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METHOD OF MAKING MOLDS AND APPARATUS THHREFOR.

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1,430,859. Patented Oct. 3, 1922.

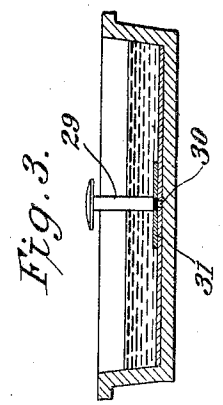


Fig. 3.

Fig. 1.

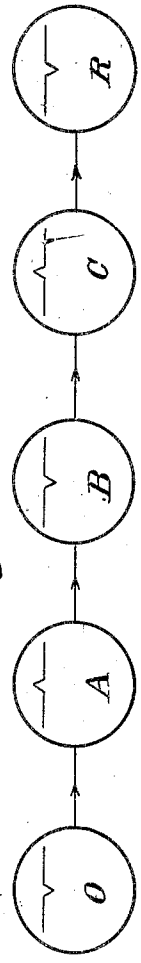


Fig. 2.

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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING MOLDS AND APPARATUS THEREFOR.

Application filed January 21, 1920, Serial No. 353,127. Renewed April 18, 1921. Serial No. 462,340.

To all whom it may concern:

Be it known that I, EMILE DE STUBNER, a citizen of the Republic of Switzerland, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Methods of Making Molds and Apparatus Therefor, of which the following is a full, clear, and exact description.

The invention which constitutes the subject-matter of this application relates broadly to the art of obtaining molds or casts of engravings in steel, copper or other material, of heliogravures, electrotypes, etc., for use in galvanoplastic processes.

It is an object of the invention to provide a method which will insure that the fine lines of the engraving, electrotype, or other object shall be perfectly reproduced in the mold or cast to the end that a perfect duplicate of the original may be obtained therefrom by electro-deposition of metal thereon.

The invention consists broadly in covering the object to be reproduced while in a vacuum with a layer of normally hard but temporarily fluid or plastic material, allowing the material to partially harden as by cooling if the material has been heated, and finally subjecting it to heavy pressure while hardening, or cooling to normal temperature.

The invention is particularly well adapted for use in the making of records in the phonographic art and will therefore be more fully described as practiced in connection therewith. Certain terms common to this art will be used but merely for convenience of description. The term "wax" as used is intended to mean any material which becomes plastic or fluid upon the application of heat. It is to be understood, therefore, that such description is in nowise to be taken as a limitation of the invention but merely as an illustration of its application to one particular art.

The invention also contemplates the provision of apparatus for the successful practice of the invention.

In the manufacture of commercial records as at present conducted, three electrotypes intervene between the original wax and commercial records. The first, called the "master," is derived from the original wax record; the second, called the "mother," is derived from the master; and the third called the "stamper" is derived from the mother. The first and third are true negatives of the original wax record, the second is a positive of the same.

The master, being a negative, is, of course, adapted for use as a stamper in pressing or stamping commercial records which are facsimiles of the original. For various reasons, however, it is not desirable so to employ the master, the chief perhaps being that the original wax record was probably unavoidably sacrificed in making the master. Possible injury to the master would therefore result in the permanent loss of the originally recorded sound waves.

Considerable time is necessarily required in obtaining the three electrotypes and this constitutes one of the great objections to the three-electrotype method of making commercial records. It has seemed impossible, however, to devise a practical method which would require less than three electrotypes, principally, it seems, because no other known method would so faithfully reproduce the reverse of the sound waves to be copied.

I have discovered a method of making mothers which requires much less time than is required by the three-electrotype method and which produces mothers that are faithful copies in the reverse of the master and that lend themselves as readily as the original wax record to the making of electrotypes therefrom which, in the phonographic art, would be stampers for use in making the final commercial records.

The method consists in making wax mothers from the master and using them in the making of stampers. The mothers are made by covering the face of the master with molten wax in a vacuum and putting pressure on the wax during its final cooling stages to prevent it from "drawing" or contracting across the face of the master while cooling to normal temperature. By maintaining a vacuum while covering the master with wax, the occlusion of gases as well as any possible confinement of the same between the wax and master is effectually pre-

vented. This, taken in connection with the pressure, produces a mother which gives a perfect fac-simile of the master in the reverse or, in other words, is a perfect duplicate of the original wax record free from imperfections such as blow holes due to confined air or to drawing and which may be subjected to any operations to which the original wax record may be subjected as, for example, the making of electrotypes.

In order that the method may be more readily understood, it will be more fully described in connection with the apparatus shown in the accompanying drawing in which,

Fig. 1 shows schematic view of the apparatus as arranged for battery operation, only one complete apparatus, however, being shown;

Fig. 2 illustrates the order of making the various records, O being the original wax, A the master, B the mother, C the stamper, and R the commercial record;

Fig. 3 is a section showing the wax-covered master in place in the bowl of the vacuum pan.

Numeral 10 indicates a tank containing a supply of wax kept in a molten condition preferably by means of an oil bath in a container 11, a suitable source of heat being supplied as by a series of gas burners 12; numeral 13 indicating an exhaust pump. Letter V indicates a vacuum pan comprising a bowl 14 and a top or cover 15. Located above the same is a receptacle 16 adapted to hold sufficient wax to make one mother. If desired, a means 17 for visualizing the temperature and quantity of the wax in the receptacle and a supplemental heating means 18 for the same may be provided. Suitable conduits 19, 20, 21 are provided between the wax tank and receptacle, the latter and the vacuum pan, the latter and the exhaust pump, respectively, the conduits being provided with suitable cut-offs 22, 23, 24. The conduit 21 preferably includes an exhaust chamber 25 to facilitate the quick exhaustion of the vacuum pan. Unions 26, 27 in the conduits 20, 21 permit the pan to be severed therefrom for any purpose as for setting it aside for cooling after the wax has been poured.

The bowl is supported on a hot plate 28 which serves to heat the bowl and master in place within the same, prior to the pouring of the wax, for preventing undesirable sudden chilling of the latter.

The master is usually provided with a central hole and in this is placed a suitable pin or post 29. The post is preferably threaded, adjacent its tip 30 that enters the master, to receive a small disk 31 which lies flat on the master and which will be embedded in the wax mother, the post and disk subsequently serving as a center contact in the electrolytic process of making a stamper. The upper end of the post may be provided with a cap, preferably removable, to facilitate the lifting of master and mother from the bowl.

After the wax on the master has cooled to a gummy-like consistency, which will be in about fifteen minutes, a metal slab of substantially the same area as the top of the mother is placed on the latter for supporting heavy weights or other pressure. The pressure applied should be sufficient to press the mother into such intimate contact with the face of the master that the natural tendency of the wax to draw or contract does not act in a direction parallel to the face of the master. Forty to sixty pounds per square inch has been found sufficient to accomplish this result. The pressure may, however, vary within quite wide limits depending on the wax used. The mother so produced is a perfect copy in the negative of the master and has a smooth polished surface equal to that of the master against which it was in contact.

The mode of operating the apparatus is substantially as follows:—The vacuum pan, preferably of bronze, with the master in position, is heated by the hot plate 28 and exhausted to as high a degree as possible, say 29 inches by the gauge. Molten wax is then allowed to flow from the receptacle 16 into the pan to cover the master to a depth of an inch or more after which the wax and exhaust conduits are closed by their respective cut-offs 23 and 24, the latter also opening the pan to the atmosphere. The pan may now be severed from said conduits and set aside to cool until the wax is of a gummy-like consistency after which the cover is removed and the wax subjected to heavy pressure as already indicated. After the wax is completely cooled the master with superposed mother is removed from the bowl and the mother separated from the master. The mother is then subjected to electro-deposition of metal, the electrotype so obtained being employed as a stamper for making commercial records, a new mother being used for each stamper made, primarily for the reason that the conductor on the mother is usually damaged in separating it from the electrotype.

The time required in making mothers by my method is approximately one fourth of that required in making electrotype mothers, about eleven hours being required for the latter while less than three hours is required in making wax mothers. This saving of time is of far reaching effect. Four wax mothers can be made in about the time formerly required to make one electrotype mother. Four duplicate mothers can thus be subjected at one time to electro-deposition of metal for the purpose of obtaining stam-

pers and four times as many records can be made at the end of the period required to make one electrotype as could formerly be made for the reason that four stampers are now available where only one was available under the three-electrotype method.

This saving in time is perhaps of greater importance in the phonographic art than in any other on account of the nature of the market demand for records. When first released to the market, the demand may often exceed the supply. My invention enables a larger initial quantity of records to be put on the market than was formerly possible in a given time or to state facts a different way, enables the records, the product of one stamper, to be put on the market at an earlier date due to reduction of time of manufacture made possible by the practice of my invention.

When there is an immediate demand for a great number of records a certain number of stampers are of course required and the advantages of the method will be obvious. Should the demand die out all of the stampers, excepting the one original may be discarded if desired as the time element involved in the production of new stampers by this method is not a factor should a second or third demand arise. This avoids the care required in preserving matrices to take care of future demands, also avoids the tying up of capital in matrices and also eliminates the space, trouble and equipment for taking care of these matrices.

The material used for making the molds or mothers should preferably be of such character that the mold surface thereof will remain unaffected by atmospheric conditions at ordinary temperature and pressure. The so-called recording waxes have been found to give the best results and this of course is an added advantage, as it relates to the phonographic art.

What I claim as new and desire to secure by Letters Patent is:

1. The method of making a mother from a master which consists in covering the latter with molten wax in reduced atmospheric pressure, partially cooling the wax, and then subjecting it to pressure while cooling to normal temperature.

2. The method of making a mother from a master which consists in covering the latter with molten wax in reduced atmospheric pressure, cooling it until of a gummy-like consistency and then subjecting it to pressure while cooling to normal temperature.

3. The method of making a mother from a master which consists in covering the latter with molten wax in reduced atmospheric pressure, partially cooling the wax, and then subjecting it to uniform and continued pressure while cooling to normal temperature.

4. The method of making a mother from a master which consists in covering the latter with molten wax in reduced atmospheric pressure, partially cooling it to a gummy-like consistency and then subjecting it to a uniform and contained pressure while cooling to normal temperature.

5. The method of making a mother from a master which consists in preliminarily heating the latter and covering it with molten wax in reduced atmospheric pressure, partially cooling the wax to a gummy-like consistency, and then subjecting it to pressure while cooling to normal temperature.

6. The method of making a mother from a master which consists in covering the latter with recording wax in reduced atmospheric pressure, partially cooling the wax until of a gummy-like consistency, and subjecting it to heavy pressure while cooling to normal.

7. The method of making a mother from a master which consists in covering the latter with a layer of thermoplastic material in reduced atmospheric pressure, partially cooling the material, and then subjecting it to heavy pressure while cooling to normal temperature.

8. The method of obtaining a mold or cast of an object which consists in covering it with a layer of temporarily fluid material while in a vacuum, permitting said material to partly set or harden, and then subjecting the same to heavy pressure while it permanently sets or hardens under ordinary conditions of temperature and atmospheric pressure.

9. The apparatus for making molds comprising a vacuum pan, a supply tank for a thermoplastic material, a receptacle for a portion of the latter interposed between the tank and vacuum pan and connected by conduits therewith, and a vacuum pump connected to the vacuum pan for exhausting the same.

10. The step in the method of making a mother from a flat disk master which consists in covering the latter with a layer of moldable material in reduced atmospheric pressure.

11. The method of making a mother from a flat disk master which consists in covering the latter with a layer of moldable material in reduced atmospheric pressure, and then subjecting the layer to pressure.

12. The method of making a mother from a flat disk master which consists in covering the latter with a layer of moldable material in reduced atmospheric pressure, and then permitting it to set or harden in ordinary atmospheric pressure.

13. The method of making a mother from a flat disk master which consists in covering the latter with a layer of moldable material in reduced atmospheric pressure, and then

permitting it to set or harden in ordinary atmospheric temperature and pressure.

14. The method of reproducing a sound record, which consists in first making a wax master, making a metal master therefrom, making a wax mother from the metal master, and then making a record stamper from the wax mother.

15. The method of reproducing a sound record, which consists in producing a molded wax duplicate of the original record, and then making a record stamper from the wax duplicate.

16. The method of forming a flat wax slab or disk for use in the production of sound records, which consists in first casting the wax in a form, and then subjecting it to pressure while hardening.

17. The method of forming a flat wax slab or disk for use in the production of sound records, which consists in first casting the wax in a form in reduced atmospheric pressure, and then subjecting it to pressure while hardening.

18. The method of forming a flat wax slab or disk for use in the production of sound records, which consists in first casting the wax in a form in reduced atmospheric pressure, and then allowing it to harden under pressure and at ordinary temperature.

19. In an apparatus for making flat wax slabs or disks for use in the production of sound records, means for casting the slabs or disks in reduced atmospheric pressure.

20. In an apparatus for making flat wax slabs or disks for use in the production of sound records, means for casting the slabs or disks in reduced atmospheric pressure, and means for removing the slabs or disks while in an unhardened state.

In testimony whereof, I affix my signature.

EMILE DE STUBNER.