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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number: WO 93/25139
A61B 1/12, A61M 3/02	A1	(43) International Publication Date: 23 December 1993 (23.12.93)

(21) International Application Number: PCT/DK93/00204

(22) International Filing Date: 17 June 1993 (17.06.93)

(30) Priority data:

0815/92	18 June 1992 (18.06.92)	DK
1259/92	14 October 1992 (14.10.92)	DK

(81) Designated States: US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

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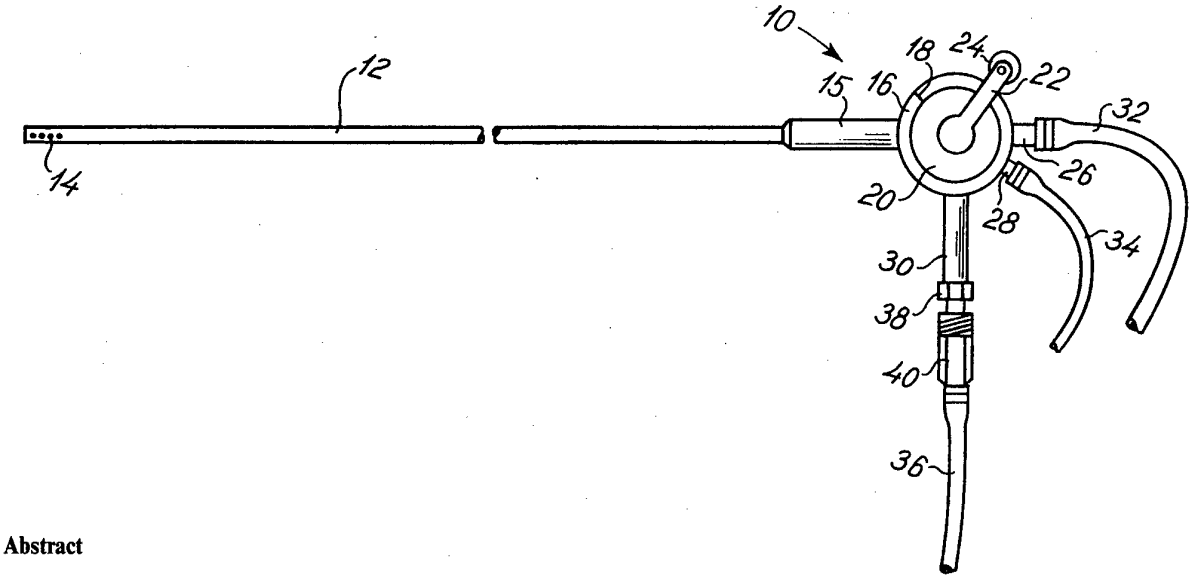
(54) Title: AN INSTRUMENT AND AN ASSEMBLY FOR SURGICAL USE



(57) Abstract

An instrument for surgical use comprises a valve housing (16) from which an elongated tubular element (12) protrudes. A valve (20) is housed within a housing (16) and communicates with the elongated tubular instrument (12). A first connector (26) is further provided for connection to a vacuum source and communicates with the valve for establishing communication from the vacuum source to the elongated tubular component through the valve, provided the valve is in a first operative state. A second connector (30) is provided for connection to a pressurized rinsing liquid supply source and communicates with the valve means for establishing communication from the supply source to the elongated tubular component through the valve means, provided the valve is in a second operative state. A third connector (28) is further provided for connection to an activation port of the supply source and communicates with the valve for establishing communication from the vacuum source to the activation port of the supply source through the first connector (26) and the third connector (28) for turning on the supply source provided the valve is in the second operative state. The instrument may further comprise a filter and may still further be adapted to receive an elongated surgical instrument.

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An instrument and an assembly for surgical use.

The present invention relates to the technical field of surgery, and more precisely to novel surgical instruments and assemblies. In specific aspects of the present invention, endoscopic or laparoscopic high-pressure suction/irrigation instruments and surgical instruments for the surgical operation of bone prosthetic fixation are provided.

The technical field of endoscopic or laparoscopic surgical operations has recently been refined. A trend toward integration of multi-purpose instruments and facilities has resulted in highly elaborated and complex instruments which, on the one hand, render it possible to carry out multiple functions by means of a single instrument, on the other hand are complex and complicated to operate.

A specific drawback of the prior art multi-function endoscopic or laparoscopic instruments is based on the fact that a specific shift from one operation to another operation has to be carried out by the surgeon by operating switching means, such as foot switches, specialized switch-boards, etc.

Within a specialized surgical field, the field of preparation of prosthetic fixation, numerous instruments have been devised, vide e.g. US Patent No. 4,941,872, US Patent No. 4,299,221, published International Patent Application, International Publication No. WO 91/17790, and published International Patent Application, Publication No. WO 86/04247. Various drainage systems are also described within the art, vide e.g. US Patent No. 5,015,227, US Patent No. 5,034,000, US Patent No. 5,100,377, US Patent No. 4,922,902, US Patent No. 4,642,098, US Patent No. 3,828,780, US Patent No. 4,567,880, US Patent No. 4,776,840, US Patent No. 4,617,013, US Patent No. 4,526,573, US Patent No. 4,826,494, US Patent No. 4,569,674, published European Patent Application, Publication No. 0 100 672, US Patent No. 4,655,754, and published International Patent Application, Publication No. WO 86/02844. Reference is made to the above-listed patents and the above-listed US patents are further incorporated in the present specification by reference.

According to a first aspect of the present invention, an instrument for surgical use as a high-pressure suction, or alternatively a high-pressure irrigation instrument is provided, which instrument in co-operation and communication with a pressurized rinsing liquid supply source, such as a source supplying pressurized rinsing water, turns the liquid supply source on and off as the instrument is used as an irriga-

tion instrument or alternatively used as a suction instrument or further alternatively not in operation.

A particular advantage and feature of the instrument according to the present invention relates to a minimum component adaptation of the capability of turning the pressurized rinsing liquid supply source on and off, dependent on the operative state of the instrument.

The above object, advantage, and feature of the present invention together with numerous alternative objects, advantages, and features which will be evident from the below detailed description of preferred embodiments of the invention, are obtained by means of an instrument for surgical use, which instrument in accordance with a first aspect of the present invention comprises:

a body,

an elongated tubular means defining a through-going bore and being connected to and supported by said body,

valve means housed within said body and communicating with said elongated tubular means,

a first connector means for connection to a vacuum source and communicating with said valve means for establishing communication from said vacuum source to said elongated tubular means through said valve means, provided said valve means is in a first operative state,

a second connector means for connection to a pressurized rinsing liquid supply source and communicating with said valve means for establishing communication from said supply source to said elongated tubular means through said valve means, provided said valve means is in a second operative state, and

a third connector means for connection to an activation port of said supply source and communicating with said valve means for establishing communication from said vacuum source to said activation port of said supply source through said first connector means and said third connector means for turning on said supply source by venting said activation port through said vacuum source, provided said valve means is in said second operative state.

From US Patent No. 4,567,880, an endoscopic device with a three-wave valve is known. The three-wave valve allows that the device may be shifted from an inoperative state by shifting a valve element to a first operative state in which irrigation is affected or alternatively to a second operative state in which drainage is affected. However, the

device includes no additional elements for operating external equipment such as an external high-pressure water supply source in accordance with the operation of the valve element for causing turning on/turning off of the source.

The valve means which according to the present invention establishes communication from the vacuum source and the pressurized rinsing liquid supply source to the elongated tubular means of the instrument in the first operative state and the second operative state, respectively, and further evacuates the activation port of the supply source in the second operative state, may be implemented as any appropriate valve means such as rotary valve means or push-button operated valve means. Thus, the valve means may according to a presently preferred embodiment of the instrument according to the present invention be constituted by a rotary valve means, comprising a rotary valve body having passages for establishing said communication from said first connector means to said elongated tubular means, provided said rotary body is in a first rotary position relative to said body defining said first operative state, and from said second connector means to said elongated tubular means and from said first connector means to said third connector means, provided said rotary body is in a second rotary position relative to said body defining said second operative state. Alternatively, the valve means may be constituted by push-button operated valve means comprising one or more single-position or multi-position/multi-way valves.

In order to adapt the instrument according to the present invention for even further operations, apart from the high-pressure suction and high-pressure irrigation, the body of the instrument may have a through-going passage in registration with the through-going bore of the elongated tubular means for receiving a separate surgical instrument, such as a blunt, a knife, a needle, a spatula, a hook, a dissection/grasper insert, a scissors insert, a separate optic fiber, or an electrode of an electrode system, of an electric treatment or the like.

The instrument according to the first aspect of the present invention may be implemented as an integral instrument or alternatively in accordance with a particular advantageous embodiment of the instrument implemented as a modular structure in which the elongated tubular means constitutes a separate elongated tubular component defining a distal end and a proximal end and being connectable to the body constituting a separate component at said proximal end of the elongated tubular component

through respective coupling means of the elongated tubular component and the body. By providing a modular structure, the separate elongated tubular component may constitute a disposable component, whereas the body which is of a complex and elaborated structure may constitute a component to be reused after rinsing and sterilization. By providing the separate elongated tubular component as a disposable component, the risk of transferring diseases or infections from a patient who has previously been subjected to surgery, to a patient who is at present in surgery is radically reduced. Alternatively, the composite instrument may be adapted to be a disposable instrument, which, however, to a great extent increases the overall costs as the composite instrument is far more costly than the disposable, separate elongated tubular component.

A further advantage by providing a separate elongated tubular component relates to the fact that one and the same body, housing the valve means and the first, second, and third connector means of the instrument may be used for numerous different applications involving different surgical applications and further necessitating the use of different elongated tubular components. The separate tubular components may integrally comprise surgical instruments, such as the above-mentioned separate surgical instruments.

The coupling means of the separate elongated tubular component and the separate body may be implemented in accordance with any appropriate technique, e.g. constituted by conical coupling means, threaded coupling means, or preferably bayonet coupling means comprising cooperating male and female coupling components. The male coupling means or component of the bayonet coupling means may be provided at the separate elongated tubular component, or alternatively and preferably, constitute a component of the body, whereas the female coupling component or means of the bayonet coupling means may be provided at the separate body, or alternatively and preferably, constitute a component of the separate elongated tubular component.

The instrument according to the first aspect of the present invention may, in accordance with the above described preferred and advantageous embodiment comprising a separate elongated tubular component and a separate body, be implemented for electro-surgery as the elongated tubular component may comprise a conductor means extending through the elongated tubular component and protruding from the distal end thereof.

For establishing electrical connection from an external electric

source, such as a voltage or current source, to the conductor means of the elongated tubular component, the elongated tubular component of the instrument according to the first aspect of the present invention is preferably provided with an electrical connector means provided at the proximal end of the elongated tubular component which electrical connector means is connected to the conductor means of the elongated tubular component.

In order to rinse the air evacuated through the elongated tubular means in order to hinder that any particles may block the evacuation or suction system comprising the vacuum pump, the instrument preferably further comprises a sealed filter means interconnected between the first connector means and the valve means. In order to ensure that the filter means is not blocked during a surgical operation, the filter means must have a capability in excess of 10 cm^3, such as a capability of the order of 10-100 cm^3, such as 20-60 cm^3, e.g. approximately 40 cm^3, in order to ensure that the filter means is not blocked during a surgical operation. When preparing bone prosthetic fixations, an extreme amount of bone dust is produced, which has to be removed by means of the suction instrument. Experiments have revealed that a filter having a capability of approximately 40 cm^3 fulfils the requirement as to eliminating the risk that the filter means is blocked by bone particles during a single surgical operation.

As the surgical instrument has to be flexible in order to render it possible that the surgeon may reach any specific side or location during a surgical operation, the filter means is preferably a flexible filter means.

According to a particular advantageous embodiment of the instrument according to the present invention, the flexible filter means is constituted by a first flexible hose and a second, perforated flexible hose, said first hose defining a filter input means and a filter output means, and said second hose being enclosed within said first hose and defining an open end at said filter input means and a closed end at said filter output end.

In order to reduce the overall size of the instrument, the flexible filter means may be partially enclosed within the body of the instrument, which body may further constitute a handle.

According to a first embodiment of the instrument according to the present invention, the elongated tubular means is provided with a single

through-going bore which is conneccted to the first connector means or alternatively the second connector means in the first operative state and the second operative state, respectively.

In a second or alternative embodiment of the instrument according to the present invention, the elongated tubular means defines separate first and second through-going bores connectable to the first and second connector means, respectively, through the valve means.

In a further embodiment of the instrument according to the present invention particularly adapted for the preparation of bone prosthetic fixations, a fiber optic means is provided extending to and being exposed at a distal end of the elongated tubular means.

According to a second aspect of the present invention, an elongated tubular instrument for surgical use is provided,

said elongated tubular instrument defining a through-going bore and a distal end and a proximal end, and comprising a coupling means provided at said proximal end for cooperating with a coupling means of a valve body, said valve body comprising:

valve means housed within said valve body and communicating with said coupling means,

a first connector means for connection to a vacuum source and communicating with said valve means for establishing communication from said vacuum source to said coupling means through said valve means, provided said valve means is in the first operative state,

a second connector means for connection to a pressurized rinsing liquid supply source and communicating with said valve means for establishing communication from said supply source to said coupling means through said valve means, provided said valve means is in the second operative state, and

a third connector means for connection to an activation port of said supply source and communicating with said valve means for establishing communication from said vacuum source to said activation port of said supply source through said first connector means and said third connector means for turning on said supply source by venting said activation port through said vacuum source, provided said valve means is in said second operative state.

The elongated tubular instrument according to the second aspect of the present invention and the valve body together constitute an instrument according to the first aspect of the present invention and may,

consequently, comprise any of the characteristics of the instrument according to the first aspect of the present invention. Basically, the elongated tubular instrument according to the second aspect of the present invention is identical to the above described separate elongated tubular component of the advantageous and preferred embodiment of the instrument according to the first aspect of the present invention.

According to a third aspect of the present invention, an assembly for surgical use is provided, comprising:

a pressurized rinsing liquid supply source having an activation port for turning on said supply source for supplying pressurized rinsing liquid, provided said activation port is vented, and

an instrument for surgical use, comprising:

a body,

an elongated tubular means defining a through-going bore and being connected to and supported by said body,

valve means housed within said body and communicating with said elongated tubular means,

a first connector means for connection to a vacuum source and communicating with said valve means for establishing communication from said vacuum source to said elongated tubular means through said valve means, provided said valve means is in a first operative state,

a second connector means for connection to said pressurized rinsing liquid supply source and communicating with said valve means for establishing communication from said supply source to said elongated tubular means through said valve means, provided said valve means is in a second operative state, and

a third connector means for connection to said activation port of said supply source and communicating with said valve means for establishing communication from said vacuum source to said activation port of said supply source through said first connector means and said third connector means for turning on said supply source by venting said activation port through said vacuum source, provided said valve means is in said second operative state.

The assembly according to the third aspect of the present invention may comprise any of the characteristics of the instrument according to the first aspect of the present invention.

According to a fourth aspect of the present invention, an instrument for surgical use, and more precisely for use in preparing bone

prosthetics, is produced, which instrument according to the present invention comprises:

a body,

an elongated tubular means defining a through-going bore and being connected to and supported by said body,

a first connector means for connection to a vacuum source and for establishing communication from said vacuum source to said elongated tubular means,

a second connector means for connection to a pressurized rinsing liquid supply source and for establishing communication from said supply source to said elongated tubular means,

a sealed filter means interconnected between said first connector means and said valve means.

The instrument according to the fourth aspect of the present invention may also comprise any of the characteristics of the instrument according to the first aspect of the present invention.

The present invention will now be further described with reference to the drawings, in which

Fig. 1 is a schematic view of a first embodiment of an endoscopic or laparoscopic high-pressure suction/irrigation instrument according to the present invention,

Fig. 2 is a perspective and partly cut-away and exploded view of the first embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument shown in Fig. 1,

Fig. 3 is a schematic view of a second embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument adapted to surgical applications,

Fig. 4 is a sectional and schematic view of a valve body of the second embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument shown in Fig. 3,

Fig. 5 is a schematic view of the first embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument shown in Figs. 1 and 2 in an application also including a motor and a membrane pump,

Fig. 6 is a schematic view of the circuit diagram of the motor and membrane pump shown in Fig. 5,

Fig. 7 is a schematic view of a third embodiment of an endoscopic or laparoscopic high-pressure suction/irrigation instrument according to

the present invention, also adapted to surgical applications,

Fig. 8 is a schematic view of a fourth embodiment of a high-pressure suction/irrigation instrument for surgical use, and more specifically for use in surgical preparation of bones for a prosthetic joint replacement,

Fig. 9a is a perspective and schematic view of a valve body constituting a component of an endoscopic or laparoscopic high-pressure suction/irrigation instrument similar to the instrument shown in Figs. 1 and 2,

Figs. 9b, 9c, 9d, and 9e are perspective, schematic, and sectional views of four alternative embodiments of an elongated tubular component constituting a separate component to be connected to the valve body shown in Fig. 9a for providing an endoscopic or laparoscopic instrument according to the present invention,

Fig. 10 is a perspective view illustrating a detail of the valve body,

Fig. 11 is a perspective view of the first embodiment of the elongated tubular component shown in Fig. 9b illustrating a detail of the component,

Fig. 12 is a perspective, schematic, and sectional view of a detail of an alternative embodiment of the elongated tubular component to be connected with the valve body shown in Fig. 9a for providing an endoscopic or laparoscopic instrument according to the present invention,

Fig. 13 is a sectional and schematic view similar to the view of Fig. 4 of an alternative embodiment of the endoscopic or laparoscopic instrument according to the present invention, including a separate valve body and an elongated tubular component to be connected with the valve body,

Fig. 14 is a schematic view of an alternative and presently preferred embodiment of a motor and pump assembly including a hose pump,

Fig. 15 is a sectional view along the line XV-XV of Fig. 14 of the hose pump of the motor and pump assembly shown in Fig. 14,

Fig. 16 is a sectional view along the line XVI-XVI of Fig. 14, illustrating a detail of the motor and pump assembly shown in Fig. 14.

Fig. 17 is a schematic view of a sixth embodiment of the endoscopic or laparoscopic high pressure suction/irrigation instrument adapted to surgery applications, and

Fig. 18 is a schematic view of a seventh embodiment of a high-

pressure suction/irrigation instrument for surgical use.

In Fig. 1, a first embodiment implemented as a prototype implementation of an endoscopic or laparoscopic high-pressure suction/irrigation instrument according to the present invention is shown. The instrument is designated the reference numeral 10 in its entirety. In the present context, the terms endoscopic and laparoscopic are used synonymously describing the technique of visual inspection of internal organs by means of fiber optic devices and video-monitoring systems and of carrying out surgical operations by means of rigid or flexible instruments which are inserted into a body cavity.

The instrument 10 comprises an elongated tube 12 which is provided with a through-going bore and at its distal end provided with transversal bores or holes 14. The tube 12 is at its proximal end rigidly connected to a support tube 15 which is further rigidly connected to a cylindrical housing component 16 which is provided with a conical aperture. Within the conical aperture of the housing component 16, a conical valve body 20 is received. The conical valve body 20 tapers from a first plane side surface shown in Fig. 1 and constituting an exterior side surface of the instrument 10 towards a second plane side surface constituting an interior side surface shown in Fig. 2, from which interior side surface a threaded pin 42 protrudes. A proximal end of a lever 22 is fastened to the first or exterior side surface of the conical valve body 20 and a grip 24 is provided at the distal end of the lever 22. As is evident from Figs. 1 and 2, a recess of the housing component 16 defines abutments 18, which abutments co-operate with the lever 22 for defining end positions of the lever 22, and consequently of the conical valve body 20 relative to the housing component 16, in order to define specific positions of activation of the instrument 10, as will be evident from the below description.

The instrument 10 is further provided with tubular fittings 26, 28, and 30. The tubular fitting 26 is arranged in registration with the through-going hole of the tube 12 and is adapted to receive a hose 32 establishing communication between the instrument 10 and a vacuum source of a suction or evacuation system. Similarly, the tubular fitting 26 is adapted to receive a hose 34 for establishing communication between the instrument 10 and an activation port of a motor assembly of a pulsed, high-pressure water supply pump to be described in greater details below with reference to Figs. 5 and 6. The tubular fitting 30 is adapted to

receive a water supply hose 36 of the above-mentioned water supply pump for receiving pulsed, high-pressure sterilized water from the water supply pump. The hose 36 is connected to the tubular fitting 30 through a set of meshing connectors 38 and 40 of the tubular fitting 30 and the hose 36, respectively. The connectors 38 and 40 serve the purpose of providing an easily assembled and easily disassembled connection between the instrument 10 and the high-pressure water supply source constituted by the above-mentioned water supply pump.

The conical valve body 20 is, as mentioned above, received within the housing component 16 and is fixated relative to the housing component 16 by means of a locking plate 44 which co-operates with a knob 46 which is provided with an internal thread meshing with the outer thread of the threaded pin 42 and which is further connected to the locking plate 44 by means of a spring, which biases the knob 46 away from the locking plate 44. Thus, the conical valve 20 is, when received within the inner conical aperture of the housing component 16, biased towards the locking plate 44 by the force generated by the spring acting on the knob 46.

The conical valve body 20 is, as is evident from Fig. 2, provided with a through-going transversal bore 48 and a branching-off bore 50 which is connected to the through-going transversal bore 48. Furthermore, a cut 52 is provided at the exterior conical surface of the conical valve body 20. The transversal through-going bore 48 and the branching-off bore 50 serve the purpose of establishing direct connection between the through-going bore of the tube 12 and the through-going holes of one of the tubular fittings 26 and 30 in a specific activation position. Thus, provided the lever 22 is in the position in which the lever abuts the rearmost abutment 18, i.e. the position shown in Fig. 1, a direct connection is established through the through-going bore 48 from the tube 12 to the through-going hole of the fitting 26, so that the elongated tube 12 is connected to the above-mentioned vacuum source of the suction or evacuation system also mentioned above.

Provided the lever 22 is in the foremost position shown in Fig. 2, in which position the lever 22 abuts the foremost abutment 18, a connection is established from the through-going bore of the tube 12 through the branching-off bore 50 and the transversal through-going bore 48 to the through-going hole of the fitting 30, so as to establish direct connection from the pulsed, high-pressure water supply pump mentioned above

to the elongated tube which consequently constitutes a high-pressure irrigation tube for supply of pulsed, high-pressure water. Provided the lever 22 is in the position shown in Fig. 2, the cut 52 provides a connection from the through-going hole of the tubular fitting 28 to the through-going hole of the tubular fitting 26 so as to vent the hose 34 which is connected to the activation port of the motor assembly mentioned above through the hose 32 which is connected to the vacuum source of the evacuation system. As the activation port of the motor assembly is vented, the motor assembly powering the high-pressure water supply pump is turned on so as to supply high-pressure water to the elongated tube 12 through the hose 36 connected to the tubular fitting 30.

Provided the conical valve body 20 is in a position different from the positions in which the lever 22 abuts one of the abutments 18, the communication or connection from the through-going bore of the tube 12 to the tubular fittings 26 and 30 is disconnected or interrupted. A specific feature of the instrument 10 characteristic of the present invention lies in that the motor assembly powering the high-pressure water supply pump is turned off, unless the lever 22 is in the activation position in which the connection for supply of high-pressure water from the hose 36 to the tube 12 is established as a shunt connection is established by means of the cut 52 venting the activation port of the motor assembly through the evacuation hose 32. A further feature of the instrument is shown in Fig. 2, as a circumferential inner recess 54 is provided, which recess is connected to the through-going hole of the fitting 26 through a cut 56, which recess 54 and which cut 56 serve the purpose of providing a reservoir in which any excess water supplied from the pump is received and further evacuated through the hose 32 connected to the tubular fitting 26. Thus, any leakage of water from the instrument 10 is prevented, as any leaking water is eliminated through the hose 32. Thus, it is to be realized that the instrument which is a surgical instrument and which has to be cleaned and sterilized after use has to be disassembled and reassembled after sterilization. Therefore, the provision of e.g. sealing elements, such as O-rings or the like, is rendered impossible due to the necessity of an easy disassembly and assembly procedure and the possibility of sterilizing the whole instrument.

In Fig. 3, a second embodiment of an endoscopic or laparoscopic high-pressure suction/irrigation instrument acccording to the present

invention is shown. The second embodiment shown in Fig. 3 is designated the reference numeral 60 in its entirety and basically differs from the first embodiment described above with reference to Figs. 1 and 2 in that the instrument is provided with a fitting 70 for receiving a surgical instrument 72 and further in that the valve means constituted by the conical valve body 20 co-operating with the housing component 16 of the first embodiment 10 is substituted by push-button operable valves to be described below with reference to Fig. 4. Thus, in the third embodiment 60 shown in Fig. 3, the tubes 12 and 15 are rigidly connected to a first or upper housing part 64 in which two push-buttons 66 and 68 are received, which push-buttons are connected to the push-button operable valves mentioned above and to be described in greater details below with reference to Fig. 4. The upper housing part 64 is provided with a through-going passage, shown in Fig. 4 and designated 80, in registration with the through-going hole of the tube 12, which through-going passage is connected to a fitting 70 through which the surgical instrument 72 may be introduced into the through-going passage of the upper housing part 64 and further ejected through the through-going hole of the tube 12. Due to the through-going passage of the upper housing part 64, the push-buttons 66 and 68 are offset relative to the through-going passage of the upper housing part 64. A second or lower housing part 62 is provided, in which the valves operable by means of the push-buttons 66 and 68 are received. The fittings 26, 28, and 30 are also rigidly connected to the lower housing part 62 for establishing connection to the external vacuum source of the suction or evacuation system, to the high-pressure water supply pump and to the activation port of the motor assembly, respectively, as discussed above with reference to Fig. 1. The fitting 70 is a fitting including a sealing O-ring, allowing that a hermetic seal round the surgical instrument 72 is established. The surgical instrument 72 may constitute any surgical instrument which is used for endoscopic or laparoscopic purposes, such as a blunt, a knife, a needle, a spatula, a hook, a dissection/grasper insert, a scissors insert, a separate optic fiber, or an electrode of an electrode system, of an electric treatment system or the like.

Fig. 4 is a sectional view of the lower housing part 62 of the instrument 60. In Fig. 4, two valve bodies 76 and 78 are shown, received within bores of the lower housing parts 62 and biased upwardly to shut off positions by means of springs 77 and 79, respectively. Provided the

push-button 66 is activated, causing the valve body 76 to be depressed to a fully activated position, a passage 86 connected to the fitting 26 is connected to a passage 92 which is further connected to the through-going passage of the lower housing part 62 and further to the through-going bore of the tube 12 so as to evacuate the through-going bore of the tube 12 through the hose connected to the fitting 26. Provided the push-button 68 is activated instead of the push-button 66, causing the valve body 78 to be fully depressed, a passage 90 connected to the fitting 30 is connected to the passage 92 and further to the through-going bore of the tube 12, causing the supply of high-pressure water from the high-pressure water supply pump to the tube 12. Simultaneously, a communication from the fitting 28 to the fitting 26 is established through a passage 88, causing the venting of the activation port of the motor assembly, and further causing the turn-on of the motor assembly as discussed above. Provided both push-buttons 66 and 68 are depressed, the supply of high-pressure water from the high-pressure water supplying pump is blocked by the valve body 76, whereas the motor assembly is turned on due to the establishment of a connection through the passage 88 from the fitting 28 to the fitting 26. Of course, any arbitrary blocking of the functions of supplying high-pressure water, turn-on/-turn-off of the motor assembly of the pump and further the evacuation of the through-going hole of the tube 12 through the fitting 26 to the vacuum source of the suction system may be established by means of appropriate multi-position valve bodies co-operating in any desired mutual blocking.

In Fig. 5, the application of the first embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument 10 described above with reference to Figs. 1 and 2 is shown. In Fig. 5, the instrument 10 is connected to the above-mentioned suction or evacuation system through the hose 32 and a shut-off valve 96, constituting an evacuation wall outlet. The hoses 34 and 36 are connected to a motor assembly designated 100 in its entirety and a pump 110, respectively. The motor assembly 100 comprises a housing 102 in which the individual elements of the motor assembly are enclosed. At the uppermost end of the housing 102, a strap 104 is provided together with an on/off switch 106 and a rotatable pulse frequency-determining button 108. The pump 110 is constituted by a disposable membrane pump which is received and fixated relative to the motor assembly 100 in a bayonet fixation. The membrane

pump 110 is provided with a water-inlet hose 116 which is connected to a shut-off valve 118, constituting a sterilized water supply wall outlet. The hose 36 is connected to an outlet of the pump 110. The hose 34 is connected to the activation port of the motor assembly 100 mentioned above, which activation port is constituted by a hose fitting 120. The motor assembly 100 is powered by pressurized air which is supplied from a shut-off valve 114 constituting a pressurized air wall outlet through a hose 112 which is connected to a pressurized air-inlet 122 of the motor assembly 100.

In Fig. 6, a block diagram of the circuitry of the motor assembly 100 is shown together with the membrane pump 110. The pressurized air-inlet 122 and the activation port 120 are also shown in Fig. 6. The pressurized air is supplied to the motor assembly through a pressure reduction and air-rinsing assembly 124. The pressurized air is supplied from the assembly 124 through a supply line 126 to a first 3-way valve 128 which controls the supply of pressurized air to the membrane pump 110. The pressurized air is also supplied to a second 3-way valve constituting an on/off valve 130 which is operated by means of the on/off switch 106. Provided the second 3-way valve 130 is in the on-state, the pressurized air is supplied to a third 3-way valve 132 which is activated by means of a pressure line which is supplied through a throttle valve 134 and further vented through the activation port 120. Thus, provided the activation port 120 is unblocked or vented, the pressurized air supplied from the throttle valve 134 to the activation port 120 is vented, causing no activation of the third 3-way valve 132. Provided the activation port 120 is blocked, the pressurized air supplied to the activation port 120 through the throttle valve 134 generates an activation pressure which is supplied to the third 3-way valve 132, causing an activation of the third 3-way valve 132 and causing a turn-off of the supply of pressurized air through the third 3-way valve 132.

Provided the third 3-way valve 132 is reversed, the venting of the activation pressure through the activation port 120 causes a turn-off of the supply of pressurized air through the third 3-way valve, whereas a blocking of the activation port 120 causes a turn-on of supply of pressurized air through the third 3-way valve 132.

The pressurized air supplied from the third 3-way valve 132 is supplied to a fourth 3-way valve 134 which controls the first 3-way valve 128 for the supply of pressurized air from the main supply line 126 to

the pump 110 through the first 3-way valve 128. The fourth 3-way valve 134 is activated in an internal loop comprising a throttle valve 138 and a pressure reduction assembly 140, respectively. The fourth 3-way valve 136 is operated in the following way. The pressurized air supplied from the 3-way valve 136 is supplied to the first 3-way valve 128 and also supplied as an activation pressure to the third 3-way valve 136 through the throttle valve 138 and the assembly 140. As the activation pressure of the fourth 3-way valve 136 increases, the fourth 3-way valve 136 is turned off, also causing a turn-off of the first 3-way valve 128. As the activation pressure of the fourth 3-way valve 136 drops, the fourth 3-way valve 136 is turned on, initiating the above described cycle of supplying air to the first 3-way valve 128 and to the fourth 3-way valve 136 itself through the throttle valve 138 and the assembly 140. By adjusting the throttle valve 138, the frequency of turn-on and turn-off of the first and fourth 3-way valves, 136 and 128, respectively, and consequently of the pump 110, is controlled, which controlling is established by means of the rotatable button 108.

In Fig. 7, a third embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument according to the present invention is shown, designated the reference numeral 150 in its entirety. Basically, the third embodiment shown in Fig. 7 constitutes a combination of the first and second embodiments shown in Figs. 1, 2, and 3, respectively, as the first embodiment shown in Fig. 1 is modified so as to include a through-going passage corresponding to the through-going passage 80 of the housing component 62 of the second embodiment 60 described above. Thus, the housing component 16 described above with reference to Figs. 1 and 2 is substituted by an alternative housing component 160 in which a through-going passage is provided, communicating with a passage corresponding to the radial passage of the housing component 16 through which the through-going bore of the tube 12 is connectable to the bores 48 and 50 of the conical valve body 20. In Fig. 7, the sealable fitting 70 is also shown together with a surgical instrument 73 which is slightly different from the surgical instrument 72 described above with reference to Fig. 3.

In Fig. 8, a fourth embodiment of the high-pressure irrigation and suction instrument according to the present invention for use in surgical operations for prosthetic fixation is shown. The instrument is designated the reference numeral 210 in its entirety. The instrument

comprises a handle 220 in which two push-buttons 222 and 224 are received, which push-buttons operate respective push-button-operated valves similar to the valves shown in Fig. 4. From a first end of the handle 220, an elongated tube 212 protrudes in which a rinsing liquid or rinsing water ejection nozzle 214, a suction tube 216, and an exposed outer end 218 of an optic fiber protrude. The ejection nozzle 214 is connected to a hose 230 which protrudes from a second end of the handle 220 and is provided with a fitting 238 similar to the fitting 38 discussed above with reference to Figs. 1 and 5. From the second end of the handle 220, a hose 234 similar to the hose 34 discussed above with reference to Figs. 1 and 5 also protrudes, which hose is provided with a fitting 240 at its distal or outer end. The exposed end 218 of the optic fiber constitutes an exposed end of an optic fiber 236 which is provided with a connector 242, and which protrudes from the second end of the handle 220. A hose 232 is also provided, which hose serves the same purpose as the hose 32 discussed above with reference to Figs. 1 and 5. The hose 232 is, like the hoses 230 and 234, connected to the valves operated by means of the push-buttons 222 and 224 and enclosed within the handle 220. However, the hose 232 is, as is evident from Fig. 8, connected to a flexible filter element comprising two co-axially arranged hoses 246 and 248, of which the hose 248 constitutes an inner, perforated hose which is provided with a sealing plug 247. The hose 232 is connected to the outer end of the outer hose 246 through a fitting 244. The inner end of the hose 248, i.e. the end opposite to the outer end connected to the fitting 244, is received within the handle 220 for providing a maximum length flexible filter element of minimum exterior space requirement. The input end of the filter element constituted by the co-axially arranged hoses 246 and 248, which input end is received within the handle 220, is connected to an inner end of the suction tube 216, the inner end of which is received within the inner hose 246. As solid material is transported through the suction tube 216, propelled by the vacuum generated through the hose 232, the solid material is filtered from the air within the inner space defined within the perforated hose 246 which is sealed by means of the plug 247.

In Fig.18, a fifth embodiment of the the high-pressure irrigation and suction instrument according to the present invention for use in surgical operations for prosthetic fixation is shown. The fifth embodiment is designated the reference numeral 210′ in its entirety and

differs from the above described fourth embodiment 210 shown in Fig. 8 in that the push-botton operated valves operated by means of the push-bottons 222 and 224 are omitted from the handle 220. The instrument 210' shown in fig. 18 is as will be readily understood a passive instrument which is connected to three external sources, a vacuum source which is connected to the filter of the instrument through the hose 232, a light source which is connected to the optic fiber 236 through the connector 242 and a water supply source which is connected to the hose 230 through the fitting 238. The external vacuum source is controlled by means of external equipment not shown in Fig. 18 as the control pressure hose 234 shown in Fig. 8 is omitted from the instrument 210'.

In Fig. 9a, a valve assembly is shown designated the reference numeral 10' in its entirety. The valve assembly 10' is adapted to cooperate with an elongated tubular component shown in Fig. 9b and designated the reference numeral 13 for providing an endoscopic or laparoscopic high-pressure suction/irrigation instrument similar to the instrument 10 described above with reference to Figs. 1 and 2. In Fig. 9a, the reference numerals 16, 18, 20, 22, 24, 26, 28, and 30 designate components identical to the components designated the same reference numerals described above with reference to Figs. 1 and 2. The valve assembly 10', however, differs from the instrument 10 in that the tube 15 of the instrument 10 is substituted by a male coupling component 15', which male coupling component is provided with a circumferential recess 21' for cooperating with a sealing O-ring of the elongated tubular component 13 to be described in greater details below with reference to Fig 9b, and a guiding flange 19' for guiding the coupling component 15' into cooperation with a mating coupling component of the elongated tubular component 13. In Fig. 10, details of the coupling component 15', the flange 19', and the circumferential recess 21' are disclosed.

Figs. 9b-9e illustrate different embodiments of elongated tubular components for cooperating with the valve assembly 10' described above with reference to Fig. 9a for providing a composite endoscopic or laparoscopic instrument. In Fig. 9b, a first embodiment of the elongated tubular component is shown, designated the reference numeral 13 and comprising the tube 12 and a female coupling component 17 for cooperating with the male coupling component 15' of the valve assembly 10'. At the proximal end of the elongated tubular component 13, the coupling component 17 is provided with an aperture 23 for receiving the coupling com-

ponent 15′ of the valve assembly 10′. Within the aperture 23, means are provided for cooperating with the flange 19′ and the circumferential recess 21′ of the coupling component 15′ of the valve assembly 10′. These means are disclosed in greater details in Fig. 11 and comprise a pin 25′ for cooperating with the flange 19′ for guiding the male coupling component 15′ into engagement within the recess 23 and a sealing O-ring 27 for cooperating with the circumferential recess 21′ of the coupling component 15′.

In Figs. 9C and 9D, a second and a third embodiment of the elongated tubular component for cooperating with the valve assembly 10′ are shown, designated the reference numerals 13′ and 13′′, respectively. The second and third embodiments 13′ and 13′′, respectively, comprise an internal through-going metal tube 29 which is provided with an outer insulating covering 35. The metal tube 29 is at its proximal end connected to a male connector 33 for establishing electrically conductive connection with an external voltage or current source through an electric wire provided with a female plug or connector for cooperating with the connector 33. The distal end of the metal tube 29 is connected to a surgical instrument constituted by a bent wire constituting an elbow 31 shown in Fig. 9C, and a spatula 31′ shown in Fig. 9D.

In Fig. 9E, a fourth embodiment of the elongated tubular component is shown, designated the reference numeral 10′′′ in its entirety. The fourth embodiment 13′′′ differs from the above described first, second, and third embodiments shown in Figs. 9b, 9c, and 9d, respectively, in that the coupling component 17 shown in Figs. 9b, 9c, and 9d is substituted by a coupling component 17′ which differs from the coupling component 17 in that an electric switch 41 is provided. The metal tube 29 is also omitted and substituted by two through-going conductors 31′′ and 31′′′, which through-going conductors protrude from the distal end of the insulating covering 35 of the tube 12, defining surgical pins or instruments. The through-going conductors 31′′ and 31′′′ are connectable to pins 37 and 39, respectively, of a male connector 33′ through the switch 41. As will be readily understood, the male connector 31′ serves a purpose similar to the purpose of the connector 33 described above with reference to Figs. 9C and 9D, viz. the purpose of establishing electrically conductive connection to an external 2-pole current or voltage source connectable to the through-going conductors 31′′ and 31′′′ through the switch 41. The switch 41 may constitute a

single-pole or a 2-pole switch.

In Fig. 12, a detail of the distal end of a fifth embodiment of the elongated tubular component is shown, disclosing the metal tube 29 covered by the insulating covering 35. A hook 31'''', constituting a surgical instrument similar to the instruments 31-31''' discussed above, is connected to the inner surface of the tube 29 through a soldered joint 43.

In Fig. 13, a modified embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument 60 discussed above with reference to Figs. 3 and 4 is shown, which alternative embodiment differs from the instrument 60, firstly, in that the fitting 70 and the through-going passage 80 are omitted, and, secondly, in that the alternative embodiment is of a modular structure similar to the structure discussed above with reference to Figs. 9a-12, as the endoscopic or laparoscopic instrument is composed of a valve body or valve assembly 60' provided with the male coupling component 15' described above with reference to Figs. 9a and 10, and comprising the flange 19' and the circumferential recess 21' for cooperating with a female coupling component 17'' of an elongated tubular instrument similar to the instrument 13 discussed above with reference to Fig. 9b. The coupling component 17'', however, differs from the coupling component 17 discussed above in that a through-going conductor 75 is provided for establishing electrically conductive connection through a soldered joint to the metal tube 29 from a male connector 71 protruding from the proximal end of the coupling component 17''.

The male connector 71 is adapted to cooperate with a female connector 67 constituting an integral component of the valve assembly 60', which female connector is connected to a switch 65 which is constituted by a push-botton switch operable by means of a push-botton 69 similar to the push-bottons 66 and 68 discussed above with referenc to Figs. 3 and 4. The switch 65 is connected to a conductor 63 which is included within the housing part 62 of the valve assembly 60' and is connected to a multi-plug connector 61 also including connectors for establishing connection to the passages 86, 88, and 90 of the valve assembly 60'.

The embodiment described above with reference to Fig. 13 may be modified so as to allow that the valve assembly 60' is used in connection with the alternative embodiments of the elongated tubular components 13, 13', and 13'' described above with reference to Figs. 9b, 9c, and 9d,

respectively, by omitting the switch 65 and the components cooperating with the switch, viz. the conductor 63, the female connector 67, and the push-botton 69.

In Fig. 17, a further or sixth embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument according to the present invention is shown designated the reference numerals 250 in its entirety. The sixth embodiment 250 is like the above described valve assembly 10′ shown in Fig. 9a adapted to be used in connection with any of the embodiments of the elongated tubular components shown in Figs. 9b, 9c, 9d and 9e, and similar embodiments of the irrigated tubular component. In Fig. 17, the second embodiment of the elongated tubular component 13′ shown in Fig. 9c is disclosed. The male connector 33 of the second embodiment 13′ of the irrigated tubular component is connected to a female connector or plug 274 which is further connected to a wire 276 for establishing electrically conductive connection to an external voltage or current source.

The sixth embodiment 250 comprises a housing 260 including a cylindrical housing component 262 in which a valve element operated by means of a push-botton 264 is received. The valve element serves the purpose of establishing connection between the through-going bore of the elongated tubular component 13′ and the high-pressure water supply source or alternatively the vacuum source connected to the cylindrical housing component 252 of the housing component 250 through the hoses 32 and 36, respectively. The hose 32 is connected to the cylindrical housing component 262 through a fitting 268 and the hose 36 is connected to the cylindrical housing component 262 through a fitting 272. The control hose 34 is similarly connected to the cylindrical housing component 262 through a fitting 270 and the control hose 34 is connected to the control terminal of the high-pressure water supply source as described above with reference to Figs. 1, 2 and 5. The push-botton 264 is received by a plug body 256 and the opposite end of the cylindrical housing component 262 is sealed by means of a further plug body cap 267.

The sixth embodiment 250 of the endoscopic of laparoscopic high-pressure suction/irrigation instrument shown in Fig. 17 operates in the following manner. The push-botton 264 is biased towards the position shown in Fig. 17, by means of a spring not shown in Fig. 17, in which position the instrument is inoperative and in which position the through-going bore of the elongated tubular instrument 13′ is

disconnected from the vacuum source connected to the instrument through the hose 32 and also the high-pressure water supply source connected to the instrument through the hose 36. Provided the push-button 264 is depressed to a first activated position, the hose 32 is connected to the through going bore of the elongated tubular instrument 13′ for causing evacuation of the bore through the hose 32. Provided the push-botton 264 is further depressed, the hose 36 is connected to the through-going bore of the elongated tubular instrument 13′ for supplying high-pressure water to the through-going bore of the elongated tubular instrument 13′ and at the same time, the control hose 34 is connected to the vacuum source through the hose 32 causing turn on of the high-pressure water supply source as described above with reference to Fig. 5. Alternatively, the first activated position of the push-botton 264 may cause supply of high-pressure water to the elongated tubular instrument 13′ and the second activated position may consequently constitute a position in which the through-going bore of the elongated tubular instrument 13′ is evacuated through the hose 32.

In Figs. 14, 15, and 16, a motor and pump assembly is shown, which motor and pump assembly in its entirety is designated the reference numeral 100′. The motor and pump assembly 100′ is operable in the same manner as the motor 100 described above with reference to Figs. 5 and 6, i.e. the motor and pump assembly 100′ is turned on and off through the venting of an activation port of the motor and pump assembly, which activation port, however, is not shown in Fig. 1, through the hose 34 communicating with the valve of the instrument 10 or the instrument 60, alternatively the valve assemblies 10′ and 60′ described above with reference to Figs. 9a and 13, respectively. The motor and pump assembly 100′, basically, differs from the motor 100 and the pump 110 in that the motor and pump assembly 100′ includes a hose pump rendering it possible to connect the motor and pump assembly directly to a hose 36′, which hose interconnects the connector 40 of the instrument 10 and the water supply wall outlet comprising the shut-off valve 118 shown in Fig. 5.

The motor and pump assembly 100′ comprises a motor housing 102 which is of a basically cylindrical configuration. Within the motor housing 102, a pressurized air powered motor is arranged and encapsulated by means of a lower housing component 162. An output shaft 164 of the motor is journalled relative to the housing component 162 in a journalling bearing 166 and is connected to a triangularly shaped wheel

plate 172 supports three wheels 174 in a triangular configuration. As the shaft 164 is caused to rotate, the plate 172 is also caused to rotate as the plate 172 is in direct power transmitting connection with the shaft 164.

Below the housing component 162, a further housing component 170 is arranged, which housing component 170 defines a lower supporting plate on which the hose 36' is supported. The hose 36' is further supported by shiftable wall components 184 and 186 which are shiftable from a position shown in solid line in Fig. 16 to a position shown in dotted line in Fig. 16, allowing that the hose 36' is positioned correctly relative to the triangularly shaped wheel supporting plate 172, whereupon the shiftable wall components 184 and 186 are shifted from the position shown in dotted line in Fig. 16 to the position shown in solid line in Fig. 16 and also shown in Fig. 15, in which position the wall components 184 and 186 support the hose 36' for cooperating with the wheels 174 supportd by the plate 172.

As the shaft 64 is rotated, the plate 172 is rotated in a counterclockwise direction. Consequently, the uppermost part of the hose 36' protruding from the housing 102' of the motor and pump assembly 100' constitutes a water inlet, whereas the lowermost part of the hose 36' protruding from the housing 102' of the motor and pump assembly 100' constitutes a water outlet. A pulsed water supply is generated by means of a pin 176 which is reciprocated relative to the adjacent inner wall of the wall component 186 and the segment of the hose 36' positioned within the wall component 186 as the pin 176 is journalled in a roller bearing 178 within an oval guideway 180 of the plate 172. As the plate 172 is caused to rotate a single revolution, the pin 176 is retracted from its contact with the hose 36' twice for allowing the water to be expelled from the motor and pump assembly 100' through the above described water outlet and also twice caused to shut off the hose 36' for interrupting or discontinuing the supply of water from the water and pump assembly 100' generating a pulsed water supply.

The shifting of the shiftable wall components 184 and 186 between the position shown in solid line in Fig. 16 constituting an operable position of the motor and pump assembly 100' and the position shown in dotted line in Fig. 16 constituting an inoperable position of the motor and pump assembly 100' is established by means of a lever 189 which is integrally connected to a plate 188 which is journalled on a journalling

pin 190 relative to the support plate of the housing component 170. The plate 188 and the lever 189 are encased within a further housing component 182 constituting a lower end wall of the housing of the motor and pump assembly 100'. The wall components 184 and 186 are rigidly connected to and supported on slidable support plates 185 and 187, respectively, which are guided by pins 198. The shifting of the wall components 184 and 186 is further established by means of a guiding plate 196 which is provided with a slit or guideway in which the pins 198 are guided. The plate 196 is shifted from a position shown in solid line in Fig. 16 to a position shown in dotted line in Fig. 16, as the lever 189 is shifted from its position shown in solid line to its position shown in dotted line by means of a pin 192 of the plate 196, which pin is received within a guideway 194 of the plate 188.

As will be understood, the guidance of the pin 192 within the guideway 194 forces the plate 196 to its central position shown in dotted line in Fig. 16, further forcing the pins 198 of the supporting plates 185 and 186 to be separated due to their meshing with the longitudinal slit or guideway of the plate 196.

Example 1

A prototype implementation of the above described first embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument 10 shown in Figs. 1 and 5 was made from the following components:

The elongated tube 12 was made from a stainless steel tube of a total length of 330 mm having an outer diameter of 5 mm and an inner diameter of 4.65 mm. The tube 15 was made from a brass tube of an outer diameter of 7.5 mm. The housing component 16 was made from a brass body constituted by a cylindrical tubular body of a height of 15 mm and an outer diameter of 25 mm. The conical aperture of the housing component 16 varied from a maximum diameter of 17 mm to a minimum diameter of 14 mm. The fittings 26, 28, and 30 were made from brass. The conical valve body 20 was made from brass and had a height of 15 mm and an outer diameter varying from a minimum outer diameter of 14.2 mm to a maximum outer diameter of 17.2 mm and was matched to the conical aperture of the housing component 16 in an adjustment process. The locking plate 44 and the knob 46 were made from brass and the spring mentioned above contained within the knob 46 was made from stainless steel.

Example 2

A prototype implementation of the surgical instrument 210' shown in Fig. 18 was made from the following components:

The handle 220 was a solid cylindrical PVC body of a length of 120 mm, an outer diameter of 32 mm and an inner diameter of 14 mm. The tube 212 was constituted by a crimped PVC tube. The suction tube 216 was a PVC tube of an outer diameter of 8 mm and an inner diameter of 6 mm. The ejection nozzle 214 was a PVC nozzle which was glued to the end of a nylon hose of an outer diameter of 4 mm and constituting the hose 230 and further fixated by means of the tube 216. The optic fiber 236 was a conventional fiber optic element provided with an exposed end constituting the end 218. The hose 234 was constituted by a nylon hose of an outer diameter of 4 mm. The hose 232 was a PVC hose of an outer diameter of 8 mm. The overall length of the assembly comprising the tube 212, the suction tube 216, the exposed optic fiber end 218, and the ejection tube 214 was 250 mm. The filter element constituted by the hoses 246 and 248 were made from a PVC hose of an outer diameter of 18 mm and an inner diameter of 15 mm constituting the outer hose 246, and a perforated PVC hose of an outer diameter of 12 mm and an inner diameter of 10 mm, constituting the perforated inner hose 248. The plug 247 was made from PVC. The overall length of the filter element was 500 mm, and a length of approximately 440 mm of the filter element was protruding from the outer or second end of the handle 220.

10 first embodiment of an endoscopic or laparoscopic high-pressure suction/irrigation instrument, comprising:
12 elongated tube
14 transversal bore or hole
15 tube
16 housing component
18 abutments
20 conical valve body
22 lever
24 grip
26 tubular fitting
28 tubular fitting
30 tubular fitting
32 hose
34 hose
36 hose
38 connector
40 connector
42 threaded pin
44 locking plate
46 knob
48 transversal through-going bore
50 branching-off bore
52 cut
54 recess
56 cut

60 second embodiment of an endoscopic or laparoscopic high-pressure suction/irrigation instrument, comprising:
62 second or lower housing part
64 first or upper housing part
66 push-button
68 push-button
70 fitting
72 surgical instrument
73 surgical instrument
76 valve body
77 spring

78 valve body
79 spring
80 through-going passage
86 passage
88 passage
90 passage
92 passage
96 shut-off valve

100 motor assembly or pump assembly, comprising:
102 housing
104 hanging strap
106 on/off switch
108 rotatable knob
110 membrane pump
112 hose
114 valve/outlet
116 hose
118 valve/outlet
120 activation port/hose fitting
122 inlet
124 assembly
126 supply line
128 first 3-way valve
130 second 3-way valve
132 third 3-way valve
134 throttle valve
136 fourth 3-way valve
138 throttle valve
140 assembly

150 third embodiment of an endoscopic or laparoscopic high-pressure suction/irrigation instrument, comprising:
160 housing component
12 elongated tube
14 transversal bore or hole
15 tube
18 abutments

20 conical valve body
22 lever
24 grip
26 tubular fitting
28 tubular fitting
30 tubular fitting
32 hose
34 hose
70 sealable fitting
73 surgical instrument

210 fourth embodiment of high pressure suction/irrigation instrument and
210′ seventh embodiment of high pressure suction/irrigation instrument, each comprising:
212 elongated tube
214 ejection nozzle
216 suction tube
218 exposed end of optic fiber
220 handle
222 push-button
224 push-button
230 hose
232 hose
234 hose
236 optic fiber
238 fitting
240 fitting
242 connector
244 fitting
246 outer hose
247 plug
248 inner, perforated hose

10′ valve assembly constituting component of the first embodiment of an endoscopic or laparoscopic high-pressure suction/irrigation instrument, comprising:
16 housing component

18 abutments
20 conical valve body
22 lever
24 grip
26 tubular fitting
28 tubular fitting
30 tubular fitting
15′ male coupling component
19′ flange
21′ circumferential recess

13, 13′, 13″, 13‴ first, second, third, and fourth embodiment of elongated tubular component constituting component of an endoscopic or laparoscopic high-pressure suction/irrigation instrument, comprising:

17, 17′ female coupling component
23 aperture
25 pin
27 O-ring
29 metal tube
31 elbow
31′ spatula
31″, 31‴ through-going conductors
31⁗ hook
33 male connector
33′ connector
35 insulating covering
37, 39 connector pins
41 switch
43 soldered joint

60′ valve assembly constituting component of fifth embodiment of the endoscopic or laparoscopic high-pressure suction/irrigation instrument, comprising:
61 multi-pin connector
62 housing part
63 conductor

65 switch
66 push-botton
67 female connector
68 push-botton
69 push-botton
76 valve body
77 spring
78 valve body
79 spring
86 passage
88 passage
90 passage
15′ male coupling component
19′ flange
21′ circumferential recess
17′′ female coupling component
25 pin
27 O-ring
29 metal tube
35 insulating covering
71 male connector
75 conductor

100′ motor or pump assembly, comprising:
36′ hose
102′ housing
162 housing component
164 output shaft
166 journalling bearing
168 fitting
170 housing component
172 triangularly shaped wheel supporting plate
174 wheels
176 pin
178 bearing
180 guideway
182 housing component
184 wall component

185 supporting plate
186 wall component
187 supporting plate
188 plate
189 lever
190 pin
192 pin
194 guideway
196 plate
198 pins

250 sixth embodiment of an endoscopic or laparoscopic high-pressure suction/irrigation instrument, comprising:
260 housing
262 cylindrical housing component
264 push-botton
266 plug body
267 plug body
268 fitting
270 fitting
272 fitting
274 plug
276 wire
13' elongated tubular component

C L A I M S

1. An instrument for surgical use, comprising:

a body,

an elongated tubular means defining a through-going bore and being connected to and supported by said body,

valve means housed within said body and communicating with said elongated tubular means,

a first connector means for connection to a vacuum source and communicating with said valve means for establishing communication from said vacuum source to said elongated tubular means through said valve means, provided said valve means is in a first operative state,

a second connector means for connection to a pressurized rinsing liquid supply source and communicating with said valve means for establishing communication from said supply source to said elongated tubular means through said valve means, provided said valve means is in a second operative state, and

a third connector means for connection to an activation port of said supply source and communicating with said valve means for establishing communication from said vacuum source to said activation port of said supply source through said first connector means and said third connector means for turning on said supply source by venting said activation port through said vacuum source, provided said valve means is in said second operative state.

2. The instrument of Claim 1, said valve means being constituted by a rotary valve means, comprising a rotary valve body having passages for establishing said communication from said first connector means to said elongated tubular means, provided said rotary body is in a first rotary position relative to said body defining said first operative state, and from said second connector means to said elongated tubular means and from said first connector means to said third connector means, provided said rotary body is in a second rotary position relative to said body defining said second operative state.

3. The instrument of Claim 1, said valve means being constituted by push-button operated valve means comprising one or more single-position or multi-position/multi-way valves.

4. The instrument of any of the Claims 1-3, said body having a through-going passage in registration with said through-going bore of said elongated tubular means for receiving a separate surgical instru-

ment, such as a blunt, a knife, a needle, a spatula, a hook, a dissection/grasper insert, a scissors insert, a separate optic fiber, or an electrode of an electrode system, of an electric treatment system or the like.

5. The instrument of any of the Claims 1-4, said elongated tubular means constituting a separate elongated tubular component defining a distal end and a proximal end and being connectable to said body at said proximal end of said elongated tubular component through respective coupling means of said elongated tubular component and said body.

6. The instrument of Claim 5, said coupling means being constituted by bayonet coupling means comprising a male coupling means of said body and a female coupling means of said elongated tubular component.

7. The instrument of any of the Claims 5 or 6, said elongated tubular component comprising a conductor means extending through said elongated tubular component and protruding from said distal end thereof.

8. The instrument of Claim 7, said elongated tubular component further comprising an electrical connector means provided at said proximal end of said elongated tubular component and being connected to said conductor means.

9. The instrument of any of the Claims 1-8, further comprising a sealed filter means interconnected between said first connector means and said valve means.

10. The instrument according to Claim 9, said filter means having a filter capacity of the order of 10-100 cm^3, such as 20-60 cm^3, e.g. approximately 40 cm^3.

11. The instrument according to any of the Claims 9 or 10, said filter means being a flexible filter means.

12. The instrument according to Claim 11, said flexible filter means being constituted by a first flexible hose and a second, perforated flexible hose, said first hose defining a filter input means and a filter output means, and said second hose being enclosed within said first hose and defining an open end at said filter input means and a closed end at said filter output end.

13. The instrument according to Claim 12, said flexible filter means being partially enclosed within said body.

14. The instrument according to any of the Claims 1-13, said elongated tubular means defining separate first and second through-going bores connectable to said first and second connector means, respective-

ly, through said valve means.

15. The instrument according to any of the Claims 1-14, further comprising a fiber optic means extending to and being exposed at a distal end of said elongated tubular means.

16. An elongated tubular instrument for surgical use,

said elongated tubular instrument defining a through-going bore and a distal end and a proximal end, and comprising a coupling means provided at said proximal end for cooperating with a coupling means of a valve body, said valve body comprising:

valve means housed within said valve body and communicating with said coupling means,

a first connector means for connection to a vacuum source and communicating with said valve means for establishing communication from said vacuum source to said coupling means through said valve means, provided said valve means is in the first operative state,

a second connector means for connection to a pressurized rinsing liquid supply source and communicating with said valve means for establishing communication from said supply source to said coupling means through said valve means, provided said valve means is in the second operative state, and

a third connector means for connection to an activation port of said supply source and communicating with said valve means for establishing communication from said vacuum source to said activation port of said supply source through said first connector means and said third connector means for turning on said supply source by venting said activation port through said vacuum source, provided said valve means is in said second operative state.

17. The instrument according to Claim 16, said instrument and said valve body further having any of the characteristics of the instrument according to any of the Claims 1-15.

18. An assembly for surgical use, comprising:

a pressurized rinsing liquid supply source having an activation port for turning on said supply source for supplying pressurized rinsing liquid, provided said activation port is vented, and

an instrument for surgical use, comprising:

a body,

an elongated tubular means defining a through-going bore and being connected to and supported by said body,

valve means housed within said body and communicating with said elongated tubular means,

a first connector means for connection to a vacuum source and communicating with said valve means for establishing communication from said vacuum source to said elongated tubular means through said valve means, provided said valve means is in a first operative state,

a second connector means for connection to said pressurized rinsing liquid supply source and communicating with said valve means for establishing communication from said supply source to said elongated tubular means through said valve means, provided said valve means is in a second operative state, and

a third connector means for connection to said activation port of said supply source and communicating with said valve means for establishing communication from said vacuum source to said activation port of said supply source through said first connector means and said third connector means for turning on said supply source by venting said activation port through said vacuum source, provided said valve means is in said second operative state.

19. The assembly according to Claim 18, further having any of the characteristics of the instrument according to any of the Claims 1-15.

20. An instrument for surgical use, comprising:

a body,

an elongated tubular means defining a through-going bore and being connected to and supported by said body,

a first connector means for connection to a vacuum source and for establishing communication from said vacuum source to said elongated tubular means,

a second connector means for connection to a pressurized rinsing liquid supply source and for establishing communication from said supply source to said elongated tubular means,

a sealed filter means interconnected between said first connector means and said valve means.

21. The instrument according to Claim 20, further having any of the characteristics of the instrument according to any of the Claims 1-15.

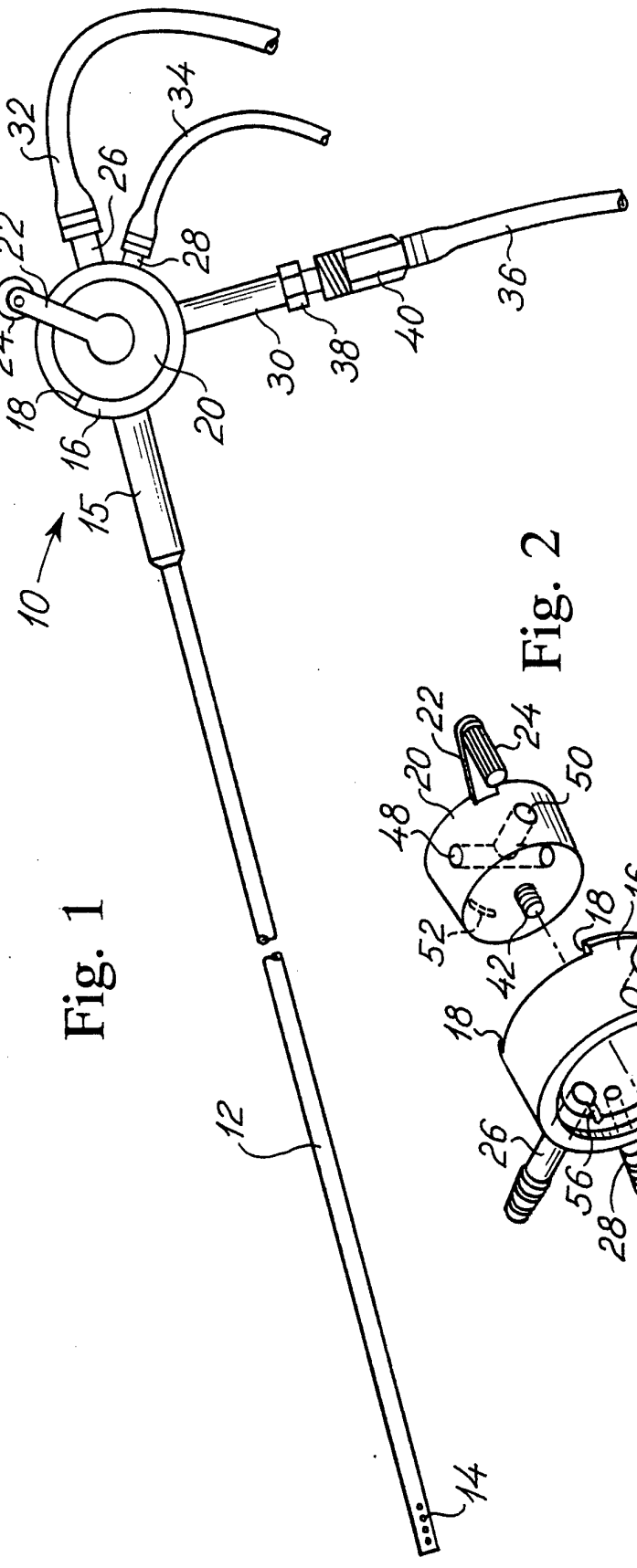

Fig. 1

Fig. 2

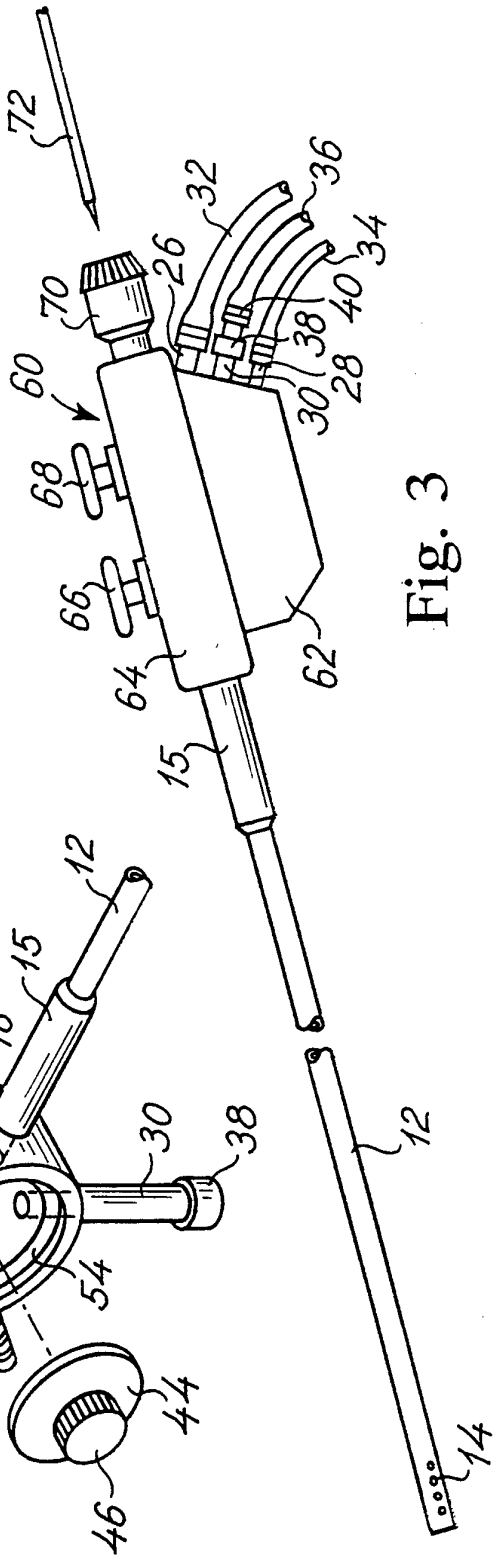

Fig. 3

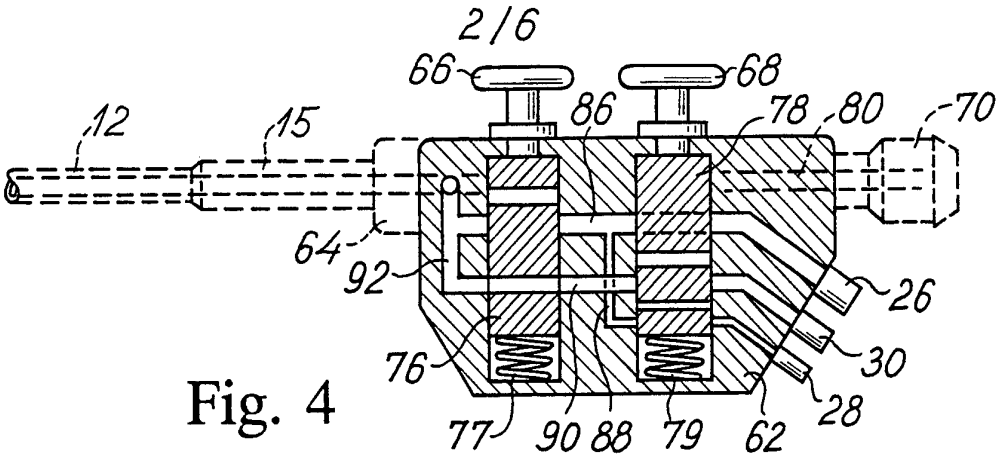

Fig. 4

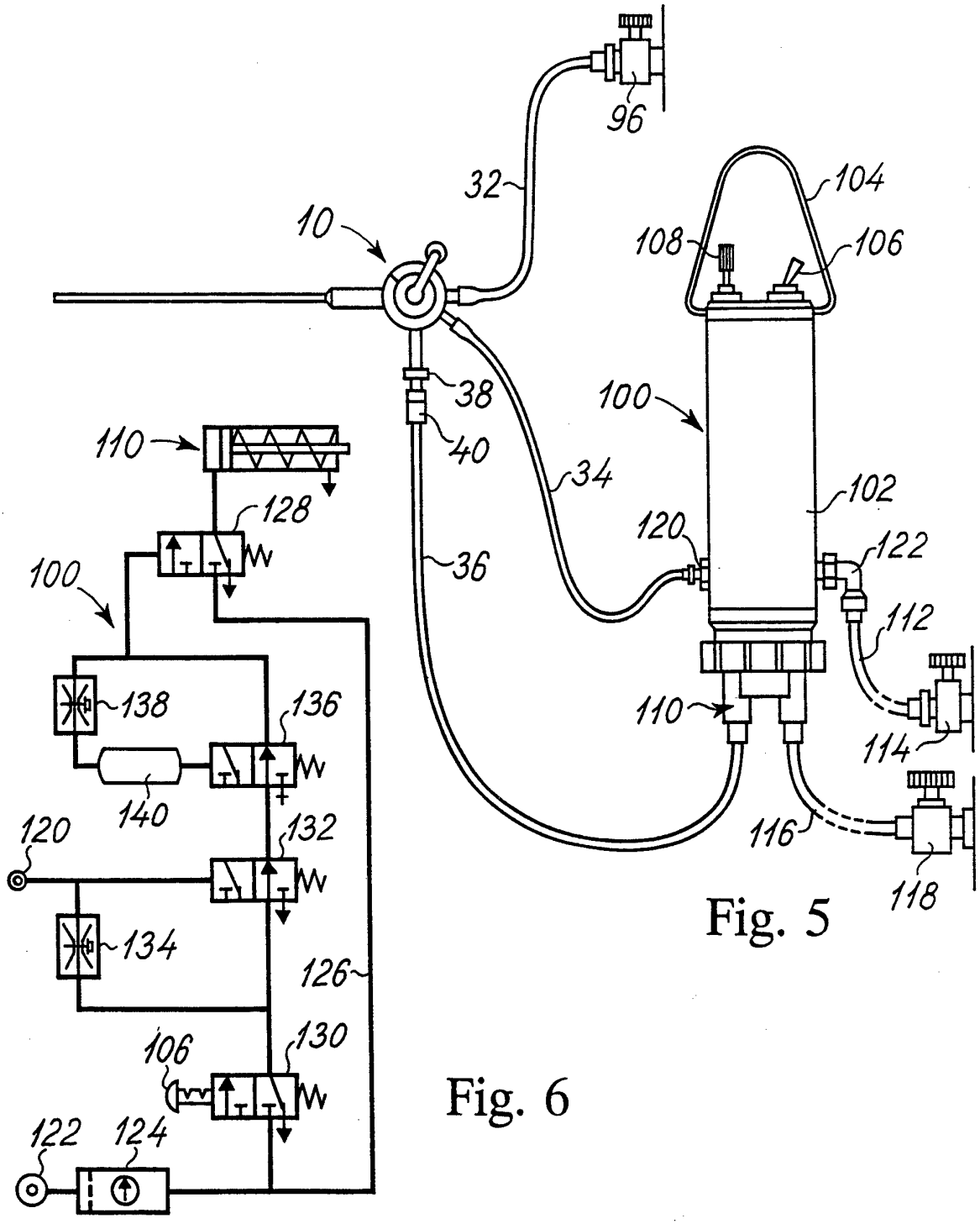

Fig. 5

Fig. 6

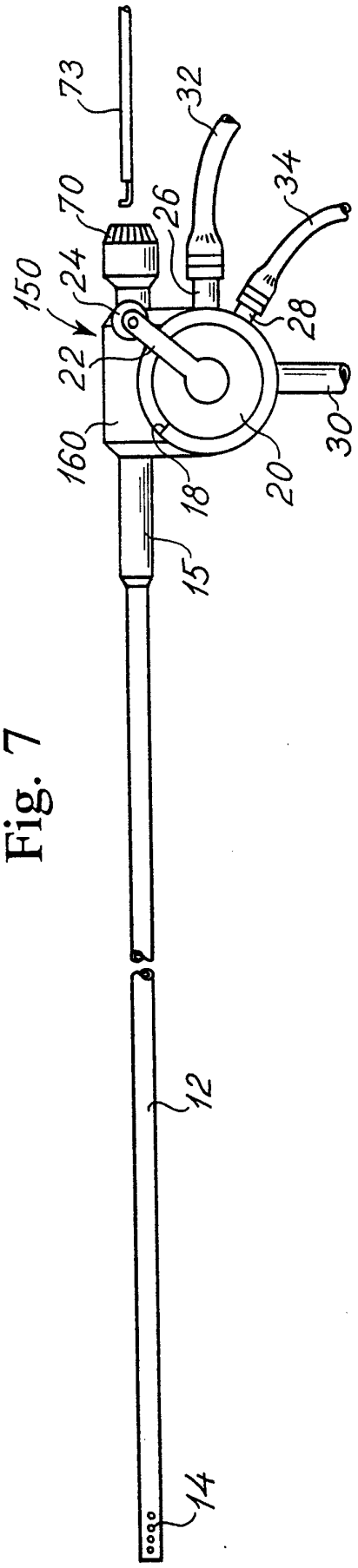
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Fig. 7

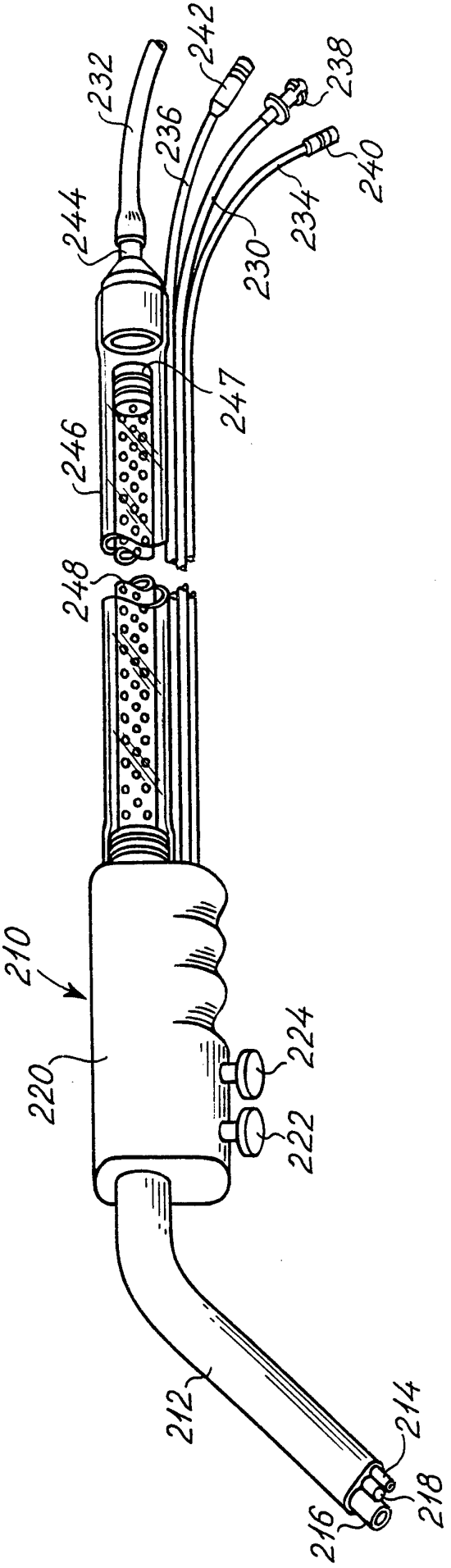
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Fig. 8

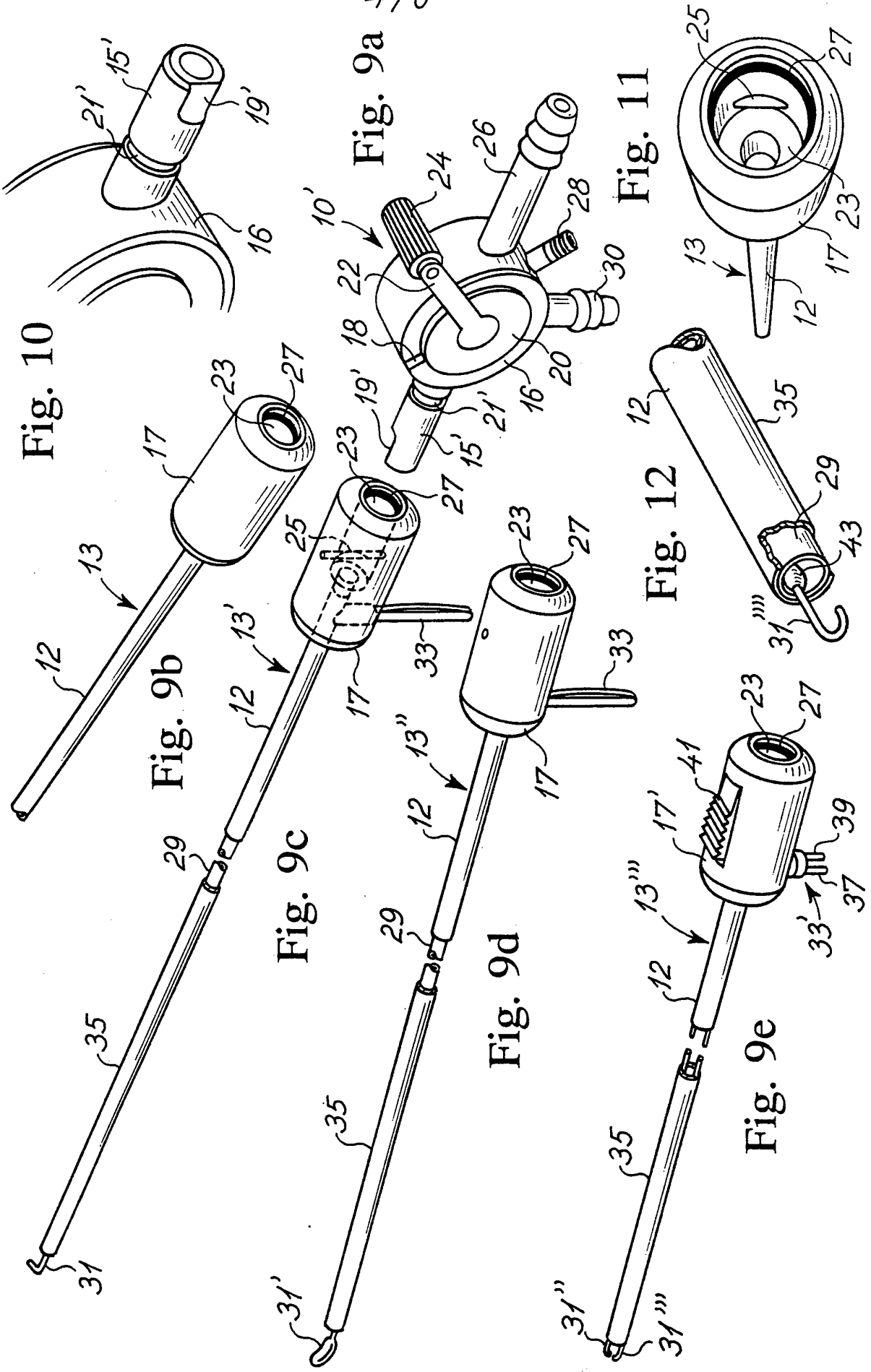
Fig. 10
Fig. 9a
Fig. 11
Fig. 9b
Fig. 12
Fig. 9c
Fig. 9d
Fig. 9e

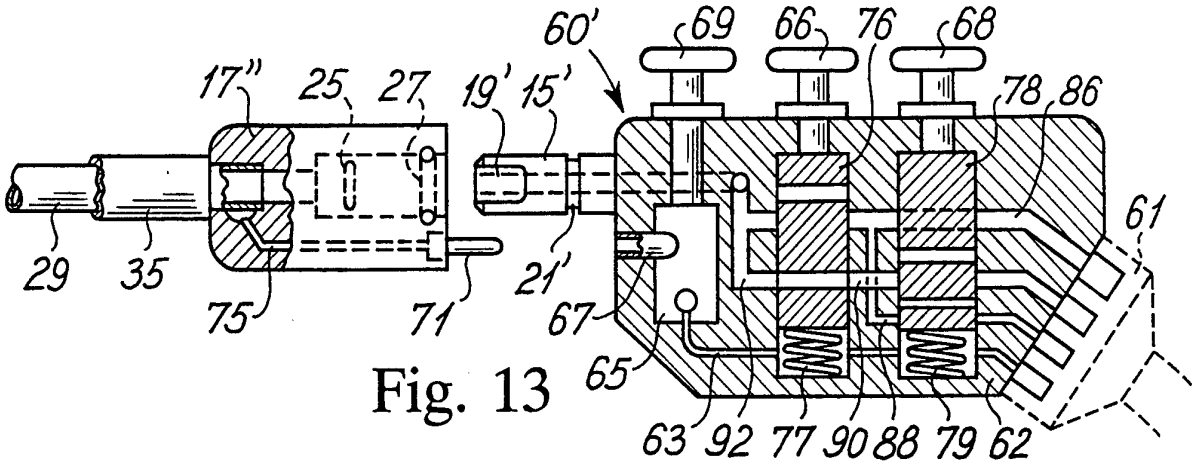

Fig. 13

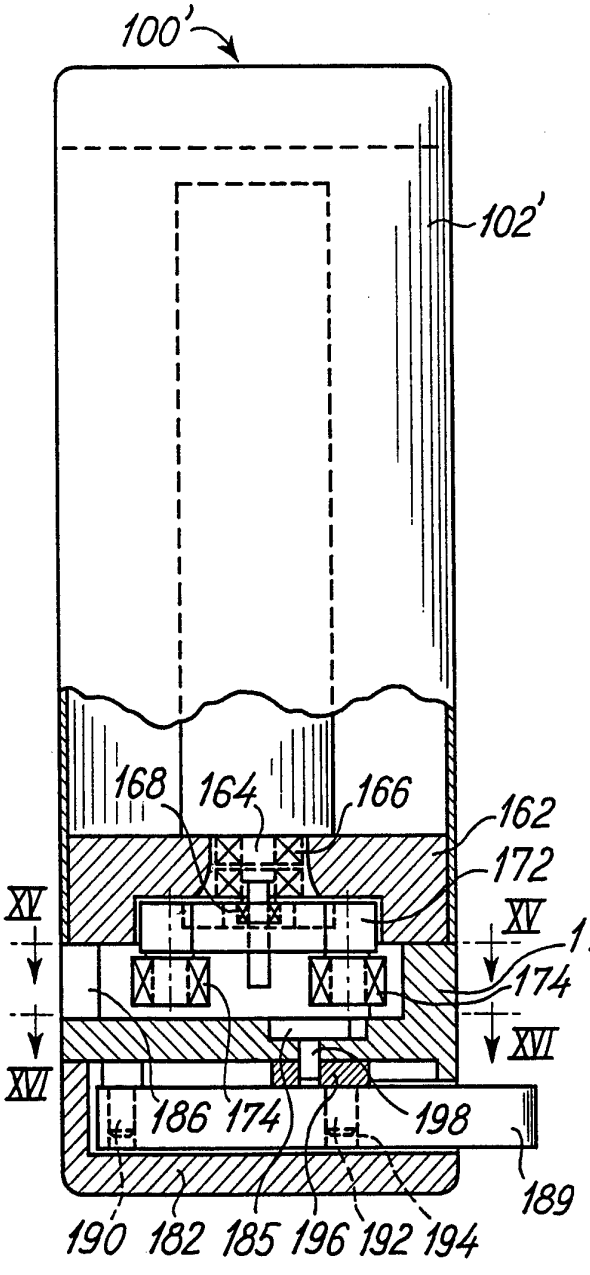

Fig. 14

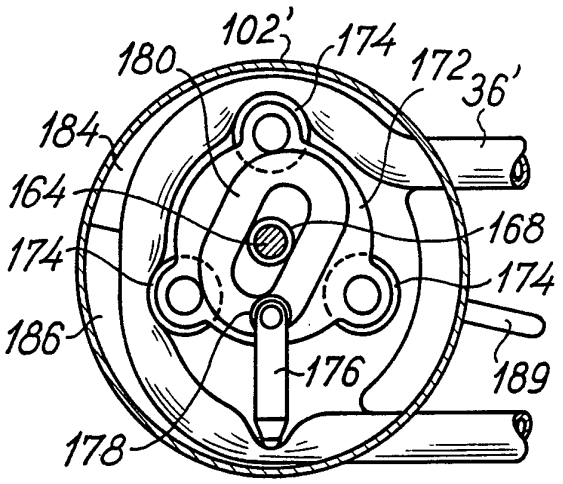

Fig. 15

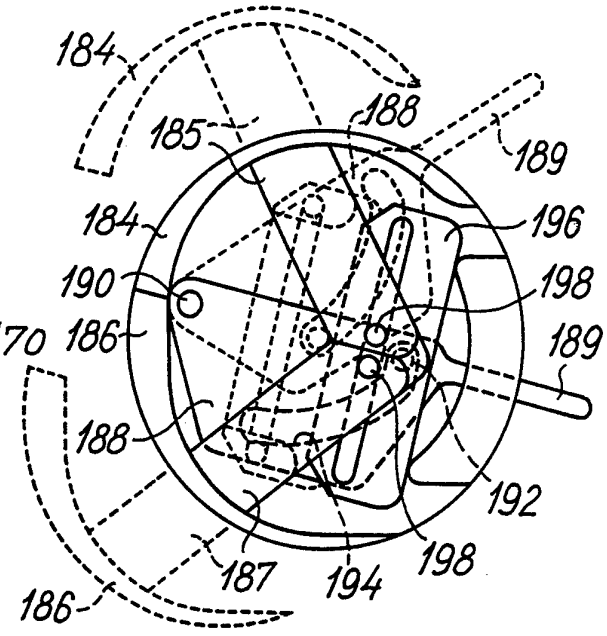

Fig. 16

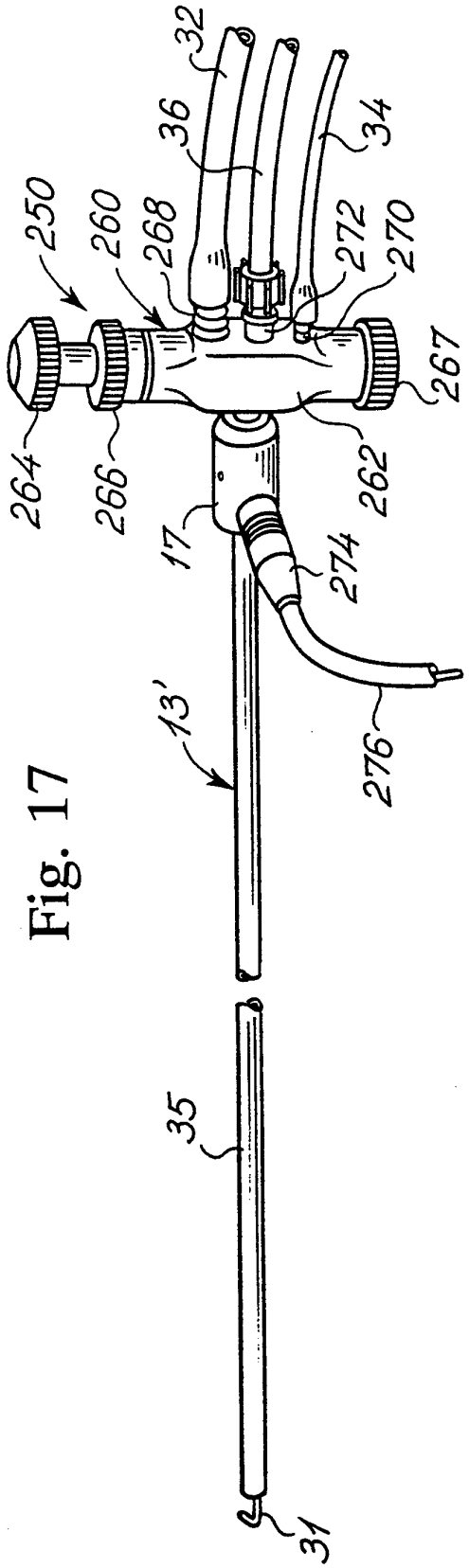
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Fig. 17

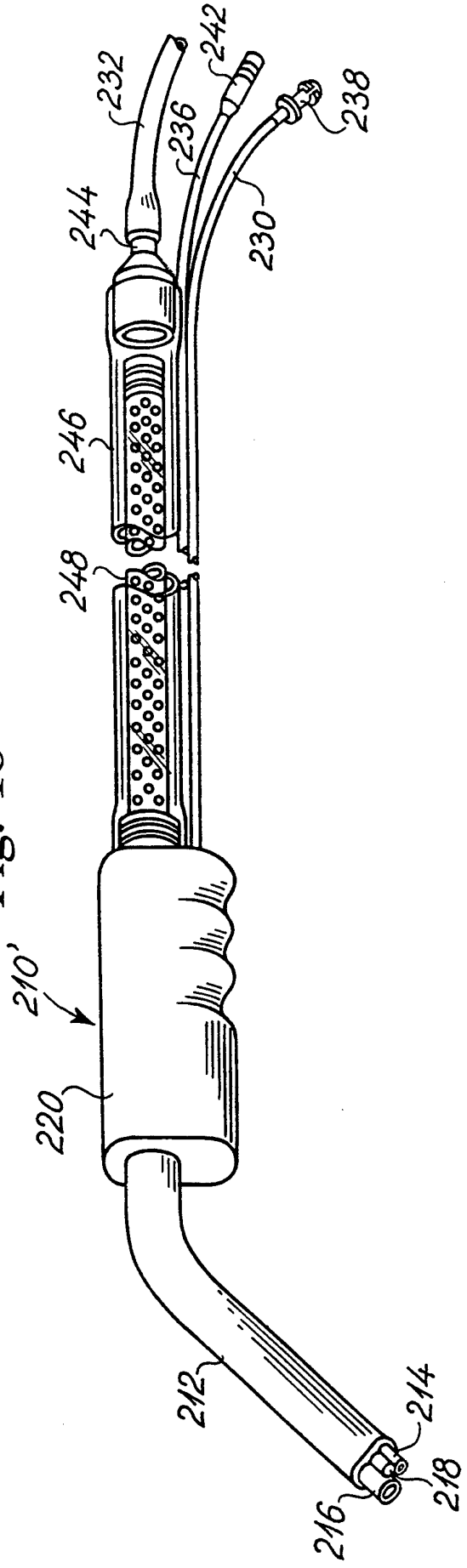
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Fig. 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 93/00204

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: A61B 1/12, A61M 3/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: A61B, A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4567880 (TOBIAS M. GOODMAN), 4 February 1986 (04.02.86), column 2, line 19 - line 36; column 4, line 45 - line 53; column 5, line 4 - line 33, column 6, line 7 - line 14; claims 1-5	1-21
A	EP, A1, 0389818 (DEXIDE, INC.), 3 October 1990 (03.10.90)	1-21
A	US, A, 4617013 (JOHN J.E. BETZ), 14 October 1986 (14.10.86), figure 5, abstract	1-21

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 Sept 1993	23 -09- 1993
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Inger Löfgren Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 93/00204

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4708717 (GRAHAM DEANE ET AL), 24 November 1987 (24.11.87) -- --------	1-21

INTERNATIONAL SEARCH REPORT

Information on patent family members

26/08/93

International application No.
PCT/DK 93/00204

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4567880	04/02/86	NONE	
EP-A1- 0389818	03/10/90	CA-A- 2011154	28/09/90
		US-A- 5034000	23/07/91
		US-A- 5100377	31/03/92
US-A- 4617013	14/10/86	NONE	
US-A- 4708717	24/11/87	GB-A,B- 2171312	28/08/86