Film-Tech

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The Intermittent Movement

AN ULTIMATE ILLUSION

Conventional motion pictures rely on a unique characteristic of the human brain . . . persistence of vision . . . to create the illusion of motion. When successive images are presented to an observer at a sufficiently rapid rate, each individual image is retained long enough to blend, or overlap, into the next image presented (Figure 1). If the succession of images shows a moving object in progressively different positions, the rapid presentation of these individual still images will produce the illusion of continuous, smooth movement in the original scene. Without image retention, movement of the object would be seen only as a series of jerky, mechanical, still images. True, if the images were presented at a very high rate, the movement would appear very smooth, but other impractical and annoying factors would be present—including the wasting of many miles of film.

Fortunately, the present projection rate of 24 frames per second provides an adequately smooth illusion and allows current projector designers to cope with shutters, flicker, and intermittent film motion. Although there are continuous (nonintermittent) film systems that provide a convincing motion picture presentation through the use of mirrors or prisms, their complex mechanical features do not compare favorably with the simplicity of conventional intermittent systems.

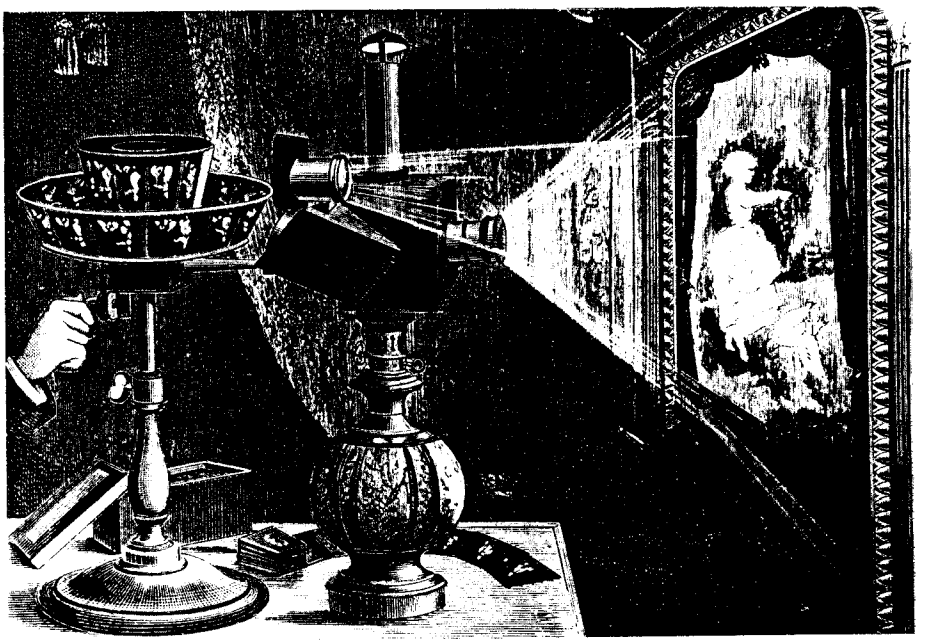

Figure 1. Print courtesy of the International Museum of Photography, Rochester, New York.
REYNAUD'S NEW PROJECTING PRAXINOSCOPE
The Praxinoscope was one of the early devices to use the principle of persistence of vision in a workable device. To operate the Praxinoscope, one merely turned a small crank (shown at the extreme left) causing the images to rotate past a reflector and lens assembly and to be projected onto a suitable screen for viewing.

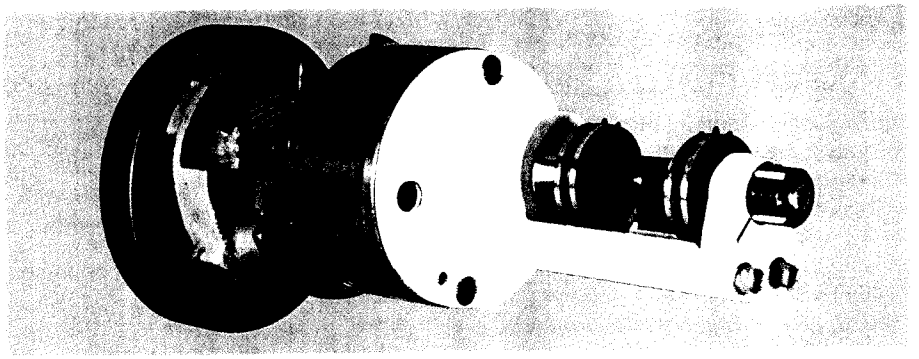

Figure 2.
A Geneva movement from a 35 mm projector.

For theatrical motion picture presentation, the heart of the projector . . . the thing that makes it all happen on the silver screen . . . is the intermittent movement (Figure 2). This extremely durable mechanism, without which there would be no conventional movies, imparts a very precise and very necessary intermittent motion to the film.

Motion Picture Ratings (of 6,344 movies rated from 1968 through July 21, 1983)
(MPAA)

Rating	*Percent*
G	*13.9%*
PG	*36.8%*
R	*43.7%*
X	*5.6%*

U.S. Theatre Employment (Nonsupervisory) (1982)—*115,700*
(NATO Encyclopedia)

HOW MUCH IS TOO MUCH?

The intermittent system is designed to operate with a maximum variation in the positioning of each film frame of about 0.0004 inch. In other words, when the screen image is 20 feet high, its vertical unsteadiness from the intermittent alone should be less than 0.2 inch.

The additional unsteadiness attributed to the camera, the film printers, the film itself, and perforation or equipment wear tend to increase this value when projecting most final prints; but since certain effects frequently cancel, the extreme condition where everything is additive is seldom found in any theatre. Typical projection systems, along with good quality release prints, should be capable of providing a screen image with less than 0.3 percent vertical unsteadiness, or 0.7 inch on a 20-foot-high screen image.

NOTE: Using the SMPTE Test Film No. 35IQ, 35 mm Projector Alignment and Image Quality Film, that was designed and manufactured specifically to measure projector performance, we have observed screen images with less than half the above values.

A MOVEMENT CALLED GENEVA

The typical intermittent movement produces intermittent film motion in the projector through a mechanical device called the *Geneva* or *Maltese Cross* movement. The principle behind this movement is illustrated in Figure 3 (a. through e.). The precision with which the cam and starwheel mate in the "dwell" period, as seen in (a.) and (e.), is the prime factor in projected image steadiness (provided that other conditions, such as worn sprocket teeth or improper gate tension, do not exist). If the precise fit between the cam and starwheel becomes loose because of wear or maladjustment, the result will be vertical unsteadiness.

DWELL CAN TELL

A quick determination can be made to see if wear is present. Turn the projector by hand until the sprocket is in the dwell or locked position. Rock the sprocket back and forth with your fingers and feel for backlash. If you notice even a very little bit of backlash by this method, the movement should be serviced as soon as possible.

CAUTION: Unless you are thoroughly familiar with the adjustment procedures, we do not recommend that you attempt to adjust the movement yourself. Send the unit to an authorized service facility.

Almost all service areas and theatre supply houses have "loaner" movements to keep you in operation. Although we caution against in-house adjustment and repair, a simple description of typical professional servicing might prove interesting and educational.

FOR YOUR INFORMATION

When the movement arrives at the service shop, it will generally be checked for backlash first and an attempt will be made to adjust the unit to eliminate any noticeable backlash. Most units are designed so that the cover plate, which contains the starwheel and sprocket shaft, can be shifted slightly in a direction that "snugs-up" the starwheel to the cam. If this initial adjustment is not successful, the unit is disassembled to reach the starwheel and cam, as shown in Figures 4 and 5. These two components are removed and replaced with new parts after the bearings are checked for wear. Once replaced, the unit is reassembled, adjusted, and run in for at least 8 hours to lap the mating surfaces of the starwheel and cam. If the unit becomes too warm during this period, signifying less than optimum adjustment, the cover plate is readjusted and the lapping continues. After the run-in period is completed, the unit is ready to be returned to the theatre. This brief description cannot begin to explain the precision and time involved for the repair and preparation of an intermittent movement, and is the prime reason why we recommend a competent service facility.

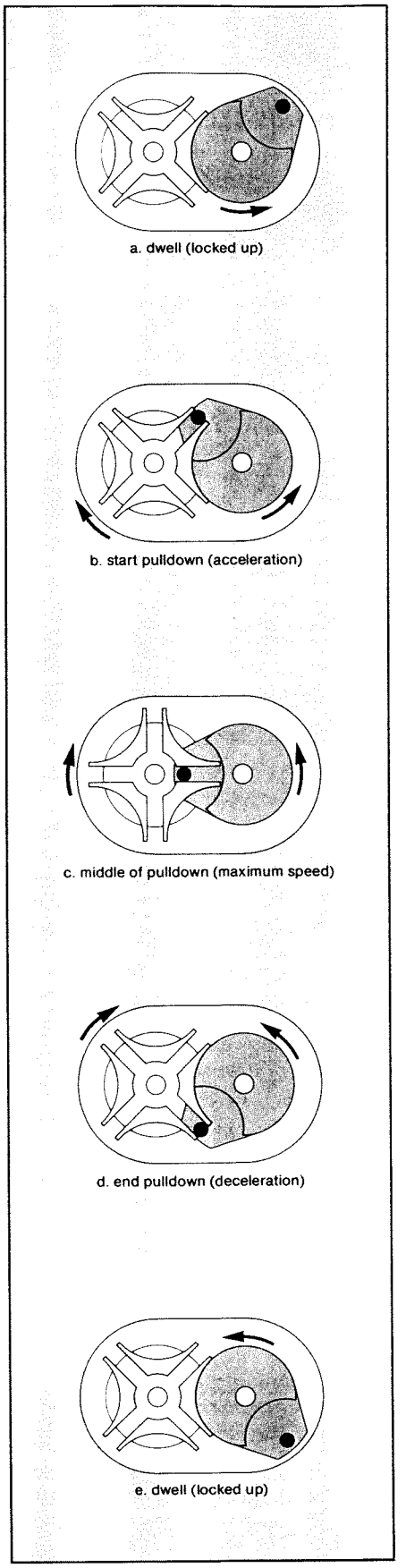

Figure 3. (a. through e.)
Principle of operation of a Geneva movement