Report of the Optics Committee

Since the last meeting of the society, your Committee on Optics has had three meetings to determine, if possible, the effect on an optience of tint in a motion picture. Unfortunately, due to the wide scattering of the committee, at no meeting have there been more than four members present. In spite of this, however, the committee has at least made a start toward collecting the data required of it. This report then it but a preliminary one showing results already obtained and pointing the way to a large field of most interesting investigation in the future.

In the first place, it was thought color could affect the picture on the screen in five ways. The apparent brightness may be affected. The clearness. The contrast. Then again color may improve the naturalness of the picture. For example, a blue tint for the sea, a red tint for a burning building, etc. The fifth way is in the effect of color on the mood. These last two ways the committee has, for the time being, disregarded as belonging to the psychological rather than the physiological phase of the subject, and so a question for the producer rather than the engineer.

At the first meeting of the committee, March 23rd, a general method of approaching the problem was decided upon. It would seem that screens that would absorb part of the spectrum, when illuminated with white light (i. e., tinted screens) could be assumed to give identical effects on the eye, as white screens illuminated by light from which the same part of the spectrum had been absorbed by some interposed filter. Accordingly, considerations of convenience led to the adoption for the tests at hand of white screens and of white light, from which different colors had been absorbed. The only way of comparing colors accurately was thought to be the observing of a picture in each color thrown simultaneously on the screen side by side. A request was then sent the Eastman Kodak Co. for a number of short lengths from the same film (i. e., all the lengths printed and finished from the same negative film under the same conditions), each length to be dyed different color. These were very kindly furnished the committee. Each length was then fastened in a loop so that it could be run through a machine continuously.

While these films were in the course of preparation, some crude preliminary experiments were made at a meeting on April 13th. These tests consisted in running a loop of untinted film through a machine and observing the effect of interposing a number of tinted gelatine filters (furnished by the Bausch & Lomb Co.) in the light beam in front of the objective. It was found, as had been expected, that it was impossible to remember the characteristics of a previous color well enough to compare it with the color on the screen, except in cases of extreme difference. So extreme did these differences have to be that the committee almost despaired of arriving at any helpful conclusions.

When the tinted films arrived the facilities of the Cinema

Quipment Center in New York were generously put at the disposal of the Committee for the test. Two arc projectors, similar in all respects, were arranged to throw two pictures, side by side, on a single white beaded screen, and the optience (from 5 to 8 in number) sat in the line between the two pictures. Both arcs were maintained, as nearly as possible, at 60 amperes and 50 volts throughout the tests. To each person were given slips of papers having spaces for checking his preference of the two pictures on the screen in respect to brightness, clearness and contrast. With light beams intercepted, the untinted loop of film was put in one machine and a tinted loop in the other. The room lights were turned off and then the two pictures thrown on the screen. It was originally planned for each observer to note his first impression of the relative brightness, clearness and contrast of the two pictures and then after examining the pictures for two minutes, to note again in separate columns his final decision. It was found, however, that it took so long to form any definite opinion that the pictures were run for one-half minute and judged on the final decision alone. After this half-minute run, the light beams were cut off and the room lights turned on in order that the eyes of the optience might regain their original sensitiveness.

A thin metal disc, having holes all over it ¼ inch between centers, and of such a size that just one-half of the disc area was cut away (i. e.,, hole .2 inch in diameter) was placed in the front of the objective throwing the untinted picture. A second test was now made and judged as before. Then a third with a disc having one-quarter of its area cut away (.141 inch holes), and a fourth with one-eighth (.1 inch holes) cut away. These discs, of course, reduced the quantity of light from the untinted film to one-half, one-quarter and one-eighth of its original value respectively, while the tinted picture remained unchanged.

The results of tnese tests are given in the table. Only a decided majority of votes was considered as an indication of difference. It was quite astonishing, however, to find how closely the opinions coincided in the great majority of cases. The colors tried were:

Pale rose, pale carmine, deep red and deep carmine.

Pale amber, pale yellow, pale lemon, lemon and deep amber.

Very pale green, pale blue green, pale olive, grass green and deep green.

Pale blue, blue, deep blue, red blue, very red blue, deep purple and deep violet.

Perhaps the most striking thing shown by the table is that the pale yellow and pale green give the appearance of equal or greater brightness, though, of course, having less energy delivered to the screen by the amount absorbed in the dye on the film. This effect was so marked that in the case of the pale amber, the films and machines were interchanged with results that checked with the previous test. Of equal interest is the fact that the contrast was invariably increased by pale colors, and the clearness as well, with the exception of pale blue, pale blue green, pale olive and pale car-

mine. Deep blue and deep purple reduce apparent contrast. The purple gave a picture on which it was noticeably hard to focus the eyes satisfactorily. Pale carmine was the first tint run and it afterwards developed that some of the judges had not understood the system on this first color, and through an oversight, this was not run again. This probably accounts for its eccentric behavior.

I. UNTINTED LIGHT UNREDUCED

INCREASE	NO EFFECT	DECREASE	SUMMARY INCREASE	SUMMARY NO EFFECT	SUMMARY DECREASE
		Brightness			
Pale	Pale Yellow	All others	1	3	17
Amber	Pale Lemon				
	Very Pale Green				
		Clearness			
{Very red / Blue}	Pale blue	Blue	6	6	9
		Grass green			
Pale rose	Red blue	Deep blue			
		Deep blue green			
Pale amber	Deep carmine	Deep purple			
Pale yellow	Deep amber	Deep violet			
	{Pale blue / green}	Deep red			
Pale lemon					
{Very pale / green}	Pale olive	Pale carmine			
		Lemon			
		Contrast			
All others	Blue	Deep blue			
	Red blue	Deep purple	14	5	2
	Deep violet				
	Deep red				
	Deep blue green				

II. UNTINTED LIGHT REDUCED TO ¼

INCREASE	NO EFFECT	DECREASE	SUMMARY INCREASE	SUMMARY NO EFFECT	SUMMARY DECREASE
		Brightness			
Red blue	Pale blue	Very red blue			
Pale carmine	Pale rose	Blue			
Deep red	Deep carmine	Deep blue			
Pale amber	Pale olive	Deep purple			
Pale yellow		Deep violet	9	4	8
Pale lemon		Grass green			
Lemon		Pale blue green			
Deep amber		Deep blue green			
Very pale green					
		Clearness			
All others	Deep violet	Deep blue			
		Deep purple			
		Deep blue green	17	1	3
		Contrast			
	Deep blue	Deep purple	19	1	1

III. UNTINTED LIGHT REDUCED TO ⅛

INCREASE	NO EFFECT	DECREASE	SUMMARY INCREASE	SUMMARY NO EFFECT	SUMMARY DECREASE
		Brightness			
All others	Deep blue	Deep purple			
	Pale carmine		17	3	1
	Deep blue green				
		Clearness			
All others	Deep blue	Deep purple			
	Pale carmine		10	2	1
		Contrast			
All others	Pale carmine	Deep purple	19	1	1

IV. UNTINTED LIGHT REDUCED TO 1/16

INCREASE	NO EFFECT	DECREASE	SUMMARY INCREASE	SUMMARY NO EFFECT	SUMMARY DECREASE
		Brightness			
	Pale carmine		20	1	0
		Clearness			
	Pale carmine	Deep purple	19	1	1
		Contrast			
	Pale carmine				

The above results are not complete, as the committee has not yet been able to determine the quantity of light absorbed by the dye, and accordingly the ratio between the actual energy passing through the tinted and untinted films. When this is known, it is expected that the advantage of tints will be still more strongly marked. The committee hopes to have this information by the next meeting of the society.