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F. HAMBURGER, NOW BY JUDICIAL CHANGE
OF NAME FRAY HARDWICK
TELEPHONE SUBSTATION APPARATUS
Filed Oct. 8, 1937

FIG. 1

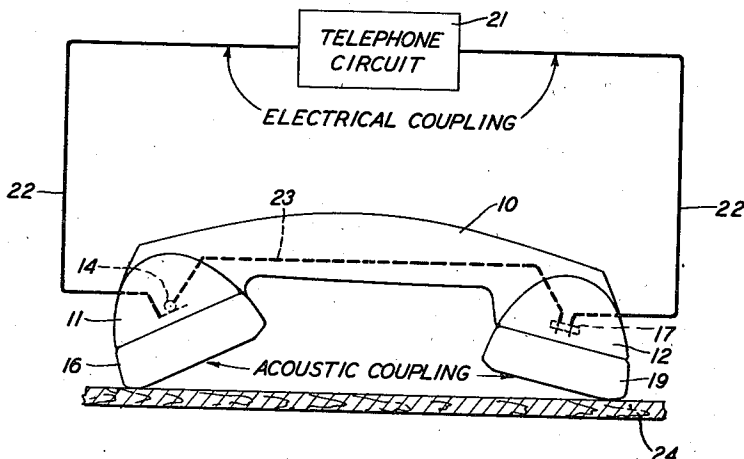


FIG. 2

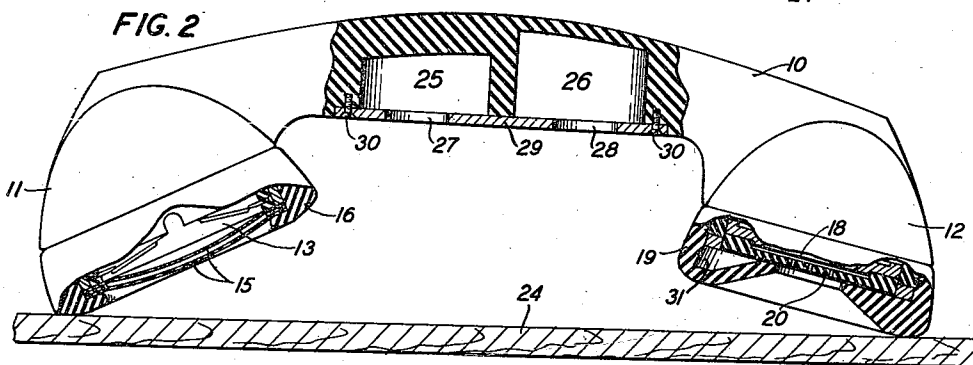


FIG. 3

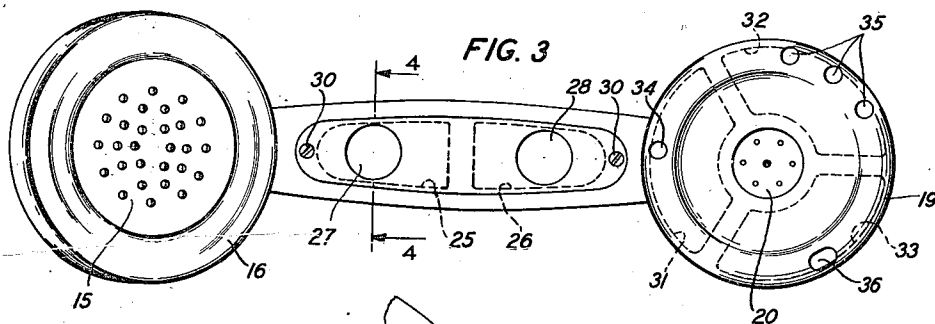
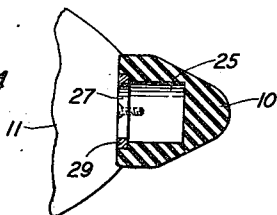


FIG. 4



INVENTOR
F. HAMBURGER
BY

Walter C. Kiesel
ATTORNEY

UNITED STATES PATENT OFFICE

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TELEPHONE SUBSTATION APPARATUS

Frey Hamburger, Orange, N. J., now by judicial change of name Fray Hardwick, assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application October 8, 1937, Serial No. 167,904

7 Claims. (Cl. 179—103)

This invention relates to telephone substation apparatus and more particularly to telephone handsets.

Telephone handsets usually comprise a handle, a transmitter mounted at or adjacent one end of the handle and a receiver mounted at or adjacent the other end of the handle. When the handset is used, the user may find it convenient or necessary during the course of a telephone conversation to place the handset upon a support, such, for example, as the top of a desk or table. When the handset is thus positioned, a relatively close acoustic coupling is established between the diaphragms of the transmitter and the receiver and an electro-acoustic circuit including the receiver and the transmitter is completed. This circuit may have a natural period within the audio-frequency range so that when the handset is placed upon the support the circuit resonates and an objectionable howling is produced.

One object of this invention is to substantially prevent or minimize the howling tendency in telephone handsets under certain conditions of use.

In accordance with one feature of this invention, the handle of the handset is provided with one or more cavities having a restricted orifice extending from the face of the handle nearest the transmitter and receiver. Each cavity and its associated orifice constitute an acoustic resonator which absorbs energy from the sound field between the diaphragms of the transmitter and receiver so that the acoustic coupling between the diaphragms is reduced. The resonator preferably is so designed that its natural frequency is substantially equal to or of the order of the resonant frequency of the electro-acoustic system when conditions are the most conducive to the production of the howling tone.

The invention and the foregoing and other features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is a view partly schematic and partly diagrammatic of telephone apparatus, illustrating the couplings between the transmitter and the receiver of the telephone handset;

Fig. 2 is a side view of a telephone handset constructed in accordance with this invention, portions of the handle and of the transmitter and receiver caps being broken away to show parts of the transmitter and receiver and the resonators in the handle;

Fig. 3 is a front view of the handset shown in Fig. 2; and

Fig. 4 is an enlarged sectional view along line 4—4 of Fig. 3 illustrating the configuration of the cavities in the handle of the handset.

Referring now to the drawing, the telephone handset comprises a support, which may be of molded insulating material, including a handle 10, a transmitter portion 11 at one end of the handle and a receiver portion 12 at the other end of the handle, the portions 11 and 12 having cavities therein for accommodating a transmitter and a receiver respectively. The transmitter and receiver may be of any of the usual types. For example, the transmitter may include a unit of the general construction disclosed in Patent 2,042,822, granted June 2, 1936, to Arthur F. Bennett and William L. Tuffnell and comprising a diaphragm 13 and a carbon granule element 14. The transmitter unit may be held in place, together with protective grills 15, by a centrally apertured clamping member, cap or mouthpiece 16.

The receiver may include a unit of the general construction disclosed in the application of Louis A. Morrison and Edward E. Mott, Serial No. 93,792, filed August 1, 1936, and comprising an electromagnet element 17 and a magnetic diaphragm 18 associated with the electromagnet element. The receiver unit may be held on position in the portion 12 by a clamping member, cap or ear-piece 19 having a central grid portion 20.

As shown in Figs. 1 and 2, the clamping members or caps 16 and 19 are inclined toward each other.

When the handset is used, the transmitter and receiver are coupled electrically to each other and a telephone line 21 by conductors 22 and 23, the latter of which may be embedded in the handle 10. In the course of a telephone conversation, the user may place the handset upon a support 24, such for example as a shelf or the top of a desk or table, with the diaphragms 13 and 18 thereadjacent. Consequently, a confined sound path is established between the diaphragms 13 and 18 and a relatively close acoustic coupling exists between the transmitter and receiver. An electro-acoustic circuit is also completed including the telephone line 21, the transmitter and receiver and the acoustic path between the diaphragms 13 and 18. This circuit may resonate at a frequency within the audio-frequency range as a result of which a sharp sustained tone is produced and an objectionable howling or singing established.

In accordance with one feature of this inven-

tion, means are provided in the handle of the handset for reducing the acoustic coupling between the transmitter and the receiver under the aforesaid conditions of use, so that the howling tendency is suppressed or minimized. In one form, this means comprises a plurality of chambers or cavities 25 and 26 in the handle 10, the chambers or cavities having communication with the atmosphere through restricted openings or orifices 27 and 28 respectively in a plate member 29 seated in the inner substantially flat surface of the handle and affixed thereto as by screws 30.

The chambers or cavities together with the orifices therefore constitute acoustic resonators 15 which absorb energy from the sound field or restricted sound path between the transmitter and receiver diaphragms. By thus absorbing energy, the resonators in effect introduce losses in the electro-acoustic system which may be commensurate with the gains in the circuit attributable to the transmitter and thereby prevent or at least greatly reduce the pressures in the vicinity of the transmitter diaphragm 13 occasioned by waves emanating from the receiver diaphragm 18. Consequently, the establishment of close acoustic coupling between the transmitter and the receiver is prevented and the howling tendency is suppressed.

The extent to which the resonators will absorb energy is dependent upon the dimensions thereof which, of course, determine the natural frequency of the resonators. The natural frequency may be ascertained from the relation

$$F_0 = \frac{C}{2\pi} \sqrt{\frac{K}{V_0}}$$

where

F_0 is the natural period or frequency,

C is the velocity of sound in air,

K is the ratio $\frac{(A)}{(L)}$ of the area (A) of the orifice to the length (L) thereof, and

V_0 is the volume of the cavity.

Each of the resonators will absorb the most energy at frequencies commensurate with the natural period thereof. Hence, preferably the resonators are designed so that each is resonant somewhat broadly at approximately the frequency of the howling tone which would be produced when the handset is placed upon the support 24 with the diaphragms 13 and 18 in approximately face to face relation therewith. Inasmuch as the howling frequency may vary over some range depending upon the character of the support 24 and the position of the diaphragms with respect thereto, it is preferable that the resonators have different natural frequencies within the range of howling frequencies apt to be produced. For example, in a specific handset design it was found that when the handset was positioned upon a support as shown in Fig. 2, the greatest tendency to howl occurred at about 2600 cycles per second. This tendency could be substantially suppressed by designing the resonator constituted by the cavity 25 and orifice 27 to have a natural frequency of about 2400 cycles per second and the resonator constituted by the cavity 26 and orifice 28 to have a natural period of about 2800 cycles per second.

As disclosed in the copending application of Arthur F. Bennett, Serial No. 167,894, filed October 8, 1937, the receiver cap 19 may be provided with a plurality of cavities 31, 32 and 33 having orifices 34, 35 and 36 respectively, which consti-

tute resonators and absorb energy from the sound field between the receiver and the transmitter. These resonators may have natural periods of 2200, 2500 and 2800 cycles per second respectively. In a handset having such resonators in the receiver cap, or in the transmitter cap, preferably the resonators 25, 27 and 26, 28 should have natural periods different from those of the resonators in the receiver or transmitter cap. For example, in a specific case where in the latter resonators had natural periods as set forth above, it was found satisfactory to have the resonators in the handle 10 resonate at 1800 and 2000 cycles per second.

Although in the specific embodiment of the invention shown and described, two resonators are provided in the handle 10, it will be understood that a single resonator or more than two resonators may be provided therein. Furthermore, it will be understood that various other modifications may be made in the telephone handset shown and described without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. A telephone handset comprising a handle having an elongated surface, and a pair of telephone instruments mounted on said handle adjacent opposite ends of said surface and having vibratile elements facing in generally the same direction with respect to said handle, said handle having a cavity therein with a resonant frequency within the range to be translated by said instruments, said cavity being connected to the atmosphere through an opening in said surface facing the sound field between said instruments.

2. A telephone handset comprising a handle including a portion having a substantially flat surface, a receiver and a transmitter mounted in spaced relation on said handle and having diaphragms facing in substantially the same direction as said surface, and an air chamber in said handle connected with the atmosphere through an opening in said surface, said chamber and opening being constructed and arranged to constitute a resonator resonating at a preassigned frequency.

3. A telephone handset comprising a support including a handle, telephone instruments mounted in spaced relation on said support, resonant means in said handset adjacent one of said instruments, and other resonant means in said handle, said first and second means having natural periods within the range of frequencies to be translated by said telephone instruments and being acoustically coupled to the sound field directly between said instruments.

4. A telephone handset in accordance with claim 3 wherein said first and said second resonant means have different natural periods.

5. A telephone handset comprising a support including a handle, a transmitter at one end of said handle, a receiver at the other end of said handle, a plurality of resonators in said handset adjacent said receiver, said resonators having different resonant frequencies, and a plurality of resonators in said handle having resonant frequencies different from the resonant frequency of said first resonators.

6. A telephone handset comprising a handle, a transmitter at one end of said handle, a receiver at the other end of said handle, a plurality of cavities in said handle intermediate the ends thereof, and a plate member overlying said cavities and having a plurality of restricted open-

ings each in communication with one of said cavities and the sound field directly between said transmitter and receiver.

5 7. A telephone handset comprising a handle, a transmitter at one end of said handle, a receiver at the other end of said handle, said receiver and said transmitter being inclined toward each other, and a cavity in said handle having an orifice in communication with the sound field

between said receiver and said transmitter, said cavity and orifice constituting a resonator having a natural frequency of the order of the frequency at which said handset tends to howl when placed upon a surface with said transmitter and said receiver in substantially face to face relation therewith. 5

FREY HAMBURGER.