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PROVISIONAL SPECIFICATION.

**Improvements in and relating to Sound Recording and  
Reproducing Devices and the like.**

I, EUGENE AUGUSTIN LAUSTE, of 12A, Melbourne Square, Brixton, S.W.,  
Electrical Engineer, do hereby declare the nature of this invention to be as  
follows:—

This invention relates to improvements in recording and reproducing means,  
5 particularly to apparatus of this type in which synchronous movements and  
sounds are recorded and reproduced.

It has been proposed in Patent No. 18,057 A.D. 1906 to record simultaneously  
the movements of persons and objects and the sounds relating to them optically  
upon the same photographic film, the sound records running side by side with,  
10 and at the same rate as, the image record.

I have found that with the rates of image recording commonly in use, a sound  
record, when taken upon the same film and *pari passu* with the image record,  
as indicated in the above patent, will be indistinct and of poor quality owing  
15 to the fact that the successive sound vibrations follow one another with such  
rapidity that they become merged and blurred due to the relatively slow  
passage of the sound recording light over the surface of the film.

The present invention consists in recording simultaneously with and upon a  
cinematographic record of images an optical record of sounds relating to the  
images, the linear rate of recording the sounds being substantially greater than  
20 the rate of recording the images.

The present invention further consists in optically recording sounds upon a  
sensitised surface by means of a beam of light of oblong section, the arrange-  
ment being such that according to the nature of the sounds a greater or less  
portion of the linear image of said beam falls lengthwise upon a cylindrical  
25 lens past which the sensitised substance passes, the remainder of the beam  
image extending beyond the lens.

In carrying my invention into effect the sound-recording device may, accord-  
ing to one modification, be constructed as follows:—

A slot substantially transverse to the length of the film is provided in a film  
30 gate through which the film is led at a uniform speed. Behind this gate, upon  
a disc or band, are mounted a plurality of cylindrical lenses, for instance, three  
lenses. These lenses are adapted to move past the slot with their lengths sub-  
stantially at right angles to the slot. The rate at which the disc or band carry-  
ing the cylindrical lenses is driven is such that light passing through the lenses  
35 and through the slot will be traversed across that portion of the film reserved  
for the sound recording in the space equivalent to one picture as many times  
as there are lenses; that is to say, the sound record will take the form of groups  
of a plurality of lines, for instance, three lines, approximately transverse to

[Price 8d.]



*Improvements in and relating to Sound Recording and Reproducing Devices, &c.*

the length of the film. These three lines will occupy a length of film equal to that occupied by a picture.

In the case when a disc carrying lenses is used, a beam of light of oblong section is directed upon the side of the disc remote from the slot, the beam being adjusted so that if the disc were removed it would completely fill the length of the slot transverse to the film, but would only fill a portion of the width of the slot, for instance, half the width. The beam of light is provided by a lantern having an adjustable aperture, so that the size of the beam may be adjusted. The vibrations of the sound to be recorded are caused by suitable means to produce a corresponding variation in the light and shadow in the slot, which variation is recorded upon the film by the passage of the lenses across the slot. 5 10

It is to be observed that by employing an oblong or substantially oblong section beam of light and reflecting it towards and through a cylindrical or substantially cylindrical lens as above described, an optical record of the sound is obtained which consists not in a single thin line, but in a band of light or shade or light and shade of mutually varying extent. It is important that the line of demarcation between the light and shade is kept as sharp as possible by suitably focussing *etc.* A suitable form of sound reproducer which I prefer to employ is a reversed form of the lens-carrying disc or band recorder above described and is arranged as follows:— 15 20

The film is arranged to pass through a gate having a slot in it. The whole of this slot is illuminated from a suitable source. On the side of the slot remote from the light the disc or band carrying the cylindrical lenses is positioned. The effect of this arrangement is that light from the slot illuminates the sound record on the film. The lenses passing in front of the film pick out each successive sound record formed by the demarcation line of light and shade on the photographic film, and thus transmit more or less light, the variation in the light being caused to reproduce the sound in the usual way, by the use of a selenium cell. 25 30

Dated this 3rd day of May, 1912.

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Agents for the Applicant.

## COMPLETE SPECIFICATION.

**Improvements in and relating to Sound Recording and Reproducing Devices and the like.**

I, EUGENE AUGUSTIN LAUSTE, of 12A, Melbourne Square, Brixton, S.W., Electrical Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:— 40

This invention relates to a method of and apparatus for use in the recording and reproduction of photographic sound records more especially where such records are made in respect of sounds relating to the images or pictures of a cinematograph record and are taken simultaneously therewith and upon the same film, the sound record being made by causing a narrow beam of light to fall upon the film while it is moving uniformly and continuously, and varying the length of the section of the narrow beam of light falling on the film in sympathy with the vibration of the sound to be recorded. 45

Such a method of and apparatus for the production of a combined record 50

*Improvements in and relating to Sound Recording and Reproducing Devices, &c.*

have been described in the Specification of Letters Patent, No. 18,057 of 1906, for which I was an applicant.

It is found, in the production of such combined records, that the usual speed of movement of the film through the cinematographic recorder is not sufficiently  
5 high to secure perfectly clear and accurate records of sounds having a high frequency of vibration. They become indistinct and of poor quality owing to the fact that the successive sound vibrations follow one another with such rapidity that in the record they become merged and blurred owing to the relatively slow passage of the sound-recording light over the surface of the film.  
10 It is of course possible to increase the speed of travel of the film through the cinematograph recorder and to take a larger number of pictures or images per unit of time than is usual but no useful purpose would be served, so far as the cinematographic record is concerned, inasmuch as it would appear that the eye is not capable of appreciating the presentation of more than a certain number  
15 of pictures or images per second, with which the representation of all ordinary movements appears to be perfect.

The invention has for its object to provide means for the production of a clear record of all sounds relating to the pictures or images of a cinematograph record on the same film without an increase in the speed of movement of the  
20 film.

According to the invention the sounds are recorded simultaneously with and upon the same film as the cinematographic record of pictures or images to which they relate at a speed substantially greater than the rate of movement of the film.

25 According to the invention also means are provided by which it is possible to cause the recording beam of light to travel over the film surface at a speed considerably greater than the speed of movement of the film through the cinematograph recorder which speed of movement may be that it is usual to employ.

The means provided according to the invention comprise a plurality of  
30 cylindrical lenses adapted to be moved across the length of the film with their axes parallel thereto, the lenses being masked on the side adjacent the film in such manner as to leave narrow slits parallel with their axes, which are caused, in the movement of the lenses, to travel across the field of a film exposure aperture disposed transversely to the length of the film and upon which the  
35 recording beam of light is directed so as to pass through the lenses and their slits.

The width of the exposure aperture is determined by the number of times it is desired to cause the beam of light to pass across the width of film reserved for the sound record in the space equal to the width of  
40 a picture space, while the length is determined by the width of the said portion of film upon which the sound record is made and determines the distance between the lenses which must be such that the slit of one lens passes from the field of the exposure aperture as the slit of the succeeding lens comes into the field.

45 The beam of light which passes through the lens slits and the exposure aperture for the purpose of making the record is normally reduced to half the effective length of the slit which crosses the field of the exposure aperture by the interposition, in the beam of light, before it reaches the lenses, of a shadow-producing device which may be caused to vibrate in sympathy with the vibra-  
50 tions of sound which are to be recorded and thus varies the length of the section of the beam of light passing through the slits accordingly.

The accompanying drawings illustrate a convenient construction of the moving lens device hereinbefore referred to, suitable for use both in recording and reproducing the cinematographic record of pictures or images and the photo-  
55 graphic record of sounds on the same film.

Fig. 1 is a front elevation of the lens device showing the film gate,

*Improvements in and relating to Sound Recording and Reproducing Devices, &c.*

Fig. 2 is a sectional elevation of the lens device taken on the line A A of Fig. 1,

Fig. 3 is a plan view of the lens device,

Fig. 4 is a rear elevation of the lens device,

Fig. 5 is a rear view of the lens carrier, and

Fig. 6 is a representation of a portion of the film having the combined record upon it, to a smaller scale.

The construction of lens device illustrated in the drawings is adapted to traverse the recording beam of light across the portion of film reserved for the sound record three times in the width of a picture space (Fig. 6) and is provided with six cylindrical lenses.

The device is suitable, however, for use both in the recording of the sounds and in their reproduction from the record.

The film gate is formed, in the usual manner, of two parts *a b* hinged together, provided with a film passage of a width sufficient to receive the greater width of film employed for the combined record.

The part *a* is recessed upon its front face to form a channel for the film, which channel has near its sides two polished rails *a*<sup>1</sup> upon which the film may rest. The exposure aperture *a*<sup>2</sup> is formed to one side of the channel as determined by the position of the sound record on the film. Hinge lugs *a*<sup>3</sup> are provided adjacent one side of the channel to carry the part *b* of the film gate while adjacent the other side, there is a hollow bolt lug *a*<sup>4</sup> to receive the locking bolt. At the rear the part *a* is formed with a circular seating *a*<sup>5</sup> to receive a flange *c*<sup>2</sup> of the lens casing, being suitably shaped on the one side for the purpose of permitting the axis of the lens casing to be brought below the middle of the exposure aperture *a*<sup>2</sup>. Suitable holding plates *a*<sup>6</sup> are provided to retain the flange *c*<sup>2</sup> in position and are mounted by means of screws in the part *a*, engaged by suitable nuts, and washers. The part *a* is also conveniently provided with a rearwardly extending plate *a*<sup>7</sup> by which the device may be mounted in any suitable position.

The part *b* of the film gate is cut away at its edges so that it may fit within the channel of the part *a*, leaving sufficient space for the film to pass freely, and is provided in the rear face near each edge with grooves or slots in which are received polished rails *b*<sup>1</sup> adapted to press the film against the rails *a*<sup>1</sup>, which rails *b*<sup>1</sup> are provided with projections *b*<sup>2</sup> which extend through slots in the part *b* to the front face, and the two rails are connected together by transverse bars *b*<sup>3</sup> secured to the projections *b*<sup>2</sup> and mounted under the action of springs *b*<sup>4</sup> disposed around headed pins secured in the part *b* and tending always to press the rails *b*<sup>1</sup> upon the rails *a*<sup>1</sup>. In a suitable position the part *b* is provided with an aperture *b*<sup>5</sup> to register with the exposure aperture *a*<sup>2</sup>; the aperture *b*<sup>5</sup> is only required, however, when reproducing; when recording, it should be blocked unless other means are adopted to prevent light reaching the film except by way of the lenses *f*. At one edge the part *b* is provided with hinge lugs *b*<sup>6</sup> for its support upon the lugs *a*<sup>3</sup> and at the other edge with a locking bolt *b*<sup>7</sup> for engagement with the hollow lug *a*<sup>4</sup>.

The lens casing is provided as a cup-shaped fitting conveniently formed in two parts *c d* of which the part *c* is of an annular shape and serves to surround the lens carrier while the part *d* forms the rear of the casing, the front of which is formed by the part *a* of the film gate.

The part *c* is provided at the rear with a flange *c*<sup>1</sup> adapted to seat in the part *d* and at diametrically opposite sides with two outwardly extending lugs one of which *c*<sup>3</sup> serves to form part of a hinge between the two parts while the other *c*<sup>4</sup> is adapted to carry a swing loop *c*<sup>5</sup> in which is mounted a thumb screw and lock nut for the locking of the loop over a lug *d*<sup>4</sup> at the corresponding side of the part *d* of the casing. The position of the part *c* of the casing with reference to the part *a* of the film gate is determined by a pin or pins mounted

*Improvements in and relating to Sound Recording and Reproducing Devices, &c.*

in the flange  $e^2$  for engagement in a hole or holes in the seating  $a^5$ . The part  $d$  of the casing is provided with an aperture  $d^1$  suitably disposed to register with the exposure aperture and carries a hood  $d^2$  by which the recording beam of light may be directed upon such aperture. At the one side it is provided with hinge lugs  $d^3$  while at the other side it has the lug  $d^4$  before referred to. At the centre it is thickened or formed with a boss to provide a bearing for the shaft  $e^1$  of the lens carrier.

If desired the casing may be formed in one part merely as a cup shaped fitting adapted to enclose the lens carrier and to be secured to the film gate.

10 The lens carrier is conveniently formed as a cylindrical casting  $e$  bored radially from the periphery at equal intervals to form pockets to receive the cylindrical lenses  $f$ , the front wall of each pocket being thin and having formed in it a narrow slit  $f^1$  while in the rear wall there is a larger slit  $f^2$  of similar shape. The lenses are held in position by a holding ring  $e^2$  fitted upon the periphery of the casting  $e$  and secured thereto by suitable screws or pins. 15 The casting  $e$  is provided with a boss  $e^3$ , by which it may be fitted to the driving shaft  $e^1$  and secured thereon and in the forward face it is recessed to permit the use of an adjustable thrust bearing mounted upon the rear face of the part  $a$  of the film gate. The adjustable centre is conveniently formed by a 20 screwed pin  $g$ , having a hardened conical point, which is mounted in the part  $a$  of the film gate and a boss provided on the rear thereof and is locked in position by suitable lock nuts in such manner as to permit the forward face of the lens carrier to be brought immediately adjacent a machined face at the rear of the part  $a$  of the film gate so that the slits  $f^1$ , in the rotation of the carrier 25 pass immediately at the rear of the exposure aperture  $a^2$ . A fibre washer  $g^1$  may be introduced at the rear of the boss  $e^3$ .

Any suitable means may be provided for the rotation of the shaft  $e^1$ .

It will be also understood that the details of construction hereinbefore described are given merely by way of example and may be varied. For instance, 30 the number of lenses employed may be varied as convenient and according to the particular conditions under which the recording is to be carried out. Further, the lens carrier need not be in the form of a rotatable body. It may, for example, be in the form of an endless flexible member such as a chain or band. Again any construction of film gate fulfilling the particular requirements 35 may be employed. The construction and mounting of the lens carrier also may be varied.

In the use of the device for recording, the beam of light is projected into the hood  $d^1$  and the obturating shield or other device which is caused to vibrate in sympathy with the vibrations of the sound to be recorded is advantageously 40 so positioned that its shadow fills the exposure aperture  $a^2$  for half its width, so that thus the light passing through the slits  $f^1$  normally fills only one half of the length of the slits.

When reproducing, the aperture  $b^5$  being open, light is projected through the aperture  $b^5$  upon the moving film and thence passes through the lenses  $f$  to a 45 selenium cell or the like which serves to vary a current passing to an electromagnetically operated reproducing diaphragm.

I am, of course, aware that it has before been proposed, in recording sound photographically, to utilise a series of lenses upon a rotatable disc for concentrating a beam of light upon a narrow slit in a stationary screen behind which 50 a sensitised surface is caused to travel in a direction transverse to the length of the slit.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

55 1. Recording simultaneously with and upon the same film or surface as a cinematographic record of pictures or images a photographic record of sounds

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*Improvements in and relating to Sound Recording and Reproducing Devices, &c.*

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relating to the said images or pictures at a speed substantially greater than the rate of movement of the film substantially as described.

2. A combined cinematograph record of images and photographic record of sounds relating to the images in which the sound record is made at a speed substantially greater than the speed of movement of the film or surface upon which the combined record is made, substantially as described. 5

3. Means for use in the production of a combined record, as set forth in Claim 2, comprising a plurality of cylindrical lenses adapted to be moved across the film with their axes parallel with its length and masked so as to leave narrow slits or apertures parallel with their axes, an exposure aperture transverse to the length of the film across which the narrow slits or apertures are caused to pass and means for moving the lenses and their masks substantially as described. 10

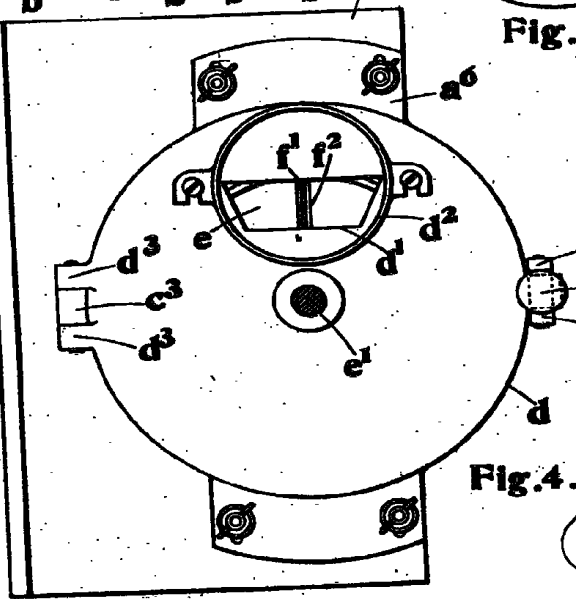
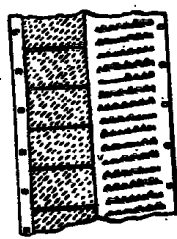
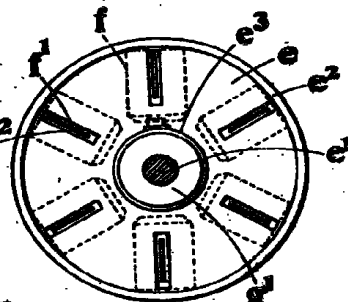
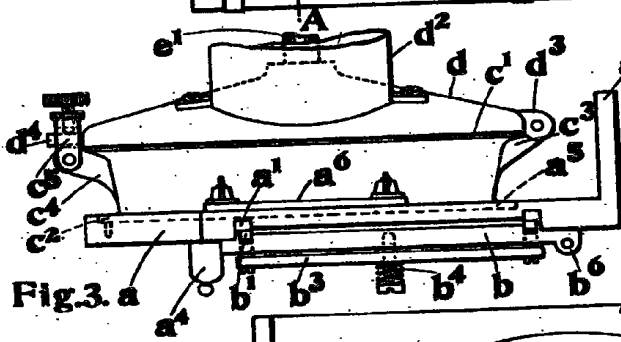
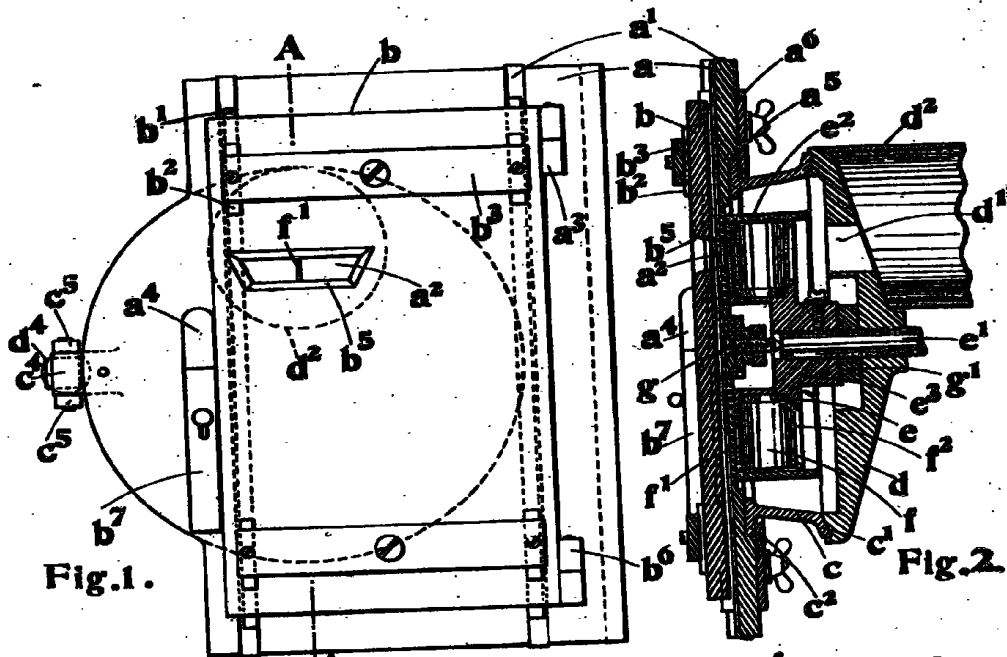
4. Apparatus for use in the recording and reproduction of photographic records of sound substantially as described with reference to and as shown in Figs. 1 to 6 of the accompanying drawings. 15

Dated this 3rd day of May, 1912.

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*[This Drawing is a reproduction of the Original on a reduced scale.]*



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