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SURGICAL INSTRUMENT FOR BILE DUCT EXPLORATIONS

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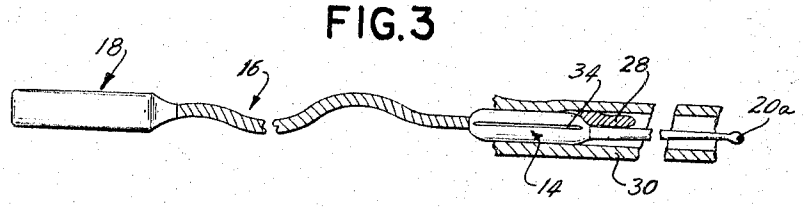


FIG.3

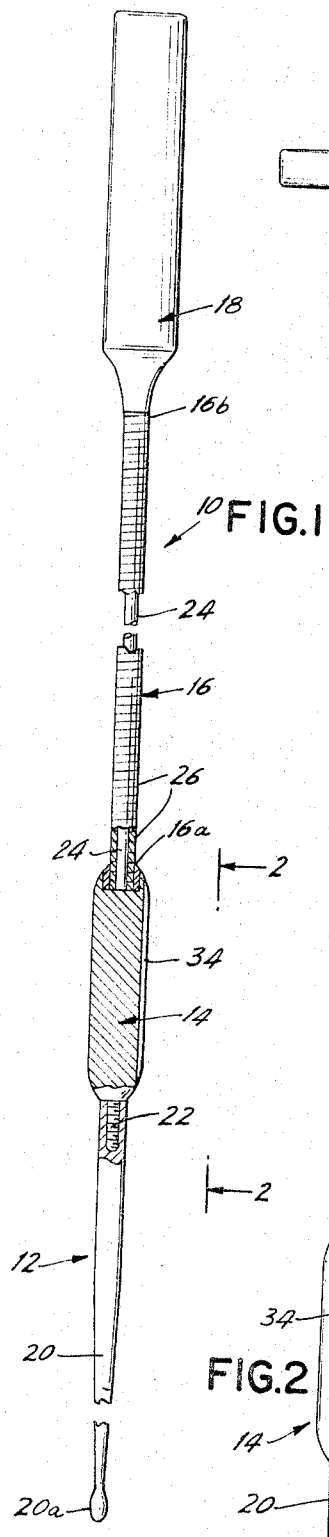


FIG.1

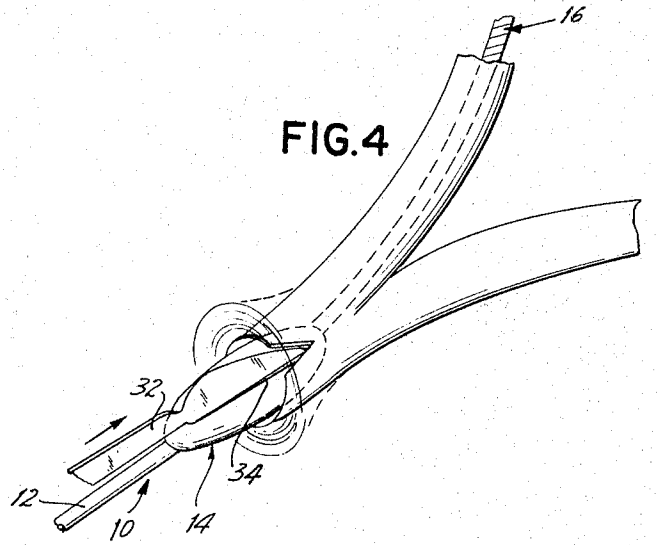


FIG.4

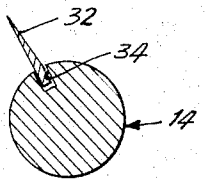


FIG.5

FIG.2

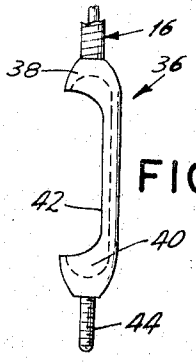


FIG.6

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SURGICAL INSTRUMENT FOR BILE DUCT EXPLORATIONS

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The present invention relates generally to surgical instruments, and more particularly to an instrument for the performance of common bile duct explorations.

In the surgical exploration of the common bile duct, it has become standard practice to employ a surgical instrument of elongated shape, commonly called a bougie, and to thread same along the length of the duct being explored. Initially, incision is made at the appropriate point in the digestive tract and in the instrument inserted. The bougies which have been previously employed have an elongated tubular shaft formed of a pliable material such that the surgeon can bend the tube to conform to the approximate shape of the duct prior to insertion, thereby disturbing as little as possible the position of the organ and minimizing as much as possible the danger of false passage. Although such instruments have been generally accepted, substantial need has existed for an improved surgical instrument for exploration of the bile duct, to improve and augment the results of these surgical procedures and to decrease the occurrence of postoperative morbidity associated with common bile duct surgery.

Accordingly, it is a general object of the present invention to provide an improved surgical instrument for use in connection with common bile duct surgery. It is specifically an object of the present invention to provide a bougie having a flexible shaft in order to allow the instrument to conform to the shape and radius of curvature of the duct into which the instrument is inserted.

It is further within the contemplation of the present invention to provide a surgical tool for use in common bile duct surgery wherein a filiform may be inserted into a duct and a choice of bougies or stone scoops may be progressively secured to the filiform for passage along the length of the duct.

In accordance with one illustrative embodiment of the present invention, there is provided a surgical instrument for insertion into the common bile duct comprising a bougie having a filiform releasably attached to the forward end thereof. The bougie comprises an olive, a flexible shaft and a handle. Conveniently, the means for securing the filiform to the forward end of the bougie is a threaded connection such that various combinations of bougies and filiforms may be made either within the patient's intestinal tract or prior to operation. An elongated flexible shaft is provided including an inner core of flexible material and an outer sheath formed of stainless steel material helically wound about the core such that the core and the sheath are co-extensive and coaxial. The core and the sheath are rigidly secured together at each of their respective ends and one of the ends of the flexible shaft is rigidly secured to the end of the olive opposite from the filiform and is coaxial therewith. The other end of the flexible shaft is secured to the handle such that the surgeon may manipulate the bougie while it is contained within the duct. The handle may be of a variety of convenient shapes such that the bougie may be moved axially or rotated about its own axis as desired by the surgeon. If desired, a linear trough may be formed on the olive to provide a guide for a scalpel making an insertion into the duct. Furthermore, the instrument according to the present invention may be provided with a stone scoop rather than an olive.

The foregoing brief description, as well as further objects, features and advantages of the present invention, will be best understood by reference to the following detailed description of one preferred embodiment of the present invention when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is an elevational view with portions in section and portions broken away illustrating a surgical instrument for insertion into the common duct constructed in accordance with the present invention;

FIG. 2 is a partial elevational view of the olive utilized in the device in FIG. 2;

FIG. 3 is a diagrammatic view, with portions broken away, of the bougie of FIG. 1 in use within a duct;

FIG. 4 is a further diagrammatic view of the device inserted within the common bile duct and in operative relationship with a surgeon's scalpel;

FIG. 5 is a transverse sectional view of the olive bougie portion of the device showing the relative relationships between the bougie, the trough in the olive and the scalpel; and

FIG. 6 is an elevational view of a stone scoop which may be incorporated within an instrument according to the present invention.

Referring now to the drawings, there is shown a surgical instrument generally designated by the numeral **10** which is composed of a filiform **12** detachably secured and of an olive **14** and coaxial therewith which in turn is secured to one end of a flexible shaft **16**, the other end of which is engaged with a handle **18**. As may be best appreciated by observing FIGS. 1 and 3, the instrument **10** is inserted into a patient's duct, for example through a choledochostomy, with the filiform guiding the instrument along the length of the duct. The filiform may be of a variety of shapes and has a tapered portion **20** at its forward end which may be terminated in a rounded nose **20***a* at its tip providing a blunt but small profile to guide the instrument along the length of the duct.

At its rearward end, the filiform **12** is secured to the olive **14** by a threaded connection to a stud **22** which is rigid with the olive **14** and extends axially therefrom. A complementary female thread is formed axially within the filiform such that the surgeon may select a combination of filiform and olive of the respective sizes and shapes best suited for the particular operative procedure.

The flexible shaft **16** according to this invention is secured to the rearward end of the olive **14** in a manner which will be described below and comprises an inner flexible core **24** and an outer sheath **26**. The core **24** is preferably constructed of a flexible material such as steel formed in a cylindrical or wire-like configuration. The core **24** demonstrates a relatively high coefficient of elasticity such that it may be bent rather severely but nevertheless resiliently returns to its undeformed shape. The sheath **26** is formed of a stainless steel material which is wrapped helically about the core **24** with each adjacent coil of the helix abutting in side-to-side relationship such that the entire length of the core **24** is completely covered by the stainless steel sheath **26**. At each of the ends **16***a* and **16***b* of the flexible shaft **16**, the sheath **26** is rigidly connected to the core **24** by means such as silver solder to securely bond the elements together. By this helical sheathing construction, a flexible shaft is produced which demonstrates the desired characteristics of the flexibility of a relatively thin band of stainless steel (the material of the sheath **26**) but which also displays the size and corrosion resistant aspects of a stainless steel rod of the diameter of the sheath **16**. At its forwardly facing end **16***a*, the flexible shaft **16** is rigidly secured to the rear end of the olive **14** and is coaxial therewith. A rigid securement may be conveniently achieved by a sil-

ver solder connection. Similarly, at its rearward end **16***b*, the flexible shaft **16** is rigidly secured to a handle **18**, again by such means as silver soldering, with the handle **18** providing adequate gripping means for the bougie **10**. Although a simple cylindrical handle is illustrated in the drawings, it should be appreciated that handles of variety of shapes may be employed to provide various functions. For example, a flat handle may be constructed in lieu of the cylindrical handle illustrated in order to provide a more positive gripping point for the surgeon to rotate and accurately position a stone scoop or other such device.

In FIG. 3 there is diagrammatically illustrated the engagement of the olive **14** of the instrument **10** with an obstruction **28** in the wall of a duct generally designated by the numeral **30**. In this figure, there is shown one of the interesting advantages of a flexible shaft constructed in accordance with the teachings of this invention. Contrary to the situation which occurs in a preshaped bougie as known in the prior art, when the instrument **10** of the present invention meets an obstruction in its passage through a duct, the flexible shaft **16** will react to the obstruction by buckling at a number of locations along its length, thereby giving the surgeon visible indication of an otherwise hidden obstruction.

Now referring to FIG. 4, the instrument **10** is shown in position within the common bile duct with the olive **14** at the sphincter of Oddi. A surgeon's scalpel **32** is positioned in engagement with the olive **14** at a scalpel trough **34**. Reference to FIGS. 2 and 5 will generally illustrate the position and configuration of the trough **34**. The trough **34** has for its purpose the guiding of a scalpel during an operative process such as a sphincterotomy. It will be appreciated that the surgeon may accurately locate the olive at a desired point along the length of the duct and may accurately position the trough **34** by turning the handle **18** since the shaft **16** will conform to the shape of the duct.

Similarly, the composite flexible shaft **16** provides advantageous features in an instrument such as the bougie **10** where the olive **14** is replaced with a stone scoop, such as the scoop **36** illustrated in FIG. 6. The scoop **36** comprises an enlarged body **38** having formed therein an internal cavity **40**, indicated by the dotted lines in FIG. 6, which is opened at one side as at **42**. At its forward end, the stone scoop **36** has an axially projecting threaded stud **44** which is adapted to be secured to a filiform such as the filiform **12**. At its rearward end, the stone scoop **36** is rigidly secured to a flexible shaft **16** in the same manner as the connection between the olive **14** and the flexible shaft **16** described above. The stone scoop **36** may be inserted within a duct in exactly the same manner as described above and a stone may be easily engaged in the cavity **40** by the delicate axial and rotational movements which may be accomplished due to the flexible

shaft **16**. Specifically, whereas with a preformed shaft, a stone scoop could be inserted in only one rotational orientation, in an instrument as described herein, the stone scoop may be inserted within a duct and then rotated in any manner desired by the surgeon.

It will be appreciated from the foregoing that there is provided a surgical instrument which offers a high degree of versatility and adaptability for the purposes intended. The device according to the present invention provides surgical equipment which broadens the area of safe activity for a surgeon since it provides means for further and more delicate manipulation of instruments within the common bile duct of a patient while at the same time decreasing the risks which accompanied the use of prior art equipment.

The specific devices illustrated and described herein are not, of course, the only embodiment of the present invention. The design of these devices may be varied and nevertheless incorporate the advantageous features of this invention. Accordingly, the following claims should be construed broadly and in a manner consistent with the spirit and scope of the invention.

What is claimed is:

1. A surgical instrument for insertion into an intestinal duct comprising a bougie, a filiform attached to the forward end of said bougie, a flexible shaft including an inner core of flexible material and an outer sheath formed of flat stainless steel material helically wound about said core with adjacent coils of the helix abutting in side-to-side relationship, said core and said sheath being rigidly secured together at each of their ends, said flexible shaft being resiliently deformable such that it may be passed through the intestinal duct of a human being and conform to the shape thereof, one of the ends of said flexible shaft being secured to said bougie, and a handle secured to the other end of said flexible shaft.

2. A surgical instrument in accordance with claim **1** wherein said bougie includes an olive-shaped portion having a scalpel-guiding trough cut therein.

3. A surgical instrument in accordance with claim **1** wherein said bougie includes a stone scoop portion having a body with an internal cavity therein.

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