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METHOD AND APPARATUS FOR PRODUCING STROBOSCOPIC EFFECT.

APPLICATION FILED NOV. 4, 1916.

1,322,549. Patented Nov. 25, 1919.

Fig. 1.

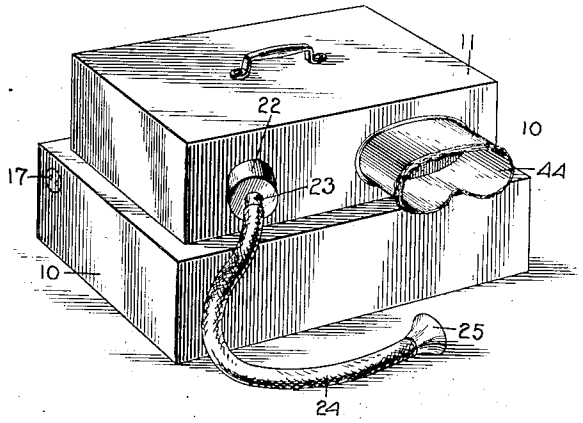


Fig. 2.

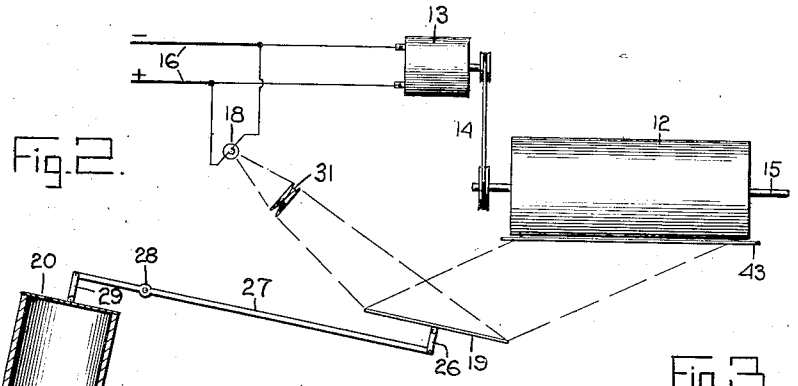
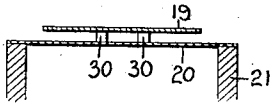


Fig. 3.



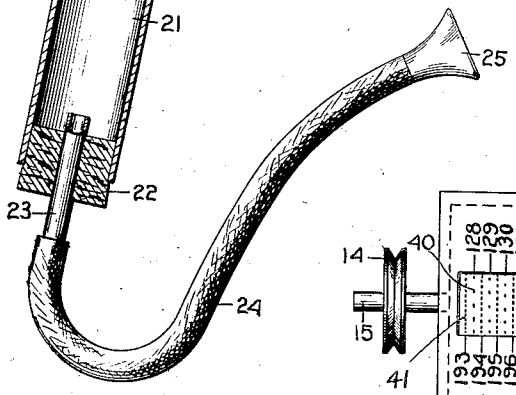
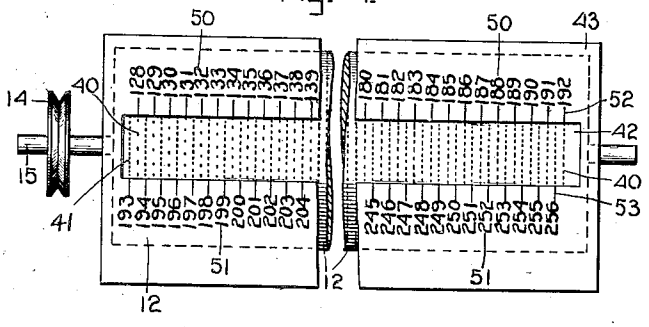


Fig. 4.



WITNESSES

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METHOD AND APPARATUS FOR PRODUCING STROBOSCOPIC EFFECT.

1,322,549. Specification of Letters Patent. Patented Nov. 25, 1919.

Application filed November 4, 1916. Serial No. 129,460.

To all whom it may concern:

Be it known that I, LAURENCE E. DODD, a citizen of the United States, and a resident of Iowa City, in the county of Johnson and State of Iowa, have invented a new and Improved Method and Apparatus for Producing Stroboscopic Effect, of which the following is a full, clear, and exact description.

The invention relates to means for producing stroboscopic effect, such, for instance, as is required in an alternating current frequency meter or in a tonoscope for indicating the absolute pitch (vibrations per second) of a sounded tone, whether sounded by a voice or by any instrument capable of emitting musical notes.

The object of the invention is to provide a new and improved method and apparatus for producing stroboscopic effect by very simple means and in an exceedingly effective manner. Another object is to provide a self-contained portable tonoscope arranged to enable a person to readily and distinctly read the absolute pitch of a sounded tone. Another object is to dispense with the manometric gas flame heretofore employed for producing stroboscopic effect.

In order to accomplish the desired result use is made of a method which consists in vibrating a light transferring means and causing the rays of light from a source of light to be transferred from the said transferring means for producing a stroboscopic effect.

In order to carry this method into effect use is made of an apparatus, comprising an illuminated reflecting surface mounted to vibrate, and a stroboscopic screen mounted to receive the rays of light reflected by the said reflecting surface.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a perspective view of an apparatus in the form of a tonoscope;

Fig. 2 is a diagrammatic view of the same;

Fig. 3 is a sectional plan view of a modified form of the mirror mounted on the membrane of the sound-receiving chamber; and

Fig. 4 is a front elevation of the stroboscopic screen and scale therefor.

The principle involved in this invention is shown applied to a tonoscope hereinafter more fully described in detail, but I do not limit myself to the application of the principle to this particular apparatus as the same underlying principle may be used in alternating current frequency meters and in a variety of other apparatus employed for purposes different from that for which a tonoscope or such meter is used but which apparatus requires a stroboscopic effect.

In order to clearly set forth the nature of my invention, I have deemed it best to disclose the underlying principle as applied to a tonoscope which is mounted in a suitably constructed casing 10 having a cover 11 which can be readily opened for gaining access to the interior of the casing 10. Within the casing 10 is mounted a stroboscopic screen 12, preferably in the form of a cylinder, driven at a predetermined and constant speed from a motor 13 of any approved construction. As shown in Fig. 2, this motor 13 is an electric motor and is connected by pulleys and belt 14 with the shaft 15 of the screen 12, but I do not limit myself to this particular arrangement as the motor 13 may be of the spring motor type and other connecting means may be employed for connecting the motor with the shaft 15 of the stroboscopic screen 12.

The electric motor 13 shown in Fig. 2 has its wires 16 connected with a socket 17 mounted on one side of the casing 10 to permit of readily connecting this socket 17 by a plug and wires with a suitable source of electricity, such as is now generally employed for illuminating and power purposes. The wires 16 are also connected with an electric light 18 arranged within the casing 10, but any other source of light may be employed. The rays of light from the electric lamp 18 are directed onto a reflecting surface 19, preferably in the form of a mirror, and mounted to vibrate in unison with a membrane 20 attached to one end of a sound-receiving chamber 21 arranged within the casing 10. The sound-receiving chamber 21 is closed at its other end by a stopper 22 in which is inserted a short pipe 23 extending through the front of the casing 10 to the outside thereof, to permit of passing sounds into the sound-receiving chamber 21 either by the voice or by any instrument capable of emitting musical notes. In order to conduct the voice of a person into the sound-receiving chamber, use is preferably made

of a flexible tube 24 attached at one end to the outer end of the tube 23 and provided at its other end with a suitable mouthpiece 25.

It is understood that the sounds passing into the sound-receiving chamber 21 vibrate the membrane 20 which in turn vibrates the reflecting surface 19 in unison with it, and this reflecting surface 19 is arranged in such a relative position to the source of light 18 and the front of the stroboscopic screen 12 that the rays of light pass from the reflecting surface 19 onto the front of the stroboscopic screen 12 throughout the width thereof.

The connection between the reflecting surface 19 and the membrane 20 may be in various ways: for instance, by the use of the mechanism shown in Fig. 2 or that illustrated in Fig. 3. As shown in Fig. 2, the back of the reflecting surface 19 is pivotally connected by a link 26 with one end of a lever 27 fulcrumed at 28 in the casing 10, and the other end of the said lever 27 is connected by a link 29 with the membrane 20, preferably at the middle thereof. Thus any vibratory motion given to the membrane 20 is transmitted by the mechanism described to the reflecting surface 19. Instead of pivotally mounting the reflecting surface on one end of a lever, the other end of which is pivotally connected with the membrane of the sound-receiving chambers, as shown in Fig. 2, the reflecting surface may be mounted directly on the membrane as shown in Fig. 3. In this figure the reflecting surface 19 has its back provided with legs 30 glued or otherwise fastened to the membrane 20 of the sound-receiving chamber 21.

I do not limit myself, however, to the particular means disclosed for vibrating the reflecting surface 19 in unison with the membrane 20 as other means may be employed for the purpose.

If desired, a converging lens 31 may be interposed between the source of light 18 and the reflecting surface 19 to intensify the illumination thereof.

The peripheral surface of the cylinder of the stroboscopic screen 12 is provided with two sets of annular rows of dots 40 and 41, of which the rows of dots of the set 40 alternate with the rows of dots of the other set 41. The total number of dots in a row is different for different rows. The number of dots in the successive rows of dots in the set 40 are arranged in an arithmetical progression say from 128 to 192, as shown in Fig. 4, and the number of dots in the rows of dots of the other set 41 are arranged in an arithmetical progression which forms a continuation of the arithmetical progression of the rows of dots 40, that is, from 193 to 256. It is understood that the first left-hand annular row of dots in the set of dots 40 contains 128 dots, and the last right-hand row of this set of dots contains 192 dots. In a like manner, the first row at the left of the set of dots 41 contains 193 dots and the last row at the right of this set of dots contains 256 dots.

The front portion of the stroboscopic screen 12 is visible through an opening 42 formed in a scale plate 43 held within the casing 10 in front of the screen. The opening 42 is in register with a viewing hood 44 attached to the casing 10 and extending to the outside thereof so that the user can readily see through the hood 44 and view the rows of dots 40 and 41 through the opening 42. Two rows or sets of numerals 50 and 51 correesponding to the number of dots in the several rows of dots are marked on the face of the scale plate 43 above and below the opening 42, and lines or other marks 52 and 53 lead from the numerals of the rows of numerals 50 and 51 to the edges of the opening and are arranged in register with the corresponding annular rows of dots 40 and 41, as will be readily understood by reference to Fig. 4.

In using the tonoscope it is only necessary for the user to apply the eyes to the outer end of the viewing hood 44 and to speak or sing into the mouthpiece 25 at the time the motor is running and the source of light 18 is in action. It will be noticed that the sounds passing into the sound-receiving chamber 21 set the membrane 20 in vibration and this vibratory motion is transmitted to the reflecting surface 19 whereby the rays of light receive an intermittent character and are reflected as such through the opening 42 onto the front portion of the stroboscopic screen 12, and as this portion is in full view of the observer the latter can readily observe which of the rows of dots 40 and 41 is apparently stationary and can also read the corresponding number of the apparently stationary rows of dots on the scale plate.

It is understood that the function of the vibrating surface 19 is to give an intermittent character to the reflected light and the frequency of the reflected light is the same as that of the sounded tone owing to the connection between the reflecting surface 19 and the membrane 20.

It will also be understood that the light beam from the reflecting surface to the screen is of non-uniform intensity, and as it is essential that this beam oscillate periodically in a direction perpendicular to its own direction, that it will create periodically varying intensity on a small area of the screen where the beam may chance to fall. That is to say, on a small area of the screen will be periodic illuminations, whose intensity periodically varies by virtue of the lateral oscillation of a non-uniform beam. Since this condition holds for all small areas

where the beam falls, it follows that over all the surface of the screen where the beam impinges there is periodic illumination of the same kind.

By the use of minute dots on the stroboscopic screen the latter can be made correspondingly small and the illuminated surface thereof can be readily observed by the user through the hood 44, thus insuring an accurate and quick reading of the instrument. Use may be made of a magnifying glass to enable the observer to readily view very small dots.

It will also be noticed that the entire instrument is rendered portable and takes up comparatively little space.

It will further be noticed that by the use of the improved tonoscope a more satisfactory result is had than by the use of a manometric gas flame as heretofore used in instruments of this type especially as such flame is subject to flickering and hence more fatiguing to the eyes of the observer.

It will further be noticed that no light reaches the eyes of the observer except that which is reflected from the screen itself and the whole of the stroboscopic screen and scale are at the distance of most distinct vision from the eyes of the observer and the whole of the screen and scale can be taken in with a single glance.

Although I have shown and described but a single membrane and a single reflecting surface it is evident that a series of membranes and reflecting surfaces may be employed to obtain stroboscopic effects and hence I do not limit myself to the particular arrangement disclosed.

I also do not limit myself to the use of an electric lamp as any other suitable source of light of the proper intensity may be used.

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

1. The herein described method for producing stroboscopic effect, which consists in reflecting rays of light from a vibrating reflecting surface directly upon a stroboscopic screen without the interposition of any object between the vibrating reflecting surface and the stroboscopic screen, the necessary intermittent illumination of the stroboscopic screen being provided by the transverse oscillations of a reflected beam of light of non-uniform intensity over its cross section.

2. The herein described method for producing stroboscopic effect, which consists in directing the rays of light upon a vibrating reflecting surface and reflecting the rays from said reflecting surface directly on to a stroboscopic screen, without the interposition of any object between the vibrating reflecting surface and the stroboscopic screen, to render the whole surface of the stroboscopic screen responsive.

3. A tonoscope, comprising an illuminated reflecting surface mounted to vibrate under the influence of a sounded tone, a stroboscopic screen mounted to receive directly the rays of light reflected by the said reflecting surface, and means for rotating said screen.

4. A tonoscope, comprising a membrane capable of vibrating under the influence of a sounded tone, a reflecting surface vibrating in unison with the said membrane, a stroboscopic screen mounted to receive the rays of light reflected by the said reflecting surface, and means for rotating the screen.

5. A tonoscope, comprising a sound-receiving chamber for receiving sounded tones, a membrane in the said sound chamber and vibrated by the sounded tones passing into the said sound chamber, a light transferring means connected with and vibrated in unison with the said membrane, a stroboscopic screen arranged in juxtaposition to the said light transferring means to receive the rays of light from the latter, and means for rotating the screen.

6. A tonoscope, comprising a vibrating illuminated mirror, means for vibrating the said mirror in unison with the vibrations of a sounded tone, a stroboscopic screen receiving directly the rays of light collected by the said mirror, and means for rotating the screen.

7. A tonoscope, comprising a sound-receiving chamber provided with a membrane, an illuminated reflecting surface mounted to vibrate in unison with the said membrane, a stroboscopic screen mounted to receive the rays of light reflected by the said reflecting surface, and means for rotating the screen.

8. A tonoscope, comprising a sound-receiving chamber provided at one end with a mouthpiece and at the other end with a membrane, a mirror mounted to vibrate in unison with the said membrane, a source of light illuminating the reflecting surface of the said mirror, a stroboscopic screen mounted to receive the rays of light reflected by the said mirror, and means for rotating the screen.

9. A tonoscope, comprising a closed casing provided with a fixed exterior viewing hood, a sound-receiving chamber mounted within the said casing and having a mouth-piece extending to the outside of the casing, a membrane mounted in the said receiving chamber and under the influence of the sounds passing into the said sound receiving chamber, a mirror, means connecting the mirror with the said membrane to vibrate the mirror in unison with the said membrane, a source of light within the said casing and illuminating the reflecting surface of the said mirror, a stroboscopic screen mounted to revolve in the said casing and receiving the rays of light reflected by the said

mirror, the said viewing hood being located directly opposite the illuminated portion of the revolving screen, and means for rotating the screen.

10. A tonoscope, comprising a closed casing provided with an exterior viewing hood, a sound-receiving chamber mounted within the said casing and having a mouthpiece extending to the outside of the casing, a membrane mounted in the said receiving chamber and under the influence of the sounds passing into the said sound-receiving chamber, a mirror, means connecting the mirror with the said membrane to vibrate the mirror in unison with the said membrane, a source of light within the said casing and illuminating the reflecting surface of the said mirror, a stroboscopic screen mounted to revolve in the said casing and receiving the rays of light reflected by the said mirror, the said viewing hood being located directly opposite the illuminated portion of the revolving screen, and a motor mounted in the said casing and adapted to drive the said stroboscopic screen.

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