UNITED STATES PATENT OFFICE.

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PRODUCTION OF MOLDED ARTICLES.

1,411,425. Specification of Letters Patent. Patented Apr. 4, 1922.

No Drawing. Application filed April 30, 1919. Serial No. 293,595.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, and a resident of Llewellyn Park, West Orange, Essex County, New Jersey, have invented certain new and useful Improvements in the Production of Molded Articles, of which the following is a description.

My invention relates generally to an improved method of producing molded articles from material containing a substance comprising ingredients which react upon the application of sufficient heat to form a final hardened infusible condensation product, and more particularly to a method of producing sound records in which the sound waves are impressed in a surface layer or veneer formed of such a substance applied to a suitably shaped and preferably thermoplastic blank which constitutes a backing for the sound record.

The substance referred to may consist of any fusible resin of phenolic origin mixed with any material containing the methylene radical CH_2 which is capable of reacting with the resin upon the application of heat to form a final hardened infusible condensation product; but in the production of a sound record comprising a backing or base having a surface layer applied thereto for receiving the sound wave impressions, in connection with which I shall specifically describe my invention, I preferably employ as the substance from which the said surface layer is formed a fusible phenol resin mixed with hexa-methylene-tetra-amine as the hardening agent, such as the lacquer or varnish described in United States Patent No. 1,098,608, granted June 2, 1914 to Jonas W. Aylsworth. This substance also preferably contains a coloring pigment, such as lamp black, and a small amount of para-phenylene-di-amine to increase the speed of the chemical reaction which causes the formation of the final hardened product upon the application of sufficient heat, as disclosed in United States Patent No. 1,283,706, granted to me November 5, 1918.

It has heretofore been customary in forming sound records such as described above to provide the record blank or backing with the surface layer of varnish in its fusible state, that is, before the first hardening or condensing reaction takes place, and to then impress the sound waves into such layer by molding the coated blank or tablet under pressure and with the application of sufficient heat to effect the final hardening reaction, whereby the surface layer of the record tablet as the latter is taken from the mold, will be in its final condensed infusible condition with the sound waves permanently formed therein. The hardening or condensing reaction requires a considerable time even when a relatively high temperature is employed, and consequently, when this method is followed, the number of facsimiles which may be made from each matrix per day is limited, and it is necessary to employ a large number of such matrices, which are very expensive, in order to obtain the required output of a given sound record.

It has also been proposed to convert the surface layer or veneer of the coated blank or tablet into the final hardened or completely condensed state by heating or curing the coated blank to effect and complete the final hardening reaction, before subjecting the same to the molding operation, and to thereafter form the sound record groove in the hardened surface layer by heating the latter sufficiently to render the same somewhat plastic and impressing the sound record matrix therein under pressure. This process, however, is objectionable, for during the final hardening reaction of the said veneer or coating, the solvent therein is driven off and escapes from the outer surface of the veneer in the form of small bubbles, resulting in the formation of small cavities throughout the veneer, that is, an increase in the porosity of the veneer, and therefore an inferior surface for receiving the record impression.

The principal object of my invention resides in a method whereby more records of the character described herein may be obtained in a given time from a single matrix than in the case where the curing or condensing and hardening of the fusible condensation product of the surface layer of the record blanks or tablets are wholly performed during the molding of the sound records, and whereby the record receiving surfaces of the records obtained will be free from imperfections which are produced, as described above, when the veneer or coating of the record blanks is finally hardened prior to the molding operation; and my invention consists broadly in partially curing

or condensing the surface layer or veneer of the coated blank prior to the molding operation in order that the latter may be performed in less time.

In practicing my method in producing sound records of the character above described, I first coat the surface of a suitably shaped blank or tablet which is preferably quite porous, with a layer or veneer of the varnish composed of the mixture of phenol resin and hexa-methylene-tetra-amine in its fusible condition, and preferably in a liquid state, as by brushing. When in a liquid state the varnish contains a suitable solvent, preferably alcohol, in which the phenol resin is dissolved. The record blank or tablet to which the coating is applied preferably contains a suitable substance, preferably a resin, which renders the same thermoplastic and which is also soluble in the said solvent. It will thus be apparent that some of the alcohol or other solvent in the varnish penetrate the blank and dissolve a certain amount of the resin in the latter, and therefore that as the varnish dries, it will be rigidly attached to the blank and substantially integral therewith. After the application of the varnish, the coated blank is dried in the air for a short time until the surface layer becomes somewhat tacky or sticky. A great number of blanks coated and dried as just described are then placed in an oven or other receptacle in which they are heated or baked for a considerable period, preferably about six hours, during which the temperature of the oven is gradually raised from room temperature, that is, about 80 degrees F., to a point preferably between 180 degrees F and 220 degrees F., and preferably about 200 degrees F.

The heating or baking of the coated blanks in this manner cures the varnish or surface layer thereof, bringing the same to a semi-condensed or semi-final state, in which it is still somewhat soluble in alcohol. The blanks are now removed from the oven and allowed to cool. The condensation material comprising the surface layer will then be in what is known as the "rubbery" stage. When in this "rubbery" stage, the material of the surface layer is neither hard nor sticky and may be readily rendered sufficiently plastic, by the application of a small amount of heat, to be easily impressed by the sound record matrix. Moreover, when the varnish is in this "rubbery" stage, the hardening or condensing reaction may be quickly completed to thereby obtain the final hardened product, with the application of but a comparatively small additional amount of heat. Each of such coated blanks, with its semi-cured and semi-condensed surface layer, is then placed in a printing mold and subjected to a comparatively low pressure for a short period, during which it is subjected to sufficient heat to render its semi-condensed and semi-cured veneer or surface layer thoroughly plastic. The holding pressure is then gradually increased until it is in the neighborhood of 1000 pounds per square inch, and the record tablet is kept in the mold under this pressure and preferably under a temperature substantially equal to that of steam at 125 pounds, for a period of about nine minutes, during which the sound waves on the matrix are, of course, impressed into the surface layer of the tablet and the final hardening or condensing reaction of the material constituting the said surface layer is completed. During the final hardening of the surface layer in this manner, the alcohol or other solvent which may still be present therein will be driven therefrom back into the porous blank without any resultant increase in the porosity of the surface layer. The record tablet is then suitably cooled while in the mold, and without reducing the molding pressure, after which the pressure is released and the tablet removed from the mold.

While I have described my improved method particularly in connection with the production of a specific form of sound record, it is to be understood that the same is adapted for making other forms of sound records and for many other purposes, and that the method is subject to various changes and modifications without departing from the spirit of the invention and the scope of the appended claims.

Having now described by invention, what I claim as new and desire to secure by Letters Patent is as follows:

1. The method of producing a molded article which consists in providing a member with a surface layer containing a fusible condensation product, curing said surface layer by the application of heat until the same is brought to a semi-final or semi-condensed state, and then molding said member with the application of heat to further condense said surface layer, substantially as described.

2. The method of producing a molded article which consists in providing a member with a surface layer containing a fusible condensation product, curing said surface layer by the application of heat until the same is brought to a semi-final or semi-condensed state, and then molding said member with the application of sufficient heat to bring the material of said surface layer to its final hardened infusible state, substantially as described.

3. The method of producing a molded article, which consists in subjecting a member comprising a fusible condensation material to heat until such material is brought to a semi-final or semi-condensed state, and then molding said member with the application

of sufficient heat to bring said material to its final hardened infusible state, substantially as described.

4. The method of producing a molded article, which consists in providing a member with a surface layer containing a fusible condensation material, subjecting said member to a gradually increasing heat until the surface layer is brought to a semi-final or semi-condensed state, and then molding the said member with the application of sufficient heat to complete the condensation reaction, substantially as described.

5. The method of producing a molded article, which consists in providing a member with a surface layer containing a fusible condensation material, subjecting said member for a period of substantially six hours to a heat gradually increased from room temperature to a point between 200 degrees F. and 300 degrees F. during such period, until the surface layer is brought to a semi-final or semi-condensed state, and then molding the said member with the application of sufficient heat to complete the condensation reaction, substantially as described.

6. The method of producing a molded article, which consists in providing a member with a surface layer containing a fusible condensation material, curing said surface layer by the application of heat until the same is brought to the "rubbery" stage, and then molding said member with the application of sufficient heat to bring the material of said surface layer to a final hardened infusible condition, substantially as described.

7. The method of producing a molded article, which consists in coating a blank with a liquid varnish containing a fusible condensation material, allowing the coated blank to dry in air, then heating said blank until the coating thereof is brought to a semi-final or semi-condensed state, and then molding the coated blank with the application of sufficient heat to bring the coating thereof to its final hardened infusible state, substantially as described.

8. The method of producing a molded article, which consists in forming a blank containing a plasticity ingredient, coating said blank with a liquid varnish containing a fusible condensation product comprising a phenol resin and a solvent for the latter in which said ingredient is soluble, allowing the coating of said blank to dry in air, then heating said coated blank until the coating thereof is brought to a semi-final state, and then molding the coated blank with the application of sufficient heat to bring the coating thereof to the final hardened infusible and insoluble state, substantially as described.

9. The method of producing a molded article, which consists in providing a member with a surface layer containing a fusible condensation material, heating said member until said surface layer is brought to a semi-final state, then allowing said member to cool, then heating said member until the surface layer is plastic and molding said member with the application of sufficient additional heat to bring said surface layer to its final hardened state, and then cooling said member without releasing the molding pressure, substantially as described.

This specification signed this 24th day of April 1919.

THOS. A. EDISON.