

Eliminating the Flicker From the Moving Picture

A New System of Motion Picture Projection

By Joseph B. Baker

THE ordinary motion picture apparatus demands a good deal of what might be termed continuity-preserving effort on the part of the human eye—just as catching spoken words reproduced by a phonograph or in a telephone receiver demands a good deal of the ear, in supplying with the imagination vocal sounds which are not fully reproduced by these instruments or not reproduced at all. (The field of mechanical devices is full of such partial accomplishments eked out by the accommodating human senses.) In the present system of motion picture projection, moreover, the rapidly recurring dark intervals between successive screen images and the eye-strain by variation of illumination (the so-called "flicker") have been objectionable to the observer. In the projecting machine, also, the intermittent movement of the film, the danger of fire from the heat to which the film is subjected during the instant it is held still for the projection of each picture, and the noise of operation, have been features that demanded radical improvement. A picture is projected for about 75 per cent of the picture interval of one sixteenth of a second; in the remaining 25 per cent of this interval the image is cut off by the blade of a revolving shutter, while the next picture is being brought into the focus of the lens; then No. 2 picture is projected. Part of the time a single, fixed image is on the screen; the rest of the time the illumination is absolutely cut off. The eye, staring at the screen, must use its faculty of persistence of impression to help fill in, so to speak, the abrupt dark interval and then suddenly receive a new shock of full illumination. The eye is bombarded with a series of impressions very sharply and definitely spaced apart by periods of absence of illumination on the screen. As in watching a prestidigitator we enjoy imagining an actual flight of the mysterious coin from the operator's palm to the table-top thirty feet away, so the eye "plays up" in the enormously more rapid and continuously exacting game of bridging the gaps of the motion picture film.

But in enduring the flicker the eye pays heavily for its self-imposed delusion. The resulting eye-strain is a disadvantage which the public puts up with, and seeks to counteract by watching the screen at a distance of at least

Motion picture projection rests upon the physiological phenomenon of "persistence of visual impression," whereby a momentary glimpse of a well-illuminated object prints an image on the retina which remains about one sixteenth of a second. In the ordinary motion picture method a rapidly succeeding series of snapshots are taken. These pictures are made one after another at the rate of sixteen per second upon a narrow strip of film, which is made to travel through the motion picture camera at the rate of one foot per second. There are therefore sixteen complete pictures in every foot of film. If the camera is pointed toward a scene in which is a falling weight, and the first picture shows the weight in the middle of the view, the second picture, taken one sixteenth of a second later, will show the weight in a new position slightly below, and the third will show a still further displacement of the weight, and so on. Say the weight has moved one foot between the instant of taking the first picture and the instant of taking the second picture. These two pictures will then show the beginning and the end of that one foot of movement, and there is nothing but a gap or blank in the interval between the pictures.

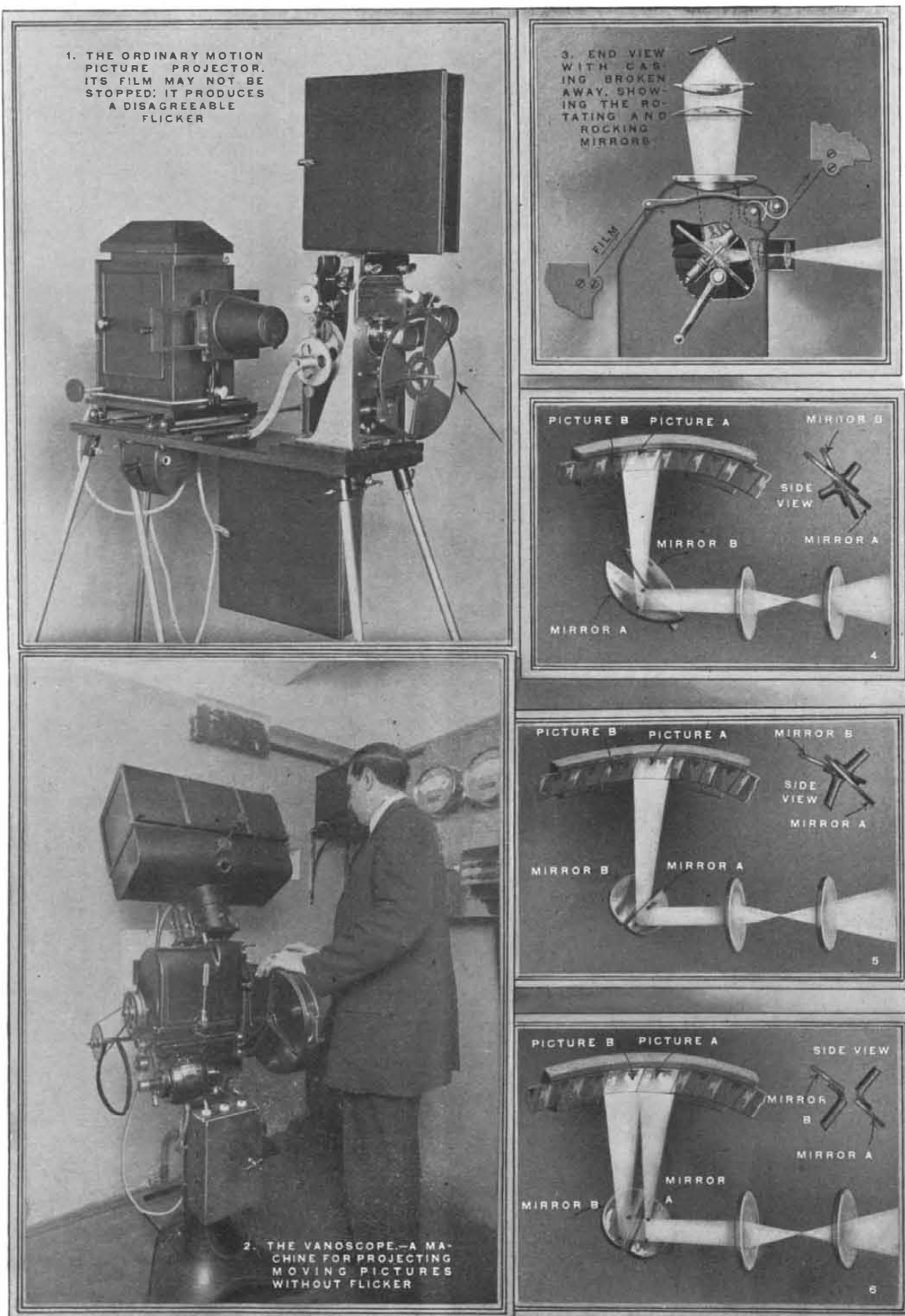
A thousand feet or more of this film may be taken of any moving scene. The projection on a screen to simulate the original scene is accomplished by making a positive transparency of the film negative and running the same through a specially contrived projection lantern, which throws an enlargement of the first picture upon the screen for an instant, then cuts off this image and one sixteenth of a second later throws the second picture on the screen, and so on. Before the impression of the first image has faded from the retina of the observer, the second image is impressed. The eye, retaining its impression of the falling weight as at one point in the general view and receiving an impression of the weight as at a new point, superposed upon the still lingering first impression, takes for granted the intermediate positions of the moving object. Thus it supplies, subjectively, the continuity of movement of the object—a continuity which is really quite lacking in the series of screen pictures. The action is just the same as viewing a field of running horses through a picket fence, as one travels along outside the fence. At a given instant the eyes have a clear view of the animated scene through a space between two pickets, the next instant the view is absolutely cut off by an interposing picket, then comes a new view through another space and another cut-off; but all the time the movements of the horses are seen apparently without a break. This system has its objectionable aspects. The film must move constantly so that it may not catch fire, and the "flicker" produced by the rapidly succeeding pictures produces eye strain. In the accompanying article an ingenious method is described, whereby it is sought to overcome these defects.—EDITOR.

twenty feet back within a rather narrow sector.

The fire danger may be estimated from the intense light necessary to obtain a continuous visual effect of good illumination in the screen picture notwithstanding the very large ratio of enlargement (about 1 to 97,000) and notwithstanding the intermittency of the actual illumination. It may be said that the film is always just on the verge of igniting. Hence the strict fire laws governing motion picture exhibitions.

A new machine called the vanoscope overcomes these imperfections in an apparatus giving a continuous visual impression from a steadily moving film. Its "moving picture" is not made up of abruptly succeeding fixed images separated by dark intervals, but of images which genuinely dissolve into one another without any interruption of the full illumination upon the screen. While the apparatus will project any standard film, the successive pictures may be taken at very much longer intervals if desired, that is, fewer per second than the limit of sixteen per second required for the present system, and they may be reproduced at the same slow rate on the screen—a feature invaluable for educational and motion study work. In fact, the normal speed is 8 per second, which gives very great reduction in the length of film. It is possible to put a "1,000-foot play" on 300 feet of film. "Travel ghost" is eliminated. The pictures are projected without being abruptly cut off by a shutter, but by actually "dissolving," one image decreasing in intensity of illumination simultaneously with the increase in illumination of the next succeeding image. As at an ordinary lantern-slide exhibition, where a view of Fujiyama, for example, melts into a view of a crowded street in Nagasaki, the eye has only to relinquish the outlines of one picture and take up the outlines of the next, with comparatively little physiological effort.

To obtain this result a new mechanical movement of four mirrors, being the four right-angle segments of a circle, which deliver the film image to the projecting lens, is employed. Each segment of this four-part reflector has conveyed to it a movement such as would be given by rotating it on an imaginary axis and simultaneously rocking it for-



Eliminating the flicker from the moving picture. A series of pictures that show how it is done.

(Concluded on page 151.)

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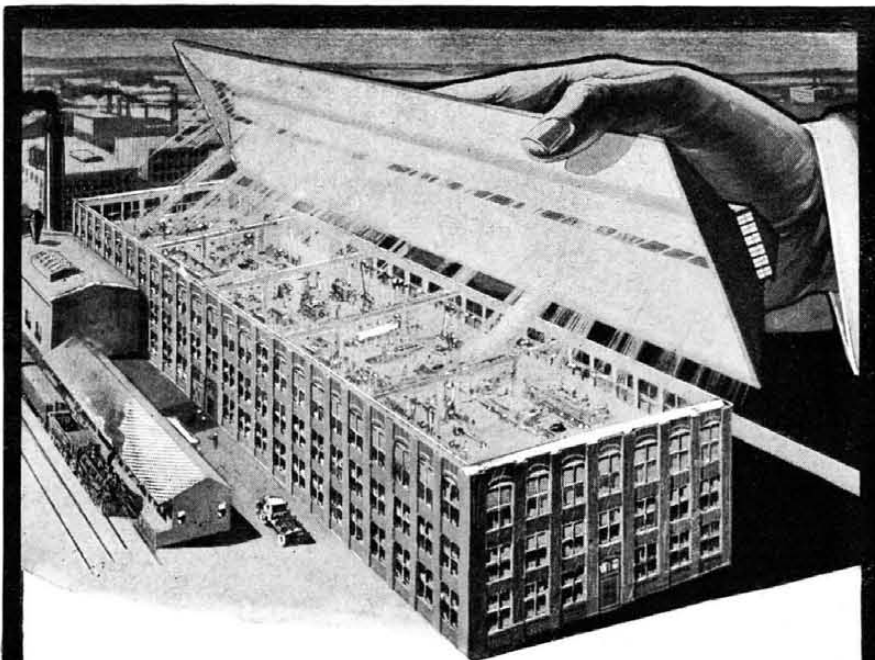
Eliminating the Flicker from the Moving Picture

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ward at one half the angular velocity at which the film travels. The annexed drawings of a vanoscope apparatus of earlier design, equipped with two half-circle instead of four quarter-circle mirrors, show the succession of events by perspective and side views. In the perspective view of Fig. 1 the picture A is being projected by mirror A through the lens to the screens; the side view shows the position of the mirrors (exaggerated for clearness) when picture A is being projected solely by mirror A. Fig. 2 shows the conditions after the film has been moved forward a short distance, and mirror A has been rotated to a point where it is about to pass out of the field of light; and mirror A has also been rocked forward, as shown in the side view, at one half the angular velocity of the film, so that the picture as projected has been continued as a stationary image on the screen. Fig. 3 shows picture A after the film has moved still farther forward and mirror A has been rotated to a position partly out of the light field. The whole of the picture is still being projected upon the screen by this mirror, but the image is only partially as brilliant as it was when the mirror was fully exposed to the light; and picture B is now also being projected, with partial illumination, by mirror B, and is gradually increasing in brilliancy in proportion as the illumination from mirror A is decreasing. The actual image on the screen is therefore now made up of both picture A and picture B. It is in fact a composite of them both, the pair making together 100 per cent of illumination in a dissolving picture. As one mirror segment moves out of the field the lessened illumination is compensated for by the increased illumination of the next mirror segment moving into the field.

Whereas in the ordinary motion picture apparatus the illusion of continuity is a physiological effect, in the new system this illusion is largely produced as an optical effect in the apparatus. Persistence of visual impression is not so severely taxed, and in the co-operation of machine and eye the machine does a much greater part of the work than it does in the old system. The picture appears to "stand out" from the screen, owing to the heightening of verisimilitude by the presence of two dissolving images.

Fire danger is almost eliminated, because for given average screen illumination the amount of light (and heat) to which the film is subjected is not as intense as in the present system. In ordinary projecting the film is always moving continuously, not intermittently, so that the heat that does impinge on the celluloid strip does not have time to raise any point to anywhere near the igniting temperature. The lessened heat allows the feed of the moving film to be varied at will, and allows the film to be stopped at any desired point, as in the analysis of complex manual or mechanical motions or in nature study. The absence of sudden start and stop of the film eliminates the need of looping the film, renders the machine noiseless and free from the tremor which often makes the screen image indistinct, and saves the surface of the film from



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scratches and pinholes which show up so prominently in the projected image.

Governor for Motor Vehicles

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output of the motor above its possible output on high gear.

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IMPORTANT deposits of platinum have been discovered at Wenden, Westphalia, in a region previously well known for its deposits of other metals. A territory of 500 acres has been examined and the borings from nine different drill holes show the presence of from 0.9 to 1.9 troy ounces of platinum per cubic yard, which is said to be a higher content than in the Russian deposits of this valuable metal. The actual extent of the German deposits is not even vaguely known as yet, but Mr. Thomas H. Norton, American consul at Chemnitz, who has made a report on this discovery, thinks that the platinum market is likely to be profoundly affected. It appears that the metal was found alloyed with silver, and therefore would have escaped detection in an ordinary ore analysis, as in this state it is dissolved by nitric acid. The consul (who is a chemical expert) suggests that the German discovery will lead to a revision of rock analysis in other parts of the world, with the possible result of platinum being found to be a much commoner metal than it is now supposed to be. The diminishing supply of platinum has long been a serious economic problem. The present annual production is about 13,250 pounds, 95 per cent of which comes from Russia. The demand far exceeds the supply, and the price has advanced since 1892 from \$89 to \$488 per troy pound. The unique value of platinum depends upon the fact that its coefficient of expansion is the same as that of glass and of the materials used by dentists for artificial teeth. About one-third of the world's supply is used in the electro-technical industries, and another one third in dentistry.

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