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USE AND CARE OF MOTION PICTURE FILM

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FILM INSPECTION ROOM.

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USE AND CARE OF MOTION PICTURE FILMS

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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 of the common troubles and methods for correction or prevention of them.

MOTION PICTURE FILM INFLAMMABLE AND NON-INFLAMMABLE

There are today, two general types of motion picture films in use, the nitrate of cellulose or inflammable stock and the acetate of cellulose or non-inflammable stock, more familiarly known, perhaps, as "safety" film. "Safety" film is so indicated by the word "safety" which is printed at intervals along the outer margin of the film.

The inflammable stock is used almost entirely in theatres while the "safety" stock is coming to be used more and more for educational purposes.

Theatres are better able to cope with the fire hazard, and inasmuch as "safety" film is much more subject to deterioration than the inflammable stock, they do not use "safety" material extensively.

BOOTH REQUIREMENTS

The National Board of Fire Underwriters specify that all projectors must be enclosed in standard fireproof booths when using inflammable stock. Certain portable projectors are authorized for use by non-professional operators and with slow-burning or non-inflammable stock, standard width, without booths. Local ordinances and electrical codes should be consulted at all times.

WIDTHS OF FILM

Standard width motion picture film will be considered exclusively in this publication. This film is 1⅜ inches in width with 5.4 perforations per inch of length. All film used in commercial work is standard width.

There are two other types of film that may be of interest. These are shown in Figure 1, in contrast with (a) standard width.

Film (b) is what is now considered as standard narrow width stock. This film is 16 mm. in width and is made only non-inflammable.

Film (c) is also made only non-inflammable and is 9½ mm. wide. It is used in a small projector called the Pathex.

These two latter types have been discussed incidentally. As indicated previously only standard width film will be considered in this publication.

PHYSICAL CHARACTERISTICS OF MOTION PICTURE FILM

The average reel of motion picture film contains about 1,000 feet upon which are printed 16 separate and distinct pictures per foot. Each reel is a photographic reproduction of a series of snap shots printed from a master film or negative.

Films are very fragile, easily injured and a single wrong adjustment 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 average rate of one foot per second with 16 distinct stops and starts per foot. One-sixth of the time the film is in motion and during the remainder of the time the film is motionless at the aperture.

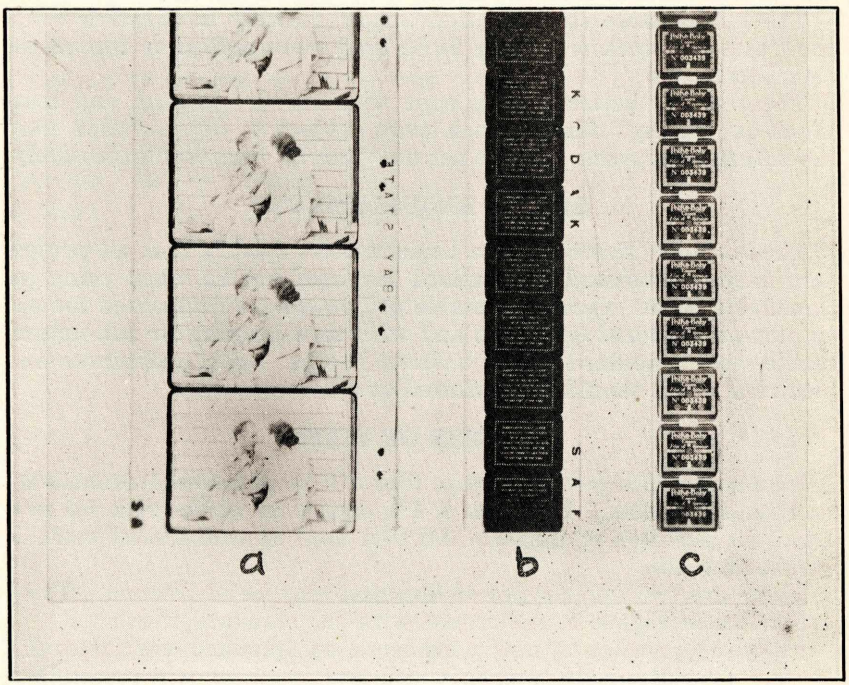

Fig. 1. WIDTHS OF MOTION PICTURE FILM. (a) Standard width—35 M.M. (b) Narrow width—16 M.M. (c) 9½ M.M. stock.

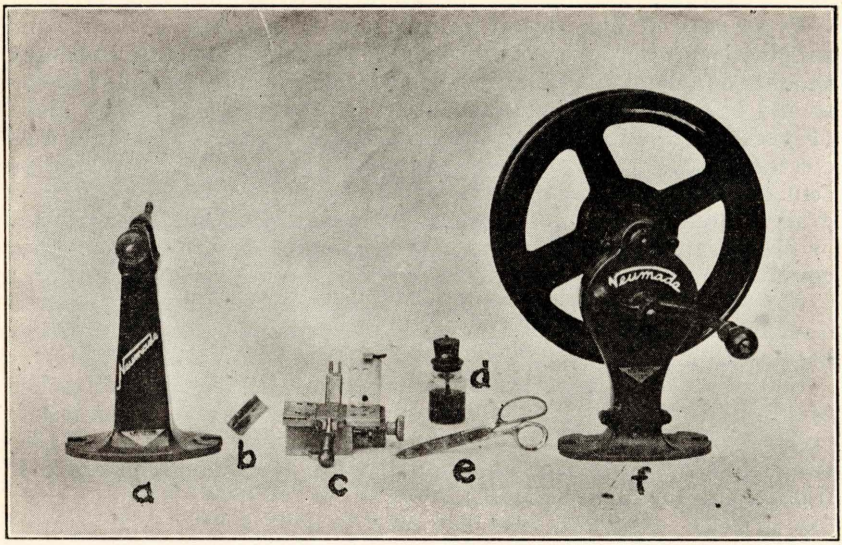

Fig. 2. FILM INSPECTION EQUIPMENT. (a) and (f) are the two parts of the rewind. (b) is a safety razor blade. (c) indicates the film mender. (d) shows the bottle of film cement. (e) indicates the scissors. The ground glass is usually located immediately back of the mender.

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 considerable strain on the film, particularly at the sprocket hole perforations along both edges of the film. The following contribute to rapid film deterioration and subsequent projection difficulties:

Dirt accumulations.
Worn sprocket teeth.
Too strong tension.
Poorly adjusted idlers.
Misalignments of working parts.
Surplus of oil and grit.
Accumulation of loose emulsion and wax.
Careless rewinding, packing, shipping, and storing.

FILM INSPECTION

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

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 inches should be cut in the bench and fitted with a piece of ground glass. (Figure 2.) Beneath the ground glass may be placed a 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 of film cement (not glue or library paste), a safety razor blade or film scraper, and a small pair of scissors complete the necessary equipment.

Portable projectors are equipped so that rewinding may be successfully handled but this method is not satisfactory for inspection, because of the inability to have close contact with the film.

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, with the emulsion or dull side out. The film should be held between the left forefinger and thumb with just enough pressure to *slightly* cup the film. (Fig. 3.)

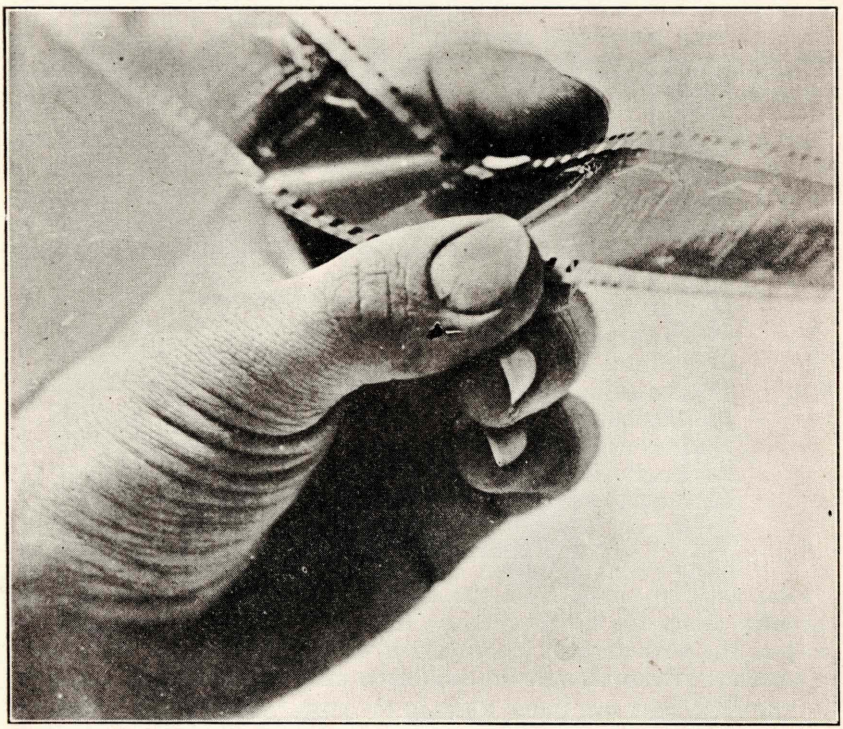

Fig. 3. HOLDING THE FILM WHEN REWINDING. The film should be held between the left forefinger and thumb with just enough pressure to slightly cup the film.

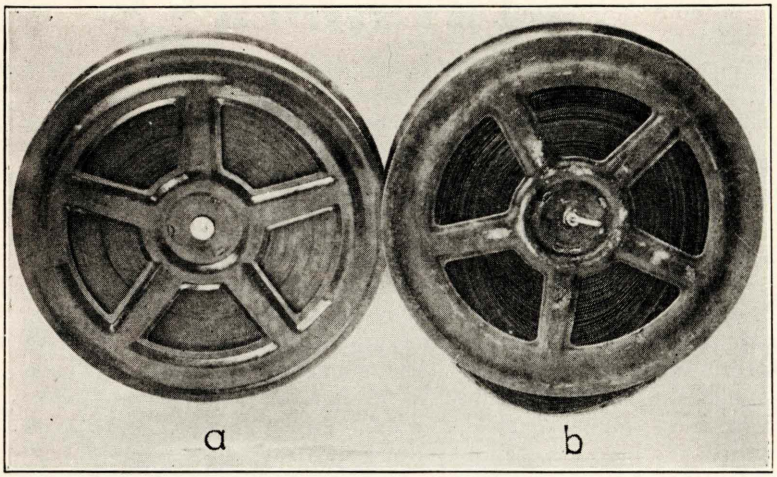

Fig. 4. (a) SHOWS A REEL OF FILM PROPERLY REWOUND. Notice the flat disc-like surface. Contrast this with (b) which is wound too loosely. The surface formed by the film edges is uneven. Movement of the film on the reel will break the edges of the film. Dirt may accumulate between the various film layers,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

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 disc-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.*

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" or scratches running longitudinally on the film are many times caused by "pulling down." When the 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.)

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 5.

The use of common pins is extremely dangerous, 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 6. 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.

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 7. Please note (b) in Figure 7. The corners of the V-shaped notch have been carefully rounded.

Never cut into the picture as in (c). Should it be necessary to remove several damaged sprocket holes, it is suggested that a splice be made where more than three holes are missing. Never make removals of two or more holes on sides of the film directly across from each other. If the broken portions of the film are not repaired they may catch on the idlers, wind around sprockets and cause the loss of a loop or cause a break.

The least possible number of frames should be removed. One end of the film should be cut on the frame line immediately between two of the sprocket holes. The other end of the film should be cut so

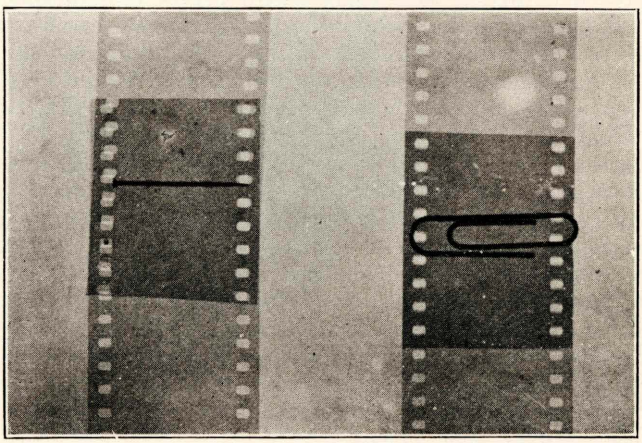

Fig. 5. CORRECT AND INCORRECT TEMPORARY REPAIR. If a film breaks in the projector during an exhibition, time is saved by fastening the two ends of the film together with a paper clip. A pin should never be used for temporary repair.

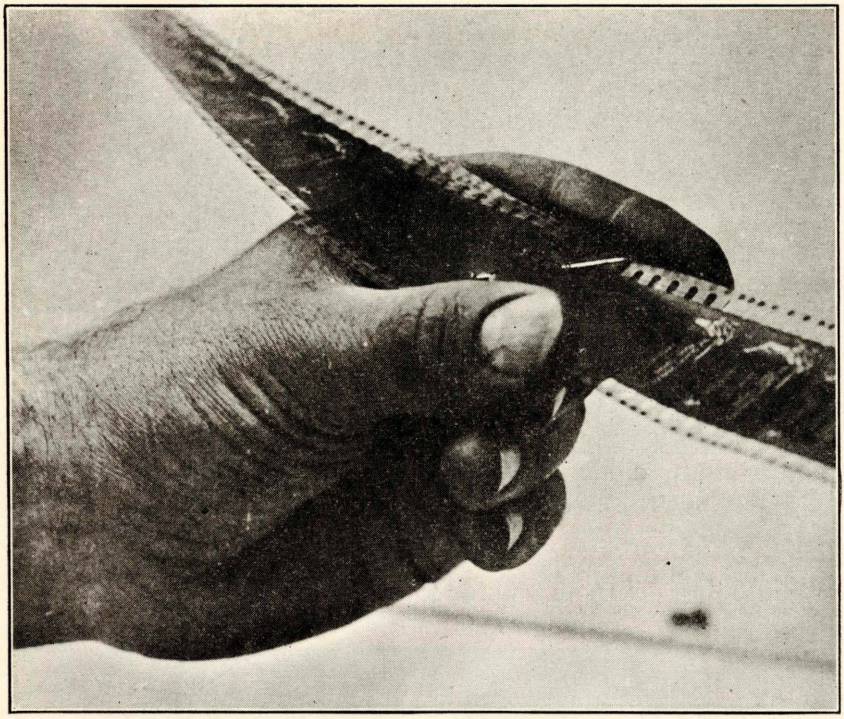

Fig. 6. PAINFUL AND SERIOUS INJURY TO THE INSPECTOR MAY BE CAUSED BY A PIN IN THE FILM. Here is how it may happen.

that it extends to within about 1/8 or 3/16 inch beyond the frame line. Thus the second cut will be between the first and second sprocket holes beyond the frame line. (Figure 8.)

All of the emulsion should be scraped from the second portion of the film, that beyond the frame line. A razor blade may be used for this very satisfactorily. (Figure 9.) The film from which the emulsion is to be removed should be placed upon the illuminated piece of ground glass, emulsion side up. In this way the frame lines may be easily detected. Some operators moisten the part from which the emulsion is to be removed, but this is not necessary. All moisture should be wiped off before the cement is applied. The important thing is to remove all of the emulsion up to the frame line and at the same time avoid removing any of the emulsion from any portion of the next frame. Do not scrape the film more than is necessary for the complete removal of the emulsion. If the celluloid base is scraped to any extent, the possibilities of a good splice are decreased. When this base is thin, the cement oftentimes dissolves it and makes it pliable and quite useless as far as a necessary part of a good splice

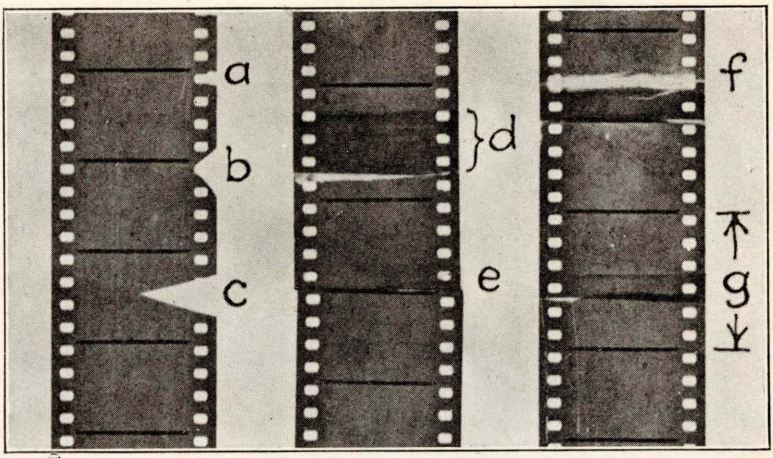

Fig. 7. IMPROPER REPAIRS. (a) is a torn sprocket perforation. A proper repair of this defect is shown at (b). (c) shows the work of a novice or an incompetent operator. Not only will there be a flash of light on the screen but the edges may catch on the idlers, tear the film, or cause other serious accidents. (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.

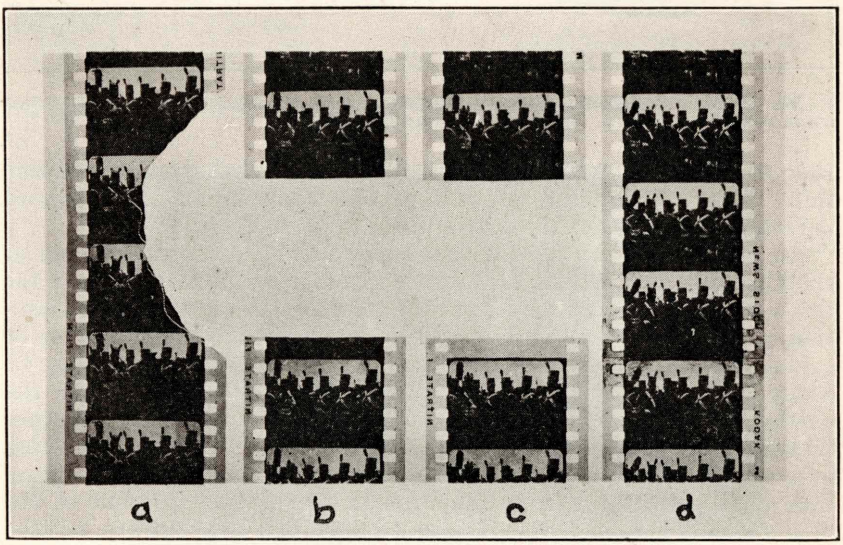

Fig. 8. THE VARIOUS STAGES OF MAKING A SPLICE. (a) shows a torn film. (b) shows the torn part removed. Note particularly where the film is cut. (c) The emulsion has been removed from the lower end. (d) A perfect splice. Note that the edges align perfectly, the frame lines are exactly superimposed and the sprocket holes are in the correct position. The picture is "in frame."

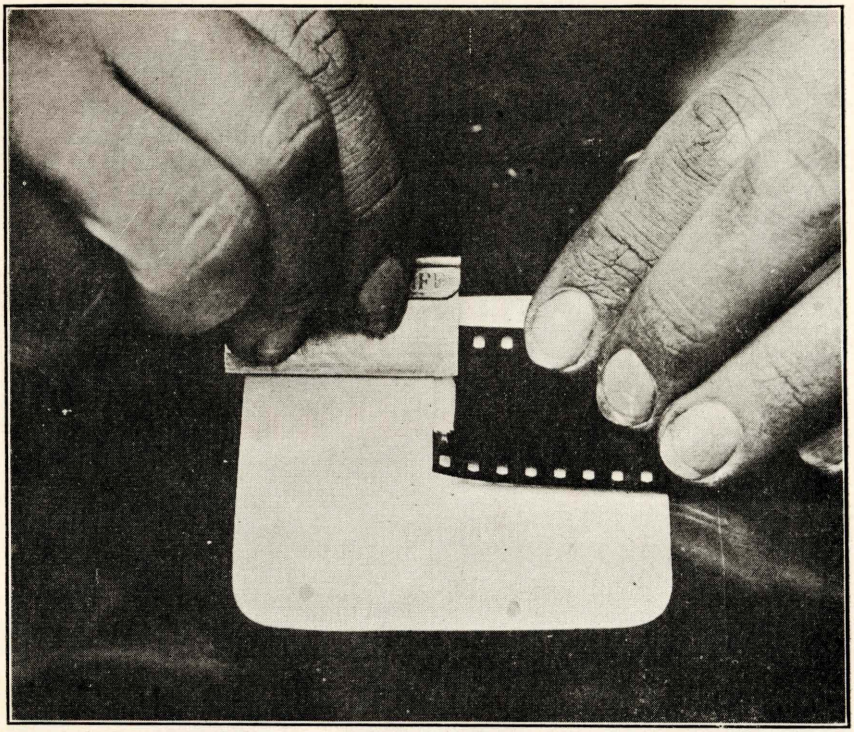

Fig. 9. EMULSION IS REMOVED BY A SAFETY RAZOR BLADE. The illuminated ground glass immediately below permits the repairman to see what he is doing.

is concerned. Always remember that if the emulsion is removed carelessly, a firm splice is an impossibility.

It is also very important to be sure that when the splice is completed, the regular sequence of pictures is complete, that is, the distance between each frame line should include four complete sprocket holes. If this rule is not followed, when the picture is projected, there will be a time when part of one picture and part of another will appear on the screen. When this occurs there is in the film what is commonly termed, a misframe.

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 regular 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 the film be sure that the celluloid side of the other is clean so that the cement will have free access to the film. The two ends should be placed in a film mender, being sure that the frame lines are exactly superimposed. (Figure 10.) The operator should see to it that the sprocket holes 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 two pieces of film is a cohesion process and resembles a weld, rather than an adhesion. Glue or library paste cannot be used for mending film. Slightly dried cement loses those properties that make the film cohere. When making splices it is necessary to work very rapidly. A few drops of glacial acetic acid added to the cement will help in making splices.

The time between the moment the cement is applied and pressure

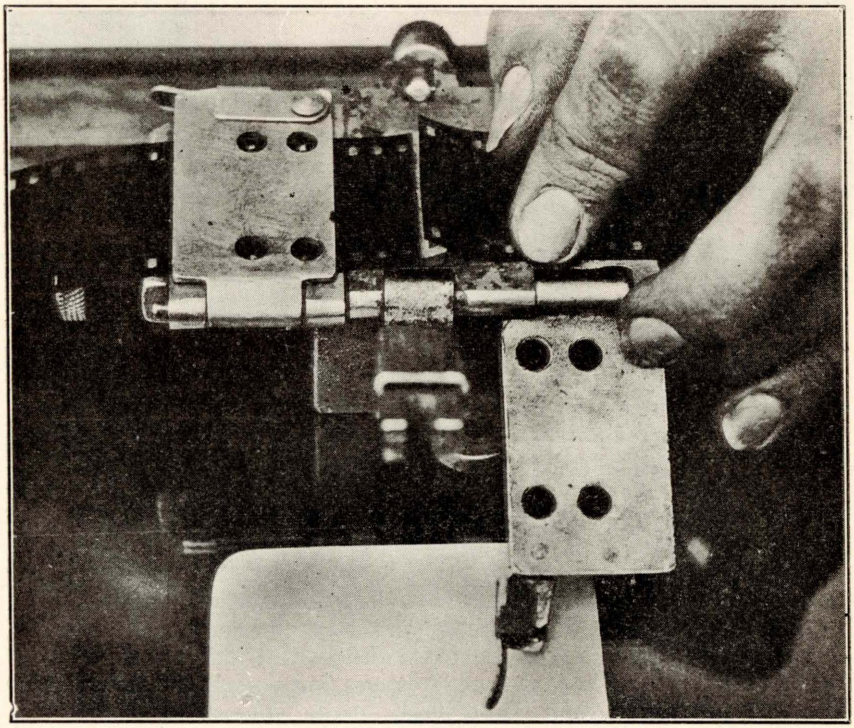

Fig. 10. FILM PLACED IN THE MENDER PREPARATORY TO THE APPLICATION OF THE CEMENT. The repairman should align the edges of the film and sprocket holes perfectly.

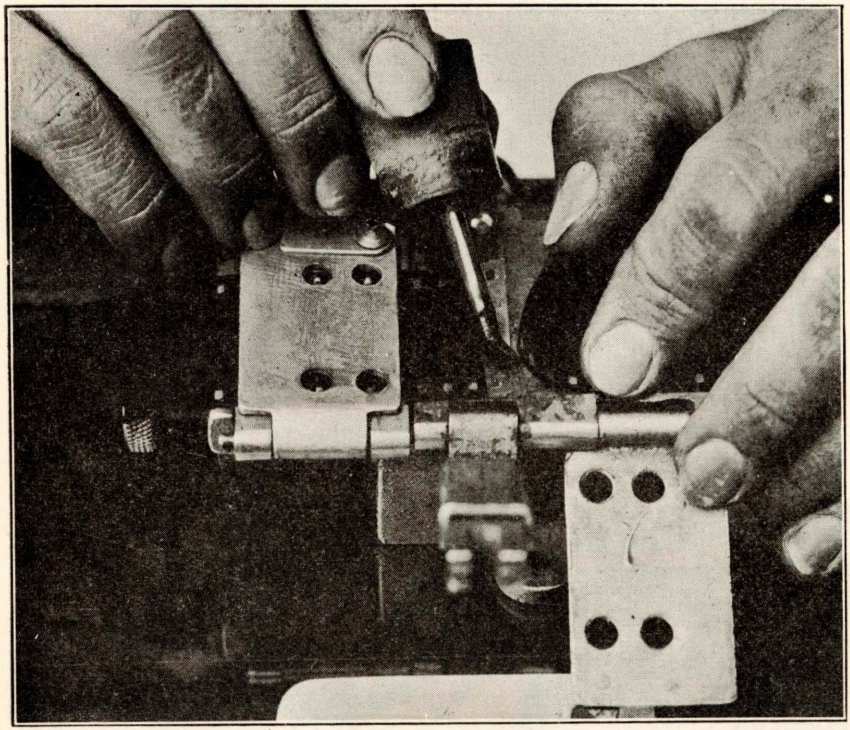

Fig. 11. APPLYING FILM CEMENT WITH A CAMEL'S HAIR BRUSH. Note that the upper end of the film is held up while a very thin coat of cement is applied to the lower end.

is applied should be brief. 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 10. 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. (Figure 11.) The part held by the thumb and finger should be released instantly, the surplus cement removed by passing a finger across the splice (Figure 12), and the pressure clamp on the film mender set firmly for a few seconds. The application of cement and the application and removal of pressure should not require more than five or six seconds. Too much cement will result in a hard, inflexible splice. All surplus cement should be removed from the sprocket holes.

If the splice is made wider than 1/8 or 3/16 inch there is a tendency for it to dry out and buckle slightly. If the splice is very wide, it will cause trouble when the film passes through the projector.

SPLICING "SAFETY" OR NON-INFLAMMABLE STOCK

"Safety" or non-inflammable stock has certain properties that tend to make it, in many cases, somewhat difficult to splice. The two parts of the film should be prepared in exactly the same way as indicated above. However, in this case, it will aid materially if the celluloid side of the film that is to be used in the splice, could be abraded or scraped slightly. When splicing this type of film use cement that has been prepared for both inflammable and non-inflammable film. Another aid is to add a very small amount of glacial acetic acid to the bottle of cement. A few drops added to a small bottle of cement will suffice. When splicing "safety" film it is necessary to work very quickly. *Remember not to use too much cement.*

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

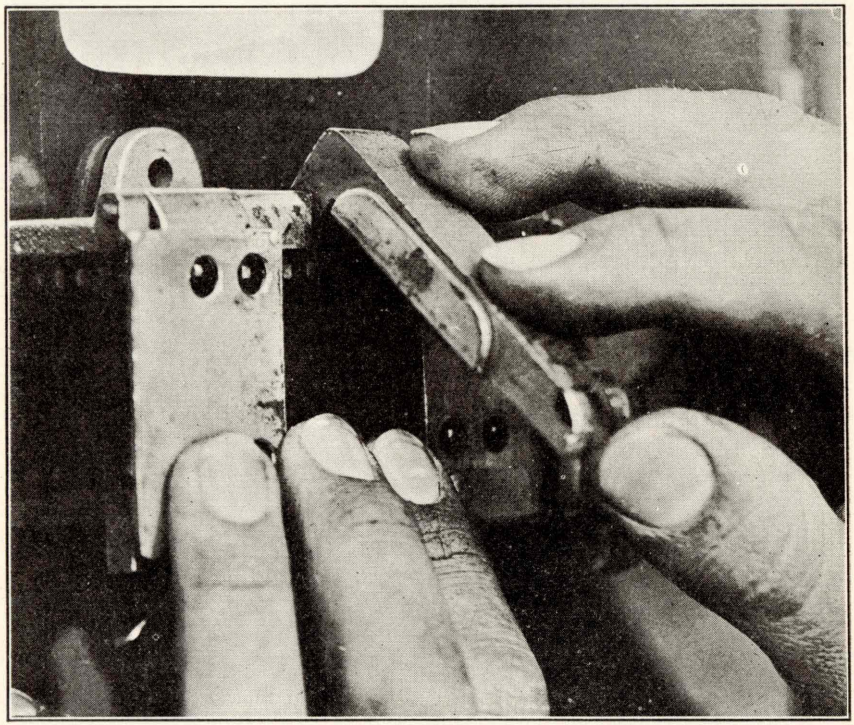

Fig. 12. THE UPPER FILM END HAS BEEN RELEASED SO THAT THE TWO PIECES ARE WELDED BY THE CEMENT. The clamp will be adjusted immediately and pressure applied for a few seconds.

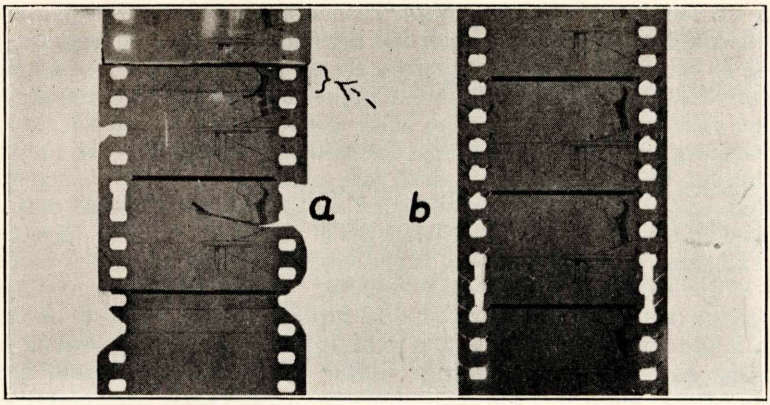

Fig. 13. SHOWS A POOR SPLICE (a) AND WHAT HAPPENED TO THE FILM WHEN IT PASSED THROUGH THE PROJECTOR. Torn and picked sprocket holes (b) caused by too much tension either at the take-up or the aperture plate. Note the small radial lines extending from the corners of the sprocket holes. It will be noted that minute pieces of film have been cut out. This may be caused either by too much tension or undercut spocket teeth.

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 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 frequently 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.

New film is said to be "green." In order that it will pass through the projector satisfactorily, the film must be waxed. When a new film is projected, if it is not waxed, an accumulation gathers on the tension shoes immediately in front of the aperture, and on other surfaces. This substance becomes very hard and difficult to remove. It may be removed by using alcohol as a solvent, or scraping the accumulation away with a coin. Never use a knife because steel will scratch the surfaces. Dirt deposits, scratches, and dirt all tend to injure the film. The photographic quality may not be injured but the film surrounding the sprocket holes may be scratched quite badly.

Keeping a projector clean is an important task of the projectionist.

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 runs just tightly enough to turn the reel. Such devices require frequent adjustments lest for any reason, the belt becomes too loose or too tight. Other machines are provided with devices which enable the tension to be regulated by a small screw adjustment. 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 13 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.

The tension shoes may never require adjustment, although they should always be kept free from 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.

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

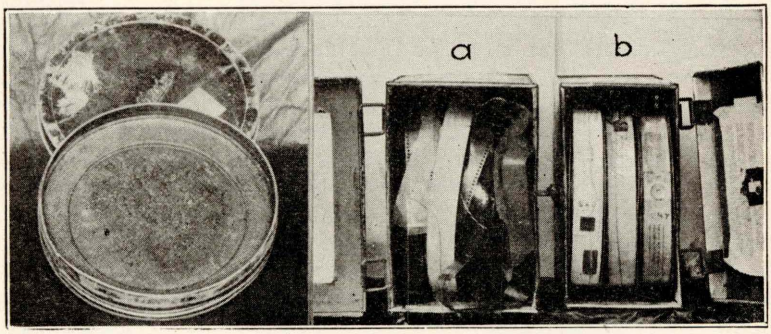

Fig. 14. INTERIOR OF A HUMIDOR VAULT CAN. Film softening solution is placed in the bottom of this can and is prevented from coming in direct contact with the film by a screen.

Fig. 15. 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.

are pushed into position the fragile film edges are broken or torn. This is one reason why the first few feet of many films are in poor condition.

Watch the tension of the projector carefully. It is very important.

RECEIPT, STORAGE, AND SHIPMENT

Immediately on receipt of the film program it is always desirable to rewind the program, inspect the films, and if necessary, clean them. The exchange tries at all times to keep the films in the best possible condition, but occasionally a reel will "slip through the hands" of an inspector who may be a bit careless.

Film should always be kept in metal containers when not in the projector or in the process of inspection.

All film will dry out and become brittle if exposed to the air for long periods. "Safety" or non-inflammable stock dries out very quickly.

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 14, 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 films 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 humid atmosphere at all times or inside tightly closed metal containers.

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 involved 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 film 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

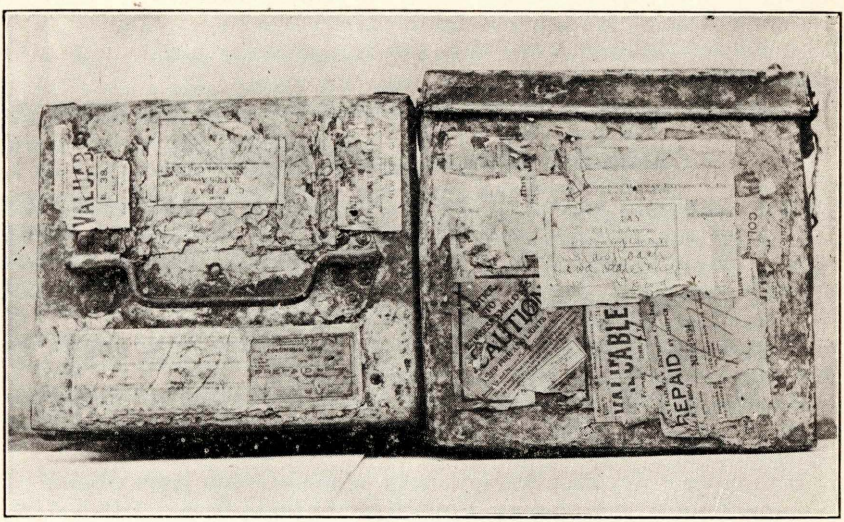

Fig. 16. EXAMPLES OF WHY SHIPMENTS GO ASTRAY. All former addresses, labels, tags, and stamps should be removed from the outside of the film case, before the shipment is sent on.

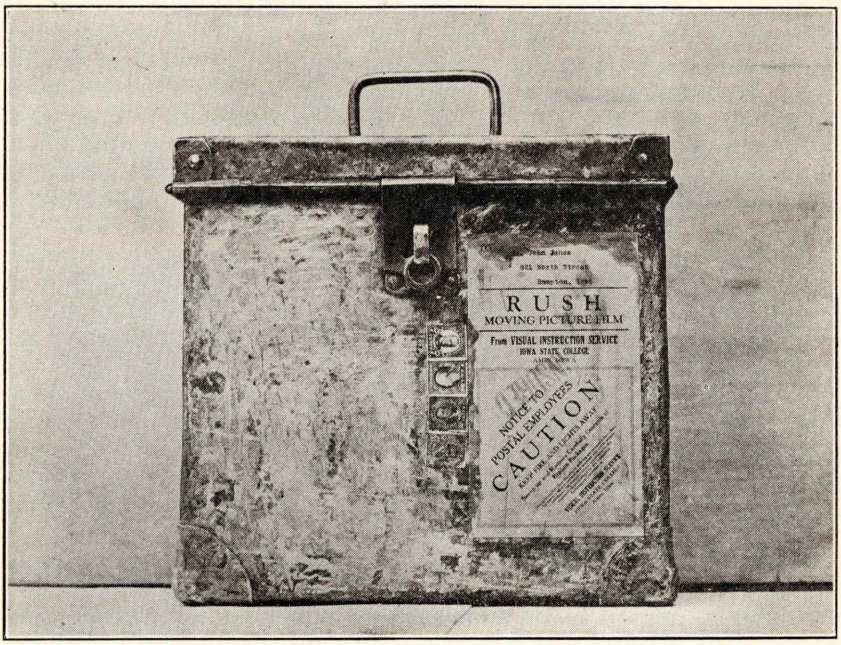

Fig. 17. A BOX OF FILM READY FOR SHIPMENT BY PARCEL POST. Note that the box has been cleaned and scraped carefully. The shipment is plainly labeled and stamped.

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 15.

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 films 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 BY EXPRESS OR PARCEL POST

All former addresses, labels, tags, and stamps should be removed from the outside of the film case, before the shipment is sent on.

Each case must carry a new yellow caution label bearing the name of the shipper. Labels on express shipments must also carry the date when the shipment was made. The case must bear the words "Motion Picture Film." (Figures 16 and 17.)

METHODS OF SHIPMENT

As a general rule, within the first and second zones, parcel post rates are less than express.

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. This stamped envelope may be attached to the shipping case. The express company permits writing to be placed in any container without extra charge.

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.

SHIPPING LABELS

The shipping label should indicate the name of the consignor as well as the consignee. Library paste is not recommended for affix-

ing labels. Use a good glue for this. Shippers should fasten tags on the container by heavy cord or wire.

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 LENS SYSTEM

The objective or projection lens is the picture-forming lens combination and is an important part of the projection machine. This lens system is made up from a number of separate lenses and the combination is mounted in a metal tube.

The amount of light transmitted by the lens indicates to a large degree the brightness of the picture on the screen. This amount of illumination that is transmitted depends upon the cleanliness of the lens. Dirty lenses mean loss of light and subsequent loss of definition. Finger marks cause dirty lenses.

A soft linen cloth is the best for cleaning lenses. This cloth should be washed frequently. To remove finger marks, breathe upon the surface of the glass and wipe lightly with a circular movement. Never use any kind of polishing material, alcohol, or any other solvent on a lens.

The various parts of the lens are cemented together with Canada Balsam. Therefore the lens should not be exposed to the heat of the sun or of steam pipes. Lenses should not be allowed to remain for a long time in a damp place.

In any projection apparatus the condensing lens system has as its function the gathering up of as great a volume of light as possible, and the concentration of the light which it gathers at the center of the objective when the objective is located at the proper distance from the slide or film. This distance is determined by the focal length of the objective.

The condensers should be cleaned carefully with a clean, soft, linen cloth. If the condensers are removed from their mountings great care should be taken when replacing them.

Condenser breakage is often due to unequal expansion or contraction caused by sudden extreme changes in temperature.

LENS CALCULATION FORMULA FOR MOTION PICTURE PROJECTORS

The formula for the size of the motion picture is secured from the following proportion:

9/10: Width of Picture = Equivalent focus of lens: Distance of projection from screen in feet.

SIZES OF PICTURES PROJECTED WITH VARIOUS LENSES

Lens Focus	Size of Picture: 3x2 ft.	4x3 ft.	6x4½ ft.	8x6 ft.	10x7½ ft.	12x9 ft.
	Distance from Screen					
4 in.	13 ft.	18 ft.	27 ft.	35 ft.	44 ft.	53 ft.
5 in.	16 ft.	22 ft.	33 ft.	44 ft.	55 ft.	66 ft.
6 in.	20 ft.	27 ft.	40 ft.	53 ft.	66 ft.	80 ft.
7 in.	24 ft.	32 ft.	47 ft.	62 ft.	77 ft.	92 ft.

LENS DEFINITIONS

Axis, Principal—A straight line drawn through the centers of curvature of a lens or in case of a lens having one curved and one plane face, it is a line through the center of curvature of the one face, and perpendicular to, and thru the center of the other face.

Center of Curvature—Since a lens is made up of the intersection of two spheres, or of one sphere and one plane, the center of curvature of the lens may be considered as the center of the sphere of which its face is a part.

Condensers—The lens combination which deflects the divergent rays of the luminant into the objective.

Focus, Equivalent—The equivalent focus of a plurality of lenses in combination is the focal length of a simple thin lens which will, under all conditions, form an image having the same magnification as will the given lens combination.

Focal Length—The distance from the center of the lens to the principal focus is called the focal length.

Focus, Principal—The principal focus of a lens is the point on the principal axis at which rays parallel to the principal axis come to a focus.

Lens—A lens may be defined as a piece of glass, or other transparent substance, having two curved surfaces or one curved and one plane surface.

Objective—The picture-forming member (lens) of the optical system. This is sometimes called the projection lens.

Projection Lens—Properly called projection objective.

Projection Distance—The distance between the objective and the screen of a stereopticon or motion picture projector.

Working Distance—The distance from the slide or film in a system to the nearest lens of the objective.

DEFINITION OF TERMS PERTAINING TO FILMS AND PROJECTION

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. Film cement 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 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 similar 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.

Géneva Movement—A form of intermittent movement first used in Geneva, Switzerland; hence the name. It is the form of intermittent movement that is most used.

Intermittent—The device that moves the film normally at 16 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.

Legend—Titles and Subtitles—Words of explanation descriptive of various scenes in the film.

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

Mazda Equipment—The incandescent lighting unit used in professional projectors. All portable and semi-portable machines are equipped with incandescent lamps. Carbon arcs are used in professional projectors. Where it is necessary to project pictures at great distances carbon arcs are always used. Mazda equipment is coming to be used more and more as time goes on, for shorter projection distances.

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.

Screen—A surface upon which the picture is projected.

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.

Shutter (Revolving)—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. Two blade and 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 sprockets; one found immediately after the film leaves the reel; the intermittent sprocket which jerks the film sixteen times per foot between the loops and the lower or take-up 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.

Trailer—Blank or opaque pieces of film at the end of the reel. This is placed there as a protection against damage to the valuable film in the reel.

Travel Ghost—The peculiar hazy appearance often seen in a motion picture. It is produced by the improper setting of the revolving shutter.

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