Dec. 29, 1925. 1,567,683

H. SMITH

SOUND TRANSMISSION APPARATUS

Original Filed June 8, 1918 2 Sheets-Sheet 1

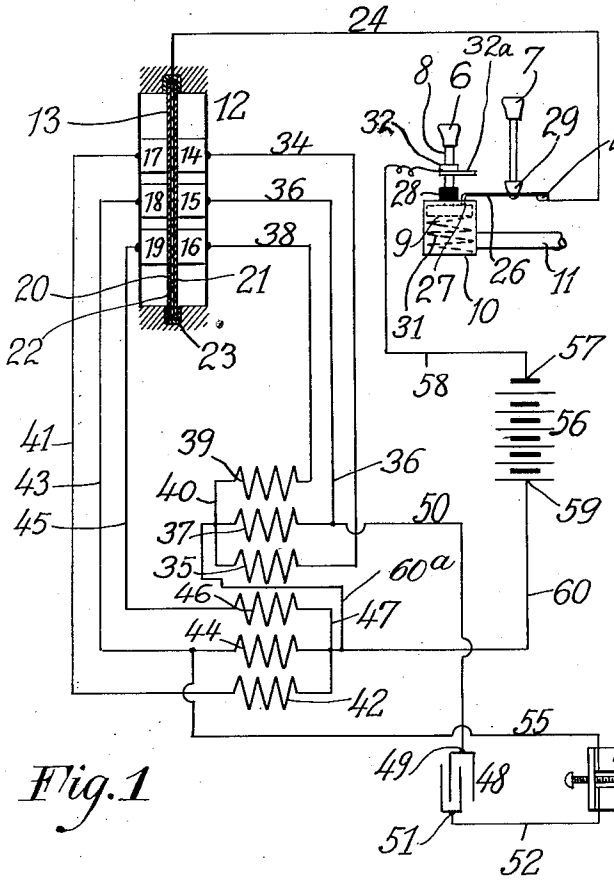


Fig. 1

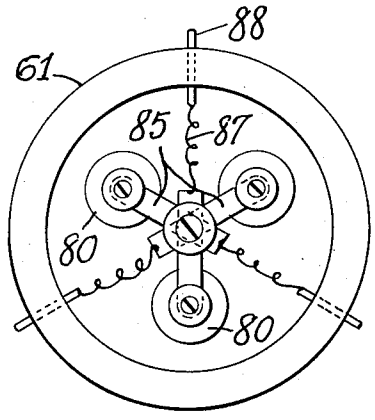


Fig. 9

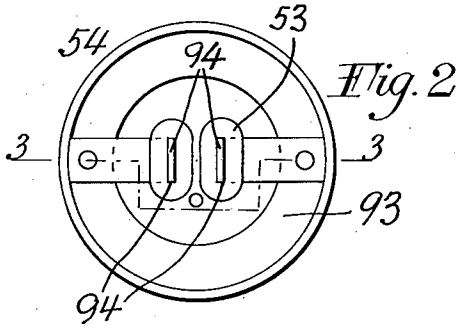


Fig. 2

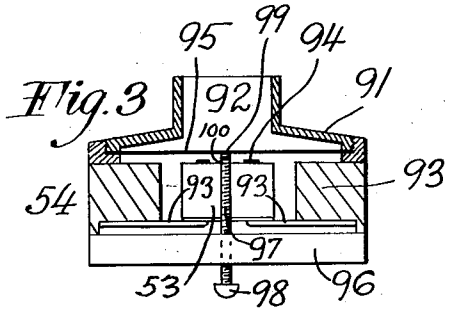


Fig. 3



Fig. 4

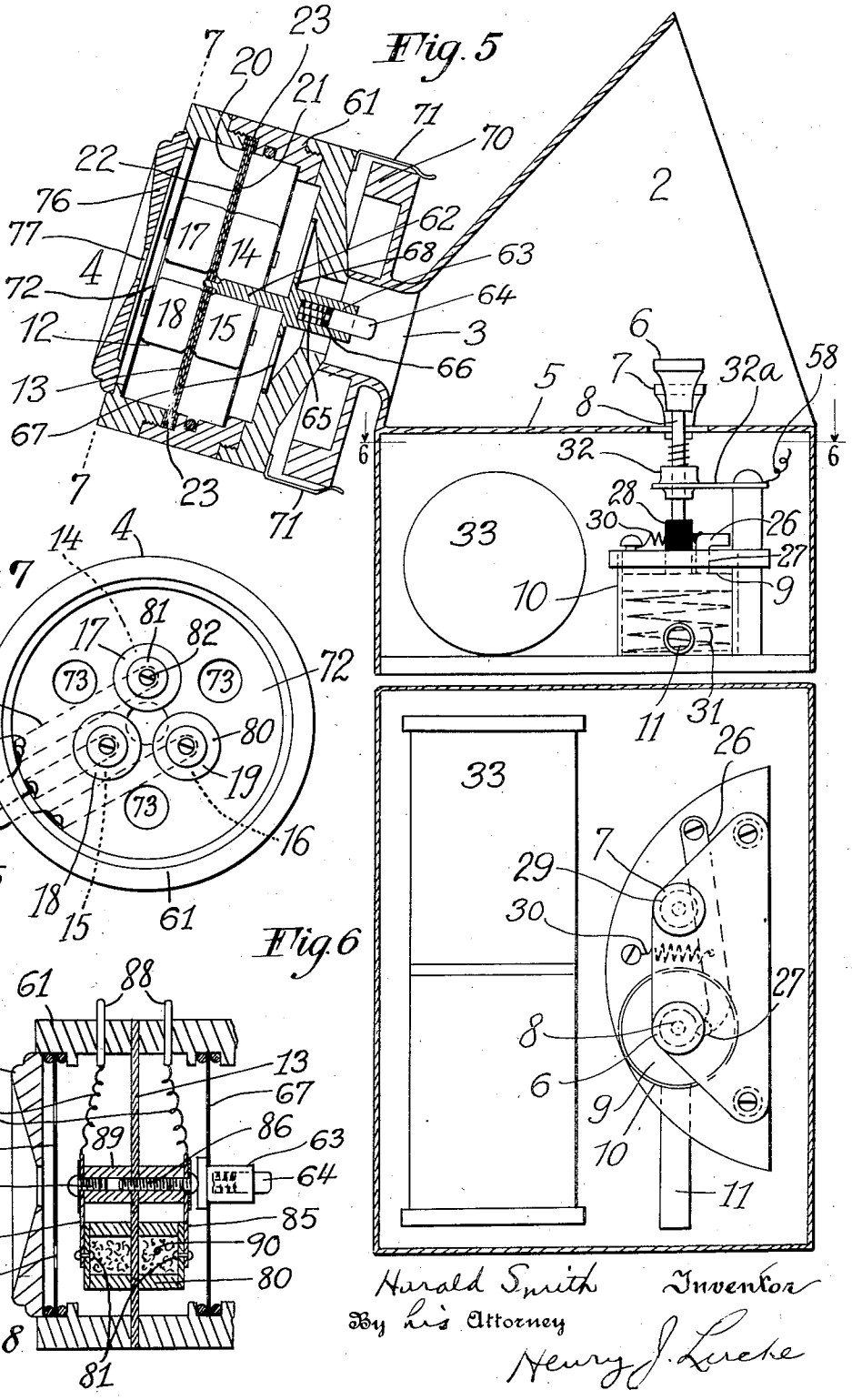
Inventor
Harald Smith
By his Attorney
Henry J. Lucke

Dec. 29, 1925. 1,567,683

H. SMITH

SOUND TRANSMISSION APPARATUS

Original Filed June 8, 1918 2 Sheets-Sheet 2



Patented Dec. 29, 1925. 1,567,683

UNITED STATES PATENT OFFICE.

HARALD SMITH, OF COPENHAGEN, DENMARK.

SOUND-TRANSMISSION APPARATUS.

Application filed June 8, 1918, Serial No. 238,874. Renewed May 27, 1925.

To all whom it may concern:

Be it known that I, HARALD SMITH, a subject of the King of Denmark, residing at Copenhagen, Denmark, have invented certain new and useful Improvements in Sound-Transmission Apparatus, of which the following is a specification.

This invention relates to sound transmission apparatus.

The features and objects of the invention will be fully understood from the following description of an embodiment of the invention shown in the accompanying drawings, forming a part of this application in which drawings—

Fig. 1 is a diagrammatic view showing one form of sound transmission apparatus, comprising certain features of my invention;

Fig. 2 is a front elevation of one form of my receiving means;

Fig. 3 is a sectional elevation on line 3—3 of Fig. 2;

Fig. 4 illustrates the use of one form of my invention;

Fig. 5 is a central elevation of one form of transmitting means of my invention applicable in the arrangement shown in Fig. 1;

Fig. 6 is a horizontal sectional view on the line 6—6 of Fig. 5;

Fig. 7 is a sectional elevation on line 7—7 of Fig. 5; and

Figs. 8 and 9 are respectively a central transverse section and end view of a modification.

Referring to the general arrangement shown in Fig. 1, the invention is applicable for use for receiving and transmitting a communication to a dictating machine, such as a commercial talking machine. The recording cylinder of the recording talking machine is indicated diagrammatically at 1. For dictation purposes, the communication desired to be recorded is acoustically directed by the talker toward the transmitter horn 2, see Figs. 5 and 6, having the outlet passage 3 communicating with the transmitter proper 4. The horn 2 may be conveniently mounted on a box 5 adapted to rest on a table or other suitable support, such as the usual universally adjustable bracket for telephones and the like.

Within the box 5 may be positioned the means for starting and stopping the talking machine, and for such purpose I have shown a pneumatic type of start and stop control, comprising the starting button 6 and stopping button 7. As shown in Figs. 1 and 5, the starting button 6 is mounted on the metallic stem 8 carrying the plunger 9 enclosed in the pneumatic cylinder 10, communicating by means of the rubber tubing 11, or equivalent, with the inlet of the usual pneumatic control of dictating recording machines.

The arrangement of the transmitter, amplifier, condenser, source of current and receiver corresponds generally to the apparatus described and shown in my U. S. Patent No. 1,113,499, Sound magnifying appliances for telephonic and telegraphonic purposes, granted October 13, 1914.

In the particular arrangement indicated in the drawings of the present application, wherein I have shown means for amplifying the voice electrical currents at two stages, as generally described in my said Patent No. 1,113,499, the amplifying means may provide for but one stage of amplification.

The microphone means is indicated generally at 12 comprising the diaphragm 13, a set of three microphones 14, 15, 16 on one side of the diaphragm 13, and a set of three microphones 17, 18 and 19 on the opposite side of the diaphragm 13. The diaphragm 13 is preferably formed of two outer disks 20, 21, of carbon, or equivalent material, and an inner disk 22 of leather or like yielding material, the said three disks being clamped together to form a unitary diaphragm element by means of the U-shaped edge piece 23, preferably of metal or like relatively rigid and electrically conductive material. The diaphragm 13 may be connected by the wire 24 to the contact 25. Movably connected to the contact 25 is the electrically conductive arm 26, carrying the finger 27, adapted when the starting button 6 is in depressed position to engage the metallic stem 8, of the button 6, whereby upon closure of the circuit, as set forth more fully hereinafter, the amplifier is operative.

As one form of contact making and breaking means, including the arm 26, I have shown the stem 8, see Figs. 5 and 6, provided with the collar 28 of insulating material, above which the stem 8 of electrically conductive material is exposed. The spring 31 restores the plunger 9 and moves the arm 26 toward the button 6.

The stem of the stopping key 7 is provided with the cam button 29, whereby upon depressing the key 7, the cam button 29 swings the arm 26 away from the stem 8, permitting the latter to be raised by its restoring spring 31, disposed in the cup 10 and acting against the piston 9. The stem of the key 6 is guided in the closely engaging thimble 32, mounted on the plate 32ª, which may serve as a contact or binding post for the connecting wire 58. The stem of the key 7 may be mounted in a similar thimble guide, which, however, is not utilized as a part of the electrical circuit.

As indicated in Fig. 1, and pursuant to the general arrangement set forth in my aforesaid Letters Patent No. 1,113,499, the microphone 14 is connected by the wire 34 to one end of the coil 35, the microphone 15 is connected by the wire 36 to one end of the coil 37, and, similarly, the microphone 16 is connected by the wire 38 to one end of the coil 39, the remaining ends of said coils 35, 37 and 39 being connected to one another by the wire 40.

Similarly, the microphone 17 is connected by the wire 41 with one end of the coil 42, the microphone 18 by the wire 43 with one end of the coil 44 and the microphone 19 by the wire 45 with one end of the coil 46, the remaining ends of said coils 42, 44 and 46 being connected to one another by wiring 47. Said six coils are arranged in mutual inductive relation to form a composite induction coil, provided with a laminated core and adjusted as may be desired, as set forth in my aforesaid Patent No. 1,113,499. Preferably said group of coils 35, 37 and 39 are arranged in mutual inductive relation with the group of coils 42, 44 and 46, so that one group of coils is wound oppositely with respect to the other group of coils. The common wire 40 of the coils 35, 37, 39 is connected by the conductor 60ª to the conductor 60 leading from one terminal of the battery 56. The resulting induction coil is designated 33 in Figs. 5 and 6.

The condenser 48 has its terminal 49 connected by the wire 50 to the wire 36 and its other terminal 51 connected by the wire 52 to one end of the coil 53 of the receiver 54, or other electro-responsive device for actuating the recording stylus of the talking machine 1. The other end of the coil 53 is connected by the wire 55 with the wire 43.

The source of current, indicated as the battery 56, is connected in series with the aforesaid inductive coils, as may be attained by connecting the terminal 57 of the battery 56 by the wire 58 with the thimble 32 and the metallic stem 8 of the starting button 6, the other terminal 59, of the battery 56 being connected by the wire 60 to the wire 47.

Tracing the circuit from the terminal 59 of the battery 56, assuming the starting button 6 to have been depressed, the current flows from the terminal 59, (Fig. 1) through the wire 60 thence to the common wire 47 of the respective coils 42, 44, 46, in parallel to one another, thence in parallel through the wires 41, 43, 45 to the respective outer terminals of the microphones 17, 18, 19, whereby said microphones 17, 18, 19 are connected in parallel to one another. The opposite, inner terminals of the microphones 17, 18, 19 are connected in common to the conductive outer plate 22 of the diaphragm 13 from whence the current flows through the conductor 24, contact 25, contact arm 26, plunger 9, stem 8, collar 32, arm 32ª, (Fig. 5), and through wire 58 in return to the terminal 57 of the battery 56.

Similarly, the current flows from the conductor 60 through the conductor 60ª thence to the common wire 40, thence through the induction coils 35, 37, 39 in parallel, thence through the conductors 34, 36, 38, thence through the microphones 14, 15, 16 in parallel and to the common conducting diaphragm plate 21 and in return through the conductor 24, as aforesaid.

If desired, the electrical contact arm 26, 9, may be replaced by an ordinary contact maker, having a closing button arranged in front of and in alignment with the starting button 6, to permit concomitant closure of the circuit and pneumatically starting the talking machine, and the opening button similarly arranged in front of and in alignment with the stopping button 7, as is understood by the art.

The aforesaid arrangement is shown in compact form, as one embodiment of the invention, in Fig. 5. The microphone means 12, comprising the diaphragm 13 and sets of individual microphones arranged and constructed as aforesaid, is preferably mounted in the casing 61 formed of separable, or screw-threaded section parts, to facilitate assembly, inspection and repair. Coacting with the diaphragm 13 is arranged the vibration transferring means of the construction and arrangement as set forth in my U. S. Patent No. 1,313,751, entitled Vibration transferring means, granted August 19, 1919, the arrangement shown in the drawings of the present application comprising the stem 62 connected with the hollow outer member 63, frictionally embracing the inner plug member 64, the spring 65, and the yieldable element 66 of felt or like material, said hollow outer member 63 being guided by the edges of the perforation in the diaphragm 67 mounted within the casing 61, said outer member having the laterally extending flange 68, adapted to abut the inner face of said diaphragm 67, of bakelite or the like, when the hollow member 63 is in its outermost position. As is set forth in my aforesaid U. S. Patent No. 1,313,751, granted

August 19, 1919, said hollow outer member and said inner plug member are preferably of electrostatic material, such as guttapercha, vulcanite, ebony or the like, to generate electrostatic currents, which appear to facilitate the transferring action.

The transmitter 4, preferably embodying such vibration transferring means is applicable for use with a telephone receiver, as for recording a telephone conversation on the dictating machine, as appears more fully hereinafter. For such purpose, the casing 61 is removably mounted on the horn 2, as by means of the support member 70 and the spaced springs 71, the latter being fixed to the front face of the casing 61 and adapted to frictionally embrace said support member 70. The diaphragm 72, of bakelite, is similar to the plate 67 and similarly provided with a number of perforations 73, three perforations 73 being indicated in Fig. 7, affording passage for the sounds directed from the horn 2 through the outer passage 3 thereof, to permit passage of the sounds through the plate 67 to the effective face of the diaphragm 13, and likewise through the plate 72, as appears more fully hereinafter. Such perforations also safeguard against accumulation of any undue pressure of the air or other medium within the microphone casing.

The use of my said microphone means 12 in coaction with the telephone receiver is indicated in Fig. 4, the telephone receiver being designated 75, and the microphone casing 61 being attached to the front face of the telephone receiver 75 by means of the aforesaid spaced springs 71. Referring to Fig. 5 as well as Fig. 4, the rear face of the microphone casing 61 is provided with the outlet cap 76 of usual concave conical face and having the central outlet opening 77, said cap being adapted to be positioned adjacent the ear of the operator when in use, whereby the conversation transmitted through the telephone receiver 75 and transferred by the plug 64 and members 63, 62, to the microphone means 12, is also heard by the operator through the outlet opening 77. When the microphone means 12 is thus fixed to the telephone receiver 75, the plug member 64 is brought into engagement with the diaphragm of the telephone receiver 75 and continuously maintained in such engagement by means of the spring 65 and felt 66. The microphone casing 61 is further provided with the plate 72, as aforesaid, similar to the plate 67 and provided with the perforations 73 to afford passage for the sound waves to the ear of the operator.

As is set forth more fully hereinafter, the microphones are constructed and arranged to be in operative position when the microphone casing 61 is in horizontal position, or approximately, but when placed in vertical position, as when hanging the telephone receiver 75 on its hook, with the microphone casing 61 attached thereto, the circuit of the amplifier is automatically broken.

In the use of my invention for recording telephone conversation, the operator upon receiving the call announced by the call bell, starts the talking machine by depressing the starting button 6 and at the same time connecting the contact 25 with one terminal of the battery. The telephone receiver having the microphone means 12 attached thereto, is then removed from the telephone hook, and upon placing the rear cap 76 of the casing 12 proximate the ear of the operator, the circuit through the amplifier is completed. Such utilization of my invention assures recording the entire telephone conversation, in that the talking machine is set in operation prior to the transmission of any conversation to the operator and loss of current through the amplifier circuit is precluded by reason of the circuit through the amplifier being completed only when the telephone receiver is brought in effective relation with the ear of the operator. The microphone means 12 comprises the individual microphones on each side of the carbon diaphragm 13, each microphone preferably embodying the construction of the reserve chamber for the carbon granules, as set forth in my United States Letters Patent No. 1,170,356, granted February 1, 1916, entitled Telephonic apparatus.

As indicated in Fig. 7, the walls of each microphone may be of a cylinder of felt 80, the contact button 81 being mounted by a screw 82 at one end of the metallic strips 83, of brass, copper or the like, extending freely toward one side of the casing section 61, whereto it is affixed by the screw 84, serving also to electrically connect its wire leading to its coil of the induction coil 33, as aforesaid.

My preferred form of microphone arrangement is shown in Figs. 8 and 9, comprising the relatively stiff flat strips 85, of brass or the like, extending radially and supported on the central sectional posts 86, the set of three strips 85, on each side of the diaphragm 13 being insulated from one another, and loosely suspended leads 87 respectively connecting said strips 85 to the contacts 88, the latter being respectively connected to the leads 34, 36 and 38, and 41, 43 and 45, as aforesaid. The insulating post sections 86 are connected together by the rod 89, extending through the diaphragm 13. The vibration transferring means comprising the outer member 63 and inner or plug member 64 are arranged similarly as set forth above.

The carbon granules 90 are enclosed in

the cylindrical wall 80 of felt, in each individual microphone, and coact with the carbon diaphragm 13, as its one contact, and with the carbon button 81 as its other contact. The stiff brass strips or arms 85 operate as mechanical damping means, as well as electrical conductors.

By means of such arrangement, each set of microphones on any side of the diaphragm operates as a unit and provides for uniform movement of the individual microphones, thereby greatly improving the intensity of amplification and the clearness, particularly of the most difficult "t" and "e" vocalizations, and otherwise obviating distortion. The suspension construction of a single post 86, a single damping arm 85 and yieldable wall 80, of felt, enclosing the carbon granules 90 may be advantageously employed in the construction of a single microphone for general use.

The transmitter 54 preferably embodies the construction shown in Figs. 2 and 3, comprising the casing 91, having the outlet 92, and enclosing the permanent magnet 93, having the pole pieces 94, 94, about which are arranged the electromagnetic coils 53. The diaphragm 95 of steel or the like, is seated at its edges in a groove within the casing 91, formed preferably of threaded casing sections. Through the rear face 96, of the casing 91, extends the adjusting screw-threaded rod 97, having the outer slotted head 98, and carrying the pad 99 of felt at its inner end 100, normally touching the rear face of the diaphragm 95, i. e., when the latter is in its normal position. The adjustable rod 97 serves to damp the diaphragm and clarify the sounds emitted by the diaphragm under action of the electro-responsive means comprising the coils 53 and the permanent magnet 93.

My transmitter is applicable for general use in telephone or other acoustic apparatus.

Whereas I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the invention defined by the appended claims.

I claim:

1. The combination with a telephone set comprising a receiver and a transmitter, of a casing constructed to be attached externally to the telephone receiver, said casing being provided with an opening for the transmission of the sounds emitted by the diaphragm of said telephone receiver, microphone means disposed within said casing, an outer wall of said casing being provided with an opening constructed to be positioned against the ear of the operator and communication being afforded through the casing from said first-named opening to said second-named opening, sound recording means and electrical circuit means connecting said sound recording means with said microphone means.

2. The combination with a telephone set comprising a receiver and a transmitter, of a unitary device constructed to be secured to the telephone receiver, said unitary device comprising a casing having a wall provided with an opening for communication with the opening of the telephone receiver, microphone means disposed within said casing, an outer wall of said casing being provided with an opening constructed to be positioned adjacent the ear of the operator, communication being afforded within said casing from said first-named opening to said second-named opening, sound recording means and electrical circuit means connecting said sound recording means with said microphone means.

3. The combination with a telephone set comprising a receiver and a transmitter, of sound transmitting means comprising in combination microphone means embodying a casing having oppositely disposed, exposed openings, means for securing said casing to the casing of said telephone receiver to position one of said exposed openings in communication with the opening of the telephone receiver, the other of said exposed openings being constructed to be positioned adjacent the ear of the operator, sound recording means and electrical circuit means connecting said microphone means with said sound recording means.

4. Sound transmitting means comprising in combination microphone means embodying a casing having oppositely disposed, exposed openings and further embodying a diaphragm and a plunger and extending through one of said exposed openings, means for securing the opening of the casing of a telephone receiver in communication with said one exposed opening, the other of said exposed openings being freely exposed to the atmosphere, sound recording means and electrical circuit means connecting said sound recording means with said microphone means.

In testimony whereof I have signed this specification this 3rd day of June, 1918.

HARALD SMITH.