Nov. 23, 1943. F. J. BINGLEY 2,335,168

EXCITER LAMP FOR USE IN PHOTO-ELECTRIC DEVICES

Filed June 28, 1941

Fig. 1.

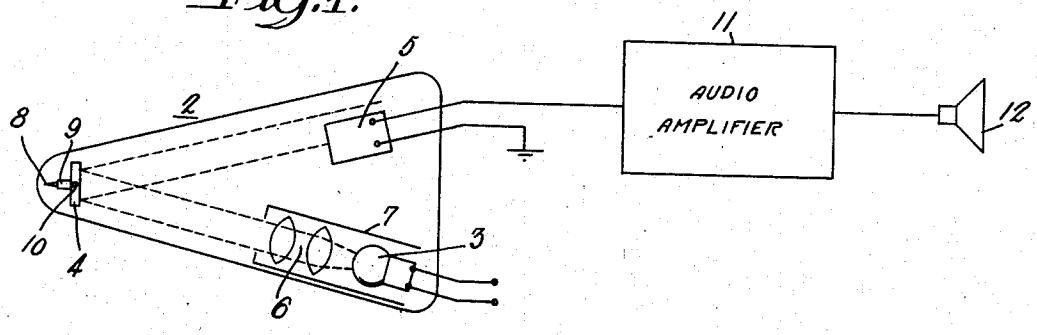


Fig. 2.

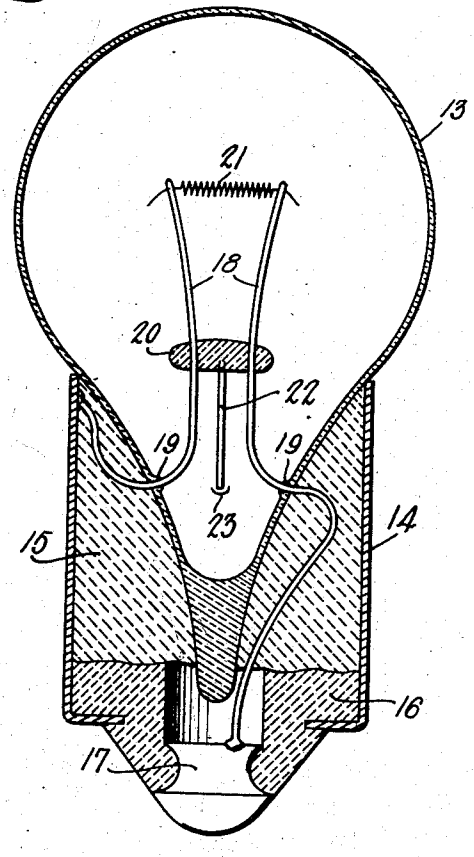
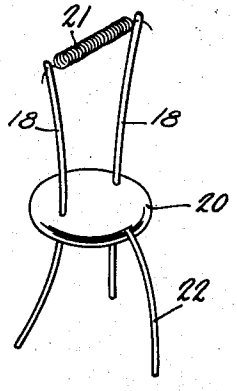


Fig. 3.



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Patented Nov. 23, 1943

2,335,168

UNITED STATES PATENT OFFICE

2,335,168

EXCITER LAMP FOR USE IN PHOTO-ELECTRIC DEVICES

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Application June 28, 1941, Serial No. 400,315

2 Claims. (Cl. 176—39)

This invention relates to incandescent exciter lamps for use in photo-electric devices adapted to produce audio-frequency currents.

The invention is particularly concerned with lamps of the above general character adapted for use in devices where it is desired to effect a very accurate modulation of the output of the photo-electric cell. An example of such a device is the photo-electric phonograph pick-up disclosed in the co-pending application of E. O. Thompson, Serial No. 357,322, filed September 18, 1940, wherein the entire photo-electric translating system is carried by a pick-up head at one end of the tone arm.

Photo-electric pick-up devices of this character comprise a light source, a mechanical system for fluctuating the beam of light from said source in accordance with the recorded sound, and a photo-electric cell which is exposed to the fluctuating light beam and which, under the influence of the light, functions to generate an electrical signal whose waveform corresponds to the fluctuations of the light beam. As disclosed in the said co-pending application, the light impinging on the photo-electric cell may be varied by means of a small mirror arranged for vibration by the stylus in accordance with the undulations of the record grooves. I have discovered that the lamp employed in a device of this character frequently gives rise to microphonic action due to the fact that the filament supporting structure has a natural period of vibration within the audio-frequency range. This action tends to produce undesired modulation of the cell output, and the undesired audio-frequency currents thus produced are amplified and translated into sound.

Generally speaking, there are two types of lamps which may be employed, one employing a common glass press for supporting the filament and the other employing a glass bead spaced from the lamp envelope and attached to the filament support wires. Space limitations in a device of this character require the use of a very small lamp having an envelope diameter in the neighborhood of one-half inch. The small size of the lamp makes it undesirable to employ a lamp of the type utilizing a common glass press for supporting the filament. The heat generated within the confined space of the small envelope has a tendency to crack the press, and, in addition, the cost of this construction is prohibitive in a very small lamp. Accordingly, it has been found desirable to use a lamp of the type having a glass bead as mentioned above. However, in this type of lamp, the mass of the glass bead together with the supporting wires form a vibratory combination which has been found to be resonant within the audio-frequency band, giving rise to pronounced vibration of the filament. Since, as will be seen from the later description, the lamp and cell are preferably so adjusted with respect to the mirror that the beam of light is normally half on and half off the cell, the filament vibration causes an undesirable modulation of the output of the photo-electric cell.

It is the primary object of the present invention to overcome the aforesaid difficulties by the provision, in a lamp of the above type, of a novel filament support which raises the resonant frequency thereof outside of the audio band.

A more specific object of the invention is to provide a novel tripod support for the lamp filament having such stiffness in relation to mass that vibration within the audio-frequency range is substantially prevented.

It is a further object of the invention to provide such a non-microphonic lamp which may be inexpensively manufactured, even in very small sizes.

The manner in which the above objects and advantages are realized will be best understood by reference to the following description taken together with the accompanying drawing, in which:

Fig. 1 is a schematic representation of a phonograph pick-up device and associated amplifier, and shows the lamp of the invention applied thereto;

Fig. 2 is an enlarged cross-sectional view of the lamp; and

Fig. 3 is a perspective view of the filament support structure, taken from a different angle to better illustrate the preferred positioning of the different elements.

Referring more particularly to the drawing, in Fig. 1 the pick-up, generally indicated at **2**, is of the type disclosed in the above-mentioned Thompson application, and comprises an exciter lamp **3**, a vibrating mirror **4**, and a photo-electric cell **5**. Light from the lamp may be directed onto the mirror by means of a suitable lens system **6**, the lenses and lamp being conveniently held in proper alignment by means of a metal cylindrical container **7**. Displacement of the stylus **8** affixed to the mirror by means of crank arm **9**, causes the mirror to be vibrated about the central axis **10** which extends perpendicularly to the plane of the record. The lamp and cell are preferably so adjusted with respect to

the mirror, as pointed out above, that the beam of light is normally half on and half off the cell 5, so that when the pick-up is placed on a recording, the undulations of the record grooves will cause the illuminated area of the cell to vary in accordance with said undulations. The electrical output of the cell may be applied to an audio amplifier 11 and thence to a loud speaker 12. The lamp 3 may be energized from any suitable current source.

A brief consideration of Fig. 1 will serve to clearly indicate how vibrations of the lamp filament may cause distortion of the signal reproduced by the loud speaker. Sound vibrations transmitted from the loud speaker either directly, or through the cabinet structure, normally tend to cause vibration of the lamp filament, ment, which in turn effects a modulation of the light falling on the photocell 5. The resulting signal is amplified and reproduced, and if this occurs in the proper phase, a sustained oscillation or "howl" may result.

Figs. 2 and 3 illustrate the exciter lamp of the present invention, which is particularly adapted to overcome the microphonic problem outlined above.

This non-microphonic lamp comprises a generally pear-shaped envelope 13, fitted into a brass base 14, filled with basing cement 15, and capped with a black-glass insulator 16, which also serves to hold and position the center contact eyelet 17. In assembling the lamp, one of two lead wires 18—18 protrudes through a central aperture formed in the black-glass insulator and into the eyelet 17. Solder is then dropped into the eyelet from outside the lamp, and fixes the lead wire to the eyelet.

The other of the supporting-conducting leads 18 is soldered to the base shell 14, and both leads are introduced through the envelope, as at 19, and extend upwardly through a glass bead 20, to support and supply current to the filament 21. A third wire or rod 22 has its upper end firmly embedded in the bead 20 and extends downwardly through the envelope as at 23 and into the basing cement 15.

As will be apparent from Fig. 3, the legs of this novel tripod construction, i. e., wire 22 and the supporting-conducting leads 18, are preferably disposed about 120° with respect to one another, while the element 22 in addition, is seated in bead 20 at or very near the outer edge thereof. This results in a rigid multi-support filament construction of such stiffness that its natural resonant frequency is well above the audio band.

The resonant frequency of a mechanical structure is expressed by the formula

$$f = \frac{1}{2\pi}\sqrt{\frac{S}{M}}$$

where f is the resonant frequency, S is the stiffness, and M is the mass. It will be seen, therefore, that by increasing the stiffness S, the resonant frequency may be raised. The tripod structure of this invention imparts such stiffness to the filament support, in relation to its mass, that the resonant frequency is outside the audio-frequency range.

Preferably, the element 22 should be formed of wire of about the same size as the wires 18. In any event, these elements should have sufficient rigidity to serve the desired purpose.

From the foregoing description, it will be seen that the invention provides a novel lamp which solves the troublesome problem of microphonics which arises in photo-electric devices of the type described. Moreover, the invention provides a construction which is relatively simple and inexpensive to manufacture.

It will be understood that the invention is not limited to the specific structure illustrated, but is capable of modification within the scope of the appended claims.

I claim:

1. A miniature incandescent lamp having a filament mount comprising a pair of lead wires held in spaced relation by a refractory bead and carrying a filament on their free ends, said lead wires being sealed into and passing through the neck of the bulb, and an anchor wire sealed to said bead at one end and sealed to the bulb neck at its other end substantially at the level of the seals of the leads and spaced therefrom to provide a three-legged support for the mount preventing the setting up of harmful vibrations, the seals of the leads and anchor wire to the bulb neck being spaced apart from each other a distance substantially of the order of the distance from said seals to said refractory bead.

2. An incandescent lamp comprising in combination an envelope, a filament therein, a refractory bead supported by three wires sealed thereto at points out of line with each other to provide a three-legged mount therefor, two of said wires extending beyond said bead and serving as supporting and lead wires for said filament.

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