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RESONANT DIAPHRAGM AND PROCESS OF MAKING SAME.
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Fig. 1.

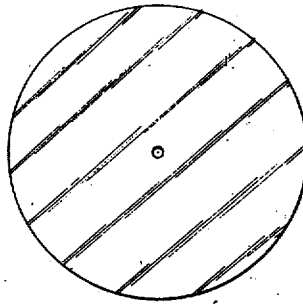
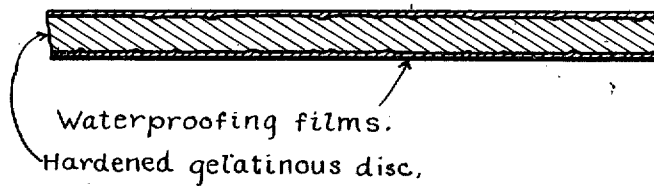


Fig. 2.



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RESONANT DIAPHRAGM AND PROCESS OF MAKING SAME.

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To all whom it may concern:

Be it known that I, ALFRED GELBERT, citizen of the United States, residing at Chicago, Illinois, have invented certain new and useful Improvements in Resonant Diaphragms and Processes of Making Same; 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 relates to resonant diaphragms of the general class which includes the reproducer disks commonly used on phonographs, and to methods of manufacturing such diaphragms. Generally speaking, my invention aims to provide resonant diaphragms which will be more resonant, more durable, more uniform, more handsome, more easily mounted, and yet lower in cost than the mica disks heretofore commonly used for such purposes.

At present, the one material employed in the better grades of phonograph reproducers for the needle-actuated diaphragm is mica, a mineral which varies so much in physical structure that it is practically impossible to obtain two pieces exactly alike. Even with the best grades of mica, the thickness depends partly on the natural cleavage, so that this will vary to an extent which makes it difficult to secure any desired dimension. Likewise, the brittleness of this mineral makes it impractical to go below a certain thickness for any given diameter, thereby restricting the available flexibility and elasticity, which is also limited by the nature of the mineral. Furthermore, the flakiness of the mica is apt to cause particles to be detached from either face of the disk, the drilling of the disk for connecting it to the record-actuated lever is apt to damage it, and the mica is easily scratched even by a finger nail. Such scratching or other damaging decidedly impairs the tonal quality of the disk, thus further limiting its desirability or even rendering the disk entirely useless. So also, the color of the mica is predetermined by nature and cannot readily be altered to match the color scheme of the phonograph without impairing its tonal qualities.

My present invention aims to overcome

these and other objections to the mica disks by providing disks which can readily be made in great uniformity of thickness, which will be entirely homogeneous in structure, which cannot easily be scratched or damaged, which may be colored as desired, which can readily be cut or drilled without chipping or flaking and which will be superior in resonance to mica. Generally speaking, I attain these and other objects by producing a gelatinous disk and then treating this in such a manner as to make it both resilient and waterproof. Further objects will appear from the following specification and from the accompanying drawings, in which Figure 1 is an elevation of a phonograph reproducer diaphragm made according to my invention.

Fig. 2 is an enlarged transverse section through the same.

Illustrative of my invention, I may dissolve four ounces of gelatin in one quart of water with the aid of heat, adding to this some ingredient for hardening the product during the subsequent evaporation, as for example a quarter ounce of manganese borate. Or I may use alum as the hardening ingredient, or both, and may start with some other gelatinous substance, such as glue. If a colored diaphragm is desired, I also add a suitable coloring matter. The resulting mixture is then formed into sheets, either by floating it upon glass or by evaporating it in suitable pans or on netting. In either case, it is desirably passed between suitably adjusted rollers before it has entirely hardened, thereby squeezing out any air bubbles or gas bubbles which may be due to the chemical action of a hardening ingredient and also insuring the desired exactness as to the thickness of the resulting sheets. By varying the amount of the hardening ingredient or ingredients, I can readily produce such sheets in any desired hardness, and in practice, I may harden the sheets to a degree considerably in excess of that required for affording the desired resiliency and resonance, thereby permitting me to waterproof the material without unduly softening the same.

Without such waterproofing, the gelatinous material would readily absorb moisture, thereby causing it to swell and warp out of

shape, so that its initial tonal qualities would rapidly disappear. I therefore subject the material to a treatment which renders it proof against humidity or other atmospheric action, as for example by employing the waterproofing process disclosed more fully hereafter. For the purpose, I may employ a liquid composed of camphor, pyroxilene, a suitable solvent (such as an alcohol, a ketone or ether), turpentine or the like, gum such as mastic, oil (preferably vegetable) and a clearing agent (such as amyl acetate.) This liquid is brushed over both faces of the sheet (or of the disks if these have been previously cut from the sheet), or the previously prepared gelatinous material may be dipped into the waterproofing liquid. In either case, the extent to which this liquid acts upon the sheets or disks depends on the proportion of the solvent to the other ingredients and on the particular ingredients used; that is to say, on the time which will elapse before the volatile parts of the liquid vaporize. By suitably choosing and proportioning the various ingredients I can therefore obtain an action on the sheets or disks which will not only waterproof the same effectively, but which will also soften the previously unduly hardened material to just the degree of elasticity and resiliency required for obtaining the desired resonance. For example, I may dissolve three pounds of celluloid in four gallons of acetone, adding one gallon of amyl acetate and eight ounces of a suitable vegetable oil such as castor oil. With this mixture, the amyl acetate acts as a clearing agent, while the castor oil supplies the desired softening action, so that I can vary the surface softening effect by varying the proportion of the castor oil.

Having made such a product in sheet form, I can readily cut disks of any desired diameter from the same by means of ordinary blanking dies or rotary cutters, and can also drill or otherwise machine the disks without any flaking or chipping. Consequently, I can obtain an accuracy in size and a perfection in finish which is practically impossible to secure even with the best grades of imported mica, and in practice I can produce such diaphragms at a cost below that of mica. Moreover, I have found that the diaphragms as thus manufactured are far superior in tonal quality to the mica disks used even on the highest priced phonographs, that they cannot be scratched with a finger nail or otherwise easily damaged, and that such disks will afford both a greater volume of tone and a far greater resonance than mica disks of the same diameter, as evidenced by their selectively accentuating the different instruments in orchestral records, and by their reproducing high notes in vocal records with clear and non-metallic tones.

Indeed, I have found that after deliberately subjecting one of my diaphragms to unduly rough treatment (as by creasing it with a tool during the hardening process, or even by mending a cracked disk) I can still secure tonal effects decidedly superior to those obtainable with the most carefully selected mica disks.

However, while I have described highly desirable means of carrying out my invention, I do not wish to be limited to the precise disclosure, as the same might obviously be modified in many ways without departing from the spirit of the appended claims. For example, the diaphragms may be cut into the desired shapes before they are subjected to the treatment which simultaneously waterproofs the surface of the diaphragms, softens the latter and makes them sufficiently pliable for affording the desired resonance; various equivalents may be substituted for the ingredients above named; the waterproofing and resonance imparting treatment may be applied to gelatinous sheets made in other ways than that above recited; and some other waterproofing mixture may be used instead of the one above disclosed.

If desired, the amyl acetate or other clearing agent may be omitted; however, if such an ingredient is not used, a deposit on the finished diaphragm will be plainly visible, hence I preferably employ such a clearing ingredient to render the coating transparent and therefore practically invisible. Since the rate of evaporation of the treating liquid depends both on the temperature and the humidity, I am not here reciting any particular proportions, as any one familiar with the manufacture of gelatin can readily blend the ingredients as required, increasing the amount of oil to enhance the pliability, and adding to the gum to increase the hardness of the deposit and the stiffness of the diaphragms.

So also, I herewith am not broadly claiming either the process of manufacture above recited, or the resulting gelatinous material, but am only claiming the process and product as related to resonant diaphragms. That is to say:

I claim as my invention:

1. A resonant diaphragm comprising a gelatinous base provided on both sides with a water-excluding coating.
2. A resonant diaphragm comprising a gelatinous base provide on both sides with a water-excluding coating which also increases the pliability of the resulting diaphragm.
3. A resonant diaphragm comprising a gelatinous base provided on both sides with a water-excluding coating of a more pliable material.
4. A resonant diaphragm comprising a

hardened gelatinous base provided on both sides with a more pliable coating of a water-excluding gelatinous material.

5 5. A resonant diaphragm comprising a gelatinous base provided on both sides with a transparent and water-excluding facing.

6. A resonant diaphragm comprising a gelatinous base provided on both sides with a transparent and water-excluding facing of
10 greater pliability than the said base.

7. A resonant diaphragm comprising a gelatinous base and a facing of transparent water-excluding material integrally united therewith.

15 8. The method of producing a resonant diaphragm which consists in softening the surface of a previously hardened gelatinous material.

9. The method of producing a resonant
20 diaphragm which consists in softening the surface of a previously hardened gelatinous

material by treating the latter with a material also adapted to form a water-excluding facing.

10. The method of producing a perma- 25 nently resonant diaphragm which consists in subjecting the face of a previously excessively hardened gelatinous base to a vaporizable liquid adapted to form a water-excluding deposit and containing an ingredi- 30 ent for increasing the pliability of the base.

11. The method of making a resonant diaphragm of predetermined resiliency, which consists in first producing a gelatinous material hardened beyond the desired 35 resiliency, and then reducing the resiliency thereof by treating it with a softening agent adapted to form a water-excluding deposit thereon.

Signed at Chicago, August 27th, 1919.

ALFRED GELBERT.