

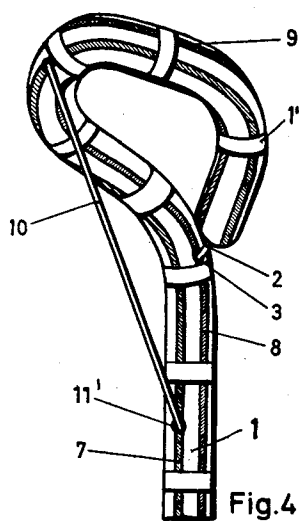
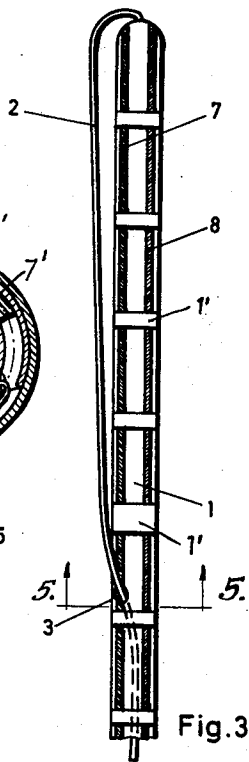
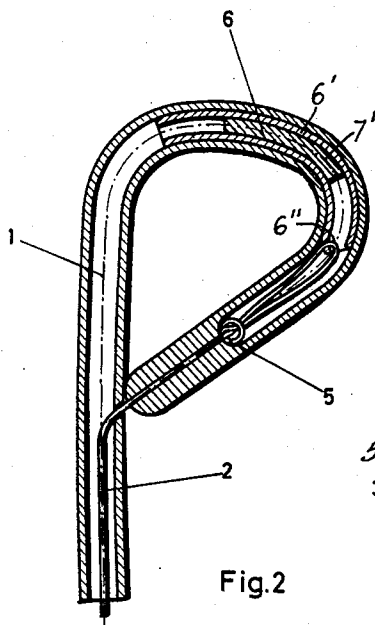
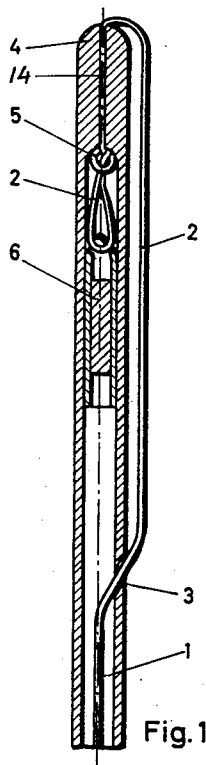
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KARL-LUDWIG ZEISS
CATHETER

3,119,392

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3 Sheets-Sheet 1



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3 Sheets-Sheet 2

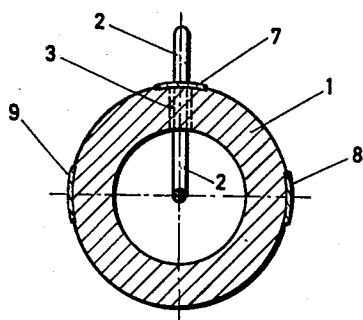


Fig. 5

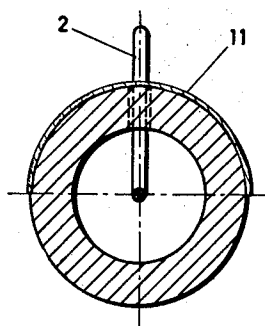


Fig. 6

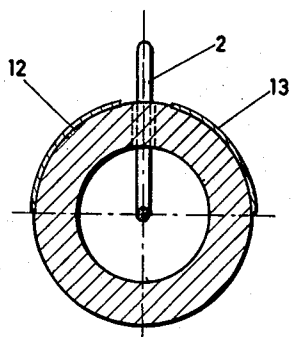


Fig. 7

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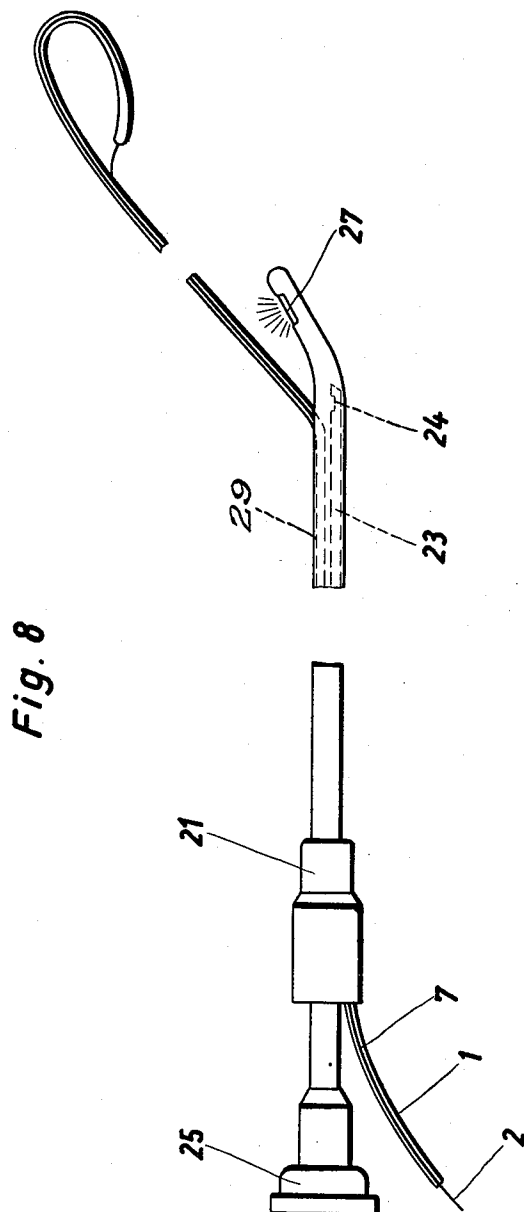
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3 Sheets-Sheet 3



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3,119,392

CATHETER

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This invention relates to a catheter, and more particularly to a catheter having a loop for the removal of stones located in the ureter.

A loop catheter consists of a flexible catheter tube which has a thread emerging from the front end thereof which enters the catheter tube through a hole a few centimeters behind the front end of the tube. The thread then extends inside the tube and comes out of the back end of the tube. If one holds the back end of the tube firmly and pulls out a piece of the thread, then a loop is formed by the catheter tube at the front end of the tube.

A kidney stone which is located in the ureter may be removed in the following manner. First, one finds out by means of an X-ray picture where the stone is located in the ureter. Then a cystoscope is inserted into the bladder of the patient. A conventional urinary duct catheter is inserted through the cystoscope and introduced into the ureter. The urinary duct catheter is moved up inside the ureter until it has passed the stone. Next, another X-ray picture is taken to determine on which side of the catheter the stone is located. The urinary duct catheter is then removed, and the loop catheter is inserted into the ureter. It passes the stone in most cases at the same side as the urinary duct catheter. The loop catheter must be inserted into the ureter in such a way that the loop formed is in the direction of the stone, or in other words, the entrance opening must confront the stone while the front end of the catheter is guided past the stone. The loop does not develop in the form of a tennis racket, whose lateral expansions are both of equal size, but it always develops asymmetrically and only toward the side of the catheter where the entrance opening for the thread is located. The loop is formed above the stone and pulled downward. While doing this, the stone is pressed from the walls of the ureter into the loop and held in the loop. By pulling the loop from the ureter, the stone is pulled out.

It is difficult to insert a loop catheter into the ureter with the proper orientation relative to the stone, and often several attempts are required. Even if one had introduced the catheter into the cystoscope with the correct orientation, and also made sure in the cystoscope-optic system that the loop thread at the front end of the catheter had the correct position when inserted into the ureter, involuntary twisting of the catheter during further upward movement cannot be avoided. This is the case especially when the catheter must be moved very high inside the ureter, namely up to the kidney region or even into the pelvis of the kidney and into the kidney calyx. In such cases, a distance of up to 32 centimeters must be traversed from the opening of the ureter into the bladder.

It is an object of the present invention to provide a loop catheter with means for facilitating insertion of the catheter into the ureter with the proper orientation.

More specifically, it is an object of the present invention to provide a loop catheter with indicia which may be visually observed to insert the catheter into the ureter at the proper angular orientation to the stone to form a loop which will engage the stone.

In accordance with the invention, the loop catheter is provided with at least one straight longitudinal stripe parallel to the axis of the catheter, which is visible from the

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exterior of the catheter and is of a color contrasting with the color of the catheter tube. As a result, it is possible for the attending physician to control the cystoscope continuously while it is pushed in, so that the catheter does not turn from its desired position. Furthermore, when the catheter tube is pushed in afterwards, checking can be carried out which, up to now, had not been possible. The longitudinal stripe of the catheter tube may be observed inside the urinary bladder through the optic system of the cystoscope. Thus, care can be taken continuously so that the catheter tube is pushed into the ureter in a correct position. As a result, twisting of the catheter as it moves from the outer end of the cystoscope to the entry into the ureter is avoided. This distance is approximately 30 centimeters, or about the same length as the largest distance to be covered in the ureter itself.

Further objects and advantages of the invention will be apparent from the following description, particularly when viewed in connection with the drawings, in which:

FIGURE 1 is a longitudinal sectional view of a loop catheter constructed according to the present invention and shown extended, the width of the catheter being enlarged more than the length;

FIGURE 2 is a longitudinal section of the front end of the same catheter after formation of the loop;

FIGURE 3 is an elevational view of the front end of the loop catheter of FIGURES 1 and 2;

FIGURE 4 is an isometric view of the front end of another embodiment of the invention employing a tilted loop catheter, the view illustrating the tilted loop;

FIGURE 5 is a sectional view of the front end of the catheter of FIGURES 1 through 3 taken along the line 5—5 of FIGURE 3;

FIGURES 6 and 7 are sectional views similar to FIGURE 5 showing alternate constructions in accordance with the invention; and

FIGURE 8 is a schematic elevational view of a cystoscope with a catheter of the type illustrated in FIGURES 1 and 2 extending therethrough.

In FIGURES 1 and 2, the front end of a loop catheter is shown in section. The catheter tube 1 is made of silk hose saturated with lacquer so that a flexible catheter tube results which is smooth on the outside and which, in spite of its flexibility, is stiff enough to be pushed forward in the ureter. The exterior diameter of the catheter tube, for instance, is 1.8 millimeters. A strand of thread 2 runs inside the tube for the entire length of the rear part of the catheter which is not shown, and it emerges laterally through a slanted opening 3 and then it extends for about 3 to 8 centimeters outside of the tube and enters the tube again at the tip 4 of the tube. The tip has only a very thin channel 14 through which the thread passes to the interior of the tube. A knot 5, which is formed by thread 2, secures the thread against slipping out through the channel. The thread 2 runs beyond the knot 5, and is secured to an elastic insert member 6 which is snugly disposed in the catheter tube. The insert 6 is in the form of a hollow tube 6' which is snugly disposed within the catheter tube 1 and has an aperture 6'' at its forward end for engaging the thread 2. The tube 6' also has a flexible filler body 7' centrally therein. It is the task of this member 6 to hold the loop in the ureter in a spread condition against the pressure of the ureter walls.

The lacquer of the catheter tube 1 contains a barium or lead compound so that the catheter tube thereby gives a good shadow in an X-ray picture. Furthermore, a centimeter scale in form of colored rings 1' (FIGURES 3 and 4) is disposed on the exterior of the tube and extends about the tube in a plane normal to the axis thereof.

In accordance with the invention, a longitudinal stripe 7, preferably red, is applied on the outside of the catheter

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tube parallel to the axis of symmetry of the tube. The stripe 7 extends over opening 3, and, without twist, to the rear end of the catheter tube. Two additional longitudinal stripes 8 and 9 of a different color are arranged on opposite sides of the stripe 7 and each of these stripes is displaced from the stripe 7 by 90 degrees. In FIGURE 3, only one of these additional stripes 8 can be seen which, for instance, may be blue. The other longitudinal stripe 9, which is visible in FIGURE 5, may, for instance, be green.

If it is desired to form the loop toward the front, then it is necessary only to keep the red stripe 7 in constant view during introduction into the cystoscope. However, if one keeps the blue longitudinal stripe 8 in view, then the loop forms toward the left. If one has the green longitudinal stripe 9 in view, then the loop forms toward the right. If one has no stripe at all in view, then the loop forms toward the rear (dorsally). Preferably, the stripe is made narrow in comparison to the diameter of the catheter.

In addition to the mentioned simple loop catheters, the invention is also applicable to "tilted" loop catheters in which a first thread is provided for the formation of a simple loop and, in addition to it, a second thread is provided for twisting the loop. The second thread, designated 10 in FIGURE 4, is secured near the upper end of the catheter tube and then extends for a distance outside of the catheter tube. The second thread 10 enters the tube laterally through an opening 11' which is located on the side of the opening 3 for the thread of the simple loop remote from the end, and the opening 11' is angularly displaced from the opening 3 by 90 degrees relative to the axis of the tube. As a result, a simple catheter loop in the ureter may be "tilted," and thus moved to a transverse position. Such "tilted" loops are used when elongated or perhaps symmetrical stones are located in the ureter in a longitudinal direction causing a simple loop to slip off. The loop of a tilted loop catheter is brought into its tilted position above such a stone, pulled toward the stone so that it reaches over one end of the stone, and then pulled out with the stone. With such catheters, the attending physician must know the direction which the simple loop has to be tilted, since, after tilting, the entire loop formation points toward this side.

FIGURE 4 shows the arrangement of the longitudinal stripes in connection with a tilted loop catheter. Here, a simple loop similar to the loop of FIGURE 2 is in addition put in a transverse position or "tilted" by the special tilting thread 10. Since, in connection with this loop, the tilting direction is especially important, the middle, i.e. the red, stripe 7 runs past the entry opening 11' of the tilting thread. The blue stripe 8, turned by 90 degrees counterclockwise in relation to the red stripe, runs through the opening 3. The green stripe 9 is turned by 180 degrees in relation to the blue stripe 8.

In order to save expenses, a single wide stripe 11 (FIGURE 6) may be used in place of the three stripes of different color; this stripe covers 180 degrees of the circumference of the catheter tube 1. When such a catheter is introduced, the physician must be careful that, in accordance with the direction in which the loop should form, he either sees the color stripe in its entire width or no stripe at all, or that he sees the right or the left edge of the stripe. It is true, this arrangement of the color stripe is cheaper than the arrangement of three color stripes in accordance with FIGURE 5, however, it will cause somewhat less exact work, especially if one has to tilt the loop forward and therefore must pay attention to the center of the color stripe.

An arrangement which is somewhat improved in comparison to FIGURE 6 is, therefore, shown in FIGURE 7, where two spaced color stripes 12 and 13 of the same color are illustrated. Between the two color stripes, a very small stripe is formed by the basic color of the catheter tube. This stripe passes through the entry open-

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ing for the loop thread 2, or the opening for the tilted loop thread. The reverse side of the tube (the entire 180 degrees) is again not covered by the color stripe.

The color stripes 7, 8, 9, 11, 12 or 13 may be applied to the already finished catheter tube by means of a special durable paint. This procedure is inexpensive, however, part of the color stripe may be scraped off occasionally by a stone. Preferably, the stripe is worked into the lacquer during the manufacturing of the catheter tube so that a massive piece of color forms part of the tube wall. If part of this color material is scraped off, the color stripe remains visible, nevertheless.

It is preferable to apply the longitudinal stripes first, and then the cross rings 1' of the centimeter scale, especially on longitudinal stripe types in accordance with FIGURES 6 and 7, so that the centimeter scale may be recognized well in each position of the longitudinal stripes.

FIGURE 8 illustrates a cystoscope with a loop catheter slideably disposed therein and extending from both ends of the cystoscope. The cystoscope is generally indicated by the reference numeral 21, and has a tube 23 which extends therethrough for viewing the interior of a cavity of a patient. The tube 23 extends from a viewer 25 which is disposed exterior of the patient in use and may be referred to as the outer end of the cystoscope. The opposite end of the tube 23 may be referred to as the inner end of the cystoscope, and it terminates at 24. A lamp 27 is disposed at the inner end of the cystoscope to illuminate the cavity of the patient for viewing purposes. The tube 1 of the catheter is illustrated as disposed within the channel 29 and extending from the inner end of the cystoscope. It is to be noted that the reference numerals applied to the catheter correspond to those shown in FIGURES 1 through 3.

From the foregoing disclosure, those skilled in the art will readily devise many modifications to the structure here set forth, and many additional applications of the present invention. It is, therefore, intended that the scope of the invention be not limited by the foregoing disclosure, but rather only by the appended claims.

The invention claimed is:

1. A device for removing stones in the ureter of a patient comprising a cystoscope having an exterior end adapted to be disposed exterior of the patient and an interior end adapted to be disposed within the bladder of the patient for viewing the interior of the bladder, said cystoscope having a channel extending from the exterior to the interior ends thereof, and a catheter having a hollow flexible tube slideably disposed within the channel of the cystoscope and extending from both ends of the cystoscope, said catheter being of sufficient length to extend from the interior end of the cystoscope through the bladder and ureter of the patient to the kidney of said patient, said tube having an axis of elongation and an opening therein spaced from one end thereof, a thread of greater flexibility than the tube secured at one end to said one end of the tube and entering the tube through the opening thereof, said thread extending slidably within the tube and from the other end of the tube for forming the portion of the tube adjacent to said one end of the tube into a loop by tensioning the thread, means disposed within the tube located between said one end of the tube and the opening for preventing collapse of this portion of the tube, said means comprising an elastic insert disposed within the tube and abutting the surface thereof, and a stripe of a different color than the tube extending along the exterior surface of the tube parallel to the axis of elongation of the tube for the entire length of the tube, said stripe being at a known orientation relative to the aperture in the tube, whereby the tube may be inserted into the ureter by manipulating the tube exterior of the patient and the rotational position of the tube in the ureter controlled at the mouth of the ureter by viewing the location of the stripe at the mouth of the ureter through the optical

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system of the cystoscope for the purpose of locating the loop of the catheter relative to the position of the stone.

2. A device for removing stones in the ureter of a patient comprising the elements of claim 1 wherein the tube is provided with a second opening disposed on a radius of the tube angularly displaced from the radius of the first opening and on the opposite side of the first opening from said one end of the tube, and in combination with a second thread secured to the tube between the first opening and said one end of the tube and extending exterior of the tube to the second opening, through the second opening, and slideably along the interior of the tube away from said one end of the tube.

3. A device for removing stones in the ureter of a patient comprising the elements of claim 1 wherein the stripe is narrow compared to the circumference of the catheter and extends over the opening in the tube.

4. A device for removing stones in the ureter of a patient comprising the elements of claim 1 wherein a second stripe of a different color than the first stripe is disposed on the exterior surface of the tube parallel to and spaced from the first stripe.

5. A device for removing stones in the ureter of a patient comprising the elements of claim 1 in combination with a second and a third stripe parallel and equally spaced from the first stripe, the second and third stripes being on

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opposite sides of the first stripe and each stripe being on opposite sides of the first stripe and each stripe being of a different color than the other stripes.

6. A device for removing stones in the ureter of a patient comprising the elements of claim 1 in combination with a second stripe of a different color than the tube parallel to the first stripe, the first and second stripes being on opposite sides of the opening and equally spaced therefrom, said first and second stripes being on the same half of the tube and each having one edge on an axial plane of the tube.

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