

Film-Tech

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FILM MUTILATION



And how to
prevent it

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and

How to Prevent it



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FILM MUTILATION and HOW TO PREVENT IT

EVERY year the loss through needless film mutilation runs into staggering sums and of course someone has to pay the bill. There are several contributing causes to this waste, as will be pointed out in the pages that follow, and it is with the frank purpose of giving exchange managers, exhibitors, and projectionists helpful facts with which they may not be familiar that this book is published.

Needless film mutilation may be caused by defective manufacture, faulty laboratory methods, poor inspection in the exchanges, careless handling in the projection room and worn or imperfectly adjusted projection machines, and, while it is difficult in many cases to fix the exact responsibility, each possible source of damage will be fully discussed.

The Film

The film can be blamed only when the manufacture is defective. The base or support of motion picture film, which is of standardized thickness, is made from cotton and with reasonable care will fulfill the requirements of commercial use but due to the nature of its origin consideration should always be given to the fact that it has physical limitations. The Eastman Kodak Company with its years of experience in the manufacture of motion picture film (it was Eastman film that first made motion pictures possible) quite naturally observes every possible precaution to assure itself that the quality of its product is kept uniform. Samples from all coatings are thoroughly tested for their photographic and physical properties and must pass careful scrutiny of inspectors whose sole duty is to find flaws or imperfections.

The matter of accurate perforating is of the utmost importance and is only accomplished by constant vigilance on the part of experts to keep the machines at the highest degree of precision.

A recent change in the shape of the perforation of Eastman positive film was adopted only after prolonged practical tests had proved that it greatly increased the wearing properties.

As a final check against photographic quality and physical characteristics, test lengths are run through regular commercial projectors, under exactly the same conditions as would be encountered in the theaters.

The Laboratory

Improvements in equipment and methods of manipulation in all the important laboratories have reduced the possibility of affecting the physical properties of the film during the printing, developing and finishing operations to an extent as to be almost negligible.

The Exchange

Investigation of the general procedure in the inspection and repair of prints indicates that a considerable proportion of the burden of print mutilation begins in the film exchanges. It is not so much that the exchange starts the damage as that it fails to stop it. Inspections are invariably too rapid to be thorough. Splicing is carelessly done with the result that the films are frequently sent to the theatres in such poor condition as to be unable to withstand ordinary projection, to say nothing of the super requirements, particularly with respect to high speed of projection and rapid rewinding, which are all too frequently the case. In rewinding, care should be taken to see that the "rewind" is properly lined up so that the film will feed from the one reel to the other without striking the edges of the reels. The use of defective reels causes untold damage in the rewinding operation. Cinching occurs when the person rewinding attempts to tighten

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the roll. This causes scratches on both sides of the film. Cupping the film to detect damaged edges, perforations, or loose splices is very apt to crack or split the film, more especially on subjects which have had repeated projection on projectors using high amperage. Careful inspection and repairs in the exchanges will result in better service to the exhibitor, eliminate breaks which are the frequent cause of film damage, reduce the amount of replacements due to break-down, and make the subjects available for constant service. Longer commercial life means increased earning capacity.

The Exhibitor

Good projection adds patronage and increased revenue to the theatre.

Good projection is entirely dependent on the skill of the projectionist and the condition of the film and the projection machine. Thorough constant use projection machine parts become worn and out of adjustment. Projectors should never be permitted to get in this condition. Replacement parts are readily available and for the most part inexpensive, and any expenditure in this connection will improve projection and materially help in the reduction of unnecessary film loss.

Careful study of the following pages will be helpful to all concerned with motion picture film.

Splices

Splicing, whether done in the film laboratories, film exchanges or projection rooms, has such direct bearing on the welfare of the film as to call for special and constant attention.

Much film is ruined by poor splicing. Splices that are wide, stiff, buckled and out of line cause the film to jump the sprockets resulting in torn perforations or breaks. Perforations in the vicinity of a splice of this kind will always be found to be strained or broken out. Stiff and buckled splices are caused by excessive scraping of the film, or a too

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liberal application of cement or both. The use of a poor quality cement results in splices pulling apart especially in the film gate or trap. This constitutes a hazard; therefore, all weak or otherwise bad splices should be remade before projection. FIGURE 1 shows the well known full-hole splice which is the most widely used and if properly made gives the best all-around results.

Pamphlets on splicing instructions may be had without charge on application to the Eastman Kodak Company, Rochester, N. Y.

Whenever film is damaged on a projector, it is generally customary to lay the cause of the trouble to one or more of three different things; namely, sprockets, idlers, and tension exerted on the film by the springs in the gate or film trap.

While it is true that in most cases the trouble can be traced to one or more of these points, it must be admitted that the direct cause of a great amount of film damage is never definitely settled between the film

Exchanges and the Projectionists, especially when the projectors in question have been gone over quite carefully and everything has been found to be in apparently good condition.

In cases of this kind, it is only natural to assume that the film stock is at fault. There are, however, various projector parts, generally considered more or less unimportant which, as a rule receive little or no attention on the part of the Projectionist. The result is that film trouble is apt to start at any one of them.

The following résumé covers the more important points which must be given careful attention by the Projectionists, if the maximum wearing qualities are to be obtained from the film.

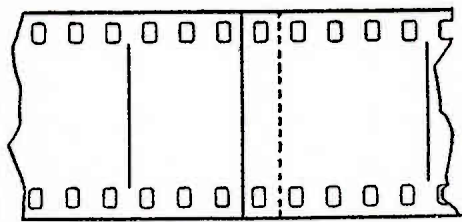


FIG. 1. The Full Hole Splice Generally Recommended.

Tension on Springs in Gate or Trap

One of the principal sources of trouble is the use of excessive tension exerted on the film by the springs in the gate or trap. A great variation will be found in tension on various projection machines being used in the trade. Moreover, there are some Projectionists who are not familiar with the amount of tension which should be used, and as far as we know, there is no set standard which is generally accepted as being correct.

It is common practice to set the springs just tight enough to hold the film stationary at the speed which is used in a given theatre. For proper screen reproduction the speed of a projector should be determined by the action of the picture. This is very seldom done, the average program being run at one set speed regardless of the action. This cannot be considered the fault of the Projectionist as he is under a certain time limit to project a given number of reels.

Excessive tension as high as 34 ounces has been found to exist on certain projection machines and causes badly nicked and pulled out perforations. Heavy tension on one side can be caused by a poorly adjusted, weak or broken spring and results in an uneven pull-down strain on the film.

On projectors using the gate a stop or catch is provided which holds the gate in the same position each time it is closed.

Projectors using a trap door or pressure plate are not provided with a stop of any kind, thereby allowing varying amounts of tension to be applied to the film. The trap door or plate should never be let back against the film with great force as this results in exceptionally heavy tension, which must be withstood by the film until the door or plate has worked back to its proper position. The proper tension exerted by the springs should be 8 ounces for each spring or 16 ounces combined tension. FIGURES 2A and 2B show the proper method of making a tension test.

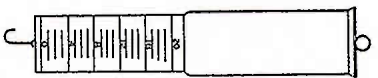


FIG. 2A. A spring balance graduated in ounces is convenient for tension tests.

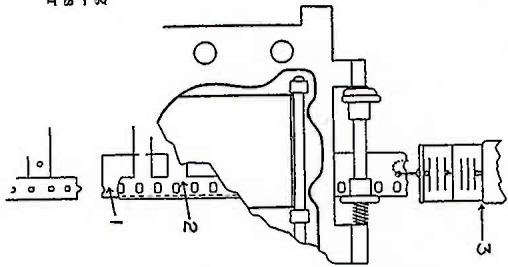


FIG. 2B. Tension tests are made on each side. 1 is the film, 2 the pressure plate and 3 is the spring balance at 8 ounces.

fastening the end of the strip of film to the balance a straight even upward pull is made until the 8 ounce mark is reached. At this point the film will start to pull from the gate if the spring is set properly.

The combined tension of both sides is then checked as shown in Figure 3, using a full width piece of film placed in the gate so that both sides of the shoe hold it firmly against the aperture plate. After making sure that the perforations on this strip of film are not engaged by the sprocket teeth proceed as before with a straight upward pull until the 16 ounce mark is

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Referring to illustration B: first the tension on one side and then on the other is taken by using one half of a strip of film about 8" long. This strip is prepared by slitting a piece of film down through the center. Care should be taken to observe that the perforations on this strip of film are free of the teeth on the intermittent sprocket and are held properly in place by the tension shoe before proceeding further. After

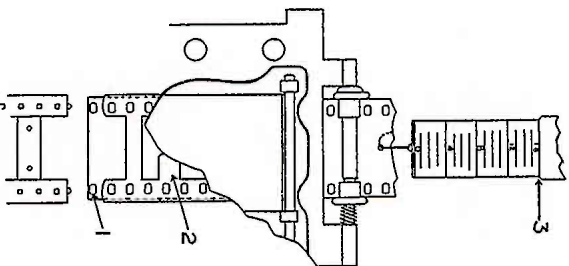


FIG. 3. A tension test is then made on both sides. 1 is the film, 2 the pressure plate and 3 the balance at 16 ounces.

reached. At this point if both springs are adjusted correctly the film can be pulled from the gate. To make this test correctly, the projector should be cold, using film of the average thickness.

The tension springs on some projectors can be regulated by means of small set screws while on others no adjusting device has been provided and springs must be bent by hand, but in doing this great care must be taken to get the proper adjustment.

Sprockets

Through carelessness and neglect sprockets are frequently left on projectors until the teeth develop bad hooks and knife-like edges. Film damage caused by under-cut teeth is unmistakable in appearance and in many cases film is practically ruined after one or two showings if run on a projector equipped with such sprockets. (Figure 4)

The changing of an intermittent sprocket must be done with great care as the shaft can be bent very easily. Equipped with the proper tools any competent Projectionist can make the change but in many cases it may be advisable to have the work done at the factory to insure the best results.

Before placing new sprockets on projection machines, a careful examination should be made of the teeth to be sure that none of them have been damaged by coming in contact with one another or some other hard surface. If a sprocket is accidentally dropped on the floor the teeth are likely to be burred or bent and if used on a projection machine, will cause untold damage to film. This will be true even if only one tooth has been damaged.

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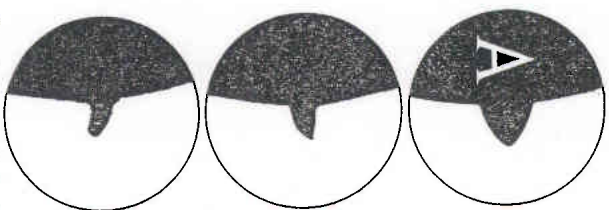


FIG. 4. Sprockets taken from projectors actually in daily use. Sprocket A is a new sprocket.

Adhesion of Emulsion to Shoe or Film Tracks

All new film should be waxed to insure against adhesion

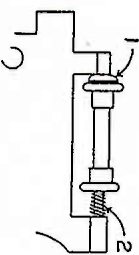


Fig. 5. This guide roller is not adjustable. Spring 2 is supposed to hold it snugly against the washer 1. If it is not properly aligned, return the head to the manufacturer.

print can be completely ruined in this manner at one showing.

In removing the hardened emulsion deposits from the film tracks and tension shoes use no steel or iron implement such as a screw driver, safety razor blade or file. Instead use a dampened cloth and if necessary a coin as this will not scratch the highly polished surface.

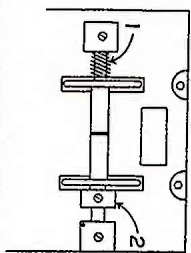


Fig. 6. This guide roller may be adjusted by loosening the set screw in collar 2 and then after centering, tightening the screw. Great care should be taken not to "spring" the shaft.

Guide Rollers

The guide rollers located above the gate or film-trap are there for the purpose of properly guiding the film down past the aperture to the intermittent sprocket. If these rollers are out of line with the sprocket, the teeth will naturally strike the film perforations off-center.

On some projectors these rollers are adjustable by means of a collar and set-screw, while on others there is no regulating device. Certain manufacturers using the latter type, rely on the proper centering to be made at the factory, nevertheless there are times when an adjustment is found to be necessary and it is very important that great care should be

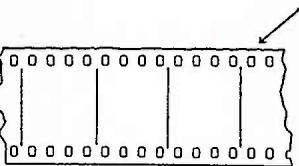


Fig. 7. The arrow shows where the film edge has been bent away by sprocket teeth or imperfect alignment of the upper magazine.

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used in lining up the guide rollers with the intermittent sprocket, otherwise damaged perforations will result. See Figures 5 and 6.

If these rollers bind, the face of the rollers will develop ridges which will roughen the edge of the film as shown in Figure 7. It is also well to examine new rollers closely as in some cases they are received from the factory in a semi-finished condition, and have rough faces against which the edge of the film comes in contact.

Friction Take-up

The take-up adjustment should be checked up closely from time to time. An excessive pull can always be detected by the film making a "singing" sound at the take-up sprocket. The sprocket, of course, acts as a hold-back or brake and puts a strain on the film, when starting on a small hubbed reel. This is sometimes enough to cause very severe damage to the upper side of the perforation. Figure 8 shows the sprocket damage resulting from a tight take-up.

Proper setting of the spring is a simple matter and care should always be taken to keep the friction disc, whether leather, cork or fiber, absolutely free from oil. Contrary to some opinions oil will not cause smoother operation in a case of this kind, but will really create a certain amount of suction which in turn results in an uneven, excessive pull.

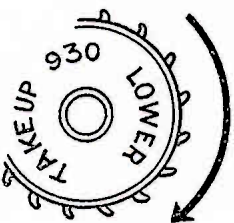


Fig. 8. The teeth of this sprocket have been undercut because the take-up was too tight.

Tension on Upper Magazine Shaft or Spindle

Some widely used makes of projectors have an adjustable spring tension on the upper magazine shaft or spindle. Proper adjustment of this spring is important. If set too loosely the film will come from the feed roll with a jerky motion. This is especially noticeable if used with a bent reel, which is bad for any film, particularly film which is in a dried-out condition or badly worn.

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If the tension is too tight the effect would not be noticeable on a full reel of film, but the tension on the last 50 or 75 feet would be sufficient to cause serious perforation damage when a small hubbed reel is used. It is not uncommon for the film to break under this strain.

Sprocket Idlers

All sprocket idlers must be properly adjusted. If set too far from the sprockets, the film is liable to jump out of place and ride over the teeth, whereas, if they are set too close they will ride the film, causing creasing, especially on the lower sprocket which acts as a brake on the friction take-up.

The small lock nuts on all idler adjusting screws should always be kept tight. Failure to observe this rule will allow the idlers to drop, not only causing creasing but otherwise weakening and permanently marking the film.

It has been found that the safest distance to set an idler from a sprocket is the thickness of two pieces of film. Some manufacturers recommend the thickness of one piece of film but this is insufficient as the distance between the sprocket and idler is too small to allow the average splice free passage.

When the idlers are properly adjusted, it should be possible to move any idler from side to side without danger of touching the sprocket teeth. Badly worn idlers mark the film and should be replaced immediately.

Intermittent Film Guide

The intermittent film guide, is for the purpose of holding the film snugly against the intermittent sprocket but otherwise has nothing to do with the steadiness of the picture. Filing the openings in the film guide holders is sometimes necessary to insure the proper amount of side clearance for the sprocket teeth. Moving the film guide from side to side while the pro-

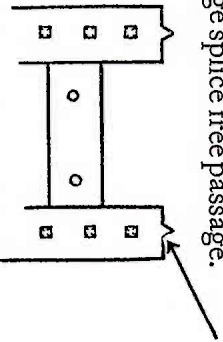


FIG. 9 The arrow shows where the teeth have been grooved to a knife-like sharpness by coming in contact with the wall of the film guide. This will ruin film.

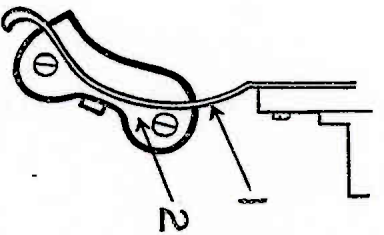


FIG. 10 This is the correct position for the film guide. Arrow 1 shows the guide holder and 2 is the film guide.

especially if the splices are stiff, thick or buckled.

Many Projectionists have found it advisable to substitute a slightly lighter film guide holder spring for the stiff one now furnished by the manufacturers. By this small change, less strain is put on the film at this point, with absolutely no change in screen results, wide and stiff splices, especially, going through with greatly decreased resistance thereby lessening the chance of film breakage due to the yielding of the film guide.

One of the main reasons for picture unsteadiness is an excessive amount of play between the moving parts of the intermittent movement, due to wear. Readjustment is made by means of an eccentric bearing but care must be taken to see that it is not set too tightly, otherwise the parts will bind.

Projector models using an eccentric bearing at each end of the intermittent shaft should be checked carefully after

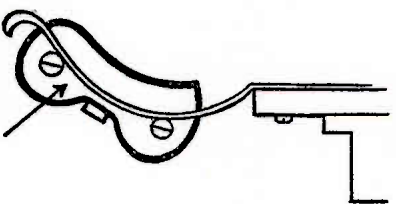


FIG. 11 Here the film guide is upside down allowing the film to strike the sharp end of the guide. Stiff splices won't last under these conditions.

an adjustment has been made, to see that both bearings are lined up correctly, otherwise the intermittent sprocket will run out of true, resulting in the breaking out of the perforation on one side of the film.

Some Projectors provide for a side adjustment of the intermittent shaft by means of a collar and set-screw. Proper alignment is necessary to insure against the intermittent sprocket striking the film perforations off-center.

Excessive wear of the pin-cross type of intermittent movement results in flat sides on the pins, thereby causing a slightly quickened pull-down which gives an added strain on the film perforations. On newer models these pins are equipped with rollers insuring smoother operation.

Proper Alignment of Upper Magazine

One widely used projection machine has an adjustment on the top magazine which allows for its proper alignment. Unless great care is taken to see that the magazine is in line, the film coming from the valve rollers will not feed squarely under the idle roller. This generally causes fractured film to crack from the perforations to the edge of the film.

This improper alignment also causes film breaks resulting from film with nicked edges and from loose splices coming in direct contact with the side of the valve.

Size of Idler Rollers

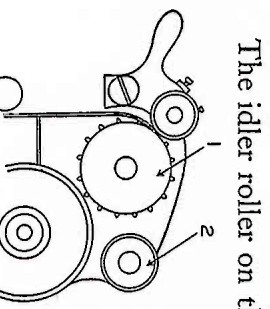


Fig. 12. Shows 1 the feed sprocket and the small roller 2.

The idler roller on the same machine mentioned above is $\frac{1}{2}$ " diameter and causes the film to make a sharp turn on itself. On a roller of this size film which has been dried out and thus has become brittle may break especially if there is an improper amount of tension on the feed roll.

If trouble of this nature is encountered the substitution of a

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larger roller, preferably the diameter of a sprocket namely, $1\frac{1}{16}$ " is a practical remedy. This means but a small amount of work, as only a simple extension is necessary to allow the proper amount of clearance and it will be found to be well worth while. FIGURES 12 AND 13 illustrate the $\frac{1}{2}$ " roller and how the large idler roller can be installed in its place.

Reels

Bent reels and reels with loose and sharp edged flanges should be discarded immediately. FIG. 7, on page 10, plainly shows what happens to the film when such reels are used.

Framing

In framing a picture, it is common practice to move the framing lever very quickly.

FIGURE 14 shows what happens to the film when the framing lever is given a sharp, downward blow on a projector where the complete intermittent carriage moves as one unit. FIGURE 15 shows the same damaging result on a model on which the intermittent sprocket *only* moves in synchronism with the framing lever.

Film Loops

Excessively large upper or lower loops either cause a rattle in the film guard above or allow the film to drag in any oil which may be present below. The film also has a tendency to jump the sprockets, which can take place if the idlers are set too far from the sprockets.

The practice of resetting loops while the projector is running should be discouraged as in many cases the sprocket teeth strike outside of the perforations, or otherwise damage the film.

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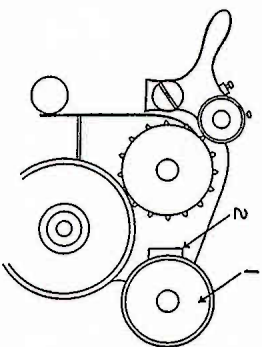


FIG. 13. Here a $1\frac{1}{16}$ " idler replaced the smaller one shown in FIG. 12. The bar, 2, is the only other alteration necessary. The larger idler makes the film last longer.

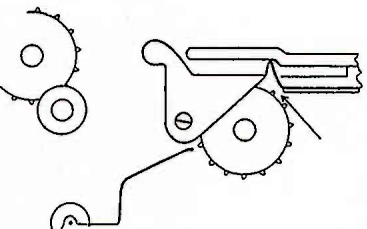


FIG. 14. Suddenly jerking the framing lever on this machine puts a kink in the film shown by the arrow. Frame carefully and slowly.

Film Tracks or Trap Shoes

Many scratches are caused by worn film tracks, or trap-shoes as they are known on one of the projectors, allowing the face of the film to scrape against the recessed aperture plate.

Such tracks or trap-shoes together with all tension shoes or door pads that show a "wavy" or badly worn-down surface, should be replaced by new ones.

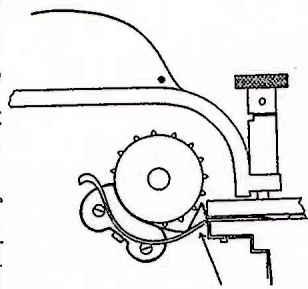


Fig. 15 On this type of projector, also in common use, buckling of the film will occur if framing is done too rapidly.

Fire or Valve Rollers

The valve rollers of both magazines should always be kept clean. Care should be taken to see that they revolve freely as a sticking roller can cause bad emulsion scratches especially if it is worn, thereby allowing the center of the roller to come in direct contact with the face of the film. This is especially true of the upper magazine rollers around which dirt and small pieces of film very often accumulate.

Adjustment of Film Trap Door

On one make of projection machine the film trap door is designed so that it can be easily removed by merely lifting it from its holder. In replacing this film trap door care should be taken to see that it is seated properly, as unless this is done one is liable to ruin the intermittent sprocket, bend the shaft as well as ruin the film which happens to be running through the projector at the time.

Strippers on Upper and Lower Sprockets

On some projectors, so called strippers or stripping plates are provided to prevent, by any chance, the film from winding around or "following" the sprockets as well as to remove any accumulation of dirt that may tend to form at either side of the sprocket teeth. In resetting these

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strippers after the replacement of sprockets, extreme care must be taken to see that they do not come in contact with the teeth as this will cause the teeth to wear to a sharp edge which will damage any film coming in contact with it.

Unnecessary Oiling

Flooding the mechanism with oil is unnecessary and causes oil to get on the film. Dust then adheres to the film making good clear projection impossible. This practice also is a fire hazard as oily film will catch fire a great deal easier than that which is clean. Aside from the intermittent case, one drop of good oil in each oil hole will be sufficient for the average day's run.

One Method of Tracing Film Damage

Film damage can sometimes be more easily traced if it will be remembered that certain projectors run the film emulsion or dull side against all three sprockets, while on others the support or shiny side, only touches the sprockets. For example; if film is received showing tooth marks on the emulsion side, it is fairly simple to determine on what make or makes of projectors this film has been run, especially if the investigator has familiarized himself with the different types of sprocket teeth.

Why Film Should be Waxed

In conclusion, special attention is drawn to the desirability of waxing new prints along the perforations to prevent unsteadiness and premature breakdown.

In making the light sensitive emulsion of motion picture film one of the chief ingredients is gelatin—a substance which readily absorbs and gives off moisture. In freshly developed film the gelatin contains a considerably higher percentage of moisture than is found in seasoned film, and when in this condition it is easily affected by heat, tending to make it soft and tacky particularly in a moist atmosphere. The first point at which new film comes in contact with unusual temperature is at the aperture plate of the

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projector where the light is concentrated, producing heat to a degree which softens the gelatin and causes it to collect on the tension springs or shoes where it rapidly dries and forms a flint-like deposit. As the new film is projected, the hardened deposit of gelatin continues to accumulate and offers further resistance, causing scratches along the perforations. As the resistance increases there is the added danger of the teeth of the intermittent sprocket tearing and damaging the perforations, sometimes to an extent where injury to the print is irreparable.

Careful waxing produces, under the action of heat, a smooth and polished surface on the gelatin along the perforations; provides against undue straining during the first projections of new prints; materially benefits successive runs, and greatly prolongs the commercial life of the prints.

Cold wax should never be used as it is impossible to apply it evenly. There is also the danger with the cold method of over-waxing with the result that, in contact with the heated pressure springs, the wax melts and spreads over the picture. A very slight application is all that is necessary and is best accomplished by a waxing machine which deposits a thin layer of hot wax along the perforations. New prints treated in this manner require no further waxing.