



RESTORATION OF MOTION PICTURE FILM

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Mark-Paul Meyer

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for the Gamma Group

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news film, and television in the 1960s later used 16 mm film extensively.

The 9.5 mm film (also known as Pathé Baby) never made it beyond the home movie environment and was practically ousted from the market when 8 mm film was introduced. It had a smaller surface area than 16 mm when it was introduced and therefore a lower quality, but its principal drawback was mechanical, a result of the single, centrally located sprocket hole.

4.5 70 mm SIZE FORMAT STOCK

Almost from the very birth of motion pictures, larger gauges than 35 mm were used, but it was not until the 1960s that a standard 70 mm printing system with six magnetic soundtracks came into use. For filming, 75 mm or 65 mm gauges were used. From these negatives, it is possible to make smaller copies in 35 mm anamorphic. Later 70 mm prints from films shot on anamorphic 35 mm were made.

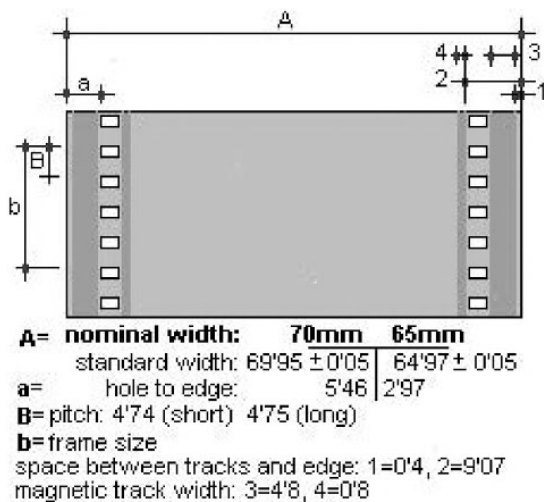


Figure 4.7 70 mm film

The screening systems for curved or super-scope screens employ this type of stock. In some 70 mm systems (e.g. Imax), the motion picture is filmed and projected horizontally, and the frame takes up to 15 perforations (71.25 mm).

4.6 8 mm FILM STOCK

In 1933, when 16 mm stock started being used for professional film making, Kodak launched a new type of film for home movies – 8 mm film (or Double 8), which would be marketed worldwide and, in the 1950s, would become universal for making home movies.

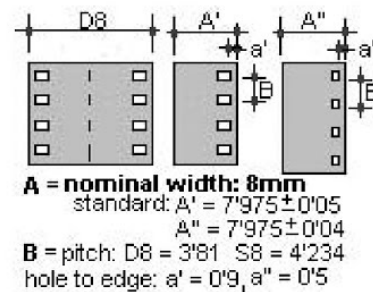


Figure 4.8 8 mm gauges

Double 8 film was manufactured on 16 mm stock perforated with twice the number of sprocket holes on each edge and reversal film emulsions, such as Kodachrome. The film was exposed in the camera down one side of the film, then reversed and exposed down the other side. After developing, the laboratory slit the roll along its lengthwise axis, obtaining two 8 mm strips which were spliced together to make one length.

The Super 8 and Single 8 formats were presented by Kodak and Fuj, respectively, in 1965. The main advantage lay in using a smaller perforation and therefore an image almost doubled that of Double 8 with a considerable increase in image quality. The 8 mm wide single strand film was supplied in a 'cartridge' or 'cassette' which made camera loading easier. When home video cameras came out, sales of this type of film vanished.

4.7 FILM PROJECTION

4.7.1 Frame rates

Except to create special effects, the number of frames projected per second must match the camera speed.

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The human eye and its data reception and transmission system can form, transmit and analyse 10–12 images per second. The vision centre in the brain retains each individual image for one-fifteenth of a second. If the vision centre in the brain receives another image during this fifteenth of a second, the sight mechanisms will create the sensation of visual continuity.

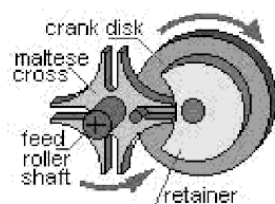


Figure 4.9 The Maltese Cross shutter

Both the two basic speeds employed throughout film making history (16 frames per second and 24 frames per second) adequately provide the requirements of visual continuity.

In laboratory testing, it has been found that the human sense of sight can distinguish up to 48 flashes of light per second, the switching from light to dark not being detected when they take place at higher rates of speed. Therefore, for example, the flickering of lamps operating on alternating current at 50 cycles per second is not visible to the human eye. At slower rates of speeds (i.e. 16–24 times per second), the changes in brightness are perceived as flicker, which becomes more distracting the greater the brightness of the flash.

4.7.2 Feed and shutter synchronization

In the Maltese Cross system, the system most used for projectors, the wheel which transfers the impulse to the film transport system (the crank disk) must make one full turn to move the Maltese Cross once. The Cross is connected to a sprocket wheel which revolves by one-quarter turns (corresponding to four sprocket holes) which transport one frame the distance of one frame. During this film movement, the shutter, which is synchronized with the crank disk, shuts out the projector light. The combination of these mechanisms, persistence of vision, and a sufficient frame

rate enables the sequence of still images to be perceived as continuous motion.

4.7.3 Silent film shutter and screening speeds

To achieve visual continuity, the shutter need open and close the aperture once per frame (using a single bladed shutter). At the speed of silent movies, this means that the screen is lit and goes dark 16 times per second. As the Lumière Brothers and others must have discovered from the start, the picture on the screen flickers intolerably at this rate. Using a dual blade shutter doubles the number of interruptions and provides a better (but not perfect) effect. Later, theatres equipped with large screens and high-powered projector arc lamps made the shutter flicker even worse, and it became necessary to use triple-blade shutters (one of the blades of which was to cover a 90° angle that concealed the film transport). Alternatively the frame rate must be increased.

A triple-blade shutter shuts out at least 54% of the projector light and requires greater precision than single or double shutters. There was also a need to make the projector arcs more powerful so as to show to larger audiences. Throughout the entire silent screen era no real consensus of opinion was reached over filming and screening speeds.

Generally speaking, films were shot at a rate of 16 images per second and were screened at whatever speed the cinema management chose. A number of films were intended to be shown at higher frame rates.

After 1930 and the introduction of sound tracks, 24 frames/sec became the norm. At this rate flicker with double-bladed shutters is not noticeable, although modern systems are equipped with three-bladed shutters to provide for better light continuity.

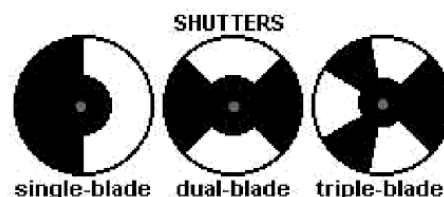


Figure 4.10 Single-, double- and triple-bladed projector shutters