

# A Tale of Technical Excellence and Endurance

The choice of explorers, Hollywood cinematographers and army provisioners alike, Cooke lenses from Leicester have documented the history of the 20th century, capturing some of the most famous expeditions, countless feature films and the natural wonders of our world. Dudley Darby takes a look at some of the seminal moments in the remarkable history of these British lenses. Continuing a long tradition of technical excellence and innovation, today Cooke Optics Ltd manufactures a full range of high-tech primes and zooms for 35mm, digital and Super 16mm photography, plus a range of large format stills lenses.



▲ Frank Hurley on the Antarctic ice near to Shackleton's 'Endurance'

In 2009 the town of Allertorp in East Yorkshire, saw the unveiling of a plaque in the village hall commemorating the achievements of one of its sons, Thomas Cooke. With little formal education, Cooke had taught himself the intricacies of optics, astronomy and navigation, and would give his name to some of the finest photographic, cinematographic and television lenses in the world. I choose these words carefully, since the company that he founded in 1836, T. Cooke and Sons of York, never actually commercially manufactured a photographic lens, although were much-respected makers of astronomical telescopes and optical instruments. Thomas Cooke died in 1868, but his company thrived under the management of his two sons and their optical designer, H. Dennis Taylor.

## Taylor's Triplet

Lens designers had long grappled with distortion at the outer edges of lenses, photographs often requiring

exceptionally long exposure times as apertures of around  $f/32$  were required to achieve sharpness across the frame. Harold Dennis Taylor cracked this problem in the early 1890s with a simple, elegant and revolutionary concept, the Triplet lens. He patented the design in 1893 (British patent no. 1991/93) but the company was less than enthusiastic, the Cooke brothers showing no interest in his photographic lens designs.

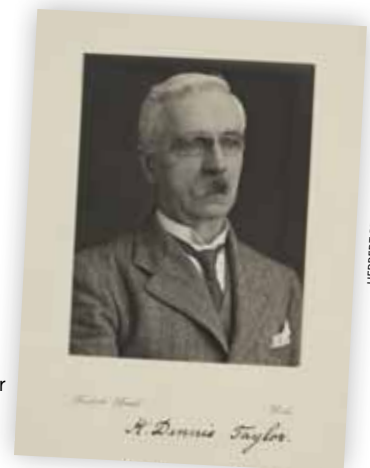
Undeterred, after building a prototype of the Triplet, Dennis wrote to a Leicester company, Taylor, Taylor & Hobson (Tt&H), makers of fine optical products, in September 1893. He enclosed a sharp print from a negative of York Minster taken at  $f/7.7$  with his  $7\frac{1}{4}$ " trial lens taken on a  $7\frac{1}{2}$ " x 5" plate. The result was even more remarkable as he had to lift the rising front by  $1\frac{1}{2}$ " inches meaning the lens was not centrally aligned. When the Taylors responded positively and agreed to manufacture the lens, the Cooke brothers were livid. It was

the first they'd heard of the Triplet. This led to the proviso in the licensing agreement that all lenses would be sold under the Cooke brand name.

Tt&H produced the first Cooke photographic lens under the Cooke Triplet patent in 1894 and the following year won the Royal Photographic Society's medal for 'improvements in lenses within recent times'. The early lenses had brass casings and were inscribed 'H. D. Taylor's patents'. H. Dennis Taylor designed five series of photographic lenses for Tt&H, some with such steep curvature of the elements that production was extremely difficult.

By the early 1900s, the relatively small

**Cooke lenses gained a reputation for resilience in harsh environmental conditions as well as optical quality, which made them the lens of choice for some of the greatest expeditions of the early 20th century**



▲ H. Dennis Taylor, designer of the Cooke Triplet

manufacturing company had grown and become a limited company. In addition to photographic and cinematographic lenses, they produced some Dennis Taylor designed object lenses for telescopes, notably a 2.5" aperture f/2 objective with a 30° field of view for the Mt Wilson Observatory in 1917.

Prior to obtaining the Cooke licence, TT&H already made a

conditions as well as optical quality, which made them the lens of choice for some of the greatest expeditions of the early 20th century, the first of which was Ernest Shackleton's 1914 Antarctic Expedition. The expedition's photographer, Frank Hurley, used a Cooke Series VIII 12" f/3.5 telephoto lens on a Graflex camera to record daily life on the ice as well as the destruction of the expedition's ship,

Sinclair camera produced excellent motion pictures of the climbers from two miles away. Both expeditions culminated in deaths on the mountain, the first climb claiming the lives of seven porters, the second those of George Mallory and Andrew Irvine.

Cooke lenses were also used on other 1920s Polar expeditions, the United States Department of the Interior's Alaskan Geological Survey,

**The Aviar**

The First World War and the advent of aerial reconnaissance brought a requirement for fast, high definition lenses. The Royal Flying Corps and Royal Naval Air Service had purchased 'suitable' German lenses but, with German glass virtually impossible to procure, something new was needed. Arthur Warmisham, who had joined

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◀ TTH's Stoughton Street premises in Leicester

▶ Taylor Hobson Cooke advertisement with picture and endorsement sent by Sir Ernest Shackleton

▼ Captain John Noel using Cooke Series VIII 20" telephoto on Mt Everest



ROYAL GEOGRAPHICAL SOCIETY

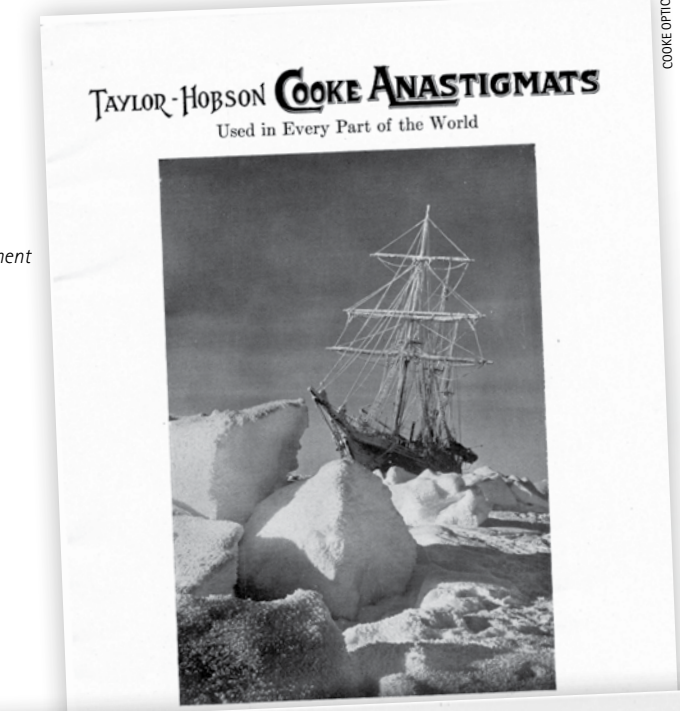
soft-focus portrait lens called the Rapid View. This lens had achieved much acclaim through the works of Clarence White and Alfred Stieglitz in the early 1900s and demand for this type of lens led to an updated version with an added iris diaphragm, the Cooke Achromatic Portrait Lens f/7.5, produced in 1913. Focal lengths corresponded to the four most popular plate sizes. Various series of portrait lenses followed, all engraved with series numbers rather than names, the most popular being the Series II f/4.5.

**Expeditions**

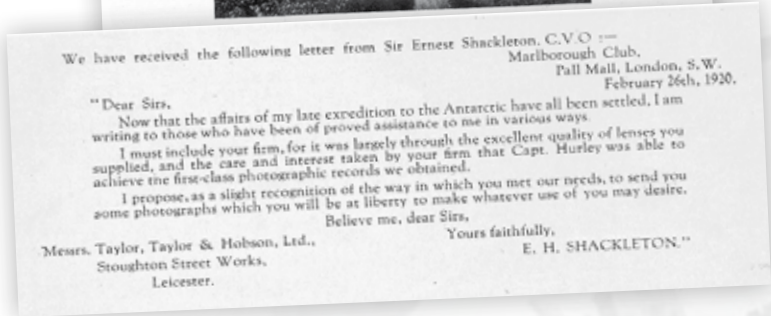
Cooke lenses gained a reputation for resilience in harsh environmental

Endurance, as it was slowly crushed. Many of Hurley's glass negatives went down with the ship, but fine prints from those he salvaged can still be seen in exhibitions worldwide.

Almost a decade later, Captain John Noel became official photographer to the Royal Geographic Society's 1922 and 1924 Everest expeditions led by Brigadier Charles Bruce. The photographic kit comprised three movie cameras, two panoramic cameras, four sheet cameras, a stereo camera and five small Kodak vest pocket devices that the climbers could take with them. Just as well they had some 160 porters! A Cooke Series VIII 20" f/5.6 Telephoto attached to a specially-built 40lb Newiman



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**The Cooke Aviar appeared at about the same time as William Vinten's Model B aerial camera, and was adopted by the Royal Flying Corps and later the Royal Air Force**

expeditions to Africa and Asia, and aerial expeditions by Lt Cmdr Richard E. Byrd and Captain Amundsen over the North Pole by aeroplane and airship, respectively, in May 1926. The latter two expeditions used Taylor Hobson Cooke f/2.5 lenses attached to Bell & Howell Eyemo cameras.

TT&H Ltd in 1912, took on the task of designing a new lens superior in performance to German lenses; the Cooke Aviar was patented in 1916 (British patent 113590). It appeared at about the same time as William Vinten's Model B aerial camera, and was adopted by the Royal Flying

GOLDEN AGE TV



◀ Bell & Howell Eyemo Spyder with Cooke lenses

▶ Edmund Burke O'Connell, US Army newsreel cameraman with B&H Eyemo camera

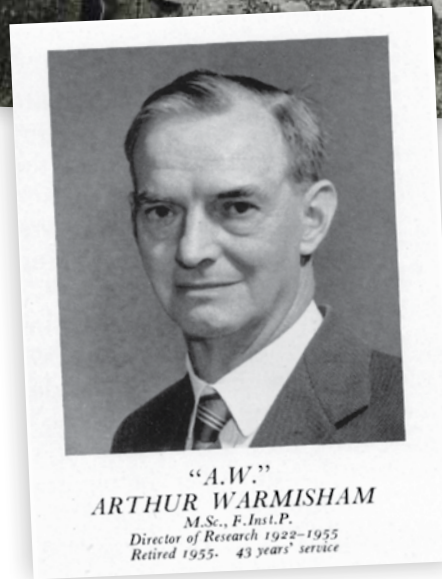
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▲ Cylindrical slide rule and calculator used by Gordon Cook



USED WITH PERMISSION FROM THE AUTHORS OF THE LAST FAREWELL - A JOURNEY OF THE HEART, © 2006 EDMUND BURKE O'CONNELL, JULIE WHITMAN JONES AND THOMAS J. SULLIVAN, JR.



COOKE OPTICS

◀ Arthur Warmisham, prolific designer of Cooke lenses for 43 years

Corps and later the Royal Air Force. A post-war visit to the Stoughton Street factory by King George V and Queen Mary on 10 June 1919 recognized the company's contribution to the war effort. In 1924, the Aviar, generally considered the finest Anastigmat ever to be produced, was adapted as a general photographic lens and continued in production in various focal lengths until the early 1960s.

During the first half of the 20th century, TT&H Ltd designed a variety of Cooke lenses for Graflex cameras. Perhaps the most desirable of these cameras was the Series C, a 3 1/4" x 4 1/4" still camera supplied with the Cooke 6 1/2" f/2.5, their fastest lens for the Graflex range. Production continued from 1926 through to 1935.

**Making it in Hollywood**

As cinematography blossomed, particularly in Hollywood, the reputation of Cooke lenses spread.

It was claimed that Cooke Series VIII B Telephoto Anastigmat f/3.5 lenses were being extensively used on Hollywood feature films. At the time, Famous Players-Lasky dominated production and distribution, and their DoP, Frank E Carbutt had written to TT&H in 1926 confirming that 'over 100 Cooke lenses of various focal lengths are used by the photographic department of Famous Players-Lasky studios'.

Horace Lee, one of the most notable lens designers of the 20th century, who joined TT&H in 1913 as Arthur Warmisham's assistant, designed the f/2 Cooke Speed Panchro in 1921, based on the very fast Cooke Series O f/2.0 lens. With the advent of the 'talkies' signalling the demise of noisy arc lamps, this lens, first to market with a wider angular view and better definition at low light levels, would become extremely popular. Horace Lee subsequently became

totally deaf and verbal communication with him was difficult, colleagues usually resorting to notes on pieces of paper.

Together, Warmisham and Lee kept TT&H at the forefront of optical design engineering, rising to every challenge thrown up by advances in the film industry. Lens design in the 1920s and 1930s was a major undertaking. All calculations of light ray paths had to be performed manually by an army of female assistants known as 'computers' using trigonometrical tables, mechanical calculators and Fuller's cylindrical slide rules with helical scales 40 feet (12m) long. Two computers would work simultaneously and if their results agreed these were deemed to be accurate.

Development of the 3-strip Technicolor camera with a beam-splitting prism behind the lens made it impossible to use existing wide angle, large aperture lenses. Again,

an answer to the problem was found by Arthur Warmisham who came up with an inverted telephoto, patented in 1931. A year later, Lee patented the Cooke Series XV Triple Convertible, a combination still lens that provided three focal lengths, still popular with large format photographers.

**Working with Bell & Howell**

1931 also saw a partnership between TT&H and Bell & Howell of Chicago, makers of professional and amateur cine cameras. Arthur Warmisham, in collaboration with R.F. Mitchell of Bell & Howell, designed the first non-telescopic complex zoom lens for 35mm cameras, the Cooke Varo 40-120mm (British patent 398,307, October 1932), manufactured and marketed by Bell & Howell. By 1935, the Cooke Speed Panchro range stretched to eight focal lengths from 24mm to 108mm and accounted for the majority of Hollywood's,

and indeed much of the world's, film production. Bell & Howell's Eyemo 35mm camera, supplied exclusively with Cooke lenses, had sold well to the studios, later becoming standard issue for camera operators during World War II. George Eastman commented to William Taylor that "90% of 16mm film used in America passed behind lenses made in Leicester".

Around this time, Horace Lee decided to move on. Charles Wynne, a TB sufferer and ex-ladder salesman with an Oxford physics degree in optics, replaced him, taking over his desk which sported a large prototype lens as a paperweight and numerous

most for any single optical designer, and Series II and III Speed Panchros were developed, including an 18mm 80° variant for widescreen Technicolor. Significantly, there was a move into the amateur market, RTH supplying Cooke lenses in various guises for all of Bell & Howell's 16mm and 8mm cameras. Television also beckoned. Dallmeyer had dominated the early United Kingdom TV market, but with the advent of the Image Orthicon, RTH came to the fore with fixed focus turret lenses (the Ortal and Vidital ranges designed by Gordon H. Cook) and the Varotal 1, 2 and 3 zoom lenses. The Bowden cable-operated

its fortunes declined as a small, and somewhat neglected, part of Rank. Eventually, in 1997, it was sold to Schroders Ventures. For some time Taylor Hobson had been manufacturing fine metrology instrumentation, and by July a year later decided that that was its future. The optics division of the company was sold to Les Zellan, a long-time distributor of Cooke lenses in the United States, and firm believer in the principles of innovation and optical design excellence established by the Taylor brothers a little more than a century earlier. Cooke lenses were being produced by a dedicated

T2.0 primes, then the development of /i Technology, digital technology that allows lens data to be recorded along with each frame. Thales-Angénieux, recognising its benefits, formed a collaborative partnership with Cooke Optics Ltd to introduce it on their range of film lenses.

IBC 2009 saw the launch of the Cooke 5/i, T1.4 series of Super 35 lenses and a prototype of a totally new rework of one of Cooke's classics, the Panchro by Cooke, both of which Mark Gerchman's team had designed. The f2.8 Panchro lenses would provide a lower cost compact option for shooting situations where T2.8 is

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notes for Lee. Warmisham and Wynne investigated the possibilities of designing lenses using crystalline materials which led to a number of early patents in this field, but didn't result in any practical lens designs at that time.

The early 1940s saw uneasiness among some of the younger design staff over the company's tight-fisted approach to money management. Wynne recalled a time when he was off sick and was sent his wages in a linen, registered envelope, the cost of which had been deducted. As was permitted by the Post Office at that time, he returned the envelope to its sender (the company), who were then required to refund the cost – two pence more than the deduction! He left TT&H in 1943 and became known in the 1950s for his work that would ultimately lead to computer-aided lens design.

**Rank Taylor Hobson**  
Process prisms and Cooke Apochromatic process lenses, the first of British design, had been produced since 1921. During World War II, these were used for high-quality map production for the armed forces, and by 1947 an estimated 75% of photoengravers in the United Kingdom and America were using Cooke brand lenses. By then, TT&H had been acquired by the Rank Organisation and become Rank Taylor Hobson (RTH). Changes were afoot. Arthur Warmisham retired in 1955 with some 99 optical patents to his name, the

Varotal 2 covered less focal length range than a standard turret, so was really only of use in studios whereas the Varotal 1 had an 8"–40" range more suited to outside use. As they were not film lenses, they didn't carry the Cooke name. Longer range OB zooms were later developed, production continuing until the late 1960s.

Professional 16mm cameras and film stock quality had improved to the point where they were becoming a cost-effective alternative to 35mm in some environments, so the company responded by producing nine wide aperture 16mm prime lenses.

### Zoom lenses

With the advent of colour television, zoom lenses became the norm. Taylor Hobson Optics, as the division was known, produced new servo-controlled variants in the Varotal range to fit the four-tube Marconi Mk VII and much-loved EMI2001 cameras, among others. Gordon Cook also produced a new design of film zoom with a fixed front element and sealed focus unit which remained the basis for Cooke's later range of film zooms and helped earn him the 1988 Donald E. Sawyer Award from the Academy of Motion Picture Arts and Sciences for technological advances during his career.

Competition in the lucrative television lens market from France, Germany and Japan was fierce. Although the company won a Design Council award for the Varotal 30,



▲ The new and the old. A state of the art Cooke 5/i 25mm lens with 1932 Cooke Varo 40-120mm, the first zoom lens.

company, Cooke Optics Ltd.

Announced before the end of 1998, design of the award-winning S4 T2.0 series was completed by Mark Gerchman, Cooke's talented new chief optical designer, capturing a large chunk of the digital cinematography market. The company moved across Leicester to new 20,000 square feet premises as the 21st century commenced. Two large-format photographic lenses (PS945 and XVa Triple Convertible) followed, the first new Cooke still lenses in 50 years, SK4 Super 16mm

adequate. The three series of lenses, S4, 5/i, and Panchro by Cooke are colour matched allowing a mix and match of lenses

William Taylor's philosophy of "not doing what everyone else was doing, but doing something new" has been maintained by Cooke lens designers through the various incarnations of the same company, and always designed and crafted in Leicester facilities, touching three centuries now. What of the future? Wait and see. It is bound to be something spectacular.

## Fact File

**Dudley Darby** worked for BBC TV from 1963–2001 on camera, mainly multi-camera in the studios. He also undertook operational evaluations of equipment, and was involved with H&S as a safety rep. He has been freelance since 2001 on both studio multi-camera and location single camera shoots. Read Dudley Darby's article about the high-precision techniques involved in making Cooke lenses in Zerb 71, Spring 2010.

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The photo of **Edmund Burke O'Connell** comes from 'The Last Farewell' by Julie Whitman Jones and Thomas J Sullivan Jnr, a memoir of war photographer O'Connell seen through the viewfinder of his still and B&H Eyemo camera during the Italian campaign of the Second World War. More about the book at: [www.thelastfarewell.net](http://www.thelastfarewell.net)