

Nov. 21, 1967

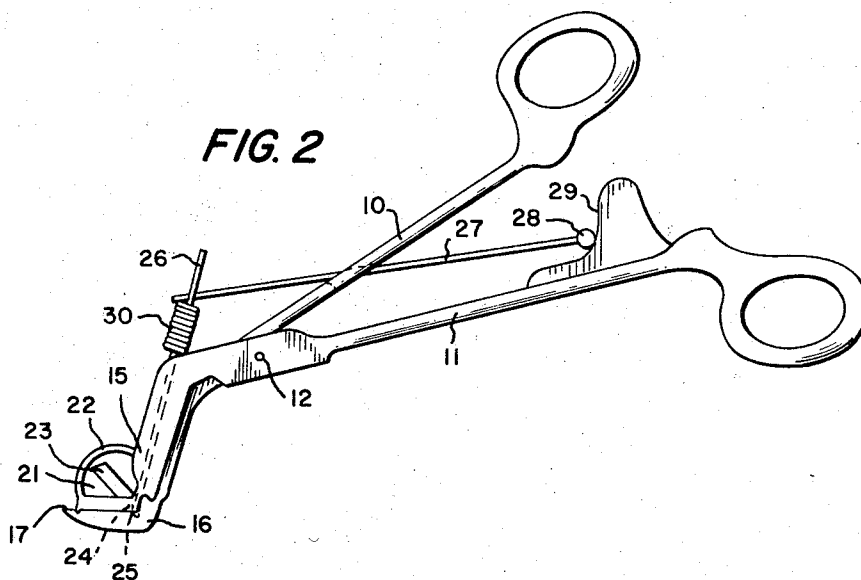
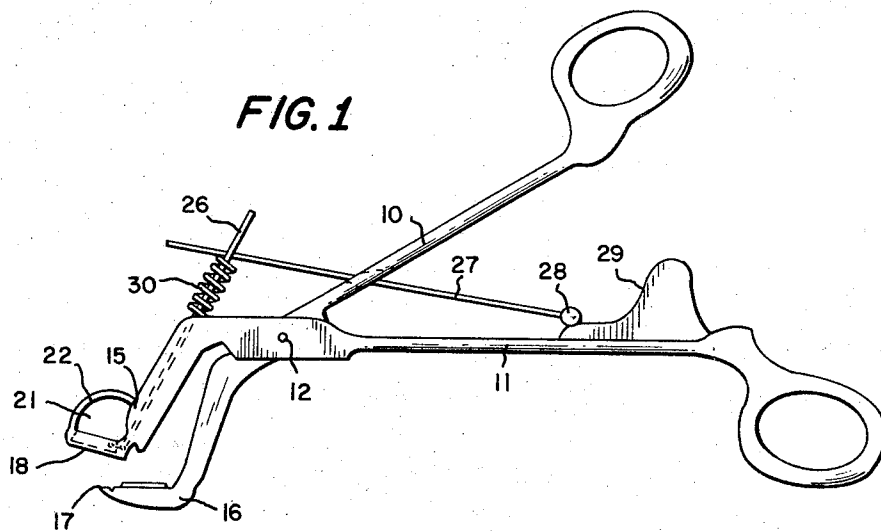
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3,353,531

BIOPSY INSTRUMENT WITH SPECIMEN LIFTING MEANS

Filed Oct. 22, 1965

3 Sheets-Sheet 1



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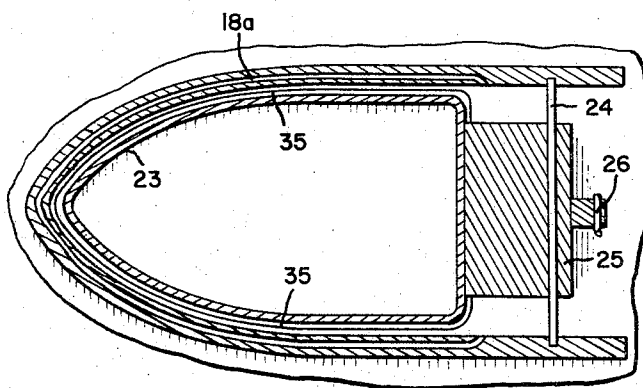
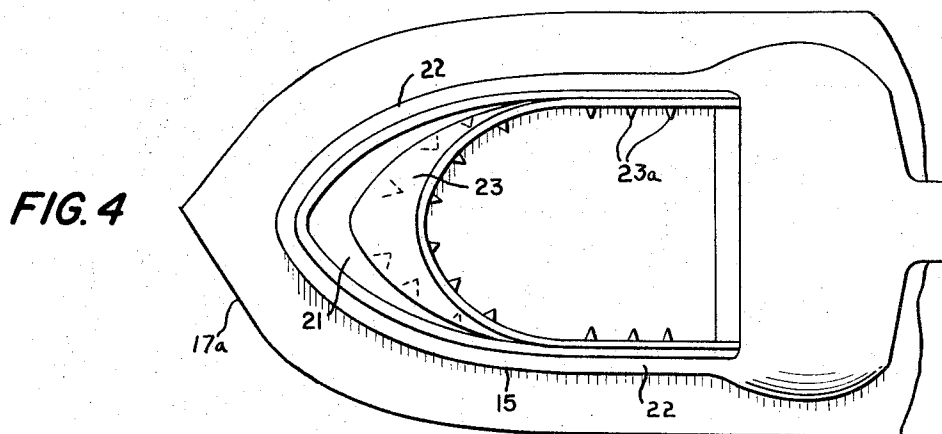
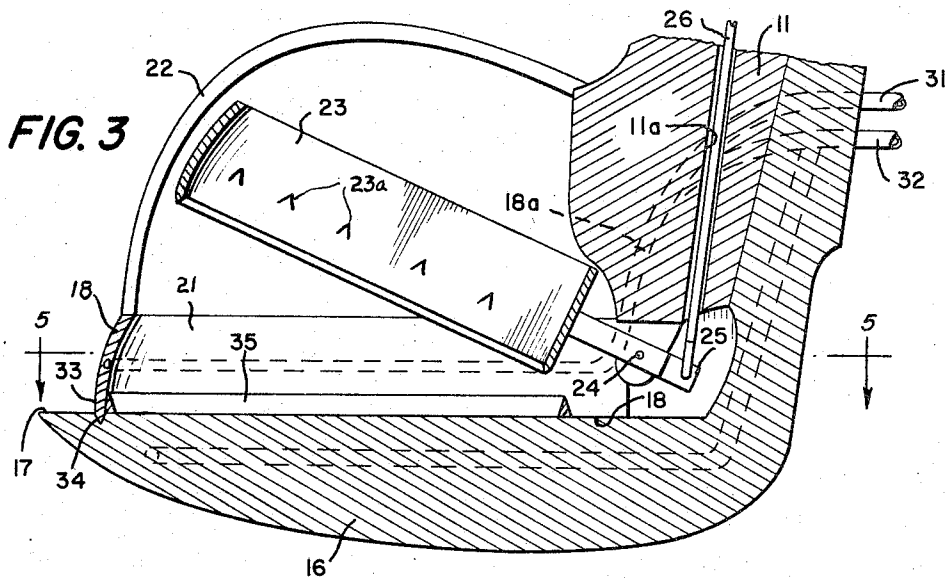


FIG. 5

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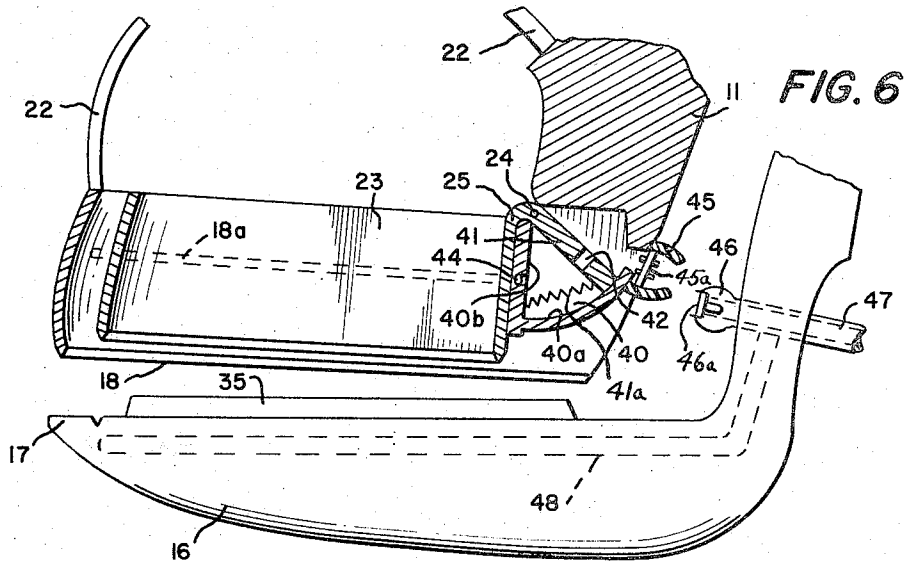


FIG. 6a

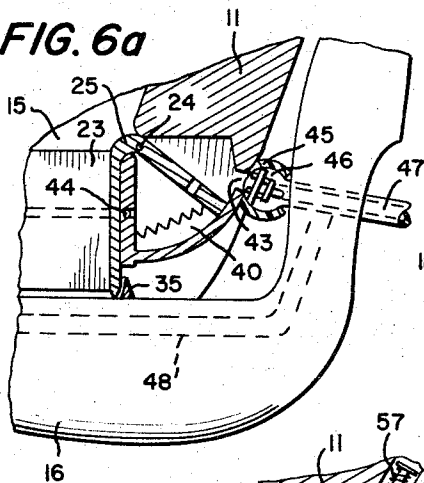


FIG. 7

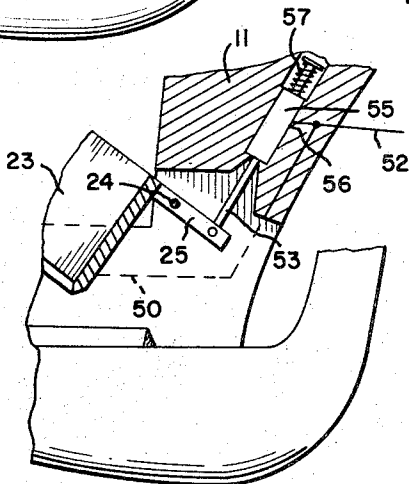
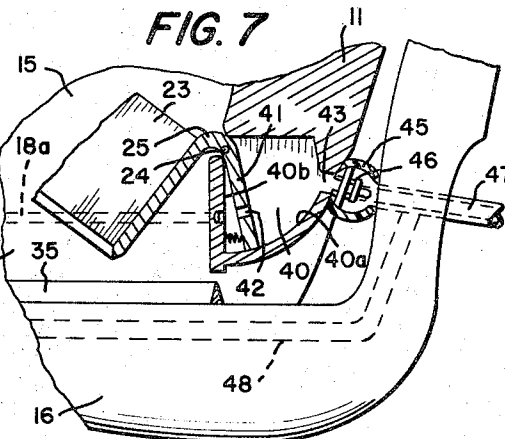


FIG. 8

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BIOPSY INSTRUMENT WITH SPECIMEN LIFTING MEANS

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Filed Oct. 22, 1965, Ser. No. 501,068

8 Claims. (Cl. 128—2)

ABSTRACT OF THE DISCLOSURE

A biopsy instrument comprising a pair of elongated manually hinged members extending in a common plane and containing a hinge, an activating handle integral with each elongated member, interengaging cutting members integral with the elongated members, which cutting members are in an upper and lower position relative to one another during the normal use of the instrument, said upper cutting member having a cutting edge which is substantially vertical in the normal use position of the instrument, said upper cutting member defining within it a specimen receiving cavity, said lower cutting member having a tip on the forward end thereof, means in at least said upper cutting member for effecting heat transfer between said upper cutting member and tissue being cut thereby, a specimen lifting member in said specimen receiving cavity in said upper cutting member for receiving in it a specimen cut between said cooperating upper and lower cutting members, and means coupled to said specimen lifting member for moving said specimen lifting member out of said cavity, said specimen lifting member having one end pivotally mounted on the elongated member on which the upper cutting member is mounted.

This invention relates to a biopsy instrument, and more particularly to a biopsy instrument with means for lifting a specimen which has been cut out of a mass of tissue away from the cutting portion of the instrument while the tissue of the mass around the incision is treated with heat or cold.

In my copending application Ser. No. 447,604, filed Apr. 5, 1965, there is described a biopsy instrument having a lower member adapted to be inserted directly under the tissue at the point at which a specimen is to be taken, and an upper member pivoted to the lower member and having a cooperating cutting edge thereon, which upper member moves down onto the lower member, cutting a specimen out of the tissue over the lower member and holding the specimen in a hollow in the upper member while cold or heat is applied to the tissue along the cut therein to cauterize or freeze the tissue at his point.

Because the specimen is held in the hollow of the upper member of the instrument during the application of heat or cold through the instrument to the tissue from which the specimen has been cut, the specimen itself has the heat or cold applied to it, and if the specimen is small, it may be permanently changed by the heat or cold, thereby spoiling it for further use and testing.

It is an object of the present invention to provide a means for such a biopsy instrument which will remove the specimen from the hollow in the upper member before heat or cold is applied through the instrument to the tissue from which the specimen has been cut.

It is a further object of the present invention to provide such a specimen removal means which can be actuated from the handles of the upper and lower members.

It is a still further object of the present invention to provide such a specimen removal means which can be actuated automatically to remove the specimen when either the heat or cold is applied to the tissue cutting members of the instrument.

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The biopsy instrument according to the invention comprises a pair of elongated mutually hinged members extending in a common plane and containing a hinge. An activating handle is integral with each elongated member, and there are interengaging cutting members integral with the elongated members, which cutting members are in upper and lower position relative to one another during the normal use of the instrument. The upper cutting member has an upper cutting edge which is substantially vertical in the normal use position of the instrument which defines within it a specimen receiving cavity. The lower cutting member has a tip on the forward end thereof which has surgically sharp cutting edges along the rearwardly extending side edges thereof. Within the specimen receiving hollow is a specimen lifting member having a thin vertical wall in the shape of a closed figure, said thin vertical wall lying against the inside wall of the specimen receiving cavity in the upper member. The specimen lifting member is pivotally mounted on said upper member for pivoting movement of the lifting member upwardly out of the specimen receiving hollow, and means are provided on said handles for so pivoting said specimen lifting member. In addition, means are provided in at least said upper cutting member for heating or cooling it.

The invention will now be described in greater detail in the following specification and claims, and in the accompanying drawings, in which:

FIG. 1 is a side elevation view of the biopsy instrument according to the present invention in the open position;

FIG. 2 is a view similar to FIG. 1 with the elements in the closed position and the specimen lifting member in the raised position.

FIG. 3 is an enlarged sectional view of the elements in the FIG. 2 position;

FIG. 4 is an enlarged plan view of the elements in the same position as in FIG. 3;

FIG. 5 is a horizontal sectional view taken on line 5—5 of FIG. 3;

FIG. 6 is an enlarged sectional view of a slightly different form of the instrument with the elements in the open position;

FIG. 6a is a view, on an enlarged scale, of a portion of the instrument of FIG. 6;

FIG. 7 is a sectional view similar to FIG. 6a with the elements in the closed position; and

FIG. 8 is a sectional view of a further modification of the instrument with the elements in the closed position.

Referring to FIG. 1—5, the biopsy instrument according to the present invention comprises a pair of elongated elements 10 and 11 connected to each other by a hinge 12. An upper cutting member 15 on the element 11 cooperates with a lower cutting member 16 on the member 10 to punch out a tissue specimen when the members are brought together. A pointed tip 17 on the end of the lower cutting member 16 has lateral cutting edges 17a along the rearwardly extending side edges thereof and permits easy entry of the member 16 into tissue. After pointed tip 17 has been inserted into the tissue and the member 16 is thrust fully into the tissue and under the area from which the specimen is desired, the instrument is closed and an upper cutting edge 18 cuts or punches out the specimen.

Within the upper cutting member is a cavity 21 defined by the interior of the upper cutting member 15. Reinforcing struts 22 extend from the front end of the cutting member 15 back to the element 11 and are spaced from each other a distance substantially equal the width of the cavity 21 and arched to leave a space beneath them. The rear end of the cutting element is secured to the element 11, and in the embodiment shown does not extend laterally across the element 11. However, the cutting

member 15 can so extend, in which case it defines a closed figure.

Positioned within the cavity 21 is a specimen lifting member 23, which has a thin substantially vertical wall, preferably of a heat insulating material, in the shape of a closed figure, the thin wall lying against the inside of the specimen cavity 21. Barbs 23a are positioned on the interior of the thin wall. The specimen lifting member 23 is pivotally mounted on a pin 24 which extends between the rear ends of the cutting member 15 where it joins the element 11. The specimen lifting member has a rearwardly projecting arm 25 through which the pin 24 extends, the arm extending rearwardly beyond the pin and being pivotally connected to a first link 26 of a pivoting means slidably mounted in a bore 11a in said element 11. In the form of pivoting means shown in FIGS. 1-5, the pivoting means further comprises a second link 27 connected to said first link 26 by means of a slotted connection. The second link 27 extends through a slot in the element 10, and the end thereof has a roller 28 thereon which rests on a cam member 29 on the element 11. A spring 30 is positioned around the first link 26 between the link 27 and the portion of the element 11 which has the bore 11a therein, said spring normally being uncompressed.

Extending through the cutting member 15 is a conduit 18a, having lead in and lead out extensions 31 and 32. The extensions 31 and 32 lead to a source of cryogenic fluid, or to a source of hot fluid, so that the cutting member can either be cooled or heated. Alternatively, electrical heating means could be provided, in which case the conduit 30 would be replaced by resistance elements and the extensions 31 and 32 would be wires.

The top of the specimen cavity 21 and the top of the specimen lifting member 23 are preferably open so as to readily accommodate the specimen without distortion, bruising or squeezing of the specimen. The specimen is held by the barbs 23a so that it does not come out of the top of the specimen lifting member.

Preferably the forward cutting end 33 of the upper cutting edge 18 extends downwardly slightly beyond the edge 18, when the instrument is closed this extended forward cutting end 33 is accommodated within the groove 34 in the lower cutting member 16, so that the sharpness of the forward cutting end 33 is preserved. If desired, the lower cutting member 16 can have a raised lower cutting edge 35 which cooperates with the cutting edge 18 of the upper cutting member 15 to punch out the tissue specimen. In addition, it is preferred to have the area of the lower element 11 within the cutting edge coated with Teflon or the like.

As pointed out above, when the tip 17 has been inserted into the tissue from which a specimen is to be taken and the member 16 is thrust fully into the tissue and under the area from which the specimen is desired, and the instrument is closed, the upper cutting edge 18 cooperating with the lower cutting member 16 and with the lower cutting edge 35 if it is present, a specimen of tissue will be cut out, and will be positioned within the specimen lifting member 23 within the cavity 21. At this time, spring 30 is still uncompressed, and no force is exerted on the arm by the first link 26.

The conduit 18a or the equivalent electric heating means is provided for the purpose of treating the tissue from which the specimen has been cut so as to curtail bleeding and, in the case of the use of cryogenic fluids, to produce stasis or cauterization. However, when either heat or cold is applied to the upper cutting member 15, it cannot be prevented from affecting the tissue specimen within the cavity 21 as well as the surrounding tissue from which the specimen has been cut, and the application of heat or cold can change the character of the tissue of the specimen so that a true indication of the condition of the tissue cannot be obtained.

This drawback is avoided in the instrument of the present invention. Prior to passing a heat exchange fluid

through the conduit 18a to either heat or cool the tissue lying against the outside of the cutting member 15, the pivoting means for pivoting the specimen lifting member 23 is actuated by drawing the second link 27 rearwardly along the element 11 so that the roller 28 rolls along the cam surface 29. This causes the end of the second link 27 which is coupled to the first link 26 at the slotted connection to move downwardly against the action of the spring 30. This in turn pivots the arm 25 around the pin 24, causing the specimen lifting member to swing upwardly out of the cavity 21 in the space beneath the struts 22. Only then is a heat exchange fluid caused to flow through the conduit 18a to heat or cool the upper cutting member 15. It will be seen that with the specimen lifting member in the raised position, the heat or cold will be applied only to the tissue lying against the outside of the cutting member 15, and the tissue specimen within the specimen lifting member will be unaffected by the heat or cold and will remain in its natural condition. In addition, when the instrument is in a narrow body conduit, the specimen does not contact the tissue of the conduit since it lies within the space beneath the arched struts. This is important when dealing with cancerous tissue. After the heat or cold treatment is completed, the link 27 is released and spring 30 expands to return the parts to their initial positions.

Since the members 10 and 11 should close completely to bring the cooperating cutting members 15 and 16 together before the specimen lifting member 23 is caused to pivot so as to lift the tissue specimen out of the cavity 21, it is not too practical to build a mechanical linkage which automatically pivots the specimen lifting member 23 until after the cutting members have closed. But since the tissue specimen can be lifted out of the cavity 21 as late as the time at which the application of the heat or cold is started, it is feasible to provide means for automatically pivoting the specimen lifting member which are actuated by the medium by which the heat or cold is supplied to the cutting member 15. In the embodiment shown in FIGS. 6 and 7, such an automatic pivoting means is shown in which the actuation is by the fluid supplied to the conduit 18a.

As seen in FIGS. 6, 6a and 7, the lower end of the element 11 to which the upper cutting member 15 is secured has a hollow chamber 40 therein, through which the pin 24 extends. The arm 25 on the rear end of the specimen lifting member 23, which arm is pivoted on the pin 24, has a vane 41 on the free end thereof which fits into the chamber 40 and wipes along the side walls thereof and along a bottom wall 40a thereof as the arm 25 pivots. The engagement of the edges of the vane with the walls of the chamber 40 is substantially gas and liquid tight. The vane 41 has an aperture 42 therein which when the vane is against the front wall 40b of the chamber is in alignment with the aperture 44 opening into the conduit 18a which extends through the upper cutting member 15. Spring 41a urges the vane 41 away from the front wall to pivot the specimen holding member to the down position. Opening into the rear of the chamber 40 is an aperture 43 which at the other end thereof opens out of the base of the element 11 and has a nozzle receiving member 45 therearound. The nozzle receiving member 45 is positioned to receive nozzle 46 mounted on the other element 10 when the elements 10 and 11 are closed. Valve members 45a and 46a are positioned in members 45 and 46 respectively to normally close these members and to open them only when the valve members 45a and 46a mate. A conduit 47 extends through the element 10 to the nozzle 46, and also has a branch 48 which extends into the lower cutting member 16 for passing the heat exchange fluid therethrough.

With the elements 10 and 11 open, the nozzle 46 does not engage the nozzle receiving member 45, and no heat exchange medium can enter chamber 40. Heat exchange fluid can then be directed through the lower element 11 to pre-cool it sufficiently to cause stasis to prevent bleed-

ing and temporary anesthesia. The use of an anesthetic, such as novocaine can then be avoided. Only then are the elements 10 and 11 closed. With the elements 10 and 11 closed, the spring 41a will keep the specimen receiving member 23 within the cavity 21 within the upper cutting member 15, with the vane 41 in the position shown in FIGS. 6 and 6a. However, when heat exchange medium is caused to flow through the conduit 47 with the elements 10 and 11 in the closed position, the pressure of the medium will act against vane 41, causing it to swing the specimen receiving member 23 around the pin 24, until the vane abuts the front wall 40b of the chamber 40, as shown in FIG. 7. At this point, the aperture 42 will be aligned with the opening 44, and heat exchange medium will flow through the conduit 18a within the upper cutting member 15.

It should be understood that the aperture 42 should be small enough so that the pressure created on the vane 41 by the heat exchange medium is sufficient to pivot the specimen receiving member 23 despite the fact that some of the heat exchange medium will pass through the aperture 42 even when the vane is in the FIG. 6a position. The necessary pressure-flow relationship of the heat exchange medium will have to be established in order to make the specimen receiving member 23 pivot. It should also be understood that there is a separate conduit (not shown) to conduct the heat exchange medium away from the upper cutting member.

The specimen receiving member 23 is thus automatically pivoted to lift the specimen out of the upper cutting member at the time the heat exchange medium starts to flow in the upper cutting member. The Teflon coating will prevent sticking of the specimen to the lower element 16.

A somewhat different embodiment of automatic pivoting means for the specimen receiving member 23 is shown in FIG. 8. The means for heating the upper cutting member 15 in this embodiment is electrical resistance means 50, which is supplied with current through a branch wire 51 in the member 11. The specimen receiving member 23 is pivoted on the pin 24 on the arm 25, and a link 53 is pivoted to the free end of the arm 25. The link extends through a bore 54 in the element 11, to a solenoid 55, the core of which is mounted on the other end of the link 53. The solenoid 55 can be conveniently set in a recess 56 in the element 11. A second branch wire 56 extends to a junction between the first branch wire 51 and the main supply wire 52 which in turn is connected to a source of current. A spring 57 between the end of the link 53 and the end of the solenoid urges the link upwardly.

In operation, when the elements 10 and 11 are brought together and current is not supplied to the solenoid or the heating resistance 50, the spring 57 holds the link 53 in the raised position, so that the specimen holding member 23 is held in the down position. When current is supplied to the heating resistance 50, it is supplied at the same time to the solenoid 55, and moves the link 53 downwardly to pivot the arm 25 around the pin 24 and thus raise the specimen receiving member 23. The downward movement of the link 53 compresses spring 57, so that when the current is shut off, the spring expands and moves link 53 upwardly, thereby lowering the specimen receiving member 23.

It is thought that the invention and its advantages will be understood from the foregoing description and it is apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing its material advantages, the forms hereinbefore described and illustrated in the drawings being merely preferred embodiments thereof.

What I claim is:

1. A biopsy instrument comprising a pair of elongated mutually hinged members extending in a common plane

and containing a hinge, an activating handle integral with each elongated member, interengaging cutting members integral with the elongated members, which cutting members are in an upper and lower position relative to one another during the normal use of the instrument, said upper cutting member having a cutting edge which is substantially vertical in the normal use position of the instrument, said upper cutting member defining within it a specimen receiving cavity, said lower cutting member having a tip on the forward end thereof, means in at least said upper cutting member for effecting heat transfer between said upper cutting member and tissue being cut thereby, a specimen lifting member in said specimen receiving cavity in said upper cutting member for receiving in it a specimen cut between said cooperating upper and lower cutting members, and means coupled to said specimen lifting member for moving said specimen lifting member out of said cavity, said specimen lifting member having one end pivotally mounted on the elongated member on which the upper cutting member is mounted.

2. A biopsy instrument as claimed in claim 1 in which said means for moving said specimen lifting member comprises linkage means coupled to said specimen lifting member for pivoting said specimen lifting member.

3. A biopsy instrument as claimed in claim 2 in which said specimen lifting member has an arm thereon, a pin on said elongated member on which said arm is pivoted, a first link pivotally connected to the free end of said arm, and further linkage means coupled to said first link for moving said first link to pivot said arm around said pin.

4. A biopsy instrument as claimed in claim 3 in which said further linkage means comprises a further link coupled to said first link, a roller on the other end of said first link, and spring means between said further link and said elongated member for normally urging said further link and said first link upwardly of said elongated member for pivoting said arm and said specimen receiving member to a position within said cavity.

5. A biopsy instrument as claimed in claim 2 in which said specimen lifting member has an arm thereon, a pin on said elongated member on which said arm is pivoted, a first link pivotally connected to the free end of said arm, and electromagnetic means coupled to said first link for moving said first link to pivot said arm around said pin.

6. A biopsy instrument as claimed in claim 2 in which said electromagnetic means comprises a solenoid around the other end of said first link, and a magnet on said link adjacent said solenoid.

7. A biopsy instrument as claimed in claim 1 in which said means for moving said specimen lifting member comprises an arm on said specimen lifting member, a pin on said elongated member on which said arm is pivotally mounted, a vane on the free end of said arm, said elongated member having a chamber therein, said vane fitting in said chamber and moving between two positions in said chamber, a first position in which said specimen receiving member is in the lowered position and the second in which said specimen receiving member is in the raised position, and conduit means opening into said chamber for delivering a heat exchange medium to said chamber for moving said vane from said first position to said second position.

8. A biopsy instrument as claimed in claim 7 in which said upper cutting member has a heat exchange medium conduit extending therethrough and opening out of said chamber from behind said vane when said vane is in said second position, said vane having an aperture therein which is aligned with said conduit when said vane is in said second position, and nozzle means on the other of said elongated members connecting to said conduit means opening into said chamber only when said elongated members are in the closed position with the cutting members cooperating with each other for cutting a specimen between them, and further conduit means coupled to said

nozzle means for supplying a heat exchange medium to
said nozzle means.

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