

Aug. 30, 1927.

H. P. DORN

1,641,136

PHONOMETER

Filed March 27, 1922

2 Sheets-Sheet 1

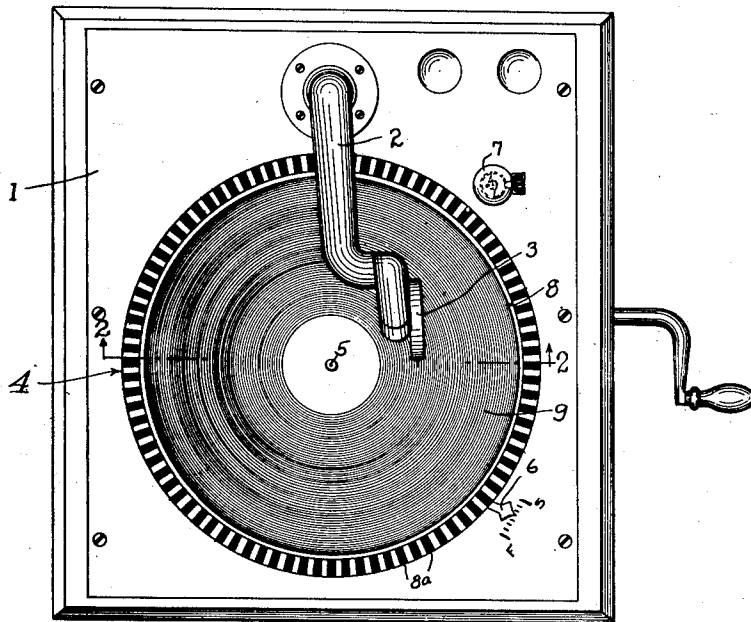


FIG. 1.

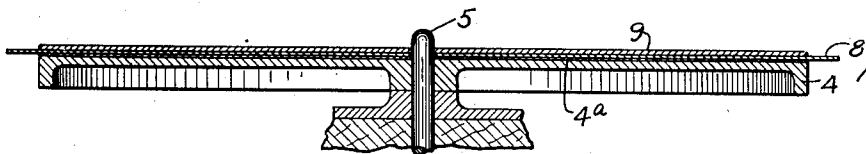


FIG. 2.

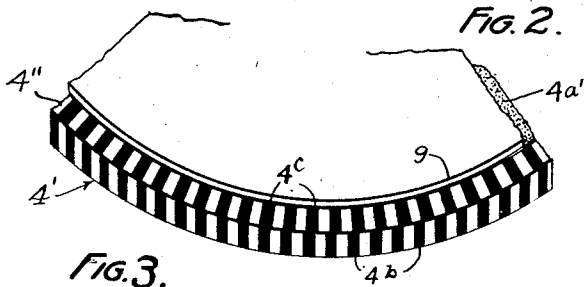


FIG. 3.

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2 Sheets-Sheet 2

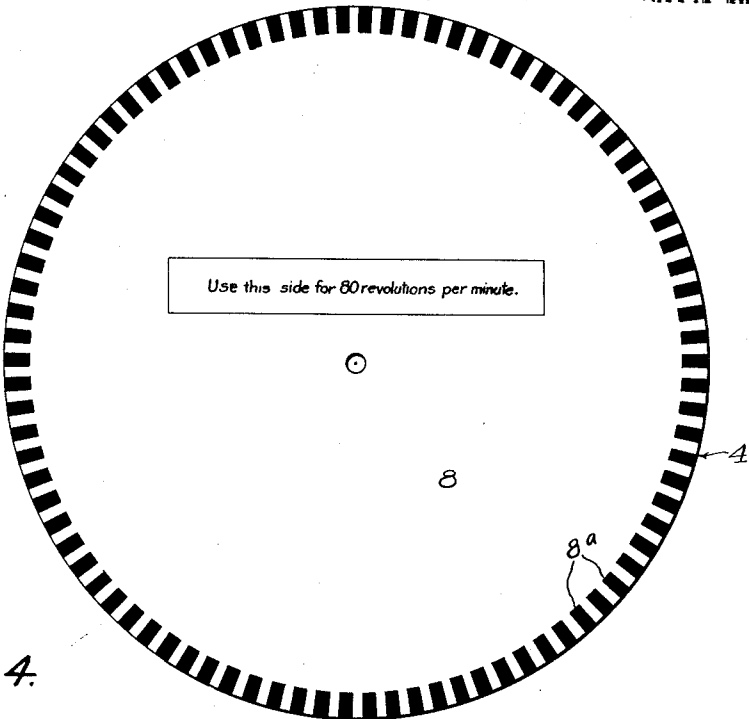


FIG. 4.

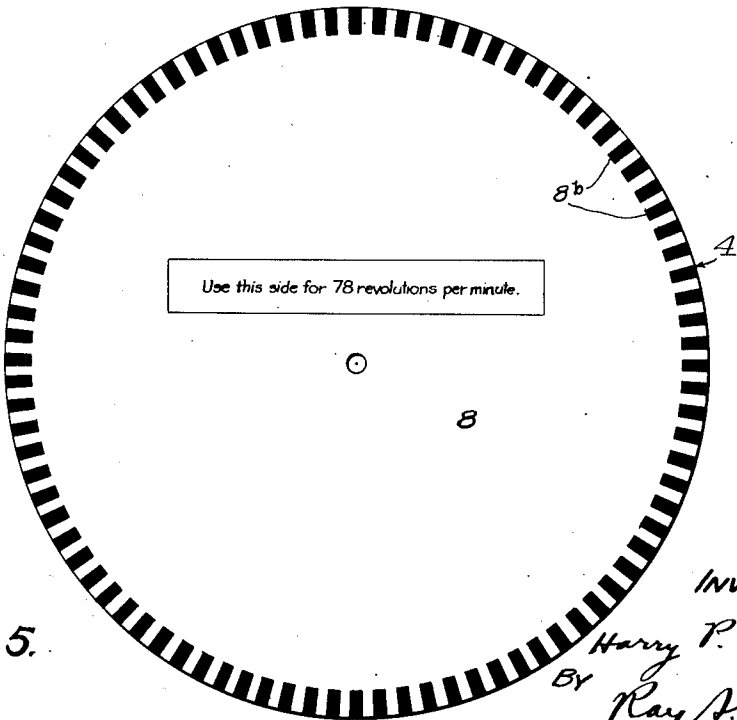


FIG. 5.

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UNITED STATES PATENT OFFICE.

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PHONOMETER.

Application filed March 27, 1922. Serial No. 547,000.

This invention relates to means for indicating variations from a predetermined normal speed of rotation or other periodic movement and it is especially intended for use in connection with phonographs to indicate the speed of the record turn table, and permit it to be readily adjusted to normal speed.

The object of the invention is to provide a simple, inexpensive and sensitive speed indicating device by the use of which variations in speed can be indicated to permit regulation of said speed.

To this end I make use of the stroboscopic principle in a novel manner by taking advantage of the pulsating character of a light made by ordinary alternating electric current, as will be explained in detail in connection with the accompanying drawings which illustrate preferred embodiments of the invention.

In the drawings, Fig. 1 is a plan view of the phonograph with my invention applied thereto.

Fig. 2 is a section on the line 2—2, Fig. 1.

Fig. 3 is a fragmentary perspective view of the peripheral part of a phonograph turn table illustrating a modified form of construction.

Fig. 4 is a face view of the spaced indicating disc shown in Figs. 1 and 2.

Fig. 5 is an opposite face view of the said disc.

Referring in detail to the construction illustrated, 1 designates the cabinet of a phonograph, 2 the tone arm thereof carrying at its end the usual sound box 3. 4 is the record turn table mounted on the spindle 5 which is driven in the usual manner by any suitable motor, not shown. The speed of rotation of the motor and, therefore, of the turn table 4, is determined by means of a brake governor (not shown) of any suitable form, the manual adjusting lever of which is shown at 6. At one side of the table on the cabinet is mounted an electric light bulb 7 the terminals of which are connected by leads (not shown) to an alternating current lighting circuit. Phonograph cabinets are now frequently fitted with electric light bulbs in this manner so that the operator can see to put on and remove records, start the needle on the record, etc.

As shown in Fig. 2, the table 4 has its top surface provided with a cloth or felt sheet

4^a and on this top surface is placed a thin disc 8 which is centrally perforated to pass over the spindle 5 and may be made of any suitable material, such as a good quality of cardboard. This disc 8 by reason of its frictional engagement with the top surface of the table turns with the latter and may be considered as a detachable part of the table upon which the record 9 rests when it is being played. The disc 8 is made of a diameter somewhat greater than the diameter of the largest record to be played so that its peripheral part projects beyond the record as indicated in Figs. 1 and 2.

On this peripheral projecting part of the disc 8 I form on one side a uniform series of marks 8^a and on the other side a uniform series of marks 8^b. The marks 8^a and 8^b can be of various forms and colors provided they contrast strongly with the background formed by the surface of the disc. I prefer however to make the marks, as shown, in bar form and in black on a white ground, and of the same width as the intervening white spaces. The numbers and spacings of the two series of marks are determined by the following considerations:

The light emitted by an electric lamp energized by alternating current consists in reality of a series of light impulses, although due to the persistence of vision the light seems to the observer uniformly continuous. Two such light impulses occur during each complete cycle of the current, these impulses corresponding to the positive and negative maximum current values. This variation of the intensity of the light is especially marked in the case of alternating current arc lamps. In the case of alternating current incandescent lamps the effect is less marked but I have discovered that it is sufficiently marked so that if the marks (8^a or 8^b) on the stroboscopic disc are illuminated by light from an alternating current incandescent lamp, their images formed by the maximum light impulses referred to persist with sufficient strength and definiteness so that if the speed of rotation of the disc is such that the travel of the disc during the interval between two consecutive light impulses equals the circular pitch distance of the series of marks, said marks appear to stand still when the disc is rotated. Therefore, knowing the predetermined normal

speed of rotation of the phonograph turn table and the number of current alternations per unit of time, it is possible to make the size and spacings of the marks 8^a, or 8^b, such that the marks will appear to stand still when the phonograph table turns at normal speed, whereas if it turns faster than the normal speed the marks will appear to more or less slowly advance in the direction of rotation and, if it turns more slowly than the normal speed, the marks will appear to turn more or less slowly in the reverse direction. In the case of some makes of phonograph records the normal speed of rotation is 80 R. P. M., while in case of other makes the normal speed of rotation is 78 R. P. M. By normal speed of rotation I mean the speed used in making the original record and the speed, therefore which should be used in playing reproductions of the original record. In common commercial practice 60 cycle alternating currents are used for lighting purposes, and an electric lamp on such a circuit gives $2 \times 60 \times 60 = 7200$ light impulses per minute. Therefore for 80 R. P. M. the correct number of bars or marks 8^a is $7200 \div 80 = 90$. Similarly it is found that 92 bars or marks are correct for approximately 78 R. P. M. In the same manner the number of marks can be determined for alternating currents of frequencies other than 60 cycles per second.

The face of the disc 8 as shown in Fig. 4 is provided with 90 marks and is therefore adapted for use on phonographs rotating normally at 80 R. P. M., while the opposite face of the disc, as shown at Fig. 5, is provided with 92 marks and is therefore adapted for use with phonographs rotating normally at 78 R. P. M.

Theoretically it should be possible to secure to a measurable degree the stroboscopic effect above described if the speed of rotation of the disc is such that its travel during the interval between two consecutive light impulses has a commensurable ratio with the circular pitch distance of the series of marks on the disc when said ratio has a value other than unity as well as when it has a value of unity. Indeed, within certain limits this effect with the ratio other than unity is noticeable when an alternating current arc light is used. For example, if the said ratio be made one to two or two to one, the rotating marks clearly appear to stand still when illuminated by the alternating current arc light. However I have found that when an incandescent lamp is used the stroboscopic effect described is secured clearly only when the ratio mentioned is unity. In other words, in the case of the incandescent lamp the desired effect is secured only when the conditions are most favorable.

The use of my improved indicator in connection with phonographs will readily be understood from the foregoing description.

The disc 8, rotating with the turn table and record, when illuminated by the alternating current electric light 7, indicates instantaneously to the observer whether the turn table is rotating at the correct speed. If the speed of rotation is the correct or normal one the marks 8^a, or 8^b, appear to stand still whereas if the speed of rotation is too great the marks appear to slowly advance in the direction of rotation, while if the speed is too slow the marks appear to slowly move in the opposite direction. In either case the operator needs but to adjust the governor lever 6 until the indicator marks appear to remain stationary and this brings the speed exactly to normal.

It will, of course, be understood that in commercial practice the frequency of alternating current lines is maintained with very slight variations, in fact not to exceed one to two per cent. The commercial alternating lighting current therefore serves as a satisfactory standard in maintaining the phonograph speed substantially constant.

I have referred to illumination of the indicator marks by the light 7 on the phonograph cabinet but it is to be understood that illumination of said marks by alternating current lamps any place in the room will serve the purpose and the invention is not limited to any particular location for the lamp or lamps.

It will be seen that the discs 8 constitute a very simple indicator adapted to be applied to any phonograph. The indicator may however be made an integral part of the phonograph, as indicated in Fig. 3. As here shown the phonograph turn table 4' is formed with a circumferential extension 4'' which extends radially beyond the felt top 4' of the turn table. On the top surface of the extension 4'' is placed an annular series of marks 4^a, 90 in number, and upon the vertical cylindrical extension 4' is placed an annular series of marks 4^b, 92 in number. Thus whether the stroboscopic marks are placed upon a separate disk or the like or upon a portion of the turn table itself, the part bearing these marks can be described as means supported by the turn table bearing an annular uniform series of marks rotatable in unison with the table, and I employ language of this latter character in the appended claims accordingly.

While I have illustrated preferred embodiments of my invention, it will be understood that there can be various modifications of these embodiments without departing from the invention as defined in the appended claims.

What I claim is:

1. In a phonograph, the combination of a turn table, means for rotating the table, a manually adjustable governor for regulating

ing the rotation of the table to a predetermined normal speed, means supported by said table bearing, an annular uniform series of marks rotatable in unison with the table, and an alternating current incandescent light arranged to illuminate the said marks as the table rotates, said marks having a circular pitch distance equal to their normal speed travel with the table during the interval between two consecutive light impulses due to the alternating current.

2. In a phonograph, the combination of a turn table, means for rotating the table, a manually adjustable governor for regulating the rotation of the table to a predetermined normal speed, a detachable disc bearing an annular uniform series of marks and supported to turn in unison with the table, and an alternating current incandescent light arranged to illuminate said marks as the table turns, said marks having a circular pitch distance equal to their normal speed travel with the table during the interval between

two consecutive light impulses due to the alternating current.

3. The combination of a phonograph turn table and means supported by said table bearing, an annular uniform series of marks and having a circular pitch distance approximately equal to the travel of said marks at the normal table speed during a half-cycle of the commercial alternating electric lighting current.

4. As a new article of manufacture, a disc adapted to be supported on a phonograph turn table to turn in unison therewith and having an annular uniform series of marks approximately equal in number to twice the number of cycles per minute of the commercial alternating electric lighting current divided by the normal number of revolutions per minute of the phonograph turn table.

In testimony whereof, I hereunto affix my signature.

HARRY P. DORN.