Jan. 10, 1933. R. E. COLEMAN 1,893,796

ACOUSTIC DEVICE

Filed Aug. 21, 1929

Fig. 1.

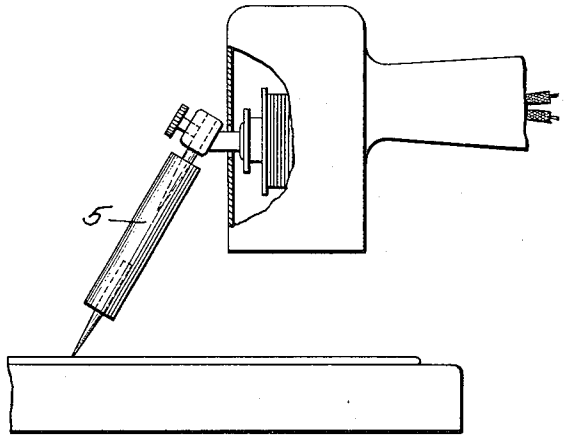


Fig. 2.

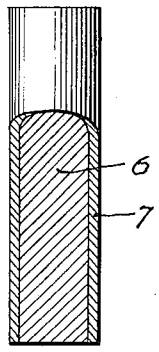


Fig. 3.

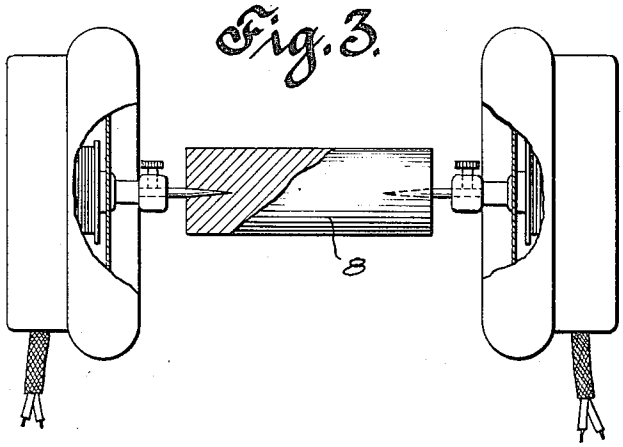
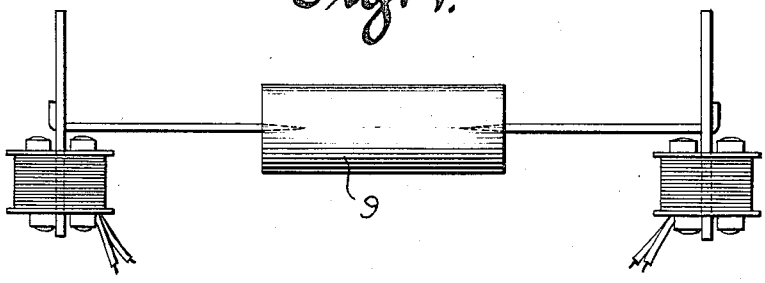


Fig. 4.



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UNITED STATES PATENT OFFICE

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ACOUSTIC DEVICE

Application filed August 21, 1929. Serial No. 387,558.

My invention relates to a method of controlling and conducting sound vibrations.

It has been observed that bodies possessing certain physical characteristics are particularly sensitive to vibration and to the transmission of vibrations. Certain substances satisfactorily transmit certain frequencies better than other frequencies.

It is the principal object of the present invention to provide a method of and means for selectively controlling and conducting sound vibrations.

It is a more specific object to produce a sound conducting medium in such physical state and having such vibrating and vibration conducting characteristics as may be desired to secure a predetermined or desired degree or characteristic of sound wave conduction so as to clarify or amplify certain transmitted sounds.

Material masses having great internal surfaces, namely those in the colloidal state and particularly those of gel formation and colloidal solutions, are peculiarly sensitive to vibration and vibration conduction. They vary in the velocity that they conduct sound waves and certain masses are highly resonant and sensitive to forced vibrations thus enabling them to act as resonators. Substances in this (colloidal and especially gel) state, are free from large particles. They vibrate easily and conduct sound waves and vibrations with a minimum of inertia.

Masses of matter or substances in a colloidal state are physically heterogeneous and consist of two spacially different phases, in which there exists a great degree of dispersion of one phase within the other. These two phases are indicated as the disperse phase (the dispersed phase) and the disperse means (or dispersion means). Surface boundary and contact exists between these two phases. Substances or masses of matter are considered to be colloids or in the colloidal state when the particle sizes of the disperse phase lie within certain limits. These limits have been established as being from about 0.1 μ to about 1 $\mu\mu$ in diameter. The surface area resulting from the great subdivision of the mass particles gives rise to the development of enormous surface boundaries and area between the phases. This surface contact between the two phases constitutes the internal surface of the mass. The development and existence of great internal surface is recognized as one of the outstanding characteristics of the colloidal state. Associated with this internal surface are such surface tension and surface energy conditions as are peculiar to the surface and which form an important part of the physical properties of the substance. Substances are considered to be colloidal only when the size of the dispersed particles lies within the approximate limits specified. If the substances are molecularly dispersed, physical heterogeneity and internal surface are absent. If the dispersed particles are much larger than the lower limit, a condition of a mechanical mixture is considered to be present—in this state the internal surface is relatively small and the physical properties of the colloidal state absent.

The vibration characteristics depend upon the character of the internal structure, the amount of internal surfaces, vibrating peculiarities and the size of the conducting member.

There are many materials and combinations of materials in a colloidal state which are suitable for use as sound conducting or transmission media. As examples of materials which are particularly suitable either alone or combined so as to give the desired conduction characteristics may be mentioned: elastic gels, such as gelatine and glues either dry or in aqueous solution or coagulated by formaldehyde, alum, tannic acid or the like; aqueous or alcohol gels of gums tragacanth, Karaya, agar-agar, and similar materials; soap gels of potassium, sodium, and ammonium of the various fatty acids and in various concentrations; normally non-elastic gels in an elastic state such as hydrated silicic acid, ferric and stannic oxide gels of various concentrations; resins such as phenol formaldehyde resins, glycerine-pthalic anhydrid resins, urea-thio-urea resins; cellulose esters—nitrate and acetate; glyceride oil gels such as vulcanized oils, glyceride oils as linseed, soya

bean, corn, rape seed, neatsfoot oil, etc. with sulfur chloride; oil gels of polymerized and oxidized drying oils such as perilla, linseed and China wood oil and semi-fluid solutions of these gels in suitable solvents such as turpentine or petroleum naphtha; oil-water emulsions; rubber of varying forms and compositions; colloidal solutions of various inorganic substances in various means.

In carrying my improved method into effect, I interpose in the sound circuit or transmission system one or more sound conducting masses or combinations of various masses to produce a device having the desired sound transmission characteristics.

In the construction of the conducting unit the selection of the media used will be influenced by the resonance, conduction velocity, and vibrating characteristics desired.

The conducting means may consist of only one medium having the desired conduction and vibrating characteristics or it may be a structure containing a number of media each differing in their vibrating and conducting peculiarities, for example a unit may consist of several media arranged either in parallel or in series certain of which will conduct certain frequencies better than others. Compounds can be included in the system that vibrate longitudinally, others transversely. Depending on the size, shape and the vibrating and conduction peculiarities of the media units used an infinite variety of conducting effects can be produced.

A conducting unit may also consist of an emulsion of two or more substances each differing in their conducting properties, so as to produce a more or less homogeneous mass having the desired vibrating and conducting properties.

The conducting media may be unenclosed allowing such sound waves as are radiated to pass into the surrounding air.

The conducting medium may be surrounded by an outer casing of low conducting and vibrating properties such as lead or suitable paper so as to confine within the conducting medium the sound waves that are being transmitted or by materials having pronounced sound absorbing properties such as felt, cloth and the like.

The conducting medium may be separated from the outer casing either by an air space or by the use of a suitable material that will prevent adhesion of the conducting medium to the outer casing. Thus either by preventing or allowing adhesion of the conducting medium to the inside wall of the outer casing a tension of the conducting medium can be effected that may influence its vibrating peculiarities.

When the conducting medium is of liquid or semi-liquid consistency a container of glass or other suitable material may be provided. This container when desired may be enclosed in any of the types of outer casings described above.

The sound conducting unit consisting of the particular mass or substance or combination may be put directly in the sound transmission system, that is to say, there may be a sound intake element such as a diaphragm, and a sound discharge element such as another diaphragm and between these two either directly or through other conducting media my improved sound conducting element may be interposed. For example, the sound waves may be introduced into the unit by a mechanically vibrating diaphragm actuated by sound waves transmitted through air or they may be as forced vibrations from a conducting member such as through a phonograph needle from a record or from electrical energy through a magnetic diaphragm.

The discharge from the unit may be through a mechanically operated diaphragm as sound waves which may be allowed to radiate into the air, or picked up by a microphone and converted into electrical energy for transmission through an electrical circuit or they may be at the discharge converted into electrical energy through a magnetic diaphragm and thence through an electrical transmission circuit. The above are given by way of example.

The invention is applicable wherever sound waves are transmitted, for example, in telephone circuits, phonograph recording and reproduction, dictating machines, radio apparatus, talking pictures and the like.

The peculiar vibrating and sound conducting properties of substances in a colloidal state and the fact that colloidal masses can be very readily produced with definite degrees of colloidality and with definite colloidal properties enables the production of sound conducting media having certain desired properties. A very much greater variety and a very much wider range of tone qualities can be produced with materials in the colloidal state than can be secured by non-colloidal substances or masses that are in the form of mechanical mixes only or in true solution. By selecting the proper substance and selecting the particular degree of concentration, a colloidal conducting element can be produced having just the desired sound conducting characteristics. For example, a colloidal gel consisting of sodium stearate and oleate with a comparatively low amount of water (approximately 25%) conducts high frequencies particularly well and a speaking voice of fairly high register very definitely and without overtones. With the decrease in concentration (approximately 60% water) a more pronounced production of sound of lower frequencies is obtained. Speaking and singing voices through all concentrations are distinct and free from pronounced overtones. Thus, in the field of sound recording, for ex-

ample, if a particular voice does not register well, a particular sound conducting medium can be interposed in the sound circuit, whereby the shortcomings of that particular voice will be remedied and a satisfactory record made.

The invention as heretofore indicated may be variously embodied.

In the drawing which shows, for illustrative purposes only, certain embodiments—

Fig. 1 is a fragmentary illustrative view of a talking machine embodying the invention;

Fig. 2 is an enlarged view of a sound conducting element embodying the invention;

Fig. 3 is an illustrative view showing an improved sound conducting element interposed between diaphragms;

Fig. 4 is a view similar to Fig. 3 but illustrating mechanical vibraters instead of diaphragms.

In Fig. 1 a sound conducting element 5 is interposed between the talking machine needle and the diaphragm or other reproducing mechanism. The element 5 is preferably arranged so that it does not necessarily vibrate as a whole but only so that the vibrations are transmitted through the transmitting substance in the colloidal state.

In Fig. 2 is illustrated the conducting medium 6 in the colloidal state, enclosed in a casing 7, as heretofore indicated. This casing may be of any desired substance, as heretofore noted. For a conducting medium in a fluid state the casing 7 would preferably be of such form as to confine the conducting medium on all sides.

In Fig. 3 the conducting element 8 is of solid or semi-solid consistency, such that no supporting or other casing is required.

In that form shown in Fig. 4 the sound conducting element 9 may embody the casing for confining the conducting medium.

In the form shown in Figs. 3 and 4 the connections to the conducting element are preferably so small or so loose that the entire element preferably does not vibrate as a whole, but only transmit the vibrations through the transmitting medium in the colloidal state.

While the invention has been described in considerable detail and various substances mentioned by way of example and various embodiments disclosed, it is to be understood that the specification is but illustrative, and that various modifications and changes may be made within the scope of the invention as defined in the appended claims.

I claim:

1. In a transmission system, a pair of vibrators and an element comprising a substance of great internal surface between said vibrators, said element being substantially free of said vibrators so as to avoid substantial damping of the latter.

2. In a transmission system, a vibratory colloid interposed between an actuating vibrator and a pick up vibrator, said colloid being physically self sustaining.

3. In a transmission system, an actuating vibrator, a pick up vibrator, a vibratory unit comprising a colloid interposed between said vibrators, said colloid and vibrators being connected impositively so as to avoid substantial damping of either of said actuators.

4. In a transmission system, an actuating vibrator, a pick up vibrator, a vibratory unit comprising a colloid interposed between said vibrators, said colloid being connected to said vibrators with a point contact for the purpose described.

5. In a transmission system, an actuating vibrator, a pick up vibrator, a vibratory unit comprising a colloid interposed between said vibrators, said colloid being confined in a casing independent of the vibrators for the purpose described.

ROY E. COLEMAN.