March 1, 1938. H. R. WARNKE 2,109,761

TELEPHONIC DEVICE

Filed Sept. 20, 1935

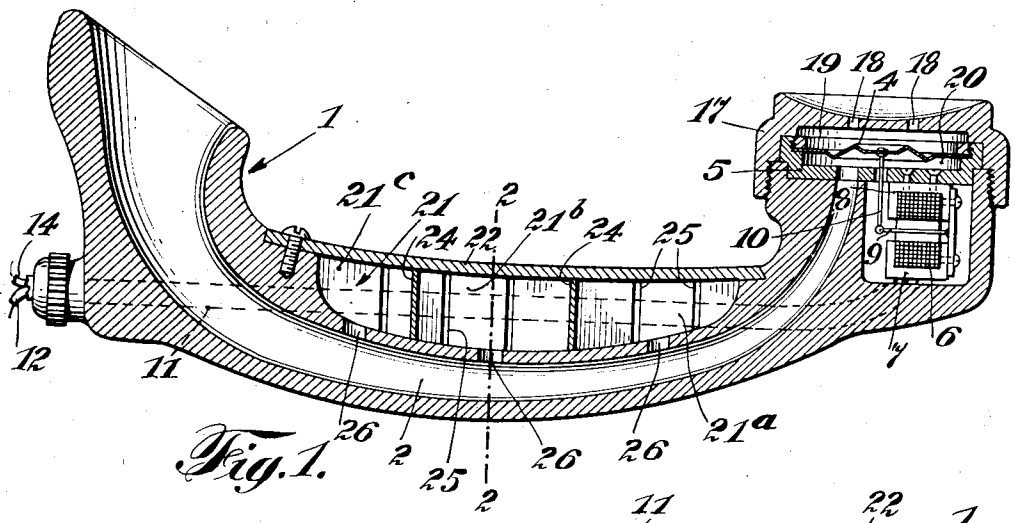

Fig. 1.

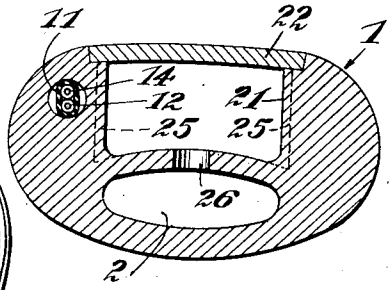

Fig. 2.

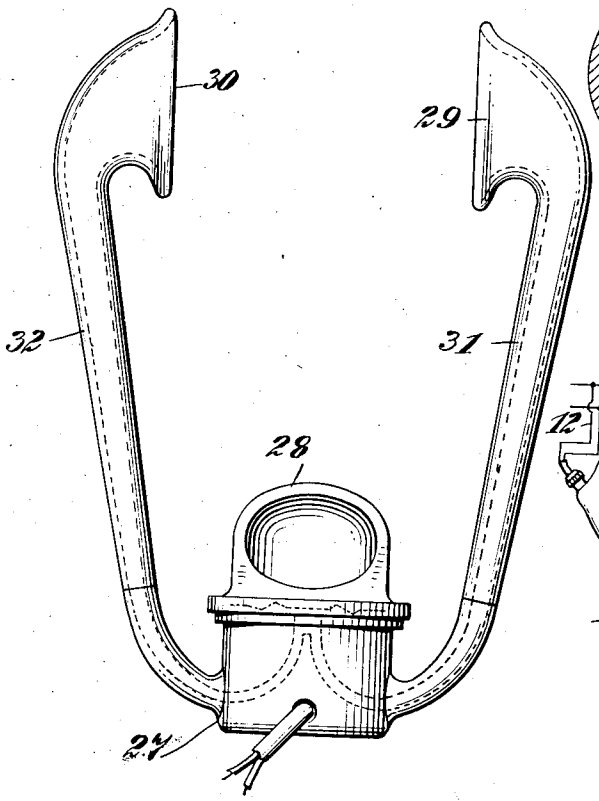

Fig. 3.

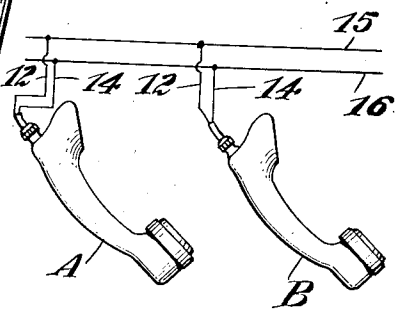

Fig. 4.

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TELEPHONIC DEVICE

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Application September 20, 1935, Serial No. 41,337

3 Claims. (Cl. 179—102)

The present invention relates broadly to electrical apparatus and more especially to a telephonic instrument of a simple construction.

The device comprising the present invention is a type of electrical telephone characterized more especially by simplicity, and, therefore, particularly adapted for use where complicated mechanism is to be avoided, such as in apartment houses, simple intercommunicating systems, telephone systems on ships, battle ships, and the like.

The apparatus embodying the present invention comprises a hand piece adapted to support an energizing unit which is electrically connected with a circuit, and wherein the current in the circuit is produced by energy from sound waves which are translated into electrical energy that supplies the circuit, without the aid of batteries, and which energy is transmitted to a similar instrument that is utilized as a receiver. In other words, the same device comprises both a receiving and transmitting member. It is particularly desirable, especially on battle ships, for the operator to be able to transmit and receive without removing the instrument from operating position. Therefore, the preferred form of the present invention comprises a hand support for the unit, which support is provided with a horn so that one end of the device may be placed over the operator's ear and the other end of the device may terminate adjacent the operator's mouth, with the operating unit properly arranged in the support in such manner that the operator may speak into the unit for transmission or listen to the unit for reception without removing the device from operative position.

The use of a single unit for sending and receiving, in a self-energizing system, is a decided improvement over the separate transmitting and receiving units in such system in that the effective energy is concentrated in single units rather than being dissipated in double units. This is of prime importance on battle ships, where, for example, more than one hundred units may be simultaneously in use on the same circuit, and it is also important on battle ships that such a device be at all times operative to transmit and receive while held in a single operative position.

The present invention also contemplates a tuned relation between the diaphragm and the air column of the horn so as to cover a band of sound frequency best adapted for voice transmission. A further object of the present invention is the provision of a resonating chamber which may be connected to the air column of the horn by adjustable partitions in such manner as to provide a single resonating chamber or a plurality of resonating chambers of such size as to dampen out or eliminate extraneous noises which are not within the speaking voice range and which otherwise would interfere with the efficiency of the device. These resonating chambers, therefore, in effect narrow the range of the effective air column to air wave frequencies efficient for voice transmission.

Preferably, the air column is so connected with the diaphragm as to permit freedom of operation of the diaphragm in such manner as to obtain maximum vibration thereof within the desired frequency range, thereby producing maximum voice currents for the electrical circuit.

Other and further objects of the present invention will in part be obvious and will in part be pointed out hereinafter in the specification following by reference to the accompanying drawing forming a part thereof, and wherein like parts in the various figures are designated by like characters.

It is recognized that the present invention may be embodied in constructions other than those specifically disclosed herewith, and, therefore, it is to be understood that the disclosure is to be considered as illustrative and not in the limiting sense.

Fig. 1 illustrates a longitudinal section through the preferred form of the present invention.

Fig. 2 is a transverse section taken on line 2—2 of Fig. 1.

Fig. 3 illustrates a modified form of the apparatus provided with double ear pieces.

Fig. 4 illustrates two stations utilizing apparatus in accordance with the present invention.

Referring now to the drawing and more especially to Fig. 1, which illustrates a longitudinal section through the preferred form of the device, the body 1 of the support preferably is constructed of molded material and may be either light weight metal or other suitable moldable material commonly used in the electrical and telephonic arts. An opening 2 comprising a sound transmitting conduit or horn extends from one end of the body to the other, and in the preferred form is of the type known as an exponential horn. This opening or horn 2 terminates with the smaller end thereof adjacent a diaphragm 4 which is mounted in a supporting frame 5 that carries a coil 6 of insulated wire enclosed within pole pieces 7 and 8. An armature 9 is effectively mounted to vibrate between the pole pieces 7 and 8 and is connected by a strut 10 with the diaphragm 4. Thus, as the diaphragm

vibrates, a variable electrical wave is set up in the coill 6, and conversely, when a variable electrical wave passes through the coil 6, the diaphragm is vibrated. An opening 11, indicated in Fig. 1 in dotted lines, is provided to comprise a conduit for connecting wires 12 and 14 which extend through a flexible cable, as is common in the art, to permit the coil 6 to be electrically connected with the circuit 15—16, Fig. 4. Where the diaphragm 4 is mounted on one end of the device as is illustrated in Fig. 1, a protective cap 17 is suitably secured over the diaphragm. This protective cap is provided with suitable openings 18 to permit sound waves to enter and emit from the chamber 19 above the diaphragm. It is to be noted that in the preferred form, the operating horn 2 connects with the chamber 20 below the diaphragm 4 so that the diaphragm constitutes a partition between the chambers 19 and 20, and in the preferred form the diaphragm operates to set up air waves in the chamber 19 above the diaphragm while the transmitted or spoken sound waves are effective on the diaphragm through the chamber 20 below the diaphragm. Preferably, the diaphragm and the air column of the horn are so tuned as to be in harmonious relation one to the other over a band of air frequencies best adapted for voice transmission and also it will be noted that the chamber 19 above the diaphragm is open to atmosphere whereas the chamber 20 below the diaphragm is also open to atmosphere through the horn 2, so that there is little dampening effect on the diaphragm 4 due to confined air spaces. The result of this is a maximum vibration of the diaphragm when it is operating and this adds to the efficiency of the device. The open end of the horn may be used as an ear piece and under these conditions, the message to be transmitted is spoken directly against the diaphragm or in the preferred use, the diaphragm end of the device, as shown, is placed over the operator's ear and the spoken words are transmitted through the horn 2 to the diaphragm.

Another feature of the invention is the provision of resonating chambers which may be used as dampeners to dampen out undesirable peaks in the voice frequency range and to this end the body 1 is provided with a chamber 21 which may be molded into the body 1 of the support and may be provided with a cover plate 22 suitably held in position to form a closed chamber. Preferably, provision is made to support partitions 24 within the chamber 21 in such manner as to divide this chamber 21 into compartments 21*a*, 21*b*, and 21*c*. These partitions 24 may be held in place by guide slots 25 formed in the side walls of the chamber 21. These slots are arranged in such manner that the partitions 24 are adjustable. The partitions may be entirely omitted or as many partitions may be inserted as is desired, to form resonating chambers, and these chambers may be adjusted to proper size by placing the partitions in guide slots 25 in such manner as to enlarge or decrease the size of the chambers. These resonating chambers 21 may connect with the horn 2 through openings 26, and if it is found that additional openings are desired, such openings are easily provided by drilling through the bottom wall of the chamber 21 into the sound conduit or horn. Also, if the particular installation requires less sound chambers, the openings 26 may be plugged in any suitable manner so that sound chambers may be dispensed with in whole or in part as may be desired. As is customary in the manufacture of diaphragms of this character, the diaphragm 4 is so constructed as to be sensitive to and respond to waves of a predetermined frequency range; for example, a range of from approximately 700 to 2500 cycles, which range corresponds roughly to the voice range. Thus, with the diaphragm properly designed, the horn can be adjusted by varying the resonant chambers so that the horn acts most efficiently as a passageway for waves of the desired frequency range.

Fig. 3 illustrates a modification of the device in which the energizing unit is mounted in a casing 27 which is provided with a mouth piece 28 and also with a pair of transmitting horns 29 and 30 which may comprise ear pieces. Preferably, the outer portions 31 and 32 of these ear pieces are made from rubber or other material having sufficient flexibility to permit the adjustment of the ear piece ends to the ears of the user. The device may be held in place entirely by the resiliency of the horn portions 31 and 32 or it may be suspended by a suitable strap passing around the neck of the operator, as is common in the art.

Fig. 4 illustrates a pair of units such as shown in Fig. 1 connected in parallel in an electrical circuit so that the operators at stations A and B may communicate with each other through the system.

It will be observed that in the device shown in Fig. 1, the operating diaphragm unit is located at one end of the device, whereas in the construction shown in Fig. 3, the operating unit is located at the middle of the device, and that in the construction shown in Fig. 3, it is possible to utilize one of the horns, for example the horn 29, as a receiving device and to utilize the other horn 30 as a mouth piece to talk into the device to vibrate the diaphragm. It, therefore, will be seen that the operating diaphragm unit may be mounted between the ear piece and the mouth piece, or as previously stated in the preferred form, the operating unit is mounted at one end of the device.

The extreme simplicity of the instrument makes it particularly adapted for naval ships, and the characteristics of the device whereby the air column and diaphragm may be suitably tuned for a particular band of voice frequencies renders it especially adapted for use in the midst of machinery noises and other noises which are present in the operation of the battle ship, or similar conditions of operations where this device is particularly of use.

What I claim is:

1. A device of the class described comprising a supporting handle having a horn-shaped opening extending substantially the length of said handle, a diaphragm mounted adjacent one end of said horn-shaped opening, electrical means operatively connected with said diaphragm whereby the vibrations of said diaphragm produce a variable electrical current in said electrical means and whereby said electrical means is operative to vibrate said diaphragm when a variable electrical current is transmitted to said electrical means, and a chamber wholly within said handle operatively connected with said horn-shaped opening to comprise a resonating chamber to absorb undesirable sounds and prevent the same from reaching said diaphragm through said horn-shaped opening.

2. A telephonic handpiece device comprising casing adapted to the grip of a hand, a single diaphragm therein, separate sound chambers on opposite sides of said diaphragm, a horn-shaped

passageway connected with one of said sound chambers, sound transmitting passageways connected with the other of said sound chambers, a chamber wholly within said casing operatively connected with said horn-shaped passageway to comprise a resonating chamber to absorb undesirable sounds and prevent the same from reaching said diaphragm through said horn-shaped opening, and electrical means connected with said diaphragm to translate the movements of said diaphragm into a variable electrical current.

3. A telephonic handpiece device comprising casing adapted to the grip of a hand, a single diaphragm therein, separate sound chambers on opposite sides of said diaphragm, a horn-shaped passageway connected with one of said sound chambers, sound transmitting passageways connected with the other of said sound chambers, a chamber wholly within said casing operatively connected with said horn-shaped passageway to comprise a resonating chamber to absorb undesirable sounds and prevent the same from reaching said diaphragm through said horn-shaped opening, and electrical means connected with said diaphragm to translate the movements of said diaphragm into a variable electrical current, said last-mentioned chamber being of variable character whereby the sound transmitting characteristics of said horn-shaped passageway can be varied.

HERBERT R. WARNKE.