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Iowa State College of Agriculture and Mechanic Arts Official Publication

VOL. XX

AUGUST 10, 1921

NO. 11

USE AND CARE OF MOTION PICTURE FILM

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BULLETIN NO. 49

ENGINEERING EXTENSION DEPARTMENT

AMES, IOWA

Published weekly by Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa.
Entered as second-class matter, and accepted for mailing at special rate of postage provided for
in Section 429, P. L. & R., Act August 24, 1912, authorized April 12, 1920.

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USE AND CARE OF MOTION PICTURE FILM

PREFACE

This bulletin is intended primarily for the non-theatrical operator who, on account of his relationship to a church, school or social center, has never had the time or inclination to become, and has never felt it necessary to become, an expert projectionist. These pages are not intended to be an exhaustive treatise but it is hoped that they may point out some causes of the most common troubles and methods for correction or prevention of them.

MOTION PICTURE FILM

A reel of motion picture film is a thin, fragile, perforated strip of celluloid $1\frac{3}{8}$ inches wide and about a 1000 feet long upon which are printed 16 separate distinct pictures per foot. Each reel is a photographic reproduction of a series of snap shots printed from a master film or negative.

Film are very fragile, easily injured and a single maladjustment of a projector will do irreparable damage to them. The greatest sources of trouble arise from the sprocket hole perforations and poorly made splices—(sometimes called patches). During projection the film moves in front of the light at the rate of one foot or more per second with 16 distinct stops and starts a foot. One-sixth of the time the film is moving, and during the remainder of the time the film is motionless at the aperture. At normal speed each successive picture moves into position before the aperture in approximately $1/100$ of a second. It can be readily understood that there is a considerable strain on the film particularly at the sprocket hole perforations along both edges of the film. Dirt accumulations, worn sprocket teeth, too strong tension, poorly adjusted idlers, misalignment of working parts, surplus of oil, grit, accumulation of loose emulsion, careless rewinding, packing, shipping and storage, contribute to rapid film deterioration and subsequent projection difficulties.

FILM INSPECTION

Film usually come from the exchange properly wound and apparently ready for the projector, however, it is never advisable to project film without first inspecting it through the rewind. Even though the exchanges may employ inspectors who are capable, there are times when in the rush to make shipments the inspection is done carelessly. Loose patches, misframes, broken sprocket holes and small tears may have escaped attention.

Sample - 28-268-114
7-31-1975

HOW TO INSPECT FILM

Every user of film should be provided with a bench film rewind supplied with a brake. The bench rewind, as the name indicates, should be fastened to a table, shelf or bench. A hole about 4x4

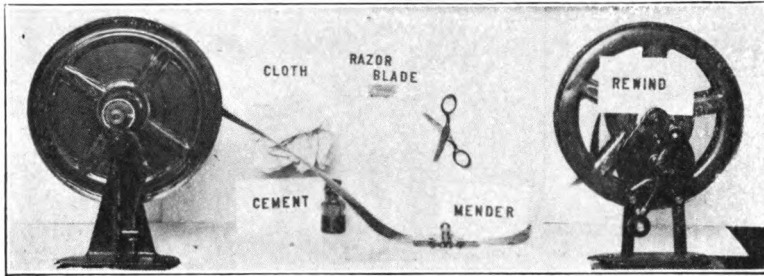


FIG. 1. SHOWS ALL OF THE ACCESSORIES NECESSARY FOR MAKING FILM REPAIRS. The ground glass may be seen immediately in front of the film mender. It is illuminated by an 10 watt Mazda lamp beneath, controlled by a snap switch on the side of the bench.

inches should be cut in the bench and fitted with a piece of ground glass. (Fig. 1). Beneath the ground glass should be placed an 5 or 10 watt electric lamp. A film mender should be permanently fastened adjacent to the ground glass on the bench or table. A bottle of the best grade film cement (not glue or library paste), a safety razor blade or film scraper, and a small pair of scissors complete the necessary equipment. The rewinds found inside some portable projectors are not satisfactory for inspection purposes.

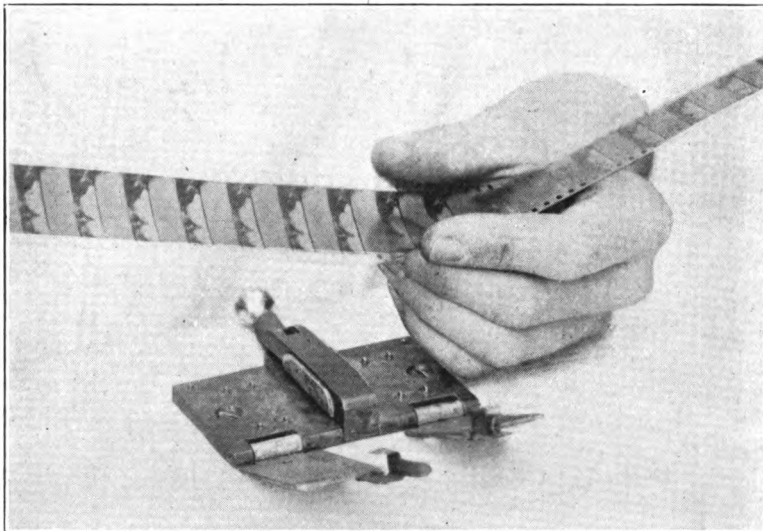


FIG. 2. BY HOLDING THE FILM BETWEEN FINGER AND THUMB IT IS POSSIBLE TO DETECT BROKEN OR TORN SPROCKET HOLES, AS WELL AS HARSH OR POOR SPLICES.

For inspection, the reels should be placed on the rewind attached to a table so that the film, while being rewound, travels from left to right, winding the emulsion (dull) side out. The film should be grasped between the left fore finger and thumb with just enough pressure to slightly cup the film. If rewound very slowly it is possible to detect every broken sprocket hole, tear, defective patch or misframe. Especial care must be exercised not to overspeed the rewinding process, lest the rough sides of an imperfect, bent, or distorted reel may injure the film. It is impossible to detect imperfections when the film is traveling rapidly. If the film is guided into the reel properly the edges of the successive turns of the film will build a perfectly flat disk-like surface. A thousand foot reel should never be rewound in less than five minutes—a longer time is recommended. As much damage may be done during one careless rewinding operation as would be done during many trips thru a projector. The temptation to hurry has ruined thousands of feet of film.

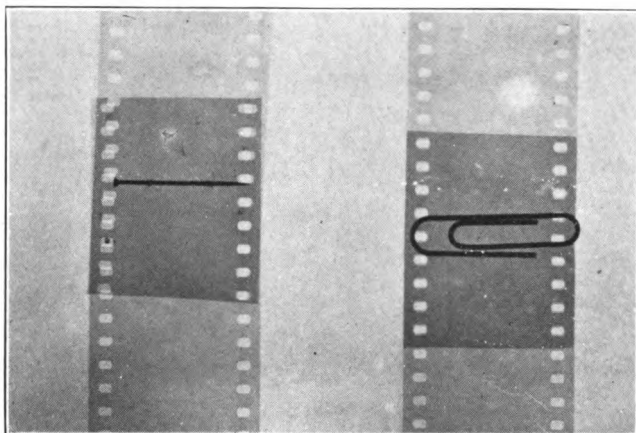


FIG. 3. CORRECT AND INCORRECT TEMPORARY REPAIR If a film breaks in the projector during an exhibition, time is saved by fastening the two ends of the film together with a paper clip. A pin should never be used for temporary repair.

During the rewinding and inspecting operations it is always advisable to have a brake attached on the part of the rewind holding the film being rewound, so that a slight tension may be kept on the film. This is especially necessary for any reel that contains a thousand feet or more. If loosely rewound the reel will be more than filled. There is then a temptation to “pull down” the film, causing it to tighten on the reel with a crunching sound. Rain streaks on the emulsion are caused by “pulling down.” When streaks once appear they cannot be permanently removed. The careful projectionist never “pulls down” film. He rewinds it a second time if necessary.

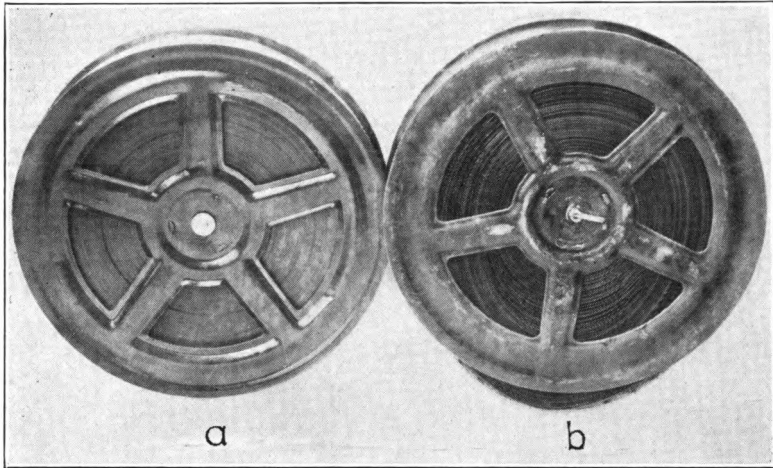


FIG. 4. (a) SHOWS A REEL OF FILM PROPERLY REWOUND. Notice the flat disc-like surface. Contrast this with (b) which is wound too loosely. The surface formed by the film edges is uneven. Movement of the film on the reel will break the edges of the film. Dirt may accumulate between the various film layers, inducing rain streaks and the air has ready access to the film stock causing it to dry out unduly.

HOW TO MAKE REPAIRS

If the film breaks in the projector, the two pieces may be temporarily fastened by means of wire paper clips as shown in figure 3 and the permanent repair deferred until the reel is taken out of the machine. The use of common pins is extremely dangerous

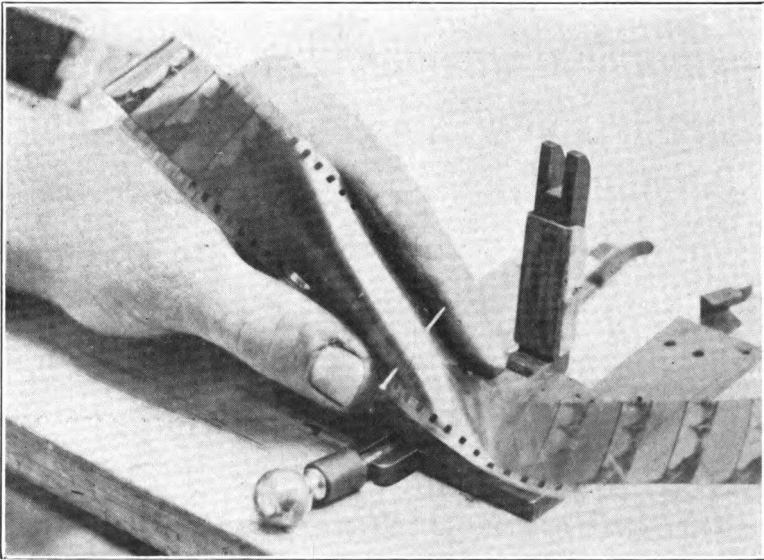


FIG. 5. PAINFUL AND SERIOUS INJURY TO THE INSPECTOR MAY BE CAUSED BY A PIN IN THE FILM. Here is how it may happen.

especially for the inspector who, when he rewinds the film, unaware of the pin, may suffer a severe and painful injury from it as indicated in figure 5. Infections, as a result, are not uncommon, and subsequent amputation of finger, thumb or hand may be necessary. No considerate operator will deliberately return a film, fastened by a pin, to an exchange, nor send it to a fellow exhibitor on circuit in that condition.

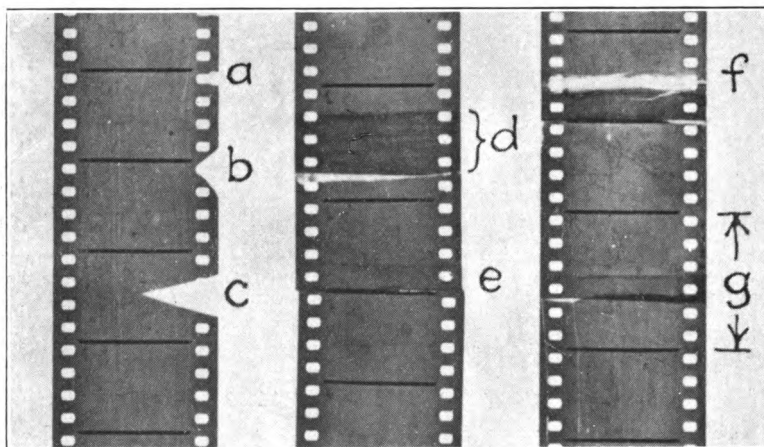


FIG. 6. IMPROPER REPAIRS. (a) is a torn sprocket perforation. A proper repair of this defect is shown at (b). (c) shows the work of a novice or an incompetent operator. Not only will there be a flash of light on the screen but the edges may catch on the idlers, tear the film or cause other serious accident. (d) illustrates too great lapping of film. A hard, harsh, inflexible splice results. (e) the operator who made this splice neither aligned the edges nor superimposed the sprocket holes. The first trip thru the projector will ruin the sprocket holes and the edges of the film. (f) too much emulsion was scraped from the film. (g) the splice is perfectly made but the picture is out of frame. Note there are six sprocket holes between the two frame lines. There should be but four.

When possible repairs should be made as soon as the necessity for them is detected. The most numerous film defects are broken or torn sprocket hole perforations. The repair is made by cutting the "V" shaped notches as is illustrated in figure 6. Care must be exercised not to cut into the picture itself. If the broken portions are not repaired they may catch on the idlers, wind around sprockets, cause the loss of loop, or a break. Sometimes several feet will be torn before the machine can be stopped. It is generally considered best practice to make a splice where more than two successive perforations are torn. To make a splice is a simple though important matter. It must be done quickly, neatly and very carefully. The various steps in the process are shown in figure 7.

The least possible number of frames should be cut out. One end should be cut on the frame line immediately between two sprocket holes. The other end should be cut so that about $\frac{1}{8}$ inch extends beyond the frame line. This brings the second cut immediately between the first and second sprocket holes beyond the frame line, as shown by illustration.

All of the emulsion should be scraped from the second portion of the film, beyond the frame line. For this purpose a safety razor blade may be used satisfactorily. The film, from which the emulsion is to be removed should be placed upon the illuminated piece of ground glass, emulsion side up. The frame lines may be readily detected. Some operators moisten the part from which the emulsion is to be removed, but moisture is unnecessary. Other operators place a straight edge on the frame line and remove the emulsion with a stiff wire brush. The important thing, however, is to remove all of the emulsion up to the frame line and at the same time avoid removing the emulsion from any portion in the next succeeding frame. If the emulsion is removed superficially, a firm splice is an impossibility.

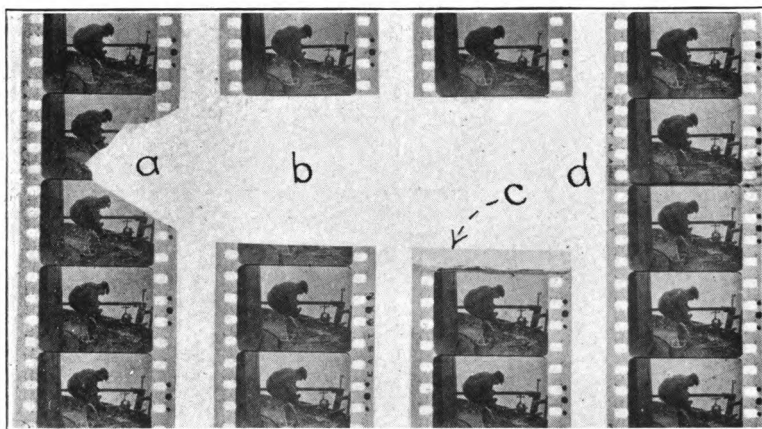


FIG. 7. THE VARIOUS STAGES OF MAKING A SPLICE. (a) shows a torn film. (b) the torn part removed. Note particularly where the film is cut. (c) the emulsion has been removed from the lower end (d) a perfect splice. Note the edges align perfectly, the frame lines are exactly superimposed and the sprocket holes are in the correct position. The picture is "in frame."

The next operation is equally important although it is frequently done carelessly. It should be remembered that every slight variation at the aperture is multiplied many fold on the screen. It is commonly observed on many screens that the picture jumps vertically, at irregular intervals. There are many causes, but among the many, none is more prevalent than imperfectly made splices. Perhaps the sprocket holes do not match. It is absolutely necessary that sprocket holes match perfectly if a proper splice is to be made. The following procedure is recommended.

After the emulsion has been properly removed from the one end of film, the celluloid side of the other end should be slightly abraded to remove all possible oil or dirt so that the cement will have free access to the film. A wire brush or a piece of sand paper will serve the purpose. The two ends should be placed in a film mender observing that the frame lines are exactly superimposed. The operator should see to it that the sprocket holes

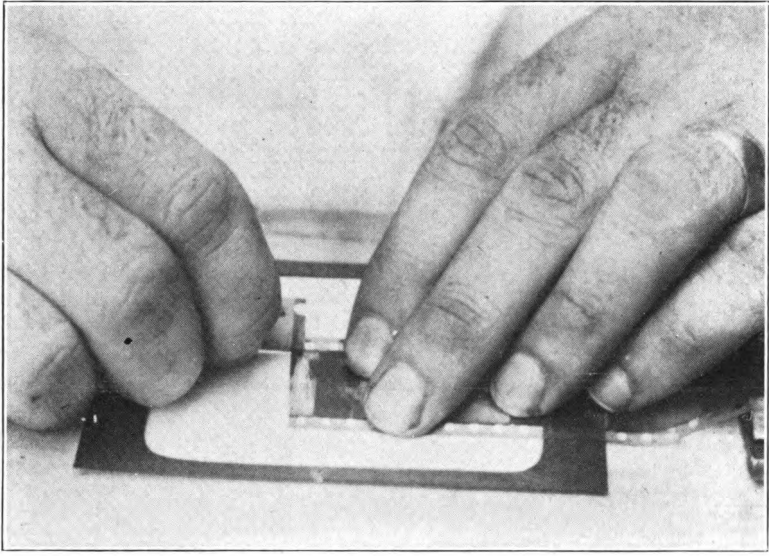


FIG. 8. EMULSION IS REMOVED BY A SAFETY RAZOR BLADE. The illuminated ground glass immediately below permits the repairman to see what he is doing.

exactly coincide and the edges of the film are in perfect alignment before the cement is applied. Film cement is a solvent and dissolves the film, but it is so composed that the active agent evaporates very rapidly. The union of the two pieces of film is a cohesion process and resembles a weld, rather than an adhesion. This is why glue or library paste cannot be used for mending film. Slightly dried cement loses those properties that makes the film cohere.

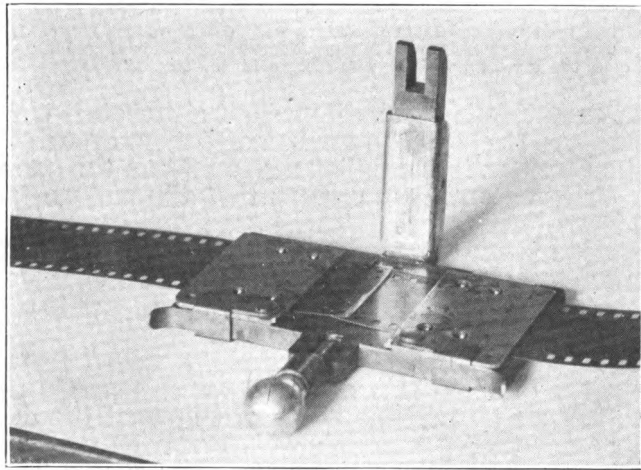


FIG. 9. FILM PLACED IN THE MENDER PREPARATORY TO THE APPLICATION OF THE CEMENT. The repairman should align the edges of the film and sprocket holes perfectly.

It is necessary to work very rapidly. The shorter the time between the moment the cement is applied and pressure applied, the better. The operation can be accomplished quickly by having first perfectly superimposed the holes and frame lines and properly aligned the film edges in the mending device, as indicated in figure 9. One end of the film should then be lifted by the left thumb and forefinger and a very thin coating of film cement applied to the other piece. The part held by the thumb and finger should be released instantly, the surplus film cement removed by a soft lintless cloth and the pressure clamp on the film mender set firmly for a few seconds. The application of cement, the application and removal of pressure should not require more than five or six seconds. The application of too much cement will result in a hard, inflexible splice. All surplus cement should be removed from the sprocket holes.

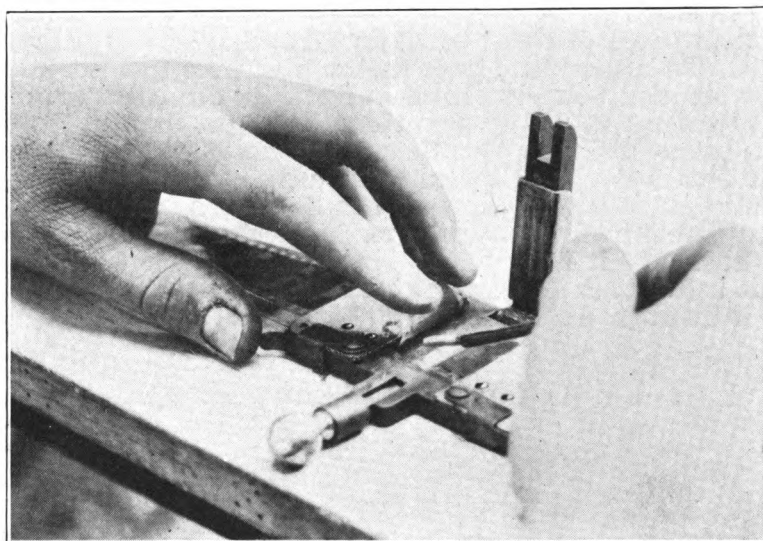


FIG. 10. APPLYING FILM CEMENT WITH A CAMEL'S HAIR BRUSH. Note that the upper end of the film is held up while a very thin coat of cement is applied to the lower end.

REMOVAL OF OIL AND DIRT

If for any reason a surplus of oil accumulates on the projector it is quite likely that some will fall on the film, and tend to hold any dust or dirt that may come in contact with it. This oil and dirt may deposit around sprockets, in the idlers, in the film track and at the aperture opening, and may interfere with perfect projection or may otherwise damage the film itself. There are several simple film cleaners on the market that may be bought at small cost. In the absence of a film cleaner, a soft lintless cloth held in contact with both surfaces of the film will serve very acceptably. It is quite important to use clean cloths just as fre-

quently as old ones become soiled. If soiled cloths are used there is a likelihood that rain streaks will be produced. A stiff bristled tooth brush may be used to remove dirt from the parts of the projector.

TENSION ON FILM

Many films have been injured by too strong tension on the take up reel. Some projectors are designed so that the belt driving the take up should run just tightly enough to turn the reel. Such devices require frequent adjustments lest for any reason, the belt become too loose or stretched too tightly. Other machines are provided with friction plates, the tension of which is regulated by a spring and thumb screw. In either case if the tension is too loose the reel may fail to turn when it becomes nearly filled. If the tension is too tight there may be numerous breaks while the first few hundred feet are being projected. Loss of the lower loop may occur. Great damage may be caused to the sprocket holes themselves. The small radial lines that extend from the four corners of the sprocket holes as shown in figure 12 are evidences of too great tension. Film may pass through the projector without the notice of any difficulty even though the tension is too strong, but if the film is closely examined afterwards, the damage can easily be detected. After the damage has been done, nothing can undo it. The life of the film is greatly shortened and possibly the very next time it is projected will complete its destruction. No film is better than its sprocket holes. The operator can, by care, keep them in good shape if he will but do so.

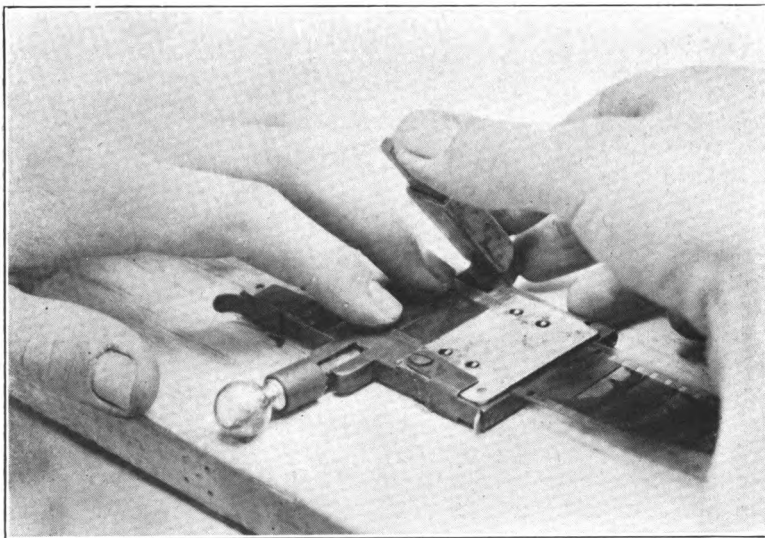


FIG 11 .THE UPPER FILM END HAS BEEN RELEASED SO THAT THE TWO PIECES ARE WELDED BY THE CEMENT. The clamp will be adjusted immediately and pressure applied for a few seconds.

The tension shoes, which hold the film immediately in front of the aperture, may never require adjustment altho they should be kept free from all dirt accumulations at all times. If the tension is unusually strong at the tension shoes it will cause a drag on the film that will not only injure the holes but will cause unusual wear on the intermittent movement and on the intermittent sprocket teeth. Sometimes, especially where new film is run for the first time, a hard flinty substance accumulates on the tension shoes. This is emulsion worn from the film itself. The accumulation should be removed by the finger nail, aided by moisture if necessary, but never by the use of a hard metallic instrument. Scratches on the polished surface of the tension shoes will aggravate the trouble. Usually the tension shoes emit a pounding sound when these accumulations are present. Paraffin applied to the tension shoes will afford temporary relief.

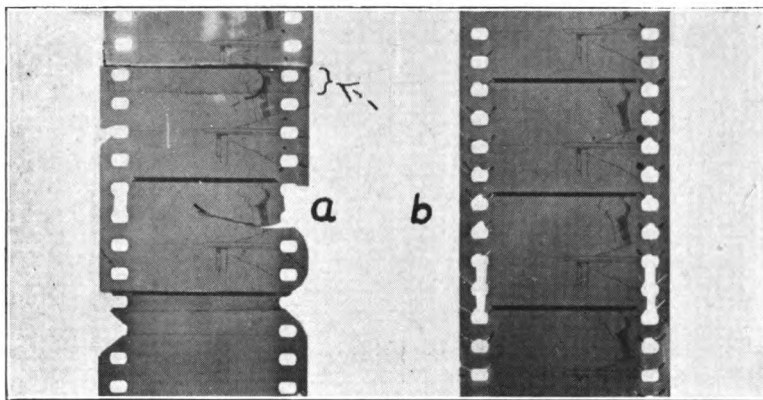


FIG. 12. SHOWS A POOR SPLICE (a) AND WHAT HAPPENED TO THE FILM WHEN IT PASSED THRU THE PROJECTOR. Torn and picked sprocket holes (b) caused by too much tension either at the take up or the aperture plate. Note the small radial lines extending from the corners of the sprocket holes. It will be noted that minute pieces of film have been cut out. This may be caused either by too much tension or undercut sprocket teeth.

At the very first sign of wear or undercutting on the sprocket teeth a new sprocket should be placed in the machine.

Film are frequently injured during the time they are being threaded into the projector. In his hurry to change reels, the operator may not exercise sufficient care to see that the sprocket hole perforations properly mesh with the sprocket teeth. When the idlers are pushed into position the fragile film edges are broken or torn. Here again is an additional reason why the first few feet of many film are in poor condition.

RECEIPT, STORAGE AND SHIPMENT

Immediately on receipt of the film package, it is wise to inspect, repair, and if necessary, clean each reel. All film should be kept in metal containers at all times when not in the projector or in the process of being inspected.

If the film is dry and brittle it may be made much more pliable by winding loosely and placing it in a humid atmosphere. A basement, far removed from fire or furnace, a cellar or cave, make excellent storage rooms. Sometimes a few blotters containing moisture placed in the metal film box will prove advantageous.

Humidor cans, one type of which is illustrated in figure 13, are for sale by dealers. A solution of eucalyptol, camphor, menthol and glycerine is reputed to soften even the most brittle and least pliable film. Extreme care must be exercised in any case so that the moisture does not come in direct contact with the emulsion. When film lose their original pliability it is difficult to bring that quality back, permanently, by any artificial means. For that reason film should be kept in a moist atmosphere at all times or inside tightly closed metal containers.

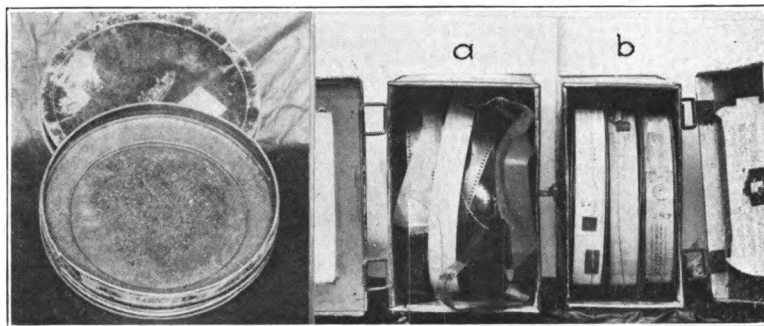


FIG. 13. INTERIOR OF A HUMIDOR VAULT CAN. Film softening solution is placed in the bottom of this can and is prevented from coming in direct contact with the film by a screen.

FIG. 14. SHOWS HOW FILM ARE INJURED IN TRANSIT. The reel bands in (a) were not fastened securely. Film packed as shown in (b) are shipped without injury.

The film stock in most common use is celluloid, although a slow burning film can be had. It is unwise to bring film near a stove, furnace, fire place, kerosene, gas or gasoline lamp for celluloid film is highly inflammable, although not explosive. Practically all projectors are provided with necessary and adequate fire protection devices. Some projectors will ignite a film only when the operator deliberately permits it to happen. Raising the fire shutter while the light shines on the film is inexcusable. The modern machine even then would only permit one frame to be burned, but taking such a chance cannot be condemned too severely.

No film should be left exposed at any time. The small pieces which accumulate during repair operations should never be permitted to accumulate on the bench or on the floor. They should be deposited in a tight metal box and removed to some safe place outside of the building where they may be destroyed.

If handled with the same precautions as are necessary for safe handling of gasoline, kerosene, oil, ether, celluloid toilet articles or even the rolls of film used in a camera or kodak, the danger in-

volved with motion picture film is small. A bucket full of sand, wet sawdust, a chemical fire extinguisher or even a wet woolen blanket should be kept handy to be used in case of an emergency.

Following the exhibition, film should be replaced on exchange reels, the roll retained by securely fastened reel bands, and each reel immediately placed in the metal film container. It is commonly observed that the first and last twenty-five feet of film are in poorest physical condition, due partially at least, to the improper manner in which reel bands are attached by indifferent operators. The reel bands come off, the loose ends unwind from the reels and become jostled during transit as illustrated in figure 14.

The exchanges prefer to have film reach them just as the reels come out of the projector, and reel bands usually bear the words "Do not rewind after showing." This request is made to save time at the exchanges.

When film are on circuit the operator should repair all breaks and make all patches before he ships the program to the next destination. This is particularly necessary because film on circuit reach the film exchanges at more or less irregular intervals. If the repairs are left to accumulate, by the time the program reaches the last town on circuit, the film may be in unusable condition. The circuit plan of distribution is very satisfactory if each member on the circuit has the proper "circuit conscience." A greater number of exhibitions can be scheduled for a given period, transportation charges reduced more than half and the overhead reduced materially. The operators using circuit programs are naturally expected to give every reel careful attention.

SHIPPING

All former addresses, labels, tags and stamps should be removed from the outside of the container before using.

Each package must carry a new yellow caution label bearing name of shipper and date of shipment. The package must bear the words "Motion Picture Film."

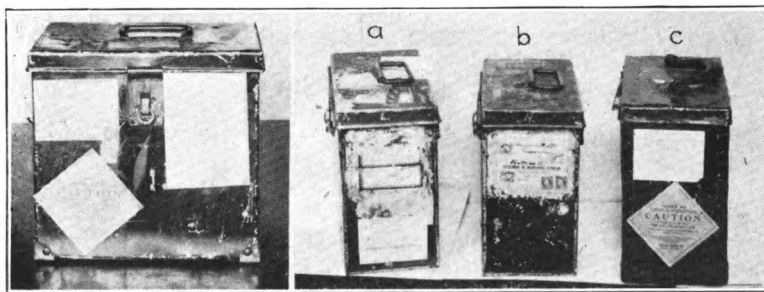


FIG. 15. A BOX OF FILM READY FOR SHIPMENT BY PARCEL POST. All old labels and addresses have been removed. The postal regulations do not permit writing to be enclosed with the film. Envelopes may be attached to the container if they carry a two-cent stamp.

FIG. 16. (a) AND (b) SHOW WHY SOME SHIPMENTS GO ASTRAY. (a) bears parts of seven addresses. The expressman or postman will not be confused with (c).

COST FOR TRANSPORTATION

Parcel Post shipments from Ames to any point within Iowa are much cheaper than express. A single reel may be shipped for 26c and three reels for 35c, including insurance. These same shipments by express cost twice as much, or more.

Postal regulations do not permit written material to be enclosed with a package shipped by parcel post. Messages should be placed in an envelope bearing a two-cent stamp, attached outside the container as shown in figure 15. The express company permits writing to be placed in any container without extra charge. In case of doubt, the postmaster or express agent should be consulted.

INSURANCE

The express company guarantees safe arrival of a package, and insurance against loss up to \$50.00 without extra fee, but postal shipments are at shipper's risk unless insured. Packages sent through the mail, requiring rapid transit, should be sent by special delivery.

The shipping label should indicate the name of the consignor as well as the consignee. Library paste is not recommended for affixing labels. Shippers should fasten tags on the container by heavy cord or wire, or affix them with a special glue intended for that purpose.

Exchanges require the exhibitors to pay both incoming as well as outgoing transportation charges. Express or postal receipts should always be preserved for future reference, should any occasion demand their presentation. The consignor may recover damages only upon surrender of these receipts.

DEFINITION OF TERMS

Aperture—The opening thru which the light passes between its source and the screen. The film passes vertically at the aperture.

Cement—A chemical solvent used to join two pieces of film together. Ether is one of its active constituents. It evaporates quickly, therefore should be kept in tightly corked containers.

Exchange—A central depository from which film may be bought, rented or borrowed.

Film Mender—A clamp-like device used to facilitate the splicing of film.

Footage—Refers to the length of a roll of film.

Frame (noun)—Refers to a single photograph in the roll of film. There are 16 frames to every foot of standard film.

Frame (verb)—The operation of correctly aligning the picture on the screen. "Framing" is accomplished by moving a lever or some other device.

Frame Line—The line that divides the top of one image from the bottom of the other. This line is observed when picture is in misframe on the screen.

Intermittent—The device that moves the film normally at sixteen frames per second.

Leader—Blank or opaque pieces of film at beginning of the reel placed immediately ahead of the title. It is placed there to facilitate threading the

projector and to protect the first few feet of the title. Such film placed at the end is called tail piece or trailer.

Legend—Titles and Subtitles—Words of explanation that are inserted between scenes.

Loop—Slack places left in the film, one immediately above the aperture and another immediately after the intermittent sprocket.

Misframe—Caused by an improperly spliced film, or incorrect threading of projector.

Operator—The individual who manipulates the projection apparatus.

Perforations—Sometimes called sprocket holes—on both edges of the film. In standard film there are 64 perforations on each edge, per foot.

Positive Print—Film exposed to light behind a negative. The positive is used in the projector.

Patch—See Splice.

Projector—An apparatus provided with the necessary devices for showing pictures on a screen.

Projectionist—A skilled operator of motion picture apparatus—an expert.

Rain Streak—Tiny scratches in the emulsion that soon accumulate dirt. Caused by dirty projector or “pulling down” film.

Reel—The spool upon which film is wound. Sometimes the term reel refers to the film itself as well as the spool upon which it is wound.

Rewind (noun)—A device used to change film from one spool to another either for the purpose of inspection or to make it ready for the next exhibition.

Rewind (verb) —To change film from one reel to another.

Safety Shutter—Sometimes called fire shutter. The safety shutter is located between the film and the light source and opens or closes at the aperture automatically when the machine starts or stops.

Screen—A surface upon which the picture is projected.

Shutter—The device used to intercept the light during the time the film is in motion at the aperture. The shutter also serves to minimize the flicker on the screen by increasing the oscillations of light and shade to such a frequency that the eye cannot detect them. The two blade or three blade shutters are in general use.

Splice—A place where two pieces of film have been joined by use of film cement. Such a union is sometimes called a patch.

Sprocket Wheels—The revolving toothed wheels that engage the perforations and thereby move the film thru the projector. There are usually three such wheels; the upper sprocket found immediately after the film leaves the reel; the intermittent sprocket which jerks the film sixteen times per foot between the loops; the lower sprocket from which the film passes directly into the take up reel.

Take Up—The device used to wind the film as it passes thru the projector.

Tension Shoes—Found on either side of the aperture. They hold the film gently yet firmly against the aperture.

Throw—Distance from screen to the projector.



The College

The Iowa State College of Agriculture and Mechanic Arts conducts work along five major lines:

Agriculture

Engineering

Home Economics

Industrial Science

Veterinary Medicine

The Graduate College conducts advanced research and instruction in all these five lines.

Four, five and six-year collegiate courses are offered in different divisions of the College. Non-collegiate courses are offered in agriculture, trades and industries, and home economics. Summer Sessions include graduate, collegiate and non-collegiate work. Short courses are offered in the winter.

Extension courses are conducted at various points throughout the state.

Research work is conducted in the Agricultural and Engineering Experiment Stations and in the Veterinary Research Laboratories.

Special announcements of the different branches of the work are supplied, free of charge, on application. The general bulletins will be sent on request.

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