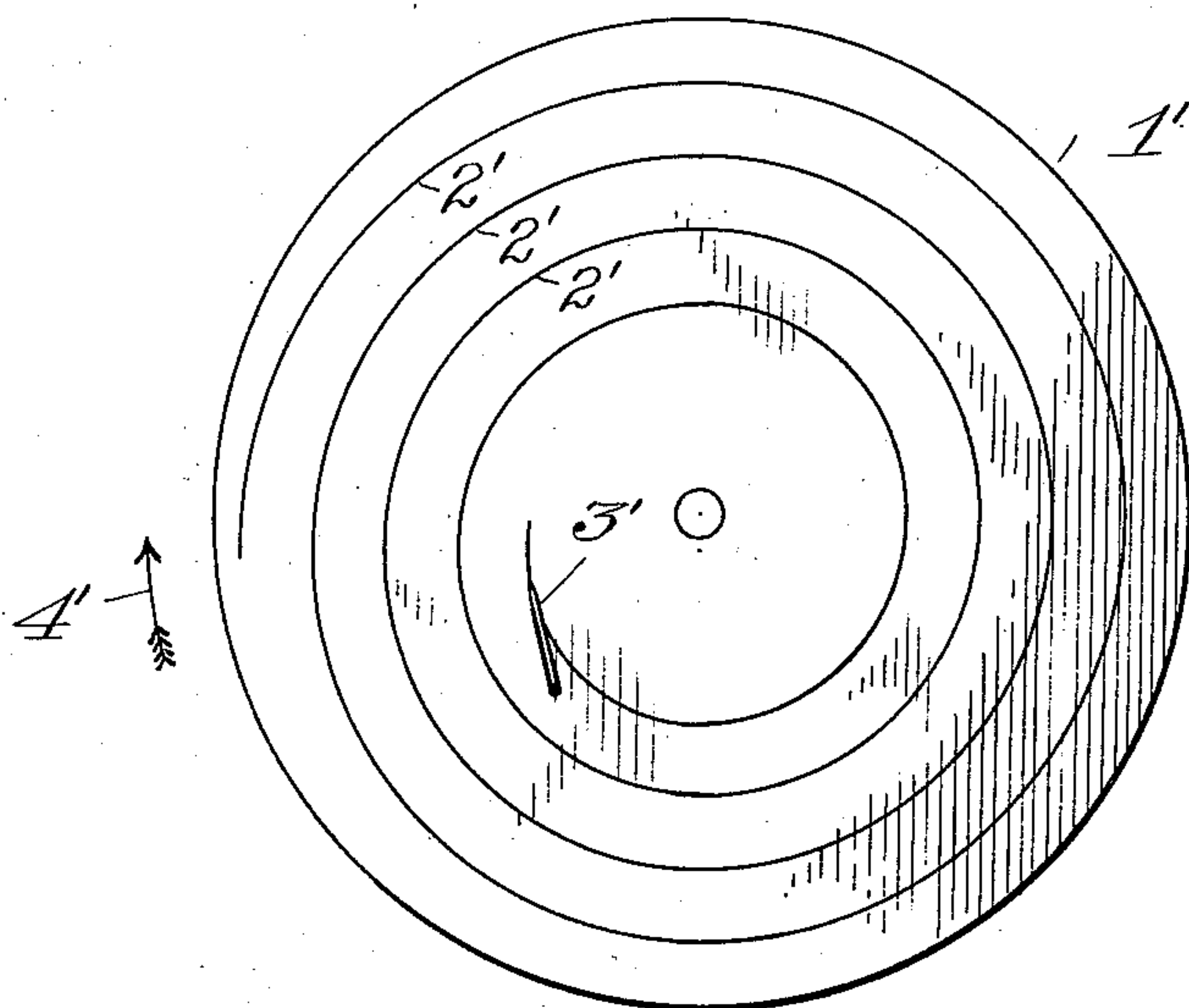


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H. S. BERLINER.
GRAMOPHONE RECORD.
APPLICATION FILED DEC. 1, 1904.



Inventor:

Herbert S. Berliner,

By *Lyons & Bissing,*

Attorneys.

Witnesses:

Edwin L. Jewell,
F. J. Chapman.

UNITED STATES PATENT OFFICE.

HERBERT S. BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA.

GRAMOPHONE-RECORD.

SPECIFICATION forming part of Letters Patent No. 785,191, dated March 21, 1905.

Application filed December 1, 1904. Serial No. 235,067.

To all whom it may concern:

Be it known that I, HERBERT S. BERLINER, a citizen of the United States, and a resident of Washington, in the District of Columbia, have
5 invented certain new and useful Improvements in Gramophone-Records, of which the following is a specification.

My invention has reference to improvements in gramophone sound-record tablets, and is designed to overcome the gradual weakening and muffling of the reproduction from any individual gramophone-record as the reproduction proceeds from one end of the record-groove to the other.

15 It is a common experience that when the reproduction from a gramophone-record is started the sounds emitted by the reproducer are full, clear, and loud and that as the reproduction continues, whereby the reproducing-style engages successive portions of the record-groove, the reproduction becomes weaker and
20 ever weaker as the end of the record is more and more approached. I have found that this lack of uniformity of the loudness and clearness of reproduction is due to two causes, which I will presently explain.

Gramophone-records are sinuous grooves produced in the surface of a flat disk of hard resisting material in a spiral which, beginning
30 near the edge of the disk, gradually approaches the center thereof, so that the convolutions become gradually smaller as the end of the record is approached. In the act of recording the disk upon which the record is made is rotated with uniform velocity, from which it
35 follows that the surface speed of the disk under the recording-style is greatest at the beginning of the record and gradually diminishes and is smallest at the end of the record. It follows also from this that any given sound
40 will be represented on the record by the same number of undulations on all arcs of the spiral that are measured by the same angle from the center. Thus, for instance, if on an arc of, say, ten degrees on the innermost spiral there are,
45 say, one hundred undulations for a given sound then on an arc of ten degrees on the outermost spiral and on each intermediate spiral there are also one hundred undulations for the same

sound. In other words, the same angular measure of arc has the same number of undulations for the same sound. Now it is well known that for reasons which need not be here explained the record is more perfectly inscribed when the recording-disk moves at the higher surface
50 speed under the style and, similarly, that the reproduction is more perfect when the record-disk moves at that higher surface speed under the reproducing-style. As a consequence of this and since in reproducing the record-disk is
55 again moved with uniform angular velocity from beginning to end the reproduction at the beginning will be the loudest and clearest and will gradually weaken and become more indistinct as the convolutions of the spiral under
60 the style become smaller toward the end of the record. Another and still more powerful cause for the weak and indistinct reproduction obtained from the end part of the record is found in the fact that owing to the hard
65 resisting material of the disk the reproducing-style is ground off by the record-groove, so that a tongue is formed at the point of the style. This tongue when first formed fits the
70 groove rather snugly; but as the reproduction continues it becomes thinner and does not fill the groove any more, whereby lost motion of the style and diaphragm is experienced. Now
75 in the ordinary gramophone-record these two causes conspire to make the reproduction weaker and more indistinct toward the end of the record, for the reproducing-style which
80 has been ground off and which thus becomes mutilated by the first and better part of the record has now to reproduce from the poorer part
85 of the record. As a consequence of all this it has been found impracticable to make a record-groove of much greater length than is now ordinarily made, and particularly has it
90 been found impracticable to continue the record-groove as close toward the center of the disk as might be done if the style were not ground off by the first and better part of the record-groove and if the decreasing diameter
95 of the spiral toward the center did not result in a weaker and less distinct record. By my invention this imperfection in gramophone reproduction is largely overcome, and the in-

vention broadly consists in a gramophone-record tablet in which a sound-record groove begins at the inner end of the spiral and progresses outwardly and terminates at the outer end of the record-groove, but still has for the same sound the same number of undulations on all arcs of the spiral that are measured by the same angle drawn from the center. With this construction reproduction is obtained by bringing the reproducing-style into engagement with the inner end of the spiral at the start and then propelling it and its reproducer-head or sound-box gradually outwardly until the outer end of the spiral is reached. By this mode of reproduction, which follows of necessity from the new mode of recording, the new style primarily engages the poorer part of the record—that part which is unavoidably the less perfect. The needle is then gradually ground off at its point into a tongue by the hard resisting material of the disk, and the more it is ground off—that is to say, the more the needle becomes deteriorated—it engages gradually the more and more perfect part of the record—namely, the part which is inscribed in the spiral of the greater and greater diameter.

It will be seen from the foregoing that while in reproducing from the ordinary gramophone-record tablet the style when in its best condition engages the best part of the record and when in its poorest condition engages the poorest part of the record, with my invention the style when in its best condition engages the poorest part of the record and when in its poorest condition engages the best part of the record. At first sight it would seem that by this arrangement the improvement of reproduction from the parts of the spiral of smaller diameter secured by my invention is in a manner counterbalanced by the weakening of the reproduction from the parts of the spiral which has the greater diameters. This, however, is not the case, since the part of the record inscribed on the spirals of larger diameter will be reproduced by a style which has been ground off almost, if not quite, as well as if the style were quite new and had not been ground off, so that as a matter of fact by my improvement the reproduction not only becomes uniform, but it becomes uniformly good.

The accompanying drawing, which forms a part of this specification, shows a diagram illustrating my improved construction of gramophone-record tablet.

On the ordinary gramophone-record disk the sound-groove starts near the edge of the plate and continues in a spiral line in a counter-clockwise direction toward the center of the disk, and the record terminates with or near the inner end of the spiral. In reproducing from such record the reproducing-style is brought into engagement with some part of the outer turn of the spiral groove, and the rec-

ord-disk is rotated in the clockwise direction. As is well known, the style, with the sound-box on which it is mounted, is propelled by the record-groove itself inwardly across the record-tablet, and thereby its point comes successively in engagement with all parts of the record.

In my improved gramophone-record disk 1' the record-groove starts or may start with or in the first innermost turn of the spiral groove 2', and this spiral continues outwardly counter-clockwise and terminates with or in the last outer turn of the spiral. In reproducing from this plate the style 3' is at the start placed in engagement with some part of the inner spiral, and the plate is rotated, as in the machines now on the market, in the direction of the arrow—namely, clockwise. It will be seen from this that my improved gramophone-record tablet may be used with the ordinary gramophone-reproducer machine now on the market.

In reproducing from any gramophone-record tablet the style must incline at an acute angle to the plane of the gramophone-disk in the direction opposed to that of the movement of the disk, so that the point of the style may trail in the record-groove. By reference to the drawing it will be seen that with the record-groove constructed in accordance with my invention the inclination of the reproducing-style will be precisely the same as that in the old form of gramophone-record, so that no change whatever has to be made in the ordinary gramophone-reproducing machine to adapt it for use with my improved record-tablet, so long as the precaution is observed to place the style in engagement with the record-groove on the same side of the center of the disk as is now done with the ordinary record-tablet. This is due to the fact that whereas the record spiral in the old gramophone-disk proceeds counter-clockwise from the outer turn inwardly in my improved tablet the record-groove proceeds spirally counter-clockwise from the inner turn of the spiral outwardly.

I am of course not limited to this particular arrangement of the spiral, for I may just as well make the record-groove to proceed from the inner turn outwardly in a clockwise direction; but in that case either the direction of rotation of the disk in the act of reproducing or both the direction of rotation of the disk and the direction of inclination of the style have to be changed, so that the ordinary reproducing apparatus would have to be modified to adapt for use with my improved record-tablet.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. A gramophone-record tablet having a sound-record groove progressing spirally outwardly, substantially as described.

2. A gramophone-record tablet composed

of a disk of hard resisting material having a sound-record groove progressing spirally outwardly, substantially as described.

3. A gramophone-record tablet having a sound-record groove progressing spirally outwardly in counter-clockwise direction, substantially as described.

4. A gramophone-record tablet having a sound-record groove progressing spirally outwardly and having for the same sound the same number of undulations in the same angular measure of arc of the spiral, substantially as described.

5. A gramophone-record tablet composed of a disk of hard resisting material having a sound-record groove progressing spirally outwardly and having for the same sound the

same number of undulations in the same angular measure of arc of the spiral, substantially as described.

6. A gramophone-record tablet having a sound-record groove progressing spirally outwardly in counter-clockwise direction and having for the same sound the same number of undulations in the same angular measure of arc of the spiral, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HERBERT S. BERLINER.

Witnesses:

F. T. CHAPMAN,
EDWIN S. CLARKSON.