

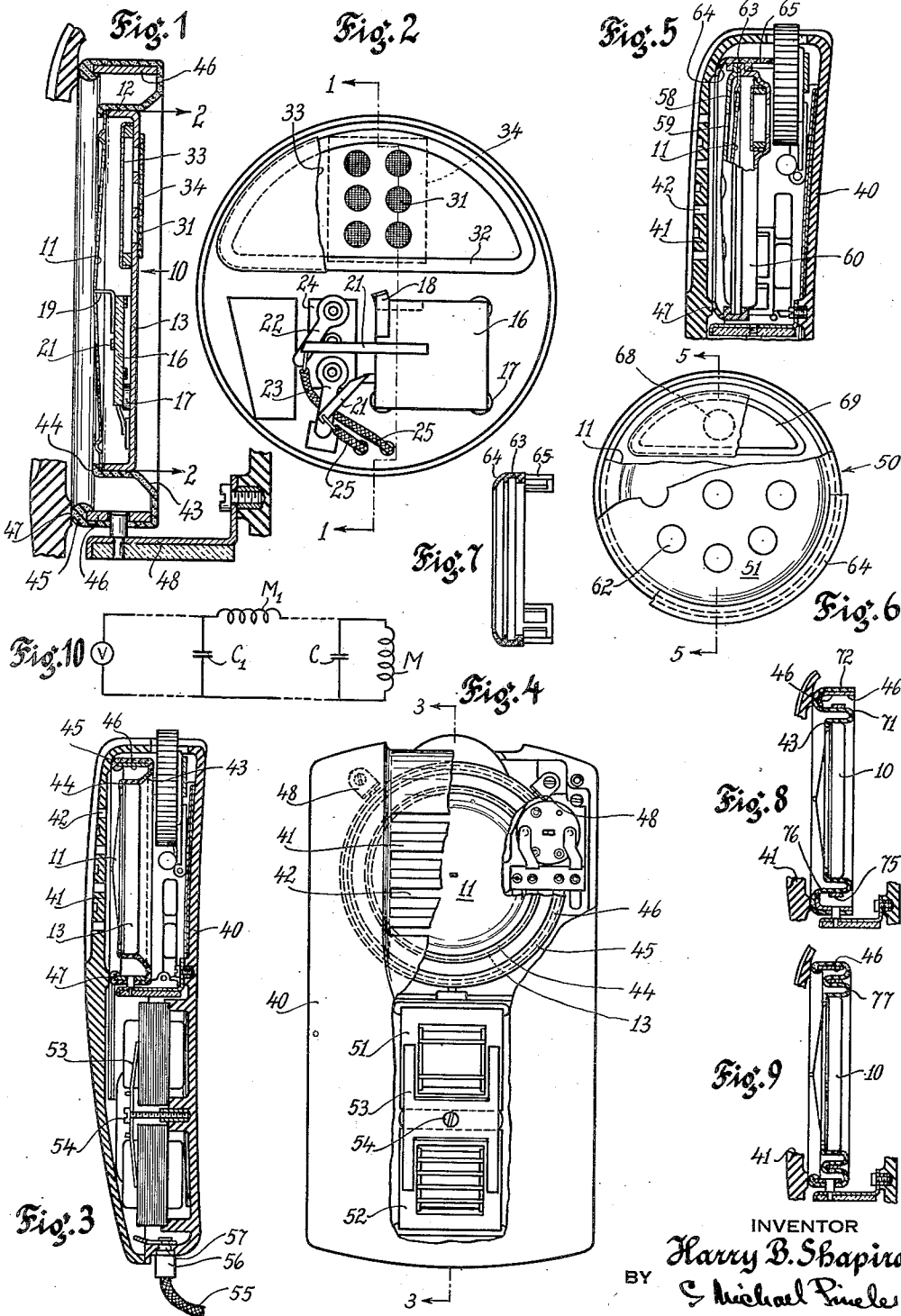
Aug. 17, 1943.

H. B. SHAPIRO

2,327,137

HEARING AID MICROPHONE

Filed May 21, 1941



INVENTOR
Harry B. Shapiro
 BY **S. Michael Pines**
 ATTORNEY

UNITED STATES PATENT OFFICE

2,327,137

HEARING AID MICROPHONE

Harry B. Shapiro, Cleveland, Ohio, assignor to
Sonotone Corporation, Elmsford, N. Y., a cor-
poration of New York

Application May 21, 1941, Serial No. 394,527

22 Claims. (Cl. 179—107)

This application is a continuation-in-part of my application Serial No. 294,649, filed September 13, 1939, and my application Serial No. 350,595, filed August 3, 1940.

This invention relates to hearing aid microphones, and particularly to such microphones which are mounted in the interior of a flat enclosing casing and interconnected through a cord with the other elements of a hearing aid, all of which are designed to be small enough for inconspicuous wear on the body of the user.

Among the objects of the invention is a microphone arrangement of the foregoing type in which the microphone unit is yieldably carried in its operative position within its casing by a supporting member comprising elements of yieldable material proportioned and arranged so as to effectively impede the propagation of mechanical vibrations from the walls of the casing to the microphone unit by maintaining the microphone unit in its operative position within the casing; providing the yieldable support of such microphone with an endless sheet portion of yieldable material extending between the periphery of the microphone unit and the periphery of the acoustically-pervious casing wall portion for providing an acoustic barrier separating the space between the diaphragm forming the front of the microphone from the space of the casing in the back of the microphone; arranging the acoustically-pervious wall portion of the microphone casing lying in front of the microphone diaphragm so that its exterior surface is recessed relatively to the adjacent bordering wall portions of the casing, and thereby keep a garment portion resting over the casing out of contact with the acoustically-pervious wall portion; and combining the microphone casing with substantial masses so proportioned and located along the wall of the casing in relation to the location of the microphone as to impede and suppress the propagation of mechanical voice vibrations along the walls of the casing toward the microphone.

The foregoing and other objects of the invention will be best understood from the following description of exemplifications thereof, reference being had to the accompanying drawing, wherein

Fig. 1 is a vertical cross-sectional view along line 1—1 of Fig. 2 of a hearing aid microphone exemplifying the invention;

Fig. 2 is a view along line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view along line 3—3 of Fig. 4 illustrating a wearable electron tube amplifier unit with the microphone of Figs. 1 and 2 mounted therein;

Fig. 4 is a front elevational view of the microphone of Fig. 3 with parts broken away;

Fig. 5 is a view similar to Fig. 1 illustrating a modified arrangement of the microphone;

Fig. 6 is a front view of the microphone of Fig. 5;

Fig. 7 is a detailed cross-sectional view of the yieldable supporting collar of the microphone supporting member of Fig. 5;

Figs. 8 and 9 are views similar to Fig. 1 illustrating other forms of microphone arrangements of the invention; and

Fig. 10 is an electrical circuit analogous to the mechanical arrangement of the elements of the microphone arrangements of the invention.

Hearing aid microphones, and particularly high impedance hearing aid microphones, which are used as a part of a high gain electron amplifier hearing aid, have to operate under conditions utterly different from those encountered in other microphone applications. This is due to the fact that the amplifier casing in which the microphone must be housed has to be worn more or less hidden under the clothing of the user and has to be connected by a cord to the receiver and the battery, resulting in noise vibrations caused by rubbing with the clothing or the like imparted to the cord and to the casing and propagated along the walls of the casing to the microphone.

The microphone arrangements of the invention, various forms of which are shown in the drawing, effectively impede and suppress the propagation of mechanical noise vibrations from the casing to the microphone unit held in its operative position behind the sound-pervious wall of the casing. One form of such microphone arrangement is shown in connection with Figs. 3 and 4 illustrating a flat compact casing 40 small enough for inconspicuous wear in the vest pocket or under any garment portion of the user, the casing serving to house an electron tube amplifier and a microphone forming a part of an electron tube amplifier hearing aid which may be arranged in the way described in my copending application Serial No. 294,649, filed September 13, 1939, the specification of which is hereby made a part hereof.

In the form shown, the microphone unit itself, illustrated in detail in Figs. 1 and 2, comprises an outwardly tapering conically-shaped light vibratory diaphragm 11 having its peripheral edge sealed to the flange 12 of a shallow casing wall 13, so as to form a flat cavity. The diaphragm 11 is very thin so as to reduce its mass, and its

outwardly tapered shallow conical shape in combination with the peripheral corrugation 14 gives it the desired stiffness, while confining the dimensions of the cavity to a very narrow space, being in its central part just wide enough to house a Rochelle salt crystal transducer unit 16. As an alternative, an electret-type condenser-transducer structure may be mounted in the cavity and arranged to be actuated by the diaphragm.

In the form shown, a standard Rochelle salt crystal bimorph 16 of the twister type is used having overall dimensions of $\frac{5}{8} \times \frac{5}{8} \times \frac{1}{2}$ of an inch. Three corners of the crystal unit are secured across spacer pads 17 to the inner face of the casing wall 13, the spacer pads 17 being of a slightly yieldable highly viscous material. To the free corner of the crystal 16 which is located underneath the vertex of the conical diaphragm 11 is secured a metallic mounting strip 18 of a driving link 19, the outer end of which is united, as by cementing, to the tip of the diaphragm 11 so that vibrations of the diaphragm are transmitted to the bimorph 16.

One electrode layer of the crystal 16 is connected through a foil strip 21 to a terminal tip 22 which is riveted over an insulating strip 24 to the rear wall 13 of the casing, the insulating strip 24 serving also as an insulating support for another terminal tip 23 to which is connected a similar foil strip 21 extending from the other electrode layer of the crystal. Two insulated cord leads 25 connected to the two terminal tips 22, 23 and tightly sealed by vapor-proof seals in small holes of the cavity wall 13 provide the external microphone output leads.

The shallow casing wall 13 enclosing the microphone cavity is provided with vent holes 31 and an overlying auxiliary diaphragm 33 and is designed and arranged to cooperate with the associated elements of the microphone unit in accordance with the principles of the invention disclosed and forming part of the invention claimed in my application Serial No. 350,595, filed August 3, 1940, the specification of which is hereby made a part hereof.

The microphone unit is held in its operative position within the casing 40 behind its recessed wall portion 41 which is provided with vent slits 42 so as to render it acoustically pervious, the diaphragm 11 of the microphone facing the acoustically-pervious wall portion 41 of the casing. The microphone unit is yieldably supported, behind the acoustically-pervious recessed wall 41 of the casing so that sound is propagated through the vents 42 for actuating the diaphragm 11 of the microphone.

A supporting member 43 formed of resiliently yieldable sound-absorbing and damping sheet material, such as Neoprene or a suitable rubber, has an outer peripheral portion folded and united, as by cementing, over a supporting collar 44 to form in front thereof a sealing bead 45 sealingly engaging and held against the adjacent inner surface portion of the casing surrounding the acoustically-pervious wall portion 41 thereof, and a radially spaced inner portion 46 of the channel-like sheet member 43 is united, as by cementing, to the periphery of the microphone unit so as to hold it floatingly spaced from the walls of the casing 40 as well as all other structural elements housed therein, while constituting an acoustic seal or barrier separating the space between the microphone diaphragm 11 and the sound-pervious wall portion 41 from

the space in the casing lying in the back of the microphone unit.

As explained in my copending application Serial No. 294,649, referred to above, the casing 40 also houses the elements of the electron tube amplifier which utilizes a magnetic core inductance 51 and a magnetic core transformer 52 which are suitably clamped as by a clamping member 53 and a clamping bolt 54 against the rear wall of the casing 40. The hearing aid elements housed in the casing are interconnected to the other elements of the hearing aid, namely, the battery and the receiver, not shown in the drawing, by a suitable cord 55 having a plug member 56 arranged for establishing detachable engagement with the socket terminals 57 suitably secured in a flanged border wall portion of the casing 40. The portion of the recessed casing wall 41 facing the microphone unit is reinforced by an annularly shaped ridge formation 47 against which the sealing portion 45 of the supporting member is sealingly held through the engagement of its supporting collar 44 with three brackets 48 having legs suitably secured to the rear wall of the casing 40 so as to keep the microphone unit in its operative position within the casing, while permitting assembly of its front wall with the acoustically-pervious wall portion 41 without disturbing the location of the elements forming the microphone amplifier assembly housed in the casing.

By interposing the relatively large mass of the amplifier casing which is increased by the mass of the magnetic core structures 51, 52 between the yieldable vibration absorbing support 43, which holds the microphone unit floatingly spaced from the casing structure, the mechanical propagation of rubbing noises reaching the casing by propagation along the cord 55 or directly imparted by rubbing with a garment portion held in contact with the casing, is effectively impeded and suppressed.

The collar 44 associated with the yieldable support 43 is of a width somewhat larger than the overall thickness of the microphone unit so as to protect the microphone unit against contact with the casing or any other elements housed therein, while keeping it yieldably suspended on the yieldable supporting member 43 in the inner space of the collar and at the same time providing an acoustic seal around the space between the diaphragm and the acoustically-pervious recessed wall 41 of the casing. The delicate diaphragm is additionally protected against disturbance through an external force by mounting in front of it a dome-shaped plate 58 having openings 59 through which sound is propagated to the diaphragm 11 and having its periphery held against the periphery of the microphone unit, for instance, by cementing it thereto or by holding it clamped thereto by the overlying edge portion of the yieldable supporting member 43 engaging the periphery of the microphone unit.

By recessing the acoustically-pervious wall portion 41 of the casing behind which the microphone is mounted relatively to the bordering exterior wall surfaces of the casing 40, garment parts which come in contact with the exterior wall surface of the casing are kept away from the edges of the vent openings 42 so as to prevent generation of noise by rubbing thereon; and by keeping the microphone yieldably suspended and spaced from the amplifier casing unit, mechanical

propagation of noise to the microphone is suppressed.

In Figs. 5 and 6 is shown a modified form of microphone arrangement of the invention. In this arrangement, the periphery of the microphone 60 is yieldably supported by the intermediate portion of a collar 63 of resiliently yieldable sheet material, having a circular front portion 64 held in engagement with the facing inner surface bordering the recessed wall portion 41 of the amplifier casing so as to form an acoustic seal between the diaphragm 11 and the recessed acoustically-pervious wall, the yieldable collar 63 having rearwardly extending projections 65 resting on the structure of the electron tube amplifier assembly underlying the microphone 60.

The rear wall 66 of the extremely thin microphone unit 60 enclosing its cavity has a very shallow rearwardly depressed wall portion 67 provided with a vent hole 68 which is enclosed by a diaphragm 69 and designed in the way disclosed in my aforesaid copending application Serial No. 350,595, filed August 3, 1940.

In the microphone arrangements described above in connection with Figs. 1 to 4 and 5 to 7, respectively, the resiliently yieldable supporting members 43 and 65, respectively, which form the sole support carrying the microphone in the microphone casing, are so designed and proportioned as to constitute with the associated elements of the microphone structure and its support a mechanical filter which bypasses the mechanical noise vibrations on their path from the casing to the microphone unit before they reach the microphone unit. In other words, the mechanical filter suppresses the noise vibrations and prevents their reaching the microphone unit.

A microphone support forming such mechanical filter may be represented by an analogous electrical circuit diagram, such as shown in Fig. 10, in which V represents the source of the mechanical noise vibrations, C the stiffness of the resilient support interposed between the mass of the microphone unit and the wall portions of the casing which hold in position the yieldable microphone support, and M the mass of the microphone unit. In the practical construction of a microphone, such as shown in Figs. 1 to 3, the elements of the mechanical filter are so designed that disturbing noise vibrations, for instance, all vibrations above 200 cycles, should be suppressed and bypassed by the action of the resilient support, represented by the condenser C, before they reach the microphone unit, represented by the mass M, the elements M_1 and C_1 not forming part of this system.

The effectiveness of such microphone support in suppressing noise vibrations may be increased by resorting to an arrangement, such as shown in Fig. 8. In this arrangement, the mass of the microphone unit 10 is suspended on a supporting member 71 formed of an endless sheet portion of resiliently yieldable material, such as rubber, bent to have a wavy transverse cross section, the outer edge portion 72 of the sheet member 71 being secured, as by cementing, to a metallic collar 46, and the inner edge portion 73 of the sheet member being affixed to the microphone unit so as to keep it suspended in back of the sound-pervious wall portion 41 of the microphone casing, as in the arrangement of Fig. 1. An additional ring member 75 of metal, for instance, is united, as by cementing, to the intermediate portion 76 of the resilient supporting sheet member 71.

In the microphone arrangement of Fig. 8, the mass of the microphone unit 10 and the stiffness of the resilient sheet portion 71 extending between the microphone 10 and the ring 75 may be represented by the mass M and the condenser C of Fig. 10; and the mass of the ring 75 and the stiffness of the resilient sheet portion extending between the ring 75 and the outer ring 72 may be represented by the inductance M_1 and the condenser C_1 , indicated in Fig. 10 in dotted lines as an additional filter section connected in series with the filter section formed by the mass M and the condenser C to increase the overall effectiveness of the filter system in suppressing the noise vibrations before they reach the microphone unit.

Fig. 9 illustrates a modified microphone arrangement similar to Fig. 8, differing thereover only by the different shape imparted to the yieldable supporting sheet member 77 which is utilized to form the resilient members of the two filter sections.

The principles of the invention explained in connection with specific exemplifications thereof will suggest to those skilled in the art many other applications and modifications of the same. It is accordingly desired that the appended claims be construed broadly, and that they shall not be limited to the specific details shown and described in connection with exemplifications thereof.

I claim:

1. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical noise vibrations due to rubbing contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit housed in said casing having a diaphragm; a supporting member comprising elements of yieldable material held in said casing and yieldably carrying said microphone unit in a relatively movable condition so that the microphone diaphragm faces operatively said acoustically-pervious wall portion; said supporting member having an endless sheet portion of yieldable material extending between said microphone unit and the periphery of the casing wall portion surrounding said acoustically-pervious wall portion so as to constitute an acoustic barrier interposed between the casing space in the back of said microphone and the space between its diaphragm and said acoustically-pervious wall portion; the yieldable elements of said supporting member including the sheet portion interposed between the microphone unit and the casing walls being so arranged, and being proportioned to have sufficient self-restoring yieldability, as to effectively impede the propagation of mechanical vibrations from the walls of said casing to said microphone unit, while maintaining said microphone unit in its operative position within said casing.

2. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical rubbing vibrations due to contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit housed in said casing having a diaphragm facing said acoustically-pervious wall portion; a supporting member comprising elements of restoringly yieldable material held in said casing and forming the sole support yieldably carrying said microphone

unit so that the microphone diaphragm faces operatively said acoustically-pervious wall portion; said supporting member having an endless sheet portion of restoringly yieldable material extending between said microphone unit and the periphery of the casing wall portion surrounding said acoustically-pervious wall portion so as to constitute an acoustic barrier interposed between the casing space in the back of said microphone and the space between its diaphragm and said acoustically-pervious wall portion; the yieldable elements of said supporting member including the sheet portion interposed between the microphone unit and the casing walls being so arranged, and being proportioned to have sufficient self-restoring yieldability, as to effectively impede the propagation of mechanical vibrations from the walls of said casing to said microphone unit, while maintaining said microphone unit in its operative position within said casing.

3. In an electronic amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical rubbing vibrations due to contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit housed in said casing having a diaphragm facing said acoustically-pervious wall portion; a supporting member comprising elements of resiliently yieldable material held in said casing and yieldably carrying said microphone unit so that the microphone diaphragm faces operatively said acoustically-pervious wall portion; said supporting member having an endless generally channel-shaped resiliently-yieldable sheet portion of curved transverse cross section extending between said microphone unit and the periphery of the casing wall portion surrounding said acoustically-pervious wall portion so as to constitute an acoustic barrier interposed between the casing space in the back of said microphone and the space between its diaphragm and said acoustically-pervious wall portion; the yieldable elements of said supporting member including the sheet portion interposed between the microphone unit and the casing walls being so arranged, and being proportioned to have sufficient self-restoring yieldability, as to effectively impede the propagation of mechanical vibrations from the walls of said casing to said microphone unit, while maintaining said microphone unit in its operative position within said casing.

4. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a case having an exterior wall surface subjected to mechanical vibrations caused by rubbing contact with a garment portion of the user or the like; a microphone housed in said case; a noise-minimizing mounting having elements of yieldable material held in said case and yieldably carrying said microphone in a relatively movable position therein; said mounting comprising a resilient gasket curved in transverse section with its end portions adapted to be held in engagement with the microphone and case and arranged so that the gasket forms a laterally opening channel whose opposite walls are movable in all directions relative to each other and are effective in impeding the propagation of noise vibrations to the microphone.

5. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a case having an exterior wall surface subjected to mechanical vibrations caused

by rubbing contact with a garment portion of the user or the like; said case having an acoustically-pervious wall portion; a microphone housed in said case having a diaphragm exposed to said pervious wall portion; a noise-minimizing mounting having elements of yieldable material held in said case and yieldably carrying said microphone in a relatively movable position therein; said mounting comprising a resilient gasket adapted to surround the microphone and being curved in transverse section with its end portions adapted to be held in engagement with the microphone and the facing surface of the casing surrounding the acoustically-pervious wall portion of the case adjacent the microphone's diaphragm, and arranged so that the gasket forms a laterally opening channel whose opposite walls are movable in all directions relative to each other and are effective in impeding the propagation of noise vibrations to the microphone.

6. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a case having an exterior wall surface subjected to mechanical vibrations caused by rubbing contact with a garment portion of the user or the like; a microphone disposed in said case spaced from its sides; and a resilient gasket curved in transverse section with its end portions held in engagement with the microphone and adjacent side of the case, and arranged so that the gasket forms a laterally opening channel whose opposite walls are movable in all directions relative to each other and constitutes the sole support for the microphone carrying it floatingly in the case, for impeding the propagation of noise vibrations to the microphone.

7. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a case having an exterior wall surface subjected to mechanical vibrations caused by rubbing contact with a garment portion of the user or the like; said case having an acoustically-pervious wall portion; a microphone disposed in said case spaced from its sides and having a diaphragm exposed to said pervious wall portion; and a resilient gasket surrounding the microphone and holding it against the acoustically-pervious wall portion of the case so as to substantially seal acoustically the space between said wall portion and the diaphragm against the space in the back of the microphone; said gasket being curved in transverse section with only its end portions in engagement with the microphone and case and forming a laterally opening channel whose walls are movable toward and away from each other, and are effective in impeding the propagation of noise vibrations to the microphone; the back of the microphone being spaced from the back of the case.

8. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a case having an exterior wall surface subjected to mechanical vibrations caused by rubbing contact with a garment portion of the user or the like; a microphone disposed in said case spaced from its sides; a resilient gasket curved in transverse section to form an outwardly opening channel the inner wall of which is connected to the microphone; and means including a clamping ring overlying the outer wall of said channel for detachably holding said ring and therethrough the gasket against the case; said gasket having sufficient resiliency so as to

be effective in impeding the propagation of noise vibrations to the microphone.

9. In a portable microphone instrument to be worn on the person, as a part of a hearing aid apparatus, having an outside casing therefor provided with a sound-pervious wall portion, a microphone enclosed thereby, and a supporting member comprising elements of pliant stretchable rubber-like material carrying said microphone suspended in a bodily freely movable condition within said casing so as to insulate said microphone against the communication thereto of vibrations set up in the said outside casing by scratching or contact or friction thereon, said supporting member having an endless sheet portion of yieldable material extending between the microphone and a casing portion surrounding said sound-pervious wall portion so as to constitute a sound barrier confining the space between the microphone and the sound-pervious wall portion.

10. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical rubbing vibrations due to contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit supported in the interior of said casing and having a diaphragm facing said acoustically-pervious wall portion; substantially the entire exterior area of said acoustically-pervious wall portion of the casing being recessed relatively to the adjacent bordering exterior surface portions of the casing and being free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

11. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical rubbing vibrations due to contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit supported in the interior of said casing and having a diaphragm facing said acoustically-pervious wall portion; inwardly facing wall portions of said casing having inwardly extending elements of relatively great specific weight and substantial mass united to said inwardly facing wall portion and constituting therewith a massive structure so arranged relatively to the location of said microphone unit and so proportioned as to impede propagation of mechanical noise vibrations past said inwardly facing wall portions toward said acoustically-pervious wall portion; substantially the entire exterior area of said acoustically-pervious wall portion of the casing being recessed relatively to the adjacent bordering exterior surface portions of the casing and being free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

12. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical rubbing vibrations due to contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit supported in the interior of said casing and having a diaphragm facing said acoustically-pervious wall portion; another portion of said casing constitut-

ing a wall support for ends of cord leads forming part of said hearing aid; inwardly facing wall portions of said casing, located between said acoustically-pervious wall portion and said wall support, having inwardly extending elements of relatively great specific weight and substantial mass united to said inwardly facing wall portion and constituting therewith a massive structure so arranged and proportioned relatively to said microphone unit as to impede propagation of mechanical noise vibrations from said wall support past said inwardly facing wall portions toward said acoustically-pervious wall portion.

13. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical rubbing vibrations due to contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit supported in the interior of said casing and having a diaphragm facing said acoustically-pervious wall portion; another portion of said casing constituting a wall support for ends of cord leads forming part of said hearing aid; inwardly facing wall portions of said casing, located between said acoustically-pervious wall portion and said wall support, having inwardly extending elements of relatively great specific weight and substantial mass united to said inwardly facing wall portion and constituting therewith a massive structure so arranged and proportioned relatively to said microphone unit as to impede propagation of mechanical noise vibrations from said wall support past said inwardly facing wall portions toward said acoustically-pervious wall portion; substantially the entire exterior area of said acoustically-pervious wall portion of the casing being recessed relatively to the adjacent bordering exterior surface portions of the casing and being free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

14. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical noise vibrations due to rubbing contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit housed in said casing having a diaphragm; a supporting member comprising elements of yieldable material held in said casing and yieldably carrying said microphone unit in a relatively movable condition so that the microphone diaphragm faces operatively said acoustically-pervious wall portion; said supporting member having an endless sheet portion of yieldable material extending between said microphone unit and the periphery of the casing wall portion surrounding said acoustically-pervious wall portion so as to constitute an acoustic barrier interposed between the casing space in the back of said microphone and the space between its diaphragm and said acoustically-pervious wall portion; the yieldable elements of said supporting member including the sheet portion interposed between the microphone unit and the casing walls being so arranged, and being proportioned to have sufficient self-restoring yieldability, as to effectively impede the propagation of mechanical vibrations from the walls of said casing to said microphone unit, while maintaining said microphone unit in its operative position within said casing; another

portion of said casing constituting a wall support for ends of cord leads forming part of said hearing aid; inwardly facing wall portions of said casing, located between said acoustically-pervious wall portion and said wall support, having inwardly extending elements of relatively great specific weight and substantial mass united to said inwardly facing wall portion and constituting therewith a massive structure so arranged and proportioned relatively to said microphone unit as to impede propagation of mechanical noise vibrations from said wall support past said inwardly facing wall portions toward said acoustically-pervious wall portion.

15. In an amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical rubbing vibrations due to contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit housed in said casing having a diaphragm facing said acoustically-pervious wall portion; a supporting member comprising elements of restoringly yieldable material held in said casing and forming the sole support yieldably carrying said microphone unit so that the microphone diaphragm faces operatively said acoustically-pervious wall portion; said supporting member having an endless sheet portion of restoringly yieldable material extending between said microphone unit and the periphery of the casing wall portion surrounding said acoustically-pervious wall portion so as to constitute an acoustic barrier interposed between the casing space in the back of said microphone and the space between its diaphragm and said acoustically-pervious wall portion; the yieldable elements of said supporting member including the sheet portion interposed between the microphone unit and the casing walls being so arranged, and being proportioned to have sufficient self-restoring yieldability, as to effectively impede the propagation of mechanical vibrations from the walls of the casing to said microphone unit, while maintaining said microphone unit in its operative position within said casing; another portion of said casing constituting a wall support for ends of cord leads forming part of said hearing aid; inwardly facing wall portions of said casing, located between said acoustically-pervious wall portion and said wall support, having inwardly extending elements of relatively great specific weight and substantial mass united to said inwardly facing wall portion and constituting therewith a massive structure so arranged and proportioned relatively to said microphone unit as to impede propagation of mechanical noise vibrations from said wall support past said inwardly facing wall portions toward said acoustically-pervious wall portion.

16. In an electronic amplifier hearing aid designed to be small enough for inconspicuous wear on the body of the user: a casing having an exterior wall surface exposed to mechanical rubbing vibrations due to contact with a garment portion of the user; said casing including an acoustically-pervious wall portion; a microphone unit housed in said casing having a diaphragm facing said acoustically-pervious wall portion; a supporting member comprising elements of resiliently yieldable material held in said casing and yieldably carrying said microphone unit so that the microphone diaphragm faces operatively said acoustically-pervious wall portion; said support-

ing member having an endless generally channel-shaped resiliently-yieldable sheet portion of curved transverse cross section extending between said microphone unit and the periphery of the casing wall portion surrounding said acoustically-pervious wall portion so as to constitute an acoustic barrier interposed between the casing space in the back of said microphone and the space between its diaphragm and said acoustically-pervious wall portion; the yieldable elements of said supporting member including the sheet portion interposed between the microphone unit and the casing walls being so arranged, and being proportioned to have sufficient self-restoring yieldability, as to effectively impede the propagation of mechanical vibrations from the walls of said casing to said microphone unit, while maintaining said microphone unit in its operative position within said casing; another portion of said casing constituting a wall support for ends of cord leads forming part of said hearing aid; inwardly facing wall portions of said casing, located between said acoustically-pervious wall portion and said wall support, having inwardly extending elements of relatively great specific weight and substantial mass united to said inwardly facing wall portion and constituting therewith a massive structure so arranged and proportioned relatively to said microphone unit as to impede propagation of mechanical noise vibrations from said wall support past said inwardly facing wall portions toward said acoustically-pervious wall portion.

17. A hearing aid microphone arrangement defined by claim 1, characterized by the fact that substantially the entire exterior area of the acoustically-pervious wall portion of the casing is recessed relatively to the adjacent bordering exterior surface portions of the casing and is free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

18. A hearing aid microphone arrangement defined by claim 2, characterized by the fact that substantially the entire exterior area of the acoustically-pervious wall portion of the casing is recessed relatively to the adjacent bordering exterior surface portions of the casing and is free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

19. A hearing aid microphone arrangement defined by claim 3, characterized by the fact that substantially the entire exterior area of the acoustically-pervious wall portion of the casing is recessed relatively to the adjacent bordering exterior surface portions of the casing and is free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

20. A hearing aid microphone arrangement defined by claim 14, characterized by the fact that substantially the entire exterior area of the acoustically-pervious wall portion of the casing is recessed relatively to the adjacent bordering exterior surface portions of the casing and is free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

21. A hearing aid microphone arrangement defined by claim 15, characterized by the fact that

substantially the entire exterior area of the acoustically-pervious wall portion of the casing is recessed relatively to the adjacent bordering exterior surface portions of the casing and is free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

22. A hearing aid microphone arrangement defined by claim 16, characterized by the fact that 10

substantially the entire exterior area of the acoustically-pervious wall portion of the casing is recessed relatively to the adjacent bordering exterior surface portions of the casing and is free from outward protuberances throughout its extent so that a garment portion overlying said exterior area is maintained out of contact with all the elements thereof.

HARRY B. SHAPIRO.