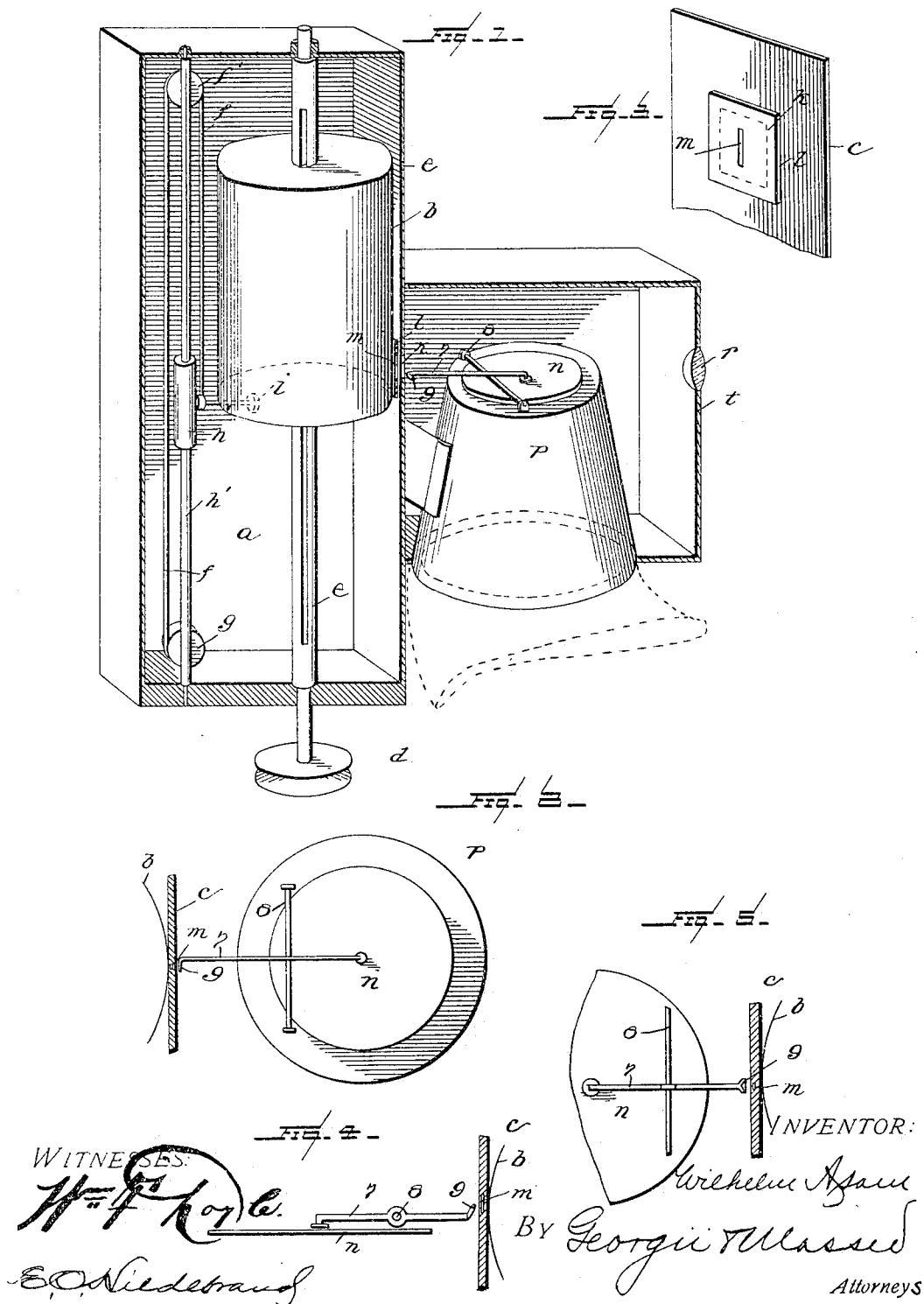


No. 801,634.

PATENTED OCT. 10, 1905.

W. ASAM.
PHONOGRAPH.
APPLICATION FILED MAR. 17, 1903.



UNITED STATES PATENT OFFICE.

WILHELM ASAM, OF MURNAU, GERMANY.

PHONOGRAPH.

No. 801,634.

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To all whom it may concern:

Be it known that I, WILHELM ASAM, residing at Murnau, Bavaria, Germany, have invented certain new and useful Improvements in Phonographs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

10 This invention relates to the registering and reproduction of sounds, and has for its object the reproduction of softer tones—such, for instance, as the human voice in ordinary conversation—or to faithfully register the sounds
15 of a softer-toned instrument playing in an orchestra.

In connection with the reproduction of sounds as hitherto usually accomplished the sensitiveness and accuracy of the reproducing instrument, and consequently the faithfulness of reproduction, are impaired by the fact that the pin or stylus connected with the vibrating membrane is charged with the work of transferring the vibrations to a blackened plate or
20 of impressing them in a soft mass. In order to insure the requisite delicacy of operation necessary to the faithful reproduction of the softer tones, the membrane must be relieved of the work of itself performing the indentations. This object may be attained by the aid
30 of photography; but in the attempt to do so it is essential, first, that the vibrations be obtained in the form of the very finest lines, and, second, that these lines be then converted into impressions in a suitable mass by means of a further process, such as photographic bas-relief and photogravure. The photographing of sound-waves for this purpose has been heretofore attempted with greater or less success;
40 but the methods employed have usually been open to the objection that the resultant lines are not of a sufficient degree of fineness and delicacy to constitute a satisfactory graphic representation of sound-waves.

Generally speaking, the present invention is based upon the fact that if a very fine and light lever is mounted with one end connected to the vibrating membrane and its other end disposed in front of a very thin slot in a stationary wall behind which a light-sensitive film is moved that portion of the sensitive film
50 lying in the shadow of the vibrating lever will represent in the form of a white negative line the exact expression of the vibration of the membrane. Since in this case the direct rays
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of light come into play and the lever and slot are made as fine as is possible, the fineness of the phonogram is correspondingly accurate in the finest details. As a support to the light-sensitive film a drum or disk is advantageously
60 used, to which is imparted a rotary movement and simultaneously a progressive axial movement, whereby the white sensitive line upon the surface of the film is in the form of a continuous spiral of sound-waves. The employ-
65 ment of a disk facilitates the subsequent conversion of the photographed lines into the depressed sound-lines of the phonograph or gramophone disk. The fact, however, that the speed of the disk must be accommodated
70 to the decreased circumference near the center of the disk renders it difficult to utilize all of the space thereon, and consequently the use of a drum as a support is preferred, since the spirals on the drum are of the same size, and consequently a uniform speed of rotation may be maintained.

In order that the invention may be readily understood, reference is made to the accompanying drawings, in which is shown fragmentarily an embodiment of the invention which is specially adapted for the accurate reproduction of sound-waves from the membrane of the speaking apparatus by means of photography.
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In the drawings, Figure 1 is a perspective sectional view of one embodiment of the invention. Fig. 2 is a top plan of the diaphragm and lever. Fig. 3 is a detail showing the arrangement of the light-apertures. Fig. 4 is a side view of a modification, and Fig. 5 is a top plan of Fig. 3.

In the form of apparatus shown in Figs. 1 and 2 a rotary drum or disk provided with a light-sensitive surface *b* is caused to rotate
95 in a light-tight case *a* and as close as possible to one wall *c* of said case. By means of a pulley *d* or other suitable well-known mechanism an even rotary movement is given to the drum or disk about its axis. The drum is also simultaneously moved in a direction longitudinally of the shaft *e*, which is grooved, as shown, by the unwinding of a chain *f* from the spool *g*, the said chain being guided over a top guide-roll *f'* and attached to a slide-block *h*, adapted
100 to slide on a guide-rod *h'*. The said block *h* carries an arm with a roll *i*, which extends under and carries the weight of the roll or drum *b*. Thus as the block descends the drum *b* will be gradually lowered. Any suitable
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mechanism may be employed for driving the pulley *d* and for operating the chain *f*. The driving mechanism should be regulated to impart to the drum between seventy and one hundred revolutions per minute. At the point where the drum is nearest to the wall *c* the latter is provided with a rectangular opening *k*. (Shown in dotted lines in Fig. 3.) Inside the case this opening is covered by a light-proof plate *l*, having a very fine slot *m*. By a suitable arrangement of micrometer-screws this slot may be adjusted with great accuracy and fineness. A light lever 7 is pivoted at 8 adjacent to the speaking apparatus and in such relation thereto that one of its arms rests loosely upon the membrane *n* upon the sound-bell *p*, while the other end of the lever is bent horizontally, being formed as a fine wire 9. The relation of the end of the lever to the case is such that the wire 9 extends directly across the narrow slot *m*.

The membrane must be very sensitive and may be of any desired material. It is advantageously made of the finest india-rubber or of an organic skin, such as fish-bladder. The lever carrying the wire 9 is very accurately balanced on the membrane and may be connected to the same by means of a drop of wax. Instead of a membrane the receiving-surface of a telephone may be provided with the lever and the sound-waves might be photographed in this manner.

As the membrane vibrates under the influence of sound-waves its movement is transmitted by means of the lever to the wire 9, the shadow of which falls upon the light-sensitive surface *b* and leaves a negative impression, as a spiral wavy line, upon the sensitive surface, which corresponds faithfully with the vibrations of the membrane.

Instead of arranging the wire 9 as shown in Figs. 1 and 2 the end of the lever may be upturned and forked, as shown in Figs. 4 and 5, and the wire 9 arranged to extend between the two forks of the lever to serve the purpose of wire 9, as shown in Figs. 1 and 2, the manner of operation and the result in either case being the same.

The source of light should be intense and of small area—such, for instance, as a lime-light or an electric-arc light, if direct sunlight is not available—and may be admitted through a lens *r*, advantageously mounted in the wall *t* of a casing adjoining the case *a* and containing the sound-bell and lever.

I claim as my invention—

1. In an apparatus for reproducing sound-waves, the combination, with a sensitized surface, and an inclosure therefor provided with a light-admitting aperture movable relative to the sensitized surface, of a sound-recording membrane or diaphragm, and means connected with the diaphragm for intercepting the rays of light passing through said aperture oppo-

site the point where the record is to be reproduced.

2. In an apparatus for reproducing sound-waves, the combination, with a sensitized surface, means for rotating the same, and an inclosure therefor provided with a light-admitting aperture, of a sound-recording diaphragm, and means connected with the diaphragm for intercepting that portion of the rays of light passing through said aperture opposite the point where the record is to be reproduced.

3. In an apparatus for reproducing sound-waves, the combination, with a sensitized surface, means for imparting to the said surface a rotary and longitudinal movement, and an inclosure for said surface provided with a light-admitting aperture, of a sound-recording diaphragm, and a lever pivoted in such relation thereto that one arm will rest upon the diaphragm and move therewith and the other end will intercept that portion of the light-rays passing through said aperture opposite the point where the record is to be reproduced.

4. In an apparatus for reproducing sound-waves, the combination, with a cylindrical sensitized surface, means for imparting to said surface a rotary movement and a movement longitudinally of its axis, and an inclosure for said sensitive surface provided with a narrow light-admitting slot, of a sound-recording diaphragm, and a lever pivoted adjacent to the diaphragm with one end resting thereon and the other end extending across the slot in such manner as to intercept a portion of the light-rays passing therethrough opposite the point where the record is to be reproduced.

5. In an apparatus for reproducing sound-waves, the combination, with a cylindrical sensitized surface, means for imparting to said surface a rotary movement and a movement longitudinally of its axis, and an inclosure for said sensitive surface provided with a narrow longitudinal light-admitting slot, of a sound-recording diaphragm, a lever pivoted adjacent to the diaphragm with one arm resting thereon and the other end extending perpendicularly to the sensitive surface and terminating in a fine filament extending across the slot in such manner as to intercept that portion of the light-rays passing therethrough opposite the point where the record is to be reproduced.

6. The method of reproducing sound-waves, which consists in transferring the same by means of photography from a vibrating diaphragm to a sensitive surface in the form of a negative line.

7. The method of reproducing sound-waves, which consists in transferring the same by means of photography from a vibrating diaphragm to a sensitive surface in the form of an unexposed line corresponding to the vibrations of the diaphragm and bounded on both sides by an exposed area.

8. The method of reproducing sound-waves,
which consists in transferring the same by
means of photography from a vibrating dia-
phragm to a sensitive surface in the form of
5 a spiral wavy unexposed line corresponding
to the vibrations of the diaphragm and bound-
ed on each side by an exposed area.

In testimony whereof I affix my signature in
presence of two witnesses.

WILHELM ASAM.

Witnesses:

CLARA I. PARKER,
WALTER E. BOWMAN.