

A CONNECTOR CONFIGURED TO ALLOW ACOUSTIC TRANSMISSION OR DIGITAL TRANSMISSION FOR A STETHOSCOPE

FIELD OF THE INVENTION:

This invention relates to the field of medical engineering.

Particularly, this invention relates to a connector configured to convert an acoustic stethoscope to a digital stethoscope.

BACKGROUND OF THE INVENTION:

Auscultation is the technique to hear internal body sounds of body. Using auscultation, a physician can tell about abnormality in a body. Auscultation is performed for the purposes of examining the circulatory and respiratory systems (heart and breath sounds), as well as the gastrointestinal system (bowel sounds).

Auscultation is a skill that requires substantial clinical experience, a fine stethoscope and good listening skills. Health professionals (doctors, nurses, etc.) listen to three main organs and organ systems during auscultation: the heart, the lungs, and the gastrointestinal system.

A stethoscope is an acoustic medical device for auscultation, or listening to the internal sounds of an animal or human body. It typically has a small disc-shaped resonator that is placed against the chest, and two tubes connected to earpieces. It is often used to listen to lung and heart sounds. It is also used to listen to intestines and blood flow in arteries and veins. In combination with a sphygmomanometer, it is commonly used for measurements of blood pressure.

An electronic stethoscope (or stethophone) overcomes the low sound levels by electronically amplifying body sounds. However, amplification of stethoscope contact artifacts, and component cutoffs (frequency response thresholds of electronic stethoscope microphones, pre-amps, amps, and speakers) limit electronically amplified stethoscopes' overall utility by amplifying mid-range sounds, while simultaneously attenuating high- and low- frequency range sounds.

Currently, a number of companies offer electronic stethoscopes. Electronic stethoscopes require conversion of acoustic sound waves to electrical signals which can then be amplified and processed for optimal listening.

Current digital stethoscope is mobile dependant for simultaneous auscultation and it changes the look of conventional stethoscope. For auscultation, medical practitioner has to be within a certain distance because of the stethoscope tubing. During epidemics this becomes a problem for medical practitioner as he / she is prone to get affected.

To increase the amplitude and to record and analyse body sounds, a digital stethoscope is required which has gain which is very large than a conventional acoustic stethoscope.

Moreover, there is a need for a connector which can convert any acoustic stethoscope into an electronic stethoscope. Additionally, there is a need for a connector which can convert an acoustic stethoscope into a wireless stethoscope with its chest piece side spaced apart from the ear piece side.

OBJECTS OF THE INVENTION:

An object of the invention is to provide a body sounds' auscultation device.

Another object of the invention is to provide a connector to convert any acoustic stethoscope into an electronic or a digital stethoscope.

Yet another object of the invention is to provide a connector which allows conventional auscultation as well as electronic recording, transmitting wireless information and simultaneous hearing by multiple users.

Still another object of the invention is to provide a body sounds' auscultation device which gives flexibility to a user.

An additional object of the invention is to provide a body sounds' auscultation device which provides improved auscultation.

Another additional object of the invention is to provide a body sounds' auscultation device which comprises a modular attachment for any stethoscope.

Yet another additional object of the invention is to provide a body sounds' auscultation device wherein the device can be modified to be used in analog / digital modes without the barrier of distance.

Still another object of the invention is to provide a connector which allows any acoustic stethoscope to function in split-mode wherein a chest-piece side is split and spaced apart from an ear-piece side.

SUMMARY OF THE INVENTION:

According to this invention there is provided a connector configured to allow acoustic transmission or digital transmission for a stethoscope, said convertor comprises:

- a first piece communicably coupled to a chest piece of said stethoscope, through a first extruded channel;
- a second piece communicably coupled to an ear piece of said stethoscope, through a second extruded channel;
- an inner element configured to be ensconced, at least partially, within said first piece, characterised in that, said inner element being configured to be displaceable within said first piece, said inner element further comprising at least two first-piece end openings on said first piece end and at least two second-piece end openings on said second piece end;
- an inner element channel, within said inner element, configured to be in line with said first extruded channel and said second extruded channel, in a first displaced mode, wherein one of said first-piece end openings and one of said second-piece end openings are collinear with said inner element channel, said first extruded channel, and said second extruded channel in order to provide an acoustic mode of functioning, characterised in that, said first extruded channel, said inner element channel, said second extruded channel, each successive channel having a diameter which is decreased in dimension with respect to a previous channel, along direction of sound;
- a first transducer, located inside said inner element, subsequent to one of said first-piece end openings, in a manner such that it completely blocks any acoustic transmission from said first extruded channel, and a second transducer located inside said inner element prior to one of said second-piece end openings, said first transducer configured to be in line with said first extruded channel and said second transducer configured to be in line with said second extruded channel, in a second displaced mode, in order to provide an electronic mode of functioning; and
- a switching mechanism configured to displace said inner element between said first displaced mode and said second displaced mode, thereby

switching said connector between corresponding said acoustic mode and said electronic mode.

In at least an embodiment, said displacement is angular displacement.

In at least another embodiment, said displacement is linear displacement.

Typically, said first piece is an open-ended casing.

Preferably, said first piece is a cylindrical casing.

Typically, said first piece comprises a first slit to provide said angular displacement, said first slit being a partial-circumferential slit

Typically, said switching mechanism is a knob extending from said inner element, said knob being a switching mechanism which switches said connector between its acoustic version and its electronic version, by angularly displacing said inner element between its first position and its second position

Typically, said knob extends from said inner element through a first slit, said first slit being a partial-circumferential slit.

Typically, said inner element comprises at least a first transducer along with a transmitter.

Typically said inner element comprises at least a second transducer along with a receiver.

Typically, said inner element is a cylinder with a first end and a second end, wherein said first end comprises at least two openings and wherein said second end comprises at least two openings.

Typically, in its first position, said knob makes the connector work in an acoustic manner, characterised in that, a first opening is in line with said first extruded channel, thereby making said connector work in an acoustic manner, said first opening, further extending into an inner element channel which traverses the length of said inner element.

Typically, in its second position, said knob makes the connector work in an electronic manner, characterised in that, a second opening is in line with said first extruded channel, thereby making the connector work in an electronic manner, said second opening being in line with a first transducer, located in-line and just behind said second opening.

Typically, said inner element comprises two parts such that a first inner element part comprises said knob, said inner element channel, and a first transducer while a second inner element part comprises a second transducer along with a receiver.

Typically, said inner element comprises at least a first inner element part and second inner element part, characterised in that, said first inner element part and said second inner element part are complementary, in that, said second inner element part slides into said first inner element part in order to be ensconced by it.

Typically, said inner element comprises at least a first inner element part and second inner element part, characterised in that, said first inner element part comprises at least two openings.

Typically, said inner element comprises at least a first inner element part and second inner element part, characterised in that, said second inner element part comprises at least two openings.

Typically, said inner element comprises at least a first inner element part and second inner element part, characterised in that, said first inner element part comprises at least two openings, further characterised in that, as said knob moves from its first position to its second position, the inner element channel is in line with the first extruded channel, thereby determining the connector to work in an acoustic manner.

Typically, said inner element comprises at least a first inner element part and second inner element part, characterised in that, said first inner element part comprises at least two openings, further characterised in that, as said knob moves from its second position to its first position, the first transducer is in line with the first extruded channel, thereby determining the connector to work in an electronic manner.

Typically, said second piece is an open-ended casing.

Preferably, said second piece is a cylindrical casing.

Typically, said second piece comprises a second slit corresponds to a first slit of said first piece, in that, when said second piece is completely ensconced within

said first piece, the first slit and the second slit overlap, seamlessly, so as to define one single slit.

Typically, said second piece comprises a second slit, said second slit being a partial-circumferential slit and extending in an orthogonal fashion, from its one end, parallel to the axis of said connector to form an axis-wise channelled notch which opens at the open-end of said second piece.

Typically, said inner element comprises at least a first inner element and at least a second inner element, characterised in that, said first inner element comprises said first transducer along with a transmitter at its chest-side end.

Typically, said inner element comprises at least a first inner element and at least a second inner element, characterised in that said first inner element is configured to be spaced apart from said second inner element in order to render split electronic wireless mode of functioning of said connector.

Typically, said inner element comprises at least a first inner element and at least a second inner element, characterised in that, said first inner element comprises said first transducer along with a transmitter at its chest-side end, further characterised in that, said first transducer being located just behind the second opening in a manner such that it completely blocks any acoustic transmission from said first extruded channel.

Typically, said inner element comprises at least a first inner element and at least a second inner element, characterised in that, said first inner element comprises said first transducer along with a transmitter at its chest-side end, further characterised in that, said first transducer being located just behind the second opening in a manner such that it, in its electronic mode of operation, said first

extruded channel and said transducer are collinear, co-axial, and abutting each other in a manner such that there is no acoustic loss outside said channel.

Typically, said inner element comprises at least a first inner element and at least a second inner element, characterised in that, said second inner element comprises said second transducer along with a receiver at its chest-side end.

Typically, in its acoustic mode of functioning, said first extruded channel, said inner element channel, and said second extruded channel are collinear and co-axial.

Typically, diameter of said first extruded channel is greater than the diameter of said inner element channel.

Typically, diameter of said diameter of the inner element channel is greater than the diameter of the second extruded channel.

Typically, said connector comprising a first locking coupler to provide locking and coupling between said first extruded channel and the inner element channel.

Typically, said connector comprises a first locking coupler to provide locking and coupling between said first extruded channel and the inner element channel, characterised in that, said first locking coupler being located in said first piece in communication with at least an opening of said inner element, said at least an opening being configured to be in communication with said first extruded channel.

Typically, said connector comprises a first locking coupler to provide locking and coupling between said first extruded channel and the inner element channel,

characterised in that, said first locking coupler being located in said first piece in communication with at least another opening of said inner element, said at least another opening being configured to be in communication with said first extruded channel.

Typically, said connector comprises a second locking coupler provides locking and coupling between the second extruded channel and the inner element channel.

Typically, said connector comprises a first locking coupler to provide locking and coupling between said first extruded channel and the inner element channel, characterised in that said first locking coupler being a spring-loaded coupler and tapering in its dimension along its longitudinal axis from said first extruded channel to an inner element channel.

Typically, said inner element comprises a first end and a second end, wherein said first end comprises at least two openings and wherein said second end comprises at least two openings, characterised in that, one opening is a first acoustic opening, on the first piece side of said inner element, said first acoustic opening comprising a cam profile which is a hemispherical cam profile in order to receive a first locking coupler, which acts as a cam follower, to enable locking and coupling.

Typically, said connector comprises a second locking coupler provides locking and coupling between the second extruded channel and the inner element channel, characterised in that, said second locking coupler being a spring-loaded coupler and tapering in its dimension along its longitudinal axis from an inner element channel to said second extruded channel.

Typically, said inner element comprises a first end and a second end, wherein said first end comprises at least two openings and wherein said second end comprises at least two openings, characterised in that, the other opening is a second acoustic opening, on the second piece side of said inner element, said second acoustic opening comprising a cam profile which is a hemispherical cam profile, which acts as a cam follower, in order to receive a second locking coupler to enable locking and coupling.

Typically, said connector comprises a second locking coupler to provide locking and coupling between the second extruded channel and the inner element channel, characterised in that, said second locking coupler being located in said second piece in communication with at least an opening of said inner element, said at least an opening being configured to be in communication with said second extruded channel.

Typically, said connector comprises a second locking coupler to provide locking and coupling between the second extruded channel and the inner element channel, characterised in that, said second locking coupler being located in said second piece in communication with at least another opening of said inner element, said at least another opening being configured to be in communication with said second extruded channel.

Typically, said connector comprises an interlocking mechanism in order to lock said first piece to said second piece in order for it to convert from an engaged acoustic mode to a split electronic wireless mode.

Typically, said connector comprises a first centre rod and a second centre rod for providing support along a longitudinal axis along which said inner element angularly displaces itself.

Typically, said connector comprises a first centre rod and a second centre rod for providing support along a longitudinal axis along which said inner element angularly displaces itself, characterised in that, said first centre rod has its first end support at the first piece and its second end support at the inner element.

Typically, said connector comprises a first centre rod and a second centre rod for providing support along a longitudinal axis along which said inner element angularly displaces itself, characterised in that, said second centre rod has its first end support at the second piece and its second end support at the inner element where the first end rod ends.

Typically, said connector comprises a first centre rod and a second centre rod for providing support along a longitudinal axis along which said inner element angularly displaces itself, characterised in that, said first end rod and said second end rod are collinear and co-axial.

Typically, in its electronic mode of functioning, said first extruded channel and said first transducer are in line and said second transducer is in line with said second extruded channel.

Typically, in its electronic mode of functioning, said first transducer is in-line, with direction of sound, in-line with said first extruded channel.

Typically, in its electronic mode of functioning, said second transducer is in-line, with the direction of sound, in line with said second extruded channel.

Typically, said inner element comprises a first inner element and a second inner element, characterised in that, said connector comprises a first electronic board

located in said first inner element configured to receive connector pins from a second electronic board located in said second inner element, said connector pins configured to charge a battery to be used in an electronic wireless mode of functioning of said connector, to power said first electronic board, thereby deactivating said transmitter and said receiver and thereby deactivating wireless mode of functioning.

Typically, said inner element comprises a speaker.

Typically, said connector comprises a button to provide the functions of record, playback, forward, and rewind in its electronic mode of functioning.

Typically, said connector comprises a noise cancellation mechanism, characterised in that, said mechanism comprises at least a third transducer located, advantageously, to pick up surrounding noise, said mechanism employing active noise cancellation techniques with respect to sound input from said first transducer and sound input from said third transducer in order to reduce ambient noise and to provide noise-cancelled sound at output said third transducer.

Typically, in its acoustic mode of functioning, sound waves are transmitted through said first extruded channel, said inner element channel, and said second extruded channel.

Typically, in its electronic wired mode of functioning, sound waves are converted to an electrical signal by said first transducer, processed, and transmitted to said second transducer where said electrical signal is converted to an acoustic signal for hearing at said ear piece.

Typically, in its split electronic wireless mode of functioning, sound waves are captured by a first transducer, sent to a transmitter and wirelessly transmitted to at least a receiver and corresponding at least a second transducer.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS:

The invention will now be described in relation to the accompanying drawings, in which:

Figure 1 illustrates a perspective view of the stethoscope along with the connector of this invention;

Figure 2 illustrates a view showing the first part connected to the stem of the stethoscope chest piece;

Figure 3 illustrates a view showing the second part connected to the stethoscope tubing which connects to the earpiece;

Figure 4 illustrates a schematic view of the connector;

Figure 5a illustrates another schematic view, from the ear piece side, of the connector;

Figure 5b illustrates another schematic view, from the chest piece side, of the connector;

Figure 6 illustrates a schematic exploded view of the connector depicting the first part and the second part;

Figure 7 illustrates a schematic cut-section view of the connector when it is used in its acoustic / mechanical mode;

Figure 8 illustrates a schematic cut-section view of the connector when it is used in its acoustic / mechanical mode, wherein the changes in transmission channel profile can be seen;

Figure 9 illustrates a schematic cut-section view of the connector when it is used in its electronic wired mode;

Figure 10 illustrates another schematic cut-section view of the connector when it is used in its electronic wired mode;

Figures 11a and 11b illustrate schematic views of the connector when it is used in its split electronic wireless mode;

Figure 12 illustrates a schematic cut-section view of the connector when it is used in its split electronic wireless mode; and

Figure 13 illustrates a schematic view of the connector when it is used in its electronic wired mode.

DETAILED DESCRIPTION OF THE ACCOMPANYING DRAWINGS:

According to this invention, there is provided **a connector configured to convert an acoustic stethoscope to a digital stethoscope.**

For the purposes of this specification, the term ‘digital’ comprises an electronic function with a wired or wireless configuration. Specifically, for the purposes of this invention, there is a ‘mechanical’ / ‘acoustic’ version of functioning wherein no electronics are involved and a ‘digital’ mode of functioning wherein

electronic components are involved which overcome limitations possessed by the mechanical / acoustic mode.

Figure 1 illustrates a perspective view of the stethoscope along with the connector of this invention.

In accordance with an embodiment of this invention, there is provided a connector configured to be communicably coupled to a chest piece (1) and the connector (100) further is configured to be connected to an ear piece (6).

In at least an embodiment, the connector comprises a first part (12) and a second part (28). The first part (12) is configured to be communicably coupled to the chest piece (1) and the second part (28) is configured to be communicably coupled to the ear piece (6).

Figure 2 illustrates a view showing the first part (12) on the stethoscope chest piece (1).

Figure 3 illustrates a view showing the second part (28) on the stethoscope tubing (5) which connects to the earpiece (6).

Figure 4 illustrates a schematic view of the connector.

Figure 5a illustrates another schematic view, from the ear piece side, of the connector.

Figure 5b illustrates another schematic view, from the chest piece side, of the connector.

Figure 6 illustrates a schematic exploded view of the connector depicting the first part and the second part.

Figure 7 illustrates a schematic cut-section view of the connector when it is used in its acoustic / mechanical mode.

Figure 8 illustrates a schematic cut-section view of the connector when it is used in its acoustic / mechanical mode, wherein the changes in transmission channel profile can be seen.

Figure 9 illustrates a schematic cut-section view of the connector when it is used in its electronic / wired mode.

Figure 10 illustrates another schematic cut-section view of the connector when it is used in its electronic wired mode.

Figures 11a and 11b illustrate schematic views of the connector when it is used in its electronic wireless mode.

Figure 12 illustrates a schematic cut-section view of the connector when it is used in its split electronic wireless mode. It shows a split view of the connector so that the chest piece is spaced apart from the ear piece. Multiple such ear pieces can be used to sync with the chest piece since the connector can be split in a wireless fashion.

The connector, of this invention, is configured to be operated in the following three modes:

- 1) Acoustic mechanical mode;
- 2) Electronic wired mode; and

3) Split Electronic wireless mode.

Additionally, in its split electronic wireless mode, the connector is configured to work in the following modes:

3a) one-to-one electronic wireless mode: communication between one chest piece and one ear piece;

3b) one-to-many electronic wireless mode: communication between one chest piece and a plurality of ear pieces or a plurality of remotely located computational devices (91) or a plurality of remotely located mobile devices (93).

In at least an embodiment, the **first piece (12)** is an open-ended casing. Typically, this is a cylindrical casing. It may also be referred to as a chest-side casing or a chest-side piece. One end of this casing is open-ended which allows it to receive additional parts or components of this invention in a manner such that the first piece is a partial outer cover of the connector of this invention. The other end of this casing comprises a **first extruded channel (14)** which is configured to be coupled to a stethoscope tube which extends from the chest piece of the stethoscope tube.

In at least an embodiment, the first piece (12) comprises an **inner element (16)** configured to be ensconced, at least partially, within the first piece (12), characterised in that, the inner element (16) is configured to be angularly displaceable within the first piece (12). The angular displacement is restricted by means of a **first slit (18)** provided in the first piece (12) and a **knob (20)** that extends from the inner element (16) through the first slit (18). The first slit is a partial-circumferential slit. Typically, this inner element is a cylinder with a first end and a second end, wherein the first end comprises at least **two openings (21, 23)** and wherein the second end comprises at least **two openings (31, 33)**.

In at least an embodiment, the knob (20) is the switching mechanism which switches the connector of this invention, and hence the stethoscope, from its acoustic version to its electronic version. When the knob (20) is in its first position, which makes the connector work in an acoustic manner, a first opening (21) is in line with the extruded channel (14). The first opening (21), further extends into an **inner element channel (24)** which traverses the length of the inner element (16). Further, when the knob (20) is angularly displaced from its first position to its second position, the inner element (16) also correspondingly angularly displaces such that the second opening (23) is in line with the first extruded channel (14), thereby making the connector work in an electronic manner. In its electronic version, the second opening (23) is in line with a **first transducer (36)**, located in-line and just behind the second opening (23).

In at least another embodiment, the inner element (16) may comprise two parts (16a, 16b) such that the **first inner element part (16a)** comprises the knob (20), the inner element channel (24), and the first transducer (36) while the **second inner element part (16b)** comprises a **second transducer (26) along with a receiver (35)**. Typically, the first inner element part (16a) and the second inner element part (16b) are complementary, in that, the second inner element part (16b) slides into the first inner element part (16a) in order to be ensconced by it and the two parts fit into each other. In a preferred embodiment, the first inner element part (16a) comprises at least two openings (21, 23). In a preferred embodiment, the second inner element part (16b) comprises at least two openings (31, 33). As the knob (20) moves from its first position to its second position, either the inner element channel (24) is in line with the first extruded channel (14) or the first transducer (36) is in line with the first extruded channel (14), thereby determining if the connector is to work in an acoustic manner or in an electronic manner.

In at least a preferred embodiment, the first inner element is substantially a cylinder with one first-piece side disc end with two openings and a hollow second-piece side to receive the second inner element. In at least a preferred embodiment, the second inner element is substantially a partial cylinder with a second-piece side disc end with two openings.

In at least yet another embodiment, the **second piece (28)** is an open-ended casing. Typically, this is a cylindrical casing. It may also be referred to as an ear-side casing or an ear-side piece. One end of this casing is open-ended which allows it to receive additional parts or components, of this invention, in a manner such that the first piece is a partial outer cover of the connector of this invention and the second piece receives the inner element and also slides into the first piece as a middle layer. The other end of this casing comprises a **second extruded channel (30)** which is configured to be coupled to a stethoscope tube which extends from the ear piece of the stethoscope tube. A **second slit (32)** at one end of the this second piece (28) corresponds to the first slit (18) of the first piece (12), in that, when the second piece (28) is completely ensconced within the first piece (12), the first slit (18) and the second slit (32) overlap, seamlessly, so as to define one single slit. Furthermore, this second slit is also a partial-circumferential slit and extends in an orthogonal fashion, from its one end, parallel to the axis of the connector to form an **axis-wise channelled notch (34)** which opens at the open-end of the second piece (28). This allows for the knob to securely slide out when the first piece (12) is spaced apart from the second piece (28), in the connector's wireless configuration.

In at least an embodiment, the first inner element (16a) comprises a **first transducer along (36) with a transmitter (25)** at its chest-side end i.e. the end with the first inner element (12). Typically, the first transducer (36) is located

just behind the second opening (23) in a manner such that it completely blocks any acoustic transmission from the first extruded channel (14). In other words, in its electronic mode of operation, the first extruded channel (14) and the transducer (36) are not only collinear and co-axial, they are also abutting each other in a manner such that there is no acoustic loss outside the channel or from its transmission from one channel to the other.

In at least an embodiment, the second inner element channel (26) comprises a second transducer (26) and a **receiver (35)**.

In its **acoustic mode of functioning**, the first extruded channel (14), the inner element channel (24), and the second extruded channel (30) are collinear and co-axial. The diameter of the first extruded channel (14) is greater than the diameter of the inner element channel (24). The diameter of the inner element channel (24) is greater than the diameter of the second extruded channel (30). This narrowing in diameter across the channels and across the direction of traverse of sound / acoustic waves from the chest piece to the ear piece of the stethoscope ensures that there is quasi-amplification of sound since concentration of energy increases as sound / acoustic waves traverse from a larger area to a narrower area, thereby increasing concentration in energy of the sound / acoustic wave per unit volume.

A **first locking coupler (42)** provides locking and coupling between the first extruded channel (14) and the inner element channel (24). The first coupler (42) is located in the first piece (12), which can seal openings (21) and (23) when brought near the opening, due to spring action. The shape of the coupler is such that it tapers along the direction of sound, thereby increasing concentration in energy of the sound / acoustic wave per unit volume, when the sound is transmitted from the first extruded channel (14) to the second extruded channel

(30). The first locking coupler (42) is a spring-loaded coupler and tapers in its dimension along its longitudinal axis from the first extruded channel (14) to the inner element channel (24). One opening (21) which is the acoustic opening, on the chest-piece side of the inner element (16), comprises a cam profile which is a hemispherical cam profile in order to receive the first locking coupler (41), which acts as a cam follower, to enable locking and coupling.

A **second locking coupler (44)** provides locking and coupling between the second extruded channel (30) and the inner element channel (24). The second coupler (44) is located in the second piece (28), which can seal openings (31) and (33) when brought near the opening, due to spring action. The shape of the coupler it tapers along the direction of sound, thereby increasing concentration in energy of the sound / acoustic wave per unit volume, when the sound is coming from first extruded channel (14) to second extruded channel (30). The second locking coupler (44) is a spring-loaded coupler and tapers in its dimension along its longitudinal axis from the inner element channel (24) to the second extruded channel (30). The other opening (31) which is the acoustic opening, on the ear-piece side of the inner element (16), comprises a cam profile which is a hemispherical cam profile in order to receive the second locking coupler (44), which acts as a cam follower, to enable locking and coupling.

In its **electronic mode of functioning**, it is important to note that the first transducer (36) is in-line with the direction of sound i.e. in-line with the first extruded channel (14). Also, in its electronic mode of functioning, it is important to note that the second transducer (26) is in-line with the direction of sound i.e. in line with the second extruded channel (30).

In at least another embodiment, an interlocking mechanism is provided in order to lock the first piece (12) to the second piece (28) in order for it to convert from an engaged acoustic mode to a split electronic wireless mode.

In at least another embodiment, a first centre rod (56) and second centre rod (58) provide the support and the longitudinal axis along which the inner element angularly displaces itself. Typically, the first centre rod (56) has its first end support at the first piece (12) and its second end support at the inner element (16). Typically, the second centre rod (58) has its first end support at the second piece (28) and its second end support at the inner element (16) where the first end rod (56) ends. The first end rod (56) and the second end rod (58) are collinear and co-axial.

Figure 13 illustrates a schematic view of the connector when it is used in its electronic wired mode.

In this mode, the first extruded channel (14) and the first transducer (36) are seen in line. The second transducer (26) is seen in line with the second extruded channel (30). A first electronic board (62) located in the first inner element (16a) receives connector pins (64) from the second electronic board (66) located in the second inner element (16b). The speaker is located in the second inner element (16b). Reference numeral 68 refers to the slots of the first electronic board (62) which receives the connector pins (64). These connector pins (64) charge a battery which is to be used during the split electronic wireless mode of functioning of this converter. Therefore, during the electronic wired mode of functioning of this converter, the transmitter and receiver are not activated, thereby saving battery.

In at least an embodiment, a button (29) is provided. This button comprises the functions of record, playback, and the like in its electronic mode of functioning.

In at least an embodiment, a noise cancellation mechanism is provided. This mechanism involves use of a third transducer or a second microphone which picks up surrounding noise and the mechanism, then, uses active noise cancellation to reduce ambience noise. Typically, this transducer is located in a manner that it receives external noise.

Accordingly, when the chest piece (1) is placed against a patient for sensing body sounds, it vibrates according to the patient's diaphragm, creating acoustic pressure waves which travel up to the first part (12).

Accordingly, in its **acoustic mode of functioning**, the waves are transmitted through the channels to the second part (28). The nature of the channels is such that amplification occurs at the ear piece (6).

Accordingly, in its **electronic wired mode of functioning**, the waves are converted to an electrical signal by a first transducer (36), processed, and transmitted to a second transducer (26) where the electrical signal is converted to an acoustic signal for hearing at the ear piece (6). In this mode, the transmitter (25) and the receiver (35) are not used.

Accordingly, in its **electronic wireless mode of functioning**, the waves are captured by a first transducer (36), sent to a transmitter (25) and wirelessly transmitted to a second transducer (26) along with a receiver (35) or multiple such receivers (35).

This entire setup, due to the connector of this invention, assists in transmission of body sound through conventional stethoscope, wirelessly. It allows switching between an acoustic mode and a digital mode by means of a switching mechanism. Additionally, it allows a wired digital mode as well as wireless

digital mode. Still additionally, it allows a one to many wireless digital mode wherein a single chest piece can transmit its readings to a plurality of remotely located earpieces or remotely located computational or mobile devices.

The **TECHNICAL ADVANTAGE** of the current invention lies in eliminating a mobile device or an earphone for simultaneous auscultation. The current invention is mobile independent and a stethoscope ear piece with attachment can be used for simultaneous auscultation of body sounds, the modular design of attachment gives flexibility of using the stethoscope in acoustic or electronic modes as well as wireless mode. Any stethoscope can be made as digital stethoscope by adding an attachment.

Thus, the connector configured a stethoscope to work in the following modes:

- 1) Acoustic mode;
- 2) Electronic wired mode; and
- 3) Electronic wireless mode.

Additionally, in its electronic wireless mode, the connector configured the stethoscope to work in the following modes:

- 3a) one-to-one electronic wireless mode: communication between one chest piece and one ear piece; and
- 3b) one-to-many electronic wireless mode: communication between one chest piece and a plurality of ear pieces or a plurality of remotely located computational devices or a plurality of remotely located mobile devices.

While this detailed description has disclosed certain specific embodiments for illustrative purposes, various modifications will be apparent to those skilled in the art which do not constitute departures from the spirit and scope of the invention as defined in the following claims, and it is to be distinctly understood

that the foregoing descriptive matter is to be interpreted merely as illustrative of the invention and not as a limitation.

CLAIMS

1. A connector permitting acoustic and digital transmission from a stethoscope, the connector comprising:

a first piece communicatively coupled to a chest piece of the stethoscope through a first extruded channel;

a second piece communicatively coupled to an earpiece of the stethoscope through a second extruded channel;

an inner element at least partially within the first piece and displaceable within the first piece, wherein the inner element includes at least two first-piece end openings on an end of the first piece and at least two second-piece end openings on an end of the second piece;

an inner element channel within the inner element in line with the first extruded channel and the second extruded channel, in a first position to provide an acoustic mode of functioning, wherein one of the first-piece end openings and second-piece end openings are collinear with the inner element channel, the first extruded channel, and the second extruded channel, and wherein the first extruded channel, the inner element channel, and the second extruded channel have diameters that decrease in a direction of sound;

a first transducer inside the inner element past one of the first-piece end openings to substantially block acoustic transmission from the first extruded channel;

a second transducer inside the inner element before one of the second-piece end openings, wherein, in a second position, the first transducer is in line with the first extruded channel and the second transducer is configured to be in line with the second extruded channel to provide an electronic mode of functioning; and

a switch configured to displace the inner element between the first position and the second position so as to switch the connector between the acoustic mode and the electronic mode.

2. The connector of claim 1, wherein the switch is configured to displace the inner element in one of angular displacement and linear displacement.

3. The connector of claim 2, wherein the first piece includes a first partial-circumferential slit to provide the angular displacement.

4. The connector of claim 1, wherein the switch is a knob extending from the inner element, wherein the knob is configured to displace the inner element by angularly displacing the inner element between the first position and the second position, and wherein the knob extends from the inner element through a first partial-circumferential slit (18).

5. The connector of claim 1, wherein the inner element includes at least one of, said first transducer and a transmitter, and said second transducer and a receiver.

6. The connector of claim 1, wherein the inner element is a cylinder with a first end and a second end, wherein the first end includes at least two openings, and wherein the second end includes at least two openings.

7. The connector of claim 6, wherein, in the first position, a first opening is in line with the first extruded channel and extends into an inner element channel that traverses a length of the inner element, and wherein, in the second position, a second

opening is in line with the first extruded channel and in line with said first transducer in-line and behind the second opening.

8. The connector of claim 1, wherein, the inner element includes a first inner element part and a second inner element part that are complementary such that the second inner element part slides into the first inner element part, and wherein the first inner element part includes at least two openings and the second inner element part includes at least two openings.

9. The connector of claim 1, wherein when the switch moves from the first position to the second position, the inner element channel is in line with the first extruded channel, and wherein when the switch moves from the second position to the first position, the first transducer is in line with the first extruded channel.

10. The connector of claim 1, wherein the second piece includes a second slit and the first piece includes a first slit corresponding to the second slit such that when the second piece is completely within the first piece, the first slit and the second slit overlap seamlessly, and wherein the second slit is a partial-circumferential slit and extending orthogonally from its one end, parallel to the axis of the connector to form an axis-wise channelled notch that opens at the open-end of the second piece.

11. The connector of claim 1, wherein the inner element includes at least a first inner element and a second inner element, wherein the first inner element includes the first transducer and a transmitter at a chest-side end behind the second opening so that in the electronic mode of operation, the first extruded channel and the transducer are collinear, co-axial, and abutting each to prevent acoustic loss outside the channel.

12. The connector of claim 11, wherein the first inner element is spaced apart from the second inner element so as to achieve a split electronic wireless mode of functioning.

13. The connector of claim 1, wherein, in the acoustic mode of functioning, the first extruded channel, the inner element channel, and the second extruded channel are collinear and co-axial.

14. The connector of claim 1, further comprising:
a first locking coupler locking and coupling between the first extruded channel and the inner element channel, wherein the first locking coupler is in the first piece in communication with an opening of the inner element that is in communication with the first extruded channel.

15. The connector of claim 14, wherein the first locking coupler is in communication with another opening of the inner element that is in communication with the first extruded channel.

16. The connector of claim 14, wherein the first locking coupler is a spring-loaded coupler and tapering in its dimension along its longitudinal axis from the first extruded channel to an inner element channel.

17. The connector of claim 1, further comprising:
a first locking coupler, wherein the inner element includes a first end and a second end, wherein the first end includes at least two openings and wherein the second end

includes at least a first acoustic opening on the first piece side of the inner element that includes a hemispherical cam profile to receive a first locking coupler.

18. A connector of claim 14, further comprising:

a second locking coupler locking and coupling between the second extruded channel and the inner element channel, wherein the second locking coupler is a spring-loaded coupler and tapering in its dimension along its longitudinal axis from an inner element channel to the second extruded channel.

19. The connector of claim 1, further comprising:

a first centre rod and a second centre rod configured to provide support along a longitudinal axis along which the inner element angularly displaces.

20. The connector of claim 19, wherein the first centre rod has its first end support at the first piece and its second end support at the inner element.

21. A connector of claim 19, wherein the second centre rod has its first end support at the second piece and its second end support at the inner element where the first end rod ends.

22. A connector of claim 19, wherein the first end rod and the second end rod are collinear and co-axial.

23. The connector of claim 1, wherein in the electronic mode of functioning, the first extruded channel and the first transducer are in line and the second transducer is in line with the second extruded channel.

24. The connector of claim 1, wherein in the electronic mode of functioning, the first transducer is in line with direction of sound and the first extruded channel, and wherein the second transducer is in-line with the direction of sound and, in line with the second extruded channel.

25. The connector of claim 1, wherein the inner element includes a first inner element and a second inner element, the connector further comprising:

a first electronic board in the first inner element and configured to receive connector pins from a second electronic board in the second inner element to charge a battery to be used in an electronic wireless mode of functioning and power the first electronic board.