The First Successful Color Movie

How an Inventor, by Ingeniously Combining Blue-Green and Red-Orange on Double Photograph, Tricks Our Eyes into Seeing Delicate Shades of All Colors, Vividly Representing Life

By Thomas Elway

WHEN I was told, a few weeks ago, that another new process for taking motion pictures in color had been "perfected," I confess I smiled skeptically to myself.

I had seen many colored movies before. They had left me either unimpressed or thoroughly displeased.

To be sure, I knew that this new method had been invented by a scientist of distinction—Dr. Daniel Frost Comstock, of Boston—and that 10 years of patient research and experiment had gone into its development. I was told that more than $1,000,000 had been spent upon these experiments; that the enterprise had the financial backing of no less a figure than William Travers Jerome, former District Attorney of New York, and that artists and motion picture experts who had seen the film hailed it as a phenomenal improvement, charming in its colorful realism, lessening eyestrain, and destined to revolutionize motion picture work.

A Colorful Dream Comes True

And, finally, I had fully shared the great dream of motion picture enthusiasts during the past decade—the dream that the movies some day would be shown to us in all the beauty of natural color, enhancing enormously the power of their appeal.

Nevertheless, I did not realize the art had advanced far enough to make this dream a reality. But when I witnessed the private exhibition in New York of this new colored film feature—a play called "The Toll of the Sea," starring the young Chinese girl, Anna May Wong, whose fame has begun to spread eastward from California—I was frankly surprised by the unexpectedly high quality of the color work. Here was a film in which colorful costumes and feminine beauty moved convincingly across the screen, with slight trace of the garishness, flicker, and distracting color fringes that have hurt so many other color films.

Not that this color work is perfect. Some of the reproductions of blues and greens are bad. The yellows are even less satisfying. But this motion picture does constitute, to my mind, the best color work done so far in the films, and the process used, the new Technicolor process, promises still better things to come. For the first time I have begun to expect something really big from color photography on the screen, something that will affect the fundamentals of motion picture art. It isn't only that we may expect enhanced charm of settings, and still greater beauty of feature in our heroines; or that we shall see them blush real blushes, as we now see them weep real tears; that expressions will be more lifelike, costumes more fascinating, natural scenery more magnificent.

A successful color movie can do something much more fundamental than this. It can give us not merely an improved art, but a new art; a new kind of dramatic production, differing from the present productions in black and white as completely, perhaps, as these differ from the productions of the spoken stage.

How can this be? Because color alone, pure color, has a powerful appeal to the human mind. This is always the great aim of drama—to seize on the emotions, to contrive that you are completely "carried away" by the thrill, sentiment, joy or sorrow of the play.

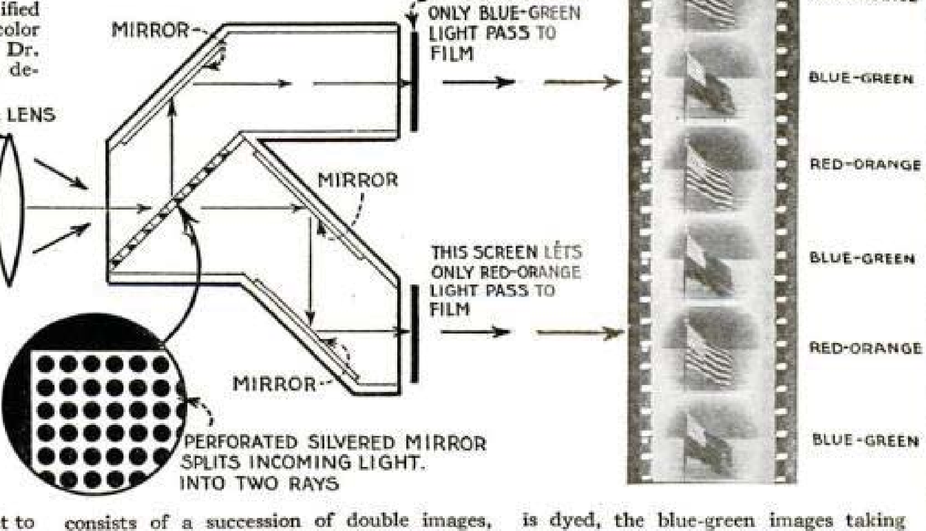
There is no doubt that color has this appeal. Red excites and stimulates us;

The New Color Film
and Its Inventor

HERE is an exact-size reproduction of a section of the new color motion picture feature film, "The Toll of the Sea," starring the young Chinese actress, Anna May Wong. This lifelike movie made possible by the remarkable color process invented by Dr. Daniel Frost Comstock (inset), is called by the artist, Maxfield Parrish, "highly successful from a color point of view and an invention with endless possibilities—a revolution in the moving picture art"

Light Rays Split and Filtered in New Color Camera

THIS diagram explains in simplified form the ingenious process of color movie photography perfected by Dr. Daniel Frost Comstock and fully described in the accompanying article. Two photographs of an object, such as the flag shown above, are taken at the same instant through the single lens of the movie camera. Incoming light is split in half by a perforated mirror just back of the lens, one half being led through a color filter that allows only blue-green light to reach the film negative, the other half led through a second color filter that allows only red-orange light to pass to the film.



Thus the film negative of the flag, shown at the right (slightly reduced), consists of a succession of double images, alternating blue-green and red-orange impressions, but still in black and white. In the positive print of this negative, the blue-green and red-orange images are superimposed, one on the front, the other on the back of the positive film. The positive film then is dyed, the blue-green images taking blue-green dye and the red-orange images red-orange dye.

When projected on the screen, the film gives the effect of reproducing all the original colors of the flag in their natural shades.

George Fitzmaurice, Movie Producer, Says:

"AS TO whether color photography will enhance the dramatic quality and realism of the picture—that is rather hard to tell. I cannot see where natural color will detract from the drama so long as the color remains neutral and unobtrusive.

"Still, I think that the great progressive step will be taken when stereoscope photography has been fully developed. And the millennium will come when stereoscopy and color combine to produce the perfect whole."

Rupert Hughes, Motion Picture Writer, Says:

"IT SEEMS to me that color processes in motion pictures will probably follow the same line as in book and magazine illustration: for certain special effects they will furnish great charm, richness, and contrast, but for general use the single-tone pictures will enormously prevail. It would be ridiculous to deny the beautiful possibilities of occasional color, though I cannot believe that it will ever drive the monochrome, or one color, process off the screen."

green is restful and sedative. To play on people's minds with color as we now play on them with moving images or written words, will require, of course, a completely new kind of directing. There will be new lighting, new make-up, a new technique of screen acting.

But first there is a scientific problem—Can it be done? Is the color movie an accomplished fact?

As yet we cannot say that it is. But we can say that it promises to be. The new process we are discussing is a long step toward the fulfilment of this promise.

A College Professor's Vision

This process is a professor's dream come true. Ten years ago, Dr. Daniel Frost Comstock was a professor of physics in the Massachusetts Institute of Technology. He knew a good deal about color photography. He dreamed of applying it to motion pictures. With Mr. Herbert T. Kalmus, his partner in an engineering firm, he went to work. They began experiments. They organized the Technicolor Company and gathered a group of able scientists and engineers.

For years the experiments failed. Finally, success began to come. One by one the worst of the technical difficulties were overcome: the difficulty of taking two pictures at once through the same lens; the difficulty of finding the two dyes that were exactly the right ones to use in coloring the film after it had been photographed; the many difficulties that came from the extreme weakness of the light after it had passed through the complicated system of lenses and prisms required for the color camera. Film shrinkage, too, was overcome and the many other obstacles that stood in the way of making the two differently colored images fit exactly one on top of the other when they came to be printed on the same strip of film.

Probably you have heard color photographs described as "two-color" or "three-color." Doctor Comstock's films use only two colors to produce the effect of six. To understand what this means, we must recall a few facts about the nature of color and about color vision.

Ordinary white light like sunlight is made up, you remember, of six primary colors: red, orange, yellow, green, blue, and violet. You can prove this by putting a glass prism into a beam of sunlight, and noting how it splits the white light into a strip of these colors, a spectrum. You see them in a rainbow.

White light is believed to be made up of waves or vibrations of various lengths, each wave length producing a distinct color sensation. Red light from a red glass lamp globe looks red because the waves producing the other five color sensations are held back by the red glass. The orange, yellow, green, blue, and violet waves are absorbed. Only the red waves get through. Similarly a blue globe lets through only blue light, and so on. A red paint or dye is merely a substance that reflects only red light, absorbing all the others. A yellow paint reflects only yellow light, etc. These are the physical fundamentals of colors.

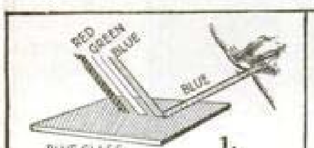
How Our Eyes Mix Colors

But this color theory is partial. It leaves out the human eye. You look, for instance, at an apple. Something happens in your eye. You have a sensation of redness, an impression that the apple is sending red light into your eye.

This seems straightforward enough. The eye, you say, must contain some mechanism able to perceive red light as such, able to sort out the light of the six different primary colors and recognize each for what it is; to recognize each color by itself. What could be simpler?

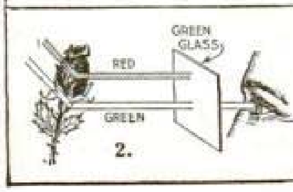
It is simple, true enough, but it is not what happens. Make an experiment. Take

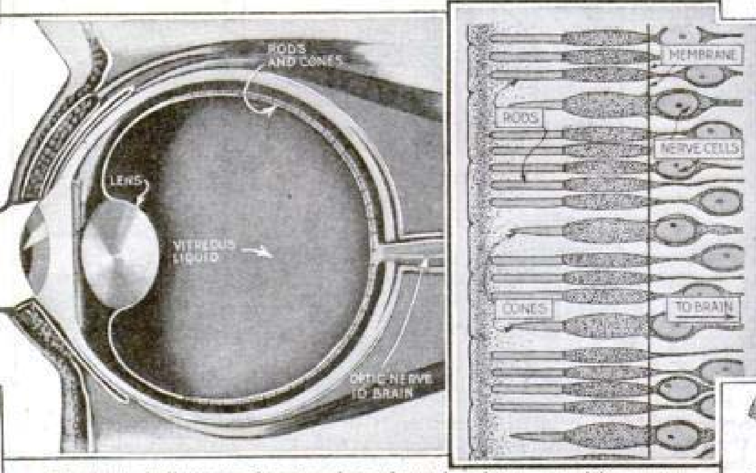
Facts Explaining How We See Color and How Color Screens Work



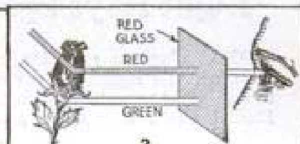
Sunlight contains rays causing all color sensations. Light from a blue glass looks blue to us because the blue glass absorbs all the light rays except the blue rays that it reflects to our eyes

Below: A green glass absorbs the red rays from the rose, but allows the green rays from the stem to reach the eye



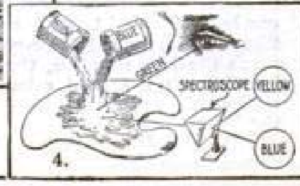


Scientists believe we detect colors through minute, sensitive nerve endings, called "rods" and "cones," in the membrane of the retina behind the eyeball. These nerve endings (shown in highly enlarged cross section at upper right) transmit light stimuli to the brain



Above: A red glass absorbs the green light waves, allowing only the waves that produce the red sensation to reach our eyes from the rose

Below: Analyzed in front of a spectroscope, a mixture of yellow and blue paint is found to produce yellow light and blue light; yet our eyes, in blending these lights seem to see green



Marcus Loew, Owner of 75 Theaters, Says:

"I RECENTLY witnessed a showing of a colored moving picture of the Chinese story called, 'The Toll of the Sea,' which was shown by Judge William Travers Jerome. I thoroughly enjoyed the picture and consider the process highly successful.

"The picture was made far more effective and convincing by the soft, wonderful coloring."

Charles Dana Gibson, Artist-Illustrator, Says:

"I HAVE seen all the color processes so far, and the new process represented in the picture, 'The Toll of the Sea,' is far and away the best. The effect is convincing and most restful to the eyes and altogether irresistible.

"I am looking forward to seeing the picture again.

"It is my belief that this new process will revolutionize the motion picture industry."

some yellow paint and some blue paint and mix them. What do you get? You get *green* paint.

This fact is so familiar that we are apt to forget how startling it is. Think for a moment of what it really means. There are six primary colors. These are separate physical things—different kinds of light. You mix two of them, yellow and blue. You do not get a mere mixture, a yellowish blue or a bluish yellow. You get a third *primary* color, totally different from the yellow and blue, another one of the original six!

What is the explanation? Simply this: The mix-up is in the human eye. The eye does *not* perceive the six primary colors separately and individually. It confuses and blends them in a very complicated way.

Green Isn't Green

Take, for instance, our mixture of yellow and blue paint. Put this in front of a spectroscope, and analyze the light from it. You get yellow light and blue light —no green light at all. Physically, the mixture of paint reflects just the lights that the two separate paints did. The blending of these lights to make green is done, somehow, in the eye. The eye is fooled. It really sees blue plus yellow. It thinks it sees green.

There are innumerable other ways to fool the eye on colors. For instance, mixed red and green (of the proper tints) look white. Certain yellows and certain violets, when mixed, also look white. The eye is simply unable to distinguish between a red-green mixture that looks white, a violet-yellow mixture that looks white, and a true white containing all six spectrum colors.

The theory for all this is very uncertain. In the membrane that lines the back of the eyeball—the retina—there are two kinds of minute nerve endings—the rods and the cones. It is supposed that we detect colors through the sensitiveness of these nerve endings to different light vibrations. It used to be believed that the rods saw red and green and the cones saw blue and yellow. This was disproved. Then it was believed that the cones saw all colors, while the rods saw only light intensity, that is, differences between light and dark. Now even this is doubtful. The plain fact is that we don't know how we see. We know only that the mechanism is extremely complicated, that color vision is especially so, and that, somehow or other, the nerve endings in the retina are variously stimulated by various wave lengths of light, and transmit the stimulus to the brain, where the consequent perception of varying colors is produced.

How Constance Talmadge Would Make Up for Color Movies

ON THE right side of this popular star's portrait are indicated the points in her make-up for black-and-white movies. See how entirely different is the make-up she will be likely to use in color movies, indicated on the left side of the picture. This probable make-up is based on results of recent experiment

But perhaps you are asking what all this has to do with color movies. It has everything to do with them. Color movies are possible at all only because we *are* able to fool the eye about colors.

The new Technicolor process, for instance, is a "two-color" process. This means merely that we dye the films with two colors only, but by mixing them in different proportions we are going to try to represent all colors. A mixed red and green, you remember, will look like white. We are going to extend this. We are going to choose two colors, make various mixtures of these two colors and fool the eye, if possible, into thinking that it recognizes in these mixtures all of the six primary colors.

The best proof that this can be done is that it *has* been done. As you view a two-color film like "The Toll of the Sea," you think you see all the colors. With a few exceptions to be noted later, the eye is fooled successfully enough.

Two-Color Dyes

In this particular feature, as in most other color movie processes, the two colors selected are a reddish orange and a bluish green. These colors are represented by two dyes, carefully chosen from more than 200 dyes that were tried. As I shall explain later, the original photograph consists of two separate images. One image, printed on one side of the film used in projection, is dyed blue-green; the other, printed on the reverse of the film, is dyed red-orange. Where the images overlap, these dyes blend. In projection onto a screen the light is colored by the dyed images, the colors blend likewise, we see both images together, and the eye does the rest.

What we really see are various shades and mixtures of blue-green and red-orange. What we think we see are all the colors of the spectrum. It all depends upon the capacity of the eye for being wrong about colors. It is just like the rabbit that you think you see coming out of the conjurer's hat.

This is what the two-color photograph is, but how is it taken? In exactly the same way. You take two photographs at the same time, one through a screen that lets pass only the blue-green color, absorbing all others; the second through a screen that absorbs all but the red-orange. Suppose you are photographing a red and blue dress. The red parts "take" only on the

(*Continued on page 114*)