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2,336,624

PHONOGRAPH PICKUP APPARATUS

Filed March 11, 1942

Fig. 1

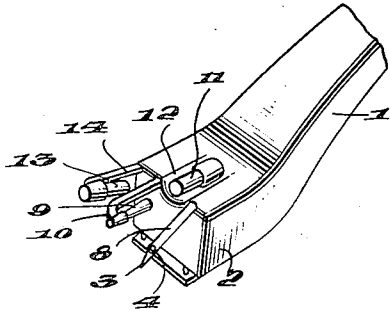


Fig. 2

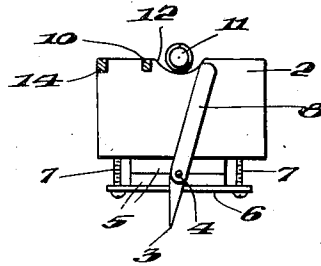


Fig. 3

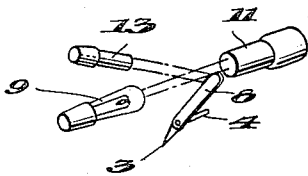


Fig. 4

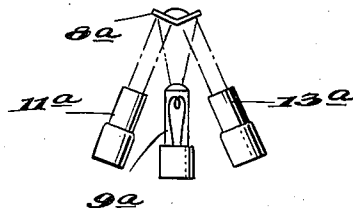


Fig. 5

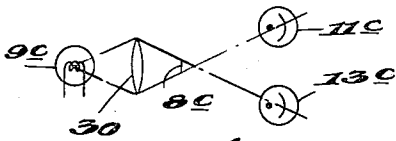


Fig. 6

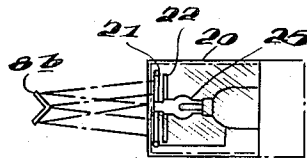


Fig. 7

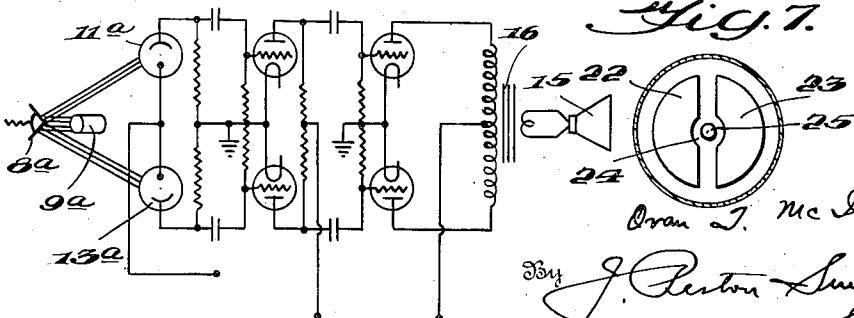
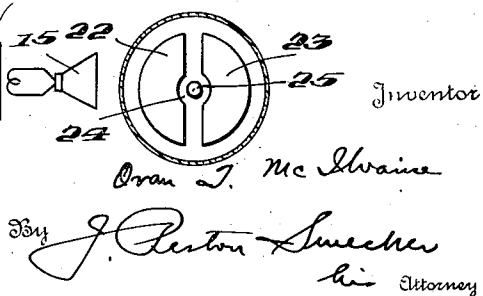


Fig. 8



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PHONOGRAPH PICKUP APPARATUS

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10 Claims. (Cl. 179-100.41)

This invention relates to an improvement in phonograph pick-up apparatus of the character used for reproducing sounds from phonograph records.

The object of this invention is to improve the character of the pick-up apparatus so as to produce an increased output volume with clearer tones than have been possible heretofore, which result is obtained without materially increasing the complexity of the apparatus or the weight of the moving system relative to the arm of the reproducer, whereby the desired ratio of the weight of the moving arm to the reproducing member may be maintained.

This object is accomplished by the utilization of a plurality of light responsive devices, such as photo-electric tubes, adapted to be connected in an amplifying circuit which is modulated by the movement of the stylus or needle to vary the amount of light on the respective devices, which in turn so control the amplifying circuit as to provide reproduction of better quality and tone with an increased volume, over what has been possible heretofore through the use of a single cell.

A vane is connected with the stylus or needle and so arranged as to vary the amount of light directed on the respective cells in response to the movement of the needle, which is accomplished preferably by reflection of a part or all of the light onto one or both of the cells, according to the position of the vane in the light beam. The arrangement is such that the amount of light directed from one cell by the intercepting movement of the vane in response to vibrations of the needle, is directed to the other cell so as to produce a balancing action on the amplifying circuit that increases the volume thereof with better tone.

Different embodiments of the invention are shown in the accompanying drawing, in which:

Fig. 1 is a perspective view showing an end portion of a tone arm mounting a plurality of cells arranged in one embodiment of the invention;

Fig. 2 is an end elevation thereof, partly in section;

Fig. 3 is a diagrammatic view of the optical system and stylus of the form shown in Fig. 1;

Fig. 4 is a similar view showing a modified form of optical system and stylus vane;

Fig. 5 is a similar view of still another form thereof;

Fig. 6 is a similar view showing another form

of optical system used in a multiple cathode tube;

Fig. 7 is an end elevation of said tube; and

Fig. 8 is a diagrammatic view showing the application of this invention to an amplifying circuit.

The invention is adapted for use in connection with phonograph apparatus of any suitable or well-known form in which a record disc is usually mounted on a rotary turntable, over which the pick-up unit is supported by a tone arm that extends laterally over the record disc and is pivotally supported at its opposite end. This structure, being conventional, is not illustrated, but it will be understood that the invention is not limited in its application to this type of phonograph apparatus, and it may be used with different forms thereof, wherever it may be desired.

The tone arm is shown in the drawing, being designated generally by the numeral 1, being adapted for pivotal support at one end thereof, while the opposite end designated 2 is preferably weighted or constructed of relatively heavy material to provide for the necessary and desired differential in weight between the arm and the stylus.

The stylus or needle is shown at 3, being mounted on a journal pin 4 pivotally supported at the under side of the end 2 of the arm to adapt the stylus or needle 3 for swinging movement transversely relative to the length of the tone arm 1 in response to transverse variations of the sound track formed in the record disc, following the contour thereof. The journal pin 4 is not entirely free for turning movement, but is confined between resilient blocks 5, such as soft rubber, confined by a supporting plate 6, secured to the under side of the tone arm end 2 by screws 7, which may be adjusted to provide the desired tension on the journal pin 4 to allow movement of the stylus or needle 3 in following the sound groove but without too free movement thereof.

The stylus or needle 3 has an upstanding vane 8, rigidly attached thereto or to the journal pin 4, so as to move laterally with the stylus. The front face of the vane 8 is formed preferably as a reflecting surface to reflect light as hereinafter described.

I have discovered through experimentation that the tone arm 1 should be relatively heavy in proportion to the moving means, including the needle 3 and vane 8, as well as the pivotal support thereof, and that this ratio must be at least greater than five to one, the weight or mass of the tone arm being at least five times heavier than the needle vane unit that is moved relative thereto.

The higher the proportion, the more perfect reproduction is obtained thereby, and as the weight of the tone arm is increased, it may be supported separately than on the needle.

Provision is made for supporting a source of light on the tone arm end 2, such as an incandescent lamp shown at 9 carried by a support 10, which lamp is disposed to direct the light therefrom toward the vane 8. A light responsive device, such as a photo-electric tube, is shown at 11 on the opposite side of the vane 8 from the source of light 9, said tube 11 being mounted in a recess 12 in the tone arm end 2. The photo-electric tube 11 contains the usual anode and cathode and is arranged in a beam of light projected from the lamp 9, on the opposite side of the vane 8 therefrom, in position for interception of said beam of light by the vane 8.

A second light responsive device 13, such as a photo-electric cell, is also supported as by a bracket 14, on the tone arm end 2, in position to have light directed thereto from the reflecting surface of the vane 8, as will be evident from Fig. 3.

As shown, a beam of light will be directed normally from the lamp 9 onto the cathode of the photo-electric tube 11 when the vane 8 is out of the path thereof, or only partly intercepts the same. As the vane is moved back and forth in the beam of light in response to the undulations of the sound track groove, the light from the lamp 9 will be directed to varying degrees onto the photo-electric tube 11, but the amount thereof reflected by the vane 8 will be directed onto the tube 13, so that the entire beam of light will be applied at all times onto one or both of these photo-electric tubes.

Both tubes may be connected with a single amplifying circuit, so as to produce reproduction of the sound in response to the light projected onto the respective tubes.

In Fig. 4, is shown a modified form of this optical system in which two photo-electric tubes 11a and 13a are both located on a corresponding side of the stylus-operated vane 8a, which vane is constructed of angular cross section, as shown, with outer reflecting surfaces arranged in the path of light from a lamp 9a, to reflect said light onto the tubes 11a and 13a. The beam of light from the lamp 9a will be of sufficient width so as to project on both angular sides of the vane 8a in equal amounts when the stylus is in a central position. However, when the stylus is vibrated to one side or the other in response to the sound track groove, a greater degree of the light beam will then be reflected onto the corresponding tube. For instance, when the stylus is vibrated from the position shown in Fig. 4, to dispose the vane 8a further to the right, the left hand side of said vane will direct a greater proportion of the light onto the cathode of the tube 11a, and a smaller proportion will then be directed to the tube 13a. Then when the vane oscillates back in the reverse direction, this action will be reversed and the greater proportion will then be directed onto the tube 13a.

The application of this optical system to an amplifier circuit is shown in Fig. 8, as applied to a well-known push-pull circuit connected with a sound reproducer 15.

This push-pull circuit, as is well-known, comprises two side bands having amplifier tubes connected therein and jointly connected at the output sides thereof through a transformer 16 with the reproducer 15. The respective photo-electric

tubes, such as the tubes 11a and 13a, are connected at the in-put of the side bands of the push-pull circuit in position for the direction of light thereon from the vibrating vane 8a, which right will vary on the respective tubes in accordance with the vibration of the stylus or needle during its travel in the sound groove. As the light increases on one of the tubes, it decreases to the same degree on the other, and both side bands are thus energized to corresponding degrees according to the amount of light directed onto the photo-electric tubes, which energizes the reproducer 15. This produces at least twice the output volume, with smoother and better tone because the push-pull circuit balances out the extraneous things common to both circuits, and thus makes it possible to utilize such a push-pull circuit for energizing the amplifier of a sound reproducer.

As the reflector of the vane is shifted into and out of the beam of light from the lamp, it varies the quantity of light reflected to each of the respective cells, but it does not vary the angle of the light nor deflect the light off the cell, as the cell cathode is always larger than the beam of light directed thereon.

Still another form is shown in Figs. 6 and 7, in which a single tube is constructed to act as two separate tubes. The tube is designated generally by the numeral 20 and has a photo anode 21 mounted therein, preferably in the form of a ring and surrounding cathodes 22 and 23, each of which is in the form of a disc segment which are slightly spaced from each other and have a central opening 24 therebetween that receives an incandescent lamp 25 which is arranged to direct a beam of light through the opening 24 onto the vane 8b. The beam of light will be reflected from the vane onto the cathodes 22 and 23 in proportion according to the position of the vane, and as the same is vibrated by the stylus or needle. The cathodes may be connected with the respective opposite sides of the push-pull circuit substantially like the tubes shown in Fig. 8. This contains both the lamp and the tubes in one envelope and has the advantage of giving twice the modulation, double the volume and it also eliminates the hum that may be in the lamp.

In Fig. 5 is shown an optical system in which the light from the lamp 9c is directed through a lens 30 and divided into separate beams which are directed onto the respective tubes 11c, 13c. The vane 8c is spaced from the apex of the light cones so that vibration of the vane in response to movement of the needle will vary the amount of light thus directed onto the respective tubes. When these tubes are then connected in the push-pull amplifier circuit, they will act on the respective sides thereof to energize the reproducer, generally in the manner described above.

I claim:

1. In a pick-up device, the combination of a source of light, a plurality of light responsive units, a stylus, and means actuated by the stylus for controlling the supply of light from said light source to the respective light responsive units.

2. In a pick-up device, the combination of a plurality of light responsive units, a source of light adapted to supply light jointly to said light responsive units, and stylus-actuated means for controlling the relative amounts of light supplied by said light source to the respective light responsive units.

3. In a pick-up device, the combination of a plurality of light responsive units, a source of

light arranged to project beams of light jointly to the respective light responsive units, and stylus-actuated means for controlling and varying the amount of light of the respective beams directed to the respective light-responsive units.

4. In a pick-up device, the combination of a plurality of light responsive units, a source of light adapted to supply light jointly to said light responsive units, and stylus-actuated means so constructed and arranged as to vary by reflection the light supplied to the respective units.

5. In a pick-up device, the combination of a plurality of light responsive units, a source of light adapted to supply light jointly to said light responsive units, and stylus-actuated means so constructed and arranged in the path of the light from said source as to reflect light to one or more of said light responsive units varying the amount of light directed thereto.

6. In a pick-up device, the combination of a plurality of light responsive units, a source of light adapted to supply light jointly to said light responsive units, and stylus-actuated means so constructed and arranged as to reflect light from said source to the respective light responsive units and movable relative thereto for respectively increasing and decreasing the amount of light supplied thereto.

7. In a phonograph pick-up device, the combination of a pair of photo-electric tubes, a

source of light in position to direct a beam of light to one of said tubes, and a stylus-actuated vane in position to intercept said beam of light and to reflect a portion thereof to the second photo-electric tube.

8. In a phonograph pick-up device, the combination of a source of light, a pair of photo-electric tubes arranged on opposite sides of the light source, and a stylus-actuated vane having angular portions in position to reflect light from said source onto the tubes and to respectively increase and decrease the light thereon in response to vibrations of the stylus.

9. In a phonograph pick-up device, the combination of a light responsive tube having a pair of disc-segmental cathodes with an opening therebetween, a lamp mounted in said tube in position to direct a beam of light therefrom through said opening, and a stylus-actuated vane in position to reflect said beam of light onto the cathodes.

10. In a pick-up device, the combination of a source of light, light responsive means including a plurality of photo-electric cathodes arranged to receive light from said source, and stylus-actuated means for controlling the relative amounts of light from said source to the respective cathodes.

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