

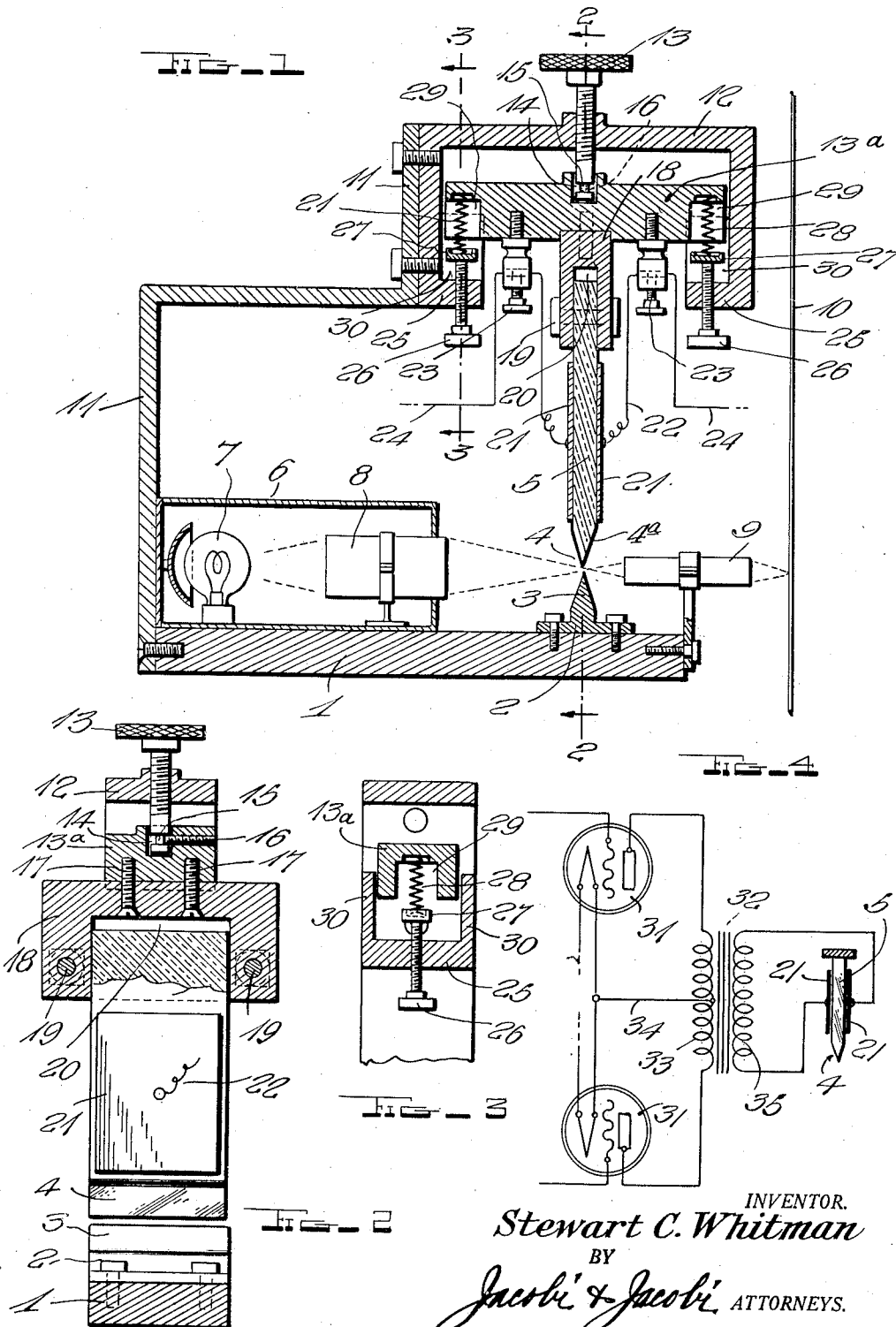
Nov. 3, 1936.

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2,059,504

APPARATUS AND METHOD FOR RECORDING SOUND ON FILMS

Filed Dec. 6, 1932



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UNITED STATES PATENT OFFICE

2,059,504

APPARATUS AND METHOD FOR RECORDING
SOUND ON FILM

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Application December 6, 1932, Serial No. 645,996

13 Claims. (Cl. 88—61)

This invention relates to new and useful improvements in the art of sound recording and more particularly to a photographic light valve to accomplish this result.

5 An object of this invention is to produce a photographic sound-on-film recording device which is free from frequency limitations.

Another object of this invention is to provide a recording device which is free from mechanical failure in the case of overload.

10 A further object of the invention resides in the production of a recording device which may be regulated and operated simply and directly.

Still another object of the invention lies in the production of a recording device of extreme simplicity and economy.

20 With these and numerous other objects in view, my invention consists in the novel features of construction, combination and arrangement of parts as will be hereinafter referred to and more particularly pointed out in the specification and claims.

In the drawing forming a part of this application:

25 Figure 1 is a central vertical longitudinal sectional view of an adaptation of the device;

Figure 2 is a transverse vertical section taken on the line 2—2 of Figure 1, looking in the direction of the arrows;

30 Figure 3 is a similar view as seen on line 3—3 of Figure 1, looking in the direction of the arrows; and

Figure 4 is a schematic diagram showing the relations of the device to associated amplification apparatus.

35 In recording sound on film by mechanical light valve means, it is found that the mechanical inertia present in the various systems prohibits faithful recording over the entire audible range. In addition, great care must be exercised in the supervision, adjustment, and control of such systems due to the extremely small physical tolerances which are allowable and due to the destructive effect of overload. The present invention offers a device which is practically inertialess and which is free from the dangers of overload and the necessity for fine supervision and control.

45 The piezo-electric characteristics of certain crystals, as, for instance, Rochelle salt, are well known. By virtue of this property electrical energy may be converted into mechanical energy, that is, electrification of such a free crystal, causes it to vibrate at a constant frequency depending on its physical and molecular dimensions.

55 The role which this phenomenon plays in moni-

toring the wave lengths of radio broadcast transmitters is well known.

Consider a crystal cut in the form of a rectangular slab having its major faces perpendicular to the electric or "a" axis and its major peripheral edges at a forty-five degree angle to its "b" and "c" axes. If, now, the major faces are coated with an electrically conductive foil and alternating potential applied thereto, the crystal will expand and contract in the directions of the "b" and "c" axes, provided one edge of the crystal slab is rigidly clamped. Furthermore, this extension and compression occurs in perfect synchronism with the applied potential.

15 The present invention utilizes such a crystal as the moving element in a light valve for photographically recording sound on motion picture film.

In the accompanying drawing which is for illustrative purposes only and therefore not drawn to any particular scale, I have shown a base plate designated by the numeral 1, carrying the fixedly mounted element 2 terminating in a beveled knife edge 3, adapted to coact with the knife edge 4, provided at the lower edge 4 of the pulsating crystal 5. I have also shown a chamber 6, containing an appropriate source of light 7 adapted to coact with a condenser 8. The numeral 9 designates the objective, and at 10 I have shown a strip of conventional film, on the sound groove of which the light pulsations are to be impressed. Rising from the base 1 is a standard 11 and bolted to the upper end thereof is the bridge member 12, carrying the manual adjusting screw 13. This manual adjusting screw 13 is adapted to enter the recess 14 in the floating member 13a and is provided with a reduced portion 15 securely held by the screws 16. Screwed to the lower part of the member 13a, as shown at 17, is a block 18 carrying a pair of clamping bolts 19, and provided at its interior with a pocket 20 adapted to receive a crystal 5.

In electrical relation with the faces of the crystal 5 are the electrodes 21, and 22 denotes wires leading to the binding posts 23 from which in turn are taken off the two wires 24, leading to the amplifying means. The lower part of the member 12 is provided with laterally inwardly extending feet 25 carrying the adjusting screws 26 provided at their upper ends with cups 27 adapted to receive spiral springs 28, located within the pockets 29. To appropriately confine the floating member 13a, the inwardly extending ledges or feet 25 are provided with upwardly extending walls 30 confining the movable element

13a. It will thus be seen that I have provided means to securely clamp one edge of the crystal and the operator has at his disposal mechanical means to accurately adjust the widths of the gap formed between the lower edge of the crystal 4 and its stationary coacting member 3.

At 31 I have shown a pair of tubes arranged in push-pull fashion and at 32 I have shown an output transformer, the primary 33 of which is appropriately tapped as at 34. The secondary 35 is connected to the electrodes located on either side of the pulsating crystal. The latter is preferably blackened completely as shown at 4—a so that no light is transmitted through the crystal. This arrangement may also be used in place of the usual reproducing slit by impressing a radio frequency current thereupon and causing the slit to vary from practically zero width to maximum width.

It is understood that other variations in the combination may be employed without departing from the spirit of the invention, and that I do not intend any limitation to my invention except as set forth in the appended claims.

Having thus described the invention, what is claimed is:

1. In an electro-mechanical light shutter, a fixed blade member, a piezo-electric crystal element having a blade portion complementary to and mounted to nearly touch said fixed blade member, said crystal element having two substantially parallel faces pointing in the direction of said blade portion thereof, the end of said crystal element remote from said blade portion being fixedly mounted with reference to said fixed blade member, and a pair of electrodes for respectively applying potential between said parallel faces of said crystal element, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between said fixed end and said blade portion thereof.

2. In an electro-mechanical light shutter, a fixed blade member, a piezo-electric crystal element having a blade portion complementary to and mounted to nearly touch said fixed blade member, said crystal element having two substantially parallel faces pointing in the direction of said blade portion thereof, the end of said crystal element remote from said blade portion being fixedly mounted with reference to said fixed blade member, and a pair of electrodes for respectively applying potential between said parallel faces of said crystal element, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between said fixed end and said blade portion thereof, said blade portion of said crystal element being opaque to light.

3. In an electro-mechanical light shutter, a fixed blade member, a piezo-electric crystal element having a blade portion complementary to and mounted to nearly touch said fixed blade member, said crystal element having two substantially parallel faces pointing in the direction of said blade portion thereof, a pair of electrodes for respectively applying potential between said parallel faces of said crystal element, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between the end of said crystal element remote from said blade portion thereof, and said

blade portion thereof, and means for controlling the position of the end of said crystal element remote from said blade portion thereof with reference to said fixed blade member.

4. In an electro-mechanical light shutter, a fixed blade member, a substantially flat piezo-electric crystal element having flat parallel faces and having one thin end thereof mounted adjacent and complementary to and nearly touching said fixed blade member, the thin end of said crystal element opposite said end adjacent said fixed blade member being mounted in fixed position relative to said fixed blade member, and a pair of electrodes for applying potential between said flat parallel faces of said crystal element, said crystal element being so cut that variations in potential applied between said flat parallel faces cause corresponding variations in the length of said crystal element between said fixed end thereof and the end thereof adjacent said fixed blade member.

5. In an electro-mechanical light shutter, a fixed blade member, a piezo-electric crystal element having two substantially parallel faces, opaque means carried by one end of said crystal element complementary to said fixed blade member for forming with said fixed blade member a variable light shutter, said crystal element being mounted at a point thereof removed from said opaque means fixedly with reference to said fixed blade member, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between said fixed mounting point thereof and the end thereof carrying said opaque means, and means for applying actuating voltage to said parallel faces of said crystal element.

6. In an electro-mechanical light shutter, a fixed blade member, a piezo-electric crystal element having two substantially parallel faces, opaque means carried by one end of said crystal element complementary to said fixed blade member for forming with said fixed blade member a variable light shutter, supporting means attached to a point of said crystal element remote from said opaque means, adjustable means for mounting said supporting means in adjustably fixed relation to said fixed blade member, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between said fixed mounting point thereof and the end thereof carrying said opaque means, and means for applying actuating voltage to said parallel faces of said crystal element.

7. In an electro-mechanical light shutter, a fixed blade member, a piezo-electric crystal element having a mounting portion mounted in fixed relation to said fixed blade member and also having a complementary portion removed from said first mentioned portion and complementary to said fixed blade member for forming therewith a variable light shutter, said crystal element having two substantially parallel faces and being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between said mounting portion thereof and said complementary portion thereof, and a pair of electrodes for applying potential between said parallel faces of said crystal element.

8. In an electromechanical light shutter, a piezoelectric crystal element having a terminal blade portion and two substantially parallel faces

pointing in the direction of said blade portion, the end of said crystal element remote from said blade portion being fixedly mounted, a pair of electrodes for respectively applying potential between said parallel faces of said crystal element, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between said fixed end and said blade portion thereof, and opaque means complementary to said terminal blade portion of said crystal element and adapted to form therewith a slit of variable width.

9. In an electromechanical light shutter, a piezoelectric crystal element having a terminal blade portion and two substantially parallel faces pointing in the direction of said blade portion, a pair of electrodes for respectively applying potential between said parallel faces of said crystal element, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between the end of said crystal element remote from said blade portion thereof, and said blade portion thereof, opaque means complementary to said terminal blade portion of said crystal element and adapted to form therewith a slit of variable width, and means for variably controlling the position of the end of said crystal element remote from said blade portion thereof with reference to said opaque means.

10. In the area modulation of a beam of light from a source employing a piezoelectric crystal element having two flat parallel faces and a fixed terminal portion and carrying opaque means on an opposite free terminal portion and being so cut that voltages applied across said flat faces cause corresponding variations in the length of said crystal element, the method of varying the cross-sectional area of a directly transmitted beam of light in accordance with variations in an electrical voltage which consists in variably obstructing a portion of the cross-sectional area of the path of said beam of light by variably intruding said opaque means carried by said crystal element into the path of said beam a fractional part of the breadth thereof but not entirely through said beam, and piezoelectrically instantaneously varying the portion of said cross-sectional area which is obstructed by applying said varying voltage to said opposite faces of said crystal element, whereby the unobstructed portion of said beam of light is directly transmitted from said source past said opaque means.

11. In the modulation of the intensity of a source beam of light employing a piezoelectric crystal element having two flat parallel faces and a fixed terminal portion and carrying opaque means on an opposite free terminal portion and being so cut that voltages applied across said flat

faces cause corresponding variations in the length of said crystal element, the method of producing a concentrated light source of intensity varying in accordance with an electrical voltage which consists in directing a source beam of light upon said opaque means, variably obstructing a portion of the cross-sectional area of the path of said source beam of light by variably intruding said opaque means carried by said crystal element into the path of said source beam a fractional part of the breadth thereof but not entirely through said source beam, and thereby permitting the unobstructed portion of said source beam of light to be directly transmitted past said opaque means, optically concentrating the unobstructed portion of said source beam of light which is directly transmitted past said opaque means, and piezoelectrically instantaneously varying the portion of said cross-sectional area of said source beam which is obstructed by applying said varying voltage to said opposite faces of said crystal element.

12. In an electromechanical light shutter, a piezoelectric crystal element having a terminal blade portion and two substantially parallel faces pointing in the direction of said terminal portion, the end of said crystal element remote from said terminal portion being fixedly mounted, a first opaque means carried by said terminal portion, a pair of electrodes for respectively applying potential between said parallel faces of said crystal element, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between said fixed end and said terminal portion thereof, and a second opaque means complementary to said first opaque means and adapted to form therewith a slit of variable width.

13. In an electromechanical light shutter, a piezoelectric crystal element having a terminal blade portion and two substantially parallel faces pointing in the direction of said terminal portion, a first opaque means carried by said terminal portion, a pair of electrodes for respectively applying potential between said parallel faces of said crystal element, said crystal element being so cut that variations in potential applied between said parallel faces cause corresponding variations in the length of said crystal element between the end of said crystal element remote from said terminal portion thereof carrying said first opaque means, and said terminal portion thereof, a second opaque means complementary to said first opaque means and adapted to form therewith a slit of variable width, and means for variably controlling the position of the end of said crystal element remote from said blade portion thereof with reference to said second opaque means.

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