Nov. 28, 1933. E. M. PATTERSON 1,936,686

SOUND RECORDING MATERIAL AND METHOD OF MANUFACTURE

Filed March 23, 1931

FIG. 1

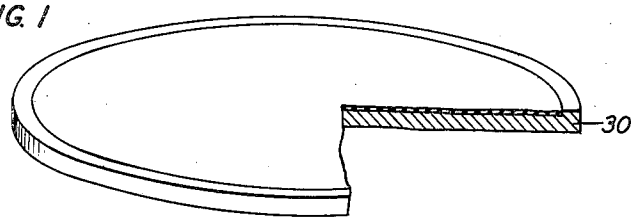


FIG. 2

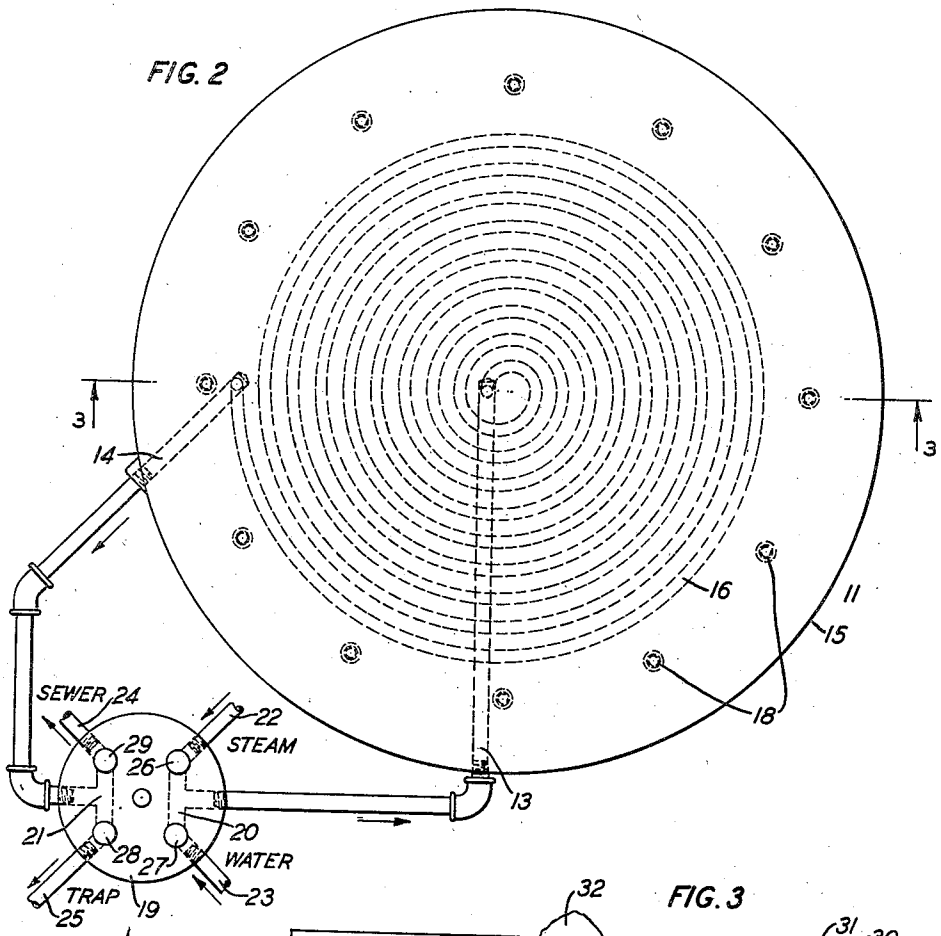
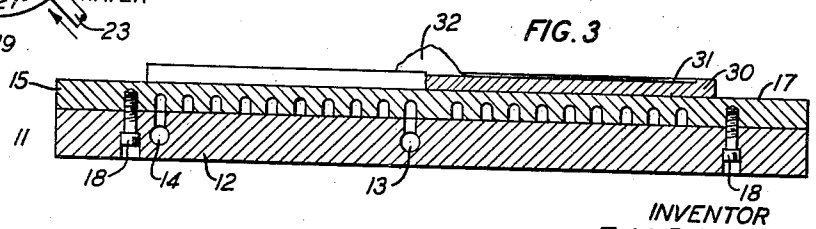


FIG. 3



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SOUND RECORDING MATERIAL AND METHOD OF MANUFACTURE

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6 Claims. (Cl. 91—70)

This invention relates to wax phonograph recording blanks and more particularly to composite blanks comprising a layer of wax upon a backing member, and to methods of making such blanks.

The object of the invention is to provide recording blanks of this nature which are well adapted to high quality sound recording.

It is a very old expedient in the art to form a recording surface by pouring melted wax into a recess formed by the turned-up edge of a thin metal plate. Many other recording surfaces formed by coating other materials such as paper, with wax have also been proposed from time to time but while they are relatively cheap, none of these blanks have been found satisfactory for high quality work. It is, therefore, still the practice to use discs of wax about two inches thick for original recordings and to shave them after each use to form a new recording surface. This procedure, however, is not entirely satisfactory for several reasons. Such waxes are expensive; they are very heavy (about twelve pounds when new); a large percentage of breakage in handling seems to be unavoidable, and in addition to all this they give objectionable scratch noise particularly when a very wide range of frequencies (such as up to 10,000 cycles) is recorded and reproduced. This noise may be due in part to the inherent imperfections in the best shaved surfaces and possibly to the crystalline structure of the wax obtained by the usual methods of casting.

In making blanks of this kind it is customary to melt a rather large quantity at one time and to flow it into suitable molds. Since they are made in quantity and are of rather large bulk, the wax is in a melted condition for some little time so that considerable volatizilation takes place which seems to cause deterioration in the physical properties of the wax.

In accordance with the general features of the present invention, a very satisfactory recording surface is obtained by melting suitable wax directly in a stiff, recessed metal plate which forms the backing member for the wax surface so obtained. By carefully controlling the temperature so that the plate and wax are not heated to more than a very few degrees above the melting point of the wax and by slowly cooling it after it is fully melted, a very smooth surface, with much better cutting properties than the best shaved surfaces, is obtained. An aluminum plate about one-quarter inch thick with a 20 mil recess to retain the wax has been found satisfactory for this purpose and best results from the standpoint of both high frequency definition and surface noise have been obtained when Matthews M wax is used.

In carrying out the process of making these blanks, the disc containing a lump of wax may be placed in contact with a steam platen which preferably contains a spiral steam channel arranged to give a temperature gradient outwardly from the center. Steam at the proper pressure to give the required temperature is admitted till the wax has flowed from the center of the disc outwardly to fill the recess. Cooling water of such a temperature that the wax is slowly reduced to room temperature is then circulated through the platen. By this method the wax is in a melted condition for only a brief interval and hence has little opportunity to deteriorate. Due to the thinness of the film of wax, cooling at this rate does not produce flow line irregularities in the surface such as appear when thicker waxes are cast and any occluded gases work to the surface before the wax sets so that surface depressions due to the contraction of occluded gases do not appear in the finished blank.

In the drawing Fig. 1 is a perspective view partly in section of a recording surface according to this invention; Fig. 2 is a plan view of the preferred platen and the valve connections for carrying out the invention and Fig. 3 is a sectional view of the platen showing a record disc in position.

Referring now to Figs. 2 and 3 the platen 11 consists of two main parts, a steel bottom plate 12 having an inlet 13 and an outlet 14 and a steel top plate 15 about ⅞ inch thick having a spirally arranged channel 16 between the outlets as shown. The channel, which is preferably about ⅜ inch wide and extends to within about ⅜ inch of the upper surface 17, is tightly closed at the bottom by the plate 12 which is held in place by a number of machine screws 18. In carrying out the process of the invention it is necessary that some arrangement be provided for readily supplying steam and cooling water to the platen. One convenient valve arrangement for this purpose is shown in Fig. 2 in which the multiple valve 19 has two entirely separate chambers 20 and 21 connected to the platen inlet and outlet respectively. The chamber 20 has steam and water connections 22 and 23 and the chamber 21 has connections 24 and 25 to a sewer or other receiver and to a steam trap as indicated. The inlet and outlet connections are always open but the ports 26, 27, 28 and 29 are

opened only in the proper sequence as described below.

The backing plate or disc 30 must be a good conductor of heat and is preferably of duralumin or other lightweight metal about ¼ inch thick for the usual 12 inch record. It has a recess 31, deep enough to confine the required thickness of wax which may be of the order of 20 mils. It must of course be somewhat greater than the maximum depth of cut to be made but if made too deep, difficulty will be experienced in obtaining a sufficiently smooth surface because of the tendency of flow lines to appear in the wax during cooling. Moreover a very thin layer of wax such as one of 20 mils thickness backed up by a stiff plate is of low resiliency and hence does not tend to deform excessively under the stress of the cutting tool.

To prepare a recording surface according to this invention a disc with a smooth under surface is placed in contact with the platen as shown and a lump of wax 32 more than sufficient to fill the recess when melted is placed in the center of the disc. Care must be taken in the choice of the wax used particularly with regard to its coefficient of expansion and to its mechanical impedance or hardness. Ordinary waxes have high expansion coefficients and are unsuitable for the purposes of this invention since flow lines appear and the surface becomes slightly dished in cooling. From the standpoint of good definition of the sounds to be recorded a low impedance wax is preferred. A wax known to the trade as Matthews M, for instance, has been found quite satisfactory for the purpose; the exact composition of this wax is not known but it is believed to consist essentially of lead and aluminum stearates with some Montan wax. Its melting point is usually about 330° F. and hence care must be taken to avoid raising its temperature above 334° or 335° F. during the melting process for any further increase in temperature produces noticeable deterioration as to both cutting properties and surface noise. One convenient way of accomplishing this is by the use of saturated steam at about 90–95 lbs. gage pressure for heating the disc. In this way the wax is melted without raising its temperature at any time above 335° F. It will be understood of course that the melting point of different lots of the same wax will vary a few degrees and that the figures just given are merely illustrative. The important thing to be remembered is that when the melting point of a particular lot has been accurately determined, as by gradually increasing the applied steam pressure, care must then be taken that the wax is not heated to more than 5° F. at most above this temperature.

In the first position of the valve 19 ports 26 and 29 are open and ports 27 and 28 are closed. Steam enters the platen through inlet 13 forcing any cooling water remaining from the last operation out through the outlet 14 and port 29 to the sewer. The valve is then moved to the second position in which port 28 opens, port 26 remains open and ports 27 and 29 are closed. The steam then exhausts into the trap, builds up pressure in the platen and soon raises its temperature to the desired value, the temperature gradient being from the center outward. In two or three minutes the wax is fully melted and the valve is then turned to the third position in which ports 26 and 28 are closed and ports 27 and 29 are open so that cooling water enters the platen and cools the wax from the center outwardly as before. The cooling operation should be carried out rather slowly to avoid flow lines, that is the disc should be reduced to room temperature in about 5 or 6 minutes. This produces a very smooth flat surface on the wax which may be used immediately for recording without further treatment and when such a record is reproduced directly from the wax it is found to be much lower in surface noise, particularly at high frequencies, than waxes prepared in other known ways. The records may of course be used as masters and processed in the usual manner and the improvement with respect to noise and definition will be inherent in any pressings made from them.

The reason for the reduction in noise is not yet fully understood but several factors apparently contribute to the result. The surface obtained in this manner is smoother than a carefully shaved surface and due to the thinness of the wax layer the usual defects due to air bubbles are substantially eliminated as already pointed out. Another very important factor is the fact that the original physical properties of the wax are not substantially changed as is the case when the wax is held in a melted state for an appreciable time. Recording waxes ordinarily contain one or more organic substances such as Montan wax which is made from fossils and such substances usually have a complicated comparatively unstable molecular structure which would seem to account for the tendency to polymerize or undergo a change of physical properties when in the liquid state.

While molding with pressure against a smooth plate yields an equally good surface on the wax this procedure has been found to increase materially the hardness and mechanical impedance of the wax and also its surface noise particularly for frequencies above 3000 cycles. At the present time a range extending up to 5000 to 6000 cycles is considered commercial high quality but with previous materials the noise is objectionable in the upper part of this range and increases very rapidly for higher frequencies. The records of the present invention however are about 10 decibels lower in noise than the noise in the commercial range of previous materials and there is no noticeable increase for frequencies up to 10,000 cycles.

The invention has been described with reference to particular dimensions, materials and apparatus for purposes of description and illustration but it is intended to be limited only by the scope of the following claims.

What is claimed is:

1. The method of preparing a phonograph recording blank consisting of a thin film of wax in a recessed metal disc which comprises melting the wax on the metal under close temperature control to preserve the original physical properties of the wax and slowly cooling the disc to produce a smooth surface on the wax.

2. The step in the method of preparing a recording surface comprising a wax-coated disc which comprises melting the wax on the disc under temperature control to preserve the original physical properties of wax.

3. The step in the method of preparing a recording surface comprising a wax-coated disc which consists in melting the wax on the disc by heating the disc to a temperature not in excess of 5° F. above the melting point of the wax.

4. The method of preparing a phonograph recording surface consisting of a wax-coated metal

disc which comprises placing unmelted wax on the disc, heating the disc from its center outwardly to a temperature not more than 5° F. in excess of the melting point of the wax and slowly cooling the disc from the center outwardly as soon as the wax has fully melted.

5. The method of preparing a phonograph recording surface consisting of a wax-coated metal disc which comprises placing unmelted wax on the disc, heating the disc to a temperature not in excess of 5° F. above the melting point of the wax and slowly cooling the disc.

6. The method of preparing a wax-coated metal disc for recording purposes which consists in melting the wax on the disc by the application of steam at a temperature only slightly in excess of the melting point of the wax for a period not exceeding five minutes and cooling the disc at such a rate that it is reduced to room temperature in not less than two minutes.

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