project light rays through the transparent casing **20** to illuminate the area of the stomach to be observed.

Also disposed in the casing **20**, inwardly of the lamp **23**, is a sleeve **24**, which may be rotatably mounted in a bushing **25** secured in the fitting **19**, and mounted within the sleeve **24** is an objective lens **26**. A prism **27** is mounted in the sleeve **24** outwardly of the objective lens **26**, and the prism **27** serves to reflect light rays entering the sleeve **24** at right angles thereto through the objective lens **26**. If desired, a suitable supplemental lens **28** may be attached to the prism **27**.

A gear **29** is provided on the inner end of the sleeve **24**, and such gear **29** meshes with a pinion gear **30** fixed to a shaft **31** rotatably mounted in the bushing **25**. The shaft **31** in turn is fixed to a flexible shaft **32**, which, as clearly shown in FIGS. 3 and 4, extends through the tube **10** between the inner wall **14** and the spiral supporting member **15**.

As best shown in FIG. 5, an elongated, hollow body member **33** is attached to the inner end of the flexible tube **10**, and rotatably mounted in the body member **33** is a shaft **34**, to which is fixed a pinion gear **35**. The shaft **34** is fixed to the inner end of the flexible shaft **32** extending through the tube **10**. Rotatably mounted on the body member **33** is a ring **36** which may be conveniently, manually rotated by grasping the surface thereof, or by means of a finger-engaging knob **37**, and the ring **36** is provided with a gear **38** which meshes the pinion gear **35** on the shaft **34**.

It will be seen from the above-described structure that upon rotation of the ring **36**, the pinion gear **35**, as well as the shaft **34** and the flexible shaft **32** attached thereto will be rotated, which in turn will serve to rotate the pinion gear **30**, the gear **29**, and the sleeve **24** carried thereby. This will serve to rotate the prism **27** through 360°, thereby permitting observation through the transparent casing **20** throughout a complete circle.

In order to provide for convenient flexing or bending of the tube **10**, there may be provided a pair of tension members **39** and **40** which, as clearly shown in FIGS. 3, 4 and 7, extend through the tube **10**, and are fixed at their outer ends **41** and **42** to the inner wall **14** of the tube **10**. The inner ends of the tension members **39** and **40** are secured at **43** and **44** to a pair of racks **45** and **46**, respectively, which are slidably mounted in the body member **33**. As best shown in FIGS. 5 and 6, a pinion gear **47** is disposed between and meshes with the racks **45** and **46**, and the pinion gear **47** is provided with a spindle **48** rotatably mounted in the body member **33**, and to which is fixed a finger-engaging knob **49**. Surrounding the spindle **48** is a brake band **50**, which engages the spindle **48** to prevent rotation thereof with the pinion **47** carried thereby, and in order to release the brake band **50** to permit rotation of the spindle **48** and pinion gear **47**, there may be provided a cam **51**, pivotally mounted at **52** on the knob **49**, and the cam **41** may be provided with a finger-engaging member **53** to permit convenient operation thereof to release the brake **50**, or permit engagement thereof with the spindle **48**.

It will be seen that upon rotation of the finger-engaging knob **49**, the pinion gear **47** will operate to move the racks **45** and **46** in opposite directions, depending upon the direction of rotation of the knob **49**, and movement of the racks **45** and **46** will apply tension to one of the tension members **39** and **40**, while releasing tension in the other tension member, resulting in flexing or bending the tube **10** in either direction in a single plane, since, as set forth above, the outer ends of the tension members **39** and **40** are fixed to the tube **10**. Obviously, when it is desired to bend or flex the tube **10**, the cam **51** is actuated to release the brake **50**, and upon completion of the bending operation, the cam **51** is released to permit application of the brake **50**, thereby locking the tube **10** in the desired position of adjustment.

Since it is desired to prevent flexure or bending of the tube **10** in other than a single plane, there may be provided means to accomplish this purpose in the form of a pair of rods **54** and **55**, extending through the tube **10** on diametrically opposite sides thereof, and spaced angularly 90° from the tension members **41** and **42**, and the rods **54** and **55** are secured along their lengths to the spiral-supporting member **15** of the tube **10**. The provision of such rods **54** and **55** will serve to prevent bending of the tube **10** in planes other than the plane of flexure resulting from operation of the tension members **41** and **42**.

With particular reference to FIGS. 2, 8 and 9, the flexible, optical system may comprise a plurality of elongated, rigid links **56** disposed in end-to-end relationship in the tube **10**, and link between the end links may comprise a tubular housing **57** with a triangular prism **58** mounted in one end of the tube **57**, and a triangular prism **59** mounted in the opposite end of the tube **57**. Disposed between the prisms **58** and **59** is an inverting lens system **60**. The end links in the flexible, optical system may, as shown in FIG. 8, comprise a housing **61** having a triangular prism **62** mounted in one end thereof, and an inverting lens system **63** mounted in the housing **61**. The housing **61** of the end link adjacent the outer end of the instrument may be secured to the bushing **25**, while the end link at the inner end of the instrument may be secured to the body member, **33**.

As best shown in FIGS. 8 and 9, the face **64** of the prism **58** overlaps the face **65** of the prism **62**, and as shown in FIG. 9, an articulation joint **66** is provided between the housings **57** of the links **56**, and between the housing **57** and the casing **61** of each end link. The axis of the articulation joint **66** coincides with the axes of the faces **64** and **65** of the overlapping prisms **58** and **62**.

It will thus be seen that the entire optical system comprising the links **56** may be bent or flexed in either direction in a single plane, and regardless of the position will serve to transmit an image through the system, without deterioration due to the flexing of the system. As shown in FIG. 10, the tube **10** and optical system carried thereby may be flexed through an angle of 70° to each side of the center line, thereby providing a total flexure of 140°, which together with rotation of the observation prism **27** through 360°, provides for adequate observation of the entire interior of the stomach.

As shown in FIG. 7, the body member **33** may be provided with an electrical connection **67** for connecting a source of electric power, which, through a conductor **68** extending through the tube **10**, serves to energize the electric lamp **23**. Also provided on the body member **33**, as shown in FIG. 5, is a connecting fitting **69** for connecting a source of air pressure which may flow into the space **70** between the outer wall **13**, and inner wall **14** of the tube **10** to distend the outer wall **13**, thereby eliminating wrinkles in the stomach. The fitting **69** may be closed by a cap **71** when the same is not in use.

It will be seen that by the above-described invention there has been provided a flexible gastroscope of minimum dimensions which may be utilized to provide adequate observation of the entire interior of the stomach, and in which the image transmitted through the gastroscope is of substantially the same quality as would be provided by a straight instrument, even though the instrument of this invention may be flexed or bent through an angle of 140°, and the field of view may encompass a complete circle.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What is claimed is:

1. A flexible gastroscope comprising an elongated flexible tube, an eyepiece attached to the inner end of said tube and an observation head attached to the outer end of said tube, said observation head including a cylindrical transparent tubular casing providing a viewing window