W. W. YOUNG.

METHOD OF MAKING TALKING MACHINE DIAPHRAGMS.

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980,470.

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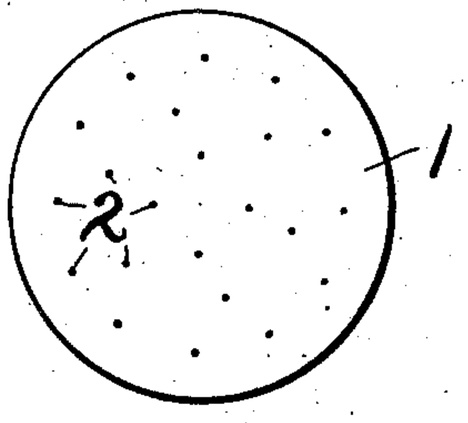

FIG. 1.

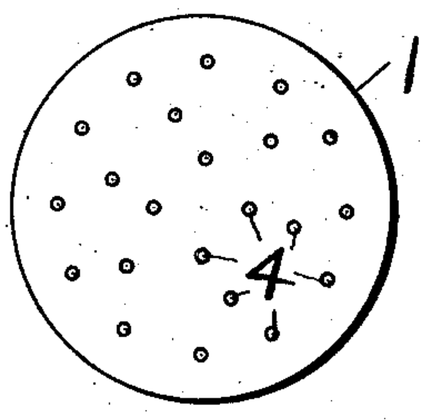

FIG. 2.

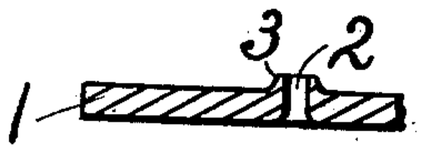

FIG. 3.

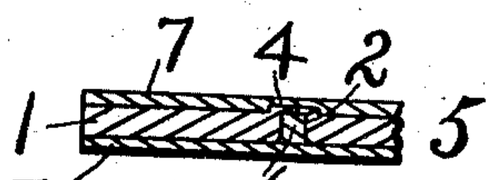

FIG. 4.

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METHOD OF MAKING TALKING-MACHINE DIAPHRAGMS.

980,470. Specification of Letters Patent. Patented Jan. 3, 1911.

Application filed December 12, 1908. Serial No. 467,225.

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 a new and useful Method of Making Talking-Machine Diaphragms, of which the following is a specification.

My invention relates to improvements in methods of manufacturing reproducing diaphragms for talking-machines.

Broadly the new method consists in perforating thin sheet material, and when deemed necessary in producing burs thereon by punching instead of cutting out the perforations, and if desired in upsetting such burs.

More specifically the new method may consist in perforating imporous material, in filling the perforations in the imporous material and in coating the latter with a material or materials, while in a liquid state or plastic condition, which possess the necessary characteristics and qualifications or qualities, in partially drying the imporous material thus treated, and in subjecting the same to pressure. The coating, drying and pressing operations in the order named are usually repeated one or more times and a thorough and complete drying by subjection to heat is given after pressing.

It will thus be seen that my invention contemplates the progressive method whereby is produced a perforated diaphragm of thin material which may or may not have flattened burs thereon and which may or may not have a filling and coating material or materials in its perforations and on one or both of its sides. Or, to state it differently, it may be said that initially a diaphragm is produced which consists of thin, perforated material either with or without burs thereon and if with burs then either with or without them in a flattened condition, but by adding the filling and coating and taking the additional steps for that purpose the aforesaid diaphragm consisting of one material is converted and transformed into a diaphragm consisting of different materials, the structure of the first being homogeneous and that of the second heterogeneous.

With the mica and the ordinary sheet-metal, reproducing diaphragms commonly used in talking machines, it has not been possible to obtain the best results from such machines, because neither of these diaphragms is capable of producing such results; moreover, the mica diaphragms or disks, which greatly exceed in number the ordinary sheet-metal diaphragms or disks, are very fragile and also expensive since there is a great waste incident to procuring disks of the proper size and character; the mica disks, too, deteriorate with use; the primary object of my invention, therefore, is to produce a substitute for mica, ordinary sheet-metal, and other kinds of diaphragms heretofore employed, which substitute is durable and does not deteriorate, is resilient and resonant, is impervious to moisture and unaffected by climatic changes especially when coated, and is capable of giving out clear, loud, and distinct tones of great depth and volume, of evenly distributing the sound waves and making a quick, complete, and perfect recovery, and of lessening to a great extent 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 through the several views—Figure 1 is a side view of a sheet metal disk perforated and represents the unfilled diaphragm; Fig. 2, a view of a diaphragm as it appears when the burs left by the perforating punch have been upset or pressed into small bosses and when seen from the side upon which such bosses are located, the appearance being practically the same whether said diaphragm be filled and coated or not provided that, in the former instance, the coating be transparent; Fig. 3, an enlarged fragment in section of the disk or diaphragm shown in the first view, and, Fig. 4, an enlarged fragment in section of a diaphragm which has been filled and coated and pressed.

Although it is my practice to make the diaphragms out of individual disks, the process might be applied to strips or sheets of material which are afterward cut up into disks.

Various kinds of metals and their alloys which have been rolled or otherwise made thin can be utilized in the manufacture of my improved diaphragms, among which mention may be made of aluminum and copper, the former being an exceedingly good metal for the purpose. In addition to sheet-metals other materials which are sufficiently

hard and dense and possess the other necessary qualities to a greater or less degree may be used, the materials being imporous when they are to be filled and coated.

In carrying out my method I take a disk 1, of aluminum for example, and make a number of small holes 2 therein. The holes 2 are more or less numerous, they extend through the disk 1 from side to side, and they are preferably punched rather than cut so as to leave projections or burs on one side of said disk, as shown at 3, in Fig. 3. The object of perforating the disk, and more especially of perforating it in the manner just stated, is for the purpose of breaking up the structure of the same and of obtaining the small bosses which are formed by flattening the aforesaid burs, as will presently be made clear, such changes in the character of the original disk being productive of beneficial results. A further object of the perforations may be to afford means for producing a structure of different materials, or a structure that consists of unlike parts in texture, as is done when the perforations are subsequently filled. This last phase of the invention will be dealt with at length in the course of this description.

In some cases the burs 3 may be left intact, but usually they will be upset to form small, flat bosses 4, Figs. 2 and 4, on one side of the disk 1 at the corresponding ends of the holes 2. In reality, the bosses 4 are necessarily somewhat irregular in shape, and the openings in their centers are often so exceedingly minute as scarcely to be discernible, but of course the metal, which has been perforated by punching, when subjected to pressure in the upsetting process does not return to its former place or condition. In the drawings the holes 2, burs 3, and bosses 4 are on an exaggerated scale. The disk 1 is pressed between steel plates or their equivalent to flatten the burs 3 into the bosses 4.

In order to produce a more complex and perhaps in some respects better diaphragm than that previously described, I have recourse to the method which I will now explain, and in carrying out which I make use of one or more suitable chemical substances or materials for a filling and coating agent for the perforated disk 1. Any material or materials which will give the desired results may be employed for the aforesaid filling and coating, such as soluble minerals like plaster-of-paris, oxid of zinc, silicate of soda, etc., but I do not intend to be restricted in this particular; neither do I intend 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.

Assuming now, that the disk 1 has been perforated by punching, and that a filling and coating compound, solution, mixture, or emulsion of silicate of soda or silicate of potash and oxid of zinc, for example, has been prepared, the next step is to introduce such filling and coating emulsion into the holes 2 and to spread it on one or both sides of said disk, generally on both sides. The disk, after being treated as above set forth is next dried or rather partially dried, then the filled and coated disk is pressed between the steel plates or equivalent mediums, of which mention already has been made, in order to transform the burs 3 into the bosses 4 and to compress the filling and coating material or agent within the holes 2 and on the outside of the disk. Following the pressing the disk is dried by being subjected to heat. One or more additional coats of the emulsion are usually given the disk, after the foregoing steps have been taken, the application of such coats being followed preferably by the partial drying, the pressing, and the thorough drying by subjection to heat. By subjecting the filled and coated diaphragm to heat at a certain stage or stages during the process of making the same and especially after the final pressing, all moisture is driven out and the compound, mixture, solution, or emulsion which constitutes the filling and coating material is rendered hard and otherwise fit to serve its purpose. In the end a diaphragm 5, Fig. 4, is produced which possesses the necessary and desired qualities. In this view the filler is represented at 6 and the two coats at 7. By following this method any number of diaphragms may be produced and all will be of a similar nature.

When the burs 3 are flattened the substance of the disk 1 is forced partly into the adjacent ends of the holes or perforations 2 and into the filling when present, but enough remains outside to form the bosses 4.

The several partial and complete dryings before and after pressing are effected by exposing the treated material to different degrees of temperature such as will bring about the required result in each case. The last drying after pressing, whether the latter operation be repeated or not, should be very thorough and complete in order that no moisture whatever shall be left in the finished diaphragm. It is generally better to dry after each pressing, provided there be more than one, but in any event there should be a final drying, as stated above; it is well to dry after the first pressing also, when there is a subsequent pressing or pressings.

Air drying at an ordinary temperature might do for the partial drying, but would be slow, so I make use either of an open or closed heater of some kind in connection with this step of my method, and also for

the complete drying, the open heater being employed as a general thing for both unless the drying is to amount to an actual baking which with these diaphragms is not deemed to be necessary or desirable even.

It has been found that diaphragms made by treating wire-mesh, -cloth, or -gauze in the manner hereinbefore explained give fairly good results. In this case the perforations are in the base medium or disk to start with, and there are no bosses, but otherwise the steps and the resulting product are substantially the same as before.

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

1. The method of manufacturing diaphragms, for talking-machines, consisting in punching holes in thin sheet metal and in so punching them as to form burs around such holes at one end of each, and in upsetting said burs.

2. The method of manufacturing diaphragms, for talking-machines, consisting in punching holes in thin sheet metal and in so punching them as to produce burs around such holes at one end of each, and in pressing said burs back into said holes and at the same time flattening them around the latter to form bosses on the adjacent surface of said material.

3. The method of manufacturing diaphragms, for talking-machines, consisting in perforating a piece of imporous material, in introducing filling material into the perforations in said imporous material and coating the latter with such filling material, and in drying and pressing the treated piece of imporous material.

4. The method of manufacturing diaphragms, for talking-machines, consisting in punching holes in a piece of imporous material and in so punching them as to produce burs around such holes at one end of each, in introducing filling material into said holes and coating such perforated material with such filling material, in drying the treated piece, and in pressing the same to flatten the burs left by the punching operation and to compress the filling material in and on said piece.

5. The method of manufacturing diaphragms, for talking-machines, consisting in introducing filling material into imporous perforated material and coating such imporous material with such filling material, in partially drying the treated imporous material, in pressing the same, in subjecting it to heat, and in again coating, partially drying, pressing, and subjecting to heat.

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