History of Extraction.—It is uncertain whether the ancients were acquainted with this method; it is probable however, that they were, as passages in Galen and Pliny have been thought to refer to the removal of the cataract from the eye. At all events, if known, it fell into nearly complete disuse and oblivion; and not until the time of Daviel, in 1750, did it begin to be cultivated as a recognized procedure. This surgeon used numerous instruments, consisting of narrow sharp and blunt knives, and scissors; he made at first a small opening in the cornea, enlarged it afterward, and then removed the lens. His followers sought to improve his method by simplifying its application, and soon superseded the various instruments he had used by a single knife. This was subsequently modified, especially by Beer, to whom we owe the form of knife used in flap extraction at the present day. Gradually more exact rules were laid down for the performance of this operation; the situation and size of the cut, the best method of opening the capsule and pressing out the lens were all perfected. Despite the utmost care, however, used in carrying out the various steps of the operation and in the after-treatment of the patient, there was an appreciable percentage of loss; owing largely to one of three causes—diffuse suppuration of the corneal flap, defined suppuration of the same, and iritis. To diminish the danger of the second of these, but more particularly to guard against the last, Mooren proposed, in 1862, that a preliminary iridectomy be performed some two weeks before the extraction. The results which he obtained by pursuing this method were proved to be incontestably superior to those that had followed the simple operation. This was the first great step forward in the path now pursued. It allowed the lens to emerge more readily, and subjected the iris to less danger from pressure and bruising in the process. In 1863 Jakobson proposed the following operation: He narcotized his patient and made a lower section in the sclero-corneal junction, practising a broad iridectomy downward after the removal of the lens. He thus gained the advantage of doing the whole operation at one time, but incurred the disturbing effect of an iridectomy downward. Previous to the bringing forward of either of these methods, Schuft (now Waldau) had invented, and in 1860 published, a series of spoons intended to remove the lens through a small wound at the edge of the cornea. These were, however, large and clumsy, did great violence to the eye, and were, in 1865, superseded by others much more delicate, invented by Bowman and Critchett. Outspooning remained for a time a favorite method in England, but was afterward given up on account of the dangers which it involved. In 1865 von Graefe brought out the method that bears his name, and gave an account of it to the Heidelberg Society at its annual meeting. It quickly found its way into general favor, and, with the modification in the cut described in the course of this article, has remained the popular method up to the present day.

Other modern procedures demand a brief notice. In 1866 Alexander Pagenstecher described an operation for removing the lens in its capsule through a broad incision made with a lance knife, and by means of an iridectomy downward and outward. A specially constructed scoop was employed. In 1867 Weber devised a lance-knife, 12 mm. broad and somewhat concave on its back. With this he entered the anterior chamber at the lower or lower-inner edge of the cornea, in the plane of its basis, and made a wound 10 mm. in length. If he thought it best to remove any iris, he excised but a small piece, and that from the pupillary edge. The opening of the capsule and removal of the lens, which latter was effected by pressure, completed the operation. Kuechler, in 1868, proposed to remove the lens through the natural pupil, making an incision straight across the cornea in its horizontal meridian. Analogous to this are the operations of Liebreich and Lebrun, already described.

A consideration of the following figures will show why flap extraction has fallen into disuse, and why the peripheric linear method has taken its place.

Graefe's own statistics were as follows: Simple flap-extractions, 600—loss, 7 per cent.; flap extractions with iridectomy, 900—loss, 5 per cent.; linear extractions, 600—loss, 2.8 per cent. Horner gives: Linear extractions, 1,088—loss, 2.67 per cent. Noyes has collected from various sources: Flap extractions, 10,094—loss, 10.4 per cent.; linear extractions, 10,661—loss, 5.8 per cent.

The larger proportion of loss given, according to the figures of Dr. Noyes, would naturally be connected with the large number and varying skill of the surgeons whose results are thus grouped. *Hasket Derby.*

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CATARRH, NASAL. See *Nasal Cavities, etc.*

CATECHU.—Cutch; Black Catechu. "An extract prepared from the wood of *Acacia Catechu* (L.f.) Willd. (fam. *Leguminosæ*)" (U. S. P.). Catechu is similarly obtained from the wood of *A. Suma* Kurz. That of the present edition of the British Pharmacopœia is discussed under *Gambir*. This species of acacia is a crooked, straggling tree of thirty to forty feet in height, with a trunk about a foot in diameter. It grows commonly in India and Burmah, and yields a very durable, hard timber and a tan bark. The sap wood is whitish, the heart wood of a very dark brown. It is said that both are extracted for the catechu, the process being by boiling the chips. The decoction, more or less purified by straining, is evaporated by artificial heat and is then moulded into various forms. The moulds are commonly lined with leaves, the remains of which adhere to the outer surface of the dried masses. The latter are of various forms and sizes, according to the custom of the locality or the convenience of the maker. The best usually come in the form of slabs or blocks, of the size and form of an ordinary bread pan. In India a superior quality, of a light brown color, is prepared chiefly for mastication by introducing sticks into the thickened decoction, when the catechu collects upon them, after the form of crystals. Dymoch and Hooper ("Pharmacographia Indica," i., 558) describe a very high-priced sort which is collected from cavities in the trunk. This is called *Khersal* or *Khairsal*, and is of a very pale-brown or yellow color. The official description of catechu is as follows:

In irregular masses, containing fragments of leaves, dark brown, brittle, somewhat porous and glossy, when freshly broken. It is nearly inodorous and has a strongly astringent and sweetish taste.

If 20 parts of catechu be digested with 200 parts of alcohol and the liquid filtered, the undissolved matter, after being dried at 100° C. (212° F.), should not exceed 3 parts in weight.

The tincture, diluted with 100 parts of water, acquires a green color on the addition of ferric chloride T.S.

If 2 parts of catechu be boiled with 20 parts of water, a brownish-red, turbid liquid will be obtained which turns blue litmus paper red.

Upon incineration, catechu should not leave more than six per cent. of ash.

To this description it may be added that the color of some which is very good may be better characterized as a brown-black, and that a microscopical examination reveals the presence of a large quantity of minute crystals of catechin. Emphasis should be laid upon the fact that good catechu is nearly odorless. Much of what comes to our market possesses a vile odor. It is toughish, scarcely porous, and has a waxy or greasy looking surface instead of the lively, slightly sparkling lustre of that which is pure. Such is largely used for tanning and similar purposes, but is not fit for medicinal use.

About one-third of catechu consists of *catechin* ($C_{21}H_{14}O_9 + 5H_2O$), and about one-half of *catechu-tannic acid* ($C_{21}H_{14}O_9$). The latter can be obtained from catechin by heating, especially with the addition of water or alkalies.

Catechu, as its composition would indicate, is a pure astringent, which may be generally used either externally or internally, when this effect is desired. We have official a compound tincture, of ten-per-cent. strength, with diluted alcohol and one-half per cent. of cassia, the dose 2 to 8 c.c. (fl. ʒ ss. to ij.). The official troches contain each 6 cgm. (about gr. i.) of catechu, with tragacanth and sugar. *Henry H. Rusby.*

CATHARTICS. See *Laxatives* and *Purgatives.*

CATHETERISM OF THE URETHRA.—The term catheterism, often erroneously written catheterization, is employed to designate the various methods used in exploring and relieving the many pathological conditions of the urethra and bladder. The term is especially used to designate the introduction of hollow instruments through the urethra into the bladder for the purposes of withdrawing the urine, evacuating blood clots, removing fragments of stone after litholapaxy, exploring, irrigating the urethra and bladder; and the employment of solid instruments for the purposes of dilating stricture, of removing foreign bodies, and of crushing stone.

The word catheter, derived from the Greek καθίημι, meaning a "thing to send down," or "to let into," conveys no idea of the character of the instrument or of its use, nor whether it is solid or hollow, straight or curved, conical or cylindrical, large or small. But the derivation of the word may serve to explain why the term catheterism is employed to indicate the introduction of all varieties of urethral instruments for whatever purpose employed.

Throughout this article the term catheterism will be confined in its meaning to the introduction of hollow instruments into the bladder, through the urethra, for the purposes of evacuating the urine; of examining the urethra and interior surface of the bladder; of introducing various medicaments for the relief of pain or for the cure of diseases; of irrigating the urethra and bladder; of distending the last-named organ with either water or air as a preliminary to operative interference, and of establishing continuous drainage in cases of cystitis after injuries or operations upon the urethra, prostate gland, or bladder.

A catheter is a hollow instrument either open at both ends or terminating at one end in a solid point with an opening placed laterally or on the superior aspect of the instrument; this opening is known as "the eye." Catheters vary in size from 2 to 30 mm. in circumference, and from thirteen to fifteen inches in length. They are either flexible or rigid, straight or curved, cylindrical or conical. If the instrument is cylindrical, a uniform calibre is maintained throughout its entire length; if it is conical, it tapers toward the vesical end and terminates either in a fine point or in an olivary tip, becoming smaller in diameter as the end of the instrument is reached.

The exact method of manufacturing the best grades of flexible catheter is a secret with the individuals by whom the instruments are made; especially is this true of the preparations employed for coating, as well as of the method of giving the high polish and satin finish which the better grades of instruments possess.

Soft rubber, bevelled-eye catheters, the so-called "soft caoutchouc catheters," are made from india rubber which has been vulcanized. There is also a more rigid form, the cheaper grades of which are manufactured from either cotton or linen; these materials are employed as a framework, and are coated with either shellac or resin varnish.

The objection to the cheaper forms of flexible catheter is the readiness with which they absorb water, making them liable to swell, as a result of which the coats crack and peel, the elasticity disappears, and the instrument is rendered stiff, brittle, and worthless. The use of antiseptic solutions causes the instrument to become rough on its surface and so brittle as easily to be broken.

Fig. 1166.—Woven Eye of Catheter.

The most expensive and reliable flexible catheters are made from either cotton, or Lisle, or silk thread woven into a web and usually coated with a gummy material. As soon as this material becomes dry it forms a translucent cover, takes on a high polish, and at the same time remains elastic and pliable. When properly coated the instrument should be able to withstand moist heat, steam, dry heat, or immersion in boiling water for at least five minutes, and should have the power to resist the action of ordinary antiseptic solutions, acid or alkaline urine, and pus. The frame should be perfectly smooth and free from irregularities, the end should be firmly stayed, and the whole instrument should possess the highest tensile strength.

Interesting statistics are given by Gouley in an article on catheterism which appeared in the New York *Medical Journal*, November 4th, 1899, in which he says: "The tensile strength of different qualities of web catheters was ascertained to be as follows: That of an English commercial catheter was 42 pounds; that of an American commercial catheter 54 pounds; that of an American Lisle thread catheter 56 pounds; that of an American silken linen catheter 60 pounds, and that of an English silk web catheter 85 pounds. An American silk web catheter of the best quality was then tested to 115 pounds without breaking, but the varnish was stripped off at each end."

Theoretically these instruments are supposed to be as highly polished on the inside as on the outside, so that they may be more readily cleansed and sterilized, and the danger of infection thereby lessened. Unfortunately, it is wellnigh impossible to arrive at this condition of perfection. The nearest approach is to be found in the high grade of catheter, but at a greatly increased cost. The eye of all flexible web catheters should be woven,

Fig. 1167.—Eye Cut with a Punch.

strengthened, and stayed, whereby the continuity of the frame is left unimpaired. In the inferior grade of web-catheters the eye is formed by cutting with a punch, which is most objectionable, as the catheter is very apt to fracture at that point.

Flexible catheters made of silk web are by far the most serviceable and the best. They cost more than those made from other materials, but are cheaper in the end; for they are more durable, and, with proper care, can be made to last a long time. They are not so liable to crack or break as are the cheaper varieties; they are more easily sterilized, and hence are the safest of all the varieties of web instruments that can be employed. The danger of infection from their use is lessened. They do not become sticky, nor do they blister in warm weather;

they are not injured by contact with antiseptic solutions, tissue fluids, or the fatty materials with which they are anointed before use.

In the shops is found a hard-rubber gum elastic catheter which is sold under the name of "the English catheter." This instrument is very durable and is coated with a material which is highly polished; the shaft is re-enforced by a steel stilette. On being subjected to heat the instrument becomes soft and pliable and may be made to assume an exaggerated curve, which being maintained by the stilette, will become permanent on cooling. This form of catheter may be bent to assume the prostatic curve; it is then passed into the urethra, as far as the membranous portion, when on gently removing the stilette the curve will become greatly expanded and will oftentimes pass over an enormously enlarged middle lobe of the prostrate gland when all other forms of catheters have failed. Gross states that in some cases it is of advantage "to bend back the shaft of the instrument so that it will resemble somewhat an italic *S* procumbent." Catheters of this description may be kept on an over-curved stilette, by which means the increased prostatic curve, desired in some cases of prostatic hypertrophy, is maintained, the instrument being always ready for use in case of an emergency. The sphere of usefulness of the English gum catheter is limited; in some conditions of prostatic hypertrophy it is invaluable.

The india-rubber or soft vulcanized caoutchouc catheter, the most improved form of which is manufactured in the United States, is sold under the name of "Nélaton," or "Jacques catheter," so-called after its original Parisian maker. Many cheap and poor varieties of this instrument are sold. If an inferior quality of catheter is employed, it will be found that after having been used for a short period the instrument has become swollen, soft, and flexible, and has increased in calibre as well as in length, so that its further use is impossible. Should the rubber contain an excess of vulcanizing material it soon becomes hard and brittle, and when catheterism is attempted the instrument may break and a portion be left in either the urethra or the bladder. In warm weather catheters are liable to become hard and brittle, notwithstanding the care expended on their preservation. They are injuriously acted on by fatty acids and by the materials employed as lubricants. They withstand boiling but poorly, and are soon rendered useless by the action of the materials applied to sterilize them.

"The eye" is often badly constructed and is generally situated too far from the vesical end. The lumen is usually too large, rendering the end of the catheter overflexible, so that its passage through the urethra is accomplished with difficulty; at the same time such an instrument is liable to double on itself, thereby injuring the urethra. The site at which "the eye" is located is in danger of being fractured. Another objection is that the instrument from the eye to the tip is hollow, whereas it should be solid so as to prevent the accumulation of foreign material, such as pus, blood, and microbes. When hollow it is very difficult to cleanse, and wellnigh impossible to sterilize. In practice many cases are met with in which the use of an inferior variety of soft-rubber catheter has given rise to much trouble. In one instance, where the patient was practising auto-catheterism, the end of the instrument broke off, and was left in the bladder; owing to a hypertrophic condition of the prostate gland a perineal section was rendered necessary to remove the fragment. In another case part of the instrument was broken off in the urethra and was then forced into the bladder by the attendant in his efforts at removal; it was extracted by means of a lithotrite.

Recently there has been put upon the market a new form of soft-rubber catheter which—so it is claimed—combines the qualities of the pliable soft-rubber catheter with the elastic spring of the firm, flexible instrument. This is accomplished by having the anterior portion pliant and the posterior more rigid. By this device it is presumed that the pliant portion will apply itself to the curves of the urethra, while the firmness of the posterior part will permit the operator readily to pass the instrument through an irritable, spasmodic urethra or through an obstructing lobe of the prostate gland into the bladder. The vesical end of the instrument terminates in either a cylindrical or an olivary tip. This form of catheter is still on trial.

The soft-rubber catheter is probably the one in most general use. It easily adjusts itself to the shape of the urethra; it is not liable to exert an injurious pressure on the canal, and there is no danger of producing a false passage. A properly constructed soft-rubber catheter should be at least thirteen inches long, should vary in circumference from 10 to 30 mm., and should be perfectly pliable and highly polished. The eye should be a little less than one-quarter inch (5 mm.) from the vesical end, and its diameter should be the same as that of the lumen of the instrument. Usually the eye is placed laterally, but recently an improved form of soft-rubber catheter has been manufactured in which the lateral eye is omitted; the tip of the vesical end is left well rounded and open. In my experience this modification has proved most satisfactory. When the eye is placed laterally, the tip of the catheter, from the eye to the vesical end, should be solid, and not hollow, for reasons already given. The termination of the instrument may be either conical or cylindrical. The proximal end should be conical in shape and of a larger calibre than the shaft, so that the nozzle of the irrigating apparatus can be easily attached when required.

The soft-rubber catheter is especially designed for evacuating the urine; for irrigating the urethra and bladder with various medicated solutions; for introducing anæsthetic remedies for the production of local anæsthesia; for distending the bladder with either water or air, when it is proposed to perform suprapubic cystotomy or Bottini's operation on the prostate gland; for supplying continuous drainage for the relief of chronic cystitis and inflammatory diseases of the prostate gland, and for preventing urethral fever after operations on the urethra. It is sometimes employed as a means whereby to measure the increase in length of the urethra in cases of prostatic hypertrophy. It should be used, wherever possible, in preference to any other form of catheter. Its introduction gives rise to but little pain except in those cases in which the urethra is very sensitive and spasmodic; then a more flexible instrument, such as the silk web catheter, will pass with greater ease and with less pain. In cases in which it is found difficult to pass the catheter, owing to urethral spasm, its firmness may be re-enforced by the introduction of either a filiform bougie or a wire stilette, which should extend to within a quarter of an inch of the eye of the instrument and should be removed as soon as the compressor urethræ muscles are passed. The finest grade of soft-rubber catheter is not only very durable, but is more readily sterilized than any other grade of flexible instrument. It can be boiled for the space of five minutes without injury. It is always

FIG. 1168.—Tips of Soft-Rubber Catheter.

the instrument to be chosen for self-catheterism, wherever possible. Not only is its use attended with less pain, but it is almost impossible for the patient, unless the urethra and prostate gland be very much inflamed or congested, to injure himself, no matter how roughly it may be used.

The soft, pliable instrument is to be selected, if possible, when the establishment of continuous drainage is required. Occasionally it will be found necessary, owing to the condition of the urethra or the prostate gland, to make use of a flexible web or even a metal catheter. Continuous drainage by use of the latter instrument is

always attended with more or less pain and danger of an abscess forming at the peno-scrotal junction. When it becomes necessary to leave a metal instrument in the urethra the patient should be carefully watched.

Five years ago the writer read before the Philadelphia Academy of Surgery a paper in which he strongly advocated continuous drainage after injuries of, or after operations upon, the urethra, prostate gland, or bladder; and also in chronic inflammatory diseases of these organs, especially when associated with alkaline urine, pain, tenesmus, and frequency of micturition, and with chronic urethral fever. The ideas put forth were based upon large experience. The subject elicited a heated discussion, every member of the society who was in attendance taking exception to the method of treatment suggested. A radical change in the views of the profession on this subject has since taken place, doubtless owing to the investigations and writings of Guyon and Michan, who have strongly advocated in suitable cases the mode of treatment here described, and who fully verified all that was claimed for the benefit to be derived from this method; since which time its employment has become general. This treatment is to be followed in cases of chronic cystitis, especially when there is frequency of urination; in cases of pain attended with an ammoniacal urine which is loaded with pus; and also in cases in which the inflammation of the bladder depends on obstructive enlargement of the prostate gland. When retention of urine is due to the last-named cause, and a flexible catheter has been successfully passed, it should be allowed to remain in the urethra for at least four days. If the instrument is removed immediately after the urine has been evacuated, in a few hours catheterism will again become necessary, and, as is frequently the case, it will be found impossible to reinsert the instrument; thus making either aspiration or some more radical operation necessary, which would have been avoided if the catheter had been allowed to remain *in situ*. When the catheter is permitted to remain in the urethra, a beneficial effect of continuous pressure on the inflamed and congested canal is produced, the tenesmus is relieved, and the bladder is put at rest. When the instrument is allowed to remain in the urethra for the period indicated, it will be found that on its removal not only can a much larger instrument be easily inserted, but usually no further difficulty from urination will be experienced. This method of draining the bladder is also indicated in wounds of, or after plastic operations upon, the urethra, and with proper care the catheter may be allowed to remain *in situ* for a week, or longer if necessary.

FIG. 1169.—Continuous Catheterism, in the Recumbent Posture. (Horwitz.)

In over one hundred and fifty-eight cases of external perineal urethrotomy which have been performed by the writer, and in which the soft-rubber catheter was allowed to remain in the urethra until the new canal had entirely formed around it, in not a single instance did a perineal fistula follow, as is so commonly the result in the old method of treatment. Whenever it was possible the wound was closed by means of interrupted sutures, union taking place by first intention, and the patient being thus saved several weeks of tedious convalescence.

In cases in which internal and external urethrotomy combined has been performed, and it is then found to be difficult to pass a catheter in the usual manner, on account of the rough and nodular condition of the urethra, the act can be readily accomplished by inserting a long pair of forceps, designed for the purpose of removing foreign bodies from the urethra through the meatus, and making the jaws of the instrument appear at the perineal wound. The proximal end of the catheter is then caught and drawn from behind forward until it protrudes an inch or so beyond the meatus. The vesical end is then passed along a steel gorget, through the membranous and prostatic portions of the urethra, into the bladder. In cases of hæmaturia in which the bleeding is due either to a vesical growth or to some pathological condition of the prostate gland, continuous drainage is invaluable. In chronic cystitis associated with alkaline urine, polyuria, and frequency in passing water, especially if due to prostatic

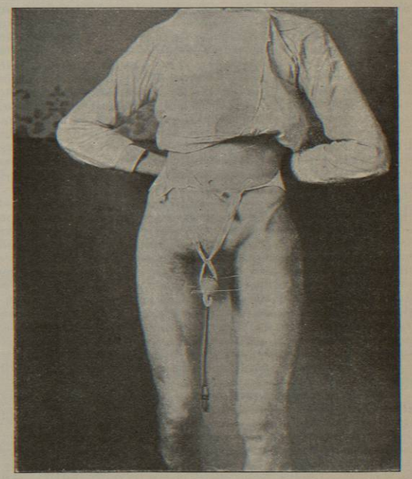

FIG. 1170. — Intermittent Drainage; Continuous Catheterism. (Horwitz.)

hypertrophy, or when attempting to get the patient in proper condition for a capital operation on the urethra, prostate gland, or bladder, continuous drainage is always indicated as the preferable method of treatment. In a few instances it will be found that the presence of a catheter in the urethra will give rise to urethritis. This is especially true if the instrument has been previously sterilized with formalin and not thoroughly washed before its introduction. This condition, however, is harmless; it usually requires no treatment, and, as a rule, promptly disappears on removal of the instrument. When continuous drainage is employed there is always danger of an abscess forming at the peno-scrotal junction, the result of pressure whilst the penis is in the pendant position. This complication is not liable to follow the use of a soft-rubber catheter, but may ensue when either a flexible or a metal instrument is employed; the latter being most liable to give rise to the trouble. If the surgeon, on the alert for this danger, watches the peno-scrotal junction for any suspicious redness, tenderness, or œdema (forerunners of an abscess and urinary fistula), the threatened condition can be averted by the prompt removal of the catheter.

Singular as it may seem, the presence of a catheter placed permanently in the urethra, far from producing pain, is usually followed by relief, by assuaging strangury and by putting the bladder at rest and permitting the patient to secure much-required sleep. For a few hours after the introduction of the catheter a feeling of weight in the perineum is usually complained of, but this soon subsides.

Many methods have been suggested to insure the retention of the catheter within the canal and prevent its slipping from the urethra. After making trial of the various modes that have been devised, the writer has fixed upon the following as the most practicable: The patient is placed in bed; the catheter is inserted, and connected with a drainage tube, which conducts the urine into a vessel at the foot of the bed. The instrument is kept in place by means of a piece of tape, tied so that the knot is located on the under surface of the catheter. The two ends of the tape are carried to the middle of the body of the penis and then knotted once more; the ends are carried around the organ and another knot is tied on the dorsum of the penis; the extremities are then carried up and fastened to a band around the waist. The manner of securing the instrument is probably more clearly delineated in the accompanying figure (Fig. 1171.)

If a soft-rubber catheter cannot be employed a good flexible web instrument should be used. The objection to these instruments is that their continued presence gives rise to irritation, and they are consequently not so well borne by the patient; the utensil in a short time becomes blistered, cracked, and worthless, especially if the urine be alkaline and contain an excess of phosphates. It is always well, no matter what variety of catheter is employed, to change it at least every third day. The urethra and bladder should be irrigated daily with a normal saline or warm boric-acid solution. Care should be taken to prevent the eye of the catheter, which is just within the vesical sphincter, from becoming plugged with blood or pus.

Various self-retaining catheters have been devised by surgeons, but they have not generally met with the approval of the profession. They are usually unmanageable, hard to introduce, frequently give rise to hemorrhage, and are difficult to sterilize. They possess no advantage over the method of retaining the catheter suggested by the writer. Their employment is not recommended. An instrument of this description devised by Petzzer consists of a soft-rubber catheter the vesical end of which is made to project laterally well beyond the shaft of the instrument. This projecting portion, when stretched over a metal carrier, becomes obliterated. After the catheter has been introduced the stilette is removed, when the projection reappears and is held in place by coming in contact with the narrow vesical neck. A simple device is that suggested by Malécot; it consists of a soft-rubber catheter, with two pliable loops at the vesical end. When this instrument is passed through the urethra the loops are pressed against the shaft of the catheter, and then, owing to their elasticity, they return to their original position as soon as the catheter enters the bladder and the pressure exerted upon them by the walls of the urethra is removed.

It is only in acute cases accompanied by fever, and after operations upon the urethra, prostate gland, and bladder, that it is necessary to keep the patient in bed whilst continuous drainage is made. In many cases of long-standing prostatic disease the writer has prolonged this method of treatment for the space of six weeks with great benefit, the patient being allowed to sit in a chair, to lie on a sofa, or to walk to a limited extent around his chamber. When it is desired to let the patient be up

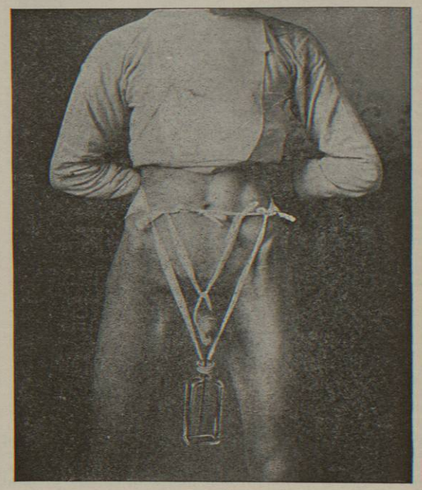

Fig. 1171.—Continuous Drainage, the Patient Being Allowed to be Up and to Walk About. (Horwitz.)

and about and still maintain continuous drainage, the catheter is kept in place as shown in Fig. 1171, the end of the instrument draining into a six-ounce bottle, which is suspended by tapes to the harness around the patient's waist, and which can be emptied whenever necessary.

In cases of external perineal urethrotomy in which drainage is to be maintained until the perineal wound is healed, the object being to prevent the urine from passing through the wound, it will be seen by Fig. 1170 that the catheter is kept in place in the manner already described, the proximal end being closed with a plug, to be removed whenever there is a desire for urination.

Flexible web catheters should be at least thirteen inches in length and may vary in circumference from 2 to 25 mm. They should be thoroughly covered with the coating of gum employed for the purpose; the entire surface of the instrument should be perfectly smooth, highly polished, and capable of resisting heat, at a temperature of 212° F., for at least five minutes. Catheters of this description should possess firmness and elasticity, and at the same time they should be pliable, having the same degree of stability from one end to the other. They should never be rigid, especially toward the vesical end. In order to

accommodate the nozzle of the irrigating apparatus the proximal end should be funnel-shaped and of a larger calibre than the shaft of the instrument. Except in flexible catheters, designed for evacuating blood clots from the bladder, these instruments should possess but

Fig. 1172.—Flexible Woven Eye Cylindrical Catheter.

a single eye, which should be at a distance of rather less than a quarter of an inch from the vesical end and located laterally. The lateral eye of straight web catheters is frequently omitted, the instrument being simply a tube open at both ends. In some forms of curved catheters, the so-called "elbow catheter," it is found to be advantageous to have the eye on the superior aspect of the concavity of the point instead of being placed laterally. When catheters terminate with either an olivary tip or a long conical point, the eye must be situated about one inch from the vesical end. The eye should always be woven into the instrument, and from the eye to the vesical end the tip should be solid. The shape and curve given to the vesical end of the instrument will depend on the purpose for which the catheter is designed.

Flexible catheters, being firmer and not so pliable as the soft-rubber instruments, possess the advantage of having a greater resistance along the shaft, are less apt to bend, and are more likely to pass along a urethra in which obstructions exist; besides, they are always under the control of the operator. The employment of flexible catheters is indicated in cases in which there is an

Fig. 1173.—Olivary Tip Catheter.

irritable or spasmodic condition of the urethra, arising from either inflammation or hyperæsthesia. The instrument usually employed when these conditions exist is a flexible woven-eye cylindrical catheter, shown in Fig. 1172.

In cases of stricture of the urethra of large calibre a flexible catheter, varying in calibre from 5 to 15 mm., may be employed; it must be cylindrical, or must terminate in an olivary or conical tip. This form of catheter is likewise made with a sharp conical termination shaped somewhat like a rat's tail; hence it is frequently spoken of as the "rat-tail catheter." Instruments of this form are of special service in cases of retention of urine due to prostatic hypertrophy in which the obstruction results from enlargement of the lateral lobe, causing the urethra to deviate markedly to one side or the other. In such cases the long narrow projection at the vesical end readily follows the lateral curve of the prostatic portion of the canal. When the retention of urine is due to enlargement of the middle lobe it is well to employ a flexible catheter which at about one-half inch from its vesical end is bent at a slight angle, or "elbowed" as it is called, so that the tip of the catheter glides along the anterior wall of the ure-

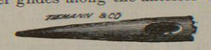

Fig. 1174.—Conical Tip (Rat-Tail) Catheter.

thra and is readily guided over the obstructing lobe of the gland, passing through the urethra into the bladder. This instrument is known as "Mercier's coudé catheter," more commonly spoken of as the "prostatic catheter."

In order to facilitate the passage of the Mercier catheter in difficult cases, Guyon recommends that the instrument be constructed with beaks of different lengths, and that the angle formed by the junction of the beak and the shaft should be of different degrees. The angles that he suggests the catheter should have are 40, 35, 30, and 25 degrees.

Mercier's catheter is frequently employed to determine the length of the urethra in cases of senile hypertrophy. When there is marked increase in the size of the prostatic gland, with lengthening of the urethra, a modification of the elbow catheter is employed, known as "Mercier's bicoudé catheter." In this instrument there are two bends—one about half an inch from the vesical tip and a second one at a distance of a little over two inches from the first.

Guyon has devised a catheter intended for the relief of retention of urine due to prostatic obstruction. In this instrument, which is constructed somewhat on the same principle as Mercier's, the angle at the point is more acute and the instrument terminates in a conical tip, the eye being located on the superior, instead of the lateral, aspect of the catheter.

In rare instances, where there is a very unusual enlargement of the middle lobe of the prostate gland, and

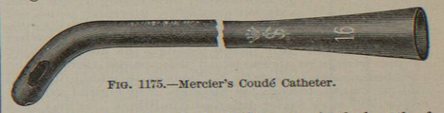

Fig. 1175.—Mercier's Coudé Catheter.

especially where there is marked increase in the length of the urethra, some surgeons prefer a catheter with a full semicircular curve, terminating in either a conical or an olivary point.

Flexible catheters are never to be employed when a soft-rubber instrument will answer the purpose. When auto-catheterism becomes necessary, as in prostatic hypertrophy, the use of the flexible instrument should be reserved until the soft-rubber catheter can no longer be employed.

Flexible double current catheters have been devised for the purpose of irrigating the bladder. They are quite rigid and possess no advantage over those made of metal. Their use is not recommended.

My experience has led me to infer that no benefit is derived from the employment of these double current instruments. There are many other varieties and forms of catheters which have been designed at different times

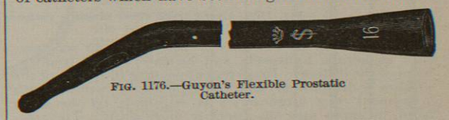

Fig. 1176.—Guyon's Flexible Prostatic Catheter.

for the relief of various conditions, but they have not met with the approbation of the profession and have but few advocates.

"Evacuating catheterism" is a term used to designate the use of the instrument when rendered necessary for the discharge of purulent urine, for the expelling of residual urine retained by stricture, by prostatic hypertrophy, or by blood clots, or for the removal of detritus following the crushing of stone.

In some of these conditions the use of metal catheters is essential. But the great improvement effected in recent years in flexible instruments, which are now made of any desirable size or curve, has caused the profession generally to abandon the employment of metal instruments, except for the relief of retention of urine due to tight strictures, for the removal of blood clots or of fragments of stone after litholapaxy, and for making an endoscopic examination.

Metal catheters are made of either tin, steel, silver, or German silver, the latter being most commonly in use. These instruments should be ten inches in length, and should vary in diameter from 5 to 30 mm. They must be perfectly smooth, polished, and of light weight. Close to