The electric illumination of the bladder and urethra as a means of diagnosis of obscure vesico-urethral diseases / by E. Hurry Fenwick.

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OF THE

BLADDER AND URETHRA

AS A MEANS OF

DIAGNOSIS OF OBSCURE VESICO-URETHRAL DISEASES

BY

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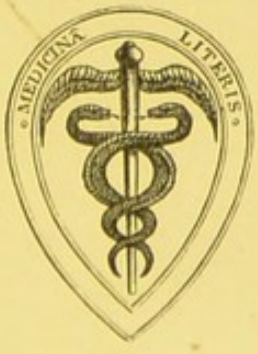
WITH THIRTY ILLUSTRATIONS



LONDON
J. & A. CHURCHILL
11, NEW BURLINGTON STREET
1888

TO

MY COLLEAGUES

AT

ST. PETER'S HOSPITAL FOR URINARY DISEASES

PREFACE.

THE following pages embrace the substance of two clinical lectures which I delivered at the commencement of this year at the London Hospital (January 27th) and at St. Peter's Hospital for Urinary Diseases (February 15th) upon the value of electric illumination of the bladder and urethra in the diagnosis of obscure vesico-urethral diseases (the Nitze method). I had previously demonstrated the construction of the instruments required for carrying out the examinations,—the Nitze incandescent-lamp cystoscope; the Leiter incandescent-lamp cystoscope; the Leiter incandescent-lamp urethroscope, and Schall's batteries, at a meeting of the Medical Society, January 23rd. I attempted in this way to draw attention to the great improvement which had taken place in the cumbersome Nitze-Leiter instruments of 1879* by the substitu-

* Introduced into this country by Sir H. Thompson, 'Lancet,' 1880, April, p. 529.

tion of an incandescent lamp for the platinum loop. From my experience of the *new* instruments I was convinced that we had arrived at an important epoch in the diagnosis and treatment of diseases of the bladder and urethra, which had, curiously enough, been completely overlooked in this country. The cystoscope of 1879 has the same relation to that of 1887 as the "Puffing Billy" of Stephenson to later locomotives; and though, doubtless, we have not reached its perfect completion, yet it is sufficiently practical to become an indispensable factor in the diagnosis of obscure diseases of the urinary tract. I have to cordially acknowledge the courtesy of Dr. Nitze (the able originator of the method) for permitting me to copy the cystoscopic pictures adorning his article on electric cystoscopy.* I have used them in my lectures, and have inserted three (Figs. 19, 22, 23) in the following pages. I am, moreover, much indebted to Mr. Leiter, of Vienna, for allowing me to use woodcuts from his 'Handbook of Electric Illumination'† to illustrate the construction of the instruments.

* Dr. Nitze, "Beiträge zur Endoskopie," 'Langenbeck's Archiv,' vol. xxxvi, Heft 3.

† Josef Leiter, 'Elektro-endoskopische Instrumente,' 1880, Wien.

Bearing in mind the acrimonious dispute between Türck and Czermak over the laryngoscope, imitated by a somewhat similar and much-to-be deplored controversy between Dr. Nitze and Mr. Leiter concerning the cystoscope, I have avoided any participation in so needless a disagreement by quoting directly from the literature of the subject. The appearance of this work as a guide to electric cystoscopy and urethroscopy will be, I trust, condoned when it is realised that many volumes upon the ophthalmoscope, laryngoscope, and otoscope enrich the literature of these specialities; but that with the exception of Dr. Nitze's article, none at present describe the use and the capabilities of electric light in affording us a direct visual diagnosis of diseases of the bladder and urethra without a cutting operation.

E. HURRY FENWICK.

5, Old Burlington Street;
April 10*th*, 1888.

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CHAPTER VI.

ON

ELECTRIC ENDOSCOPY.

CHAPTER I.

THE HISTORY OF VESICO-URETHRAL ENDOSCOPY.

It will be found on reference to the abundant literature of endoscopy that the history of its progress falls without effort into three distinct periods. The opening of each period is a measureable advance upon the progress of its predecessor.

The first period commenced in 1805 with the invention by Dr. Bozzini,* of Frankfurt, of an apparatus which he termed the light conductor (Lichtleiter). Although the instrument was condemned by the Medical Faculty of Vienna on the ground of insufficient illumination, yet the idea was grasped by the profession, and the method

* Bozzini, "Lichtleiter, eine Erfindung zur anschuung innerer Theile und Krankheiten," 'Journ. d. prakt. Arznk. u. Wundarznk.,' Berlin, 1806, xxiv, 107—124.

found many imitators. Thus, John Fisher, in 1824, completed an instrument which was identical in principle and almost similar in construction with that of Desormeaux's. Ségalas, to whom Desormeaux wrongly accords the merit of originating the principles of endoscopy, followed Fisher with a speculum urethrocysticum. Bombalgini, John Avery, of London, Cazenave, of Paris, Gessler, Malherbe, Espezel, all added to the literature of the subject and attempted to improve the instruments for visual examination of the urethra and bladder.

The second period was opened in 1853 by Desormeaux, "the father of endoscopy," as Warwick has called him. Desormeaux laid the first practical endoscope before the Academy of Medicine at Paris, and his powerful and enthusiastic advocacy did much to favour the development of the science. Furstenheim made the endoscope popular in Germany. In 1865 Cruise,* of Dublin, made an important improvement in Desormeaux's endoscope. This consisted in concentrating upon a reflector *the edge of a flat flame* of an ordinary petroleum lamp.

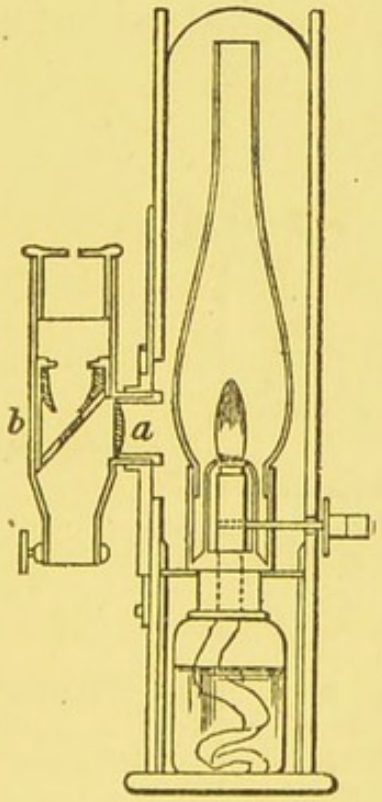
Camphor was mixed with the petroleum (gr.

* Cruise, 'Dublin Quarterly Journal,' May 1st, 1865.

x ad ℥j) to increase the brilliancy of the light, and an extra tall chimney was added to produce a steady flame. As this endoscope is typical of this period we shall describe it in Mr. Cruise's own words.

Fig. 1 shows it in sectional view. It consists of a lantern, in the interior of which the lamp is

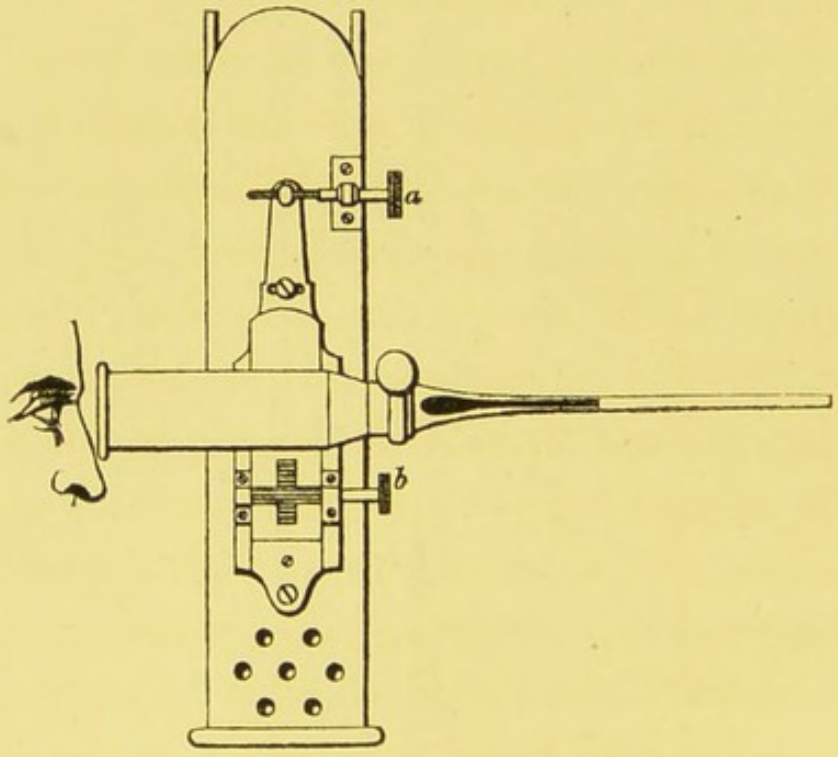
Fig. 1.



suspended by means of a diaphragm, which slides in grooves and holds it perfectly steady. The lamp is so placed when in the lantern that the *edge* of the flame is opposite the aperture of the

tube, *a*. This tube rotates freely in the socket which receives it, and carries the condensing lens. It is attached at right angles to another tube, *b*, which, in the woodcut, for clearness' sake is represented in the vertical position. This latter tube holds the perforated mirror, and terminates at one end in a socket, which, by means of a thumb-screw,

FIG. 1 A.



can be fitted to the various exploring specula; while at the other extremity is placed an eye-piece through which the observer looks. Although represented in Fig. 1 in the vertical position in

order to show a section of its interior, in use it is kept as nearly as possible horizontal, as delineated in Fig. 1 A. In order to protect the observer's eye from glare as much as possible, a conical diaphragm with a very minute aperture is placed directly behind the perforated mirror, and the interior of the apparatus and specula is carefully blackened. To suit myopic and presbyopic eyes adjusting glasses are provided, and, when required, take the place of the eye-piece.

To prevent inconvenience from the great heat evolved by this powerful light the lantern is made of mahogany, and consequently never becomes so warm as to inconvenience the hand; were it of metal it would soon be impossible even to touch it. This end is further carried out by having the top open, and air-holes perforated in the lower part of its sides (*vide* Fig. 1 A) and in the diaphragm. These arrangements produce a constant draught of cool air through the apparatus, which has the additional good effect of steadying and intensifying the flame.

The mode of adjustment of the condensing lens and mirror to the pencil of light given off by the edge of the flame is the next point to be explained. The tube, *a* (Fig. 1), is received into a socket,

wherein it freely rotates; this socket is mounted on a doubly shifting stage, the mechanism of which will be best understood by reference to Fig. 1 A. It admits, as may easily be seen, of two motions, right and left, governed by the tangent screw, *a*; up and down, regulated by the rack and pinion, *b*. By this contrivance the lens can be easily shifted about as required. The height of the flame itself is regulated by the button, *c* (Fig. 1 A), and requires special attention.*

Soon after Cruise had perfected the instrument Christopher Heath used it at the Lock Hospital in London, and introduced it to the profession in England. Following Heath is a long list of contributors to the subject: H. Thompson, Pridgin Teale, Henry Dick, Burnstead, Brunton (otoscope), Mallez, Tarnowsky, Stein (photoendoskop), Wales, Ebermann, Rider, Emmert, Fenger, Weir, Lee, Couriard, Grünfeld† and others.

Langlebert produced a very much simpler urethroscope in 1868, which could be used with daylight, lamp, or candle. Probably Langlebert's urethroscope was a model of Warwick's in 1867.

* Cruise, 'Dublin Quarterly Journal,' May 1st, 1865.

† We are indebted to Grünfeld's article, "Das Endoskop." Wiener Klinik, 1877, for many references to the literature and much sound knowledge.

With certain changes in the reflection of the light from plane or concave mirrors, and in the source of light, as gas, magnesium light, oxycalcium or Drummond light, sunlight, daylight, candle, and lamp, the endoscope underwent but little modification until the commencement of our *third period*, the electrical, in 1879.

CHAPTER II.

THE ELECTRICAL PERIOD.

The Platinum Loop.

ALTHOUGH to Dr. Max Nitze belongs the honour and the credit of introducing the method of employing the electric light in the illumination of the deeper cavities of the body, such as the stomach and bladder, for diagnostic purposes; yet the successful use of electric light in endoscopy, and even the method of its production, was by no means an innovation in 1879. Fifteen years prior to the date of Dr. Nitze's original experiments, Bruck,* of Breslau, a dentist, had conceived the brilliant idea of utilising a platinum loop, maintained at a white heat by means of a galvanic current, as the source of light for examining the mouth. He constructed and successfully used an instrument of this kind which he called the

* Bruck, "Das Urethroscop und das Stomatoscop zur durchleuchtung der Blase und der Zähne und ihrer Nachbartheile durch galvanisches Glühlicht," Breslau, 1867.

stomatoscope. He even advocated the use of the electric light in examination of the rectum and bladder; but the diaphanoscope which he designed for this purpose was tried at the Vienna Hospital and found to be unpractical. The method was forgotten, and the instrument fell into unmerited disuse. The construction of Bruck's diaphanoscope is of the simplest, and as Dr. Nitze's and the Nitze-Leiter instruments are modelled upon the same principle, it will not be out of place to introduce it here by way of illustration.

Bruck's diaphanoscope is represented in Fig. 2.

It will be seen that the incandescent loop of platinum, *g*, is surrounded and kept cool by a water cylinder, *a*, which is supplied with a continual stream of cold water from the cistern, *c*, through the pipe, *d*; *h* is the battery generating the galvanic current.

Dr. Schramm, of Dresden also, to whom Dr. Nitze was assistant, and from whom may be Dr. Nitze received the idea of the platinum loop, had caused a similar instrument to be constructed for diaphanoscopy of the ovaries. The intention was to cause a light placed in the vagina to traverse the abdomen, and to allow the physician to distinguish the outline of, and to notice any change in,

FIG. 2.

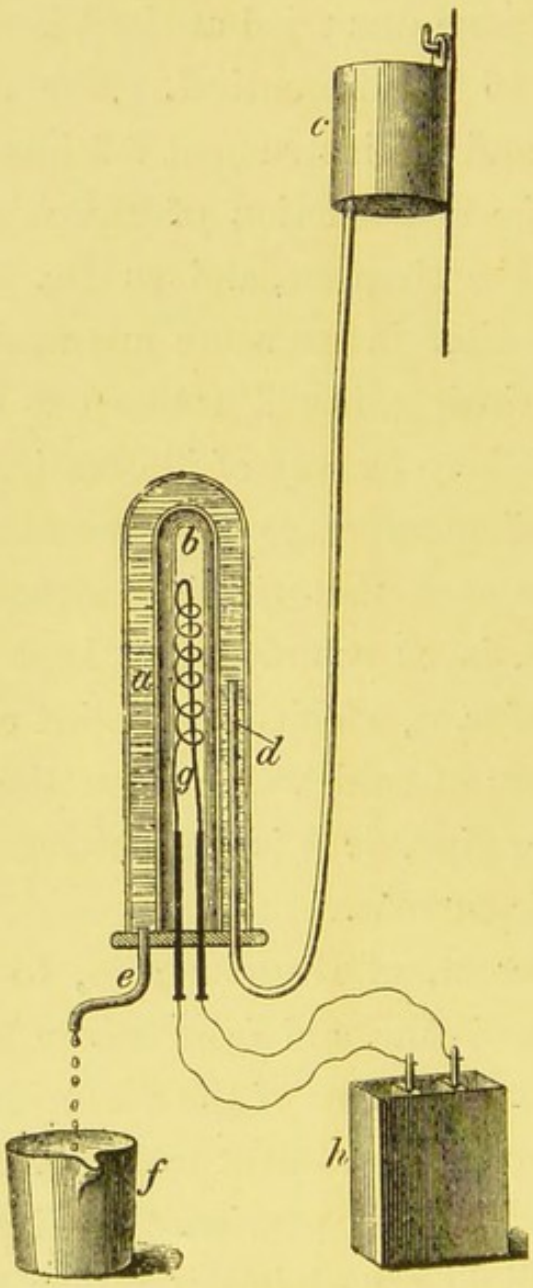
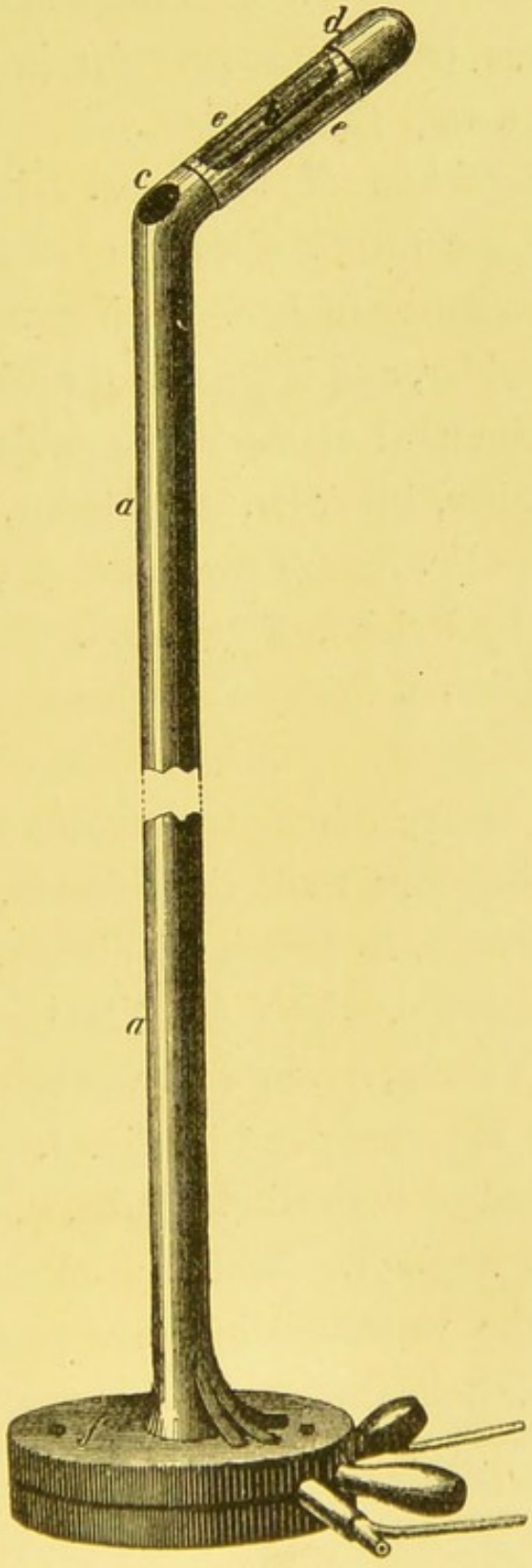


FIG. 3.



the size of the ovary by means of the transmitted light. I have been given to understand that the attempt was partially successful in a darkened room with a very thin subject.

*In the middle of 1876 Dr. Nitze had the skeleton of the future electric cystoscope ready, and in the autumn of 1877 the instrument for the urethra, bladder, and larynx so far advanced that they could be used on the living subject.

In December, 1877, Dr. Oberländer, of Dresden, began to use Dr. Nitze's urethroscope, which had been made by Deicke, of Dresden. But the practical completion of the cystoscope and gastroscope presented difficulties with which the Dresden instrument maker Deicke was unable to cope, and Dr. Nitze therefore took these latter, as well as the urethroscope, to Leiter, of Vienna.

The cystoscope, which Dr. Nitze submitted to Leiter,† of Vienna, to improve, was constructed as follows. It is represented in Fig. 3.

It consisted of the catheter tube, *a*, which was bent at the angle *c*. Both the electric connections and the water-cooling arrangements were

* Oberländer, 'Berlin klin. Wochenschr.,' 1879, No. 48.

† We give these and other details so as to avoid taking any part in the acrimonious dispute as to the authorship of the cystoscope.

very complicated. Thus, along the outside of the concave surface of the round tube two triangular tubes were soldered on; these communicated together at the end-piece, *d*. A third metal tube was fastened in the same way between these two tubes. Into this latter tube a fourth one, insulated by means of a silk covering, was slipped. This fourth tube was for the wire connecting the battery and the platinum loop in the end of the instrument, *b*. The platinum loop was protected by a piece of quill, *e e*. A telescope tube had to be pushed down the length of the instrument until it reached the window, *c*. The principle failings in the instrument consisted (1) in the complicated water-cooling apparatus; (2) in the sharply oval shape of this five-tube catheter; (3) in the quill piece being insufficient to protect the platinum loop from the water in the bladder; (4) in the non-transparency of the quill; (5) in the fact that the quill was apt to get burnt by the heat just at that spot where translucency was needed; (6) the window of the straight tube not being closed, the lenses of the telescope readily got soiled by the water in the bladder and impeded a clear view.

This, then, was Dr. Nitze's original cystoscope, and it will immediately be seen that Leiter, to

whom it was entrusted, has simplified and perfected the water cooling arrangements, besides increasing the capabilities of the light. These improvements were at the cost of ten months of painstaking and expensive labour. As Dr. Nitze himself remarked before the Medical Society at Vienna,* "between the conception of an instrument and its practical completion there is a long and difficult path," yet that way was trodden by Leiter, and the honour of practically completing

* 'Wiener Med. Presse,' 1879, No. 26. "Ich halte es für meine Pflicht, an dieser Stelle einer Anzahl von Herren in dankbarer Weise zu erwähnen, die sich um die Anfertigung der Instrumente die grössten Verdienste erworben haben. Zwischen der Idee, meine Herren, zwischen der Konzeption eines Instrumentes und zwischen der vollkommen gebrauchsfähigen Darstellung desselben liegt oft noch ein weiter und schwieriger Weg. Ehe ich nach Wien kam, waren die Instrumente noch in mancher Hinsicht unvollkommen, unzuverlässig und liessen in der äusseren Form noch Manches zu wünschen übrig. Die wirkliche Vollendung der vorliegenden Instrumente durch die wichtigsten konstruktiven Veränderungen ist das nicht hoch genug anzuschlagende Verdienst des Herrn Leiter, der schon seit 10 Monaten seine ganze Kraft und Energie einsetzt und vor keinem Opfer zurückscheut, um die Instrumente möglichst brauchbar und vollkommen herzustellen. . . . Herr Leiter wird die Instrumente demonstriren und er ist ja um so berufener dazu, als ein Theil der jetzigen Konstruction *sein eigenstes geistiges Eigenthum ist*," u. s. w. Compare a stronger expression of Dr. Nitze's appreciation in 'Wiener Medizinische Wochen,' No. 25, 1879, p. 688.

the brilliant innovation of Dr. Nitze is due to Leiter, and the profession, as a recognition of the patience, skill, and ingenuity of the latter, have linked his name with that of Dr. Nitze in the designation of the electric cystoscope of 1879.

The Nitze-Leiter Cystoscope of 1879.

Although this instrument is very similar in outward appearance to the Nitze cystoscope (Fig. 3), it differs very greatly from it in its internal arrangement. We shall therefore explain its construction in detail, and also describe here its necessary accompaniments, viz., the water-cooling apparatus and Bunsen battery, so as to avoid repetition of these latter in the chapter upon the Nitze-Leiter urethroscope (Chap. V).

1. *The Cystoscope.*—The instrument has the form of a calculus sound, of 21 French catheter gauge, with a sharp elbow and a longish beak (Figs. 4 and 5). Two forms are necessary, one (Fig. 4) is for the examination of the neck, anterior wall, and sides of the bladder, and the other (Fig. 5) is for the posterior wall and base. These instruments, however, agree in form and differ merely in the

Fig. 4.

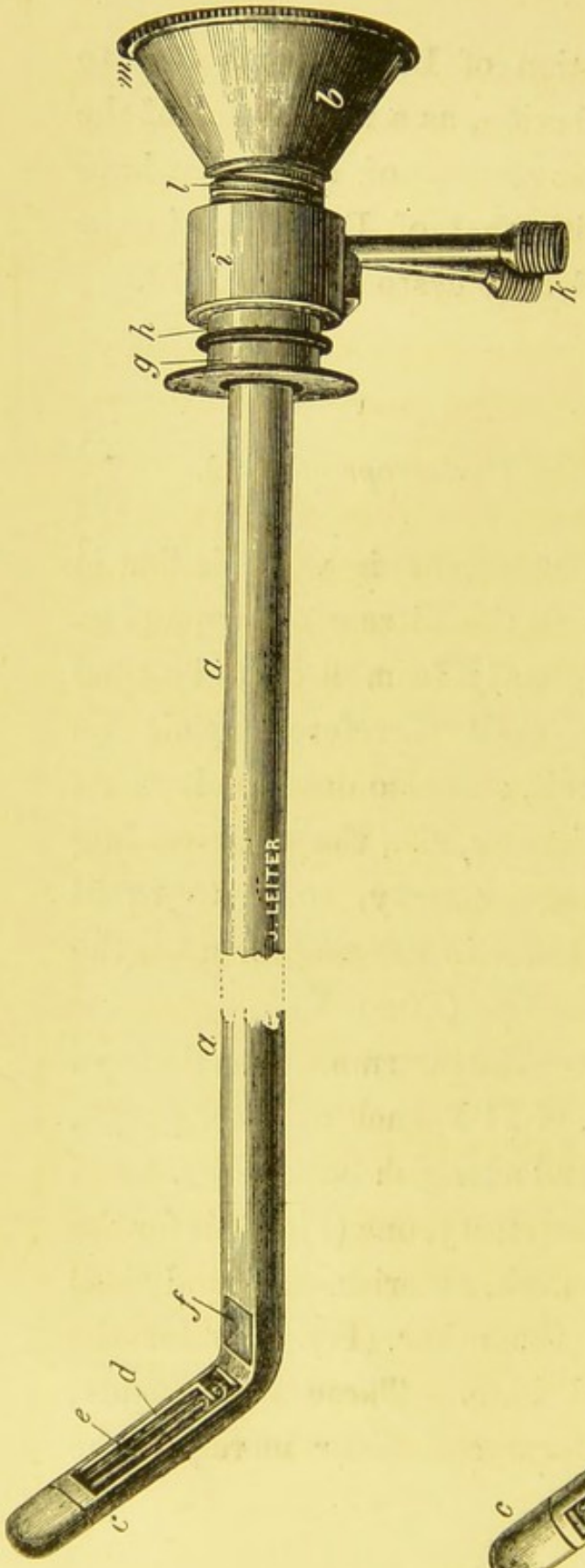
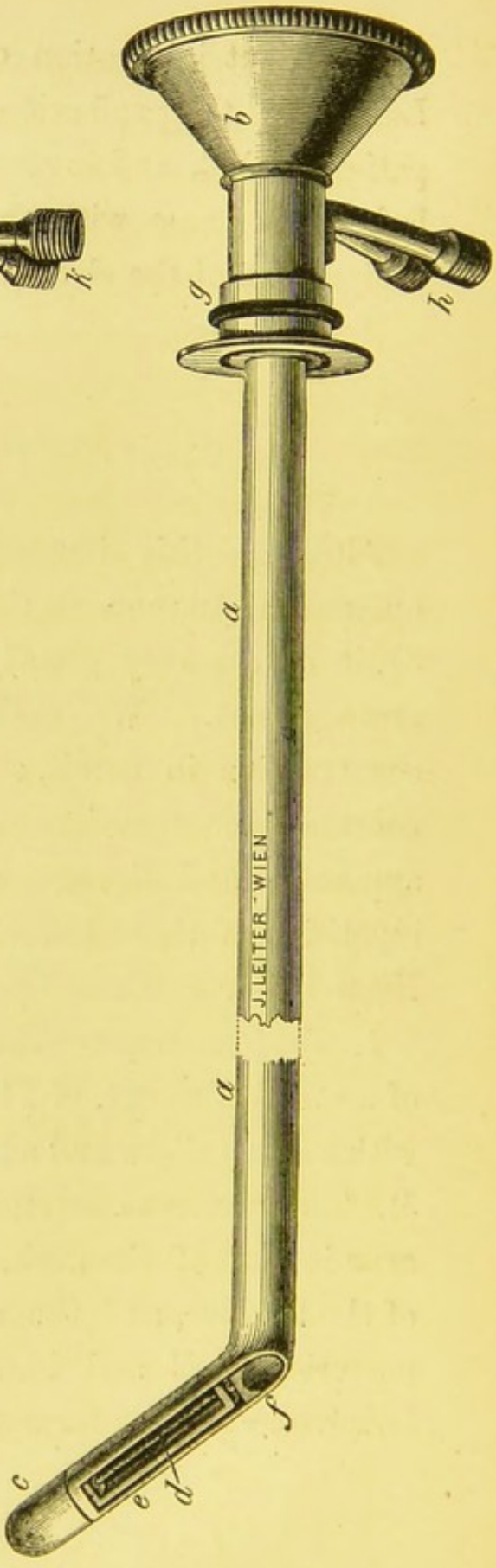


Fig. 5.



position of the light and the arrangement of the lens and windows. Thus, in Fig. 4 the light (*e*) and the window (*f*) are in the concavity, and in Fig. 5 the light and the window are in the convexity of the beak and elbow.

Both instruments are made up of three sections :

A. The beak (*c*), which carries the electric lamp.

B. The body or shaft (*a a*), which contains the telescope or ocular tubes and the water-cooling tubes, and conveys the insulated wire from the battery to the lamp. It is furnished with a window at the elbow(*f*).

C. The ocular end (*b*), which is furnished with binding screws for the battery wires and funnels for the water reservoir tubes.

These sections have now to be considered in detail.

A. The Beak (Fig. 6).

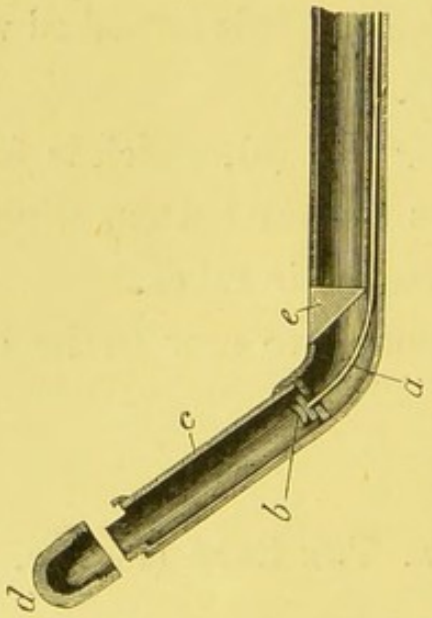
The entire beak is occupied by the source of light,—the platinum wire. The wire itself has been removed in Fig. 6 for the sake of clearness, but it is seen in Fig. 4 (*e*) or Fig. 5 (*d*).

The end of the wire rests upon the little cup,

b, Fig. 6, and thus comes into connection with the battery by means of the insulated wire, *a*, Fig. 6. The other end is kept pressed against the inner wall of the beak; the wall forming a conducting path for the current and thus completing the circuit.

This platinum wire lamp is almost surrounded by a water compartment which is formed by the junction of the two water canals passing along the shaft. The beak has an elongated oval aperture in it 20 mm. long (Fig. 4, *d*), for the exit of the

FIG. 6.



rays of light emitted by the platinum lamp. The aperture is securely closed by a solid piece of rock crystal. The beak terminates in a cup, *d*, Fig. 6 (Figs. 4 and 5, *e*), which can be screwed off and on in order to allow of access to the platinum wire.

B. The Shaft.

B. The shaft or body of the cystoscope is little more than five inches in length, and is of 21 French catheter gauge in size. It is divided into four compartments (Fig. 7). The largest of these is the centrally placed telescope tube, which extends from the window at the elbow to the ocular or external end. It measures 5 mm. across, and is provided with a system of lenses at either end and in the middle like a microscope, for increasing the size of the image refracted through the window prism (*f*, Fig. 4; *e*, Fig. 6). Along one side of this telescope tube are placed two water canals or compartments (Fig. 7), which unite, as

Fig. 7.

we have just mentioned, in the beak. The shaft has, moreover, an insulated compartment for the conveyance of the conducting wire for the platinum loop. This is placed between the two water canals. The window is furnished with a prism

(Fig. 6, *e*) to refract the entering rays of light directed along the shaft to the observer's eye.

c. The ocular end is furnished with the funnel-tubes (*h*, Fig. 5), which place the water canals and terminal compartments of the cystoscope in open communication with the water reservoir, so that a continuous stream of cold water can be made, under pressure, to traverse the length of the instrument and effectually absorb the great heat emitted by the platinum loop when in action. The ocular end also possesses a grip or binding screw for the attachment of the connecting cords from the battery—one of these connecting cords is placed in contact with the insulated wire in the shaft of the cystoscope and the other is attached to the metal wall of the instrument which serves as the completer of the circuit.

A small knob on the ocular ring serves to show the position of the beak.

2. *The Water-Cooling Apparatus.*

The heat which is evolved by the platinum loop is so great that a water-cooling apparatus is absolutely indispensable. We have just described the channels through which the water may enter the

cystoscope, traverse its shaft, surround the lamp, and pass off, after absorbing the heat of the lamp, by means of an exit tube, *h*. It is obvious, however, that a large amount of water pressure is requisite in order to obtain a continuous current of cold water through such narrow and tortuous tubes. To secure an uninterrupted flow the water reservoir has either to be greatly elevated, or the water has to be driven up out of a tank placed on the floor by means of appropriate pressure. The former method is less complicated, and Fig. 8 shows the apparatus which was generally supplied. From the reservoir, *d*, which could be raised or lowered by means of a pulley, the water is carried to *c*, where the force of the current could be regulated by means of a tap before it traversed the cystoscope or urethroscope (*i*). The outfall was allowed to drop into the receiver, *l*.

A less cumbersome but more complicated water apparatus was subsequently made. It is represented in Fig. 9. It will be seen that the water in the reservoir is forced upward through the tube, *i*, by the pressure of a heavy plunger weight, *bg*. It will be observed that once filled, the reservoir is self-feeding, for the plunger weight is so valved that it offers no obstruction to the re-accu

Fig. 8.

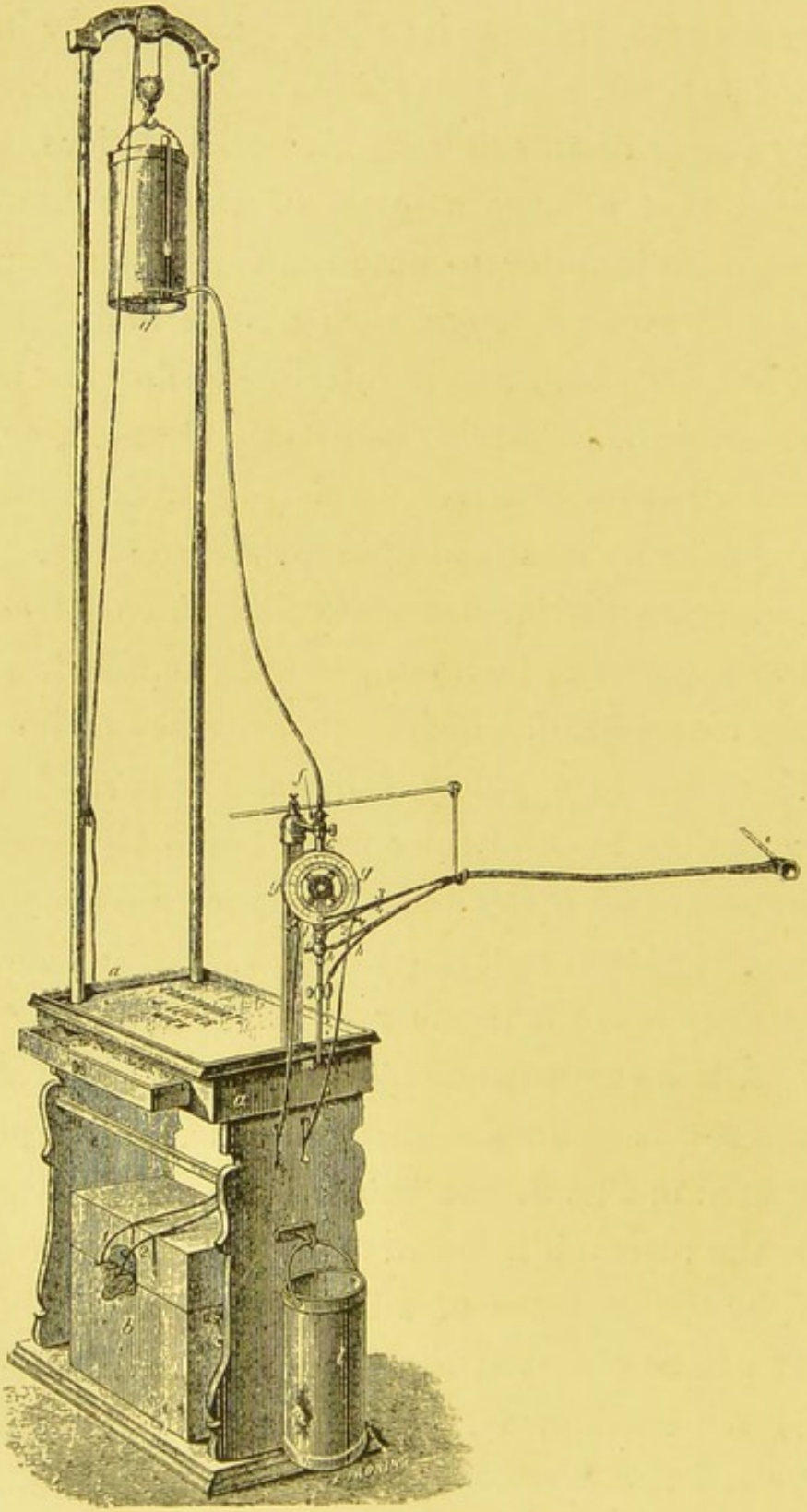
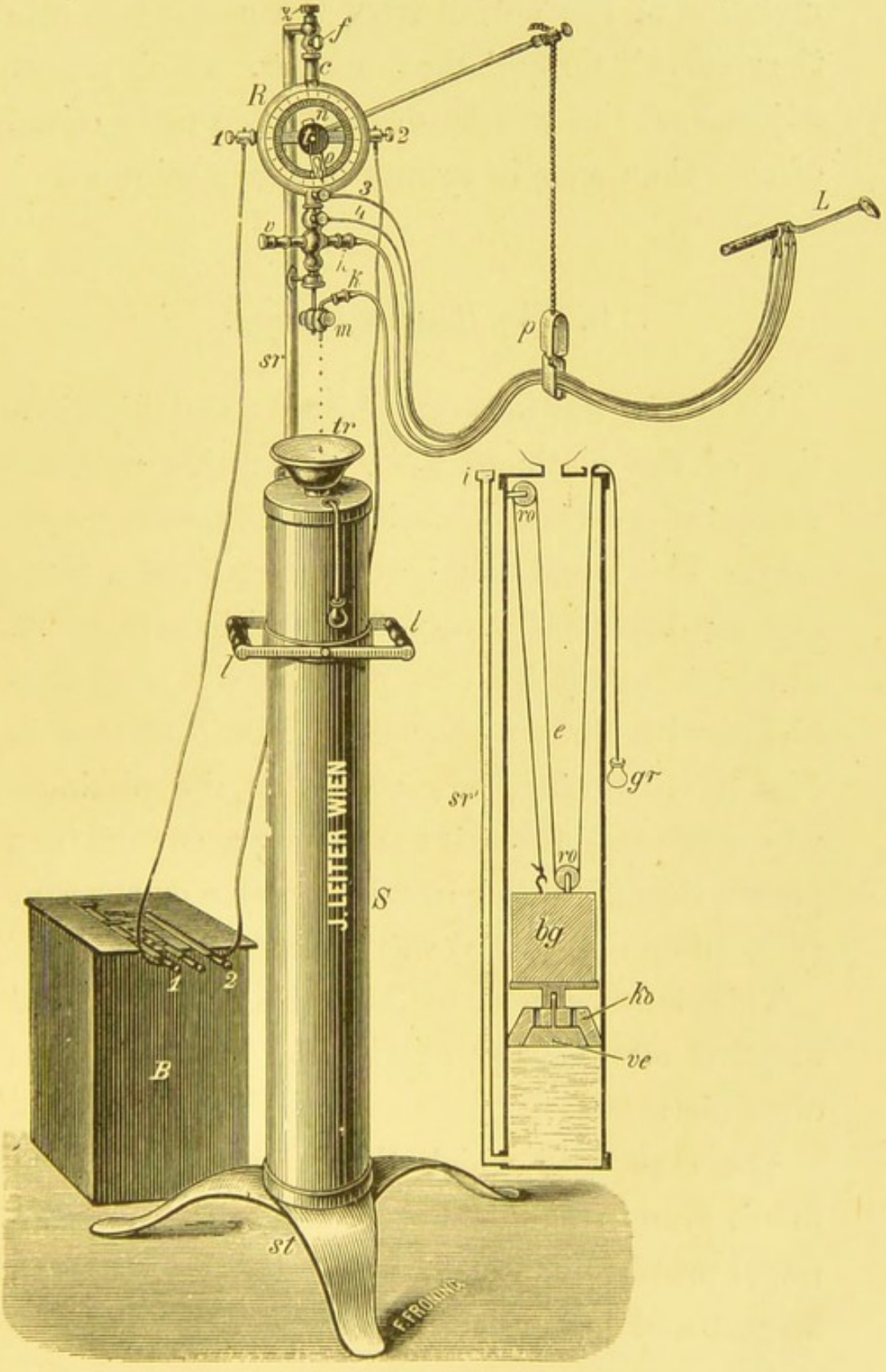


FIG. 9.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J. LEITER WIEN

mulation of the outfall from the cystoscope into the reservoir through the funnel, *tr.* With proper adjustment the weight did not need to be raised oftener than once in twenty or thirty minutes.

3. *The Bunsen Battery.*

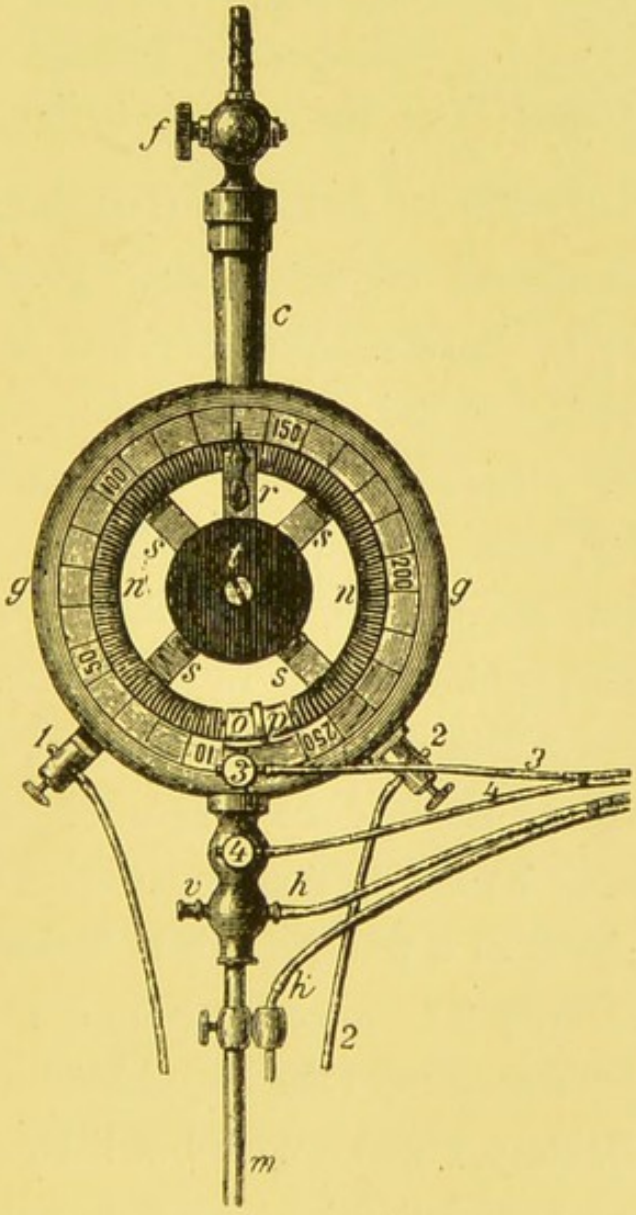
To obtain the necessary heating and illumination of the platinum wire, an equable constant current of a certain intensity was of course necessary. This could only be obtained from a large and cumbersome battery fitted with a rheostat. The best battery for this purpose was that furnished with Bunsen elements. It will be seen in Fig. 8, *b*. Seeing, moreover, that the platinum wire was easily fused if too strong a current was passed through it, a current regulator or rheostat (Fig. 10 or Fig. 8, *g g*) was indispensable.

This battery had to be refilled before, and emptied after every operation. Its smell was often distressing.

The ease with which the platinum loop was fused, even in skilled hands, and with the additional protection of a good rheostat (Fig. 10), can be gathered from a letter which Mr. Schall wrote

to the 'Lancet' on February 11, 1888. Mr. Schall had to repair the platinum loop of a cystoscope nearly every week for two years. The

Fig. 10.



instrument belonged to a distinguished German specialist who persevered in its use, and though

well skilled in galvanic technique could not avoid the almost weekly fusion of the lamp. The instrument therefore was rarely out of the hands of a skilled mechanician.

The Capabilities of the Nitze-Leiter Cystoscope.

Directly the Nitze-Leiter Cystoscope appeared, its fame spread far and wide. Professional men in every civilized nation hastened to accord it a fair trial. Some wrote an account about its powers, others exhibited the instrument, few, however, persevered in its use.

Dittel, Nicoladoni, Ultzmann, Maas, and Oberländer all spoke warmly in its favour. Sir Henry Thompson brought it before the Royal Medical and Chirurgical Society in England. Roswell Park advocated its use in America. It was even made the subject of a monograph in Tokio.*

Sir Henry Thompson, whilst demonstrating its use upon a patient at the Royal Medical and Chirurgical Society,† spoke with but little enthusiasm of its powers, and plainly indicated its greatest defect in saying " that he was indebted to Mr. Weiss for

* Tano, S., " On the Endoscope," Iji. Shinbun Tokio, 1880.

† 'Lancet,' p. 529, April, 1880.

his intelligent and careful management of the apparatus, since it was essential for this, as well as for its maintenance in good working order, that it should be under the care of a person well versed in the use of galvanic apparatus, and competent to adjust or repair if necessary the very delicate details which formed the essential parts of this somewhat complicated but very complete instrument." It was evident that an instrument which needed the constant supervision of a skilled mechanician would find but little favour with practical surgeons, and Sir Henry Thompson struck the key-note of its subsequent disfavour in the words we have just quoted.

In a lecture on the "Diagnosis of Surgical Urinary Disease,"* Sir H. Thompson gave his opinion upon the instrument in the following words: "There are some morbid conditions the existence of which we sometimes suspect but cannot positively affirm to exist, whose presence may now be ascertained through the agency of the new endoscope (the Nitze-Leiter). I refer to the identification of sacculated stone as the cause of persisting and unrelieved symptoms; to the

* 'Lancet,' Dec. 6th, 1879, p. 823, pl. 2.

detection of pedunculated growth, and of villous disease of the bladder removable by operation; and, lastly, to the investigation of the nature of foreign bodies other than calculi which have become lodged there. All these cases are, however, more or less rare; nevertheless *it is our duty** to be provided with every resource, whatever it may be, which enables us to deal more effectively than heretofore with conditions on the management of which grave issues depend. . . . . I have lately seen a fatal case of vesical growth which might have been easily removed by operation; in such a case the new endoscope may possibly render essential service."

Unfortunately, however, the Nitze-Leiter cystoscope does not seem to have fulfilled the expectations which were raised by its introducer. In a series of forty-three cases of obscure vesical disease which commenced in 1880, and which comprised twenty cases of vesical growth, Sir H. Thompson does not once make mention of the use of the endoscope which he had in his possession, but resorted to digital exploration for diagnostic purposes instead.†

* The italics are our own.

† 'Tumours of the Bladder,' 1884.

We learn also from other sources, that another Nitze-Leiter instrument was obtained by Khrone and Sesemann, of Duke Street, W., that it was tried at a hospital and returned the second day afterwards with the platinum wire fused and a note to the effect that the instrument was too complicated for practical purposes.

John Weiss and Son write* also to the 'Lancet,' February 4th, 1888, to say that they have still the original instrument shown at the Royal Medical and Chirurgical Society in 1879 in their possession.

The reason why the Nitze-Leiter cystoscope failed to receive recognition will be realised by anyone looking at Figs. 8 or 9. Its cumbersomeness can thus be estimated at a glance. We have said sufficient to prove its extreme complication, and it only remains for us to add that its working was decidedly fickle and its cost a very great one.

* 'Lancet,' "Electric Illumination of the Male Bladder."

CHAPTER III.

THE INCANDESCENT-LAMP CYSTOSCOPE OF 1887.

At the time of the construction of the Nitze-Leiter cystoscope of 1879, the Edison incandescent lamp had not been patented;* and although, even when the construction of the latter had been made public, and its employment as a source of light in endoscopy was fully recognised and made use of in the specula for the throat, nose, ear, and rectum, yet it was not until 1887 that the incandescent-lamp cystoscope made its appearance. It is difficult to understand the reason for this delay. It had been suggested apparently by Professor Dr. von Dittel, of Vienna, in 1883.† Dr. Nitze, of Berlin, claims to have been the first to employ it in the cystoscope.‡ Be this as it may two incandescent-lamp cystoscopes appeared

* Vide Appendix, p. 154..

† Leiter, 'Neue Beleuchtungs apparate,' Wien, 1887-8, p. 1.

‡ Nitze, "Beiträge zur Endoskopie," 'Langenbeck Archiv,' vol. 36, Heft 3.

before the public almost simultaneously,* one after the design of Dr. Nitze (who had quarrelled and left his former co-worker Leiter, of Vienna) made by Hartwig, of Berlin, the other emanating from the firm of Leiter, of Vienna. Although these two instruments are the same in principle, yet they differ somewhat in detail; we shall attempt to place before the reader a description of each, and our practical experience of the relative value of the two forms.

The Nitze Incandescent-Lamp Cystoscope.

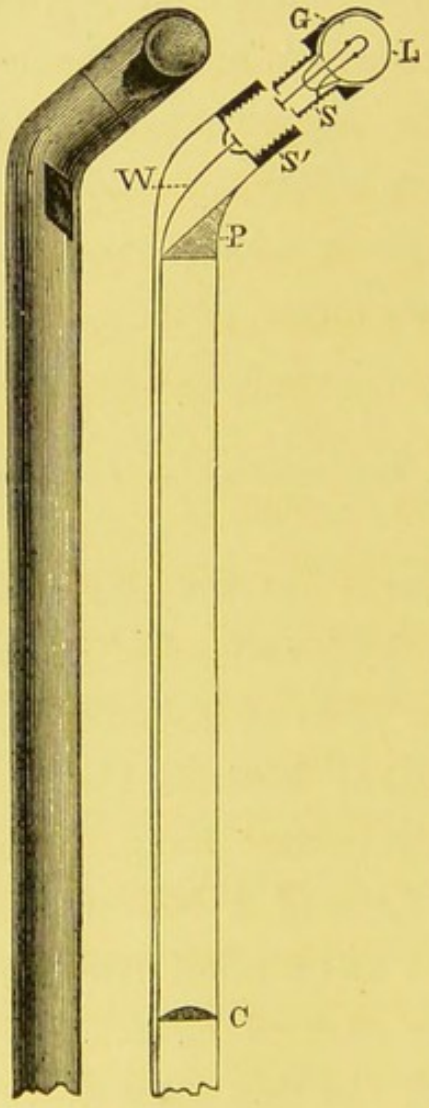
The instrument retains the appearance of a short-beaked calculus sound of 22 gauge (French) in size. Three parts of it demand explanation.

The Beak.—The beak is short, and contains the small incandescent lamp. The tip of the beak is in the form of a hollow silver cap (G S, Fig. 11), which has a small oval slit in it for the passage of the rays of light. This slit is only covered in with the thin glass of the lamp. The cap fits on to the body of the beak,—S screwing

* Nitze, 'Illustrirte Monatschrift der ärztlichen Polytechnik,' March, 1887; Leiter, 'Konig. Gesellschaft der Aerzte zu Wien,' March, 1887.

into S′. Into this hollow cap a small Edison or Swan incandescent lamp is cemented. One terminal of the carbon filament comes into contact

Fig. 11.



This figure is taken from Nitze's article.

with the insulated wire, W, when the cap is screwed home; and the other terminal becomes

connected at the same time with the outer wall of the cystoscope, which serves as one of the conducting paths to connect the lamp with the battery. It will be realised that the carbon filament is burning naked in a globe and lacks a rock-crystal window (*vide* p. 37). Should the filament burn through, the tip has to be sent to the instrument-maker for repair. Generally, the operator has two or more silver tips all armed with the carbon filament soldered in and ready for use. So that if one fails another can be screwed on immediately.

The Shaft.—A glance at the figure (Fig. 11) will show that the calibre of the shaft of the cystoscope is no longer encroached upon and diminished by water-cooling compartments as in the Nitze-Leiter of 1879. It is given up almost entirely to visual purposes, and forms a hollow tube furnished with a system of lenses, for increasing the size of the object examined.

Rays of light from the object under examination enter the window situated at the bend of the elbow, are refracted by the prism, P (Fig. 11), closing the window, and, passing through the system of lenses just mentioned, are perceived by the observer's eye.

It will be noticed that the window and the light are in this instrument placed upon the concavity. There is another in which the light and the window, P, are placed upon the convexity as in the 1879 instrument.

The Ocular End.—The end at which the observer's eye is placed has an arrangement for connecting the battery wires with the insulated wire, W (Fig. 11), and the outer wall of the instrument. A slot under the management of the thumb serves as "a key" for opening and shutting the circuit.

Dr. Nitze has lately invented another cystoscope in which the window is situated, not at the elbow but on the convexity of the beak itself. It is used for cases in which an enlarged prostate is encountered.*

* Nitze, "Beiträge zur Endoscopie," 'Verhandlung der deutschen Gesellschaft für Chirurgie,' p. 184, 1887. 16ter Congress.

Leiter's Incandescent-Lamp Cystoscope.

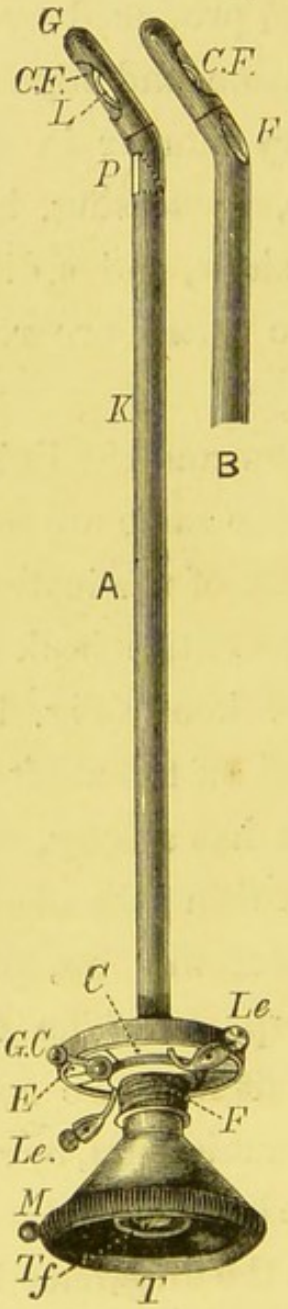
The cystoscope, produced by Joseph Leiter, of Vienna, is a reliable and highly finished instrument. It is very similar in appearance to the Nitze cystoscope, possessing, however, a longer beak, a shorter shaft, and a differently arranged ocular end. Two forms are represented in Fig. 12, A and B).

In A the window and the light are on the concavity, and in B the same are on the convexity of the elbow and beak of the instrument.

The Beak.—The entire beak (Fig. 12, G; Fig. 13, G) is a hollow hood (Fig. 13, G), which can be screwed on and off the shaft of the instrument (Fig. 13, Le). It has a long, oval aperture, C F, covered in with a thin pane of rock crystal. The hood, G, when screwed on, protects the small incandescent lamp, L. The terminals of this "Mignon" lamp fit into two sockets, C C, which are in direct communication, by means of insulated surfaces, with the battery. Here we have the first practical point in the difference between the Nitze and the Leiter cystoscopes. In Nitze's, if a carbon filament burns through, we are forced to send the

entire tip, *i. e.* an integral part of the instrument, to the makers for repair. But in Leiter's, if the

FIG. 12.



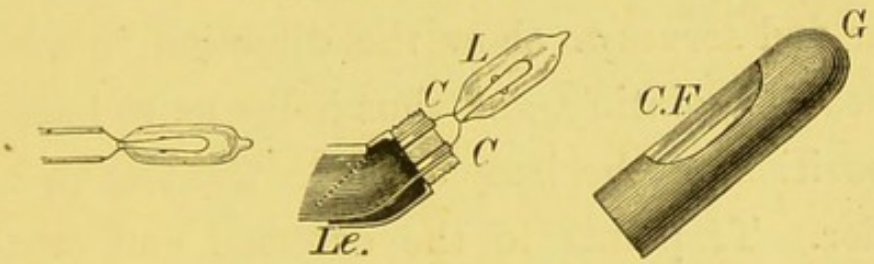
The two forms of Leiter's electric cystoscopes, A and B.

same accident happens—and it does pretty fre-

quently at first in unskilled hands—all that is needed is to unscrew the hood, pull out the little lamp with the fingers or forceps, take a fresh one from our store, fit the terminals in the sockets, screw on the hood, and we are again at work after a pause of perhaps a couple of minutes.

By this little manœuvre we avoid the unnecessary trouble of constantly sending our cystoscope

FIG. 13.



(1) the lamp; (2) the lamp (L) adjusted; and (3) the silver hood (G) for the lamp (in Leiter's cystoscope).

tips to Berlin, to say nothing of the expense of repair. These little incandescent lamps, so readily adjustable in the Leiter's instrument, cost about half the price of repairing the Nitze filaments.

But there are other important differences: 1st. It will be seen that the apertures in the caps or hoods for the passage of the rays of light are of different sizes. That found in Leiter's instrument is a much larger and longer oval, and gives a proportionately larger area of light,—no small

consideration in the bladder. 2nd. It will be seen that if the lamp glass should break in Leiter's cystoscope it is still further protected by the hood.

The shaft of Leiter's is practically the same as in Nitze's cystoscope. Its size is 22 or 30 (French gauge).

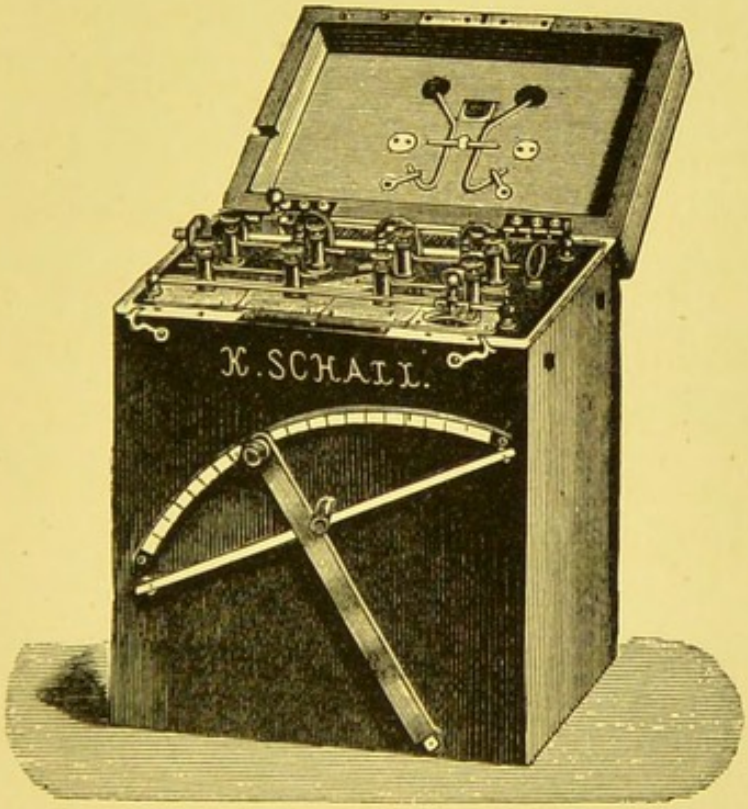
The ocular end possesses two binding screws, Le Le, Fig. 12, for the battery wires, and a small "kick-over" or key, G C, for opening and shutting the circuit. A small knob, M, on the rim of the ocular end serves to show the direction in which the beak is pointing, and thus helps us to localise the position of the lamp and the window in the bladder. Tf points to the external end of the telescope tube, which can be drawn out for cleansing purposes.

The Battery.

As the battery for working the cystoscope is the same as that employed in the use of the urethroscope we shall introduce it here, and merely refer to this chapter in our subsequent description of the latter instrument. Almost any form of battery supplying a constant current of 4 to 6 volts intensity may be used. After trying a

variety of batteries I have at last found one admirably suited to the purpose, which is made by Schall, of Wigmore Street. It is an ordinary six-cell chromi-sulphuric plunge battery, with a very convenient lever arrangement for immersing the carbon-zinc elements in the fluid (Fig. 14).

Fig. 14.



It is fitted with a rheostat. This latter is absolutely indispensable. If the battery be without one, as in Leiter's own little battery, endless annoyance and expense is incurred.

I have given Leiter's battery a fair trial and have found it most unsuitable for the work; the

current is not of equable intensity and it rapidly burns through or damages the lamp. Nitze* recommends a small six-celled battery made by Hartwig, of Berlin, with Grenet elements. He further mentions that little accumulators may be used which slip into the pocket. There may be a future for the accumulators, but I can only say they are at present not at all satisfactory.

Schall's six-celled battery, if well worked, will need re-filling every month.

A very convenient form of large battery is supplied by Schall (Fig. 15), which is fitted with rheostat and galvanometer for electrolysis and only needs re-filling every three months. It is, however, more useful for hospital work or a specialist than for private practice.

I need hardly say that the success of cystoscopy and urethroscopy depends largely upon the battery, and the more careful the practitioner is in his choice of a reliable apparatus so much greater will be his power of diagnosis.

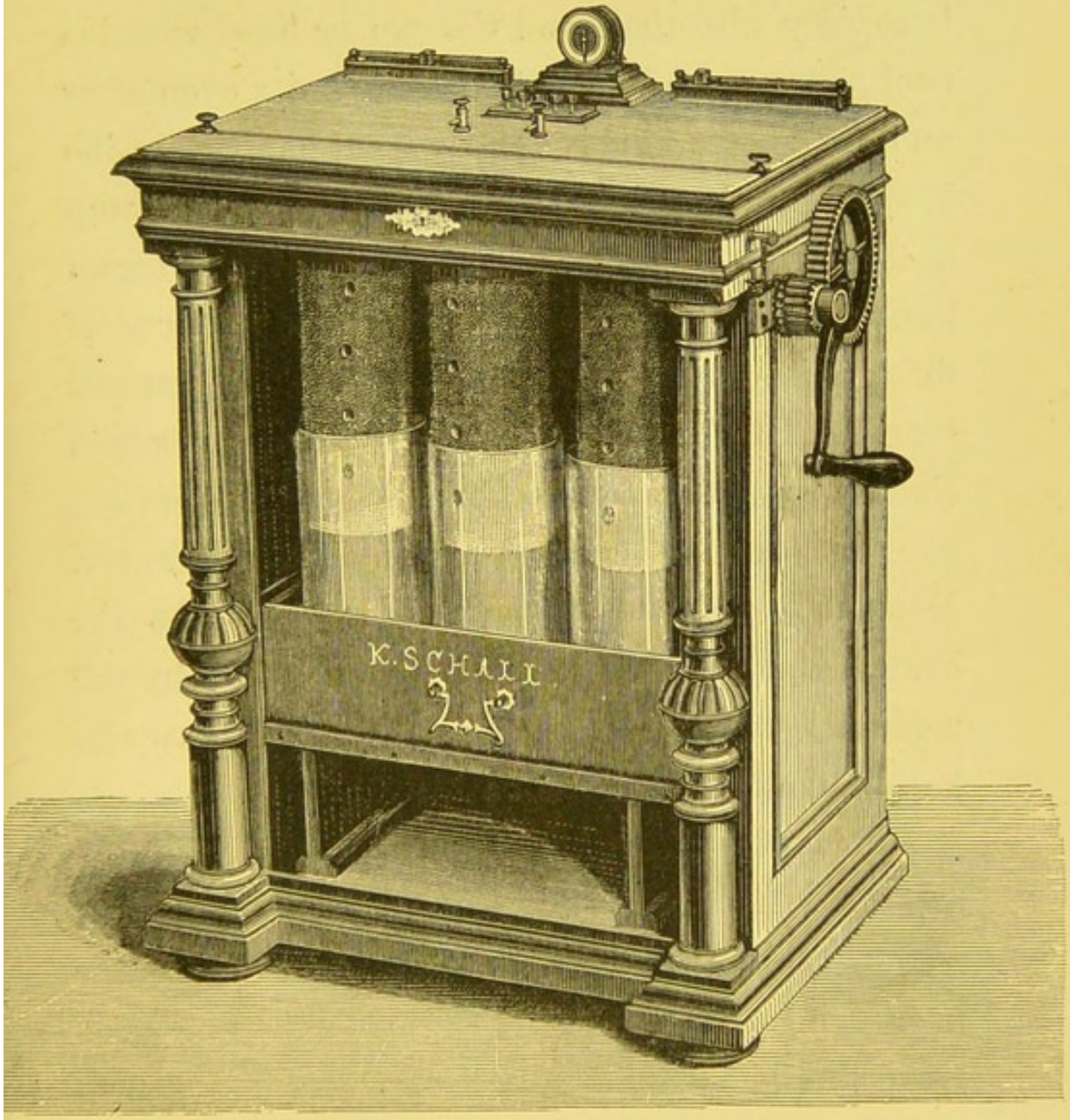
Two objections might reasonably be made to the use of the incandescent-lamp cystoscope:

1. *Burning of the Mucous Membrane.*—Although the heat emitted by the cap or hood with its con-

* Nitze, op. cit., p. 182.

tained incandescent lamp, when in action, is not so great as that given off by the platinum wire

Fig. 15.



lamp, yet it does become very quickly hot if it is allowed to burn in air instead of under water.

Thus it becomes warm after four seconds,

unbearable after ten, and scorches the skin severely after fifteen seconds. If, however, the tip of the instrument is placed in water the heat is rapidly absorbed and the cap or hood remains cool and may be handled with impunity even after an hour's use. This is exactly what happens in the bladder, for the urine carries off the heat of the lamp as fast as it is formed. " They may be burnt for an hour in a male bladder, holding seven ounces of fluid, without perceptibly raising the general temperature " (Brenner).* It is a *sine quâ non* in electric cystoscopy that the bladder has to contain five or six ounces at least of urine or water. Now, although the urine or water absorbs the heat of the cap if it be freely surrounded by the medium, yet this does not happen if the cap be held in contact with the vesical wall.

A just estimate of what would happen if the cap were kept in contact with the bladder wall may be very advantageously gained by the operator in carrying out the following simple experiment :— Burn the lamp in a cupful of water and gently rest the tip of the finger on the hood. The finger will soon become unpleasantly warm. The rest

* Brenner, '16ter Congress Deutschen Gesell. für Chirurgie,' p. 91.

of the hood will of course be found to remain cool, for it is surrounded by water. When the operator, moreover, realises that the soft mucous membrane of the bladder is much less resistant than the hard cutis of the finger and less tolerant of injury, the necessity for avoiding any prolonged contact of the lamp with the bladder wall will be readily appreciated.

2. *Breakage of the lamp.*—It might be feared that the contact of the water with the heated hood would crack the small lamp, or might even crack the rock crystal plate which covers the aperture for light. If there was any chance of such an accident happening it would be fatal to the use of the cystoscope altogether. The fear is happily quite groundless in the Leiter pattern. If an ill-made lamp should shiver, and I have never heard or known of such an event, it would still be enclosed in a metal hood, the aperture in which is occupied by an unbreakable plate of rock crystal two millimetres thick.

I have tested these rock crystal plates with over-anxious roughness, tapping them roughly on a marble table top, rapping them with a stone so as to imitate—to a very exaggerated degree—any violence they might be subjected to if they

came in contact with a vesical calculus. The only result has been to break the carbon filament of a Nitze cystoscopic lamp. I have also applied firm finger and thumb pressure on the plate, but have only succeeded in cracking one, and this cracked one I subsequently and frequently used, without any damage being done to the little globe within.*

Having now described the Nitze-Leiter instrument of 1879, and the new incandescent lamp cystoscopes of 1887, it will be most advantageous to enumerate the advance made by the latter.

1. The new instruments do not need any water-cooling apparatus, and therefore the unwieldy reservoirs are dispensed with. The shaft of the instrument is also freed from its water compartments ; almost its entire calibre is therefore given up to the telescope-tube, and hence a much larger field of view is obtainable.

2. The cumbersome Bunsen battery and complicated rheostat is unnecessary ; it is replaced by a small plunge battery supplying a current of four

* As this was passing through the press I learnt that a rock crystal plate had been broken by burning the lamp in the air for some time. The hood got almost red hot and cracked the crystal plate.

to six volts intensity. The former battery emitted a most offensive smell, and had to be emptied after each operation. The latter has to be refilled once a month, and can be placed in action by merely raising a lever.

3. Accumulators which slip into the pocket

Fig. 16.

along with the cystocsope may be used, though the former are not always to be relied upon (compare Fig. 9), contrasting thus favorably with the old instrument which required a porter to carry it (Fig. 16).

4. The new instrument is one third the price

of its predecessor, and the outlay once made the only further expense is the battery fluid and a stock of small lamps.

5. The instrument is not complicated nor fragile; it requires no special technical knowledge for its manipulation; indeed, if a Leiter's cystoscope is procured there is no need for any further assistance from the instrument makers, for all the necessary changes of lamps can be done in a minute or two by the practitioner himself.

A few words of advice in buying an instrument may be not unacceptable. The Leiter cystoscope is the better and more practical instrument of the two. See that the straight part or shaft measures seven and a half inches, Leiter's original supply being too short in the body, See that the lenses are bright and clear, giving a good image of the window or some other object in the room, and of the hand or finger placed near the window of the cystoscope, because in some of the instruments supplied the lenses are not accurately placed. Make sure that the insulation is perfect. Let the lamp be put into action. Shake the instrument and place it in various positions to see that the light is still maintained. Lastly, in choosing a stock of lamps have every one tested with the

battery, and select those which give out the brightest light with the weakest current.

The battery requires but little notice. The chief failure rests in the evaporation of the fluid, the chief disaster in the practitioner forgetting to lift the carbon and zinc elements out of the fluid after he has finished. A few hours of such contact will so erode and crack the plates as to render the machine valueless.

CHAPTER IV.

METHOD OF USING THE INCANDESCENT-LAMP CYSTOSCOPE, ITS CAPABILITIES, VALUE, AND RANK AS A DIAGNOSTIC AGENT.

The actual management of the instrument requires, as we have said, but little technical knowledge, but the power of gentle purposive manipulation of the cystoscope when in the bladder can only be acquired by extensive practice. Those who are constantly in the habit of using the calculus sound, and of passing solid steel bougies or catheters will have nothing to learn in the actual introduction of the cystoscope into the bladder, for the latter is as easy as the former; but the pointing of the beak, and due rotation of the instrument so that a certain patch of the bladder wall may become illuminated and examined, requires a great deal of practice and patience. It is wise to use the instrument freely on the dead subject first, for we gain thereby a more rapid knowledge of the capabililities of the instrument

than we can expect to acquire in the living. The various little manipulative dodges of gently *placing* the light are also learnt. Leiter supplies a phantom bladder which is extremely useful if the mortuary subject cannot be obtained. This phantom has a small window at the top by which the interior of the bladder and the position of the light may be inspected. The eye can thus guide and teach the hand which is manipulating the instrument through the dummy urethra. Several blood-red irregular masses, made so as to resemble polypi, project from the wall, and one or two calculi and foreign bodies rest on the base. The ureteral orifices and vessels are marked.

I always advise a little practice on the phantom first, before the mortuary subject is used. The instrument-maker supplying the cystoscope usually has a phantom for demonstration purposes, and a quarter of an hour's use of it is readily granted.

But though we may become rapidly proficient in placing the light, it is far otherwise in the just appreciation of what is seen. A stone or needle encrusted with phosphates or a typical growth is as readily recognisable as are some well-marked conditions of the retina, tympanum, and larynx,

when examined by means of the ophthalmoscope, otoscope and laryngoscope.

There are certain conditions of the mucous membrane which are at first exceedingly puzzling, and which require some experience to determine their nature. One of these pitfalls consists in swollen mucous membrane, another in rugæ of the mucous membrane in the insufficiently dilated bladder simulating outgrowths from the wall. We shall have to allude to these and other conditions in the following pages. Lastly, it is very difficult to appreciate the exact size of the object we examine. The size of the object as seen through the instrument varies according to the distance of the prism from it. If the prism be near, the object is magnified, and we are deceived as to its proportions; if the prism be withdrawn, the opposite effect and error is induced.

It will be found that the cystoscope fails under three conditions:

1. It can rarely be passed without undue violence in patients the subjects of irregularly enlarged prostates, *i. e.* in which the prostatic canal is very devious, for blood becomes smeared on the window and mixed with the urine in the bladder. An ordinary enlarged prostate offers

but little impediment to the introduction of the instrument, but it is impossible to examine the pouch behind the prostate if that depression is deep. Nor can the base be thoroughly searched if the intra-vesical prostatic outgrowth be large. The ureteral orifices also, are rarely seen in this class of case.

2. Stricture of the urethra of course offers an impediment to the passage of the cystoscope. This obstruction can easily be removed by dilatation. It may happen, moreover, as it did to Nitze,* that in dilating the stricture to facilitate the introduction of the instrument we may remove the cause of the obscure symptoms which have suggested the electric exploration of the bladder. If the meatus be small it can easily be cut inferiorly, under cocaine, to the proper size by a touch of a blunt-pointed bistoury.

3. If the bladder contain blood or pus the wall cannot be distinctly made out, for the light seems to be placed in a red or yellow fog, and everything is obscure; this is, however, generally obviated by washing out the bladder and replacing the murky medium with water.

* Nitze, op. cit., 'Deutsche Congress,' p. 188.

4. It will be found that the cystoscope is difficult to work in contracted bladders.

Summing these points up briefly, we may say that there are three conditions indispensable for the employment of the cystoscope.

1. The urethral canal must have a calibre of 22 French catheter gauge.

2. The bladder must have a capacity of at least four ounces.

3. The water in the bladder must be translucent and ought to be perfectly transparent.

Rules and Directions for the Use of the Cystoscope.

Before commencing to arrange the patient, it will save a good deal of annoyance if the lamp and battery are examined and proved to be in good working order. Connect the battery wires to the cystoscope, immerse the elements, keeping the rheostat at the point of greatest resistance; and use the "kick-over" or key attached to the ocular end of the instrument to close the circuit. The incandescent lamp will now burn a dull red. Gradually move the rheostat until the filament emits a bright, white light. The instrument is

now ready. Open the circuit, withdraw the elements from the chrom-sulphuric acid fluid, and turn your attention to the patient.

This initial examination of the lamp is necessary because after some time the carbon filament gets burnt and offers less and less resistance to the current, throwing out less and less light. By moving the rheostat to its proper point of resistance we are able to depend upon the brightness of the light. The lamp may possibly require changing. It may have burnt through. Nothing is easier in the Leiter instrument (page 37) than to replace it with another. But here a caution is necessary. No two lamps have exactly the same resistance, so that one lamp may burn brightly with the rheostat at maximum, its carbon filament offering but little resistance to the current; and another will only emit the necessary white light when the rheostat approaches zero, or the minimum. Hence, every lamp ought to be first gauged by the rheostat in the manner just described. If this is not done, the operator will either fuse a number of lamps, or will only obtain a useless, dull, red light.

The slight operation of cystoscopy may be performed under cocaine (20 per cent.), or even with-

out cocaine in practised hands. Presuming that no obstruction to the introduction of the instrument has been found in the urethra such as stricture, meatal contraction or deviation of the prostatic canal, the patient is to be interrogated as to the amount of urine in the bladder. There is no transparent medium so perfect or so suitable as clear, healthy urine, and I always make a point of getting the patient to retain his urine, if it be free from blood and pus, so as to allow of at least five or six ounces being found in the bladder. Practically speaking, the more distended the bladder is, so much the easier is the examination ; but it will be found that the varying positions of the individual parts of the bladder produced by different degrees of distension are at first a source of fallacy to the operator. This difficulty may easily be appreciated by introducing the cystoscope and searching for the ureteral orifices in the dead subject when the bladder contains ten ounces of water. Now draw off five ounces and repeat the search ; it will be found that the position of the ureters have changed, and they may be entirely concealed by the folds of the bladder.

Should the patient have passed his urine lately, or should there be pus or blood in his urine, it is

of course necessary to replace that medium with water. A soft Jacques catheter is passed, and the bladder is well washed out with a warm solution of boracic acid. After the washings become quite clear, three or four ounces of the same solution are run into the bladder, a drachm or more of a 20 per cent. solution of cocaine is now injected through the same instrument, and followed up by more boracic acid solution.

This cocaine rapidly diffuses itself throughout the water, and serves not only to deaden the sensibility of the vesical mucous membrane for the cystoscopic manipulation, but also to allow of a still larger introduction of the boracic solution. The bladder may sometimes accommodate as much as six ounces without discomfort. As the Jacques catheter is being withdrawn I squirt a little of a 20 per cent. solution of cocaine into the urethral canal, anæsthetising especially the prostatic section. No apprehension need be felt about the application of the cocaine.* It is much more satisfactory to have the patient anæsthetised, for often in the middle of an examination without

* I have used injections of the drug continually in large out-patient practice, and have *never* seen any case presenting symptoms of so-called cocaine poisoning (compare p. 133).

chloroform the patient is seized with an uncontrollable desire to pass water, and the medium has to be renewed if his wishes are acceded to.

The patient lies upon his back with his buttocks drawn to the edge of the table, with his legs bare and separated, the feet being supported upon chairs of suitable height. If an anæsthetic is used the lithotomy position is the best. The operator, being seated between the patient's thighs, now takes up the instrument, and either uses a drop or two of glycerine to smear its surface with, or tries to pass the elbow and a little of the shaft without any application whatever. A dab of vaseline at the meatus will now lubricate the rest of the shaft. This prevents murking the prism of the window. It is of the greatest importance that the key or kick-over is not moved until the elbow is felt to have entered the bladder. If this is not attended to the lamp may be set in action while it rests in the prostatic urethra, and that section of the canal is soon scorched by the heat of the hood.

On applying the eye to the ocular end of the instrument when the beak has been felt to have entered the vesical water and the key has been turned to close the circuit, the observer will

immediately perceive a yellowish-red glare at the end of the tube. With a little manipulation he will readily recognise the trabeculated surface of the bladder, and the minute vessels which ramify in the mucous membrane. If the medium be quite transparent, the vesical wall will be seen illuminated by a bright white light, and the details of the wall will be as clear as if they were viewed by direct sunlight. It must be remembered that the brilliancy of the light and the success of the examination *depends upon the operator.*

1st. The lenses must be clean. 2nd. The lamp must have sufficient battery power to produce a steady white light. 3rd. The medium must be quite transparent* and sufficient in quantity.

Figs. 17 and 18 show the light thrown upon the floor and anterior wall of the bladder. They represent fairly well the direction of the rays emitted from the end of the instrument,† and they also demonstrate the use of the two forms of the cystoscope, viz. that in which the light is at the convexity of the beak (Fig. 17), preferable for the floor and posterior wall; and that in which the light is

* Hæmaturial cases are more favorable than pyurial.

† In Figs. 17 and 18 the black area is incorrect; it is introduced for the sake of contrast. The entire bladder is lighted up more or less.

situated at the concavity (Fig. 18), applicable for the anterior wall and sides. Practically, however, it will be found that the latter is the more

Fig. 17.

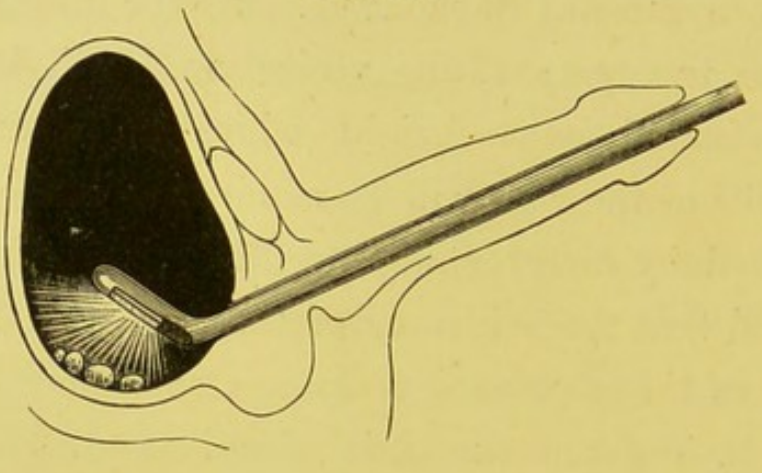
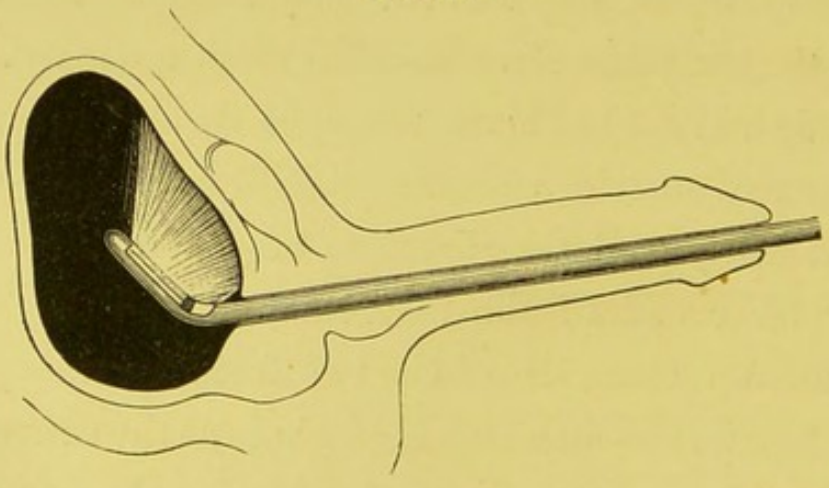


Fig. 18.



useful instrument, for it can be turned completely over in the bladder to survey the base.

Doubtless with larger instruments and improved boric lenses we shall be able to see a wider area of

the vesical surface at a time, and that more clearly. Whitehead, of Manchester, has already introduced an improvement. The cystoscope which Mr. Leiter has made at his request is identical in principle with the new pattern, but of 40 Fr. gauge instead of 22 Fr. The advantages of this increased size lie in the wider field of vision obtained, and the employment of a larger incandescent lamp, with correspondingly increased brilliancy of light. The window of observation in the new instrument is $\frac{6}{16}$ in. square, *i. e.* at least twice the area of that in the original one; and the lamp is double the size. Mr. Whitehead uses this instrument through a median incision in the membranous urethra. A small opening is made on the staff, and a catheter probe passed along it. Sufficient urine is now evacuated to show that the bladder has been reached, and the staff thereupon withdrawn.

The operation is now facilitated by using a conical-pointed pilot catheter of 40 French gauge to dilate the prostatic urethra. This instrument is guided to the bladder through the perineal opening by means of a flat director previously inserted. The bladder is washed out, and injected through the pilot catheter with boracic solution. The left index finger is then placed in the rectum,

and pressure is made on the vesical neck so as to prevent the outflow of the medium, whilst the pilot is being withdrawn. The cystoscope is finally introduced. Mr. Whitehead* speaks well of the instrument, saying that "the illumination and the field of vision left nothing to be desired." The innovation is a valuable one, although it directly traverses the *raison d'être* of cystoscopy, which is a visual diagnosis without a cutting operation. It at once suggests the employment of a larger instrument upon females. This has proved invaluable, for with a slight dilatation of the female urethra No. 40 French cystoscope is easily passed. Leiter has made at my suggestion such an instrument to be used exclusively for the female bladder. Its shaft is four and a half inches in length.

Even with a slight experience of this larger size of incandescent-lamp cystoscope one can conceive that it will be of the greatest value in that class of case in which the exploring finger cannot reach the bladder through the membranous urethra by reason of certain mechanical obstacles such as (1) the stoutness of the

* "A New Incandescent Lamp Cystocope," 'British Medical Journal,' April 7th, 1888, p. 768.

patient by which the depth of the perinæum is increased; (2) an enlargement of the prostate by which the bladder is pushed farther from the surface; (3) a considerable narrowing of the pelvic outlet which prevents the hand being well pushed into the perinæum* (compare p. 86, a case of sacculated stone under the care of Professor Dittel).

It will be also of importance in controlling digital exploration by visual examination in that variety of vesical papilloma which is known by the names of "sub-villoid," "cropped villoid," or "papillôme en nappe."

In these cases there is no definite clump or clumps of growth, but large areas of the mucous membrane of the bladder are converted into a velvety condition, which can easily remain undetected by the finger, but the existence of which a visual examination will at once reveal. These velvety patches are composed of innumerable blunt, stunted, isolated papilliform projections.

There are eleven specimens of this disease in the museums of England and Scotland. It is found in 18·3 % of the cases of vesical villous papillomata.†

* Whitehead and Pollard, 'The Surgical Treatment of Tumours and other Obscure Conditions of the Bladder,' p. 9.

† Author, "Villous Papillomata," 'Path. Trans.,' 1888.

The following case* will add weight to the above statement:

Case.—Male, æt. 28. Onset of symptoms of vesical disease in 1882. Frequent micturition with a sense of burning at end of act, pus and occasionally blood. In 1884 perineal cystotomy and exploration performed; no relief afforded. In 1885 cystotomy and exploration repeated, with a like result. The frequency continued, the patient micturating every hour, day and night. Urine still contained blood and pus.

Patient then applied to Professor Keyes, of New York. A supra-pubic cystotomy was performed, and the pelvis placed in what is known as the Trendelenberg position. By this means and a good light, the mucous membrane was seen to be the seat in one third of its extent of a finely sub-villoid growth, which bled at the slightest touch. It occupied the base and anterior wall. There was no tubercular deposit, and no ulceration. The line of demarcation between the healthy and the diseased parts was well marked. The curette was used with a good result. Had the cystoscope, and preferably the large size, been used through

* Keyes, 'Journal of Cutaneous and Genito-Urinary Diseases,' July, 1887, p. 247.

the perineal incision, the second and the third operation would have been dispensed with.

Lastly, the larger instrument may be used to regulate the *complete* removal of a vesical tumour by the Boutonnière operation, just as the mirror is used by the dentist to control the burring of the carious parts of a tooth preparatory to stopping.

The departure therefore is a valuable one, but it cannot be forgotten that it is the adjunct of a *cutting* operation, and that it does not attempt, as the smaller-sized instrument does, to furnish a diagnosis of obscure vesical disease without operative interference.

Brief Rules.

In starting an examination let the operator commence with the instrument shown in Fig. 18, and bear in mind the following golden rules:

1. See that the bladder contains at least six ounces of *clear* fluid.

2. Regulate the lamp beforehand, and do not start the lamp until the elbow is well within the bladder.

3. Do not keep the cap in contact with the wall.

4. Let the manipulation be gentle and purposive.

5. Let the instrument remain half a minute in the bladder after the current has been shut off in order to completely cool the hood before you withdraw.

6. Let the base of the bladder be examined first, for the inferior zone of the bladder is to vesical endoscopy what the optic disc is to ophthalmoscopy,—the most important area in the examination. It is to the inferior zone that the cystoscope is first directed; for it is this section of the bladder which contains or conceals for the most part those diseases which rank as "obscure." Thus calculi: free, latent, or sacculated; foreign bodies (other than stones); growths: malignant or benign; ulcerations; and even pouches are all more common in the inferior zone than in the middle or superior.

The principal points in the inferior zone are the ureteral orifices.* I never feel quite safe in

* Short note concerning the location of *single* tumours found in the museums of Great Britain:

Villous papilloma (author, 'Path. Trans.,' 1888).

Conclusions—1. Growths that are single are generally found in the inferior zone (86 per cent.).

2. They spring from the *margins* of the trigone.

3. They are found at the right ureteral orifice in 43 per cent., at the left ureteral orifice in 26 per cent., and on the interureteral bar in 10 per cent. of the cases.

a cystoscopic examination unless I have clearly seen these openings and their immediate neighbourhood. (*Vide* p. 69.)

4. They are generally pedunculated or tend to become pedunculated in the proportion of 2 : 1 (43 per cent. are pedunculated, 20 per cent. are subsessile, 33 per cent. are sessile).

Fibromata.—90 per cent. are at the ureteral orifices.

Sarcoma (author, ibid.).—Sarcoma of the adults. The trigone is rarely the site of the disease. The favourite spot is the posterior wall, either just behind the right or the left ureteral orifice They are usually sessile (10 per cent. possessed pedicles).

Carcinoma (author, ibid.).—The right and left ureteral orifices are rarely the origin of carcinoma, though of course they may, and generally do, become implicated by extension. The posterior wall in the middle zone is the part most often affected, *i. e.* 63 per cent.; next to this comes the trigone itself, 20 per cent.

As regards the liability of the three zones to become affected by SINGLE cancerous growths the following statistics are of importance to the cystocopist. They are estimated from 100 cases of carcinoma vesicæ examined by the author:

Upper zone . . .	7·2 per cent.
Upper and middle zone . .	7·2 ,,
Middle zone . . .	22·5 ,,
Middle and lower zone . .	17·5 ,,
Lower zone . . .	42·5 ,,

The upper : middle : lower zone :: 1 : 3 : 6 as regards liability to carcinoma.

The Normal Bladder as seen by the Electric Cystoscope.

Before entering upon the description of the appearances of the pathological conditions of the urinary bladder, it will be as well to give a short sketch of the aspect of the mucous membrane of the healthy viscus. It will be found that the slight differences which do exist in the arrangement of the vessel-branches and muscle-bundles in the normal bladder are immaterial, and any healthy man of twenty-five will afford a good standard for comparison with abnormal deviations.

The mucous membrane of the healthy living bladder appears, under the electric light, of a reddish-yellow or light straw colour. Its surface, although covered with water, is bright and glistening. Coursing here and there are a few sparsely scattered arborescent vessels, which issue at unfixed points, and run their course, dividing and subdividing apparently without anastomosis with other trunklets. These vessels are of varied tints. Some are thicker, and are evidently venous branchlets; others possess a more arterial hue. The retinal appearance of the healthy mucous membrane will be at once remarked. The ques-

tion has often arisen in my mind why large areas should appear without these vessels, and what has called the isolated systems that are seen into a visual existence?

Depressing the handle of the cystoscope (Fig. 18) we examine the anterior wall, and perceive projecting, in ill-defined longitudinal bundles, the fasciculi of the so-called detrusor urinæ muscle. This condition is more marked towards the posterior surface, for here the bundles interlace, and form an intricate trellis-work-like mesh of greater or lesser delicacy. Between the lattice-bands are slight depressions, pits, or dimples—the precursors of the herniæ of disease. The cystoscope disposes of the belief that this trabeculated condition is only observable in the pathological bladder. The elements are nearly always present, and need but the exaggeration of increased functional activity to produce the columniform bladder with its accompanying diverticula.

Attached to the mucous membrane will be seen, perhaps, a small, glistening, glass-like globe, reflecting the incandescent lamp upon its convex surface. It oscillates at every movement of the instrument or at every jerk given to the patient's pelvis. It is an air-bubble introduced with the

catheter or injection, puzzling the uninitiated as to its cause and character, but bearing with it a fruitful lesson for care in the prophylaxis of urinary or so-called catheter fever.*

By depressing the handle of the cystoscope, and rotating it completely on its long axis, the window and the lamp can be made to overlook and lighten up the base. In a healthy bladder the trigone forms a very beautiful object, reminding one of a sandy shore, so even and yellow is its surface. More posteriorly, and at the angles, are placed the orifices of the ureters situated upon elongated oval-shaped projections. If the bladder is healthy and full of clear urine there will be no difficulty in discovering their slit-like openings. Sometimes the lips are rather thick and pouting—a condition which, if not exaggerated, is not incompatible with perfect health. If one of these orifices be watched carefully the curious phenomenon of efflux will be seen.† The little slit will suddenly gape and a tiny swirl of

* Author, "Precautions to be Adopted in the Removal of Residual Urine," 'Trans. of the West Lond. Medico-Chir. Society,' vol. ii, p. 101.

† Ureteral contraction passes from above downwards (from the renal pelvis to the bladder) at the rate of 20—30 mm. a second, the adjoining bladder wall apparently participating in the wave

fluid will be emitted. Should blood be present in the ureter the effect is heightened, and the appearance of the jet of bloody urine issuing from the mouth of the canal reminds one of a miniature cuttle-fish squirting out its inky fluid into the surrounding water.

The ureters are sometimes indiscoverable, and no amount of skilful rotation or manipulation of the instrument will bring them into view.

Let the operator remove his cystoscope and inject a little more water. This manœuvre not infrequently produces the desired effect, for in an insufficiently dilated bladder the mucous membrane forms folds which overlap and conceal the orifices most effectually. Sometimes a ureter is displaced* by disease, only rarely is it absent.†

(Stansky). The evacuation takes place every three quarters of a minute (Mulder). Dr. A. J. Zamskin ('Eyendelnaia klinisches kaia Gazeta,' No. 1, 1887, p. 13) has worked at the subject of ureteral efflux in a Finnish woman, aged forty-two, who had an extensive recto-vesico-vaginal fistula. Both orifices were exposed. Nine observations were made, each lasting an hour. It was found that the contractions of the orifices were rarely synchronous, and that they did not contract equally as regards number. I have been able to watch and time the efflux in an ectopian vesical case sent to me for operation by Mr. Heycock.

* Author, "Case of Tubercular Exfoliating Cystitis," 'Path. Trans.,' vol. xxxvii, p. 310.

† Author, "Atresia (Congenital?) of the Vesical Orifice of the Left Ureter," ibid., p. 300.

The urethral orifice can be thoroughly searched by withdrawing the cystoscope until the window is at the opening of the bladder. It is seen as a crescentic fold, blood-red in colour from the transmission of the rays of light through its vascular substance. It is not usually a sharp-edged fold, being more generally rounded. By rotating the instrument every part of the circle can be examined.

The cystoscope demonstrates very clearly in the undilated bladder the rugæ, their danger and deceptions. The thick folds of mucous membrane stand out into the cavity of the viscus as large projecting ridges. It is easy enough to thrust the incandescent lamp between these rugæ. The lamp being thus enveloped its light is so diminished as to be rendered useless, and the concealing folds are in danger of being burnt or injured by the prolonged contact. The rugæ often simulate projecting growths, the likeness being heightened by the roughness and swelling in inflammatory diseases.

Value of the Electric Cystoscope.

Pathological Conditions of the Living Bladder as seen by Electric Illumination.

The value of the electric cystoscope may be considered in two different aspects. The instrument can either afford us a clearer insight into the physiological and the more usual pathological conditions of the vesical mucous membrane, allowing us to control our clinical observations and speculations by direct visual research; or it may at once elucidate for us the cause of certain obscure symptoms of urinary disease of which we otherwise could obtain no clue without a cutting operation.

The following cases will demonstrate the value of this method of examination in both the above aspects.

Cystitis.

The progress of inflammation of the bladder through the various stages of acute, subacute, and chronic disease, can be watched not only with ease but also with profit by means of the

electric light. Such a study is very necessary to develop a skilful cystoscopist, for the mucous membrane is most protean in its aspect, and the appearance and disposition of the swollen folds in the semi-dilated bladder are puzzling to a degree.

Acute Cystitis.—This has been well investigated by Finger,* who restricted his examination to gonorrhœal cystitis. The appearances, according to that observer, are as follows. The mucous membrane, in proportion to the extent and intensity of the process, is more or less affected. It is especially changed at the neck of the bladder, being swollen into irregular hillocky projections. This turgescence is either marked with dendritically anastomosing, greatly dilated vessels, or, in very acute cases, it is printed with hæmorrhagic spots, and streaks or blotches ; or it appears of a uniform dark red colour. The epithelium is either collected in clumps or in long thready streamers, which float in the contents of the viscus. Acute cystitis of other origin has very nearly the same appearance, only its extent is more marked. By keeping cases under observation it will be found that these deeply-red injected patches disappear one by one as the intensity

* Finger, ' Wiener med. Presse,' 1880, S. 997.

of the inflammation subsides. Some of these patches take a very long while in subsiding.

Case 1, æt. 34. Patient had suffered from recurrent and profuse hæmaturia for some months; generally pain before micturition. Had been sounded by several hospital surgeons. The hæmaturia subsided until it was reduced to the occasional passage of very small tadpole-like clots. The cystoscope revealed the remains of a hæmorrhagic cystitis. Upon the trigone and in its left half was an elongated, oval, blood-red patch of upraised, injected, and swollen mucous membrane; it was well circumscribed. The surrounding surface was apparently healthy. I re-examined the bladder four weeks afterwards; the symptoms had greatly subsided, the hæmorrhagic swelling had disappeared.

Chronic Cystitis.—According to Professor Dittel, there are two cystoscopic varieties of this grade of vesical inflammation, one in which the mucous membrane is strikingly pale, and another in which the surface is more swollen and reddened. The former is encountered in such obstructive diseases as hypertrophy of the prostate, in which the inflammatory condition is slight and the result of the irritation of residual urine. As an example

of this class the following case, extracted from my note-book, will suffice :

" Mucous membrane somewhat white and more bloodless than normal. Hanging dependent from the surface of the bladder walls are larger and smaller clumps of muco-pus. These every now and again loose their hold, and, falling, drop on to the prism and obscure the view until dislodged ; or float gently downwards and pass the lamp and prism like large irregular snow-flakes. The surface has lost its glistening reflex ; it is blurred."

Of the second class, the following are good examples :

Case 1 (seen with Dr. Herman).—Female, has never had hæmaturia, but has long suffered from muco-purulent urine and other symptoms of vesical disease. On the introduction of the light the mucous membrane was dark red, and appeared swollen and so lumpy in one part as to give me the impression of a growth. The urethra was dilated, the bladder was found to be free.

Case 2 (examined with Mr. Bowreman Jessett). —R. S., æt. 27. Noticed three years ago that her urine had become thick and cloudy. There is pain before and after micturition. There is undue

frequency. The urine is also thick, and contains much muco-pus. A cyst was removed from the urethra by Mr. Jessett, but the symptoms continued unabated.

The urine was evacuated, and the bladder washed out, but the medium introduced became immediately cloudy. "The mucous membrane was greatly swollen and heaped up in every part of the base. That covering the lateral and posterior walls was less injected, and appeared less thick.

"The trigonal surface could be slightly rucked up by the beak of the cystoscope, and an appearance produced very like a projecting growth.

"The ureteral orifices were deeply sunken in the surrounding spongy mucous membrane. A uniform dark red was noticed at the base, the colour becoming more of a normal reddish straw towards the sides and vertex."

Foreign Bodies.

Case 1.—Discovery of a Nélaton catheter in the male bladder. Fillenbaum's* case stands first in

* Fillenbaum, "Extraction eines Nélaton-Katheters aus der Harnblase," 'Deutsche Zeitschrift für Chirurgie,' Bd. 20, S. 453, 1884. Compare Schustler, 'Wiener med. Wochenschrift,' 1885,

the literature, and affords a just comparison between the use of the cystoscope worked by electric light, and that by other sources of illumination.

Case 1.—Herr Franz R., æt. 54, had suffered from tabetic atony of the bladder for some years, and was in the habit of relieving himself with a Nélaton catheter. He was awakened one night by a call for micturition. He passed the catheter in the dark and evacuated the bladder. Thereupon he must have fallen asleep without withdrawing the instrument, for on awaking he found, to his horror, that the instrument was nowhere to be seen; a diligent but fruitless search was made, and, as he suffered no inconvenience, his story was doubted by his attendants. He came under Professor Dittel's care. Neither the catheter, sound, nor lithotrite revealed the presence of a foreign body in the bladder. The urethra was roomy, and the bladder anæsthetic. Grunfeld's endoscope was therefore introduced. "The examination gave, however, a completely negative result. The cystoscopic 'picture' was badly illuminated and blurred. The mucous membrane appeared of a dark red colour; at one moment it seemed as if a

p. 238, No. 8. The piece of the Nélaton catheter found in the bladder in Dittel's case was 18 cm. long. It was thickly coated with phosphatic deposit.

dark shadow lay before the prism, but it could not be accurately defined, nor was an opinion arrived at as to whether a foreign body was present in the bladder or not." On the next day the Nitze-Leiter endoscope was used. "The appearances were unusually sharp and bold, the base of the bladder appeared bright red, like the retina of the eye. Suddenly there came into view a symmetrical, elongated, yellowish body, somewhat like an *Ascaris lumbricoides*, which was evidently the catheter covered with a yellow urinary deposit." The worm-like appearance of the instrument is well shown in two (rather highly) coloured pictures which illustrate the article. It was removed by means of a small Leroy d'Etiolles lithotrite. Schustler records a similar case.

Case 2 (Nicoladoni).—Demonstration of a needle sticking in the wall of the bladder. Alois K., æt. 18, came under the care of Nicoladoni; nine days previously he had inserted a pin head-foremost into his urethra; it had slipped suddenly from between his fingers, and had disappeared; since which time pain, especially great towards the end of micturition, had been experienced. Sounding gave a negative result The result of the endoscopy is thus described:

"By sinking the ocular end of the Nitze-Leiter cystoscope one could distinguish the metallic glisten of the pin, which was sticking in the wall on the right half of the anterior surface, towards the apex of the bladder, measuring with the head about 2 cm. in length. It was somewhat bent, and threw a strikingly conspicuous shadow upon the bladder wall, the pale mucous membrane of which was marked by meshes of anastomosing vessels. I was able to demonstrate most satisfactorily this never-to-be-forgotten picture to a large class of students and colleagues."*

Supra-pubic cystotomy was performed, and the pin removed; it was 4 cm. long. It had been buried 2 cm. deep, and though it had been in the bladder fourteen days yet its surface was unencrusted. The wound healed by first intention.

No case could be more conclusive as to the practical value of the electric cystoscope than the following, which came under the care of Dr. Nitze, the able introducer of this brilliant innovation. We quote this and other of his cases from his contribution on vesical endoscopy to the Berlin Surgical Congress of 1887.

* Nicoladoni, "Stecknadel in der Männlichen Harnblase," 'Wiener med. Wochenschrift,' 1886, Nos. 7 and 8.

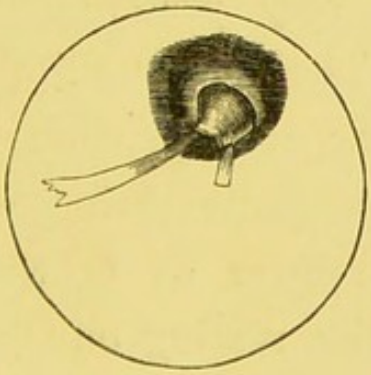
Case 3.—Frl. S., æt. 35, had ovariotomy performed upon her on the 10th of April, 1885, by Dr. Martin, the left ovary being removed. The pedicle was secured by numerous silk ligatures, and dropped back into the pelvis. The recovery was rapid, and in twenty-one days the patient left the hospital well. She remained in good health until the onset of her present trouble, which commenced in February, 1887 (*i. e.* twenty-two months after the operation), with frequency, straining, and burning at the end of micturition. By the middle of May the cystitis was very severe, and the patient had to keep her bed, suffering from high fever, frequent rigors, cystospasmus, great frequency, painful micturition, and defæcation. At first the urine was only murky, but suddenly it became mixed with blood, pus, and necrotic débris. This condition remained some weeks, and finally gradually cleared off, leaving the urine murky as before. On the 25th July a stone was discovered by means of the sound, and in the following week a portion was removed with the lithotrite. After this sitting the patient evacuated with her urine a silk thread $1\frac{1}{2}$ centimetres long.

On the 18th August the patient came under the care of Dr. Nitze. The sound demonstrated the presence of the stone left at the first operation. After cocainisation the stone was crushed, and a large part removed; subsequently a thick silk *ligature* was passed. On the next day another sitting was undertaken and all the stone removed. In attempting to remove the lithotrite, however, a resistance was encountered as if it was being held by some power in the bladder. Dr. Nitze realised that such restraint could not be due to a fold of the mucous membrane caught between the blades, for the instrument was freely movable in all directions, only when he attempted to withdraw it was the difficulty encountered. On the careful application of extra traction the instrument was removed, and between the jaws was found the cause of its detention,—a loop of silk ligature, which had evidently been one of those employed in treating the ovarian pedicle. It had doubtless ulcerated its way through the vesical wall along with the other loops, inducing the acute cystitis which had supervened, and the deposition upon them, as foreign bodies, of calculous material. The one just withdrawn had evidently become entangled in the blades of the

lithotrite, and had been dragged out of its bed in the mucous membrane.

On the 20th August neither sound nor lithotrite could detect anything further in the bladder. The cystoscope was thereupon introduced to ascertain if any more ligatures were embedded in the wall, upon which more phosphatic material could be deposited and the disease perpetuated. Upon the left side of the bladder another ligature was discovered. One of the ends projected out from the wall, glistening in the brilliant illumination of the light, a smaller and shorter end was found below, and the middle, or loop and knot part, was buried in a rose-coloured granulation-papilla, which rose out of a well-marked crater-

Fig. 19.



like depression in the mucous membrane (Fig. 19). The longer thread threw a distinct shadow on to the subjacent surface, which tra-

velled to and fro according to the movements of the lamp. The ligature had exactly the same appearance as the one removed the previous day in the blades of the lithotrite. The transit of this latter loop and its predecessors had left small but visible scars upon the wall.

Dr. Nitze now introduced a lithotrite, turned its beak towards the point indicated by the cystoscope, cleverly caught the end of the ligature in the grasp of the instrument, and jerked it free. A two-centimetre-long thread without the knot was found between the blades. The knot remained in the wall.

Calculi.

Calculi form very pretty objects under the electric light. They are readily diagnosed, and that without the manipulation which is often needed to demonstrate their presence with the sound. They appear as brownish or whitish marble-like bodies resting on the bladder base, and throwing a dark shadow upon the subjacent mucous membrane. Dr. Nitze thus describes a case which he demonstrated to Professor von Bergmann. Directly the prism had penetrated

the bladder one perceived a group of stones with facetted surfaces, like piled-up chalk blocks. The rotation of the cystoscope slowly on its axis caused the picture to be changed like a kaleidoscopic view, in which a built-up system is suddenly overthrown, and the pieces fall together in apparent confusion, but only to become arranged in another and as definite a pattern. Two large lumps built together a gateway opening, through which the inflamed mucous membrane could be seen; but at the next there was a sudden downfall, and finally one stone dropped across the prism and seemingly plunged the bladder into darkness.

The following cases from my note-book will serve as illustrations.

Case 1.—Mr. H. H., æt. 31, sent by Mr. J. C. Molson, of Plaistow. Patient complained of difficulty and pain in making water. He gave the following history. Eight years ago, after an attack of smallpox, he noticed a difficulty in making water. The impediment, if such existed, was soon overcome, and the circumstance was forgotten. Some time after this he suffered from right renal colic on several occasions, and ever since the date of the last attack, four years ago, he

has had increasing difficulty in urination. He has had no hæmaturia; the pain experienced was variable in amount and site, but it was always present in the back. Sometimes it was suprapubic, sometimes penile and perineal. He complains, moreover, that he feels something move about in his inside, and this something he has to shift before the urine can be evacuated. His urine was murky, containing albumen and much phosphatic débris. Residual urine was found to the amount of eight ounces. On introduction of the cystoscope a large, irregular, brownish-white calculus with a flocculent envelope was seen lying on the right side of the base of the bladder. It was subsequently verified by the lithotrite, and gauged to be one and a half inches long.

Case 2.—Mr. M. J. C—, æt. 66, send by Mr. Hichens, of Redruth, with the diagnosis of calculus. I am indebted for the notes of the case to Mr. W. C. Hichens. The patient had never been sounded, for he would not allow of instrumentation except under an anæsthetic. He had enjoyed very good health until the present illness. He is hale and hearty for his age.

Ten years ago the patient had, judging from the description he gives of his symptoms, an attack

of renal colic. He noticed that he passed some sand with his urine at the time. He remained well and free from any further renal trouble until sixteen months ago, when he found blood in his urine, and evacuated some gravel as on the previous occasion. Eight months after this (*i. e.* eight months ago) he had another severe attack of renal colic, accompanied with the discharge of more gravel. But after this attack he experienced some straining on micturition and occasionally a stoppage of the flow of the urine during the act. He suffered but little pain: being quite free when at rest, and having only slight pain on taking gentle exercise. Any violent exertion, however, induced a good deal of suffering and a free evacuation of blood.

I was inclined to believe that a growth or intravesical prostatic outgrowth was the cause of the violent hæmorrhage which supervened on any unusual exertion, for the bleeding was quite out of proportion to the pain experienced. The patient, moreover, had no characteristic penile or perineal pain on micturition. I determined, therefore, to use the cystoscope before the sound. The patient was chloroformed and Leiter's instrument introduced. The sides of the bladder were

healthy but trabeculated. On turning the instrument over so as to overlook the trigone I saw a glistening white stone lying partially concealed in a fresh blood-clot. No growth was discovered. The stone lay in a pouch behind the upraised collarette of the enlarged prostate. The sound was introduced, turned over, and the stone immediately struck, ringing sharply; the lithotrite gauged a stone one and a half inches long. I removed it supra-pubically. It was an elongated oval stone, with a nodular surface; the projection of brown uratic nodules were surrounded by, and partly overlaid with, a white phosphatic encrustation.

Encysted Stone.

Schustler* reports a case under Professor Dittel, of a man, æt. 68, suffering from hypertrophy of the prostate and the presence of a large, soft, vesical calculus. On performing lateral lithotomy it was found that the great enlargement of the prostate prevented the finger-point from penetrating the bladder. On attempting to remove

* Schustler, 'Beiträge zur kystoskopischen Diagnostik,' 'Wiener med. Wochenschrift,' 1886, No. 13.

the stone with the forceps, the former broke into pieces and the fragments were removed piecemeal. Subsequently stones were found from time to time by means of the sound, and were removed through the perineal wound. Despite four months' thorough treatment, the bladder symptoms remained unabated, and the Nitze-Leiter cystoscope was therefore introduced. "This examination showed, to the surprise of all who had watched the case, the presence of a stone, which was confined in a diverticulum deep in the base of the bladder, and which projected but a slight way out of the mouth of the sac. The calculus was firmly fixed and resisted all efforts at removal."

Tumours of the Bladder.

Growths of the bladder, as seen by the electric light, often form objects which Dittel has justly designated as truly charming (entzückend schön).* More especially worthy of his praise are certain forms of villous papillomata—those whose long and delicately branched leafy processes, rose red

* Quoted from Nitze, op. cit., p. 201.

in colour from their capillary blood, float freely about in the vesical water, trembling and swaying at every movement or eddy set up by the manipulation of the beak of the cystoscope. The entire picture is like some small aquarium with an attached sea anemone moving its delicate tentacles around in search of prey. "If the prism is placed near the villi, their vessels with every trunk, even to the finest branchlet, can be seen" (Nitze). If these should be so far damaged by the examination as to bleed, a little stream of blood may be watched issuing from the wound and mixing with the medium around. The following are illustrations of vesical tumours:

Case 1 (I am indebted to Mr. Eve for permission to publish this case and to Mr. C. Daniels, house surgeon, for the history).—N. C., æt. 71. In November, 1886 (sixteen months before death), patient noticed that he began to pass blood in his urine, accompanied by pains across his chest, and cough. He was admitted into the London Hospital July, 1887, under the care of Dr. Samuel Fenwick, and his case is thus recorded:

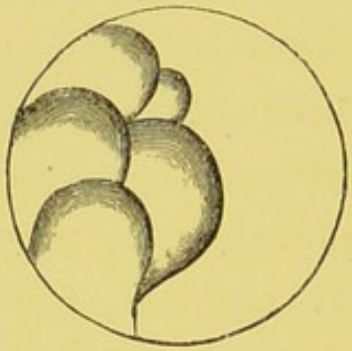
Patient has been in robust health all his life. No history of syphilis. Has been a heavy beer

drinker. Family history of longevity—a fact so often noticeable in carcinoma of the bladder.

Status præsens.—Patient is a well-nourished, powerful man, but anæmic. He passes his water three or four times daily, and gets up at night once or twice for the same object. Urine is of a cerise colour, acid, sp. gr. 1013, contains $\frac{1}{6}$ albumen (due to the blood). Prostate not enlarged. Six ounces of residual urine. No stone or growth to be discovered by sound or microscopical examination of urine. Hæmaturia, spontaneous and symptomless, of vesical origin; under partial control by means of hæmostatics. No cause ascertainable. He was transferred to Mr. Eve, and after a prolonged stay, during which he ceased passing clots, he was made an out-patient. On January 3rd, 1888, he was re-admitted under Mr. Eve with increase of all his symptoms, passing clots of blood in his urine, which is of a uniform dark, port-wine colour. He micturates five times during the night, and as many times in the day. He complains of slight penile pain and discomfort, but beyond this he is free from suffering. Bimanual examination and an exhaustive search of the bladder and urine revealed nothing. His urine became ammo-

niacal, depositing triple phosphate crystals abundantly. Attacks of retention due to the impaction of clots in the urethra necessitated occasional catheterism. I was now asked to examine him with the electric cystoscope. The instrument was introduced and turned on to its side, and a subsessile lobulated growth was immediately discovered on the right side of the trigone. The lobes were large and deeply injected. Fig. 20 represents the sketch taken. The lobes in

Fig. 20.



the sketch are larger than natural, for they were seen as magnified by the prism. The rest of the bladder was but slightly inflamed. Taking into account the man's age, his extreme weakness from the continued drain of fifteen months' hæmaturia, the position of the growth on the trigone itself [vide *Note*, Carcinoma, page 65], and its subsessile, lobulated appearance so very similar to

Dr. Nitze's case, Fig. 23, page 104, it was deemed advisable to leave the tumour undisturbed. The termination of the case justified the non-intervention.

The frequency gradually increased until his sleep became disturbed every hour by a call for micturition. A larger quantity of blood was voided. Clotting caused retention, until at last perineal cystotomy was performed for drainage purposes. On digital examination the right half of the trigone, up to the orifice of the right ureter, was found to be covered with a sessile, lobulated outgrowth, projecting half an inch from the surface. The cystoscopic appearances were thus completely verified.

The patient gradually sank, and on post-mortem examination the condition just described was found. Secondary deposits existed in the liver and kidney. The prostate was unaffected.

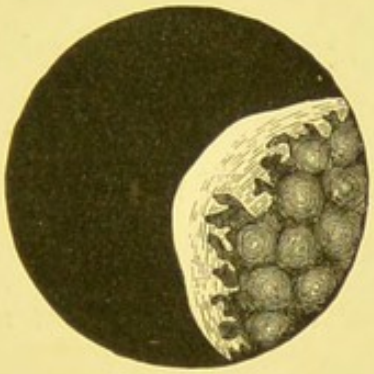
Case 2 (I am indebted to Mr. Heycock for permission to publish the case, and to Mr. F. H. Norvill, house surgeon, for the notes).—Mary B., æt. 55, had suffered for three years from occasional hæmaturia. When patient was first seen (December, 1887) she was troubled with frequency of, and some pain on, micturition. The

urine was turbid with muco-pus, it was evacuated fifteen times in every twenty-four hours. Patient stated she could only pass water when on her back. The bladder was carefully sounded and found to contain no stone; no growth felt; residual urine two ounces and more. Patient's condition improved with vesical irrigation, the nightly use of the catheter, and balsamic medicines. The urine continued free from blood until March, 1888, when several large clots were passed. Mr. Heycock now recommended exploration for vesical growth and kindly gave me leave to explore the bladder with the electric light before dilatation of the urethra.

The patient was put under chloroform, the bladder washed out, and clean water substituted for the hæmaturial urine; the cystoscope was introduced and the right side of the trigone shown to be quite free. On turning the cystoscope on to the left side and slightly directing the prism towards the floor, a walnut-sized growth was discovered; it certainly presented a remarkable appearance (Fig. 21), its surface was slightly nodular, but the cracks and crannies were filled with a glistening white layer of phosphatic deposit. Floating away from, but partially attached to, the

summit was a cloak of clear mucus, which wavered at every current set up by the movements of the instrument. The urethra was dilated, and the position and size of the growth verified by digital examination : it was found to have a well-defined stalk, the occurrence of which explained the

FIG. 21.



(The mucous film has been omitted.)

difficulty the patient experienced in passing water in the upright position, for the pedicle was long enough to allow the tumour to get sucked into the out-flowing current and thus partially to cork the urethral orifice.

A week later Mr. Heycock re-dilated the urethra, seized the growth with a pair of forceps, and slipped the loop of a wire écraseur over it. The pedicle was readily cut through and the tumour removed. It proved to be a firm fibro-papilloma, encrusted with a phosphatic deposit.

The bleeding, frequency, and pain ceased; the incontinence gradually diminished, and the patient left the hospital cured a fortnight after.

Schustler* reports an array of cases from the clinic of Professor Dittel:

Case 1.—S. K., æt. 62, had noticed frequent attacks of hæmaturia for three and a half months; the hæmorrhage was increased by exercise or unusual exertion; beyond this there were no subjective symptoms. The sound, bimanual and microscopical examination, revealed nothing. On introducing the Nitze-Leiter cystoscope a hazel-nut-sized tumour was perceived at the left upper angle of the trigone. It was attached to the wall by a pedicle the thickness of a goosequill. It had a sublobulated surface, which was in parts villous covered. Its intense blood-red colour differentiated it very sharply from the rosy mucous membrane around.

Sectio alta demonstrated the correctness of the site, size, and appearance of the growth. It was removed with a good result.

Case 2.—A. H., æt. 51, was suddenly seized in March, 1884, with an attack of retention which

* Schustler, "Perinealschmitt und Sectio Alta," 'Wiener med. Wochenschrift,' 1885, No. 8, also Ibid., 1886, No. 13.

lasted ten hours. The retention was evidently due to obstructing clots, for an immense amount of blood and clot was subsequently passed. The urine regained its normal colour, but the patient passed, off and on, small pieces of blood-clot. The hæmaturia recurred in August, 1884. In October, the microscope pointed to the probable existence of a vesical growth. Rectal examination gave no clue. The Nitze-Leiter cystoscope showed a growth springing from the left side of the trigone. It rested upon a base the size of half-a-crown piece. The volume of the tumour was equal to a small apple. Its colour was blood red and its surface was villoid in patches.

Sectio alta verified these details. The tumour was extirpated with a good result.

Case 3.—Patient, æt. 60, had suffered from hæmaturia for a long time. The cystoscope revealed a vesical tumour placed upon the left wall of the bladder, with a lumpy, slightly necrotic surface, and having a wide area of insertion.

Sectio alta corroborated the position and appearance of the growth, even to the smallest detail, as shown by the electric light.

Case 4.—Patient, æt. 55, had suffered from hæmaturia for nine months, the cause for which

could not be ascertained. The cystoscope demonstrated the presence of a growth, which is thus described :—Upon the right side of the posterior wall above the trigone is situated a greyish-white protuberance with a slightly nodulated surface, and beneath it a similar smaller outgrowth with a broad base of attachment. The remainder of the mucous membrane is markedly injected and speckled with hæmorrhages (acute cystitis), otherwise it is unchanged. The patient died eleven months after onset of the hæmaturia.

The autopsy showed that there existed an extensive carcinomatous infiltration of the right bladder wall above and behind the right horn of the trigone. Projecting from the diseased surface was a walnut-sized medullary outgrowth, the surface of which, as well as the rest of the mucous membrane, was necrotic and covered with phosphatic débris.

Case 5.—A patient, æt. 47, stated that for eight months he had passed bloody urine with great pain. No characteristic subjective symptom. The electric cystoscope revealed a broad-based tumour, projecting into the cavity of the bladder from the left side of the trigone. The growth bled continuously during the examina-

tion, so that the picture was not a very clear one.

Sectio alta.—Upon opening the bladder the tumour was discovered as described, and removed by means of Volkmann's spoon and the cautery.

Case 6.—Patient, æt. 57, had suffered for a year from hæmaturia. The cystoscope showed a somewhat broad-pedicled, greyish-white tumour, with an encrusted villoid surface projecting from the right wall of the bladder, and a smaller similar one to the left of the trigone. No operation advised.

Case 7.—A patient, æt. 61, had had hæmaturia for ten months. Nothing definite discoverable by ordinary methods of examination. The cystoscope showed a growth of the right wall of the bladder. It projected but slightly from the vesical surface, and it was covered with hæmorrhages. On the left side, hanging from above, could be seen two forked villous processes. An operation was not advised.

Nicoladoni records* the history of a patient, æt. 63, who had suffered for four months from hæmaturia. A fragment of papillomatous growth was found in the urine. The cystoscope was

*Nicoladoni, 'Wiener med. Wochensch.,' 1886, No. 8.

introduced, and showed on the anterior wall of the bladder a hazel-nut-sized papillomatous outgrowth, with floating villous processes covered with glistening white material. Moreover, towards the apex and more to the left was seen a second finely fimbriated growth.

Sectio alta displayed three papillomatous neoplasms, one on the anterior wall, and over it a second, both of which had been demonstrated by the cystoscope. They were covered with phosphatic-encrusted villous processes, and were easily removed by means of the scissors. The third and overlooked growth sprang from the trigone. It was the size of a four-kreuzer piece. Nicoladoni says, "I could not diagnose this with the endoscope, as I had not that instrument by which the posterior wall is examined" (Fig. 17).

Dr. Nitze* records fifteen cases.

Case 1.—Herr H., æt. 55, had suffered nearly thirty years from occasional attacks of hæmaturia. The duration and violence of these attacks was very variable. Some lasted a few days, others a few weeks.

At one time the blood admixture was but

* Dr. Max Nitze, "Deutsche Congress," op. cit., p. 202, contains eight cases, and the remaining seven are in the Appendix, appearing whilst these pages were issuing from the press.

slight, at another so profuse was the hæmorrhage that the patient became greatly collapsed.

The hæmaturia was sudden, symptomless, and spontaneous. The pauses between the attacks lasted at first for months. For the last six years, however, the aspect of the case was changed by the appearance of other vesical symptoms. Great straining was induced, the stream became weak, stopping frequently, and the patient had the feeling that he could not empty his bladder. Attacks of great frequency and dysuria were often experienced. The patient consulted many surgeons without obtaining any definite diagnosis.

The sound and other forms of examination gave a negative result. He had regular catheterisation, vesical irrigation, baths, and the usual medicinal remedies, but all proved useless, and the patient got worse. Fever towards evening, loss of strength, and signs of chronic cystitis, were observed to have set in.

He now came under Dr. Nitze's care, who examined him with the cystoscope. Directly the prism entered the bladder a growth was seen on the left side of the anterior wall, which trespassed upon the left wall of the bladder. It was circum-

scribed and covered with a mucous film; the left side of the urethral orifice was entirely overlapped by the growth.

On another occasion the cystoscope showed that the floating film had gone, and that the tumour was covered with a thick, glistening, white layer, which lined the furrows between the red projections of the cauliflower growth. The right side of the trigone was also covered with pointed, equal-sized, deeply red papillæ. The patient gradually sank.

Post-mortem.—The ureters and renal pelves were widely dilated, especially on the left side, which was filled with pus. The kidneys had suffered, the left more so. The bladder wall was thickened but soft. Its cavity was filled with pus. The mucous membrane showed everywhere signs of a severe chronic catarrh. Upon the front of the base of the bladder was a fungous-looking prominent growth, with a circumference the size of a five-shilling piece. Its faded red colour stood out in bold relief against the dirty-grey mucous membrane. It was made up of variously formed papillæ arranged in a cauliflower manner, and displayed about its centre a flattish depression, which proved to be the urethral orifice. On

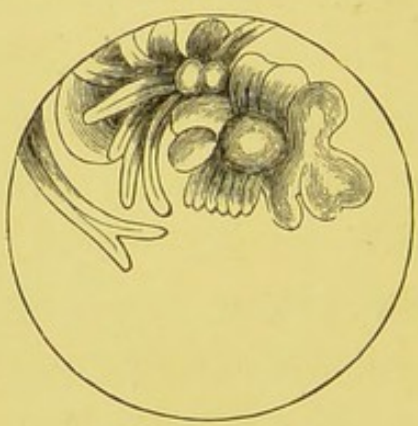
more careful examination it was seen that the growth began behind the trigone, embracing the ureteral orifices, passing forwards had invaded the urethral orifice. Projecting from this patch were definite isolated masses as localised outgrowths; especially was this the case behind and to the side of the ureteral orifice, for springing from this position was a considerable mass which overhung the trigone.

Case 2.—A patient, æt. 50, had suffered for two years from vesical symptoms. When the bladder was full the urination commenced with a strong continuous current. Gradually, however, as the evacuation progressed, so the act became difficult, and in spite of energetic pressure and straining, declined into an intermittent stream, which finally was completely arrested by an obstruction which no amount of pressure could overcome. The patient was compelled to relinquish his efforts with the feeling and conviction that the bladder had not emptied itself. Hæmaturia was never seen; the urine was completely clear. The patient introduced a catheter, and withdrew in its eye a fragment which Professor Küster recognised as a villous process. The endóscope was introduced, and directly the prism

entered the bladder a dependent growth could be most clearly distinguished immediately above the normal fold of the urethral orifice. It was composed (Fig. 22) of a large number of villous processes, for the most part of a delicate rose colour. In the centre of some of the larger processes fine vascular branches could be seen.

By gentle movements of the cystoscope it was proved that the growth was attached to the right half of the anterior wall, $2\frac{1}{2}$ cm. to the right of, and external to, the urethral orifice, also that it did not overlap the middle line. Its size was

FIG. 22.



correctly estimated. But it was more difficult to determine whether the growth was stalked or whether it was attached by a broad basis.

The discovery of the position of the tumour at once explained the cause for the abnormal

symptoms of micturition; so long as the bladder was full, so long did the growth remain suspended above and out of the way of the urethral orifice; in proportion, however, as the urine diminished so the growth descended until it was finally caught in the outflowing stream and the orifice plugged by it.

Prof. V. Bergmanu performed sectio alta and corroborated the cystoscopic examination in every detail. The growth was like a walnut-sized raspberry, and pedicled.

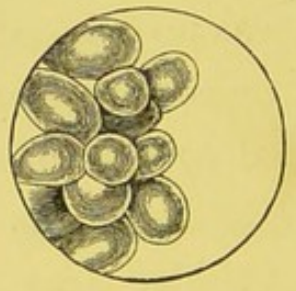
Case 3.—Herr R., æt. 55, had suffered for five years from recurrent hæmaturia. The microscope had demonstrated the presence of a great number of large, irregular, club-shaped cells, which often appear in villous papillomatous cases, but which are scarcely characteristic of the disease.

The cystoscope was introduced, and the anterior wall and vertex proved to be normal, but when the beak was placed towards the left side of the patient, a broad-based tumour situated on the left side of the bladder near the left ureteral orifice was seen. It seemed to be about the volume of a medium-sized strawberry.

Prof. Madelung removed it by sectio alta, confirming the cystoscopic examination in every detail.

Case 4.—A Jew patient with malignant growth of the bladder wall had been operated upon by Dr. Israel, of Berlin, in the hopes of arresting a profuse hæmaturia. The growth had been found so extensive that only the most prominent parts were removed, and the greater portion of the growth, together with the infiltrated wall, had been left undisturbed. Microscopical examination showed the growth to be carcinoma. The result of this interference had been remarkably successful. Not only had the bleeding been arrested; not only had the wound healed in the most satisfactory manner, but the patient also had been freed from all his symptoms, and had regained control over his urine, the latter becoming clear. Under these

Fig. 23.



conditions it could not be but interesting to ascertain what had become of that part of the carcinoma which had been left untouched. The cystoscopic appearances were in direct antagonism

to the patient's favorable condition. Springing from the right side of the bladder could be seen multiple warty club-shaped excrescences, which thickly covered a space the size of a three-shilling piece.

On carrying the cystoscope still further into the bladder this growth was seen to occupy the entire anterior half of the right wall of that viscus. The movements of the instrument, however, caused some hæmorrhage, and "one could see very plainly the blood flowing out in a stream from a wounded papilla."

Case 5.—The patient stated that he had for nearly nine months been forced to strain for some time in making water before the urine would commence to flow. There was no pain. A slight and transient recurrent hæmaturia was, however, noticed. The sound revealed nothing. The cystoscope was therefore introduced, and on turning it towards the left side of the patient a villous papilloma was detected. The attachment was at the left ureteral orifice, but the growth appeared to reach almost to the urethral opening. The rest of the mucous membrane was normal.

Case 6.—Herr B., had suffered for many years from frequency and straining in micturition; for

the last seven months, pain had been experienced in the region of the neck of the bladder, passing in a wave along the penis. Blood had frequently appeared since the pain had been observed. On introduction of the cystoscope the greater portion of the inferior half of the right wall and the adjoining part of the base up to the right ureteral orifice was seen to be thickly covered with irregular, rose-coloured, knobby or warty excrescences, without the production of any prominent tumour. It was evidently an ulcerated malignant infiltration of the bladder wall. The rest of the surface was healthy. No operation was advised.

Case 7.—W. M., æt. 34. Two and a half years ago the patient observed that the last few drops of urine were bloody, and this without any apparent cause. The urine next passed was distinctly hæmaturial, thereupon the water regained its normal colour. Since this time, without warning and at irregular intervals, bloody urine had been evacuated. The attacks became more frequent, the hæmaturia more profuse and longer in its duration. Pain was felt only on the passage of clots. In the pauses of the disease the patient felt perfectly well.

On introducing the cystoscope there was seen

projecting from the left side, separated from the urethral orifice by a strip of healthy mucous membrane, 1½ cm. wide, a villous papilloma. It was about the size of a pigeon's egg and was composed of closely-set villous processes, of which some were necrotic and overlaid with a white material. The case was demonstrated at a meeting of a society.

Case 8.—A patient, æt. 60, who had long suffered from hæmaturia. No other symptoms were observable. Nothing was discoverable, nor was the site of the hæmorrhage ascertained. Immediately upon the entrance of the cystoscope a walnut-sized tumour was perceived hanging from the anterior wall. It was composed of a great number of closely-set villous processes; the rest of the bladder was healthy.

The Rank of the Electric Cystoscope.

Having placed a sufficient number of illustrative cases before the reader to enable him to judge of the capabilities of the electric cystoscope, it only remains for us to touch upon certain important questions as to the rank which the instrument will assume in the diagnosis, prophy-

laxis, prognosis, and treatment of obscure reno-vesical diseases.

Diagnosis.—There are few cases more perplexing or more unsatisfactory to treat than those of hæmaturia. Very often the evacuated urine contains no clue as to the source of the blood, and in only a small proportion of cases does the microscope reveal its cause. Not infrequently bimanual or rectal examination proves valueless in the localisation of the disease, while the sound, evacuator, and lithotrite sometimes afford only negative results. It is in this class that the cystoscope has, and will, prove of so much value.

Renal hæmaturia.—A close and prolonged examination of the ureteral orifices will demonstrate the source of the hæmorrhage if it be renal (p. 69).* This is a step of the utmost importance, for it sometimes happens that renal simulates vesical hæmaturia most closely. The following case, which came under my notice, will serve as an illustration.†

The history of the patient was as follows:—Ten months before death patient noticed some

* Author, "The Value of Electric Cystoscopy," 'Brit. Med. Journ.,' April 14th, p. 786, 1888.

† Author, 'Path. Trans.,' p. 166, vol. xxxviii, 1887.

obstruction in passing water, and voided a blood-clot, which was followed by a profuse hæmaturia of a painless character. After twelve hours the bleeding was arrested. For three months he was free, when another attack supervened of three days' duration. Character: profuse, painless, and vesical. He was again free for ten weeks, when a painless hæmaturia again ensued. Since this time he has had recurrent attacks every ten days.

Status præsens.—No stone, no cause assignable for outbreak. Prostate rather large. Urine of sp. gr. 1015, alkaline. Blood almost pure and of a scarlet colour.

Digital exploration of the bladder was performed by Mr. Coulson, in the hope of finding a villous growth, but the bladder was found to be free. The patient had a severe attack of suppression of urine, from which he recovered, with a profuse attack of herpes labialis. He died a month after the operation. The bladder was somewhat hypertrophied but otherwise healthy. The right kidney enlarged. Section showed the upper quarter to be renal substance, with innumerable deposits of encephaloid cancer scattered through it, and the lower three quarters to be transformed into a disintegrating blood-red

mass of the same character, evidently growth, with a large extravasation of blood. Left kidney was normal, but a branch of the left renal artery contained a hollowed plug (a canalised clot).

The entire aorta was extensively atheromatous. The inferior vena cava was similarly but less diseased. There is no doubt that the renal bleeding had been sudden and profuse, and the bladder being rapidly distended with a weighty alkaline fluid had as rapidly contracted. A renal hæmaturia had thus simulated one of vesical origin.

The instrument will therefore obviously tend to replace the large collection of instruments or procedures which attempt the differential diagnosis of the source of hæmaturia and pyuria.* It cannot altogether displace such instruments as Tuchmann's,† &c., for before an attempt is made to excise a kidney the existence and working capacity of its fellow gland must be ascertained.‡ Upon the capacity of the latter to bear the double burden depends the advisability of the proposed

* Cf. author, "Suction of the Male Ureters," 'Lancet,' Sept. 18th, 1886, p. 529.

† Tuchmann, 'Die Diagnose der Blasen und Nieren Krankheiten,' Berlin, 1887.

‡ Cf. R. W. Weir, "Extirpation of Kidney," 'Annals of Surgery,' 1885, p. 317, vol. i.

nephrectomy. Now, the stress resistance of a kidney can only be accurately grasped by a rigid examination of the urine; and further, that secretion must be obtained directly from the fountain head; it must not be contaminated by the admixture of urine flowing from its diseased companion. The material for such an examination can only be obtained by means of Tuchmann's ureteral forceps or the author's ureter aspirator.

Vesical Hæmaturia.—The cystoscope will be an efficient diagnostic agent in the detection of villous papillomata and other vesical growths, the existence of which one may suspect, but which, without a cutting operation in the shape of a digital exploration, one often cannot absolutely diagnose to be present in the bladder. It will also be of service in the differential diagnosis of the various causes of vesical hæmaturia. A careful visual inspection of the surface of the bladder will reveal a hæmorrhagic cystitis, a growth, a calculus, an enlarged prostate, or an ulceration, as the source of the hæmorrhage.

Foreign Bodies.—It sometimes happens that a case of obscure vesical disease is met with, and a foreign body is suspected of being the cause of the anomalous symptoms, although no direct

evidence can be obtained from the patient as to the introduction of the same into the bladder. Calcareous deposit may rapidly form upon it, and, being detected by the sound, may tempt removal by the lithotrite. The calculous deposit may be removed, but the nucleus left behind to induce a fresh accumulation. As a good example of the value of the cystoscope in this class the following may be given.

A deaf mute,* æt. 22, with infantile paralysis of the right side, was brought by his father for relief. Symptoms of stone had been noticed three months. The boy had been in the habit of masturbating.

A stone was detected and crushed by Mr. Heycock, under whose care the case came, and to whom I am indebted for permission to publish these details. It was noticed, however, that the fragments evacuated did not correspond to the size of the stone, which had been gauged by the lithotrite at the commencement of the operation, and the most careful sounding did not reveal where the deficit lay. The boy developed symptoms of peritonitis and died.

On post-mortem, slate-coloured pus was found

* Author, 'Path. Trans.,' 1887, vol. xxxviii, p. 193.

in the sheath of the right rectus, and which proved to be an extension upwards of severe extra-peritoneal cellulitis. I found this had started and had spread from the posterior surface of the bladder. The loops of small intestine, which occupied the rectovesical pouch, were glued together and to the back of the bladder by soft lymph. The bladder and prostate were, therefore, removed *en masse*, and the former was opened in front. The vesical wall was thick, the cavity contracted, being only as large as a duck's egg. A split india-rubber umbrella ring was found behind the trigone; one side of its circumference rested on the interureteral bar, and the other dipped into an ulcer of the posterior wall. On removing the ring and examining the ulcer more carefully, it was seen to have perforated all the coats of the bladder, with the exception of the peritoneal, and it was evident that the urine had percolated through this opening, and had set up, primarily, cellulitis, and secondarily, peritonitis. There is no doubt that this ulcer was caused by the foreign body, and must have finally given way under the distending force of the water used in the evacuation of the fragments, for the traces of the rush of water were visible under the peritoneal covering up to

the top of the bladder in the form of a track of fine, calculous débris.

The mucous membrane of the bladder was inflamed, the ureters healthy, and the condition of the other viscera apparently normal. It is presumable that the split umbrella ring had been pressed down the canal to produce erotic sensations.

The case has, however, an important clinical aspect. It will be at once conceded that the operator may be justly exonerated for having left so soft, so elastic, so resilient a body as india rubber in the bladder after litholapaxy. Doubtless, when his instrument engaged the ring he would suppose that a fold of an atonic bladder had been grasped, and would wisely desist from crushing the same, while it is obvious that so sound-deadening a material would give no just or reliable evidence of its presence when struck with the beak of a solid, steel sound, though it could have been at once detected by the electric cystoscope.

Stones—The cystoscope cannot displace the manageable sound in the diagnosis of stone in the bladder, but there are some cases overlooked by the practitioner, which have but few characteristic

symptoms, and which are classed as "latent" calculi.* In this class the cystoscope may glean what the sound has left behind, or may discover stones for which the sound has not been used. Electric illumination will be of use in sacculated stone (*vide* p. 86) and post-prostatic, or post-trigonal pouch stones. It has been said that the electric light will be useful in ascertaining the *entire* removal of fragments after litholapaxy. This is hardly likely. The useful hint given by Freyer† of using the aspirator and cannula in the examination of small calculi, will usually demonstrate the completion of the operation.

Prophylaxis.—A belief has been expressed that the early use of the cystoscope in hæmaturia will tend to limit the size and number of vesical papillomata by enabling us to detect and remove these and other growths in their very infancy.

I do not quite agree with this belief, for a careful examination of histories and pathological specimens of vesical growths have convinced me that the tumour does not obey a fixed law of deve-

* Author, "Latent Vesical Calculus," 'Trans. of the West Lond. Medico-Chir. Society,' vol. ii, p. 45.

† "Stone Operations," 'Brit. Med. Journ.,' p. 1373, Dec. 24th, 1887.

lopment, increasing in size *pari passu* with the duration of symptoms.* The increase depends upon the character of the growth, its position in the bladder, and its method of attachment to the wall. Nay further, the growth may have attained a considerable size before any evidence is obtained of its presence, lying "latent" until a chance congestion or accident develops the characteristic hæmaturia.†

Prognosis.—With a greater visual experience of vesical growths there is but little doubt that the cystoscope will become an important factor in the prognosis of the disease. Our prognostic power will largely depend upon the knowledge acquired from museum specimens, for although the tumour alters greatly after death, and more so after a long retention in spirits, yet there are certain points in these bladders which immediately strike us as having malignant characters; and if the cystoscope reveals similar appearances, operation for removal

* Small *apple*-sized growths were found, 5 weeks, 6 months, 2 years, 5 years, 14 years, after the onset of symptoms, whilst *nut*-sized tumours were discovered 5 months, 9 months, 18 months, 2½ years, 4 years, 7 years, and 28 years after the first outbreak of the hæmaturia.

† Thus a case under A. R. Jackson ('Boston Med.-Chirurg.,' April 2nd, 1870, p. 120) presented symptoms for only five weeks, and yet a mass weighing 8½ oz. was removed—fibro-papilloma.

is contra-indicated. As an example I would mention the very suspicious combination of pure villous papillomata with a lumpy or nodular growth, especially if these two forms of neoplasm are upon apposed surfaces of the bladder. Such a condition is nearly always malignant, occurring chiefly in carcinoma,* but sometimes in sarcoma. In 10 per cent. of the carcinomata of the bladder *pure* villous papillomata co-exists. They are perhaps produced by the irritation of the *contact* of the carcinomatous growth. If two or more distinct nodules, or isolated projecting growths, are found in the same bladder, especially if they be on apposed surfaces, the disease is undoubtedly malignant, and is probably carcinoma reduplicated or multiplied by contact.†

In some of the cases we have quoted (pages 97, 106), the operation contemplated was at once *vetoed*, the cystoscopic appearances demonstrating the malignant nature of the growth.

Instead, therefore, of blindly operating upon all vesical neoplasms,‡ and obtaining by such routine

* Author, Jacksonian Prize Essay, "Tumours of the Bladder."

† Author, 'Path. Trans.,' 1888; 'Lancet,' March 10th, 1888.

‡ No operator would of course attempt to remove those growths which have plainly infiltrated the bladder base or wall. Such cases do not need the employment of the electric cystoscope.

a large operative death-rate, we shall be in a better position, after cystoscopic examination, to select those cases suitable for operative interference, and leave those untouched which it is the wisest policy to leave alone.

Treatment.—Not only will the cystoscope enable us to discover foreign bodies (other than stones) but will by revealing their shape and nature decide us as to the operation which is most suitable for their removal. If the body be long and able to be extracted by the lithotrite (compare pages 77 and 112), the beak can be guided to that part of the bladder which contains the end or portion best suited for seizure by the blades and the body removed through the urethra. If the object has become so bulky by calculous deposition the cystoscope will then enable the operator to decide upon a cutting operation.

A case which came under my notice in Brussels affords a good example. A boy, æt. 18, had thrust by some means or other a full ear of corn down his urethra, most probably for erotic purposes. The stalk broke off and the ear made its way into the bladder, where a large calculus was speedily constructed upon it as a nucleus. Litholapaxy was performed, and though the superficies

was partially removed yet the main body, of course, could not be extracted, for every part was densely infiltrated with cretaceous material. The operator, uncertain, I believe, of the true nature of the substance he was dealing with, finally performed supra-pubic lithotomy, and removed an oval, irregular mass, which on section displayed an ear of corn as its nucleus.* In this the cystoscope would have at once revealed the nature and size of the object which could have been extracted by lateral lithotomy.

It is, moreover, probable that upon the cystoscopic appearances of the growth will depend the method of operation, whether the route chosen be through the perinæum or above the pubes. Those tumours which are shown to be small, slightly pedicled, and near the urethral orifice, may easily be treated by the Boutonnière, whilst those which are multiple, bulky, or sessile need the wider access which is afforded by a *sectio alta*. It is, perhaps, Utopian to point to those cases in which the growth was removed in the eye of a catheter and the patient at once freed from the cause of

* Similar cases are to be found in Harrison, 'Clinical Lectures,' "Meadow Fox-tail Grass (*Alopecurus pratensis*);" Heath, of Manchester, 'Manchester Medical and Surgical Reports,' vol. ii; Thompson, 'Brit. Med. Journal,' April 14th, 1888, p. 776.

his trouble,* and to express a hope that in a limited class we may be able, after having localised a small growth by means of a cystoscope, to remove the same with properly constructed lithotrite or evacuating catheters.

It has already been pointed out that the enlarged 40 French guage cystoscope will be of use in the Boutonnière operation in controlling the operator's fingers and forceps, step by step, so that no growth is left behind. One of the causes for recurrence (apart from malignant disease) is the *incompleteness* of the eradication of the tumour.†

The cystoscope will also be a useful guide in the indication of MacGill's operation,‡ the suprapubic removal of the prostatic "third lobe." For this purpose Nitze's third cystoscope (page 34) is the best.

Summing up briefly the question of the rank which the cystoscope will assume, it may be fairly said that it will be reserved for those cases of obscure vesical disease which other methods of

* Bryant, 'Surgery,' p. 67, female child; Ultzmann, Wiener Klinik, "Hematurie," male, æt. 60; Maas, 'Berlin. klin. Woch.,' 1876, p. 46, three cases, all males, aged respectively 53, 33, 38.

† Author, Jacksonian Prize Essay, "Tumours of the Bladder."

‡ MacGill, "Hypertrophy of the Prostate and its Relief by Operation," 'Lancet,' Feb. 4th, 1888, p. 215.

examination have failed to elucidate. It will never become so popular or so generally employed as its kindred, the ophthalmoscope, laryngoscope, and otoscope, for the necessary adjunct of the battery and the natural objection of the patient to instrumentation will considerably curtail its use. It will become an important atom in the molecule of the diagnosis and treatment of obscure vesical disease, for it procures for us *a visual examination of the bladder without a cutting operation.* It will therefore rank immediately before, and in some cases supersede, the operation of Boutonnière or Sir H. Thompson's digital exploration of the bladder.

CHAPTER V.

ELECTRIC ILLUMINATION OF THE URETHRA.

The Electric Urethroscope.

a. The platinum loop (the Nitze-Lieter) 1879.

b. The incandescent lamp (Schall, Leiter) 1886, 1887.

The Nitze-Leiter urethroscope is constructed upon the same principle as the cystoscope (Chapter II). Its source of illumination is a platinum wire, and the light is not cast from without as is the fashion of most urethroscopes, but being fixed in the distal end of the cannula is introduced into the urethra to illuminate a given area of the surface of that canal. This instrument is hampered by the same water-cooling apparatus, is encumbered by the same large and evil-smelling Bunsen battery, and is therefore almost as costly and as complicated as the Nitze-Leiter cystoscope.

The original Nitze urethroscope needed but little

improvement at Leiter's hands. Some changes were made, however, the most important of which was for effectually shielding the eye from the blinding rays of light which were cast towards the ocular end of the tube in Nitze's original instrument.

The Nitze-Leiter urethroscope will be best understood by a reference to Fig. 24. The instrument has had the cannula, which is represented by the dotted line, removed. The straight portion *b b*, contains the illuminating and cooling apparatus. At the distal end of this shaft is the platinum loop *c*, shown on a larger scale in Fig. 25. This platinum loop is easily fitted into the sockets *a b*, Fig. 25, and therefore readily renewable. The metal body of the shaft (*b b*, Fig. 24) serves as one of the connections between the battery and the loop, the other conductor being an insulated wire packed in with the water tube (Fig. 26, *h*, *g*, *i*,). The minute anatomy of the shaft (*b*, *b*, Fig. 24) is represented in Fig. 26. The water canals and the currents traversing them, are indicated by arrows *d*, *a*, *b*, *e*, the reservoir connections fit on to these water tubes *d* and *e*, by what workmen call "Dutch screws" (Fig. 24, *h*, *i*).

Fig. 24.

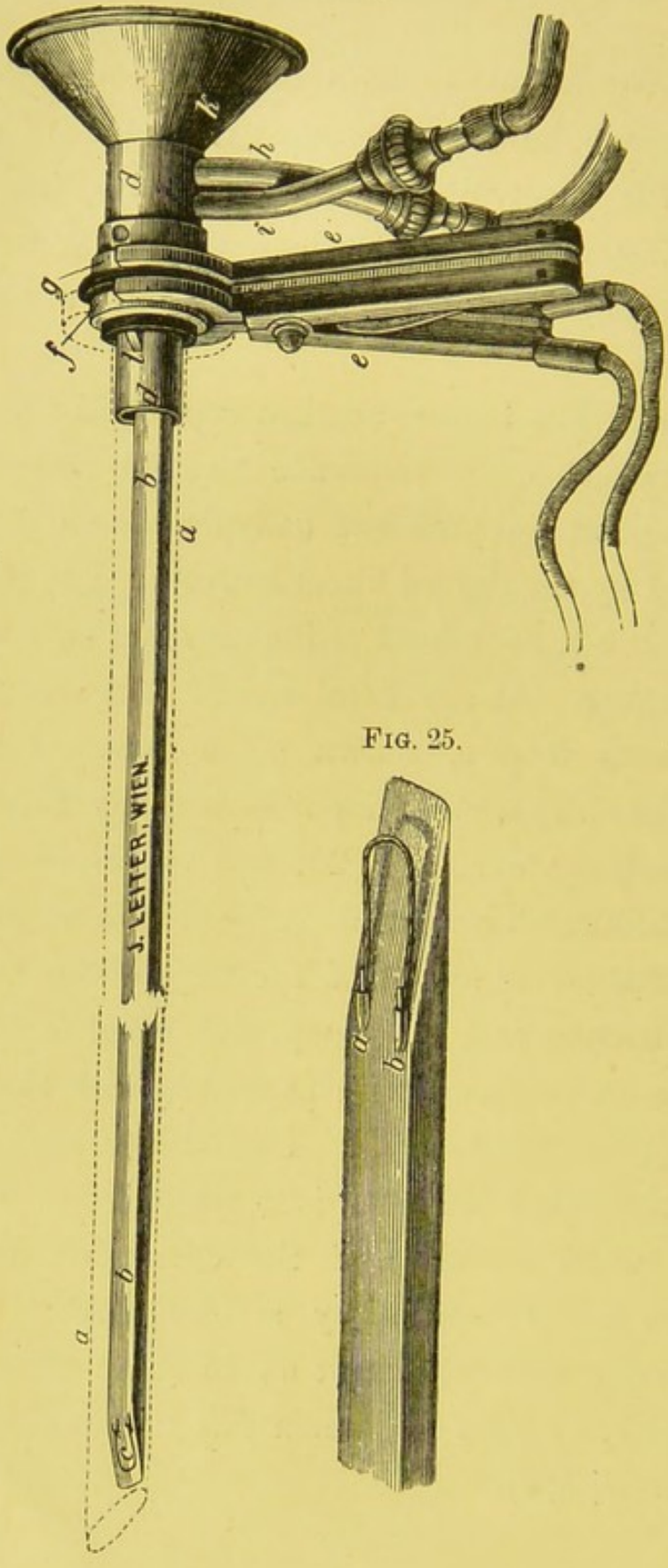
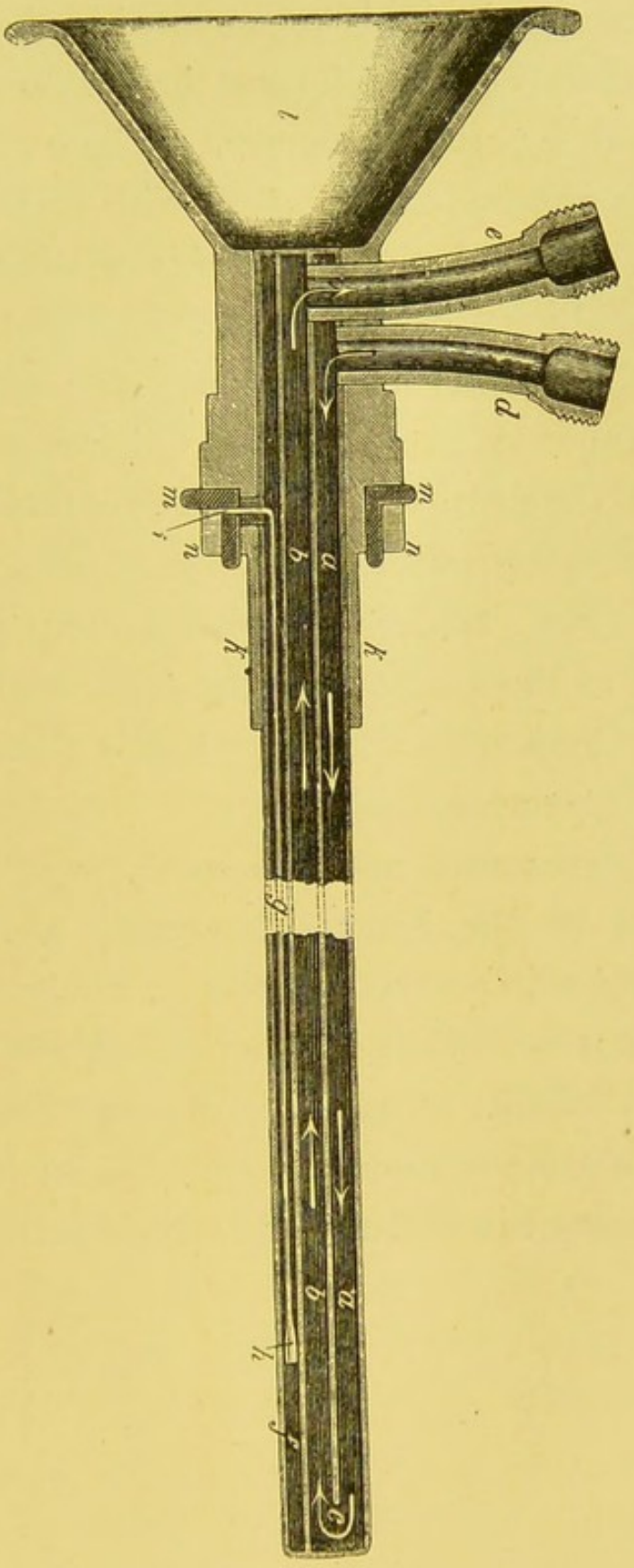


Fig. 25.

Fig. 26.



The insulated wire is represented in Fig. 26, *h*.

This shaft (Fig. 24, *b*, *b*,) was thrust into various-sized and lengthed cannulæ. Those for the prostatic urethra have an elbow with a window on the convexity of the bend, this window being hermetically sealed with a small glass plate.

The Nitze-Leiter urethroscope was a very great advance upon its predecessors. Thorough illumination of the entire urethra could be obtained by it, a surface of the urethra 1 cm. square being lighted up at a time. It could be used without any discomfort to the patient, for the great heat of the platinum loop lamp was immediately absorbed by the cooling currents of water.

The instrument never became popular. It remained in the hands of certain continental specialists, who persevered with it, cumbersome as it was, and who did good and sound work by its means. Schall's instrument, in which the light is cast from without, rapidly superseded it; but only to be replaced in its turn by Leiter's pattern.

(*b*) *The Incandescent-Lamp Urethroscope.*

Directly the Edison or Swan lamp in its smallest form was introduced it was employed for the illumination of a variety of endoscopic instruments, such as those for the vagina, nose, throat, ear, and rectum. Mr. Schall, of the firm of Reiniger, Gebbert, and Schall of Erlangen, constructed an incandescent-lamp urethroscope which somewhat resembled the old-fashioned Desormeaux-Cruise instrument, the hot and unwieldy paraffin lamp of the latter being replaced by a small incandescent lamp.

The Schall Urethroscope.

This instrument is made up of three pieces, the cannula, the lantern box, and the handle (Fig. 27).

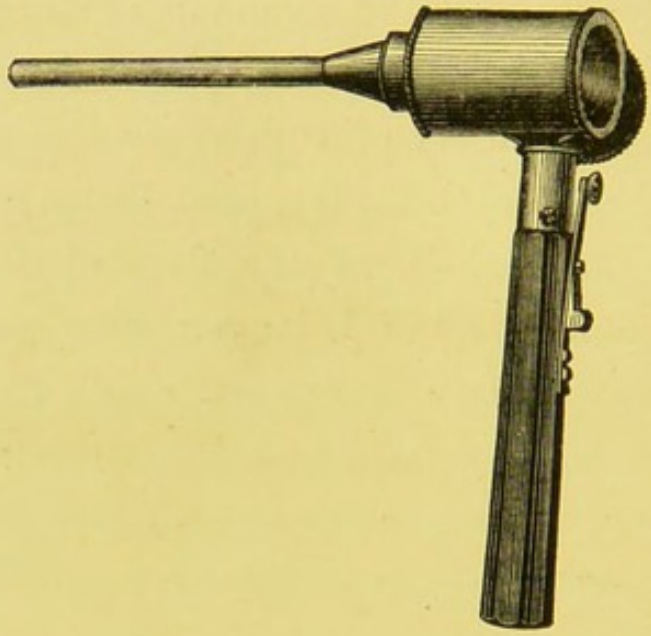
The handle carries an incandescent lamp upon its summit, and fits into the lantern-box.

The lantern-box is a closed cylinder which is furnished with an obliquely placed flat or concave mirror for reflecting the rays of light along the cannula.

This instrument is a powerful one, but it has

been entirely superseded by a simpler and more perfect innovation,—Leiter's new incandescent-

Fig. 27.



lamp urethroscope, which has been apparently modelled upon Schall's.*

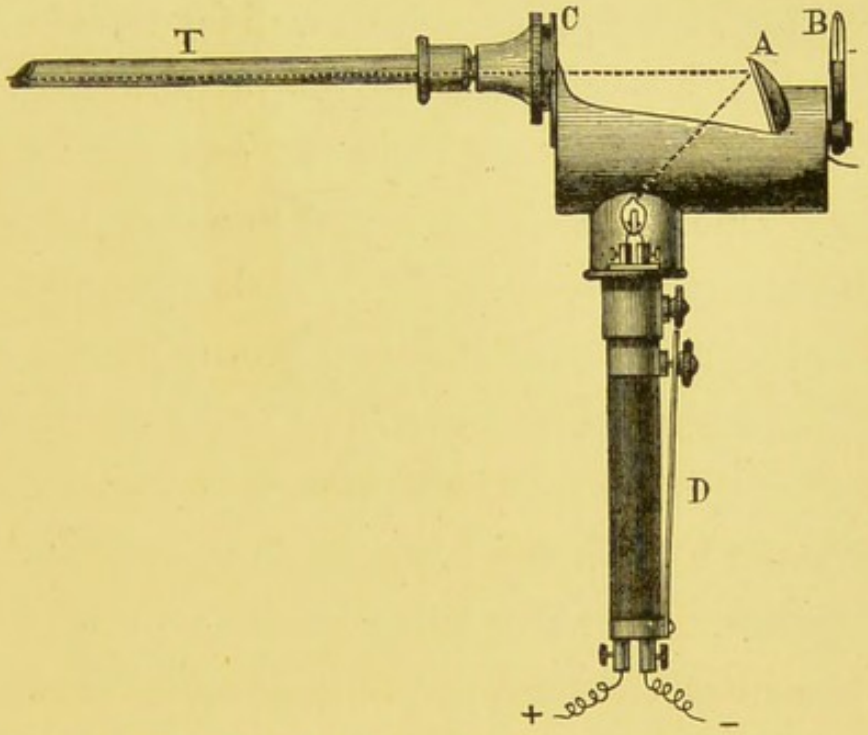
The Leiter Incandescent-Lamp Urethroscope.

Construction.—The incandescent-lamp urethroscope is made up of three pieces, D, B, C, and T, (Fig. 28). These pieces may be described as follows: 1. The handle D is made of caoutchouc, and carries on its upper end a small incandescent lamp, which is connected with the two binding

* J. Leiters, 'Neue Beleuctungs apparate,' Wien, 1887 (Notiz zur Priorität).

screws which project from its lower end. A light steel spring forms the key. The handle fits into the bottom of the lantern B C. 2. The lantern B C is a roofless gutter-shaped box, carrying at one end a fixed, obliquely-placed concave mirror A for reflecting light along the urethral

FIG. 28.



Leiter's Electric Endoscope for Urethral Examination.

cannula T, and at the other the nozzle C for fitting on the urethral tubes. Two additional and important items of the lantern consist in small perforations around the lamp for ventilating off the heat, and a small movable lens B for myopic or hypermetropic observers. 3. A series of urethral

cannulæ T of various sizes and lengths. (Those supplied at present by Leiter are not long enough.)

Fig. 28 shows that the light from the lamp is cast directly along the tube, and that the observer's eye, which is placed at B, is shielded from the blinding light emitted by the lamp. It is worked by the same battery as the cystoscope.

The instrument is especially well made, is handy, and bears a good deal of rough usage. It is difficult to understand how it can get out of order. One or two points are, however, of some practical importance. The little incandescent lamp may, after a month or two of good usage, become blackened or fused, and require changing. To effect this all that is necessary is to withdraw the handle D from the lantern B C by relaxing the grip-screw. The two small binding screws which are shown at the base of the "Mignon" lamp are then relaxed, the lamp lifted out, and a fresh one fixed in, care being taken that the binding screws are sent sufficiently home to make firm contact with the terminals of the lamp. The handle is now refitted into the bottom of the lantern, and fixed there with a turn of the grip-screw. In performing this little manœuvre the light must be placed at the proper level to allow of the full

reflection of its rays along the cannula from the mirror. If the lamp be thrust too far or not far enough into the lantern, the observer will be annoyed to find in his next urethral examination that an insufficient illumination is afforded by the lamp.

To prevent this subsequent unnecessary delay and vexation, let it be made a rule on changing a lamp to obtain its proper position in the lantern at the same time. Insert the handle into the lantern; put the lamp in action, and project the light emitted from the end of the affixed cannula upon a dark surface. By elevating or depressing the handle, and watching the varying illumination of the circle of light cast upon the screen, that position of the lamp which will afford the greatest brilliancy can be readily ascertained, and a turn of the grip-screw will thus secure it.

CHAPTER VI.

THE USE AND CAPABILITIES OF THE INCANDESCENT-LAMP URETHROSCOPE.

No difficulty can be encountered in the use of the urethroscope, and but few precautions are necessary to secure a brilliantly illuminated urethral surface. The only obstacle to a successful examination is the oozing of blood, if the examination has been rough; or the presence of pus or lubricant, even a small quantity of which will effectually obscure the vision.

Select a cannula of medium length* and of a gauge which the meatus will admit. It will be found that the larger the tubes are, so much more searching and accurate will the examination prove. I do not hesitate to slit the meatus downwards prior to the urethroscopy if it be at all narrow, for not only is a gleet or an urethral pain, or even a functionally irritable bladder, often

* By compressing the penis in its long axis the operator can often make a very short cannula suffice for the purpose of urethroscopy. It is a useful knack to acquire, for obviously the light diminishes in direct proportion to the increased length of the cannula.

cured by this slight operation, but a due expansion of the urethral folds by the larger calibred cannula is obtained. It is not improbable that small patches of disease lurking in the folds of an insufficiently distended urethra may be overlooked if the small-gauged cannula be employed.

I make it a rule to examine under the influence of cocaine.* It might be thought that the cocaine is likely to doubly deceive the observer. First, that its supposed constrictive action on the small capillaries would render the mucous membranes bloodless or less congested than they otherwise would appear, and so mislead the surgeon, who is

* Much has been written and said about the danger of this drug, and there is some confusion as to when untoward effects are to be expected from its use. I have seen faintings after applications to the larynx and pharynx, which is conceivable in a position so highly endowed with reflexes. But I have never noticed any bad result from vesico-urethral injections except in one patient, and that a medical man who had read up the subject. I cannot honestly estimate how often I have used the 20 per cent. solution of cocaine in vesico-urethral practice, but the actual number of applications must be very great. I obtained the drug directly after its introduction in 1884, and have used it freely in lithotrity, internal urethrotomy, dilatation of stricture, and other operations on the bladder and urethra. Over 400 vesico-urethral cases attend my out-patient department at St. Peter's Hospital every week, and cocaine is and has been used routinely since January, 1885. I believe the apprehension of dangerous symptoms following its use upon the urethra to be quite unfounded.

greatly guided by the aspect of the vascularity. Secondly, in painful or neuralgic urethra, where the patient can localise the site of the pain or discomfort, it might be supposed, as all sensation is in abeyance after the cocaine application, that the surgeon would be without a trustworthy guide to the position of the diseased patch. The former objection is more theoretical than practical. It is an open question if the application of cocaine does constrict the vessels of the urethral mucous membrane to any marked degree. Even if this is the case, and I doubt it, the slight change in the visual field cannot outweigh the moral influence of a promised painless examination, or the opportunity such must afford for a searching and prolonged urethroscopy.

Again, the objection to the use of cocaine as inducing a loss of localising power is certainly a valid one. It can, however, be easily overcome by marking with an aniline pencil on the outside of the penis or the perinæum the spot which is indicated by the patient as the site of the pain. Even this is seldom necessary, for with practice the eye gets accustomed to any deviation from the normal, and proves frequently a more trustworthy guide than even the patient's sensations.

The application of the cocaine is simple enough. Suck up into a medicine dropper fifteen to twenty drops of a 4—20 per cent. solution of cocaine and inject the same into the urethra. Pass the fingers of the left hand gently along the under surface of the penis, whilst the glans is being laterally compressed by the fingers of the right, so as to drive the injection deep into the canal. There is no necessity to wait for a perfect anæsthetic condition to develop if a 20 per cent. solution has been used, for the cannula can be immediately passed without pain to the hilt, a drop or two of glycerine sufficing to lubricate its surface. If an obstruction is met with : stop at once, withdraw the plug, affix the lantern, and examine what the obstruction be due to, whether it be stricture, granulation, or growth. The greatest gentleness is necessary, for if the vessels be engorged a slight violence may rupture them, and the consequent bleeding will prove troublesome in obscuring the view. If no obstruction is encountered : pass the cannula to the hilt, withdraw the plug gently,—for a sudden and brusque movement may jerk the end of the canal against the wall and produce bleeding, fit in the lantern, and examine the mucous membrane as the cannula is being slowly withdrawn. If the

cannulæ are marked in inches a note of the exact position of the diseased mucous membrane can be made for future reference. Frequently a drop of mucus, gleet, or the lubricant will obscure the surface of the mucous membrane; a pledget of cotton-wool on a stylet removes it, hence it is wise to use as little glycerine as possible. Should the wool slip off the end of the stylet it will be passed on urination or may be removed by a hook-ended stylet applied through the cannula.*

Capabilities.—The illuminating power is very considerable. Every section of the urethra can be thoroughly examined, piece by piece, and every detail of its surface as easily studied as if the canal were exposed to direct sunlight. It is said that the openings of the lacunæ are readily recognised, and that with appropriate elbowed cannulæ that the prostatic urethra and its caput gallinaginis and openings for the prostatic sinuses can be distinguished.

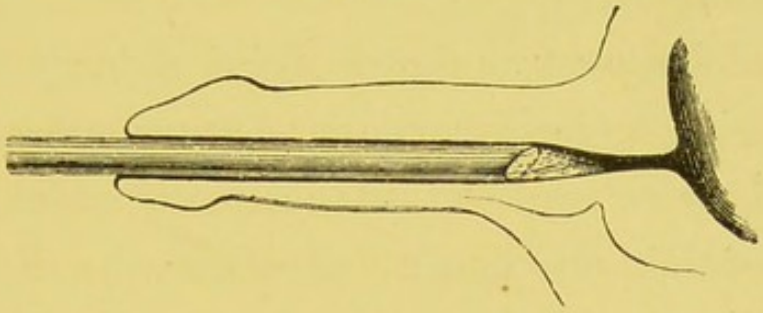
I have not had occasion to examine the prostatic urethra, but if this be so the urethroscope may throw some light upon the cause, and control

* In dealing with tight stricture it must be remembered that the stream of urine will barely suffice to eject the pledget, and that in these cases it becomes absolutely necessary to recover it with the hooked stylet.

the present empirical treatment of profuse seminal emissions.

Fig. 29 shows the light from the end of the tube upon the adjoining surface of the urethra, but the sketch is only diagrammatic. The urethra closes

Fig. 29.



in over the end of the cannula in the form of a cone, funnel, or circle of mucous membrane with a depressed centre. It is upon this funnel that the observer's eye is fixed, and it is upon the appearances of its component parts, viz. (*a*) the rim, (*b*) the central figure (Grünfeld) or depressed centre, and (*c*) the intervening surface, that the diagnosis of health or disease depends.

The form and shape of the funnel varies. This is partly owing to the pressure of the end of the cannula, but it is greatly dependent upon the character of the mucosa. If the mucosa be healthy and pliant it will yield and fall over the end of the cannula. If its natural elasticity be

replaced by the stiffness of inflammatory exudation or the induration of cicatricial contraction, the funnel lengthens, and the alteration in shape is readily recognised.

(*a*) The rim or edge of the funnel generally appears white from the pressure of the rim of the cannula.

(*b*) The central figure is of a very variable shape, it may be a mere linear, transverse crack, a dimple or an oval slit. It is usually obscured by a drop of fluid and needs well cleansing. Radiating from the centre in (*c*) the intermediate part, are a number of fine folds, the thickness of which affords us a certain knowledge of the condition of the mucosa, whether it be infiltrated or not. The surface, if the urethra be normal, is smooth, glistening, and of a yellowish-red colour. It is covered with innumerable small vessels, some obviously arterial, others venous in character. The direction of their course is, for the most part, along the long axis of the canal.

Uses.

Gleet.—Few practitioners will agree with Dr. Oberländer in his belief that a gonorrhœa cannot be

thoroughly cured without an endoscope, and yet many will readily admit that in intractable cases of gleet, a searching visual examination of the diseased surface would be of the greatest advantage. For not only might the cause for the chronicity be revealed, but a more efficient and less empirical form of local treatment could be adopted to arrest the discharge. The urethroscope has never been a popular instrument, and I believe it is due to this fact that so many of the old-standing neglected gleets lapse into a stricture which might have been avoided. From the earliest days of endoscopy we have been made familiar with a variety of morbid conditions of the urethra which produce a discharge or gleet. Thus we have urethritis granulosa (described by Desormeaux); urethritis membranacea; urethritis hæmorrhagica; urethritis glandularis; urethritis squamosa; urethritis simplex, &c.

It has been contended that these divisions are artificial, and the outcome of mistaken diagnosis from insufficient illumination. It will be for the incandescent-lamp urethroscope to clear up definitely these contradictory statements. After having used the instrument upon a large number of gleety urethræ, I cannot help feeling that the

above nomenclature is unnecessary. For the most part the urethræ of patients who had suffered from a gleety discharge for years might be called "sweaty." The surface is moist, and when cleaned with the stylet pledget appears dull, as if the epithelial layer had desquamated and become thinner. The vessels are full and congested, sometimes purplish; the whole mucous membrane appears "toneless." The elasticity, judged by the flexibility of the "funnel," does not generally seem impaired. This class did well under Thallin bougies, and astringent injections.*

This purplish, "toneless" condition was especially well marked in a case in which the gleet had lasted seven years. I showed the patient at the Medical Society (January 23rd), and demonstrated the congested condition with the incandescent-lamp urethroscope, contrasting with it normal and strictured urethræ.† This gleet was rapidly dried up by means of Thallin bougies, and for some days I congratulated myself at the success attendant on their use. The gleet relapsed,

* Author, "The Use of the Antrophores or Spring Bougies in Eighty Cases of Chronic Gleet," 'Lancet,' April 14th, 1888.

† Author, 'British Medical Journal,' March 2nd, 1888.

however, on their discontinuance. The urethra admitted a No. 14, English.

A congested condition of the *entire* urethra is seen in some cases of morbus cordis, apparently giving rise to no discomfort or discharge, unless a urethritis has been contracted. The gleet is then very difficult to cure.

Urethritis granulosa.—This is, in my experience, a rare disease of the urethra, but a more extensive series of electric endoscopic examinations may show this belief to be incorrect. It has been said that such a condition *never* exists, but that the appearance of "granulations" is due to awkward manipulation of the cannula, producing badly-illuminated local congestions. This contention cannot be maintained with the improved method of lighting, and some cases will show the granular condition of the mucous membrane most clearly. The disease is generally seen as a little patch or patches of granulation-like projections, which are small in size and numerous. They are often deeply congested, and bleed at the slightest touch. The surrounding mucous membrane is thickened (succulent). Nothing short of local and careful application, such as that of powdered lead acetate, caustics, or the galvano-cautery, has any effect.

The following case, which my friend and colleague Mr. Swinford Edwards brought me to examine, is a good example.

J. K., æt. 23, had suffered pain in the urethra, at one and a half inches from the meatus, for eighteen months. He has been treated with a great number of drugs, including Soda Salicylate, gr. xx, thrice a day; Potassium Bromide and Valerian. The porte-caustique had been applied to the painful spot, after which he felt some relief, but the pain returned. Electric illumination of the urethra was therefore decided upon.

On introducing the urethroscope after cocainisation, a granular condition very similar to that found in the palpebral conjunctiva was immediately discovered. The "granulations" were unusually large and firm, and deeply injected; a few dabs with the stylet pad soaked in nitrate of silver (gr. xx ad ℥j) turned the vivid red to a milk white. Next day the patient was much easier, and for a week his pain greatly decreased. It returned, however, in a lesser degree and needed, as these cases nearly always do, a few reapplications of the caustic.

It is this lumpy, readily-bleeding surface which deceives the ill-educated, unskilled hand whilst

passing a bougie. A stricture is diagnosed from the bleeding, and constant irritation is, thereupon, induced by the passage of bougies to overcome a contraction which never existed, and a localised, morbid condition which, if treated properly and in time, would have subsided.

Urethral neuralgia.—The value of the urethral endoscope will be most apparent in the diagnosis and treatment of cases of persistent urethral neuralgia, one of the causes of which has just been stated to be a granular condition. The apparent change most often found in the urethral mucous membrane at the spot where the continual discomfort or pain is complained of is a dark or congested patch of slightly swollen mucous membrane. There may be no swelling at all, merely a flush of injection. When this is cauterised with direct application of a solution of nitrate of silver of appropriate strength, the pain will greatly diminish and the urethra will resume a more normal appearance. It is remarkable how these neuralgic urethræ affect the patient. Their obstinate continuance has a most depressing effect, even upon sensible men. It is a question whether the pain, said to be experienced in the urethra, is not the index of some demoralisation of the nervous

system, for a history of onanism, excessive sexual intercourse, or of cerebral family taint may sometimes be elicited in these cases. There is also another very striking feature: neuralgia of other parts besides the urethra is frequently complained of, and the pain experienced seems to depend for its origin and acuteness upon the urethral condition. The following cases will serve to illustrate this extended sympathy with the urethra as well as the benefit derived from their local treatment.

Case 1.—A gentleman came to me from Servia complaining of constant pain in his face, limbs, and urethra. The urethral pain had existed for five years, and was consequent upon an attack of gonorrhœa. The patient was a well-built, athletic man of forty; he had had several severe attacks of malaria. His knee-jerks were excessive. He suffered from pin-and-needle sensations in his limbs which he described as "feeling like small grains of glass fixed in his muscles." He had lost all sexual power and had a frequent desire to vomit; his pupils were unequal. There was no swaying gait and no residual urine. Believing that his nervous system was thoroughly demoralised by malaria, and that under these circumstances an urethral granulation might have in-

duced and augmented the continual neuralgias of which he complained, I proceeded to pass the old-fashioned endoscope to examine his urethra; before doing so I applied in the ordinary routine fashion a few drops of a 20 per-cent. solution of cocaine to his urethra. In about sixty seconds he exclaimed that the neuralgia in his face was leaving him, and in two minutes he was completely free from the pain in his face, limbs, and urethra, which he assured me had been so constant a visitor as to cause him to throw up an important and lucrative official position. I found a very sensitive spot two and a half inches from the meatus (granulation patch ?), and cauterized it lightly on two occasions. He got rapidly well and returned, I believe, to Servia, in anticipation of the approaching war.*

Case 2.—T. B., æt. 39, married, has suffered pain in his urethra just behind his glans penis for seven months. He feels it most when at work. He has no stricture, stone, or prostatic trouble. Nothing seemed to relieve him. He began gradually to complain of pain in the thighs and groins, also in the ankles and down the tibiæ. Week after week he attended the out-patient depart-

* Author, "A Novel Extension of the Use of Cocaine," 'Medical Society's Trans.,' 1888.

ment with the same tale. Antipyrin in five-grain doses relieved for a few days but the pain returned. A congested patch about two inches down the urethra was seen by means of the electric urethroscope. I could hardly believe so apparently trifling a condition could set up so much neuralgic disturbance, but I soon found my mistake. I lightly cauterised the spot with a solution of nitrate of silver (gr. v ad ℥j) with immediate relief, not only from the urethral pain but also the leg and thigh discomfort. I repeated the application several succeeding weeks with excellent and, I believe, permanent result.

Another well-marked case was relieved of an obstinate groin pain, apparently produced by a localised congested patch in the penile urethra.* There are two positions affected by these painful

* The widespread nervous connections with the urethral mucous membrane is a well-recognised fact. A proof, if such were needed, can be established by the application of cocaine to the urethra upon the principle of its reflex inhibitory power, a subject which I have lately brought before the profession. ("A Novel Extension of the Uses of Cocaine," 'Med. Soc. Trans.,' 1888, from the manuscript of which communication Case 1 has been excerpted). The following case is a better example. It is very similar to one recorded by Sir Benjamin Brodie of a stricture which induced lameness and pain in the foot. The symptoms being promptly removed by the use of the bougie:

W. S—, æt. 38, married, nine children, came complaining that

patches. One anterior, a little way behind the glans, and the other posterior, at the entrance to the membranous urethra.

Ulcerations.—Definite ulcers of the mucous membrane are said to exist in the acutest form of gonorrhœa. They occur, of course, behind strictures, and are also produced by impaction of stones. In urethral pain I have seen them at two inches from the meatus as dimples surrounded by a purple ring.

Herpes.—Herpetic patches are said to be found in those who are liable to herpes of the glans and prepuce. I have not yet met with a case. They are as transient as the disease.

Syphilis.—Syphilitic roseola undoubtedly exists, and is not infrequently evidenced by a sudden

he has been "suffering" (*i.e.* worried?) from a burning pain in the glans penis and legs for seven years. No syphilis, ataxia, malaria, or vesico-urethral disease. Some relief was obtained from a mixture of bromide of potassium and valerian. I then lost sight of him for some months. One day he appeared, limping with evident pain, and stated that for three months the pain in his calves, ankles, and insteps had increased. "Sometimes," said he, "it is the left leg, sometimes the right, sometimes both, and to-day it is both, and I cannot walk without hobbling, and I get no relief from anything. I injected 30 minims of a 20 per-cent. solution of cocaine into his urethra. In twenty seconds he could press his feet flat on the floor, and in ninety seconds he was running lightly up and down the room. The relief continued for some hours.

urethral discharge coincident with the onset of the secondary symptoms. Chancres have been recorded in the penile urethra.

Impacted Stone.—Small renal calculi or fragments of a vesical concretion, fractured spontaneously or by the lithotrite, are sometimes arrested in the urethral canal. They can usually be pressed back into the bladder, and subsequently removed by the aspirator and evacuating catheter, or crushed and evacuated by litholapaxy. Now and again these little stones become impacted in the urethral wall, which rapidly swells and partially covers them, rendering it most difficult to push them back or pull them forward with the forceps. By passing an endoscopic cannula up to the stone, the body can be so manipulated out of its pit with a fine wire or stylet working in the light, that its removal becomes possible.

Foreign Bodies.—The same remark applies to foreign bodies. The light proving a most efficient guide to the forceps in the extraction of the same.

Pouches.—Such rare and obscure conditions as pouches of the urethra can be investigated by means of the urethroscope, but without much practical value.*

* Author, "Pouch of Penile Urethra which had contained

Tumours.—The urethroscope has proved of great value in the diagnosis and treatment of these very rare affections. As a primary affection they are only met with in the fibrous (polypoid or papillary) and the vascular forms. The female is more affected, but the male is not exempt. Thus I was able by means of a very short tube to find a collection of small warts, evidently of gonorrhœal origin, situated in the canal not far from the urinary meatus. They had kept up a discharge which had been treated for long by various medical men with balsams and injections. Local application soon removed them. Gross* gives two similar cases.

Dr. Ebermann† has an ingenious method of

Seven Small Facetted Stones and One Large Irregular Calculus," 'Med. Soc. Proc.,' 1887, p. 32.

* Gross, 'Diseases of the Urinary Organs,' p. 530, 1876, 3rd edit.; compare Roger, 'Gazette Hebdom.,' No. 32, 1860, p. 555. In a very remarkable case recorded by Roger the vegetations which formed dendritic club-shaped villosities, from the size of a pin's head to that of a pea, reached from the bulb to the meatus, greatly distending the urethra, which measured two inches and two fifths in circumference at the level of the bulb. The walls of the canal were greatly thickened and indurated. The patient had always suffered from dysuria, which amounted to retention, for twenty-four hours before death from phthisis. The enlarged and lengthened penis was always in a state of semi-erection.

† Ebermann, 'St. Petersburger Medicin Zeitschrift,' Bd. 8, 1865, p. 252.

removing these and other urethral growths. This consists in introducing an endoscopic tube, the end of which is closed, but its side is furnished with a large oval eye. The polypus or growth is first entangled in this eye, and a second tube, the extremity of which is open and sharp, is passed into the former, and the polypus cut off. On withdrawing the latter tube the wound is cauterized with nitrate of silver.

Grünfeld* mentions that he has seen eight cases, on five of which he has operated. They were all seen with the old-fashioned urethroscope.

Case 1.—A waiter, æt. 25, who had previously suffered from a urethritis and meatal condylomata for eighteen months, came under Dr. Grünfeld with a recurrence of the discharge. On passing the cannula a polypus of the urethra was discovered 6·2 cm. from the orifice. It was attached to the right upper wall. Anterior to its site, the urethra was in a state of acute inflammation. The polypus was removed with the polypus forceps, and its base of attachment touched with caustic.

Case 2.—Patient, æt. 29, passing urethral blood, was examined and a polypus 13 mm. across and

* Grünfeld, "Das Harnröhrenspiegel," 'Wiener Klinik,' 1877, pp. 94 and 95.

25 mm. long, was discovered with the urethroscope, and removed by means of the snare.

Stricture.—I now approach the subject of the diagnosis and treatment of stricture by means of the electric light. The stricture itself is easily recognisable, for on pressing the cannula against a narrow stricture, the end of the tube is seen blocked by a yellowish-white or whitish substance. Nothing but an irregular wall of this material can be seen. On withdrawing the cannula slightly and relieving the face of the stricture from the pressure of the end of the instrument the central figure will become visible. It is represented generally as a fine vertical crack, or a dark, shadowy point, placed, may be, excentrically, having perhaps a drop of mucus upon it. Into this crack or depression a fine bougie may be guided by the eye, and passed through the stricture.

In *commencing* stricture the appearance of the funnel is a very characteristic one. Part or all of the circumference of the urethral mucous membrane is transformed into a small condensed plate, which does not roll, in the normal fashion, into the end of the cannula as it is withdrawn, but which abruptly closes over it like a trap-door. Its colour is much whiter than the adjoining nor-

mal mucous membrane. The central figure of the funnel is not always readily found and needs a little manipulation to bring it into view.

But, given, that a stricture is seen, and that its opening can readily be engaged by the bougie guided thereto by the eye, is the method of any practical value? Rarely.

It is certain that with so simple and practical an urethroscope as Leiter's, and with a greater visual knowledge of urethral diseases, that we shall have fewer false diagnoses of stricture, and therefore fewer instances of normal urethræ "worried into stricture" by unnecessary and harmful instrumentation. But it is equally apparent to any medical man accustomed to frequent manipulations of urethral bougies that delicacy of touch is of much greater value and importance in the *practical* and successful treatment of stricture than the electric light.

Moreover, strictures are nearly half as often multiple as single. Thus, taking two of my out-patient attendances at St. Peter's Hospital, as these pages were being revised (April 21st and 23rd), as being a rough average, 38 cases of stricture attended, and of these 16 were shown to have multiple constrictions. An urethroscopic

cannula would demonstrate the opening of the most anterior of these strictures, but the orifices of those more posteriorly placed would have to be engaged by the bougie, guided by the sense of touch.

In false passages.—The instrument may possibly be of use in false passages made by rough and unskilful instrumentation.

H. C—, æt. 36, had suffered from stricture for some time. He states that he was seized with a sudden retention, for the relief of which a surgeon passed a silver catheter of the smallest size nearly up to the hilt (?), but no urine came through the instrument. He was relieved by a hot bath. He applied to me for treatment, and I attempted to introduce a black elastic bougie, but the instrument always slipped into the wrong track, which commenced at the triangular ligament just in front of the stricture. On passing the endoscope two orifices were seen: an excentrically placed orifice leading to the bladder, and a second excentrically bloody-edged slit, the opening apparently of the false passage. The stricture admitted a No. 6 French without gripping, and the bladder was readily reached.

In such cases as these the instrument may be of some value.

APPENDIX.

The Evolution of the Incandescence System.*

Edison's and Swan's incandescence systems were announced practically at the same time.

Edison's first patent incandescent lamp (dated June 17th, 1879) related to the combination of a sealed vacuum chamber, made of a glass vessel, with a continuous incandescent conductor of metal, such as platinum, carried on an infusible bobbin.

In the second patent (dated November 10th, 1879), the intention of using a carbon wire in an exhausted bulb for incandescence is proclaimed. After referring to the practice, which had been followed up to that date (by Konn and others) of using relatively large rods of carbon in closed

* This note has been added to supply information about the lamps to those interested in their construction. Many questions have been asked me concerning them which have shown me that some confusion exists as to the history of the invention.

vessels containing gases that do not combine with the carbon, such rods having a relatively low resistance, Mr. Edison proceeds as follows: "I have reversed this practice; I have discovered that even a cotton thread properly carbonized, and placed in a sealed glass bulb, exhausted to one millionth of an atmosphere, offers from 100 to 500 ohms resistance to the passage of the current, and that it is absolutely stable at a very high temperature; that if the thread be coiled as a spiral and carbonised, or if any fibrous vegetable substance, which will leave a carbon residue after heating in a closed chamber, be so coiled, that as much as 2000 ohms resistance may be obtained without presenting a radiating surface of more than $\frac{3}{16}$ths of an inch; that if such fibrous material be rubbed with a plastic compound composed of lamp-black and tar, its resistance may be made high or low according to the amount of lamp-black placed upon it." Edison had at that time experimented with carbonised "cotton and linen thread, wood splints, paper coiled in various ways, also lamp-black, plumbago, and carbon in various forms." Cotton thread, it will be observed, had been tried by Edison, but it had not occurred to him to convert the thread,

before carbonising, into a new material by sulphuric acid, as Mr. Swan did a few months afterwards, thus creating an efficient and thoroughly reliable filament.

The fourth patent (dated September 16th, 1880) is still nearer the final evolution of the little lamps we use in the cystoscope. The specification of this patent, which is very voluminous, is interesting and important, as it describes in great detail the mode of preparing the carbon filaments, and the physical properties which, according to Edison, are necessary in the carbons to produce efficient lighting. For incandescent lamps, Mr. Edison states that he discovered that the filament should have the highest possible resistance in a very small bulk, and be capable of resisting the disintegrating effects of very high heats, and the absence of atmospheric pressure, and further, that carbons which are purely structural in character alone possess these qualities.

By purely structural is meant a carbon wherein the natural structure, cellular or otherwise, of the original material is preserved unaltered, that is, not modified by any treatment which tends to fill up the cells or pores with unstructural carbon, or to increase its density or to alter its resistance.

The preferable single fibres are those of which jute, bast, manilla, hemp, &c., are good types, the more preferable one being a fibrous grass from South America called "Monkey Bast" fibre, each blade of which is generally round and composed of a great number of elementary fibres held together by a natural cement or resin, which, carbonising, locks all the elementary fibres together into a homogeneous filament.

In this patent the use of cane and bamboo as a suitable material for carbon is mentioned. Thus the cane is split into pieces somewhat wider than necessary, and the inner or pith portion removed. It is then cut into strips, which are passed through a shaving tool, in which the knife is fixed, the material being forced against it by a movable block provided with an adjustable stop-screw, by which the distance of the block from the knife can be regulated to adjust the thickness to be given to the slip. The slip is thus shaved on both sides until the proper thickness is attained. It is then placed in a clamp made in two halves, of a length equal to the desired length of the slip. In one half a shoulder or offset is formed at a distance from the edge greater than the desired width, upon which one edge of the fibre rests,

which is then clamped between the two halves, and the protruding portion carefully shaved off, which may be done by hand or by a cutting-blade moved by machinery. On the opposite side of the clamps is an offset in one half, at a distance from the edge exactly equal to the width to be given the slip. Upon the same side of the clamps and at the ends, projections are made of the exact shape and size to be given to the broadened ends of the carbons. The slip, shaved upon both sides and one edge, is transferred to the opening in the clamps, and the extra material shaved or cut off.

It is now of uniform size throughout its body, with enlarged ends (the widening is only on one edge) formed upon it. Detailed descriptions are given of modes of carbonisation, which may be summarised as follows:—A metal (preferably nickel) flask is employed, in the bottom of which is cut a groove of a curved or horseshoe form, which the filament is ultimately to receive; the filament is placed within this groove, and a relatively heavy metal cover is laid upon it in the flask, the upper face of the cover having a similar groove cut in it to receive a second filament, over which a similar cover is placed, and so on, until the flask is full, and a considerable number of

filaments are ready for carbonisation. The flask so filled is placed in an oven and subjected to an intense heat, produced by gas fuel and a suitable blast directed upon the flask. In some cases it is stated to be found desirable to maintain an atmosphere of hydrogen, "or some hydro-carbon," within the flask during carbonisation to prevent excessive oxidation of the filaments.

When the moulds are opened, the filaments are in a condition to be electro-plated to their platinum supports and introduced into their lamp-bulbs, but yet another process is required to confer upon them their perfectly homogeneous and elastic character, as well as their refractory nature at high degrees of incandescence, which are such essential characteristics in an incandescent lamp. This further process is applied when the lamp is attached to the pump, and while exhaustion is going on; it consists in alternately heating and cooling the filament in the Sprengel-Vacuum by passing currents of electricity through it of increasing strength until high degrees of incandescence are reached, and between each increase of current allowing it to cool down, exhaustion going on all the time. By this process, not only are the occluded gases eliminated, but as the fibre is sub-

jected to a far more severe test than it can ever be subjected to in working, none but "the fittest" survive, and a healthy generation of lamps is insured.

Swan.

The first published notice of the Swan incandescence lamp appeared in the issue of the 'Photographic Journal,' for June, 1880, but Mr. Swan had publicly exhibited a carbon filament lamp, which gave excellent results, twelve months before the above-named date, at the conclusion of a lecture he delivered in Newcastle; Sir William Armstrong having presided at this meeting. Mr. Swan had ultimately adopted cotton thread, which is susceptible to the parchmentizing operation that had enabled him to obtain such promising results with paper prepared in the same manner. Steeping cotton in a solution of sulphuric acid and water until the tissue is destroyed produces, when properly washed and dried, a horny homogeneous filament of a very considerable strength. To increase the density and uniformity of the filament thus obtained it is passed between compressing rollers and flattened so that a somewhat increased area of incandescent surface is thus obtained.

It was on the 17th of June, 1879, that Edison took out his patent in this country for the manufacture of incandescence electric lamps with prepared platinum or alloyed platinum luminous loops, but, like the inventors twenty years before him, quickly abandoned metallic and availed himself of vegetable filaments. Mr. Swan, on the other hand, had worked with the latter from the beginning, and the evolution of his system, from the first imperfect and rapidly failing horseshoe of carbonised paper, to his permanent metal-like filament of carbonised thread, is interesting but foreign to our subject. Those of our readers who wish for further information cannot do better than consult Dredge's 'Electric Illumination,' vol. i, 1882, from the able and exhaustive pages of which I have collated the preceding.

APPENDIX II.*

Case 9.—A patient, æt. 60, in the clinique of Professor v. Bergmann. For a long time he had had attacks of hæmaturia and difficulty in emptying the bladder. Repeated examinations by sound and rectal palpation had given negative results. On November 14th, 1887, cystoscopic examination was made. I saw on the floor of the bladder a flat button-shaped tumour covered by short villi. The front of the left lateral wall was found covered with similar villi as far as the orifice of the urethra. On November 17th operation (high section) was performed, when the cystoscopical appearances were in every respect confirmed, but at the same time it was observed that the carcinomatous infiltration under the normal mucous membrane was so extensive that a complete removal was impossi-

* Quoted from Dr. Max Nitze, "On Tumours of the Bladder," 'Lancet,' April 21, 1888, p. 765.

ble. After some time the patient died from the new formation.

Case 10.—A female patient of Professor Sonnenburg, æt. 21, observed for nine months from time to time that the urine was mixed with blood. Lately a well-marked villus was expelled with the urine. The examination by sound showed nothing abnormal. On November 21st cystoscopic examination showed on the outer side of the right ureter a flat coin-shaped tumour consisting of short villi. As the patient was in the fourth month of pregnancy a radical operation was rejected. Professor Sonnenburg dilated the urethra and scraped the tumour away with his finger-nail. The conditions corresponded exactly to the cystoscopical appearance.

Case 11.—A man, æt. 67, sent to me by Dr. Behnke, had since January, 1887, attacks of hæmaturia of gradually increasing frequency. On November 30th cystoscopical examination was made. I found on the lowest part of the right wall of the bladder a prominent tumour with a villous surface, as large as a walnut. I removed it by means of the high section on December 9th. Concerning the size, site, and form, the swelling corresponded to the examination. The microscope

confirmed the malignant character of the excised swelling. The patient made a good recovery. The wound cicatrised completely, when, in the middle of the new cicatrisation, two suspicious prominences appeared, which grew quickly, and present now a richly proliferating tumour over the symphysis.

Case 12.—A female patient under the care of Professor Jacobson. For some years she had had intermittent attacks of hæmaturia. Some of the symptoms were in favour of the origin of the blood being from the kidney. On January 21st cystoscopical examination was made. Immediately behind the internal orifice of the urethra, on the floor of the bladder, a tubercular tumour consisting of blunt papillæ was found. Operation was proposed, but refused by the patient.

Case 13.—A man, æt. 53, had suffered since 1885 from intermittent hæmaturia. By degrees the bleeding increased in frequency and quantity. In June, 1887, the patient went into a Berlin hospital, where he was examined per rectum and by the sound by an eminent surgeon. Nothing abnormal could be detected in the bladder. The examination was followed by fever, which continued for some weeks, the patient at the same

time losing strength. The loss of blood ceased for a long time, but there occurred pain on micturition of increasing intensity. In November, 1887, there was a recurrence of hæmaturia. On Dec. 15th I undertook the cystoscopic examination, which was rendered difficult from the fact that on introducing the prism copious hæmorrhage took place. In spite of this, I could distinctly observe on the right wall of the bladder a tumour the size of a small apple. I removed the tumour on Jan. 12th, 1888, by means of the high section. The conditions corresponded exactly to the appearances found on cystoscopic examination. The apple-sized tumour hung from a firm pedicle, of the thickness of two centimetres, with its edges curved in so as to resemble a mushroom. The patient recovered.

Case 14.—This patient, æt. 49, had suffered many years ago from gonorrhœa, accompanied by cystitis, orchitis, and suppurative prostatitis. Eventually these gonorrhœal complications disappeared, but a slight catarrh remained. On account of the presence of blood in the urine, Dr. Mark, of Wildungen, under whose care the patient was, suspected the existence of a bladder tumour, and sent the patient to me. On Jan. 14th cystoscopic

examination showed a papilloma as large as a walnut, situated on the lower part of the right wall of the bladder. On Jan. 25th I excised the tumour by means of the high section. The conditions confirmed exactly what was observed on endoscopic examination. The wound has now nearly healed, and the patient is otherwise well.

Case 15.—This patient (a man, æt. 57) was sent to me by Dr. Kreissmann, suffering from repeated attacks of hæmaturia, dating from November, 1887. The cystoscope showed an irregularly shaped tumour covered with short villi on the left wall of the bladder, and also a second one smaller in size and more rounded in form. On March 10th I undertook the extirpation of the tumour, excising the tumour together with the corresponding part of the wall of the bladder, after opening the bladder by means of supra-pubic operation. The conditions confirmed the appearances found endoscopically. As yet the patient is free from fever.

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* I have not hesitated to avail myself of that most valuable of catalogues, the Index-Catalogue of the Library of the Surgeon-General's Office, United States Army.

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