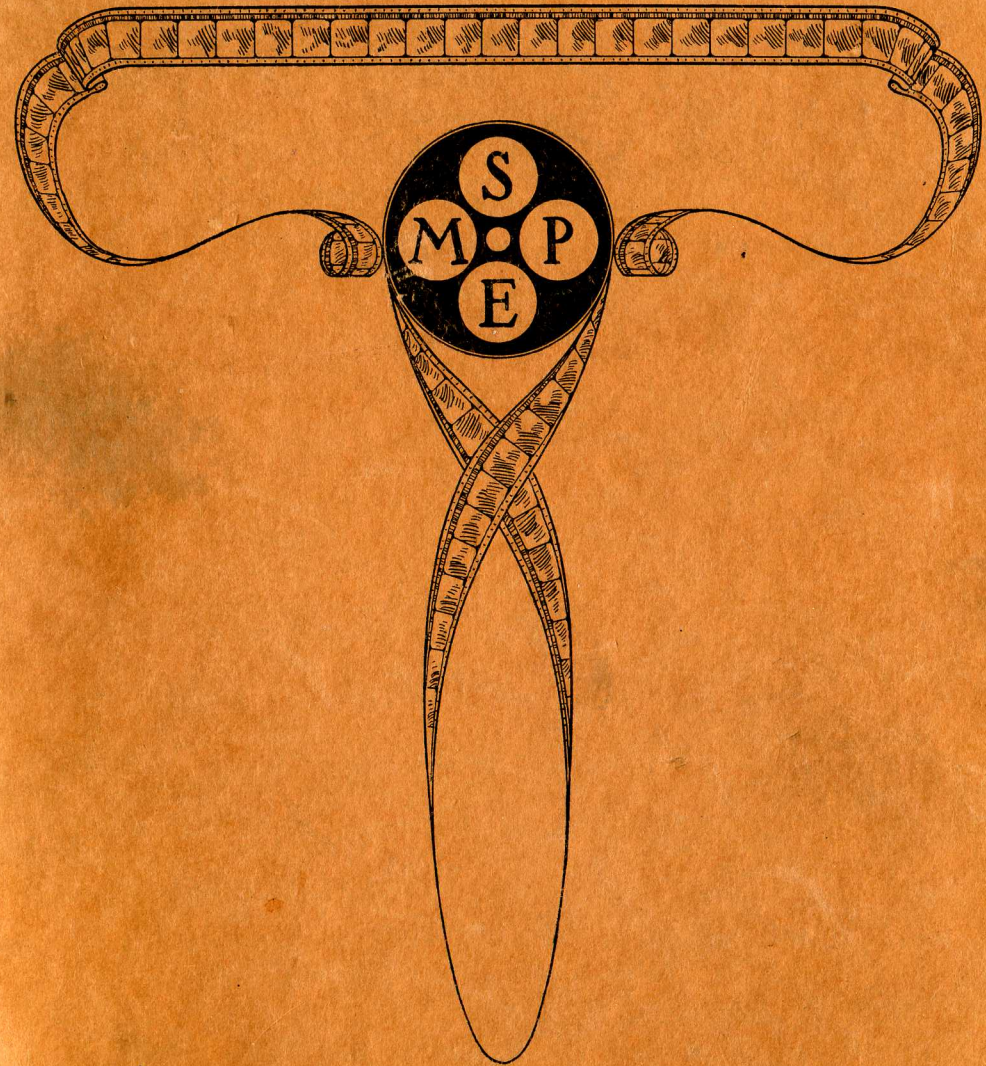


VOL. XIV

NO. 1

JOURNAL  
OF THE SOCIETY OF  
MOTION PICTURE ENGINEERS



JANUARY, 1930

PUBLISHED MONTHLY, AT EASTON, PA., BY THE  
SOCIETY OF MOTION PICTURE ENGINEERS

VOL. XIV, No. 1 JOURNAL OF THE SOCIETY OF MOTION PICTURE ENGINEERS JANUARY, 1930



## The Society of Motion Picture Engineers

### Its Aims and Accomplishments

The Society was founded in 1916, its purpose as expressed in its constitution being, "advancement in the theory and practice of motion picture engineering and the allied arts and sciences, the standardization of the mechanisms and practices employed therein, and the maintenance of a high professional standing among its members."

The Society is composed of the best technical experts in the various research laboratories and other engineering branches of the industry in the country, as well as executives in the manufacturing and producing ends of the business. The commercial interests also are represented by associate membership in the Society.

The Society holds two conventions a year, one in the spring and one in the fall, the meetings being generally of four days' duration each, and being held at various places. At these meetings papers are presented and discussed on all phases of the industry, theoretical, technical, and practical. Demonstrations of new equipment and methods are often given. A wide range of subjects is covered, and many of the authors are the highest authorities in their distinctive lines.

Papers presented at conventions, together with discussions, contributed articles, translations and reprints, abstracts and abridgements, and other material of interest to the motion picture engineer are published in the Journal of the Society.

The publications of the Society constitute the most complete existing technical library for the motion picture industry.

# JOURNAL

## OF THE SOCIETY OF

# MOTION PICTURE ENGINEERS

LOYD A. JONES, EDITOR *pro tem.*

### Associate Editors

G. L. CHANIER  
O. M. GLUNT  
A. C. HARDY

P. MOLE  
W. B. RAYTON  
P. E. SABINE

S. E. SHEPPARD  
J. L. SPENCE  
L. T. TROLAND

Volume XIV

JANUARY, 1930

Number 1

### CONTENTS

	Page
A Milestone.....	J. I. CRABTREE 3
Our New Journal.....	LOYD A. JONES 7
The Sound Film Situation in Europe.....	N. D. GOLDEN 11
Early History of Motion Picture Cameras for Film Wider than 35 mm.....	CARL LOUIS GREGORY 27
Rectangle Proportions in Pictorial Composition..	LOYD A. JONES 32
The Optical Problems of Wide Film Motion Pictures.....	W. B. RAYTON 50
Some Practical Aspects of and Recommendations on Wide Film Standards.....	A. S. HOWELL AND J. A. DUBRAY 59
Acoustic Control of Recording for Talking Motion Pictures....	J. P. MAXFIELD 85
Some New Aspects of Reverberation.....	EDWARD W. KELLOGG 96
Camera and Projector Apertures in Relation to Sound-on-Film Pictures.....	LESTER COWAN 108
Report of Standards and Nomenclature Committee.....	122
Abstracts.....	138
Book Reviews.....	142
Officers.....	144
Committees.....	145

Published Monthly by the  
SOCIETY OF MOTION PICTURE ENGINEERS  
20th & Northampton Sts., Easton, Pa.  
Editorial Office: 343 State St., Rochester, N. Y.



## CAMERA AND PROJECTOR APERTURES IN RELATION TO SOUND-ON-FILM PICTURES

LESTER COWAN\*

Recently much concern was aroused among Hollywood studio technicians by the fact that in some theaters the heads and feet of characters, important words in titles, and other vital elements of the picture were being cut off in projection of sound-on-film pictures. Projectionists were inserting in the film gate a solid sliding aperture (Fig. 1) which masked out from the top and bottom

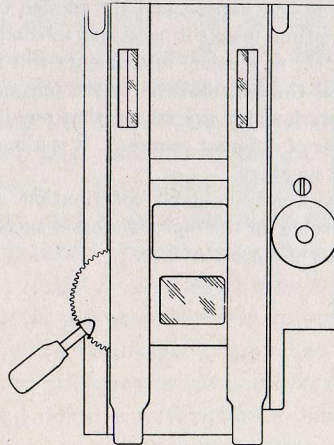


FIG. 1. Drawing of one attachment used to simplify change from small oblong aperture to large aperture.

of the picture an amount sufficient to restore the normal picture proportions. The smaller aperture reduced the height to three-fourths of the width which had been diminished by the addition of the sound track. The smaller rectangular picture when projected with a one-half inch shorter focal length lens filled the screen with a picture equal in area to the silent picture.

\* Assistant Secretary, Academy of Motion Picture Arts and Sciences.

Except in a few cases cinematographers had not been warned of the reduced aperture practice. They did not anticipate it in their photography. The result was that parts of the picture were being cut out which cameramen assumed would reach the screen as usual. Studio technicians in general were at a loss to know what to do; they did not know the extent of the practice or the exact size of the reduced aperture. An immediate coördination of studio practices with existing theater methods was imperative. To this end a nation-wide survey of theater chain and production studio practices was launched by the Academy of Motion Picture Arts and Sciences with the assistance of the Technical Bureau of the Association of Motion Picture Producers. Theater chains listed in Table I and studios listed in Table II responded to the inquiries which were sent out.

### SUMMARY OF SURVEY DATA—THEATER PRACTICES

Replies from theaters reveal four different practices, alike in that each provides for matting out the sound track by a movable masking device, but different in their manner of compensating for the screen area left blank because of reduced picture width due to the addition of the sound track. For the sake of convenience let us refer to these four practices or methods as methods A, B, C, and D.

*Method A—Combination of Reduced Aperture with Shorter Focal Length Lens.*—An aperture is inserted in the film gate which masks out, in addition to the sound track, a portion from the top and bottom of the picture sufficient to reduce the height to about three-fourths of the reduced width. The smaller 3 by 4 picture is enlarged by a one-half inch shorter focal length lens to fill the screen. Recentering is accomplished by auxiliary devices which enable the lens on the machine to be moved from right to left. Unless due allowance has been made in production for this smaller aperture vital portions of the picture will almost certainly be cut out. The estimated cost of installing this method is \$200.

*Method B—Movable Mask or Flipper.*—A movable mask or flipper about 30 inches wide at the left side and facing the screen changes the screen shape to correspond with the picture shape. When sound-on-film pictures are being shown it is moved over to cover the blank strip on the left of the screen. The flipper is operated by a stage



TABLE I Summary of Data on Theater Projection Aperture Practices

Theater Chain	Report by	Projector Aperture Policy for Sound-on-Film Pictures	Projector Aperture Dimensions for Sound-on-Film Picture*
Publix Theaters, Inc.	Dr. N. M. Laporte, Research Dept.	Method A standard for all larger houses	0.593" × 0.796"
Loews, Inc.	Lester B. Isaacs, Supt. of Projection	Method A standard for all larger houses	0.607" × 0.800"
Fox-West Coast	R. H. McCullough, Supt. of Projection and Electrical Equipment	Method A standard for all houses. About 65 houses already installed	0.597" × 0.796"
Fox-New England	Herschell Stuart, General Manager	Method B in all houses; if no better improvement by fall, will adopt Method A	0.680" × 0.820" (approximate)
Balaban and Katz	J. H. Goldberg, Supt. of Projection	Method A standard for circuit	0.609" × 0.815"
Warner Brothers-Skouras Bros. Circuit	Charles Skouras, Manager	Method B in all theaters	0.680" × 0.820" (approximate)
Saenger Theaters	F. Sander, Mgr. Supply Dept.	Method A standard for circuit for Silent and Vitaphone as well as sound-on-film	0.610" × 0.829"
Universal Theaters	D. B. Lederman, Constr. Dept.	Methods B, C, and D	0.680" × 0.820" (approximate)
Commerford Theaters	Edw. W. Parsons, Chief Projectionist	Method A standard for circuit	0.600" × 0.810"
R. B. R. Amusement Company	J. H. Rowley, Manager	Methods B, C, and D	
R. & R. Circuit	B. L. Brockman, Manager	Methods B, C, and D	
R. C. A. equipped theaters. (R-K-O, etc.)	M. C. Batsil, Chief Engineer	Method B standard for all houses	0.687" × 0.812"
		Method A in not more than 5%	0.624" × 0.812"

TABLE I (Continued)

Theater Chain	Report by	Projector Aperture Policy for Sound-on-Film Pictures	Projector Aperture Dimensions for Sound-on-Film Picture*
E. R. P. I. equipped theaters in Western U. S. A. (306 theaters)	Nathan Levinson, W. Division Mgr.	Out of 306 theaters about one-third use Method A; about one-third Method B; and about one-third Methods C and D	
Method A—Combination of reduced aperture with shorter focal length lens			
Method B—Movable mask or flipper			
Method C—Blank strip on the left side of picture			
Method D—Small blank strip on each side of the picture			

\* S. M. P. E. standard projection aperture—0.680" × 0.906".

When sound track only is masked out the aperture is reduced to approximately 0.680" × 0.820".

Simplex standard apertures—Vitaphone or silent picture, 0.679" × 0.904".

—Movietone picture, 0.6093" × 0.7968".



hand, some member of the regular house staff, or by remote control from the booth.

*Method C—Blank Strip on the Left Side of Picture.*—A sliding plate masks out the sound track. A blank strip shows on one side of the screen.

*Method D—Small Blank Strip on Each Side of the Picture.*—Rather than leave a blank strip on the left side of the picture some theaters shift the projection machine in order to center the picture, so as to divide the blank area between the two sides.

As conditions are constantly changing it does not seem possible at this time to give an accurate estimate of the number of theaters employing each of the four methods referred to above. From information received it is reasonable to assume that theaters using methods C and D are almost exclusively the smaller houses with less critical audiences due to lower admission prices. These theaters proceed cautiously before adding new devices which increase their overhead or operating expenses. The installation of a flipper costs only about \$50 but to this must be added the labor cost of operating it. In many localities the flipper can be operated only by the employment of an extra stage hand. The alternative—a new set of lenses and aperture plates—would cost approximately \$200, a very considerable amount to the small theater owner. It is likely that many of these small houses will continue to show their sound-on-film pictures with a blank strip either on one side or on both sides of the screen.

Practically all of the better class or *de luxe* houses fall within classes A or B. At present the theaters in class B probably outnumber those in class A but the tendency is definitely toward the spread of the reduced aperture-shorter focal length lens method.

The following example illustrates the rapidly changing conditions and the tendency. Electrical Research Products, Inc., undertook on behalf of the Academy a complete survey of the aperture situation in all theaters west of Denver using E. R. P. I. equipment. The current practice in 306 theaters was reported by E. R. P. I. field representatives. A tabulation of the reports made on August 9th gave the following results:

Theaters using method A	35
Theaters using method B	123

Theaters using method C	136
Theaters using method D	12
Total	306

On August 20th—eleven days later—a supplementary report gave the following additional information: “Since our last report of August 9th Fox West Coast Theaters has decided to equip all of its theaters with the proportional masks and change of lenses.” Publix Theaters, Incorporated, are also doing this in all of their theaters in the western part of the country, except those of the

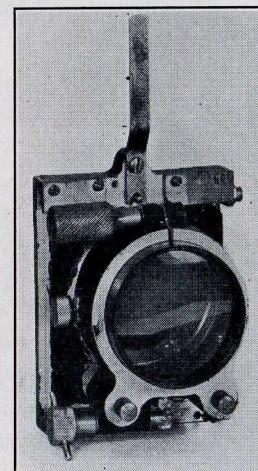


FIG. 2. Movable lens mount to center undersized aperture as developed by Publix Theaters.

Marcus enterprises recently acquired. These new developments would raise the number of theaters first reported as using method A from 35 to at least 100.

*Recentering.*—Probably the most difficult problem in connection with the reduced aperture method (A) is to recenter the picture after it has been enlarged. The amount masked out from the top and bottom of the picture in reducing the aperture is calculated to balance the increased magnification so that from the standpoint of height the picture will fit into the screen frame. Magnification



extends the left margin of the picture to cover about half of the blank strip. The right margin is extended an equal amount beyond the black border so that the picture must be moved to the left in order to be properly centered. Standard equipment now in use does not provide for this need. Movement of the picture from left to right is not possible due to the stationary base which gives a fixed position to the projection machine.

There are two ways in which recentring may be accomplished, both involving the use of auxiliary devices. The first and most

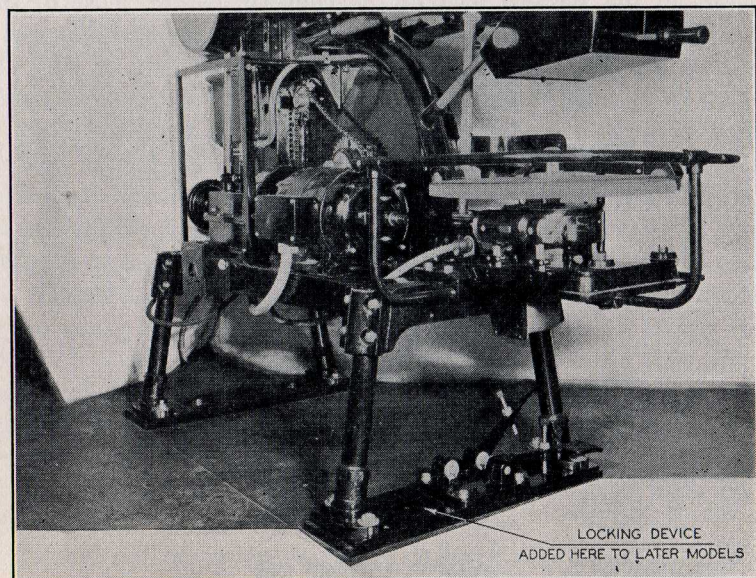


FIG. 3. Screen centering base incorporated in new models of Electrical Research Products, Inc., reproducer set equipment.

common method of recentring is by moving the lens slightly to the left. Publix theaters use a lever operated, horizontally movable lens mount (Fig. 2) which moves the optical center of the lens 0.080 in. to the left. This introduces spherical aberration which is sometimes noticeable on the screen but usually not enough to be considered a defect. An "Ilex" lens has been developed with optical corrections permitting sharp definition at two focal lengths, thus simplifying the procedure by eliminating the necessity of actual lens changing. The second method of recentring is by use of a device which makes it possible to move the equipment on the horizontal

plane. A lever at the front moves the front end of the machine laterally to preset stops.

The newest development which promises a satisfactory solution to the problem is a shifting device (Fig. 3) developed by the Bell Laboratories for the E. R. P. I. reproducer set for the specific purpose of centering small aperture pictures on the screen.

The shifting device consists primarily of these two units: a pivot plate for the forward pair of legs, and a plate incorporating a pedal mechanism for the rear pair of legs. Provisions are made for anchoring the foot pads of the reproducer set to these units, which in turn are bolted securely to the floor. By proper adjustment of the stop screws on the foot pedal mechanism a full sized picture is centered by depressing the right hand pedal until further motion is halted by the adjustable stop, and the smaller picture is centered by depressing the left hand pedal. The locking device, which consists of a quick release screw clamp, maintains either position and assures the picture remaining centered. Briefly, the device permits the operator to quickly center either sized picture at will and maintain that position constantly.

*Other Aspects of the Reduced Aperture Method.*—Attention has been called to several other aspects of the reduced aperture practice.

1. The shorter focal length lens increases the graininess of the picture on the screen. No theater reported this as a serious defect.
2. One theater chain called attention to the fact that the smaller aperture slightly reduces the amount of light that gets to the screen. Due to the fact that the size of the picture is increased, this reduced light must cover a larger screen area. However, there has been no indication that this constitutes a serious problem.

3. The projectionist's problem of keeping his picture in the frame is more difficult and requires painstaking care. Although the cameraman may keep his action within the smaller area he usually fills up the balance of the frame with foreground and background for the benefit of theaters using the standard aperture. This means that the projectionist finds no indication on the picture as to the exact line of its upper and lower limits. More is dependent upon his own judgment than formerly and his responsibilities are greater.

#### SUMMARY OF SURVEY DATA—STUDIO PRACTICES

Now let us turn our attention to the studios to see what, if anything, they are doing to meet these changing conditions in the theater.



Twelve studios reported in the Academy survey. All were making allowance in photography for the sound track either through a definite marking on the camera ground glass or through instructions to cameramen to center their pictures to the right so that the addition of the sound track would not affect their composition. Two of the twelve studios, Fox and Paramount, who had been in communication with their own theater chains, were informed of the new practices and accordingly had markings put on their camera ground glasses delineating a smaller rectangle within which all action was to be photographed. The pictures photographed within these new ground glass markings did not suffer from the reduced aperture practice.

As the ground glass markings shown in Table II indicate, when compared with the dimensions of the reduced projection machine aperture, most of the studios had done nothing to anticipate the new theater methods.

TABLE II. Summary of Survey of Studio Aperture Practices

Studio	Dimensions of Ground Glass Markings
Paramount	0.623" × 0.812"
Fox	0.650" × 0.835"
Metro-Goldwyn-Mayer	0.723" × 0.835"
Columbia	0.725" × 0.950"
United Artists	0.700" × 0.920"
Universal—Bell & Howell	0.720" × 0.969"
Mitchell	0.723" × 0.835"
Sennett	0.720" × 0.865"
R-K-O—Bell & Howell	0.720" × 0.855"
Mitchell	0.723" × 0.835"
Educational	0.723" × 0.895"
Darmour	0.700" × 0.840"
Tiffany-Stahl	0.700" × 0.868"
Pathe	0.723" × 0.887"

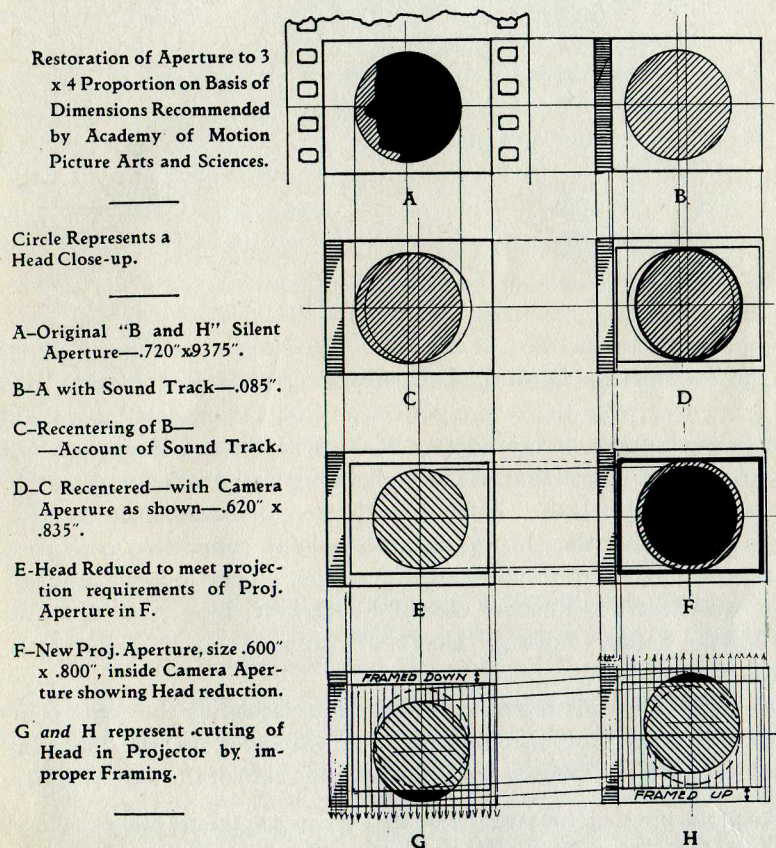
Note: Aperture on Bell & Howell cameras is 0.720" × 0.969"; on Mitchell cameras, 0.720" × 0.923".

It is interesting to note that twelve studios reported twelve different dimensions marked on camera ground glasses. This is partly explained by the fact that some studios have had the sound track width indicated by a line on the ground glass while others simply instructed cameramen to center their compositions to the right so as to make room for the sound track.

When the cameraman looks into his ground glass he must bear in

mind that the picture which he is composing is likely to be projected through apertures of three different sizes:

1. Movietone—0.680" × 0.820" (approximately)
2. Reduced Aperture—0.600" × 0.800" (approximately)
3. Standard Aperture for Silent and Disk Release—0.680" × 0.906" (approximately)



By V. E. Miller, Paramount-Famous-Lasky

The picture must look well in all three forms. The practice of most cameramen is to favor the reduced Movietone apertures by centering their picture a bit to the right. A properly composed picture will confine the action within the smaller area with a suitable background and foreground for theaters using the Movietone or standard apertures. If any of the three forms suffer it will most likely be



the picture for silent or disk release. Successful examples of triple composition have been made proving that it is possible to have the picture look well under all conditions. In this connection a comment made at a recent Academy meeting is interesting:

"There is a way, I think, whereby we can satisfy both the silent picture exhibitor and the sound picture exhibitor, giving them both an identical composition in the 3 by 4 ratio. The method is just the reverse of what Photophone did when they first began. The method is to take the picture in the camera on a smaller size, masking off the rest of the film, then printing the release for the sound version in the usual manner and printing the release for the silent version on optical printers. Such a printer is being used back in New York. It is made by Bell & Howell. At one time nobody knew how to do optical printing, but with all the skill there is in the business, it could be done."

#### CONCLUSION

The facts summarized above were presented at a joint meeting of the 'Technicians' Branch of the Academy of Motion Picture Arts and Sciences with the American Society of Cinematographers and the local chapters of the Society of Motion Picture Engineers and the American Projection Society, held in the Academy assembly room on August 15th. After an extended discussion the meeting decided to refer the survey data to a joint committee composed of representatives of the four organizations. This Joint Committee was constituted as follows: Gerald F. Rackett, John Arnold, E. W. Anderson, Sidney Burton, Albert Feinstein, John F. Seitz, J. F. Westerberg.

At a second joint meeting of these four societies the joint committee reported the recommendations embodied in the following resolution, which was adopted by unanimous vote of the four societies.

WHEREAS, investigation has revealed wide variance in theater projection practices and that there is no effective standard aperture for projection of sound-on-film talking motion pictures:

*Be it resolved:* That as a temporary measure this committee recommends that all studios and cinematographers using sound-on-film methods make marks on the camera ground glass equally spaced from the top and bottom in addition to the mat or mark for the sound track; these marks to delineate a rectangle 0.620 by 0.835 inch in size and that all vital portions of the picture be composed within these limits.

*Be it also resolved:* That the committee further recommends that theaters which make a practice of reestablishing the full screen proportions from sound-on-

film pictures do so by the use of an aperture whose size would be 0.600 by 0.800 inch on the basis of projection on the level, the horizontal center of the aperture coinciding with the horizontal center of the S. M. P. E. Standard Aperture.

Copies of this resolution have been sent to executives of all motion picture studios and leading theater chains. The following Hollywood studios have already reported that markings would be made on the ground glass of all cameras in accordance with the specifications contained in the resolution: Paramount-Famous-Lasky, Metro-Goldwyn-Mayer, United Artists, Pathe, Universal, R-K-O, Tiffany-Stahl, Mack Sennett, Darmour, and Educational. Present markings on Fox Studio cameras approximate the recommended practice. This assures a uniform practice in the studios that anticipates and is in accord with existing practices in the theaters. The aperture dimension recommended to theaters represents a mean of dimensions reported by theaters now using the smaller aperture and may serve as a guide to theaters which may choose to adopt it in the future.

Copies of this resolution have also been sent to the Standards Committee of the S. M. P. E.\* and the Projectionists Advisory Council in the hope that these two important bodies would interest themselves in working out a set of permanent standards to meet the new conditions.

#### ADDENDA

The following item, although not a part of this paper, I thought might be an interesting sidelight to some members of the Society.

A supervising projectionist of one of the largest theater chains in his reply to our inquiry raises a very pertinent question. He says: "The matting off at the top and bottom of the picture seems essential to members of the profession but the thought occurs to us, 'Does the shape of the projected picture matter to the general public?'" Our curiosity aroused, we put the question of the comparative advantages of the square and rectangular screen among others, to Dr. Walter R. Miles of Stanford University. Dr. Miles is professor of experimental psychology and an outstanding authority in his field. He was passing through Hollywood on his way east to attend international congresses of physiology and psychology. His comments on the proportions of the screen are given below.

\* *Editor's note:* This resolution was recommended as standard practice by the Standards Committee of the S. M. P. E. See report in this issue.



According to the view of Dr. Miles, the physical nature of the eye as well as long habit is against the nearly square shape of the sound-on-film picture for the motion picture image as compared with the rectangular shape silent picture. He says:

"No generation of man is entirely free from former generations. Whether this is accident or intention it is hard to determine. If we make a survey of the tools and household articles that were used in Egypt as compared to those that are used today we find, perhaps to our surprise, considerable uniformity in shapes and sizes. For example, there is an optimal size and weight for the hammer that is used in one hand. There is an optimal size and shape for the hand mirror to be used by a woman. Many illustrations of this come to one's mind.

"The proportions of the rectangle have been a subject of scientific study since about 1875. At that time it was noted that man, in using the rectangle in nearly all of his buildings, furniture, and conveniences, adopted a ratio which was strikingly different from the perfect square. Although there is no correct exactness in this ratio it tends to be about five to eight, a combination which has been called the golden cut, frequently found in crosses, windows, *et cetera*. The formula has been: the short side is to the long side as the long one is to the sum of the two. This must not be regarded as a law to be striven for or which will bring punishment if it is transgressed.

"If we seek for a basis in the physiology of the eyes and in the psychology of perception the following points come to our notice. The eyes have one pair of muscles for moving them in the horizontal but two pairs for moving them in the vertical. Vertical movements are harder to make over a wide visual angle. As man has lived in his natural environment he has usually been forced to perceive more objects arranged in the horizontal than in the vertical. This has apparently established a very deep-seated habit which operates throughout his visual perception. Perhaps we can see the whole thing typified in the opening through which the human eye looks; it is characteristically much wider than it is high.

"If one thinks over the famous paintings with which he is familiar or visits a gallery he finds most of the canvases with a longer horizontal axis than vertical. They are thus true to nature as man experiences nature. Movement can take place more easily on the horizontal and therefore this axis may well be a longer one than the vertical.

"One final feature in the psychology of visual perception is that the vertical axis is over-estimated. A true square looks about three units too high.

"We therefore see conformity with man's general experience as well as with the accepted art practice in projecting a picture that is wider than it is tall."

Upon his return from the east Dr. Miles took pains to reassure us that some of the leading physiologists and psychologists of the world with whom he had discussed this very interesting subject had in general confirmed his opinions. This is very interesting especially in view of the fact that the proportions of some of the wide films in use are two to one and the opinion expressed by Dr. Miles gave eight to five as the proportion for maximum efficiency.