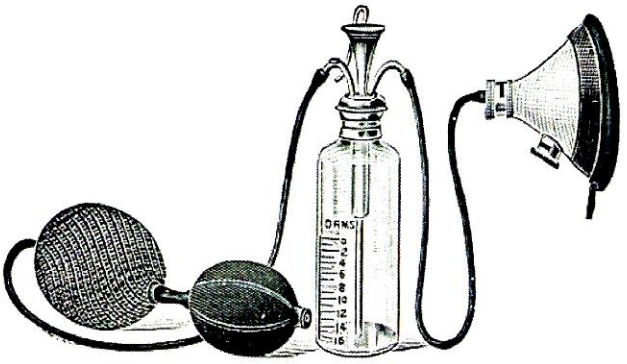
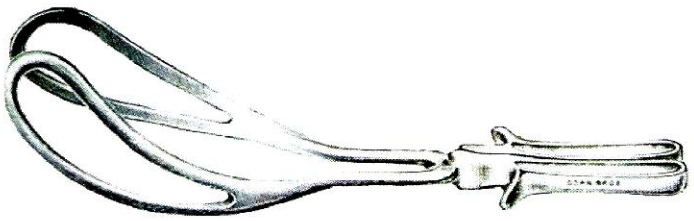


The Historical Medical Equipment Society



BULLETIN NO. 30 ISSN 1366 - 4719 AUGUST 2015

EXECUTIVE COMMITTEE

CONTENTS

EDITORIAL

Twenty-six members and guests attended the meeting of the HMES held on Friday 17 April 2015 at the Hunterian Society Collection at the London clinic Annexe near Regents Park. We owe thanks to Ravi Kunzru for securing this excellent venue, the smooth running of the meeting and organising an excellent lunch. The Hunterian Society, named in honour of John Hunter (1728-93), was founded in 1819 as a London Medical Society for the pursuit of medical knowledge and the promotion of medical history. The Society has a large collection of historical archives, books and artefacts relating to Hunter held in the Wellcome Library, the Science Museum and displays in the London Clinic. Ravi and Nicholas Cambridge are co-curators of the collection and opened the meeting with a video and brief history of the Society and its collection and ended the meeting with guided tour of the displays of the Hunterian memorabilia. One item in the collection, a restored Dudgeon sphygmograph, was given a working demonstration by Dr Kunzru as part of the opening lecture.

The main theme of the meeting was the First World War. This horrific conflict laid waste to millions of lives and devastated civilization. Nevertheless historians acknowledge that some advancement in science and technology were accelerated during WW1 and some have argued that medicine and surgery benefited in this way. Such a view should be expressed with caution and the weighed against the cost of such massive destruction; indeed it's likely that many 'advances' attributed to the War would have emerged regardless. Peter Starling's lecture, 'medical innovations in the field during WW1' described various ingenious types of stretchers and other devices, designed to overcome the problems of moving injured soldiers along narrow zigzag trenches. Tim Smith's account 'development of anaesthetic equipment in WW1' described the evolution from simple mask anaesthesia with ether and chloroform to safer quantitative techniques using oxygen and nitrous oxide. Many innovative improvements were introduced by American medical staff from 1917 onwards. Harold Gillies (1882-1960) pioneering plastic surgery techniques for facial injuries and Ivan Magill's (1888-1986) special anaesthetic techniques for such patients were developed as a direct response to deal with these most challenging of shrapnel injuries. John Kirkup explained 'the management of open femoral fractures'. Being stuck in muddy shell-holes, blood loss and contaminated wounds all contributed to the 80% mortality. The Thomas splint, prompt evacuation to a dressing station and motorised transport to hospital, and blood transfusion all helped to reduced deaths to 16%. Apart from serious physical injuries many were incapacitated by a mysterious condition, 'soldier's heart' (De Costa syndrome). James Mackenzie and Thomas Lewis investigated over a thousand cases but could find no obvious cause. Dr Otto Leyton advocated using the 'Bock differential stethoscope' (1909) but it also failed to detect any cardiac abnormality. Lewis concluded it was not a cardiac problem and termed it 'effort syndrome', in retrospect due to severe stress-induced chronic anxiety. David Radstone's lecture provided a full chronology of cancer brachytherapy from radium to iridium. Safe techniques, special applicators and instruments are mandatory and during WW1 radium had to be stored in remote sites such as a cave or mine. After the War radium which had been used to illuminate gun sights and dials was collected and distributed to cancer hospitals by the Radium Commission.

John Prosser chaired a short business meeting. There was general agreement that the HMES should continue with one meeting in the spring each year, in or near to London. Peter Mohr has agreed to organise such a further meeting in April 2016 (venue to be decided). Adrian Padfield has offered to take up the post of Treasurer and a small annual fee to go towards the cost of the *Bulletin* will be reinstated in September (this will be £10 for single membership and £15 for couples). Tim Smith has also agreed to produce a further *Bulletin*. If any members want to organise a meeting or suggest a venue, please contact Peter Mohr.

Peter Mohr pjdmohr@gmail.com
John Prosser

DUDGEON AND HIS SPHYGMOGRAPH

K.M.N. KUNZRU & N.A. CAMBRIDGE

Palpation and 'analysis' of the arterial pulse have long been part of the clinical examination of patients (Chinese pulse diagnosis describes a few thousand 'types'). Stephen Hales (1677-1761) first measured the height of the blood column in a glass cannula inserted in a horse's artery in 1733[1]. The actual mechanical recording of the human pulse only started in the 19th century. Around 1828 Jean Poiseuille (1797-1869), using a mercury manometer attached to the arterial cannula, was able to demonstrate oscillations of the mercury column, and Carl Ludwig (1816-95) used a kymograph (a revolving drum with smoked paper) recording from a stylus attached to a float above the mercury column in the 1840s[2].

Karl Vierordt (1818-84) devised the first, quite cumbersome sphygmograph in 1855 to record the pulse directly from the wrist without cannulation of the radial artery. Étienne-Jules Marey (1830-1904) devised a simpler, more portable instrument in 1863 but still quite large, with calibration difficulties, producing reproducible tracings on smoked paper. It was improved by Frederick Mahomed (1848-84), a Guy's physician, though the instrument remained similar in size, it was less portable, and never gained general clinical use (fig.1).

In 1882 Dr Robert Ellis Dudgeon (1820-1904)[3] published his monograph of a redesigned pocket sized instrument for clinical use, as illustrated (figs.2&3). It still required considerable practice to produce reproducible tracings on smoked paper, but was easier to calibrate. In addition to showing the shape of the normal and pathological pulse wave, the excursions of the stylus could be damped by turning the calibrated knob, giving an indirect measure of arterial tension (blood pressure), while the normal rebound of the arterial wall on aortic valve closure, the dicrotic notch, was also identified. The instrument remained popular with clinical physiologists well into the 20th century and James MacKenzie used it as part of his polygraph experiments[4].

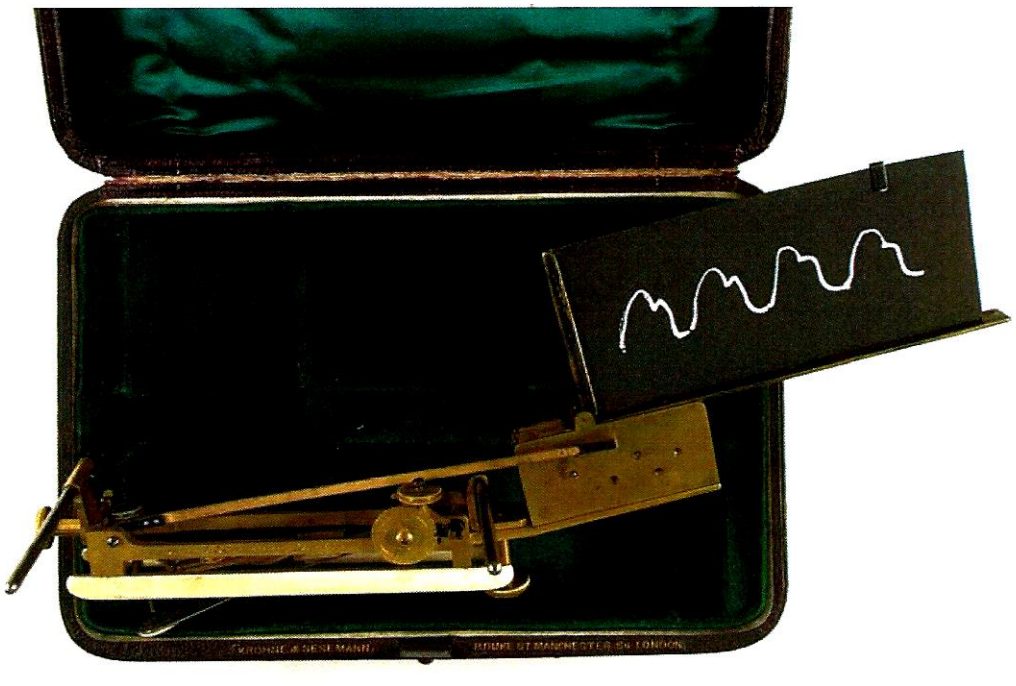


Figure 1. The Mahomed sphygmograph

Dudgeon[5] qualified LRCS Edinburgh in 1839 and, after the usual Continental medical tour, gained his Edinburgh MD in 1841. He made a second trip to Vienna and Berlin for training in ophthalmology. While in Vienna he was converted to homeopathy by Drysdale, and came back to London to

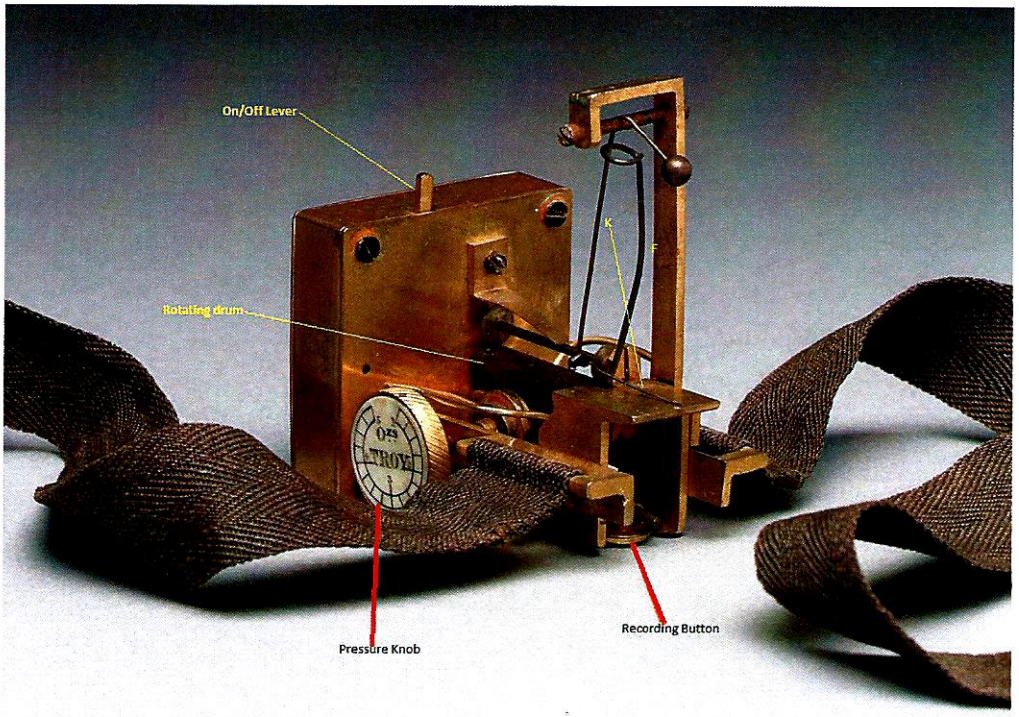


Fig.2 The Dudgeon sphygmograph

set up the Homeopathic Hospital in Bloomsbury Square, which later merged to form the present Royal London Homeopathic Hospital, and to practise ophthalmology. He edited the *Homeopathic Journal* for over four decades. Apart from inventing the sphygmograph, he wrote on optics[6] and also devised 'goggles' for underwater swimming – another passion[7].

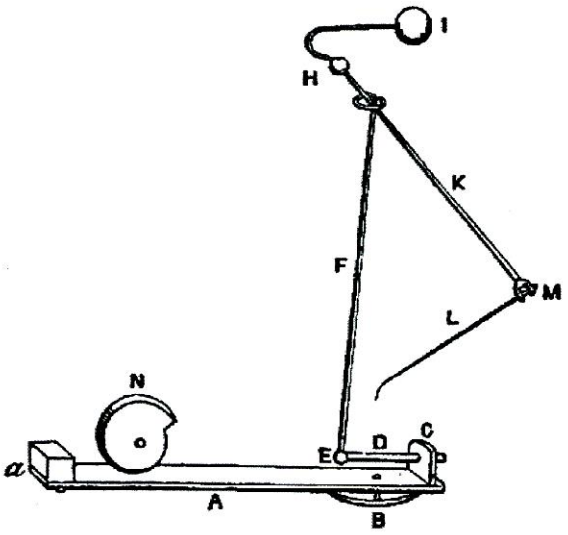


Fig.3 Details of the 'pen' of the Dudgeon sphygmograph

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INNOVATION AND INVENTION IN THE FIRST WORLD WAR

PETER STARLING

At the start of the war the equipment available to the Royal Army Medical Corps had improved much since the South African War but it was never envisaged that the war would last four years with much of it spent in trenches.

Trenches were not constructed in a straight line, good for defence but not for getting wounded out. The standard military stretcher, 7ft 9ins long by 1ft 11ins wide would not fit along a front line trench. Let us not forget that trenches became very crowded with men and equipment and were very often waterlogged.

It did not take long before the RAMC began to improvise trench stretchers such as Lt. C Hamilton Withers' stretcher with a detachable canvas bed. By folding the handles the length could be reduced to 5ft 9 inches and in a confined space the width of the bed could also be reduced. Captain R Stirling invented a stretcher made entirely of canvas which could be made rigid by inserting pieces of wood or a bayonet into loops (fig.1).

Fig.1 Stirling stretcher

Many more were tried and tested and also over head monorails and light railways wagons were brought into use .

It was not only in the trenches that innovation was found; the Casualty Clearing Hospital of 1914 did not have any beds, casualties lay on stretchers on the ground. Captain MacFadyen RAMC, had trestles made to bring the stretcher up to a more comfortable height for the medical staff (fig.2).

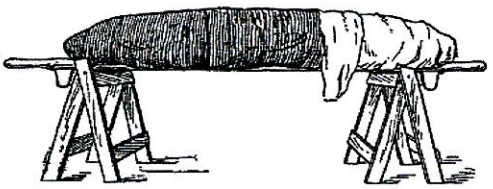

FIG. 2.—Bed improvised from trestles and stretcher.

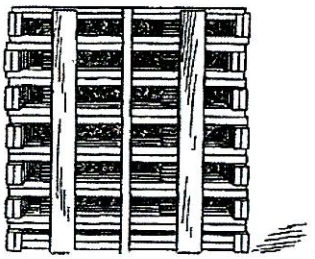

FIG. 3.—Bundle of eleven trestles packed for transport.

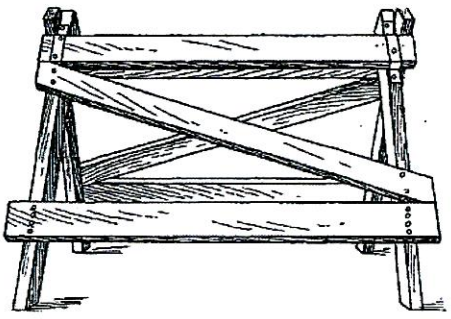

FIG. 4.

Fig.2 Stretcher trestles

Back in England unloading hospital ships could be both tiring for the stretcher bearers and painful for the patients so various ways of unloading ships were tried including an aerial ropeway designed by Lt. Withers (fig.3).

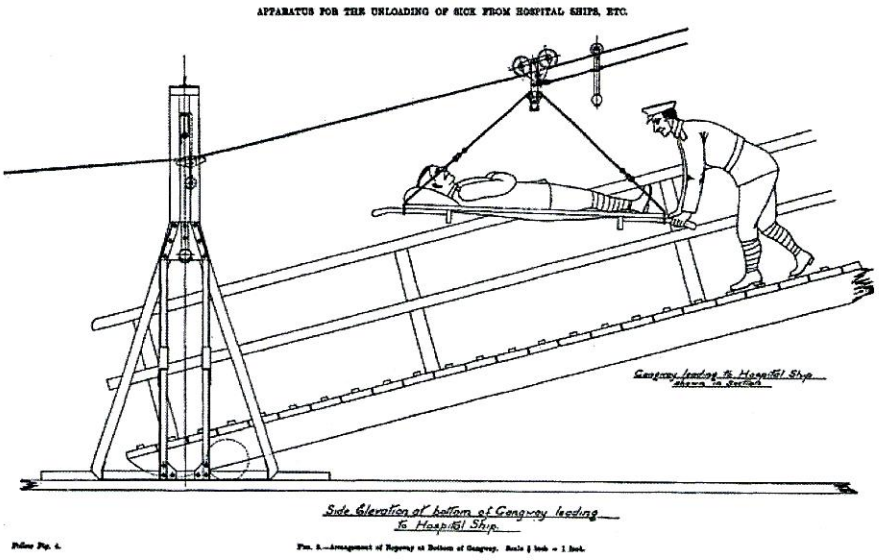

Fig.3 Withers aerial rope-way

There were many more inventions that perhaps never came to light or once the war was over were forgotten, but they certainly made life and work more bearable for medical staff during those four years of war.

THE DEVELOPMENT OF ANAESTHESIA DURING THE FIRST WORLD WAR

TIM SMITH

The First World War produced unprecedented challenges for the medical and surgical services. The sheer numbers of casualties were at times overwhelming. New problems arose such as gas warfare and shellshock. At the start of the war anaesthesia was not a speciality in its own right but it soon became clear that specialist anaesthetic services were needed. At the start of the war British anaesthesia was in the doldrums. There had been few advances since the 1870s and anaesthesia was essentially by face mask with ether or chloroform in air. Shipway's apparatus of 1916 (Fig.1) still delivered chloroform or ether in air. Ether and chloroform both produced myocardial depression. Chloroform occasionally produced ventricular fibrillation in light anaesthesia while ether was associated with prolonged vomiting and a slow recovery period. Spinal anaesthesia was occasionally used but was a poor choice for shocked patients.

Problems for the anaesthetist included sepsis, hypovolaemia, debilitation and in particular facial injury. Although the patients were young they were all chronic smokers.

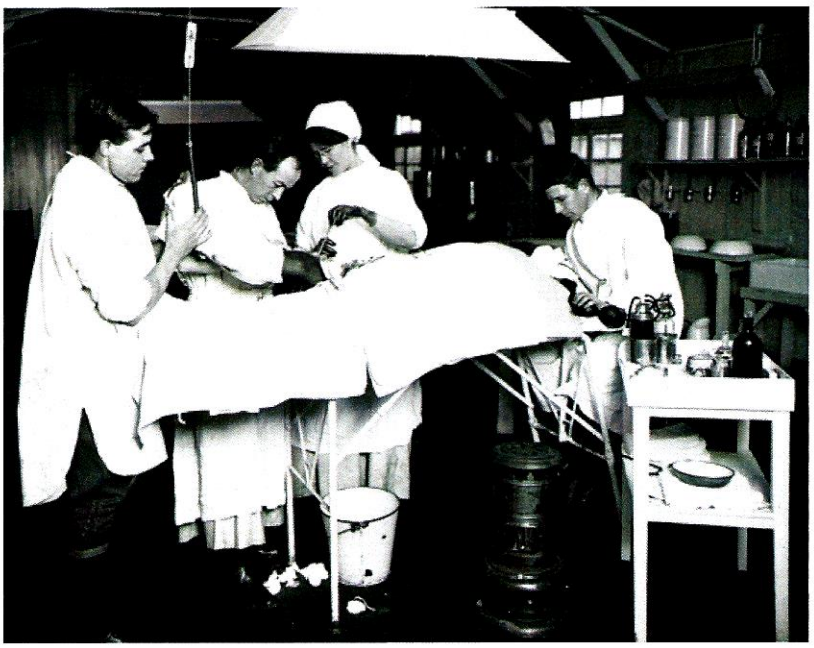

Fig.1 A casualty clearing station in 1917. Shipway's anaesthetic apparatus (1916) is being used. This delivered 'warm' chloroform/ether in air. Oxygen/ nitrous oxide machines eventually replaced such devices.

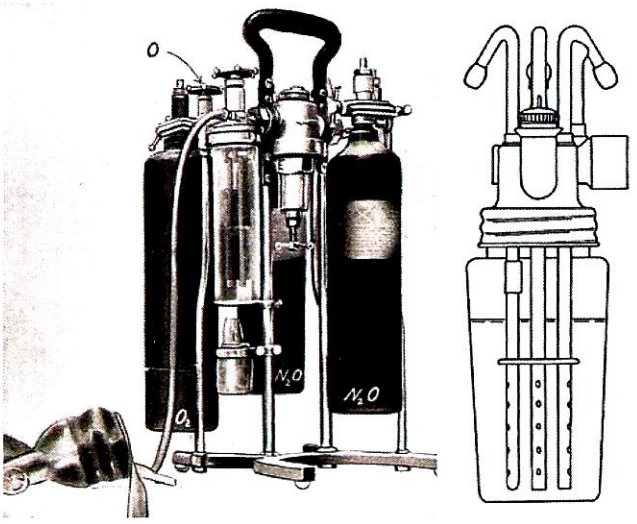

Fig.2 Gwathmey oxygen/ nitrous oxide apparatus (1912). The diagram shows a water sight flow meter where bubbles give a quantitative assessment of the flow of each gas.

At this time anaesthesia in the United States was significantly more advanced. Machines such as that of James Gwathmey delivered a known concentration of oxygen and nitrous oxide (Fig.2). These machines were copied by the English clinicians Edmund Boyle and Geoffrey Marshall. With the entry of the United States into the War in 1917 and particularly following the conclusions of the 1917 Paris Inter-Allied Surgical Conference the safety of anaesthesia was given greater prominence. The Conference recommended premedication with morphine/scopolamine, local anaesthesia with novocaine and gas/ oxygen anaesthesia. Marshall later said "*With gas-oxygen we cut down the mortality from about 90% to something like 25%*". The Boyle machine (figs.3&4) and its later modific-

ations became the mainstay of British anaesthesia.

The problem of facial injury remained. Patients might be anaesthetised with chloroform in the sitting-forward position through a nasal catheter with naso-pharyngeal packing. Occasionally rectal oil/ether was used. Neither of these methods was satisfactory. It was not until after the War that Ivan Magill (fig.5) and Stanley Rowbotham solved the problem. Working with pioneering plastic surgeon Harold Gillies at Queen's Hospital, Sidcup, their work (between 1919 and 1923) culminated in the single wide-bore nasal (uncuffed) endotracheal tube (fig.6). This subsequently became an essential part of the anaesthetist's armamentarium. Magill also developed his eponymous forceps at this time (fig.7).

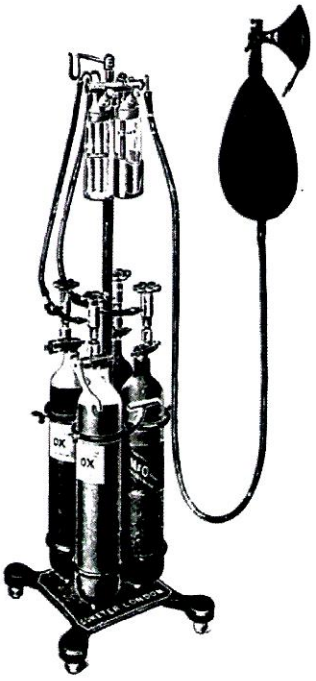

Fig.3 Boyle anaesthetic machine of 1917

Fig.4 Boyle anaesthetic machine of the 1960s

During the War gum acacia was given intravenously as volume replacement and from 1917 onwards blood transfusion with stored blood became a practical possibility. These and other procedures such as the administration of oxygen to gas victims gave rise to skills that would be part of the emerging specialty of anaesthesia. By the end of the War anaesthesia had become a full medical discipline in its own right.

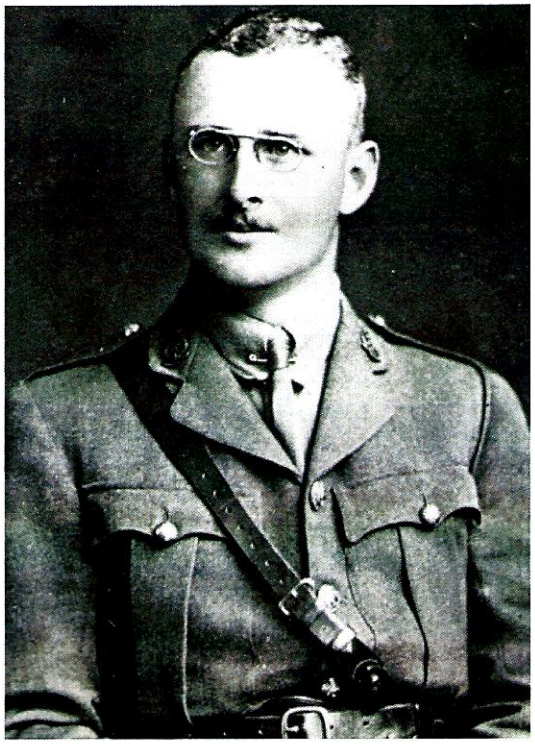

Fig.5 Ivan Magill in uniform c.1919

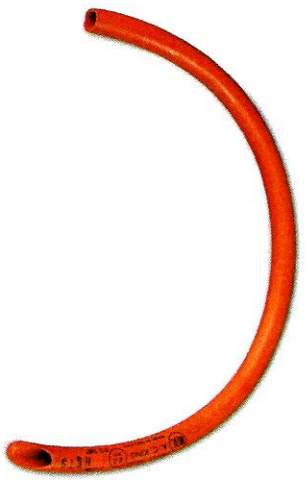

Fig.6 Magill uncuffed red rubber endotracheal tube

Fig.7 Magill forceps 1920

THE BOCK-LEYTON DIFFERENTIAL STETHOSCOPE AND "SOLDIER'S HEART"

PETER & JULIE MOHR

'Soldier's heart'[1] was a puzzling condition studied by Dr Jacob De Costa (1830-1900), an army surgeon during the American Civil War; he described the syndrome in detail: chest pains, breathless, fainting, palpitations, sweating and anxiety. Official reports in the 1870s suggested various mechanical causes such as heavy backpacks and excessive rifle drill which might damage the aorta. During World War 1 (WW1) this 'mechanical explanation' was questioned when hundreds of troops were transferred to the Military Ward of University College Hospital in 1915-16. Capt. Thomas Lewis FRCP[2] was in charge of the ward and also employed by the Medical Research Committee to develop the ECG. In addition the War Office asked Sir James Mackenzie FRCP[3]at the London Hospital to produce a report on soldier's heart. Mackenzie was well known for his cardiac research with the polygraph and was the leading authority on heart diseases. A cardiac research unit was opened at Mount Vernon Hospital and later moved to a larger unit at Colchester. Lewis and Mackenzie set about extensive investigations into all possible causes: infection, thyroid disease, beriberi, poison gas, physical exertion etc. Lewis reviewed 1000 cases for the MRC (1917). Polygraphs, ECGs etc. were all normal. One popular theory was that it was due to a toxin from typhoid, but there was no evidence to support this. Lewis concluded that there was no heart abnormality and the condition was due to an exaggerated response to effort – 'effort syndrome'.

Dr Otto Leyto FRCP (1873-1938)

Leyton[4], a physician at the London Hospital, became interested in soldier's heart when his older brother, Major Albert Leyton FRCP[5] became ill in France, probably with typhoid, and was left debilitated with a weak heart and died in 1921. Otto believed his brother had soldier's heart caused by a typhoid toxin and in 1916 suggested using a Bock differential stethoscope to diagnose the weak myocardium. He examined a few of his own patients with various heart diseases but never examined any actual cases of soldier's heart, which he wrongly believed was due to a toxin[6].

The Bock Differential Stethoscope

Early differential stethoscopes (fig.1) were constructed with double chest-pieces and intended to compare breath sounds on both sides[7]. The Oertel type (fig.2) had a single chest-piece with a

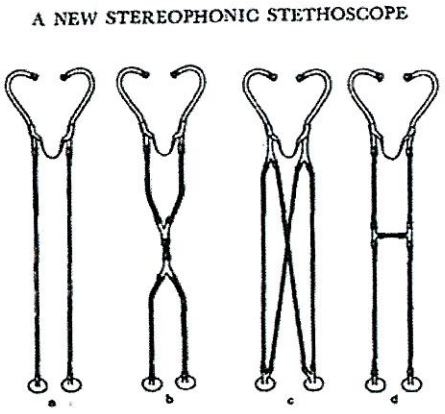

Fig.1 Different types of 'double' differential stethoscopes 1856-1940

variable sound slot but only worked in a silent room. The Bock stethoscope was designed in to

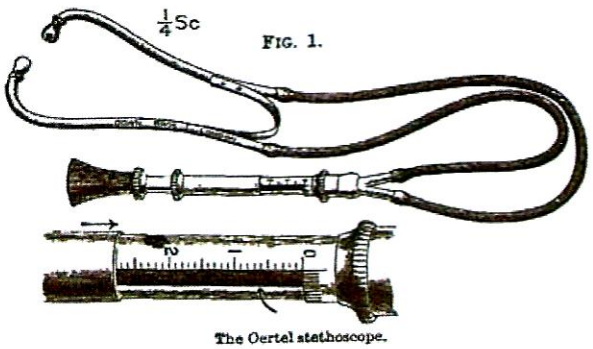

Fig. 2 Oertel's single chest piece differential stethoscope c.1900. The loudness is controlled by a sliding collar over a slot in the chest piece tube

room. The Bock stethoscope was designed in to compare and measure the loudness of the heart sounds (figs.3-5). The diaphragm has a central hole which can be opened or closed by a screw. As the hole opens the heart sounds get louder and can be measured by a dial attached to the screw[8]. The hearts sounds over the apex are normally twice as loud as those over the base of the heart (2:1) but in myocardial failure the ratio tends to unity (1:1). If soldier's heart had been due to some type of cardiomyopathy the Bock would have been useful in detecting the abnormal heart signs, but that was not the case – the myocardium was normal in 'soldier's heart' and the clinical features quite different from typhoid myocarditis. Leyton was right about his brother's diagnosis but misunderstood the true nature of soldier's heart.

After the War

Mackenzie and Lewis never sanctioned the use of the differential stethoscope or referred to Leyton's publications. After the War Mackenzie moved to St Andrew's and Lewis continued with the MRC. Nine percent of all war pensions were for 'cardiac disease' and claimants were assessed by a group of heart experts, the Cardiac Club, which was later reformed as the Cardiac Society, the founders of the *British Heart Journal* and forerunners of modern cardiology in Britain – something positive from the chaos.

Fig.3 The Bock differential stethoscope chest piece 1909

The psychological nature of soldier's heart was finally recognised in WW2 as part of combat or 'battle fatigue' – a severe chronic anxiety reaction – just one facet of post-traumatic stress syndrome.

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[3]RCP, *Munk's Role,* Sir James Mackenzie MD FRCP (1853-1925)

[4]RCP, *Munk's Role,* Dr Otto Fritz Leyton MA MB DSc FRCP (1873-1938). Born in England, birth name 'Grubaum'. His main interest was diabetes.

[5]*RCP, Munk's Role,* Major Albert Frankau Leyton MA MD DPH FRCP (1869-1921). Prof. of pathology at Leeds.University.

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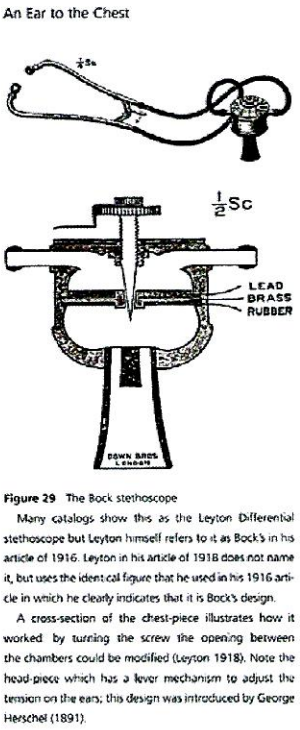
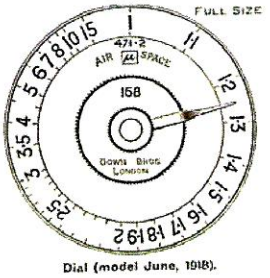


Figure 29 The Bock stethoscope

Many catalogs show this as the Leyton Differential stethoscope but Leyton himself refers to it as Bock's in his article of 1916. Leyton in his article of 1918 does not name it, but uses the identical figure that he used in his 1916 article in which he clearly indicates that it is Bock's design.

A cross-section of the chest-piece illustrates how it worked: by turning the screw the opening between the chambers could be modified (Leyton 1918). Note the head-piece which has a lever mechanism to adjust the tension on the ears; this design was introduced by George Herschel (1891).

Fig. 4 Structure and workings of the Bock stethoscope



Dial (model June, 1918).

Fig. 5 The dial of the Bock stethoscope

THE MANAGEMENT OF OPEN FEMORAL FRACTURES IN WORLD WAR ONE

JOHN KIRKUP

The Flanders experience of unprecedented trench-warfare in frequent all-embracing mud, caused severe restrictions on movement especially for the infantry. And for those wounded in no-mans-land, evacuation was always problematic despite the efforts of stretcher-bearers (fig. 1).

Fig.1 . Stretcher-bearers battle through a muddy quagmire, Flanders, 1917.

Most wounds (some 77 percent) were due to shrapnel fragments producing ragged penetrating wounds which carried in clothing, buttons, coins, etc and soil contaminated with gas gangrene and tetanus bacteria to cause lethal infections. By contrast bullets produced less traumatic wounds. Femoral fractures required evacuation by stretcher yet the numbers needing assistance often overwhelmed the bearers who themselves were often shot deliberately in no-mans-land. An Australian report stated that all 32 bearers of a battalion became casualties in one morning.

Out of no-mans-land, carries were difficult as narrow trenches zig-zagged, requiring bearers to lift stretchers above their heads, leading to attempts to shorten stretchers (fig. 2). Yet the journey of evacuation had hardly begun; after morphine and splintage at a Regimental Aid Post, further carries to wheeled horse transport might be a mile away. Survivors were taken to an Advanced Dressing Station, at up to nine miles for tetanus toxoid and review. If surgery was required this was only possible at a Casualty Clearing Station, out of enemy shelling range some 25 miles back.

It has been calculated open femoral fractures took on average 3-4 days to obtain surgery, if these survived blood loss and infection. The overall femoral fracture mortality was stated to be 80 percent in 1916. By 1917, dramatic improvements followed immediate application of the Thomas knee splint (fig. 3) by a team of three trained to apply even in darkness. Rapid evacuation by motor transport resulted in a much re-

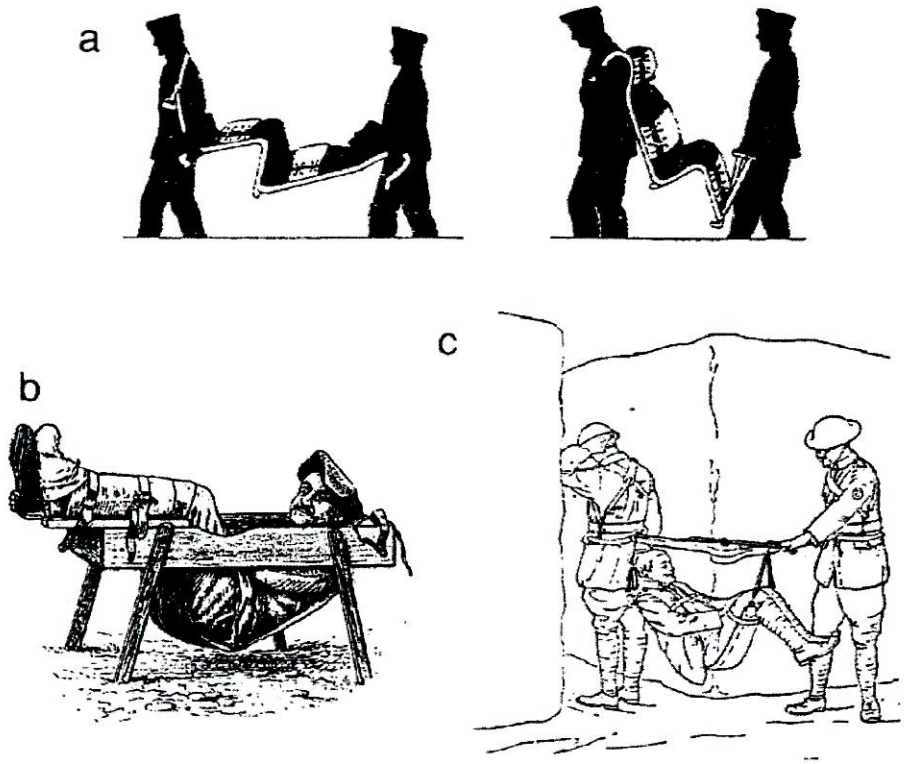


Fig. 2. Stretchers adapted for negotiating corners in narrow trenches; a) German bent metal frame; b) French wooden frame; c) British wooden articulating frame. None of these immobilised femoral fractures efficiently.

evacuation by motor transport resulted in a much reduced mortality: 16 percent is mentioned.

The paper concluded with two detailed histories of remarkable survivors with reference to amputation, and also the despair and misery of dying and death before transfusion and antibiotics when also isolated from family and friends.

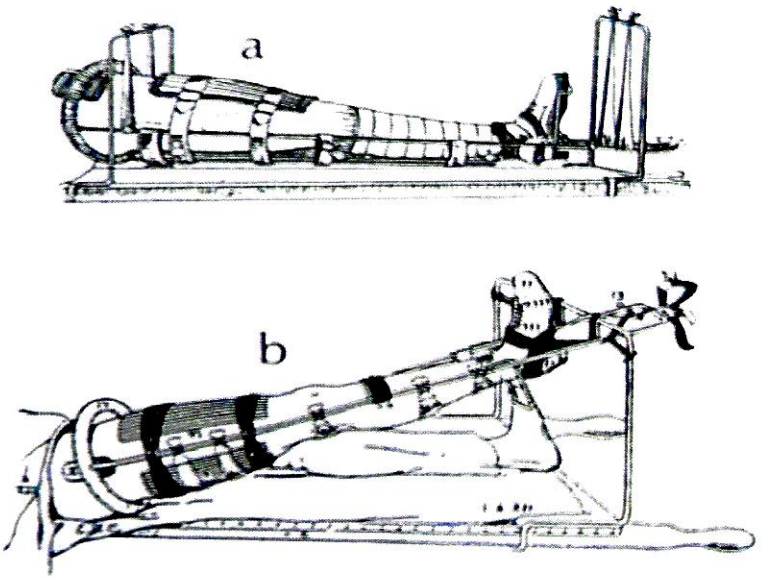


Fig. 3. Thomas knee splints attached to stretchers.

A VISIT TO THE SIR ARCHIBALD MCINDOE FRCS (1900-60) COLLECTION THE EAST GRINSTEAD MUSEUM

PETER AND JULIE MOHR

During World War 2 plastic surgeon Archibald McIndoe devoted his skills to treating the severe burns and injuries of over 600 RAF pilots and others at the East Grinstead Hospital. He pioneered new techniques for treating burns and skin grafting and was famous for his devoted care not only in the operating theatre but also for helping these severely injured young men to cope with their deformities and returning to their families and normal life. Many also returned to the RAF.

A collection of surgical instruments, equipment, archives and drawings related to his work and his patients who formed the 'Guinea Pig Club' in 1941 is now housed at the East Grinstead Museum. There are items in a display cabinet and an archive room. There is a remarkable collection of surgical drawings by Molly Lantaigne who was nurse on the burns ward. Much of the collection is stored in the Museum but can be viewed by arrangement. The collection was originally displayed in the Hospital but was dismantled and transferred to the town Museum in 2009. The collection has been carefully preserved since 1970 by Honorary Curator, Bob Marchant. More details are on the leaflet.

Jessica Hadfield (Collection Curator)
East Grinstead Museum
Cantelupe Road
RH19 3BJ
www.eastgrinsteadmuseum.org.uk

Bob Marchant, Honorary Curator & Secretary of Guinea Pigs Club

Figure 1 Bronze statue of McIndoe & burned airman by Martin Jennings. Unveiled on the High Street, East Grinstead, 2014.

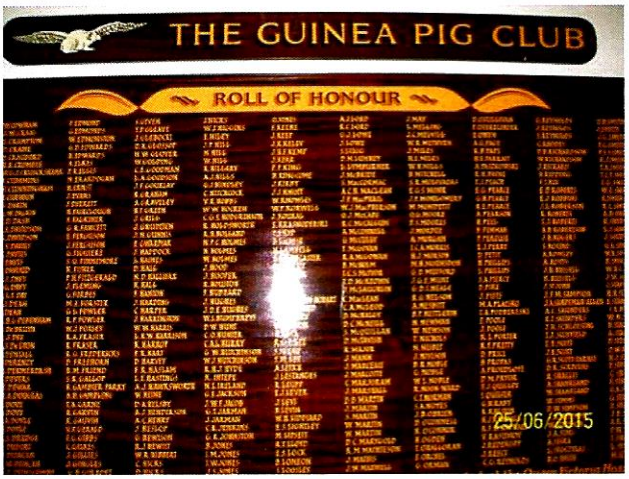


Figure 2 Role of Honour at the East Grinstead Hospital

Archibald McIndoe

At the outbreak of WWII Archibald McIndoe was posted to the Queen Victoria Hospital in East Grinstead to treat aircrew who had been badly burned.

He developed the pedicles which had been pioneered by Harold Gilles in WWI and introduced saline baths.

Perhaps, even more importantly, he realised the effect that their terrible disfugurements would mean to these very young men.

He encouraged the people of East Grinstead to treat them normally and the town responded. They talked to them, danced with them and invited them to their own homes.

East Grinstead earned the title:

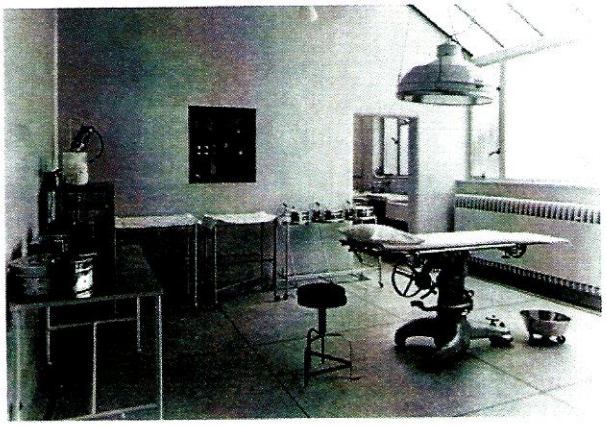
"The Little Town that Did Not Stare"

By the end of the war his revolutionary, holistic approach gave all of the 649 airmen the potential to live full and happy lives.

"One day someone will tell the complete story of Ward III in the way it should be told".

Archibald McIndoe

The story of the Guinea Pig Club and the pioneering work of Archibald McIndoe is one that the museum is keen to tell. McIndoe himself thought that it should be told, not to glorify his part in the story but to celebrate the bravery of his Guinea Pigs.



The Trustees of the Museum hope to recreate McIndoe's operating theatre from 1939 in a corner of the museum. We have the original operating table along with other items from that period. The scene will be brought to life with a model of the "Boss", as his patients called him.

In order to achieve this we will need to raise in the region of £40,000. This appeal is for the people of East Grinstead and others who think that a permanent reminder of his work in the town is essential so that his legacy is not forgotten.

As Sir Archibald said towards the end of the war:

"We are the trustees of each other, we do well to remember that the privilege of dying for one's country is not equal to the privilege of living for it."

The Guinea Pigs

The Guinea Pig Club was formed on July 20 1941, as a drinking club, by a group of burned airmen, passing time in their newly erected hut, Ward III.

Someone suggested that the "Guinea Pig Club" would be an appropriate name, as these animals were used for medical experimentation, and so were they. Burns treatment and plastic surgery were in their infancy and new methods were being tried on them.

A committee was duly formed with Archibald McIndoe as president. The secretary was a pilot with badly burned fingers, which meant he was excused from writing letters. A man with legs which were badly burned became the treasurer, thus ensuring he could not abscond with the money.

To qualify as a member, patients had to have served with the Allied Air Forces, during WWII, suffered burns or other crash related injuries and undergone at least two operations at the Queen Victoria Hospital.

The aim of the club today is to ensure that the surviving Guinea Pigs or their widows are taken care of, and the name of the club is never forgotten.

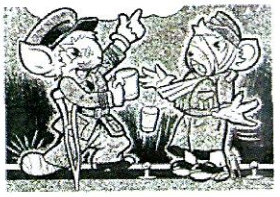


Figure 3 Flyer for East Grinstead Museum's proposed "Rebuilding Bodies and Souls" project.

WHAT IS IT? (March 2014)

Answers:
from the top the scissors are -

i) umbilical cord (American), 20th c.

ii) bandage removal scissors with probe ended blade (Liston's), late 19th c.

iii) fine, for stich removal (Heath's), late 19th c.

iv) tonsillar (Erichsen's), circa 1880.

v) gynaecological (Heywood-Smith's), circa 1885 – the short blades can be angled in relation to the handles by applying a small key (not shown).

WHAT IS IT? (Aug 2015)