June 26, 1923. 1,459,803

J. A. STEURER

DIAPHRAGM FOR SOUND REPRODUCING APPARATUS

Filed May 29, 1922

Fig. 1.

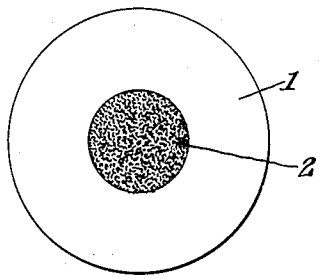


Fig. 2.

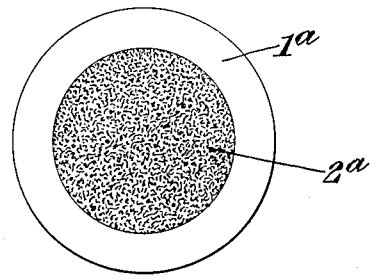


Fig. 3.



Fig. 4.

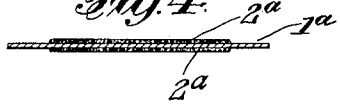


Fig. 5.

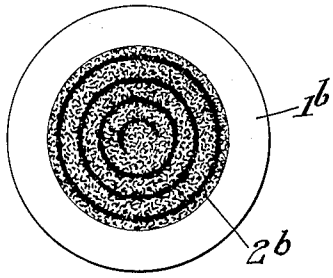
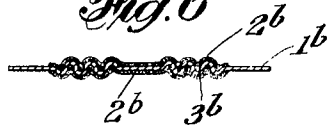


Fig. 6



Inventor

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By his Attorney

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UNITED STATES PATENT OFFICE.

JOHN A. STEURER, OF NEW YORK, N. Y.

DIAPHRAGM FOR SOUND-REPRODUCING APPARATUS.

Application filed May 29, 1922. Serial No. 564,352.

To all whom it may concern:

Be it known that I, JOHN A. STEURER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Diaphragms for Sound-Reproducing Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawing which illustrates several embodiments of the invention selected by me for purposes of illustration and the said invention is fully disclosed in the following description and claims.

The object of my invention is to provide a diaphragm suitable for use in all forms of sound reproducing apparatus, such as phonographs or talking machines, telephones, amplifying devices for loud speakers, for use with wireless or other telephonic apparatus, or for any other purposes for the reproduction of sound, which shall be practically free from metallic resonance, and so-called "blasts" and other objectionable noises, so that it will transmit articulate speech, music, and other sounds clearly and accurately, and render a true and substantially perfect reproduction of the sounds transmitted to it.

My improved diaphragm comprises a disc of non-absorbent sheet material, such as metal, mica glass and the like, provided on one or both faces with a dried coating of adhesive material having combined therewith, and distributed substantially uniformly throughout, finely divided damping material, preferably in pulverulent form, which will clarify the sound intended to be transmitted by the diaphragm and eliminate the inherent and unintended metallic resonance, blasts and rattles, etc., produced in and by the material of the diaphragm body itself in so doing, said coating being disposed concentrically with the center of the diaphragm and extending to a greater or less extent toward the periphery, and being preferably of circular form. When the diaphragm is intended to be subjected to the direct action of magnets in sound reproducing or amplifying apparatus, the disc or body of the diaphragm will necessarily be formed of a magnetic metal, such as soft iron or steel, although for other purposes, non-magnetic metals and other non-absorbent materials may be employed. The preferred adhesive substance which is employed is a solution of phenolic condensation product (such as bakelite, redmonol or condensite) in a suitable vehicle, through which is distributed and mixed finely powdered particles of wood, cork, flock, vegetable ivory, carbon (charcoal, lamp black or gas black), or any other suitable finely divided material, which will produce the said clarifying effect.

In the accompanying drawings,

Fig. 1 represents a plan view of one form of diaphragm embodying my invention.

Fig. 2 represents a sectional view of the same somewhat exaggerated in thickness in order to facilitate the graphic illustration of the invention.

Fig. 3 is a plan view of another form of diaphragm embodying the invention.

Fig. 4 is a sectional view of the same, similar to Fig. 2.

Fig. 5 is a plan view of another form of diaphragm embodying my invention.

Fig. 6 represents a sectional view of the same prepared in the same manner as Figs. 2 and 4, for purposes of illustration.

In the form of my invention illustrated in Figs. 1 and 2, 1 represents a disc or body of non-absorbent material, such as metal (iron, steel, aluminum, brass or other metal), glass, mica, celluloid or other suitable non-metallic substance, of the desired size to fit the instrument with which it is to be used. A suitable adhesive material, preferably a solution of phenolic condensation product, such as bakelite, redmonol, or condensite, or the like, dissolved or dispersed in a suitable vehicle, is prepared and is combined with a finely divided damping material, which may be powdered cork, powdered wood, powdered flock, vegetable ivory or carbon (charcoal, lamp black or gas black for example) or with a combina-

tion of two or more of these substances. This adhesive material in liquid form combined with the finely divided damping material, is applied as a coating, indicated at 2, to the non-absorbent body, 1, of the diaphragm, so as to form an area concentric with the centre of the body, 1, and of any desired diameter. The adhesive material combined with the finely divided damping material is permitted to dry upon the body, 1, of the diaphragm so as to form a hard, tough adhesive coating when dry, in which the finely divided material is distributed with the greatest possible uniformity. This adhesive coating may be applied to one or both faces of the body of the diaphragm, according to the particular use to which the diaphragm is to be put. It will be understood that the finely divided damping material is not only uniformly distributed throughout the coating, but is submerged in the coating so as to modify throughout the extent of the coating the action, which is also a damping action, of the phenolic condensation product, so that as each portion of the diaphragm vibrates, its tone producing qualities will be modified both by the phenolic condensation product and the submerged finely divided particles of damping material, with the result that the tone is clarified and all metallic resonance and blasts are eliminated.

In Figs. 3 and 4, for example, I have illustrated a diaphragm or main body, indicated at 1^a, provided with the concentric damping coating, indicated at 2^a, of considerably larger size than the coating 2 shown in Figs. 1 and 2, and applied in this instance to both faces of the diaphragm.

In some instances the diaphragm body may be provided with one one or more concentric flutes or ribs formed by pressing the material out of the plane of the other portions of the body so as to form a groove on one face and rib or projection on the other face, circular in form and concentric with the center of the diaphragm. Such a diaphragm body is illustrated in Figs. 5 and 6 at 1^b, the concentric ribs or flutes being indicated at 3^b, and the body 1^b is provided in this instance on both faces with the dried adhesive coating containing finely divided damping material, as above described, the coatings being indicated at 2^b—2^b, in Figs. 5 and 6.

Obviously where my improved diaphragm is to be subjected directly to the action of magnets, as in certin forms of magneto electric sound reproducing or amplifying apparatus, the body, 1, is formed of a metal readily attracted by such magnets, such as, for example, soft iron or steel. Where the diaphragms are employed with apparatus in which it is not subjected directly to the action of magnets, the main body may be of iron or steel, or it may be of other metals not affected by magnets, or it may be formed of mica, glass, celluloid or other non-metallic material.

The dried adhesive coating containing the damping material in powdered form has the effect of eliminating the metallic resonance of the diaphragm and the rattle, blast or other extraneous noises which are so frequently produced by the vibration of diaphragms used for sound reproduction, so that the transmitted sounds intended to be reproduced by the diaphragm are actually reproduced clearly, distinctly and free from extraneous noises, distortions and objectionable metallic resonance and blast. The use of my improved diaphragm facilitate the reproduction of the transmitted sounds with the greatest accuracy, clearness and mellowness and eliminates harsh over tones and other extraneous noises.

While I prefer to employ a solution of phenolic condensation product (preferably redmonol dissolved in a suitable vehicle) as the adhesive material, I do not wish to be limited to this particular material, as other adhesive substances may be employed with beneficial results, for example, I may employ a solution of a natural resinous gum, such as spar varnish or other varnish, or other similar adhesive material in which is combined the finely divided damping material.

In carrying out my invention in its prefferred form, I prefer to use either powdered cork or lamp black, or a combination of powdered cork and lamp black in combination with the solution of redmonol or other suitable adhesive material. I prefer to employ as the adhesive material a solution of phenolic condensation product and particularly redmonol for the reason that it dries hard, and to all intents and purposes becomes an integral part of the diaphragm so that it cannot be removed therefrom, except by actually cutting it away. At the same time it is extremely tough so that it does not break, crack or splinter, and it readily responds to the movements of the diaphragm body without the possibility of becoming injured or separated from the body of the diaphragm under any conditions of use.

As before stated, the dried adhesive coating containing the finely divided damping material is applied concentrically with the center of the diaphragm and may extend from the center toward the periphery to any desired extent. The greater the diameter of the dried adhesive damping coating, the greater will be the damping effect upon the diaphragm, and by varying the diameter of the dried adhesive damping coating the diaphragm may be adjusted with respect to the particular instrument or sound reproducing

apparatus with which it is used, so as to obtain the best results.

It is to be noted that my improved diaphragm is not a laminated structure in any sense. The coating is applied to the central portion of the body of the diaphragm and every part of it becomes practically an integral part of the diaphragm body. The finely divided particles of damping material which are distributed throughout the adhesive coating modify the continuity, density and vibration of the adhesive coating and coacts with the adhesive material in modifying the vibrations of the non-absorbent body of the diaphragm, producing an entirely different effect from that which would be produced by an uninterrupted coating of the adhesive material alone.

Obviously the use of a metal body for a diaphragm is highly desirable on account of its strength and uniformity, but also obviously metal diaphragms have heretofore been most subject to objectionable metallic resonance, rattle, blasts and so forth, before referred to. For this reason other substances than metal have been resorted to in constructing diaphragms where this was possible, as in talking machines and other sound reproducing apparatus, in which the action of magnetism plays no necessary part. A diaphragm constructed in accordance with my invention with a metal disc or body provided with the described concentric coating, completely eliminates the objectionable features of metallic resonance, rattles, blasts, etc., heretofore experienced with metallic diaphragms, while presenting the characteristics of uniformity and durability due to the metallic body, and further by employing a metal affected by magnetic action, the beneficial results of my improved diaphragm can be extended to all forms of electromagnetic sound reproducing apparatus such as the ordinary telephone, the wireless telephone, electric amplifiers for telephonic receivers, and other forms of electromagnetic sound amplifiers including those in which it is necessary to use a diaphragm which will be directly affected by magnetic attraction.

The described adhesive coating may also be of any desired thickness depending upon the damping effect desired, and it may be produced by a single application or coat, or by the application of successive coats. In the latter case, however, the successive coats unite to form a single coating of the desired thickness, and no laminated or stratified effect results.

What I claim and desire to secure by Letters Patent is:—

1. As a new article of manufacture, a diaphragm for sound reproducing apparatus comprising a disc of non-absorbent material, provided on at least one face with a concentric coating composed of dried liquid adhesive material, combined with finely divided damping material, distributed substantially uniformly therethrough, and submerged therein.

2. As a new article of manufacture, a diaphragm for sound reproducing apparatus comprising a disc of non-absorbent material, provided on at least one face with a concentric coating, composed of dried liquid resinous adhesive material, combined with finely divided damping material, distributed substantially uniformly therethrough, and submerged therein.

3. As a new article of manufacture, a diaphragm for sound reproducing apparatus, comprising a disc of non-absorbent material provided on at least one face with a concentric coating of dried liquid adhesive consisting of a phenolic condensation product dissolved in a suitable volatile vehicle and having combined therewith finely divided particles of damping material distributed substantially uniformly throughout said coating, and submerged therein.

4. As a new article of manufacture a diaphragm for sound reproducing apparatus, comprising a disc of non-absorbent material provided on at least one face with a concentric coating of dried liquid adhesive material consisting of a phenolic condensation product dissolved in a volatile vehicle, and combined with finely divided cork, distributed substantially uniformly throughout the coating, and submerged therein.

5. As a new article of manufacture a diaphragm for sound reproducing apparatus, comprising a disc of non-absorbent material provided on at least one face with a concentric coating of dried liquid adhesive material consisting of a phenolic condensation product dissolved in a volatile vehicle, and combined with finely divided cork, and lamp black, distributed substantially uniformly throughout the coating, and submerged therein.

6. As a new article of manufacture a diaphragm for sound reproducing apparatus, comprising a disc of non-absorbent material provided on at least one face with a concentric coating of dried liquid adhesive material comprising a phenolic condensation product dissolved in a volatile vehicle.

7. As a new article of manufacture, a diaphragm comprising a disc of magnetic metal provided on at least one face with a concentric coating of dried liquid adhesive material, consisting of a phenolic condensation product dissolved in a volatile vehicle.

8. As a new article of manufacture, a diaphragm comprising a disc of magnetic metal provided on at least one face with a concentric coating composed of dried liquid adhesive material, combined with finely divided damping material, distributed sub-

stantially uniformly throughout the coating, and submerged therein.

9. As a new article of manufacture, a diaphragm comprising a disc of magnetic metal provided on at least one face with a concentric coating composed of dried liquid adhesive material, consisting of a phenolic condensation product dissolved in a volatile vehicle, combined with finely divided damping material, distributed substantially uniformly throughout the coating, and submerged therein.

In testimony whereof I affix my signature.

JOHN A. STEURER.