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FLEXIBLE GASTROSCOPE

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This application is a continuation-in-part of our co-pending application Serial No. 846,767, filed July 22, 1959, now abandoned.

This invention relates to medical instruments, and more particularly to a flexible gastroscope primarily intended for examination of the interior of the stomach.

Numerous attempts have heretofore been made to provide flexible gastroscopes which would serve to permit examination of the entire interior of the stomach, but much difficulty has been experienced in providing such gastroscopes having acceptable image quality, a suitable field of vision, ease and convenience of operation, and in fact, it has proved virtually impossible to provide a satisfactory instrument of this nature of a sufficiently small size to be useable for the purpose intended. These prior art devices have included the use of rotatable mirrors, or mirrors utilized in other ways, the use of supplementary prisms disposed in the light path between the objective lens and the area to be observed, a device in the nature of an inflatable balloon for distending the stomach wall as well as a device in which the outer end of the instrument may be flexed or bent to change the location and field of observation. As mentioned above, such instruments have proved inadequate to solve the problem, and consequently have not come into general use.

It is accordingly an object of this invention to provide a flexible gastroscope of relatively small external diameter, and of a nature to permit flexure in either direction in a single plane, as well as rotation of an objective element through 360° to provide adequate observation of the entire interior of the stomach.

A further object of the invention is the provision of a flexible gastroscope incorporating a flexible optical system which serves to transmit an image of the area under observation, with the tube of the gastroscope flexed to position the outer end thereof at any desired location within the stomach, the transmitted image being of substantially the same quality as would be the case if the tube of the gastroscope were straight.

A still further object of the invention is the provision of a flexible gastroscope, including means for illuminating the interior of the stomach to be examined, and also including an objective viewing system rotatable through 360°, and including mechanism conveniently permitting such rotation from the inner end of the instrument adjacent the eyepiece.

Another object of the invention is the provision of a flexible gastroscope in which flexing of the tube is accomplished by means of a finger-engaging knob disposed on the inner end of the tube adjacent the eyepiece, actuation of such knob serving to flex the tube of the gastroscope in either direction in a single plane, there also being included means to lock the flexing means in any desired position of adjustment, and further means being provided to prevent flexure of the tube in planes other than the plane of flexure.

A further object of the invention is the provision of a flexible gastroscope for examination of the interior of the stomach, the outer wall of the tube of the gastroscope

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being yieldable, whereby upon the introduction of air pressure to the interior thereof, such wall will be distended, and will smooth out wrinkles in the stomach.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is an elevational view showing a flexible gastroscope constructed in accordance with this invention;

FIG. 2, a fragmentary, longitudinal sectional view to an enlarged scale, showing the structure of the outer or observing end of the instrument, as well as a portion of the flexible optical system disposed in the tube of the instrument;

FIG. 3, a fragmentary sectional view to a still further enlarged scale showing the outer or observing end of the instrument, and taken substantially on the line 2-2 of FIG. 4;

FIG. 4, a sectional view taken substantially on the line 4-4 of FIG. 3;

FIG. 5, a fragmentary, longitudinal, sectional view showing the structure of the inner or eyepiece end of the instrument, together with the mechanism for rotating the objective observation system, as well as the mechanism for flexing the tube;

FIG. 6, an elevational view with parts in section for greater clarity, and showing a portion of the means for flexing the tube of the gastroscope of this invention;

FIG. 7, a fragmentary elevational view with parts in section, and further showing the mechanism for flexing the tube of the instrument;

FIG. 8, a diagrammatic view showing the flexible optical system in a straight as well as in a curved position;

FIG. 9, a fragmentary, sectional view showing the articulation joint between the links of the flexible, optical system;

FIG. 10, a view in perspective, with parts broken away, and showing to an enlarged scale the mechanism for flexing the tube of the gastroscope of this invention; and,

FIG. 11, a more or less diagrammatic view to an enlarged scale, and showing the mechanism for rotating the objective observation system of the gastroscope of this invention.

With continued reference to the drawings, there is shown a flexible gastroscope constructed in accordance with this invention, and which may well comprise an elongated, flexible tube 10 having an eyepiece 11 attached to the inner end thereof, and an observation head 12 attached to the outer end of the tube. As best shown in FIGS. 2, 3 and 4, the tube 10 may consist of an outer flexible and yieldable wall 13, an inner wall 14, spaced from the wall 13, and an inner spirally wound supporting member 15 which may be of metal or other suitable material. This entire structure is of course flexible to permit bending or flexure of the tube 10.

The eyepiece 11, as best shown in FIG. 5, may include an eyecup 16, and mounted axially within the cup 16 is an eyepiece lens 17, as well as a transparent cover plate 18. The eyepiece 11 is attached to the inner end of the tube 10 in any suitable manner.

With particular reference to FIGS. 2 and 3, the observation head 12 may well comprise a fitting 19 secured to the outer end of the tube 10 in any desired manner, and attached to the fitting 19 is a cylindrical, transparent tubular casing 20 which serves to provide a viewing window, permitting observation through 360°. Secured to the outer end of the casing 20 is a fitting 21, to which may be attached a pilot member 22 of yieldable material which may be of suitable configuration, and which serves to facilitate introduction of the instrument into the stomach to be examined. Disposed within the outer end of the casing 20 is a suitable electric lamp 23 which serves to