Section of Urology

President David M Wallace OBE FRCS

Meeting 26 October 1972

President's Address

New Lamps for Old

by David M Wallace OBE FRCS
(*London*)

The fascination of old instruments is a pleasure that may not be shared by everybody, but all urologists before inventing new instruments should have a knowledge of the development of their present equipment. Our forebears had many good ideas and some of their instruments are things of beauty in their own right.

The earliest attempt at cystoscopy was by Bozzini in 1806 when, in a room that exists today virtually unchanged, he demonstrated his *Lichtleiter*. This instrument, made of silver and protected with shark skin, is at present in the museum of the College of Surgeons in Chicago (Fig 1). The light was a beeswax candle spring-loaded to keep the flame steady, with a silver mirror to reflect the light down the examining tube. The examiner looked past the mirror from behind the instrument. Various attachments allowed inspection of the vulva, the urethra, the rectum, the female bladder and the upper air passages. One of the attachments included a fitting for right-angle observation. Segelas, and Fisher of Boston both suggested endoscopes but none has been preserved. In 1865 Desormeaux of Paris described his endoscope with a lamp burning terebinth, alcohol and paraffin. The examining portions were designed for urethroscopy and proctoscopy. The light was reflected by a mirror down the tube and the examination carried out by observation through a small hole in the centre of the mirror. Two specimens of this instrument have

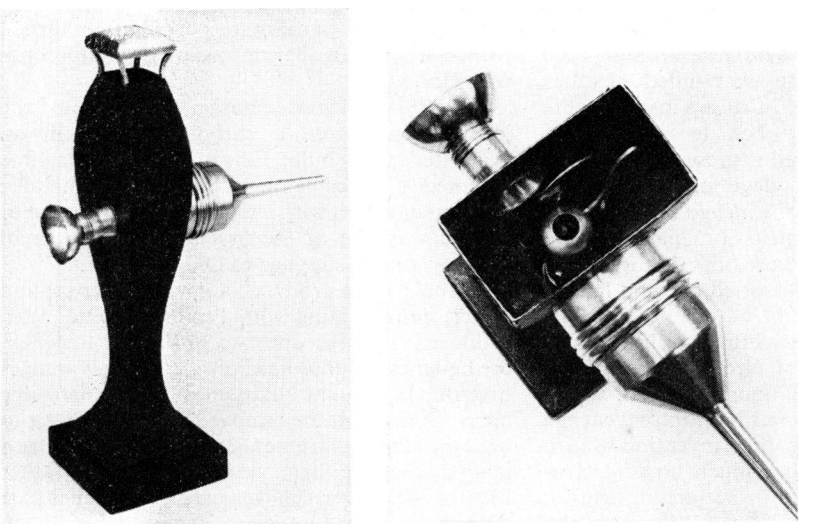

Fig 1 A, B *Bozzini's lichtleiter as used in 1806 and demonstrated in Vienna. (Note the candle and the mirror behind to reflect the light down the sheath)*

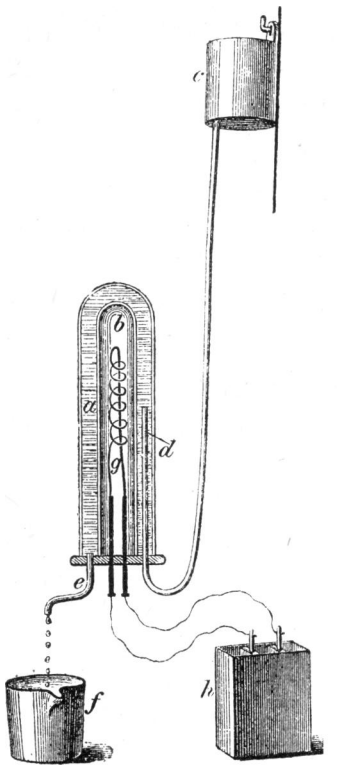

Fig 2 *Bruck's stomatoscope for use in the rectum or vagina. (Reproduced from Fenwick 1888b, by kind permission)*

been discovered, one in Vienna and one in Caracas, Venezuela. Cruise (1865) of Dublin not merely improved the lighting by using the wick on edge to produce a point source, and increasing the intensity by adding camphor, but also by using mirrors and windows on the examining tube was able to examine the water-filled bladder, especially the anterior wall. Cruise's instrument is encased in a mahogany box to prevent the examiner getting burnt and is preserved in working condition in the College of Surgeons in Dublin. Andrews (1867) of Chicago modified this instrument by burning a strip of magnesium wire as a light source – in his words the urethra could be visualized as though dissected out and laid in bright sunlight.

Bruck (1867), a dentist of Breslau, introduced a stomatoscope – the first electrical instrument lit by an incandescent platinum filament, which had to be enclosed in a water bath to prevent the patient being burnt. His first invention was a dental mirror, his second a much larger instrument which was passed into the rectum (Fig 2). By passing at the same time a tube into the bladder he was able to see, by transmitted light, the mucosa of the posterior wall. Schramm of Dresden, a gynæcologist, inserted the same lamp into the vagina, and in a thin woman in a darkened room he was able to see by transillumination the shadows of the ovaries and uterus on the anterior abdominal wall. Schramm's assistant at this time was Max Nitze (Fig 3) who began to experiment with an instrument for urethroscopy and gastroscopy. Deicke of Dresden was unable to make these instruments to the satisfaction of Nitze, who then proceeded in 1879 to Vienna where he joined the clinic of Professor Dittel. Nitze's original instrument of 1876 had a goose quill to protect the platinum filament and was the first, but far from satisfactory, telescopic system to be used endoscopically. Working as assistant to Dittel in his clinic he collaborated for a time with Leiter, the founder of the famous Viennese instrument factory. Dittel gave Nitze complete clinical freedom and allowed him to cystoscope all the patients in his clinic that he wished. Leiter worked for ten months to produce a cystoscope which was demonstrated to the Viennese Academy by both Leiter and Nitze. This instrument, a few models of which are preserved in Vienna, has a flat rectangular window which forms the outer wall of the water jacket. Within is a platinum filament. To use this cystoscope an elaborate system of water cooling was required, and the filament burnt out easily. However, with the telescopic system devised by Nitze and improved by Leiter it was and still is possible to see the interior of the bladder through this instrument.

At this time, in gay Vienna, Nitze was a young and handsome man of 30, who began 'to go other ways', according to Leiter, and he failed to complete the clinical evaluation of the cystoscope with Leiter who had developed and described the technical aspects of the cystoscope. Nitze returned to Berlin where he began to develop cystoscopes with Hartwig.

In 1878–9, Swan demonstrated the use of the incandescent lamp, a carbon filament in an evacuated glass bulb. Edison at the same time patented a similar lamp – at first with a metallic filament and then with a carbon one. Heymann of Vienna was one of the first to make the small mignon lamp as supplied to Leiter in 1887.

In 1887, Nitze produced a new cystoscope, and Leiter, collaborating with Professor Dittel, also produced a cystoscope. According to Fenwick, the Leiter cystoscope had considerable advantages over that of the new Nitze since it had a cartridge lamp which could be removed without having to send the whole instrument back for repair. Nitze's lamp on the other hand was a screw-on unit rather like the Ringleb which was used in the ealier part of this century.

About the same time Newman of Glasgow (1883) passed a lamp into the female bladder, and

Fig 3 *Max Nitze (1848–1906) – the inventor of the cystoscope with the terminal lamp and the telescopic optics.*

by using a tube with a distal window and an ingenious form of obturator, was able to catheterize both ureters in the female. This instrument has not yet been found.

The so-called Nitze-Leiter cystoscope was developed at an extraordinarily rapid rate. A photographic cystoscope was devised which enabled Nitze to take quite reasonable pictures inside the bladder. Operating units, diathermy units, catheterizing units, and multiple other units followed in rapid succession including one that allowed application of radium to the base of a bladder tumour.

Many of these original cystoscopes were optically uncorrected, the view being in fact a mirror image of the object. This was overcome either by the insertion of a prism at the operator's end of the telescope, or, as introduced by Ringleb, the Amici prism which corrected the image at the distal end of the cystoscope.

Endoscopic Operating

One of the earliest instruments for transurethral operating was the Bottini prostatotome which was used at the end of the nineteenth century in Italy to cut the bladder neck in patients with enlarged prostates. The operative mortality as reported by Bottini (1874) was 4%. The platinum blade was heated by means of a galvanic current and, by using it as a cautery knife, it was able to cut through the bladder neck. A similar instrument but fitted with a telescope contained a knife which could be elevated or retracted, advanced or retarded. This instrument is in the Institute of Urology collection; it was made in Berlin but has not yet been identified.

The use of the cold punch had been known and used for lesions in the urethra in Russia in about 1865 by a surgeon named Ebermann. Hugh Young (1913) rediscovered this principle and one of his earliest punches in the collection has the characteristic two prongs in the beak of the instrument to engage in the bladder neck. The instrument was reinforced by a steel plate on the back and the blade was then rammed forward without any visual control. The second instrument in this collection has been fitted with a telescope and a lamp which is housed in the spine of the instrument. The punch was therefore carried out under direct vision. It was obvious that one of the problems encountered by Young was that of bleeding, because the next punch was Caulk's cautery punch where an irido-platinum band was heated by the galvanic current and burnt its way through the prostate by means of heat. The Braasch cystoscope, a direct-vision instrument using a column of water to transmit the vision, was the trainer for the Braasch Bumpus punch. This punch with its terminal lamp had a cluster of needles which could be plunged into the substance of the prostate and the tissue coagulated. These needles were then removed and a cutting blade was rammed through the charred tissue. The introduction, however, of the Gershwin Thompson punch at the Mayo Clinic is the penultimate model in the punch series. This instrument has the reputation of having made more money than any other instrument in the whole of surgery.

Resectoscopes

It is not generally realized that the major delay in the development of endoscopic surgery was an inability to cut, using diathermy, under water. In the late 1920s Canny Ryall and Millin were both using modified cystoscopes to cut through the prostate, with liquid paraffin as a medium. Stern in America devised a form of resectoscope with an opening on the side of the sheath and incorporating a diathermy loop. This was subsequently modified by McCarthy who realized that the open-ended sheath was more effective than a sheath with a side window. The resectoscope has undergone many modifications in actual mechanism and optics. Ogier Ward introduced a modification whereby as the loop came towards the sheath the telescope retracted at the same time. He also introduced a ramp which allowed the loop to be inserted more deeply into the prostate. For twenty years, however, the simple mechanism

of the Stern McCarthy resectoscope was not in any way modified, although in the last twenty years numerous modifications by Baumrucker, Iglesia, Mitchell, Semple and Nesbit have all found considerable favour.

The Advent of Fibre Optics

Strange though it may seem, the principle of fibre optics was first announced to the Royal Society in London where Tindall demonstrated in 1872 that, by using internal reflection, light could be made to bend round corners. However, little was done about this until 1951 when Hopkins introduced the principle of coating fibres of glass with an outer layer of glass which had a different refractive index. This ensured internal reflection of the light. The introduction of these glass fibres as noncoherent fibres has done more to facilitate the examination of the bladder than many inventions of this century. By bringing the light back to the operator's end of the cystoscope we have completed a full circle so that we are once again in the era of Bozzini where the light is placed outside the patient and is transmitted into the bladder by physical means. The most recent evolution in the optical system was again due to Hopkins who in 1956 demonstrated to the British Association of Urological Surgeons in Glasgow his new solid rod lens system, which has subsequently been adopted by Stortz. This lens system, which is yet another milestone on the road to perfect endoscopy, used solid rods of glass with small spaces between them to act as a lens. The improved optics of this system has contributed markedly to better visualization and even to photography of the interior of the bladder.

REFERENCES

Andrews E (1867) *Canada Medical Journal and Monthly Record of Medical and Surgical Science* **3**, 461
Bottini (1874) Di un nuovo cauterizzatore ed incisore termo galvanico contro le iscurie da ipertrofia prostatica. Galyani **2**, 437
Bozzini P (1806) *Journal der Practischen Arzneykunde und Wundarzneykunst* **24**, 107
Bruck (1867) Das Urethroscop und das Stomatoscop zur Durchleuchtung der Blase und der Zähne und ihrer Nachbartheile durch galvanisches Gluhlicht. Breslau
Cruise F R
(1865) *Dublin Quarterly Journal of Medical Science* **39**, 329–363
Desormeaux A J (1865) De l'endoscope et de ses applications au diagnostic et au traitement des affections de l'urèthre et de la vessie. Paris
Ebermann
(1865) *St Petersburger Medicinische Wochenschrift* **8**, 252; **9**, 327
Fenwick E H
(1888a) *British Medical Journal* i, 193, 462
(1888b) The Electric Illumination of the Bladder and Urethra as a Means of Diagnosis of Obscure Vesicourethral Diseases. Churchill, London
Leiter (1880) Elektro Endoskopische Instrumente. Wien
Nitze M (1887) *Archiv für Klinische Chirurgie* **36**, 661–732
Newman D
(1883) *Glasgow Medical Journal* **20**, 81–139
(1888) Lectures to Practitioners on the Diseases of the Kidney Amenable to Surgical Treatment. London
Young H H
(1913) *Journal of the American Medical Association* **60**, 253