

[54] **SPECULUM INSTRUMENT WITH DISPOSABLE FORWARD SECTION**

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 [51] Int. Cl. **A61b 1/06, F16l 35/00, F16l 55/00**
 [58] Field of Search **128/6; 285/39, 321, 285/331**

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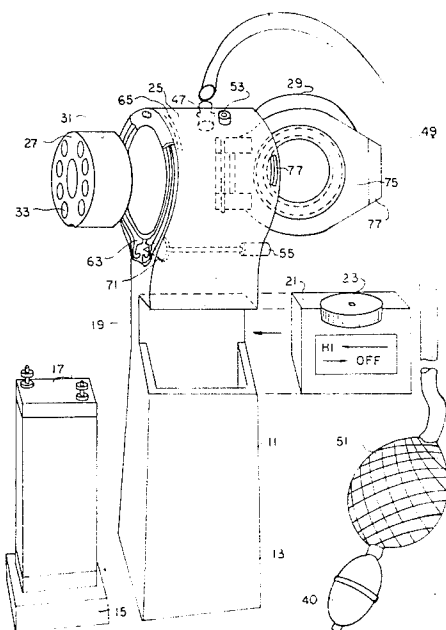
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[57] **ABSTRACT**

Speculum instrument for use with disposable plastic (polyethylene) sigmoidoscope or proctoscope tube. The elongated tubes are tapered to provision for the geometric optics employed, and contain a light shield, which acts to diffuse the light source and also protect the light source and instrument from cantamination. The tubes contain a rectangular groove that provides for its captivation by the instrument. A disposable plastic obturator is also provided with each tube. The instrument is fitted with a cylindrical lamp holder assembly having a plurality of lamps, an eye piece that allows one to look through the cylinder of lamps, a spring retaining ring that provides for the colletting of the disposable tubes, a cam push button arrangement for opening the retaining ring collet and ejecting the disposable tube, a handle that contains a rechargeable battery, a reostat with thumb wheel which controls the amount of light, a fitting for rubber tubing to allow for the admission of air, an air valve for the release of air, and gasket seals to provide for an air tight assembly.

5 Claims, 10 Drawing Figures



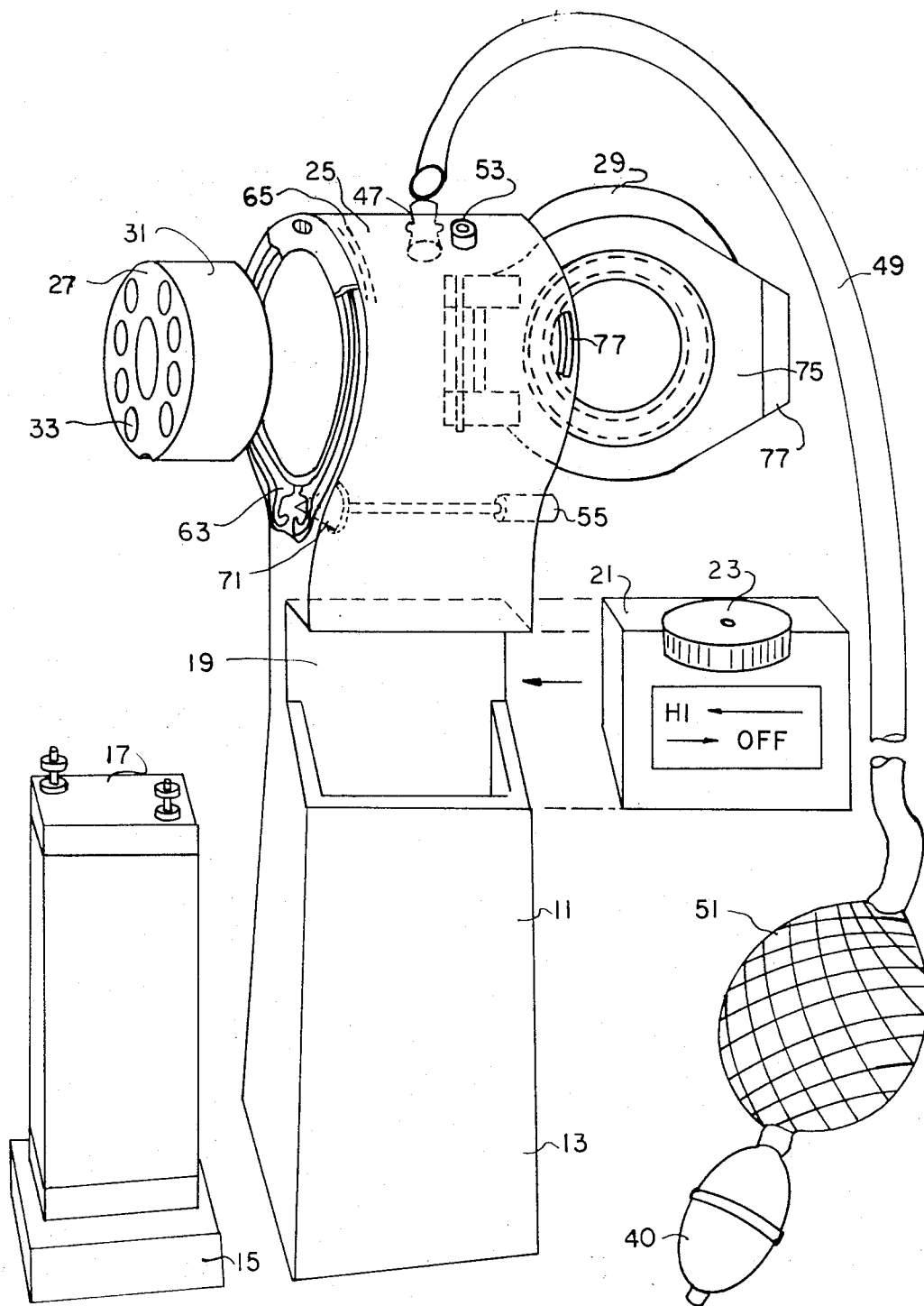
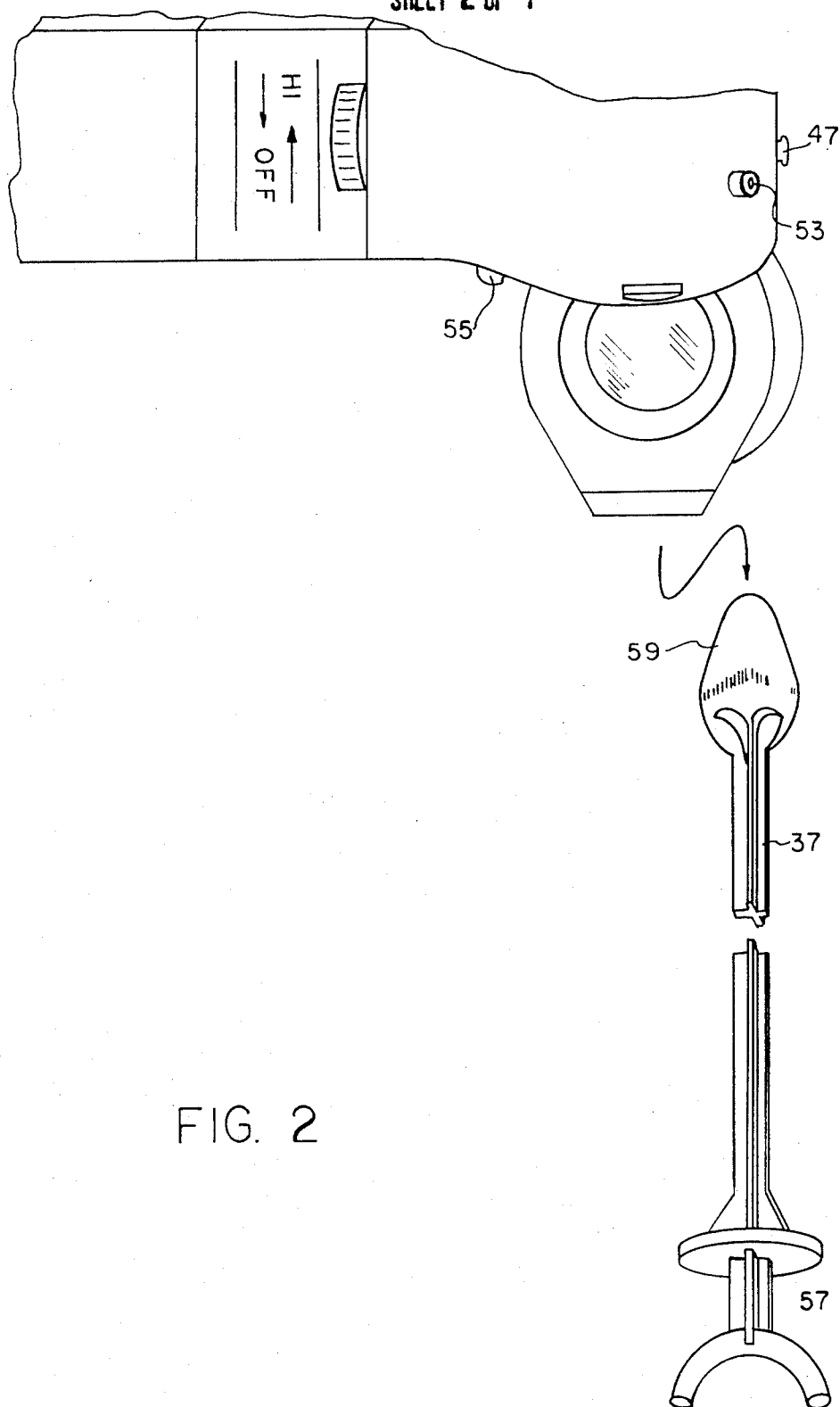


FIG. 1



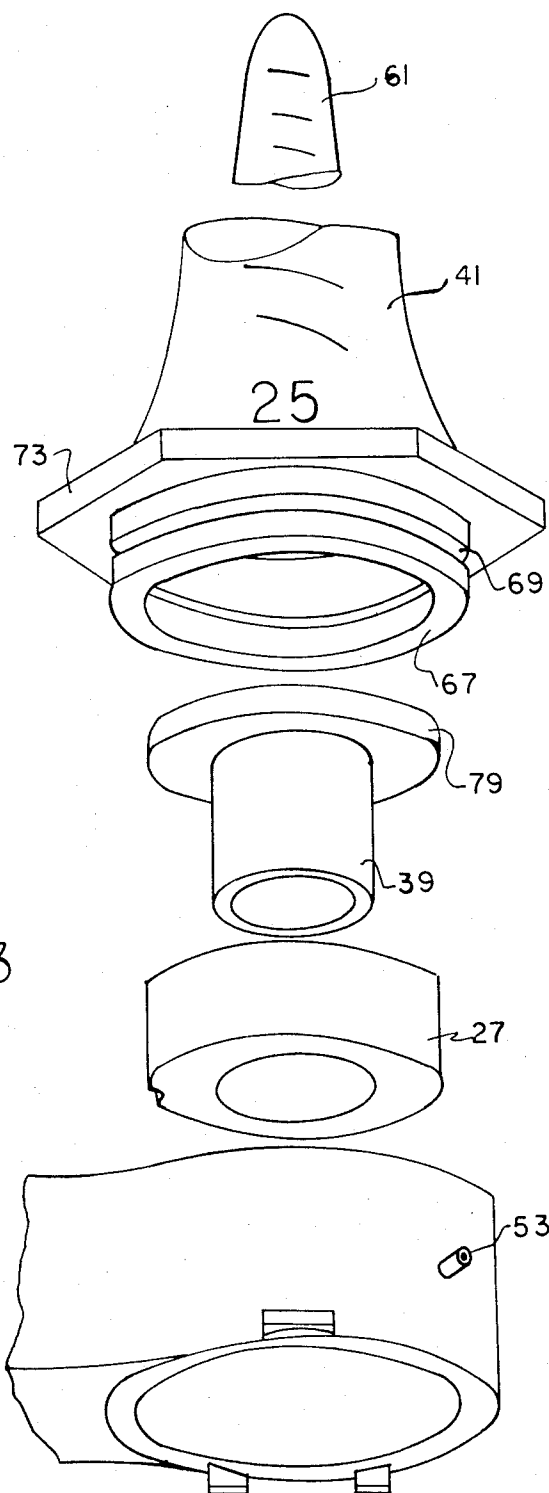


FIG. 3

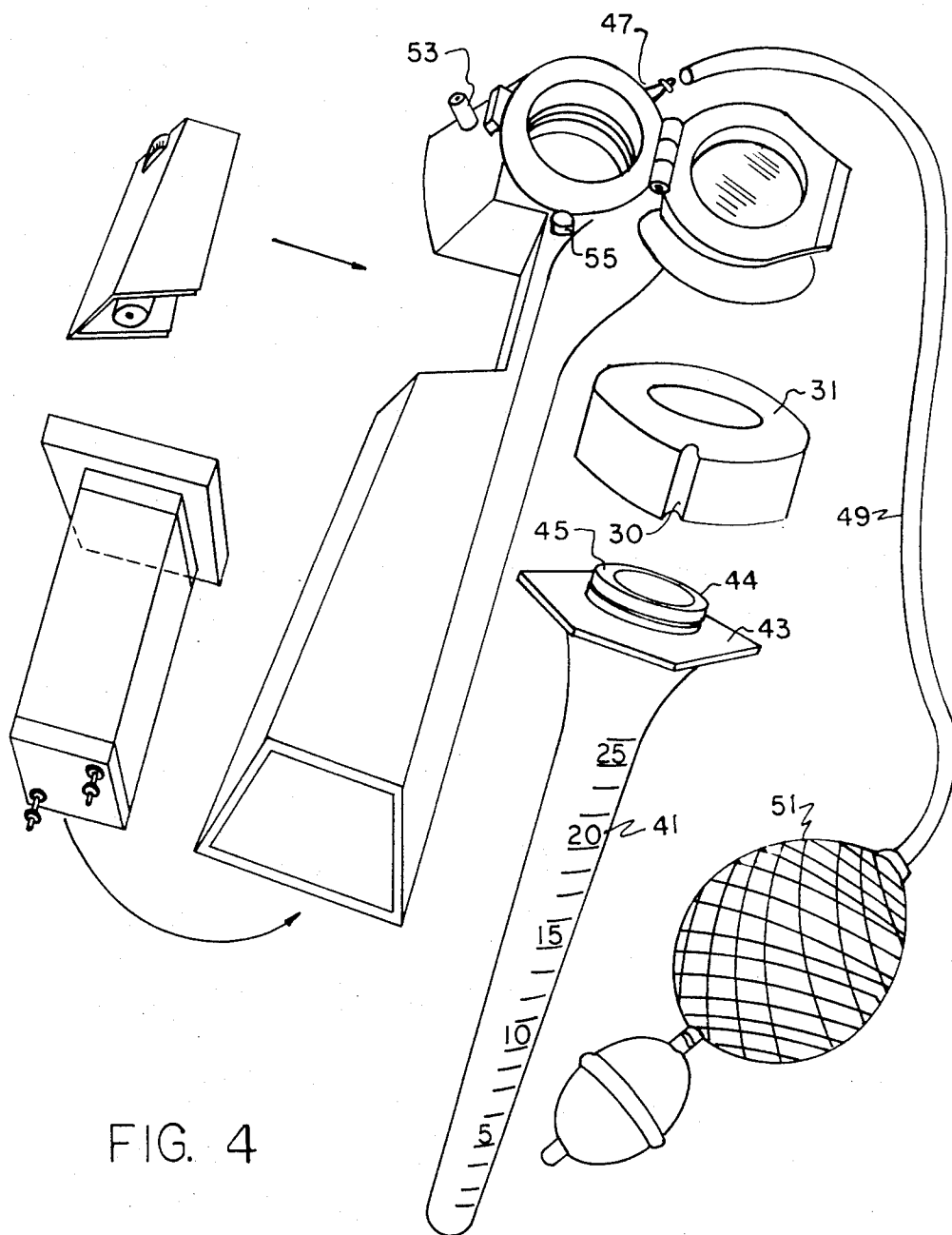


FIG. 4

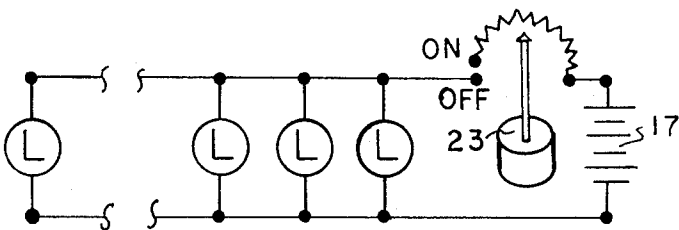


FIG. 5

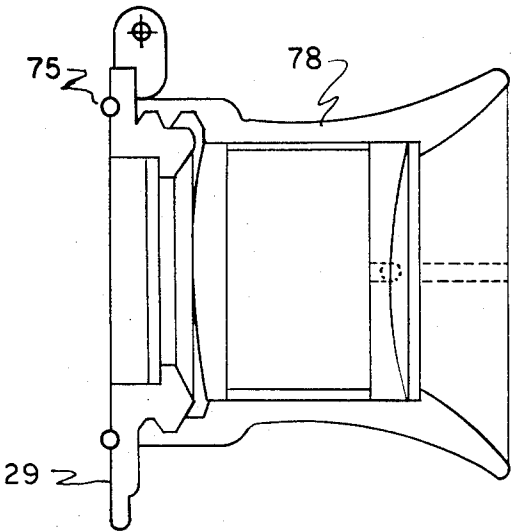


FIG. 6

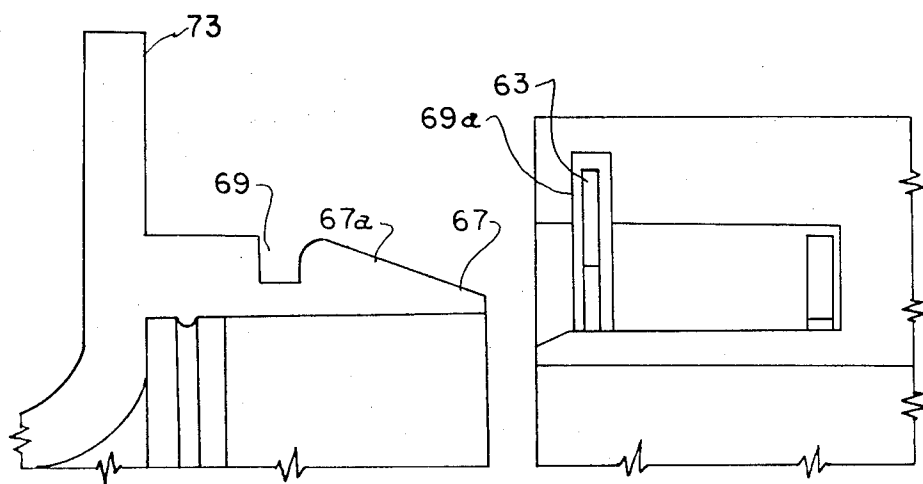


FIG. 7

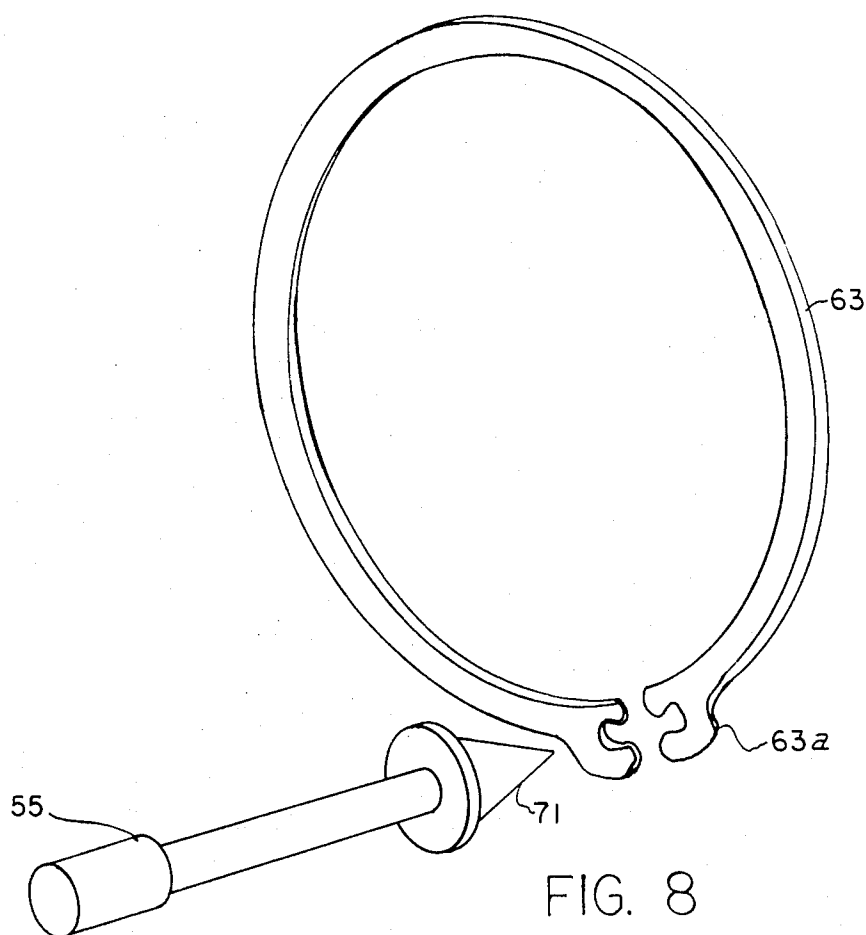


FIG. 8

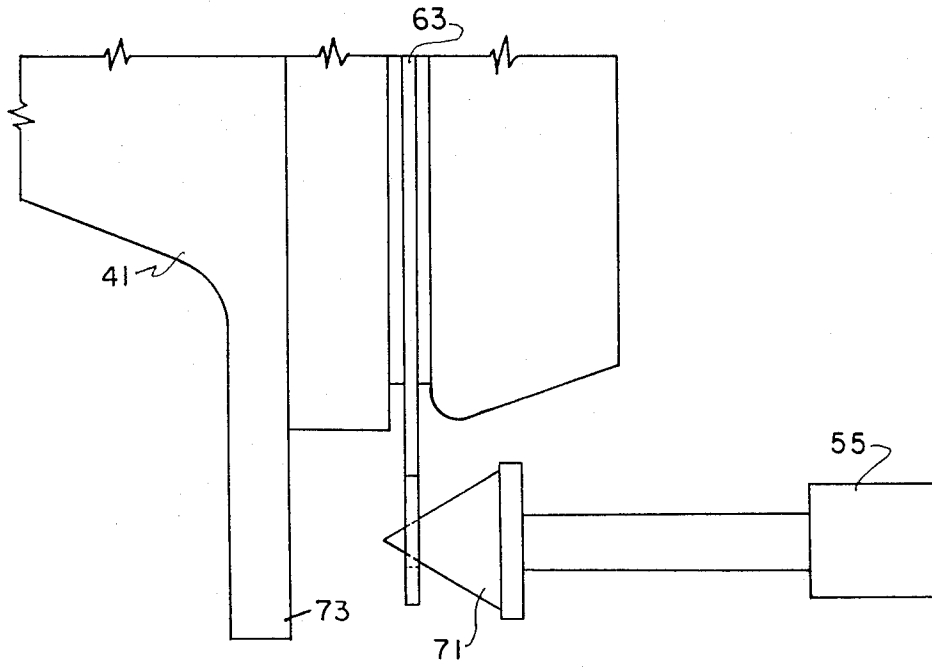


FIG. 9

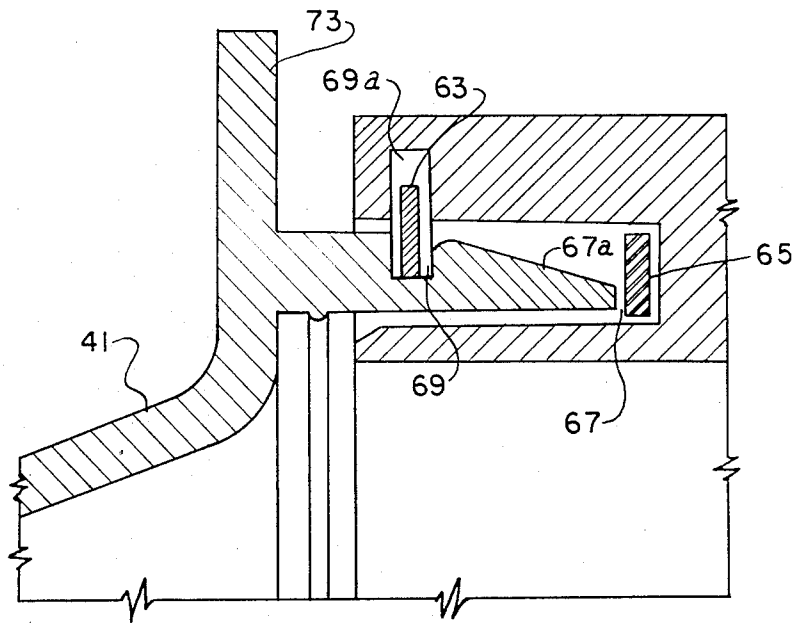


FIG. 10

SPECULUM INSTRUMENT WITH DISPOSABLE FORWARD SECTION

BACKGROUND OF THE INVENTION

The present invention relates to speculum instruments having rapid, easy coupling and releasing means for a disposable forward section, either sigmoidoscope or proctoscope and more particularly, a cordless speculum instrument having a contamination free lighting arrangement.

DESCRIPTION OF THE PRIOR ART

Speculum instruments may be defined broadly as instruments adaptable for insertion into a body opening, human or animal, in order to medically observe or treat an inner portion. In particular, rectal speculum instruments, which generally include proctoscopes, anosopes and sigmoidoscope, have become increasingly important in routine and preventative medical examinations, as well as for medical treatment. More specifically, there is increased use of sigmoidoscope for examination and treatment of the upper reaches of the colon in conjunction with the early diagnosis of cancer and treatment thereof. The ease of use of the speculum instrument together with good illumination are highly desirable for this purpose.

Instruments of this type have been produced using fiber optics for illumination. These have various shortcomings. One, because of the brittle nature of the plastic employed, it can crack and shatter in a fashion similar to glass. Secondly, it does not present a uniform light field, leaving a dark spot in the center. Another problem has been that of the electric cord. Assistants have tripped over the cord causing complications. There has been considerable controversy with regard to the light source; in view of this situation, some authorities even suggest that a light source should be external to the instrument. It is quite apparent that a one-piece instrument is better than a two piece instrument and what is required is a light source which is part of the instrument, but which is readily controllable and which will be external to the patient. Heretofore, a light source near the end of the instrument would suffice for short-length speculum devices where relatively low lighting levels are sufficient. However, in the longer speculum instruments, such as a sigmoidoscope, where the effective length may be on the order of 25 centimeters and where the instrument is of necessity an enclosing cylinder, more lighting is necessary because of the distance involved and the inverse square law relationship for illumination.

Because of this situation it is usual design practice in sigmoidoscope to have the light source placed inside the cylindrical tube adjacent the forward end. In this position, however, the light source is subject to contamination from contact with the patient, impeding reuse for other patients without intervening cleansing. Therefore, the highly desirable disposability concept of the sigmoidoscope is limited by its being combined and employed with a lighting means which is not disposable or immediately reusable.

Another problem associated with the above described and other lighting means incorporated with the speculum relates to the ease of assembly and detachability of the disposable parts from the lighting means without disturbing or contaminating the light source. A further problem with proctoscopic devices employing

an obturator relates to provision for removing the obturator while the lighting means is in position without subsequent reassembly of component parts.

SUMMARY OF THE INVENTION

Generally speaking, the present invention contemplates an optical medical instrument for use with a single use disposable plastic speculum and obturator. The instrument handle has space for the insertion of a rechargeable battery, and contains a reostat with a thumb wheel which controls the reostat. The instrument houses a cylindrical lamp holder having a plurality of lamps. These lamps are connected in parallel with each other and in series with the battery, reostat and thumb wheel control. The lamp assembly is fitted with electrical pin connections which mate up with receptacles in the handle. The lamp assembly can be easily removed for replacement at end of life of the lamps. In line with the axis of the speculum and behind the lamp cylinder assembly is an eye piece which can swing out of the way for removal of the obturator or to allow for the introduction of a suction catheter during the examination. The eye piece is fitted with precision optics to allow for variation in the examiner's vision and provide an optimal depth of field at the distant position of the speculum. Interchangeable lenses are available for different specula. The instrument is fitted with a spring retaining ring which captivates the disposable speculum while also making an air pressure tight seal between the speculum and the instrument. The eye piece is also fitted with an O-ring to provide an air seal when it is swung into the closed position. An air fitting is provided on the body of the instrument for connecting a rubber tube and air bag to allow air to be pumped into the barrel of the tube during examination. An air release valve is also affixed to the body of the instrument to control the release of air during examination.

The invention, as well as other objects and advantages thereof, will become more readily apparent from the following detailed description when taken together with the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective and partly exploded view of some of the components used in the inventive concept;

FIG. 2 shows another perspective view of some of the components used in the inventive concept;

FIG. 3, likewise presents in a perspective view, components contemplated herein;

FIG. 4 is a partly exploded and perspective explanation of most of the components of the device contemplated herein;

FIG. 5 is a schematic diagram of the electric circuitry used herein;

FIG. 6 is a cross-sectional view of the optical train contemplated;

FIG. 7 is a sectional view of a portion of the instrument explaining the union of the disposable part thereto;

FIG. 8 is a perspective view of the union components;

FIG. 9 is a side view of the release mechanism; and,

FIG. 10 is a sectional view of the union of the disposable part to the instrument.

DETAILED DESCRIPTION

Shown in the drawing is an elongated handle 11 serving as the battery housing. Handle 11 having a trapezoi-

dal cross-section has a lower portion 13 which will contain a rechargeable battery assembly 17. The battery contained in assembly 17 consists of commercially available rechargeable nickel-cadmium sealed cells available from various companies under various trademarks, e.g., G.E. Batteries, Marathon Batteries. Battery assembly 17 fits into handle 11 when inserted from the lower portion 13 and electrical contact is made by means of miniature pin jacks. The battery assembly is retained in the instrument handle by two machine screws. At the upper portion of the instrument handle is an opening 19 to receive a holder 21 for the reostat and thumb wheel 23 which moves the reostat contact. Thus, by turning the thumb wheel, the lamps can be switched from off to on and the current through the lamps and thereby their intensity can be controlled. The upper portion of the drawing shows the cylindrical head 25 of the instrument which houses the cylindrical lamp holder assembly 27 at the front and has an eye piece holder 29 at the rear. Lamp holder assembly 27 consists of hollow metal cylinder with a thick cylindrical wall 31. Eight lamps 33 are disposed within this wall. At the inner end of the lamp holder unit is a printed circuit board (shown schematically in FIG. 5) which connects the miniature lamps in parallel and terminates in two conductor pin plugs. The cylinder contains a guide key 30, and fits snugly within the cylindrical head of the instrument while engaging two mating pin connectors. The miniature lamps contain lenses to concentrate the light in the forward direction of the instrument. The polished metal walls around the lamps act as reflectors and scatter the light in the forward direction of the instrument. The lamp holder assembly is kept in the instrument head 25 at all times in normal use and is only removed for replacement in case of lamp failure or end of life of the lamps. As is customary in this type of instrument, an air fitting nipple 47 is attached to the head 25. An air release valve 53 is also attached to the instrument head 25. A retaining ring 63 is located at the front face of the instrument head and acts as a collet when holding and receiving tube 41. Directly behind retaining ring 63 is rubber pad 65 which is compressed and forms an air seal with the insertion of tube 41 against the edge 67 when it is retained in groove 69. Release button 55 is connected to cam activator 71 which when depressed works against the spring action of the retaining ring 63 to release it from the groove in the tube and thence pushing on the tube wall 73 to eject the tube 41 from the instrument.

This arrangement is shown in FIGS. 7 to 10. As is evident, it is necessary to quickly release the disposable tube barrel 41 from the instrument head 25. On the inner end of the barrel 41 is an outer groove 69 and on the inner portion of the head 25 is a corresponding groove 69a, as shown in FIG. 7. Now, as shown in FIG. 7, the inner edge 67 of the barrel 41 can slide into the head 25 because of the taper 67a before the inner edge 67. Just past the taper 67a is barrel groove 69, which when the taper 67a is pushed into the head will be opposite corresponding groove 69a. Within groove 69a is ring 63, better shown in FIG. 9. This ring has an enlarged bottom horseshoe section 63a. When release button 55 is pushed, the cam activator 71 will enter the horseshoe section 63a opening the ring so that it does not enter groove 69. However, when the release button is not depressed, the ring assumes the position shown in FIG. 10, engaging both grooves 69 and 69a, so as to

hold the barrel 41 to the head 25. Because of the taper 67a, it is usually possible for the barrel to be inserted into the head without pressing the release button. However, when the ring has engaged groove 69, the barrel will not be separated from the head unless the release button is pressed.

Thus, cam activator 71 centers and opens the retaining ring 63 and can also be used when inserting the disposable barrel 41 in the head to aid in the operation. When groove 69 coincides with groove 69a the ring snaps into groove 69 and latches the disposable barrel into position. The rubber pad 65 is depressed at this point and provides a seal. To disconnect the union, the release button 55 is pressed causing cam activator 71 to slide through the horseshoe section 63a which opens the ring so as to eject the disposable barrel. The ejector is returned to its original position by the spring properties of the ring reacting against cam activator 71.

Eye piece holder 29 is hinged to the instrument head 25 at the rear at an angle of 30° with the horizontal. An O-ring 75 is contained in the eye piece holder to provide an air seal when the eye piece holder 29 is in a closed position and retained by latch 77. The eye piece holder 29 is fitted with a clear lens to permit viewing through the instrument and also effect the air seal when the eye piece holder is latched closed. The eye piece holder 29 is further provisioned to accept a screw on viewer which is comprised of a concave and convex lens to form a Galalian telescope 78 (FIG. 6).

The plastic disposable parts that are used in conjunction with the instrument consist of the sigmoidoscope tube which has a barrel 41, that extends for 25 centimeters and is marked with graduations in centimeters. It has a matching obturator 37 which is a separate part and also made of high density polyethylene. The plastic is opaque and is colored turquoise. In the case of a proctoscope the barrel length extends for 15 centimeters instead of 25 centimeters. The disposable tube has a hexagonal front face 73 for rotational orientation and handling and a tapered end which contains the captivation groove 69 and sealing edge 67. The light shield 39 is a part of the disposable sigmoidoscope tube and is captivated within the hollow portion at a position approximately in line with the front face 73. The light shield 39 is comprised of an opaque plastic hollow thin wall tube fitted to a semi-transparent plastic washer 79. When installed in the instrument with a sigmoidoscope tube the hollow tube of the light shield 39 extends all the way up to the eye piece holder 29 and the semi-transparent plastic washer 79 is up against the lamp assembly 27 so as to isolate the instrument from the patient by means of the disposable parts. Also used in conjunction with the instrument is a hand air pump which contains air bag 51 and rubber tube 49 which gets attached to the instrument air nipple 47. The air bag and tube are commercially available and indeed interchangeable with those used on other medical instruments.

OPERATION OF THE INSTRUMENT

When the instrument is not in use it is inserted into the well of the battery charger, such as described in co-pending patent application entitled "Battery Charger," Ser. No. 174,611, filed on Aug. 25, 1971. The charger is fitted with matching pin jacks to make electrical connection to the rechargeable battery connectors contained in the handle of the instrument 15. The charger

restores the electrical energy to the battery immediately after use and makes the instrument rapidly available for reuse.

The instrument is usually prepared for use by a nurse. The obturator 37 is normally furnished in the barrel of the tube 41. A lubricant is generally applied at the tip 59 of the obturator 37. The instrument is removed from the battery charger and the eye piece holder 29 is unlatched and left open. The sigmoidoscope and obturator are then inserted from the front end of the instrument through the hole in the lamp assembly 27 so that the handle of the obturator 57 extends outside the rear of the instrument at the eye piece holder 29. The tube is pushed inward in the instrument which expands the retaining ring 63 because of the taper of the tube wall between edge 67 and the surface 73 until the retaining ring reaches groove 69 which allows the retaining ring 63 to collapse and thus captivates the tube in the instrument. The instrument is now ready for use by the physician who generally performs his examination in a darkened examination area. Entrance to the body cavity is first made with the obturator forward in the tube with the tip 59 protruding. After access has been achieved past the anus the obturator is removed through the rear of the instrument and discarded. The eye piece holder 29 is then swung shut and the thumb wheel 23 rotated turning the lamps 33 on. The thumb wheel 23 is adjusted to give the desired amount of light. The sigmoidoscope tube 41 is progressively advanced while observing through the eye piece. Air is introduced as desired by means of the hand pump 40 and released by means of the release valve 53 to expand the bowel in front of the tube end. The location of the diagnosis is recorded based on the orientation of the instrument tube in relation to the patient's normal position using the numbers of the face of a clock as reference and the depth of insertion by the distance in centimeters that the tube has been inserted, i.e., 2 o'clock 10 centimeters.

It may be necessary during the examination to remove a small amount of fluid (usually less than a teaspoon full) that has remained in the colon. This is done when the fluid can be seen by opening the eye piece holder door 29 and introducing a suction catheter which is connected to a vacuum line. After the fluid has been removed the eye piece holder 29 is shut and the examination continued. At the completion of the examination the tube is carefully withdrawn and the sigmoidoscope tube is discarded by pushing the release button. The instrument is then inserted in the battery charger which restores the consumed energy to the battery

and the instrument is again ready for use.

We claim:

1. A speculum instrument including an extended handle unit for holding a barrel, comprising in combination:

- a. a hollow cylindrical head at one end of said handle introducing an eye piece pivotally attached thereto;
- b. a hollow cylindrical lamp holder unit held in said head, said handle having a thick cylindrical outer wall with lamp holding places defined in said wall holding a plurality of lamps so as to reflect their light in a direction substantially normal to said extended handle;
- c. a rheostat and thumb wheel control unit removably held at the part of said handle adjacent said head;
- d. a battery space between said unit and said handle other end including means holding a rechargeable battery in said handle, means connecting said battery to said lamps through said rheostat unit; and,
- e. a disposable plastic elongated barrel including a tapered collecting sleeve for latching onto said cylindrical head, said head and said barrel having corresponding circular grooves, a split resilient ring band in said head for engaging said grooves, said ring band having a radially extending enlarged split section, and plunger release means for pressing into the split at said enlarged split section across said head to release said barrel from said head.

2. The instrument as claimed in claim 1, said grooves being an outer groove on said barrel and an inner groove on said head, said enlarged section having two wide open portions on each side of said split, said release means, including a cam with a tapered end penetrating said open portions widening said ring so as to effectuate said release.

3. The instrument as claimed in claim 2, said release means further comprising a plunger release button in said head, a plunger rod connected to said button, said rod in turn being connected to said cam which is so disposed that the tapered end will penetrate said wide open portions on each side of said slit, the pressing on said button causing said cam to penetrate said slot.

4. The instrument as claimed in claim 3, wherein said barrel is made of polyethylene and has graduations on the outside thereof.

5. The instrument as claimed in claim 4, including a removable elongated obturator which can be removed from said head when said eye piece is pivotally open.

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