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ENDOSCOPE

Frederick J. Wallace, New York, N.Y., assignor to American Cystoscope Makers, Inc., Pelham Manor, N.Y., a corporation of New York

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This application is a continuation-in-part of application Serial No. 305,304, filed August 29, 1963.

This invention relates to endoscopic instruments for the examination of internal body orifices, and more particularly relates to such instruments which utilize optic fibers for illumination of the internal orifices.

An endoscope must meet limitations of size and shape dictated by the anatomical structure of the orifice in which it is to be used. Also, an endoscope must provide for light, vision and operating instruments or high frequency electrodes. For precision in diagnosis or other procedure, a fine, brilliant image that is accurate in regard to both color and definition is essential to the operator. Within the relatively small lumen or space inside the tubular portion of known endoscopes, there is a complete electrical circuit of which a lamp is a part. The lamp circuit requires an insulated conductor or wire to carry current from a contact near the proximal end, to the lamp frequently located at the distal end. The circuit must function perfectly under water and must not be affected by other solutions during sterilization, a requirement most difficult to fulfill in any electrical structure. While the instruments are water-tight when they leave the factory, due to the fact that they must be opened for the replacement of lamps, their ability to exclude moisture is almost entirely dependent upon the care exercised by the user in again sealing the instruments.

In known endoscopic instruments most premature burning out of lamps results from attempts to obtain unusually brilliant illumination. The extent of illumination is limited by the filament of the lamp itself. It is the practice to make use of a current regulator and observe the lamp filament closely while gradually increasing the current. The limit of safe current is reached when the definite reddish tint of the lamp suddenly becomes white. Further increase in illumination by increasing the current beyond this point results in premature burning out of the lamp. Once the lamp burns out it is necessary to remove it, thus introducing the possibility of the problems described above.

Problems also arise from the disinfection of parts of the endoscope containing lamps. It is not practicable to boil or autoclave any part of the endoscope which contains lamps. The usual chemical disinfectants may not be used or leaks and short circuits in the wiring may follow. As a result it is necessary to use special disinfectant methods and solutions in cleaning known endoscopes.

It is an object of the present invention to provide means for viewing internal body orifices which means transmit significantly brighter illumination than was heretofore possible and which may be sterilized by boiling, autoclaving or chemicals without deleterious results.

It is another object of the present invention to provide endoscopic instruments having illuminating means with an expected life equivalent to that of the rest of the instrument, which means do not require maintenance or replacement of parts in normal use.

It is yet another object of this invention to provide an improved endoscope, adapted to be used either alone or in association with operative instruments, for the purpose of viewing under illumination interior portions of the genitourinary tract.

It is still another object of the present invention to provide a telescope utilizing as its illumination transmission means a bundle of optic fibers which may be shaped at its distal end to one of a number of configurations especially adapted to the particular use of the telescope and any endescope that may be associated with it.

Further objects as well as advantages in the present invention will be apparent from the following description and the accompanying drawings, in which:

FIGURE 1 is a perspective view of a telescope constructed in accordance with the present invention;

FIGURE 2 is a transverse cross-sectional view taken generally along lines 2—2 of FIGURE 1;

FIGURE 3 is a cross-sectional view taken generally along lines 3—3 of FIGURE 1;

FIGURE 4 is an enlarged cross-sectional view of the distal end of one embodiment of the telescope of this invention;

FIGURE 5 is a perspective view of a cystoscope constructed in accordance with the present invention;

FIGURE 6 is a top view of a cystoscope embodiment of this invention;

FIGURE 7 is a sectional view taken generally along lines 7—7 of FIGURE 6;

FIGURE 8 is a cross-sectional view taken generally along lines 8—8 of FIGURE 6;

FIGURE 9 is an alternate embodiment of the cystoscope of this invention in which a convex beak is used;

FIGURE 10 is a perspective view of a culdoscope embodying the principles of this invention;

FIGURE 11 is a top view of the culoscope employing the principles of this invention;

FIGURE 12 is a sectional view of the culdoscope of this invention taken generally along lines 12—12 of FIGURE 11;

FIGURE 13 is a cross-sectional view taken generally along lines 13—13 of FIGURE 11.

The objects of this invention may be achieved by utilizing tubular means preferably formed by eccentrically disposing an inner elongated tube within an outer elongated tube. Preferably the outer surface of the inner tube defines a crescent-shaped elongated chamber with the interior surface of the outer tube. A bundle containing a large number of optic fibers is disposed in the crescent-shaped chamber. Preferably, both ends of the bundle are optically polished to improve overall light transmission.

The distal end portion of the outer tube extends beyond the inner tube. The distal end portion of the optic fiber bundle extends partway between the ends of the inner and outer tubes as shown in the drawings. The outer tube is substantially shorter than the inner tube, and at the proximal end the inner tube extends beyond the outer tube. Both the inner and outer tubes are supported in suitable mounting members at their proximal ends. The tubes may be circular in cross-section but for some applications are preferably slightly elliptical and for some applications are preferably tapered.

A polished metallic tip is applied to the extended portion of the distal end of the outer tube. The distal ends of the optic fibers are formed into a rod shape and arranged adjacent the proximal end of the tip. A bridge is inserted across the distal end of the outer tube between the distal end portion of the optic fiber bundle and the distal end of the inner tube and serves to position and protect the distal end portion of the fiber bundle. At the proximal end the optic fiber bundle is gathered into a cylindrical rod at an angle to the axis of the inner and outer tubes, the gathering being aided by the differential length of the tubes. The proximal end of the bundle is supported by a jack which adapts the bundle to be coupled