

April 17, 1962

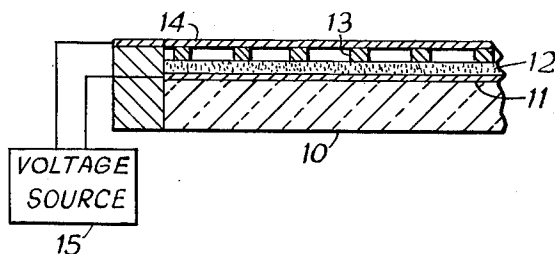
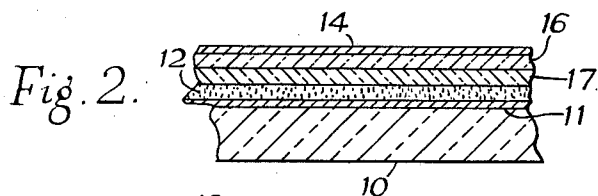
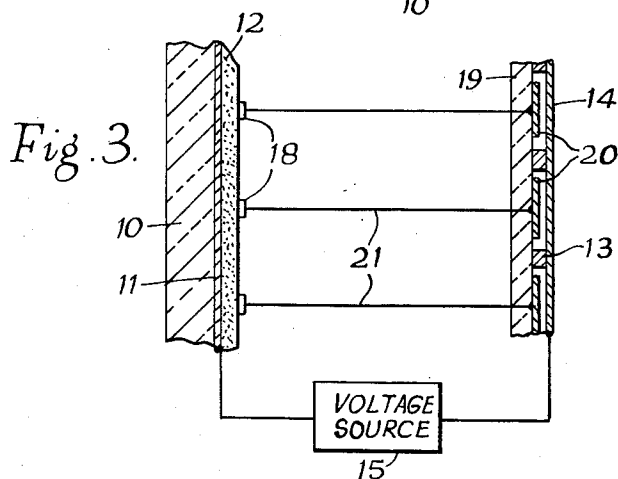
D. H. MASH

3,030,540

CONVERSION OF SONIC INTO LUMINOUS EFFECTS

Filed March 18, 1960

Fig. 1.



INVENTOR

DEREK HUBERT MASH

BY

Edward J. Jahn

ATTORNEY

1

3,030,540

CONVERSION OF SONIC INTO LUMINOUS EFFECTS

Derek Hubert Mash, London, England, assignor to Thorn Electrical Industries Limited, London, England
Filed Mar. 18, 1960, Ser. No. 15,876
2 Claims. (Cl. 313-108)

The present invention relates to the conversion of sonic into luminous effects.

It has been proposed to provide a cathode ray tube with a screen including a quartz plate. The outer surface of the quartz plate can be exposed to sound waves, for instance ultrasonic waves, and the inner surface is scanned by a cathode ray beam. The plate may be cut to resonate at a convenient frequency, such for example as 4 mc./s., and its outer surface may be immersed in water so that it does not vibrate as a whole but is subjected to a pattern of stress corresponding to the pattern of sound waves transmitted thereto through the water. When the inner surface is scanned there are generated voltages representative of the said pattern and these voltages are used to control the intensity of the beam in another cathode ray tube on the fluorescent screen of which a luminous pattern corresponding to the stress pattern is produced.

In this arrangement the size of the quartz plate is limited by the need for sufficient mechanical strength to withstand atmospheric pressure when the cathode ray tube in which it is arranged is evacuated.

The present invention has for one of its objects to provide an improved device for the conversion of sonic into luminous effects which does not suffer from the aforesaid limitation of size of sound-responsive element and which can be of simple construction.

According to the present invention there is provided a device for converting sonic into luminous effects comprising a sound-responsive member having a number of surface elements adapted to be exposed to a sound pattern, each element, when the device is suitably connected to a voltage source, generating a voltage representative of the sound falling thereon, and an electro-luminescent member arranged to have the said voltages applied to elements of its surface in such a manner that there is produced on a viewing surface of the electro-luminescent member a light pattern corresponding to the sound pattern.

The said elements of the surfaces of the sound-responsive and electro-luminescent members may be separate, these surfaces then being discontinuous, or the elements may be parts of continuous surfaces.

The two members may be in juxtaposition or they may be spatially separated.

The invention will be described, by way of example, with reference to the accompanying drawing in which—

FIG. 1 is a diagrammatic view in section of one embodiment,

FIG. 2 is a diagrammatic view in section of part of a modified structure that may be used in the embodiment of FIG. 1, and

FIG. 3 is a diagrammatic view in section of another embodiment.

Referring to FIG. 1, a sheet 10 of glass is provided with an electrically conducting, transparent film 11 over which is a coating 12 of an electro-luminescent phosphor. Over this coating is fixed a piece of silk gauze 13, for example having 5 to 10 strands per centimetre. Over the gauze is stretched tightly a thin aluminium foil sheet 14. The gauze 13 acts as a spacer and divides the surface of the foil 14 effectively into a number of discrete elements.

2

Each element of the aluminium foil constitutes an elemental diaphragm which vibrates, independently of the other elemental diaphragm, under the influence of sound waves impinging upon it. Each elemental diaphragm constitutes with the conducting film 11 on the glass plate a condenser.

In use a direct potential difference of, say, 500 volts may be applied from a source 15 between the aluminium foil 14 and the conducting film 11. No light will be emitted by the electro-luminescent layer 12 excepting in those elemental regions where the diaphragm is set in vibration by sound waves. The light emitted from each elemental region will be dependent upon the sound falling upon the elemental diaphragm of such region. When the electro-luminescent layer 12 is viewed through the glass plate 10 there will be seen a luminous pattern corresponding to the sound pattern upon the aluminium foil 14.

The device may be used to investigate the acoustic properties of a room or hall, the sound pattern being brought to a focus on the aluminium foil by means of sound-lenses or a parabolic sound mirror. The light image then reveals the intensities and directions of echoes. The device may also be used for investigating the sound distribution from loudspeakers or public address systems. Used in conjunction with a source of sound, it may be used for indicating the positions of sound-reflecting bodies in fog or conditions where light sources cannot be used. The device is not limited in its application to sound-waves that can be perceived directly by the human ear; ultra-sonic frequencies may be used of such a wavelength that good resolution of small objects is obtained. With such ultra-sonic waves, the device can be used for fault-finding in materials utilising the anomalous echoes caused by cracks etc., or for medical diagnostic purposes.

The electro-luminescent layer 12 may be formed of an intimate mixture of electroluminescent and dielectric materials and there may be interposed between the electro-luminescent layer 12 and the gauze 13 a further layer comprising a dielectric material of higher dielectric constant than the dielectric material of the electro-luminescent layer as described in the specification of British Patent No. 798,503.

Instead of a direct potential difference the source 15 may provide an alternating potential difference, preferably of a frequency higher than the frequencies of the sound waves to be converted. The electro-luminescent layer 12 then emits light in the absence of sound waves. However, when sound waves impinge on the diaphragm, it will vibrate, giving rise to increases and decreases in the amplitude of the applied alternating potential difference. Owing to the fact that the brightness of the electro-luminescence increases at a rate which is more than linear with increase in voltage, the effect of the impinging sound waves is to increase the brightness of luminescence.

Instead of the aluminium foil 14 there may be used a film of a suitable plastic provided with a conducting surface.

Other means than the silk gauze 13 may be provided to space the diaphragm from the electro-luminescent layer and sub-divide the diaphragm into elements. For instance a layer of small glass beads, known as "ballotini" may be used. The interstices of the gauze or ballotini may be filled with a liquid. Alternatively, as shown in FIG. 2 the gauze may be replaced by a yielding layer 16 permitting independent movements of different parts of the diaphragm 14 without subdividing it physically into separate elements. Such a layer may be formed of soft plastic or a thin film of oil or other liquid. In FIG. 2 there is also shown a further layer 17 such as has already

been referred to composed of a dielectric material. When the electro-luminescent layer 12 is formed of a mixture of electroluminescent and dielectric materials, the dielectric material of the layer 17 preferably has a higher dielectric constant than that of the layer 12.

In the arrangements so far described, vibrations of the diaphragm elements have generated voltage variations by changes in capacitance. This is not essential. For instance changes in electrical resistance may be produced by vibration of the diaphragm by disposing graphite or other partially conducting powder between the conducting material of the diaphragm 14 and the electro-luminescent layer 12. In this case if D.C. is used, it is necessary to provide an electrical leakage path through the electro-luminescent material, for example by incorporating graphite, stannic oxide or other partially conducting material in the electro-luminescent layer.

The sound-responsive member may be constructed as a separate unit from the electroluminescent member, the elements of the two members being connected together by wires.

In one example of such an arrangement shown in FIG. 3 the electroluminescent member is formed of a sheet of glass 10 having a transparent, electrically conducting surface 11 over which is a layer of electroluminescent material 12. Upon the exposed surface of the electroluminescent layer 12 is provided a mosaic of mutually insulated electrically conducting elements 18. The sound-responsive member comprises a suitable base 19 supporting a diaphragm 14 spaced from the base by a gauze 13 or otherwise as hereinbefore described. On the side of the base on which the diaphragm 14 is disposed is provided a mosaic of mutually insulated conducting elements 20 spaced from the diaphragm. When a gauze spacer is used there may be one conducting element in each mesh of the gauze. Each element 20 of the sound-responsive member is connected by a separate wire 21 to the correspondingly located element 18 of the electroluminescent member. A suitable direct or alternating potential difference may be applied from a source 15, as before, between the conducting coating 11 on the glass and the diaphragm 14.

I claim:

1. An electroluminescent device comprising a transparent electrode; an electroluminescent layer, said electrode being in contact with one surface of said layer; a first mosaic in contact with the other surface of said layer, said first mosaic having a plurality of insulatedly separated conductive segments; a second like mosaic, each first mosaic segment being electrically connected to the corresponding second mosaic segment; said first and second mosaics being physically separated from each other; an electrically conductive diaphragm adjacent said second mosaic; and insulating spacer means interposed between said second mosaic and said diaphragm to divide said diaphragm into elemental areas which correspond in number and position to the segments of said second mosaic, each of said areas being adapted to move toward and away from the corresponding segment of said second mosaic upon being irradiated with sonic energy.

2. An electroluminescent device comprising a transparent electrode; an electroluminescent layer, said electrode being in contact with one surface of said layer; a first mosaic in contact with the other surface of said layer, said first mosaic having a plurality of insulatedly separated conductive segments; a second like mosaic, each first mosaic segment being electrically connected to the corresponding second mosaic segment; said first and second mosaics being physically separated from each other; an electrically conductive diaphragm adjacent said second mosaic; insulating spacer means interposed between said second mosaic and said diaphragm to divide said diaphragm into elemental areas which correspond in number and position to the segments of said second mosaic, each of said areas being adapted to move toward and away from the corresponding segment of said second mosaic upon being irradiated with sonic energy; and means to apply a voltage between said electrode and said diaphragm.

References Cited in the file of this patent

UNITED STATES PATENTS

2,855,531	Nicoll	Oct. 7, 1958
2,866,182	Mash	Dec. 23, 1958