CINEMATOGRAPHY IN COLORS

S. Eric Howse, '30

FROM the earliest times of human history of which there is any knowledge, we as a race, have been striving to record the sights and sounds of the surrounding world. Just why we have shown this predilection to recreate our environment is a matter for the philosophers to speculate upon, but the fact remains that through the stages of recording patterns, colors, perspective, and their combination with motion and sound, the progress has always been directed, with the aid of science, towards realism. Without fear of contradiction, it may be said that the production of a three color motion picture print with sound track draws more liberally upon the physical sciences than does any other form of art.

By means of photographic materials it is possible to record images of the visual world in gradations of the scale white-gray-black. With this much established, Clerk Maxwell and other pioneers of color photography must have asked themselves, how can the photographic process be made to repeat the functions of the eye in all respects including color? They demonstrated that lights of the three primary colors could be projected in varying proportions onto a screen to produce any color sensation, and this was the foundation of the so-called Additive Process. It appeared to offer the simplest solution to the reproducing problem.

Any process for making photographs in color consists of two aspects, namely recording and reproducing. The fundamentals of recording consist of making three photographic images of a scene, each taken through a glass or gelatin color filter of one of the three primary colors, red, green, and blue. Each of the negatives thus obtained bears a record of the color component of the scene which is transmitted by the filter used. These are known as color separation negatives. Thus the scene has been analysed into red, green, and blue components, but recorded in graduations of the neutral scale.

When black and white positives are made from these negatives, they may be projected by means of a source of white light onto a screen, each through a filter similar to the one used in recording, and if the images are accurately superimposed, the composite will reproduce the scene in colors. It is curious that the brain will synthesize various proportions of the three components into any color of the visible spectrum.

From the standpoint of commercial photography, this additive process had definite disadvantages owing to the fact that equipment for reproducing the black and white movie had become so standardized and widespread that radical modifications to permit the superposition of three pictures each in a different color was economically unjustified. It soon became evident, therefore, that a satisfactory reproducing process must consist of projecting a single picture containing all the colors on the film. Such a process is known as Subtractive because in reproducing, let us say, a red object, the film subtracts from the white projection light all but red from the spectrum.

It is recognized that under existing circumstances the ultimate goal for a successful motion picture process in color must be threefold: it must add a full range of colors to the black and white technic, it must involve no complications to theatre projection, and it must add a minimum of increased cost both in recording and in manufacturing prints. With these qualifications clearly in view, the Technicolor organization entered upon an extensive program of research and development. At the present time the color separation negatives are simultaneously exposed on three separate films through a single lens, so that space and time parallax are entirely avoided. These three negatives are then developed in essentially the same manner as the single negative of the familiar black and white film.

Following their development comes a printing operation which, however, is not the final step as in the black and white technic, but an intermediate one. This printing produces three color separation positive exposures, and by development and subsequent processing, the silver images are converted to relief images of hardened gelatin. These positives or matrices are now analogous to the etched zinc or copper plates used in photolithography, and are used to transfer dye images to previously blank film which is to become the end product of the process. As the thickness of the relief changes from point to point in delineating the image, so does its capacity for absorbing dye change. Thus the areas which are in greatest relief, transfer the greatest intensity of dye to the blank. This method of making prints in color is known as imbibition—the blank "imbibes" the dye from the matrix.

Transfering the three dyes successively is an extraordinarily delicate technic, as each dye image must be in exact register with the other two if color fringing is to be avoided. Some appreciation of the precision required may be gained by considering the magnification which any defect receives in being projected from a frame of motion picture film onto a theatre screen. Not only are requirements exacting from a mechanical standpoint, but also the factors controlling the transfer of the dyes must be under very close regulation to insure that the proper ratio between the colors be maintained. In spite of these rigorous operating conditions, the machines which perform this part of the process handle the film at a quantity rate.

It is evident by this time that a wide variety of technical aspects are embodied in this sequence of operations, and these have attracted a group of Tech men with a diversity of

interests. Physicists, chemists, and engineers cooperate at Technicolor to carry on the racial heritage of recording and reproducing the visible world.

Editor's Note: ERIC HOWSE, '30, who writes this interesting article on the production of colored motion pictures, is the Office Engineer for Technicolor in their large Hollywood plant on Cole Avenue. He mentions the following Caltech graduates who are members of the Technicolor organization which, as you may know, are the largest makers of colored motion pictures.

NELSON CORDES, '31, is an assistant in the camera department.

FRED DETMERS, '33, is a member of the camera department who has made a number of jaunts to out-of-the way places for travelogue material for color shorts.

JOHN HAMILTON, '30, has been with the camera department for several years during which time he has toured Japan, Mexico, and Holland in seach of travelogue material.

WINTON HOKE, '31, also associated with the camera department, has made many trips including one around the world.

HENRY IMUS, '30, is with the camera department of the British unit of Technicolor near London.

CARL OVERHAGE, '31, Ph.D. '37, has recently joined the research department of Technicolor.

WADSWORTH POHL, '29, who has been with the organization since graduation is now an assistant to the plant manager.

LEE PRENTICE, '25, who is in the production department is in charge of the Positive Assembly.

MERLIN THAYER, '30, is now a laboratory technician with Technicolor having formerly worked first for General Electric and later as refrigeration engineer with the United Fruit Steamship Line.

SIDNEY ZIPSER, '30, who likewise spent several years with the General Electric Company both at Schenectady and at Fort Wayne, has for some time now been a member of the camera department. In this capacity he has traveled to the Pacific Northwest and even to the South Sea Islands for travelogue material.

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CALTECH TEACHERS WILL SERVE ON FACULTY OF SCHOOL OF DESIGN

Appointment has been made of additional members to the faculty of the new Southern California School of Design, a graduate institution for industrial art to be opened in October at Carmelita Gardens.

The new faculty members will be associated with Dr. Walter Baermann, noted industrial designer of New York and Massachusetts, whose selection as professor of design and faculty head was announced several weeks ago.

A course titled "Materials and Manufacturing Processes" is to be given by Dr. Donald S. Clark of the California Institute of Technology. This essential part of the modern designer's equipment will enable the student to create in terms of new materials and methods of production through an understanding of their inherent qualities and limitations.

"Economic Background" will be taught by Philip S. Fogg, assistant professor of economics at Caltech. This course will cover problems in marketing, production, credit, etc., with related sociology in studying the consumers for whom modern design creates.

The course in "History of Design" will be given by J. Donald Young, formerly of Columbia University, New York, and now assistant professor of art and archaeology at Occidental College, where he is acting chairman of the department of art.

Differing from the usual vocational training heretofore generally offered in the design field, the purpose of the new Pasadena institution is to train thinkers in terms of design; to base achievement on the creative, scientific and practical analysis of design problems rather than to produce mere technicians or handicraftsmen.

Secretary of the school will be Miss Mildred Varney, formerly executive secretary of the Bureau of Business Research at the Harvard Graduate School of Business Administration.

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ROBLEY D. EVANS WINS $1000

The American Association for the Advancement of Science announced late in June the award of a $1000 prize to a youthful scientist for medical discoveries. Dr. Robley D. Evans, '29, Ph.D. '32, won the award for his discovery of a method of detecting radium poisoning before its fatal stage and a treatment for extracting the radium from bones before it is too late. The award is based largely on work done for his thesis while studying for his doctorate at Caltech.

Dr. Evans who is entering his fourth year as assistant professor of Physics at Massachusetts Institute of Technology is the first person to receive this new award of the American Association for the Advancement of Science. The award carries a bronze medal with it.

Dr. and Mrs. Evans and their two youngsters; Richard, age 7 and Nadia Ann, age 4, have just returned to Cambridge after having spent a pleasant summer vacation in California. During his stay in the Southland Robley Evans visited the campus on several occasions.