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SOUND RECORDING COMPOSITIONS

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This application is a continuation in part of an application filed on February 19, 1936, Serial No. 64,721.

This invention relates to a composition of matter or material suitable for use in the manufacture of sound records. These records are ordinarily cut in relatively soft wax and the material of the invention is wax-like in its physical characteristics.

An object of the invention is an improved wax-like homogeneous, non-crystalline material having a wrinkle-free surface, which is easily cut or engraved and which has the physical characteristics necessary to retain the sound record cut or engraved in its surface.

In accordance with the invention, this and other objects are attained by forming a sound recording material from metallic soaps of one or more of the fatty acids to which there is added a plasticizer, such as methyl abietate. The ratio of free acids to combined acids in the composition is an important factor in determining the physical characteristics of the material, and, in accordance with the invention, this ratio is maintained within rather close limits.

It has long been well known that materials for use in making sound recordings should have entirely different physical characteristics from materials used in making duplicate records from which the sound is produced. In general, the materials for recording have been some form of rather soft wax or wax-like material because of the ease with which the cutting tool can remove portions thereof to form the record. In fact, so common has the use of wax been for this purpose that these materials and the wax recording itself are commonly referred to as "waxes."

It has been proposed in making the duplicate records which are used for reproducing to combine with wax-like materials other materials designed to provide mechanical strength, moldability and a resistance to wear or the abrasive action of the reproducing stylus. In such materials, it has been proposed to use metallic soaps, such as stearates and palmitates of sodium and aluminum to which carnauba wax has been added, together with a small amount of ceresin. Such materials have been considered unsuitable for recording "waxes" because of their hardness.

In accordance with this invention, homogeneous compositions are prepared which are especially desirable for use in high fidelity recording. These compositions comprise a homogeneous dispersion of metallic soaps in an excess of long-chain fatty acids. The molar ratio of uncombined acids to combined acids is within a range of from .34 to .57. The ratio of the various constituents in these compositions is critical and must be obtained to secure satisfactory compositions for high fidelity recording.

One composition in which the molar ratio of free to combined acid falls within the range of from .34 to .57 and which has been found satisfactory as a recording material is as follows:

	Example No. 1	
	Grams	Percent by weight
Stearic acid	632	59.52
Montan wax	140	13.22
Anhydrous sodium carbonate (Na_2CO_3)	55	5.18
Basic lead carbonate ($2PbCO_3.Pb(OH)_2$)	84	7.93
Abalyn (methyl abietate)	150	14.15
Total	1061 (2.34 lbs.)	100.00

The montan wax in the above formula is known commercially as bleached montan wax. According to the literature, the amount of montanic acid in montan wax may vary from 50 to 90 per cent montanic acid content. If the montan wax varies in montanic acid content from 50 to 90 per cent, the ratio of free to combined acid in the above formula varies from .41 to .49. The stearic acid employed is triple pressed commercial stearic acid. In ascertaining the free to combined acid ratio, it is assumed that this material comprises 100 per cent stearic acid ($CH_3(CH_2)_{16}COOH$).

The acid number of the montan wax is preferably determined by the following method. Three grams of montan wax are dispersed in approximately 25 cc. of normal butyl alcohol by heating. The mixture is then cooled and 100 cc. of ethyl alcohol are added, and it is then refluxed until dissolved, after which the solution is removed from the source of heat and titrated with N/2 alcoholic potassium hydroxide using phenolphthalein as an indicator. The acid number is the number of milligrams of potassium hydroxide required to neutralize one gram of montan wax.

A montan wax having an acid number of 79.4 as determined by this method has been found satisfactory when employed in the above described formula. The amount of montanic acid in the montan wax having an acid number of 79.4 ascribing to the montanic acid the formula $CH_3(CH_2)_{27}COOH$, is 62 per cent and the cal-

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culated ratio of free fatty acids, expressed as stearic acid, to combined fatty acids, expressed as stearic acid, is .43. The composition in the above formula, with a montan wax having an acid number of 79.4, has been found especially desirable for recording materials. In the event that the amount of montanic acid in the montan wax in the above formula is 80 per cent, the molar ratio of uncombined to combined fatty acids is .47. While recording compositions having a free to combined acid ratio within a range as wide as .34 to .57 have been found satisfactory for recording purposes, it is preferred to employ compositions in which the ratio of the free to combined acids is between .38 and .48.

Examples of compositions which were found to represent the extreme limits of the ratio of free to combined acids are as follows:

	Example No. 2		Example No. 3	
	Grams	Per cent by weight	Grams	Per cent by weight
Stearic acid	612	61.88	652	57.59
Montan wax:				
50% $CH_3(CH_2)_{27}COOH$	100	10.12		
90% $CH_3(CH_2)_{27}COOH$			180	15.85
Anhydrous sodium carbonate (Na_2CO_3)	55	5.55	55	4.85
Basic lead carbonate ($2PbCO_3.Pb(OH)_2$)	84	8.50	84	7.41
Plasticizers (methyl abietate)	138	13.95	162	14.30
Total	989	100.00	1,133	100.00
Ratio of free to combined acids	.34		.57	

Instead of the sodium and lead salts employed in the above examples, similar salts or other soap-forming metals, the anion reaction products of which are volatile or the more reactive metals by themselves such as aluminum, zinc, etc., may be used. However, the metal content of such salts of other metals, such as the other alkali metals, alkaline earth metals (calcium, barium, magnesium, etc.), or other metals such as aluminum, etc., must be substituted in stoichiometric proportions to fall within the above ratio, to make a satisfactory recording wax. For example, 9 grams of aluminum are equivalent to 23 grams of sodium or 103 grams of lead. Likewise, other waxes having a high acid value, such as carnauba wax, may be employed instead of montan wax. Instead of stearic and montanic acids, other monocarboxylic fatty acids may be used, preferably those having more than 12 carbon atoms such as palmitic, myristic, monodecanoic, etc. While a record composition can be made by using only one acid containing material and only one metallic soap, it has been found that a composition containing at least two fatty acids and at least two definite metal soaps thereof prevents subsequent crystallization of the record composition. The prevention of crystallization eliminates one common source of noise which is often present in recording compositions. This inhibition of crystallization is a result of steric hindrance of the molecules in the lyophilic colloid produced in forming compositions of this invention.

To make the surface of this composition suitable for record purposes, it is desirable to add a plasticizer and, for that purpose, there is added to the base mixture the above specified amount of methyl abietate. The amount of plasticizer added is critical, inasmuch as the cutting properties, as related to the temperature during cutting, are governed by the plasticizer. Other substances, such as sperm oil, ceresin, petrolatum, semi-drying oils, alkyl phthalates, such as dimethyl phthalate, and chlorinated diphenyls may be used as plasticizers. However, the esters of abietic or similar acids, such as methyl abietate, were found considerably more suitable owing to their wide range of compatibility and attendant wide cutting range. Methyl abietate has been found most satisfactory since it permits recording over a range of temperatures.

In preparing the material the ingredients are weighed out in the proportions noted and the carbonates are thoroughly mixed and placed in a drying cabinet for preheating and drying. It has been found that an improvement in the rate and smoothness of the reaction results if the particles of the carbonates are heated to about 175° C. The stearic acid and montan wax are melted together and preferably heated to 175° C. and the previously mixed and heated carbonates are added. While 175° C. appears to be the best temperature, the reaction can be satisfactorily carried on at temperatures from 140° C. to 190° C. At this point, copious frothing takes place and considerable carbon dioxide is evolved. In about ten minutes the reaction will be found to have materially subsided and then the plasticizer, previously heated to the same temperature range, is added, after which the heating is continued for a few more minutes and the product is then ready for filtration and casting. During the entire reaction the temperature is preferably maintained at about 175° C. By following the above procedure, the reaction is controlled, thermal decomposition reduced and a wax which is highly translucent when cold is obtained.

If the proportions of acids to carbonates are held to those above specified, the resulting product will include a certain amount of free or uncombined acids. Expressed in terms of stearic acid, the molar ratio of free to combined acids calculated on the base formulae without the plasticizer will be that noted in the respective formulae. If the product is to be suitable for use as a recording medium in the manufacture of sound records, the ratio is important and should not exceed the limits .34 to .57. Various other metals may be substituted in the formula for sodium or lead and other long chain organic acids for the stearic acid or the montan wax and if the ratio above stated is maintained, a base material having the desired homogeneity for a recording "wax" will result.

While preferred embodiments of this invention have been described, various modifications may be made therein without departing from the scope of the appended claims.

What is claimed is:

1. A composition for sound recording comprising, by weight, approximately stearic acid 60 per cent, montan wax 13 per cent, anhydrous sodium carbonate 5 per cent, basic lead carbonate 8 per cent and a plasticizer 14 per cent.

2. A material for sound recording comprising as major constituents stearic acid and montan wax, a portion of the free fatty acids of said stearic acid and said montan wax being combined to form metallic soap and the molar ratio of the free fatty acids expressed as stearic acid in said material to the combined fatty acids expressed as stearic acid in said material being within the range of from .34 to .57.

3. A material for sound recording comprising as major constituents stearic acid and montan

wax, a portion of the free fatty acids of said stearic acid and said montan wax being combined to form metallic soap and the molar ratio of the free fatty acids expressed as stearic acid in said material to the combined fatty acids expressed as stearic acid in said material being within the range of .38 to .48.

4. A material for sound recording comprising as major constituents stearic acid and montan wax, a portion of the free fatty acids of said stearic acid and said montan wax being combined to form metallic soap and the molar ratio of the free fatty acids expressed as stearic acid in said material to the combined fatty acids expressed as stearic acid in said material being approximately .43.

5. A material for sound recording consisting of stearic acid, montan wax, sodium and lead soaps and not more than 16% of other ingredients, a portion of said stearic acid and said montan wax being combined to form metallic soaps of sodium and lead and the molar ratio of the free fatty acids in said material expressed as stearic acid to the combined fatty acids in said material expressed as stearic acid being within the range of .38 to .48.

6. A material for sound recording comprising 57.6% to 61.9%, stearic acid 10.1% to 15.8% montan wax and a compatible plasticizer, a portion of the free fatty acid in said stearic acid and said montan wax being combined to form metallic soaps and the molar ratio of the free fatty acids in said material expressed as stearic acid to the combined fatty acids in said material expressed as stearic acid being within the range of .34 to .57.

7. The composition defined by claim 2 wherein methyl abietate constitutes substantially the remainder of said composition.

8. The composition of claim 6 wherein the compatible plasticizer is methyl abietate and constitutes substantially the remainder of said composition.

9. A composition for sound recording comprising, by weight, stearic acid approximately 60%, montan wax approximately 13%, anhydrous sodium carbonate approximately 5%, basic lead carbonate approximately 8% and methyl abietate approximately 14%.

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