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ventilated, commodious projection rooms that contain high-grade equipment costing thousands of dollars, built with precision, some parts to a measurement of a ten thousandth of an inch; the current is regulated by motor generators and the machinery electrically driven.

The old time operator has developed into the projectionist, whose profession has become a highly specialized one requiring careful work and expert knowledge in mechanics, electricity, optics, screen surfaces, and many other things. He must know how to apply this knowledge to the profession of projection. As the picture on the screen depends on the final act of projection, the projectionist is as important as any person in the industry. All the work of the highly paid directors, stars, scenic artists, and expert camera men who produce wonderful photographic results mean nothing unless it is perfectly projected. There are some projectionists who have not kept up with the times, but many are waking up and procuring the expert knowledge necessary to keep them at the top notch of their profession.

A decent advancement in the industry is "the Theatre Managers Training School," which has been established recently by a large theatre circuit organization. Among other things, the students have been educated in the correct presentation of the picture on the screen. When all of the managers have been properly educated, we will have no more glare spots in motion picture theatres, especially the reflection of light on the sheet music in the orchestra, which annoys the audience by causing eye strain and by interfering with the proper view of the picture. The fine productions will not be outraged by the manager compelling the projectionist to overspeed the projector in order to keep within a given schedule. This still exists in some of our best theatres, the entire picture program being projected as fast as a hundred feet of film per minute.

The non-theatrical branch of the industry has made wonderful progress since the first industrial motion picture was made in 1902. Non-theatrical films are now used for numerous purposes by industry and by national, state, and municipal governments; by Boards of Health and all kinds of organizations for the promotion of membership and for building funds and conducting money raising campaigns. The use of motion pictures in churches and educational films in the classrooms of our schools is rapidly developing. The manufacturers of semi-portable and portable projectors are making equipment to meet every demand. And, finally, the recent development of cameras and projectors for home use has opened up a new field that has unlimited possibilities.

1936

The Lumière Cinematograph

By Louis Lumière

Summary — A historical account of the development of the cinematograph camera and projector. Work on the apparatus was begun in 1894, and a private demonstration given in March, 1895, at Paris. The first public showing at which admission was charged took place in the Grand Café on the Boulevard des Capucines, Paris, on December 28, 1895. Motion pictures were also projected upon a screen approximately 80 x 100 feet in the Galerie des Machines at the Paris Exposition grounds in 1898, using a projection distance of more than 600 feet. The paper contains an illustrated description of the apparatus.

When the Edison Kinetoscope appeared in Paris in 1894 in a shop on the boulevards, there were many who thought, after having peered into the eyepiece of this ingenious device, that the projection of the moving images, which were produced then for only one spectator at a time, would be of considerable interest. However, the continuous motion of the film in the Kinetoscope permitted the eye to perceive each of the elementary images during only a very short time (1/6000 second), and this feeble illumination, which necessitated examining the images in direct light, without interposing any diffusing surface, could not pass sufficient light for good projection. Moreover, the sharpness suffered considerably because of the motion of the elementary images, even during the very short time they were illuminated.

My brother and I decided to investigate the problem, and I soon succeeded in making a device in which the film was kept stationary, for a time corresponding to two-thirds of the total time, each time an elementary image appeared exactly on the lens axis. The device allowed the frequency of 16 images per second which I had previously established, and an illumination time of 1/25 second per image, which is more than is needed for projection. This device consisted of a sliding block (Fig. 1) driven with a reciprocating vertical

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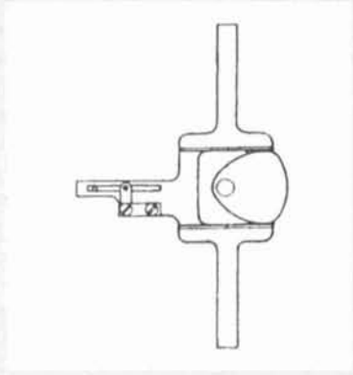

Figure 1. Sliding block and triangular eccentric of pull-down device.

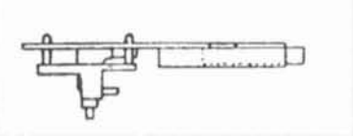

Figure 2. Section through sliding block, showing mounting of pull-down pins.

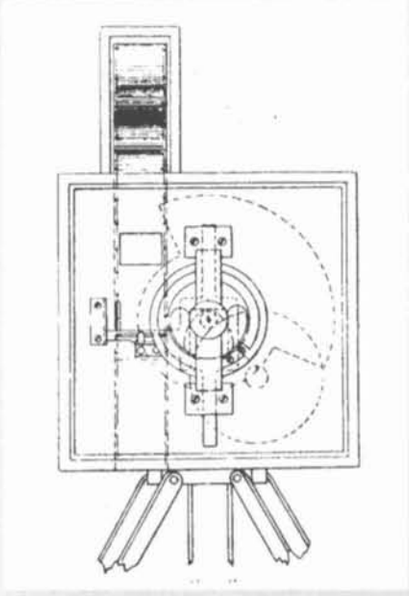

Figure 3. Front elevation of camera mechanism, showing arrangement of sliding block and pull-down pins.

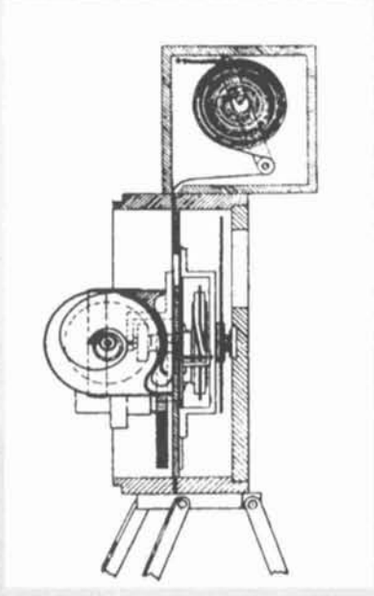

Figure 4. Side elevation of camera mechanism, showing helical cam controlling movement of pull-down pins.

motion by means of a triangular eccentric, which stopped the motion of the block completely at the top and at the bottom of its travel during one-sixth of the total time. When the block was stationary, the tines or claws (Fig. 2) of a kind of fork located at the side sank into the perforations of the film, under the control of a helical cam (Figs. 3 and 4). These pins described a rectangular path and carried the film along during their downward motion and left it motionless during their withdrawal, their upward course, and their sinking in. A pressure member, acting upon the film as a light brake, was sufficient to hold the film in perfect alignment with the gate behind which the image appeared, thus absorbing any play in the apparatus. The principle of the movement is shown in Fig. 5.

As I contemplated producing only short scenes, the length of the film was only 17 or 18 meters. I had not deemed it necessary to complicate the instrument by having a continuously running sprocket, the effects of the inertia of the small roll of film containing the images being deadened by a spring-lever (Fig. 6).

I shall not undertake to write the history of the motion picture industry; and without going back to Zoëtropes, Phenakistoscopes, etc., I shall cite only the work of the astronomer Janssen, of Muybridge, and especially of Marey of the Institute, of Demeny, and of Reynaud, who at times carried out remarkable analyses of motion; although none of the instruments of these men was able to achieve the animation of more than about 30 images, the projection of which involved much difficulty.

The first outfit I developed was made in 1894 in our factory at Lyons, according to my drawings and under my supervision, by our chief mechanic, Mr. Moisson. The first images I succeeded in obtaining were printed upon the photographic paper we were manufacturing at the time. Later, we obtained base film from the New York Celluloid Co. which we coated with sensitive emulsion in our machines, and made into perforated rolls.

The film described above had only two circular holes per image and assured unusual steadiness in projection. I demonstrated the outfit, patented in February, 1895, during the course of a lecture at the Societe d'Encouragement pour l'Industrie Nationale, in Paris, in March, 1895. At the time, I had only one film, which showed the employees leaving the Lumière factory — an easy subject, since I had simply to set up my camera in front of the factory gate at closing time.

This first demonstration was a great success. I met there Mr. Jules Carpentier, an engineer, member of the Scientific Academy, and a well known manufacturer of precision instruments, who immediately proposed to undertake to manufacture a series of Lumière cinematographs. I accepted the offer at once, and the Carpentier factory forthwith manufactured much of the apparatus, which could be used as cameras, projectors, and printers, since by providing a double-film magazine, both the raw film and the negative could be run in together and printed. Figs. 7, 8, and 9 are illustrations of the equipment.

The results obtained were submitted to the Congress of the Photographic Society of France at Lyons, on July, 1895, and greeted with a tremendous acclaim. We decided to give public demonstrations with the equipment, and on December 28, 1895, opened a place in the basement

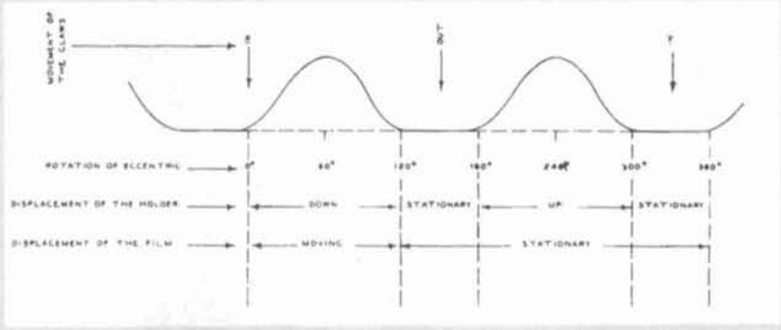

Figure 5. Movements of film and various parts of pull-down mechanism during one exposure and pull-down cycle.

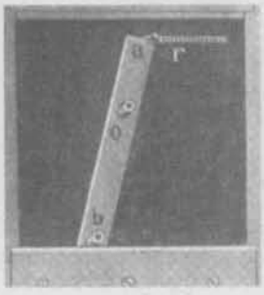

Figure 6. Spring-lever in supply magazine to reduce effects of inertia of the film roll.

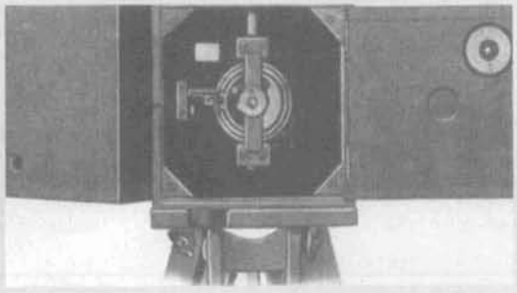

Figure 7. Front view of camera with shutter removed.

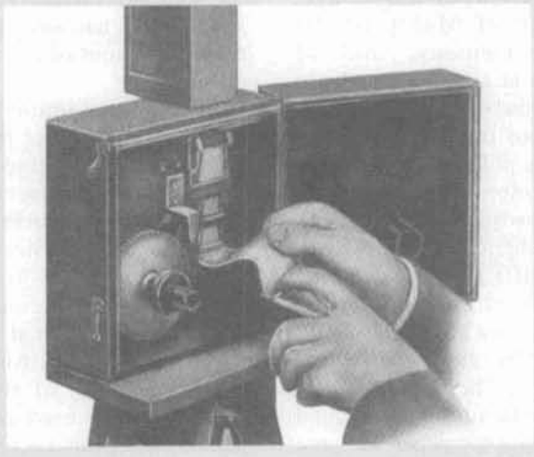

Figure 8. Rear view of camera, showing method of threading film.

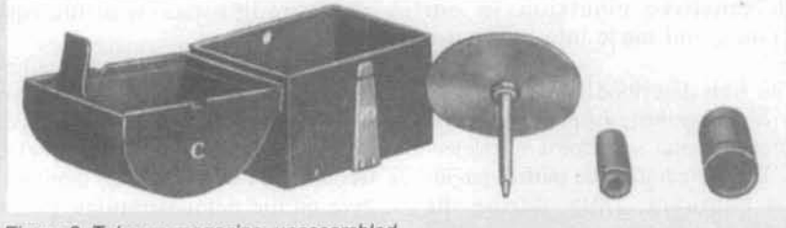

Figure 9. Take-up magazine, unassembled.

of the Grand Café, on the Boulevard des Capucines, Paris, where, for a small admission fee people could witness the projection of the following short films: *Men and Women Employees Leaving the Lumière Factory, Arrival of a Train at the Station of La Ciotat, The Baby's Lunch, The Sprinkler Sprinkled (!),* and *Boat Leaving the Harbor, etc.* The success of the showing when the existence of our place became known, was considerable, although no publicity was sought. Thus, on that date, December 28, 1895, was really born the expression: "I have been to a movie."

In 1897, I announced a device (Fig. 10) utilizing as a condenser, a simple glass flask, as nearly spherical as possible, filled with water, and carrying in the upper part a small piece of pumice stone suspended by a thread in order to regulate the boiling of the water which occurred after prolonged use. The device thus formed a block system, since the concentration of the light-beam upon the film would cease in case the flask were broken. All our machines were furnished with these devices.

When the Paris Exhibition of 1900 was decided upon, in 1898, I was called to Paris by Mr. Picard, the general secretary, to whom I proposed the experiment of projecting greatly enlarged motion pictures at the Exhibition. With the small apparatus described above, I succeeded in projecting ordinary cinematograph images covering a screen 24 meters high and 30 meters wide, set up in the middle of the Galerie des Machines, a huge building, 400 meters long by 114 meters wide, which had been constructed for the Exposition of 1889. Figure 11 gives an idea of the size of the screen, set 200 meters from the projector. As a fabric for the screen I had selected a material that reflected, when wet, as much light as it transmitted, so that one could see the projected images from any position in the big hall. To moisten the screen on the day of the experiment required the assistance of the Paris Fire Brigade, since the screen was the height of a six-story building. The results were so remarkable that the screen was retained for the

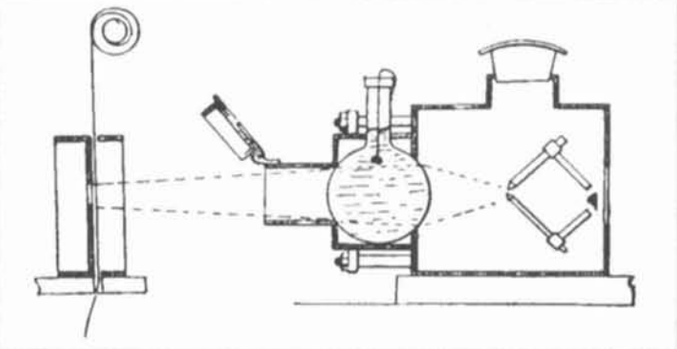

Figure 10. Illuminating system of projector, with spherical flask acting as combination condenser and heat absorber.

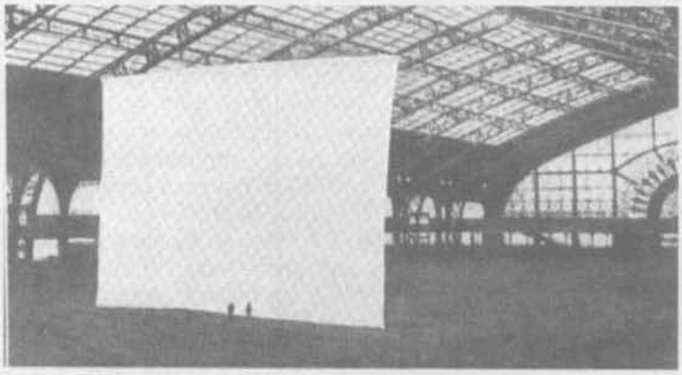

Figure 11. Large screen 24 by 30 meters (79 x 98 feet) used for projection of motion pictures at Paris Exhibition of 1900. Note figures of men at base of screen.

Figure 12. Print from film taken on opening day of Paris Exhibition of 1900 in Lumière camera using wide film (4.5 x 6 cm frame).

Exposition of 1900. Unfortunately, the Galerie des Machines was cut in the middle to make a circular hall more than 100 meters in diameter, and having a capacity of 25,000 seats. This forced me to reduce the dimensions of the screen to 16 meters high by 21 meters wide, and place it along a diameter of the hall. To avoid the difficulty of moistening the screen at the time of projection, the screen was kept immersed in a large rectangular tank of water, and each evening was raised out of the tank by a hand-winch under the cupola after removing the trap door that closed the tank during the day. I had to be satisfied with an arc of only 100 amperes, which, however, was sufficient because of the optical instruments used. The demonstrations occurred each evening, without trouble, throughout the Exposition.

To obtain better definition in the images projected upon so large a screen. I had a camera built, with the collaboration of Mr. Carpentier, capable of producing images, 4.5 by 6 cm., having perfect definition, as shown in Fig. 12, which was taken on the opening day of the Exposition of 1900. Unfortunately, the camera was not finished in time to be used for the more ambitious programs we had planned, so we kept to the original small films. Since at Lyons we were unfavorably situated to undertake the production of longer films, and since we were more interested in our laboratory investigations, we abandoned the project in 1905.

Every one knows how tremendously the motion picture projector has been developed, especially through the impetus and improvements that are due to a great extent to the efforts of American engineers and industry.

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