Dec. 13, 1932. E. W. GENT 1,890,904

TRANSLATING DEVICE

Filed May 14, 1930 2 Sheets-Sheet 1

Fig. 1.

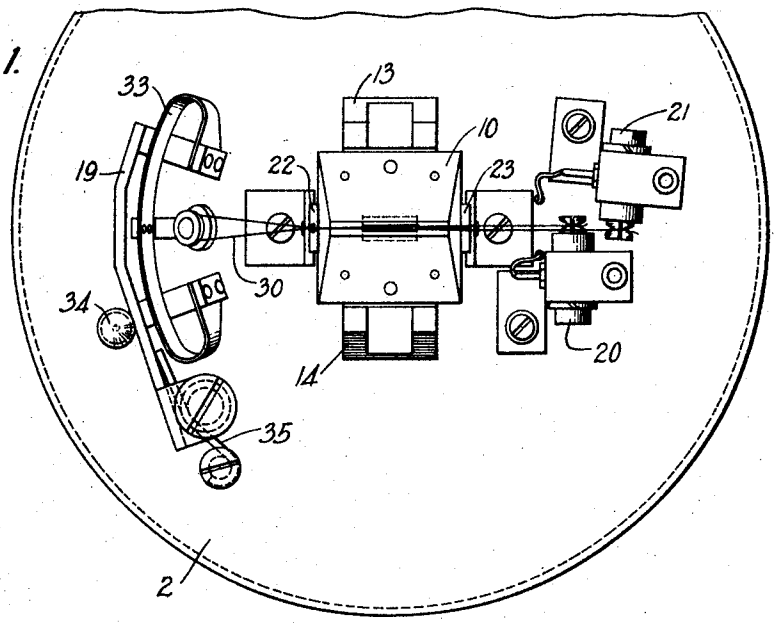

Fig. 2.

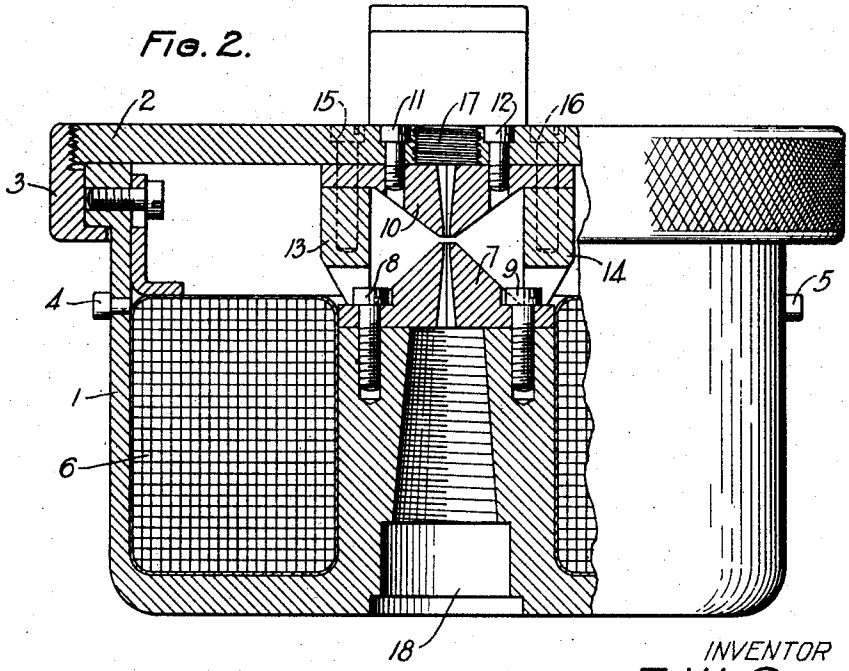

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Fig. 3.

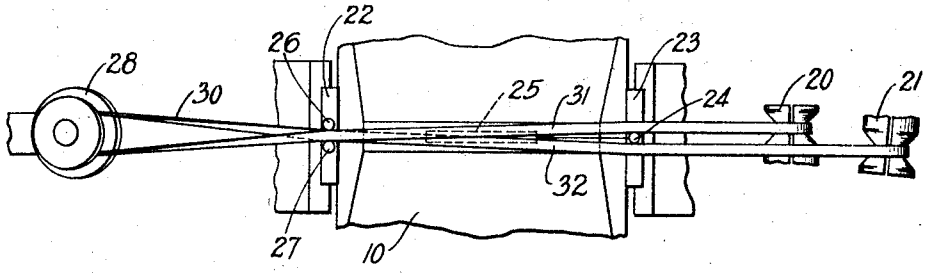


Fig. 4.

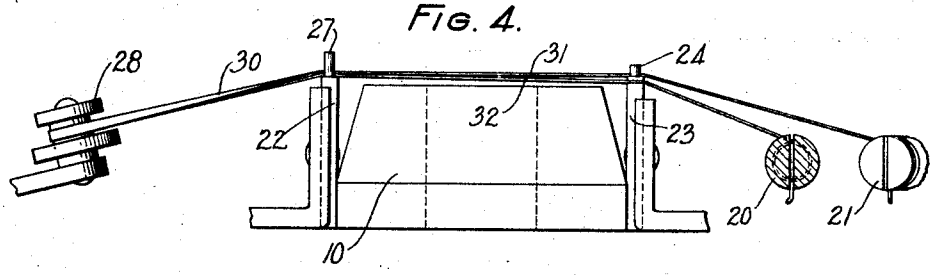


Fig. 6.

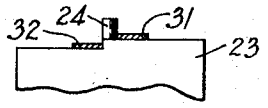


Fig. 7.

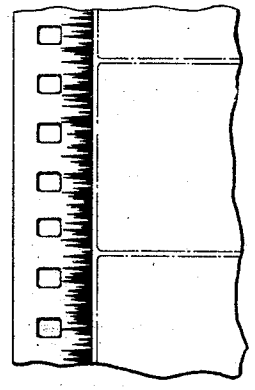
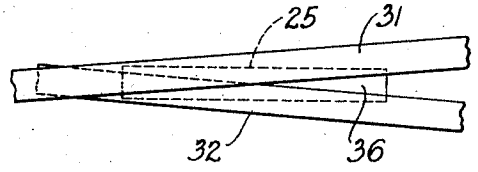


Fig. 5.



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Patented Dec. 13, 1932 1,890,904

UNITED STATES PATENT OFFICE

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TRANSLATING DEVICE

Application filed May 14, 1930. Serial No. 452,165.

This invention relates to translating and recording devices and particularly to light valves such as those employed for recording sound.

The objects of the invention are to simplify the construction of light valves, to obviate the necessity of fine adjustments, to increase their efficiency, and to otherwise improve the construction and operation of devices of this character.

It has been proposed heretofore to construct a light valve by locating two parallel current carrying strings or ribbons in a magnetic field such that the strings vibrate in response to the flow of varying currents therethrough to uncover a light-transmitting aperture or slot to permit the passage of varying amounts of light. To obtain the best results with a valve of this type, it has been the practice to adjust the strings such that their adjacent edges, when at rest, are separated by a definite amount and occupy a definite position with respect to the light-transmitting aperture. These adjustments are accomplished by means of micrometer adjusting devices arranged to move each of the strings separately.

According to the present invention, these fine adjustments are avoided and a simplified construction is secured by means of a device in which the light-controlling strings, preferably in the form of a ribbon filament, instead of being disposed in parallel with each other over the light slot, are so arranged that they cross each other at one suspension point and diverge from each other to form a triangular-shaped opening over a portion of said slot when the strings are at rest, the size and shape of the opening being determined by a separating pin which fixes the position of the ribbon elements at the second point of suspension. The vibration of the ribbon elements varies the size of the opening to produce on a moving photographic film a track which varies both in density and in area. With this construction, manufacturing variations in the width of the ribbon are not material since the size and shape of the opening are determined only by the inside or adjacent edges, and the location of these is determined by the diameter of the separating pin, which may be accurately machined to the desired size.

A feature of the invention is a device of the foregoing character in which the ribbon elements, although in physical contact with each other at their crossing point, are disposed in adjacent planes to prevent them from striking each other when vibrating.

Another feature is a device in which the loop, by means of which the ribbon is secured in place, is electrically short-circuited due to the crossing of the ribbon at the suspension point. This eliminates a substantial part of the total electrical resistance of the ribbon and thereby renders it more efficient.

Referring to the drawings Fig. 1 is a plan view of the interior of the casing cover showing one section of the light transmitting slot, the vibratory ribbon, and the tension and adjusting elements. Fig. 2 is a side elevation partly in section of the assembled light valve, certain parts including the vibratory ribbon being omitted. Fig. 3 is an enlarged view showing the manner in which the vibratory ribbon is mounted with relation to the light-transmitting slot. Fig. 4 is a side view of the parts illustrated in Fig. 3. Fig. 5 is an enlarged detail showing more clearly the arrangement of the ribbon elements with respect to the light-transmitting slot. Fig. 6 is a detail of one of the ribbon-supporting bridges. Fig. 7 is a section of a motion picture film illustrating the manner in which the sound track is recorded thereon by a light valve of the character disclosed herein.

The construction of the light valve herein disclosed and the purposes for which it may be used are in general similar to those described in the application of E. W. Gent and

L. M. Potts Serial No. 336,474, filed January 31, 1929. The principle of operation of light valves of this class is disclosed and described in the patent to E. C. Wente No. 1,638,555, granted August 9, 1927. In these prior devices, the vibratory filament or ribbon is so mounted that the vibrating portions thereof are parallel to each other adjacent to the light-transmitting slot and when at rest are spaced from each other by a definite distance. It has been found that in order to maintain a proper spacing of the ribbon delicate adjusting devices are necessary, and considerable care must be exercised in securing and maintaining the necessary adjustments. As will appear hereinafter, the present device is so constructed as to largely obviate the necessity of these fine adjustments.

Referring particularly to the drawings, the casing 1 shown in Fig. 2 forms a housing for the other parts of the device. The casing cover 2 is removably secured to the casing 1 by means of a knurled ring 3, which is provided with an internal thread to engage a corresponding external thread on the cover 2. When the knurled ring 3 is disengaged from the cover 2 to permit the removal of the cover. the ring encounters the pins 4 and 5 to prevent it from becoming disassociated from the casing 1.

Casing 1 contains a field winding 6 and one of the pole pieces 7. The field winding 6 is energized in any well-known manner by an external source of current. The pole piece 7 is secured to the casing by means of screws 8 and 9. The other pole piece 10 is secured to the cover 2 by means of screws 11 and 12. The spacing between the pole pieces 7 and 10, which are tapered to form small opposing areas, constitutes the air gap within which the vibratory filament is mounted. It is therefore essential to the proper operation of the device that the opposing faces of the pole pieces 7 and 10 be accurately spaced a definite distance apart. This spacing is secured by means of the spacing studs 13 and 14 secured respectively to the casing cover 2 by the screws 15 and 16. The ends of the studs 13 and 14 bear against the flanged portions of the pole piece 7, thus accurately defining the spacing between the pole faces. The light-transmitting aperture is formed by two rectangular slots, one in each of the pole faces 7 and 10 which register accurately with each other when the device is assembled. Light emanating from some suitable source, such as a lamp, enters the valve at the opening 17, passes through the light-transmitting slot in the pole pieces, and emerges through the passage 18.

Referring to Fig. 1, the vibratory filament or ribbon 30 is mounted between the tension bracket 19 and the take-up screws 20 and 21 and is suspended by the insulating bridges 22 and 23. The disposition of the ribbon 30 is more clearly shown in the enlarged views of Figs. 3, 4, 5 and 6. One end of the ribbon is secured to the take-up screw 21 and then passes on the lower side of the spacing pin 24 in the bridge 23. From thence it passes across a portion of the light-transmitting slot 25 and between the locating pins 26 and 27 in the bridge 26, and thence around the tension pulley 28 and returning to cross itself between the locating pins 26 and 27, and thence over the light-transmitting slot 25, on the opposite side of the spacing pin 24, and is finally secured to the second take-up screw 20. The locating pins 26 and 27 may be of any conducting material such as brass since the ribbon is in electrical contact with itself at the bridge 22. The spacing pin 24, however, is of insulating material in order that the two portions of the ribbon shall be electrically separated. When variable currents are applied to the ribbon 30 over a circuit which leads in to one of the take-up screws, such as the screw 20, thence through the ribbon and out through the other take-up screw 21, the portions of the ribbon are caused to vibrate between the bridges 22 and 23. In order that the portions of the ribbon shall not clash with each other during vibration, they are mounted at slightly different levels as is best seen in Figs. 4 and 6. This slight displacement is secured by stepped formation in the bridge 23 whereby the portion 31 on one side of the spacing pin 24 is slightly higher than the portion 32 on the other side of the spacing pin.

The tension pulley 28 is mounted on a spring 33, which in turn is mounted on the tension bracket 19. Normally the bracket 19 is urged against the adjusting screw 34 by means of a stiff spring 35. The screw 34 is accessible from the exterior of the device when assembled and serves to apply more or less tension to the ribbon 30. For a more detailed explanation of this adjusting arrangement, reference is made to the Gent-Potts application above identified.

When the filament is mounted as above described and is at rest, the vibrating portions 31 and 32 thereof form a triangular-shaped aperture 36 adjacent the light-transmitting slot 25. This is best illustrated in the enlarged detail of Fig. 5. Although the triangular-shaped opening 36 may take various positions and sizes according to the disposition of the ribbons, a satisfactory arrangement is one in which the apex of the triangle 36 occurs at about the middle point of the rectangular-shaped slot 25. With this arrangement, that portion of the slot which occurs adjacent to the triangular aperture 36 is uncovered when the ribbons are at rest, whereas the remainder of the slot 25 is covered to prevent the transmission of light. The ribbon is so disposed in the field of the magnet 6 that when current is passed through

said ribbon it vibrates in such a manner that the portions 31 and 32 move away from each other simultaneously during one half of the cycle of vibration and approach each other during the other half cycle of vibration. This means that the triangular-shaped aperture 36 opens and closes by varying amounts corresponding to the variable amplitude of vibration. Thus a variable amount of the light-transmitting slot 25 is uncovered to permit more or less light to pass.

The size, and the position of the apex, of the triangular opening 36 is determined largely by the diameter of the spacing pin 24. The distance between the locating pins 26 and 27 is so selected as to freely receive the widest ribbon which may be expected in view of manufacturing variations. With the ribbon crossing itself between the locating pins 26 and 27 and with the distance between the bridges 22 and 23 determined, the size of the triangular aperture 36 and the position of its apex will depend directly upon the diameter of the spacing pin 24. This pin may be manufactured to accurately give any desired spacing, and, having been made to a given diameter, no further adjustment is needed for the ribbon 30. Although the width of the ribbon may vary somewhat in manufacture, these variations of width are immaterial since the size of the aperture 36 is determined always by the inner edges of the ribbon and these are fixed by the spacing pin 24.

Although the terminal connections have not been shown in detail, it will be understood that the variable current which it is desired to utilize for vibrating the ribbon 30 is conducted in any suitable manner into the device and thence to one of the take-up screws 20, and, after passing through the ribbon, it returns through the other take-up screw 21 to the other side of the circuit. For a more specific explanation of the nature of the input circuit, reference is made to the above-noted Wente patent and to the Gent-Potts application.

Fig. 7 discloses the nature of the track produced by the light valve on a sensitized film. The triangular shaped exposures on the film are seen to have varying altitudes from the base line which, of course, represent varying degrees of opening by the vibrating ribbon portions 31 and 32. With the ribbon at rest, the apex of the triangular exposure on the film may fall at about the middle point of the band. For a full opening, the apex will fall at the extreme left edge of the band; for a full closure, the triangle disappears, and there is no exposure of the film. Since the film is moving at constant velocity and at right angles to the light-transmitting slot 25 during exposure, and since the width of opening past which the film travels is varied by the vibrations of the ribbon, the length of time during which a section of the film is exposed is varied accordingly and the exposed areas will have a variable density; and since the triangular-shaped opening varies in length and width, the exposure will vary also in area. Thus a track is obtained which combines both the variable density and variable area principles.

While this light valve is particularly suited for the recording of sound, it may, of course, also be used for recording pictures, scenes and the like.

What is claimed is:

1. The combination in a translating device of a member having a light-transmitting aperture therein, a magnet, and a filament suspended in the field of said magnet and carrying a modulated current, said filament crossing over itself to form a loop and mounted such that opposite portions thereof diverge from each other to define the opening through said aperture.

2. The combination in a light valve of a member having a light-transmitting slot therein, a magnet, and a filament suspended in the field of said magnet and carrying a modulated current, said filament comprising two vibratory elements crossing over each other and mounted so as to diverge from one another and so as to cooperate with said slot to form a triangular-shaped opening.

3. The combination in a translating device of means for producing a magnetic field, a member having an aperture therein, and a vibratory filament crossing over itself and mounted in such a manner that opposite portions thereof lie in said magnetic field and diverge from each other to limit the opening through said aperture.

4. The combination in a translating device of a member having an aperture therein, two supports, one on either side of said aperture, a magnet, and a filament carrying a modulated current in the field of said magnet, said filament comprising two vibratory elements mounted on said supports in such a way as to cross and diverge from one another to define a triangular opening through said aperture.

5. In a translating device, a member having a light-transmitting slot therein, a magnet, and a filament suspended in the field of said magnet, said filament carrying a modulated current and formed in a loop with its opposite portions crossing in contact with each other to electrically short-circuit said loop and diverging from the point of crossing to form a triangular shaped opening in cooperation with said slot.

6. In a translating device, a member having a light-transmitting slot therein, two supporting bridges, one on either side of said slot, a vibratory filament suspended between said bridges, said filament having its two extending portions crossing in electrical contact with each other at one bridge and diverg-

ing from each other to limit the opening through which light passes to a portion of said light-transmitting slot.

7. In a translating device, an element having an aperture therein, two supporting members, one on either side of said aperture, two locating pins in one of said supporting members, a separating pin in the other of said members, and a filament comprising two vibrating elements crossing each other between said locating pins and separated from each other by said separating pin to limit the passage of light through said aperture.

8. In a translating device, a member having a light-transmitting aperture therein, a vibratory string having two portions which cross over each other and diverge to limit the opening through said aperture, means on one side of said aperture for supporting both strings at the same level, and means on the other side of said aperture for supporting said strings at different levels.

9. The combination in a light valve of a member having a light-transmitting slot therein, a vibratory string having two portions which cross over and diverge from each other to form a triangular-shaped opening in cooperation with said slot, a bridge on one side of said slot for supporting both portions of said string in the same plane at their crossing point, and a second bridge on the other side of said slot for supporting the diverging portions of said string in different planes.

10. The combination in a translating device of an element having an aperture therein, and a filament suspended in a magnetic field, said filament comprising two vibratory portions which cross over and diverge from one another such that the inner edges of said portions form a triangular-shaped opening in cooperation with said aperture.

11. A light valve comprising an element having a light-transmitting slot therein, two locating pins mounted adjacent to each other on one side of said slot, a spacing pin mounted on the opposite side of said slot, and a filament comprising two vibratory portions crossing over each other between said locating pins and separated from each other by said spacing pin in such a manner as to form a triangular-shaped opening in cooperation with said slot.

12. The combination in a light valve of a magnetic member having a light slot therein, two adjustable supports, a spacing pin, two adjacent locating pins, a tension pulley, and a vibratory filament which is mounted to cooperate with said slot by securing it to one of said adjustable supports, passing it on one side of said spacing pin, between said locating pins, around said pulley, thence between said locating pins, on the other side of said spacing pin, and securing it to said other adjustable support.

13. The combination in a recording mechanism of a member having a light-transmitting slot therein, a photographic film movable at right angles to said slot, a filament suspended in a magnetic field and comprising two vibratory portions crossing over each other and diverging from one another to define a triangular-shaped opening at the end of said slot, the vibratory motion of said portions having a component parallel to the direction of motion of said photographic film.

In witness whereof, I hereunto subscribe my name this 12th day of May, 1930.

EDGAR W. GENT.