

(No Model.)

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2 Sheets—Sheet 1.

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PHANTOSCOPE.

No. 586,953.

Patented July 20, 1897.

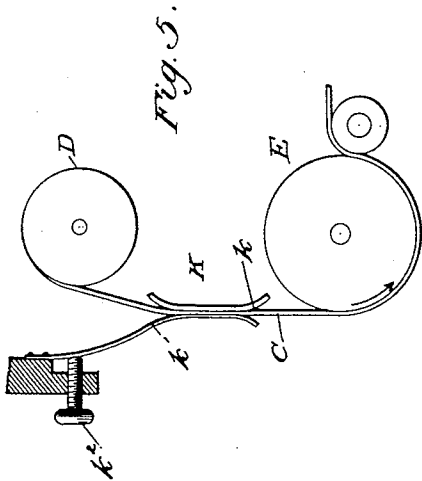


Fig. 5.

Fig. 1.

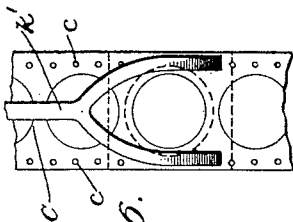
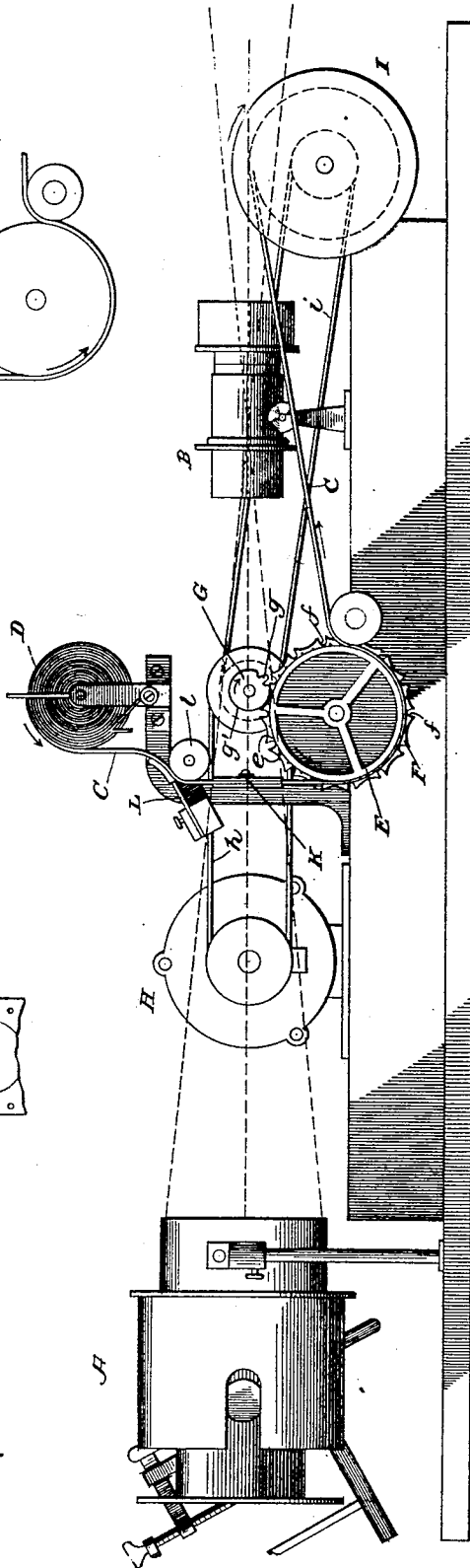


Fig. 6.



Witnesses.
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Fig. 2.

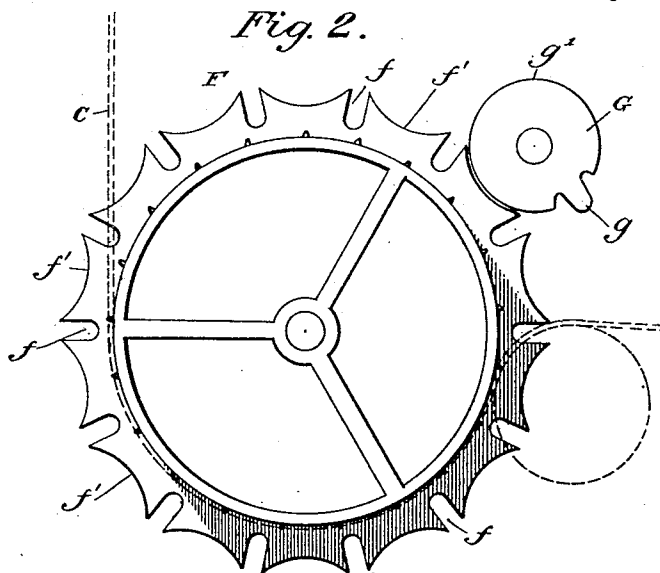


Fig. 3.

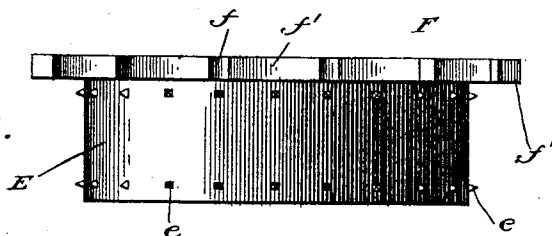
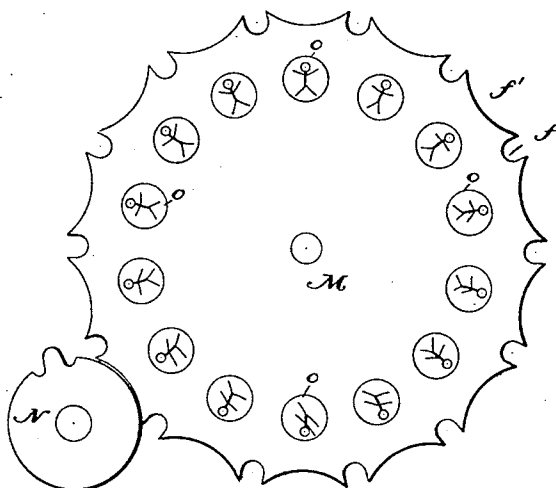


Fig. 4.



Witnesses.

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UNITED STATES PATENT OFFICE.

CHARLES FRANCIS JENKINS, OF RICHMOND, INDIANA, AND THOMAS ARMAT,
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PHANTOSCOPE.

SPECIFICATION forming part of Letters Patent No. 586,953, dated July 20, 1897.

Application filed August 28, 1895. Serial No. 560,793. (No model.)

To all whom it may concern:

Be it known that we, CHARLES FRANCIS JENKINS, residing at Richmond, in the county of Wayne and State of Indiana, and THOMAS ARMAT, residing at Washington, District of Columbia, citizens of the United States, have invented certain new and useful Improvements in Phantoscopes; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to apparatus for exhibiting pictures so as to produce the appearance of objects in motion; and the primary object of the invention is to provide efficient means whereby a series of photographic or other pictures, showing successively the different positions or attitudes assumed by a person or object in motion, may be displayed in such manner as to reproduce to the eye the appearance of the moving object through all the phases of such movement with a life-like and unblurred effect.

A further object is to provide means for effecting the displacement of a picture and the substitution of another in its stead in an interval of time less than the interval of illumination and exposure of the picture, so as to cause the interval of illumination to predominate and render the act or effect of a change imperceptible to the eye.

Another object is to provide means for accomplishing the results stated without using a shutter or equivalent device, such as has heretofore been necessary in apparatuses of a similar character, so as to utilize continuously and to the best advantage the light afforded by the illuminator and to avoid casting shadows or cloud effects produced by the passage of the shutter across the light.

The invention will first be hereinafter more particularly described with reference to the accompanying drawings, forming a part of this specification, and then pointed out in the claims at the end of the description.

In the drawings, Figure 1 represents a side elevation of an apparatus or combination of devices which may be employed in practicing the invention. Fig. 2 is a detail side view, on

a slightly-enlarged scale, of the drum and mutilated gearing for intermittingly moving the tape-like film or other surface carrying the pictures to be exhibited. Fig. 3 is a plan view of the drum and larger mutilated gear shown in Fig. 2. Fig. 4 represents in side elevation a modified form of a device embodying the invention; and Figs. 5 and 6 represent, respectively, a detail side view and a rear view of a tension device for yieldingly holding the film or picture-carrying surface.

In devices or apparatuses such as have heretofore been devised for exhibiting life-like pictures or producing the appearance of motion it has been considered most feasible to keep the series of similar pictures (whether on a disk, tape, or other surface) constantly moving at a regulated speed, corresponding with the speed at which the pictures were taken, and by means of a shutter or light-obstructing surface to alternately cover and expose the pictures successively in a manner quite similar to the method of exposing the sensitive film or substance in taking the photographs, so as to bring the opening through the shutter centrally over a picture at intervals practically equal to the intervals between exposure in taking the pictures, so that each picture may be seen only when it is in such a position that it will be exactly superposed upon the image not yet (owing to the persistence of vision) faded from the eye. The openings in such shutters, which are ordinarily in the form of revolving disks having openings near their circumferences, usually cover but a fractional part of the circumference of the disk, so that a view of the picture is afforded through an interval of time much less than the period of interruption, and as the illuminated pictures and the cloud effect or darkness of interruption caused by the passage of the shutter across the light are blended or mixed together in the eye of the observer the darkness continues to impress upon the retina so much longer than the light that the value of the illumination is very greatly diminished and the picture appears to be poorly lighted or blurred.

In the case of our invention the conditions are quite different and the results produced

are therefore more satisfactory than and superior to anything of the kind heretofore obtained, for the reason that the picture is held a much longer time than is required to remove it and substitute another in its stead, thus prolonging the period of illumination very greatly as compared with the period of interruption or change, and there is no obstruction of the light by the interposition of a shutter or opaque substance across its path, so that the impression of the picture on the eye is so much longer and permanent than the distortion or shadow effect incident to its movement, and the interval of change or interruption is so infinitesimal that the image of the picture is readily retained until displacement and substitution takes effect, and owing to the inability of the eye to receive an impression from every phase of motion the interruption or change is wholly imperceptible, and the result is a most vivid appearance of an object in motion, otherwise unchanging, clearly exhibiting all the phases of such motion with life-like effect.

In the arrangement illustrated in Fig. 1 of the drawings, A may denote an illuminator consisting, preferably, of an electric light and a condensing lens, whereby the rays of light are concentrated upon a picture located in the focus of an objective lens B.

C denotes a film or strip composed of any suitable transparent or translucent flexible substance adapted to provide a surface for carrying pictures produced thereon by photographic or other means, the several pictures in the series representing, successively, different positions of a moving object, so that the exhibition of the entire series of pictures in the order in which they were made or taken may result in the reproduction of the appearance of the moving object in every phase of its motion. This film may be wound or coiled upon a reel or spool D, from which one of its ends may pass over the surface of a drum E, said spool and drum being suitably journaled in standards or supports to permit the film to be wound upon one as it is unwound from the other and so arranged that as the film is moved the pictures thereon will be brought successively into the focus of the object-lens.

Our invention depends for its successful operation both upon the inability of the eye to receive impression of movement exceeding a certain rapidity and upon that faculty of the eye which enables it to retain an impression after the source of light has vanished—the persistence of vision—which enables us to change the pictures, one for another, imperceptibly. This we accomplish by moving the film or other picture-carrying surface intermittently in such manner that the interval of exposure and illumination of the picture shall exceed the interval of time required to effect a change sufficiently to enable the eye to form a perfect impression or image at each exposure and to retain it through the interval of motion or change and until another pic-

ture has been superimposed, as it were, upon the one displaced, thus rendering the act or effect of displacement and substitution of pictures wholly imperceptible and giving the impression to the eye of objects in motion.

Various contrivances and forms of mechanisms may be employed for effecting the intermittent movement, the requirement being that the film or other surface shall be moved quickly between successive pauses far enough to expose the next succeeding picture in the series. In the apparatus shown in Figs. 1 and 2 we have affixed to one side of the drum E a peripherally notched or toothed gear-wheel F, which is driven by a smaller gear wheel or disk G, having a single tooth *g*, which is adapted to engage one of the notches *f* in the wheel F at every revolution and move the latter a part of a revolution proportional to the relative diameters of the two gears, such part revolutions of the gear E being adapted to bring the several pictures successively into the focus of the object-lens. The periphery of the wheel F between each pair of notches *f* is formed with a concave or semi-circular depression *f'*, which is adapted to form a seat for the toothless peripheral portion *g'* of the gear G, whereby when the tooth *g* has escaped from a notch the larger gear may be locked and held in a stationary position by said toothless portion of the gear G, engaging and moving in sliding contact with one of the depressions *f'* until the smaller gear has made a complete revolution, whereupon the operation of moving the larger gear a part revolution and again locking it coincidentally with the exposure of the picture on the picture-carrying surface will again be repeated, and so on indefinitely.

Any suitable motor may be employed for imparting motion to the driving-gear G. The letter H in Fig. 1 denotes a motor for this purpose connected by a belt *h* with the shaft of the gear G. If desired, a reel, as at I, may receive the film or tape C as it is paid out by the drum E and may be rotated by the motor H by means of a belt *i*, connecting the shaft of the reel with the driving-shaft of the gear G, or in any suitable manner. Every time the gear F is moved a part revolution the film C should be moved just far enough to displace the exposed picture and substitute another in its stead, and it is also desirable that the film should be held quite taut in passing behind the lenses and maintained against flexure or bending at the point of exposure of the picture, and to this end it is preferably provided with a series of perforations along its edges, as at *c c*, to engage teats or pins *e e* on the drum E to prevent slipping, and is yieldingly clasped by a tension device K, between the members of which it passes on its way from the spool D to the drum E, said tension device being suitably supported and in such position as to adapt it to prevent flexure of the film at the point of exposure of the picture and to aid in keeping the film taut.

This tension device may consist of a fixed member or plate k , Fig. 5, placed in front of the film, and a forked member k' , Figs. 5 and 6, of spring metal bearing on the opposite side of the film, so as to hold it with a yielding pressure against the plate, the latter having an opening therethrough arranged opposite the fork of the spring k' , which straddles the picture-surface, so that the view of the picture may be unobstructed. By means of a set-screw k^2 , bearing upon the shank of the spring k' , the pressure of the latter upon the film may be varied at will. This tension device may be used either with or without a film-tightener L , Fig. 1, located nearer the reel D , though either or both of these devices may be dispensed with in some cases. The tightener L consists simply of a spring fixed at one end and having its free end padded and arranged to press the film yieldingly against a roller I , journaled below the spool D .

In the modification shown in Fig. 4 a series of similar pictures are arranged in a circle upon the upper surface of a circular plate or disk M , the periphery of which is formed with alternate notches and semicircular depressions the same as the gear-wheel F in the other figures, and adapted to be driven in the same manner by a smaller gear N , the pictures thereon being viewed through a magnifying-glass, which may be held in the hand. This picture-carrying surface or disk may be arranged to rotate in a horizontal plane or otherwise. In the horizontal position the pictures upon the plate are illuminated by light from above in case the plate is opaque, or from beneath if it be transparent. In the latter case the plate A may be made to revolve with its axis parallel with the axis of the object-lens of a microscope or an ordinary projecting lantern with the pictures in the focus of the objective, so that the pictures may be projected upon a screen the same as ordinary transparencies are, except that the picture upon the screen will possess the same life-like effect which is observed through the magnifying-glass when the latter is used. This plate may take the place of an ordinary lantern-slide of a magic lantern, the lantern being otherwise the same as ordinarily used.

The series of pictures in the form shown in Fig. 4 are arranged in a circle, as at oo , near the periphery of the disk, but various modifications of this arrangement will readily suggest themselves to those skilled in the art, such as a spiral or serpentine arrangement, which will permit a larger number of pictures to be arranged spirally on the surface of the revolving disk.

It will be understood, of course, that the results hereinbefore described may be produced by other means than intermittent gearing, and we do not desire to be limited to the use of intermittent gearing, as other means may be employed for causing the light on the screen to exceed in duration the interval of change—that is, the time required to effect

the removal of one picture and the substitution of another in its stead, which is essential to success.

We do not claim novelty in the pictures, but we are not aware that prior to our invention any instrument or apparatus has been devised by which life-like pictures may be given a very long illumination compared with the time necessary for effecting a change, and the fact that no feasible method has heretofore been devised to accomplish this result accounts for the very poor results so far attained in lantern-work.

From the foregoing description it will be seen that the pictures are brought successively into an illuminated field and that each picture is illuminated without interruption from the instant it enters such field until displaced by the next picture in the series, and that the several pictures in the series are successively substituted one for another with such rapidity that, although the exposed portion of the film or picture-carrying surface is continuously illuminated, the eye receives an impression of the picture which so greatly predominates any possible impression that might be made by the practically instantaneous motion of said film or surface, in substituting picture for picture, that the predominating impression which the eye receives, owing to its inability to receive two impressions at one and the same time, and to the persistence of vision, has the effect of rendering the movement of the film utterly imperceptible, while the successive impressions of different pictures are each retained until another picture in the series is superimposed, as it were, upon the previous impression or picture, thus rendering it possible to produce most vivid and life-like effects without any interruption whatever in the illumination, whether the film is moving or stationary, and without interposing a shutter and thereby causing a shadow or shade effect which reduces the vividness of the impression; but we do not desire to be confined to the use of the invention without a shutter, inasmuch as such a device might be used under some circumstances—as, for instance, when constructed so as to interrupt the illumination only at that instant of time when the film is moving and without rendering the interruption perceptible to the eye—but for all practical purposes a shutter of any kind is useless and objectionable and is preferably dispensed with.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. An apparatus for exhibiting pictures so as to give the impression to the eye of objects in motion, comprising a picture-carrying surface, means for supporting said surface and permitting it to be moved so as to cause the pictures or objects thereon to be successively exposed for the required interval of time in an illuminated field, and mechan-

ism adapted to intermittently quickly move said surface at short intervals for exposing or exhibiting the pictures in the order of their succession, and for holding the surface stationary during the interval of illumination of each picture, the interval of illumination of the picture being made to exceed the interval of motion or change, substantially as described.

2. The combination, in an apparatus for exhibiting pictures so as to give the impression to the eye of objects in motion, of a movable picture-carrying surface and means for intermittently moving said surface at short intervals exceeding the interval required in effecting the movement, so that the interval of pause and illumination shall exceed the interval of motion, substantially as described.

3. The combination, in picture-exhibiting apparatus for giving the impression to the eye of objects in motion, of a picture-carrying surface, means for supporting the same and means for feeding such surface intermittently in such manner that the interval of illumination of the picture shall predominate the interval of motion, substantially as described.

4. The combination, in picture-exhibiting apparatus for giving the impression to the eye of objects in motion, of a picture-carrying surface, means for supporting and intermittently quickly moving the same, and means for illuminating the pictures successively between the intervals of motion in such manner that the interval of pause and illumination of the picture shall predominate the interval of movement, substantially as described.

5. In a picture-exhibiting apparatus for giving the impression to the eye of objects in motion, the combination with a transparent picture-carrying surface, of means for intermittently moving the same step by step so as to present to view the pictures thereon in the order of their succession; the interval of time between the exhibition of successive pictures being instantaneous while the period of illumination is comparatively greatly prolonged, substantially as described.

6. In picture-exhibiting apparatus for giving the impression to the eye of objects in motion, the combination with a picture-carrying surface, of mechanism for intermittently moving said surface at short intervals so as to expose the pictures thereon successively in an illuminated field for an interval of time exceeding the interval of motion, comprising a peripherally-notched disk or wheel having semicircular or concave depressions between said notches, and a smaller gear having substantially a toothless periphery except at one point where a tooth is provided to engage the notches of the disk or wheel, so as to impart an intermittent step-by-step movement to the picture-carrying surface, and to hold the same immovable during the intervals of pause, substantially as described.

7. In picture-exhibiting apparatus for giving the impression to the eye of objects in

motion, the combination with the picture-carrying film and means for intermittently moving said film so as to expose the pictures thereon successively in an illuminated field for an interval of time exceeding the interval of motion, of the tension device comprising two members between which the film is adapted to pass, one member being adapted to yieldingly press the film toward the other so that it is held taut and prevented from flexing or puckering at the point of exposure of the picture, substantially as described.

8. In a picture-exhibiting apparatus for giving the impression to the eye of objects in motion, the combination with an illuminator and a projecting lens, of a transparent picture-carrying surface arranged in the focus of the objective of the projecting lens, means for intermittently moving the said surface in such manner that the interval of illumination shall exceed the interval of change, and a tension device adapted to keep the picture taut and prevent flexing or puckering at the point of exposure, substantially as described.

9. An apparatus for exhibiting pictures so as to give the impression to the eye of objects in motion, comprising a picture-carrying film or surface adapted to be given an intermittent step-by-step movement for bringing the pictures or objects thereon successively into position for exposure in an illuminated field, means for illuminating pictures or objects exposed in said field, and mechanism for quickly moving said surface at intervals so as to successively expose the pictures or objects thereon, the exposed picture or object being uninterruptedly illuminated during the period of exposure, the construction being such that the impression made by the illuminated picture while stationary so greatly predominates any impression liable to be caused by the motion of the film as to render the latter imperceptible to the eye, owing to the persistence of vision, substantially as described.

10. An apparatus for exhibiting pictures, comprising a movable picture-carrying surface or film adapted to be given an intermittent step-by-step movement, so as to bring a series of pictures or objects thereon successively into an illuminated field, means for illuminating the picture or object exposed in said field, and mechanism for intermittently moving said surface so as to quickly substitute one picture for another without interrupting the illumination; the construction being such that the motion of the film is rendered imperceptible to the eye by the predominating impression of the picture and the persistence of vision, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

CHAS. FRANCIS JENKINS.

THOS. ARMAT.

Witnesses:

J. A. E. CRISWELL,

WM. B. CROWELL.