the vesical end, on either side of the catheter, is placed an eye for the passage of urine. The tip should be closed, rounded off, and very nearly of the same calibre as the body of the instrument. The proximal end is open and usually provided on each side with a small ring to which pieces of tape may be fastened when it is necessary to secure the catheter *in situ*. It is important that a metal catheter should have the same curve as that assumed by the more fixed portion of the normal urethra; this curve is measured from the front of the triangular ligament to

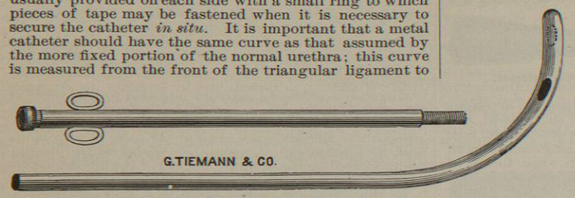

FIG. 1177.—Ordinary Metal Catheter with Thompson Curve.

the neck of the bladder. It begins in the penile urethra, about one inch and a half from the bulb, and reaches its lowest point as it passes through the anterior layer of the triangular ligament; it then passes through the membranous and prostatic portions of the canal, upward and backward, toward the bladder. The normal urethral curve will vary under different conditions. It may be a good deal straightened by lateral pressure made on either side of the root of the penis. It is lengthened when the bladder is distended with urine, or in cases of prostatic hypertrophy. The curve is more acute in children, and, according to Gross, "in adults where general development is below the average"; hence the curve of the catheter, both in adults of this type and in children generally, "should be increased, or should describe an arc of a smaller circle."

Change in the curve may result from abscess, from infiltration of urine into the perineal tissues, from tumors in the vicinity of the rectum or scrotum, such as hernia, hydrocele, and hæmatocele, or from tumors of the testicle. In corpulent persons the curve of the urethra is diminished, and consequently a catheter with a segment of a larger circle is required; on the other hand, in spare men the curve is more acute. The traction exerted by the abdominal muscles on the suspensory ligament renders the curve more abrupt, and it is for this reason that when a catheter is to be passed the patient should be placed in the recumbent posture with the shoulders elevated.

FIG. 1178.—Over-Curved Silver Prostatic Catheter.

Mr. Briggs first demonstrated that the fixed curve of the urethra is the arc of a circle three and one-quarter inches in diameter; or of a circle described by a radius one and five-eighth inches in length, the chord of the arc of which measures two and three-quarter inches. This statement was corroborated by a series of investigations made by Sir. Henry Thompson, who pointed out that the curve of the metal catheter should always be fashioned according to the rule just given; since which time instruments so constructed are spoken of as having the "Thompson curve."

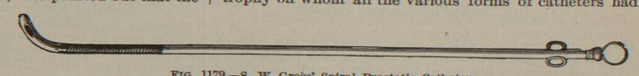

FIG. 1179.—S. W. Gross' Spiral Prostatic Catheter.

The axis of the point of the instrument should form a right angle with the axis of the shaft. The curve of the urethra can be temporarily obliterated by means of a straight instrument.

The great improvement in the manufacture of flexible catheters in the present day has caused the employment of those made of metal to be very seldom necessary. As Sir Henry Thompson has so well said: "The flexible instrument is capable of effecting all the good which can be accomplished by the metal instrument, and it does it with less pain and irritation to the patient. The difference between the two in most hands means a difference of bleeding and not bleeding, pain and very slight discomfort, freedom from subsequent irritation and an attack of chills and fever, and of course, as a sum of these differences, a safe, easy, and rapid success in place of a painful and protracted one."

The employment of the metal catheter may be advantageous when the urethra is irritable and spasmodic and when the instrument, if it is to be passed successfully, must possess a certain degree of rigidity. Its use is also indicated when the stricture is irritable, nodular, and tortuous; for the relief of retention of urine caused by blood clot; and in some cases of hypertrophy of the prostate gland. A metal instrument should not be employed for continuous drainage if it can possibly be avoided. If, however, its employment for this purpose should become necessary it should not be allowed to remain in the urethra for a longer period than four days, as its presence is liable to give rise to the formation of abscesses at the peno-scrotal junction. Flexible instruments are preferable to those made of metal when it is desired to irrigate the urethra or bladder. The double-current irrigating metal catheter is an unnecessary instrument. It possesses no advantage over the soft catheter; if the irrigating fluid is allowed to flow through the double-current instrument only a small portion of the diseased mucous membrane of the bladder is reached by the medicament. Should the outflow be checked, whereby the viscus is distended, no advantage is gained over the employment of the ordinary single tube soft-rubber catheter.

In very old men, with an inordinate enlargement of the prostate gland, especially in its longitudinal direction, an over-curved silver catheter, the so-called "prostatic catheter," is often of great service in relieving retention of urine. The instrument should be at least twelve inches in length, the curve of which should form an arc equal to one-third the circumference of a circle five and a half inches in diameter. This instrument has the high commendation of Sir Benjamin Brodie, and was rendered extremely popular in this country by the teaching of the elder Gross. Its use is restricted to exceptional cases and it should not be employed until other instruments have failed. It is very dangerous in the hands of those inexperienced in the manipulation of urethral implements. If improperly or roughly used it is very liable to lacerate the urethra or wound the prostate gland. Some genito-urinary surgeons absolutely condemn its employment; this, I am confident, is a mistake. On several occasions I have been called in consultation to attend patients suffering from retention of urine due to a prostatic hypertrophy on whom all the various forms of catheters had been unsuccessfully employed, when I was enabled to pass the over-curved prostatic catheter without injury or difficulty, hence preventing the necessity for aspirating the bladder or performing a more serious operation. The

catheter should be passed with great gentleness; no force should ever be exerted; and in some instances where the beak of the instrument is prevented from entering the bladder by the enlargement of the middle lobe of the prostate gland, its onward progress may be facilitated and often successfully accomplished by inserting the index

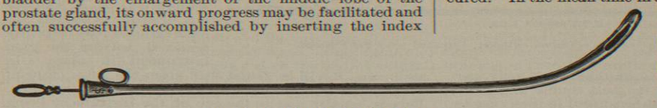

FIG. 1180.—Agnew's Mucus Catheter.

finger of the left hand, which has been well lubricated with sweet oil, into the rectum and pressing the instrument gently upward toward the pubes, whilst at the same time by means of the right hand, which holds the proximal end of the instrument, the handle should be depressed between the thighs and gently urged onward. To those who have had experience in the use of urethral instruments the prostatic catheter is of great value, but when employed by a novice it is not free from danger.

The spiral silver catheter with a Mercier coudé curve was devised by the late S. W. Gross. It is but seldom employed in civil practice, well-made flexible instruments being more serviceable. In the equipment of surgical cases for the army and navy this form of catheter is invaluable, being readily sterilized, durable, and not affected by climatic changes.

In 1850 the elder Gross devised a special form of catheter for the relief of retention of urine due to blood clot. He recommended it highly, and I have on several occasions found it very serviceable. It is of the same size and curve as the ordinary metal instrument; it has no eye, and the orifice at the vesical end is closed by means of an obturator. It is passed in the usual manner into the bladder, and by depressing the handle well between the thighs the point is passed through the blood clot lying at the base of the organ until it reaches the supernatant liquid, where by means of the mechanism connected with the handle the little button which closes the vesical end is made to project, leaving an orifice through which the urine can flow into the catheter. When the blood has been but recently effused Gross advised "that from six to eight hours be allowed to elapse so that the blood may subside and clot in the bottom of the bladder before the instrument is used." When active hemorrhage exists, with a tendency to the formation of ob-

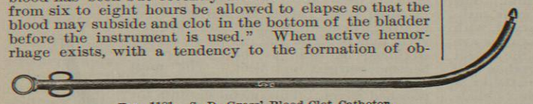

FIG. 1181.—S. D. Gross' Blood-Clot Catheter.

structive clots, attempts are to be made to prevent this condition by means of irrigation with hot hæmostatic agents and the establishment of continuous drainage. It is in cases of vesical tumor attended with a constant and free hemorrhage followed by rapid formation of clots, that this instrument finds its greatest use.

When retention is due to a tortuous stricture of small calibre, bougies about the thickness of a broom straw, called from their size "filiform bougies," are employed. They are made of catgut, rubber, or whale-bone. Those manufactured from the last-named material are the most durable and in most general use.

The filiform bougie should be eighteen inches in length, well rounded, perfectly smooth, and polished. If it be rough, chipped, or fractured it should not be employed, but discarded as worthless. Irregularities on the surface are not only apt to arrest the progress of the tunnelled instrument, which is passed over the bougie as a guide to the opening of the stricture, but, by the sudden arrest of the instrument at the point of obstruction, it is apt to cut the filiform, leaving a portion of the latter in the urethra, which may prove very difficult to remove. I have met in consultation with two cases in which this accident occurred. In one instance a portion of the filiform was broken off in the urethra. It could not be removed at the time with the instruments at hand and the patient was kept at rest until the proper utensil could be procured. In the mean time in attempting to pass water the fragment of the filiform was voided. In the second case the filiform was broken off in the clasp of a tight stricture; the patient was etherized and the stricture rapidly dilated in the hope of securing the broken portion. In performing this operation the piece of broken filiform was pushed into the bladder. It apparently gave rise to no pain or inconvenience and the individual was opposed to any further efforts toward its removal. The stricture was kept well dilated by means of steel bougies, and three weeks later the fragment was passed during the act of urination. Filiform bougies are generally straight, and they are then made to terminate in an olivary tip with a narrow, well-rounded neck. In order to facilitate the passage of the instrument through very tortuous strictures, the end of the beak is sometimes slightly angled or twisted, as is shown in Fig. 1182.

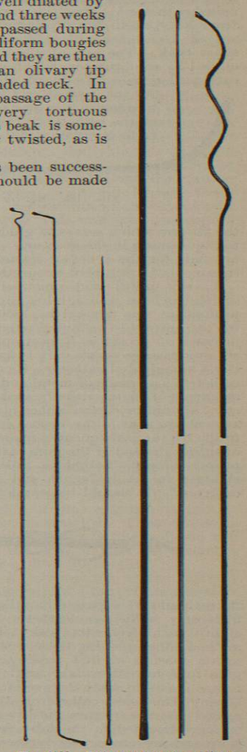

FIG. 1182.—Filiform Bougies, Olivary, Angled and Twisted.

After the filiform has been successfully passed an effort should be made to slip over it a tunnelled catheter constructed for the purpose; the bougie is then to be used as a guide. If this can be accomplished the urine can be evacuated, the catheter removed, and an attempt made to dilate the stricture by the passage of a tunnelled catheter of larger size.

In some cases it will be impossible to pass the catheter through the stricture; the filiform may then be fastened *in situ* and the patient given a hot bath; after which he should be wrapped in blankets, and a hot lemonade, containing half an ounce of whiskey, together with one-quarter grain of morphine and ten grains of quinine, should be administered. He should be encouraged to sweat freely. In the majority of cases it will be found that in a short time the urine will begin to drop from the end of the filiform by capillary attraction, and gradually the pressing symptoms will be relieved. Should the bladder be greatly distended, and the symptoms urgent, and should it be found impossible to pass the tunnelled

catheter over the filiform, through the stricture, into the bladder, the bougie may be fastened in the urethra and either the bladder aspirated, or an external perineal ure-

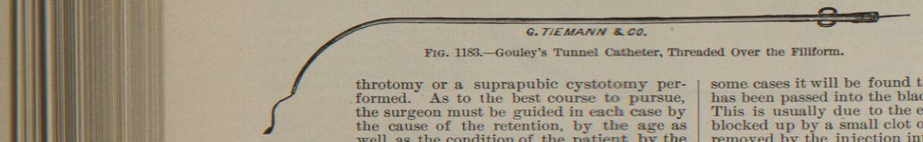

FIG. 1183.—Gouley's Tunnel Catheter, Threaded Over the Filiform.

throtomy or a suprapubic cystotomy performed. As to the best course to pursue, the surgeon must be guided in each case by the cause of the retention, by the age as well as the condition of the patient, by the symptoms, and by the length of time that the retention has existed.

The utensil which is passed over the filiform bougie as a guide is known as the "Gouley tunnelled catheter." These instruments vary in size from No. 8 up to No. 18, French scale, and consist of a catheter with a Thompson curve but short beak. The eye of the instrument is occluded by an obturator, which can be removed after the catheter has been introduced, allowing the urine to flow.

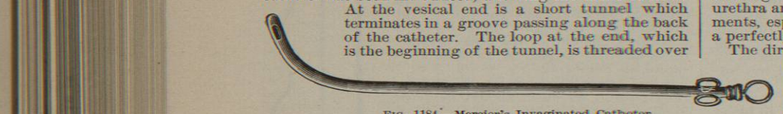

FIG. 1184.—Mercier's Invaginated Catheter.

At the vesical end is a short tunnel which terminates in a groove passing along the back of the catheter. The loop at the end, which is the beginning of the tunnel, is threaded over the filiform which serves to guide the implement directly to the opening in the stricture. These catheters are used not only for the relief of retention of urine, but in the treatment of stricture of the urethra by gradual dilatation.

A very useful and practical instrument, which has been wellnigh lost sight of by the profession, was devised in 1850 by Mercier for the purpose of relieving retention of urine in cases of prostatic hypertrophy in which a false passage exists. It is known as Mercier's invaginated catheter. It consists of two catheters, one made of metal and the other of gum. The one made of metal, usually spoken of as the "male catheter," should be eleven inches long, slightly curved, with an oval eye near to the vesical extremity. From the eye to the tip the instrument is made to slant with the object of tilting the end of the gum catheter forward when it is passed through the metal tube. The gum catheter is eighteen inches in length and is known as the "female catheter." It should be smaller in circumference than the male and when passed into the male instrument should fit loosely. The gum catheter should have an eye one-eighth inch from its end. The method of employing these instruments consists in first passing the gum tube into the male until the former almost reaches the eye of the latter. The male catheter is then passed into the urethra until its tip becomes inserted in the false passage, thereby blocking it up and preventing the further progress of the instrument. The gum catheter is now gently pushed onward until its tip emerges from the eye of the male catheter,

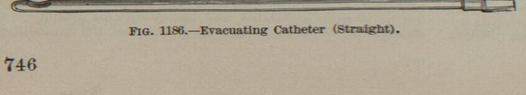

FIG. 1186.—Evacuating Catheter (Straight).

which tilts the beak upward and allows it to pass forward, along the urethra, into the bladder. After the water is drawn the gum catheter is first removed; the metal instrument is to be withdrawn, or, if continuous drainage is desired, the male catheter may be gently removed, leaving the gum instrument in place. In some cases it will be found that after the gum catheter has been passed into the bladder the urine will not flow. This is usually due to the eye of the instrument being blocked up by a small clot of blood, which can easily be removed by the injection into the catheter of a syringeful of warm distilled water. Blood clots and fragments of stone after crushing operations are removed by the large metal catheter of

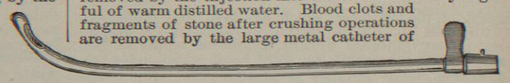

FIG. 1187.—Evacuating Catheter (Curved).

the Bigelow evacuating apparatus. Gentleness and a thorough practical knowledge of the anatomy of the urethra are necessary in the employment of these instruments, especially when the attempt is made to introduce a perfectly straight tube.

The direct visual examination of the urethra, by the insertion of hollow tubes constructed for the purpose, by means of which the canal can be illuminated either by reflected light or directly by means of a small electric lamp affixed to the end of the tube, is called "endoscopy"; while the instrument employed for the purpose is known as an "endoscope." Endoscopes are straight, cylindrical tubes varying in calibre and length to suit the size and portion of the urethra that it is desired to examine. They are made

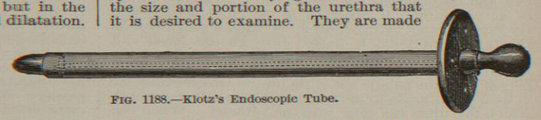

FIG. 1188.—Klotz's Endoscopic Tube.

either of hard rubber or of various metals. Those manufactured from rubber are not recommended. They are injured by caustic applications, absorb a great deal of light, and cannot be readily sterilized by heat, as they are apt to become warped and bent. The most serviceable are those made of highly polished silver. This metal permits the walls of the tube to be thin, thereby increasing the bore of the instrument and serving to make it of light weight. These instruments are easily sterilized and but slightly acted upon by caustics and acids. The most improved endoscope carries a light at the end of the tube. The most satisfactory instrument of this kind yet devised is that of Valentine, with Koch's tubes, in which the entrance of light is so arranged as not to interfere with the application of medicaments to any portion of the urethra. An endoscope

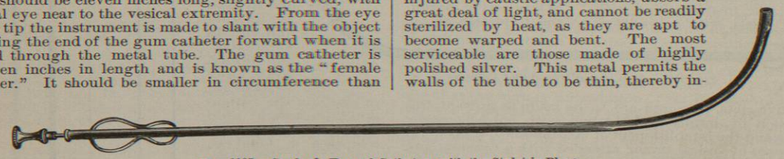

FIG. 1185.—Gouley's Tunnel Catheter, with the Stylet in Place.

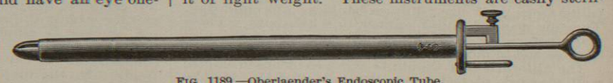

FIG. 1189.—Oberlaender's Endoscopic Tube.

exposes to view only a small portion of mucous membrane which appears at the vesical orifice of the instrument, but by moving it forward and backward the entire canal can be gradually inspected from the posterior urethra to the meatus. Endoscopic tubes are provided with obturators by means of which the vesical orifice is closed, thus facilitating the introduction of the tube into the urethra. The obturator may consist of a solid plug, made of hard rubber, or of a strong wire rod on the end of which is an olivary bulb of sufficient size to close the end of the tube. The bulb should have a deep slit corresponding with a similar one on the handle, so that the air may be allowed to enter the tube, thereby rendering the removal of the obturator easy and avoiding the danger of injury to the mucous membrane of the canal by suction.

The endoscope is manipulated on exactly the same principle as is the straight evacuating catheter of the Bigelow apparatus.

To perform catheterism skilfully it is essential that the operator should have a good practical knowledge of the anatomy of the urethra, as well as of its relations to the adjacent urinary organs.

When an attempt is made to insert an instrument of any kind into the urethra the utmost gentleness should be observed. It should be passed slowly, so that if an unexpected obstruction is encountered, the danger of injuring the canal may be avoided; force should never be exerted unless the operator is a surgeon of large experience in urethral instrumentation. Even in the most proficient hands injury may be inflicted by the employment of too much violence. It should be borne in mind that an instrument can be gently guided through the urethra when an obstruction exists, but it cannot be forced through without danger. When a novice first attempts catheterism, if it is found that an obstruction exists which prevents the easy introduction of instruments, it is wiser to seek the assistance of one who has had extensive experience in urethral surgery, rather than to persist in fruitless efforts to pass through the impediment; an attempt of this kind frequently results in traumatism, accompanied by hemorrhage, irritability, congestion of the mucous membrane, and a spasmodic condition of the urethra. The physician should always bear in mind, when dealing with urethral cases, that if he cannot benefit his patient he must at least be careful not to inflict unnecessary injury, as is unfortunately often done.

The elder Gross, in his "System of Surgery," has emphasized the fact that but few physicians pass a catheter skilfully when he says: "The introduction of a catheter, although apparently very simple, is one of the most delicate operations in surgery. It requires skill of the highest order, as well as an intimate knowledge of the anatomy of the urinary organs. *My conviction is that few men do it well.*"

In practised hands the sense of touch becomes so greatly developed that the surgeon knows with certainty exactly what portion of the urethra is being traversed as the instrument passes along; consequently he is enabled to decide by the touch alone whether the catheter should be advanced or withdrawn, raised or depressed, or if it should be allowed to remain *in situ* until the muscular spasm has relaxed.

The urethra is a canal which extends from the meatus urinarius to the bladder. Its walls are in contact, except when separated for the passage of urine, or for the emission of semen, or distended by the introduction of instruments or other foreign bodies.

In the flaccid penis the urethra forms two curves, one in the penile portion, which is obliterated when erection takes place or when traction is exerted upon the penis by stretching it upward toward the middle line of the abdomen. This part of the urethra is freely movable; it is distensible, yields to pressure, and readily changes its course, without injury, when instruments are inserted. It is only by gross negligence that a false passage can be established in this section of the canal. The more fixed division of the urethra describes a curve, which is fully explained on page 748; it yields very slightly to the advancing tip of the urethral instrument, and consequently here false passages are not uncommon.

Anatomically the urethra is divided into three parts: the penile, the membranous, and the prostatic. For clinical purposes it has been divided into two, the anterior and posterior. The former extends from the meatus to the anterior layer of the triangular ligament. The latter is the portion beyond the ligament and includes the membranous and prostatic urethra. The length of the urethra varies in different individuals; it measures from eight to nine inches. The average length is eight and one-half inches. As a rule an obstruction met with over seven inches from the meatus may be regarded as arising from an affection of the prostate gland, usually an enlargement of the organ.

The penile urethra is generally six and one-half inches in length. It is lined with a delicate mucous membrane, on the roof and floor of which are the openings of numerous ducts leading to the urethral glands; these are known as the glands of Littré. The urethra, in the spongy portion, is surrounded by involuntary, longitudinal, and circular muscular fibres, as well as by erectile tissue. The penile urethra has an expansion at either end. The dilatation back of the meatus is called the fossa navicularis, on the roof of which is a reduplication of the mucous membrane. It is valve-like in form and is called the lacuna magna. This fold, or pocket, is from one-half to three-fourths of an inch from the meatus, the distance varying in different individuals. It is the first point which is apt to catch the beak of an instrument and arrest its progress after passing through the meatus. It is for this reason that, when an attempt is made to insert a catheter, the tip of the instrument should be kept in contact with the inferior wall until the lacunæ are passed.

The bulbous portion, or the corpus spongiosum, is the termination of the penile urethra. It lies directly in front of the anterior layer of the triangular ligament. Here the spongy urethra terminates and the membranous portion begins, forming what is known as the bulbo-membranous junction; a very common site for an organic stricture of small calibre, and for the formation of false passages by urethral instrumentation.

The membranous portion of the canal joins the bulb at its upper rather than at its lower part, forming a dilatation on the inferior wall like a pouch or pocket. As men advance in years, especially if they have practised auto-catheterism for some time, this pouch becomes dilated, particularly on the floor of the urethra; it frequently acts as an obstruction and gives rise to a good deal of difficulty when one attempts to make an instrument glide past the spot. Occasionally small depressions, surrounded by folds of mucous membrane, are found on the floor of the bulbous urethra. When inflammatory conditions exist these folds become œdematous and increase the difficulty of instrumentation. These obstacles can generally be overcome by keeping the penis on the stretch and maintaining the beak of the instrument in contact with the superior wall of the urethra.

In old men in whom an obstruction at the bulbous urethra exists, and who are required to perform catheterism daily, an irritation is produced which is frequently attended by a low grade of chronic urethritis. As a result, a stricture forms, and this, in conjunction with the abnormal dilatation at the bulbous portion, renders catheterism extremely difficult.

The bulbo-membranous junction of the urethra is in contact with the anterior layer of the deep perineal fascia. When catheterism with a metal instrument is attempted, the beak touches the point of junction, the handle being well depressed between the thighs. The layer of fascia acts as a fulcrum and turns the point upward toward the opening of the membranous urethra, thereby assisting its onward passage toward the bladder. When the bulb is unusually enlarged, the fascia, instead of being an assistance to the passage of an instrument, acts as an obstruction, preventing its further transit and favoring the formation of a false passage if undue force is exerted.

Especially is this true if a stricture of small calibre is also present.

When a false passage is produced, the operator will become aware of the fact by the sudden interruption to the further progress of the instrument, together with the great local pain that immediately ensues. In addition the proximal end of the instrument will deviate from the median line. If a false passage has been made in the posterior urethra it can readily be detected by a rectal examination. As a rule, hemorrhage does not make its appearance until after the instrument has been withdrawn. It will vary in quantity from a few drops to a continuous flow, depending on the portion of the perineurethral structures which has been injured.

Catheterism of the urethra in which a false passage exists generally requires an instrument with a large curve in order to reach the bladder.

The membranous urethra is usually three-fourths of an inch in length. It lies between the anterior and posterior layers of the triangular ligament, which serves to hold it firmly in place. This portion of the canal, together with the prostatic urethra, is frequently spoken of as "the deep" or "fixed urethra." It is composed of a mucous coat, submucous tissue, a few involuntary muscular fibres, and a thin layer of vascular tissue, which bleeds freely when injured. The membranous urethra is less movable than the prostatic portion; it is surrounded by a band of strong muscular fibres called the compressor urethræ. The filaments of this muscle pass over, under, and around the urethra; they aid not only in retaining the urine when the bladder is distended, but also in protecting the entrance of the posterior urethra from the invasion of foreign bodies and urethrai instruments which are being roughly manipulated.

It is a voluntary muscle, being under the control of the will. It is markedly influenced by reflex action, giving rise to spasm, which accounts for the retention of urine which is observed occasionally in acute urethritis and after the use of strong injections, and which sometimes follows operations on the abdominal cavity, rectum, genital organs, and lower limbs.

The passage of either a catheter or a bougie is rendered difficult when resistance is offered by the firm contraction of the muscular fibres, when hyperæsthesia of the posterior urethra exists in nervous, impressionable individuals, or when rough instrumentation is used. It is usually at the bulbo-membranous junction that the most difficulty is experienced when catheterism is attempted. Strictures of the membranous portion of the urethra are usually of traumatic origin. The prostatic urethra is about one inch and a quarter in length; it is somewhat longer in cases of prostatic hypertrophy. It is more movable than the membranous portion. It is frequently the site of traumatism and false passages made by the ignorant and by rough use of urethral instruments. The prostatic urethra passes downward and forward and becomes the membranous urethra on reaching the posterior layer of the triangular ligament. The interior wall shows various deep depressions. In rare instances the mouth of the ejaculatory ducts are widely dilated and offer an obstruction to catheterism when attempted. While an instrument is passing through the prostatic urethra the tip should be kept in contact with the superior wall.

From what has been said it will be understood that the urethra is not a tube of uniform calibre, but consists of a series of physiological dilatations and contractions. This is well illustrated in the following classification given by Taylor, showing the calibre of the different portions of the canal:

	Millimetres.	Calibre.
Meatus	7– 9	21–28 F.
Fossa navicularis	10–11	30–33
Middle of pendulous portion	9–10	27–30
Bulb	11–12	33–36
Membranous urethra	9	27
Apex of prostate	10	30
Middle of prostate	15	45
Vesical end of prostate	11	33

An examination of the anatomical construction shows that one is dealing with a tube which presents two marked constrictions and three dilatations, as well as a movable and a fixed curve; the constrictions being found at the meatus and internal vesical sphincter, the dilatations at the fossa navicularis, bulb, and middle portion of the prostatic urethra. The fixed curve begins one-half inch in front of the bulb. These facts should be borne in mind by the operator.

The difference between the superior and the inferior wall of the urethra is an anatomical point of great importance. The superior wall is smoother, less vascular, not so intimately connected with the important structures, is more constant in form and regular than the inferior wall, which presents a series of broken lines due to depressions. The curve of the urethra remains regular only on the superior wall, which is the shortest route to the bladder. The dilatations of the urethra take place at the expense of the inferior wall, and they assist in causing its irregularities. The greater the curve of the urethra the greater its length, in consequence of which the depressions in the bulbous and prostatic portions of the canal will be more marked.

In selecting the size of the catheter or bougié to be employed the operator may be guided by a law first enunciated by Otis in 1883, in which he demonstrated that the calibre of the urethra bears a constant relationship to the circumference of the flaccid penis. He gives a scale exhibiting the relative proportion between the circumference of the penis and the calibre of the urethra. In my opinion the ratio laid down by Dr. Otis is too large; that suggested by White in Morrow's "System of Genito-Urinary Diseases" is more reliable (*loc. cit.*). It is as follows:—

"Circumference of penis, middle of spongy portion, 3 inches; calibre of urethra, 26–28 mm. Circumference of penis, 3¼ inches; calibre of urethra, 28–30 mm. Circumference of penis, 3½ inches; calibre of urethra, 30–32 mm. Circumference of penis, 3¾ inches; calibre of urethra, 32–34 mm. Circumference of penis, 4 inches; calibre of urethra, 34–36 mm. It is seldom necessary to go beyond this last size."

Phimosis, either congenital or acquired, may contract the orifice of the prepuce to such a degree that it will be impossible to locate the meatus. When this condition exists the foreskin may be divided on the dorsum sufficiently to render the opening visible, or if necessary circumcision may be performed.

In some instances an œdematous condition of the foreskin, due to inflammation, may render it impossible to find the meatus. The obstruction is due in part to an elongation of the prepuce, and also in part to the fact that the preputial orifice is contracted. If, after the foreskin has been retracted as far as possible, the meatus cannot be found, an attempt should be made to lessen the amount of serous effusion in the organ by pressure. This may be effected by grasping the penis firmly with the left hand, retracting the prepuce as far as possible, and making continuous pressure on the organ. Some surgeons advise the application of a broad elastic band. When pressure applied in the manner indicated fails, the skin of the penis should be sterilized and multiple punctures should be made in the vicinity of the prepuce with an aseptic tenotome, which allows the serum to escape. After this operation the foreskin can be retracted to such an extent that it will be possible to locate the meatus. When the glans penis is covered with papillomatous growths difficulty in finding the meatus may be experienced; usually under these circumstances the meatus can be detected by means of a probe.

Catheterism should always be performed with the patient lying in the recumbent posture. Unexpected and serious symptoms sometimes arise suddenly from urethral instrumentation despite the utmost gentleness and care. Individuals liable to be so affected are usually of a neurasthenic type, but these symptoms may arise in strong, robust men in whom no cause for their appearance can be found. Shock more or less severe, epileptiform convulsions, and even death have been known

to follow the introduction of an instrument into the urethra.

It is always well to have the shoulders slightly elevated, whereby the abdominal muscles are relaxed and the tension on the suspensory ligament is relieved. Flexing the thighs also aids in relaxing the abdominal muscles. The patient should be instructed to open the mouth widely and to take full, quick inspirations, which will relax the diaphragm and subdue muscular tension, in addition to occupying the mind, so that attention is diverted from the affected parts.

The method to be employed when one undertakes to carry out urethro-vesical catheterism will depend on the character of the instrument to be used, whether it be soft, flexible, metal, straight or curved. It has already been shown that the calibre of the urethra is a variable one; that it consists of a series of physiological contractions and dilatations; that the dilatability possesses a relation to the circumference of the flaccid penis. As a rule, the external meatus is the most contracted portion of the canal. It will frequently be found to vary in size; in some instances being unusually large and in others abnormally contracted. It is a safe rule to regard an instrument to be of a proper calibre when it can be readily inserted through a normal meatus and passed through the entire canal without encountering any abnormal obstruction. A normal meatus may, therefore, be taken as a guide for the size of the catheter to be employed. When the urinary outlet is abnormally contracted meatotomy should be performed.

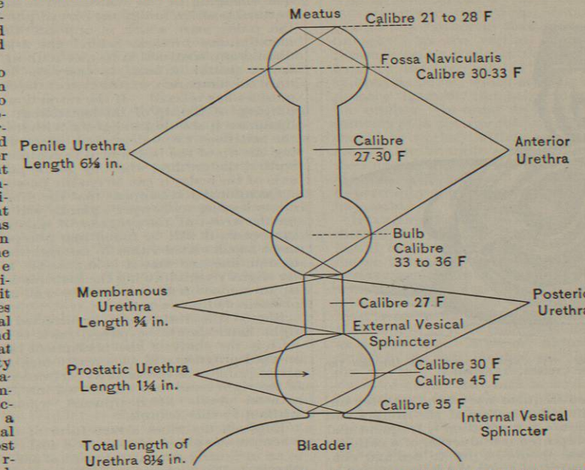

FIG. 1190.—Showing Normal Physiological Constrictions and Dilatations of Various Portions of the Urethra, with the Calibre and Length of Each. (Horwitz.)

Regarding the size of the catheter, every patient is a law unto himself, as no two individuals have a urethra of exactly the same calibre. All genito-urinary surgeons agree that a catheter should be neither too large nor too small; that the urethra should be moderately filled, but not dilated. The catheter which fulfils this indication can be inserted far more readily, will give rise to less discomfort and pain, and will involve less danger of producing a false passage or of causing attacks of urethritis and orchitis than will the use of very small catheters, which are so frequently employed by patients under the impression that they give less pain and are more free from danger. The calibre of the catheter suitable for the average individual is about 15 French.

Both soft and flexible catheters are passed in the same manner. The instrument having been sterilized and anointed with an antiseptic lubricant, and the patient having placed himself in the recumbent posture, the surgeon should stand on the left side and grasp the penis between the middle and ring fingers of the left hand, just behind the corona glandis, leaving the index finger and thumb free to retract the prepuce and separate the meatus. The penis should be stretched upward toward the middle line of the abdomen. The end of the catheter is then to be inserted and slowly and gently propelled forward with a uniform motion, introducing about a quarter of an inch of the instrument at each movement. This is to be continued until the bladder is reached. If any obstruction is met with the further progress of the instrument should be immediately arrested. It should be gently retracted for a short distance and then an effort should be made to reinsert it. After the instrument has been passed through the urethra and the urine evacuated, the proximal end of the instrument should be closed either by pinching the end of the instrument or by closing the orifice with the index finger, which prevents the urine that remains in the catheter from escaping when the eye of the catheter emerges from the meatus. When employing a catheter with a coudé curve, it should be recollected that the instrument is in contact with the two opposite walls of the urethra, so that when the bulbous portion of the canal is reached it should be more rapidly lowered toward the thighs than is the custom in employing other forms of catheter. If this advice be followed the instrument will pass readily into the membranous urethra.

Daily catheterism frequently gives rise to a low grade of chronic urethritis attended by a spasmodic condition of the urethra, rendering the operation painful. This condition is relieved by daily irrigation with a warm boric-acid solution, and by passing a conical bougie every third day. The spasm may be overcome by the administration of:

℞ Tinct. belladonnæ ..... ℥ ss.
Sodii bromidi ..... ʒ iv.
Liq. potassii ..... ʒ ij.
Syr. zingiberis ..... ♏ iij.
Aquæ destil. ..... ad ʒ vi.
M. Sig: Tablespoonful in water three times daily.

Gouley highly recommends gr. $\frac{1}{200}$ of hyoscyamus sulphate, to be given three times daily. He advises that the remedy should not be administered over three days in succession, when an interval of four days should be allowed to intervene before its administration is resumed.

Relapsing orchitis in old patients practising autocatheterism is due either to the use of infected instruments or to a too frequent use of the catheter. When this condition exists, the urethritis may be treated in the usual manner and continuous catheterism employed. In the aged, whose sexual powers have long been suspended, double vasectomy may be resorted to; for this not only prevents any further development of orchitis,