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PROVISIONAL SPECIFICATION.

“ A New or Improved Method of and Means for Simultaneously Recording and Reproducing Movements and Sounds ”.

We, ROBERT THORN HAINES, Scientific Expert, of 26, Osnanurgh Street, Regents Park, London, JOHN ST. VINCENT PLETTS, Electrical Engineer, of “Ivanhoe”, Clarence Road, Teddington, Middlesex, and EUGENE AUGUSTIN LAUSTE, Electrical Engineer, of 64, Strand, London, do hereby declare the
5 nature of this invention to be as follows:—

This invention relates to a new or improved cinematographic and phonographic method or process and to means for recording and reproducing simultaneously the movements or motions of persons or objects and the sounds produced by them.

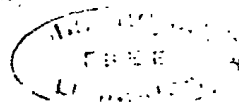
10 The object of the invention is to provide an effective method of, and means for, recording the simultaneous movements or motions of persons or objects and the sounds produced by them, so that the impressions of the movements will be recorded simultaneously with the impression of the sound waves, and will be reproduced simultaneously and in exact synchronism with them,
15 and so that the sound waves will not suffer any variation or modification in the process of recording and reproducing, but when reproduced will be similar in every respect to the original sound waves and will therefore reproduce precisely the same sounds.

20 It is essential to the correct reproduction of the movements of the persons or objects in combination with the sound waves, that the simultaneous movements and sounds should be recorded and reproduced simultaneously in exact synchronism, and that the sound-waves which constitute the sounds should not suffer any variation, alteration, or modification, in the process of recording and reproducing, but should be recorded and reproduced alone and without the
25 introduction or accompaniment of any other sound waves.

It is obvious therefore that no true record or reproduction of the sound waves could be made by any mechanical process or means in which a hard substance necessary to make the impression comes in contact with another hard substance, such for instance as the recording or reproducing pin of the phonograph or
30 gramophone, because the friction caused between the two hard substances itself creates vibration or sound waves which accompany, vary, or modify, the sound waves which it is desired to record and reproduce, and are recorded and reproduced with the latter, proving detrimental to their true reproduction. The record therefore must be taken or produced without any contact between the medium
35 caused to vibrate by the sound waves and the record or recording substance. It is further obvious that if the impressions of the movements and sounds were recorded separately on separate records or recording substance or material, the movements and sounds would be liable to vary in point of time and fail to synchronize with each other. In order to avoid this liability and ensure
40 correct synchronism, the movements and sounds must be recorded simultaneously on the same record or recording substance or material.

The essential feature of our invention is an arrangement of means for obtaining as perfect a reproduction as possible of the movements of the persons or objects and the sounds simultaneously produced by them.

[Price 8d.]



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By our method as hereinafter more particularly described, we transmit the sound waves electrically from the place where the sounds originate to the place where we desire to have them recorded, and we record them photographically in varying degrees as to area, quantity, intensity, and corresponding effect of light and shade, proportioned to their period and amplitude, simultaneously with the recording photographically of the impressions or photographs of the successive movements of the objects, on separate parts, or in separate positions, of one or the same transparent medium or recording substance or material; and when such record is obtained we reproduce it by causing light to pass through that portion of the medium containing the record of the impressions, and so project them on the screen, and simultaneously cause light to pass through that portion of the medium containing the record of the sound-waves, to a cell of selenium or other suitable substance by which the varying degrees of light and shade of the record are converted into corresponding varying electric currents, which are so transmitted to the place where it is desired to reproduce them, and are there converted into vibrations by a suitable vibrating medium which reproduces the sound waves.

For the purpose of carrying out our invention we employ the following essential features in combination, suitably arranged relatively with each other.

1. A receiver or arrangement for collecting or receiving the sound waves to be transmitted.
2. A telephonic or microphonic transmitter to transmit the sound waves in electric circuit with a telephonic or microphonic receiver.
3. A telephonic or microphonic receiver to receive them.
4. A source of light, and a screen operated by the telephonic or microphonic diaphragm so as to vary its intensity or the intensity of the beam of rays emanating from it, or a mirror to alter or vary the direction of the rays of light.
5. A sensitised transparent medium or record for receiving the photographs or impressions of the movements and sounds.
6. A combination of mechanical parts for moving or translating such sensitised transparent medium or record, to serve as a camera.
7. A source of light, and arrangement of mechanical parts for moving or translating such sensitised transparent medium or record, to serve as a projector.
8. A cell of selenium, or other suitable material, connected in proper electric circuit with a receiving or reproducing telephone or microphonic instrument, for transforming the light, varied by the varying light and shade of the record, into corresponding electric currents, and transmitting them to such receiving or reproducing instrument.
9. A telephonic or microphonic receiving and reproducing instrument to receive the electric currents and convert them into vibrations and again into sound waves.
10. A horn, or spreader, or other arrangement for amplifying or increasing the loudness of the sounds.

There are various different forms and methods of using each of these essentials, which may be conveniently employed, and which we may prefer to substitute for and use in combination with any of the other essentials, and we do not therefore confine ourselves to the particular methods or parts described to be used in combination with any of the other essentials.

We will proceed to describe the method or process, and means for carrying it out, together with various alternative means which may be conveniently employed therewith.

The sound waves as well as the motions or movements of the objects which produce them are necessarily at a considerable distance where the record must be taken, and must also be reproduced at a considerable distance from the record; it is therefore essential to provide a means of receiving the sound waves

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and transmitting them to a recording instrument, and a means of transmitting them from the recording instrument and reproducing them at a distant place.

For the purpose of collecting or receiving the sound waves we prefer to use a microphonic receiver such as is at present used for collecting the sound waves at concert or music halls for transmission, or we may use one or more horns or trumpets connected with any ordinary loud sounding telephone or microphone transmitter which receives the sound waves and transmits them to the receiving instrument, or we may prefer to use some other suitable means of collecting the sound waves for transmission.

Whatever form of transmission may be used we connect it in circuit with the receiving instrument, so that the sound waves may be converted into varying electric currents and transmitted from the transmitter to the receiver. These varying electric currents may be made to operate a diaphragm so as to reproduce the sound waves, or may be used to vary the strength of a magnet so as to vary and alter its attractive force.

We provide a suitable source of light or illuminant, and a means of varying its intensity or the intensity of the beam of rays emitted or emanating from it, so that the variations in its intensity or the intensity of the beam of rays, will be exactly proportioned to the variations in the sound waves transmitted by the corresponding electric current.

There are various means of varying the intensity of the source of light or the beam of rays of light, which may be conveniently employed.

We may prefer to use a lamp of great illuminating power having air supplied to it by a pipe which communicates with the diaphragm of the receiving instrument, so that when the diaphragm is caused to vibrate by the electric currents the amplitude and rapidity of the vibrations being proportioned to the sound waves the pulsations of air transmitted to the lamp cause proportional vibrations of the light. A reflector may be used for reflecting or directing the rays of light, and a lens or lenses for concentrating or condensing the light and bringing it to a focus.

We may prefer to vary the beam of rays emanating from the source of light by using a reflecting mirror which is caused to vibrate by the diaphragm or vibrating medium of the receiving instrument and reflects a varying beam of light through a lens or lenses into a dark chamber arranged in a camera; or instead of employing a reflecting surface two gratings may be employed one of which is arranged so as to be operated by the diaphragm or other vibrating medium of the receiving instrument, and so vary the beam of rays of light; allowing it to pass through a lens or lenses into the dark chamber or camera.

Or we may prefer to employ as a means of changing a beam of light or other radiant energy into vibrations corresponding to sound waves sensitive jets of air, gas, water, or other fluid, or we may prefer to use an oscillograph for the purpose, or any other known method of converting variations of current intensity into variations in light intensity, where the quantity or quality of the bundle of rays is controlled according to the variations of the current, may be used.

Whatever particular method or means may be employed by us for varying the light source or the rays of light emanating from it, we direct and control the light so that the variations and its intensity which correspond with the sound waves and the electric currents, will impress themselves photographically upon a sensitised transparent medium so that the impressions so made will proportionately correspond in some particular characteristic or form with the varying intensity of the light, the varying electric currents, and the varying sound waves.

For instance the impressions may be made in varying degrees of opacity and transparency, or light and shade, so as to correspond with the sound waves.

They may take the form of lines or dots of varying widths or sizes or varying distances apart.

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Or they may take the form of a varying spiral or varying wave lines, or of an opaque band varying in width so as to vary the proportion of transparency and opacity,

Or any other form which may be desired.

Within the dark chamber or camera a sensitive photographic film wide 5 enough to receive the photographic impressions or movements of the objects and also the impressions of the sound waves, side by side, is arranged to be translated by any suitable mechanism, such as is usually employed for translating the films in an ordinary cinematographic camera.

This film is operated so that one part is translated continuously past a narrow 10 slot or other suitably shaped opening in the chamber opposite the side where the sound waves are to be recorded, and the other part is translated intermittently past the lens as in an ordinary cinematograph camera.

By this means it will be seen that the record of the sound waves will not be 15 exactly opposite the picture of the simultaneous movement, but at a short distance from it,—although we may prefer to place the record of the movements and sounds in other positions relative to each other.

The sound waves which are electrically transmitted to the receiver cause 20 corresponding variations in the source, or beam of rays, of the light, which is reflected or otherwise allowed to pass through a lens and through the slot or other shaped opening to the film.

The record of the sound waves thus made on the right or left hand side of 25 the film, and the photographic impression of the motions or movements of the objects is photographed or taken simultaneously on the right or left hand side of it, side by side, so that the first of the sound wave impressions will commence at a convenient distance from the first of the impressions of the motions or movements so as to allow a loop to be made in the film in order that one part may be translated continuously and the other part intermittently.

The record thus taken of the sound waves consists of a continuous series of 30 photographic impressions of light and shade, varying in degrees of transparency and opacity corresponding with the variations and the quantity or quality of intensity of the beam of rays of light reflected or allowed to reach the film, or it may consist of, or be made to take, such other form as may be desired.

Instead of using a strip of transparent sensitive film or medium for receiving 35 the record, a sensitive circular plate of transparent material may be employed and caused to rotate by suitable mechanism and to move or change its position so that a fresh surface is presented to the light at each revolution, and the photographic impressions of the sound waves and motions or movements of the objects will be photographed in the desired positions in series on 40 its surface.

Or the record may be made or photographed on an opaque plate having a polished surface and reflected from it, or reflected from it by a polished surface.

We may prefer to use a transparent cylinder or some other form of record.

For the purpose of reproducing the record thus produced we employ an 45 instrument for translating the film similar in every respect to the former instrument described, but not enclosed in a dark box or chamber.

There are various bodies or substances whose electric conductivity is varied 50 by the rays of light which fall upon them from the sun or other sources of light. Certain substances when exposed to light waves or radiations have the property of presenting a decreasing resistance to the passage of an electric current as the intensity of the radiation increases, and other substances have the property of presenting an increasing resistance to the passage of electricity as the intensity of the radiation increases. We may employ any of the sub- 55 stances, of either of these classes, for the purpose of converting the various degrees of light or shade, which correspond with the sound waves, into varying electric currents, and transmitting them for reproduction at the place required.

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Any variation in the quantity or quality of the intensity of the radiant energy falling upon them alters their conductivity or resistance.

We prefer to use selenium prepared in a cell so as to become most sensitive to the light rays, or have its electrical resistance or conductivity altered or
5 varied to the greatest extent by the light falling upon it.

This cell is arranged in circuit with a loud sounding microphone or telephone employing a suitable source of electric current, or it may be arranged in circuit with an electric lamp used in conjunction with a horn or trumpet for amplifying the sounds; or we may prefer to use a diaphragm which will
10 vibrate and effect changes in a gas, oil, or other flame, connected with a horn or trumpet for amplifying the sounds, or we may employ any other suitable means of reproducing the electrical variations produced in the current through the selenium cell.

To reproduce the sound waves and impressions of the motions or movements
15 of the objects, the film or record is placed in proper position in the reproducing instrument with a suitable source of light placed behind it so that the light will project the pictures on the screen and at the same time it or another light is placed so as to pass through the portion of the film containing the record or photographic impressions of the sound waves, and also through a
20 lens if desired which may be interposed between the lens and the selenium cell for concentrating the rays which pass through the film and on to the selenium cell. When the film is translated at the proper speed the pictures will be projected upon the screen by the projecting lens of the instrument, and simultaneously the light passing through the film will be caused to vary in
25 quantity, quality, or intensity, by the varying degrees of opacity and transparency or other forms or conditions of the photographic impressions on the film. Such variations in the quantity and quality of the intensity of light will correspondingly vary the electrical conductivity or resistance in the selenium and transmit the corresponding varying current which will produce
30 corresponding vibrations or variations in the diaphragm or alterations in the flame or gas employed, so producing vibrations which produce the original sounds.

The sounds may be used to cause variations in light and in a cell of selenium or other substance used to transmit the sound waves in electric currents to the
35 receiver.

Any of the means of varying the light source or rays emanating from it as described for the recording purpose, may also be used for varying the light for the purposes of transmission.

It is obvious that any suitable form of cinematograph mechanism may be
40 used for translating the film, and that any desired arrangement of the pictures and record of the sound waves on the film or other medium may be used:

Instead of a microphone, where varying musical or other sounds have to be collected from a stage or the like and transmitted to the camera where they are used to affect the light in the manner described a number of conical or
45 other chambers may be arranged in suitable positions having their outer open ends enclosed by india rubber or other suitable material tubes leading from the smaller ends of the different chambers converging to one larger tube which transmits the vibrations to the gas or other lamp which is affected by their vibrations in the manner required.

50 Dated this 10th day of August, 1906.

EDWARDS AND Co.,
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Agents for the Applicants.

Means for Simultaneously Recording and Reproducing Movements and Sounds.

COMPLETE SPECIFICATION.

“A New or Improved Method of and Means for Simultaneously Recording and Reproducing Movements and Sounds”.

We, ROBERT THORN HAINES, Scientific Expert, of 26, Osnaburgh Street, Regents Park, London; JOHN ST. VINCENT FLETTS, Electrical Engineer, of “Ivanhoe”, Clarence Road, Teddington, Middlesex, and EUGENE AUGUSTIN LAUSTE, Electrical Engineer, of 64, Strand, London, 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 and accompanying drawings:—

This invention relates to a new or improved cinematographic and phonographic method or process and to means for recording and reproducing simultaneously the movements or motions of persons or objects and the sounds produced by them.

Hitherto it has been proposed to simultaneously record and reproduce animated scenes and sounds by means of combining photographic and phonographic apparatus, but without success owing to the difficulty of ensuring perfect synchronism, and the object of the invention is to provide an effective method of, and means for recording the simultaneous movements or motions of persons or objects and the sounds produced by them, so that the impressions of the movements will be recorded simultaneously with the impression of the sound waves, and will be reproduced simultaneously and in exact synchronism with them, and so that the sound waves will not suffer any variation or modification in the process of recording and reproducing, but when reproduced will be similar in every respect to the original sound waves and will therefore reproduce precisely the same sounds.

It is essential to the correct reproduction of the movements of the persons or objects in combination with the sound waves, that the simultaneous movements and sounds should be recorded and reproduced simultaneously in exact synchronism, and that the sound-waves which constitute the sounds should not suffer any variation, alteration, or modification, in the process of recording and reproducing, but should be recorded and reproduced alone and without the introduction or accompaniment of any other sound waves.

It is obvious therefore that no true record or reproduction of the sound waves could be made by any mechanical process or means in which a hard substance necessary to make the impression comes in contact with another hard substance, such for instance as the recording or reproducing pin of the phonograph or gramophone, because the friction caused between the two hard substances itself creates vibration or sound waves which accompany, vary or modify, the sound waves which it is desired to record and reproduce, and are recorded and reproduced with the latter, proving detrimental to their true reproduction. The record therefore must be taken or produced without any contact between the medium caused to vibrate by the sound waves and the record or recording substance. It is further obvious that if the impressions of the movements and sounds were recorded separately on separate records or recording substance or material, the movements and sounds would be liable to vary in point of time and fail to synchronize with each other. In order to avoid this liability and ensure correct synchronism, the movements and sounds must be recorded simultaneously on the same record or recording substance or material.

The essential feature of our invention is an arrangement or means for obtain-

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ing as perfect synchronous reproduction as possible of the movements of the persons or objects as well as the sounds simultaneously produced by them.

By our method as hereinafter more particularly described we transmit the sound waves electrically from the place where the sounds originate to the place
5 where we desire to have them recorded, and we record them photographically in varying degrees as to area, quantity, intensity, and corresponding effect of light and shade proportioned to their period and amplitude, simultaneously with the recording photographically of the impressions or photographs of the successive movements of the objects, on separate parts, or in separate positions,
10 of one or the same transparent medium or recording substance or material: and when such record is obtained we reproduce it by causing light to pass through that portion of the medium containing the record of the impressions, and so project them on the screen, and simultaneously cause light to pass through that portion of the medium containing the record of the sound-waves,
15 to a cell of selenium or other suitable substance by which the varying degrees of light and shade of the record are converted into corresponding varying electric currents, which are so transmitted to the place where it is desired to reproduce them, and are there converted into vibrations by a suitable vibrating medium which reproduces the sound waves.

20 For the purpose of carrying out our invention we employ the following essential features in combination, suitably arranged relatively with each other.

1. A receiver or arrangement for collecting or receiving the sound waves to be transmitted.

25 2. A telephonic or microphonic transmitter to transmit the sound waves in electric circuit with a suitable telephonic receiver.

3. A telephonic receiver to receive them.

4. A source of light and a screen operated by the telephonic diaphragm so as to vary its intensity or the intensity of the beam of rays emanating from it, or
30 a mirror to alter or vary the direction of the rays of light.

5. A sensitised transparent medium or record for receiving the photographs or impressions of the movements and sounds.

6. A combination of mechanical parts for moving or translating such sensitised transparent medium or record, to serve as a camera.

35 7. A source of light, and arrangement of mechanical parts for moving or translating such sensitised transparent medium or record, to serve as a projector.

8. A cell of selenium or other suitable material connected in proper electric circuit with a receiving or reproducing telephone instrument, for transform-
40 ing the light, varied by the varying light and shade of the record, into corresponding electric currents, and transmitting them to such receiving or reproducing instrument.

9. A telephonic receiving and reproducing instrument to receive the electric currents and convert them into vibrations and again into sound waves.

45 10. A horn, or spreader or other arrangement for amplifying or increasing the loudness of the sounds.

There are various different forms and methods of using each of these essentials, which may be conveniently employed, and which we may prefer to substitute for and use in combination with any of the other essentials and we do not
50 therefore confine ourselves to the particular methods or parts described to be used in combination with any of the other essentials.

We will proceed to describe the method or process and means for carrying it out, together with various alternative means which may be conveniently employed therewith.

55 The accompanying drawings are in illustration of our invention, Figure 1 being a sectional elevation shewing an arrangement of apparatus for collect-

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ing or receiving the sound waves to be transmitted and a transmitter to transmit the sound waves in electric circuit with the receiver.

Figures 2, 3, and 4, shew parts of the apparatus on a larger scale and hereinafter more particularly described.

Figure 5 is a part sectional elevation of the reproducing apparatus. 5

The sound waves as well as the motions or movements of the objects which produce them are necessarily at a considerable distance from where the record must be taken, and must also be reproduced at a considerable distance from the record; it is therefore essential to provide a means of receiving the sound waves and transmitting them to a recording instrument, and a means of transmitting them from the recording instrument and reproducing them at a distant place. 10

For the purpose of collecting or receiving the sound waves we prefer to use a microphonic transmitter such as is at present used for collecting the sound waves at concert or music halls for transmission, or we may use one or more horns or trumpets *a* connected with any ordinary loud sounding telephone or microphone transmitter *b* which receives the sound waves and transmits them to the receiving instrument. 15

Whatever form of transmitter may be used we connect it in circuit (*c, d*) with the receiving instrument A. 20

In the drawings we have shewn a magnet B connected with the terminals K, K¹, the varying electric currents from the transmitter *b* operating a diaphragm C¹ having openings D¹ and arranged to more or less uncover openings D in a corresponding fixed diaphragm C. This arrangement is clearly shewn in Figures 3 and 4 in which B is the magnet, D² a spring contact carrying the movable diaphragm C¹ operated by the varying strength of the magnet by the varying currents through the terminals from the conducting wires B¹ B²: F is a light guard through which the light from a light source *j* (Figure 1) is directed. *k* is a reflector contained in a dark chamber *l*. G is a glass or mica screen through which the light passes to the diaphragm. It will be seen that in exactly the same proportion of variation in the attractive force of the magnet due to the variation in the electric currents so the amount and intensity of the light permitted to pass through the vibrating diaphragm will vary. This diaphragm and its openings can be adjusted more or less by the screw E. 25 30 35

There are various means of varying the intensity of the source of light or the beam of rays of light, which may be conveniently employed.

We may prefer to use a lamp of great illuminating power having air supplied to it by a pipe which communicates with the diaphragm of the receiving instrument, so that when the diaphragm is caused to vibrate by the electric currents the amplitude and rapidity of the vibrations being proportioned to the sound waves the pulsations of air transmitted to the lamp cause proportional vibrations of the light. A reflector may be used for reflecting or directing the rays of light, and a lens or lenses for concentrating or condensing the light and bringing it to a focus. 40 45

We may prefer to vary the beam of rays emanating from the source of light by using a reflecting mirror which is caused to vibrate by the diaphragm or vibrating medium of the receiving instrument and reflects a varying beam of light through a lens or lenses into a dark chamber arranged as a camera.

Or we may prefer to employ as a means of changing a beam of light or other radiant energy into vibrations corresponding to sound waves sensitive jets of air, gas, water, or other fluid, or we may prefer to use an oscillograph for the purpose, or any other known method of converting variations of current intensity into variations in light intensity, where the quantity or quality of the bundle of rays is controlled according to the variations of the current, may be used. 50 55

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Whatever particular method or means may be employed by us for varying the light source or the rays of light emanating from it, we direct and control the light so that the variations and its intensity which correspond with the sound waves and the electric currents, will impress themselves photographically upon a sensitised transparent medium so that the impressions so made will proportionately correspond in some particular characteristic or form with the varying intensity of the light, the varying electric currents, and the varying sound waves.

For instance the impressions may be made in varying degrees of opacity and transparency or light and shade, so as to correspond with the sound waves.

They may take the form of lines or dots of varying width or sizes or varying distances apart.

Or they may take the form of a varying spiral or varying wave lines, or of an opaque band varying in width so as to vary the proportion of transparency and opacity, or any other form which may be desired.

Within the dark chamber or camera a sensitive photographic film m (Figure 1) wide enough to receive the photographic impressions of movements of the objects and also the impressions of the sound waves, side by side, is arranged to be translated by any suitable mechanism m^1 such as is usually employed for translating the films in an ordinary cinematographic camera.

This film is operated so that one part is translated continuously past a narrow slot or other suitably shaped opening in the chamber opposite the side where the sound waves are to be recorded, and the other part is translated intermittently past the lens n as in an ordinary cinematograph camera.

By this means it will be seen that the record of the sound waves will not be exactly opposite the picture of the simultaneous movement but at a short distance from it,—although we may prefer to place the record of the movements and sounds in other positions relative to each other.

The record of the sound waves thus made on the right or left hand side of the film, and the photographic impression of the motions or movements of the objects is photographed or taken simultaneously on the right or left hand side of it, side by side, so that the first of the sound wave impressions will commence at a convenient distance from the first of the impressions of the motions or movements so as to allow a loop to be made in the film (as shewn in Figure 1) in order that one part may be translated continuously and the other part intermittently.

In Figure 2 o indicates the sound waves upon the film and o^1 the photographic impressions.

The record thus taken of the sound waves consists of a continuous series of photographic impressions of light and shade varying in degrees of transparency and opacity corresponding with the variations and the quantity or quality of intensity of the beam of rays of light reflected or allowed to reach the film, or it may consist of, or be made to take, such other form as may be desired.

Instead of using a strip of transparent sensitive film or medium for receiving the record, a sensitive circular plate of transparent material may be employed and caused to rotate by suitable mechanism and to move or change its position so that a fresh surface is presented to the light at each revolution, and the photographic impressions of the sound waves and motions or movements of the objects will be photographed in the desired positions in series on its surface. L, L^1 are terminals to which an ordinary telephone attachment is connected so that facility of inspection as to working correctly is ensured.

Or the record may be made or photographed on an opaque plate having a polished surface and reflected from it, or reflected from it by a polished surface.

We may prefer to use a transparent cylinder or some other form of record.

For the purpose of reproducing the record thus produced we employ an

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instrument for translating the film similar in every respect to the former instrument described, but not enclosed in a dark box or chamber.

There are various bodies or substances whose electric conductivity is varied by the rays of light which fall upon them from the sun or other sources of light. Certain substances when exposed to light waves or radiations have the property of presenting a decreasing resistance to the passage of an electric current as the intensity of the radiation increases, and other substances have the property of presenting an increasing resistance to the passage of electricity as the intensity of the radiation increases. We may employ any of the substances of either of these classes, for the purpose of converting the various degrees of light or shade, which correspond with the sound waves, into varying electric currents, and transmitting them for reproduction at the place required.

Any variation in the quantity or quality of the intensity of the radiant energy falling upon them alters their conductivity or resistance.

We prefer to use selenium prepared in a cell so as to become most sensitive to the light rays, or have its electrical resistance or conductivity altered or varied to the greatest extent by the light falling upon it.

This cell is arranged in circuit with a loud sounding microphone or telephone H (Figure 5) having a suitable source of electric current M, and fitted with a horn or trumpet for amplifying the sounds. Or we may prefer to use a diaphragm which will vibrate and effect changes in a gas, oil, or other flame, connected with a horn or trumpet for amplifying the sounds, or we may employ any other suitable means of reproducing the electrical variations produced in the current through the selenium cell.

To reproduce the sound waves and impressions of the motions or movements of the objects, the film *m* or record is placed in proper position in the reproducing instrument with a suitable source of light *p* placed behind it so that the light will project the pictures on the screen and at the same time another light *p*¹ is placed so as to pass through the portion of the film containing the record or photographic impressions of the sound waves, and also through a lens *q* if desired, which may be interposed between the light and the selenium cell *r* for concentrating the rays which pass through the film and on to the selenium cell. *s* is a heat absorber placed between the selenium cell and the film. When the film is translated at the proper speed the pictures will be projected upon the screen by the projecting lens *t* of the instrument, and simultaneously the light passing through the film will be caused to vary in quantity, quality, or intensity, by the varying degrees of opacity and transparency or other forms or conditions of the photographic impressions on the film. Such variations in the quantity and quality of the intensity of light will correspondingly vary the electrical conductivity or resistance in the selenium and transmit the corresponding varying current through the terminals *u*, *u*¹ which will produce corresponding vibrations or variations in the microphone H so producing vibrations which produce the original sounds.

The sounds may be used to cause variations in light and in a cell of selenium or other substance used to transmit the sound waves in electric currents to the receiver.

Any of the means of varying the light source or rays emanating from it as described for the recording purpose, may also be used for varying the light for the purposes of reproduction.

It is obvious that any suitable form of cinematograph mechanism may be used for translating the film, and that any desired arrangement of the pictures and record of the sound waves on the film or other medium may be used.

Instead of a microphone, where varying musical or other sounds have to be collected from a stage or the like and transmitted to the camera where they

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are used to effect the light in the manner described a number of conical or other chambers may be arranged in suitable positions having their outer open ends closed by india rubber or other suitable vibrating material and having tubes leading from the smaller ends of the different chambers converging to one larger tube which transmits the vibrations to the gas or other lamp which is affected by their vibrations in the manner required.

We are aware that it is not broadly new in apparatus for recording and reproducing the sounds produced by the human voice or otherwise to employ a beam of light directed through a vibrating opaque screen containing a number of narrow slits and arranged parallel with a similarly slotted fixed screen on to a sensitive film mounted upon a transparent medium such as glass or a travelling sensitive strip for photographically recording such sounds. These photographic impressions being subsequently developed and fixed are reproduced by directing a strong beam of light so as to follow the direction of the photographic record and thence penetrate a receiver of selenium or other substance having the property of varying its conductivity of electricity in proportion to the degree of light to which it is exposed. Also that it has been proposed to arrange such receiver in circuit with a constant source of electricity as well as one or more telephone receivers.

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

1. A new or improved method of and means for recording and reproducing simultaneously the movements as well as the sounds produced by existing things or objects, the cinematographic and phonographic operations being synchronously performed, substantially as described.

2. Apparatus for simultaneously recording photographically the movements and sounds produced by existing things or objects, optically reproducing the movements and simultaneously photo-electrically transmitting and reproducing the sounds, substantially as described.

3. In an apparatus of the kind claimed in Claim 2, the employment of selenium or other equivalent substance whose electric conductivity is varied by the intensity of light, substantially as and for the purpose described.

4. In apparatus of the kind claimed in Claim 2, means for varying a source of light substantially as and for the purpose described.

5. In combination in apparatus of the kind hereinbefore referred to, a collector and transmitter for the sounds produced by existing things or objects, means for electrically varying or controlling a source of light, a recording medium, means for translating the recording medium so that it receives photographic impressions of the movements and sounds to be reproduced, means for illuminating and projecting said impressions of movements, means for illuminating the photographic impressions of sounds and converting them into corresponding electric waves, and means for transmitting and reproducing said waves, all arranged and adapted to operate substantially as described.

6. In combination in apparatus of the kind hereinbefore referred to, a receiver of sounds, a transmitter for the collected sounds, an electro-magnet arranged in circuit with said transmitter and adapted to operate a slotted screen or mirror so as to vary light rays, a translatable film for collaterally receiving and recording simultaneous movements and sounds, a projector for photographic movement impressions, a source of light and a condenser for condensing its rays, a cell of selenium for converting light rays into electric waves, and a telephonic reproducer for said electric waves, substantially as described and shewn by the accompanying drawings.

7. In apparatus of the kind claimed above, a slotted screen comprising fixed and movable diaphragms having inter-registering openings therein in combina-

Means for Simultaneously Recording and Reproducing Movements and Sounds.

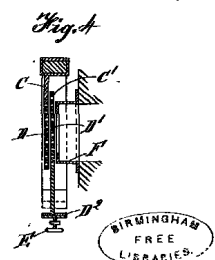
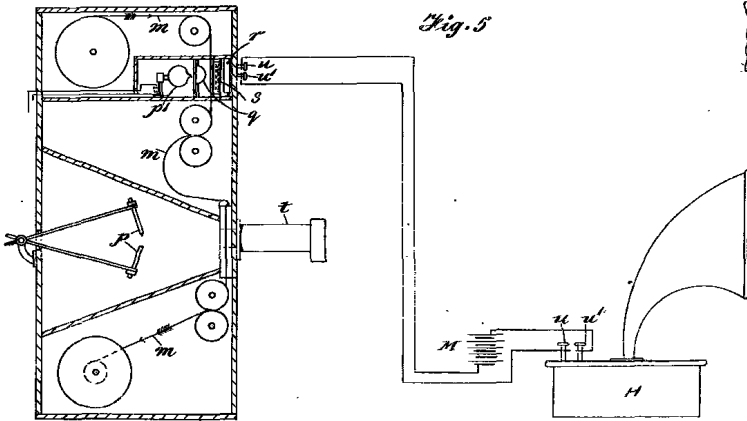
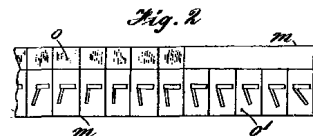
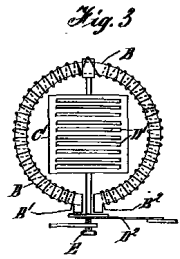
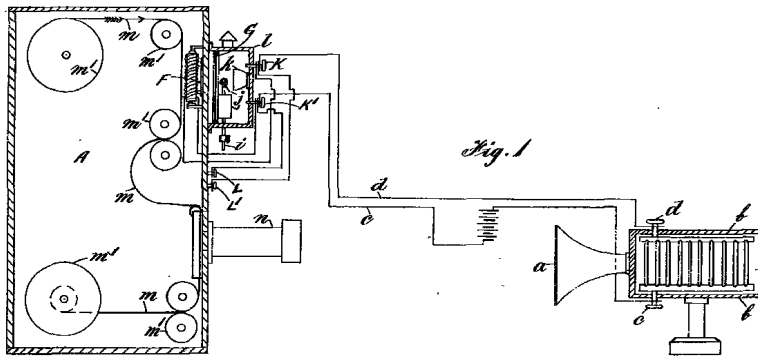
tion with an electro-magnet adapted to operate the movable diaphragm, substantially as described in reference to Figures 3 and 4 of the accompanying drawings.

Dated this 11th day of February, 1907.

EDWARDS AND Co.,
Chartered Patent Agents,
Chancery Lane Station Chambers, London.
Agents for the Applicants.

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



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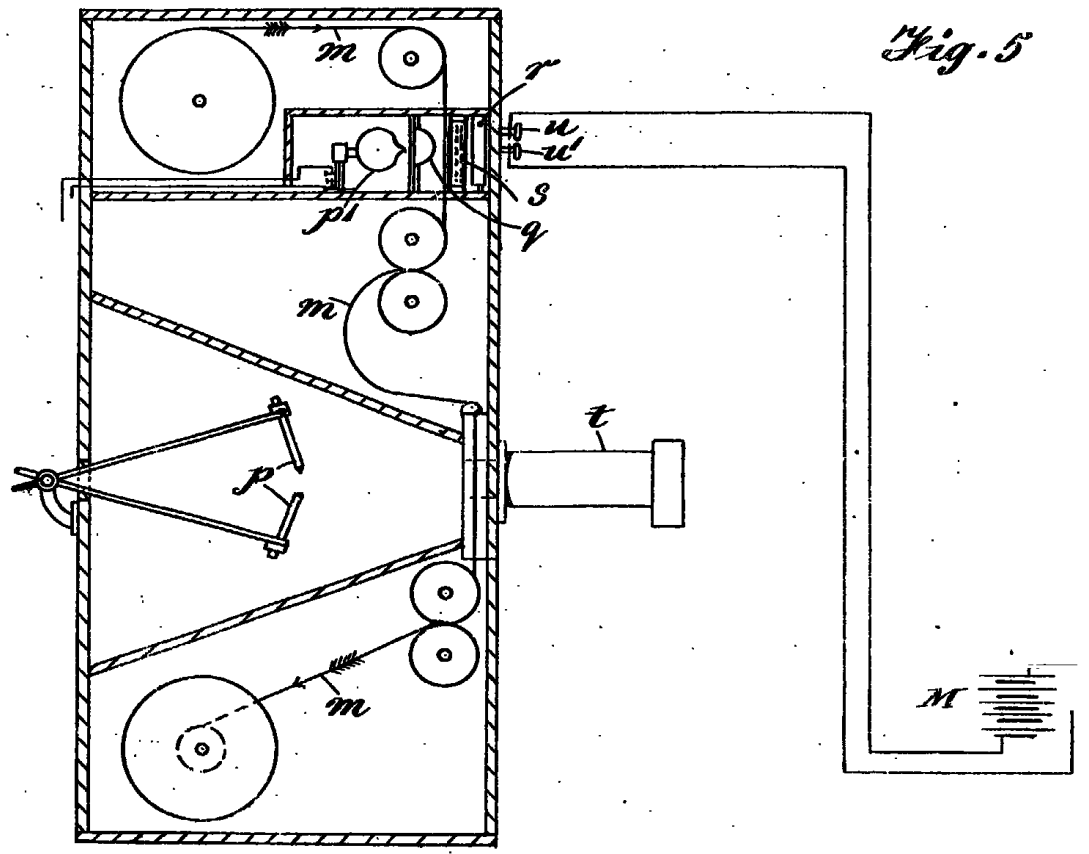
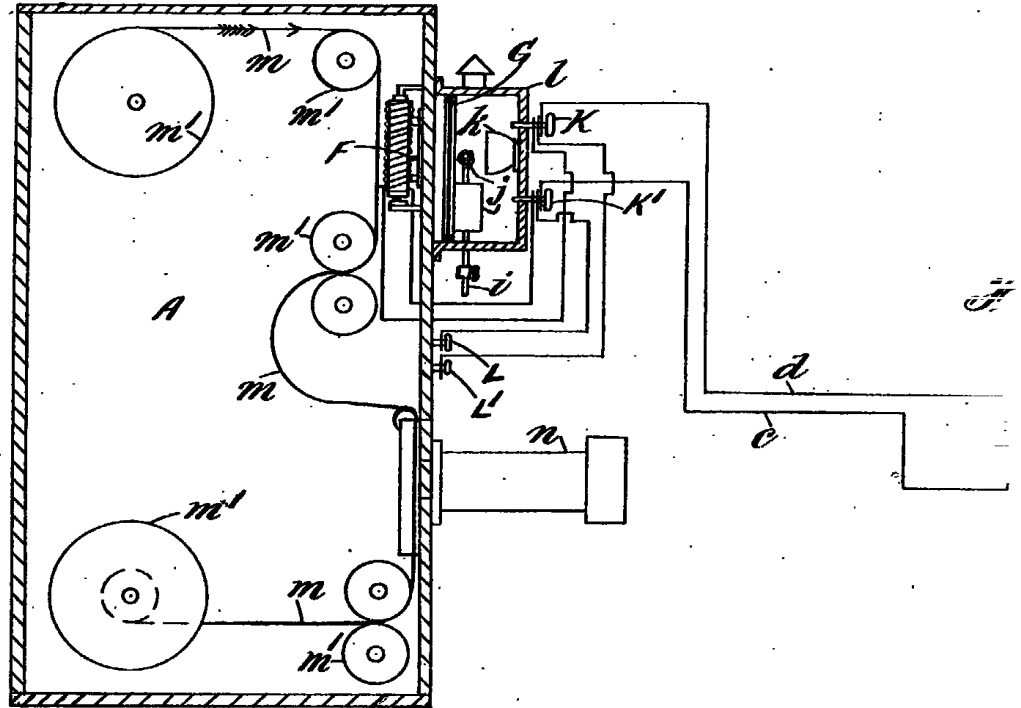


Fig. 5

Fig. 1

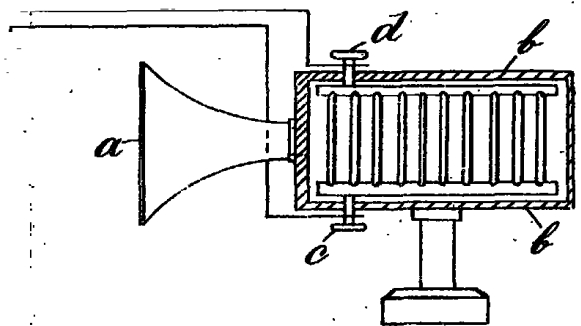


Fig. 3

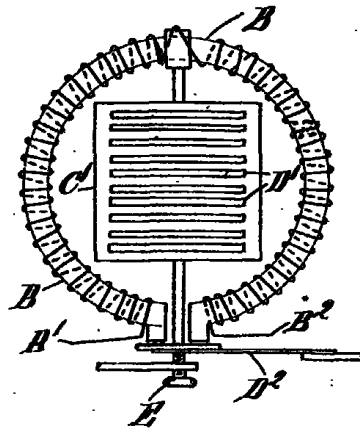


Fig. 2

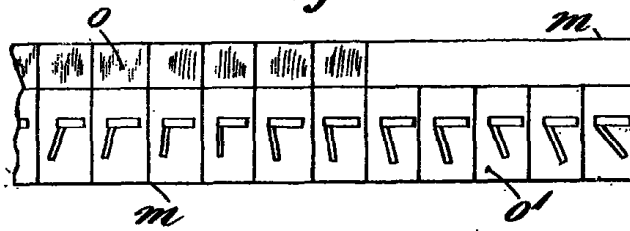
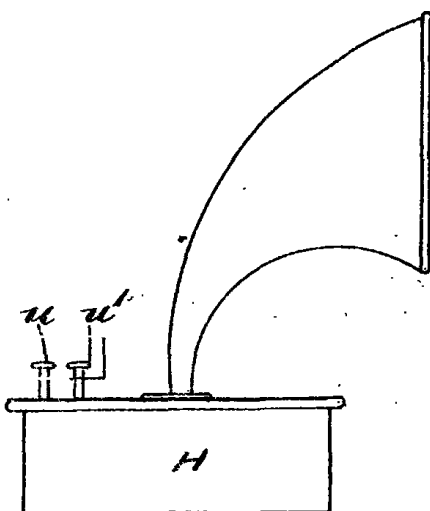
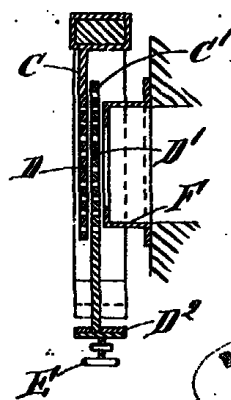


Fig. 4



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