United States Patent

[11] 3,581,738

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[54] **DISPOSABLE ILLUMINATING ENDOSCOPE AND METHOD OF MANUFACTURE**
6 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **128/6,** 156/293
[51] **Int. Cl.** **A61b 1/06,** B32b 1/06
[50] **Field of Search** ..... 128/4, 6, 7, 8, 9; 156/99, 293, 924; 350/96 B

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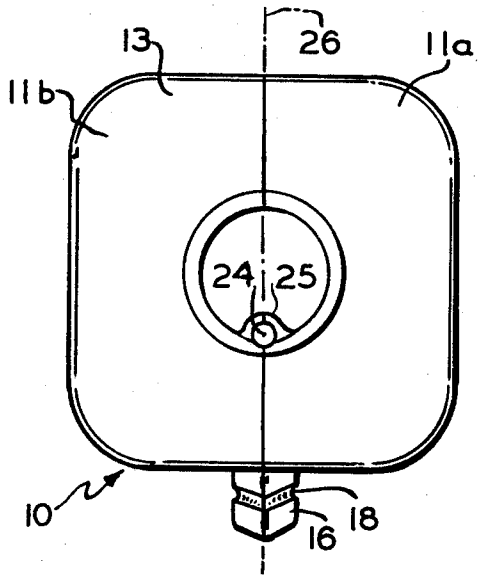
ABSTRACT: A plastic sigmoidoscope has a generally tubular body with integral shield. Proximally of the shield an extension projects angularly from the body and is adapted to fit into a light source handle. Distally of the shield the body forms a speculum wall having an elongated clad light-conducting member embedded therein. The body is formed in diametrical halves each having a groove in the extension and speculum wall, continuous from the extension end to a point spaced from the end of the speculum, into which the member has been fitted before permanently securing the halves together.



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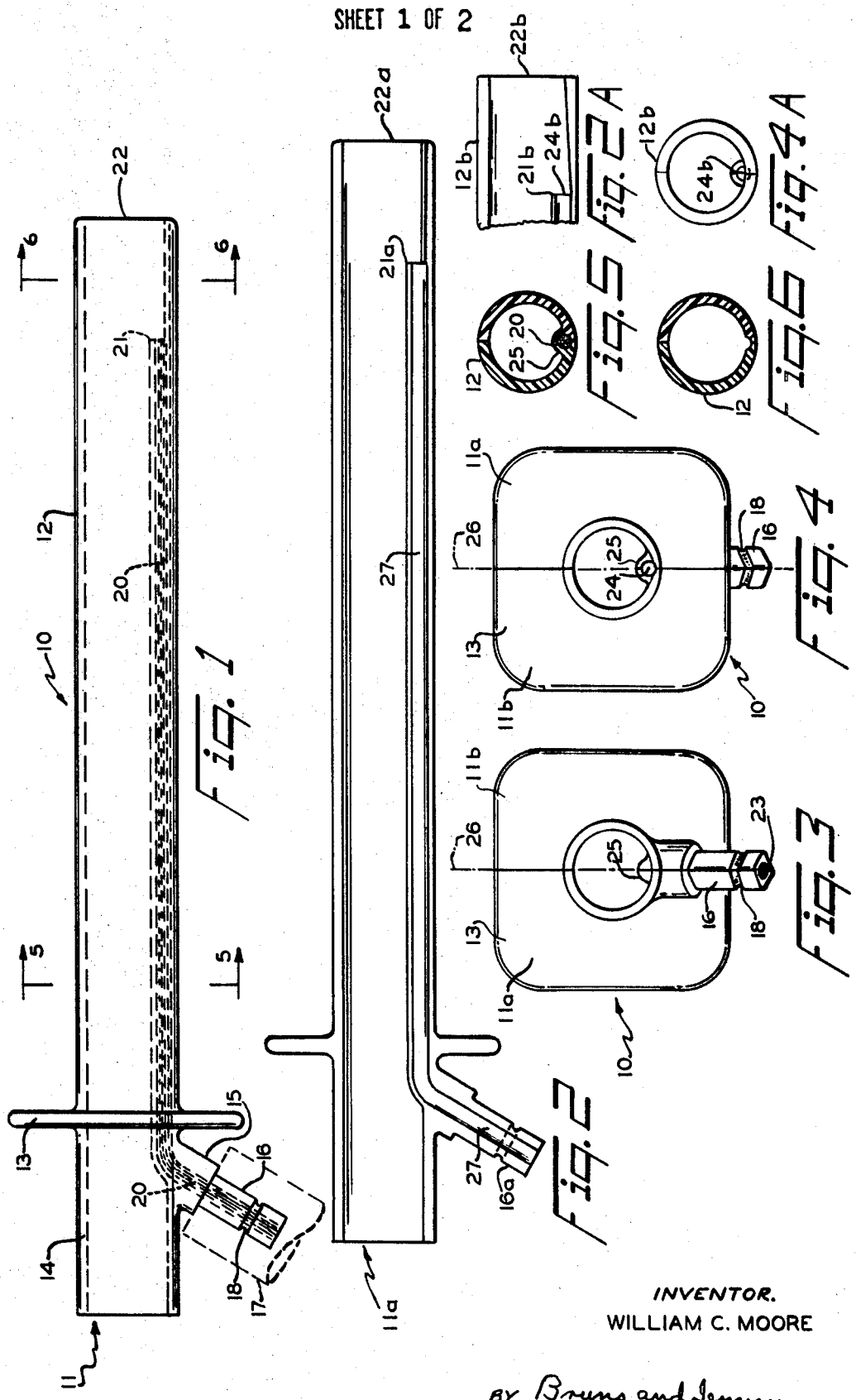

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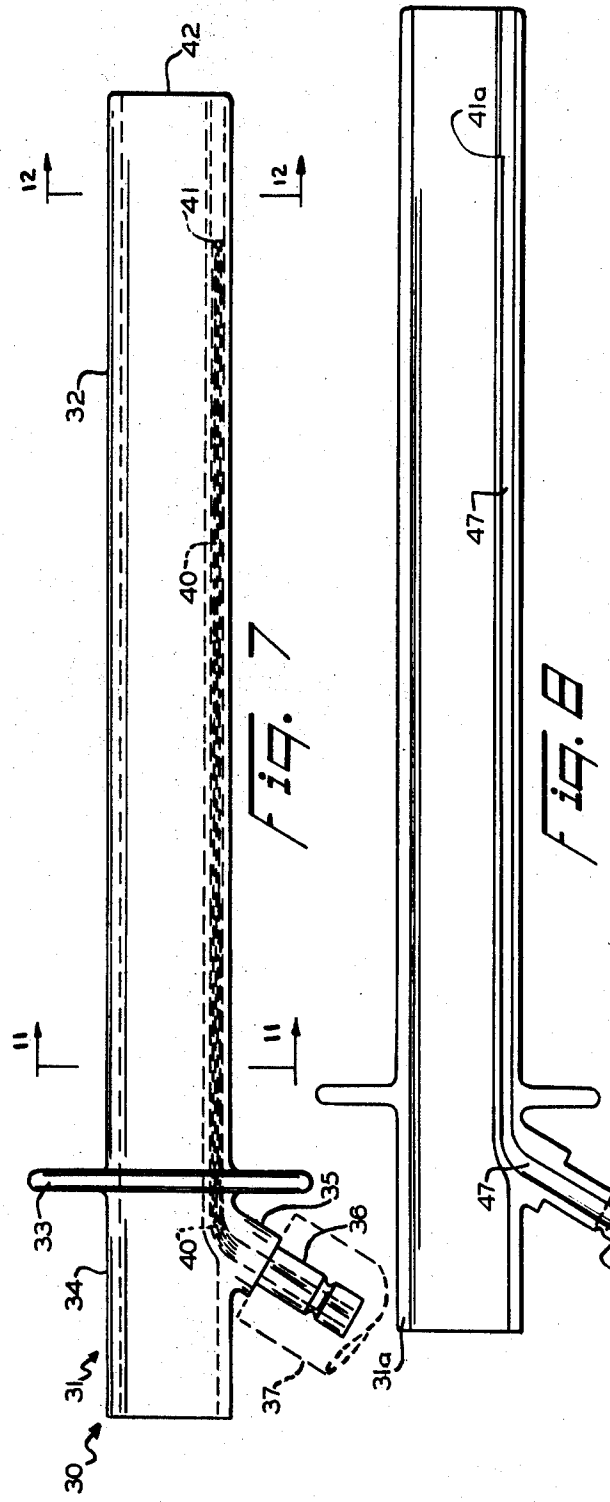

Fig. 7

Fig. 8

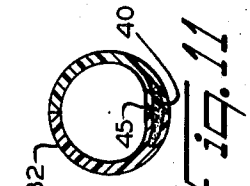

Fig. 11

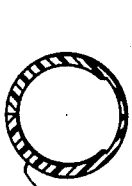

Fig. 12

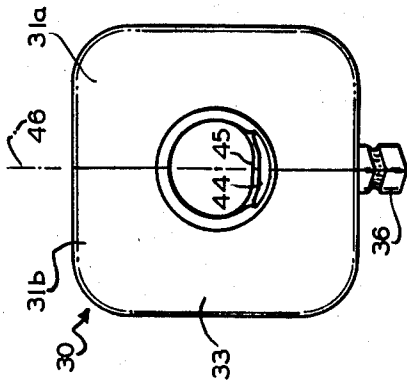

Fig. 10

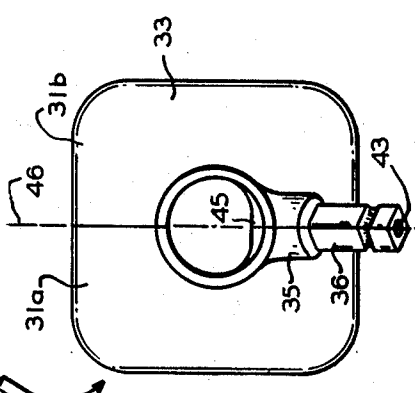

Fig. 9

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DISPOSABLE ILLUMINATING ENDOSCOPE AND METHOD OF MANUFACTURE

BACKGROUND OF THE INVENTION

This invention relates to an illuminating endoscope and more particularly to such an instrument which may be so economically constructed as to be disposable.

Endoscopes are used for examining body cavities and must be autoclaved after each use. This takes considerable time and at today's costs is expensive. The medical profession is, therefore, turning to diagnostic instruments which can be used once and then thrown away. If the cost of a diagnostic instrument is less than the cost of autoclaving, money as well as time can be saved by using a disposable instrument.

The trend in instruments such as endoscopes is toward the provision in the endoscope speculum of light-conducting means so that light from a light source at the proximal end of the endoscope is conducted to the distal end thus eliminating the light bulb at the distal end of the speculum and the necessary connecting wires from a source of electricity outside the instrument. Such light-conducting means comprise a bundle of clad glass or plastic fibers or clad rod of a plastic material such as methyl methacrylate or the like. The cladding comprises an outer layer of a transparent material having a different index of refraction from that of the light-conducting material within and it is necessary to protect the cladding from accidental removal which would cause light loss.

SUMMARY OF THE INVENTION

The present invention contemplates the forming of an endoscope of inexpensive plastic material by molding or otherwise on a mass production basis. A bundle of clad fibers or a clad rod is provided so as to extend from a projecting portion of the instrument at its proximal end to a point spaced from the distal end of the speculum so that the emitted light can spread to illuminate the area examined. The projecting portion is adapted in the forming process to be received in a light source handle.

To provide for protecting the clad bundle or rod it is embedded in the walls of the instrument by providing an instrument divided in two parts on either side of a longitudinally extending plane. Grooves are provided in each part extending from the end of the projecting portion to the distal end of the light-conducting means so that the light-conducting means can be inserted in the grooves before the two halves are welded or otherwise permanently secured together.

The principal object of the invention is to provide an economically produced endoscope with light-conducting means embedded in the speculum wall and extending to a protruding portion adapted to be received in a light source handle.

Another important object is to provide a method of forming such an endoscope which is economical and adapted for mass production.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of an endoscope according to the invention, a light source handle being fragmentarily shown in broken lines;

FIG. **2** is a side elevational view of one-half of the body portion thereof before it is secured to the other half which is a mirror image of the half shown;

FIG. **2A** is a fragmentary side elevational view of a modified form of body half;

FIGS. **3** and **4** are left- and right-hand end views, respectively, of the endoscope of FIG. **1**;

FIG. **4A** is a distal end view of the speculum portion of the endoscope of FIG. **2A**;

FIGS. **5** and **6** are sectional views on the lines **5–5** and **6–6**, respectively, of FIG. **1**;

FIG. **7** is a side elevational view of a modified form of endoscope according to the invention, a light source handle being fragmentarily shown in broken lines;

FIG. **8** is a side elevational view of one-half of the body portion of the endoscope of FIG. **7** before it is secured to the other half which is a mirror image of the half shown;

FIGS. **9** and **10** are left- and right-hand end views, respectively, of the endoscope of FIG. **7**; and

FIGS. **11** and **12** are sectional views on the lines **11–11** and **12–12**, respectively, of FIG. **7**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. **1—6** the endoscope is shown as a sigmoidoscope **10** having a generally tubular body **11** including a tubular speculum portion **12**, an integral shield **13**, and a tubular proximal portion **14** separated from the speculum portion by the shield. A tubular portion **15** projects angularly from the proximal portion **14** and its free end **16** is squared or otherwise adapted to fit into a light source handle shown fragmentarily at **17**. The end **16** may be provided with a groove **18** around the four sides of the projecting portion for receiving ball detents, not shown, in handle **17** as is more fully described in U.S. Pat. No. 3,299,884, granted Jan. 24, 1967 to W. C. Moore et al.

A light-conducting member **20**, shown as a bundle of clad fibers, is embedded in the speculum sidewall and the projecting portion **15—16** and extends from the free end of the projecting portion **16** to a point **21** in the speculum sidewall spaced from the distal end **22** of the speculum. It will be understood that the ends of member **20** are fused or cemented together, as is customary, and provided with optically polished end surfaces. The light-receiving surface **23** is best seen in FIG. **3** and the light-emitting surface **24**, at the point **21**, is best seen in FIG. **4**.

To protect the clad member **20**, the speculum portion **12** and the proximal end portion **14**, up to where the member **20** enters the projecting portion **15**, are provided with a member-enclosing wall **25** integral with the endoscope sidewall and, with the sidewall, completely enclosing and surrounding member **20** except for its end surfaces.

The body **11** of the sigmoidoscope is formed in two halves divided along a longitudinally extending plane, indicated at **26** in FIGS. **3** and **4**, which bisects the portions **12**, **13**, **14** and **15** diametrically. One body half **11***a* is shown in FIG. **2**, the other body half **11***b* being the mirror image thereof. Provision is made for embedding member **20** in the sidewalls by forming a groove **27** in each body half, the groove extending from the free end **16** of the angularly projecting portion of the half to the point **21** in the half. In the sigmoidoscope **10** each groove **27** is semicircular in cross section and is formed along the speculum portion by the speculum sidewall and the member-enclosing wall **25** in the half.

The member **20** in sigmoidoscope **10** is round and is inserted in the grooves **27** of the body halves which are placed together as shown and then welded or otherwise secured together permanently to form the unitary sigmoidoscope. Heat welding, ultrasonic welding, cementing or any other means of securing the halves together may be employed.

The central passage through the proximal end portion **14** is aligned with the central passage through the speculum portion **12** for providing a sight passage through the instrument and it will be apparent that an obturator of conventional construction may be used therewith, the obturator head being provided with a semicircular groove therealong for passage around the member-enclosing wall **25**. It will also be apparent that the open end of the proximal portion may be provided with a windowed insufflating adapter plug or cap, if desired.

It will be noted that the groove **27** of the body half **11***a*, shown in FIG. **2**, extends partially into the sidewall of the speculum portion from the point **21***a* to the speculum portion end **22***a*. The light-emitting surface **24**, therefore, is viewed in its entirety in FIG. **4** but the sidewall is thinner directly below the surface **24** at the end **22** of the speculum.

In FIGS. **2A** and **4A**, a modification is shown in which the bottom of the portion of groove **27** between the end surface

24*b* and the distal end 22*b* is slanted upward, as shown in FIG. 2A, so as to end in a sidewall of uniform thickness as shown in FIG. 4A. This does not materially affect the light output.

In FIGS. 7—12 a modified form of sigmoidoscope **30** is shown in which a flattened or oval-shaped light-conducting member is provided.

The instrument **30** has a generally tubular body **31** having a tubular speculum portion **32**, a shield **33**, and a tubular proximal end portion **34** from which a tubular portion **35** projects angularly. The portion **35** has its free end **36** adapted for reception in a light source handle indicated at **37**. A

A flattened light-conducting member **40**, shown as a bundle of clad fibers is embedded in the speculum sidewall and in portion **35**, extends from its light-emitting surface **44** at **41** spaced from the distal end **42** of the speculum to its light-receiving surface **43** at the free end of portion **35**.

Member **40** is protected by a member-enclosing wall **45** extending along the speculum from a point adjacent portion **35** to a point **41***a*, the wall being formed integrally with the instrument sidewall and, with the walls completely enclosing member **40**. The portion of member **40** extending through projecting portion **35** is, for convenience, round.

The body **31** of sigmoidoscope **30** is formed in two halves divided along a longitudinally extending plane, indicated at **46** in FIGS. **9** and **10**, which bisects portions **32**, **33**, **34** and **35** diametrically. One body half **31***a* is shown in FIG. **8**, the other body half **31***b* being the mirror image thereof. A groove **47** is formed in each body half through the angularly projecting portion and the speculum, the groove being continuous from the free end of the projecting portion to the point **41** spaced from the distal end **42**. Groove **47** is round in the projecting portion but wider and shallower along the speculum to conform to the flattened portion of member **40**.

Member **40** is placed in the grooves **47** of the body halves when they are placed together as shown and then welded or otherwise permanently secured together.

It will be noted that sigmoidoscopes **10** and **30** each have a shield portion which prevents any contact of the light source handle with the patient when the speculum is inserted in a body cavity. The sigmoidoscope, being economically manufactured, may be thrown away after use and the light source handle retained for further use.

As will be apparent to those familiar with the art, the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The embodiments disclosed are, therefore, to be considered in all respects as illustrative rather than restrictive, the scope of the invention being indicated by the appended claims.

What I claim is:

1. A unitary disposable endoscope comprising a body of synthetic resinous material having a generally tubular sidewall forming a speculum and a unitary elongated light-conducting member embedded in the sidewall, the member being formed of light-conducting material clad with a transparent material having an index of refraction different from that of the light-conducting material, the body being formed of two mating halves divided axially of the endoscope, each half having a member-enclosing wall formed integrally with the sidewall and, with the other half, providing a longitudinally extending tubular passageway in which the member is permanently enclosed.

2. A unitary disposable endoscope comprising: a body of synthetic resinous material having a generally tubular sidewall forming, in part, a tubular speculum; and an elongated light-conducting member embedded in the speculum sidewall, the member being formed of light-conducting material clad with a transparent material having an index of refraction different from that of the light-conducting material; the body being formed of two longitudinally divided diametrically opposed halves, each half having a member-enclosing wall formed integrally with the speculum sidewall to provide a longitudinally extending groove of uniform cross-sectional configuration in which the member is permanently enclosed; the body having a portion projecting angularly therefrom at its proximal end, the projecting portion being formed as portions of the body halves which are grooved in continuation of the speculum-half grooves and having means to engage a separable light source; the proximal end of the member having a light-receiving surface lying in the projecting portion grooves, and the distal end of the member having a light-emitting surface lying in the speculum-half grooves spaced from the distal end of the speculum.

3. The endoscope defined in claim **2** in which the member is a solid-clad rod having light-receiving and light-emitting surfaces at its respective ends.

4. The endoscope defined in claim **2** in which the member is a bundle of clad fibers, the bundle having fused portions with light-receiving and light-emitting surfaces at its respective ends.

5. The endoscope defined in claim **2** in which the portion of the member embedded in the speculum is round in cross section and the speculum-half grooves are semicircular.

6. The endoscope defined in claim **2** in which the portion of the member embedded in the speculum is oval in cross section and the speculum-half grooves conform to the cross-sectional sectional shape of the member therein.