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F. L. CAPPS.

DUPLICATE SOUND RECORD AND PROCESS OF FORMING SAME.

(Application filed Mar. 8, 1899.)

(No Model.)

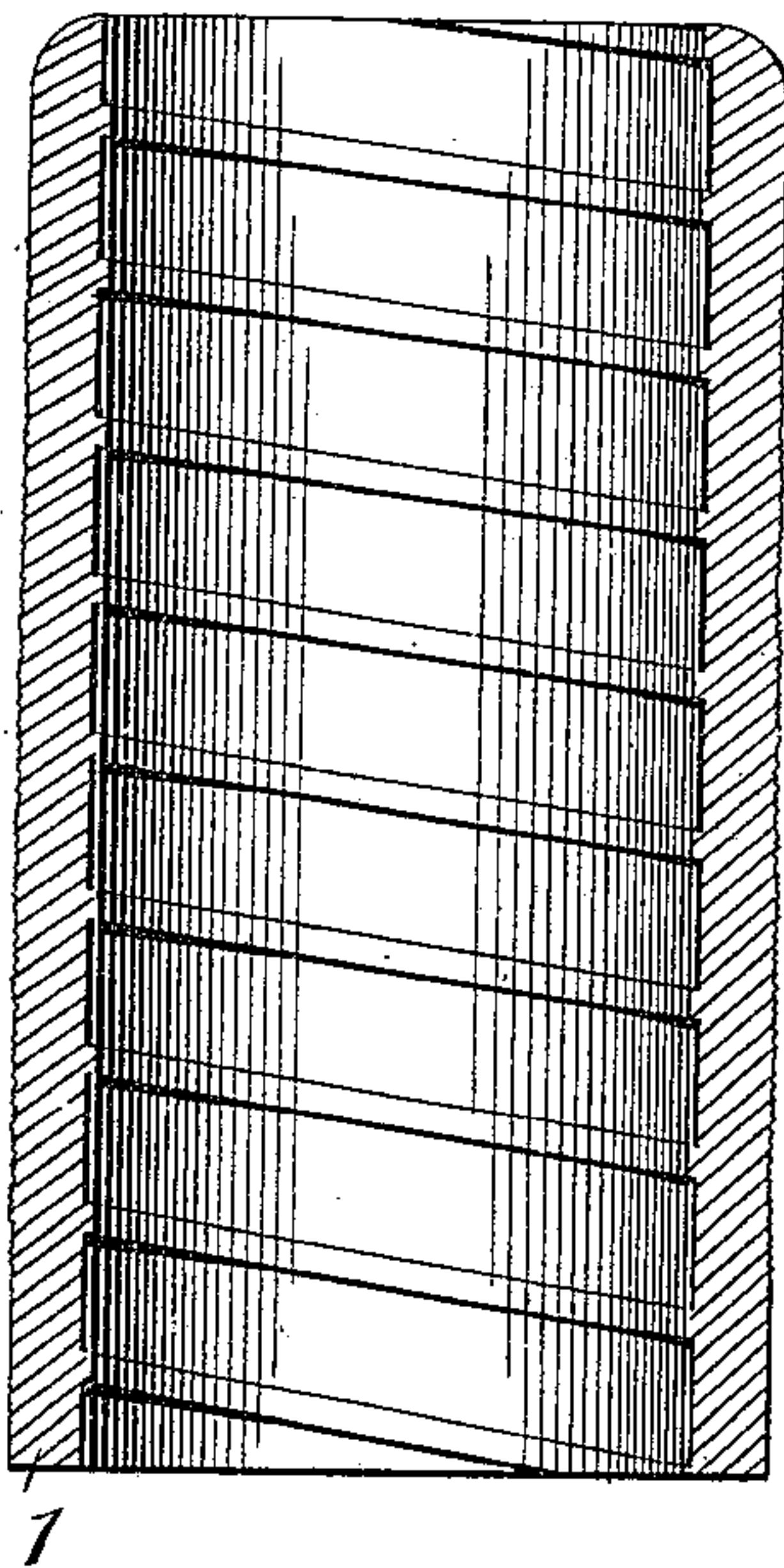


Fig. 1.

Fig. 2.

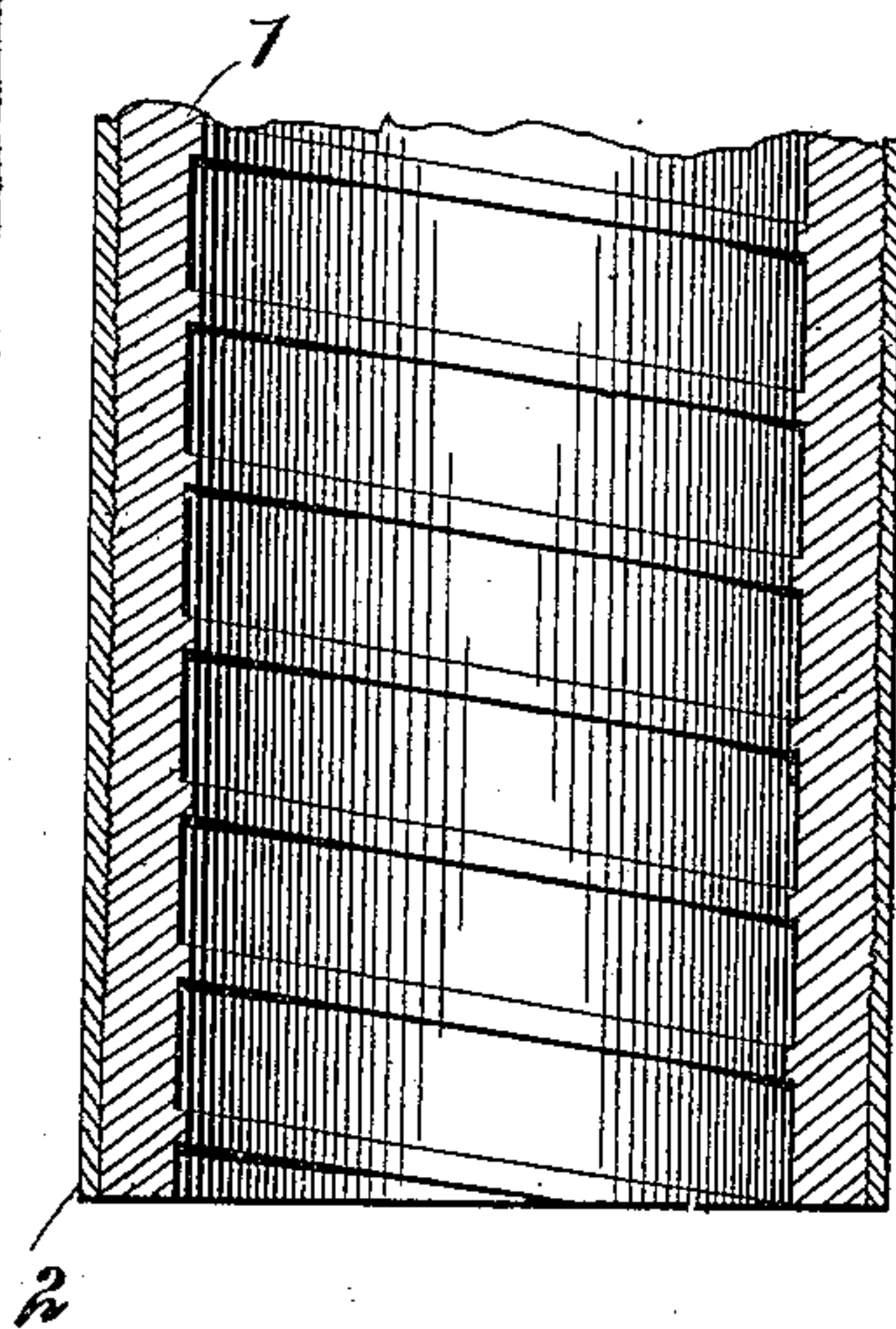


Fig. 3.

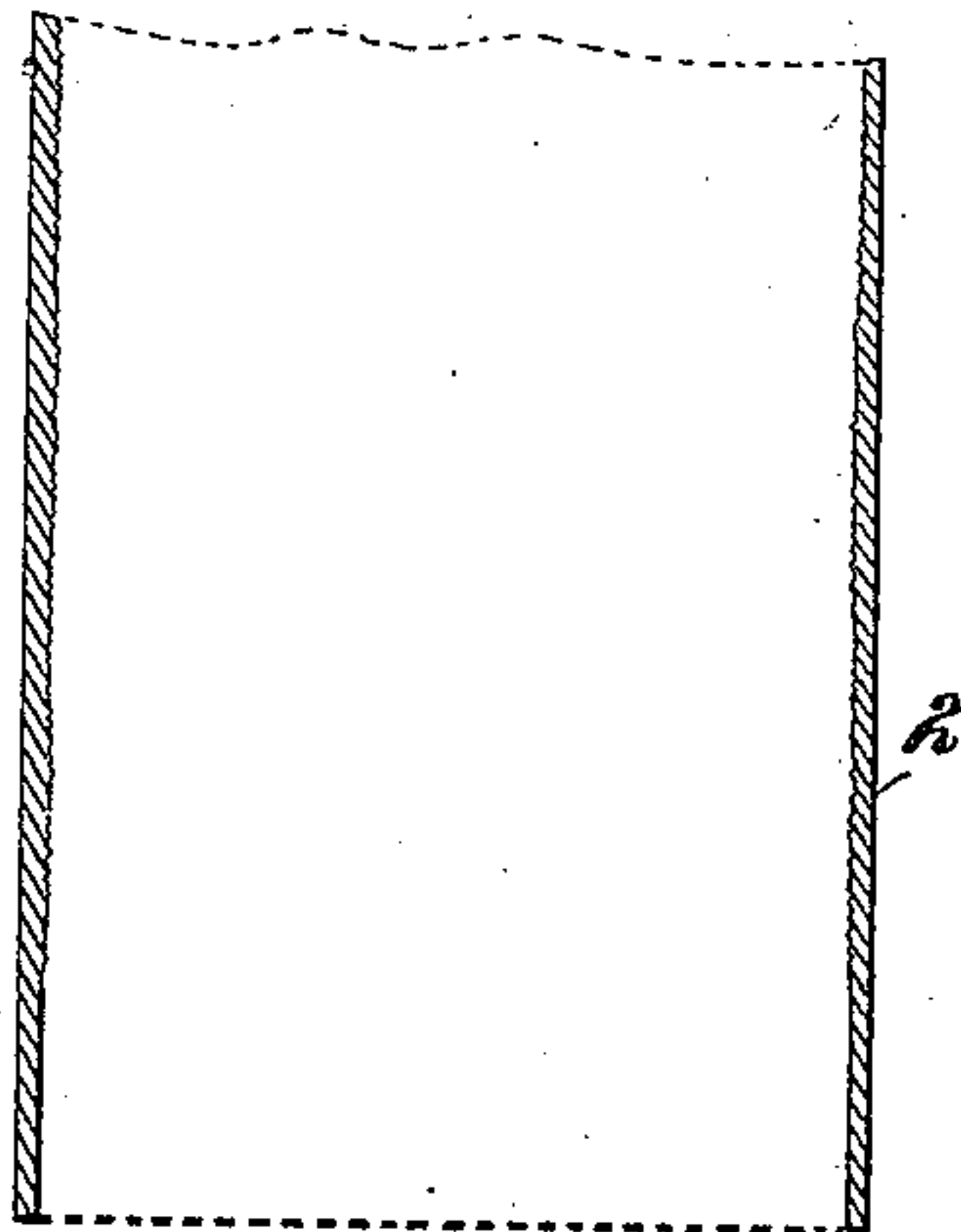


Fig. 4.

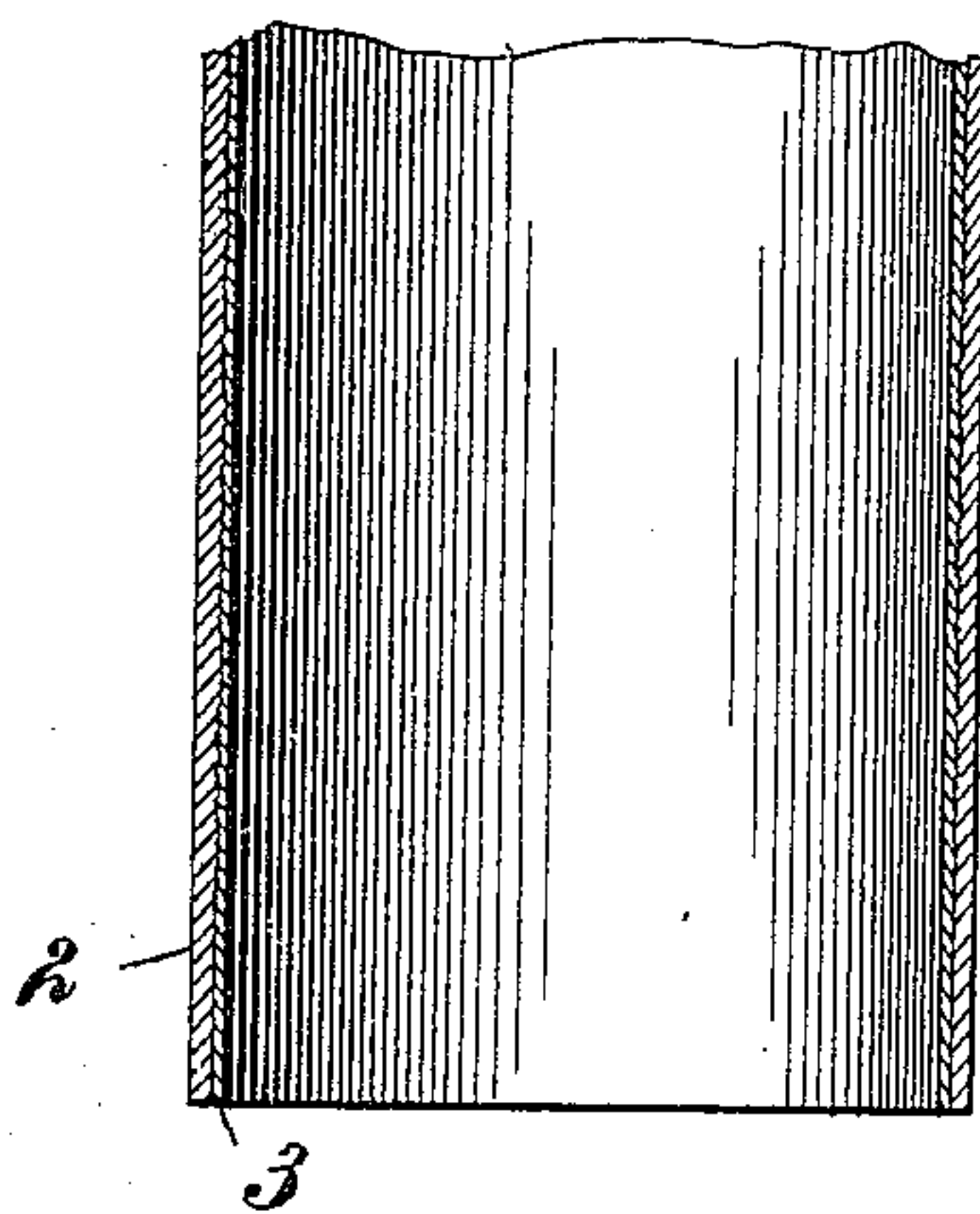


Fig. 5.

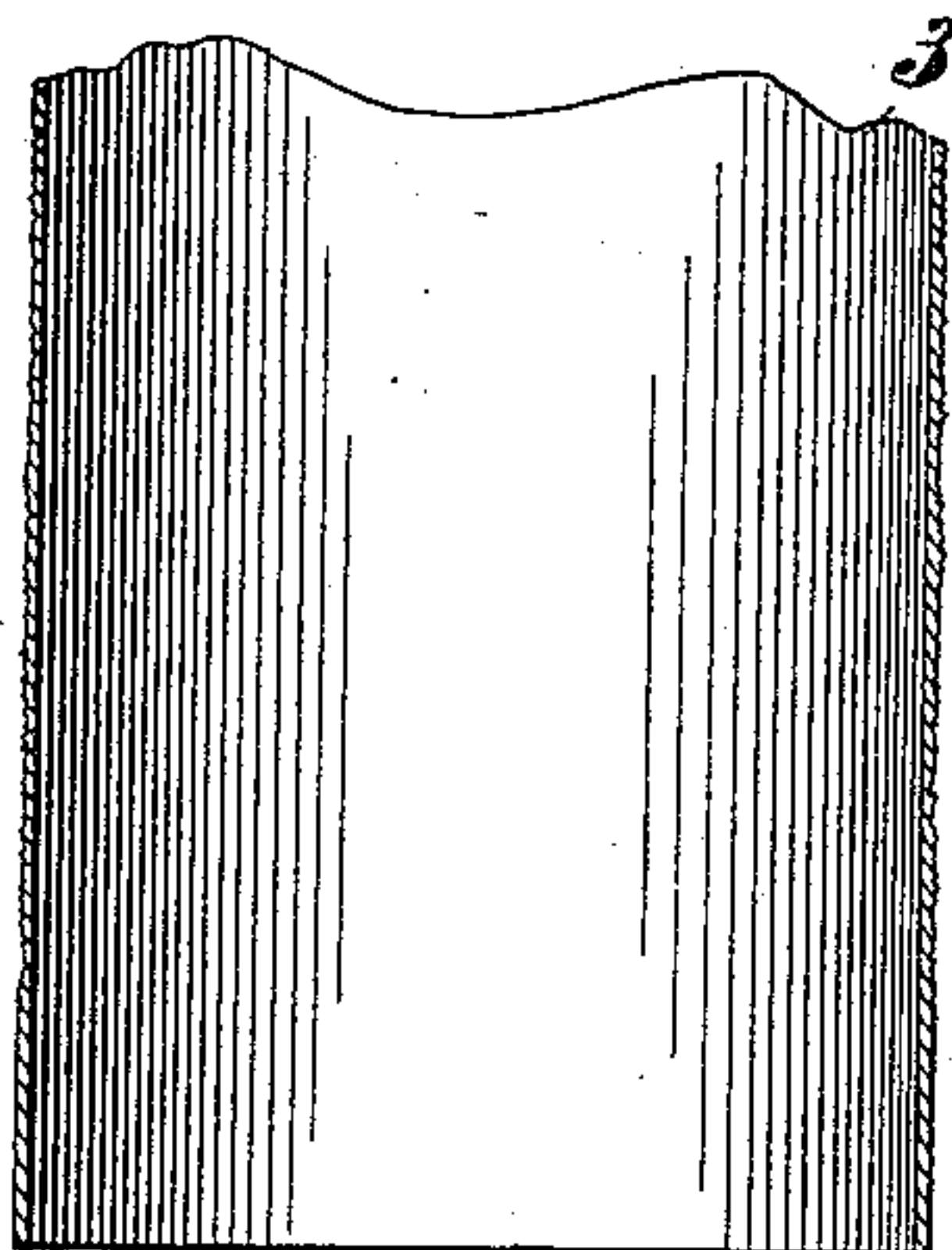
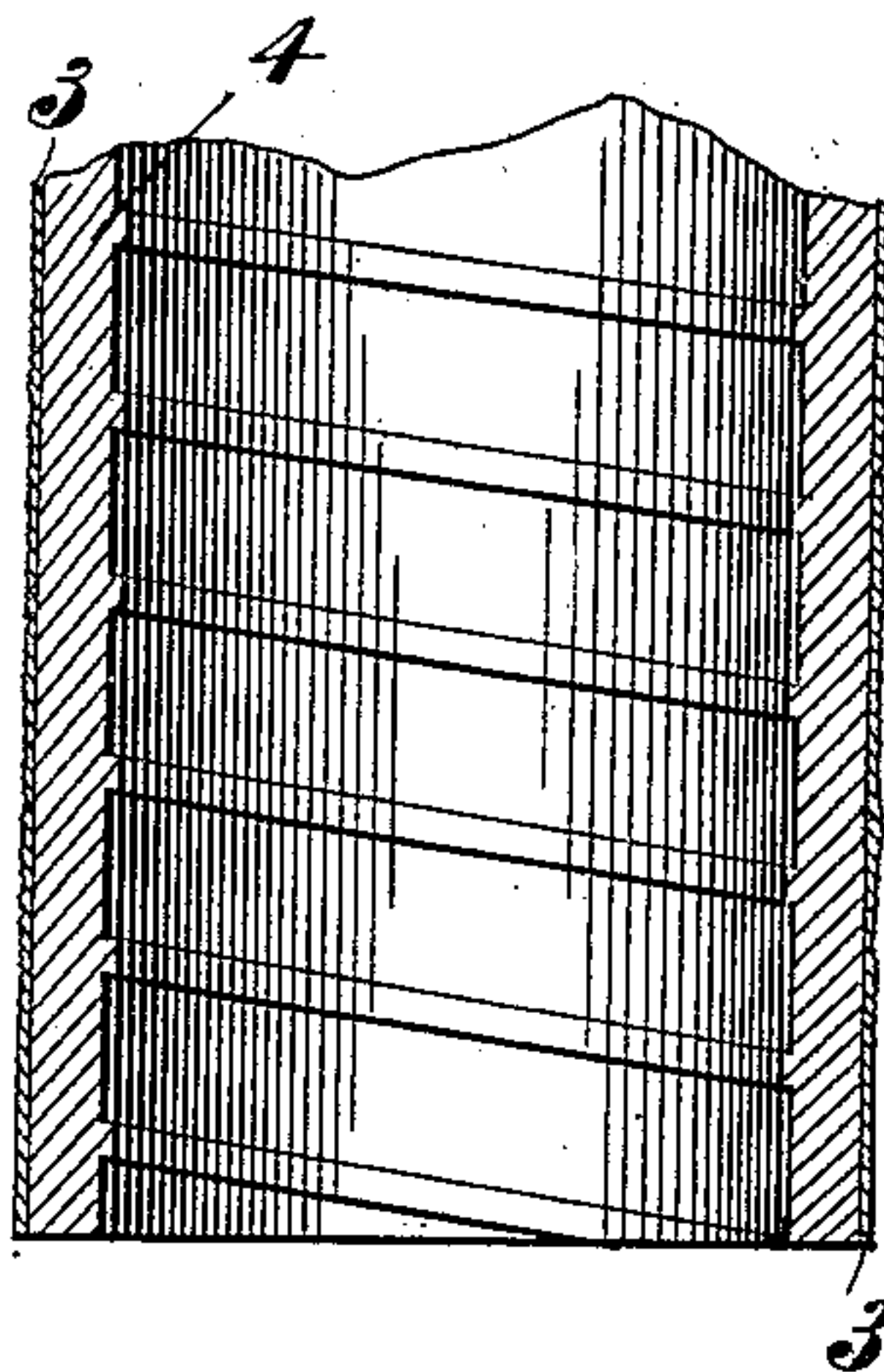


Fig. 6.



WITNESSES

Wm. A. Courtland

M. V. Birdgood

INVENTOR

Frank L. Capps

BY

Attorneys



# UNITED STATES PATENT OFFICE.

FRANK L. CAPPS, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE AMERICAN GRAPHOPHONE COMPANY, OF WASHINGTON, DISTRICT OF COLUMBIA.

## DUPLICATE SOUND-RECORD AND PROCESS OF FORMING SAME.

SPECIFICATION forming part of Letters Patent No. 666,493, dated January 22, 1901.

Application filed March 8, 1899. Serial No. 708,183. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK L. CAPPS, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Processes of Forming Duplicate Sound-Records, of which the following is a specification.

The object of my invention is to economically produce and duplicate sound-records.

There are two methods of duplicating sound-records now commonly employed. The first of these methods is the mechanical method, carried out by a suitable duplicating-machine provided with reproducing and recording styli, which respectively follow the record-groove of a rotating master-record and cut a duplication of the record in a correspondingly supported and operated blank. This mechanical method produces a satisfactory duplicate; but a single master-record can be used only a limited number of times, making the cost of the duplicates proportionately large. The other method which is commonly practiced consists in electroplating a master-record, then by suitable means removing the master-record from the electroplate, which forms a cylindrical matrix, backing up the matrix and supporting it in a hot-water or steam warming-jacket, then putting a blank of the proper size within the cylindrical matrix, supporting it therein until it becomes slightly softened by the heat of the surrounding jacket, and then applying a mandrel or former to the softened blank and forcing it into intimate contact with the matrix-surface of the electroplate, and finally removing the electroplate-matrix with attached blank and cooling in a refrigerator to cause the blank to contract so that it may be removed from the matrix. This process also produces satisfactory results, but is a long and tedious process, requiring skilled labor, and although less expensive than the mechanical method this electroplating method is not altogether satisfactory.

My present invention is distinguishable from the above-described processes and the matrices and blanks produced thereby in that my process is a "wet" process or "dipping" process of producing sound-records and my

matrices and records are formed in or upon films resulting from the evaporation of a solution of a suitable material.

Broadly considered, my improved process consists in first forming a duplicating-matrix by dipping a master-record in a solution of a suitable material or flowing the solution upon the master-record or otherwise bringing the solution (in a fluid or semifluid state) into intimate contact with the record, then removing the master-record from the matrix, and finally impressing a suitable material into the matrix or electroplating the film-matrix or dipping the matrix into a solution of a desired material or otherwise bringing the solution (in a fluid or semifluid state) into intimate contact with the matrix for the purpose of forming a record. The record so produced is detached from the matrix and may be mounted upon a suitable backing, if necessary, for strength. The duplicating-matrix may be used over and over again an unlimited number of times, as there is practically no wear upon it in making the records.

More specifically, my improved process consists, preferably, in forming a duplicate record by dipping the master-record in or otherwise coating it with a fluid solution of some suitable material, such as gelatin, then allowing the coated record to cool and dry, the gelatin or other suitable material forming a tough and elastic film-matrix upon the master-record, then breaking or otherwise removing the master-record from the matrix formed by the film of hardened gelatin or other material, then dipping the gelatin matrix into the fluid solution of a suitable material, such as celluloid, (or applying to the matrix a backing-sheet of celluloid paper or other material coated with celluloid solution or other impressible material,) then allowing the same to dry, and finally separating the celluloid-film record from the gelatin matrix and applying a suitable strengthening backing to it.

If desired, the celluloid duplicate may be employed as a master-record, from which duplicates are cut upon the ordinary blanks of commerce in the usual way with a mechanical duplicating-machine.

When the commercial water solution of gelatin is employed in the formation of the ma-



trix from the master-record, it is necessary in making the duplicate record therefrom to employ a material which will not affect the gelatin—such, for instance, as an alcohol and ether solution of celluloid or an easily-fusible composition of wax and rosin. If the gelatin is rendered waterproof by the addition of bichromate of potash and exposure to the sun, many more materials—such as water-glass, plaster-of-paris, starch, and other material having water in their composition—become available for use in forming the duplicate records and the scope of the invention thereby greatly enlarged.

My invention consists, further, of the improved film-matrix and the improved film-record formed from solutions of suitable materials, as hereinafter more particularly pointed out.

My invention consists of further features of improvement ancillary to the above-mentioned main features, and in order that my invention may be fully understood I will first describe the same with reference to the accompanying drawings and afterward point out the novelty with more particularity in the annexed claims.

In said drawings, Figure 1 is a longitudinal sectional view of a cylindrical master-record formed in the usual way upon a sound-recording machine. Fig. 2 is a similar view showing the master-record with its attached gelatin-film matrix formed by dipping the master-record in a fluid gelatin. Fig. 3 is a detail sectional view of the gelatin-film matrix detached from the master-record by breaking or otherwise removing the master-record. Fig. 4 is a similar view representing the gelatin-film matrix with the attached celluloid-film record formed by dipping the matrix in a solution of celluloid or otherwise forming the celluloid or other material therein. Fig. 5 is a detail view of a separated celluloid-film record. Fig. 6 is a similar view representing the film-record having a suitable backing fitted within it, the backing being shown as made of a suitable material molded into the film-record.

The original or master record 1, formed in the usual way upon a sound-recording machine, is dipped in a solution of gelatin to form a gelatin-film matrix 2 upon its record-surface. The record may be dipped a sufficient number of times to form a film of the desired thickness, the coating being allowed to cool and partly evaporate and dry between the dippings. The master-record, with attached film-matrix 2, is then put aside to dry for about twelve hours, when the film of gelatin will assume a hard horny aspect. The film-coated master-record is then taken in the hand and with a steel bar or other suitable instrument is given two or three sharp blows to crack the master-record within the film-matrix, when the pieces of the master-record will readily fall out, leaving a film-matrix with a perfect clear-cut negative record upon its in-

ner surface. The film-matrix 2, formed as just described, is then taken and dipped in a solution of suitable material, such as celluloid, it being dipped a sufficient number of times to produce a film-record 3 of the proper thickness. This coated matrix is then allowed to dry, and the celluloid-film record 3 will be readily detachable from the matrix. In making the solution of celluloid for producing the film-record I may add a proper quantity of a suitable material to cause the solution to contract in drying, so as to cause the film to be separated from the matrix and facilitate its removal.

In place of dipping the film-matrix in a solution of celluloid I may take a sheet of celluloid and coat its surface with a celluloid solution and impress the surface coated with the semifluid material against the matrix-face of the film-matrix, the jointed ends of the celluloid sheet being cemented by the celluloid solution and the ridge or uneven portion of the joint pressed out against the matrix. The matrix, with celluloid impressed upon, it is then allowed to dry, and the evaporation or drying out of the alcohol and ether of the celluloid solution forms a vacuum between the celluloid sheet and matrix and causes the celluloid to closely adhere to the matrix and faithfully reproduce the record thereof. When the celluloid and its film-coated surface have become perfectly dry, so as to form practically an integral cylindrical record within the matrix-cylinder, I separate the celluloid record from the matrix by bending the celluloid record inwardly away from the matrix at different points and then partially collapsing the record to allow it to be withdrawn from the matrix. This bending and collapsing of the celluloid record within the matrix does not injure the record, because of its elastic nature.

In place of the use of celluloid for the record I may employ a mixture of beeswax and rosin. The ordinary record of commerce is made up of stearic acid, aluminium or a suitable salt of aluminium, and caustic potash fused together into an intimate mass, which is molded into the desired shape. This material has a very high melting-point and could not be molded in a matrix of gelatin formed according to my process, as the heat of the material in a fluid state would melt the record upon the gelatin matrix. I have discovered that a mixture of rosin and beeswax can be kept in fluid state at a very low temperature—lower, in fact, than the beeswax alone—and as the rosin tempers the wax and removes its objectionable viscous quality I am able to form a very satisfactory record of this material. The mixture of rosin and beeswax in about equal proportions is flowed into the gelatin-film matrix or the matrix is dipped into the fluid mixture and the mixture forms upon the matrix, as in the use of the semifluid solution of celluloid. The beeswax-and-rosin record is allowed to dry and harden, and in



drying it contracts and separates from the film-matrix and can readily be removed.

If desired, a suitable paper backing may be coated with a film of celluloid or other suitable record-forming solution and the semi-fluid film-surface impressed against the matrix to form the phonographic record. The paper backing may be in any preferred shape to suit the machine for which the record is prepared.

Any other material suitable for the body of the record may be covered with the impressible fluid or semifluid material and a record impressed upon it, as above described, without departing from the spirit of my invention.

One disadvantage in the use of the ordinary commercial solution of gelatin in forming the matrices is that the gelatin is soluble in water, and therefore materials having water in their composition cannot be employed to form the records. To avoid this objection, I propose to render the gelatin solution waterproof by mixing with the solution a suitable quantity of bichromate of potash and then exposing the mixture to the sun. As is well known, this will produce a waterproof gelatin solution. With the matrix formed of this waterproof gelatin it is possible to use many materials, such as silicate of soda, plaster-of-paris, starch, and other materials which contain water. The waterproofing of the gelatin greatly broadens the scope of my invention, as many materials become available for making the records which could not otherwise be used.

The record formed as above described may or may not be of sufficient strength in itself to withstand the wear and tear to which a record is subjected. If the record is a mere film, as when made of celluloid solution, it is necessary to strengthen it by providing it with a suitable backing. This backing may be a properly-shaped paper form or it may be plaster-of-paris or other material 4, molded into the film-record around a suitable mandrel or former. In Fig. 6 I have shown the film-record upon a backing 4 of molded material, such as plaster-of-paris.

It will of course be understood that I do not limit myself to any particular shape of record, my invention being equally applicable for making a cylindrical or a flat record.

In using the term "dipping" I mean to cover flowing the fluid coating material upon the matrix or record surface, immersing the matrix or master-record in the coating material, or otherwise covering the matrix or record surface with the impressible fluid or semifluid material.

As above stated, the record may be made from the film-matrix by electroplating in the usual well-known way without departing from the spirit of my invention.

I would have it understood that those claims employing such expressions as "bring-

ing a solution of a suitable material into contact with the matrix (or record) surface" are intended to cover the use of a suitable material in any impressible state, whether fluid or semifluid and whether the material is applied direct to the matrix or record or is first applied to a backing or body material and afterward brought into contact with the matrix or record.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The herein-described process of producing sound-records, which consists in forming a matrix of the desired record, then coating the matrix with a solution of a suitable material to form thereon a film-record, and finally separating the film-record from the matrix, as set forth.

2. The herein-described process of producing sound-records, which consists in forming a matrix of the desired record, then dipping the matrix in a solution of a suitable material, then allowing the coated matrix to dry to form upon the matrix a film-record, and finally separating the film-record from the matrix, substantially as set forth.

3. The herein-described process of forming matrices of sound-records, which consists in coating a master-record with a solution of a suitable material and allowing it to dry thereon to form upon the master-record a film-matrix, and then removing the master-record, as set forth.

4. The herein-described process of forming matrices of sound-records, which consists in dipping a master-record in a solution of a suitable material, allowing the coated master-record to dry, and finally removing the master-record from the film-matrix, substantially as set forth.

5. The herein-described process of duplicating sound-records which consists in coating a master-record with a solution of a suitable material and allowing it to dry to form upon the master-record a film-matrix, then removing the master-record from the film-matrix, and finally forming a suitable material in the film-matrix and removing the matrix from the duplicate record thereby produced, substantially as set forth.

6. The herein-described process of duplicating sound-records, which consists in dipping or flowing a suitable coating material upon a master-record, allowing the same to dry and harden upon the record, then removing the master-record from the matrix thus formed, and finally forming a duplicate record in or upon the matrix, substantially as set forth.

7. The herein-described process of duplicating sound-records, which consists in dipping a master-record in a solution of a suitable material, thereby forming a film-matrix upon the master-record, next removing the master-record from the film-matrix, then dipping the film-matrix in a solution of suitable material



to form a film-record thereon, then separating the film-record from the matrix, substantially as set forth.

8. The herein-described process of duplicating sound-records, which consists in dipping a master-record in a solution of gelatin and allowing it to dry, thereby forming a film-matrix upon the master-record, next breaking or otherwise removing the master-record from the film-matrix, then dipping the film-matrix in a solution of celluloid and allowing it to dry, forming a film-record upon the matrix, then separating the film-record of celluloid from the matrix, substantially as set forth.

9. The herein-described process of duplicating sound-records, which consists in dipping a master-record in a solution of gelatin and allowing it to dry, thereby forming a film-matrix upon the master-record, next breaking or otherwise removing the master-record from the film-matrix, then dipping the film-matrix in a solution of celluloid and allowing it to dry, forming a film-record upon the matrix,

then removing the film-record of celluloid from the matrix, and finally mounting it upon a suitable backing, substantially as set forth.

10. The herein-described process of duplicating sound-records which consists in dipping a master-record in a waterproof solution of gelatin, then removing the master-record from the film-matrix formed upon the same and finally forming a duplicate record in the waterproof gelatin matrix and removing the record thus formed from the matrix, substantially as set forth.

11. As an article of manufacture, a sound-record consisting of irregularities corresponding to sound-waves, the same being molded upon a horny surface formed by the evaporation of a solution upon a suitable matrix-surface, substantially as described.

FRANK L. CAPPS.

Witnesses:

A. B. C. SALMON,  
N. CARTER.