**What is claimed is:**

1. A hearing aid, comprising:

a housing having a first flange and a second flange, at least one of the first flange and the second flange comprising a conical shape;

a tympanic membrane actuation assembly disposed within the housing, comprising:

at least one mass configured to be disposed on at least one of a medial side or a lateral side of a tympanic membrane of a user, wherein the at least one mass comprises:

a first mass structure comprising a first energy source; and

a second mass structure comprising a second energy source, the second mass structure being coupled to the first mass structure by at least one connecting member; and

at least one actuator coupled to the mass and configured to be disposed within the at least one connecting member through the tympanic membrane of the user, the actuator being configured to convert electrical signals into mechanical motion to move the mass and modulate the tympanic membrane.

2. The hearing aid of claim 1, wherein the at least one actuator comprises:

an inner ring; and

an outer ring coupled to the inner ring, the outer ring comprising a plurality of piezoelectric actuators.

3. The hearing aid of claim 1, wherein the at least one actuator comprises:

a first disk; and

a second disk, the second disk being disposed over and coupled to the first disk through a plurality of piezoelectric actuators disposed between the first disk and the second disk.

4. The hearing aid of claim 1, wherein the at least one actuator comprises a piezoelectric stack actuator.

5. The hearing aid of claim 1, wherein the at least one actuator comprises a piezoelectric microtube.

6. The hearing aid of claim 1, wherein the tympanic membrane actuation assembly further comprises:

a piezo coupling arm lever coupled to the at least one actuator.

7. The hearing aid of claim 1, wherein the tympanic membrane actuation assembly further comprises:

a fixed coupling coupled to a top side of the at least one actuator.

8. The hearing aid of claim 1, wherein the tympanic membrane actuation assembly further comprises:

a rigid coupler coupled to the at least one actuator.

9. A hearing aid, which is insertable through a user's tympanic membrane to amplify certain frequencies and cancel other frequencies, comprising:

a housing, comprising:

a first portion configured to be disposed on a medial side of the tympanic membrane of the user, the first portion having a conical shape;

a second portion configured to be disposed on a lateral side of the tympanic membrane of the user;

a connecting portion disposed between the first portion and the second portion and configured to be disposed through the tympanic membrane of the user; and

a tympanic membrane actuation assembly, comprising:

at least one mass configured to be disposed on at least one of the medial side or the lateral side of the tympanic membrane of the user, wherein the at least one mass comprises:

a first mass structure comprising a first energy source; and

a second mass structure comprising a second energy source, the second mass structure being coupled to the first mass structure by at least one connecting member; and

at least one actuator coupled to the mass and configured to be disposed within the at least one connecting member through the tympanic membrane of the user, the actuator being configured to convert electrical signals into mechanical motion to move the mass and modulate the user's tympanic membrane.

10. The hearing aid of claim 9, wherein the at least one actuator is a tubular stacked piezoelectric actuator or a cylindrical stacked piezoelectric actuator.

11. The hearing aid of claim 9, further comprising an impedance matching component coupled to the at least one actuator.

12. The hearing aid of claim 11, wherein the impedance matching component is selected from a group consisting of lever arm displacement magnifiers, rigid couplers, and fixed couplings.

13. A hearing aid, which is insertable through a user's tympanic membrane to amplify certain frequencies and cancel other frequencies, comprising:

a housing having a first flange and a second flange having a groove therebetween, at least one of the first flange and the second flange comprising a conical shape and configured as a dilator, the housing enclosing:

a microphone;

a processor coupled to the microphone; and

a tympanic membrane actuation assembly, comprising:

a mass, the mass comprising:

a first battery disposed in the first flange; and

a second battery disposed in the second flange, the first battery being configured for placement on a lateral side of the tympanic membrane, the second battery being configured for placement on a medial side of the tympanic membrane;

a connecting member coupling the first battery to the second battery, the connecting member being configured for placement through the tympanic membrane; and

an actuator coupled to the mass and disposed within the connecting member, the actuator being configured to convert electrical signals into mechanical motion to move the mass and modulate the user's tympanic membrane.

14. The hearing aid of claim 13, wherein the actuator is a tubular stacked piezoelectric actuator or a cylindrical stacked piezoelectric actuator having a hole therein configured to allow the connecting member to pass therethrough.

15. The hearing aid of claim 14, wherein a height of the actuator is between about 1 millimeter and about 4 millimeters.

16. The hearing aid of claim 14, wherein an outer diameter of the actuator is between about 1 millimeter and about 2 millimeters.