J. SANDERS.

METHOD OF PRODUCING DISK SOUND RECORDS.

APPLICATION FILED JAN. 11, 1913.

1,206,034.

Patented Nov. 28, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

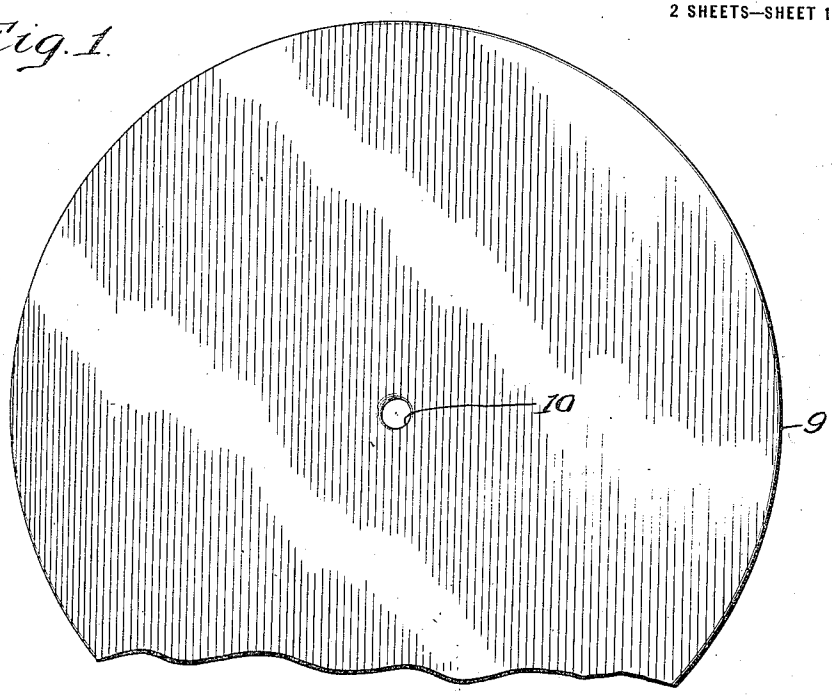


Fig. 2.

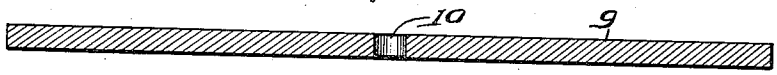
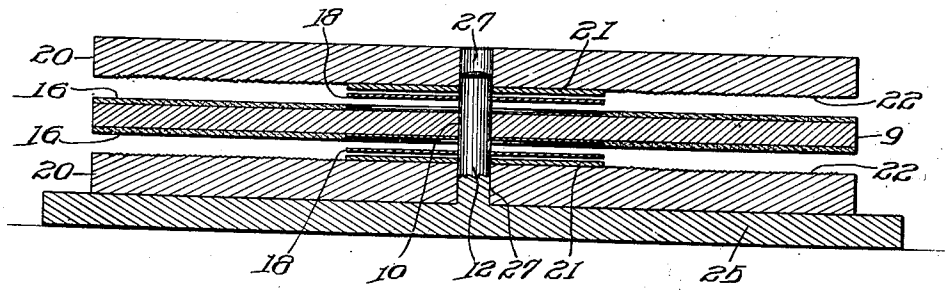


Fig. 6.



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2 SHEETS—SHEET 2.

Fig. 3

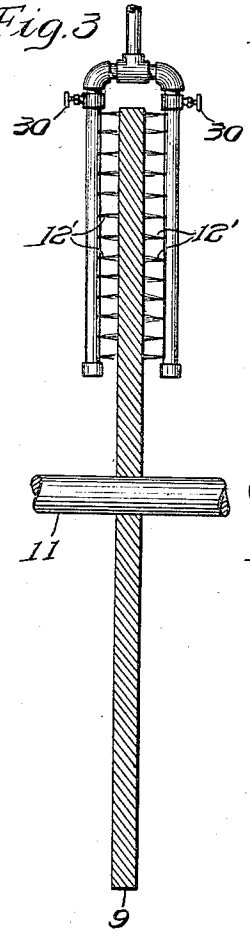


Fig. 4.

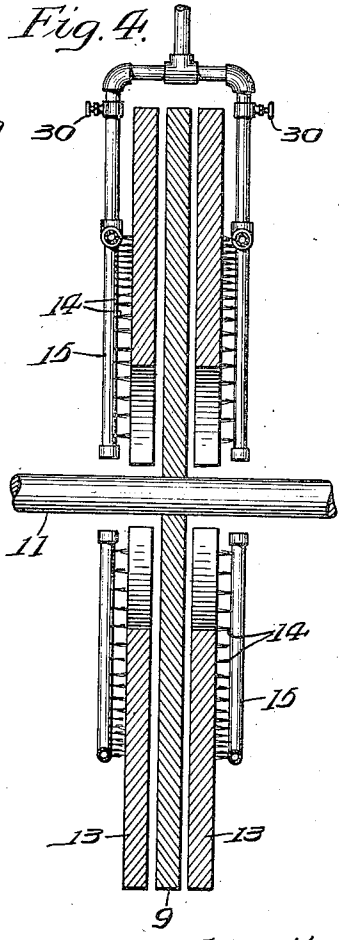


Fig. 5.

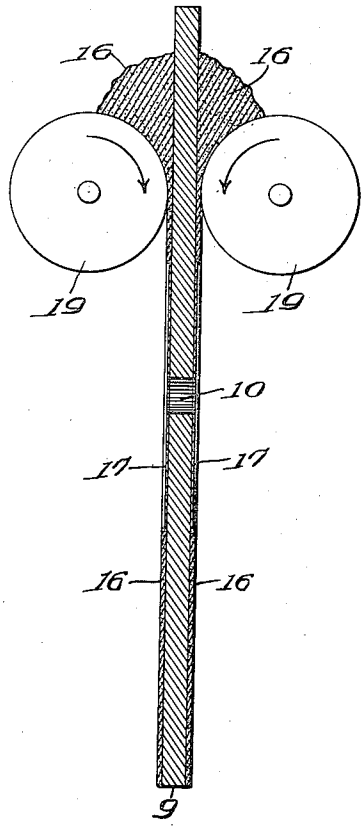


Fig. 7.

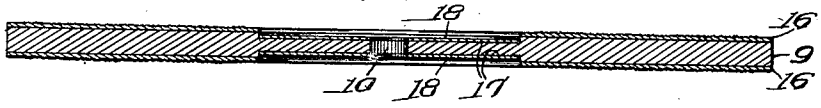
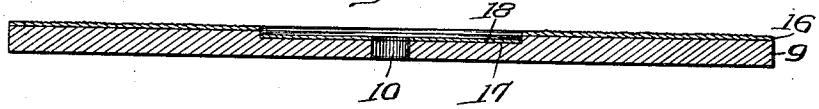


Fig. 8.



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JOSEPH SANDERS, OF WASHINGTON, DISTRICT OF COLUMBIA.

METHOD OF PRODUCING DISK SOUND-RECORDS.

1,206,034. Specification of Letters Patent. Patented Nov. 28, 1916.

Application filed January 11, 1913. Serial No. 741,377.

To all whom it may concern:

Be it known that I, JOSEPH SANDERS, a citizen of the United States, and a resident of Washington, in the District of Columbia, have invented certain new and useful Improvements in Methods of Producing Disk Sound-Records, whereof the following is a full and complete description.

The object of this invention is to provide a non-frangible disk or tablet, capable of carrying upon one or both of its plane faces an undulatory record of sound.

Another object is to provide a method of producing a non-frangible record tablet for the purpose mentioned, which will make the cost of production of such tablet considerably less than that at which present forms of record tablets are produced.

Another object of this invention is to provide a record tablet comprising a fibrous base and a coating of sound record material covering substantially only that portion of said base which is designed to carry the record of sound.

Another object of this invention is to provide a non-frangible record tablet, comprising a thermo-plastic fibrous base, carrying upon a portion of one or both of its plane faces a coating or layer of thermoplastic material, embodying in its surface a substantially indestructible undulatory record of sound.

Another object is to provide a record disk or tablet comprising a base having its central portion compressed to form a recess for the identification label, the surface of which label when applied is depressed below the plane of the surrounding portion of said base, and consequently below the plane of the outer face of the coating of record material covering said surrounding portion.

Another object is to provide a built-up sound record disk, comprising a fibrous base partially or entirely covered by a layer of thermo-plastic record material, said disk when finished being markedly resonant, and having no deadening or dampening effect upon the reproduction of the sounds recorded in the face thereof.

In accordance with the present invention, the sound record disk or tablet comprises as a base a thermo-plastic fibrous disk. By the term "thermo-plastic fibrous disk," is meant a tablet containing sufficient fiber to render the finished record disk non-frangible, together with a sufficient quantity of a suitable binder, employed for the purpose of unifying the fibrous structure, said binder being of a kind such as is plastic or pliable when heated, and solid and very hard when cold. With these elements in suitable proportions, and the application thereto of a predetermined amount of heat, the fibers comprising the structure are permitted to flow by the application of the pressure thereto, to readjust themselves to conform to the desired shape, imparted thereto while between molds or matrices; after which the binder upon hardening sets said fibrous structure permanently and substantially unyieldingly in the position which conforms to said matrices.

The basic disk is thoroughly permeated or saturated with a cement sizing which imparts thereto a bending coefficient, substantially equal to that of the surface coating which is later applied to one or both of the faces thereof, said surface coating in turn comprising a suitable thermo-plastic material capable of carrying in its surface an impression of undulatory sound record grooves. The sizing employed in said basic disk is preferably of a resinous nature, such for instance as resin or Manila gum, although other materials of the same general class may be used.

The surface coating, which is hereinafter termed record material, is of such a character that when cold it is able to successfully resist the wear of a steel or other suitable stylus point, used in connection with suitable mechanism for transforming the recorded sound waves into vibrations of the atmosphere. Said record material is composed generally speaking of shellac, earthy material and flock, and is preferably applied to the surface of the basic disk in a powdered form.

It has been found advisable to include in said material a suitable fiber, for the purpose of reinforcing the structure to resist lateral and transverse strains which may be exerted thereupon, said fiber in combination with a suitable resinous filler producing a structure which is thermo-plastic, while in applying the record material to the basic disk it is preferable for reasons hereinafter brought out to distribute the same in an annular zone concentric with said disk, and leave a central portion of said disk substantially free for the purpose of applying the usual identification label thereto.

For a complete understanding of this invention and the method in which the improved record disk is produced, reference is had to the accompanying drawings, in which—

Figure 1 is a plan view of a basic disk; Fig. 2 is a diametrical section of the disk shown in Fig. 1; Fig. 3 is a diametrical section of the disk similar to Fig. 2 and showing the same when positioned between gas burners; Fig. 4 is a diametrical section of the disk similar to Fig. 2, and showing the same when positioned between a modified form of heating means; Fig. 5 is a diametrical view of said disk and rollers during the application thereto of record material; Fig. 6 is a sectional view showing the disk with its coating of rolled record material when positioned between a pair of opposed matrices; Fig. 7 is a sectional view of a completed double-faced sound record disk; and Fig. 8 is a similar sectional view of a single-faced sound record disk.

In carrying out the present invention, a disk of suitable fibrous material such as pulp-board, cardboard or the like is saturated with resin, Manila gum, or other suitable resinous sizing material, in any desired manner, to form a basic disk 9, care being taken that said disk is thoroughly impregnated with the sizing, yet without permitting a surplusage thereof to remain upon the surface. A disk, having been thus treated, is very hard and elastic when cold and somewhat thicker than the finished sound record after passing through the complete process as hereinafter described. Furthermore, a sized disk when cold offers great resistance to any unusual forces tending to distort it, and hence the finished record tablet is under all ordinary conditions of handling, practically indestructible, quite successfully resisting a tendency to break upon being dropped or upon the application thereto of pressures which would tend to distort the same. The basic disk 9 is at the outset generally provided with a central aperture 10 for the purpose of receiving the mandrel or spindle 11, when its surfaces are being heated, and subsequently the centering pin 12 in the mold, as well as to later receive the centering pin of the turntable of any common form of disk sound reproducing machine. This disk, as before stated, being hard and substantially unyielding when cold, must be softened throughout that portion of the surface thereof to which the powdered record material is to be applied, for the purpose of maintaining the same unitarily in conjunction therewith, such coöperation between said disk and record material being made possible by the fact that when heated the surface of the former becomes tacky or gummy. The softened surface of said disk then sticks to and retains a thin layer of said finely divided record material, which, becoming softened by the heat radiated from the heated zone of the disk, in turn causes additional material, to adhere thereto, thus making an unbroken coating or layer of powdered record material upon the annular heated portion of the surface of the disk, the thickness of said coating being regulated, generally speaking, by the intensity and duration of the heat applied thereto, after which a surplus of the record material fails to adhere to the disk and subsequently falls off.

For the purpose of softening and rendering plastic a given annular portion of the disk 9, and at the same time permitting the central portion thereof to remain substantially cold and hard, there is provided suitable means for applying heat thereto. This means may take any desired form, such for instance as small jets 12′ of flame, directed upon the desired portion, and within the range of which the disk is rotated, as shown in Fig. 3, or the disk as a whole may be rotated concentrically between and at a slight but uniform distance from, one or more similar, substantially flat, unbroken, annular plates 13, of substantially uniform thickness and of a metal having a high coefficient of heat conductivity, said plates in turn receiving their heat from jets of flame at the ports 14 in the annular pipes 15 in Fig. 4, or from an electric current, steam coil, or any other suitable source.

As a result of the close association of the disk 9 with the plates 13, the surface of that portion of said disk lying directly adjacent to or between the opposed surfaces of said plates, will become tacky and gummy, while the central portion of the disk, not being in close proximity to a source of heat, will remain comparatively cool and hard, though generally enough of the shellac, or other binder-containing record material 16 of the next step in the process, adheres thereto, to serve as a thin layer 17 of adhesive for the label 18, thus making it unnecessary to coat said central portion with shellac or similar material in a separate operation. However, the amount of powdered material adhering to the center is so slight as to be negligible when considering the increase in thickness of that portion of the disk. As a next step in the process after the disk 9 has been heated to a desired degree, said disk is removed from between the jets 12′ or plates 13, and while still heated, a layer 16 of suitable record material is applied to the face thereof in any suitable manner, as by passing the disk with said material in a finely powdered form between carefully adjusted parallel rollers 19, as shown rather diagrammatically in Fig. 5. The record material generally employed comprises shellac, earthy material, such as baryta, infusorial earth, or the like, and finely divided fiber,

ordinarily termed flock, and after the disk has been passed through the rollers 19, any surplus of said material falls off as hereinbefore described. After said disk and coating have been passed through said rollers, it will be found that a homogeneous coating of record material covers an annular region of the disk from the circumference, substantially as far only as the inner diameter of that portion of the disk which was heated, but, as before stated, a relatively small amount of said material will have adhered to the central portion of the disk, to act as an adhesive for the label.

In coating the basic disk with record material, it has been found preferable to apply the same in powdered form, in view of the fact that an undue accumulation of flock is thus readily prevented. If, however, the record material be applied to the basic disk as a solution or liquid, care should be exercised to prevent an undue accumulation of said flock. The flock may be omitted, however, if desired, and the solution of record material may be applied to the blank in any suitable manner. In some cases it may be desirable to cement the record material in its powdery or finely divided form, to the surface of the disk base by applying to said base a suitable form of cement solution, but sufficient time should be allowed to permit of the proper drying of the cement, for unless the drying be thorough, difficulties may be experienced in the subsequent operations and a decrease in the normal life of a finished record may result. The invention is preferably carried out, however, by the use of an impregnated base, such as that described above, heated until its surface becomes sufficiently plastic, adhesive, or tacky, to cause a finely divided powdery record material to adhere thereto in a sufficient quantity as hereinbefore described.

In the production of homogeneous sound record disks, there is a sufficient flow of the record material to permit of the production of a sunken or depressed central portion, but when a fibrous base is employed there is no such pronounced flow of the material forming the base as there is in connection with the use of homogeneous sound records. This consequently makes it necessary or advisable to depress by compression the center of said disk sufficiently to accommodate the label. It is desirable therefore to provide a greater pressure to the central portion of the disk to which the identification label is affixed, than that applied over the major or greater portion of the surface of the record.

In accordance with the present invention, those portions of the basic disk to which a label or labels are to be applied, are left substantially free from the record material, and therefore the degree of compression required to depress the central portion of the disk is lessened beyond that which would be otherwise necessarily employed, and this lessened pressure upon the surface of the central portion of the disk is advantageous, in that the basic disk receiving directly that pressure is not subjected to the danger which might arise from distortions and transverse strains, or which might otherwise be experienced, if the said portions were covered with the record material coextensive with the surrounding portions. This is particularly true in the case of double-faced records, where the thickness of the disk is decreased to a greater extent in the center, with respect to the marginal portions, than in the case of a single-faced record. Moreover, the saving in record material is no inconsiderable item when it is considered that sound record disks are produced by millions. The disk at this step in the process is bounded by smooth surfaces, and may then be placed between any two desired opposed matrices 20, as shown in Fig. 6, said matrices preferably having smooth central raised portions 21, which when compressed together to the fullest degree desired, will exert a compression upon the opposed central portions of the basic disk 9, upon which the labels 18 have been placed, said labels corresponding to the particular selections, the phonetic vibrations of which are recorded upon the surrounding surfaces 22 of the adjacent matrices. Thus, as the marginal surface 22 of each of the opposed matrices in the case of a double disk sound record impresses its respective undulatory characteristic upon the correspondingly situated record material 16, the central surfaces 21 of the matrices will simultaneously depress the central portion 23 of the surface of the disk 9 sufficiently to receive the labels 18, and also press the said labels 18 into their respective depressions and cause them to adhere thereto by virtue of the small amunt of record material which has adhered thereto during the coating of said disk with record material, as hereinbefore described. While in some cases it may be possible to press a label directly upon the slightly heated central portion of the basic disk and have it remain in unitary relation therewith, a thin coating of shellac or other adhesive material may be applied to said surface, which operation is, however, eliminated by the adherence thereto of the thin coating 17 of record material.

The matrices 21 are applied to the disk 9, with its coating 16 in any suitable manner, either at different times or simultaneously. One method by which the operation may be performed is to place one matrix upon the usual heated bed 25, as shown in Fig. 6, with the centering pin 12 extending through the central bore 27. A label 18 identifying

the particular matrix is then placed thereupon, a disk 9 coated in the manner before described is then placed upon the label and upon a heated matrix, with the pin 12 passing through the aperture 10, a second label 18 is laid upon said disk, and a second heated matrix corresponding with said second label is placed in inverted position upon the pile, each element in turn being pierced by the pin 12. The necessary pressure generally hydraulic, is then applied to impress into the record material the record of sound, to depress the central portion of the record disk, and to attach the label to said central depressed portion. The compressed disk is then cooled in any suitable manner. The finished record so made will retain the shape into which it has been so molded, and will have the phonetic characteristics above referred to. The finished disk or record is shown in Fig. 7.

It has been found that by adjusting the valves 30, or other suitable means, the source of heat can be easily regulated, so as to finely adjust the amount of heat applied to the annular rings 13, while a disk is positioned therebetween, or directly to the basic disk by means of a flame, and by regulating the length of time that said disk is under the heating influence, it is possible to predetermine substantially the amount or thickness of the coating of record material, which will finally remain upon the annular marginal portion of said disk. In this connection it has been noted that the basic disk takes up and retains sufficient heat so that, while but a thin layer of the powdered record material initially adheres thereto, said initial amount is heated and softened by the heat conveyed thereto by said disk, and in turn heats and softens additional material, until substantially the predetermined thickness of the coating is reached, beyond which point a surplus of said record material fails to adhere to said disk and subsequently drops off.

When it is desired to make a single-faced record, that is to say, a tablet having a record of sound waves upon only one face thereof, a basic disk 9, previously prepared as hereinbefore described, is heated upon one side thereof, only slightly over the central portion but to a greater degree throughout the annular marginal portion surrounding said central portion.

This heating of the disk may be accomplished if desired by the use of the apparatus hereinbefore described, and as shown somewhat schematically in two forms in Figs. 3 and 4, respectively, in either of which cases one of the valves 30, or other suitable means may be closed against the passage of a suitable fluid therethrough, thus permitting only the face of said disk opposite thereto to become heated. It should be stated, however, that when electricity is employed as a heating means, a switch, or variable resistance, may be substituted for the valves 30, to regulate the degree of heat in the necessary resistance coils.

After the necessary amount of heat has been applied to the basic disk, said disk may be coated with record material as hereinbefore described, and as shown rather schematically in one form in Fig. 5. In this case, however, the powdered material is pressed by rollers 19, or other suitable means, against one face only of the disk, the desired thickness of said record material which adheres to the superheated tacky annular portion of said disk, depending upon the amount of heat previously applied thereto, while but a very slight amount of said material adheres to the central portion whereon the usual label is placed, all surplus material falling off, as hereinbefore described.

In its present coated condition, and while still heated, or on being re-heated, if the same has cooled in storage, or in transit, the disk may have impressed upon its coated surface the desired record of sound waves by placing the same with its heated face uppermost directly upon the heated bed 25, the heated pin 12 extending through the aperture 10 in said disk; placing a label face upward centrally thereupon and surrounding the pin; then placing a matrix face downward upon and concentrically with said disk and label; and then applying pressure to the back or upper side of said matrix. After the characteristic irregularities of the matrix have been impressed in the record material on the surface of the disk, said disk may be removed from the matrix in any suitable or approved manner. The resulting record tablet shown in Fig. 8, comprises a smooth or blank lower surface, an upper face, embodying in an annular marginal portion thereof an undulatory record of sound waves, and a label firmly adhering to the central portion of said latter face and adapted to identify the particular vocal, instrumental, or other, selection which may correspond to the adjacent impressed record of sound.

It will be noted that one of the principal advantages of the process of forming sound record disks, as hereinbefore described, lies in the fact that, instead of a lump of thermoplastic material being compressed between a pair of heated matrices, or between a matrix and a heated table, thus causing said material to spread out under the action of heat and pressure toward the peripheral portions of the matrix, the blank in this invention is already of substantially the proper diameter before the application of the heated matrices and pressure thereto. Consequently, said blank is not substantially altered in shape, except

that under the great pressure employed, it may be somewhat condensed in a direction transverse to its plane, so that the finished record disk may be thinner than the original blank, although substantially of the same size diametrically. In this latter case the finished record disk or tablet is light in weight, very strong, and otherwise equal or possibly superior in acoustic properties to a tablet of solid or homogeneous material, while, substantially all transverse strains, with their consequent tendency to cause warping of the finished record disk, are eliminated.

One of the advantages in the process of making sound record tablets as above set forth, resides in the fact that it is not necessary to separately heat the powdered material or heat it prior to the application of the same to the surface of the tablet. If the tablet be heated sufficiently, the heat retained in the tablet may be sufficient to heat the powdered material applied thereto, and to cause the same to adhere to said tablet uniformly throughout that portion of the surface so heated. The body forming the base of the tablet should have sufficient stiffness or rigidity to retain its form even when heated sufficiently to be molded or receive the impression of the matrix.

Although a preferred embodiment of this invention in the art of disk sound records and the method of producing the same has been described, it is obvious that various changes might be made in the construction and process employed, without departing from the spirit of the invention or the scope of the appended claims.

Having thus described my invention, what I claim and desire to protect by Letters Patent of the United States is:

1. The process of producing a sound record tablet, which consists in providing a thermoplastic fibrous basic disk, heating an annular marginal portion only of said disk corresponding approximately to the area exterior to and surrounding the label receiving central portion of the disk to a degree to cause applied record material to become adherent thereto, covering the heated area with record material and impressing a sound record matrix into the surface of said material.

2. The process of producing a sound record tablet, which consists in providing a thermoplastic basic disk, softening the surface of said disk, covering a portion of said surface with thermoplastic record material with the portion so covered localized to an annular band surrounding and exterior to the label receiving area of said surface, and impressing a matrix upon the surface of said record material.

3. The process of producing a sound record tablet, which consists in providing a thermoplastic fibrous basic disk, heating the disk to a temperature rendering the surface adhesive with such heat so localized as to confine it to an annular zone exterior to the label receiving area and extending therefrom to the outer edge of the disk, covering the said heated surface with finely divided thermoplastic record material, and impressing a matrix upon the surface of said material.

4. The process of producing a sound record tablet, which consists in providing a basic disk of fibrous material rendered thermoplastic by incorporation therewith of a material capable of being softened and rendered adhesive by heat, heating a circumscribed area, thereof, extending substantially from the outer edge of the disk to the outer edge of the label receiving area of said disk to a temperature to render the surface adhesive, applying powdered record receiving material to the disk for adherence to the circumscribed heated area thereof, and impressing a matrix into sound record material so applied.

5. The process of producing a sound record tablet, which consists in providing a thermo-plastic basic disk, softening an annular marginal portion of the surface of said disk, covering said portion with finely divided thermo-plastic record material, and simultaneously subjecting said material and said disk to heat and pressure, impressing a matrix upon the surface of said material, and forcing the surface of the central portion of said disk out of the plane of the adjacent marginal portion.

6. The process of producing a sound record tablet, which consists in providing a thermo-plastic basic disk, softening an annular marginal portion of the surface of said disk, covering said portion with finely divided thermo-plastic record material, and simultaneously subjecting said material and said disk to the impress of a heated matrix to force the surface of the central portion of said disk out of the plane of the adjacent marginal portion, and affix a label to said central portion.

7. The process of producing a sound record tablet, which consist in providing a thermo-plastic basic disk, softening an annular marginal portion of the surface of said disk, covering said portion with thermoplastic record material, and simultaneously subjecting said material and said disk to heat and pressure, impressing a matrix upon the surface of said material, and depressing the surface of the central portion of said disk out of the plane of said marginal portion.

8. The process of producing a sound record tablet which consists in providing a thermo-plastic basic disk, softening an annular marginal portion of each of the opposed surfaces of said disk, covering said

portions with thermo-plastic record material, and simultaneously subjecting said material and said disk to heat and pressure, impressing a matrix upon each of the opposed surfaces of said material, and compressing the central portion of said disk to remove the oppositely disposed surfaces thereof out of the planes of the respectively adjacent marginal portions of said disk.

9. The process of producing a sound record tablet which consists, in providing a base with a coating of finely divided thermo-plastic record material, and impressing a matrix into the surface of said material while the latter is softened solely by heat supplied by the heated matrix.

10. The method of making a sound record tablet, which consists in directly heating an annular portion of a fibrous base provided with a resinous binder until said heated portion is tacky, said annular portion being exterior to the label receiving area of the tablet and then bringing a finely divided record material into intimate contact with said heated surface.

11. The method of making a sound record tablet, which consists in directly heating an annular portion of a fibrous base provided with a binder which softens under the influence of heat, until said heated portion is tacky, said annular portion being exterior to the label receiving area of the tablet and then bringing finely divided record material into contact with said heated surface, whereby said finely divided material adheres to said heated portion as a layer of finely divided record material.

12. The method of making a sound record tablet, which consists in heating an annular portion of a fibrous base provided with a binder which softens under the influence of heat until said heated portion is tacky and then rolling finely divided record material into intimate contact with said heated surface.

13. The process of producing a sound record tablet, which consists in providing a base that is thermo-plastic throughout, heating said base, and then discontinuing the heating and applying a powdered material to said base, while the latter is still hot said powdered material adhering to said base by reason of the heat stored in said base.

14. The method of making a sound record tablet, which consists in heating an annular portion of a fibrous base provided with a binder which softens under the influence of heat, to a greater degree than the inner portion of said disk within said annular portion is heated to render said annular portion more tacky than said inner portion, bringing a powdered record material into contact with the entire surface of said tablet to form an impressible layer of record material on the said annular portion, and a relatively thin layer of adhesive material on said inner portion, and simultaneously impressing the sound record matrix into said annular layer of record material and pressing a label against and securing the same to said inner portion.

15. The method of making a sound record tablet, which consists in heating an annular portion of a fibrous base, provided with a binder which softens under the influence of heat, until said heated portion is tacky, simultaneously heating the inner portion of said tablet within said annular portion to a lesser degree than said annular portion is heated, and bringing a powdered record material into contact with the entire surface of said record, whereby an impressible layer of record material adheres to said annular portion to take an impression of a sound record matrix, and a relatively small amount of said record material adheres to said inner portion to form adhesive for a label.

16. The process of forming a sound record matrix, which consists in heating a fibrous base which is compressible under the influence of heat and pressure, applying to an annular portion of said base a coating of powdered record material, and to the central portion of said disk a layer of adhesive material, placing on said central portion a label, and simultaneously impressing a sound record matrix into said coated annular portion, and compressing said central portion to a greater degree than said annular portion of said tablet, to secure a label to the central portion of said tablet, and to depress said label below the plane of the surface of the finished record.

17. The method of making a sound record tablet, which consists in heating a fibrous base provided with a binder which softens under the influence of heat, until said heated portion is tacky, then removing the heated base from the source of heat, and then bringing a powdered record material into contact with said surface while hot enough to cause the record material to adhere.

18. The process of producing tablets for the reception of sound record impressions from matrices thereof which consists in providing a thermo-plastic fibrous base, softening the surface of said base throughout an annular area extending from the margin of the base toward but stopping short of the central label receiving portion thereof, then applying powdered sound record material to the softened surface and uniting the powdered material to the basic member by pressure.

19. The method of producing double faced sound record tablets which consists in providing a thermo-plastic fibrous base of a size substantially that of the finished tablet, ap-

plying to both faces thereof a sound record receiving material throughout an annular area substantially of the radial extent of the face of the tablet outside of the label receiving portion and leaving the latter portion substantially free from surfacing material, and then impressing sound record matrices simultaneously against opposite faces of the tablet and at the same time compressing the label receiving portion of the tablet below the planes of the record groove receiving portions of the tablet.

In witness whereof, I have hereunto set my hand this ninth day of January, A. D., 1913.

JOSEPH SANDERS.

Witnesses:
ALSTON B. MOULTON,
ALEXANDER PARK.