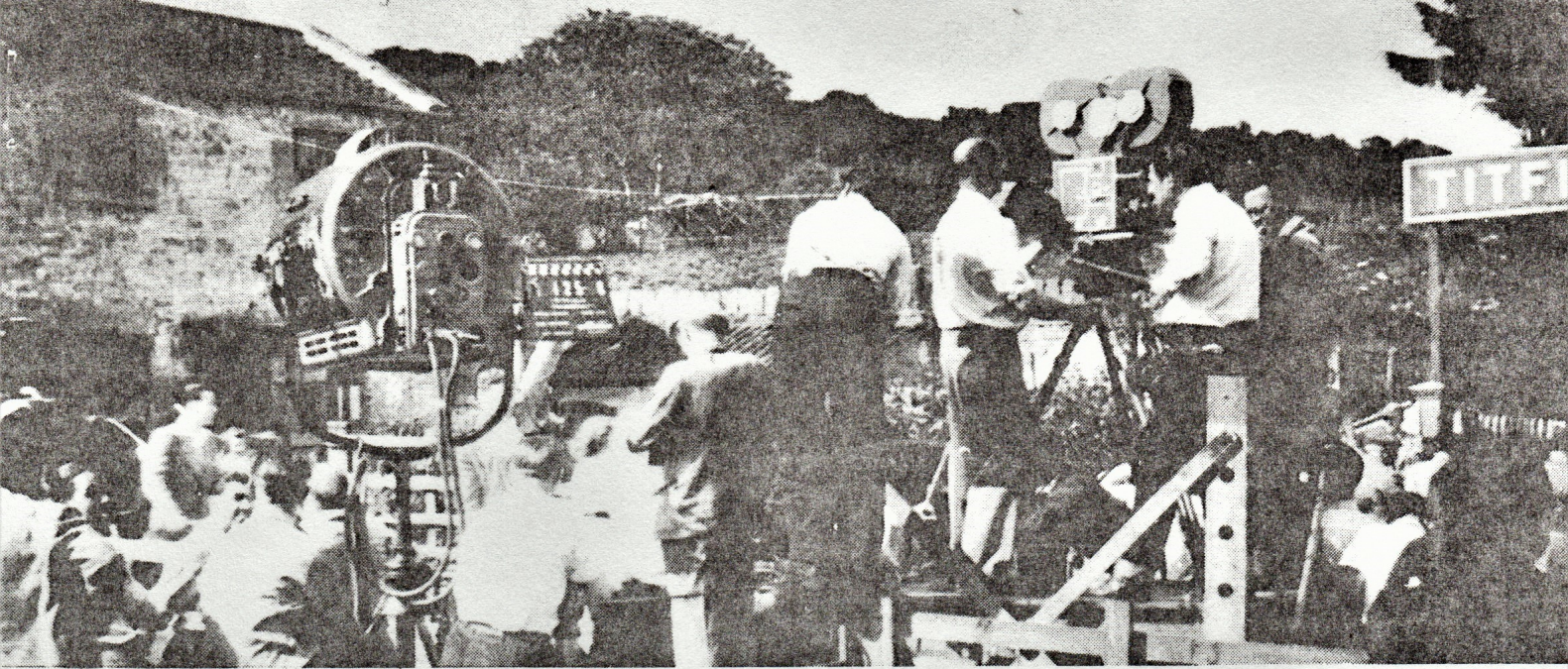


INFORMATION SHEET 4 TECHNICOLOR

by NORMAN FISHER
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The name **TECHNICOLOR** stands for the longest theme in the development of colour in motion-picture photography, and in related film technology, linked to the names of Herbert & Natalie Kalmus. Technicolor became synonymous with colour on the cinema screen to many millions of filmgoers over the World for some 25 years. Other colour systems came and went. Technicolor, with its links to Kodak, Eastmancolor, and TV electronics, is still alive and with us.

1983 marked the 102nd anniversary of the birth of Herbert T. Kalmus in Chelsea, Massachusetts, U.S.A. 1881.

EARLY DAYS

1897. W. Bennetto in Italy files Patent No. EP. 28920 for "a system of semi-dialyte separation colour photography". There is no record that it was put into practice at the time, but through Kalmus it became the basic principle of the Technicolor system.

1902. Herbert Kalmus marries Natalie, whose name was later to become an essential part of the credit titles of virtually every Technicolor picture as 'Colour Director'.

1902-1912. Herbert Kalmus, educated at Massachusetts Institute of Technology, specialising in Physics, studying in Switzerland, became Professor of Physics at Queen's University, Ontario.

1913-1915. Kalmus now Professor of Chemistry and Metallurgy and Director of Canadian Government Research Laboratories.

1915. Kalmus now partner in Research/Engineering Company, Kalmus, Comstock & Westcott of Boston, Mass. - amongst other things, machine tool makers. Kalmus vice-president and Chief Engineer. KCW shortly became The Exolon Co. Through the Kalmus interest in a practical method of putting colour on the cinema screen, Exolon acquired the 1897 Bennetto patent with the ability to make it work. Years of development follow.

1917. The name Technicolor Motion Picture Corporation appears. Liaison established with DuPont and Eastman Kodak for supply of special filmstocks and chemical processes. Short experimental films were made, using a bi-pack system, probably none of which were publicly shown. It is said that Natalie acted in one of them. One for the archives!



Natalie Kalmus

1926. "THE BLACK PIRATE". Produced, acted and directed by Douglas Fairbanks Sen. Shot in B&W but including two reels of sea-battle sequence in two-colour (blue & red), Technicolor, released for the first time on un-suspecting customers.

PERSONAL NOTE: (I saw The Black Pirate as a little lad in a Prince's Street cinema in Edinburgh in 1927. Straight from school, books under the seat, and Mum holding my hot, sticky little hand. We'd never seen blood on the screen in colour before. Technicolor was great on blood. There was no shortage of it. It flowed from the ships into the blue Pacific. This may have been due to early Technicolor problems with dye-transfer printing. There were only two colours and they tended to 'bleed' into each other. I had bad dreams and Mum was none too happy either. After all, it was 1927!) See also page 8.

1926-1931. Technicolor under the direction of Kalmus working on the problems, of which there were many. The major being reliable dye-transfer printing via imbibition from a matrix. Cameras and related optical systems improving meanwhile.

1929. Sound arrives. All singing and dancing now possible in Technicolor, usually for a couple of reels according to budget. Technicolor had still to prove itself cost-effective in terms of added attraction at the box-office. There was no shortage of customers in the golden era of the cinema. The Dream Factories of Hollywood were making millions. Front offices had to be convinced that by adding Technicolor they could make even more. Hard thinking behind long cigars decided they might just make out. Natalie Kalmus as Technicolor's chief saleswoman, (sorry, "salesperson") may have had some influence on the decisions made in these smoke-filled rooms. A woman with much 'know-how' and personality.

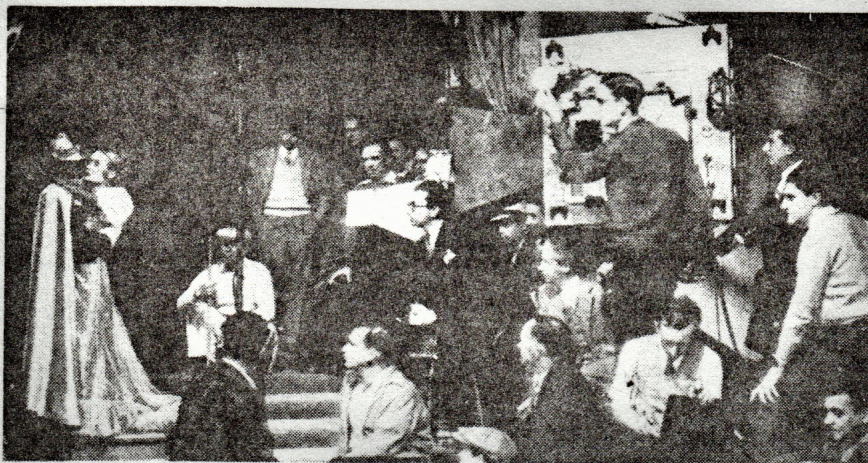


John Boles & Bebe Daniels
in "Rio Rita". (1929).

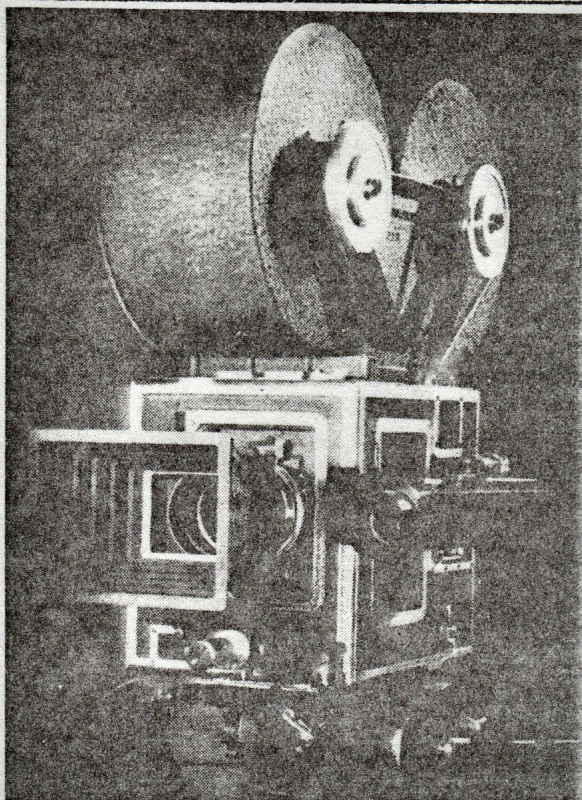
1929 onwards. From front office fog came sanction for pictures with partial Technicolor sequences like "Rio Rita", "Hell's Angels", made by Howard Hughes regardless of cost with magnificent flying sequences and including two reels of Technicolor with Jean Harlow which have not survived. Technicolor prints at this stage were not very stable. Ray Rennahan, who was the first approved Technicolor lighting cameraman, later said that as far as leading ladies were concerned, platinum blondes and black were out, in terms of dealing with contrast range within the Technicolor system. Jean Harlow was platinum blonde. It would be great to see her now. Later, "Gold Diggers of Broadway", "On With the Show" (which may have had in the chorus line a guy whose name sounded like Bing Crosby!). "King of Jazz" with Paul Whiteman and his band featuring a notable sequence with a shiny black dancer, blue lit, dancing on a huge drum to Gershwin's "Rhapsody in Blue". It is to be regretted that so few of these sequences have survived.

Technicolor had now become accepted as the only feasible colour system for the mass-production Hollywood method of film production. Front offices took a lot of convincing, so did producers, directors and art directors. Natalie Kalmus as Colour Director and salesperson was there to help them make up their minds. Born in Boston, Mass., 1882, she studied Art at the University of Zurich, Switzerland and the B. Stetson University, Florida. She had a very highly developed sense of colour design and harmony, later to serve Technicolor well, plus a dynamic personality well able to cope with the most inflated egos of the film business.

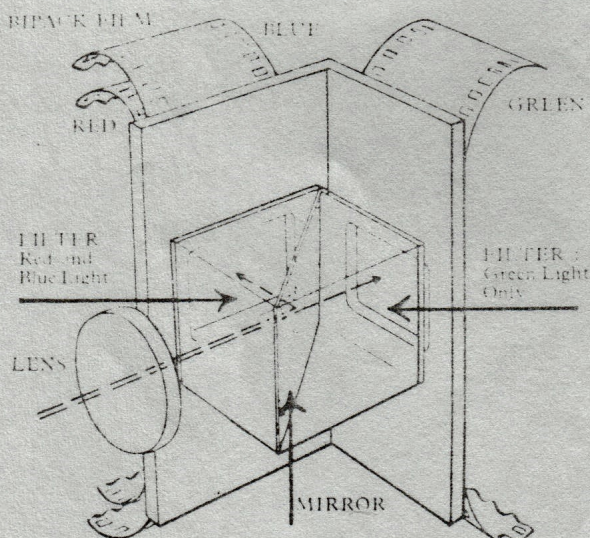
In the earlier days of screen colour, many directors wanted to use it like poster paint, the more the better. Natalie was there to ensure they did not! Under the Technicolor contract for a picture, it could only be shot using Technicolor equipment, laboratories, approved lighting cameramen and other Technicolor-trained personnel. Colour design of every scene including drapes, fabrics, costume, make-up and lighting was subject to approval in advance and on the set by a Technicolor Director, usually Natalie or one of her trained staff. She could'nt be everywhere at once, but every Technicolor picture that went out carried her name on the credit titles as Director of Colour. Natalie visualised screen colour in terms of quiet, harmonious tones from actors lips to background. Nothing to be shot beyond the capability of the system to handle it. She was ensuring that artistry in colour photography served the artistry of those others involved in a Technicolor production, rather than as an end in itself. She could, and did on occasion, order the redecoration of a set and/or changes in decor, lighting, etc., if these did not meet her approval. Her presence in the studio may have been feared, but her judgement was always respected. Together with Herbert, she was ensuring that nothing went out under the Technicolor label that was not of the best.



1935. "Becky Sharp". The first 3-colour Technicolor full-length Hollywood feature film. (Radio Pictures)



The Technicolor 3-strip in 1936.



Technicolor Beam-Splitter according to E.P. 398,339 and E.P. 373,429.

Lighting cameramen had their problems. In the studio, Technicolor required a key-light level of 800 foot-candles at f2 compared to the average 100-150 for black & white. Studios geared to B&W lighting could not supply this level to large sets and Technicolor required high colour temperature light which could only be met by bigger and better arcs. Incandescent lamps were generally too feeble and red. For instance, it was necessary to replace a 5Kw M.R. incandescent with a 150 amp M.R. arc, bigger, heavier and requiring $3\frac{1}{2}$ times as much power. This raised further

problems with lighting gantrys in the studio, together with power supply and cabling. Rigging and cabling these heavier lamps slowed down production schedules. Major studios went along with this in the interests of shooting Technicolor.

By 1934, Technicolor had proved it's superiority over competitive screen colour systems. Large investment in technology under Herbert Kalmus, backed by Kodak, strict artistic control under Natalie Kalmus, superb photography by the best lighting cameramen, and linked to the ability to supply consistently high quality bulk release prints to the voracious cinemas of the 1930's, in United States, Europe and the rest of the World, ensured that Technicolor stayed on top.

The basic principle of Technicolor may have been simple but, as with many other simple principles, it took a long time to make it practical. (Like the Zip-fastener to the atomic bomb - to make a rather unfair but suitable comparison!) Let it be said, considered as a technical achievement, the Technicolor process is a monument to the unswerving determination of the group of technicians responsible for its development in U.S. and Britain, in the areas of chemistry, dyes, optics and mechanics. Some idea of the complexities may be gathered from the number of patents in these fields filed over a period of some fifteen years by the Technicolor Corporation.

About 1932, Technicolor was working on the third, green colour component. George Mitchell, at Mitchell Camera Corporation in Hollywood had designed, built and delivered the first of the famous three-strip Technicolor cameras. Masterpieces of engineering in the Mitchell tradition.

Two negatives in bi-pack at right angles to the lens, (receiving the image via speckle gold-coated, semi-reflecting 45 deg prisms cemented together), were behind a magenta filter and recorded the RED & BLUE images. These bi-pack emulsion surfaces were in contact; the front film sensitive to BLUE and carrying a surface coating of blue absorbing dye. The rear film was panchromatic receiving the RED image. In line with the lens was the panchromatic film recording the GREEN image and this film was set behind a green filter. (See diagram at left.)

This arrangement is described under Patent No. EP 398339 & EP 373429 of 1931. The film materials were the product of Eastman Kodak of Rochester U.S.A. The optical system by Taylor, Taylor, Hobson & Cooke Ltd of Leicester, U.K. The prism, also by T.T.H.C. of Leicester, was the sacred heart of the Technicolor camera and treated with due reverence. Having been installed by its acolytes at the start of the day's shooting inside the camera, provision having been made by George Mitchell, it was cosseted throughout the day and subsequently removed to a place of overnight security. One speck of dust on that prism could have written-off a day's shooting on an expensive set-up. The camera operatives were even trained in the correct way to drop the prism, to minimise damage, in the event of such a catastrophe occurring! It was caught with the toe of the shoe to lessen the fall!



The massive 3-strip mag. weighed 70 lbs loaded. (5 stone or approx 32kg).

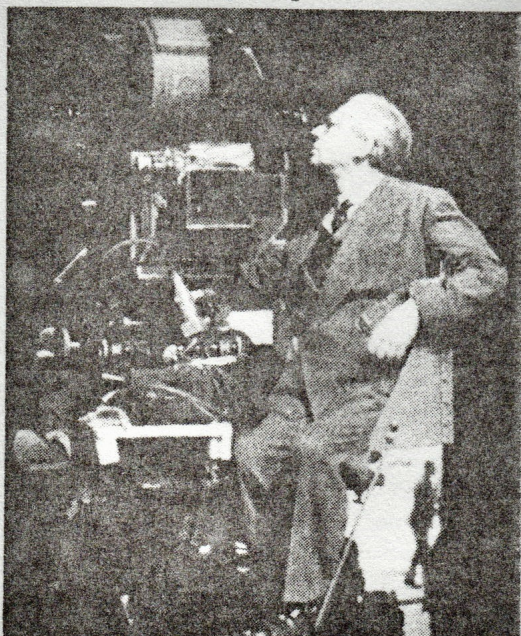
The Technicolor three-strip camera was large, due to its mechanics. Two Mitchell gate movements running at 90 deg via a beam-splitter, plus the power to pull-down three strips of negative from the magazine containing 3 parallel rolls of film-stock, made for something not very portable. Housed in its studio blimp it occupied some 16 cubic feet of space. Labour being cheap in the 1930's, it nevertheless made its way round the World as it was then known, from Balham to Bali, with many memorable feature pictures between.

Regarding the processing of Technicolor, matrices were made from the original B&W camera negatives, giving a hardened, raised relief image of each colour element, which were then used successively, suitably dyed, to impose an accurately registered 3-colour image on the final support.

was required. This was achieved by using a flexible stainless steel band fitted with register pins in the final stages.

1935. American millionaire John Hay Whitney invested in Pioneer Films to make pictures in Technicolor. First off was a delightful one-reel musical "La Cucuracha". Walt Disney took 3-colour Technicolor for his "Silly Symphonies" cartoon series, the first being "Flowers & Trees" (1932. It was the first cartoon to win an Academy Award).

1936. Herbert Kalmus announced a cross-patent agreement with Kodak with, amongst other things, the objective of a single, multi-layer, colour negative filmstock, usable in a standard motion picture camera. Kodak, following the early Kodacolor process of the 1920's, had already released Kodachrome multi-layer reversal stock for the amateur 16mm market. It has been said that Technicolor and Kodak were in competition. Not so. They were to some extent mutually dependent in this area. One for the supply of specialised filmstocks, the other for know-how gained through practical Technicolor experience in the field and working towards single-negative colour in the interests of both.



Sir Alex Korda on the Bobby crane with the Technicolor 3-strip.

"Becky Sharp" (1935) was the first full-length 3-colour Technicolor feature with Miriam Hopkins, based on Thackeray's "Vanity Fair" and was made in Hollywood. Britain's first feature was "Wings of the Morning" with Henry Fonda, Annabella and Leslie Banks. Lighting Cameraman Ray Rennahan was imported from the U.S. with operator Jack Cardiff who was later to become Britain's No.1 lighting cameraman. It was filmed at Alexander Korda's Denham Studios and processed in Hollywood as the British Technicolor Laboratories at Harmondsworth were not yet established.

1937-1953. It was Technicolor all the way! During this period some thirty to forty features and as many shorts were made in Britain alone. Hollywood was making some ten features to each British-based production. Amongst British Technicolor pictures were titles like "The Drum", "Sixty Glorious Years", "The Thief of Bagdad", "Henry V", "Western Approaches", "Caesar and Cleopatra" and "The Red Shoes", not forgetting the beautifully photographed



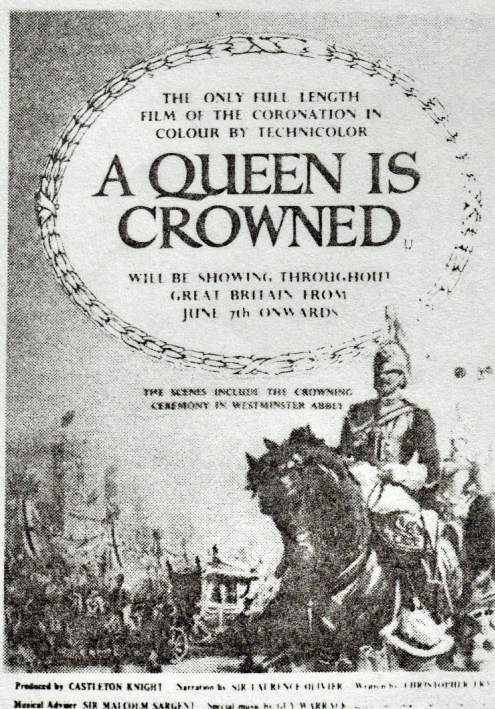
The 3-strip studio blimp. On the camera: Geofrey Unsworth. Jack Cardiff is at bottom-right.

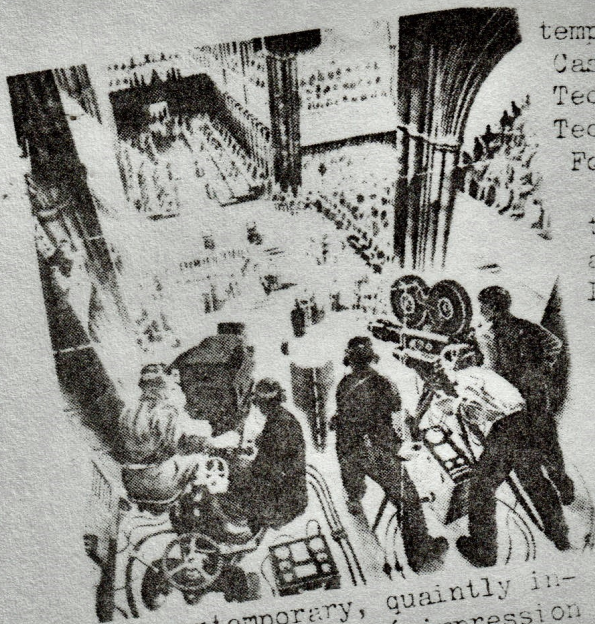
noise about it. (BAL-HAM! "Gateway to the South" - sort of thing). In both cases the camerawork was impeccable, the sunsets magnificent, the commentaries excruciating but the World was learning what it looked like in Technicolor. Humping that lot of equipment round a World largely innocent of film units and their camp-followers may have had problems, but would'nt you liked to have been there?

1937. Technicolor entered Newsreel. Hired by British Movietone News to film the procession to and from Westminster Abbey for the Coronation of King George VI and Queen Elizabeth. Movietone had already made newsreel history by filming in Dufaycolor the Jubilee procession of King George V and Queen Mary in 1935, issued as a supplement to the regular B&W twice-weekly newsreel. Dufaycolor was a single film, neg/pos reversal additive system, based on a 3-colour reseau imprinted on the film base which carried a B&W reversal emulsion, usable in any camera with a light orange filter for daylight. It could be processed and printed as rapidly as B&W in newsreel terms. The original reversal positive was remarkably good; the reversal prints were not, due to de-saturation of colour and confliction of the base grids of the two filmstocks giving a "moire effect" and lack of definition. Any way, Movietone had it in colour, even if the Guard's uniforms were salmon-pink! Dufaycolor made many subsequent improvements.

The 1937 Coronation inside Westminster Abbey was filmed by the newsreels under official suffrance. No additional lighting allowed. Movietone was limited to one camera manned by Leslie Murray using a very special 58mm T.T.H. & C. f1.3 lens mounted on a Bell & Howell combined system sound camera loaded with Agfa Ultra B&W, hypersensitised stock with a speed in modern terms of about 400 ASA, flown in from Berlin and guaranteed effective for one week only! It was then the fastest B&W filmstock in the World and Movietone secured a remarkable result. Outside, Technicolor with its three available cameras made a splendid record of the - quote - "Pomp & Pageantry" of the Processions. The combination of the two, Movietone B&W plus Technicolor put Movietone on top!

1952. February 6th. C. Castleton-Knight, boss of Gaumont-British News, and a great film showman, received news of the death of King George VI, and reached for the blower. Conversation as follows: (according to con-





A contemporary, quaintly inaccurate, artist's impression of the equipment problems. It was much more cramped!

temporary accounts),:

Castleton-Knight: "Give me Technicolor!"

Technicolor: "Yes?" C-K: "King George VI just died".

Technicolor: "Yes?" C-K: "I want YOU!" Technicolor: "Yes. For the funeral?" C-K: "No - for the Queen's Coronation!!"

C. Castleton-Knight thus thinking ahead to what was to be June 2nd 1953, secured every Technicolor camera available in Europe for the Coronation of Queen Elizabeth II and his picture "A Queen is Crowned". Predictably the last occasion a Queen would be crowned in Britain or anywhere else. Only eight Technicolor cameras were available in Europe. Some of these were taken from feature production in Italy and moved to London, regardless of cost, for an occasion that was one of the greatest shows on Earth.

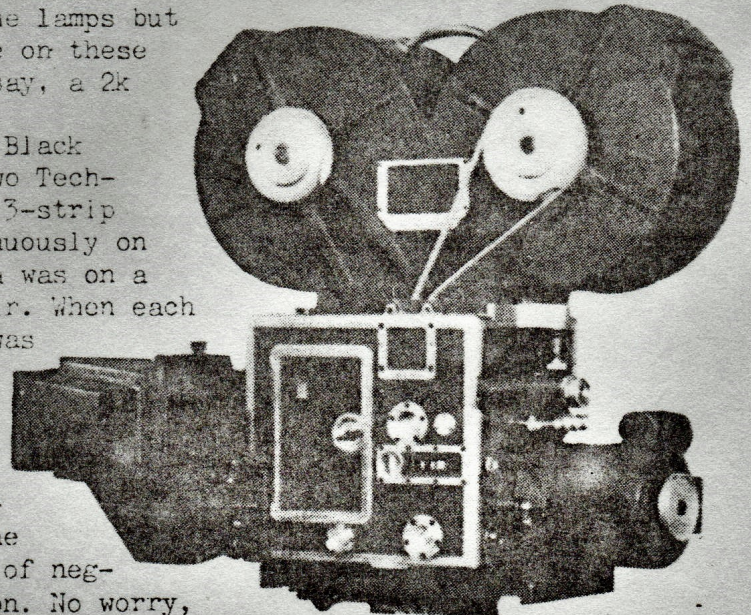
1953 June 2nd. (PERSONAL NOTE) On behalf of British Movietone News, using a Wall combined system camera loaded with Gevacolor single-film colour negative, I shared a cramped, sound-proofed, optically double-glazed box, built by the then Ministry of Works into the tomb of Edward the Black Prince, at very high cost, alongside the High Altar. To the right: the Coronation Chair at a distance of about 40 ft. To our left: the High Altar.

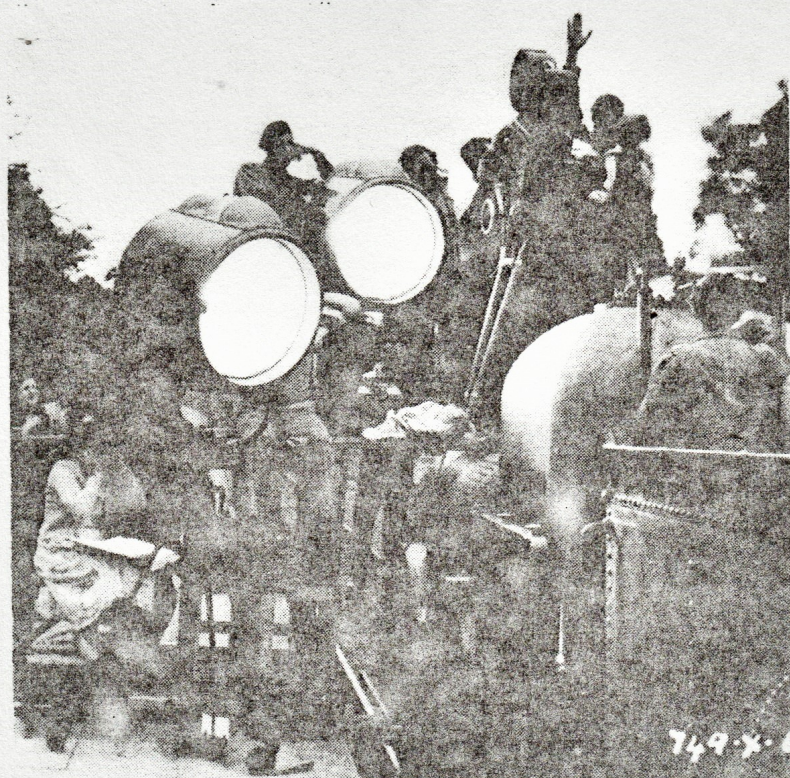
Present also were Paramount, Gaumont-British and Pathe newsreels together with the two massive Technicolor 3-strip cameras shooting on behalf of Castleton-Knight's "A Queen is Crowned". The average light level in this area was about 120 foot-candles, supplied by Mole-Richardson. The lighting level was the result of previous on the spot consultation with Church and State who decided that our Queen should not be subjected to undue heat and light - and rightly too.

A SECRET REVEALED! Shall we say after 30 years have passed, that a slight deception was perpetrated? Mole-Richardson rigged a huge lighting set-up throughout the Abbey, consisting of some 500 10k, 5k. & 2k incandescent units placed very high up. To get the full 3250 deg Kelvin colour temperature for colour, they had to be run at full voltage, requiring additional power from six mobile generators outside the Abbey. All lamps were on dimmers. When Authority arrived to inspect the lighting, it was recognised that Authority would lift its eyes to the roof and stare straight into the lamps and say: "No, No - much too bright!" Even a 25 watt bulb looks bright if you stare straight at it. The dimmers would therefore come down a few notches, we kept our light-meters in our pockets. Authority departed satisfied, up went the dimmers and we got on with our lighting tests.

The Ministry of Works, who were responsible for the furnishing and decoration of the Abbey, in response to slight nudging, co-operated splendidly by replacing the original Royal Blue carpet in the Coronation area - highly light absorbent - with a light 'Gold' carpet which gave very worthwhile reflection from lamps high up and shooting down at a steep angle. On the day, we had a nice lighting balance, the minimum needed, the Queen was not inconvenienced, Authority didn't see any difference and all the heat in that large building came not from the lamps but from the 3000 people there assembled. People on these occasions seem to give off more heat than, say, a 2k lamp individually!

Back in our little box, on top of Edward Black Prince, we newsreel boys did our bit. Our two Technicolor chums were struggling with two huge 3-strip cameras and a brief that said: "Shoot continuously on essential action". This they did. The camera was on a fixed mount lined-up on the Coronation Chair. When each magazine finished its ten-minute 'take' it was replaced by the second camera and reloaded on the floor by an assistant using a torch. The cameras, loaded, weighed about 250 lbs (18 stone or 114kg). We all lent a hand to put them up and take them down in the interests of Castleton-Knight and Technicolor. The cost of Technicolor 3-strip running 3000 ft of negative every 10 minutes is open to speculation. No worry,





The two 225amp M-R 'Brutes' used as 'fill-lights' indicates the amount of light needed for 3-strip Technicolor. (Titfield Thunderbolt. Ealing, 1952.)

pictures in the studios of Hollywood, Britain and Italy. On the water, underwater and in the air. In the Arctic and the tropics and numerous unlikely corners of the World, they had behaved impeccably. Some were taken-over for conversion to 70mm by Todd-AO & 20th Century-Fox for such as "Around the World in Eighty Days" & "Cleopatra". Others saw many years of additional service in special effects photography in the U.S., serving as an ideal machine for the production of travelling mattes. A notable example being the famous trick-work for "Mary Poppins". Some were converted to VistaVision. Others found their way into museums. They were few in number costing, in 1937 terms, some £35,000 each to build! PPT members so interested and wishing to pay their respects, should visit the splendid Samuelson Museum at Cricklewood where a Technicolor camera, complete with studio blimp, is on show with 'hands-on' facility. Ask for David Samuelson, 01-452 8090.

Two more Technicolor cameras, untouchable, may be seen at the fascinating Kodak Museum at Wealdstone Lane, Harrow, and the Film and Photography section of the Science Museum, Exhibition Road, South Kensington. At all these places many items of film and photographic history are on view, concerned with not only the means of making motion pictures but those of showing them.

The list of known and named colour film systems devised over the years roughly between 1895 & 1950 adds up to about 30. To name but a few: "Kinemacolor", "Cinecolorgraph", "Dioptochrome", "Herault Trichrome", "Dascolor", "Harriscolor", "Kelleycolor", "Splendid-color", "Jamescolor", "Sennetcolor", "Foxcolor", etc., etc. Whatever they were called, they had their brief day and vanished into the archives. Technicolor linked to Kodak proved a basic system, plus large capital investment and proved field technology, beat the lot, linked to mass production of motion pictures and the capability of supplying release printing in quantity and quality.

Herbert T. Kalmus died in 1963 age 82 and still President of the Technicolor Corporation. The method of motion picture colour photography which he conceived and linked to practical processing procedures took nearly 50 years to development, to him should be all credit due, and to his wife Natalie who ensured that the film producers in their enthusiasm, did not make a nonsense of it. We now have the pay-off in terms of Eastmancolor negative, constantly improving and servicing us well in all situations.

The name of Technicolor is not yet ready for inclusion in the dusty archives of forgotten film colour systems.

"A Queen is Crowned" was a huge success, quite the best colour record of the 1953 Coronation and made a heap for C-K and Gaumont-British News.

1953. The Coronation, Everest conquered by Hilary and Tensing, and Kodak released Eastmancolor single negative for general use. Technicolor withdrew its excellent but cumbersome system of 3-strip photography, leaving to any owner of a standard motion picture camera the facility to load Eastmancolor and shoot. Technicolor retained in its laboratories the capability to make dye-transfer/imbibition prints from matrices made by separation from single Eastmancolor negatives. These were cost effective where multiple release prints were required and of consistent quality that could not always be matched in the early days by Eastmancolor print stock.

Eastmancolor could now be processed by many film laboratories throughout the World.

The splendid George Mitchell engineered Technicolor 3-strip cameras were now redundant, having served well for some 25 years on many famous feature

Text © Norman Fisher, 1983.

EXTRACTS:

PRE "3-STRIP"

From:

THE ART OF SOUND PICTURES (1930) on 2-colour TECHNICOLOR:

"THE IDEAL KINEMA" March 14 1946.

Technicolor Printing Process

The time required for each of the dye images to transfer to the blank is of the order of three minutes, and this transfer operation is carried out at a machine speed of more than 100 feet per minute, all the while maintaining perfect registration between the three component images.

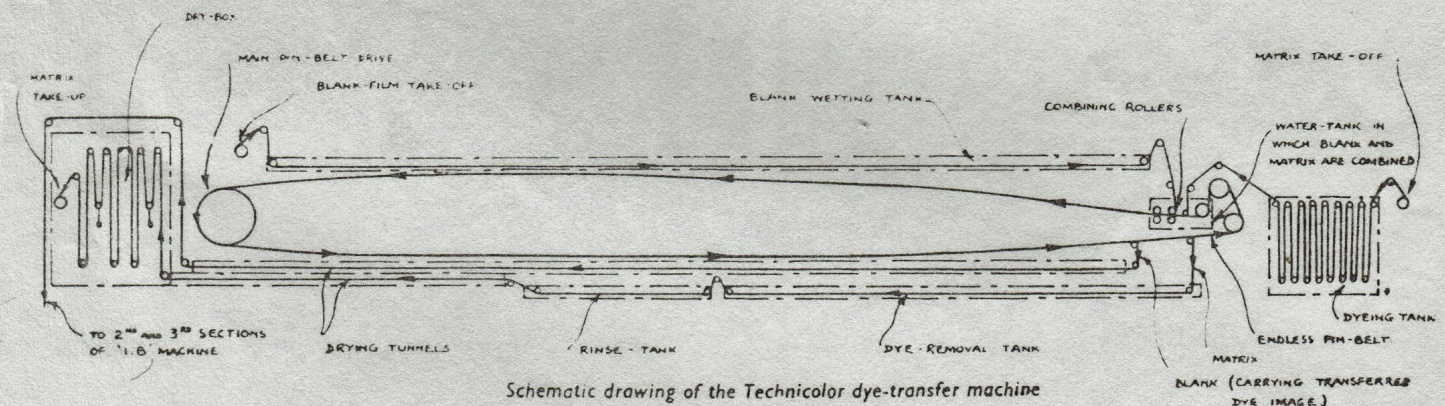
From these figures, the size of the imbibition machine used for producing Technicolor prints can be visualised. The registration of matrix and film blank is attained by the employment of a flexible steel pin-belt which hold the two films in fixed relationship. The transfer is effected under the application of heat (see diagram below).

Sub-standard (16mm) Technicolor prints are obtained from matrices which have been printed with a series of 16mm images down the centre of a 35mm film. Sound is contact-printed, and after dye transfer the 16mm perforations are added and the required width is slit from the larger film.

The Technicolor camera, in which a single lens is used, is specially built for color work. Behind the lens is a group of prisms put together in such a way that two separate pictures are thrown on two successive frames of the same film. A revolving color filter is so arranged that these two pictures, a red picture and a green picture, are photographed simultaneously. When the entire series of picture sequences has been recorded, the film is developed, and this represents the negative carrying latent red and green color values on alternate picture frames.

The negatives are now printed on two independent strips of positive film. That is, all the red color values are printed on one strip of film, and the green values on a second strip. These are developed and fixed in the usual way. The two positives are now subjected to a chemical treatment which converts the silver images into what is termed a "mordanted image." A mordanted image is one which has the property of absorbing certain dyes. Thus, a positive having the red records is dyed green, and the green records are dyed red.

When the films are dyed in their primary colors, both sets of colored pictures are transferred to the same side of a new film. In this process, a fresh film, covered with appropriate gelatine preparation, is pressed successively against the dyed films. The gelatine on the fresh film absorbs the dye from the dye film in the same way that a blank newspaper page absorbs the ink from the presses.



Schematic drawing of the Technicolor dye-transfer machine

About the Author: Norman Fisher has been in the film industry from the early thirties. He joined British Movietone News in 1934 shooting documentaries as well as newsreels but his work as a cameraman was preceded by a spell at Kay Film laboratories and the GPO Film Unit. Being closely involved with the practical and operational side of the industry, his experience of motion picture photography was not gained from behind an office desk but out in the field where it all happened. Norman's previous written work, "ANAMORPHOSIS - The Story of CinemaScope", was published in the No. 8 Issue of the Projected Picture Trust Newsletter (Autumn 1982). This Information Sheet on Technicolor was researched and compiled between contract assignments making Norman a still-active Movietone Cameraman. He is also a member of the PPT. Norman's one disappointment in producing this Information Sheet is the lack of success in trying to locate a picture of Herbert T. Kalmus. Even the Technicolor company were not able to assist!

The title picture on page 1 shows the Ealing Studios unit shooting the Technicolor production "The Titfield Thunderbolt" at Monkton Combe station, near Bath, in June 1952. The arc lamp is a 225amp Mole-Richardson "Brute". (Photo: B. King.)

Acknowledgement is made to "British Technicolor Films" by John Huntley, 1949, for pictures and other research material.