BIOPSY PROBE, AND COMBINATION THEREOF WITH AN ENDOSCOPE

André Guillant, Paris, France, assignor to Optique et
Précision de Levallois, Levallois-Perret, Seine, France,
a company of France.

Filed Mar. 6, 1962, Ser. No. 177,765

9 Claims. (Cl. 128—2)

It is already known in gastro-enterology to use a device operating by suction and cutting for biopsies on the stomach lining or the intestines. This device, which is shown in FIGURE 1 of the accompanying drawing, comprises a tubular part 1 provided with a frusto-conical orifice 2 having sharp cutting edges. Through the tubular part 1 is guided a circular knife 3 connected by a flexible cable 4 to an operating knob 5.

The part 1 is connected by aunion 6 and a tight flexible sheath 7 to a hollow grip 8, a sealed passage being provided for the cable 4 through the grip 8 by means of a seal 9. A nozzle 10 is provided for connection of the instrument to a suction pump through the medium of a length of flexible tubing 11.

The instrument is introduced into the organ from which an excision is to be made and the suction pump used to create a partial vacuum within the tube 1. This causes the mucous membrane 12 of the patient's organ to be applied against the outer wall of the tube 1 and to form a bulge 13 therein, through the lateral orifice 2. If the grip 8 be then held firmly and the knife 3 pulled, the knife 3 will cut through the section of the mucous membrane 12 and into the tube 1.

The instrument is then extracted from the patient's body and disassembled by unscrewing the part 1 from the union 6, after which the sample of mucous membrane is abstracted for histological examination.

The device as hereinbefore described has the following two drawbacks:
(1) Since the excision is made from the side of the tube, at some distance from the extremity thereof, it is difficult to reach certain areas of an organ that is concave to some extent, and this can be particularly awkward when biopsies are to be performed inside the stomach.
(2) The instrument operates blindly, its depth of penetration and its orientation alone providing indications of the excision area.

The chief aim of this invention is to overcome these drawbacks, first by providing an improved biopsy probe that is adapted to operate over its extremity, by the same principle of suction and cutting, and, second, by the combination of such an improved probe with an endoscope permitting visually controlled biopsies.

A probe head according to the invention comprises a member having one end which is shaped into a hemispherical outer surface and a cylindrical longitudinal bore which terminates in a concave hemispherical surface concentric with said outer surface. The extremity of said member is provided with a sharp-edged aperture which does not intersect the axis of said bore. Into the bore is rotatably fitted a hallowed-out component provided with cutting edges which co-operate with the edges of said aperture so that, when a partial vacuum is created in the hollow space provided thus, the portion of mucous membrane which is caused to bulge into said member through the aperture may be cut by rotation of the internal component relative to the external member.

A biopsy probe executed in accordance with the invention will thus comprise a head as hereinbefore described which communicates through a hollow union, with a flexible tube through the instrumentality of which a suction effect may be obtained, the internal component being connected to an operating knob whereby it may be rotated in order that the portion of mucous membrane drawn through the aperture in the probe head in response to the suction force may be excised.

In accordance with a further particularity of this invention, a biopsy probe as hereinbefore disclosed, adapted to operate over its extremity, is combined with an endoscope, the connection between the two instruments being so devised as to cause them to be pressed tightly against each other when the composite instrument is introduced into the patient and the probe head to be displacable within the beam of light shed by the endoscope once it is in position inside the patient's organ.

In one embodiment of the present invention, the coupling between the probe head and the endoscope is ensured by means of a link which is connected to both the endoscope and the probe head.

The description which follows with reference to the accompanying drawing, filed by way of example only and not of limitation, will give a clear understanding of how the invention may be carried into practice.

Referring to the drawing filed herewith:

FIG. 1 is a longitudinal sectional view of a conventional biopsy probe, reference to this figure having already been made in the preamble to the present description;
FIG. 2 is an axial sectional view of the front portion of a biopsy probe according to this invention;
FIG. 3 is a fragmentary sectional view of an instrument executed in accordance with the present invention, wherein the probe shown in FIG. 2 is combined with an endoscope, the compound instrument being shown in the position of introduction;
FIG. 4 is a view corresponding to FIG. 3, showing the compound instrument in the operative position;
FIG. 5 is a sectional view taken through the line V—V in FIG. 4; and
FIG. 6 is a plan view of a detail of the part used to connect the probe and the endoscope.

Referring now to FIG. 2, the probe head according to this invention comprises a hollow member 1', the extremity of which is primitively hemispherical externally. The cylindrical bore through the member 1' terminates in a concave hemispherical surface which is concentric with the primitive external shape of the extremity of the internal component. A section orifice 2' is provided at the end of the member 1', for example by taking a section through a plane inclined at about 45° to the axis of the cylindrical bore. The plane in which the orifice 2' lies passes slightly above the outward tip 14 of the inner hemispherical face of the member 1'.

A cylindrical component 3' having a primitively hemispherical extremity fits exactly into the bore of the member 1', and constitutes the probe knife. To this end, the component 3' is sectioned at 15, first through a substantially axial plane, and second through a plane perpendicular thereto, thereby forming a semi-cylindrical portion 15a dependent from a cylindrical stem 15b. The extremity of the portion 15a forms cutting edges that are further sharpened by a concave hollowed-out portion 16. A groove 17 is provided on the knife stem 15b.

In accordance with the practice commonly resorted to on such probes used heretofore, the member 1' is screwed over a hollow union 6 which engages into the extremity of a tight resilient sheath 7. The other end of the sheath 7 is fitted over a grip 8, and said grip is provided with a nozzle 10 which is connected to a suction pump through a flexible line 11 (see FIG. 3) to enable a partial vacuum to be created in the cavity 15 of the knife 3'. A cable 4 is attached to the knife 3' and extends through the union 6 and the sheath 7, and then through the outermost end of the grip 8 by way of a suitable seal. An operating
knob 5 is secured to the other end of the cable 4 and can be used to rotate the knife 3' within the member 1'.

In accordance with a further particularity of this invention, such a biopsy probe operating over its extremity may be combined advantageously with an endoscope, with a view to constituting a compound instrument such as illustrated in FIGS. 3 and 4.

The cable proper is provided with an optical tube 18. The wall or lining of the patient's organ is illuminated by a lamp 19 and examined through a lateral aperture 20 by means of an angled optical sight. To the other end of the instrument is fitted the inspection eye-piece 21.

The instrument hereinafore described, which may be of the type shown in FIG. 1, is secured to the other end of the cable 4 and can be actuated to rotate the knife 3' within the member 1'. Said opening into said external member, while said opening is placed against a tissue, part of said tissue will be sucked through said opening into said external member; and means operatively connected to said internal member to rotate the same about said axis for cutting off during such rotation the part of said tissue sucked into said opening.

2. A biopsy probe head as claimed in claim 1, in which said endless cutting edge is located in a plane which is inclined relative to the axis of said cylindrical bore.

3. A biopsy probe head as claimed in claim 2, in which said plane is inclined at about 45° to the axis of said cylindrical bore.

4. A composite instrument comprising, in combination, a biopsy probe including an elongated external member having at one end a hemispherical outer surface and being formed with an internal member extending from the other end into said member and terminating at said one end in a con cave hemispherical inner surface concentric with said outer surface, said one end being formed with a sharp-edged aperture inclined to and spaced from the axis of said member and forming at said inner surface an endless cutting edge, an internal member mounted in said bore for rotation about the axis thereof and having a front portion of substantially semi-cylindrical configuration having an end closely fitted said concave inner surface so as to form a cutting edge passage, during rotation of said internal member, substantially without clearance said endless cutting edge, said internal member having a rear portion of cylindrical configuration fitting said cylindrical bore and being formed with passage means to provide communication between said opening and said other end of said external member, a hollow union fixed in said other end of said external member, a flexible tube connected at one end thereof to said hollow union, an operating knob turnably connected to the other end of said flexible tube, connecting means between said member and said operating knob to rotate said internal member during turning of said knob, suction means communicating with said flexible tube whereby when said opening is placed against a tissue while said suction means are operated, part of said tissue will be sucked into said opening so that during subsequent rotation of said internal member by said knob said part of the tissue will be cut off from the remainder of the tissue, and a link pivotally connected at one end thereof to said external member; and an endoscope including an optical tube substantially parallel to said flexible tube, a lateral inspection window, and pivot means close to said inspection window for pivotal connection of the other end of said link to said optical tube.

5. A composite instrument as claimed in claim 4, comprising a sheath formed with two longitudinal passageways along part at least of its length, said optical tube of said endoscope extending through one of said passageways and said flexible tube of said biopsy probe being slidably inserted through the second passageway.

6. A biopsy probe head comprising, in combination, an elongated external member having at one end a hemispherical outer surface and being formed with an axial bore extending from the other end into said member and terminating at said one end in a concave hemispherical inner surface concentric with said outer surface, said one end being formed with a sharp-edged aperture inclined to and spaced from the axis of said member and forming at said inner surface an endless cutting edge spaced from said axis; an internal member mounted in said bore for rotation about said axis and having a cutting edge arranged to pass substantially without clearance said endless cutting edge during rotation of said internal member about said axis relative to said external member, said internal member being formed with passage means to provide communication between said opening and said one end of said external member so that upon application of suction to said one end of said external member, while said opening is placed against a tissue, part of said tissue will be sucked through said opening and said one end of said external member so that upon application of suction to said one end of said external member, while said opening is placed against a tissue, part of said tissue will be sucked through said opening into said external member; and means operatively connected to said internal member to rotate the same about said axis for cutting off during such rotation the part of said tissue sucked into said opening.

7. A biopsy probe head as claimed in claim 6, in which said endless cutting edge is located in a plane which is inclined relative to the axis of said cylindrical bore.
to rotate the same about said axis for cutting off during such rotation the part of said tissue sucked into said opening.

7. A biopsy probe head, comprising, in combination, an elongated external member having at one end a hemispherical outer surface and being formed with an axial bore extending from the other end into said member and terminating at said one end in a concave hemispherical inner surface concentric with said outer surface, said one end being formed with a sharp-edged aperture inclined to and spaced from the axis of said member and forming at said inner surface an endless cutting edge spaced from said axis; an internal member mounted in said bore for rotation about the axis thereof and having a front portion of substantially semi-cylindrical configuration having an end closely fitting said concave inner surface so as to form a cutting edge passing substantially without clearance said endless cutting edge during rotation of said internal member about said axis relative to said external member, said internal member having a rear portion of cylindrical configuration fitting said cylindrical bore and being formed with passage means to provide communication between said opening and said other end of said external member so that upon application of suction to said other end of said external member, while said opening is placed against a tissue, part of said tissue will be sucked through said opening into said external member; and means operatively connected to said internal member to rotate the same about said axis for cutting off during such rotation the part of said tissue sucked into said opening.

8. A biopsy probe head as set forth in claim 7 in which said front portion of said internal member is formed with a cavity inwardly of the cutting edge thereof.

9. A biopsy probe comprising, in combination, an elongated external member having at one end a hemispherical outer surface and being formed with an axial bore extending from the other end into said member and terminating at said one end in a concave hemispherical inner surface concentric with said outer surface, said one end being formed with a sharp-edged aperture inclined to and spaced from the axis of said member and forming at said inner surface an endless cutting edge; an internal member mounted in said bore for rotation about the axis thereof and having a front portion of substantially semi-cylindrical configuration having an end closely fitting said concave inner surface so as to form a cutting edge passing, during rotation of said internal member about said axis relative to said external member, substantially without clearance said endless cutting edge, said internal member having a rear portion of cylindrical configuration fitting said cylindrical bore and being formed with passage means to provide communication between said opening and said other end of said external member; a hollow union fixed in said other end of said external member; a flexible tube connected at one end thereof to said hollow union; an operating knob turnably connected to the other end of said flexible tube; connecting means between said internal member and said operating knob to rotate said internal member during turning of said knob; and suction means communicating with said flexible tube whereby when said opening is placed against a tissue while said suction means are operated, part of said tissue will be sucked into said opening so that during subsequent rotation of said internal member by said knob said part of the tissue will be cut off from the remainder of the tissue.

References Cited by the Examiner

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent</th>
<th>Date</th>
<th>Inventor</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,721,555</td>
<td>10/55</td>
<td>Jenney</td>
<td>128—305</td>
</tr>
<tr>
<td>3,007,471</td>
<td>11/61</td>
<td>McClure</td>
<td>128—2</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Patent</th>
<th>Date</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>437,932</td>
<td>11/26</td>
<td>Germany</td>
</tr>
<tr>
<td>1,053,722</td>
<td>3/59</td>
<td>Germany</td>
</tr>
</tbody>
</table>

RICHARD A. GAUDET, Primary Examiner.
JORDAN FRANKLIN, Examiner.