United States Patent [19]

Iglesias

[11] **3,835,842**

[45] **Sept. 17, 1974**

[54] **ENDOSCOPE WITH CONTINUOUS IRRIGATION**

[76] Inventor: **Jose J. Iglesias,** 1341 North Ave., Elizabeth, N.J. 07208

[22] Filed: **Sept. 20, 1973**

[21] Appl. No.: **399,197**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 268,806, July 3, 1972, and a continuation-in-part of Ser. No. 368,186, June 8, 1973.

[52] **U.S. Cl.** **128/7,** 128/303.15

[51] **Int. Cl.** **A61b 1/30**

[58] **Field of Search** 128/4, 6, 7, 240, 241, 128/303.15

[56] **References Cited**

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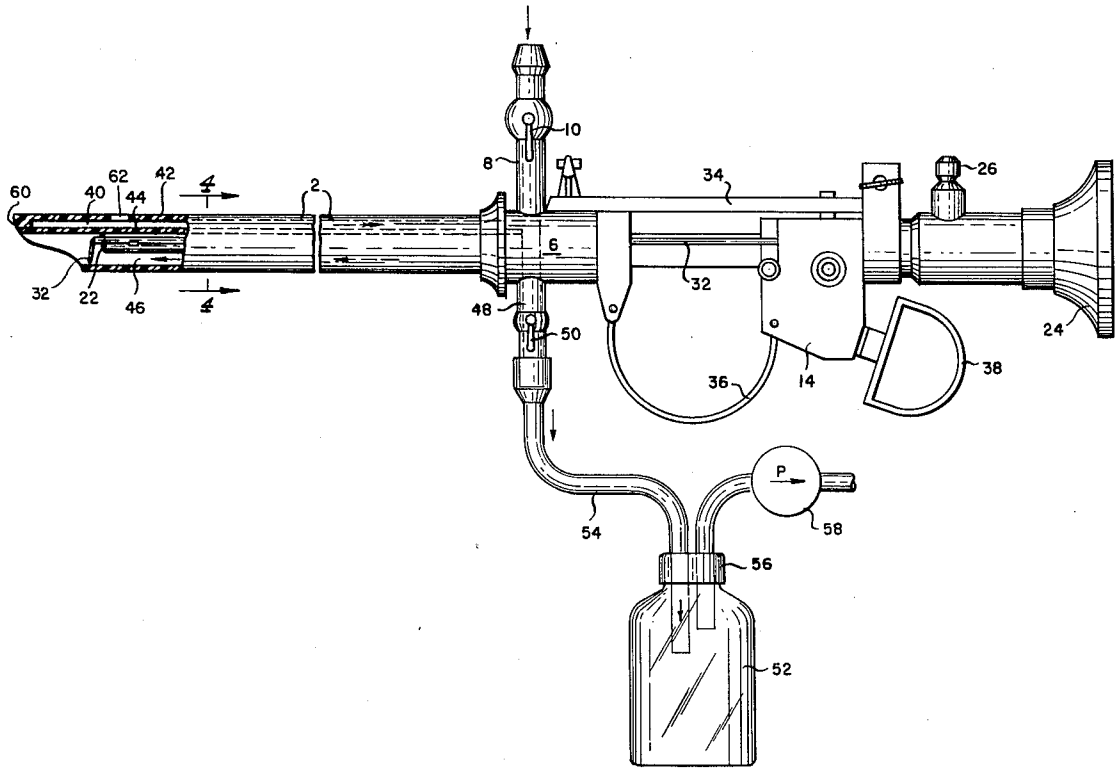
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Primary Examiner—Lucie H. Laudenslager

[57] **ABSTRACT**

Urological endoscopic instruments known before this invention do not permit continuous clear vision of the operative field because such vision is periodically obscured by the turbid fluid produced at the operative field. The invention produces continuous clear vision of the operative field by causing continuous inflow of clear irrigating fluid to the operative field and continuous outflow of turbid fluid from the operative field, thus providing a continuously flowing system which is provided by two conduits, one for inflowing clear fluid having its outflow port within the beak of the sheath and below and in front of the objective lens of the telescope which forms part of the instrument, and one for turbid outflowing fluid from the operative field having its inlet port in the exterior of the sheath above the objective lens and to the rear of the beak, so that the inflowing clear fluid must pass through the operative field to reach the inlet port of the outflow conduit, the outflow of fluid being maintained by suction applied to the outflow conduit.

13 Claims, 12 Drawing Figures



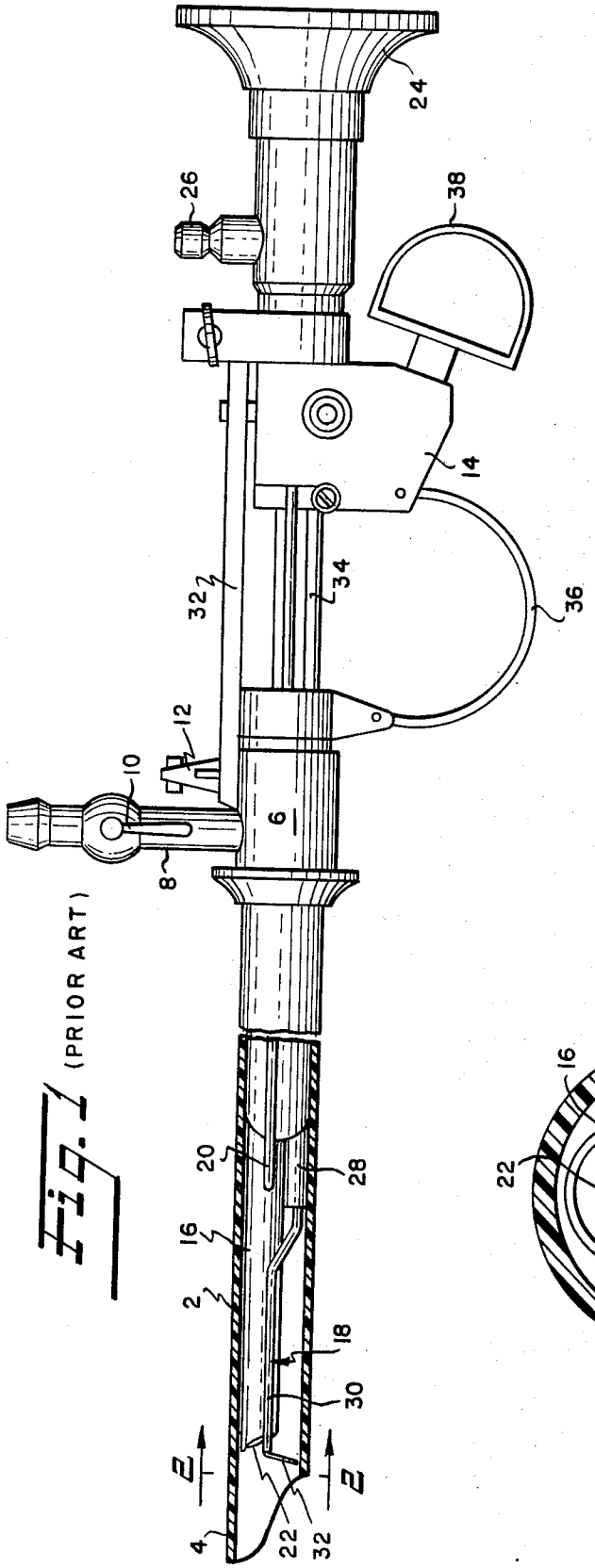


Fig. 1 (PRIOR ART)

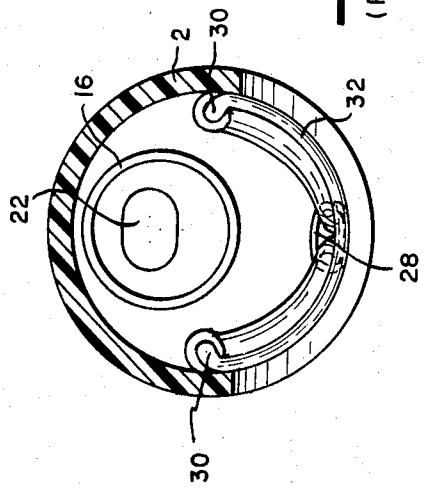


Fig. 2 (PRIOR ART)

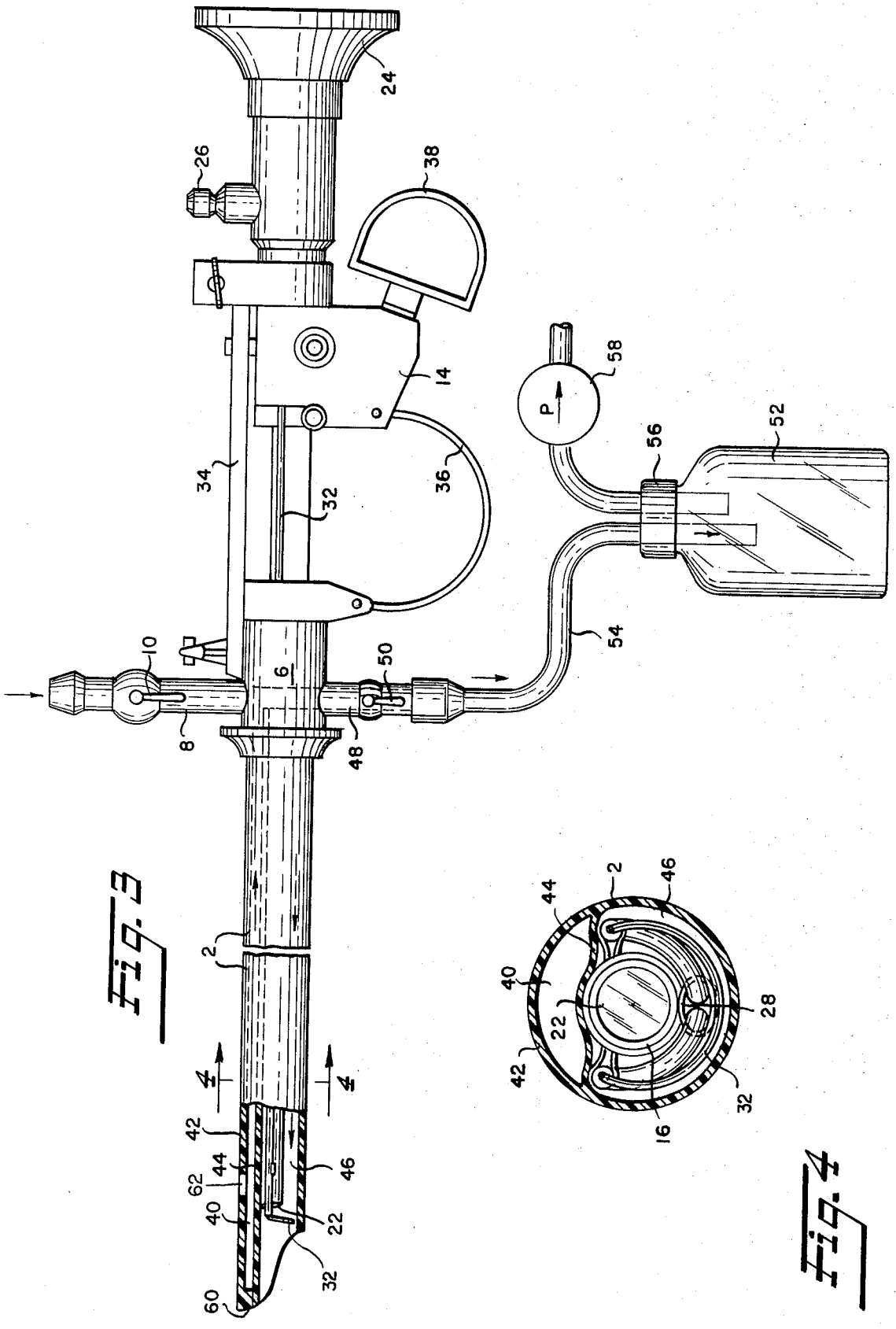

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Fig. 3

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Fig. 4

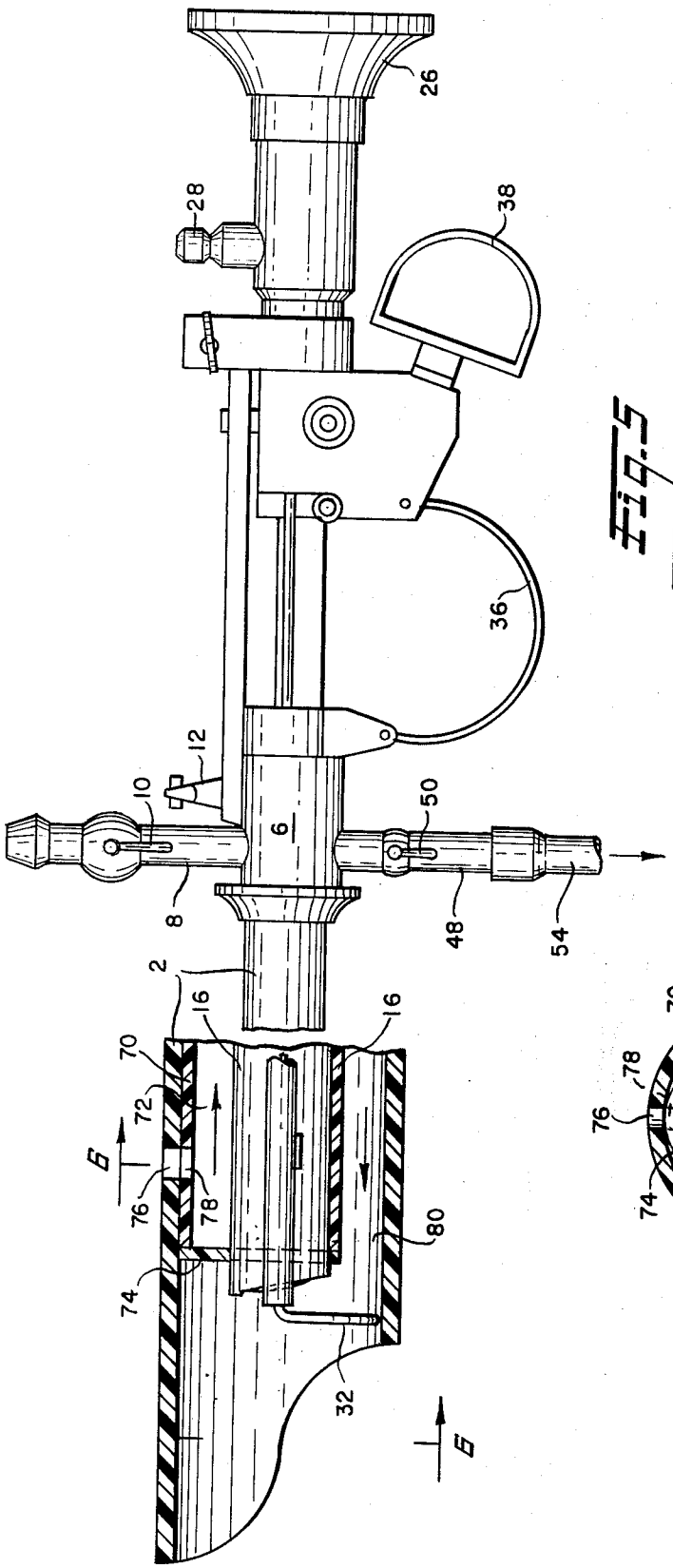

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Fig. 5

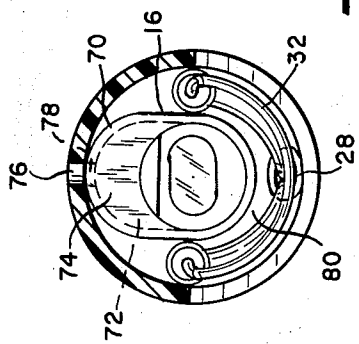

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Fig. 6

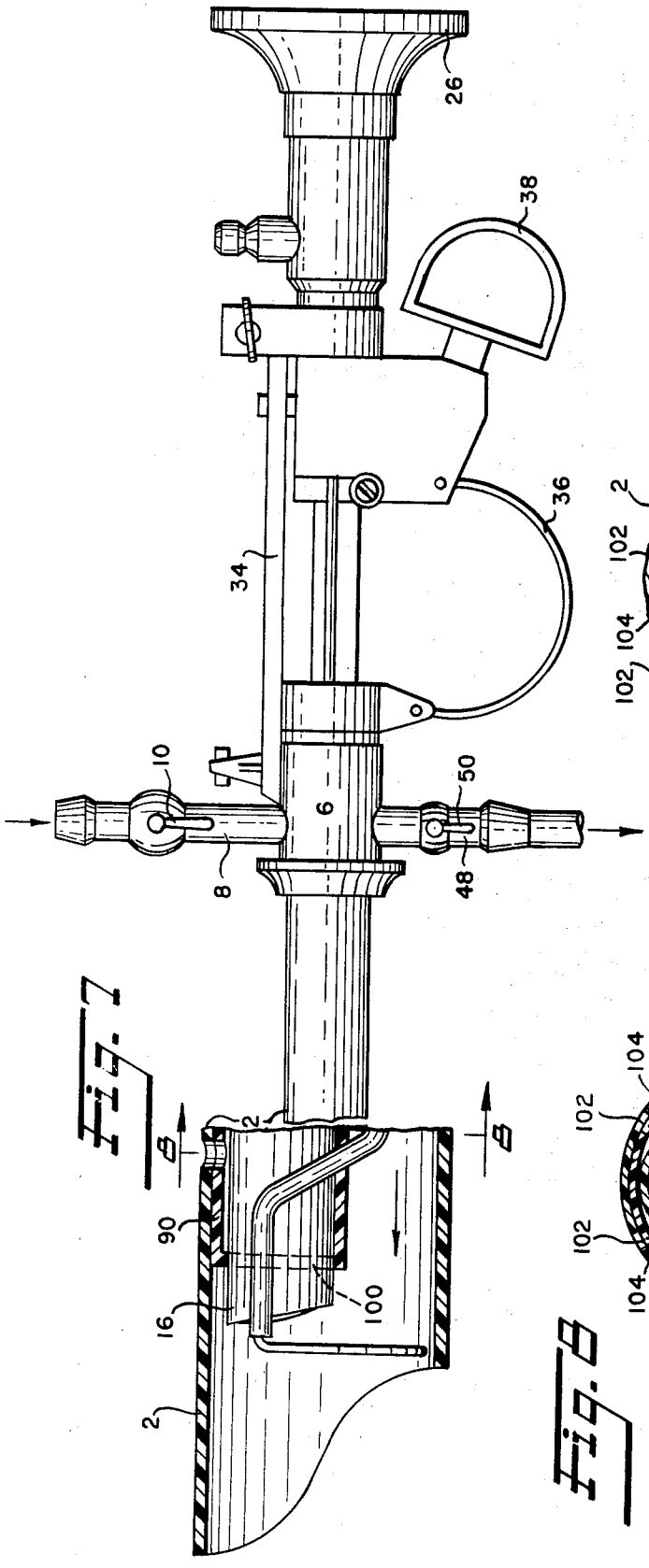


Fig. 7

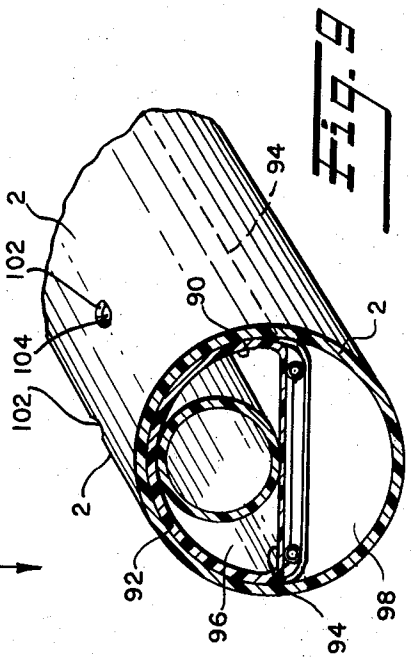


Fig. 9

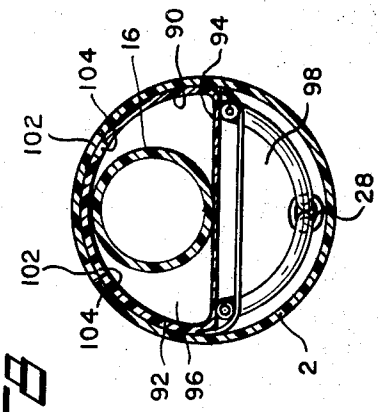


Fig. 8

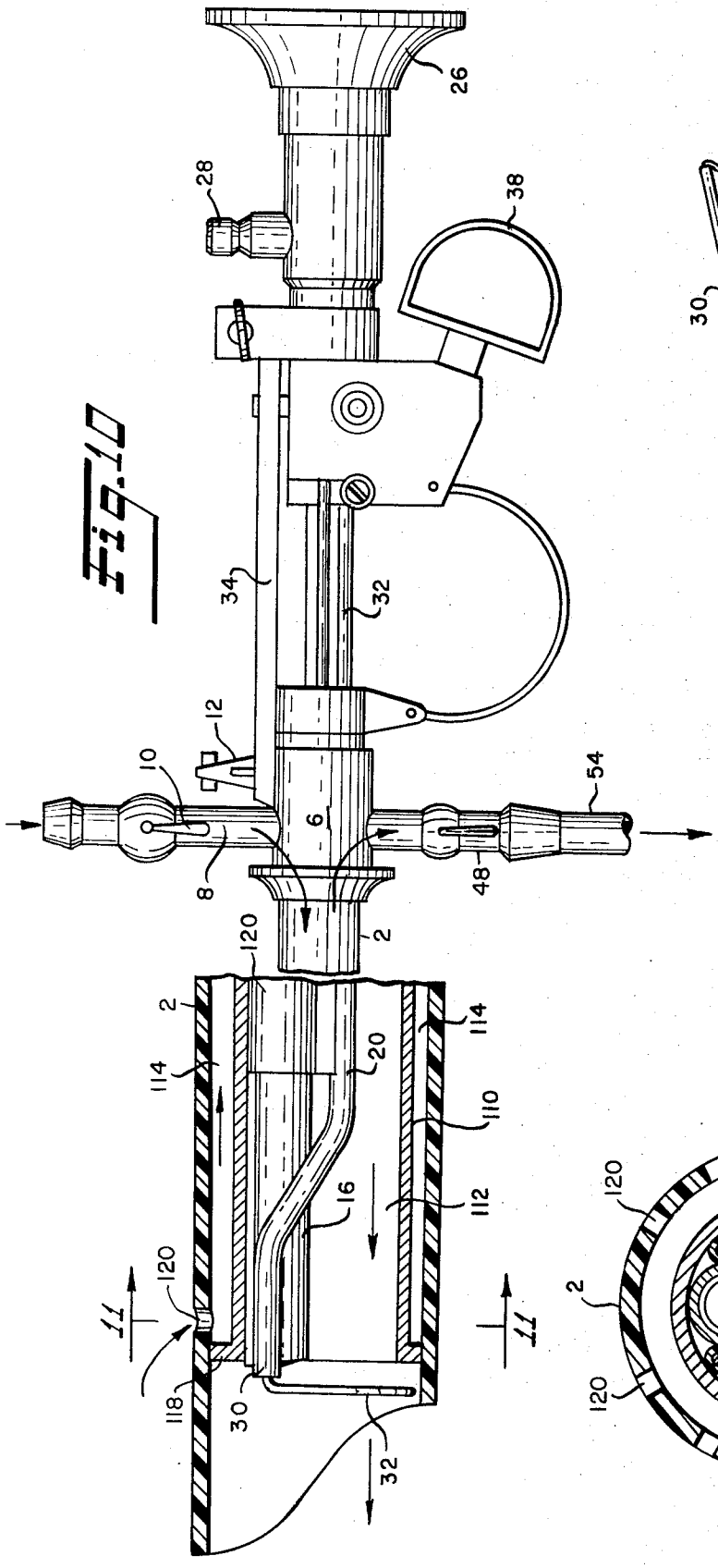


Fig. 10

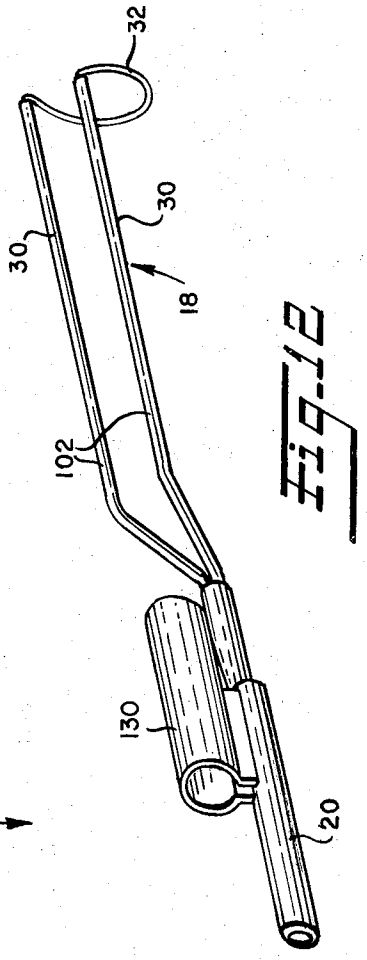


Fig. 12

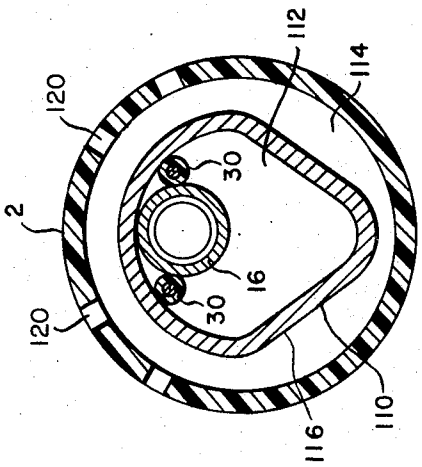


Fig. 11

ENDOSCOPE WITH CONTINUOUS IRRIGATION

RELATION TO OTHER CASES OF OTHER CASES

This application is a continuation-in-part of my copending applications Ser. No. 268,806, filed July 3, 1972 for Resectoscope With Continuous Irrigation, and Ser. No. 368,186, filed June 8, 1973, for Endoscope With Continuous Irrigation.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view, partly in section, of a resectoscope according to the prior art;

FIG. **2** is a sectional view taken on line **2—2** of FIG. **1**;

FIG. **3** is a side view, partly in section, showing one embodiment which the invention may take, the part in section being enlarged to more clearly disclose the internal structure of the instrument;

FIG. **4** is a sectional view taken on line **4—4** of FIG. **3**;

FIG. **5** is a side view, partly in section and similar to FIG. **3,** showing a second embodiment of the invention;

FIG. **6** is a sectional view taken on line **6—6** of FIG. **5**;

FIG. **7** is a side view, partly in section and similar to FIGS. **3** and **5,** showing another embodiment of the invention;

FIG. **8** is a sectional view taken on line **8—8** of FIG. **7**;

FIG. **9** is a perspective view of parts shown in FIGS. **7** and **8**;

FIG. **10** is a side view, partly in section and similar to FIGS. **3, 5** and **7,** showing a fourth embodiment of the invention;

FIG. **11** is a sectional view taken on line **11—11** of FIG. **10**; and,

FIG. **12** is a perspective view of the cutting loop assembly illustrated in FIG. **10.**

BACKGROUND OF THE INVENTION

Endoscopic instruments are widely used in urology and are introduced through the urethra to perform various operative procedures at the operative field such as the bladder, prostate or urethra, typical instruments being the resectoscope, urethro-cystoscope, lithotriptor, and biopsy endoscopic forcep.

In this specification the invention will be described in specific connection with the endoscopic instrument known as the resectoscope, which is the most complex urological instrument, but this is for illustration only as the invention is applicable to all urological endoscopic instruments.

A resectoscope is an endoscopic instrument for the transurethral resection of pathological tissues from the prostate or bladder without incision. A resectoscope of known and conventional construction is disclosed in FIGS. **1** and **2** as background for disclosure of the invention, and comprises the tubular sheath **2** which provides a passageway through the human urethra to the area of visual and operative interest, and which has a beak **4** at its distal end the shape of which is such that the side walls thereof recede in the proximate direction from the upper part of the distal end of the beak to the lower part. At its proximate end the sheath has a socket

base **6** at which there is a tube **8** with stopcock **10** for the introduction of clear irrigating fluid, a thumb screw **12** for attaching the sheath's socket to the working element **14** for activating the cutting electrode in performing an operation. Within the sheath are the telescope **16,** the cutting loop electrode assembly **18,** and an outflow conduit **20.**

The telescope has an objective lens **22** at its distal end and an ocular lens (not shown) and eyepiece **24** at its proximal end. Light conductors (not shown) extend through the telescope from an external connection **26** to the distal end for providing illumination.

The cutting loop electrode assembly **18** comprises the elongated hollow stem **28** from the distal end of which there protrude the two parallel arms **30** which are connected at their distal ends by a depending semicircular bare wire cutting loop **32** which is activated by high frequency electrical energy to resect pathological tissues and coagulate bleeding vessels. The stem **28** and arms **30** transmit reciprocating movement of the working element **14** to the cutting loop.

The working element **14** is connected by bridge member **32** to the cutting loop assembly stem **28** through the socket base **6** and may be moved toward and away from the socket base on runners **34** against the force of spring **36** by the surgeon's operation of thumb holder **38,** which movement is transmitted to the cutting loop through stem **28.**

In transurethral operative procedures there must be a fluid medium at the operative field, and proper visualization requires the presence of a clear fluid medium between the objective lens of the telescope and the tissues being observed. In known resectoscopes this is intended to be provided by the inflow of more than 300 c.c. per minute of clear fluid through the sheath which is delivered by gravity from a reservoir which is elevated more than 50 cm. above the bladder, and is controlled at the tube **8** by stopcock **10.** However, blood is produced by the resected tissues, making a turbid bloody medium at the operative field with consequent obscuring of the field and dangerous over-distention of the bladder. At this point the surgeon must stop the operation and remove the working element from the sheath in order to empty the turbid bloody fluid from the bladder through the sheath, which remains in place within the urethra. This procedure causes the fluid at the operative field to flood through the sheath, drenching the surgeon and the adjacent area of the operating theater, and this undesirable occurrence has become a conventional and expected feature of present transurethral operations. This interruption of the surgical procedure must be performed frequently when known resectoscopes are used, and these periodic interruptions produce dangerous difficulties such as temporary loss of visual orientation, prolonged bleeding and extended operative time. To avoid these frequent interruptions some surgeons attempt to maintain a clear medium at the operating field for a longer time by increasing the volume of clear fluid inflow by raising the exterior reservoir. This practice increases the intravesical hydrostatic pressure, over-distending the bladder and making possible dangerous complications when the intravesical pressure exceeds 30 cm. of water, which is the critical pressure for the absorption of the irrigant fluid into the circulatory system, producing the dangerous and sometimes fatal hypervolemic syndromes.

In an attempt to relieve over-distention of the bladder during an operative procedure, an outflow conduit such as that shown at **20** in FIG. **1** has sometimes been provided within the sheath of known resectoscopes, and therefore within the inflow conduit which is provided by the sheath, having its distal or inlet end spaced a considerable distance proximate to the distal end of the sheath and the objective lens of the telescope, and at its proximate end is connected to discharge through a lateral outlet (not shown). When the intravesical pressure increases, a part of the clear fluid inflow is drained through this outflow conduit thus preventing over-distension of the bladder. The turbid fluid from the operative field never reaches the inlet of such an outflow conduit because it cannot pass through the region of higher hydrostatic pressure of the inflowing clear fluid in the sheath, and part of the inflowing clear fluid in the sheath is therefore drained through the outflow conduit and never reaches the operative field in front of the lens. When such an outflow conduit is provided the net result is a reduction of the inflow rate, which has an adverse effect on the visibility in front of the lens, and the clear fluid which is drained before reaching the end of the sheath is entirely ineffective and is wasted. This explains why every time the stopcock of the outflow conduit is opened only a clear inflow fluid is drained, and is the reason why several modern resectoscopes have eliminated this outflow conduit.

SUMMARY OF THE INVENTION

An endoscopic urological instrument according to the invention has continuous clear vision of the operative field caused by continuous inflow of clear irrigating fluid to the operative field and simultaneous continuous outflow of turbid fluid from the operative field. This is done by providing two separate conduits within the sheath of the instrument through one of which clear irrigating fluid is constantly supplied to the operative field and through the other of which turbid fluid is constantly removed from the field under the influence of suction. The outlet port of the inflow conduit is within the beak of the sheath and below and in front of the objective lens of the telescope which forms part of the instrument, and the inlet port of the outflow conduit opens from the exterior of the sheath above and to the rear of the objective lens and to the rear of the beak, so that clear fluid flowing through the inflow conduit is compelled to pass in front of the lens and into the operative field before reaching the entrance to the outflow conduit. The two conduits are of substantially the same size to permit substantially equal fluid flows and the continuous flow of clear and turbid fluids is maintained by suction applied to the outflow conduit.

DESCRIPTION OF THE INVENTION

A resectoscope constructed in accordance with the invention is disclosed in FIGS. **3** and **4.** In this instrument the outflow conduit **40** is provided in the upper wall of the sheath **2,** being formed by a part **42** of the upper wall of the sheath and a lower wall **44** which is spaced below the wall part **42.** At its proximal end, at the socket base **6,** conduit **40** communicates with a source of suction through external tube **48** which is controlled by stopcock **50.** In the disclosed embodiment tube **48** communicates with a disposal container **52** through flexible tube **54** and closure **56,** and a pump **58** exhausts the container **52** thus applying suction to outflow conduit **40.** The outflow conduit **40** is closed at its distal end as shown at **60** and the inlet to this conduit from the operative field is provided by one or more ports **62** in the upper wall of the sheath which are above and to the rear of the objective lens **22** of the telescope and to the rear of the beak **4.** The second or inflow conduit **46** is formed by the interior of the sheath itself. The distal or outflow port of this conduit is open and within the beak **4** and below and in front of the objective lens of the telescope. At its proximate end this conduit communicates with an external tube **8** and stopcock **10** through which clear irrigating fluid is supplied to the operative field through the interior of the sheath. The two conduits are of such size that they conduct substantially equal flows of fluid, and it will be apparent that by manipulation of stopcocks **10** and **50** the inflow of clear fluid through conduit **46** and the outflow of turbid fluid through conduit **40** may be adjusted and controlled, thus also controlling the degree of distention of the bladder.

In order to accommodate the upper conduit **40** and permit it to be of sufficient size, the telescope tube **16** is lowered from its conventional position at the upper part of the sheath and made concentric with the sheath as shown in FIG. **4,** thus enlarging the space available for conduit **40.**

In a second form of resectoscope which the invention may take, which is disclosed in FIGS. **5** and **6,** one of the two conduits is provided by a tube which surrounds the telescope tube but is larger in cross section, and the second conduit is provided by the space within the sheath and outside the tube which provides the first conduit. In this embodiment the telescope **16** is surrounded throughout substantially its entire length by a second tube **70** which engages the bottom and sides of the telescope and the space **72** between the upper part of the telescope and the upper part of tube **70** provides the outflow conduit, which is connected at the socket base **6** to a source of suction through external tube **48** and stopcock **50** as disclosed in FIG. **3.** The outflow conduit **72** is closed at its distal end as shown at **74** and the inlet to this conduit is provided by registering ports **76, 78** in the upper wall of the sheath **2** and the upper wall of tube **70,** which are to the rear of and above the objective lens of the telescope. The inflow conduit is provided by the space **80** within the sheath **2** and outside the tube **70** and this conduit communicates through external tube **8** and stopcock **10** with a source of clear irrigating fluid. The outlet port of this inflow conduit, at the distal end thereof, is within the beak of the sheath and below and in front of the objective lens of the telescope, and the two conduits are of such size that they conduct substantially equal flows of fluid.

A further embodiment of the invention is disclosed in FIGS. **7, 8** and **9.** In this embodiment the telescope tube **16** is positioned at the upper part of the sheath **2** and is surrounded throughout substantially all of its length by a tube **90** which is semi-circular in cross section with its arcuate wall **92** adjacent or abutting the inner wall of the upper part of the sheath and its flat lower wall **94** lying substantially in the center of the cross section of the sheath. Tube **90** is larger in cross section than the telescope tube and the free space **96** within it provides the outflow conduit according to the invention, while the inflow conduit **98** is provided by the space within the sheath and beneath tube **90.** At its distal end the

outflow conduit **96** is closed by a wall **100** and the inlet to this conduit is provided by one or more pairs of registering openings **102, 104** in the upper wall of the sheath and the upper wall **92** of tube **90,** respectively, which are to the rear of the beak of the sheath and above and to the rear of the objective lens of the telescope. The distal end of the inflow conduit **98** is within the beak of the sheath and below and in front of the objective lens of the telescope. At its proximate end, at the socket base, the outflow conduit **96** is connected through external tube **48** and stopcock **50** to the source of suction as shown in FIG. **3,** and at its proximate end the inflow conduit is connected through external tube **8** and stopcock **10** to the source of inflowing clear fluid which is maintained more than **50** cm. above the level of the bladder. The two conduits are of such size that they conduct substantially equal flows of fluid.

In a further form which the invention may take, which is disclosed in FIGS. **10** to **12,** a fine metal tube **110** extends longitudinally within the sheath **2** and surrounds the telescope **16** and the stem **20** and arms of the cutting loop assembly **18** and is larger than these parts in cross section, whereby the interior of the tube forms the inflow conduit **112** of the instrument. This tube is smaller in cross sectional area than the sheath, leaving a space **114** between the tube and the sheath which forms the outflow conduit. The tube **110** is cylindrical in shape at its distal end and proximal to this cylindrical part the sides of its lower part converge downwardly to provide a generally triangular shape as shown at **116** in FIG. **11** in order to increase the capacity of the outflow conduit **114.**

At its proximal end at the socket base **6** of the instrument the inflow conduit provided by the interior of tube **110** communicates with external tube connection **8** through which clear irrigating fluid is provided to the operative field. At the distal end of the instrument the outflow conduit **114** is closed by a ring **118** which extends radially from the circular exterior wall of the tube **110** to the interior wall of the sheath **2,** thus closing the distal end of the outflow conduit **114,** the inlet to which is provided by two or more openings **120** in the sheath **2** adjacent the distal end thereof, which are to the rear of the objective lens of the telescope. At its proximal end at the socket base the outflow conduit **114** communicates with a source of suction through external tube **48,** and turbid fluid from the operative field is discharged through this external tube connection to the disposal container, the discharge being accelerated by suction to compensate the difference of pressure between the inflow pressure (50 cm. of water) and the intravesical pressure below 30 cm., avoiding the accumulation of turbid fluid in the bladder. At its distal end the inflow conduit **112** is open and within the beak and is below and in front of the objective lens of the telescope.

In the preferred form of this embodiment of the invention the closure at the distal end of the outflow conduit is provided by causing the interior wall of the sheath to converge slightly from its proximate end to the distal end, the difference in diameters at the two ends being of the order of 1 mm. The exterior diameter of the closure ring **118** is made equal to the interior diameter of the sheath at its distal end so that when the tube **110** and its closure ring **118** are inserted into the sheath from the proximate end thereof the insertion will be stopped by engagement of the periphery of the closure ring **118** with the smaller end of the sheath at the distal end thereof, thereby providing the required closure of the outflow conduit. The parts are so constructed that this engagement of the closure ring with the interior of the sheath will take place at a point in front of, i.e., on the distal side of, the ports **120** which provide the inlet to the outflow conduit.

The tube **110** surrounds the stem **20** and the arms **30** of the cutting loop assembly **18** as well as the telescope **16.** In accordance with the invention the arms **30** of the cutting loop assembly are elongated by approximately 2 centimeters with respect to the length of the arms of the conventional cutting loop assembly and because of this elongation the bare cutting wire **32** of the cutting loop assembly is positioned outside the distal end of tube **110** in the normal, un-extended position of the cutting loop assembly, and as the cutting loop assembly is operated the arms **30** are stabilized by sliding engagement with the inner walls of tube **110** as illustrated in FIG. **11.** In order to support and further stabilize the cutting loop assembly a short tube **130** is mounted on the distal end of stem **20** and surrounds the distal end of the telescope tube **16** and slides along that tube when the cutting loop assembly is reciprocated in performing an operation.

In accordance with the invention the parts are so designed and constructed that the inflow and outflow conduits are of substantially the same size so that they will conduct substantially the same volume of fluid per unit of time, thus permitting the continuous inflow-outflow fluid system which is provided for the first time by this invention, and the outflow conduit is subjected to suction in the manner and with the results described above.

In further accordance with the invention the arrangement of the parts of the instrument is such that the outlet port of the inflow conduit and the inlet port of the outflow conduit are separated in space, with the objective lens of the telescope and the operative field itself in the path of flow of fluid from the inflow conduit to the outflow conduit so that clear inflowing fluid is constantly in front of the objective lens, giving continuous clear vision.

The application of the invention to cystoscopes other than resectoscopes will be apparent to urological surgeons and others skilled in the arts to which the invention relates, and will usually involve the choice of which of the two conduits is to be used for inflow or outflow.

I claim:

1. A urological endoscopic instrument, comprising an elongated cylindrical beaked sheath, a telescope extending longitudinally and interiorly of the sheath and having an objective lens at its distal end, an inflow conduit extending longitudinally and interiorly of the sheath having its discharge port below and in front of the objective lens and within the beak of the sheath, an external fluid conducting connection at the proximate end of the inflow conduit for connection to a source of clear irrigating fluid, an outflow conduit extending longitudinally and interiorly of the sheath and having an inlet port provided by at least one opening from the outside of the sheath above and to the rear of the objective lens and to the rear of the beak, and means for applying suction to the outflow conduit.

2. An instrument according to claim 1, in which the two conduits are of substantially the same size to conduct substantially the same volume of fluid.

3. An instrument according to claim 1, in which the inflow conduit is formed by the interior of the sheath and the outflow conduit is formed by the space between the upper wall of the sheath and a second wall spaced radially inwardly of the sheath therefrom.

4. An instrument according to claim 3, in which the distal end of the outflow conduit is closed and the inlet to the outflow conduit is provided by a port in the upper wall of the sheath adjacent its distal end which communicates with the outflow conduit.

5. An instrument according to claim 1, in which the telescope and the sheath are concentric.

6. An instrument according to claim 1, comprising a tube extending longitudinally and interiorly of the sheath and surrounding the telescope and being larger than the telescope and smaller than the sheath in cross section, the outflow conduit being provided by the interior space of the tube and the inflow conduit being provided by the space between the tube and the sheath.

7. An instrument according to claim 6, in which the lower part of the tube engages the lower part of the telescope and the outflow conduit is provided by the space between the upper part of the telescope and the upper part of the tube.

8. An instrument according to claim 6, in which the tube is substantially semicircular in cross sectional shape, and the outflow conduit is provided by the space between the telescope and the sides of the tube.

9. An instrument according to claim 6, comprising in addition a closure between the distal end of the tube and the interior wall of the sheath, and at least one opening in the sheath proximate to the closure forming an inlet for the outflow conduit.

10. An instrument according to claim 1, comprising a tube extending longitudinally and interiorly of the sheath and surrounding the telescope and being larger than the telescope and smaller than the sheath in cross section, the inflow conduit being provided by the interior space of the tube and the outflow conduit being provided by the space between the tube and the sheath.

11. An instrument according to claim 10, comprising in addition a closure between the distal end of the tube and the interior wall of the sheath and at least one opening in the sheath proximate to the closure forming an inlet for the outflow conduit.

12. An instrument according to claim 10, in which the walls of the tube forming the inflow conduit converge downwardly throughout at least a part of their length whereby to increase the cross sectional area of the outflow conduit between the tube and the sheath.

13. An instrument according to claim 10, in which the interior wall of the sheath converges from the proximal to the distal end of the sheath, and at the distal end the internal diameter of the sheath is substantially equal to the external diameter of the closure.

* * * * *