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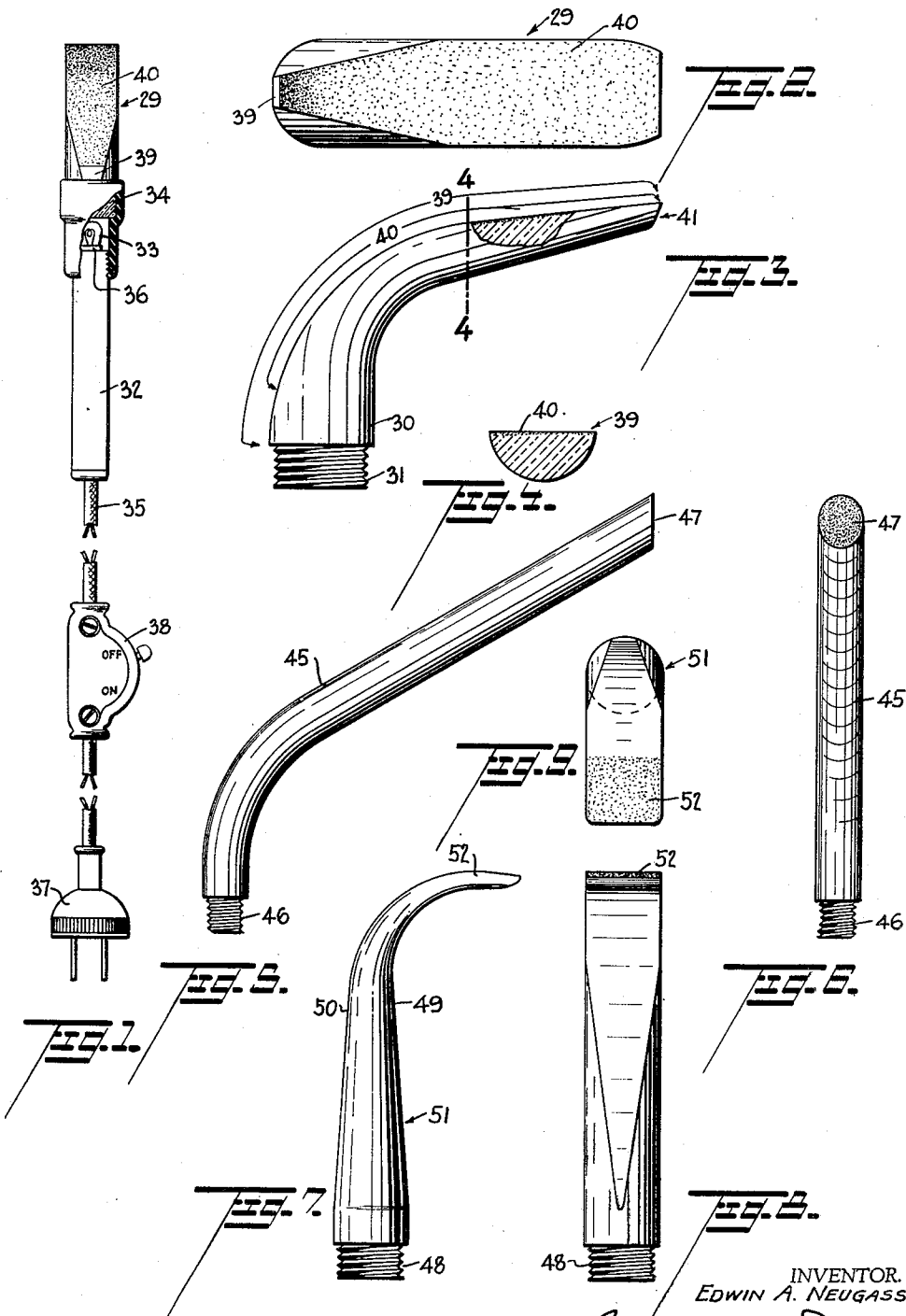
E. A. NEUGASS

2,186,143

ILLUMINATOR

Filed March 9, 1939

2 Sheets-Sheet 1



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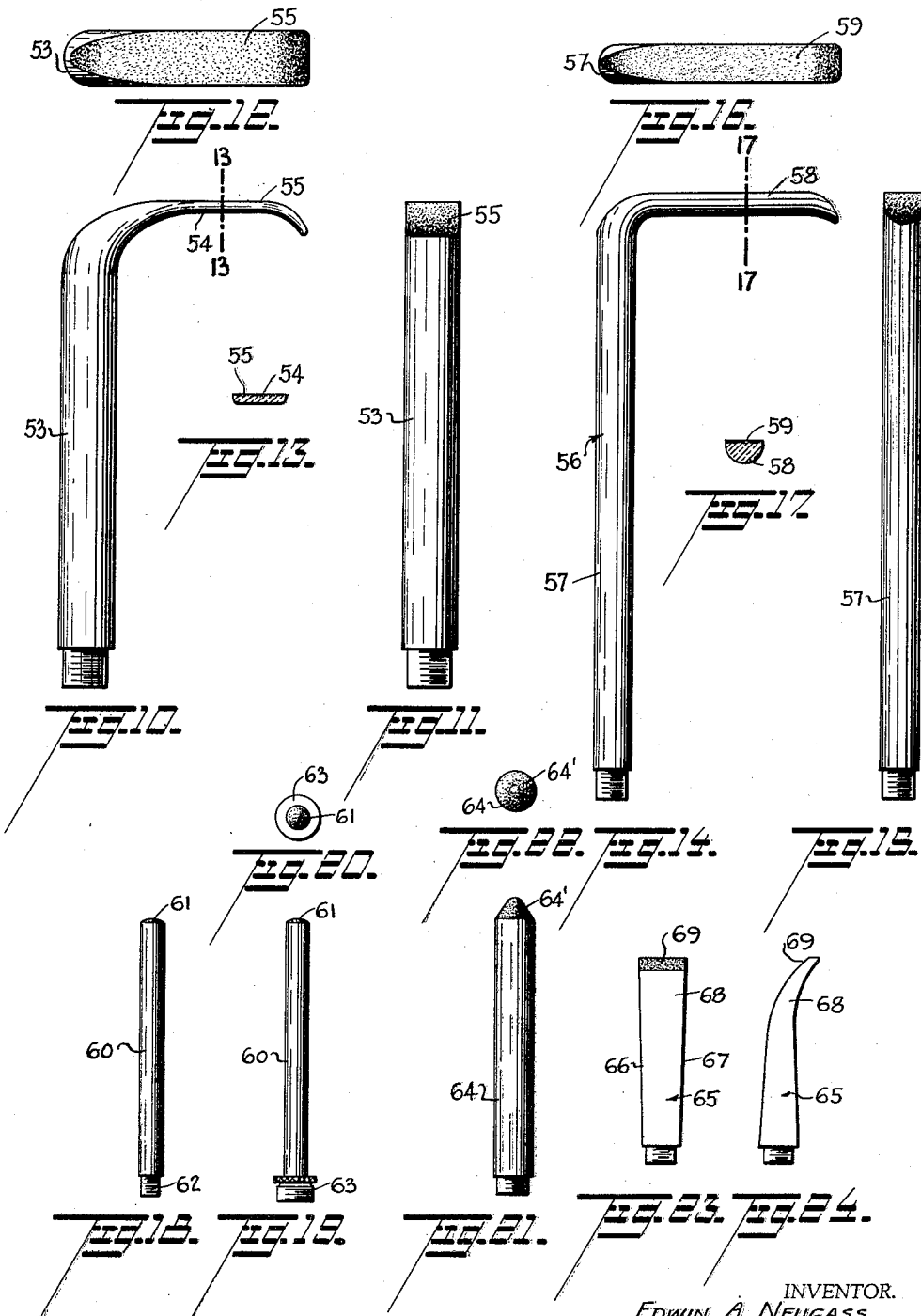
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ILLUMINATOR

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2 Sheets-Sheet 2



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ILLUMINATOR

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6 Claims. (Cl. 128—16)

This invention relates generally to devices in which light is emitted at a point remote from the light source by internal reflection and particularly to such devices as are adapted to explore and probe orifices in the human body, and as an aid in performing diagnostic and surgical investigations and work. The invention is also adapted for use in connection with cavities in the industrial field.

Heretofore and according to the prior art, devices of this character, have employed a light source and a tubular glass or quartz rod cemented or clamped to the light source.

It is an object of this invention to provide an illuminator which will emit cold light, be compact and easily manipulated and which is so designed and constructed as to improve and increase the internal reflection of light.

It is a further object of this invention to provide an illuminator which will emit light in such a manner as to produce an even diffused light, having no shadows, light ridges or unevenly lighted portions.

It is still a further object of this invention to provide a light applicator so constructed as to direct or pipe the light at the point of emission to any desired degree of intensity.

Another object is to provide a light emitting applicator of greater width at its light emitting end than its body portion, the width facilitating surgical use in retracting tissue.

Still another object is to provide an illuminator formed of an organic plastic material and capable of transmitting light from end to end, the illuminator having a light carrier portion and a bent portion formed by planes making angles with the axis of the carrier portion the bend greatly aiding the reflection of light as it includes a multiple of angles of internal reflection.

Still a further object is to provide an illuminator preferably made of organic plastic material of which has its light emitting surfaces partially or wholly matted in order to produce a diffused and evenly distributed light.

Still another object is to provide an illuminator made of organic plastic material having the light emitting portion bent relative to one or more axes.

It is yet another object of the present invention to provide an illuminator comprising body having portions of circular and non-circular cross-sections; and which may also be provided with a substantially hooked end.

It is still a further object of the invention

to provide an illuminator formed of an organic plastic material capable of transmitting light the body having an angularly disposed end through which light may be emitted and an end formed for connection with a support housing the source of light.

This invention broadly contemplates the production of an illuminator comprising a body formed of an organic plastic material capable of transmitting light endwise, the body having a light carrier portion and a portion formed by a plane making an angle with the axis of the light carrier portion, which formed portion may be bent relative to said light carrier portions, the surface of which may be matted.

Further objects and advantages of the invention will appear from the following disclosure thereof together with the attached drawings which illustrate certain forms of embodiment thereof. These forms are shown for the purpose of illustrating the invention since the same have been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

In the drawings:

Fig. 1 is a view illustrating an embodiment of the invention showing its application to a support housing the light source;

Fig. 2 is a view illustrating the device shown in Fig. 1;

Fig. 3 is a view illustrating another embodiment of the invention;

Fig. 4 is a sectional view taken along line 4—4 of Figure 3;

Figs. 5 to 8 are views illustrating other embodiments of the invention;

Fig. 9 is a top view of the device shown in Figure 8;

Figs. 10, 11, 14, 15, 18, 19, 21 and 23 are views illustrating further embodiments of the invention;

Fig. 12 is a top view of the device shown in Figure 10;

Fig. 13 is a sectional view taken along line 13—13 of Figure 10;

Fig. 16 is a top view of the device shown in Figure 14;

Fig. 17 is a sectional view taken along line 17—17 of Figure 14;

Fig. 20 is a top view of Figure 19;

Fig. 22 is a top view of Figure 21; and Fig. 24 is a side elevational view of the device shown in Fig. 23.

Heretofore and according to the prior art illuminators of this character have employed a light source housed in a tubular member to which was attached a glass or quartz rod. The glass or quartz rod has many disadvantages which at times seriously restrict and impair their use in such devices. Some of these disadvantages are the tendency for the glass or quartz rods to break, their lack of flexibility, their relative high cost, heat conductivity, their difficulty in being machined and formed from stock material. Another disadvantage is the difficulty of obtaining a glass or quartz rod which is free from bubbles, the latter interfering with the proper internal reflection and therefore with the transmission of the light rays therethrough. Where the light emitting device is used specifically for surgical purposes, the glass and quartz rods are inefficient in that they are subject to breakage particularly upon impact or strain.

By employing a rod, bar, tube or similar member made of suitable plastic material the outer surface of which may be polished or matted or both, an instrumentality is provided in which internal reflection of light introduced therein at one end will cause the light to be transmitted through the rod, tube or bar at the other end with substantially no interference; which has substantially the light-bending qualities of quartz; and which will overcome the aforementioned disadvantages inherent in light transmitting devices made of glass or quartz.

A material found very suitable for the purpose intended comprises an organic plastic, for example, a polymerized derivation of methacrylic acid, or methyl methacrylate plastic. This material being thermoplastic lends itself to shaping upon the application of heat. This material is very much lighter than glass, is highly flexible, non-breakable, strong and durable and absorbs very little moisture. Furthermore it offers resistance to most chemicals and oxidation. Furthermore, the material has a slight antiseptic value; is easily formed and machined.

A device made from such material possesses very high internal reflection qualities, being free from bubbles and other flaws or defects and when abraded does not leave a permanently marred surface and its surface is of such a nature as to be self-polishing. Furthermore, it has substantially the light-bending characteristic of quartz; its surface tension is such that foreign matter does not readily adhere to it, and liquids tend to "run off" its surface.

One of the properties utilized in illuminators made in accordance with this invention is its characteristic of piping substantially all of the light directed through its length, from end-to-end without appreciable diminution of the light intermediate the ends. This makes its use particularly desirable in medical illuminators, because it enables a surgeon or dentist to transmit the light to the desired point without scattering the light all around and without diminishing the light at the point where it is desired. This together with the low cost of this material and its low heat absorption property, whereby it never becomes warm, and its capability of being threaded or other locking means formed directly, enable medical instruments to be produced and used inexpensively and advantageously.

It is of primary consideration in a surgical

lamp to be able to obtain a spot of light at the point of inspection, such as within a cavity of the body, and yet to prevent any material conducting of the heat from the lamp to the point of contact between the material and the adjacent portion of the body which might cause burning or irritation and be seriously objectionable, as has been the case with glass and quartz. Another important consideration is the elimination of danger of fracture by even slight bending stresses applied to a relatively thin rod which would be used in an instrument of this kind and which would normally cause fracture of the glass or quartz rod but by reason of the relatively plastic condition of this material used in this invention, it yields more readily to bending stresses and does not break until it reaches its elastic limit and even then when it breaks it leaves no sharp edges, no splintering of the material which would be seriously objectionable in a surgical lamp. All of these results are accomplished by the use of the plastic material set forth in this specification which is described specifically as methyl methacrylate, which is an organic plastic material that is transparent that has an optical true surface which is more readily obtainable than in glass or quartz.

The illuminators disclosed in the drawings are preferably made of organic plastic material, such as, that hereinabove mentioned.

In Figs. 1-4 the illuminator 29 is shown as having a cylindrical portion 30 provided with a formed connection, such as, the threads 31 for attachment to a support. This support may comprise a housing in the form of handle 32 in which is located an electric bulb 33 as a lighting source for the illuminator 29, a threaded bushing or coupling 34 joining said illuminator 29 to housing 32. The internally threaded coupling 34 is constructed preferably of the same organic plastic material described above of which the illuminator 29 is formed, so that it will have the same coefficient of expansion and contraction as the illuminator when subject to changes in temperatures or the heat of the electric bulb, thereby maintaining a tight joint with a minimum of overlap. Electric cable 35 connects at one end to the socket 36 and at its other end to a plug 37. A switch 38 may be interposed in the circuit for controlling the current flow to bulb 33. An electric battery (not shown) may be inserted in housing 32 as the electric source of power in which case the switch 38, plug 37 and cord 35 may be eliminated.

Applicator 29 (Figs. 1-4) may be made from a cylindrical body milled with a small angle to its longitudinal axis, that is, formed or cut by a plane making a small angle with the longitudinal axis of the body, then bent about an axis parallel to the said plane. The milled portion or section 39 or a part thereof may have a matte surface 40. The surface of upper end 41 may be straight or angular and may be either polished or matted. Fig. 4 shows portion 39 as being arcuate in section. The body of the applicator 29 and those which are hereinafter described may be polygonal instead of circular in cross-section. By the term "a small angle" is meant an angle less than forty-five degrees with respect to the longitudinal axis of the body. The plane itself may be formed by heat and pressure, or by a bending or a cutting process or combination thereof.

The light coming from source 33 is emitted and diffused by the matte surface 40. If this surface was polished then the light would be internally

reflected and more light would be emitted from the tip 41.

Fig. 5 discloses an applicator of circular body 45 bent at an angle near the threaded end 46 and having its light emitting end 47 cut or formed by a surface inclined with respect to the longitudinal axis. This end 47 may be either flat or arcuate and may be either matted or polished. Fig. 6 is an end view of the applicator shown in Fig. 5.

Figs. 7-9 disclose an applicator having one of its ends threaded as indicated by the numeral 48, the sides 49, 50 of which have been formed in a plane having a small or slight angle with the longitudinal axis of the body 51, the tip of which has been bent about an axis outside of the body 51. The tip section 52 may have either a matte or polished surface. Tip section 52 may be substantially rectangular in section.

Figs. 10-13 disclose an applicator 53 cut or formed in a plane having a small angle to the longitudinal axis and bent about two axes substantially converging in wedge shape to a hooked portion 54 which may be in the shape of a parallelepiped and the cross-section of which may be substantially rectangular as shown in Fig. 13 and which may have a matte surface 55. This device is particularly adapted for retracting and supporting tissue covering the wall of a human cavity or incision, the light being emitted and diffused by the matte surface 55.

Figs. 14-17 illustrate an illuminator-retractor 56 having a body 57 of circular cross-section, the flattened portion 58 of which is formed by a plane parallel to the longitudinal axis of body 57 and the portion then bent about an axis outside of the body, in this instance parallel to the said plane. Fig. 17 shows the portion 58 as being arcuate in cross-section. The surface 59 may be matted as shown in the drawings.

Figs. 18-20 show a straight applicator 60 having a convex light-emitting end provided with a matte surface 61. The other end 62 may be threaded for engagement with the threads of bushing 63.

Figs. 21 and 22 show a cylindrical applicator 64 terminating in a truncated-conical light emitting end 64' which may be polished, or matted as indicated in the drawings.

Figs. 23 and 24 show a light applicator which may be employed as a tongue depressor and comprising a cylindrical body 65 the walls of part of which is formed by two converging planes 66, 67. These planes may be formed by applying pressure to the body causing the part 68 to be flattened and bulge out wider than the original diameter of the body and forming a substantially rectangle in section. The end 69 may be matted or ground to emit and diffuse the light. In the bending and/or molding or swedging process the body is heated.

In the forms of the invention shown in Figs. 1 to 3, 7 to 17, 23 and 24, it will be noted that the applicator is characterized by a cylindrical attached portion adapted to be secured to the support, and with the opposite end portion thereof turned at an angle to said cylindrical portion and formed either with a light emitting face or in a flattened section, and said portions being joined together by a substantially wedge-shaped portion, usually at the angle of the body. By "wedge-shaped" in the claims is meant the substantially flattened, tapered intermediate section of the body which somewhat resembles a wedge in side elevation.

In the said forms, it will be further noted that the illuminator or applicator comprises a body formed of an integral piece of organic plastic material capable of transmitting light from end to end thereof, the body having an attaching portion at one end thereof and having the opposite end portion extending laterally therefrom at an angle to the attaching portion and joined thereto by a substantially tapered section, substantially forming a hook, the body having a longitudinal flattened or truncated side substantially adjacent the tapered section of the body and extending along the lateral portion forming an outer face thereon. By truncated side is meant a side substantially flattened at an angle to the longitudinal axis of the attaching portion of the body.

An advantage of abrading or matting a surface of the applicators resides in obtaining a surface which emits more light, the said light being diffused and leaving no shadows, light ridges or unevenly lighted sections.

Although the drawings, and the above specification disclose the best modes in which it has been contemplated embodying the invention, the invention is in no way to be limited to the details of such disclosure, for in the further practical application of the invention many changes in the forms and proportions may be made as circumstances require or experience suggest without departing from the spirit of the invention within the scope of the appended claims.

Having thus described the invention what is claimed as new, and desired to be secured by Letters Patent, is:

1. A light applicator comprising a body formed of one integral piece of organic plastic material capable of transmitting light from end to end thereof, said body having an attaching portion at one end thereof and having the opposite end portion extending laterally therefrom at an angle to the attaching portion and joined thereto by a substantially tapered section, said body having a longitudinal flattened side substantially adjacent the tapered section of the body and extending along the lateral portion forming an outer face thereon.

2. A light applicator comprising a body formed of one integral piece of organic plastic material capable of transmitting light from end to end thereof, said body comprising an attaching portion at one end of said body, a laterally substantially flat faced portion at the other end thereof, said flat faced portion extending laterally from the axis of said attaching portion, and an intermediate substantially wedge-shaped portion joining said attaching portion and said faced portion.

3. A light applicator comprising a body formed of one integral piece of organic plastic material capable of transmitting light from end to end thereof, said body having a cylindrical attaching portion at end thereof and having the opposite end portion thereof formed substantially in the shape of a parallelepiped and extending laterally at an angle to the axis of the cylindrical portion, said portions being joined together by a substantially wedge-shaped portion.

4. A light applicator comprising a body formed of one integral piece of organic plastic material capable of transmitting light from end to end thereof, said body having a cylindrical attaching portion at one end thereof and having the opposite end portion thereof formed with a substantially flat light emitting face and extending later-

ally at an angle to the axis of the cylindrical portion, said portions being joined together by a substantially wedge-shaped portion, said flat face extending substantially throughout the length of the body and continuously along the lateral portion, the wedge-shaped portion, and the major part of the cylindrical portion of the body.

5. A retractor comprising a body formed of one integral piece of plastic material capable of transmitting light from end to end thereof, said body having a substantially cylindrical attaching portion at one end thereof and having the opposite end portion thereof extending laterally at an angle to the axis of the cylindrical portion forming a hook, said laterally extending end portion having a substantially flat light emitting face on the outer side of the hook, said portions being

joined together by an intermediate tapered section.

6. A light applicator comprising a body formed of one integral piece of organic plastic material capable of transmitting light from end to end thereof, said body having a cylindrical attaching portion at one end thereof and having the opposite end portion extending laterally therefrom at an angle to the axis of the cylindrical portion and joined thereto by a tapered section, said body having a longitudinal truncated side intersecting the rounded portion of the body and extending continuously therefrom along the tapered section and the laterally extended portion forming an outer face thereon.

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