

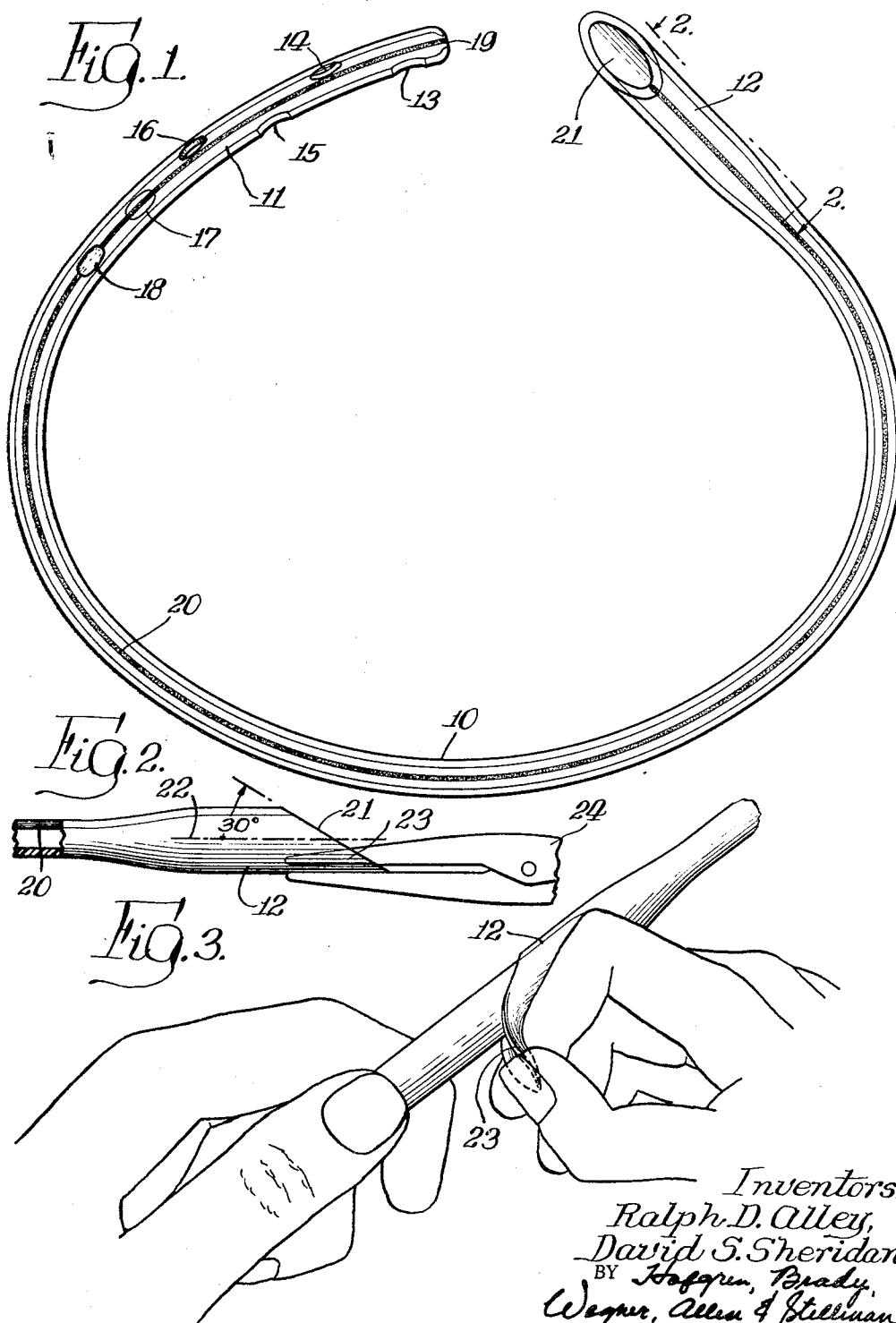
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INTERCOSTAL CATHETERS

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INTERCOSTAL CATHETERS

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The present invention relates to catheters and more particularly to an X-ray catheter which is particularly useful as an intercostal catheter.

United States Patent 2,857,915 describes an X-ray catheter which is constructed as an extruded seamless non-fibrous tube of flexible transparent waterproof plastic material having a continuous strip of X-ray opaque material extending longitudinally along the entire length thereof. The strip of opaque material appears as a line where X-ray techniques are utilized to determine the exact position of the catheter in the body. In many surgical and clinical procedures, it is not only desirable but sometimes necessary that the exact location of a catheter as it passes through the body tissues be known. Since such a catheter as disclosed in United States Patent 2,857,915 is transparent to light, the presence of matter may be observed through the catheter as it is conducted through the portion thereof outside the body. Thus, a catheter constructed in accordance with the aforementioned patent can be located by X-ray techniques inside the tissues of the body and fluids flowing through the portion of the catheter outside the body may be observed through its transparent plastic structure.

The distal end portion of such a catheter normally has a number of inlet openings for receiving fluids from a desired portion of the body. Often, it is desirable not only to locate the path of the catheter as it passes through the body tissues but to positively identify the location of these inlet holes or at least the hole furthest from the distal end to insure that it has not moved too far from a desired position. An example of such a situation is the use of an intercostal catheter following chest surgery. In the postoperative period during which the distal end of a catheter remains within the chest cavity it is necessary that the position of the last hole from the end of the catheter distal portion be known in relationship to the chest layers. If there is no mark to indicate the position of such a hole that can be recognized by X-ray techniques, the position of that hole cannot be ascertained with certainty, particularly in a surgical procedure where a portion of the catheter distal portion may be cut off prior to insertion in the body. The present invention provides a means for accurately locating the position of such a last inlet opening by X-ray techniques.

Intercostal catheters and catheters utilized in similar surgical procedures are inserted through the original incision with the proximal end portion entering the incision first; a second incision is made; forceps are inserted through the second incision to grasp the proximal end of the catheter; and the catheter is thereby pulled into the body until the distal end portion is properly positioned with the tube leading out through the second incision. Then the proximal end is connected to an appropriate tubular connector. At the present time, the proximal end of conventional catheters in general usage have a proximal end opening lying in a plane which is approximately at right angles to a center line of the tube. When the gripping or jaw portions of forceps do not exceed the diameter of the proximal end opening, it is distorted when externally gripped by both jaws of the forceps so that opposite portions of the end are forced out from between the jaws as pressure is applied by the forceps to form a closed end having two protruding points which may act as dull barbs as the proximal end portion is pulled through the

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body tissue to the second incision. These protruding barbs may rip or tear tissue during this process. If the forceps are applied to the proximal end of a conventional catheter now in general usage so that one jaw is placed internally and the other is placed externally to grip the catheter, the proximal end is not distorted, but that portion of the circumference of the proximal end which is not between the gripping jaws of the forceps will make an even larger barb to catch and tear the body tissue as the forceps are used to draw the proximal end to and through the second incision. A further accomplishment of the present invention is to eliminate such ripping and tearing by a unique proximal end portion for a catheter.

Therefore, it is an object of the present invention to provide a catheter having a proximal end portion which may be gripped by forceps to withdraw the proximal end through body tissue without ripping or tearing the body tissue.

A further object of the present invention is to provide an X-ray transparent catheter having an opaque X-ray line running longitudinally therethrough with that opaque line being interrupted by the inlet opening furthest from its distal end.

Another object of the present invention is to provide a new and improved catheter.

A primary object of the present invention is to provide an intercostal catheter composed of a light and infra-red transparent material having an X-ray opaque line embedded longitudinally therein with the opaque line being interrupted by the inlet opening furthest from its distal end and a proximal portion end having an outlet opening lying in a plane which makes less than a 45° angle with a center line of the proximal end portion.

Yet another object of the present invention is to provide a catheter having a flared proximal end portion which is capable of being easily removed from a tubular connector.

Further objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings.

In the drawings:

FIGURE 1 is an elevational view of an embodiment of the present invention;

FIGURE 2 is a side elevational view of the embodiment of the invention taken along the lines 2—2 of FIGURE 1 when the proximal end portion is grasped by forceps; and

FIGURE 3 is a pictorial view of the proximal end portion of the embodiment of the invention shown in FIGURE 1 being removed from a tubular connector.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail, an embodiment of the invention with the understanding that this present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

As aforementioned it has previously been the practice to grasp the proximal end of a catheter with either both jaws of a forceps external or with one jaw internal so that as the forceps are withdrawn to and through the second incision, a portion of the proximal end of a conventional catheter will frequently rip or tear the tissue through which the forceps are being withdrawn because the right angle edges produced by the proximal end of a conventional catheter produce barbs which easily dig into the tissue through which the forceps are being withdrawn. The construction of a catheter shown in the drawings eliminates this tearing and ripping effect as the forceps are withdrawn to pull the proximal end out through the second incision. To utilize this catheter construction, a pair of forceps are inserted in the second incision until they are in position to grasp the tip of the proximal end which

is slanted at less than a 45° angle to the center line of the proximal end. Since this construction provides an elongated tip of small cross sectional area, it is easier for it to be grasped by forceps than with a conventional catheter, for the forceps need only be opened wide enough to grab the small tip. It is not necessary to open the forceps wide enough to encompass the entire outer diameter nor it is necessary to work one jaw into the circular hole of the conventional catheter. Thus the present invention eliminates both the problem of opening the forceps wide enough to grasp the catheter with both jaws external to the catheter or maneuvering to shove one jaw into the end of the tube. The forceps are then withdrawn through the tissue which they have penetrated from the second incision drawing the slanted proximal end smoothly through the tissue. As the forceps pass through the tissues, the tissues are not contacted by any blunt barb but are parted smoothly for the passage of the maximum diameter of the catheter. Thus the present invention does not rip or tear as it passes through the tissue but smoothly parts the tissue to allow the maximum diameter of the catheter to easily slide therethrough.

The proximal end portion is withdrawn through the second incision until the distal end is believed to be in its correct position within the body. X-ray techniques can be utilized with the catheter construction shown in the drawings to precisely locate not only the distal end portion in general but the position of the holes in the distal end. By the use of earlier X-ray catheters, it had been possible to locate the path of the catheter, but it had been impossible to definitely locate the position of the distal end holes in relation to the body structure. By the use of the present invention the exact position of the distal end and its holes may be located so that the surgeons now may know that the holes in the distal end are draining the correct area of the body and that they are not draining an incorrect area. Thus as will be seen from the following detailed description, it is now possible for a surgeon to eliminate not only one but both of the problems that are presently associated with conventional catheters. No longer must he tear or rip the patient's tissue with the barbs formed by the proximal end of the catheter and no longer must he be uncertain about the exact position of the distal end of the catheter after it is inserted.

Referring initially to FIGURE 1, a catheter is composed of a tube portion 10, a distal end portion 11, and a flared proximal end portion 12. The distal end portion has a series of inlet openings 13-18 and an open distal end 19. The catheter is constructed of a seamless flexible plastic material which is transparent to both light and X-rays. Embedded in the plastic material is an X-ray opaque line running longitudinally along the catheter. The opaque line 20 is interrupted by the inlet opening 18 which is the most remote opening from the end 19 of the distal portion 11.

As may be seen in FIGURE 2, the plane of a proximal opening 21 is at an angle of less than 45° from the center line 22 of the proximal end portion 12. Although this angle between the plane of the opening and the center of the proximal portion 12 may vary in different embodiments of the present invention it must be sufficiently small that a resulting slanted end section 23 may be easily gripped by a set of forceps 24 without distorting the circular shape of the proximal portion 12. In the embodiment illustrated in FIGURE 2, the angle between the plane in which the end 21 lies and the center line 22 is approximately 30° .

Since the proximal end is internally flared, it may fit over connecting tubes of varying external diameter. When the proximal end has been attached to a connector as illustrated in FIGURE 3, it may be easily removed by grasping the slanted end section 23 and pulling upward as illustrated in FIGURE 3. Thus, the interior walls of the proximal portion 12 will loosen a grip on a connector as

the tip 23 is pulled toward the tube portion 10 of the catheter.

When a catheter of the type illustrated is to be utilized in a chest surgical procedure, the distal end portion 11 may remain as illustrated with the six inlet openings 13-18 and the open end 19 available to receive fluids from the section of the body wherein they are placed, or a length of the distal portion 11 may be cut off so that only a few inlet openings remain in the distal portion 11. Regardless of the number of inlet openings remaining, the exact length of the entire catheter or the length of the distal portion 11, the last inlet opening 18 may be located by X-ray techniques because the inlet opening 18 will show up on X-ray plates or fluoroscopes as a break in the X-ray opaque line 20. Although the embodiment illustrated shows the inlet opening 18 furthest from the distal end interrupting the line, it will be understood that other structure within the scope of the present invention may utilize more than one inlet opening to interrupt the X-ray opaque line and that in other applications of such a catheter that it may be desirable to have an inlet opening other than the one furthest from the distal end interrupting the X-ray opaque line.

The proximal end portion 12 is inserted into a primary incision of the chest. A second incision is made at another position which can receive the ends of a pair of forceps 24. As illustrated in FIGURE 2, the forceps may grasp the slanted end section 23 of the flared opening 21 so as not to distort the circular shape of the proximal end portion 12 or its opening 21. As the forceps are withdrawn through the second incision with the slanted proximal end smoothly parting the tissue to allow for the passage of the maximum diameter, the distal end portion 11 is drawn through the primary incision and into the body tissue until it arrives at the desired position. The position of the path of the entire catheter and the position of the inlet holes may now be determined by either X-ray or fluoroscope techniques prior to completing the surgical procedure or at any time after its completion to insure that the inlet openings and the tube end has not slipped or moved to an undesirable position.

We claim:

1. A catheter having a distal end and a proximal end comprising a tube of flexible material transparent to X-rays, a longitudinal line of X-ray opaque material embedded in said material, and an inlet opening interrupting said line of X-ray opaque material near the distal end.

2. A surgical catheter having a distal end and a proximal end adapted to be withdrawn through a secondary incision during a surgical procedure subsequent to its insertion into the body through a primary incision comprising a tube of flexible material and a proximal end portion having an end opening lying substantially in a plane which forms less than a 45° angle with a centerline of said proximal end portion whereby a slanted end section is formed which is adapted to be grasped by forceps for withdrawing the proximal end portion through an incision, said slanted end section smoothly parting tissue surrounding the incision to allow for the passage of the proximal end portion without ripping said tissue during said withdrawal.

3. A catheter having a distal end and a proximal end comprising a tube of flexible material transparent to X-rays, a longitudinal line of X-ray opaque material embedded in said material, an inlet opening interrupting said line of X-ray opaque material near the distal end, and a proximal end portion having an end opening lying substantially in a plane which forms less than a 45° angle with a centerline of said proximal end portion.

4. A catheter having a distal end and a proximal end comprising a seamless tube of flexible plastic material transparent to light and X-rays, a longitudinal line of X-ray opaque material embedded in said plastic material, and a number of inlet openings depressed near the distal

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end with only the inlet opening furthest from the distal end interrupting said line of X-ray opaque material.

5. A surgical catheter having a distal end and a proximal end adapted to be withdrawn through a secondary incision during a surgical procedure subsequent to its insertion into the body through a primary incision comprising a seamless tube of flexible plastic material and a proximal end portion of increased internal and external diameter having an end opening lying substantially in a plane which forms less than a 45° angle with a centerline of said proximal end portion.

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6. A non-absorptive catheter having a distal end and a proximal end, comprising an extruded, seamless, non-fibrous tube of flexible, waterproof plastic material transparent to light and X-rays; a longitudinal line of X-ray opaque material embedded in said plastic material; a number of inlet openings depressed near the distal end with only the inlet opening furthest from the distal end interrupting said line of X-ray opaque material; and a

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proximal end portion of increased internal and external diameter having a slanted end opening adapted to be grasped by forceps without distorting its normal cross-sectional shape.

References Cited by the Examiner

UNITED STATES PATENTS

2,212,334	8/40	Wallerich	-----	128—349
2,857,915	10/58	Sheridan	-----	128—349
3,042,044	7/62	Sheridan	-----	128—348

OTHER REFERENCES

A.C.M.I. Catalogue "Catheters and Accessories," American Cystoscope Makers, Inc., page 24, copyright 1960.

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