

(No Model.)

A. C. WHITE.
TELEPHONE.

No. 516,982.

Patented Mar. 20, 1894.

Fig. 1.

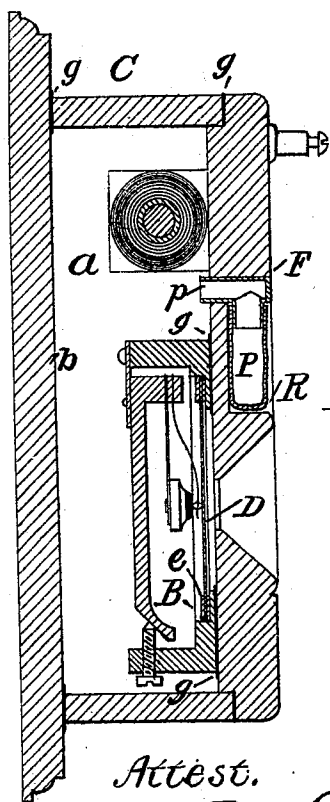
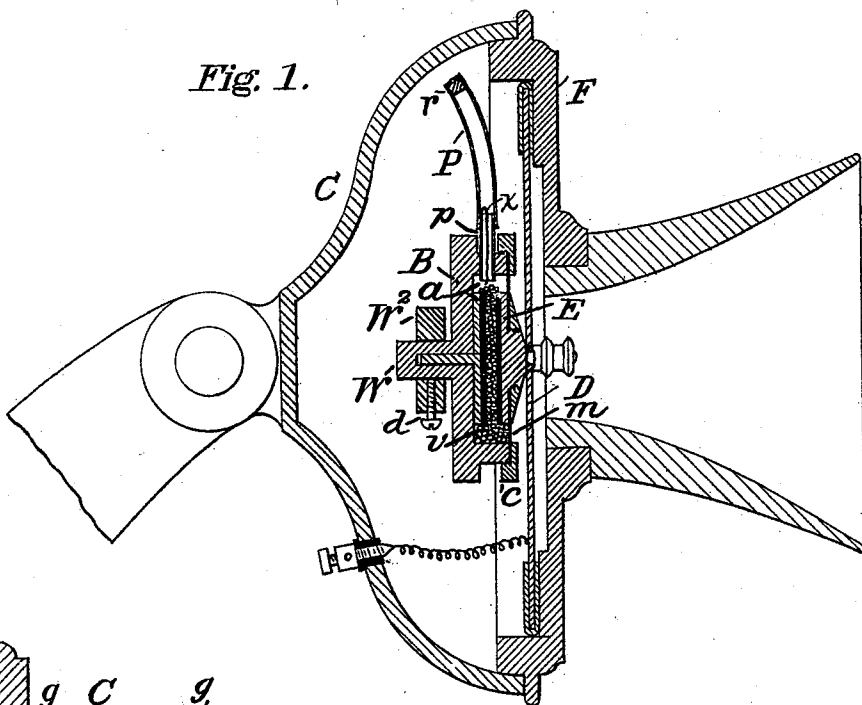


Fig. 2.

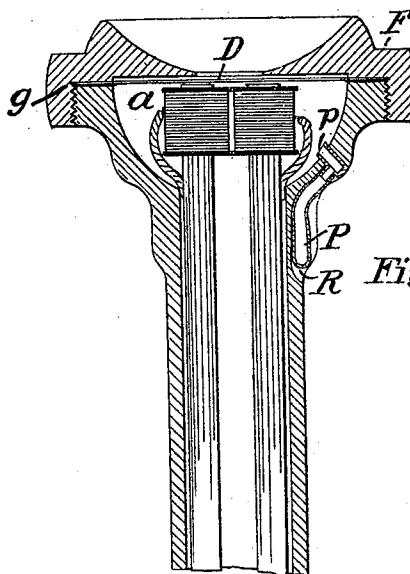


Fig. 3.

Attest.

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UNITED STATES PATENT OFFICE.

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TELEPHONE.

SPECIFICATION forming part of Letters Patent No. 516,982, dated March 20, 1894.

Application filed November 8, 1893. Serial No. 490,353. (No model.)

To all whom it may concern:

Be it known that I, ANTHONY C. WHITE, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephones, of which the following is a specification.

In nearly all telephone transmitters and receivers there is some form of diaphragm arranged to be acted upon either by the waves of the sound to be transmitted, or by the variations of a magnetic field, representing and corresponding to the waves of the transmitted sounds. One side, which may be called the front of such diaphragm, is ordinarily exposed to the atmosphere, whereas the other, which may be spoken of as the back, is ordinarily inclosed in a case of some kind or form, and is either secured to, or in contact with the elements of a variable resistance whose relation it is adapted to change; or else it is so adjusted as to be in close proximity to a magnet in front of which it may vibrate. The case which incloses the back of the diaphragm is usually not air tight, and the atmospheric conditions, such as the variations of humidity and pressure on the two sides of the diaphragm, readily adjust themselves, maintaining a substantial equilibrium. In some cases also, especially in transmitters of that class, employing granular variable resistance material, an auxiliary diaphragm is employed. Such a one is disclosed in Patent No. 485,311, granted to me November 1, 1892, which describes a construction wherein the principal, or sound receiving diaphragm, is combined with an elastic disk, or auxiliary diaphragm, supporting the front electrode, and itself secured to the center of the main diaphragm so as to participate in its movements; and with a chamber, containing the finely divided conducting material, which chamber is closed in front by the said auxiliary diaphragm.

Under certain conditions, as for example when telephones are to be used in mines, or to be used by divers, it becomes necessary to hermetically seal the case, or chamber, or make it airtight, because otherwise the great relative humidity of the air would speedily bring about corrosion of the several parts,

interfering with the operation of and ultimately destroying the instrument. But when this is done, the atmospheric conditions with respect to pressure and humidity on the two sides of the diaphragm are no longer automatically equilibrated, and considerable difference of pressure between the air within and without the case may result, as for example when an instrument adjusted and sealed at the sea level is placed in a diver's suit and carried down some distance below the surface; or is operated in a mine. This difference of pressure may affect the instrument adversely, in two distinct ways. First: The difference of the pressure exercised upon the two sides of the diaphragm respectively, causes the said diaphragm to be deflected or warped in the direction of the stronger pressure, thereby changing the adjustment, and also militating against the free vibrations of the diaphragm, by increasing the tension upon it. Second: By tending to break down the sealing of the case and thereby opening channels through which moisture may enter, causing a condition which opposes a continued successful use of the instrument.

The object of my improvement is to insure equal pressure on both sides of the diaphragm under varying conditions though the case inclosing one side of the said diaphragm be airtight or hermetically sealed; and with this end in view the invention provides and combines with a telephone, means for establishing such equal pressure; such means specifically comprising a flexible and air tight sack, reservoir or tube, having one of its surfaces in contact with the air within, while its other surface is in contact with the air without the said case.

Figure 1 of the drawings shows the invention applied to the auxiliary diaphragm of the transmitter which forms the subject of the patent to me, hereinbefore mentioned. Fig. 2, shows it applied to the sound receiving diaphragm of a Blake transmitter; and Fig. 3 indicates a magneto telephone fitted with a pressure equalizing device.

The same letters, so far as may be, represent the same parts in all the figures.

In Fig. 1, C is the outer casing which, as

shown, is not airtight. It is usually metallic, is cup shaped, is mounted on the usual jointed arm, and it supports the frame piece F.

D is the sound receiving diaphragm, E a conducting disk constituting the front or vibratory electrode, B a second disk forming the fixed rear electrode, and *v* is the finely divided conducting material, or variable resistance medium.

W, is a heavy metallic block, serving as a casing or frame for the electrodes and the finely divided conducting material, and is chambered to receive them, as shown; the side wall of said chamber in the block, W, being (as provided in my previously mentioned patent) lined with gummed paper, or some such material, to prevent the short circuiting of the instrument. The carbon disk, B, is secured to the inner face or bottom of the chambered block W, and the front electrode, E, is secured to the inner face of an auxiliary diaphragm, or plate, *m*, of mica, which is itself clamped to the sides or rim of the block, W, by a threaded clamping ring, *c*, secured to the said block as shown; a closed chamber or containing case, *a*, being thereby formed, within which the electrodes and finely divided carbon, are confined. The front electrode, E, and the parts immediately united thereto, are rigidly secured to the sound receiving diaphragm D as shown. The block W, and in fact the entire variable resistance button, is secured by a set screw, *d*, to a heavy bridge piece W² which, in a manner well understood, is mounted on the metallic frame, F, of the instrument. A metal tube, *p*, is shown as being screwed into the block, W, opening at one end into the containing chamber and having attached to the other, one end of the flexible and yielding air reservoir, P, shown as a rubber tube, having its outer end tightly closed by a stopper, *r*. This tube, it will be seen, is bodily placed in the outer space, though it opens into the containing chamber or sealed case *a*. The chamber, *a*, which is closed in front of the auxiliary diaphragm or spring disk *m*, and at the side by the stopper *r*, is now hermetically sealed in any preferred way, such as by covering all joints with asphaltum paint.

The operation of the pressure equalizer in connection with the instrument shown in Fig. 1 is as follows: The outer case, C, closed in front by the frame, F, and diaphragm, D, is not airtight, and the pressure and humidity of the surrounding atmosphere is readily communicated to the air within this outer case. If due to any such causes as have been adverted to, the pressure of the surrounding air differs from that of the air within the inner sealed chamber *a*, the walls of the tube P being flexible, yield to the superior pressure, so modifying the capacity of the hermetically sealed chamber as to approximately equalize the pressure within and without the said chamber. When the bore

of the metal tube *p* is sufficiently large to admit of the passage through it of a granule of the finely divided carbon *v*, a wire, *z*, or several wires, or a mass of fibrous material, or any such partially choking device, may be placed within the said tube; or its mouth may be partly closed by gauze.

Any air tight flexible material may be employed in the formation of the flexible air reservoir or sealed tube of my pressure compensator, and I have experimentally found that pure gum rubber, or thin antimony rubber operates satisfactorily.

In Figs. 2 and 3 the only diaphragm present is the regular and ordinary sound receiving diaphragm D. When conditions of use require that the case, or sounding box inclosing the space in the rear of this diaphragm be hermetically sealed, this is conveniently done by interposing gaskets of soft rubber or like material, *g*, between the two factors of each joint. Such a gasket in Fig. 2 is shown as being interposed between the side, C, of the casing, its baseboard *b*, and front board F; and also between the frame, B, which support the working parts, and the said front board; while the ordinary rubber ring, *e*, which encircles the diaphragm edge prevents air leakage at that point.

In the hand telephone of Fig. 3 the only joint is sealed by the interposition of a rubber ring between the diaphragm edge and its seat, but, if desired, a similar ring may be placed above the diaphragm also. A portion only of the telephone is shown, but it is of course to be understood that the entire case must be hermetically sealed. In the former case (that of Fig. 2) a recess R is cut in the casing and the rigid metal pipe *p* being so inserted as to connect the interior *a* of the casing with such groove or recess, the rubber tube is then suitably secured to the said pipe and rests in the recess, being externally exposed to the air, while internally it is in communication with the inclosed space *a*. A similar arrangement is provided for the hand telephone case where the rubber tube P lies in a hollow or recess, R, formed in the side of the case C, and connects by means of the pipe, *p*, with the air within the space *a*.

Having now described my invention, I claim—

1. In a speaking telephone the combination with the diaphragm having one side inclosed or cut-off from communication with the medium to which the other side is exposed, of a pressure equalizing or compensating device, substantially as described.

2. In a telephone, a diaphragm having one side exposed to the atmosphere, and the other side inclosed in an airtight chamber; combined with means, substantially as indicated, for automatically maintaining the air pressure on the inclosed surface equal to that on the exposed surface of the said diaphragm.

3. The combination in a speaking telephone with a diaphragm having one surface inclosed

within and forming one wall of an airtight case or sounding box; and its other surface exposed to the air on the exterior of said case; of a flexible elastic or yielding reservoir or air tube, extending through the wall of the said air tight case so that the interior of the said reservoir communicates with and forms an extension of the space on one side of the diaphragm, while its exterior surface projects into and is surrounded by the air on the other side of the diaphragm, substantially as described herein.

4. The combination in a granular variable resistance telephone transmitter of a granulation containing case or chamber closed on one side by a flexible disk or auxiliary diaphragm; with an air tube or reservoir formed of highly flexible, elastic, or yielding material extending through the wall of said case into the surrounding space, the said reservoir being closed outwardly, but opening into the said case, so that the inner surface is in contact with the air within the case and on one side of the auxiliary diaphragm, while its outer surface is exposed to the air exterior to the case and on the other side of the said

auxiliary diaphragm, substantially as described.

5. A transmitting telephone comprising a sound receiving diaphragm; a flexible or spring disk, constituting an auxiliary diaphragm mechanically connected with the center thereof; an air tight chamber closed in front by said auxiliary diaphragm and containing a mass of finely divided variable resistance material; and a device for equalizing the pressure of the air on the sides of the said auxiliary diaphragm, consisting of a rigid tube extending through the wall of the airtight chamber, and a flexible rubber tube closed at its outer end attached to the outer end of the said rigid tube, substantially as specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 3d day of November, 1893.

ANTHONY C. WHITE.

Witnesses:

MARY E. LEAHY,
VICTOR M. BERTHOLD.