

No. 1946.

f 274

To the Committee on Science and the Arts of the Franklin Inst.

The sub-committee investigating the  
merits of Jenkins' "Phantoscope",  
begs to submit the following REPORT:-

(amended report)

*H. R. Heigl*  
*Geo. A. Hoadley*  
*Jno. Carbutt*

Hall of the Franklin Institute,

Philadelphia, May 31st, 1897.

No. 1946.

The FRANKLIN INSTITUTE of the State of Pennsylvania, for the Promotion of the Mechanic Arts, acting through its Committee on Science and the Arts, investigating the merits of Jenkins' Phantoscope, reports as follows:-

The subject of this report is the "Phantoscope", a perfected apparatus for projecting upon a screen a series of photographs of moving objects taken in such rapid succession that when reproduced upon the screen, the scenes and movements are in effect realistic. This device is the invention of Mr. C. Francis Jenkins, to whom Letters-patent Nos. 536,569, 560,800, and 586,593, have been granted, copies of which, and a full description of the method of preparing the picture ribbons, are hereto annexed, and referred to for more minute details of construction and operation than are herein given.

The earliest efforts in this direction, so far as we can discover, were all within a period of the last thirty years; but little of practical value could result until flexible films were invented, by the use of which, consecutive photographs of indefinite number could be taken, and reproduced as positives on like films, which could be automatically passed between the lenses of a projecting lantern.

In August 1869, a U. S. Patent was granted to O. B. Brown, for a device to be used in connection with a "magic lantern", for the purpose of exhibiting pictures of images in motion, in which he employed a form of slide holder, in which was mounted a revolving transparent disc, upon which the pictures were fixed,

which disc received its motion by connection with a gear wheel having intermittent motion. A shaft having at one end a pinion meshing with the intermittent gear, and at the other a disc having two openings through which the light rays from the lantern would pass as this disc revolved. This apparatus was turned by hand, the effect being, to expose one portion after the other and project the same upon the screen for an instant, while the light rays passed through the opening of the revolving shutter; and, while the light was cut off, a new picture was placed in position through the quick intermittent movement of the picture disc.

The first exhibition of photographs from life, projected in rapid succession upon a screen, that is within the knowledge of the committee, was given before the Franklin Institute at its monthly meeting in March 1870. The subject was that of waltzing figures moving in exact time back and forth across the entire screen. The photographs were from time exposures on glass plates, the figures being one inch in height and magnified to life size. The apparatus used with the lantern was one that had a shutter that cut off the light while the pictures were changing places, and there were sixteen photographs in a set mounted on an intermittently revolving disc which was turned by hand. The effect was very natural and pleasing, although crude as compared with the advanced results of to-day.

Between 1877 and 1887, the art advanced somewhat through the most creditable work of Messrs Muybridge, Renand, Marey and Anschutz, in their efforts to analyze and illustrate the movements of man and animals. Means for rapid consecutive photography were a necessity, and cameras were designed which produced the results desired. First, a series of cameras stationed some distance apart, and in line with the path of the subject to be

photographed, and consecutive instantaneous exposures were made as the subject passed them.

Following this arrangement, <sup>the</sup> same the multiple ~~xxxx~~ lens camera, and a little later (about the year 1887) Mr. Anschutz brought out his single lens camera, and used in connection with it a flexible film (See Journal of the Franklin Institute for September 1887). About this time, Mr. Anschutz also exhibited his device for exhibiting photos from moving life, which he named the "Tachyscope", in which he employed an iron wheel mounted to revolve perpendicularly, around the outer edge of which <sup>where</sup> arranged the pictures in consecutive order; in front of this wheel was placed a partition with a sight opening opposite the top picture and directly behind this picture was placed a Giessler tube. In operating this device, the iron wheel was turned around regularly, by a hand crank, and as each successive picture passed the sight opening, an electric flash illuminated it for an instant, so that it was plainly visible to persons who stood before the sight opening in the partition. The effect of the flash exposure - which was but for an instant - was to fix the image upon the eye during the interval of darkness, in which the next picture came to a position to be illuminated, and although the interval of darkness was much greater than the time of illumination, the effect upon the eye was to show very naturally, all the movements of the subject exhibited. This instrument was, however, very limited in its scope for only a comparatively small number of pictures could be so mounted upon the wheel, which, after a complete revolution, could only reproduce the same views again.

About 1890, M. Demeng, who had been a collaborator with M. Marey, brought out his device for using the flexible film picture in a lantern, and the credit of devising the tapping method of

quickly moving the film one picture space at a time, <sup>Seems</sup> to be  
to due ~~him~~ at this time and for some years, some form of shutter  
was always used to cut off the light while the picture film was  
moving.

About this time (1890), Mr. C. F. Jenkins, whose inventions  
are the subject of this report, began to reduce his conceptions  
to practice, and they comprised the instruments that are nec-  
essary <sup>first</sup> to take photographs in rapid succession on a mov-  
ing ribbon or flexible negative film, and two forms of Phantoscope,  
or apparatus, which are used with the lantern to project the pic-  
tures upon the screen. These may be briefly described as fol-  
lows:-

The films used to receive the photo-negatives, and those  
upon which are reproduced the same pictures as positives, are  
made of flexible substance about an inch and three-eighths wide,  
and of any desired length. These are first prepared by punching  
a series of holes along both edges, at equal intervals, so that  
they may be automatically fed before the camera lenses by re-  
volving sprocket wheels, around which the films are carried. The  
earlier form of camera embraced means for intermittently feeding  
the negative films across the path of the light rays, and a  
revolving shutter which cut off the rays during the time that  
the film was moved along a space, by which means, a series of  
pictures at uniform distances apart, were taken in very rapid  
succession.

In a modified form of camera devised later, the mechanism  
provided for a continuous uniform movement of the film, and a  
series of lenses mounted in a circle on a revolving disc, which  
lenses moved synchronously with the negative film, so that <sup>100</sup>  
while passing an opening in the camera box, which admitted the  
light rays (the lenses and film traveling together), a sharp

picture was being developed while the lens was crossing the path of the light rays, and as it passed beyond the light, the next following lens entered the light rays and another negative was taken on a fresh portion of the film; thus, by steady continuous motion of both film and lenses, a series of well defined pictures are taken in very rapid succession, upon a ribbon film of any desired length.

A positive copy of these pictures is then made on a similar film, which is to be employed in the projecting lantern to display the pictures in greatly magnified form, on the screen.

The first form of Phantoscope, or device for projecting these pictures, was similar in construction to the first described camera, that is, it operated to move the picture film across the light rays of the magic lantern intermittently, the time of rest of the film being greater than the time of motion; and while the film moved to present the succeeding picture, the light rays were temporarily cut off by the revolving shutter; thus there was a period of light during which a picture was to be seen on the screen, and then a shorter period of total darkness, during which a new picture was substituted; these changes were so rapid (being at the rate of 30 to 35 pictures a second), that the effect upon the eye, due to persistence of vision, was to give the picture the appearance of being fixed and yet showing the progressive motions of the succeeding pictures. The short interval of total darkness having only the effect of causing a sensation of flickering, which, however, was objectionable because it was trying to the eyes after a short time. To remedy this defect, Mr. Jenkins remodeled the Phantoscope, so that there was no shutter required, and consequently no period of total darkness on the screen.

These changes were made to conform to the theory that the eye cannot distinguish two impressions at once, but will receive only the stronger, and to take advantage of this discovered fact, he made the interval of motion and of stoppage of the picture film, to be relatively as one to ten, which made the change from one picture to the next so rapid, that practically the eye does not take account of it; thus the unpleasant sensation was eliminated, and a decidedly sharper picture resulted, with extremely simple form of mechanism. Thus, by gradual and intelligent steps, the Phantoscope of to-day has become a marvel of simplicity and perfection, and the instrument that has been so long desired <sup>to enable us</sup> ~~that we might be able to~~ reproduce the movements of life for analysis, profit and pleasure, we now have in such a convenient form, that it is readily available whenever a magic lantern can be used.

It does not appear from the records of the Patent Office, or ~~xxxx~~ from any other source of information within the reach of your committee, that the principles upon which Mr. Jenkins has worked out his successful mechanisms have been previously employed; and we therefore desire ~~to~~ accord to him the credit which appears to be due to him, for having given us this simple and thoroughly practical solution of the mechanical problems ~~from~~ which have so largely contributed to the perfection of the projecting lantern. <sup>your sub. committee therefore recommends the</sup> ~~The Franklin Institute therefore awards~~ <sup>award of</sup> the Elliott Cresson Medal, to C. Francis Jenkins, for his "Phantoscope".

Adopted: December 1, 1897.

*James Christie*  
Chairman of Committee on Science and the Arts.