

No. 672,909.

Patented Apr. 30, 1901.

M. C. LEFFERTS.

ART OF MAKING PHONOGRAPHIC CYLINDERS.

(Application filed Oct. 18, 1900.)

(No Model.)

Fig. 1.

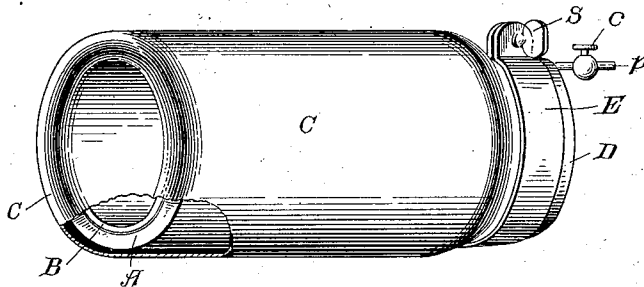


Fig. 2.

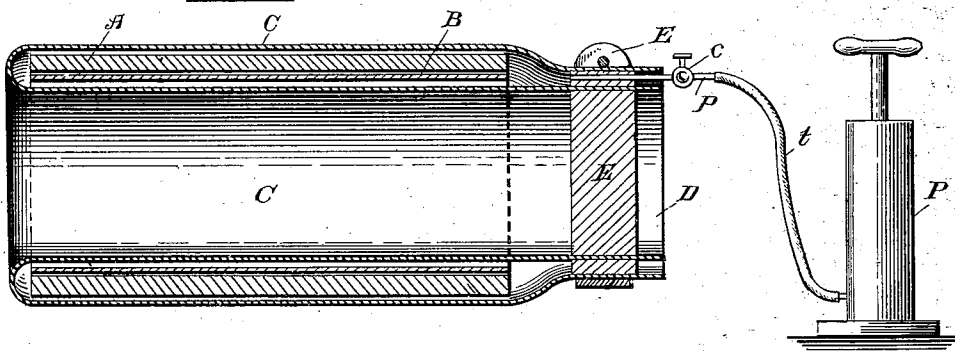
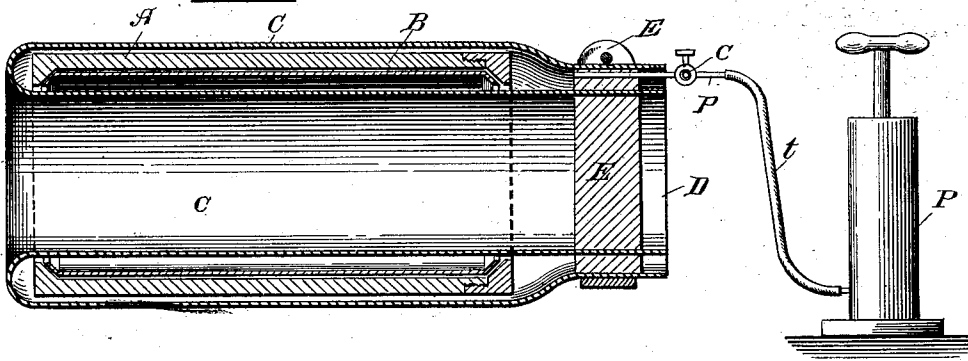


Fig. 3.



WITNESSES:

*F. N. Roehrick.*  
*James M. Stewart.*

INVENTOR

*Marshall C. Lefferts.*

BY

*John H. H. H. H.*

ATTORNEY

# UNITED STATES PATENT OFFICE.

MARSHALL C. LEFFERTS, OF NEW YORK, N. Y., ASSIGNOR TO THE CELLULOID COMPANY, OF SAME PLACE.

## ART OF MAKING PHONOGRAPHIC CYLINDERS.

SPECIFICATION forming part of Letters Patent No. 672,909, dated April 30, 1901.

Application filed October 18, 1900. Serial No. 33,427. (No specimens.)

*To all whom it may concern:*

Be it known that I, MARSHALL C. LEFFERTS, a citizen of the United States, residing in the city, county, and State of New York, have invented a new and useful Improvement in the Art of Making Phonographic Cylinders Composed of Celluloid and Similar Pyroxylin Compounds, of which the following is a specification.

This invention relates to the process of making phonographic cylinders having the sound-record on their exterior surfaces by means of a suitable matrix consisting of a copper electroplate or other suitable material.

Heretofore in molding phonographic cylinders from the matrix such cylinders have been found to be imperfect, owing to the presence of air contained between those surfaces of the matrix and the cylinder which are in contact during the process of molding; and my invention is designed to obviate this defect, as well as to produce a speedy, efficient, and economical method of molding such cylinders.

The apparatus which I employ in practicing my new process is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of the matrix and cylinder, with their inclosing jacket in place, previous to their subjection to the molding pressure. Fig. 2 is a sectional view of Fig. 1, showing the addition of an air-pump or other exhausting instrument; and Fig. 3 is a sectional view showing a modified form of the matrix and cylinder.

Similar letters of reference indicate similar parts throughout the several views.

In practicing my process I first make a matrix in copper by electroplating upon the original wax record in the manner now well understood. Any suitable metal may be used for this matrix. By this means I obtain a matrix which has the sound-record in reverse on its interior surface. In the next step of my process I insert within this matrix a cylinder of "celluloid," or similar pyroxylin compound, having an outside diameter slightly smaller than the inside diameter of the matrix. I next pass through the interior of the celluloid cylinder lying within the matrix a tube of thin soft vulcanized rubber

about three times as long as the matrix, and turn the rubber tube over on itself so as to bring it around the outside of the matrix, thus completely inclosing the celluloid cylinder and the matrix and leaving the two ends of the rubber tube projecting at one end. I then insert a plug within the ends of the rubber tube, and then adjust the ends of the rubber over the plug. I then place a clamp over the plug and ends of the rubber tube and clamp the latter tightly upon the former, so as to form an air-tight joint. The plug contains a pipe fitted with a cock, this pipe leading from the outer air to the interior of the inclosing rubber tube. This stage of my process is illustrated in Figs. 1 and 2 of the drawings, in which A represents the matrix. B is the celluloid cylinder. C is the inclosing rubber tube. D is the plug containing the pipe *p*, having the cock *c*, and E is the clamp, having the tightening-screw *s*. In the next step of my process I connect the outer end of the pipe *p* by a flexible tube *t* or other suitable means with an air-pump P (illustrated in Figs. 2 and 3) or other suitable exhaust and exhaust the air from between the sides of the inclosing rubber tube, thus leaving a vacuum between the opposing surfaces of the matrix and celluloid cylinder. I then shut the cock *c* and disconnect the apparatus from the air-pump. In the next step of my process I introduce the matrix and celluloid cylinder thus inclosed in the exhausted jacket, as above described, into a "gun" or vessel containing steam under pressure. The heat of the steam softens the celluloid cylinder and the pressure on the exterior of the rubber jacket forces the juxtaposed surfaces of the softened celluloid cylinder and the matrix into close contact, thus reproducing in relief upon the celluloid cylinder the sound-record contained in reverse upon the surface of the matrix. A cooling medium is then introduced into the gun under pressure greater than that of the steam, so as to displace the steam and cool the celluloid cylinder while still under pressure. When the cylinder is cooled and "set," the jacketed cylinder and matrix are withdrawn from the steam-chamber. The rubber jacket is then removed and the celluloid cylinder can be separated readily

from the matrix by the insertion of a knife between the two, so as to admit air. In many cases the use of the knife will not be necessary, as the contraction of the celluloid itself will be sufficient to admit air between the opposing surfaces.

I do not limit myself to the use of steam in the above operation, as heated air under pressure or hot water under pressure or any heated fluid under pressure would answer the purpose, nor is it necessary that the fluid itself should be heated, as the celluloid cylinder may be softened by a suitable solvent, such as amyl acetate, applied to the surface thereof prior to the subjection of the jacketed matrix and celluloid cylinder to the pressure of the fluid under pressure. I prefer, however, the use of steam as being more convenient and also prefer to partially soften the surface of the celluloid by the use of a solvent in addition to the use of heat, for I find that the solvent has a beneficial effect in causing the celluloid to flow more evenly under the influence of heat and pressure.

In Fig. 3 I have shown a slight modification of the shape of the matrix and celluloid cylinder. As the phonographic instruments are made of a standard size and fitted for wax cylinders of a uniform diameter, and many of these instruments are now in use, and it is desirable that they can be used both with the standard wax cylinders now in general use as well as the celluloid cylinders, and as the celluloid cylinders can be economically made thinner and with a considerably larger interior diameter than the wax cylinders, owing to the nature of the material, it is necessary to so construct the celluloid cylinders that they will fit on the mandrel of the machine which is suited to the size of the ordinary wax cylinders, and my modification is designed to effect this object. In Fig. 3 the copper matrix A is shown as made with a permanent flange *f* upon it, projecting into the interior of the matrix, the interior diameter of this flange being about the size requisite to fit upon the mandrel of the machine. After the matrix and inner celluloid cylinder have been placed within the jacket D a removable flange *f'* is screwed upon or otherwise suitably fastened to the other end of the matrix A, and during the molding operation, of course, the celluloid cylinder B will take the shape of this shaped matrix A, and thus fit upon the mandrel of the machine.

I do not limit myself to the particular mode of constructing the jacket by means of a rubber tube as herein described nor to the use of rubber solely, for any suitable material will do and any mode of constructing the jacket which incloses the matrix and celluloid cylinder in a collapsible chamber from which the air can be exhausted may be adopted, nor do I confine myself to the use of a fluid-pressure to press the surfaces of the matrix and celluloid cylinder into contact, for, if desired, mechanical pressure, such as an

expansible mandrel, may be employed for this purpose.

Where I have used the word "celluloid" in this specification and the claims, I refer to pyroxylin compounds similar to "celluloid," which is the trade-name of the best of these compounds.

Having thus described my invention, what I claim is—

1. The improvement in the art of making phonographic sound - records composed of "celluloid" and similar pyroxylin compounds, which consists in the following steps: first, placing a "celluloid" cylinder within a matrix having a sound-record on the interior surface thereof; second, placing said matrix and cylinder within a collapsible chamber, and exhausting the air from said chamber; third, subjecting the said jacketed matrix and cylinder to heat and pressure; fourth, cooling said matrix and cylinder, and separating the one from the other, substantially as described.

2. The improvement in the art of making phonographic sound - records composed of "celluloid" and similar pyroxylin compounds which consists in the following steps: first, placing a "celluloid" cylinder within a matrix having a sound-record on the interior surface thereof; second, placing said matrix and cylinder within a collapsible chamber, and exhausting the air from said chamber; third, subjecting said jacketed matrix and cylinder to the action of a heated fluid-pressure; fourth, cooling said matrix and cylinder, and separating the one from the other, substantially as described.

3. The improvement in the art of making phonographic sound - records composed of "celluloid" and similar pyroxylin compounds, which consists in the following steps: first, placing a "celluloid" cylinder within a matrix having a sound-record on the interior surface thereof; second, placing said matrix and cylinder within a collapsible chamber, and exhausting the air from said chamber; third, heating said jacketed matrix and cylinder; fourth, subjecting said heated jacketed matrix and cylinder to pressure; fifth, cooling said matrix and cylinder, and separating the one from the other, substantially as described.

4. The improvement in the art of making phonographic sound - records composed of "celluloid" and similar pyroxylin compounds, which consists in the following steps: first, placing a "celluloid" cylinder within a matrix having a sound-record on the interior surface thereof; second, placing said matrix and cylinder within a collapsible chamber, and exhausting the air from said chamber; third, heating said jacketed matrix and cylinder; fourth, subjecting said jacketed matrix and cylinder to fluid-pressure; fifth, cooling said matrix and cylinder, and separating the one from the other, substantially as described.

5. The improvement in the art of making phonographic sound - records composed of

"celluloid" and similar pyroxylin compounds, which consists in the following steps: first, softening the surface of a "celluloid" cylinder with a solvent, and placing it within  
 5 a matrix having a sound-record on the interior surface thereof; second, placing said matrix and cylinder within a collapsible chamber, and exhausting the air from said chamber; third, subjecting said jacketed matrix and  
 10 cylinder to heat and pressure; fourth, cooling said matrix and cylinder, and separating the one from the other, substantially as described.

6. The improvement in the art of making phonographic sound - records composed of  
 15 "celluloid" and similar pyroxylin compounds, which consists in the following steps: first, softening the surface of a "celluloid" cylinder with a solvent, and placing it within a matrix having a sound-record on the interior  
 20 surface thereof; second, placing said matrix and cylinder within a collapsible chamber, and exhausting the air from said chamber; third, subjecting said jacketed matrix and cylinder to the action of a heated fluid-pres-  
 25 sure; fourth, cooling said matrix and cylinder, and separating the one from the other, substantially as described.

7. The improvement in the art of making phonographic sound - records composed of  
 30 "celluloid" and similar pyroxylin compounds, which consists in the following steps:

first, softening the surface of a "celluloid" cylinder with a solvent, and placing it within a matrix having a sound-record on the interior surface thereof; second, placing said matrix  
 35 and cylinder within a collapsible chamber and exhausting the air from said chamber; third, heating said jacketed matrix and cylinder; fourth, subjecting said heated jacketed matrix and cylinder to pressure; fifth, cooling  
 40 said matrix and cylinder, and separating the one from the other, substantially as described.  
 8. The improvement in the art of making phonographic sound - records composed of  
 45 "celluloid" and similar pyroxylin compounds, which consists in the following steps: first, softening the surface of a "celluloid" cylinder with a solvent and placing it within a matrix having a sound-record on the interior  
 50 surface thereof; second, placing said matrix and cylinder within a collapsible chamber, and exhausting the air from said chamber; third, heating said jacketed matrix and cylinder; fourth, subjecting said jacketed matrix  
 55 and cylinder to fluid-pressure; fifth, cooling said matrix and cylinder, and separating the one from the other, substantially as described.

MARSHALL C. LEFFERTS.

In presence of—

J. R. HALSEY,  
 A. TISCHLER.