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C. M. HECK.

DEVICE FOR COMPARING SOUNDS.

APPLICATION FILED FEB. 5, 1915.

1,203,329.

Patented Oct. 31, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

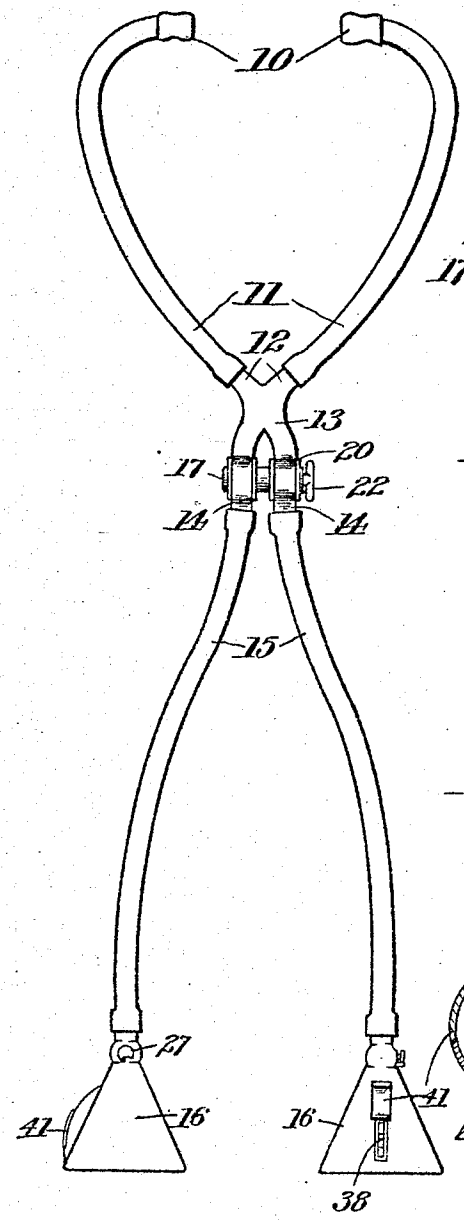


Fig. 2.

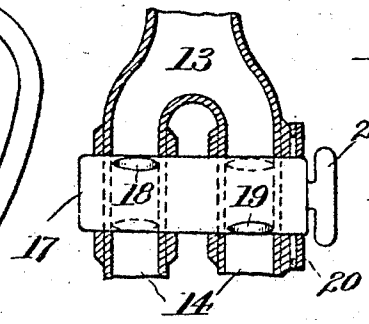


Fig. 3.

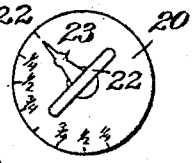


Fig. 4.

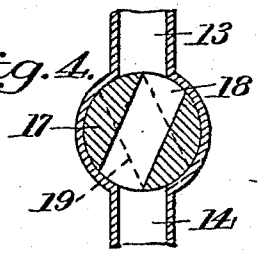


Fig. 5.

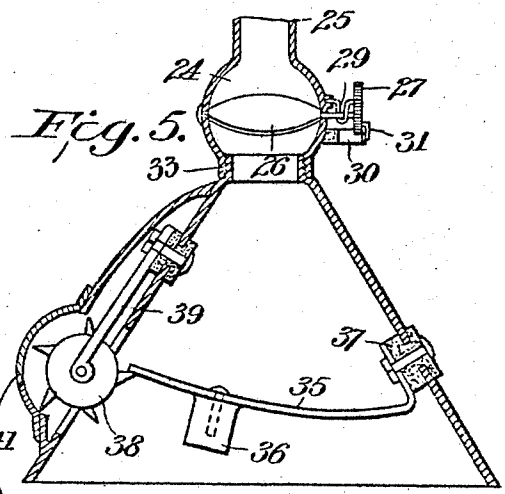
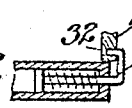


Fig. 6.



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2 SHEETS—SHEET 2.

Fig. 7.

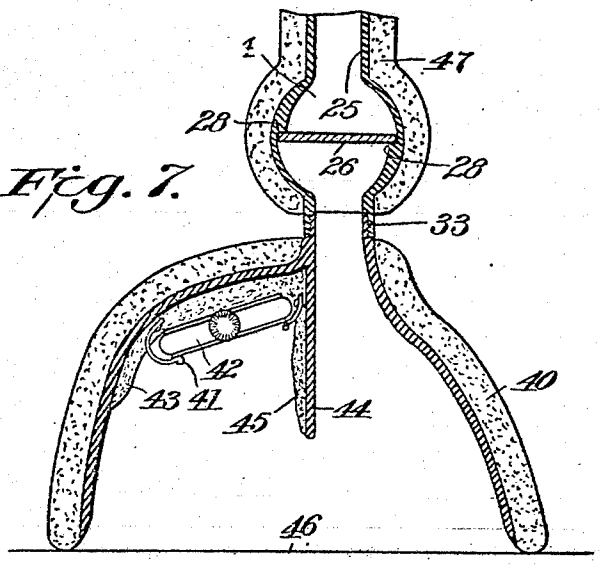
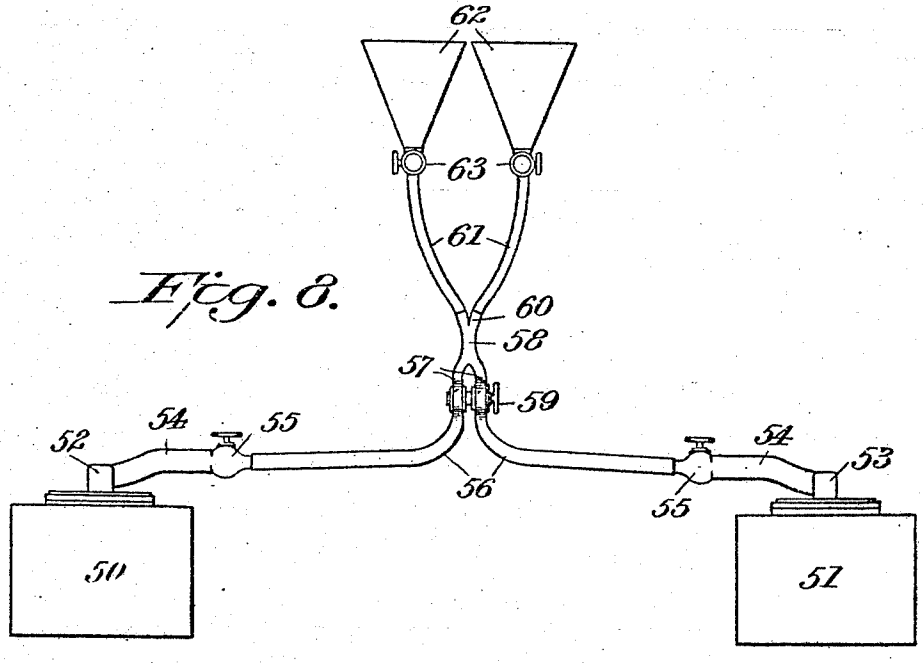


Fig. 8.



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DEVICE FOR COMPARING SOUNDS.

1,203,329. Specification of Letters Patent. Patented Oct. 31, 1916.

Application filed February 5, 1915. Serial No. 6,316.

To all whom it may concern:

Be it known that I, CHARLES M. HECK, a citizen of the United States, residing at Raleigh, in the county of Wake and State of North Carolina, have invented new and useful Improvements in Devices for Comparing Sounds, of which the following is a specification.

This invention relates to the art of sound detection and comparison.

In all observations made by the senses, impressions on the brain rapidly lose their intensity and character, the memory being thus unable to compare sensations following each other at relatively long intervals. In observations on light, some hundred fold increase of accuracy has been attained by utilizing instruments that will place two lights to be compared before the eyes at the same time, or one light after another in rapid succession.

One of the objects of the present invention is to accomplish a similar result in connection with sound observation, whereby the detection and investigation of sounds, the resonant properties of bodies, and the reflecting and absorbing quantities, may be more accurately conducted than has heretofore been possible.

A further object is to provide for efficient comparison of sounds by equalizing the volumes of the sounds being investigated, leaving the nature or character of the sounds undisturbed.

A further object is to provide means whereby resonance properties of cavities may be determined and compared by percussion or impinging of sound waves.

A further object is to provide means whereby the sound reflecting properties of surfaces may be determined and compared.

A further object is to provide means for thoroughly insulating the apparatus from extraneous sounds.

The invention will be hereinafter fully set forth and particularly pointed out in the claims.

In the accompanying drawings:—Figure 1 is a view of a stethoscope constructed in accordance with my invention, Fig. 2 is an enlarged detail view illustrating the sound equalizing device. Fig. 3 is an end view thereof. Fig. 4 is a diagrammatic transverse sectional view thereof. Fig. 5 is an enlarged detail view of one of the receiving chambers. Fig. 6 is a detail of the locking device. Fig. 7 is a detail view of a slight modification. Fig. 8 is a diagrammatic view illustrating one of the uses of my invention.

Referring to the drawing, the instrument illustrated in Fig. 1 is a convenient form of the doctor's stethoscope, although it will appear later that the instrument is not limited to medical work. The stethoscope illustrated comprises the ear nipples 10, connected with tubes 11 leading from the arms 12 of a coupling 13. Said coupling is provided with lower branches 14 from which tubes 15 lead to the cups 16, designed to receive the sound in the well known manner. For convenience, the cups 16, and tubes 15, may be called receiving members, and the tubes 11 and ear pieces 10, delivery members. Said cups 16 may also be technically called sound directing devices, for the reason that they perform the function of directing sounds received by them.

Rotatably supported by the coupling 13, and preferably by the branches 14, is a valve member 17 provided with openings 18 and 19, arranged at an angle with respect to each other, and located so as to control the passage of sound waves through said branches 14. The openings 18 and 19 are arranged as shown in Fig. 4, it being apparent from said figure that either tube may be open when the other is closed, or both open to the same extent at the same time, or one full open and the other open to any desired fraction. An indicating scale 20 mounted on one of the tubes 14, acting also as a cap to hold the valve member 17 in position, is provided, said cap being attached in suitable manner. The end of the valve member is provided with a head 22 having a pointer 23 coöperating with the scale 20 to indicate the adjustment of the valve. By the use of this arrangement, the valve member may be adjusted so that the volume of sound passing from branches 14 to the arms 12 will be equalized, rendering it possible to determine the nature of the respective sounds without regard to any difference in volume at the source. Thus two sounds of different volumes may be equalized as to the volume by adjusting the valve member so that the openings 18 and 19 will equalize any difference in the volume.

The receiving cup or mouth piece 16 may

be of any suitable or desirable construction. It is preferred however, to make them in two sections. One of said sections comprises a shutter chamber 24 provided with a neck 25 to enter the tube 15. Located within said chamber is a pivoted shutter or valve 26 heavy enough to shut off sound tending to pass through said chamber. The shutter or diaphragm 26 is provided with a milled head 27 by which it may be rotated, but is normally held in its closed position against shoulders 28 by means of a spring 29. When the shutter is opened and released the spring 29 causes the same to fly back to shut position. To prevent a noise as the shutter is closed, an insulated stop 30 is placed outside of the chamber 24 to engage the head 27, and thereby limit the movement of said shutter. Should it be desired to lock the shutter in open position, a spring latch 31 is provided having a finger adapted to engage an opening 32 in the head 27.

The mouth piece is detachably connected to the shutter chamber 24, in any suitable manner, as the threaded portion 33. For ordinary sound observation in connection with the usual medical use of a stethoscope, the cups may be of the usual type. For percussion testing however, a cup is employed in which is secured a leaf spring 35 to which is secured a suitable hammer 36, said spring being held in position by a suitable sound insulated clamp 37. Projecting through an opening in the wall of the cup is a ratchet wheel 38 rotatably supported by a leaf spring 39, which is also supported by a sound insulated clamp. The insulation comprises spaced apart felt-washers connected by an intermediate felt tube through which the bolt of the clamp passes. A suitable cover 41 may be provided for the ratchet wheel, in order to enable the cup to be used in the ordinary manner, if the percussion device is not to be utilized at any specific time.

In operation, the open end of the cup is placed upon the surface of the body to be tested, and the hand holding the mouth piece has one finger on the ratchet and by rotating the latter the teeth thereof successively engage the leaf spring and thus make a stroke with the hammer 36. Each time that the leaf spring is released by the ratchet, the hammer 36 will strike against the surface with which the cup is in contact, and the character of the sound emitted by said surface, when struck by the hammer will, of course, vary with the nature of the body being tested. To increase the intensity of the stroke, the finger while pushing the teeth forward presses the ratchet wheel inwardly, thus elevating the spring 35 a greater distance before its release. During the foregoing operation the shutter 25 is held open. When it is desired to use the stethoscope without the percussion device, the cover 41 is placed in position, and the shutter 25 is opened and closed, as the operator may desire, by means of a finger engaging the milled head 27.

In order to detect and determine the reflection and absorption of bodies with respect to sound, a mouth piece 40 is employed, as illustrated in Fig. 7. Said mouth piece is provided with an internal clamping device 41 constructed to support a watch 42, or other similar sound producing device. The watch is thoroughly insulated against transmission of sound to the wall of the cup by means of suitable packing 43, of felt or similar material. The reflector is best used with a wall 44, one side of which has a felt damper 45, said wall being so shaped as to protect the shutter chamber from sounds that may come without first reflecting against the object 46, on which the mouth of the cup is placed.

All of the cups, shutter chambers, and other parts are preferably provided with an insulating covering, best illustrated in Fig. 7, so as to protect the parts of the instrument from extraneous sounds such as produced by rubbing or striking the harder parts of the apparatus. Said insulation comprises an elastic covering 47 such as sheet rubber, inclosing a loose sound absorbing felt 48.

It will be understood that while the receiving cups and their attachments and adjuncts have been illustrated and described in connection with a double stethoscope, I do not desire to limit myself in this particular, as it is obvious that the same may be applied to any of the well known forms of stethoscope without departing from the spirit of my invention.

In Fig. 8 I have illustrated a method of comparing the diaphragms of sound reproducing machines to determine differences in quality and character of sound reproduction. Referring to said figure, 50 and 51 indicate conventionally illustrated graphophones, provided with the usual diaphragms supported in suitable manner as indicated at 52 and 53. The sound receiving cups or members 54 are connected with the diaphragm supports 52, 53 and are provided with sound excluding shutters 55. Said receiving cups or members are connected by tubes 56 with the branches 57 of a coupling member 58, and a sound equalizing device 59 is preferably provided. The upper branches 60 of the coupling member are connected by tubes 61 with the delivery members 62 which are also provided with sound excluding shutters 63. Said delivery members perform the function of sound directing devices. The shutters 55 and 63 are similar in construction to shutters 26, and

are provided with similar adjuncts. In operation, the machines 50 and 51 are operated simultaneously and the sound reproduced by each will be delivered through members 62, the shutters 63 being locked in open position. By adjusting member 59 to equalize the volumes of sound, the operator by alternately operating the shutters 55 may accurately compare the work of the two diaphragms 52, 53. If it is desired to make a comparative test of amplifying devices, they are made to perform the functions of delivery members 62, one of the shutters 55 being locked in open position. By alternately operating the shutters 63 any differences in the two amplifying devices may be readily determined.

Having thus explained the nature of my invention and described an operative manner of constructing and using the same, although without attempting to set forth all of the forms in which it may be made, or all of the forms of its use, what I claim is:—

1. A device of the character described comprising a coupling member, means for directing sounds from different sources to said coupling member, sound delivering members leading from said coupling member, and means for varying the relative volumes of the sounds passing through said coupling member to said delivering member to equalize the same.

2. A device of the character described comprising a coupling member, means for directing sounds from different sources to said coupling member, sound delivering members connected to said coupling member, and means for controlling the passage of sounds from the coupling member to the delivering members.

3. A device of the character described comprising a coupling member, means for directing sounds from different sources to said coupling member, sound delivering members connected to said coupling member, and means for controlling the passage of sounds from the receiving members to the coupling member.

4. A device of the character described comprising a coupling member, sound delivery members connected to said coupling member to deliver sounds thereto, a plurality of sound receiving members leading from said coupling member, and a rotatable valve provided with means for equalizing the volumes of the sounds passing from said receiving members to said delivering members.

5. A device of the character described comprising a coupling provided with branches, sound delivering members connected with said coupling, a plurality of sound receiving members connected with said branches, and means coöperating with said branches for equalizing the volumes of the sounds passing from said receiving members through said branches.

6. A device of the character described comprising a coupling member provided with branches, sound delivering members connected to said coupling member, a plurality of sound receiving members connected with said branches, and a valve member rotatably supported by said branches and provided with means for equalizing the volumes of the sounds passing through said branches.

7. A device of the character described comprising a coupling member, sound delivering members connected thereto, a plurality of sound receiving members also connected with said coupling members, a rotatable valve provided with openings controlling the passage of sounds from said receiving members to said delivering members, said openings being arranged at an angle to each other, and means for indicating the position of said openings.

8. A device of the character described comprising a coupling member provided with branches, sound delivering members connected with said coupling member, sound receiving members connected with said branches, a rotatable valve member supported by said branches and provided with openings controlling the passage of sounds through said branches, said openings being arranged at an angle to each other, and means for indicating the positions of said openings relative to the bores of the branches.

9. A device of the character described comprising a sound receiving member adapted to rest against an object to be tested, and a sound producing device located within said chamber and coöperating with the surface of said object.

10. A device of the character described comprising a sound receiving member adapted to rest against an object to be tested, and a percussion device located within said member and coöperating with the surface of said object.

11. A device of the character described comprising a sound receiving member adapted to rest against an object to be tested, a percussion device located within said member and coöperating with the surface of said object, and means carried by the cup for operating said percussion device.

12. A device of the character described comprising a sound receiving member adapted to rest against an object to be tested, a resilient percussion member located within said member and coöperating with the surface of said object, and means for variably operating said percussion member.

13. A device of the character described comprising a sound receiving member adapted to rest against an object to be tested, a

resilient arm supported within the receiving member and provided with a hammer member coöperating with the surface of said object, and means within the receiving member for imparting movement to said resilient arm.

14. A device of the character described comprising a sound receiving member adapted to rest against an object to be tested, a resilient arm within said receiving member having one end secured to the wall of the latter, and means supported by said receiving member for engaging the free end of said resilient arm to impart movement to the latter, whereby the same will strike the surface of said object.

15. A device of the character described comprising a sound receiving member adapted to rest against an object to be tested, a resilient percussion member located within said receiving member and coöperating with the surface of said object, and a ratchet wheel engaging said resilient member.

16. A device of the character described comprising a sound receiving member, a resilient percussion member located within said receiving member, a ratchet wheel engaging said resilient member, and means for yieldingly supporting said ratchet wheel.

17. A device of the character described comprising a sound receiving member, a percussion member located within said receiving member, a ratchet wheel engaging said resilient member, and a resilient arm secured to said cup and supporting said ratchet wheel.

18. A device of the character described comprising a sound receiving member having an opening in its wall, a ratchet wheel supported within said receiving member and extending through said opening, and a percussion device within said receiving member and operated by said ratchet wheel.

19. A device of the character described comprising a sound receiving member having an opening in one wall, a ratchet wheel supported within said receiving member and extending through said opening, a percussion device within said receiving member and operated by said ratchet wheel, and a cover for said ratchet wheel and said opening to prevent escape of sounds when the percussion device is not in use.

20. A sound comparing device comprising a coupling member provided with a main sound passage and branches communicating therewith, sound directing devices communicating with said branches, each sound directing device being independently movable in any direction, and separate means controlling the respective branches to selectively interrupt the travel of sounds therethrough.

21. A sound comparing device comprising a coupling member provided with a plurality of sound passages and sound receiving members communicating with said passages, each of said receiving members being independently movable in any direction, and means for selectively interrupting the passage of sounds through said passages.

22. A sound comparing device comprising a coupling member provided with a plurality of sound passages and sound receiving members communicating with said passages, each of said receiving members being independently movable in any direction, and means for varying the volumes of the sounds traveling through said sound passages.

23. In a sound comparing device, a coupling member provided with an air passage, means connected with said coupling member for receiving sounds found at different points, and a valve member controlling said passages and having means for opening one passage and simultaneously closing the other in proportion.

24. In a sound comparing device, a coupling member provided with air passages, and a valve member controlling said passages and having means for opening one passage and simultaneously closing the other in proportion, and means for indicating the extent of the relative openings of said passages effected by movement of the valves.

25. In a sound comparing device, a coupling member provided with air passages, means connected with said air passages for receiving sounds found at different points, a valve provided with angularly disposed openings controlling said passages, the relative angle of the openings being such that as one air passage is opened the other is closed in proportion thereto.

26. A device of the character described comprising a coupling member, means for directing sounds from different sources to said coupling member, sound delivering members leading from said coupling member, means for varying the relative volumes of the sounds passing through said coupling member to said delivering members to equalize the same, and a valve member controlling said passages and having means for opening one passage and simultaneously closing the other in proportion.

27. A device of the character described comprising a sound receiving member adapted to rest against an object to be tested, a sound percussion device located within said member and coöperating with the surface of said object, an operating device for said percussion device, and means whereby the intensity of the stroke of said percussion may be varied.

28. A device of the character described, comprising a sound receiving member adapted to rest against an object to be tested, a percussion device located within said member and coöperating with the surface of said object, a device for operating

said percussion device, and a resilient support for said operating device.

29. A sound comparing device comprising means for simultaneously receiving sounds at different points, means for directing the received sounds through different paths to a common point of observation, and means for successively controlling the passage of sounds from said receiving points to their respective path directing means.

30. In a sound controlling device, the combination with an amplifying device having a cavity adapted to be placed over and closed by a surface, and means located within the cavity for producing sounds varying with the nature of said surface.

31. A stethoscope comprising two separate transmitters, tubes secured thereto adapted to convey sound therefrom, means for preventing the passage of sound through said tubes, a chamber connected with said tubes, ear pieces, and tubes connecting the latter with said chamber.

32. A device of the character described comprising a sound receiving member having edges shaped to rest upon a surface, said member having a single outlet port, a sound conduit attached to said receiving member concentrically with respect to said outlet port to receive sound directly therefrom, a valve controlling passage of sound through said outlet port, and means for yieldingly holding said valve in a normally predetermined position.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES M. HECK.

Witnesses:
WM. S. HODGES,
CHAS. E. RIORDAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."