B. F. MIESSNER.

SPEAKING TUBE APPARATUS FOR AIRCRAFT.

APPLICATION FILED MAY 8, 1918.

1,418,388.

Patented June 6, 1922.

2 SHEETS—SHEET 1.

Fig. 14

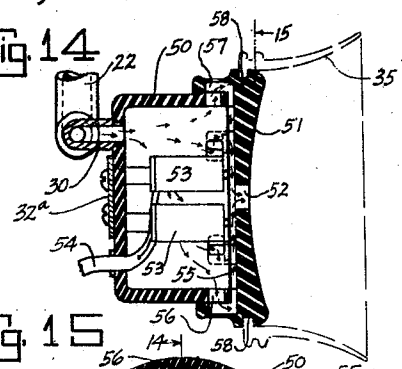


Fig. 15

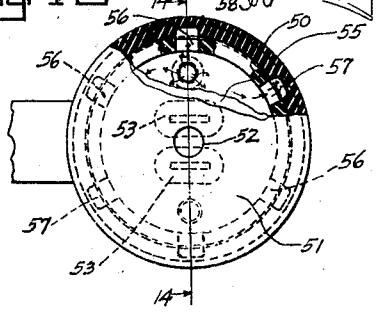


Fig. 2

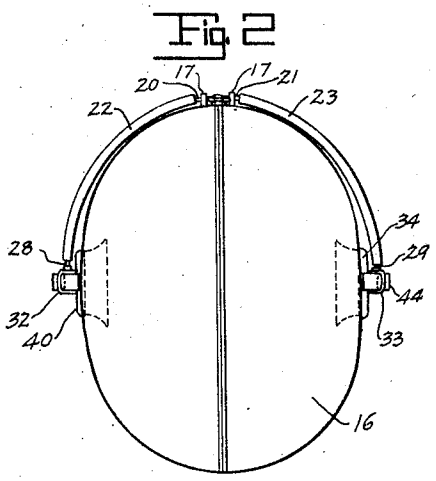


Fig. 1

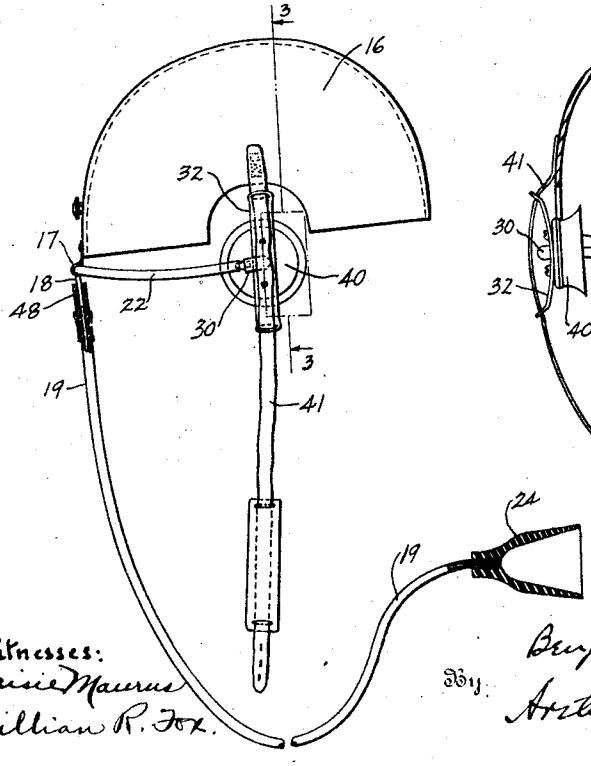
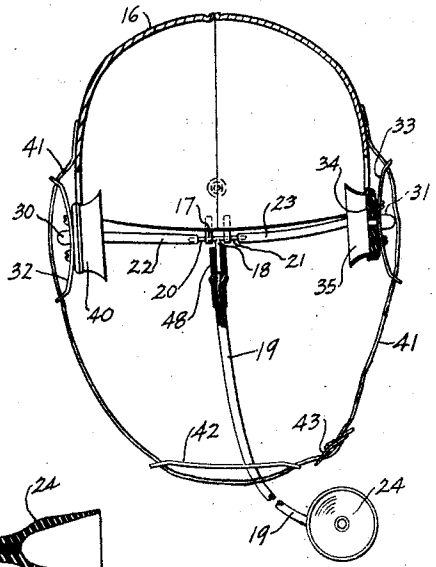


Fig. 3



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2 SHEETS—SHEET 2.

Fig. 4

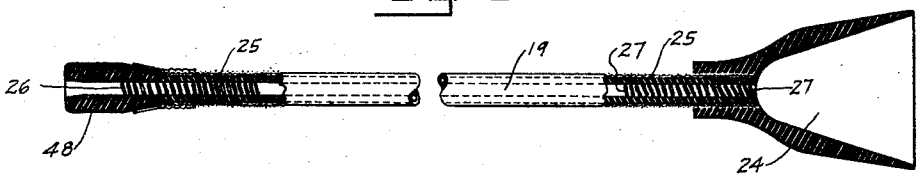


Fig. 5

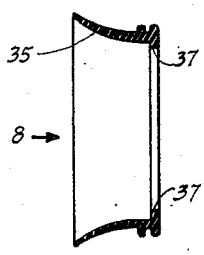


Fig. 6

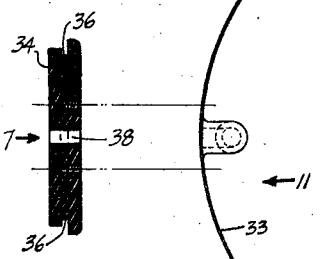


Fig. 9

Fig. 10

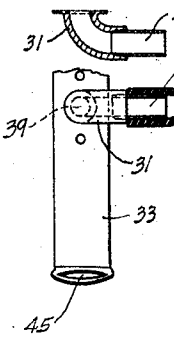


Fig. 11

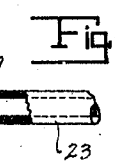


Fig. 7

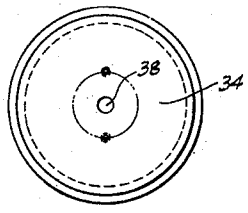


Fig. 12

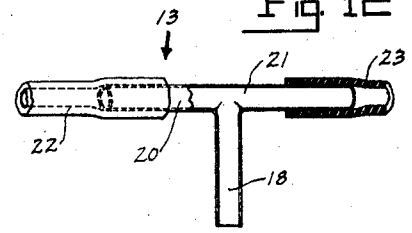


Fig. 8

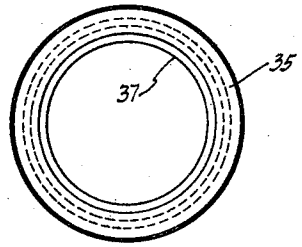
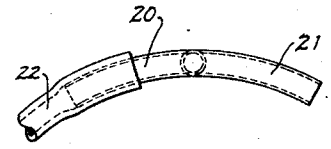


Fig. 13



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UNITED STATES PATENT OFFICE.

BENJAMIN F. MIESSNER, OF NEW YORK, N. Y.

SPEAKING-TUBE APPARATUS FOR AIRCRAFT.

1,418,388. Specification of Letters Patent. **Patented June 6, 1922.**

Application filed May 8, 1918. Serial No. 233,345.

To all whom it may concern:

Be it known that I, BENJAMIN F. MIESSNER, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Speaking-Tube Apparatus for Aircraft, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

My invention relates to speaking tube apparatus, and more especially to speaking tube apparatus by means of which one occupant of an airplane may communicate with another occupant thereof, under the usually severe noise conditions which permit of no conversational communication by the usual means.

The speaking tube forms a convenient means for intercommunication but, so far as I am aware, prior to my invention it has not been adapted to successful operation for intercommunication between occupants of an airplane, probably due to the fact that when the speaking tube apparatus heretofore known and used in other situations was used for such communication the vibrations and loud noises produced by the airplane motor and its exhaust found their way into the speaking tube and either entirely drowned out the voice sounds conveyed thereby or rendered them inaudible or not understandable.

I have discovered, however, that by using a tube of suitable size and of a certain length, relative to the wave length of the motor exhaust sounds, such that the column of air in the tube will not respond materially to the vibrations set up by the motor, the sound of the voice will be audibly conveyed from one end of the speaking tube to the other without serious interference from the severe noise produced by the motor. Further and more specific objects, features and advantages of the invention will appear from the detail description given below, taken in connection with the accompanying drawings which form a part of this specification.

In the drawings, Fig. 1 is a side view of an apparatus embodying certain main features of my invention in an approved form, certain parts being shown in section to more clearly illustrate the same.

Fig. 2 is a top or plan view of the head gear shown in Fig. 1.

Fig. 3 is a front view thereof, partly taken in section on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged broken detail of the speaking tube and mouthpiece, partly in section.

Fig. 5 is an enlarged sectional view of the earpiece of the receiver.

Fig. 6 is a similar section of the receiver base.

Fig. 7 is a face view of the receiver base looking in the direction of the arrow 7 in Fig. 6.

Fig. 8 is a face view of the earpiece looking in the direction of the arrow 8 in Fig. 5.

Fig. 9 is an edge view of one of the flat spring pieces for holding one of the receivers resiliently to the ear of the wearer.

Fig. 10 is a section through one of the connections leading to one of the receivers.

Fig. 11 is a detail illustrating the connection of the parts shown in Fig. 10 to part shown in Fig. 9 and looking in the direction of the arrow 11 in Fig. 9.

Fig. 12 is a detail showing the T connection by means of which the main portion of the speaking tube is connected to the receivers for both ears.

Fig. 13 is another view of certain parts shown in Fig. 12 looking in the direction of the arrow 13 of Fig. 12.

Fig. 14 is a section through a modified form of receiver taken on the line 14—14 of Fig. 15.

Fig. 15 is a face view of the same, part thereof being taken in section on the line 15 of Fig. 14.

Referring first to Figs. 1 to 13 inclusive, 16 represents an aviator's helmet which may be of the well known construction molded from heavy sole leather and lined with lamb's wool. This serves not only as head protection for the wearer but also as a supporting means for the speaking tube and receiving apparatus. Secured to the rear lower edge of the helmet by clips 17, is a T tube, one branch 18 of which is inserted in the receiving end piece 48 (of soft rubber) of the speaking tube 19, and the two lateral branches 20 and 21 of which are inserted in the ends of flexible rubber connecting tubes 22 and 23 respectively. At its other end the speaking tube 19 is provided with a mouthpiece 24 of suitable form of hard rubber or other suitable material. The tubes 19, 22 and 23 are most desirably made of flexible rubber tubing of the air hose type rein-

forced with strong cotton braid externally as shown at 25 in Fig. 4. The speaking tube 19 is also provided with short helical springs 26 and 27, one at each end of the tube, to prevent breaking thereof at these places of greatest strain.

The tubes 22 and 23 extend forward on each side of the helmet to connect with the receivers or earpieces, the ends of the tubes being slipped over nipples 28 and 29 respectively, these nipples being screwed into connections 30 and 31 respectively which are brazed onto flat spring pieces 32 and 33 respectively. Each of the spring pieces 32 and 33 carries a receiver 40 comprising a receiver base 34, which may be molded of some such material as bakelite and which is secured to the spring piece by means of two screws, a layer of shellac being interposed to make the joint airtight. A flexible soft rubber earpiece or cap 35 is sprung onto the receiver base 34, the base 34 being provided with a circumferential groove 36 into which an inner flange 37 on the earpiece fits to hold the latter in place thereon. Each of the bases 34 is provided with a central hole or sound opening 38 and the spring pieces 32 and 33 have holes 39 registering with the openings 38 and with the hollow or tubular connections 30 and 31 respectively so that sound vibrations may be conveyed from the branch tubes 22 and 23 into the earpieces 35. The earpieces or caps 35 are adapted to surround the rear and fit closely to the head of the user to substantially exclude outside sound vibrations.

The receivers are carried by, and when the apparatus is in use held in place by, a strap 41, the ends of which are secured to the sides of the helmet and which extends down from each side of the helmet and passes through apertures in the ends of the spring pieces 32 and 33 to pass beneath the chin of the wearer, a chin piece 42 being desirably provided through apertures in the ends of which the strap passes. The strap is made adjustable in length, as by being formed in two parts, one of which carries a buckle 43. By means of the buckle 43 the strap may be adjusted to force the receivers resiliently to the ears of the wearer of the helmet by reason of the interposition of the curved flat springs 32 and 33 causing the flexible rubber earpieces to be pressed closely against the head of the wearer to form a substantially airtight fit, and completely surround and isolate the ears from interfering engine or other noises, without material discomfort to the wearer. The spring pieces 32 and 33 may be moved up and down on the straps 41 and 44 to adjust the receivers to the ears of the wearer.

As above pointed out, the length of the speaking tube should be carefully chosen to obtain the desired results, and avoid serious interference from the airplane motor exhaust sounds when the apparatus is used on an airplane, or from other similar rapid periodic sound vibrations when the apparatus is used for other purposes. The tube should be of a length which will not respond to the engine exhaust sound vibrations, or other disturbing sound vibrations; and when the tube, as in the apparatus illustrated, becomes in use, because of the close fitting sound-excluding earpieces, in effect a tube closed at one end, it may be, and especially for airplane use most desirably is, of a length somewhat greater than, but less than three times the length of, the shortest tube which would respond to vibrations set up by the engine, that is, of a length somewhat greater than one-quarter and less than three-quarters of the wave length of the exhaust sounds, or roughly of a length equal to about half the wave length of the sounds to be excluded. With engines such as are now generally in use on airplanes this gives a tube of convenient length for the intended use. With such an ordinary four cycle eight cylinder gas engines running 1400 revolutions per minute, the wave length is about 12 feet, so that a tube about 5 or 6 feet long should be used. Inasmuch as practically all airplanes are equipped with engines having approximately the above mentioned characteristics, and as the distance between seats on such airplanes of the tandem seat type is about four feet, a tube about 6 feet long is generally found most satisfactory. A longer tube or one longer relatively to the wave length of the disturbing sounds may be desirable for some purposes, but always the tube should be of such length that the column of air therein will not respond materially to the disturbing sound vibrations.

As to the diameter of the speaking tube, that diameter should be selected which will yield a maximum ratio of voice sound intensity to motor noise intensity. That diameter, for the tube lengths recommended above, I find is about three-eights of an inch, internal diameter. The thickness of the speaking tube walls should be such as to substantially prevent the passage of interfering noises therethrough into the tube. This will vary with the nature of the material of which the tubing is made, but with flexible rubber tubing of the air hose type, reinforced as above described, I find a wall thickness of approximately one-eighth of an inch satisfactory.

In Figs. 14 and 15 I have illustrated a modified form of receiver which is a combined telephone and speaking tube receiver. It comprises a casing 50 of hard rubber, bakelite composition or other suitable material open at the front or ear side and onto the open side of which is screwed a cap or

earpiece 51, which may be of similar material, and which has the usual central opening 52 through which the sound vibrations pass to the ear of the user. Mounted within the casing is shown the usual pair of electro magnets 53 to which electrical connection is made by a cable 54 leading out through the wall of the casing, and a diaphragm 55 is held against the front of the casing inside the cap in the usual manner in position to be acted upon by the magnets. The telephone receiver is or may be of any suitable construction for receiving radio signals or telephone communications, the present invention not being concerned with the particular construction of the receiver so far as it has to do with the receiving of wireless or telephone messages. In order that the receiver may also receive speaking tube communications, the end of the speaking tube, one of the branch tubes 22 in the construction shown, is connected to the interior of the casing, such connection being shown in Fig. 14 as made by screwing the end of the connecting piece 30 into an opening in the rear wall of the casing. To provide for the passage of the sound waves from the interior of the casing to the ear opening 52, the casing is formed with a plurality of sound openings 56 adjacent its front edge and the flange of the cap or earpiece 51 is formed with a plurality of sound openings 57 to register with the openings 56 so as to provide for the passage of sound vibrations from the interior of the casing through the openings 56 and 57 and through the space between the diaphragm and the front wall of the earpiece to the ear opening 52. This arrangement, without interfering with the diaphragm 55, provides for the free passing of the sound vibrations from the speaking tube to the ear opening 52 and to the ear of the user. When used on the receiving apparatus shown in Figs. 1, 2 and 3, one of these combined telephone and speaking tube receivers may be substituted for one of the speaking tube receivers shown in Figs. 1, 2 and 3, or receivers such as shown in Figs. 14 and 15 may be used on both sides of the helmet. Such receivers may be provided with spring pieces 32^a similar to the spring pieces 32 and 33 for connection to the strap 41.

When the receiving apparatus is provided with either one or two of the combined telephone and speaking tube receivers, wireless communications as well as telephone communications may be received, in addition to communications received through the speaking tube 19. It will be understood also that this combined receiver is adapted to have the soft earpiece 35 attached thereto, the inner flange 37 of the latter being adapted to fit in a circumferential groove 58 in the cap 51.

Under service conditions, the speaking tube 19 may be made a permanent part of the airplane body by strapping it or otherwise securing it permanently in place thereon, and the helmet may be disconnected therefrom by pulling out the branch tube 18, so that the helmet may be worn on and off of the plane as desired. For two-way conversation an additional apparatus may be employed similar to that above described. The invention provides a simple, durable, inexpensive, and effective apparatus for carrying on instant and direct voice communication on aircraft, where such communication is of great importance, and also when desired for receiving radio or telephone messages.

While I have described my improvements in great detail and in connection with preferred forms thereof, I do not desire to be limited to such details and forms since many changes and modifications may be made and the improvements embodied in widely differing forms without departing from the spirit and scope of the invention in its broader aspects. Hence, I desire to cover all arrangements having the combination of features or their equivalents, set forth in any one or more of the appended claims.

What is claimed is:

1. Speaking tube apparatus for use where extraneous rapid periodic sound vibrations tend to interfere with the audibility of voice sounds through the apparatus, comprising a speaking tube with a mouthpiece at one end and a receiver at the other end, said tube having a length such that the column of air therein does not materially respond to said extraneous sound vibrations.

2. Speaking tube apparatus for use where extraneous rapid periodic sound vibrations tend to interfere with the audibility of voice sounds through the apparatus, comprising a speaking tube with a mouthpiece at one end and a sound-excluding receiver at the other end, said tube having a length such that the column of air therein does not materially respond to said extraneous sound vibrations, the length of the tube being somewhat greater than one-fourth and less than three-quarters of the wave length of said extraneous sound vibrations.

3. Speaking tube apparatus for use where extraneous rapid periodic sound vibrations tend to interfere with the audibility of voice sounds through the apparatus, comprising a speaking tube with a mouthpiece at one end and a receiver at the other end, said tube comprising reinforced flexible rubber tubing and having a length somewhat greater than one quarter of the wave length of such extraneous sound vibrations.

4. Speaking tube apparatus for use where regular and rapid extraneous sound vibrations would otherwise interfere with voice

communication, comprising a speaking tube having a length such that the column of air therein does not respond to said vibrations.

5. Speaking tube apparatus for use where regular and rapid extraneous sound vibrations would otherwise interfere with voice communication, comprising a speaking tube provided with a sound-excluding receiver at one end and which has a length greater than one-quarter and less than three-quarters of the wave length of said vibrations.

6. Apparatus of the class described, having in combination a flexible speaking tube, an aviation helmet, two ear receivers carried by said helmet and connected by branch tubing with said speaking tube, an adjustable strap having its ends secured to the sides of the helmet and adapted to extend beneath the chin of the wearer, and means intermediate the receivers and said strap for resiliently pressing said receivers over the ears of the wearer of the helmet.

7. The combination with a helmet, of a speaking tube connection mounted on the helmet, two speaking tube ear receivers carried by said helmet and connected by branch tubing with said speaking tube connection, and means for resiliently pressing said receivers over the ears of the wearer of the helmet, said last mentioned means comprising short spring pieces secured to said receivers and an adjustable strap having its ends secured to the sides of the helmet and adapted to extend beneath the chin of the wearer and bearing against the ends of said spring pieces.

8. The combination with a helmet, of a speaking tube connection mounted on the helmet, two speaking tube ear receivers carried by said helmet and connected by branch tubing with said speaking tube, and means for resiliently pressing said receivers over the ears of the wearer of the helmet, said last mentioned means comprising spring pieces secured to said receivers and an adjustable strap for operating said springs, said spring pieces comprising curved flat springs with apertures in the ends thereof through which said strap passes to extend beneath the chin of the wearer.

9. Apparatus of the class described, having in combination a flexible speaking tube, a mouthpiece connected to one end thereof, a T tube connection detachably connected to the other end thereof, an aviator's helmet, two receivers carried by said helmet and adapted to fit to the ears of the wearer thereof, flexible tubing connecting said T tube with said receivers, and means whereby said T tube is supported from the back of said helmet.

10. The combination with an aviator's helmet, of two speaking tube receivers carried by said helmet and adapted to fit to the ears of the wearer thereof, a T tube connection connected to the back of the helmet, tubing connecting said T tube with said receivers, and means for resiliently pressing said receivers to the wearer of the helmet.

11. A combined speaking tube and telephone receiver, comprising a casing having an earpiece provided with a sound opening, a diaphragm mounted within the casing, an electromagnet for vibrating the diaphragm, an air tube connection to the interior of the casing, and a passage for sound vibrations extending from the interior of the casing to the sound opening in the earpiece.

12. A combined speaking tube and telephone receiver, comprising a casing having an earpiece provided with a sound opening, electromagnetic receiving apparatus within the casing, and a speaking tube connection from which an open way for the passage of sound vibrations extends to the sound opening of the earpiece.

13. A combined speaking tube and telephone receiver, comprising a casing having an open front, an earpiece provided with a sound opening and having a flange extending about the front portion of the sides of the casing, a diaphragm mounted within the casing adjacent the earpiece, electromagnetic means within the casing for vibrating the diaphragm, openings through the casing wall adjacent the front edge, passages formed in the flange of the earpiece to register with said openings, and an air tube connection leading to the interior of the casing.

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

BENJAMIN F. MIESSNER.

Witnesses:
ETHEL JOHNES,
A. L. KENT.