



THE MUSEUM OF WESTERN FILM HISTORY

The Magic of Movies!

BEFORE we review the Museum's recent Brenkert Projector let's take a quick lesson on "How" Film Projectors bring the magic of the moving image to the screen. The article is edited from *Inside a Projectionist Booth* - September 2013.

Movie projection works because our brains retain an image for slightly longer, one twenty-fifth of a second to be exact, than we actually see it. Film, which is made up of single images, or frames, moves continuously along a feed disc, operated by an electric motor. Each frame pauses for a fraction of a second in front of the lamp and lens assembly. Here, the film is illuminated and projected onto the screen through a lens. The continuous succession of the frames causes our brains to connect each image and they seem to move.

Three excellent short films on the Way Film Projectors Work are listed at the end of this document and provide video animation and examples of projector technology.

Film and Light

Carbon to Xenon



Early non-electric light sources for projectors used in 1860's included the oil lamp which emitted a very low brightness. In the 1880s, the incandescent lamps was pioneered by Edison and in the 1890's, the development of the carbon arc afforded the best natural-looking light source for both filming movies and projecting them. Projectors used carbon arc lamps until the late 1960s. "The length of those carbons for whatever reason was only twenty minutes which also dictated the

length of the reel," says Joe Rivierzo, a third generation projectionist. With each reel and carbon arc lasting only twenty minutes long or less that meant that several reels of film and arc rods had to be used for a single feature. This cost of the rods and man-hours required was costly.

Before starting the projector, the projectionist would strike the arc by turning on the electrical power and then striking the carbons together by turning a knob or pushing a lever. The projectionist then had to maintain the arc (with help from two motors in the lamphouse, which advanced the carbons as they were consumed) at the proper size to keep the picture bright on the screen. The carbons burned at about 6000 degrees, making the booth nice and warm, summer and winter!

Later, (early 1950's) the carbon arc lamp was replaced with the safer, [xenon lamp](#) solved the problem of consumption of the carbon electrodes as they "burned" in projection arc lamps, and enabled development of long-playing film "platters" and automated projection booths.



Thus, the theaters saved n the bulbs themselves and as the Xenon bulbs would run for a thousand hours before needing to be changed, saving man-hours of service.

A Xenon bulb has a fused quartz outer shell, and a metal electrode at each end of the lamp. The bulb creates light by emitting electricity through xenon gas at high pressures emitting a brilliant white light. Even today's digital projectors use xenon lamps.

Nitrate Film

The first available film used in commercial movie projection was **nitrate**, a transparent, plasticized film base. It produced a vivid, high contrast black and white image onto the screen. The quality of the image was rich and precise. With precision came a drawback, however, because nitrate film is incredibly flammable, and, because nitrocellulose is composed of oxygen, it's very difficult to extinguish once ignited.

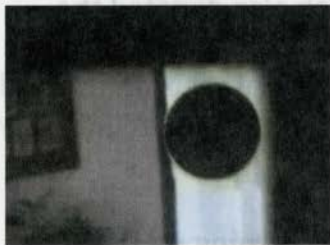
When nitrate film base was used in movie projection, projectors used a carbon arc lamp the illuminate the images. These lamps were unenclosed and could generate immense heat or spark.

There was a tremendous fear that if a fire broke out in an auditorium that there would be a stampede. People could get hurt.

Many projection booth fires did occur due to the use of nitrate film during early decades of movie projection.

To solve this issue, nitrate was discontinued in the 1950s. **Polyester bases**, which were stronger, flexible, and, most importantly, not highly flammable, took its place. A polyester base was also much more chemically stable and allowed for the construction of thinner films, which took up much less room.

The Changeover



Prior to the 1960s, projectionists used a changeover system. Reel one would be fed through the projector, containing what was currently playing on the screen. Reel two would be in the second projector, and the projectionist would peer out of a one of the port holes in the projection booth waiting for a cue, usually a blinking dot in the right corner of the screen. This first cue would tell the projectionist to turn on projector number two.

“Further past that cue there was another cue (dot) that would tell you to shut off projector one and turn to number two which would make it a seamless transition. So you, the viewer, thought that it was continuous,” Rivierzo says. The projectionist would then have to load the third reel onto projector number one, and the process continues until all of the reels were played. Then, all of these reels had to be manually rewinded for the next show.

That is, until the platter system was introduced. With this system, the individual reels are spliced together to create a single reel. The single reel containing the entire feature is wound onto a round, rotating table, or a platter, which is located next to the projector. Controlled by a payout mechanism, the platter feeds the film reel through a feed disc continuously through the projector. An empty platter below it, or the “take up reel”, collects the film already displayed on the screen and rewinds it.

Rivierzo attributes this system to the rise of multiplexes. With the two projector system, “if you had a Tenplex you’d need ten guys for each auditorium waiting for a reel to end and put on the next reel. When you got these platter systems you didn’t need that,” Rivierzo says.



To read the full article, see <https://www.asme.org/engineering-topics/articles/history-of-mechanical-engineering/inside-a-projectionists-booth>

Three excellent short films on the Way Film Projectors Work are listed below:

John Gilbert, The Old Fashioned Way: Demonstrates how projector works and a changeover. - www.youtube.com/watch?v=ywmNppYJbeo

The Mechanics of a Film Projector - www.youtube.com/watch?v=En_VooEJsU

35MM Film Projector – How it works - www.youtube.com/watch?v=ywmNppYJbeo