ADDING COLOR TO MOTION

By William V. D. Kelley

Not long ago I ran across this very interesting statement by Dr. Foote:

"The fact is, we have kept on discovering and forgetting and then re-discovering, ever since man began to think."

I was not there when man began to think, so naturally I cannot verify this part of Dr. Foote's statement. I can testify, however, to the fact that in the field of natural color photography and color photography as applied to the motion picture, we have kept on discovering and forgetting and then re-discovering.

The records show that as far back as 1785 natural color photography was engaging the attention of men of science. Men discovered at that time; later, men forgot; and then men discovered again.

I have seen samples of work done by the "bleach-out" process which was first suggested in 1813 by A. Vogel.

In 1861 the modern theory of three-color photography came to be recognized, and during the succeeding forty-five years some progress was made, slow and halting to be sure, but nevertheless, progress, in developing processes for recording scenes in color.

In the year 1900, while I was residing in London, England, an American, Mr. Tripp, was demonstrating the McDonough process of color screen prints, and later in that same winter I attended a lecture and demonstration of the Sanger-Shepherd process at the Royal Photographic Society.

At that time I was connected with the American Mutoscope and Biograph Company, and, therefore, motion picture photography and the possible application of adding color to motion was intensely interesting to me.

All of the different forms of producing natural color pictures were well known at that time, for we had the Lippman process, which is based on the interference of light waves, the McDonough, which is additive and the Sanger-Shepherd, which is subtractive.

Mr. F. E. Ives was demonstrating his Kromscope, which is an additive process, while in our Mutoscope parlors we were showing in a penny slot machine, six views of subtractive photographs made by Gaumont.

The first motion picture films in natural colors to receive any degree of publicity were those of Smith in 1906, which were fathered by Urban, of international fame, although private showings of similar films had been given some time previous to that.

The shortcomings of that process led men to see possibilities of applying the Sanger-Shepherd method to Kinemacolor negatives, and their results were promptly recorded in the British Patent Office. Some of these patents have nearly expired, but none has yet been reduced to a working basis and none has been shown publicly, to my knowledge.

So you see, in speaking on the subject of "Adding Color to

Motion," we have a certain background of discovering and forgetting and re-discovering which will not permit any one at the present time to say that adding color to motion is an entirely new science.

In the *British Journal of Photography*, December 6, 1912, Mr. H. Quentin, referring to screen plates says, "And thus it is that in screen plate color photography the chief merit consists not in inventing a screen, but in producing it commercially." In the making of Prizma pictures in natural colors, the industry with which I have been mainly identified for a number of years, our problem has been largely one of devising means and developing processes that would make motion pictures in natural colors commercially practicable.

In a report for the Society of Chemical Industry in 1916, Mr. B. V. Storr, of the Ilford Company, London, said, "A number of patents have been published both for multicolor screens and for various details in the production of positives. In the latter, apart from the mechanical difficulties of registration, the chief problem appears to be to get a method of coloring which will give a uniform tone throughout the length of film."

We had considered for some time that other steps were of more importance in the making of Prizma films, but we found at last that our main stumbling block in making the present product finally proved to be the matter of coloring.

The successful making of small pieces of film by the known methods used in photography for toning or the patented descriptions of coloring methods were found to be impracticable when applied to the commercial handling of films in long lengths, so it became necessary to work out a new method and means for coloring. This we successfully accomplished.

Our problem contained several elements that required the development of new processes in order to accomplish the result of coloring long lengths of film commercially. The film may be 200 feet long, in which length, as you know, there are 3200 separate color transparencies, all very much alike with the exception of those parts showing the steps of movement. To make each picture exactly like the next and to duplicate the copies so that they are all alike, was the problem that had not been satisfactorily solved before.

In letterpress printing, if the copies vary, no damage is done, as one seldom sees many prints together for comparison and the poor ones are discarded.

With motion pictures there is not so much chance for discarding individual pictures, for if we did the film would consist mostly of patches. This problem was overcome, and film has been produced in quantity, so that each individual image-bearing area is substantially complete in colors which may be seen by holding the film in the hand.

COLOR RENDITION

I read that, "It is not possible for anyone to explain how or why we see colors, and probably it never will be." We have our theories

which stand up well against practice, but are unable absolutely to check back and prove them out. A good portion of the audience that view natural color pictures see colors at variance with what we term normal vision. Others attempt to judge colors from their own conception of what they should be. For example, the color of the waters of the Pacific Ocean varies from that of the Atlantic Ocean, and to one who has not noted this difference by personal visit, the color rendering may be judged to be unsatisfactory. Don't be hasty in forming your judgment as to the color correctness of a picture—your neighbor may be seeing it differently from you. I have seen a picture projected in which the color of certain flags appeared as orange to me, while to my associate they were pink.

THE EXHIBITORS

In the "British Journal of Photography" of February 1, 1918, on page 8 of the Supplement, there is added to an otherwise more or less correct statement, the following:

"Altogether, it does not look as though the commercial prospects for additive processes of color cinematography are very encouraging. *We have still to wait for the ideal color film which can be bought all complete by the yard and inserted for projection into the standard cinematograph lantern.*"

On December 28, 1918, Prizma began releasing weekly natural color films which can be "bought all complete by the yard and inserted for projection into the standard cinematograph lantern."

From the exhibitor's standpoint that is the big accomplishment; for all previous natural color films required either high projection speed, so high that such films only have one-third their normal life, or an attachment, or a complete new projector. Nearly all of these forms, in actual practice, required the attention of a special trained operator from the home office, or what is just as troublesome, a course of instruction to the theater operator, before the films could be left with safety and assurance of successful shows.

THE COLOR WORKERS

For the information of those that like the "ins and outs" of the process employed will say:—

The negatives are made through two sets of complementary colors, or as we usually say, four colors.

The four color values are dyed in two colors. That is to say, the reds and oranges are dyed a red-orange color, while the greens and green-blues are dyed a color complementary to the red-orange colors used.

In many subjects when the film is examined in the hand, there is a noticeable difference in alternating images, in which case one will favor the green-blue, and the succeeding image will favor green. These blend without pronounced flicker on projecting at the customary projection speed.

The projection is on the additive principle of mixing lights while the production of the image is accomplished by the subtractive principle.

Registration of two images on the same area, done continuously in long lengths and consistently accurate, is had to 1/10,000 of an inch. This, in spite of the fact that developed negative shrinks to an average of $\frac{1}{16}$ of an inch in each foot, sometimes as much as $\frac{1}{8}$ of an inch, while there is a corresponding shrinkage laterally. The fresh positive at the time of printing is still of standard width and length, and consequently of different length and width as compared with the negative.

The above paragraphs place the matter before you in brief language. Rather than enlarge on each item by tearing to pieces and analyzing each step, I have prepared a film that demonstrates most of the steps.

So that you will know what to look for I will add that we are using a projector that permits us to stop and view the films as we would lantern slides. You will, therefore, see the difference between additive and subtractive colors in pictures and not in words, for has not someone said "that a reel of pictures will tell more than 300 pages of printed matter and in a much shorter time." You will see the nature of the colored images when separated into single colors. The results of incorrect coloring. What registration means. The accuracy of the color rendering for we have the pictures on the curtain and the fabrics that were photographed in our hands. A duplicate of the original negative will be seen, which shows the color values but which of itself is devoid of color.