The next meeting will be at the new Medical Heritage Centre at Glenfield Hospital, Leicester on Friday 5th September. If you haven't received a notice from the Secretary, contact a committe member immediately.

Our programme looks varied and interesting. The Centre is new, so let's see what it is like.

CONTENTS

Chairman of the HMES: Adrian Thomas adrian.thomas@btinternet.com
Acting Treasurer: Evelyn Barbour-Hill ebhvet@dentalvet.eclipse.co.uk
Editor of the Journal: Evelyn Barbour-Hill journaleditor@dentalvet.eclipse.co.uk
Editorial office: Veterinary Surgery, Tan y Coed, Pen y Bryn, Bangor LL57 1PX ☎ 01248 355674

Chairperson's Chatter

I like physical stuff. There is something about holding something in one's hands that gives a pleasure that no digital copy can ever match. Both digital and physical media have their place, and I am a huge fan of my iPad. The Kindle and iPad can store a large number of books and photographs. Digital media has the significant advantage of electronic transmission, and it seems an age ago that hospitals had X-rays on hard copy.

I greatly enjoyed the meeting that we had last year at the Training Centre at Karl Storz Endoscopy, and seeing their new equipment and their historical collection was a great privilege. We owe them our thanks for the welcome that we were given.

This year I am looking forward to visiting Leicester's Glenfield Hospital and hearing the presentations. Part of the pleasure of our meetings is our bringing along objects to illustrate the talks or bringing along an object for identification. The equipment that healthcare practitioners use has changed almost beyond recognition since I was a medical student. As a student everything that I saw seemed very modern and exciting, and yet in retrospect much of the equipment seems rather quaint and antiquated. It is important to both photograph and to keep equipment, and so I am looking forward to visiting the Glenfield Hospital Heritage Collection.

We have an offer of a visit to Sheffield next year, and details will be circulated in due course.

Adrian Thomas

2024 Meeting

Fifteen members and speakers attended the HMES meeting at the Karl Storz Endoscopic Training Centre, Slough on Friday 6th September 2024. The Centre is at the heart of the Storz business complex, Karl Storz Endoscopy (UK), part of a world-wide medical manufacturing company founded in 1945 by Dr Karl Storz in Tuttlingen, Germany, and still run as a family business.

The Training Centre is a modern space with robotic equipment designed to practise and learn modern endoscopic surgical techniques on computerised models equipped with robotic control and 3D imaging. The Centre also houses an excellent display of historic cystoscopes and other endoscopic equipment, alongside an auditorium and lecture space, which was ideal for our HMES meeting.

The day had been arranged by Robert Feasey, the Storz Business Manager, who opened the meeting with a short history of the development of lenses systems for cystoscopes, tracing the evolution from multiple thin lenses to long glass rod lenses, in turn replaced by the invention of fibre-optic cable for the transmission of light and images, combined with other advances such as off-set eyepieces, flexible endoscopy and image monitor display. This theme was continued by Jonathan Goddard, in his paper on Harold Hopkins DSc (1918-1994), a research professor in optical physics who invented the zoom lens for television. In 1950 he started to use glass fibre bundles for transmitting light. He also devised a rod lens system which enhanced the image, and combined with light transmitted via glass fibre bundles transformed endoscopic surgery, and he was awarded an honorary FRCS (1980). His inventions were further developed by by Karl Storz in Germany into the modern flexible endoscopes.

Adrian Thomas explained the importance of stereoscopic vision in radiology and medical imaging. Hand-held stereoscopes can be used to view images taken by special stereo cameras; indeed 'stereoscopy' was a popular hobby with the general public.

Evelyn Barbour-Hill followed with a detailed description of the equine dental instruments designed by the veterinary surgeon Thomas Gowing and made by Arnold & Sons. (A set was sold at auction in 2018 for £2,400).

Johanna and Adrian Thomas gave an excellent review of various hospital trollies, used for all sorts of medical procedures both on the wards and in the operating theatre. Each activity, e.g. a bed-bath, enema, lumbar puncture or laparotomy, requires the trolley to be set up with the appropriate equipment.

After an excellent lunch, Jennifer Wallis and Noel Snell explained the workings of the compressed-air bath, which was popular from around the 1830s in various health resorts. There were once two at the Brompton Hospital.

Mary Garthwaite demonstrated a rare Wellcome urine testing kit and discussed the long history of diagnosis by inspection of the patient's urine dating from 1500 BC. Hippocrates, Galen and all ancient physicians relied on examining the urine, and produced coloured diagnostic charts; indeed, the urine flask became a 'trade-mark' for the early medical practitioner.

Zuhdi Al-Nabulsi turned medical history on its head with an excellent account of the development of robotic surgery starting with a robotic arm that passed surgical instruments (1980s), followed by the AESOP endoscopic system (1990s) with voice control and then the present-day da Vinci surgical assistant!

Finally, Edwin Aird explained the design and physics of the Frank Farmer Dosemeter (1955-2024), which was crucial for the development of radiotherapy, and is used world-wide for radiation dosimetry. The main meeting closed with a exciting tour and demonstration of all the STORZ robotic teaching equipment.

Many of these papers are presented and enlarged upon in this issue of our journal.

The AGM was opened by Adrian Thomas. The HMES membership remains stable with 35 members (6 joint), and has re-established its associate membership with the BSHM. There was clearly enthusiasm to continue with further meetings, but careful consideration has to be given to cost, when selecting future venues. Suggestions for the location of further meetings are welcome, sent to petermohr@btinternet.com

The meeting closed with a short presentation, a tribute to John Kirkup (1928-2024), who founded the Society in 1997, recorded in the HMES Bulletin No.1, Feb.1997.

Peter Mohr

The accounts for the HMES for the year 2023–24 appear on page 8 of this journal

NOTES FOR CONTRIBUTORS

Items short or long are all welcome. They may be sent in any form including manuscript, but digital text such as Word is of course gratefully received.

Illustrations are very much desired, but PLEASE DO NOT embed them within a word-processing document. **PLEASE send them as separate images**, jpg or tif or png or psd or pdf. This is actually easier for you. Embedding them removes some quality and extracting them removes more. We want the highest resolution possible. Never reduce the size or resolution unless it's absolutely necessary. I can always reduce quality if I have to, but I cannot put it back in.

The History of Karl Storz Endoscopy

Sophie Forster

The beginning – Dr.Med.h.c. Karl Storz founds the company in Tuttlingen, Germany, in 1945

Overview

This article explores the history of the KARL STORZ company and its pivotal role in the development of modern endoscopic cameras, as well as significant advances in endoscopic illumination and vision.
It highlights key milestones and collaborations that have shaped modern endoscopy, with a focus on contributions to urology.

Introduction

The evolution of endoscopy has transformed medical diagnostics and surgery, allowing for less invasive procedures with enhanced visualisation. Founded in 1945 in Tuttlingen, Germany, KARL STORZ quickly became a pioneer in the field of endoscopy. From its early days, the company has been driven by a commitment to innovation and excellence, leading to a legacy of breakthroughs in medical technology. This paper outlines the critical innovations in endoscopic illumination and vision, culminating in the modern rigid endoscope. The journey begins with early illumination methods, progresses through advancements in optical systems, and showcases pivotal contributions to urological instruments.

Early Beginnings and Company Foundation

Dr.med.h.c. Karl Storz was born in 1911 in Tuttlingen, a city today known as the 'World Capital of Medical Technology'. Storz apprenticed as a toolmaker and later pursued further training in optics and mechanics. In 1945, he founded his own namesake company, initially focusing on manufacturing instruments for ear, nose, and throat (ENT) specialists. He sought to enhance medical procedures through improved visualisation, a goal that ultimately inspired his pioneering work in endoscopy. Storz's philosophy was driven by the belief that endoscopes should be minimally invasive while providing high-quality images, a concept that guided his innovations throughout his career. His dedication to continuous improvement and direct engagement with medical professionals helped KARL STORZ to expand its portfolio and establish a global presence in medical technology.

Illumination: The Path to Cold Light

The history of illumination in endoscopy began in 1804 when Philipp Bozzini introduced the light conductor which used wax candles and combustible fuels to illuminate the body's interior. This primitive method, while groundbreaking, generated excessive heat, posing significant risks.

In 1878, Maximilian Nitze and Josef Leiter advanced this concept by integrating a tungsten wire at the distal tip of their endoscope. However, this was soon replaced by the Edison electric mignon bulb, which, despite offering better light, was prone to burning out mid-procedure and introduced hazardous electric currents into patients.

A turning point in endoscopic illumination came in 1960 when Karl Storz, inspired by a demonstration of the first flexible gastroscope using fibre-optics for image transmission, envisioned a new approach. He patented the use of flexible glass fibres not just for transmitting images but also for channelling light from an external cold light source into the body, eliminating the heat risks of earlier methods. This innovation laid the groundwork for modern endoscopic illumination techniques.

Rigid endoscopes employed cores of clad glass rods that conducted light through internal reflection with minimal loss of intensity, while flexible scopes used non-coherent fibre bundles to transmit light from an external source, vastly improving visibility and safety during procedures.

The development of the cold light source by KARL STORZ revolutionised endoscopy, by significantly enhancing visibility while reducing the risks associated with traditional illumination methods. This breakthrough was instrumental in establishing KARL STORZ as a leader in the field of endoscopic instruments, setting new standards for safety and performance.

Vision: From Dark Images to Clear Insight

Early endoscopic instruments were rudimentary, consisting of speculum-like tubes that offered direct, albeit limited, visualisation without magnification or adequate field of view. The introduction of the Nitze-Leiter cystoscope in 1878, featuring a relay system of thin lenses separated by air spaces, marked an improvement in visualisation but still resulted in dark and distorted images.

A major leap in endoscopic vision came in the 1950s when urologist James Gow sought to improve photographic imaging of bladder tumours. He collaborated with Harold Hopkins, a young physicist who revolutionised endoscopy with the development of the rod lens system. This design replaced the traditional air-spaced lenses with solid glass rods, significantly enhancing light transmission and image clarity by up to eighty times. The HOPKINS® rod lens system was showcased in 1961, setting a new standard for endoscopic visualisation.

Figure 2
A new chapter is launched with the development of the 'cold light' source, 1960

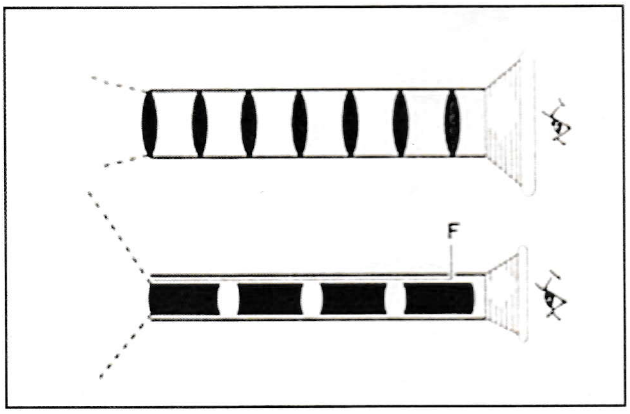


Figure 3
Introduction of the HOPKINS® rod lens system

The true integration of these advancements occurred in 1965 when KARL STORZ partnered with Hopkins. By combining Hopkins' rod lens system with Karl Storz's cold light source, they created the modern rigid endoscope, characterised by superior image quality and reliable illumination. This collaboration showcased a blend of British innovation and German engineering, setting new standards in endoscopic surgery. To this day, KARL STORZ's rod-lens telescopes bear the mark 'HOPKINS® II', honouring the pioneering spirit that revolutionised the field of endoscopy.

The commitment of KARL STORZ to innovation didn't stop at illumination and optics. Karl Storz himself was also known for his hands-on approach, often visiting operating rooms to understand the needs of surgeons and adapting his designs accordingly. This practical, user-focused development process ensured that KARL STORZ instruments were not only cutting-edge but also highly functional and suited to real-world surgical environments.

Contributions to Urology: Pioneering Specialised Instruments

The application of endoscopy in urology has a rich history marked by continual innovation. In 1941, Ernest Rupel and Robert Brown performed the first nephroscopy using a rigid cystoscope through a nephrostomy tract to remove residual stones post-surgery. This marked the beginning of endoscopic intervention in urology.

In 1977, KARL STORZ collaborated with German urologist Peter Alken to design a specialised nephroscope with a large straight working channel and an offset parallel eyepiece. This design allowed for better orientation and control during procedures, as most surgeries at the time were conducted with direct visualisation through the eyepiece.

Ureteroscopy also saw significant advancements with the help of KARL STORZ. The first ureteroscopy was performed in 1912 by American surgeon Hugh Hampton Young, who used a 9.5 Fr. paediatric cystoscope to reach the renal pelvis in a child with dilated ureters. Decades later, in 1980, Spanish urologist Enrique Perez-Castro, in collaboration with KARL STORZ, developed the first functional ureteroscope. This instrument, featuring a 2.8 mm HOPKINS® rod lens system with an 11.5 Fr. outer diameter and a 4 Fr. working channel, allowed for greater manoeuvrability and functionality, setting new standards in urological endoscopy.

KARL STORZ's dedication to advancing urological instruments extended beyond design improvements. The company activity collaborated with leading urologists worldwide, integrating their feedback to refine the instruments further. This collaborative spirit is a hallmark of the company's strategy, ensuring that their products are aligned with the evolving needs of medical professionals and patients alike. This approach not only advanced the field of urology but also established KARL STORZ as a trusted partner among medical professionals.

Conclusion

The history of KARL STORZ is a testament to the company's relentless pursuit of innovation in medical technology. From pioneering safe and effective illumination methods to revolutionising endoscopic vision and developing specialised urological instruments, Karl Storz and his collaborators have played a crucial role in shaping the field of endoscopy.

The company continued to thrive under the guidance of Karl Storz's daughter, Dr.h.c.mult. Sybill Storz, who joined the company in 1959 and assumed leadership in 1996, further expanding its global reach and product portfolio. Today, Karl-Christian Storz, the third generation of the Storz family to lead the business, continues this legacy of progress and dedication, steering the company towards new horizons in minimally invasive surgery. Under the leadership of Karl Storz, Sybill Storz, and now Karl-Christian Storz, the company has grown from a small workshop into a global leader in endoscopic equipment, known for its quality, innovation, and commitment to improving patient care. The Storz family legacy continues to influence modern surgical practices, embodying the spirit of ingenuity that bridges the gap between vision and technology.

The Author

Sophie Forster is a colleague at the Karl Storz endoscopy training centre.

ACCOUNTS
of the Historical Medical Equipment Society
2023–2024

Opening balance (Barclays)	27 July 2024	**£1427.41**
	27 July 2023	*£1730.14*
		- £ 302.73

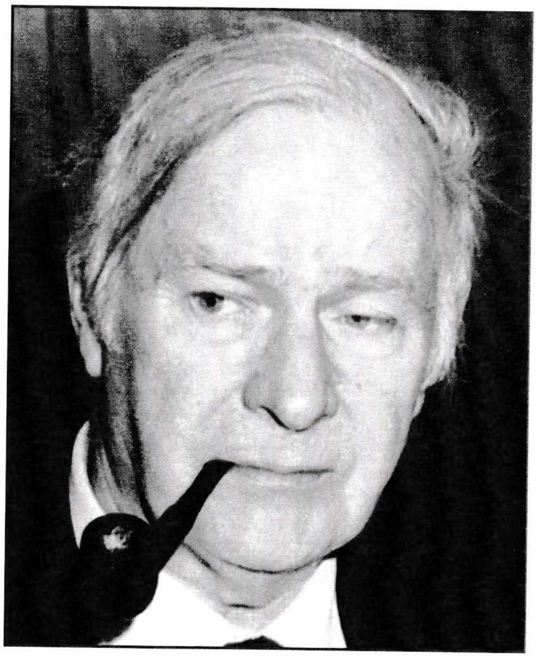
Income		**Expenditure**	
Subscriptions		Meeting costs	391.80 / *Nil*
@£10 single, £15 joint	320.00 / *365.00*	(College of Optometrists)	
Joint members' gifts	150.00	BSHM subscription 2022-23	42.00
		BSHM subscription	42.00
		Bulletin costs	296.93
	470.00 / *365.00*		730.73 / *330.00*

Total membership 35 which includes 6 joint members.
There have been some deaths and resignations.

Last report by *Adrian Padfield* Honorary Treasurer (retiring)

A Series of Fortunate Events, the story of Harold Hopkins

Jonathan Charles Goddard



Harold Hopkins (1918–1994) was a physicist and professor of optics at the University of Reading. He was a very clever man. His innovations included the Airy disc theory, a better understanding of wave aberrations leading to improved lens design, early work on lasers which led to compact discs and the invention of the zoom lens for TV cameras, first used by the BBC at Lords in 1948 (**1**).

In medicine however, the name of Hopkins is associated with his brilliant work on fibre optics and the rod lens which was pivotal to the development of endo-urology in the last quarter of the twentieth century. This work affected many spheres of medicine, and indeed including Urology, Upper and Lower GI surgery, Hepatobiliary surgery, Gastroenterology, Gynaecology and Orthopaedics, as well as non-medical applications.

Life may be seen as a series of events and decisions, of coincidences and actions that could lead one down many paths. The story of Harold Hopkins is one of multiple coincidences which make a remarkably fortunate tale that has benefited the world immeasurably.

Education

Harold Horace Hopkins was born on 6th December 1918 in Leicester, the last child of six, into a poor family. His father William, was a baker and struggled to get work in the hard economic times of the 1920's and 30's. Nevertheless, his mother, Teresa worked hard to educate and bring up all her children well. Harold attended the local state school and Sunday school as well. Even at this early age Harold appears to have made an impression. One of his teachers took his mother to one side after school to say, "Mrs Hopkins, do you realise that your son is a genius?" (**2**).

In 1929, he won a scholarship to Gateway Grammar School, the local technical college. Here he excelled in languages and literature but his headmaster, Harold Collett Dent (1894 - 1995), felt not in science and he encouraged Harold to avoid those subjects. In the first of Hopkins' fortunate events, Dent left Gateway in 1931 and was replaced by Mr E.C. White, who had an interest in science. He recognised Hopkins' abilities in Maths and encouraged him to pursue a more scientific course (**1**). This led to another scholarship in 1936, to University College Leicester where Harold read Physics and Mathematics graduating in 1939.

War

As war broke out over Europe, Hopkins found himself in a reserved occupation, working for a Leicester optics company, Taylor, Taylor and Hopson. Optics and lenses were a vital part of the war effort and he helped to design bomb aimers and gun sights (**2**). However, applications to keep a young man of fighting age in a reserved occupation had to be filed annually and as often happens in wartime and in big companies, somewhere, somehow the paperwork was not correctly filled out: Hopkins found himself drafted into the army. Although this may seem like bad luck for Hopkins and for optical research it was actually the second lucky coincidence.

Hopkins wasn't destined to remain in the forces long, but he did make some good friends including a fellow soldier called Nairs Craig. Whilst in the army Hopkins was required to present some of his research and turned up to the interview in battledress. It became very apparent to the committee that Hopkins was clearly in the wrong place and should not remain on active service; he was quickly brought back to civilian life and his research. He was allowed to continue studying for his PhD, under a special wartime dispensation, and began research for the Ministry of Aircraft Production. He subsequently joined W.W. Watsons and Son Ltd., another optics company in Barnet, as Director of Research and Development (**3**). He was awarded his PhD in 1945. In 1947, he left industry and joined Imperial College as a Research Fellow subsequently becoming a Lecturer and then Reader, later moving to Reading University as Professor of Optics.

The dinner party

In 1951 Harold Hopkins was invited to a dinner party by Nairs Craig his old army friend. At the dinner Hopkins found himself next to a consultant gastroenterologist, Hugh Gainsborough(1893-1980) of St Georges Hospital. Gainsborough was complaining about the inadequate instruments available to view the stomach lining. Rigid endoscopes could with some difficulty be used in the upper GI tract, in the style of a sword swallower, but something more flexible was needed. The difficulty of course being the transmission of light around corners and into the dark recesses of the stomach.

This serendipitous meeting prompted Hopkins to design fibre optic light transmission with his research student, Narinder Singh Kapany (b.1926). He applied the principle that light, shone onto the end of a glass fibre surrounded by any medium with a refractive index lower than glass (including air), will bounce down that fibre with only a small loss of light through the sides. In 1954, they published their idea in a letter to Nature (**4**). It detailed how they made a bundle of 0.025mm glass fibres and produced the first legible image with their new 'Fibrescope'. In a bizarre coincidence, there was a second letter in that issue of Nature by a Dutch researcher who also transmitted light along bundles of plastic fibres (**5**). The idea had already been patented by Logie Baird in 1927, so neither study was entirely novel. Hopkins however, had not only conceived the idea, but he had also studied how to practically manufacture it. Sadly because of lack of backing and thus funds, Hopkins could never make the fibrescope and it was a South African, Basil Hirschowitz (1925-2013) who made the first flexible fibreoptic gastroscope using Hopkins' principle.

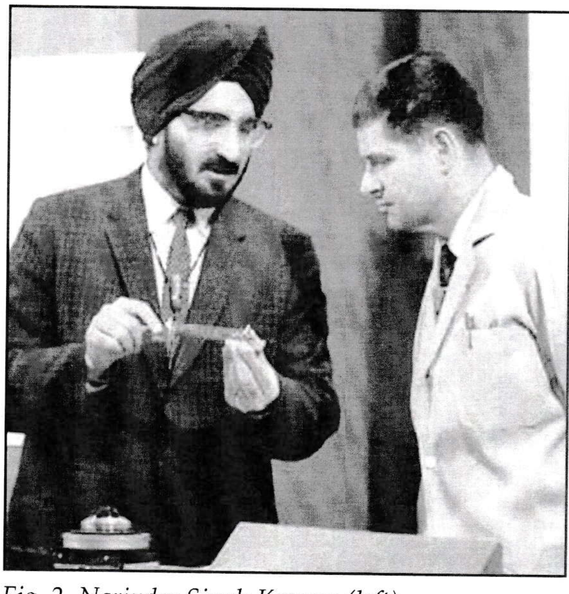


Fig. 2 Narinder Singh Kapany (left)

The practical application of fibreoptic technology was devised by Hopkins after a chance encounter with Gainsborough at a dinner party which Hopkins only attended because of a friendship with an old army friend. That friendship would never have occurred had it not been for an administration error that put Hopkins, by mistake, into brief military service.

The Urologist

The next 'fortunate event' occurred in 1957. Harold Hopkins was approached by Jim Gow (1917–2001), a urologist and keen amateur photographer from Liverpool, who was frustrated by his inability to photograph bladder tumours via a cystoscope. Gow's hobby of photography led to his attempt to produce endoscopic images of bladder tumours using a German cystoscope with a Leitz lens (which he apparently found abandoned after the battle of El Alamein and acquired as 'spoils of war' (**6**)) Even with this good quality optical system the images were poor; there was not enough light. Gow contacted the physics department at the University of Liverpool, they suggested he contacted Hopkins, then working in London (7).

Fig. 3 James Gow

Hopkins was "not enthusiastic" about working on a medical instrument project again. The disappointment of not being able to take his fibrescope idea through to development due to lack of British industry interest and funding had put him off. Gow however was not to be deterred. He obtained a grant from the Medical Research Council and returned to Hopkins with £3000; this worked. Hopkins began taking apart cystoscopes and looking at the problem of light transmission. He calculated that to take a colour photograph the light intensity traveling to the camera would need to be increased by a factor of 50 times. He realised that this would not require merely a redesign of the cystoscope but a radical 'new idea' in optics theory. Gow, once again undeterred by this, suggested that Hopkins, as the scientist "better have a new idea then" (**8**).

Firstly, Hopkins swapped round the array of glass relay lenses and air spaces in the cystoscopes such that there were now long glass rods replacing the airspaces and lens shaped air gaps. Light travels better through glass than air. A prototype of their new cystoscopic camera was demonstrated at the 1959 BAUS annual meeting in Glasgow by both Gow and Hopkins (**9**). The prototype using the new rod lenses increased light intensity by four times.

Secondly Hopkins applied an antireflective coating to the glass lenses as a proportion of light was reflected back from each lens instead of passing through it. Pass light through several lenses in a cystoscope and you can appreciate the cumulative amount of light lost. The combination of these two ideas increased the light reaching Gow's camera by 80 times (8). This system was presented at the Société International d'Urologie (SIU) meeting in Rio de Janeiro in 1961. Once again, despite the genius of Hopkins and the determination of Gow they failed to find a British cystoscope manufacturer to take the idea forward into production.

Languages

In 1961 or 62 George Berci (1921–2024) a Hungarian surgeon was visiting Imperial College, London. He asked to see an optics specialist and was directed to Hopkins. They discussed his new 'rod lens' prototype cystoscope. Berci, knowing it needed the input of a specialist instrument designer told Karl Storz (1911–1996) a precision instrument manufacturer working in Germany (**10**). In 1960, Storz had developed a cold light source, which reflected very

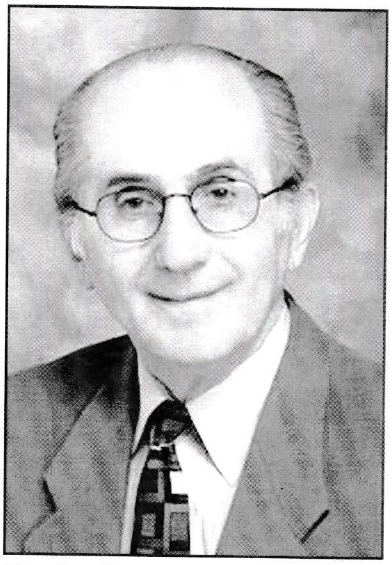


Fig. 4 George Berci

bright light from an external light source via a fibre optic cable into an instrument such as a cystoscope. [Figure 5]

Storz telephoned Hopkins in London and speaking in broken English attempted to express his interest in the rod lens system. Hopkins of course had excelled in languages at school, he spoke French and German like a native and later in life learned sign language to communicate with a colleague. Hopkins was able to speak to Storz in fluent German allowing them to discuss his new invention – another fortunate event (**1**). Using Hopkins design and Storz's instrument making skills and his cold light system, they were able to launch the Rod Lens cystoscope in 1967 at the SIU in Munich. The Hopkins lens and the Stortz cold light system revolutionised endoscopy, urology and many areas of medicine.

The End

In a sad twist of fate, Harold Hopkins, the man who revolutionised urology, died of metastatic prostate cancer in 1994 and the genius of optical science was rendered blind by retinal haemorrhages just before his death.

Hopkins, a genius in the world of optics made many major contributions to science as well as his contributions to medicine. Hopkins never thought of himself as an inventor, rather he saw himself as a physicist specialising in optics. It is entirely possible that Hopkins would not have collaborated with medicine and advanced endoscopy as he did were it not for this series of fortunate events.

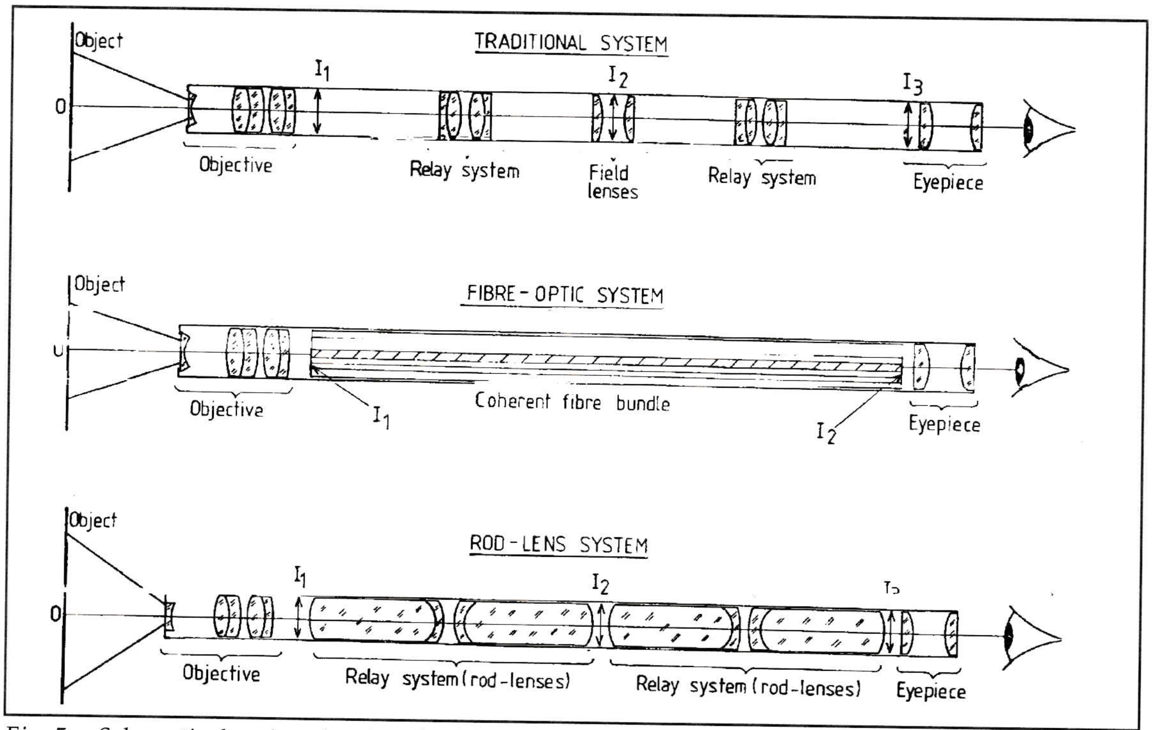


Fig. 5 Schematic drawing showing the differences between the traditional endoscope, the fibre optic system and the rod lens

This paper and the talk given at the HMES 2024 annual meeting were adapted from two articles by J C Goddard (**11**) and (**12**).

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The Author

Jonathan Charles Goddard
Consultant Urological Surgeon, Leicester General Hospital
Curator of The Museum of Urology, British Association of Urological Surgeons

George Berci

As an incidental to the paper upon Harold Hopkins, the obituary of George Berci appeared in the Times shortly after the HMES meeting in 2024, he having died in August at the age of 103. He lived through two ghastly periods of history.

Berci was Jewish, born Gyorgy Bleier in 1921 in Szeged, Hungary His first employment was as an apprentice electrician and then as a mechanical engineer, so 'gaining manufacturing and design experience that later proved invaluable'.

In 1942 he was sent to a slave labour camp. In 1944 he was bound for Auschwitz and only enabled to escape by an Allied bombing raid, when the guards fled. Then he was recruited by the resistance and undertook dangerous work until the end of the war.

After the war 'his mother insisted that he attend medical school so he could better provide for the family... " This was a time when we listened to our parents" he said in an interview...' Then came the Hungarian Revolution. Berci was a general surgeon at a Budapest hospital when Soviet forces crushed the uprising, killing thousands. Soon afterwards, Berci managed to escape to Austria with his frail mother.

He worked first in Australia. He published a paper 'Medicine and Television' and in 1962 ' produced a black-and-white camera that weighed only 350g and was small enough to attach to an endoscope'. He performed bronchoscopy on a dog with the image on a television screen.

He moved to Cedars-Sinai in Los Angeles, became director of a new surgical endoscopy unit and remained there for the rest of his life, researching, designing and innovating , and promoting endoscopic surgery. He never retired and continued working enthusiastically until close to the end of his life.

Yet 'his first love, music, remained his greatest passion.' And he was 'a trim, diminutive and sprightly centenarian.'

The Compressed-air Chamber and the Creosote Room at the Brompton Hospital

Noel Snell and Jennifer Wallis

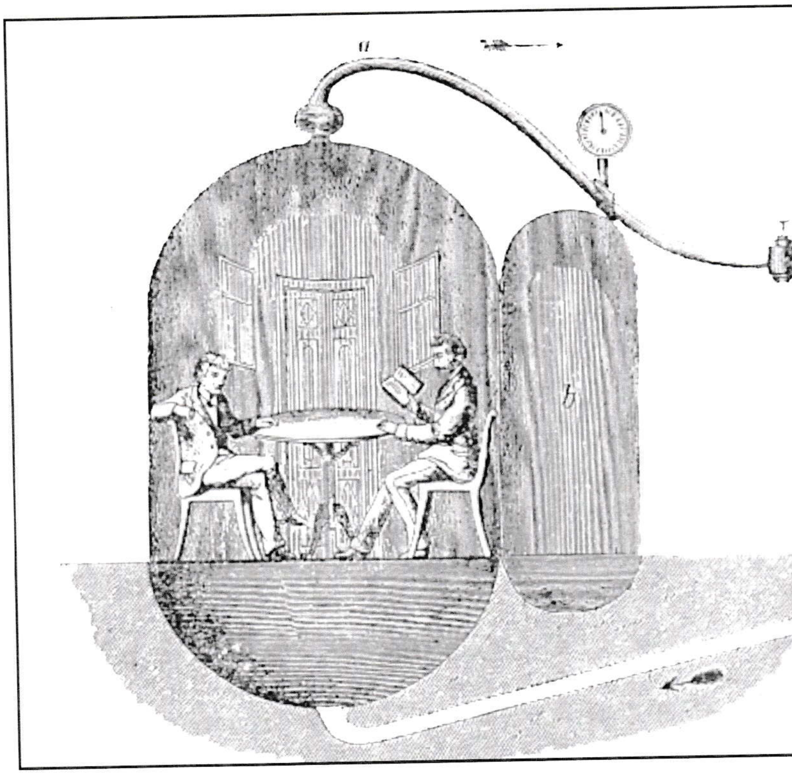

Fig 1
Emile Tabarié's Compressed Air Bath

Introduction

Until the 1940s, with the development of antibiotics and chemotherapy, effective treatment options for most respiratory disorders were limited. Inhaled or oral bronchodilators (ephedrine, atropine, stramonium) could give relief in asthma. Fortunate patients with tuberculosis (TB) were admitted to sanatoria on a regimen of rest, fresh air, nourishing food, and graded exercise. Treatments included inhalations of balsam, eucalyptus, pine oil, and antiseptic coal-tar derivatives (creosote, carbolic acid, thymol). Heliotherapy (exposure to sunlight) and cod-liver oil were also widely used, and potentially beneficial as both increase body stores o Vitamin D, which activates macrophages (whit blood cells which can engulf and kill TB bacilli).

Amongst many other treatment options whic enjoyed a period of popularity was compressed-a therapy; 19th-century moves towards 'aerotherap capitalized on new technologies. Mine, bridge, ar tunnel workers first noticed the effects of com pressed air, both beneficial and adverse. Emi Tabarié in France first designed a 'compressed-a bath' (actually an airtight chamber) which was p into operation in 1836 at Montpellier (Fig.1); som later designs could be used to reduce the air pressure in the chamber ('rarefied air'), as well increase it; both compressed and rarefied air exposure had their champions for a range of bodily disorders, from asthma to deafness. The topic has been extensively reviewed by Tissier, in 1903 (**1**). In compressed-air baths the pressure employed was an additional half to two-thirds of an atmosphere with a pressurisation rate of 1 psi every three minutes - within currently accepted safe limits for hyperbaric medicine. Courses of treatment varied, with some patients taking up to 100 'baths'.

Compressed-air baths became popular on the continent, in European spa resorts and some city centres e.g. Paris, where J.A. Fontaine's Établissement Médico-Pneumatique offered customers baths alongside social spaces. By the 1880s there were over 50 baths across Europe and the United States.

Uptake was slower in Britain. The Ben Rhydding Hydropathic Establishment in Yorkshire (founded 1844) was the first in this country to install a compressed-air bath, in 1856. Malvern Spa followed with a chamber that could seat 12 persons at a time.

Fig 2 Interior of Malvern's compressed air bath as depicted in Ralph Barnes Grindrod's Malvern: Its Claims as a Health Resort (1871). Wellcome Collection, London.

Not all such establishments had enduring success; in 1873 the Hydro Hotel, Llandudno, was advertising the following facilities: 'FOUR RUSSIAN VAPOUR and TWO COMMODIOUS and WELL-APPOINTED TURKISH BATHS, THE SEAWEED or OZONE bath', in addition to 'a Compressed Air Bath' for those suffering from asthma and other bronchial complaints. Sadly, in 1896 the local newspaper carried a notice of an auction of 'surplus household furniture and other effects, also a large wrought-iron compressed-air bath in splendid condition weighing nearly 4 tons' (**2**).

The early history of the compressed-air bath has been the subject of a detailed review by one of us (JW) (**3**). Robert Grindrod, proprietor of the Malvern establishment, gives an account of his compressed-air chamber, recommending its use in 'early phthisis (TB), asthma, loss of voice, catarrhal deafness, etc'. Interestingly he states that in 1664 an English physician, Dr Henshaw, proposed constructing an airtight chamber in which subjects could be exposed to increased air pressure (**4**).

The Brompton Hospital, London (now the Royal Brompton) which was building a new hospital block, decided to commission two baths in 1879-80, informed by the baths at the resorts in Ben Rhydding and Malvern. They had also been in contact with Fontaine's Parisian establishment during the planning stages. At the time there were no other compressed-air baths in London.

The new (South) Block (Fig.3) was opened in 1882. The compressed-air baths were housed in a basement alongside three Turkish baths (**5**). Quality of air was important: air was to be pumped 'from the outside of the building and not from the heated passages or engine room'. Nonetheless the compressed-air bath chambers could become uncomfortably hot if the Turkish Baths were in use at the same time.

The Brompton Hospital Archive contains Medical Committee reports from April 1878 to July 1902, and sub-committee reports including those of the Bath and Inhalation Sub Committee (BISC), Compressed Air Bath Sub-Committee.

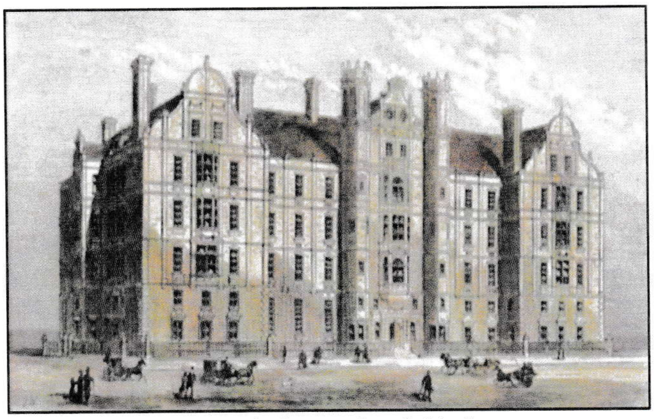

Fig 3 Brompton Hospital, new South block

Key items are abstracted below.
Special meeting 23-6-79: 'Mr Blake submits drawings for the Turkish bath and the compressed-air bath in the new building' (Blake was the manager of Messrs Haden & Sons, the contractors).
20-8-79: 'The air-bath worked by steam is preferred' (to hydraulic power).
13-2-82: 'Preliminary test of the compressed-air bath, Mr Blake in attendance'.
1-5-82: 'Estimate for additional work viz small double doors for passing anything to and from the patients inside'.
8-6-83: 'Finally testing the compressed air' - 2 leaks detected and repaired; by June 29th reported to be in 'fair working order, being in use 3-4 days a week'.
3-12-83 'Working well'. Junior dispensary porter acting as bath attendant. Ammonia and sulphuric acid kept at hand in case of emergency. Detailed 'Regulations for the use of the compressed-air bath' set out, key points being:

- Available to use on Mon-Wed-Sat, 3.00-5.00pm. Chamber to hold 4 patients, sitting to be 2 hrs.
- Relief valve will sound whistle if pressure exceeds 10psi to which the attendant's immediate attention must be given.
- Attendant must record highest and lowest temperature of chamber before and after bath, and must instruct patients on use of the inner door of the airtight cupboard; and carefully watch the pressure and regulate according to circumstances.
- Watch the patients through the glass window, and if any unfavourable symptoms, they are to communicate through the speaking-tube with the engineer to stop the engine; pass medicines through the airtight cupboard, and summon the RMO (resident medical officer) in charge.
- Recommended that the RMO or an assistant MO be within easy call and visit the air bath occasionally.

Dr. Charles Williams, a Brompton physician, published a review of compressed-air therapy and its uses, which mentions that air at reduced pressure ('rarefied air') was also used in the treatment of lung disorders, (including TB), and includes detailed diagrams of the Brompton compressed-air bath (Fig.4) (**6**).

It is not clear when the use of the Brompton compressed-air bath was discontinued, but it was certainly still in use as late as 1936 (**7**). A paper from the Brompton published that year studied 9 patients undergoing compressed-air therapy: 8 felt their symptoms had improved during the treatment and 2 considered there was some lasting benefit. Objective measurement of the vital capacity of the lungs of all 9 did not support the generally-held view that the treatment was opening up inactive alveoli [8].

One of us (NS) was a clinician at the Brompton Hospital for 39 years (1978 to 2017) and had never heard mention of the compressed-air bath. However, it made him wonder what else might have been hidden in the hospital basement. The eminent respiratory physician, Professor Guy Scadding (1907-99) was a junior doctor at the Brompton 1931-5; he once told NS that one of his jobs was to look after the 'tar pool' in the basement, around which patients with respiratory tuberculosis would sit to inhale the fumes.

We can find no mention of a 'Tar Pool', in histories of the hospital or the hospital archives. However Bishop in 'The Seven Ages of the Brompton' (**7**) describes the 'creosote room', where creosote oil on an iron tray was volatilized over a naked flame and inhaled by patients with bronchiectasis and TB (wearing goggles). It was in use from the late 19th century well into the 20th century. Creosote inhalations were recommended for TB as early as the 1830s; the 1928 Brompton Pharmacopeia included '*Solutio creositi composita*' and '*Vapor creosoti*' (**9**). There is little evidence of efficacy, either *in vitro* or

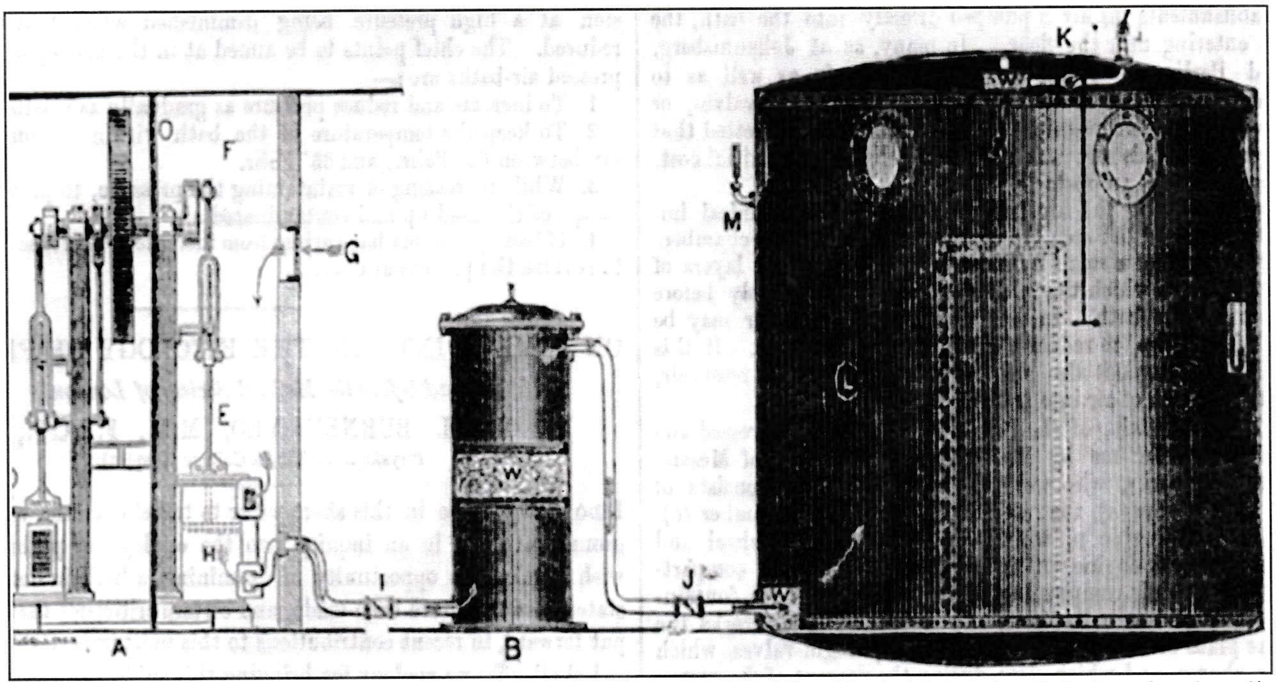

Fig 4 Brompton Hospital compressed-air bath. Airtight iron chamber (C) with air inlet and outlet pipes, 'cupboard' acting on airlock principle to pass food, drink, medicines into the chamber without loss of pressure. Chamber 10ft wide and 8ft high, to accommodate 4 patients with seating and a table. 8HP steam engine (E), to compress the air. Relief safety valve (M) which opens and blows whistle when full pressure (10psi) is reached.

in animal experiments, though a 1927 textbook claims that creosote inhalation 'almost invariably relieves cough' (**10**). The treatment was not without dangers, as chronic inhalation of creosote vapour has been reported to cause renal failure and neurotoxicity; creosote is also known to be carcinogenic (**11**).

In December 2024 the Brompton Estates Department was having a clear-out of their office and re-discovered an archive plan of the basement of the South Block. This identifies the location of the compressed-air baths, and adjacent to this and the Turkish baths is an unlabelled room; could this have been the Creosote Room?

Acknowledgments

Our thanks to the staff of the Brompton Hospital Archive, at St Bartholomew's Hospital; Sam Wheeler (Estates Department, Royal Brompton Hospital); the European Research Council; the Wellcome Collection; Dr Graham Kyle; and the late Prof. Guy Scadding. Figures are from the authors' collections, or are reproduced by permission, or are in the public domain.

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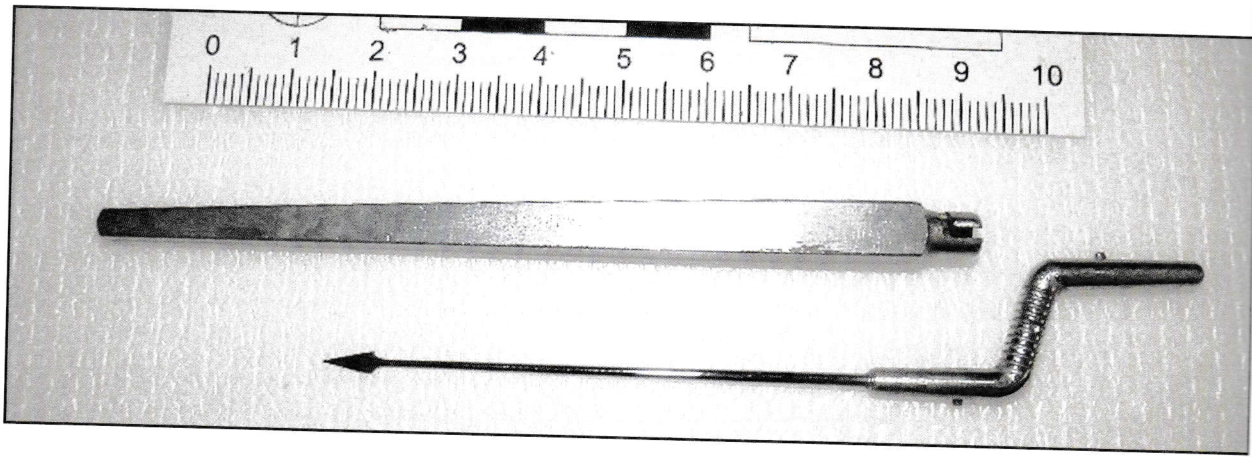
The Authors

Dr Jennifer Wallis, Faculty of Medicine, Imper
College London. j.wallis@imperial.ac.uk

Dr Noel Snell, National Heart and Lung Institu
Imperial College London. nsnell@ic.ac.uk

What was it?

This instrument was presented to you in the 2024 journal. The Allen and Hanbury all-metal surgical instrument is a handle (12.5cms.). The 'bayonet' stepped end can be turned to unclip a slim knife (12cm) with a very sharp arrowhead blade, hidden and protected inside the handle. The blade is then attached and locked on to the handle with a half-turn.



Answer: It is a Politzer bayonet myringotome knife used to make a small hole in the eardrum to drain fluid or pus.

Adam Politzer (1835-1920) was Professor of Otology at Vienna University.

He studied the innervation of the intrinsic ear muscles, and the variation in air pressure behind the eardrum, and invented several instruments including the insufflator to distend the Eustachian tubes.

He also wrote a History of Otology (in German, 1907)

Stereoscopy: 3D Imaging before computers

Adrian M. K. Thomas

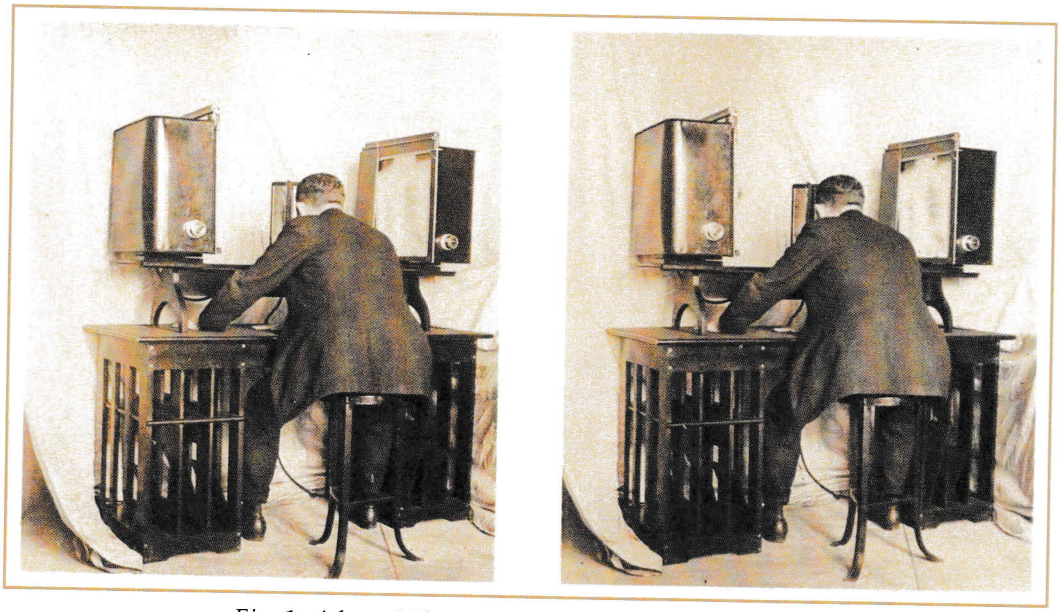


Fig. 1 A large Wheatstone stereoscope with mirrors

Introduction

Human visual perception is 3-dimensional (3D) with a sense of depth of vision. This is dependent on having two eyes, resulting in binocular vision. Stereopsis, also known as stereoscopic depth perception, has been defined by Brian Ang as the ability of both eyes to see the same object as one image and to create a perception of depth.(2) Photography is obtained from a single point, whether traditional light photography or X-ray photography. Photography was a defining technology of the 19th century and was well developed by 1895 when Wilhelm Conrad Röntgen discovered the new X-rays. The discovery of X-rays was essentially photographic, and the new science of radiology was termed 'the new photography'. The techniques of stereoscopic photography were well developed by 1895 and were soon introduced into radiography.

3-dimensional or Stereoscopic Photography

Both light and X-ray photography are produced a from a single point, either using the lens in a camera or the focal spot in the anode of an X-ra tube. In both cases a 3-dimensional object is con verted into a 2-dimensional image. The 3-D imag is created by the mind and is based on prior know ledge of what is being looked at. If we do not know what we are looking at then interpretation of the image is difficult, and this is as true for light photography as it is for radiography.

So how might the third dimension be obtained in radiography? Several X-ray techniques may be utilized to provide depth information:

1. Two radiographic views taken at right angles will show the location of the object in two planes.
2. The patient may be rotated during fluoroscopy showing the location.

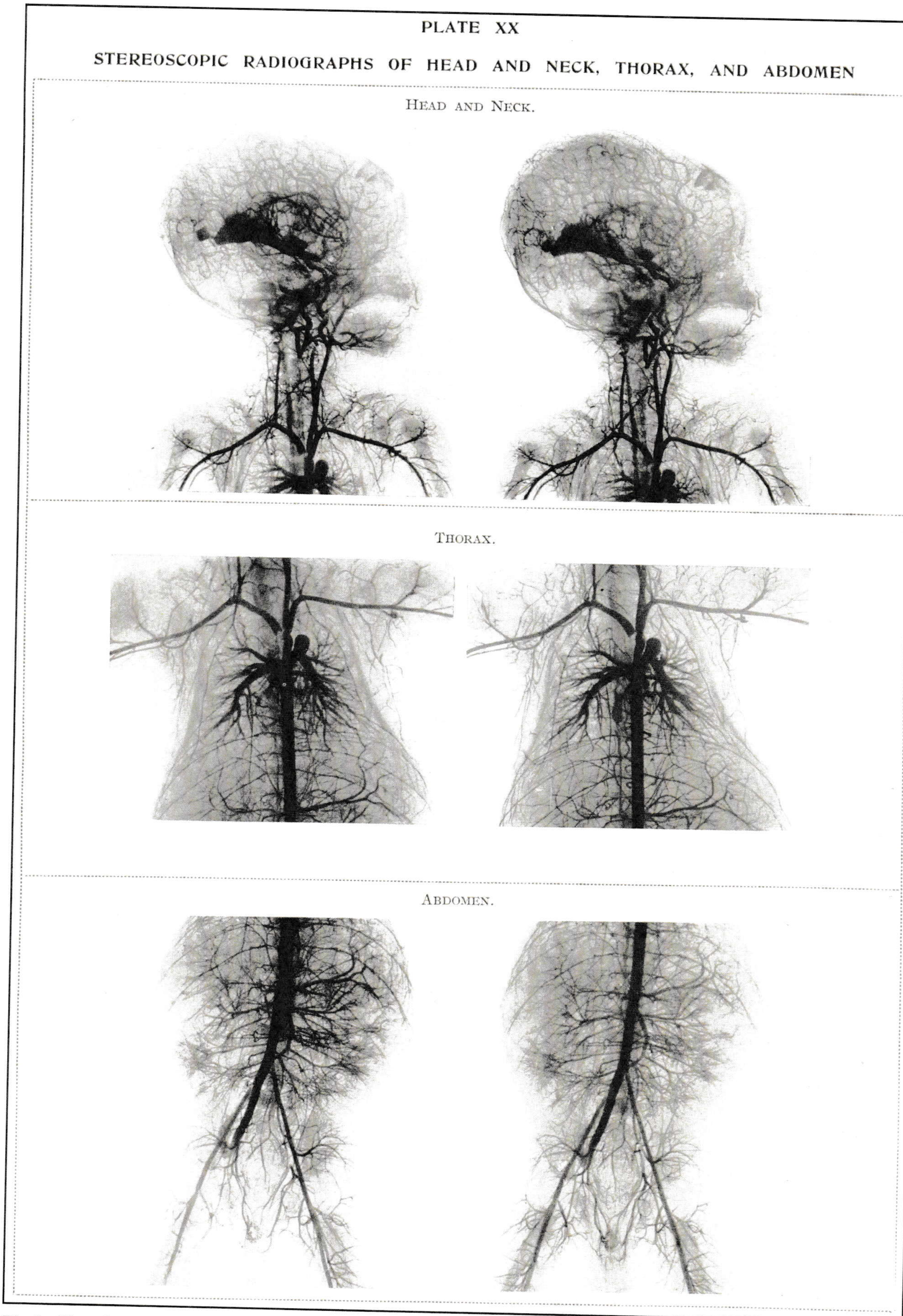


Fig 3 Plate from Orrin, ' The X-ray Atlas of the Systemic Arteries of the Body' 1920

"Computerised axial tomography (a new means of demonstrating some of the soft tissue structures the brain without the use of contrast media)'. (**7**) Whilst the technique gave depth information the results were presented as a series of 2-dimensional slices.

The most significant advance in the technology of CT scanning was spiral CT, significantly increasing its clinical value. The first clinical cases and performance measurements were presented as 'work in progress' by Willi Kalender, Peter Vock, and Wolfgang Seissler at the 75th anniversary meeting of the Radiological Society of North America in 1989. (**8**) The development of spiral CT and multi-slice scanning was primarily made possible by advances in computing – data could be reconstructed almost instantaneously. In spiral CT, the rotation of the X-ray source and the movement of the table and patient are made simultaneously, ensuring that the time for acquisition of the raw data is markedly reduced. The improved spatial resolution allows for virtual endoscopy and faster scanning enables complex dynamic studies. 3D images can be obtained routinely showing pathology with anatomical quality. However, it needs to be remembered that 3D imaging is different from stereoscopy. The 3D data set derived from a particular imaging modality is still viewed on a flat screen TV monitor. Figure 4 shows a typical image.

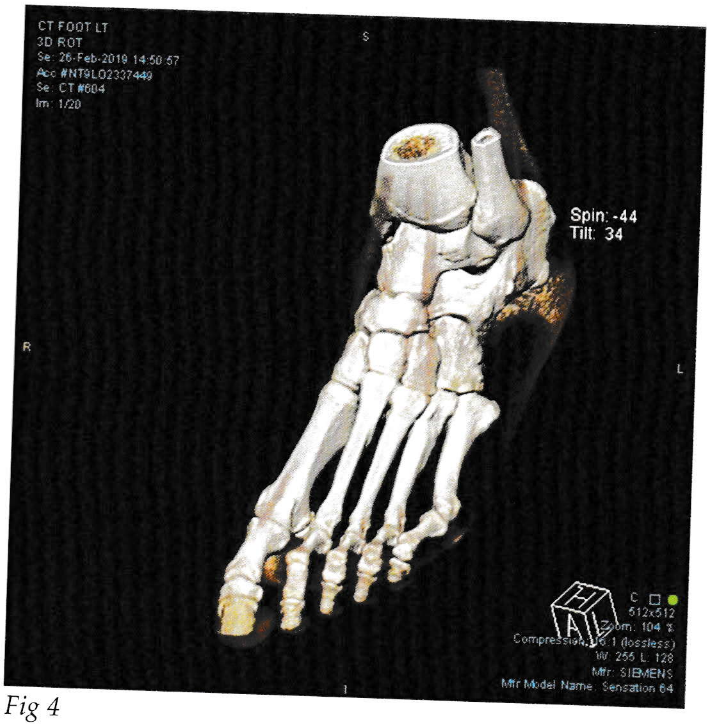


Fig 4

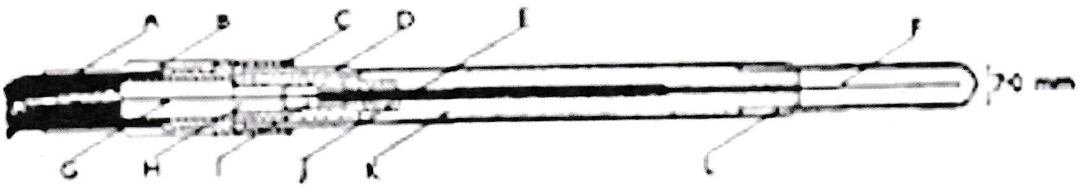
Surgical Stereovision

Omar H. Ahmed and colleagues have reviewed recent technological advances in sinus and skull base surgery. (**9**) A study from the general surgery literature had shown to Ahmed that errors that occurred during laparoscopic biliary surgery were commonly caused by visual misperceptions, and not by a lack of knowledge or technical skill. To compensate for the lack of stereopsis a number of groups had tried, over several decades, to develop 3D visualisation technology. Development has been slow, partly because otolaryngologists and other surgeons have adapted very well to two-dimensional visualization. Endoscopy has progressively developed since its introduction, with a major development in 1969 when Karl Storz and Harold H Hopkins introduced the first rod-lens system (which was demonstrated at the 2024 HMES meeting). The future of endoscopic sinus surgery may integrate developing technologies, such as 3D endoscopy, augmented reality surgical navigation systems, and robotic endoscope holders. Of note are insect eye stereo-endoscopes that incorporate an array of microscopic lenses, and a single video chip to reconstruct a 3D image. (**10**)

HMES visitors to the Karl Storz Endoscopic Training Centre were fascinated to see the new 3D laparoscopic surgery training phantom which has stereovision capabilities. Surgeons gain enhanced tissue understanding, improved hand-eye coordination, and the confidence to use advanced articulating surgical tools. Figure 5 shows the unit in action at the meeting with the image displayed on the television monitor. The monitor is viewed with special 3D glasses similar to those used in 3D films.

Conclusions

The use of 3D and stereoscopic imaging has shown progressive developments particularly in more recent times. The current developments demonstrated in the Karl Storz Endoscopic Training Centre were remarkable, and future developments are anticipated with interest.



Attachment of chamber to double braided cable.

A Cable outer sheath.
B Outer braid of able bound to dural sleeve.
C Dural.
D Dural.
E Inner electrode (electron metal).
F Inner electrode extending 2.6 cm into chamber.
G Cable conductor.
H Inner braid bound with thread.
I Alkathene.
J Perspex.
K Amber.
L Tufnol (Swan brand).

Fig 2 The original 1955 design of chamber. For clarity it has been necessary to re-type the legend but its text has been faithfully reproduced. The diameter of the chamber is 7 mm.

volume when radiation is incident on the chamber. Some of the important features (fig.2) of this chamber of 1955 are:

- inner electrode of Elektron metal
- outer electrode of graphite coating (dag) inside a tufnol cap
- insulator of amber.

The ion chamber cable was permanently attached to the electrometer.

A survey by the Hospital Physicists Association in the 1960s showed a large variation in sensitivity of these chambers in the SXT-DXT region. This was due to the lack of consistency of the average atomic number within the chamber itself (Tufnol and Elektron metal central electrode).

I started work at Newcastle Regional Department of Medical Physics in 1967, working on various radiotherapy projects; one of these projects that FTF gave me was to improve the design of the Farmer chamber.

It was realised that the materials of the chamber needed to be pure and not to change with time. (The term "air-equivalence" is used to describe the balance of atomic numbers within the chamber).

The new design (Aird Farmer 1972) was achie by using: 99.99% graphite for the chamber c 99.99% aluminium for the electrode. However, insulator was a problem. Amber was not availa in large quantities, and its atomic number var with each sample. So a search for a suitable insu tor was made (helped by J. Fowler, F. Farmer pu cation 1956 **3**) to find a very good insulator that a kept its high insulating properties under the ef of ionising radiation (induced conductivity).

For the insulator, PTCFE was found to have optimum properties in terms of insulation, espe ly under radiation. However, this material ha higher atomic number than amber; so the design includes a reduced surface area of insul within the chamber. This was achieved by addi graphite sleeve (see figure 3), while ensuring t was still sufficient insulator to prevent any cur between the electrodes. (The high voltage betw the electrodes produces the ionising current; there mustn't be any leakage between the trodes). In order to reduce unknown electric force lines that may affect the first readin charge, this was angled (An FTF wish).

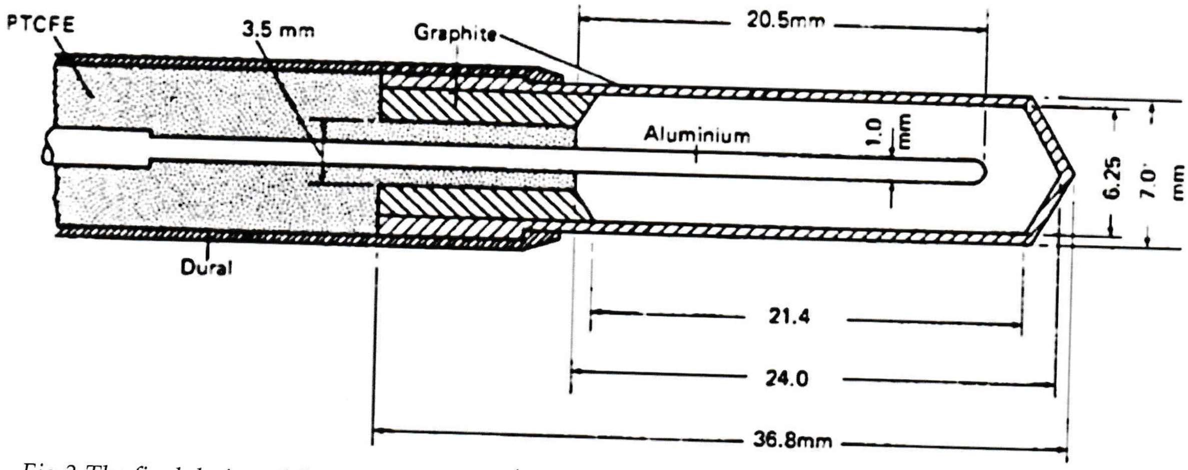
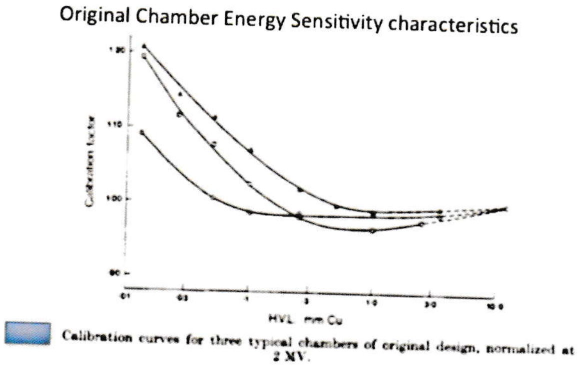
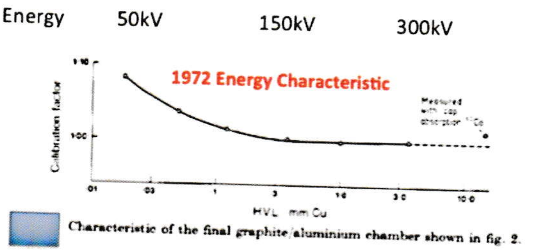


Fig 3 The final design of the Farmer Chamber 1972

Figure 4 (below) shows the final energy sensitivity curve, (calibration factor vs energy, in HVL mm Cu) together with three chambers with the old design showing the difference at the low and medium energies.

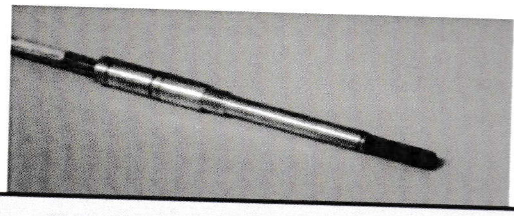




Modern Farmer and Farmer-Type Ion Chambers

Frank Farmer did not patent this design. So manufacturers of these small volume ion chambers have used various different designs; particularly those that avoid the use of graphite (for robustness), giving them the 'Farmer-Type' name. The pure graphite chamber has its drawbacks: it is extremely fragile. However, a few manufacturers have produced very close copies of the original, for example the Phoenix NE2571 Farmer Chamber.

Figure 5 shows the NE2571 from the Phoenix web site, giving the details of the materials they have used.



Physical Characteristics

Sensitive Volume: Sensitive Length:	0.69cm^3 24.1mm
Thimble materials: Inner diameter: Wall thickness:	99.99% graphite 6.3mm 0.36mm
Inner electrode: Length: Outer diameter:	99.99% aluminium 20.6mm 1.0mm
Build-up cap: Wall thickness: Outside diameter Density:	Delrin CH_20 3.87mm 15.1mm 1.425gm cm^{-3}
Stem: Outside diameter	8.62mm
Length of connecting cable:	10mm

Phoenix Dosimetry Ltd

www.phoenix-dosimetry.co.uk

Surprisingly recently there have been recommendations from certain medical physics societies (**4** for instance,in this case specifically for SXT and DXT). The IAEA TRS398 also recommends this set of chambers, which includes the NE 2571 chamber manufactured by Phoenix. (Fig 6)

Characteristics of some recommended cylindrical ionisation chambers for reference dosimetry in medium energy x-rays.

Chamber type	Volume (cm³)	Wall material	Central electrode	Wall thickness (mg cm⁻²)	Waterproof?	Manufacturer
30010	0.6	graphite & PMMA	aluminium	56.5	no	PTW[1]
30012	0.6	graphite	aluminium	79	no	PTW[1]
30013	0.6	graphite & PMMA	aluminium	56.5	yes	PTW[1]
30015 / 23331	1.0	graphite & PMMA	aluminium	73	no	PTW[1]
30016 / 23332	0.3	graphite & PMMA	aluminium	67	no	PTW[1]
31013	0.125	graphite & PMMA	aluminium	78	yes	PTW[1]
2561	0.325	graphite	aluminium	90	no	NE[2]
2611	0.325	graphite	aluminium	90	no	NE[2]
2571	0.6	graphite	aluminium	65	no	NE[2]

[1]PTW: PTW-Freiburg GmbH, Freiburg, Germany.

[2]Bicron-NE Ltd, Beenham, Reading, United Kingdom.

Fig 7

The latest design that follows the 1972 Farmer is from India, the 'FAR65' (**5**), which lacks the graphite angled collar.

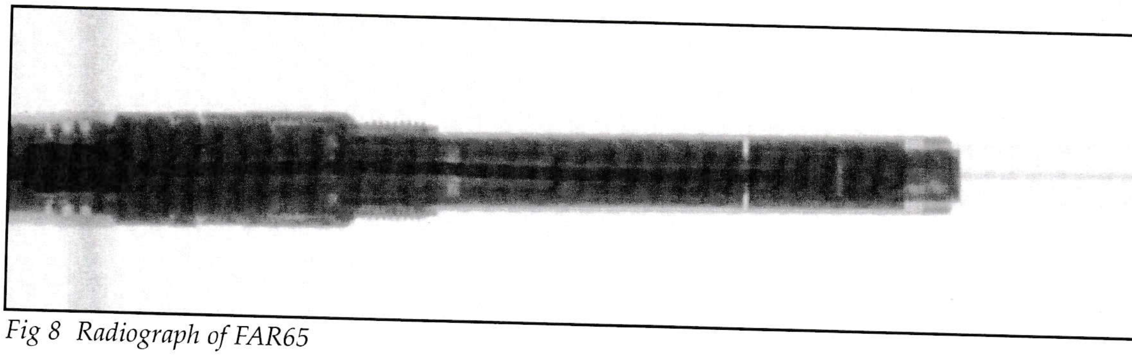


Fig 8 Radiograph of FAR65

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Technology in cancer research and treatment

The Author

Edwin Aird

I started work in Newcastle Univer
Medical Physics as a research fellow in 1
My job before retirement was Head o
Physics at Mount Vernon Hospital in N
including a connection with the Gray Ra
Laboratory.
ESTRO teaching around the world: Bas
for Radiotherapists.
I am a founding member of RTTQA, t
overseeing the QA of Radiotherapy Clin
in UK.

Mr. Gowing's Dental Instruments for the Horse

Evelyn Barbour-Hill

In 1849 in the Veterinary Record, volume 6, appeared a report of an interesting recent meeting (fig 1). As was often done, a number of members presented their own inventions – this was an age of innovation by individuals.

'Mr. Gowing exhibited a compact and admirably arranged medicine-chest..."
'He likewise exhibited his newly invented and highly ingenious dental instruments, giving a lucid description of their application, which is embodied in the subjoined essay, and subsequently directed the attention of the members to a very simple form of inhaler for the horse...'

The new balling-iron devised by Mr. Varnell is also not without some relevance, although not a subject of this article.

It may be necessary to explain at this point that dentistry was, and is, of vital importance to the health and welfare of the horse, whether the squire's hunters or his farming tenants' working horses. Horses have anelodont hypsodont teeth – by the age of about 4 the cheek teeth are fully formed, and roughly 3 inches long. The majority of the crown is buried within the jaw. The teeth have roots and are not continuously growing, but they are continuously erupting at the same rate at which they are ground down in mastication – about a tenth of an inch a year.

Clearly even the slightest of malocclusions will result in uneven wear and the development of abnormal spikes and projections. The same will also be induced by the feeding of grain and 'cake' (which require little lateral excursion), or by feeding

70 THE VETERINARY RECORD.

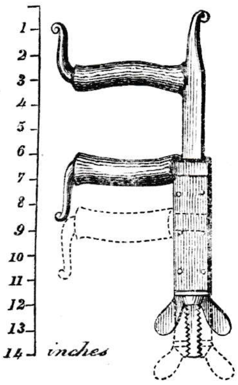
OCTOBER 23, 1849.

Mr. F. BLAKEWAY, V.P., in the Chair.

Mr. Gowing exhibited a compact and admirably arranged medicine-chest for the veterinary surgeon, formed so as to be taken by him in his chaise on his visits. Much judgment was manifested by Mr. Gowing both in the selection and the location of the different medicinal agents commonly in request in a general practice. He likewise exhibited his newly invented and highly ingenious dental instruments, giving a lucid description of their application, which is embodied in the subjoined essay; and subsequently directed the attention of the members to a very simple form of inhaler for the horse, and which might be used for the inhalation of watery vapour, either simple or medicated.

The plan recommended by Mr. Mavor for the employment of steam was shewn at a subsequent meeting. Of this a description has been given in the Proceedings of the Association for 1838-9, p. 199.

Mr. Varnell suggested a new form of the balling-iron, of which the woodcut will give the best idea; while of the advantages resulting from its use there can be no doubt. To obviate any injury to the mouth, the bars of the instrument are covered with vulcanized indian-rubber.



from high mangers or haynets rather than the floor (which alters the normal rostrocaudal relation of lower to upper jaw).

Thus veterinary attention is frequently required to reduce incipient overgrowths or remove larger ones. Yet access is not easy, and would be far less so when there were no sedatives and only the feeblest of illumination.

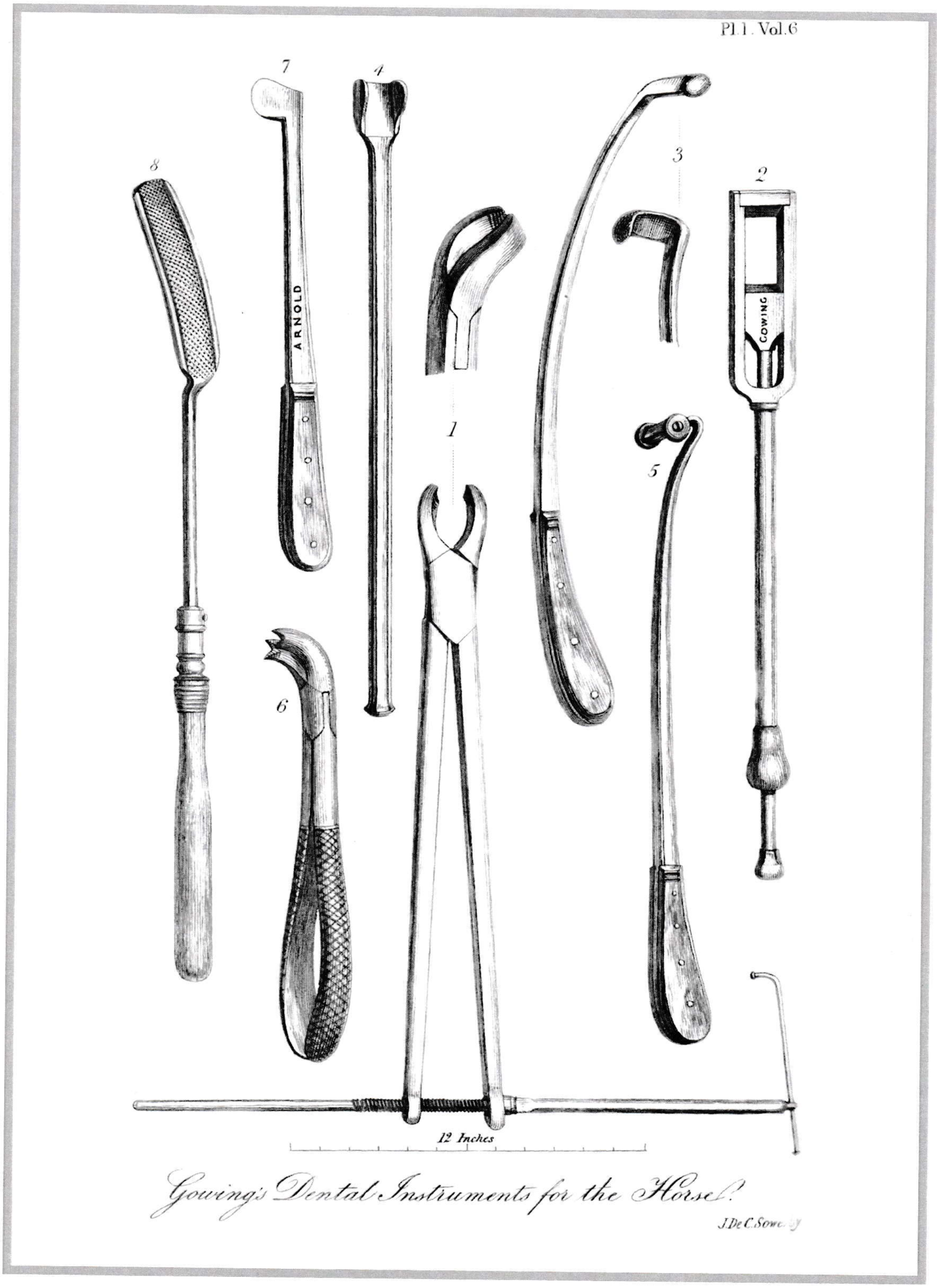


Fig 2

Plate of Gowing's Dental Instruments for the Horse published in the Veterinary Record Volume 6.
The plate is reproduced here exactly in its original size.
Take note of the numbers identifying the instruments.

Thomas William Gowing FRCVS was clearly an inventive sort of person and was fairly well-known in the veterinary profession. He was a general practitioner in London and the vast bulk of his work would have been with horses. He is thought to have been born in 1810, and he qualified from the Royal Veterinary College in 1847 – but this does not mean he was not engaged in veterinary practice before that time. He was one of the Primary Fellows of the Royal College of Veterinary Surgeons (RCVS), elected in 1877. Like many renowned veterinary surgeons in the small profession of the time, he served on RCVS Council; in his case for over 20 years, including various periods as Vice President. He died in 1888 and his grave can be found in Highgate Cemetery. His son, also named Thomas William, was also a veterinary surgeon.

A full-page size engraving of his dental instruments (Fig 2) was published in the same volume of the Veterinary Record, pasted in by hand at the start of the book. (This means of placing illustrations in a book was quite usual at the time). With his 'sub-joined' essay, we can see clearly not only what the instruments were like, but a practical (if somewhat wordy) description of how they were used.

Extraction in the horse is difficult, often extremely difficult, yet is not uncommonly essential, even today. The only possible technique, unless one wishes to embark upon invasive surgery, is a modified forceps extraction. This requires a firm hold upon the tooth for possibly as long as an hour.

Instrument 1 is a pair of extraction forceps. Gowing refers to these, interestingly, as '**the larger forceps** to be used instead of the old key-instrument'.
I have seen examples of the 'key-instrument' which are just massive imitations of the human instrument, and in my opinion would achieve nothing but fracture of the tooth, except perhaps in the very old horse. Gowing saw that good forceps were essential.

The 'larger forceps' are some 20 inches long, strongly made with a box-joint. The angle of jaws to handles is designed with much care. To apply sufficient force, and keep it applied without excessive

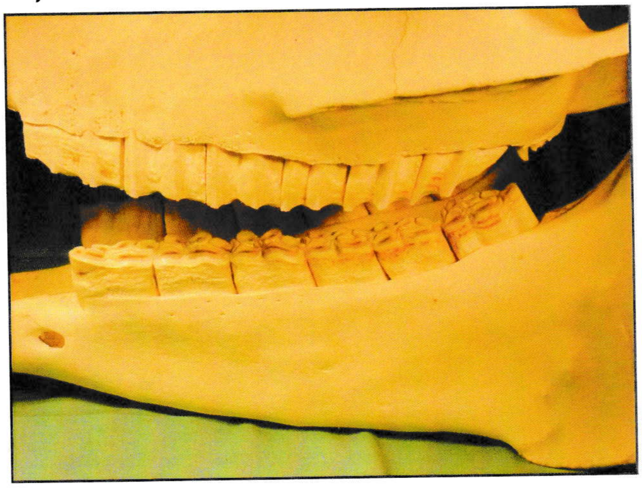


Fig 3 Cheek teeth of the horse

operator fatigue, the handles are closed together by a screw and tommy-bar – this is a key element of the design.

Jumping to instrument 6, this is described as '**the smaller forceps**'. This pair of extraction forceps, although over 16 inches long, is similar to human forceps and probably self-explanatory. It would be used where it was adequate, for loose teeth or fragments, or for 'caps' (retained portions of deciduous teeth).

Instrument 2 is '**the dental sliding chisel**'. Often large projections would have to be removed. This was commonly done with a blacksmith's chisel, struck with a hammer – the difficulties of control and the risks of serious injury to the soft tissues are obvious. The sliding chisel removes most of the risks. The chisel itself, bevelled upon the upper side only, is operated by an inner shaft and is contained within a rectangular frame. The frame would be fitted snugly over the teeth, the offending overgrowth protruding; the chisel edge would then be slid up to the overgrowth. It will be seen that the inner shaft passes through a sort of bulb on the outer shaft; this would be filled with packing so that the chisel once placed would stay where it was put. The bulb was screwed upon the outer shaft, so doubtless the tightness of the packing could be adjusted to suit the operator's preference.

Once the instrument was properly in place the chisel shaft would be struck firmly with a hammer. Gowing says '... a hammer of about two and a half pounds weight is to be selected...'

Then 'the blow will sometimes require to be repeated, and that once or even twice...'
However, there were sometimes situations where the sliding chisel could not be placed or was not quite appropriate, and then instrument 4, '**the guarded chisel**' would be used. This had some protection, being provided with turned-down guards on the sides of the blade, which would fit over the tooth and '...effectually prevent the instrument from being thrown off the teeth during an operation, or by any struggles that might ensue when the blow is given...'

The guarded chisel was not used on its own, but in conjunction with another instrument, numbered 3, '**the lateral repeller**'. This would suggest that Gowing had an assistant to hold one of the instruments, although he does not say so. The lateral repeller has at first glance a rather complex shape. The head, of '...hook-like form, flattened and bevelled, with a guard on one side...' is placed behind the tooth to be cut, mainly to take the force of the chisel, protecting the tooth behind.

Instrument 5, '**the posterior repeller**' is intended for a similar purpose where the lateral repeller does not serve, '...principally for the back or posterior teeth, the angle formed by the upper and lower jaw becoming less, as you are aware, towardsthe back of the mouth, and consequently any instrument requiring more space could not be so well applied.' The posterior repeller could be used in other ways – it could even be used to apply sufficient traction to extract a very loose tooth. Repeller and chisel could be used together to reduce or chip off '... those irregularities which interfere with mastication. By its use... the labour which is necessarily exerted when the rasp only is used is thus happily avoided.'

Instrument 7, '**the gum lancet**', I find slightly puzzling. Its form is plain enough, but despite reading Gowing's description I cannot quite fathom its exact purpose. It was used as a preliminary to extracting, with the smaller forceps, '...when absorption has taken place to a very great extent...'. 'Scarifications having been previously made with the gum lancet... which, as you see, is of considerable length, and has a handle of the description as the other instruments. length you will be able to scarify th inserting your hand through the ba thereby obstructing your view of th desirous of cutting...'
The best interpretation I can give is was used to separate gingiva from t possible. Yet I would not describe 'scarification', although I cannot se would be achieved by 'scarifying', sense, the gingiva.

Of instrument number 8, '**the rasp**', G little to say, as similar instruments wo familiar to his readers. Indeed, except details of configuration it changed li arrival of tungsten carbide to replace s the mid-1970s. (Something of a revolu

Gowing assumes in his article that th would, to hold the mouth open, be usi common balling-iron, an instrument gnised as being somewhat dangerou however extol Varnell's newly-inve iron as being considerably better for th

I cannot say for sure that Gowing truly these instruments. Perhaps the slidin the repellers were his alone, but other well be that similar articles had been themselves by other practitioners. No put some thought into the designs, r and took them to Arnolds, the great manufacturers. He had the engraving inserted into the Veterinary Record at, I own expense or perhaps with help from

The instruments illustrated would be understood by veterinary surgeons dental technicians today. Indeed, little equine dentistry apart from the introduc sedatives, and with the exception of the they would have used something simila until the motorised revolution of about 2

The Author

Evelyn Barbour-Hill BVSc MRCVS is a veterinary surgeon. ebhvet@dentalvet.ec

Surgical Instruments Require Trolleys

Adrian M K Thomas and Johanna E Thomas

Fig 1

Introduction

A given piece of medical equipment has to be presented for use, and this will usually be upon a trolley. Trolley settings were, and are, important and need to be learned by the practitioner. A piece of medical equipment is not used in isolation, and has accompanying items, such as pots, syringes, tubes and needles. For most procedures we now have single use disposable packs replacing traditional methods, and the use of single use medical devices has given rise to significant concerns regarding ongoing environmental impacts.

The Trolley

A trolley is essentially a wheeled metal basket or tray, and may be used for transporting or holding items. In daily life these items may include supermarket purchases or luggage. A trolley is also a wheel that is attached to a pole and used for collecting current from an overhead electrical cable to provide power for a vehicle such as a tram. In a medical setting a trolley may be used for holding or moving medical equipment or a patient. An operating table may be considered as a sub-type of the trolley. The medical trolley commonly has four wheeled legs, and two trays usually made of stainless steel or glass. There are commonly surrounding retaining raised edges to precent items from falling off, being flat at the front. Figure 1 shows a student nurse tutorial from a brochure promoting the School of Nursing at Farnborough Hospital in Kent. The trolley has a drawer and has equipment laid out on the top surface. The brochure is undated, but the uniforms would suggest that the brochure is from the 1960s.

Books for student nurses describing trolley settings have been produced and are of significant interest. As well as being of practical educational value at the time of publication, the books also provide exact evidence of clinical and nursing practices at a given point in time. This is of particular interest when the procedure described is now obsolete.

Books on Trolley Settings

Books on trolley settings could be produced locally or published. Such local books might be produced in a hospital or ward or in a School of Nursing. A number of books on trolley settings were published and must have been popular since they commonly went through many editions. Two such books, and a contemporary nursing textbook will be discussed.

Marjorie Houghton: Aids to Tray and Trolley Setting (1941)

Marjorie Houghton's book was first published in 1941 during wartime(**2**). The first edition of this book was prepared during the summer of 1940 in the time period between the British evacuation from Dunkirk and the beginning of the German air attacks on London (known as the Blitz). Marjorie Houghton realized that there was a need for a small book illustrating the trolley settings that were required for various ward procedures in view of the dispersal of trained staff and student nurses to the various military base hospitals during wartime.

There would be limited opportunities that wo be available for practical teaching during the c flict. In fact, the book continued to be popular p war and went into multiple editions.

In the preface to the first edition Mar Houghton stated that the book would serve t purposes:

1. The book provides an 'eye picture' (or illus tion) of each tray and trolley by means of a ph graph.
2. The book gives simple instruction as to wh required for a given procedure and how it ma arranged.
3. With the aid of the photographs and the Glos of Instruments the physical appearance of e instrument or piece of equipment is made so c that it can be quickly recognised in an emergenc memorised during instruction. With the help of book Marjorie Houghton hoped that any individ nurse would be able to learn quickly the settin trays and trolleys and having learnt them, wo find the information it contains useful to kee hand for checking up.

Fig 2

36 *AIDS TO TRAY AND TROLLEY SETTING*

CYSTOSCOPY

Examination of the bladder by means of an electrically-illuminated cystoscope is a procedure that may form a part of the examination of a patient in the urological out-patient department.

The **apparatus** shown on the **top shelf** of the trolley **is sterilised** and set out on a sterile dressing towel.

(1) **A boat-shaped receiver** for urine.

(2) **A metal bladder syringe** in a measure jug containing sterile water at a temperature of 100° F., or any mild irrigating lotion, such as normal saline solution which may be required by the surgeon.

(3) **A tall metal jar** containing sterile water for rinsing the cystoscope, this will be required if the instrument has been sterilised in an antiseptic solution or in a formalin cabinet. If the cystoscope is not one of the boilable type and a formalin cabinet is not available a second tall jar is provided containing a suitable disinfectant, *e.g.*, phenylmercuric nitrate 1 in 10,000 for sterilisation of the telescope and sheath of the cystoscope.

The **measure jug** standing by the jar contains cold sterile water with a layer of sterile liquid paraffin on the top. The cystoscope is lubricated by dipping it into the contents of the jug. Alternatively the instrument may be lubricated by a swab moistened with sterile liquid paraffin.

(4) **A dressing bowl** containing towels and swabs.

(5) **The cystoscope** and leads.

(6) **A dressing bowl** containing lotion such as 1–2,000 perchloride of mercury solution or a 1–30 solution of chloroxylenol (Dettol) for swabbing.

The bottom shelf of the trolley shows :—

(7) **The battery** to which the leads of the cystoscope are attached.

(8) **A small tray** containing swabs in surgical spirit, a record syringe and a bottle of indigo-carmine. An injection of this dye into a vein may be required

CYSTOSCOPY

CYSTOSCOPY

during the examination as a test of the efficien renal function.

(9) **A tray** containing bottles of lubricant an infectant, *e.g.*, sterile liquid paraffin, stock so of perchloride of mercury, and Dettol.

A dish for used instruments and a bowl for towels and swabs are also shown.

The book had a glossary of instruments arranged alphabetically; the left-hand page giving the name and a brief description, and the right-hand page showing an illustration of the instruments and trolley. Not every instrument was illustrated, the general intention being that those instruments which were small in the photographs could be shown large enough to be easily recognised.
Figure 2, from 'Aids to Tray and Trolley Setting' shows the equipment needed for cystoscopy in the urological outpatient department. (Rigid outpatient cystoscopy has now been replaced by flexible fibre-optic cystoscopy).

In the preface to the fifth edition of 'Aids to Tray and Trolley Setting' Max Rosenheim (**3**) wrote that in the desk of every ward sister there will be found a much-thumbed notebook full of details of treatment and of lists of the instruments required for all the various procedures and minor operations that make up the routine work of the ward. He continued saying that nurses, whether qualified or still in training, require some such book to help them in their daily round. The 'trolley book' details the requirements for almost every activity in the wards, and explains the indications for the various procedures, by photographs of ready-prepared trolleys and by a well-illustrated glossary of instruments. The nurse is therefore helped to understand and remember the procedures. The illustrations from Marjorie Houghton's book were mainly of trays and trolleys as prepared for use in the wards at University College Hospital, and with minor differences also represented the practice in most Teaching Hospitals.

Helen M Dickie: Pocket Book on Tray and Trolley Setting (1959)

Another popular book was that written by Helen M Dickie who was Sister Tutor to the Preliminary Training School at Southern General Hospital in Glasgow (**4**).

Helen Dickie in her preface to the first edition of 1959 noted that is an old Chinese proverb stating: 'A thousand hearings are not as good as one seeing.' (**5**) She also noted that the subject of visual aids in teaching was receiving considerable attention at that time, and this has continued to this day. Dickie said that no one concerned with nurse training could afford to overlook the opportunities in this field. In compiling the book no attempt was made to include every tray and trolley setting which the nurse might require to prepare in her routine ward work. However, the General Nursing Council (Scotland) Syllabus was a guide, and Dickie tried to include illustrations for most practical procedures that were carried out at the bedside. Dickie emphasised that we would do well to remember the words of the International Code of Nursing Ethics which stated that 'Service to mankind is the primary function of nurses and the reason for the existence of the nursing profession.'

Dickie wrote that, because of the existent diversity of thought regarding nursing procedures, that standardisation of technique was not easily accomplished, but that it could be accomplished was not in doubt. As a result of this diversity, the book aimed to reach a point midway between oversimplification and undue elaboration. Figure 3 is from 'Pocket Book on Tray and Trolley Setting' and illustrates the trolley set up for 'electrotherapy (E.C.T.)'. The book used is an interesting association copy since it is stamped as from the training school of St Andrews Hospital, Norwich. This is the former St Andrews Asylum, Northside, Thorpe St Andrew, in Norwich (Norfolk Lunatic Asylum Annexe)(**6**). The hospital had consisted of a large complex arrangement of traditional H-shaped buildings, all linked with a straight trunk corridor, and would have practised Electro-Convulsive Therapy (ECT).

In 1959, syringes were sterilised by autoclaving, exposure in the hot air oven, the use of infra-red radiation or, if they were of the disposable variety, were discarded after use. As a result, administration of an enema saponis (soap suds or soap and water enema), could be carried out with the minimum of effort, time and equipment.

Dickie believed that as advances were made that the requirements for practical procedures would of necessity change, but that whatever the change in pattern, that the basic nursing needs of the patient

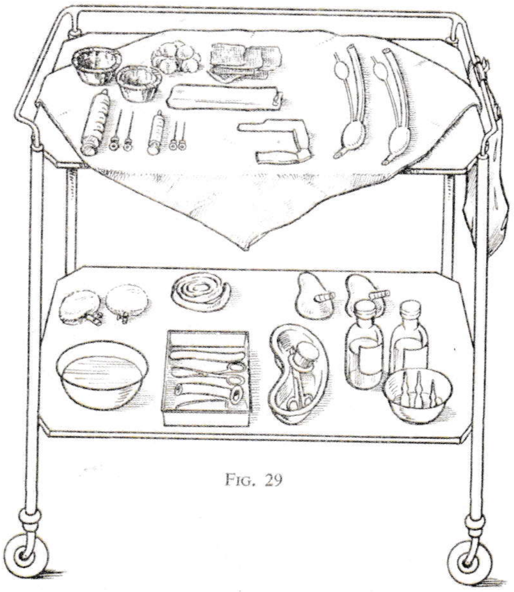


FIG. 29

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FIG. 29

Trolley for electrotherapy (E.C.T.)

1. Sterile packet containing:
   One large disposable clinical sheet.
   Gauze swabs.
   Cotton-wool mops.
   Treatment drape.
   Two disposable gallipots.
2. 20 ml. syringe and needles (for intravenous anæsthesia).
3. 2 ml. syringe and needles (for giving muscle relaxant).
4. Laryngoscope.
5. Magill's cuffed endotracheal tubes.

Disposable paper bag taped to the side of the trolley to receive soiled swabs.

6. Electrodes (well padded with cotton-wool and gauze).
7. Bowl containing normal saline solution (to moisten electrode pads).
8. Small tray or receiver with:
   Tongue depressor. Airway.
   Tongue forceps. Mouth gag.
9. Receiver with adhesive tape and scissors.
10. Tourniquet.
11. Bottle of cetavlon (1 per cent.).
12. Bottle of skin hibitane.
13. Anæsthetic face masks.
14. Drugs to be used, *e.g.*, pentothal sodium or methohexital sodium (" brietal sodium "), scoline.

Other requisites:
   Electrotherapy machine.
   Cylinder with oxygen or oxygen and 5 per cent. carbon dioxide.
   Tray with syringes, needles and emergency drugs, *e.g.*, nikethamide or adrenalin hydrochloride.

(*N.B.*—All apparatus should be checked and tested before treatment is commenced.)

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Fig 3

will emerge unaltered. So, in the future more advanced techniques would be joined by others equally complex and requiring the intelligent co-operation of the nurse at every stage. Dickie thought that in the UK they were on the eve of exciting developments in nursing. In the past two decades she had observed rumblings within the profession that were gaining in momentum. The earnest desire of all engaged in this service to humanity is that an atmosphere may be created conducive to the patient's physical, social and spiritual well-being.

In 1966 in her preface to the fourth edition Dickie wrote that when the book was published in 1959 that she did not visualise that the demand would be such as to require a fourth edition so soon. A significant change was that disposables and Central Sterile Supply (CSSD, Central Sterile Supply Department) was continuing to exert a growing influence on nursing practice, although the requirements remained fundamentally unaltered.

There is an increasing concern about the environmental impact of human activity, and medicine and nursing make their own contributions. In the UK, it is estimated that 62% of carbon emission sources in the NHS are the result of medicines, medical equiment, and other supply chain medicines. Many companies are taking seriously their environmental impact and are publishing recommendations (**7**). An innovative attitude towards medical equipment may result in better recycling or the possibility of reuse or upgrading. The reuse of medical equipment can be problematic because of the risk of cross-infection (**8**). When Dickie's book was first published, much was re-sterilised and reused, including syringes and needles, and today these have been replaced by single-use disposable units because of concerns over infection. Having appropriate radiology closer to the patient's residence will result in fewer and shorter patient journeys to the imaging centre. A cultural change within hospitals should be possible to achieve with the avoidance of waste, and the encouragement and rewarding of environmentally friendly practices.

The foreword to the 1959 edition was provided by I G McInroy who was formerly Principal Sister Tutor, Glasgow Royal Infirmary, formerly Member of the General Nursing Council for Scotland. McInroy noted the increasing amount of professional knowledge that was being demanded from the student nurse. This applied particularly to the junior nurse, who was often bewildered by the number of new subjects that needed to be learnt during her first year. Not every hospital ward possessed a procedure book, and therefore this pocket handbook provided information on tray and trolley setting in a concise form. McInroy noted a chapter on methods of sterilisation as an added asset as the problem of cross infection in hospital wards was giving increasing concern at that time to both the medical and nursing professions.

The Royal Marsden Manual of Clinical Nursing Procedures (1992)

Eamonn Sullivan as Chief Nurse of The Royal Marsden NHS Foundation Trust wrote the foreword to the tenth edition of the The Royal Marsden Manual of Clinical Nursing Procedures(**9**). Sullivan said that the manual draws together up-to-date procedures and practices, and provides an essential resource of current knowledge against which nurses can critically analyse the judgements they exercise in a variety of clinical settings. Sullivan commented that nursing care in 2020 was under constant scrutiny, and nurses are called upon on a daily basis to provide reassurance to patients, their families and loved ones, and the public at large. This has always been the role of nurses. The 'Royal Marsden Manual of Clinical Nursing Procedures' was described as 'a real practical help to all engaged in providing nursing care, whether in a ward, over the telephone, in a day-care setting or in the wider community'. Of interest is that the tenth edition included a new chapter on wellbeing and self-care, and additional information on topics such as falls management and antibiotic resistance. Sullivan echoed the other books described in this paper noting that keeping up to date also involves embracing new technologies.

The Manual has no illustrations of trolleys or settings, merely noting the need for a dressing trolley. So as an example, in procedure guideline 17.10, which is 'Short-term central venous catheter (non-cuffed and non-tunnelled) removal' the need is given for essential equipment comprising of personal protective equipment (PPE), sterile dressing pack (containing sterile gloves), occlusive dressing or another appropriate dressing, hypoallergenic tape, sterile scissors, small sterile specimen container, stitch cutter, sterile low-linting gauze swab, and finally a dressing trolley.

Conclusions

The simple dressing trolley plays a significant role in nursing and medical care, and its use is usually taken for granted. The books of trolley settings are important historical documents giving an account of medical and nursing practices at a defined point in time, and this is of particular value for obsolete procedures. The procedure books show how technological developments have changed both the scope and nature of medical and nursing practice.

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'When General Zhao Chongguo was asked by the Emperor on his strategy against the Qiangand how many men were needed, Zhao replied,
Hearing something a hundred times is not as good as seeing it once. It's difficult to estimate the required military strength from a distance. I wish to rush to Jincheng to come up with a strategy'.
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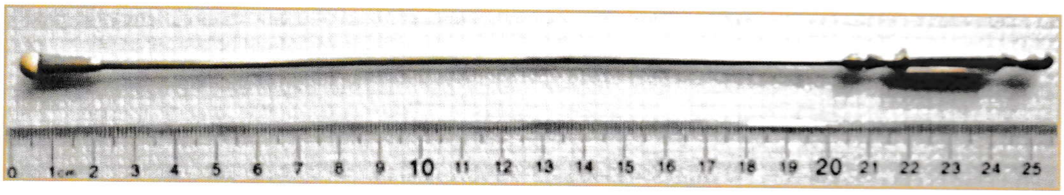
The Authors

Adrian M K Thomas
Faculty of Medicine, Health and Social Care, Canterbury Christ Church University,
North Holmes Road Campus, Canterbury, Kent CT1 1QU.
adrian.thomas@btinternet.com

Johanna E Thomas
Shortlands, Kent BR2 0SD

QUIZ

Six small objects from John Kirkup's collection



An Auguste Nelaton (1807-1873)Porcelain-tipped probe for lead bullets (1866-97).
The porcelain probe tip was 'marked' by the lead bullet or ball and distinguished it from bone.

Q. Why did the Nelaton probe become redundant in the 1890s?

Leur's 'needle' seton, in tortoise shell case, Paris, c.1850.

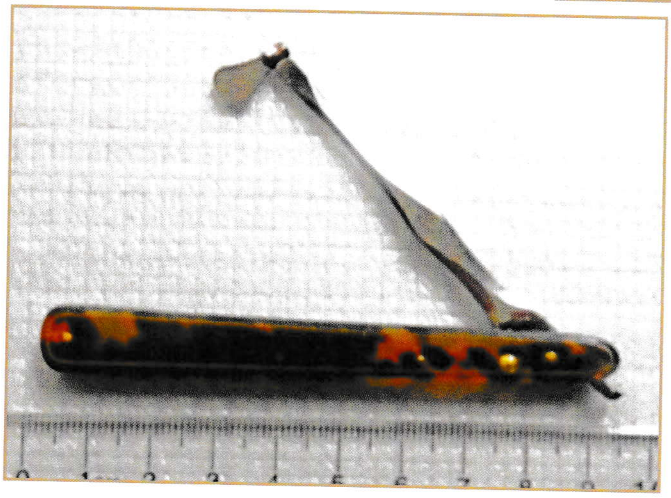
Q. What is the slot near the top for?

QUIZ continued

Josef Leiter (1830-1892)
Needle & suture passer c.1875
Steel, brass, shell, silver & ivory.
Q. But how does it work?

J&W Wood, Manchester.
Ivory & steel hook, 1860s.
Q. What was it used for?

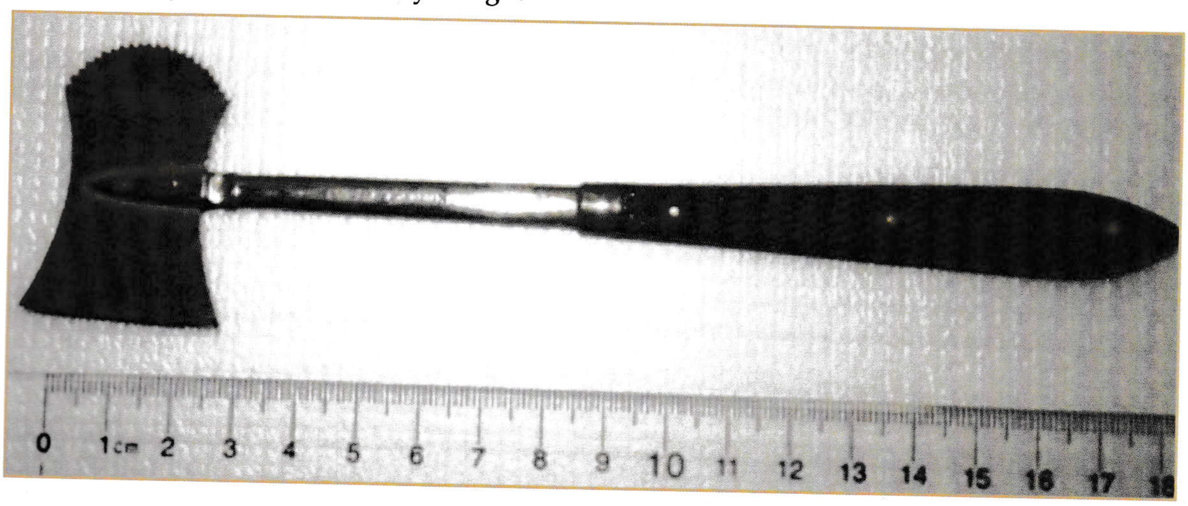
For trachy

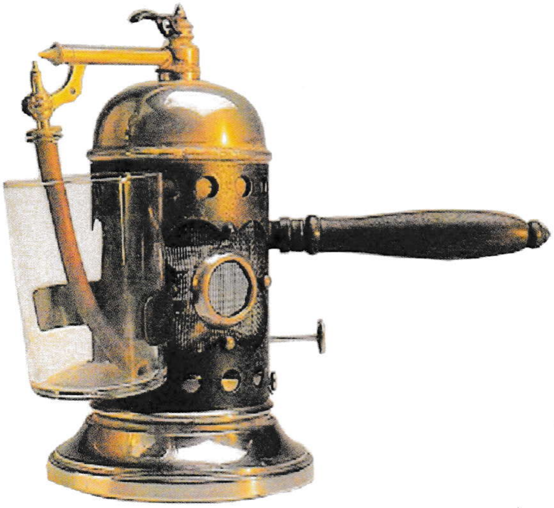


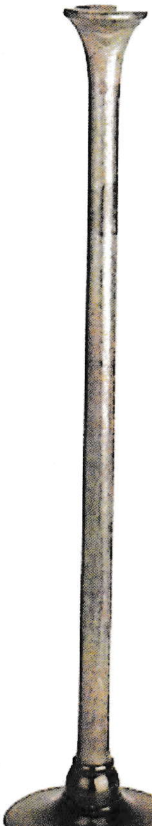
Leur, Paris, 1880s
Tortoise shell, steel, brass & gold
Q. What is this instrument called?

Gum Scarif.

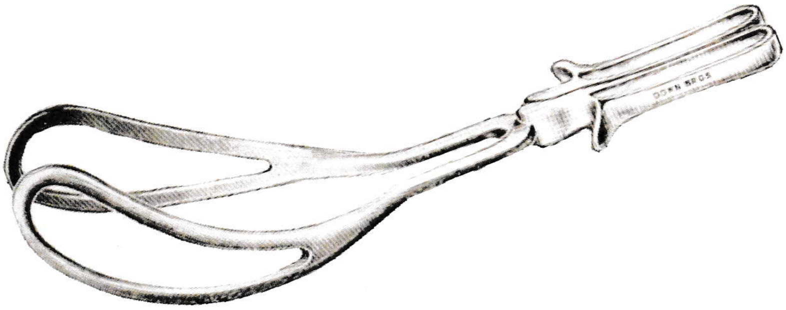
Maw, London. William Hey (1736-1819), Leeds. Skull saw, ebony handle, steel
Q. How many skull-saws did Hey design?







The Historical Medical Equipment Society



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