W. W. YOUNG.

METHOD OF MAKING DIAPHRAGMS FOR TALKING MACHINES.

APPLICATION FILED DEC. 1, 1908.

975,668. Patented Nov. 15, 1910.

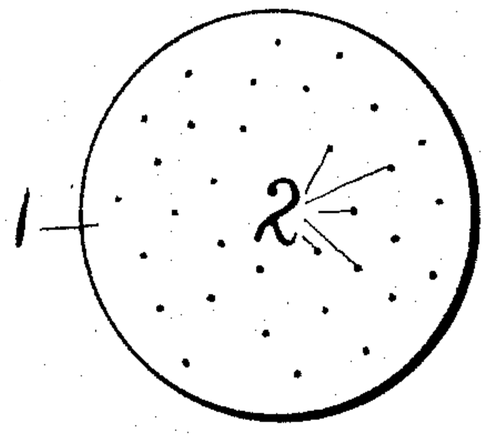

FIG. 1.

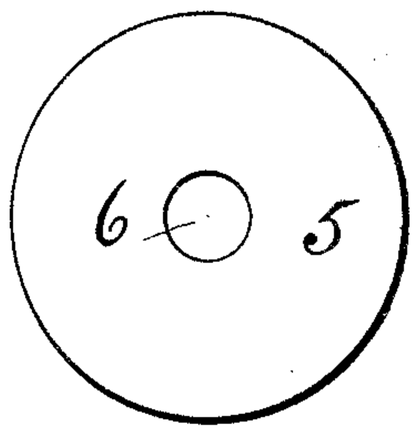

FIG. 2.

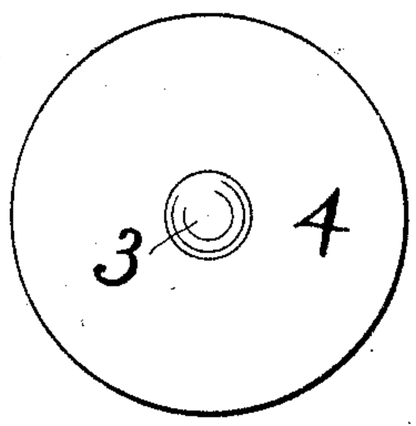

FIG. 3.

FIG. 4.

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METHOD OF MAKING DIAPHRAGMS FOR TALKING-MACHINES.

975,668. Specification of Letters Patent. Patented Nov. 15, 1910.

Application filed December 1, 1908. Serial No. 465.474.

To all whom it may concern:

Be it known that I, WILLIAM W. YOUNG, a citizen of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Methods of Making Diaphragms for Talking-Machines, of which the following is a specification.

My invention relates to improvements in methods of manufacturing reproducing diaphragms for talking-machines, and my method consists in a general way in thoroughly impregnating and permeating a suitable, more or less porous material with a compound, emulsion, or solution which possesses the necessary characteristics and qualifications, in imparting a proper surface treatment to such material, in hardening by subjecting the treated material to heat and pressure, and in raising a portion of or producing an integral protuberance on the material, the resulting diaphragm being exceedingly compact, hard, and tough, although thin, and having smooth and even surfaces and possessing a uniform thickness throughout excepting in the center where the protuberance is located, all as hereinafter set forth.

The reproducing diaphragms commonly used in talking-machines are made of mica, or sheet-metal, the mica diaphragms predominating, and owing to this fact it is not possible to obtain the best results from such machines, since neither mica nor simple sheet-metal disks used as diaphragms are capable of producing such results, moreover, the mica disks or diaphragms are extremely fragile and also expensive because of the waste incident to procuring disks of the proper size, and the primary object of my invention is to produce a substitute for mica, sheet-metal, and other kinds of diaphragms, which substitute possesses the necessary or desirable features outlined in the preceding paragraph, and in addition is resilient and resonant, is impervious to moisture and unaffected by climatic changes, and is capable of giving out clear, loud, and distinct tones of great depth and volume, of evenly distributing the sound waves and quickly, completely, and perfectly recovering its stable equilibrium, and of lessening to a great extent, if not eradicating altogether, all alien and discordant noises such as blasts and scratching sounds which are so prevalent with the ordinary diaphragm.

In the accompanying drawings, which form a part of this application and in which like characters of reference indicate like parts throughout the several views—Figure 1 is a side view of a cardboard disk perforated and ready for immersion; Fig. 2, a side view of a metallic plate which may be employed in compressing such disk; Fig. 3, a side view of a diaphragm complete, and, Fig. 4, a cross-section, on a large scale, of said diaphragm.

In carrving out my method and producing my diaphragm I make use of certain chemical substances or materials which have been found to give satisfaction, but I do not desire to be limited to these particular substances or materials; neither do I desire to be limited to the exact sequence or number of steps in putting said method into practice, since good results may be obtained even though some little departure be made in the order or number, or both, of such steps.

Although it is my practice to treat individual disks to produce the diaphragms, it is conceivable that strips or sheets of cardboard or other suitable material might be treated and the diaphragms subsequently cut out of such strips or sheets.

While it is true that almost any fibrous material or fabric, which is sufficiently porous to take up an adequate amount of a filling solution, such as leather, various kinds of paper, or cloth may be used, I find that a pure, hard-finished bristol-board which is quite thin answers better for this purpose than anything else so far tried, provided the same be perforated before it is subjected to the aforesaid solution. In the first view a bristol-board disk 1 is represented, and in this disk is a number of very fine holes 2. The holes 2 are quite numerous and extend through the disk 1 from side to side. One object of these perforations or holes 2 is to open numerous ways into the interior of the disk 1, so as to enable the solution to penetrate and permeate all parts of the disk structure and to become thoroughly and evenly distributed therein and therethrough, thus insuring after drying and pressing the disk that it will have practically no unfilled portions. Another object of the aforesaid perforations is to afford means for producing a diaphragm having a structure of dif-

ferent materials, or a structure that is broken up or divided into unlike parts as to texture.

As a filling for the texture of the disk 1, whether or not said disk be perforated, I prefer to employ one or more minerals mixed with and held in solution in water by an alkali, together with an inert or neutral mineral that will mix with water and form with the other solution when combined therewith a suitable compound, mixture, or emulsion. As the first basis for this emulsion I now employ silicate of soda or silicate of potash, and to one of these I add dry oxid of zinc. The resulting mixture or emulsion is particularly adapted for my purpose, since it readily unites with the disk 1 in a most thorough manner by entering into the texture of the same and imparts to such disk when finished and finally converted into a diaphragm just the properties that are required.

After perforating the disk 1, provided this be resorted to, as is generally the case, said disk is immersed in the filling emulsion or filler until thoroughly saturated, next the disk is partially dried either with or without artificial heat, preferably without, next a dry powder such as oxid of zinc is applied to both sides of the disk, then the latter is compressed between two steel plates, then it is subjected to heat, then it is coated on both sides with some of said filler and powder is applied as before, then it is partially dried again, as in the first instance, then compressed again, and finally the treated disk is once more subjected to heat until any moisture that might have remained has been driven out and the now practically finished diaphragm is hard. Although the diaphragm is substantially in a finished condition, the coating and the subsequent drying and heating with the intermediate compressing may be repeated one or more times as may be deemed necessary or desirable in order more perfectly to fit said diaphragm for use. During this process a portion of the disk 1 in the center has been left in a less dense and compact condition, and consequently has been raised slightly so that there is a protuberance 3 in the center of the finished diaphragm 4, on one or both sides.

In order to produce the protuberance 3 the plates between which the disk 1 is compressed might be made with male and female parts like ordinary dies, and then, of course, the raised portion of the disk would be of the same density as the other parts, but I prefer to use plates like the one shown at 5, Fig. 2. In this plate 5 it will be noticed there is a central opening 6, and it is into this opening, or a similar one in the plate on the other side of the disk 1, or in both of such openings, that the central portion of said disk expands during the compressing operation to form the protuberance 3. Thus it will be seen that the protuberance 3 may be on either or both sides of the diaphragm 4, and that in any event the texture of such protuberance will be less compact or dense and consequently thicker than that of the surrounding parts, because it is not subjected to pressure like that of said surrounding parts, this difference being clearly apparent in Fig. 4. The qualities of the diaphragm are not affected by the position of the protuberance 3 so that it is immaterial whether said protuberance be on one side or the other of said diaphragm or whether it be upon both sides.

The protuberance 3 not only reinforces the diaphragm 4, by assisting in keeping the diaphragm from getting out of shape or warping and at the same time by increasing the strength, durability, and endurance, of the same, but enhances the sound reproducing qualities of the diaphragm in a most marked degree, and is especially efficacious in causing the sound waves to be evenly distributed and the diaphragm to make a quick and perfect recovery thereafter. This protuberance is not built up out of other materials or parts, but is an intergral part of the diaphragm itself, therefore it cannot work loose and so produce a rattling sound or blast as it otherwise would be liable to do.

The effect of the compression between the steel plates, as will be very readily understood, is to force the filling into all parts of the disk 1, even into the central portion thereof, and to close the perforations 2 both with the filling and to some extent with the original texture. The surfaces of the disk are treated, as well as the interior, so that in the end there is produced a diaphragm which possesses certain characteristics that approach those of metal, such as hardness, resiliency, resonance and smoothness. The materials that I use for filling and coating the disks enter intimately into the cellular structure of said disks and thus form a mechanical union therewith, and it is probable that a chemical change also takes place. By following this method any number of diaphragms may be produced and all will have the desired qualifications.

An air drying merely for the first one. that is, the drying after the immersion of the disk in the filling bath, is generally sufficient, as it is then desired to only partially dry the saturated disk so it can be compressed, and the same is true of all dryings which immediately precede compressing. But the other dryings should be by subjection to heat, for the reasons previously given and for the further reason that heat tempers the filling and coating material to such an extent and in such a way as to enhance the resonant qualities of the diaphragm.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The method of making diaphragms, for talking-machines, consisting in introducing as a filler into porous material a deposit from a silicate, an alkali and a neutral mineral in solution, and in hardening such filled material.

2. The method of making diaphragms, for talking-machines, consisting in introducing as a filler into porous material a deposit from a silicate, an alkali and a neutral mineral in solution, and in compressing and drying such filled material.

3. The method of making diaphragms, for talking-machines, consisting in perforating a piece of fibrous material, in immersing such perforated material in a filling compound, and in compressing between hard imporous surfaces and drying the filled material.

4. The method of making diaphragms, for talking-machines, consisting in immersing porous material in a filling bath, then in partially drying the material thus treated, then in powdering such material, then in compressing the same, then in subjecting it to heat, then in coating with the filler and powdering once more, then in partially drying again, then in compressing again, and finally in subjecting to heat again

5. The method of making diaphragms, for talking-machines, consisting in immersing porous material in a filling bath, in compressing such filled material between hard plates having openings therein arranged and adapted to afford room for the expansion of such portion of the material as is adjacent to such openings, and in drying said material.

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Witnesses:

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