic, preferably polyacetal.

8. A transducer as claimed in any one of the preceding Claims,

characterized in that the transducer can be provided with differently constructed closing members which differ from one another with respect to the implementation of the passages provided in order to realize acoustic frictions and which consequently result in different acoustic characteristics of the transducer.

Patentansprüche

1. Elektroakustischer Wandler
mit einer Membran, die gegenüber einer Wandlerachse im Wesentlichen zentralsymmetrisch ist, und die imstande ist, in der Richtung der Achse des Wandlers zu schwingen, und
mit einer Sprechspule, die im Bereich des Rückvolumens des Wandlers mit der Membran verbunden ist, und
mit einem Magnetsystem, das gegenüber der Wandlerachse im Wesentlichen zentralsymmetrisch ist,
wobei dieses Magnetsystem in einem Gehäuse des Wandlers untergebracht ist und einen Magneten, eine an dem Magneten anliegende Abdeckscheibe und ein im Wesentlichen topfförmiges Joch mit einer Kernscheibe, die ebenfalls an dem Magneten anliegt, sowie einen hohlen zylinderförmigen Jochteil aufweist, der von der Kernscheibe in einer Richtung zu der Wandlerachse herausragt, und einen ringförmigen Luftspalt zwischen der Abdeckscheibe und dem hohlen zylinderförmigen Jochteil bildet, wobei in diesem Luftspalt die Sprechspule vorgesehen ist, und
mit einem im Wesentlichen ringförmigen Verschlussenteil zum verschließen des Rückvolumens, wobei dieser Verschlussenteil eine Kontaktfläche hat, die sich parallel zu einem Kreis erstreckt, der konzentrisch zu der Wandlerachse ist, wobei diese Kontaktfläche einem Kontaktteil eines Teils des Wandlers zugewandt ist, wobei dieser Teil ebenfalls

das Rückvolumen begrenzt,
und wobei dieser Verschlusssteil wenigstens einen Durchgang hat, der in der Kontaktfläche endet, zur Verwirklichung einer akustischen Reibung zwischen dem Rückvolumen und dem den Wandler umgebenden akustisch freien Raum,

dadurch gekennzeichnet, dass

das Magnetsystem im Wesentlichen hohl zylinderförmig ist und einen Ringmagneten, eine ringförmige Abdeckscheibe sowie ein hohles zylinderförmiges Joch mit einer ringförmigen Kernscheibe aufweist, von der aus der hohle zylinderförmige Jochteil in das Gebiet des inneren Durchmessers hervorragt,

und dass der Verschlusssteil einen ringförmigen Körper mit einer ringförmigen Kontaktfläche aufweist, die sich quer zu der Wandlerachse erstreckt und mit der er dem Kontaktteil des genannten Teils des Wandlers zugewandt ist, wobei dieser Kontaktteil ebenfalls sich quer zu der Wandlerachse erstreckt, und einen Ringvorsprung aufweist, der von dem ringförmigen Körper längs des ganzen Umfangs schräg hervorragt und entgegen Federwirkung verlagerbar ist, wobei mit Hilfe dieses Ringvorsprungs eine akustische Abdichtung mit einer passenden Fläche erreicht werden kann,

und der wenigstens eine Durchgang in der ringförmigen Kontaktfläche des ringförmigen Körpers endet, wobei diese Fläche sich quer zu der Wandlerachse erstreckt.

2. Wandler nach Anspruch 1, **dadurch gekennzeichnet, dass** der Ringvorsprung des Verschlusssteils von dem ringförmigen Körper des Verschlusssteils in einer Richtung weg von der Wandlerachse hervorragt.
3. Wandler nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** eine Anzahl Stabilisierungsvorsprünge, die in gleichen Abständen voneinander liegen, von dem ringförmigen Körper des Verschlusssteils schräg hervorragen, und zwar in Richtungen gegenüber der Wandlerachse, die entgegengesetzt sind zu der des ringförmigen Vorsprungs.
4. Wandler nach Anspruch 3, **dadurch gekennzeichnet, dass** die Stabilisierungsvorsprünge von dem ringförmigen Körper des Verschlusssteils hervorragen, und zwar in etwa dem gleichen Winkel wie der ringförmige Vorsprung.
5. Wandler nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** der Verschlusssteil eine bestimmte Anzahl Stabilisierungsvorsprünge und eine gleiche Anzahl Durchgänge aufweist, und dass jeder Stabilisierungsvorsprung und jeder Durchgang gegenüber einer radialen Richtung symme-

trisch vorgesehen sind.

6. Wandler nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** eine Anzahl winkelmäßig in gleichen Abständen voneinander liegender Vorsprünge, die sich im Wesentlichen in der Richtung der Wandlerachse erstrecken, mit dem ringförmigen Körper des Verschlusssteils verbunden sind, wobei mit Hilfe dieser Vorsprünge der Verschlusssteil mit einem Teil des Wandlers verbunden werden kann um den Verschlusssteil festzuhalten.
7. Wandler nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der Verschlusssteil aus einem Kunststoff, vorzugsweise Polyazetal, hergestellt ist.
8. Wandler nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der Wandler mit verschiedenen konstruierten Verschlusssteilen versehen werden kann, die in Bezug auf die Implementierung der Durchgänge voneinander abweichen, vorgesehen zum Verwirklichen akustischer Reibungen und was folglich zu verschiedenen akustischen Charakteristiken des Wandlers führt.

Revendications

1. Transducteur électroacoustique
comprenant une membrane qui est sensiblement symétrique par rapport à un axe de transducteur se trouvant au centre et qui est capable de vibrer dans la direction de l'axe de transducteur, et comprenant une bobine mobile connectée à la membrane dans la zone du volume arrière du transducteur,
et comprenant un système d'aimant qui est sensiblement symétrique par rapport à l'axe de transducteur se trouvant au centre ;
lequel système d'aimant est logé dans un logement du transducteur et comprend un aimant, un disque de couverture étant contigu à l'aimant, et une culasse sensiblement en forme de pot comprenant un disque central, qui est également contigu à l'aimant, et une partie de culasse cylindrique creuse qui fait saillie du disque central dans une direction parallèle à l'axe de transducteur,
et qui forme un entrefer annulaire entre le disque de couverture et la partie de culasse cylindrique creuse, entrefer dans lequel la bobine mobile est montée,
et comprenant un organe de fermeture sensiblement annulaire propre à fermer le volume arrière, lequel organe de fermeture comprend une surface de contact qui s'étend parallèlement à un cercle qui est concentrique par rapport à l'axe de transducteur, laquelle surface de contact est tournée

vers une partie de contact d'une partie du transducteur, laquelle partie délimite également le volume arrière,

et lequel organe de fermeture comprend au moins un passage qui se termine dans sa surface de contact, pour réaliser un frottement acoustique entre le volume arrière et l'espace libre acoustique entourant le transducteur ;

caractérisé en ce que

le système d'aimant est sensiblement cylindrique et creux et comprend un aimant annulaire et un disque de couverture annulaire ainsi qu'une culasse cylindrique creuse comportant un disque central annulaire depuis lequel la partie de culasse cylindrique creuse fait saillie dans la zone de son diamètre interne,

et l'organe de fermeture comprend

un corps annulaire comportant une surface de contact annulaire qui s'étend transversalement par rapport à l'axe de transducteur et avec laquelle elle est tournée vers la partie de contact de ladite partie du transducteur, laquelle partie de contact s'étend également transversalement par rapport à l'axe de transducteur,

et une saillie circulaire, qui fait saillie obliquement du corps annulaire sur toute sa circonférence et peut se déplacer contre l'action de ressort, saillie circulaire au moyen de laquelle une étanchéité acoustique avec une surface correspondante peut être obtenue,

et le au moins un passage se termine dans la surface de contact annulaire du corps annulaire, laquelle surface s'étend transversalement par rapport à l'axe de transducteur.

2. Transducteur suivant la revendication 1, **caractérisé en ce que** la saillie circulaire de l'organe de fermeture fait saillie du corps annulaire de l'organe de fermeture dans une direction s'éloignant de l'axe de transducteur.

3. Transducteur suivant la revendication 1 ou 2, **caractérisé en ce qu'une** pluralité de saillies de stabilisation, qui sont espacées à angles égaux les unes des autres, font saillie obliquement du corps annulaire de l'organe de fermeture dans des directions par rapport à l'axe de transducteur qui sont opposées à celle de la saillie circulaire.

4. Transducteur suivant la revendication 3, **caractérisé en ce que** les saillies de stabilisation font saillie du corps annulaire de l'organe de fermeture à sensiblement le même angle que la saillie annulaire.

5. Transducteur suivant la revendication 3 ou 4, **caractérisé en ce que** l'organe de fermeture comprend un nombre donné de saillies de stabilisation et un nombre égal de passages, et chaque saillie

de stabilisation et chaque passage sont disposés symétriquement par rapport à une direction radiale.

6. Transducteur suivant l'une quelconque des revendications précédentes, **caractérisé en ce qu'une** pluralité de saillies angulairement équidistantes, qui s'étendent sensiblement dans la direction de l'axe de transducteur, sont reliées au corps annulaire de l'organe de fermeture, saillies au moyen desquelles l'organe de fermeture peut être relié à la partie du transducteur afin de retenir l'organe de fermeture.

7. Transducteur suivant l'une quelconque des revendications précédentes, **caractérisé en ce que** l'organe de fermeture est en plastique, de préférence en polyacétal.

8. Transducteur suivant l'une quelconque des revendications précédentes, **caractérisé en ce que** le transducteur peut être muni d'organes de fermeture de construction différente qui diffèrent les uns des autres sur le plan de la mise en oeuvre des passages prévus afin de réaliser des frottements acoustiques et qui donnent par conséquent des caractéristiques acoustiques différentes du transducteur.

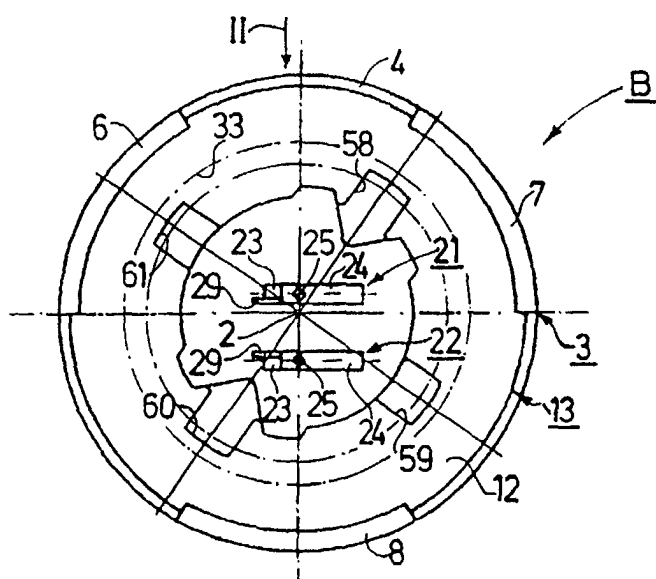


FIG. 1

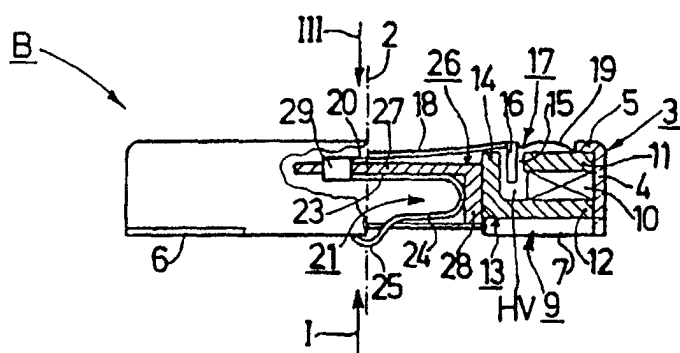


FIG. 2

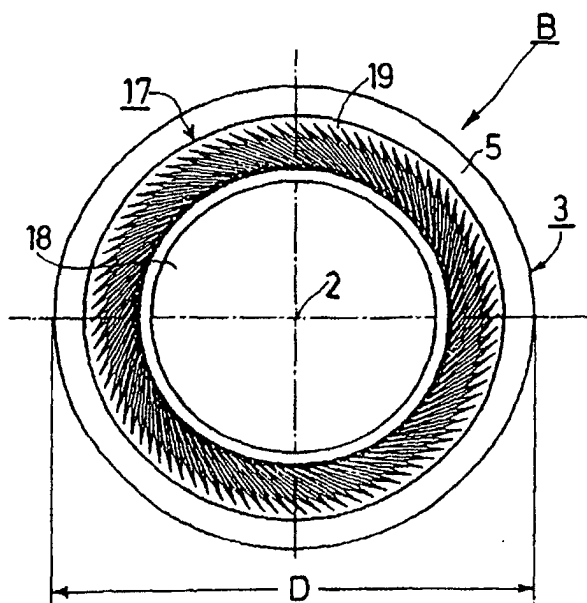


FIG. 3

