July 18, 1933. W. HERRIOTT 1,918,267

SOUND RECORDING AND REPRODUCING SYSTEM

Filed April 24, 1931

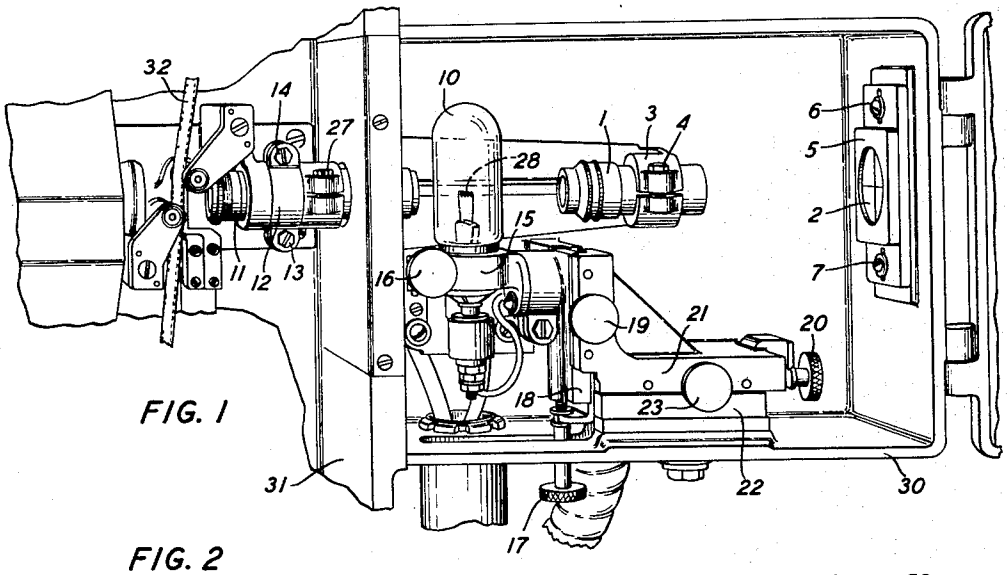


FIG. 1

FIG. 2

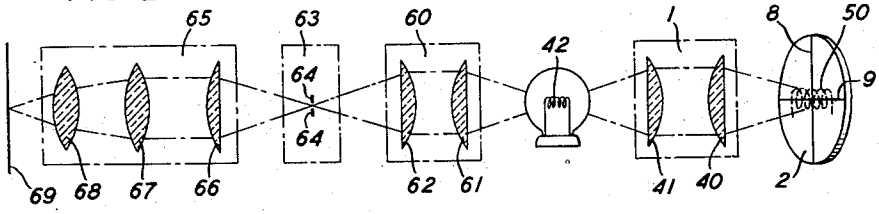
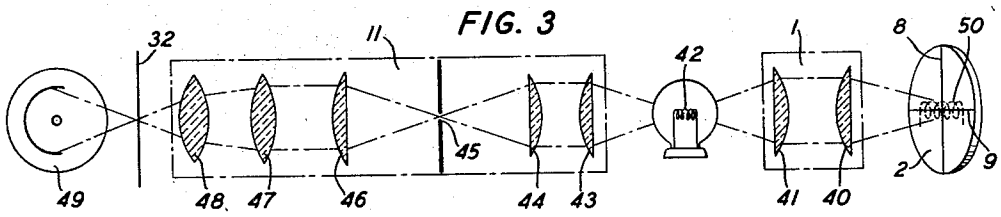


FIG. 3



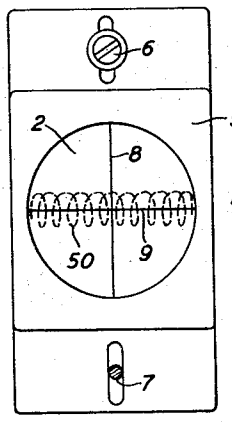
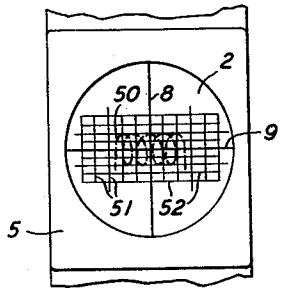


FIG. 4

FIG. 5



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SOUND RECORDING AND REPRODUCING SYSTEM

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This invention relates to sound recording and reproducing apparatus and particularly to the positioning of a lamp filament for the projection of light to the sound record or sound record area of a film.

A machine for recording sound on film provides means for the propulsion of a film at a uniform velocity past an intense and narrow beam of modulated light. In many machines of this character a light source is employed consisting of a ribbon or coil filament lamp. A condensing lens system is used to collect a given amount of light from said source which light is focused upon a particular area of a light valve. An objective lens serves to project a well defined image of the aperture formed by the light valve ribbons upon the sound record area of the film.

A machine for reproducing sound from film provides means for the propulsion of the film at a uniform velocity past an intense narrow beam of light. This beam of light is transmitted to the photoelectric cell after passing through the photographic sound record of the film. In many reproducers of this character a light source is employed consisting of a ribbon or coil filament lamp. A condensing lens system, a mechanical slit and an objective lens is often used to furnish an intense narrow beam of light at the plane of the film. This beam of light serves to scan the modulated sound track. Other reproducers employ only a light source, an objective lens and a slit adjacent to the film.

In either the recording or reproducing machine it is necessary to adjust the lamp filament with considerable precision to obtain the most efficient light for sound translation. A number of different methods of adjusting lamps to position the filament for maximum illumination at a given area have been used. A majority of the methods used at the present time require that portions of the apparatus or the machine be disassembled for this adjustment. This disassembly is repeated upon each replacement of the lamp.

The object of this invention is therefore to provide in a sound recording or reproducing machine, an indicator and cooperative means therefor, to indicate when a lamp filament is accurately positioned to provide maximum light at a given area for most efficiently recording or reproducing sound.

One embodiment of this invention comprises an optical device and screen for depicting the relation of the lamp filament position to the optical axis of a lens system and the axis of an area to be illuminated. This device consists essentially of an objective lens and a disc or screen provided with crossed lines. The objective lens and disc are so located as to produce on the disc or screen an enlarged real image of the lamp filament. The disc or screen may be made of glass and may have two lines engraved or etched upon a finely ground surface. These lines are located at right angles to each other and intersect at the center of the disc. The glass disc may be placed on the side of the lamp opposite to that occupied by the optical system used for projecting light to the film. The cross line disc may be placed any convenient distance from the lamp filament. The objective lens is used for sharply focusing the image of the lamp filament upon the cross line disc. The equivalent focal length of this objective lens may be so chosen that it will project a sharp image of the lamp filament upon the surface of the disc at a convenient magnification, for example, a magnification of 4 to 6 times.

The screen may be variously formed and made of a variety of materials. For the sake of ease and uniformity of description this screen will be hereinafter termed a cross line disc.

It is not essential that the cross line disc and associated objective lens be at the opposite side of the lamp filament from the film. It is apparent that this cross line disc and associated objective lens may be set in position at various angles and still fulfill the requirements set forth herein.

The cross line disc is not used in making the original adjustments. The original adjustments must be made for either the recording or reproducing machines by the methods prescribed for each particular machine. When the lamp filament has thus been positioned for maximum light efficiency the

objective lens, lying between the cross line disc and the lamp filament, is focused by sliding it longitudinally in its holder. This objective lens is moved to a position where an image of the lamp filament is sharply focused upon the ground surface of the cross line disc or screen. The cross line disc may be held in a framework which is arranged for adjustment. This adjustment is made after the image of the lamp filament is sharply focused upon the cross line disc. The adjustment consists in moving the disc to a point where the horizontal line will lie parallel to the length of the filament and precisely midway between the upper and lower edges of this filament. After the objective lens and cross line disc are so adjusted they are permanently sealed or fastened in position.

Some variation exists between different lamps. For this reason when a lamp is replaced the new lamp and its filament must be positioned for the projection of maximum light. After the original adjustments have been made and the optical systems have been fastened in position a lamp may be rapidly and easily replaced without disassembling the machine or the apparatus therein. The new lamp is placed in its holder and adjusted until a sharp image of the filament is projected upon the cross line disc with the filament image precisely bisected by the fixed lines of the disc.

The cross line disc or screen thus acts as an indicator at all times to indicate whether the lamp filament is in proper condition and proper position for producing the most efficient light at a given area for recording or reproducing sounds.

The invention will be better understood from a description of the illustrated embodiment in which:

Fig. 1 illustrates the portion of a reproducing machine which includes the apparatus of the invention;

Fig. 2 illustrates schematically a sound recording optical system with the apparatus of the invention associated therewith;

Fig. 3 shows schematically a sound reproducing optical system with the apparatus of the invention associated therewith; and

Figs. 4 and 5 show the cross line disc in two forms.

In the illustrated embodiment Fig. 1, an objective lens is shown at 1 and the cross line disc at 2 which with its supporting and adjusting members comprise the apparatus of the invention. The reproducing apparatus of Fig. 1 is typical of one sound reproducing machine in general use. A film is shown at 32 having a sound record thereon. An optical unit 11 is mounted in holder 12. This optical unit may comprise the parts shown in Fig. 3 such as condenser lenses 43 and 44, physical slit 45 and objective lenses 46, 47 and 48. Screws 13, 14 and 27 may be manipulated when adjustment of the optical unit 11 is required for focusing the light from the lamp filament 28 upon film 32. Lamp 10 is mounted in holder 15. The lamp is clamped in the holder by adjusting screw 16. The lamp holder 15 is fastened to a movable member 18 which is mounted in the carriage 21. The movable member 18 may be adjusted in a vertical position by the manipulation of screw 17. In this manner the position of the filament 28 of lamp 10 may be placed in the correct horizontal plane with relation to the optical axis of optical unit 11. The lamp may be moved in a horizontal plane by the manipulation of screw 20 which slides the carriage 21 in horizontal directions on its base 22. When the lamp filament has been correctly positioned, the movable member 18 is locked in position by the manipulation of screw 19 and the carriage 21 is locked in position by the manipulation of screw 23.

According to present practices the lamp filament adjustments of reproducing machines are best effected by using a film such as 32 bearing a constant frequency sound record. The filament light is projected through the film sound record to a photoelectric cell and a volume indicator is attached to the output of the photoelectric cell amplifier. The adjustments of the lamp in both the horizontal and vertical directions and the adjustment of the optical unit 11 are made while the volume indicator is constantly observed for maximum reading.

The objective lens 1 may comprise two lenses 40 and 41 as shown in Fig. 3. These lenses are placed in the cylindrical mounting as shown. A bracket for holding the objective lens unit 1 is shown at 3. This bracket is provided with screw 4 which may be loosened for axial movement of optical unit 1. When the filament 28 of lamp 10 has been satisfactorily positioned for projecting light upon the film 12 the objective lens unit 1 is adjusted. Unit 1 is moved until a sharply defined image of the filament 28 is projected upon the cross line disc 2. The objective lens 1 is then fastened in position by the manipulation of screw 4. It is now necessary to adjust the position of the cross line disc. The mounting 5 of the cross line disc may be arranged with closely fitting slots at the points engaged by screws 6 and 7. The cross line disc is now moved vertically until the horizontal line on the disc exactly intersects the sharply defined image of the filament. Screws 6 and 7 are then manipulated to fasten the mounting 5 and consequently the cross line disc 2 permanently in position.

With the foregoing adjustments accomplished the character of the lamp filament may at any time be observed. For the best lighting efficiency the lamp filament cannot deviate very much from its original state. A lamp filament either of the ribbon or coil

type may very often warp or sag. This occurs from various causes. With the ordinary equipment this cannot be readily observed. Inefficient recording or reproduction is ordinarily the first indication to the operator that the lamp filament has deteriorated in some manner.

By the use of this lamp filament indicator, the replacement of a lamp is made comparatively simple. A new lamp may be inserted in the holder 15 and clamped in position with screw 16. Following this the movable member 18 and the carriage 21 may be manipulated until the horizontal line of the cross line disc 2 intersects the image of the filament projected on the cross line disc 2. The movable member 18 and the carriage 21 are then clamped in position and no further adjustments are necessary. The cross line disc indicates that the filament of the new lamp is positioned the same as was the filament of the original lamp. This is all that is required to insure maximum efficiency of lighting.

In the schematic showing of a recording system Fig. 2, the lamp filament is shown in perspective at 42. A condenser lens unit is shown at 60 which comprises lenses 61 and 62. A light valve is shown at 63 with its light valve ribbons 64. This light valve may be of the character disclosed by E. C. Wente in United States Patents 1,686,355 and 1,638,555. An objective lens system is shown at 65 comprising lenses 66, 67 and 68. A film on which the sound is recorded is shown at 69. The lamp and its filament are adjusted in a recording machine in substantially the same manner as hereinbefore described for a reproducing machine. In practice the adjustment of the lamp is usually made with the light valve yoke removed from the light valve modulator unit. The condenser lens unit may be adjusted in a similar manner to that described for the optical unit of the reproducing machine. The adjustment of the lamp requires that the image of its filament formed by the condenser lenses shall completely and uniformly illuminate the narrow aperture formed by the light valve ribbons. The condenser lens unit is adjusted so that the image of the filament is sharply focused upon and symmetrically placed with respect to a small rectangular aperture located in the front face of the perpendicular fixed pole piece of the light valve. A line passed through the center of this pole piece aperture corresponds precisely with a line bisecting the aperture formed by the light valve ribbons. Upon the completion of the adjustment of the lamp filament and the condenser lens unit, the objective lens 1 is adjusted to sharply focus an image of the lamp filament upon the disc 2 as hereinbefore described for the reproducing system. The cross line disc is then adjusted until the horizontal line 9 precisely bisects the filament image as shown at 50.

When the foregoing adjustments, for producing the most efficient light in a particular recording machine, have once been made it is only necessary thereafter to adjust the lamp at such time or the lamp is replaced. The use of the apparatus according to this invention makes it unnecessary to disassemble the light valve or readjust the condenser lens unit after the first adjustment has been made.

The optical system for a reproducing machine shown in Fig. 3 was partly described in connection with the reproducing machine shown in Fig. 1. The optical system, for projecting a light from the lamp filament 42 to the film 32 and photoelectric cell 49, is shown at 11. In this schematic illustration the lamp filament 42 is shown in perspective. The physical slit shown at 45 may be such that a complete image of the lamp filament is not projected to the objective lenses 46, 47 and 48. These objective lenses project a real image of the slit to the film 32 and photoelectric cell 49. A complete image of the lamp filament is however apparent at one side of the slit. Only one type of physical slit is illustrated in Fig. 3. This slit may however in some cases be adjacent to the film. Regardless of the location of this slit it is usually desirable to utilize only a narrow longitudinal section of the filament. This area of the filament offers the maximum brilliancy, with a minimum variation of brilliancy and consequently provides illumination of maximum efficiency.

Figs. 4 and 5 illustrate the cross line disc in two forms. This disc may be made of glass with a finely ground surface and may have only a horizontal and a vertical line etched thereon as shown in Fig. 4. For some forms of light filaments this however may not be sufficient. Occasionally it may therefore be found an advantage to provide a series of finer lines in both horizontal and vertical directions for accurately positioning the filament image on the disc or indicator. This type of disc is shown in Fig. 5.

In some instances it may be desirable to adjust the disc mounting in a horizontal direction in addition to the adjustment shown in the vertical direction. It is within the scope of this invention to provide this form of adjustment for the disc. Other adjustments may also be necessary, as for example, an azimuth adjustment of the horizontal cross line.

The most appropriate and logical position for the screen or cross line disc and associated objective lens is on the side of the lamp filament opposite to the film and optical system ordinarily used in recording and reproducing systems. The disc and its objective lens have been shown in this manner in the illustrated embodiment. The disc and

its objective lens may however be set at any convenient angle from which an image of the lamp filament may be obtained. The arrangement disclosed could be modified to the extent of placing a reflector at any point where an image of the lamp filament exists. A reflected image may then be placed in registry with a reference disc located at a convenient place. It therefore should be considered that many modifications can be made and that the disclosure only illustrates one method of applying the invention to sound recording or reproducing machines.

What is claimed is:

1. In a sound recording or reproducing machine, a lamp having an incandescent filament, means to produce an image of said filament at a particular area, a screen adjustably secured to said machine, means to produce on said screen a reproduction of the filament image as it appears at said area, indicating means on said screen, and means to adjust said screen to a point where said entire filament image is placed in a particular relation to said indicating means.

2. In a sound recording or reproducing machine, a lamp having an incandescent filament, an optical system, means to adjust the position of said lamp to bring its filament into alignment with the optical axis of said optical system, means to adjust said optical system to produce a sharp image of said filament at a particular area, a secondary optical system, a screen with markings thereon, means to adjust said secondary optical system to produce a sharp image of said entire filament on said screen, and means to position said screen to so relate the image and markings thereon as to produce an indicator to indicate the correctly adjusted position of said lamp filament.

3. In a sound recording or reproducing machine, a lamp having an incandescent filament, an optical system, means to adjust the position of said lamp to bring said filament into alignment with the optical axis of said optical system, means to adjust said optical system to produce a sharp image of said filament at a particular area, a secondary optical system, a screen with markings thereon adjustably fixed to said machine, means to adjust said secondary optical system to produce a sharp image of said entire filament on said screen, and means to position said screen to so relate the image and markings thereon as to produce an indicator to indicate the correctly adjusted position of said lamp filament.

4. A sound recording or reproducing machine having a light source and means for focusing said light source on a particular area for sound translation comprising a lamp with an incandescent filament, an optical unit, adjusting means for positioning said lamp filament, and adjusting means for said optical unit for focusing the light from said filament upon said particular area, a second optical unit for said machine adjustably mounted therein approximately in alignment with said first optical unit, a screen with cross-markings thereon adjustably mounted in said machine in alignment with said optical units, means for adjusting and fixing said second optical unit for focusing a sharply defined image of said adjusted lamp filament upon the screen, and means for adjusting and fixing the screen to have the cross-markings intersect the image of the lamp filament to be a permanently fixed indicator of the positional adjustment required for the filament of any lamp placed in said machine so as to be in accord with the adjustment of said first optical unit.

5. A sound recording or reproducing machine having a light source and means for focusing said light source on a particular area for sound translation comprising a lamp with an incandescent filament, an optical unit, adjusting means for positioning said lamp filament and adjusting means for said optical unit for focusing the light from said filament upon said particular area, a second optical unit for said machine adjustably mounted therein approximately in alignment with said first optical unit, a screen with cross-markings thereon adjustably mounted in said machine in alignment with said optical units, means for adjusting and fixing said second optical unit for focusing a sharply defined image of the lamp filament strands upon a screen, and means for adjusting and fixing the screen to have the cross-markings intersect the image of the lamp filament strands as a permanent indicator of the positional relation said filament strands shall bear to said markings for indicating the characters of said filament.

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