DEPARTMENT OF THE INTERIOR
BUREAU OF EDUCATION

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MOTION PICTURES AND MOTION-PICTURE EQUIPMENT

A HANDBOOK OF GENERAL INFORMATION

By

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, October 21, 1919.

SIR: Motion-picture films have come to be recognized quite generally as a valuable and practical means of instruction in schools, colleges, and universities, and for clubs and societies organized for educational purposes. The number of persons making such use of them is now very large and is constantly becoming larger. To all these a handbook of general information on motion-picture equipment, installation, handling, and repair, prepared with special reference to their needs, will be very helpful. For this reason I recommend the publication of this manuscript, prepared under the direction of Mr. F. W. Reynolds, of the extension division of the University of Utah, and for some time connected with the educational extension division of this bureau.

Respectfully submitted.

P. P. CLAXTON,
Commissioner.

The SECRETARY OF THE INTERIOR.

EXPLANATORY NOTE.

No fact of the motion-picture world is more striking to-day than that of the interest in motion pictures for purposes of education. If the day of the motion picture in education has arrived—as would thus seem to be the case—and if the brains and money behind the production and distribution of motion-picture films for use in education should make the already existing source of supply of educational motion pictures not merely greater in volume but richer in content and variety and more easy of access—as would seem to be the very reasonable hope—then the problem of giving the day significance will promptly be with the users—the schools and the other organizations of whatever sort having immediate responsibility in education.

A part of the problem will, from the nature of motion pictures, be mechanical—relative to equipment and its installation and use and to the handling of motion-picture films.

It is with the hope of assisting users of motion pictures in the mechanical part of the problem that this pamphlet has been prepared.

In the course of the pamphlet is the interesting observation of the editor that high-school students who have learned to operate a motion-picture projection machine often give better exhibitions than professional theater operators. At any rate, the mechanical difficulties in the way of the use of motion pictures in schools are so easily overcome that they can in no way be urged as an objection to the use of motion pictures as an aid in education. The time is near when no school will be complete without its motion-picture projection machine, and no instructor well prepared or student mechanically inclined well taught without facility in its use.

F. W. R.

MOTION PICTURES AND MOTION-PICTURE EQUIPMENT.

Purpose of pamphlet.—There is no difference in the general principles involved between a picture-slide projector and a picture-film projector, and the slide lantern is rather well and widely understood. What difference there is between the two is in the mechanism for passing the pictures in succession through the cone of projecting light. The mechanism for moving the picture film past the projection aperture is not as intricate as at first glance one might be led to suppose.

It is to enable the educator to have at least a general knowledge of the mechanical elements involved in this new device for teaching, and to answer the more pertinent questions incident to the purchase, installation, and use of motion-picture machines that this pamphlet has been prepared. For assistance in its compilation indebtedness is acknowledged to the United States Bureau of Standards, the Eastman Kodak Co., and the Society of Motion Picture Engineers, or their publications.

Standard film only.—First of all the bureau deems it wise to caution schools and other users of film that the film furnished by the section of visual instruction is "standard film,"[1] that is, film of world-wide standard dimensions. It can not be used in any of the odd-sized machines on the market. This standard film is obtainable all over the world, and there are millions of feet available, in hundreds of thousands of subjects. This standard film is 1⅜ inches wide, with pictures thereon 16 to the foot and four perforations on each side of each picture on the film. Each single picture, or "frame," is ¾ inch by 1 inch, the latter dimension being the width of the pictures, i. e., across the film. The screen picture (motion picture) is, therefore, always three-fourths as high as it is wide. Because of this fact the size of motion pictures is almost invariably described by the width.

Portable v. nonportable projectors.—In the selection of a projection machine the first consideration is the resultant picture. It should be well lighted and of sufficient size for the audience. For an audience of 50 to 100 a well-made portable machine and a 5-foot screen are usually acceptable. For larger audiences it is obvious that a larger screen is required and in ratio a larger amount of light. For audiences of 500 to 1,000, a 10-foot screen is about right. A screen of

[1] For definition of the technical terms here used, see motion-picture nomenclature near close of this publication.

this size will require an arc light, though a special filament lamp may be used. Filament lamps used for projecting motion pictures are specially made for the purpose as to size and shape, but are in principle the ordinary electric bulb, which is in daily use in the home. The amount of light required is also measured by the kind of screen that is used. This subject of screen is treated in another paragraph.

Second-hand machines.—It is not generally wise to purchase a second-hand motion-picture machine of any kind. It is advisable by all means to put in a new equipment that will not be likely in a short time to disappoint.

Slide projection.—The older types of motion-picture machines are still made to project both lantern slides and motion pictures, though recently designed machines are made to project only motion pictures. One reason for this is that lantern slides are almost sure to be cracked or broken by the great heat incident to the strong light necessary to project motion pictures. The area of a lantern slide is about eight times the area of a motion picture "frame," and requires, therefore, much less light for the same screen brilliancy. Certainly a much more compact, lighter, and simpler apparatus can be built when the picture projector and the slide lantern are built each for its own purpose.

Luminant.—There are two acceptable sources of light for motion-picture projection, i. e., the electric arc for long throw and large screens and the electric incandescent lamp for shorter throws and smaller screens. Acetylene or other gas lights are not suitable. For large pictures and long throw (distance from machine to screen) the arc lamp only can be successfully used.

Incandescent lamps which are made specially for the projection of motion pictures give excellent results. They are of tubular bulb and filament construction which projects excellent, well-lighted pictures up to 12 feet in width and 75 feet throw. They are lighted by turning a switch and thereafter require no further attention.

Electric current.—For the operation of a motion-picture projector electric current is necessary, but as there is no standard in electric-current characteristics the projector manufacturer must know what current is available in the place where the projector is to be used. The usual voltage is 110. It may be that your electric-light company will advise you that your current is 220. They may prefer to sell you current on this basis, but it is also probable that inside of the building the 220 volts is distributed on a three-wire system. If so, this makes 110 volts available for your use.

This voltage may be either direct current (D. C.) or alternating current (A. C.). If your current is direct current, the projector manufacturer will need to know the voltage. If alternating current, advise him of the voltage, phase, and cycle.

When making inquiry about a projector, give above details about your electric current and ask the advice of the manufacturer as to the type of electric lamp and use of rheostat or transformer.

For motion pictures in the country a gasoline motor and electric generator are required. These outfits are built as a unit, are self-starting, use kerosene as engine fuel, and can be carried about with a projection machine, on a small automobile or on a trailer. Such an outfit and a good screen will produce good motion pictures.

Screen illumination and picture size.—The illumination of the screen depends upon the size of the screen and the "throw." The brilliancy of different size screens with a given light is in direct ratio to their areas; while the light required for a given area of illumination must be increased about 50 per cent of the increased "throw."

The size of any picture is increased with increased throw, although the same size picture can be obtained at different throws by changing the projecting lens.

Screens.—Motion pictures should be projected on the front of a screen; that is, on the side next to the audience. Projection through the screen from the back involves a loss of light of 50 per cent or more, in addition to which it strains the eyes.

Projection of pictures in the daytime can not, of course, equal pictures projected at night, unless the room can be made equally dark. Many assembly rooms in schools are equipped for daytime projection by fastening permanently around the inside of the window frame a strip of wood painted black and projecting from the window frame, and parallel with the sash, about 3 inches. When the window shade is pulled down between the window and this strip, the strip prevents light leaking into the room around the edges.

Even a small amount of daylight weakens the picture and strains the eye. Test out these conditions before you start projecting. A simple test is to darken the room, wait until the eyes have become adjusted to the conditions, and if you can then discern objects so that you can move freely about, there is still too much daylight entering the room.

Metallic-coated screens.—Wherever screen installation can be made permanent—that is to say, where the screen can be installed and stretched in a frame from which it does not have to be removed from time to time—a metallic-coated or highly reflective screen is by all means advisable. The screen and frame can be moved wherever space permits. There are a number of these screens on the market, and any reputable motion-picture equipment concern can be depended upon for information and advice in purchasing.

Plain white canvas-coated screens.—Where the screen can not be permanently installed as described (above), but must be rolled on a roller or folded, a plain white canvas screen coated with kalsomine,

or any of the standard white coating formulas on the market, is advisable. Any motion-picture supply house will furnish either the coating material or the formula for same.

Film hazard.—Film is not dangerous in the way gasoline is, for it is not volatile. Nevertheless, smoking near film is criminal carelessness. Film in projectors catches fire if not moving, or not moving with sufficient speed, because of the great heat of the beam of electric light. We know that "light is heat," and in this case a great deal of light is concentrated on a small space. Most projectors have an automatic shutter that drops between the light and the film when the film stops moving, but even in this case if the light is left turned on for more than a few seconds it may make the fire shutter so hot that it, in turn, may ignite the film. The obvious rule is, when the film is not moving turn off the light.

Ninety-nine per cent of the standard motion-picture film manufactured to date is of the inflammable kind. Gasoline also is inflammable, but because it is efficient we use it in automobiles. When ignited, film burns with such speed that a small extinguisher or small stream of water usually fails to put it out. Smothering the flame with sand is successful. Because of the rapidity with which it burns and the heat thus generated, motion-picture film is dangerous when ignited. When we consider the millions of reels which are handled weekly by the express company, Post Office Department, and numerous theaters and compare it with the number of fires, we find that the percentage is very small, and that of all the film fires of known cause 50 per cent of them are due to smoking in or about the projection booth. This shows that the manufacture of projection machines has reached that point of perfection where the protection of the film against being set on fire by the heat of the lantern is almost automatic. The observance of the two following paragraphs will prevent possibility of a serious film fire:

1. Never remove film from the metal container in a room containing combustible materials or an open flame, fireplace, cigar, cigarette, etc. Never lay film or film container on or near a radiator or other heat-producing object.

2. Keep all film, excepting the one reel in use, in metal containers at all times.

Circular 75, United States Bureau of Standards, says:

> **Motion-picture films have the same general composition as the materials mentioned above, celluloid and similar materials, and municipalities have drawn up elaborate specifications to regulate their use so as to minimize the fire hazard. It is not to be understood that, with reasonable care, celluloid and similar materials constitute an unusual source of danger. They are not to be condemned by the public any more than would be petroleum or any other hazardous material, but it is desirable that their highly inflammable nature be known, that they may be handled with care when used about the house or person.**

NATIONAL FIRE PROTECTION ASSOCIATION.

(Quarterly Bulletin, January, 1918, vol. 11, No. 3, p. 202.)

Motion pictures, fire record, common causes.

Classification.	Number of fires.	Per cent of common causes.
Heating	2	4.8
Lighting	12	28.5
Boiler (or fuel)	1	2.4
Smoking	22	52.4
Lighting	1	2.4
Rubbish (or sweepings)	1	2.4
Miscellaneous	3	7.1
Total	42	

The fact that over one-half the fires due to common causes were the result of careless smoking speaks for itself.

Film should be handled with care. If, however, it is accidentally broken, no particular harm is done, for it may be spliced and be again ready for use. Lantern slides, however, can not be repaired if broken or cracked. The most frequent damage to slides comes from cracking by reason of the great heat of the arc lamp light cone of the motion-picture projector having a lantern slide attachment. It is practically impossible for a lecturer to describe a slide picture before the slide cracks, if projected by a motion picture machine (with lantern slide attachment). This is one of the reasons for recommending a separate lantern for slides, though compactness, simplicity, and lightness are often considerations of importance.

Storage.—No more than 10 reels should be kept in a room unless the room is fireproof throughout.

Wherever film is stored, it should be kept in metal containers or metal cabinets, and the room should have a permanent opening to the outside air. The door to this room should open outward and be equipped with a spring check. No artificial light should be used in the room except incandescent light, and the electric light should be protected with a wire guard. Patching and inspecting of film should be done in a room of this description.

Film splicing solution.—The solution used is collodion. If very viscous, an equal amount of acetone may be added. Where this is not convenient, add one-fourth alcohol and one-fourth ether to one-half collodion.

Dense film and poor slides.—The lack of expert knowledge is often the cause of disappointment in picture exhibitions. It should not be forgotten that films of different quality, ranging from the most beautiful photographically that are seen in the finest picture theaters where only the best are acceptable, to the poorest quality, dense, or thin, or frayed, or out of focus, or all of these in one ribbon, are sometimes

given the educator because he is believed to be uninformed on the subject. A motion-picture film, like a stereopticon slide, should have clear high lights and soft shadows, with the half tones of infinite gradation, and of course should have the most minute details clearly defined. This will be readily understood when it is remembered that these miniature pictures, three-fourths by 1 inch, are often magnified to cover a 12 by 16 foot screen. Likewise, to get such a surface fully covered, a light cone of great intensities must pass through this small aperture on its way to the screen. It should also be remembered that tinted film cuts the light down, and unless tinted properly, may result in a loss of light equaling 79 per cent red tint, 62 per cent in orange, and 50 per cent tinted in blue. The selection of the tinting medium has an important bearing on the matter, for of two tinting mediums of the same color, one may be much more opaque than another. All that is here written applies to lantern slides, although obviously in lesser degree. If the screen pictures from tinted films seem underlighted, the probabilities are that the film is at fault and not the machine.

Shipping.—The United States Interstate Commerce Commission prescribes the way in which motion-picture films shall be shipped.

July 15, 1918. Revised regulations.

Par. 43. (*a*) Motion-picture films must be packed in spark-proof metal boxes or cans complying with Specification No. 321. Not more than eight reels (approximately 1,000 feet each) may be packed in one such outside container.

(*b*) Motion-picture films may also be packed in outside wooden boxes complying with Specification No. 19, provided each reel is placed in a tightly closed inside metal container. The gross weight of such a package must not exceed 200 pounds.

(*f*) Shipments of motion-picture film with advertising matter attached to the outside container must not be offered for shipment. Shippers desiring to include advertising matter with their shipments of motion-picture fil must place the same inside the outside box containing the film.

Par. 1864. (*a*) Unless exempted on account of quantity or method of packing (see columns 3 and 5, list, par. 1807), all packages containing dangerous articles named in the list, paragraph 1807, and similar articles defined by paragraphs 1802 and 1806, inclusive, must be conspicuously labeled by the shipper. Labels should be applied when practicable to that part of the package bearing the consignee's name and address.

Par. 1865. Labels must be of diamond shape, with each side 4 inches long. The color is red for inflammable liquids and compressed inflammable gases, yellow for inflammable solids and oxidizing materials, green for noninflammable compressed gases, and white for corrosive liquids. Labels must conform to standards as to size, printing, and color, and samples will be furnished, on request, by the chief inspector of the Bureau of Explosives, 30 Vesey Street, New York City.

From the above it will be seen that motion-picture film to be shipped from point to point should be in a metal box, but when intended for only one shipment, such as from laboratory to buyer, it can be

shipped in a wooden box, providing each reel is inclosed in a metal container. The shipping case must bear the yellow label previously described.

SHIPPING CONTAINER SPECIFICATION No. 19. (See par. 1822 (a).)

Boxes for inflammable solids or oxidizing materials and for mixed shipments of any dangerous articles which may be packed in the same outside container without violation of I. C. C. Regulations (except as provided in Specifications Nos. 2, 6, 17, and 18).

Effective October 1, 1914.

1. Boxes purchased hereafter for the shipment of inflammable solids or oxidizing materials, and for mixed shipments of any dangerous articles which may be packed in the same outside container without violation of I. C. C. Regulations (except as provided in Specifications Nos. 2, 6, 17, and 18), must comply with these specifications.

BOXES.

2. Boxes must be made of good sound white pine, or any wood of equal or superior strength, dry and well seasoned, and with no loose knots or knots liable to get loose in any part.

3. When the ends are single cleated, the cleats must run across the grain of the wood in the ends. The sides or tops and bottoms must extend out over the cleats, and the nailing must be staggered, at least 40 per cent of the nails being driven into the ends and at least 40 per cent into the cleats.

4. When the ends are double cleated, the sides, top, and bottom must extend out over the cleats and the nailing must be staggered, at least 40 per cent of the nails being driven into the ends and at least 40 per cent into the cleats.

5. Nailed boxes not cleated must have ends of one-piece material or must be tongued and grooved and glued; provided, that other joints may be used which after investigation made by the Bureau of Explosives are shown to possess strength equal to the tongued and grooved and glued joint.

6. All nails driven through sides, tops, or bottoms into ends or cleats or to fasten cleats to ends must be at not greater than 2½-inch centers.

7. All nails driven through tops or bottoms into sides must be at not greater than 8-inch centers.

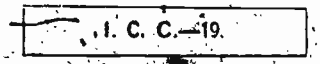
8. Gauge of nails used shall be not less than the following sizes, depending upon the thickness of lumber into which they are to be driven:

Twopenny into $\frac{5}{16}$-inch lumber.
Threepenny into $\frac{3}{8}$-inch lumber.
Fourpenny into $\frac{7}{16}$ to $\frac{1}{2}$ inch lumber.
Fivepenny into $\frac{9}{16}$ to $\frac{5}{8}$ inch lumber.
Sixpenny into $\frac{11}{16}$ to $\frac{13}{16}$ inch lumber.
Sevenpenny into $\frac{7}{8}$-inch or thicker lumber.

For example, nails driven through a $\frac{3}{8}$-inch side into a $\frac{3}{4}$-inch end must be sixpenny. Screws of equal efficiency may be used in place of nails.

MARKING OF BOXES.

9. Each box must be plainly marked with the words "COMPLIES WITH I. C. C. SPEC'N NO. 19." or, if desired, this marking may be indicated by a symbol consisting of a rectangle as follows:



The letters and figures in this symbol must be at least one-half inch high.

This symbol shall be understood to certify that the package complies with all the requirements of this specification.

When offered for shipment the package must also bear such other description as may be required by the I. C. C. Regulations for the particular article contained therein.

10. The thickness of lumber in the finished box must not be less than the following, except that a variation of $\frac{1}{64}$ inch may be allowed for material $\frac{1}{4}$ inch or less in thickness and a variation of $\frac{1}{32}$ inch be allowed for material over $\frac{1}{4}$ inch in thickness:

Box and contents not over 25 pounds gross weight.

	Ends.	Sides.	Top and bottom.	Cleats
	Inch.	*Inch.*	*Inch.*	*Inch.*
For nailed boxes not cleated	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	
For lock or dovetail corner boxes	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	
For cleated boxes	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$ by $1\frac{3}{8}$

15. (*b*).

Box and contents over 25 pounds but not over 75 pounds gross weight.

	Ends.	Sides.	Top and bottom.	Cleats.
	Inch.	*Inch.*	*Inch.*	*Inch.*
For nailed boxes not cleated	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	
For lock or dovetail corner boxes	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	
For cleated boxes	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$ by $1\frac{3}{8}$

10. (*a*).

Box and contents not over 25 pounds gross weight.

	Ends.	Sides.	Top and bottom.	Cleats.
	Inch.	*Inch.*	*Inch.*	*Inch.*
Lock or dovetail corner boxes	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	
Single-cleated boxes	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$ by $1\frac{3}{8}$
Double-cleated boxes	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$ by $1\frac{3}{8}$
Nailed boxes not cleated	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	

10. (*b*).

Box and contents over 25 pounds but not over 75 pounds gross weight.

	Ends.	Sides.	Top and bottom.	Cleats.
	Inch.	*Inch.*	*Inch.*	*Inch.*
Lock or dovetail corner boxes	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	
Single-cleated boxes	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$ by $1\frac{3}{8}$
Double-cleated boxes	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$ by $1\frac{3}{8}$
Nailed boxes not cleated	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	

10. (*c*).

Box and contents over 75 pounds but not over 125 pounds gross weight.

	Ends.	Sides.	Top and bottom.	Cleats.
	Inch.	*Inch.*	*Inch.*	*Inch.*
Lock or dovetail corner-boxes	5/8	5/8	5/8	.....
Single-cleated boxes	5/8	5/8	5/8	7/8 by 1 1/4
Double-cleated boxes	1/2	5/8	5/8	1 1/2 by 1 1/4
Nailed boxes not cleated	7/8	1 1/8	1/2	.....

SHIPPING CONTAINER SPECIFICATION No. 32. (See par. 43 (a).)

Metal cases or cans for outside containers for inflammable motion-picture films.

Effective September 30, 1918.

1. Cans or cases must be made of sheet iron not less than 0.02 inch thick. These cans or cases must be lined throughout with hard fiber board at least one-eighth inch thick, or with some other equivalent insulating material approved for this purpose by the Bureau of Explosives.

2. Covers, if hinged, must be permanently attached to metal cases or cans by not less than two hinges which must be securely riveted, or they must be slip covers, closely fitting. The covers must be lined with insulating material of the same character and thickness as required for the body of the container.

3. Hinged covers must fit tightly against the shoulder of the body, and lap over or inside the body not less than seven-eighths inch on all sides. A strong metal hasp must fit over staple or eyebolt, and must be provided with a permanently attached catch to engage in staple or eyebolt.

4. Telescope slip covers must fit tightly against the shoulder of the body and lap down over or inside the body not less than 3 inches (except that for a one-reel box the lap may be 2 inches). Telescope or slip covers must be secured to cans or cases by a strong, positive, mechanical device, made of metal. This device must be approved by the Bureau of Explosives both as to design and construction.

5. Each outside metal case or can must be plainly and permanently marked "Complies with I. C. C. Specification No. 32," or if desired, this marking may be indicated by a symbol consisting of a rectangle as follows:

I. C. C.-32.

The letters and figures in this symbol must be at least one-half inch high. The symbol shall be understood to certify that the package complies with all the requirements of this specification.

Projecting machines.—Which machine to install must be governed by the nature of your conditions and work.

If the machine is to be installed permanently in your school building, you are advised by all means to provide a standard professional machine, such as the Graphoscope, Motiograph, Powers, Simplex, etc. Your film projection will then not suffer in comparison with that of the theater. Prices for professional machines range from $225 to $500, according to equipment selected and the educational discounts offered by the manufacturers of these machines.

If you have occasion to move the machine from building to building, or if it is for use in the country, one of the so-called "portable" machines (employing standard width films, however) will be needed. The use of portable machines is inadvisable, except in sparsely settled communities. A motion-picture projector is a fine piece of machinery; constantly moving it from place to place is injurious in the same manner that it is to constantly move any piece of laboratory apparatus of fine adjustment.

A motion picture may cost $50,000 to make and if poorly projected because the machine is not in condition, or badly operated, or insufficient light, most of its value may be destroyed. Operating a motion-picture projector requires instruction, experience, and a knowledge of the "why."

In all permanent installations the use of motor-driven projectors is preferable to those operated by a hand crank. A motor-driven projector insures a steadier picture. Most beginners project at too low a speed. Speed up the action of your machine until you are approaching the point where the movements of the people or objects are unnatural. A speed slightly slower than this will be found the most efficient.

It is difficult to learn the operation of a motion-picture projector from a book of instructions. You might learn to operate a motor car in the same manner. From the standard of economic and satisfactory results, it is best to secure some instruction and information from an experienced operator. This is usually possible by inquiring at any place where motion pictures are shown. The following are a list of the items we advise learning from an experienced operator:

1. How to set up a projector properly, eliminating vibration of the picture.
2. How to operate the machine, including tension on the take-up, focusing, adjusting light so as to eliminate shadows on the screen, etc.
3. How to "thread" film through the mechanism.
4. How to rewind film, which side out and which end up.
5. How to patch a break in the film.
6. What labels, in addition to the address, are required by law on packages containing film.

Experience shows that young men and women in the schools who have learned to operate projectors are often able to give a better exhibition than the professional theater operators.

Installing a motion-picture projector.—The following are the rules to be observed:

1. Secure from the proper State authorities, city or county officials, and board of fire underwriters a copy of the existing rules and regula-

tions governing the installation and use of motion-picture apparatus and films. This will be a guide as to the handling and storage of film, insurance regulations, etc.

2. Decide upon a room or hall that is to be used.

3. Locate the place where the projector will stand and where the screen will hang.

4. Measure the distance between these two points.

5. Consult the company that manufactures your electric current and ascertain the voltage they can supply.

6. Secure from the company that insures the building a permit for the installation of a motion-picture projector.

7. Purchase projection outfit, metal cabinet with spring-hinged doors for holding reels, screen, booth, if required, pair of rewinders, patching block, bottle of cement, shipping labels, caution labels, special cement for fastening labels to metal shipping cases (glue or paste will not hold).

8. Engage competent electrician to install proper size cable for the electric current required. Also install on the ceiling of the booth one ordinary 16-candle power electric lamp, with pull chain switch.

9. Place inside of booth near door one pail of sand, one pail of water, and one small hand fire extinguisher. Also place sand, pail of water, and extinguisher near booth outside of door. Do not fill pail so full of sand that it can not be easily lifted and thrown out. This is best determined by a test.

Motion-picture standards.—The following have been adopted as standards by the Society of Motion Picture Engineers, and are promulgated to encourage uniformity and standard practice throughout the industry as a whole.

It is suggested that when making or contracting for the manufacture of motion-picture negatives you incorporate in your order the provisions of paragraphs B an C, and when ordering or manufacturing lantern slides, paragraphs D, E, and F.

A. *Film speed.*—A film movement of 60 feet per minute through motion-picture mechanisms shall be considered as standard speed.

B. *Frame line.*—The dividing line between pictures on motion-picture film shall lie exactly midway between the marginal perforations.

C. *Film perforation.*—The dimensions and location of film perforations shall be in accord with the illustrating diagram herewith.

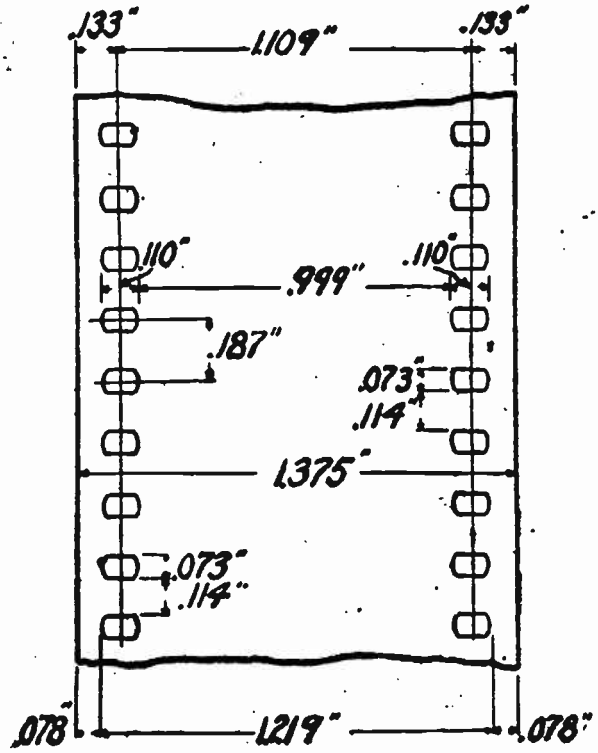
D. *Lantern slide mat opening.*—A standard opening in mats of lantern slides for use in conjunction with motion pictures shall be 3 inches wide by 2¼ inches high.

E. *Lantern strip.*—A red binding strip to be used on the lower edge of the lantern slide to indicate bottom of picture.

F. Thumb mark.—The thumb-mark spot on a lantern slide shall be located in the lower left-hand corner next the reader when the slide is held so as to be read against a light.

Projection lens mounting.—Picture-projecting lenses shall be so mounted that the light from the film picture aperture shall have an uninterrupted full path to the rear component of the lens.

Projecting lens height.—The standard height from the floor to the center of the projecting lens of a motion-picture machine shall be 48 inches.



Projecting lens opening.—Shall have the equivalent focal length marked thereon in inches and quarters and halves of an inch, in decimals, with a plus (+) or minus (−) tolerance not to exceed 1 per cent of the designated equivalent focal length also marked by the proper sign following the figure.

Picture aperture.—The standard film picture aperture in a projecting machine shall be 0.906 inch wide and 0.6795 inch high, namely, $\frac{29}{32}$ inch and $\frac{17}{25}$ inch.

Reel.—The approved standard reel shall be 11 inches in diameter; $1\frac{1}{4}$ inches inside width; with $\frac{1}{16}$-inch center hole, with a keyway

⅛ by ⅛ inch extending all the way through; a 5-inch hub; and a permissible flange wabble of not more than $\frac{1}{16}$ inch.

Standard picture film.—Shall be 1⅜ inches wide and carry a picture for each four perforations, the vertical position of the picture being longitudinal of the film.

Projection angle.—The maximum angle in picture projection shall not exceed 12° from a perpendicular to the screen surface (21.25 feet in 100 feet).

Projection lenses.—The focal length of motion-picture projection lenses shall increase in ¼-inch steps to 8 inches and from 8 to 9 in ½-inch steps.

Standard reel or film.—Shall have black film leaders, with tinted (red, green, or blue) trailers; should have marking thereon embossed rather than punched in the film; and each reel of a multiple reel story should end with a title and the next reel begin with the same title.

Take-up pull.—The take-up pull on film shall not exceed 15 ounces at the periphery of a 10-inch reel or 16 ounces on a standard (11-inch) reel.

MOTION PICTURE NOMENCLATURE.

cine.—A prefix used in description of the motion-picture art or apparatus.

change-over.—The stopping of one projecting machine and the simultaneous starting of a second machine in order to maintain an uninterrupted picture on the screen when showing a multiple-reel story.

condensers.—In an optical projection mechanism, the lens combination which gathers the diverging rays of the luminant and converges them into the objective.

collector lens.—The lens next the source of light.

converging lens.—The lens which converges the light on the picture aperture.

middle lens.—Of a three-lens combination, the lens lying between the collector lens and the converging lens.

dissolve.—The gradual transition of one scene into another.

double printing.—The exposure of a sensitive film under two negatives prior to development.

douser.—The manually operated door in the projecting machine which intercepts the light before it reaches the fire shutter.

fade-in.—The gradual formation of the picture from darkness to full-screen brilliancy.

fade-out.—The gradual disappearance of the screen picture into blackness (the reverse of fade-in).

footage.—Film length, measured in feet.

frame (noun).—A single picture of the series of a motion-picture film.

frame (verb).—The adjustment of the relative position between the aperture and the pictures on the film to bring them into register with each other.

frame line.—The dividing line between two pictures on a motion-picture film which forms the top and bottom, respectively, of adjacent pictures.

intermittent sprocket.—The sprocket (in motion-picture apparatus) which engages the film to give it intermittent movement at the light aperture.

lantern picture.—A still picture projected on a screen by means of an optical lantern.

lantern slide.—The transparent picture from which a lantern picture is projected.

leaders.—That piece of blank film attached to the beginning of the picture series.

magazine valve.—The film opening in the magazine of a motion-picture projector.

motion picture.—The synthesis of a series of related picture elements, usually of an object in motion.

motion-picture film.—The ribbon upon which the series of pictures are recorded.

motion-picture projector.—An optical lantern equipped with mechanisms for suitably moving motion-picture film across the projected light.

negative.—The developed film after being exposed in a camera.

objective.—The image-forming member of the optical system in picture apparatus.

positive.—The developed film after being printed through a negative; it may be one reel or more than one.

print.—Same as "positive."

projecting lens.—The lens (in an optical machine) which images the picture on the screen.

reel.—The flanged spool upon which film is wound for use in projecting machines.

reel.—An arbitrary unit of measure for film—approximately 1,000 feet of length.

rewind.—The process of reversing the winding of a film, usually so that the end to be first projected shall lie on the outside of the roll.

rewinder.—The mechanism by which rewinding is accomplished.

safety shutter (also known as the fire shutter).—The automatically operated door (in a projecting machine) which intercepts the light when the machine runs below normal speed.

screen.—The surface upon which a picture is optically projected.

shutter.—The obscuring device, usually a segmental revolving disc, employed to intercept the light during the movement of the film in motion-picture apparatus.

shutter.—Working blade (also known as the cutting blade or obscuring blade); that segment which intercepts the light during the movement of the film at the picture aperture.

shutter.—Intercepting blade (also known as the flicker blade); that segment which intercepts the light one or more times during the rest or projection period of the film.

sprocket.—The revolvable toothed member (in motion-picture mechanisms) which engages the perforations in the film.

still.—A picture printed from a single negative.

take-up (verb).—The process of winding the film (in a motion-picture machine) after it passes the picture aperture.

take-up (noun).—The mechanism which receives and winds the film (in a motion-picture machine) after it passes the picture aperture.

throw.—The distance to the screen from the objective lantern of a motion-picture projecting machine.

vision.—A new subject introduced into the main picture, by the gradual fading-in the fading-out of the new subject; as, for example, to visualize a thought.