Film-Tech

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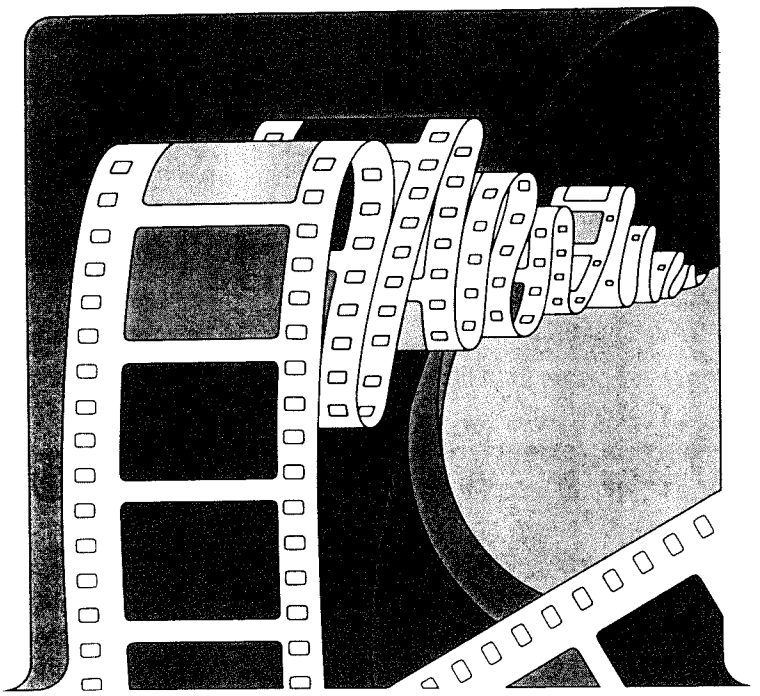
Projection Practices and Techniques

Good projection adds patronage and increases revenue to the theater, but depends to a large extent on the skill of the projectionist and the condition of the film and projector. A satisfactory screen image is not possible with a bad print, regardless of how efficient and careful the projectionist might be. Likewise, good results with a perfect print cannot be expected from faulty projection equipment or poor projection techniques. Through constant use, projector parts become worn and go out of adjustment. The replacement of worn or damaged parts when needed represents a wise investment, because properly maintained projection equipment will improve screen images and materially reduce film damage.

While the maintenance of the projection equipment is the responsibility of the theater, the projectionist can do many things to help reduce print damage. There are, for example, various projector parts (such as valve rollers and pad rollers) that may seem unimportant at times, but demand frequent attention on the part of the projectionist. Film damage can occur in any one of these areas, but may often be avoided if adjustments are made regularly and if damaged or worn parts are discovered and replaced promptly.



PRINT INSPECTION

Regardless of projection equipment condition, a damaged print will not provide satisfactory screen images. There was a time when the projectionist could rely on the projectable condition of a release print as it was received from the distributor. Current film inspection procedures, however, although not necessarily endorsed by the distributor, are directed by contract agreements between the distributor and film producer. These agreements, in some cases, call for limited film inspection or no inspection at all!

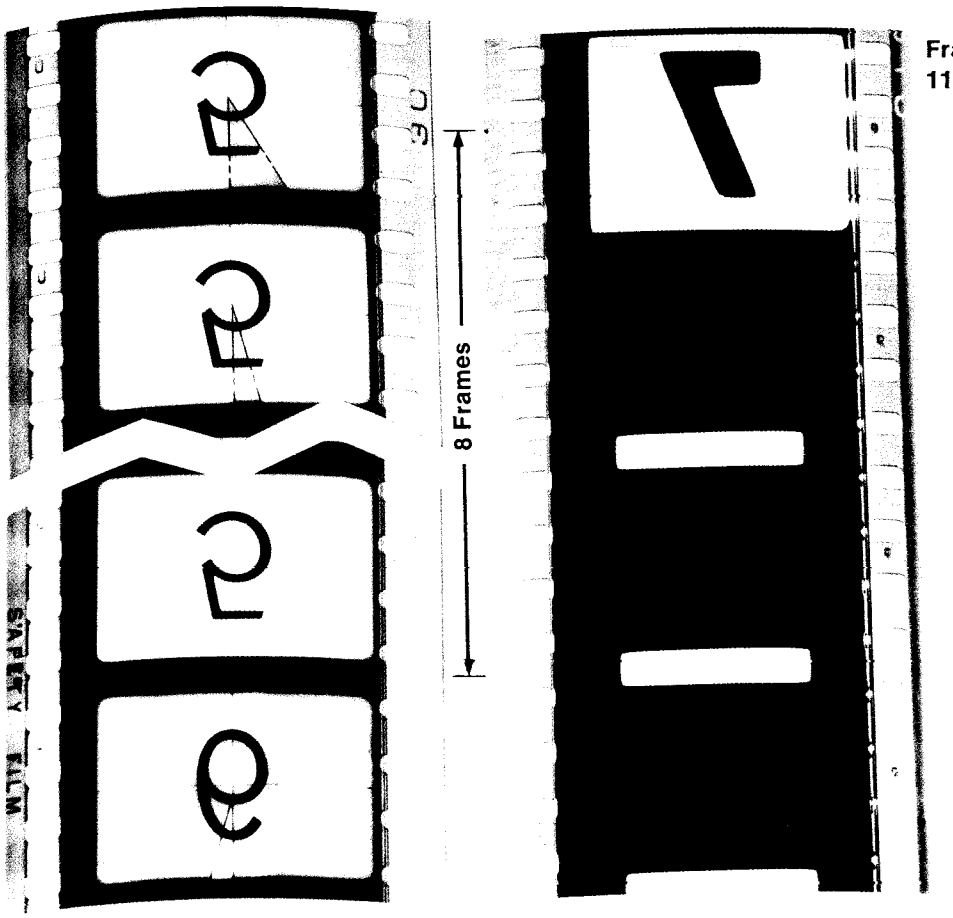
It is most important therefore that, with few exceptions, release prints coming into the theater should be carefully inspected before projection. Among the exceptions are new prints or any print that contains seals on the reel bands designating that it has been inspected. Even in these cases, it might be wise to examine the film leaders to establish subject matter and reel continuity.

Most-Oscared Motion Picture—Ben Hur (1959)—11 awards
Most-Oscared Actress—Katharine Hepburn—4 Best Actress Awards
Most-Oscared Actor—Walter Brennan—3 Best Supporting Actor Awards
Most-Oscared Director—John Ford—4 Wins

Average Number of Prints Made per Year for Theatrical Release (Major Film Companies)
650 prints (or about 1230 miles of 35 mm print film per release)

There is a section missing from this leader.

Figure 1



SMPTE Universal Leader **Academy Leader**

Frame number 112 on the SMPTE Universal Leader and the Academy Leader.

Figure 2

HOW TO INSPECT A RELEASE

The inspection of a release print prior to initial projection should involve the following items:

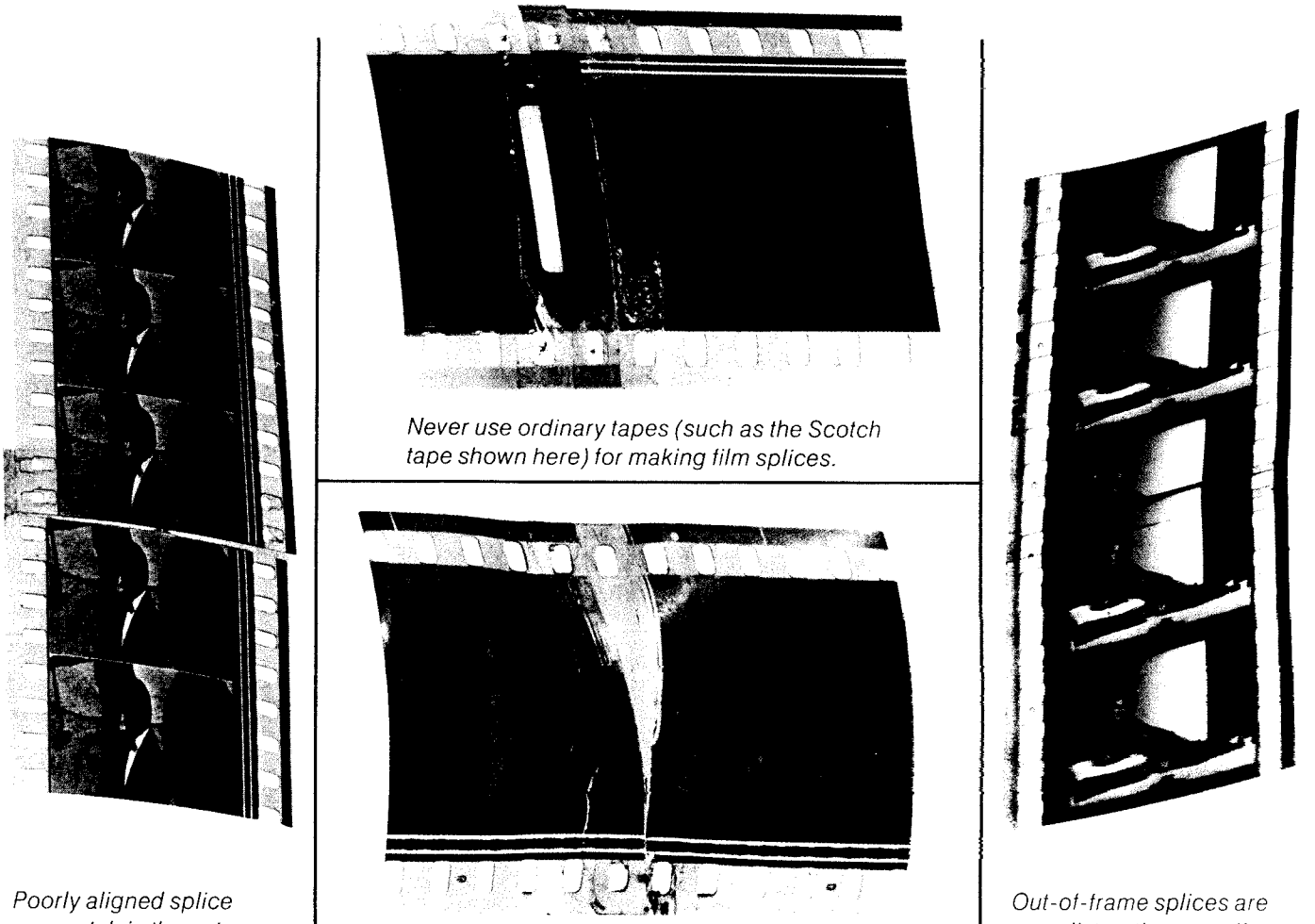
Leaders Does the leader correctly identify the subject title? Is the leader complete in length? Are there splices that suggest the leader may have been shortened (Figure 1) thus affecting correct lead-in threading for a properly timed changeover? Some prints still contain the *classic academy leader* which is a leftover from the old silent days when motion pictures were projected at 16 frames per second. Persistent efforts by the SMPTE* and some laboratories to gain a general acceptance of the SMPTE *Universal Leader*, which is based on the current 24-frames-per-second projection rate, have not been wholly successful. In spite of deeply ingrained habits formed from using the older leader, it is important to identify which leader is on the print so that proper compensation can be made during threading. For example, if you normally thread at 7 (112 frames) on the academy leader (Figure 2), the corresponding 112 frames on the SMPTE Universal Leader will be 8 frames into the numeral 5 (24 frames per numeral).

The older leader, designed for silent-film running at 16 frames per second, also happened to have 16 frames per foot of film. The current standard projection rate of 24 frames per second has no such convenient arrangement with film length (there are still 16 frames per foot), but the time dimension is considered more important for general use.

Trailers They are essential for identifying reels that have been projected and that are frequently shipped in a *tails-out* orientation. Many projectionists who normally transfer the prints from shipping reels to their own house reels prior to showing will take up the film on the shipping reels during the last show. This technique obviously saves much rewinding, but could cause time-consuming problems for the film exchange or next theater if the trailers are missing. Furthermore, some trailers provide a safety zone for the changeover that occurs only one second (24 frames) before the last picture frame on the reel. A mistimed changeover onto opaque frames can be much less distracting than a "white screen."

Splices Poor splices are the prime cause of film damage and interrupted projection. The forces acting upon a splice, particularly in the gate and

*Society of Motion Picture and Television Engineers, 862 Scarsdale Avenue, Scarsdale, New York 10583.



Never use ordinary tapes (such as the Scotch tape shown here) for making film splices.

Poorly aligned splice may catch in the gate and jam the projector.

Distorted splices are weak and can break during projection.

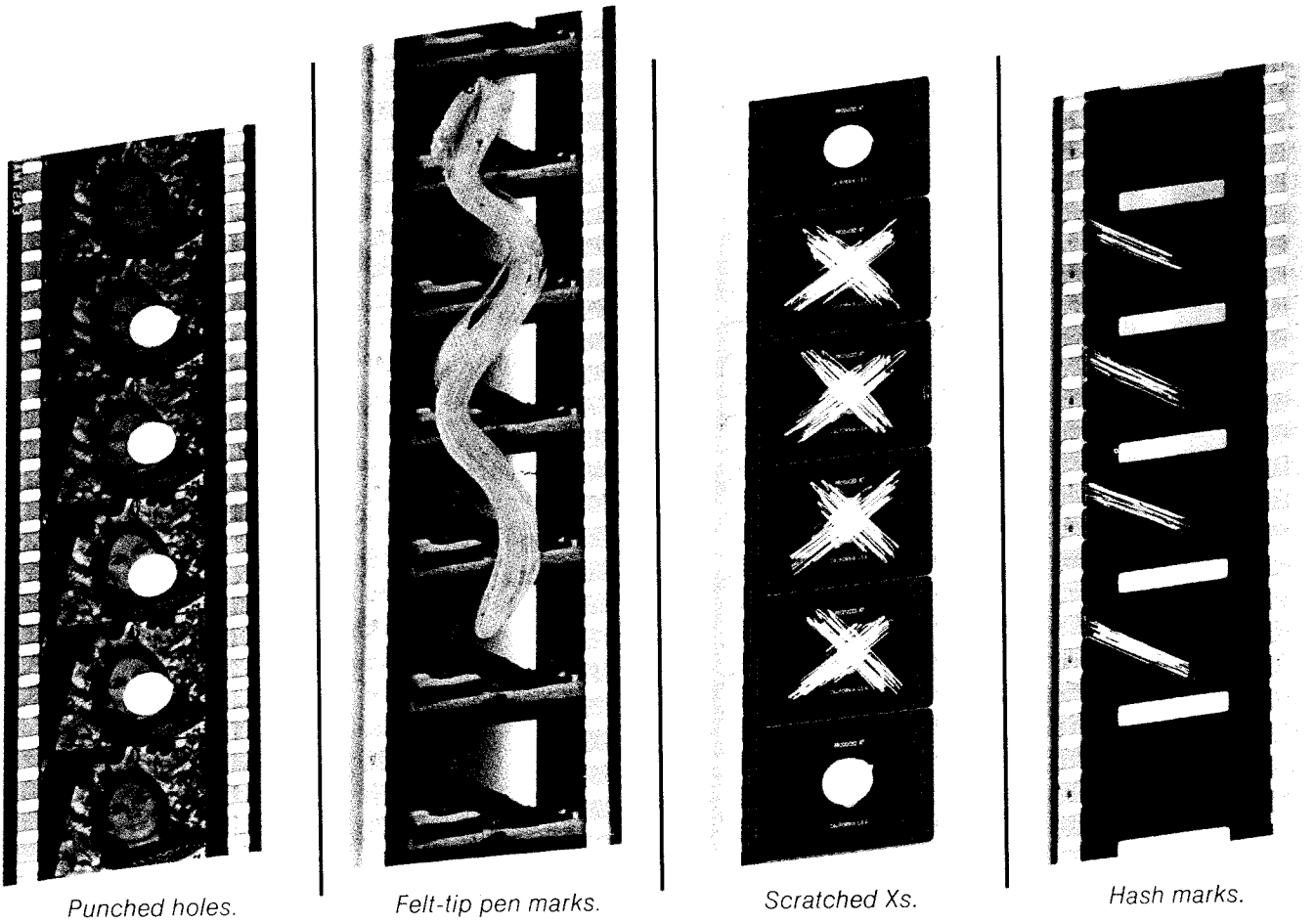
Out-of-frame splices are very distracting even if they are well made.

Figure 3

on the intermittent sprocket, can be severe. A splice, whether cement or tape, that is out of alignment can cause a sprocket pad roller to pop open, leading to a "run-off" and potential damage. The same out-of-line splice can also catch when entering the gate and cause a break. When you examine splices, be sure to flex the film gently to see if the splice will remain intact. With cement splices, the flexing will reveal if part of the splice is not properly bonded, particularly at the corners. With butt-type tape splices, the flexing will show if the splice has a tendency to hinge or collapse. Splices like those shown in Figure 3 should be remade before the film is projected to avoid further damage to the film and a possible interruption of the presentation. If you question the quality of any splice—whether due to poor alignment, improper bonding, potential collapse, or distortion—remake it. The little time required to remake a bad splice will go a long way toward maintaining a smooth presentation of your films at show times.

Particularly look for and remake splices that have been made or reinforced with masking tape or regular adhesive tape. Such splices can cause jamming in projection systems that use platters because the oozing adhesive sticks to the adjacent film convolution and produces a jam at the take-off idlers. These splices are also a source of objectionable dirt buildup. Use only polyester tape specifically designed for film splicing. These very thin and very strong transparent splicing tapes are made with non-oozing adhesives.

Physical Damage Unfortunately, there is little that can be done in the projection room to repair extended physical damage. Tears and short lengths of perforation damage, however, can be conveniently repaired with perforated polyester splicing tape. Extensively damaged footage should be removed from the reel, but doing so may seriously affect the continuity of the story and may also make your audience very unhappy. In this case, you should request a replacement reel from the distributor. In an emergency, there may be no choice but to remove the damaged footage. To knowingly leave damaged film in a reel is to invite even further film damage and a possible shutdown of operations while the film and projector are repaired.

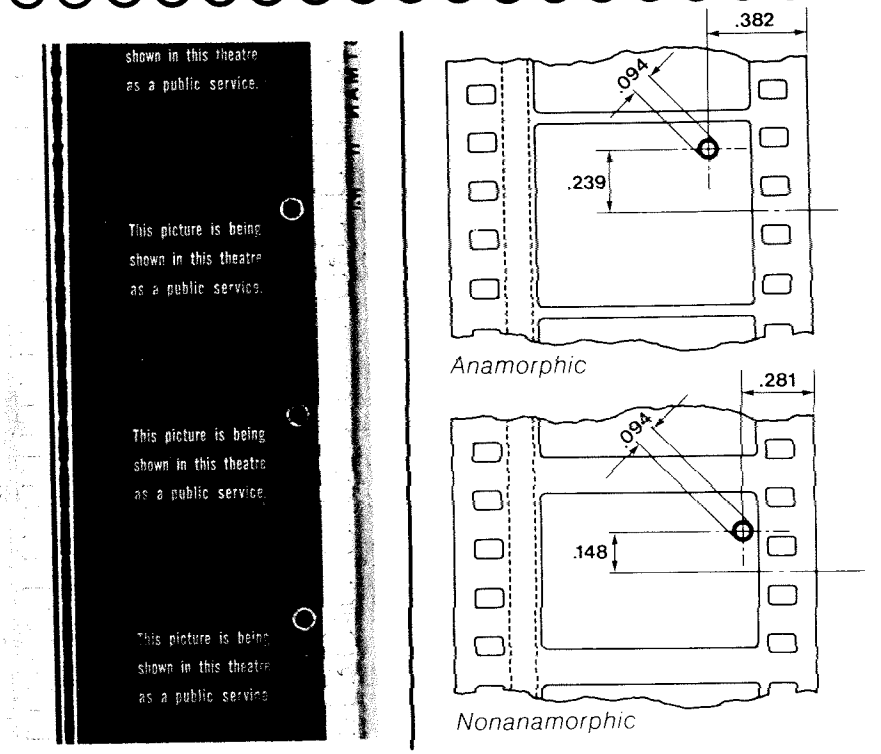


Punched holes. *Felt-tip pen marks.* *Scratched Xs.* *Hash marks.*

Figure 4

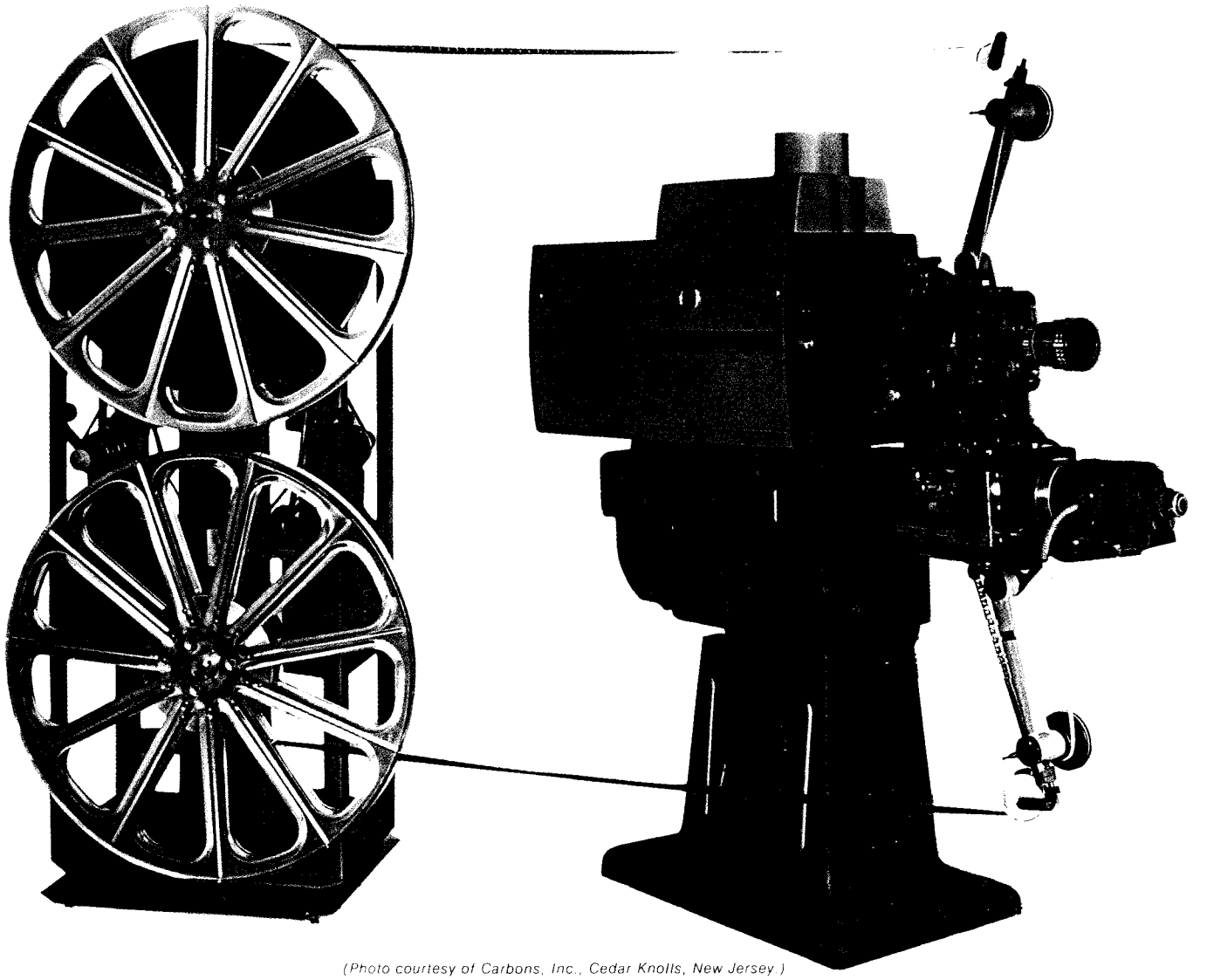
No Homemade Cues Please

Scratches and cinch marks are obviously beyond the ability of the average projectionist to remedy. One experimental technical procedure in projection, the liquid gate, can eliminate support-side scratches, but deep emulsion scratches cannot be satisfactorily removed. Similarly, the distracting homemade cues, such as punched holes, felt-tip pen marks, and scratched-in X's and hash marks (Figure 4) made by well-intended but unprofessional operators cannot be eliminated either. It is understood that if a reel has the end section missing, the changeover cues will have to be inserted. Such cues should at least approximate those made by the laboratory for location and size (Figure 5), and should never involve procedures that result in the mutilation of several frames of film.



These cue marks were made according to SMPTE-sponsored American National Standard PH 22.55-1975. Such cues normally go unnoticed by the audience. The two drawings (above, right) show recommended cue mark positions for anamorphic and nonanamorphic release prints as viewed on the screen.

Figure 5



(Photo courtesy of Carbons, Inc., Cedar Knolls, New Jersey.)

Figure 6—*Carbons, Inc., large outboard reels shown with Super Simplex projector.*

PROJECTOR PORTFOLIO

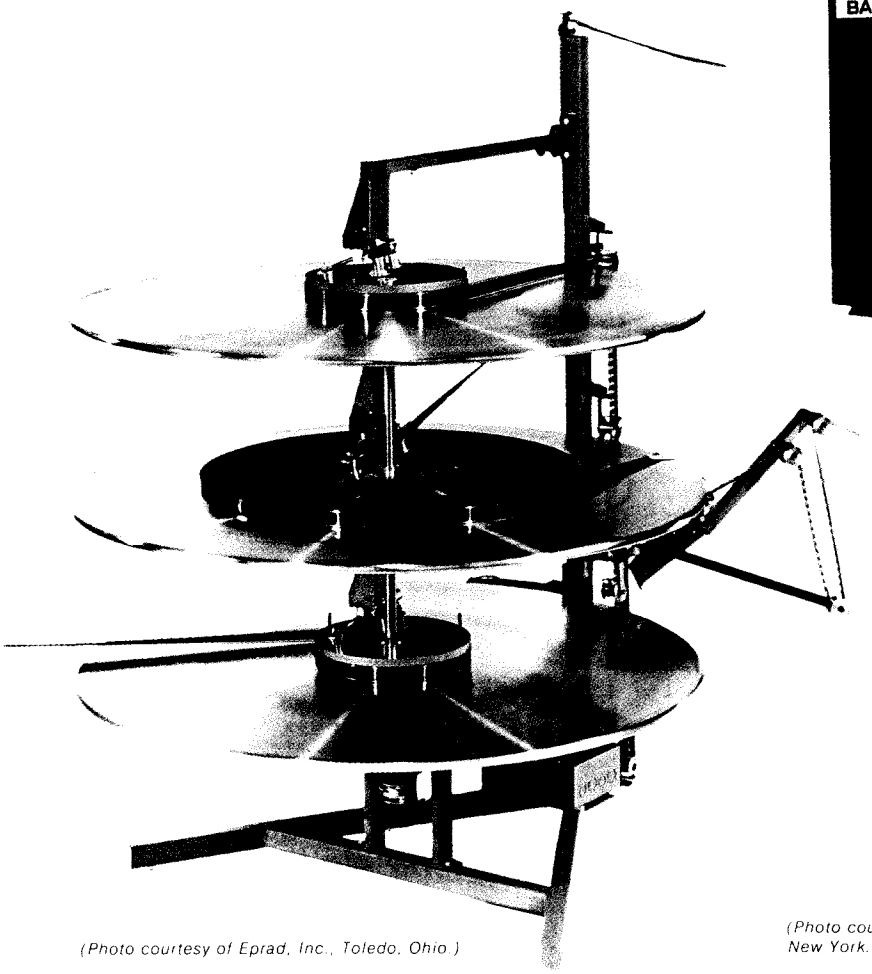
Figures 6 thru 10, general information.

Large reels (Figures 6 and 9) or the platter systems (Figure 7) can handle a complete feature film. With either method, the need for motor and changeover cues is eliminated. Reel capacity for these giants is 10,000 to 12,000 feet. Such units, in conjunction with metallic start and stop cues, are used where completely automatic facilities are needed. The semiautomatic projectors (Figures 8 and 10) normally require only one changeover during a feature-length film. Reel capacity for semiautomatic equipment is usually 6,000 feet.

IMPORTANT: The size and location of illustrations in this publication do not constitute an endorsement by Eastman Kodak Company for any particular type or make of equipment.

PREPARATION FOR LARGE REELS OR PLATTER USE

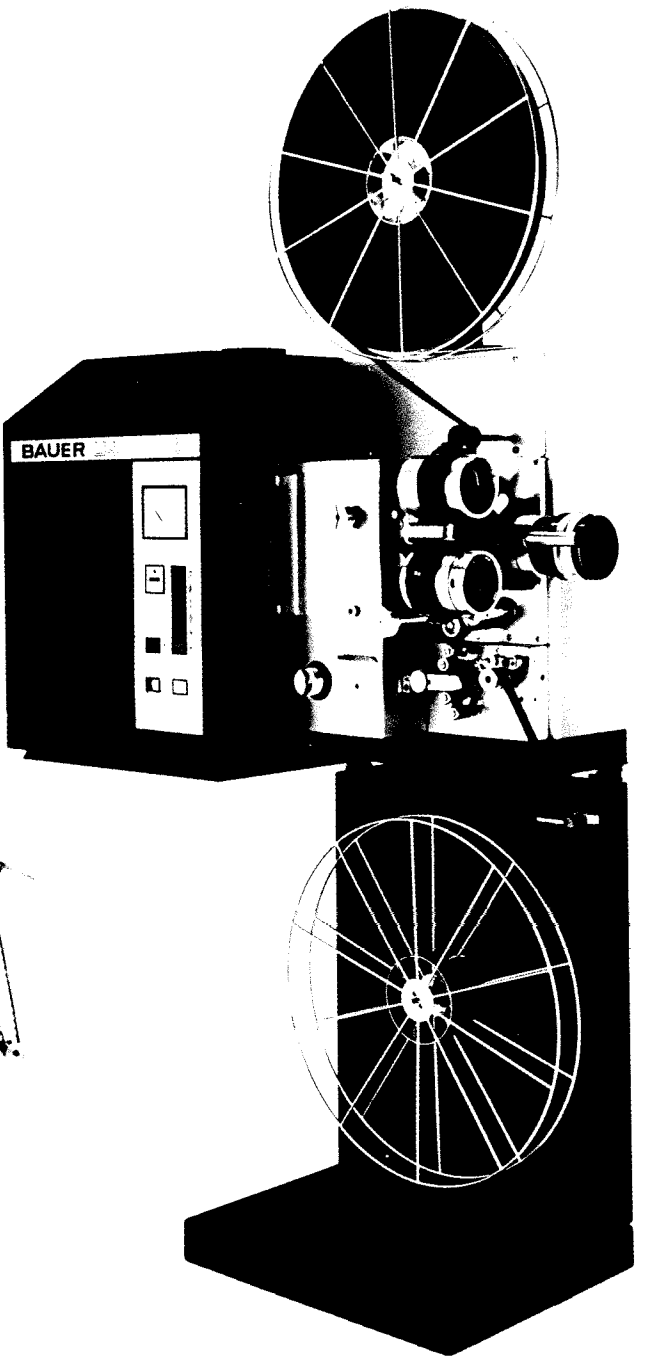
Prints intended for use with large reels or platters (Figures 6 thru 10) could be made up during inspection provided they were received with the correct winding orientation. But until film distributors can conveniently supply and ship release prints ready for use on such systems, the chore of splicing during makeup and breakdown will be necessary.



(Photo courtesy of Eprad, Inc., Toledo, Ohio.)

The Eprad platter system, like others of this type, includes supply, takeup, and rewind sections.

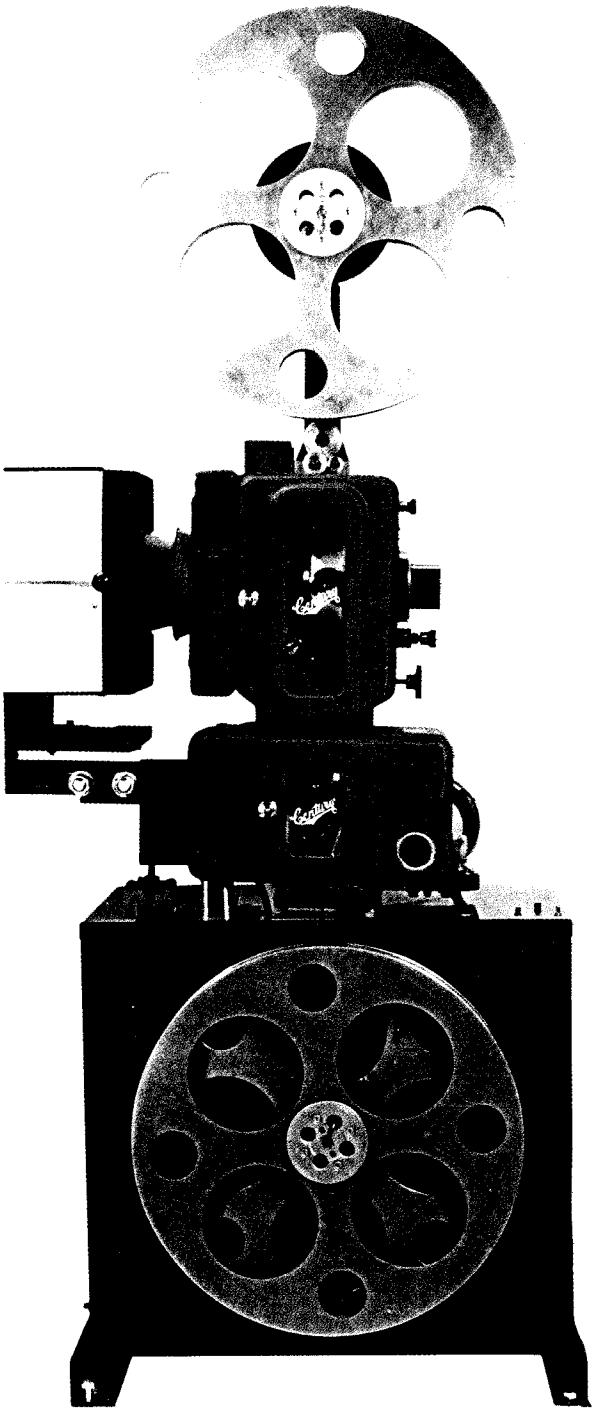
Figure 7



(Photo courtesy of Arriflex Company of America, Woodside, New York.)

The semiautomatic Bauer projector with 6000-foot reels.

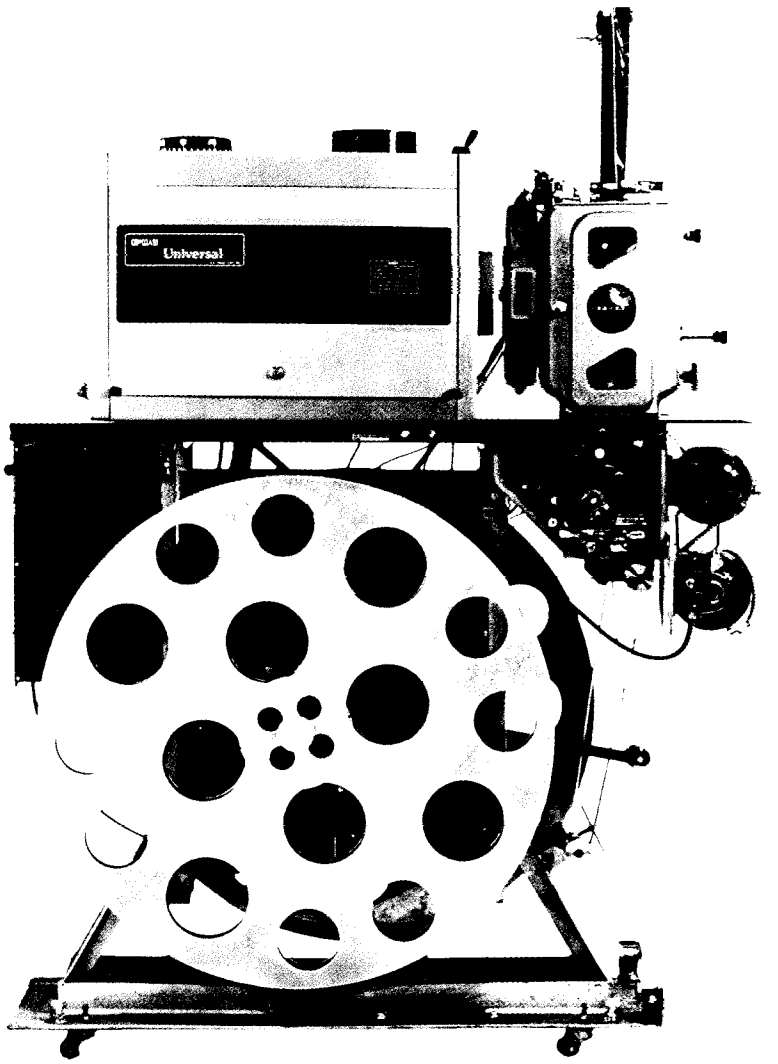
Figure 8



(Photo courtesy of Century Projector Corporation, Long Island City, New York.)

Semiautomatic Century projector with 6000-foot reels.

Figure 9



(Photo courtesy of Eprad, Inc., Toledo, Ohio.)

Eprad theater projector with large under-slung reels in a side-by-side configuration.

Figure 10

This kind of splicing is a relatively new projection room procedure and has started some experimentation among projectionists, because guidelines for universally accepted and approved techniques for large reel makeup and breakdown are not yet available. The Engineering Committee on Theatrical Projection Technology and Application of the SMPTE has been actively seeking to establish such guidelines so that film life and subject continuity can be maintained.

Waste Not, Want Not . . . Pictures!

A regular cement splice, whenever it is made, usually causes the loss of at least two frames of film. A two-frame loss is scarcely noticeable during projection if the splice is well made. Imagine, however, the same splice between two reels being made and torn apart 100 times. Assuming the loss of two frames each time the splice is remade, there will be roughly 12 feet (3.7 m), or 8 seconds of picture information removed from that section of film. You can quickly calculate how much the total film loss (in feet) will be by multiplying 12 times the number of other reel-end splices. As a result of this obviously distracting and wasteful practice, many projectionists have turned to tape splicing.

Among techniques that have been suggested to the SMPTE Engineering Committee, the following is being widely practiced. When removing the leaders and trailers from the reels, cut to include one frame of the picture information (Figure 11) for positive identification later during replacement. If the end of some reels finish with a fade-out, make some sort of matching mark on each side of the separation for later identification. Join the reels by using a tape splice as described in the first issue of Film Notes for the Reel People, Kodak Publication No. H-50-1, *Splicing for the Professional.* On breakdown, the tape is merely peeled off the existing splice and the leaders and trailers are easily replaced correctly by matching the frames and joining with a new tape splice. If this technique is followed during the life of a print, no further footage will be lost due to the frequent transfers to large reels and platters.

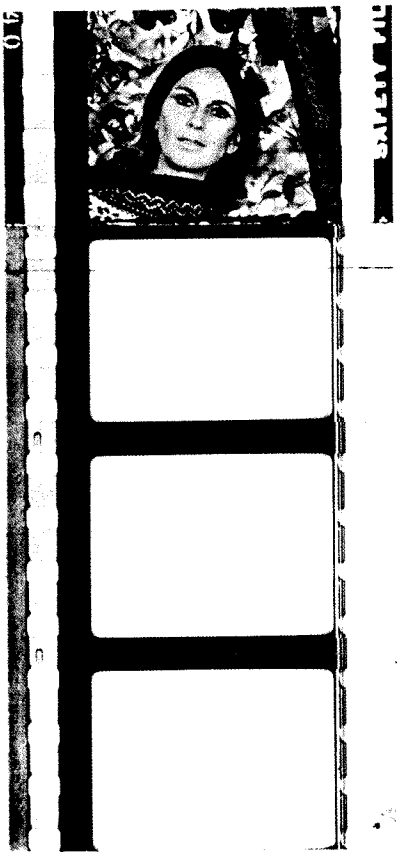
Find Those Reel-end Splices

During the makeup of the large reels or platters, a projectionist may decide to use some sort of telltale marks to help him find the reel-end splices during breakdown. This practice is acceptable providing the marks do not mutilate the film or harm the screen image. Grease pencils, white shoe polish, and other similar devices should be avoided. One current method uses white translucent polyester splicing tape. The density of the tape is low and generally passes through the projector unnoticed on the screen, but can be easily seen on the film. Such a splice, using one-inch tape, can easily be made on any of the guillotine-type splicers commercially available. However, the translucent tape should cover less than two frames to prevent unnecessary visual disturbances to your audience.

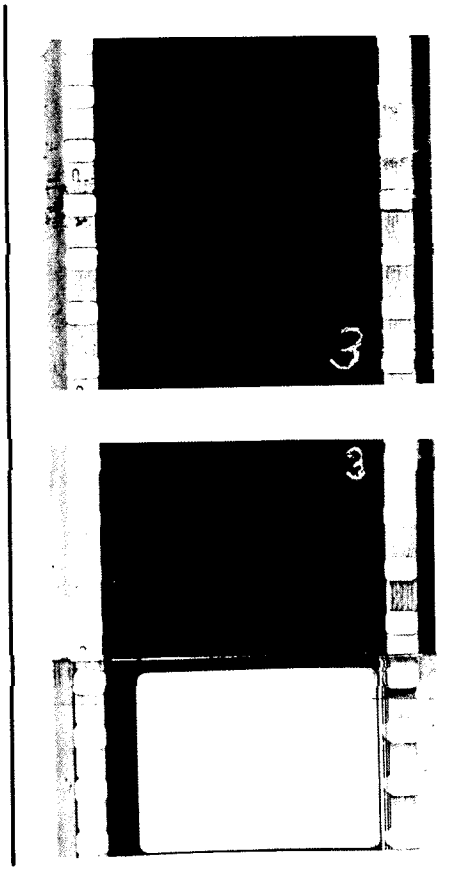
Another technique, probably more applicable to the horizontal platters, can be used during the last show if you have a free hand or a long stretch. After the splice has gone through the projector, simply insert a paper marker at the point where the splice winds onto the platter. On breakdown, as you approach the vicinity of the marker, slow down and feel for the splice. It is expected that other more ingenious and faster techniques will evolve, but keep in mind expedience is no excuse for film damage and image mutilation.

On Cue!

In situations where projection facilities are totally automated, the application of appropriate cues is necessary. When placing cues on the film, however, it is important to remember that the next theater may use a totally different type of projection facility. Magnetic cues should be placed on



Use one frame of the last scene on the reel to identify reels when replacing the trailers.



For reels that end with a fade-out, use a matching number on each side of the cut for identification.

Figure 11

the film in strict accordance with the instructions supplied with the applying device. The magnetic chip should be firmly attached to the film, but not bonded so that it will have to be cut out of the film at the end of the show. Equipment requiring electrical contact cues depends on a metalized tab or similar electrical conductor usually placed on the edge of the film. Proper tabs are generally available and can easily be removed from the film on breakdown. Care should be taken to see that the tabs do not overlap (Figure 12) the film perforations. Furthermore, because of the low voltages involved in such equipment, it is extremely important that the tabs be kept clean . . . free from oil, dirt, and any metallic oxides. Use an approved solution such as *KODAK* Film Cleaner (with Lubricant) to wipe the tabs clean. *The use of graphite/film-solvent type cues should be strictly avoided.* They cannot be removed from the film without being cut out, and their placement may not be correct for use with other types of equipment.

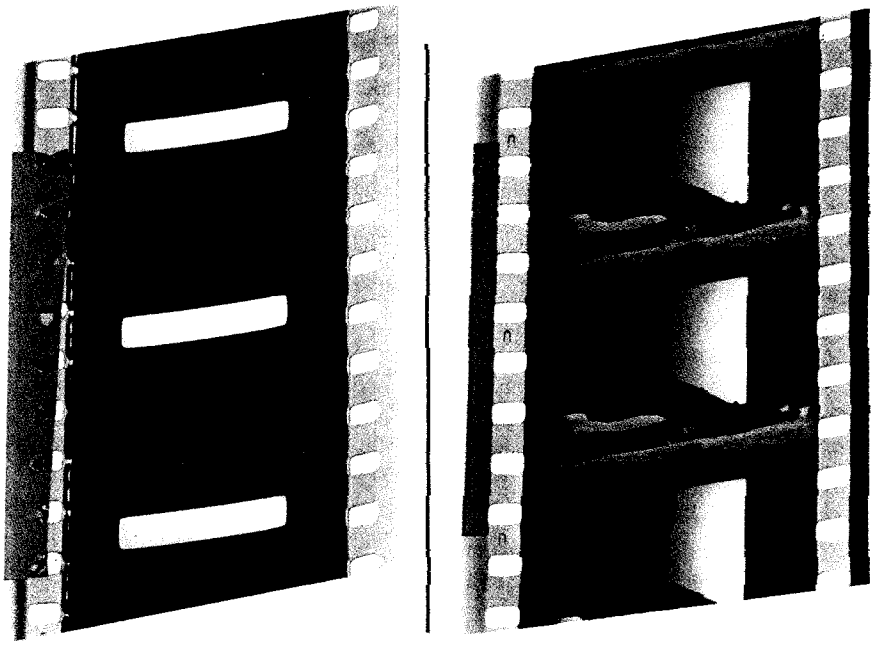
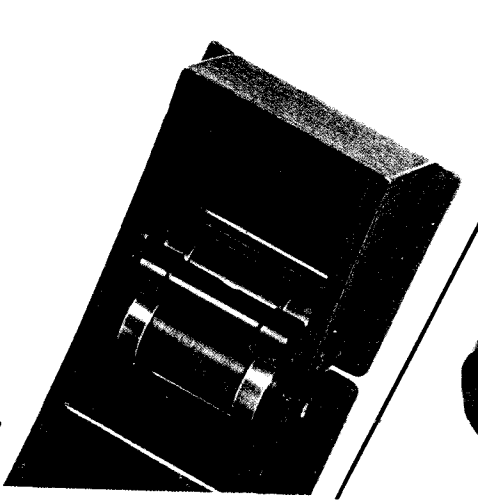


Figure 12—*Metal cuing tabs should be correctly applied.*

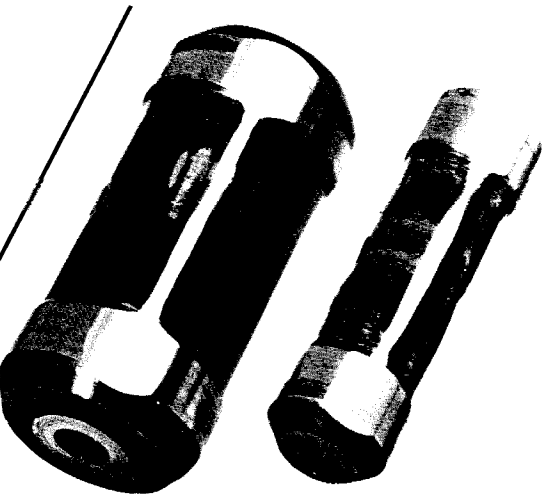
PROJECTION TECHNIQUES

Regardless of the type of projection equipment (platters, giant reels, or the traditional 2000-foot [610 m] reels) on which the print will be shown, the film path through the projector will be essentially the same. Although this publication is directed primarily at professional people who are thoroughly familiar with theater equipment, a short review of projection fundamentals may be appreciated by some readers.



Upper valve rollers (removed from projector to show details).

Figure 13



These fire rollers were deliberately worn to show the possible effect they could have on film.

Figure 14

THREADING AND START-UP

The typical theater projector has been designed to provide a smooth and continuous movement of film from the upper magazine to the lower magazine or from one platter to the other. With the exception of the sound drum, there is no place that projector components come into contact with the image area of the film. Then why is there so much abrasion, you may ask? If it isn't the equipment, it must be the people. In a previous article we reviewed the role of the distributor in dealing with abrasion and film damage. This article will discuss some of the things the projectionist can do to keep prints in good condition and thus keep audiences happy.

Keep the Fire Rollers Turning

In a conventional reel-to-reel system, the film is threaded from the upper magazine, through the projector, and into the lower magazine. Years of observation and experience have revealed that in this film path the upper valve, or fire, rollers (Figure 13) are probably prime contributors to film abrasion in an otherwise properly threaded projector. This is not a contradiction of our earlier statement that no projector component contacts the image area of the film except the sound drum. Rather, it means that this area should be checked frequently to make sure the rollers do not freeze up and allow the roller shoulders to be worn flat by the film. Once the shoulders are worn, the full length of the heavy rollers can bear on the film (Figure 14) and cause abrasion. Because of a relaxation in safety requirements during the past few years,

some of the newer projection equipment, and older equipment modified for large reels or platters, may not contain these rollers.

Who Needs Carelessness?

At this point the actual threading procedure should not have to be reviewed, but the years of repeating a routine manual operation daily can lead to carelessness. An improperly seated film over a sprocket, a pad roller that creases the film edge, and excess oil in the film path are some of the most common causes of film damage, abrasion, and dirt in the projector.

After complete threadup, the entire film path should be reexamined and advanced by hand to check it out. Has the slack been taken up between the reels and the feed and holdback sprockets? Are the tension devices correctly adjusted for the large reels? Is the film properly seated on all the idler rollers in a platter system? A "singing sprocket" signifies excessive tension somewhere in the film path. Continued projection under these conditions results in perforation wear and premature perforation breakdown. As more and more projection prints are made on polyester base film, such as *KODAK ESTAR* Base, the threat of perforation breakdown may become less important, but continued *deformation* of the perforations can eventually lead to an unsteady screen image.

FOCUS

Film wound emulsion-out on small cores has built-in strains that decrease as the diameter of the roll increases. During the normal projection of 2000-foot reels, therefore, the focus position will shift from one end of the reel to the other. This focus shift depends somewhat on the amount of heat energy that is applied to the film, but it generally exceeds the depth-of-focus of normal projection lenses. As a result, sharp focus at the start of a reel will become increasingly soft as the end of the reel approaches. To maintain the best possible screen image quality, it is important to check the focus frequently and make any adjustments that may be required when projecting reels that are wound emulsion-out. Otherwise, there may be an abrupt change in focus at the changeover.

If film is initially wound emulsion-in after processing and maintained that way, focus shifting, or drift as it is sometimes called, is practically eliminated. SMPTE Recommended Practice, RP-39, *Specifications for Maintaining an Emulsion-In Orientation on Theatrical Release Prints* discusses emulsion-in winding simply enough, but hard-to-break habits along with minor threading problems in some older equipment have hampered universal adoption of this practice in spite of its obvious advantages. Fortunately, given sufficient time, the internal strains mentioned earlier do relax somewhat if the film is kept wound on reels with large diameter hubs. The large diameters provided by the platter systems also help to minimize strain-related focus drift.

In some theaters, adequate focus is likely to be a compromise due to a combination of factors such as large projection angles, curved screens, and projection axes that are not perpendicular to the screen in both the vertical and horizontal planes. But since the center of the screen is generally the focal point for most story action, best focus is usually adjusted for the screen center.

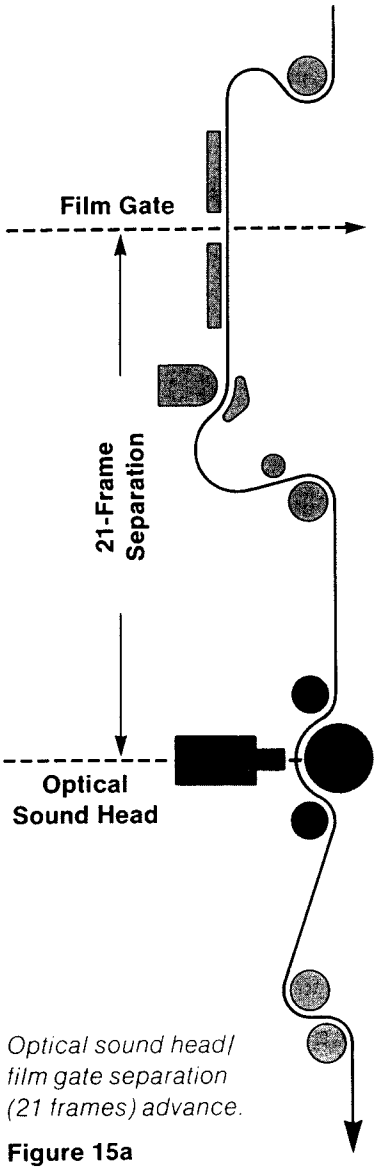
SOUND

During threading, the length of the loop between the intermittent sprocket and the sound sprocket can be critical (Figure 15a). A 21-frame threadup separation will bring corresponding picture and sound to the screen and speakers at the same instant. This is obviously the preferred threadup for drive-in use where the speaker may be only inches from the viewer's ear. Since sound travels about 1100 feet (335 m) per second, or 45 feet (13.7 m) in 1/24 of a second, a 20-frame threadup separation produces this synchronous effect at about 45 feet (13.7 m) from the screen; a 19-frame threadup separation results in picture/sound synchronism (lip synch) at about 90 feet (27.4 m) from the screen. A compromise threadup separation will be determined largely by the physical size of the theater. Since most patrons appear to prefer the back half of the auditorium, the distance from the screen to the middle row of seats may be a first choice. Many large houses thread with a 19- or 19½-frame separation. During the projection of 4-track magnetic prints, the same attention to lip synch is necessary, except that the frame separation is different. Dead synch (for drive-ins) is at 28 (Figure 15b) instead of 21 frames, and because the sound lags behind the corresponding picture frame, you must *increase* one frame for each 45 feet (13.7 m) between the screen and the audience.

The sound track, or tracks, on most release prints are recorded, printed, and processed to provide generally equal volume levels when reproduced. Special effects and unusual requirements by some directors may affect that "nailed down" level, but a considerate projectionist should step out into the auditorium from time to time and judge the sound for volume level and intelligibility. The correct volume level for a full house can sometimes be excessive in a nearly empty house. There is no intention here to suggest that any projectionist should "ride the gain." The tailoring of the sound levels to reflect the various moods and scenes of the story have been set by the film producer or director and should not be changed unless specific instructions to do so have been provided.

SCREEN LUMINANCE

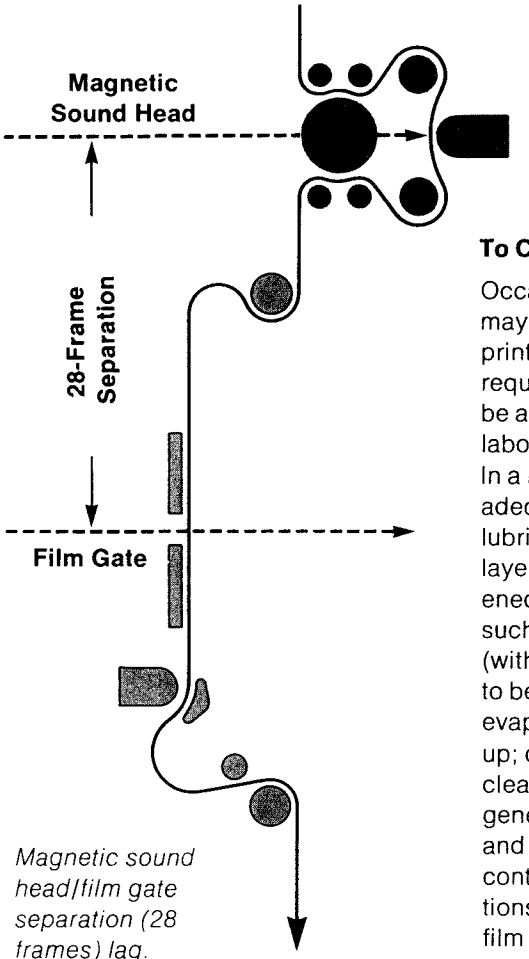
Release prints are exposed, printed, and processed to be viewed at a screen



Optical sound head/film gate separation (21 frames) advance.

Figure 15a

luminance of 16 ±2 footlamberts (55 cd/cm²) measured with the projector running, but without film in the gate. Any great change from this level will downgrade the quality of the screen image and, in the case of drive-ins for example, make some scenes practically invisible. If you notice significant flicker, particularly in light scenes, or the complete loss of detail in medium or dark scenes, your screen luminance value is probably either above or below standard.



Magnetic sound head/film gate separation (28 frames) lag.

Figure 15b

We do not expect that the average theater owner or manager will purchase equipment to check screen luminance values, but such services might be available within a theater chain. In any case, arrangements to have the screen luminance measured and have corrections made if necessary, could make a real improvement in audience satisfaction at your theater.

REWINDING AND HANDLING

With reel systems, it is also important that you review your rewinding procedures to avoid potential film damage. Leaders and trailers should not be allowed to pile up on the rewind bench or floor. When winding at any speed, but particularly at high speed under low humidity conditions, static charges can be generated that will act as a magnet to draw up loose dirt from the bench. Since the static charge persists, the dirt particles migrate into the reel and eventually cause an objectionable screen image just before the changeovers.

To Clean or Not to Clean?

Occasionally, a sincere projectionist may want to clean a dirty and/or oily print. Unfortunately, film cleaning requires special procedures that can be accomplished best by a commercial laboratory equipped for that purpose. In a real emergency, film can be adequately cleaned and lightly lubricated by passing it through several layers of velvet plush material moistened with a film cleaner/lubricant such as KODAK Movie Film Cleaner (with Lubricant). Rewinding speed has to be adjusted so that the liquid evaporates before the film is wound up; otherwise, spotting will occur. Film cleaners, with or without lubricants, generally require adequate ventilation and the avoidance of prolonged contact with the skin. If these precautions cannot be met, it is best to leave film cleaning and lubricating to the professional laboratories.

It is very important to remember that cleaning a print will invariably remove the lubrication. And although a seasoned print will not usually require relubrication, a new print will. If you find it absolutely necessary to clean a new print, locate a facility that can reapply the proper lubricant to the emulsion side edges of your print before projection.

Good Judgment

In review, the subjects discussed under Print Inspection and Projection Techniques are major factors in providing a realistic and enjoyable screen image that does not detract from the total involvement of your audience. Lack of good judgment and practice in any one of these areas can often be the cause of substandard screen presentations and will adversely affect box office receipts.

To put it in very simple words, top quality projection and sound in your theater will go a long way to make sure your *paying customers* come back again and again and again . . .
you can bet on it.