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## SOUND RECORD

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This invention relates to sound records such as films, tablets, discs, or other bodies upon which sound tracks are impressed and/or from whose surface sound tracks are reproduced, and relates more particularly to the use of thermoplastic resins obtained by the polymerization of acrylic acid, alkacrylic acid, their polymerizable derivatives and homologues, in manufacture of such sound records.

Sound records and other types of sound reproducing surfaces, as usually made from waxes, resins, or mixtures of these and other materials, often show certain disadvantages. In the case of phonograph records, for example, some of the more important include brittleness and background noise, the inability to flow freely under a moderate pressure, to set rapidly, to come away cleanly from the master and give a smooth polished article relatively free from air bubbles.

An object of the present invention is to provide a simple and economical method of making sound records of improved quality. A further object is to provide a sound record, the portion of which carries the sound tracks being substantially free of the above mentioned deficiencies in heretofore known sound records. A further object is to provide a sound record in which the playing surface at least is water insoluble, non-hygroscopic, tough, flexible, durable, and yet capable of reproducing sound with extraordinary fidelity. Other objects of the invention will be apparent from the description given hereinafter.

The above objects are accomplished according to the present invention by making at least that portion of a sound record in which the sound tracks are impressed, if not the whole record, of a composition comprising a thermoplastic resin obtained from the derivatives or homologues of acrylic acid or alkacrylic acid; particularly the nitriles, amides, substituted alkyl and aryl amides; and more specifically the esters of the alkacrylates such as the alkyl esters of methacrylic acid, for example, methyl methacrylate, ethyl methacrylate, and the alkyl esters of ethacrylic acid, as for example, methyl ethacrylate and ethyl ethacrylate, and the higher alkyl esters of the higher alkyl acrylates. Of the alkacrylic acid esters it is preferred to use methyl methacrylate, the polymer of which is unusually well adapted for the preparation of sound records. Inter polymers or mixtures of polymers of the compounds may be used if desired. The resins may either be used alone or combined with plasticizers, filling or coloring materials, and the like, depending inter alia upon the particular use and effect desired, as will be more fully understood by those skilled in the art to which this invention particularly appertains.

The above compounds may be prepared by any suitable process, the alkacrylates for example may be prepared in accord with the process described in the copending application of Rowland Hill, Serial No. 641,113, filed November 3, 1932, granted November 13, 1934, as U. S. Patent 1,980,483.

It is generally desirable to fabricate the recording surface by either first forming a record blank from the polymerized resin and subsequently impressing the sound track into the blank in a separate operation or simultaneously forming the record with the sound track in a single operation. The latter operation can be readily conducted by introducing the resin in the press as a powder or as a preform. Any other suitable mode of operation may be employed.

The polymers and particularly the methyl methacrylate polymer, which it is preferred to employ, are thermoplastic resins which have the valuable property of setting from a plastic moldable condition into a rigid or semi-rigid solid, the rigidity of which is determined, inter alia, by the particular resin and/or the type and amount of other substances present. The resin, with or without filling, plasticizing, or other addition agents, may be molded by any suitable process such as those described above. Sound records prepared in accord with this invention have the ability to reproduce with absolute fidelity the texture of the molding surface and the finished record comes away from that surface cleanly, giving a tough, durable record exceptionally free from background noise. These resins are, therefore, surprisingly well adapted for the preparation of such products. The resins may likewise be fabricated into the softer type records which are used to receive the sound track directly from a vibrating stylus.

With these products may be incorporated waxes or resins, or both, as well as filling materials. In addition in some cases plasticizing agents may be advantageously used, such for example, as triacetin, champhor, the alkyl phthalates, or any of the plasticizing and/or addition agents referred to in the above cited application. Suitable waxes may be incorporated with the alkacrylates and/or their polymers, such as hard paraffin, ceresin, ozocerite, Montan, candelilla, carnauba, shellac, Japan wax, and the like. Stearic acid may also be added as well as the stearate soaps, including those of sodium, zinc, lead, aluminum, and other metals. Aluminum

and calcium palmitate may be used, as well as also the various resinates. Natural resins, such as the copals, shellac, pontianak, rosin, dammar, sandarac, etc., may be employed, as well as the synthetic resins, such as phenol-formaldehyde, urea-formaldehyde, etc., pitches, such as stearic pitch, or petroleum or gas tars are sometimes useful. Filling materials, such as graphite, talc, clay, diatomaceous earth, and the like, may be used with or without fibrous fillers as asbestos, cellulose, cotton floc, wood powder, and the like.

Due primarily to the relatively high tensile strength and non-shatterable nature of records made from the esters of the alkacrylates, it is not generally necessary to make the record as thick as those now in use. Moreover, inasmuch as the walls are uniformly hard and homogeneous throughout, and the material is substantially unaffected by water or moderate heat, the tendency to warp, crack, or peel, is reduced to a minimum.

The outstanding advantages inherent in these thermoplastic resins is in their ability to provide an excellent surface in which to impress a permanent, durable sound track. It is, accordingly, of advantage, in some instances, especially if an inflexible record is desired, to utilize the resin as a surface supported on a more or less firm base such as are often used in this art; cardboard, light metal alloys, pitch compositions, and similar bases may, if desired, be employed. The resin may, of course, be placed on one or both sides of the record to permit the preparation of single or double faced records.

In the manufacture from the preferred ester as a base or surface upon which sound records may be impressed, there is first prepared, for example, a composition containing 90% polymerized methyl methacrylate, 9% triacetin, and 1% ethyl palmitate. The mixture is placed in a disc shaped mold, preferably already hot, conforming with the shape of the record desired and fitted with matrices. The mold is then closed and the material heated and pressed. A suitable temperature is from120–180° C., and a pressure of from approximately 2000 to 4500 pounds per square inch and up is applied for a short period, usually about two minutes. The record is then cooled and withdrawn from the press. It will be found to have faithfully reproduced both visually and orally the impression of the master.

Other compositions adapted for making sound-recording surfaces in a manner analogous to that described, are:—

*Example 1*

| | Per cent |
|---|---|
| Polymerized methyl methacrylate | 99 |
| Ethyl palmitate | 1 |

*Example 2*

| | Per cent |
|---|---|
| Polymerized methyl methacrylate | 90 |
| Diamyl phthalate | 9 |
| Stearic acid | 1 |

*Example 3*

| | Per cent |
|---|---|
| Polymerized methyl methacrylate | 87.0 |
| Dibutyl phthalate | 12.5 |
| Stearic acid | 0.5 |

*Example 4*

| | Per cent |
|---|---|
| Polymerized methyl methacrylate | 60 |
| Diamyl phthalate | 10 |
| Diatomaceous earth | 29 |
| Stearic acid | 1 |

It will be understood that the examples given above in no way limit the invention, for various compositions which are suitable for the preparation of sound records not illustrated thereby can readily be made. Moreover, it is not essential to the present invention that the above steps of forming the record be carried out, for a great many of the methods now employed in the molding of thermoplastic materials may be utilized with equally good results. If desired, the unsaturated polymerizable compound may be polymerized in situ in the mold.

Various plasticizers, such as those described in the examples, as well as those given in the Hill disclosure, are employed primarily to lower the molding temperature of the material to a convenient point, the greater the proportion of the plasticized present in the composition the lower will be its molding temperature. The above designated waxes are employed usually to aid in preventing the finished molded record, due to addition agents present or other causes, from adhering to the mold and in this capacity they act somewhat as a lubricant.

In some adaptations of the present invention the polymerization product, with or without plasticizer, may be used as a firm, more or less yielding surface which is backed by a hard, unyielding support layer. The resin veneer makes it possible to provide a tough, durable record having substantially no ground noises while the base provides an unyielding support therefor.

From a construction of the above disclosure, it will be appreciated that any sound record consisting wholly or in part of a thermoplastic resin prepared from acrylic acid, alkacrylic acid, or their homologues or derivatives, with or without plasticizers and/or addition agents, will come within the scope of this invention without sacrificing any of its advantages.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

I claim:

1. A sound record having a sound track impressed therein, the portion of said record containing the sound track being made of a composition comprising a thermoplastic resin from the group consisting of polymerized acrylic acid, alkacrylic acid, and their esters, nitriles, amides, alkyl substituted amides and aryl substituted amides.

2. A sound record having a sound track impressed therein, the portion of said record containing the sound track being made of a composition comprising a thermoplastic resin from the group consisting of polymerized acrylic acid, alkacrylic acid, and their esters, nitriles, amides, alkyl substituted amides and aryl substituted amides, and a plasticizer.

3. A sound record having a sound track impressed therein, the portion of said record containing the sound track being made of a composition comprising a polymerized alkyl ester of an alkacrylate.

4. A sound record having a sound track impressed therein, the portion of said record containing the sound track being made of a composition comprising a polymerized alkyl ester of an alkacrylate, and a plasticizer.

5. A sound record having a sound track impressed therein, the portion of said record con-

taining the sound track being made of a composition comprising a polymerized alkyl ester of an alkacrylate, a plasticizer, and a filling material.

6. A sound record having a sound track impressed therein, the portion of said record containing the sound track being made of a composition comprising polymerized methyl methacrylate.

7. A sound record having a sound track impressed therein, the portion of said record containing the sound track being made of a composition comprising polymerized methyl methacrylate, and a plasticizer.

8. A sound record having a sound track impressed therein, the portion of said record containing the sound track being made of a composition comprising polymerized methyl methacrylate, a plasticizer, and a filler.

9. A sound record having a sound track impressed therein, the portion of said record containing the sound track being made of a composition comprising approximately 90% methyl methacrylate, 9% triacetin, and 1% ethyl palmitate.

10. A sound record comprising a surface made of a composition comprising a thermoplastic resin from the group consisting of polymerized acrylic acid, alkacrylic acid, and their esters, nitriles, amides, alkyl substituted amides, and aryl substituted amides, and a backing comprising a hard, unyielding base.

11. A sound record comprising a yielding surface veneer made of a composition comprising a thermoplastic resin from the group consisting of polymerized acrylic acid, alkacrylic acid, and their esters, nitriles, amides, alkyl substituted amides, and aryl substituted amides, and a plasticizer, and a backing comprising a hard, unyielding base.

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