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[Continued on next page]

(54) Title: APPARATUS FOR ENHANCED IMAGING AND LIGHTING

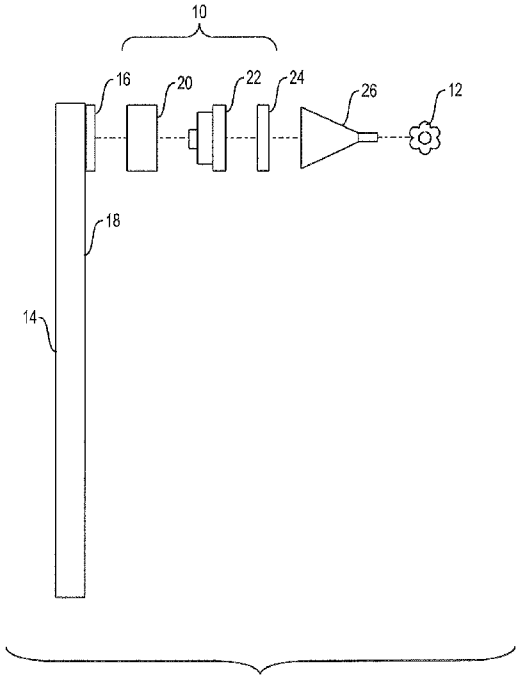

FIG. 1

(57) Abstract: A device for modifying the imaging of objects of interest. The device includes an imaging modification section and a retaining section. The imaging modification section includes an optical channel and a light aperture. The light aperture may be adjustable. The imaging modification section isolates the optics of an imaging device from the light source of the imaging device. The optical channel may include optics to modify the image. The light aperture may include a filter to modify the light source. An embodiment of the invention includes the imaging modification section and the light aperture forming part of case for an imaging device. The use of the present invention enables a wide variety of new, novel and previously unavailable applications and improvements to common digital cameras, webcams and imagers. In addition, through the use of the present invention, important and previously unavailable applications and uses are made available.

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APPARATUS FOR ENHANCED IMAGING AND LIGHTING

CROSS REFERENCE TO RELATED APPLICATION

(0001) The present application is a nonprovisional and claims the priority benefit of provisional US application serial number 61/616,837, filed March 28, 2012, entitled APPARATUS FOR ENHANCED IMAGING AND LIGHTING by the same inventors. The content of the priority application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

(0002) The present invention is in the technical field of digital image capture and transmission. More particularly, the present invention is in the technical field of adapters, lighting and optics for use with digital cameras or imagers.

(0003) Conventional cell phone cameras, imagers or webcam devices are typically manufactured with optical focal lengths suited for images captured at a relatively large distance and neither well suited for applications requiring short focal length, nor are they well suited for dark or poorly lit conditions especially at short distance. Many cameras lack sufficiently adjustable illumination capabilities for image capture applications in poorly or non illuminated conditions, and are not well suited for close proximity photography. For those cameras with flash capability, the intense light from the flash may easily saturate the camera optics and/or sensor at close range.

SUMMARY OF THE INVENTION

(0004) The present invention is an imaging modifier device for use in conjunction with an imaging device such as a digital camera of the type that may be found on a mobile phone, mobile device, imager or web-cam. The present invention allows a variable or fixed intensity light which may be further conditioned, to be transmitted either by self contained illumination or by the use of the camera's built in flash unit. An optical channel in conjunction with light isolation features and optional optical elements within the device allow magnification and close up photography without directly overwhelming the camera sensors or interfering with the camera optics. The transmitted light may be directed through or projected into an attachment or tool, and an illuminated image or video may be taken of the object of interest. Optical components may be used in the system for image modification and/or controlling

illumination conditions. Such optical components may be of any type including, but not limited to magnifiers, filters and lesnes, including wide angle and telescopic ones. Optical isolation features are provided within the present invention for isolating the light source from the optics and sensors. The use of the present invention enables a wide variety of new, novel and previously unavailable applications and improvements to common digital cameras, webcams and imagers. In addition, through the use of the present invention, important and previously unavailable applications and uses are made available.

BRIEF DESCRIPTION OF THE DRAWINGS

(0005) Fig. 1 is a simplified exploded side view of an imaging device including an embodiment of the imaging modifier of the present invention.

(0006) Fig. 2 is a simplified plan view of the imaging device with the imaging modifier of Fig. 1.

(0007) Fig. 3 is a front plan view of an embodiment of the modification section of the imaging modifier.

(0008) Fig. 4 is a perspective view of the modification section of Fig. 3.

(0009) Fig. 5 is a side view of the modification section of Fig. 3.

(0010) Fig. 6 is a perspective view of the alignment ring of the imaging modifier of Fig. 1.

(0011) Fig. 7A is a plan view of an alignment ring of the present invention and Fig. 7B is a side view of that alignment ring.

(0012) Fig. 8 is a simplified plan view of an example an alternative aperture section of the imaging modifier.

(0013) Fig. 9 is a plan view of the retaining ring of the imaging modifier.

(0014) Fig. 10 is side view of the retaining ring of Fig. 9.

(0015) Fig. 11 is a simplified block representation of a use for the imaging modifier of the present invention.

(0016) Fig. 12 is a simplified side view of an embodiment of the imaging modifier of the present invention with a self-contained light source.

(0017) Fig. 13 is a simplified side view of an imaging device of the present invention with a self-contained light source.

(0018) Fig 14 is a plan view of an imaging device including a representation of image capture and

image lighting channel options of an embodiment of the imaging modifier of the present invention.

(0019) Fig 15 is a side view of the imaging modifier of Fig. 15.

(0020) Fig. 16 is a first plan view of another imaging modifier device of the present invention.

(0021) FIG. 17 is a second plan view of the device of Fig. 16 showing the device rotated 180° with respect to the view of the device shown in Fig. 16.

(0022) Fig. 18 is a perspective view of a first side of the device of Fig. 16.

(0023) Fig. 19 is a perspective view of a second side of the device of Fig. 16 showing the device rotated 180° with respect to the view of the device shown in Fig. 18.

(0024) Fig. 20 is a third perspective side view of the device of Fig. 16.

(0025) Fig. 21 is a fourth perspective side view of the device of Fig. 16.

(0026) Fig. 22 is a perspective bottom view of the imaging modifier component of the device of Fig. 16.

(0027) Fig. 23 is a top view of an alternative imaging modifier component of the device of Fig. 16.

(0028) Fig. 24 is a side view of a spacer tool of the present invention.

(0029) Fig. 25 is a bottom view of the spacer tool.

DETAILED DESCRIPTION OF THE INVENTION

(0030) A first embodiment of an imaging modifier device 10 of the present invention is shown in FIGS. 1 and 2. The device 10 enables a user to control the illumination of an object 12 of interest for the purpose of observing, photographing or recording the object 12. The modifier device 10 is configured to be removably joined to an imaging device 14, which may be an imager, camera, mobile phone or webcam, for example. The imaging device 14 includes an imaging area 16 on side 18 of the imaging device 14. The imaging area 16 may include a camera, a light source, such as a flash, or a combination of the two with the camera spaced from the light source. The optical device 10 includes an alignment section 20, a modification section 22 and a retaining section 24. The alignment section 20 is joined to the modification section 22 on a first side thereof and is configured to align the modification section 22 with the imaging area 16 of the imaging device 14. The retaining section 24 is joined to the modification section 22 and is arranged to join to the modifier device 14 a tool 26 of interest. The tool 26 most anything that a user may wish to use for the purpose of viewing, imaging capturing or otherwise examining with the imaging device 14. One example of such a tool is a

speculum but the retaining section 24 may be used with any tool.

(0031) The alignment section 20, the modification section 22 and the retaining section 24 may be individual components that can be snap fitted together. Alternatively, one or more of those sections may be fabricated together as a unitary structure. For example, the modification section 22 may be arranged for engagement with, or forming part of, the imaging device 14 so that alignment with the component or components of the imaging area 16 without the need of the alignment section 20. Otherwise, the alignment section 20 is used to position the modification section 22 with the camera lens and/or light source of the imaging device 14. The alignment section 20 is arranged to be removably attached to, or placed on, the side 18 of the imaging device 14 over the imaging area 16. As shown in FIGS. 7A and 7B, the alignment section 20 is annular so that there is no impediment between the imaging components and the modification section 22. The alignment section 20 may be round as shown, but is not limited to this shape, and may be of any appropriate depth for the particular use of the imaging device 14. It may be constructed as a component or integrated into a mobile phone case, an adapter for attachment to a mobile phone or its case, or held in relative position to the mobile phone's camera in any appropriate method. Features may be present within the alignment section 20 to control the fit and movement relative to the modification section 22. The alignment section 20 may be attached, glued, fastened or otherwise held in relative position with respect to the surface of side 18 of the imaging device 14 providing the proper alignment and fit needed for proper operation of the modifier device 10.

(0032) The alignment of the modifier device 10 with the imaging device 14 is shown in FIG. 2. Rotation of at least the modification section 22 and the retaining section 24, pivoting on the imaging area 16, brings a light aperture of the modification section 22 across a light source of the imaging area 16 to allow varying amounts of light to pass though the aperture. That pivoting may also bring optical filters, diffusers, polarizers or other light conditioner elements into the path of the light source, thus conditioning and controlling the amount and properties of light passing though the modifier device 10 through to the object 12 of interest. Other configurations of sliding, pivoting, folding, mechanical, electrical or physical filters or apertures or combinations of such may be constructed to achieve similar results.

(0033) As shown in FIGS. 2-5, the modification section 22 includes an optical channel 28 and a light aperture 30. The optical channel 28 is a portal through which the object 12 may be viewed, imaged,

etc., with the imaging device 14. The optical channel 28 may include a lens, filter or other image modifying element. It may also be open. Interior walls of the channel 28, as well as any extensions thereof, may be lined with, or made of, opaque material to provide light shielding. The light aperture 30 is arranged to allow a user to condition and/or control light generated by the imaging device 14. The light aperture 30 may include a filter, polarizing element, diffuser, other light modifying element or any combination thereof. The light aperture 30 may be of selectable shape to allow the user to control the intensity and/or the destination of the light from the imaging device 14. The light aperture 30 shown in FIGS. 2-5 is a curved, tapered shape. An alternative version shown in FIG. 8 is a light aperture 30' of a round shape. Other shapes are contemplated. Together, the optical channel 28 and the light aperture 30 of the modifier device 10 enable a user to carry out a wide variety of imaging modification actions using the imaging device 14. Light may also be conditioned, including the adjustment of its intensity through one or more computer programs, which computer programs may be executed on the imaging device 14 or another device.

(0034) The modification section 22 may be fabricated of a nonmetallic material, such as plastic, but is not limited thereto. The modification section 22 includes an imager contact surface 32 that is designed to contact the surface 18 of the imaging device 14. At least the contact surface 32 of the modification section 22 is fabricated of a material and/or shaped to make substantial contact with the surface 18 of the device 14 encompassing image capturing component 34, which may be a lens of a camera, of the imaging device 14 (shown in FIG. 2) so that the image capturing component 34 is isolated from a light source 36, which may be a flash, of the imaging device 14. The present invention, represented by the example embodiment of the device 14, isolates a light source of an imaging device from an image capturing component of that device, in addition to providing an optional way for conditioning the light and/or conditioning the image. While shown having two openings of the optical channel 28 and the light aperture 30 through the modification section 22, it is contemplated that there may be one or more additional openings therethrough. Such additional openings may be included to allow components of, or connected to, the imaging device 14 to be available for use beyond the retaining section 24 without being disrupted by the modifier device 10. Examples of such other components for which such additional openings would be useful include a microphone or a light sensor that could share or have their own portal.

(0035) An alternative configuration for isolating the image capturing component 34 from the light

source 36 is to provide a light blocking channel around the light source 36 rather than around the image capturing component 34 as is provided with the embodiment including the optical channel 28. The configuration shown herein has both surrounded by light blocking material (the light aperture 30 also being a blocker for the light source 36). As an example, a larger lens may be designed in shape or reflective properties to allow light to pass through with minimal degradation of the image. The same material, such as a plastic, may be used to form a unitary modification section with the same material forming the lens and an equivalent of the retaining section 24 that includes a hole in the flash region. The hole in the flash region may be lined with a light blocking coating or tube, but due to the high incident angle of light, the hole alone may act as enough of a light guide to keep scatter within the lens down . This isolate's the light of the light source 36 from the lens while also allowing a larger lens area to be used. Anti-reflective coatings may also be used to minimize light scattering within the lens to achieve similar effects.

(0035) In this embodiment of the modifier device 10, rotation of the modification section 22 in combination with the retaining section 24 with respect to the alignment section 20 causes varying size aperture control of the light passing through the modifier device 10, and potentially moves filters, diffusers or other methods for conditioning the quality or properties of the light passing through the device 10 into the path of the light emitted from the light source of the imaging device 14, thus controlling and conditioning the light passing though the device 10, and if present, into the tool 26 attached or downstream from the modification section 22 such as, but not limited to an otoscope specula. For proper fit, holding strength and control of the friction between the modification section 22 and the alignment section 20, one or more of flexure points, tension bumps, ridges, or other engagement features may be present on the main body and/or alignment section 20 to ensure a good joining of those two components when formed as two separate elements. Markings may also be present on the modification section 22 and/or the alignment section 20 for reproducible settings of conditions. Note, light passing within or past the light aperture 30 may also be further channeled or sent though guides to produce a more uniform or specialized lighting condition. As an example, a plastic guide or diffuser may be used to evenly spread or diffuse the light passing though the aperture 30 to distribute the light more evenly around the top surface of the modification section 22.

(0036) An example of the retaining section 24 shown in FIGS. 9 and 10 provides a mechanism for joining to the modification section 22 tools of most any sort of interest to a user including, for example,

otoscope tips, measured reticules with measurement markings for repeatable distance and size measurements of objects, further downstream optics or filters, borescope end pieces, specula, or adapters for microscope eyepieces. The retaining section 24 may be firmly attached to, or constructed into, the modification section 22 of the device 10. The retaining section 24 may be configured to accept standard tooling or specialized tooling. The retaining section 24 is formed in such a way as to provide a secure fit and alignment between the specialized tooling represented by the tool 26 and the modification section 22, thus allowing the conditioned light passing through the device 10 to be projected into the specialized tooling, and the light reflected or emitted from the object of interest back through the optical channel 28 for use by the imaging device's optical system and software that may be used to capture and/or analyze the image. The retaining section 24 of FIGS. 9 and 10 includes a plurality of retaining ring tabs 33 and a side wall 35. The retaining tabs 33 are configured to enable a snap fit releasable joining of a tool of interest, such as the tool 26, to the modifier device 10 on inside 37 of the retaining section 24. The side wall 35 is configured with a taper of at least its exterior side 38 with larger dimensions from the side adjacent to the tool 26 when the tool 26 is engaged with the modifier device 10 to from smaller dimensions on the side adjacent to the modification section 22. This taper allows for a releasable pressure engagement of the modifier device 10 with the tool 26. Other configurations of the retaining section 24 may be used in the modifier device 10 as that section is intended to establish an interface between the modification section 22 and any tools that may be of interest to use with the imaging device 14 enhanced by the imaging modifier device 10.

(0037) An example of a usage of the imaging modifier device 10 of the present invention is described here with respect to FIG. 11, in which a user 50 of the imaging device 14 may have a question about something he or she is looking at using his or her mobile phone's camera making use of the enhanced capabilities made possible through use of the present invention, an eardrum for instance. The user 50 may make an online request for consultation though a referral service, represented by block 52, for consultation with an expert in the field of interest, an audiologist or doctor, represented by provider 54. The user 50 may have stored images or video made possible through use of the present invention on his/her mobile phone or any other sort of imaging device of interest. The referral service 52 may then make contact or provide the contact information to the user 50 for direct online consultation or for follow-up consultation with a doctor or audiologist 54. The user 50 may then contact, or be contacted by, the consultant 54 and transmit stored or live video images, represented by box 56, to the consultant

54 for advice or to get further follow-up details or local audiologists or medical professionals in the user's local area. Prior to the capabilities and enhancements made possible by the present invention, properly focused and illuminated close up images were impractical, or were not able to be captured properly or economically on common mobile phones, webcams or imagers and, thus, the present invention brings to market and makes practical a new and important range of online consultation opportunities.

(0038) The present invention makes possible and practical many applications for useful purposes. A few will be described here but it is not limited thereto. As one example, through the use of the present invention, users may request online consultation or referrals to experts using digital images, video, live video feeds or data transfer of such digital images not able to be captured previously using common mobile phone cameras, webcams or imagers. Fees may be collected for direct services or referrals from the user, advertisers, service providers or others in the communication or service chain. This is only one of many possible examples of the type of utility which is now made possible, economical, convenient and practical though the use of the new image capture capabilities the present invention creates for the common mobile phone, webcam or imager. This functionality of the present invention is not limited to the specific configurations of imaging modifier devices described herein.

(0039) A second embodiment of an imaging modifier device 100 of the present invention is shown in FIG. 12, which includes its own light source, which may be advantageous when the modifier device 100 is used in combination with an imaging device 102 that has an image capture component, such as a camera lens 104, but has no light source. The modifier device 100 includes a housing 106, a retaining section 108 suitable for releasably retaining an optional tool of interest represented by tool 110, a light source 112 within the housing 106, an optical channel 114 extending through the housing 106, a power source 116 in the housing 106, a first optional optical extension 118, and a second optional optical extension 120. As noted, the housing 106 includes the light source 112 therein. It also includes a light port 122 through which light passes from within the housing 106 to the environment to be lit. The modifier device 100 includes means with the light source 112 to control the illumination levels and conditioning of the light through mechanical, electrical, or optical filters. The light source 112 and any other components of the modifier device 100 in need of power may be connected to the power source 116, which may be a battery. Light from the light source 112 is isolated from the optical channel 114 and any optics contained in the channel 114, thus shielding such optics from excess or stray light, and

conditioning the light that passes out of the light port 122 into, or adjacent to, the attached tool 110. The optional optics in the channel 114 provide enhanced focus and image resolution for the imaging device 102. Either or both of the optional optical extensions 118 and 120 may be joined to the channel 214 to further enhance the imaging device's capability through the modifier device 100. When used in conjunction with a webcam, mobile phone or imager, the present invention of the device 100 provides controlled and conditioned illumination, enhanced optics and the ability to capture properly illuminated and focused images or video through the attached tooling at ranges not supported by the mobile device's optical system alone, particularly when it has no light source of its own.

(0040) A variant of the modifier device 100 of FIG. 12 is shown in FIG. 13, which shows an image modifier device 200 of the present invention. The device 200 includes self-contained lighting with no external mobile phone or imager is used. The device 200 includes an eye piece 202, which may include a lens or window, which eye piece effectively stands in the place of the optical sensor of a camera of a separate imaging device, and the human eye may observe the magnified and properly illuminated object of interest directly. The device 200 further includes a housing 206, a retaining section 208 suitable for releasably retaining an optional tool of interest represented by tool 210, a light source 212 within the housing 206, an optical channel 214 extending through the housing 206, a power source 216, which may be a battery, in the housing 206, and an optional optical extension 218. The housing 206 includes a light port 222 through which light passes from within the housing 206 to the environment to be lit. The modifier device 200 includes means with the light source 212 to control the illumination levels and conditioning of the light through mechanical, electrical, or optical filters. Light from the light source 212 is isolated from the optical channel 214 and any optics contained in the channel 214, thus shielding such optics from excess or stray light, and conditioning the light that passes out of the light port 222 into, or adjacent to, the attached tool 210. The optics in the channel 214 provide enhanced focus and image resolution when viewed through the eye piece 202. The optional optical extension 218 may be joined to the channel 214 to further enhance the viewing of the object of interest.

(0041) An alternative embodiment of a modification section 300 of the present invention is shown in FIGS. 14 and 15. The modification section 300 includes a lens section 302 and an aperture section 304. The lens section 302 includes a plurality of selectable lens channels 306, one or more of which may contain a lens or other sort of image modify element. The aperture section 304 includes a plurality

of selectable light aperture ports 308, one or more of which may include a light condition element, such as a filter, for example. The aperture section 304 includes a pivot pin 310 attachable to, or placeable on side 18 of the imaging device 14. The modification section 300 further includes isolation body 312 of the aperture section 306 arranged to isolate the lens channels 306 from the aperture ports 308 so that light associated with the aperture ports 308 does not affect imaging carried out through the lens channels 306. The modification section 300 may be used with a retaining section of suitable form. More generally, the modification section 300 is configured for the selection of one or more of a variety of lens and filter combinations to be selected for use with the imaging device 14. In this construction, the lens section 302 and the aperture section 304 are two rotating disks that rotate independent of one another as they are interlocked in a way that allows one disk to rotate separately in plane with the other disk. On the outer disk that is lens section 302, there are mounted a variety of lenses which, through rotation of the outer disk may be brought in front of the imaging device's camera optics. On the inside disk that is aperture section 304, there are mounted a series of filters, apertures, diffusers, or combination of such which may be brought in front of the imaging device's light source. Through the use of various combinations of lenses and/or filter combinations, the end user of a digital camera as provided by a mobile phone for example, may experience greatly enhanced photography allowing macro or micro photography with properly illuminated and controlled conditions. The disks containing the filters, lenses, apertures or combination of such may also contain blank cutouts such that the imaging device's built-in capabilities can be used without modification. This is only one of many configurations possible for allowing selectable lens, filtering, diffusing, or light conditioning elements to be brought into the path of the camera's optics and flash unit. Sliding or folding arrangements of bars with mounted optical elements, diffusers, apertures or other light conditioning elements are further examples of such arrangements. The current configuration of the modification section 300 also provides isolation of the imaging device's light source from the camera optics and optics of the lens channels 306 through the use of the isolation body 312 which may be located as part of, attached to, or in close proximity to the top or bottom surfaces of the disks.

(0042) Another imaging modifier device 400 of the present invention is shown in FIGS. 16-22. The imaging modifier device 400 includes a case body 402 and an imaging modifier section 404. The case body is sized and shaped to be friction fitted to an imaging device, such as a mobile phone but not limited thereto. The case body 402 may also include a portal 406. It is to be noted that the portal 406

may be replaced with another imaging modifier section such as the type represented by imaging modifier section 404 but not limited thereto. The case body 402 is configured to be symmetrical when rotated 180° with respect to the orientation shown in FIGS. 16 and 18 as seen in FIGS. 17 and 19. In that way, when the imaging device is a mobile phone having an imaging area in its upper left corner on the back side, the imaging modifier section 404 is aligned with the imaging area as shown in FIG. 16. On the other hand, by rotating the case body 402 180° longitudinally, the portal 406, or another imaging modifier section if one is there, becomes aligned with the imaging area in that upper left corner, as shown in FIG. 17. This symmetry of the device 400 gives the user of the imaging device the option to select how to use the imaging features of that device.

(0043) The case body 402 further includes first side cutout 408, second side cutout 410, top cutout 412 and bottom cutout 414. These cutouts 408-414 provide access to control or underlying components that may be located on either or both sides and either or both of the top and bottom of the imaging device to which the modifier device 400 is releasably joined. They are arranged so that the controls or underlying components may be accessed in the rotated orientations applicable for the device 400. The case body 402 is designed to be suitable as a replacement as a case for an imaging device such as a mobile phone. It includes flexible retaining shoulders 407 on one or more inside walls thereof to releasably engage with a groove on the outer perimeter of the imaging device. The case body 402 may not include that retaining shoulder 407 in the vicinity of the image modifier section 404 about at location 416 to facilitate removal of the modifier device 400 from the imaging device. This feature provides a leverage point or "quick release" feature and the attachment points holding the case body 402 firmly to the imaging device may be designed as noted to allow ease of removal of the device 400. Due to the symmetrical design of certain features of the case body 402, the device 400 may be rotated at specific angles (most notably 0° and 180°, but other designs may allow other angles) to allow various options of optical components, attachment points or openings in the same case body 402 to align and be held in place with respect to various underlying features of the imaging device.

(0044) The imaging modifier section 404 includes an imaging modification section 418 and a retaining section 420. The modification section 418 includes an optical channel 422 and a light portal 424. The optical channel 422 is arranged for positioning over an imaging component of the imaging device, such as camera lens. The optical channel 422 includes a connector section 426 arranged to allow the permanent or removable connection such as by bonding or snap fitting of optical components

including, but not limited to, lenses, filters, light pipe or light channels. Either or both of the optical channel 422 and the light portal 424 may be angled as shown in an alternative embodiment of the imaging modifier section 404 shown in FIG. 23 such that the opening on the top surface of the case is offset from the opening on the bottom surface. Other configurations of the light pipes, filters or openings may also be used for properly guiding or filtering light. For example, a light pipe or a filter may be fabricated as a flexible device that may be passed through a light aperture or optical channel of any of the imaging modifier devices described herein, which flexible device may be a tube or a plastic rod capable of guiding light or images therethrough.

(0045) The modifier section 404 includes one or more stress relief structures 428 may be designed into the optical channel 422 to allow ease of snap fit while maintaining optical channel light blocking functionality. The retaining section 420 includes an interior attachment elements 430 for releasable attachment of a tool thereto and a taper exterior configuration to allow pressure fitting of a tool of interest to the exterior of the modifier section 404.

(0046) Alternative modifier section 500 of FIG. 23 includes a retaining section 501 with interior retaining ribs 502 for interior attachment of a tool of interest, and a tapered exterior surface 504 for exterior attachment of a tool of interest. The exterior surface 504 may have the taper but is not required to have the taper. Raised pressure points (bumps) 506 shown in modification section 500 of FIG. 23 may be present at various points to allow firm fit and provide "graduated snap fit" or resistance to reverse twist out of attachments. That is, the twist-in attachments "snap" into place as they pass over each of the graduated bumps (placement and height) 506 and hold firm.

(0047) A tool 600 that may be if important to a user of the imaging modifier devices of the present invention is shown in FIGS. 24 and 25. The tool 600 is a measured reticule having a top 602, a bottom 604, an interior 606 and an exterior 608. The tool 600 may taper from the bottom 604 to the top 602 and is configured for a friction or pressure fit to the exterior attachment location of the retaining section of any of the imaging modifier devices described herein. The tool 600 is of a selectable length but of a fixed length when selected. As a result, when the tool 600 is attached to a modifier device and the top 602 is placed on a substrate where an object of interest for the purpose of imaging is located, the spacing between the imaging component of the imaging device associated with the modifier device and the object of interest is set. This is of advantage when there is a desire to maintain a constant focal point for the imaging activity while allowing the imaging device to move over the surface. The interior

606 may include a measuring component, such as a scale, to allow imaging of the object with a reference point for the dimensions of the object.

(0048) The present invention provides several advantages and new capabilities beyond which have been previously disclosed or available in manufactured inventions. One advantage and new capability of the present invention is that it provides add-on capability and enhancements for mobile phone cameras, webcams and imagers to allow for adjustable lighting levels and light conditioning, and may be used with imaging devices with or without integrated flash capabilities. Further, optical magnification may be incorporated into the present invention and specialized tooling may be attached or used in conjunction with the present invention to make specialized imaging applications possible using the common and convenient image capture devices found on mobile phones, webcams and imagers.

(0049) Another advantage and new capability of the present invention is that it provides shielding and light isolation for the camera optics from the light source to allow close up photography using the built in flash capability of a mobile device, which may be set to continuous illumination setting. Without use of the present invention, the device's image sensor may be easily overwhelmed or saturated from the very strong illumination produced from the device's flash unit rendering the image captured of very poor quality.

(0050) Another advantage and new capability for photographers using mobile devices with integrated cameras with flash is that the flash illumination may be conditioned, filtered or partially blocked by the aperture for fine control of lighting conditions under normal camera operation. In this case, additional optics (lenses) beyond the mobile phone camera's optics are optional for use.

(0051) Another advantage and new capability is that mobile phones, webcams or other imagers may now be adapted and used for very controlled and specialized applications such as, but not limited to use as an otoscope, medical light, magnifying camera, close up camera, hobbyist camera, veterinary camera, collectors camera, borescope or any application requiring close-up photography with controlled illumination.

(0052) Another advantage and new capability is that a variety of specialized tooling may be used and attached to the present invention thus making use of standard components such as disposable specula tips, reusable specula tips, measured reticules, or non-standard specialty tips that may also be constructed and used in conjunction with the present invention.

(0053) Another advantage of this invention is the highly portable nature of the invention and the very convenient nature of the highly popular and widely available mobile phone, webcam or imager that this invention may work with.

(0054) Another advantage is the projected cost savings of this device as compared to expensive or highly specialized alternatives for the digital otoscope market, medial light, or photography market.

(0055) Another advantage and new capability of this invention when used as a medical light or otoscope is the new ability and self sufficiency which may be gained by a user in that they may now use this device alone or with combined use of a computer or monitor, to see within his or her own ear or nose, look at and track changes in appearance of moles, or observe and/or document other locations on his or her own body out of reach or view for the normal person.

(0056) Another advantage and new capability of this invention is that when used in combination with devices capable of storing images or video and sending such via channels of electronic communication is that stored images captured using the present invention, video captured using the present invention, or live video feeds using the present invention may be transmitted to interested parties.

(0057) Another advantage and new capability of the present invention is the ability to transmit captured images or video or produce a live video feed of items or locations previously not able to be imaged with the mobile phone, webcam or other convenient imager. For example the eardrum or ear canal of oneself or a child, a throat, a chipped tooth or missing filling, a mole on the back of one's head, a magnified image of a coin or stamp, a magnified and well lit serial number, or a magnified image of a science experiment are just a few examples of images, videos, or live feeds that one may wish to transmit to someone with a particular interest or knowledge for consultation, informational, recreational or business purposes.

(0058) Another advantage and new capability of the present invention is the creation of new business opportunities whereby a person may want to be directed to another person or entity for consultation on matters that previously would have required direct and personal consultation. With the use of the present invention, initial or full consultation opportunities which may not have been possible or practical in the past may now be arranged online. As examples, a hearing aid wearer may want to simply know if he or she has too much wax in his or her ear; a new parent may seek advice on the look of his or her child's eardrum, throat, or a mole or rash. As a further example, a collector may want to be directed to a person or entity for consultation with an expert in the field. A person living in a remote

area or that lacks proper mobility, time or finances may want a direct online consultation or be directed to someone for follow-up consultation. A doctor, audiologist, field service representative or traveler may want to consult with another remote doctor, audiologist or knowledgeable person. The present invention provides the capability to produce properly illuminated and magnified close up images, video or live video feeds using commonly available mobile phones webcams or imagers and software for direct transmission and consultation, thus providing convenience, services and potentially making the consultation practical or feasible. Other uses may be created whereby a person or entity may provide the referrals or leads to or for the appropriate people or entities, or alternatively provide direct services for a fee.

(0059) Another advantage and new capability that the present invention makes possible is it provides self sufficiency to inspect at close range areas of one's body that may be awkward or impossible to see without the aid mirrors and/ or the need for a second person. For example, with the use of this device, a user may gain the ability to make the first pass assessment to find out if something is in his or her ear (bug or sand for example), make the first pass assessment on their level of personal hygiene or hair growth in one's ear, see and make assessment of the mole on his or her back, or document changes to moles or skin conditions. The present invention provides close up, properly illuminated imaging capabilities previously not available on very common mobile phone platforms, webcams or imagers.

(0060) Another advantage and capability of the present invention is that it provides a method and machine allowing the user of a mobile phone to select a variety of lenses or filters to be placed in front of the camera optics or flash unit, thus providing highly desirable, and previously unavailable combinations of features for the end user, such as selecting a diffused and selected level of light source at close proximity to an object of interest for magnified photography. Another example may be a photographer using a mobile phone that wishes to fine tune the flash conditions for a specific image.

(0061) The advantages of the present invention include but are not limited to providing a convenient adapter for common digital cameras, mobile phone cameras, webcams, mobile devices or other imagers, which provides a machine, mechanism and apparatus to fine tune and condition the lighting conditions and optical path of said imager or camera. Further, it provides shielding and isolation of the optical path used by the camera imager from the light source. Further it allows the common mobile phone, imager or webcam to be adapted for use as a specialty light, medical light, otoscope, magnification camera or to be used with a vast variety of specialty tooling, especially for close range

applications. Further the present invention makes possible a new and wide variety of selectable lens or filter combinations for modification of the optical system and lighting conditions available or produced by common mobile phones or webcams. Further, the new capabilities made available by the present invention make possible an important and a variety of applications for online consulting or other applications.

(0062) The description provided of the present invention and variations of the invention enables one of ordinary skill to understand and make and use of said invention. The invention described should not be limited to the description as stated above, as a variety of variations, combinations or equivalents may be possible.

WHAT IS CLAIMED IS:

1. A device to modify the imaging of objects with an imaging device including a camera component and a light source, the device comprising:

a. an imaging modification section including an optical channel and a light aperture, wherein the optical channel is isolated from the light aperture and wherein the imaging modification section is configured for placement on the imaging device with the optical channel aligned over the camera component and the light aperture aligned over the light source such that the camera component is isolated from the light source; and

b. a retaining section joined to the imaging modification section and arranged to releasably attach a tool thereto.

2. The device of Claim 1 further comprising an alignment section joined to the imaging modification section and arranged to align the optical channel and the light aperture with the camera component and the light source when the device is placed on the imaging device.

3. The device of Claim 2 wherein the imaging modification section is configured to rotate with respect to the alignment section.

4. The device of Claim 2 wherein the imaging modification section, the retaining section and the alignment section are formed as a unitary piece.

5. The device of Claim 1 wherein the imaging modification section and the retaining section are formed as a unitary piece.

6. The device of Claim 1 wherein the optical channel includes an optics component.

7. The device of Claim 1 wherein the light aperture includes a filter.

8. The device of Claim 1 wherein the retaining section has an interior attachment structure and an exterior attachment structure.

9. The device of Claim 1 wherein the light aperture is tapered and curved.

10. The device of Claim 1 wherein the light aperture is angled.

11. The device of Claim 1 wherein the tool is a spacer tool arranged for friction fitting to the retaining section.

12. A device to modify the imaging of objects with an imaging device including a camera component, the device comprising:

a. a housing;

a. an imaging modification section in the housing and including an optical channel, wherein the imaging modification section is configured for placement on the imaging device with the optical channel aligned over the camera component;

b. a light source in the housing isolated from the optical channel such that the camera is isolated from the light source; and

b. a retaining section joined to the imaging modification section and arranged to releasably attach a tool thereto.

13. The device of Claim 12 further comprising a power supply in the housing and connected to the light source.

14. The device of Claim 12 wherein the housing and the retaining section are formed as a unitary piece.

15. The device of Claim 12 wherein the optical channel includes an optics component.

16. The device of Claim 12 wherein the retaining section has an interior attachment structure and an exterior attachment structure.

17. A device to modify the imaging of objects with an imaging device including a camera component and a light source, the device comprising an imaging device case, wherein the imaging device case includes:

a. a case body configured to fit on the imaging device;

b. an imaging modification section forming part of the case body, the imaging modification section including an optical channel and a light aperture, wherein the optical channel is isolated from the light aperture and wherein the optical channel aligned over the camera component and the light aperture aligned over the light source such that the camera component is isolated from the light source when the case body is on the imaging device; and

b. a retaining section joined to the imaging modification section and arranged to releasably attach a tool thereto.

18. The device of Claim 17 wherein the optical channel includes an optics component.

19. The device of Claim 17 wherein the light aperture includes a filter.

20. The device of Claim 17 wherein the retaining section has an interior attachment structure and an exterior attachment structure.

21. The device of Claim 17 wherein the light aperture is angled.

22. The device of Claim 17 wherein the case body is configured to be rotated with respect to its positioning on the imaging device without blocking the camera component and the light source of the imaging device.

23. The device of Claim 22 wherein the imaging modification section and the retaining section are located in a corner of the case body, wherein the case body further includes a portal in an opposing corner thereof.

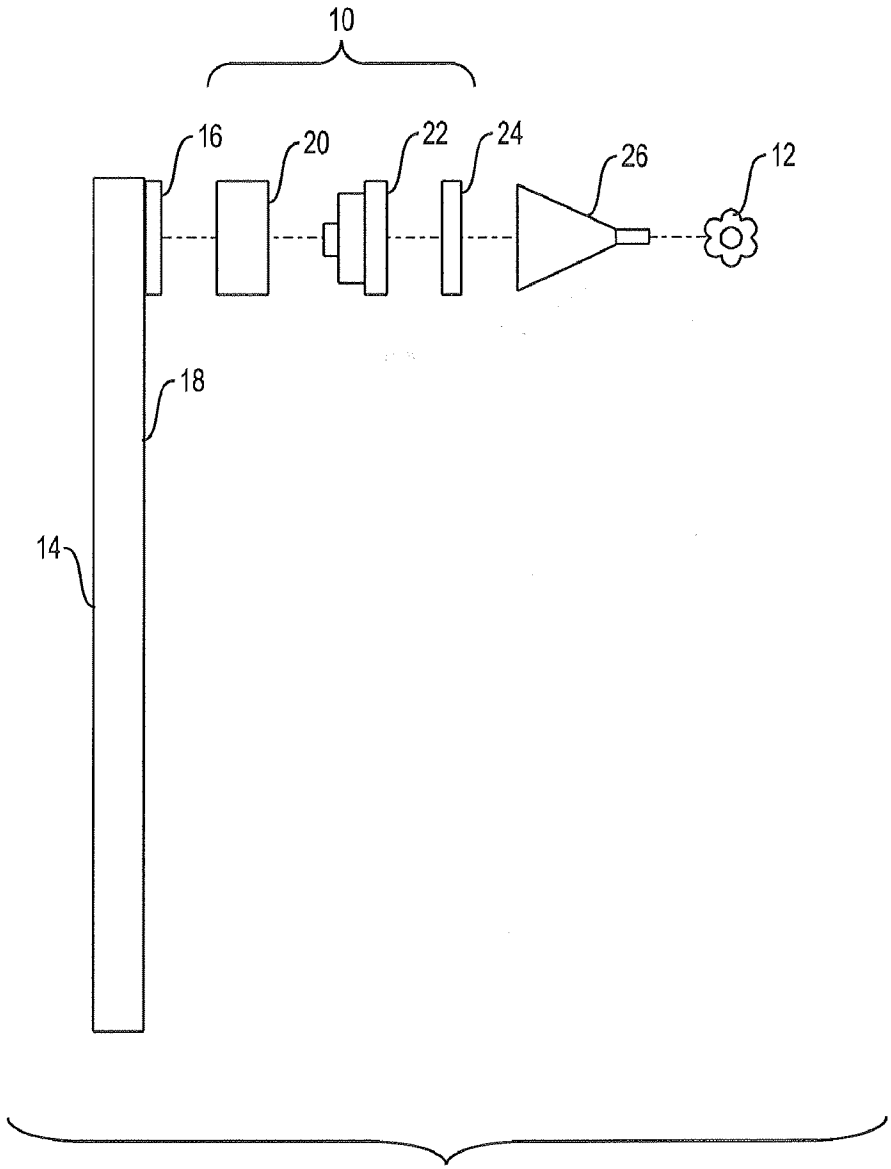

FIG. 1

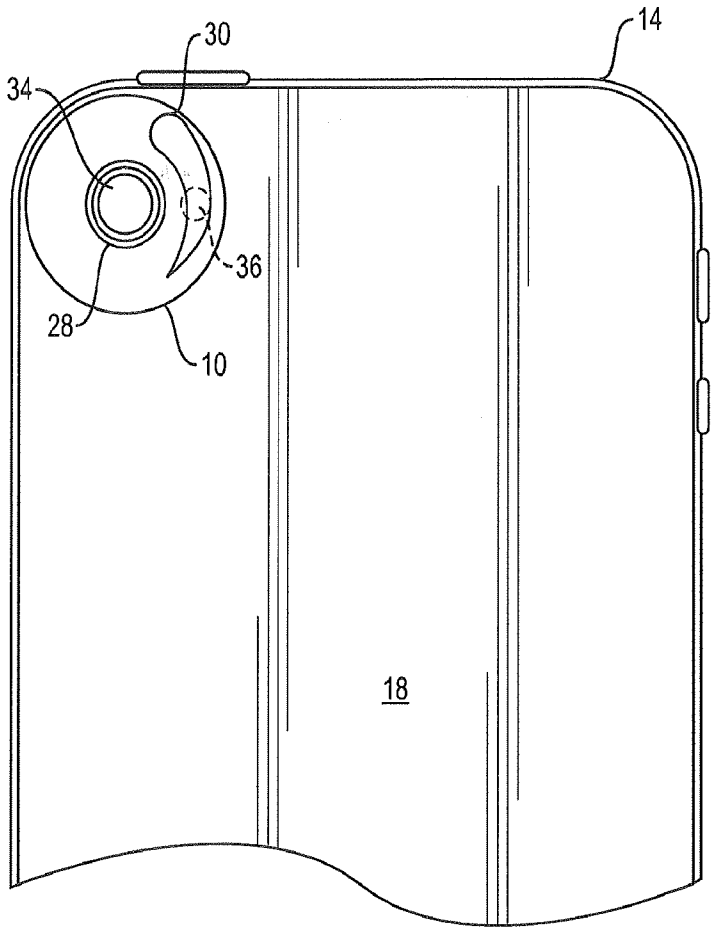

FIG. 2

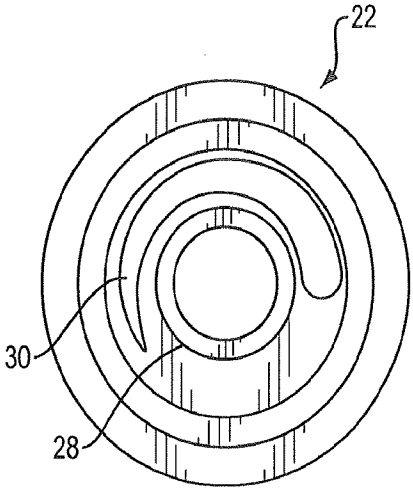

FIG. 3

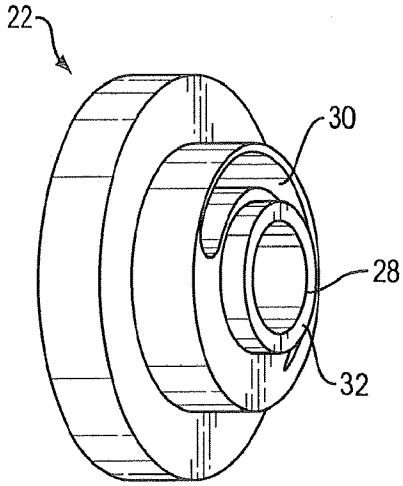

FIG. 4

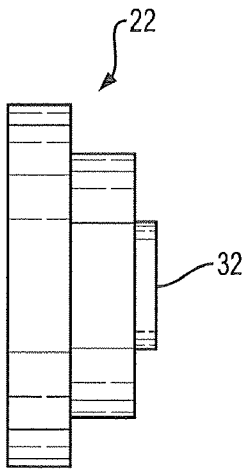

FIG. 5

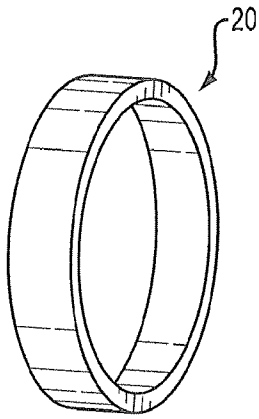

FIG. 6

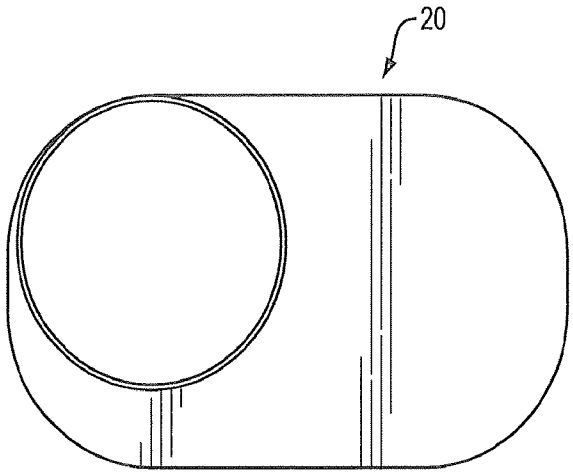

FIG. 7A

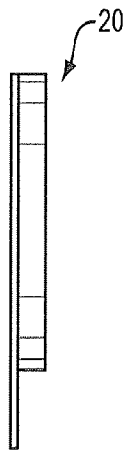

FIG. 7B

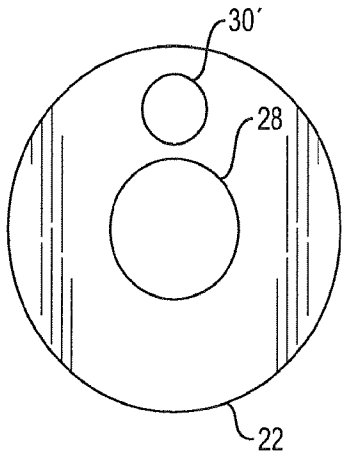

FIG. 8

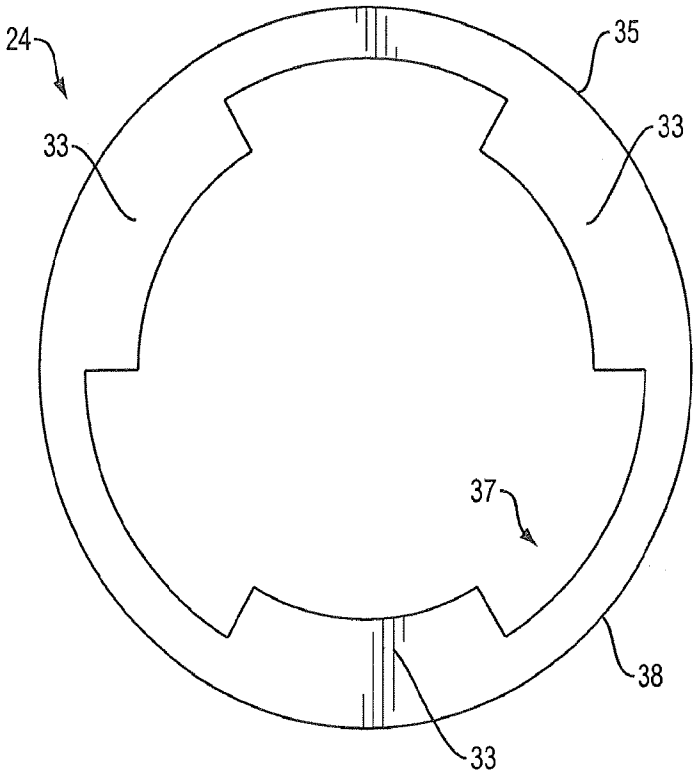

FIG. 9

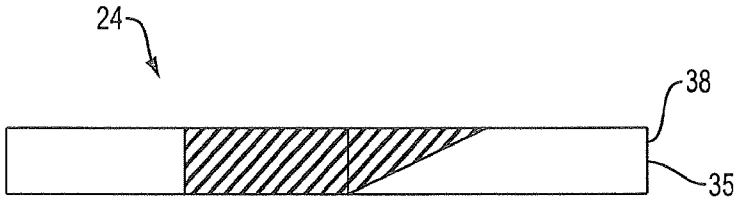

FIG. 10

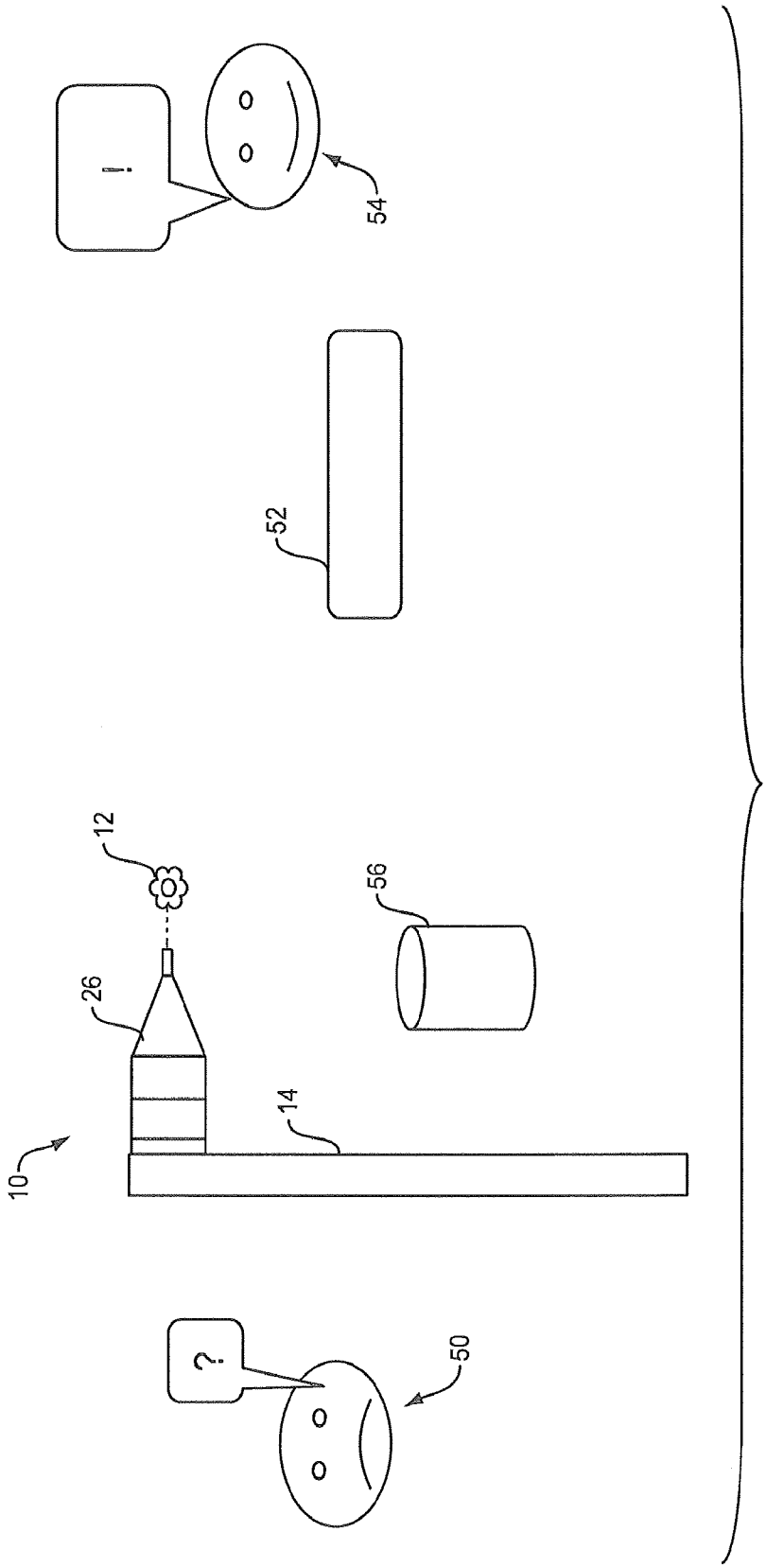

FIG. 11

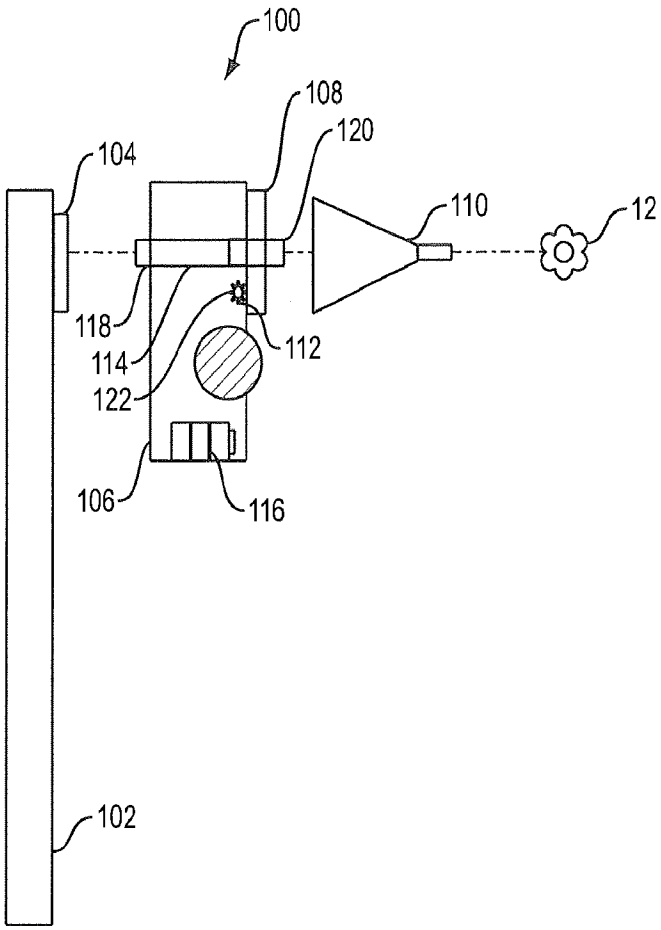

FIG. 12

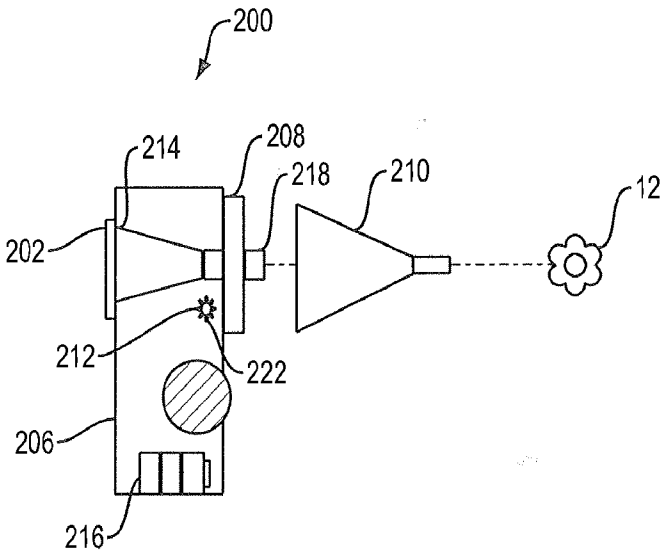

FIG. 13

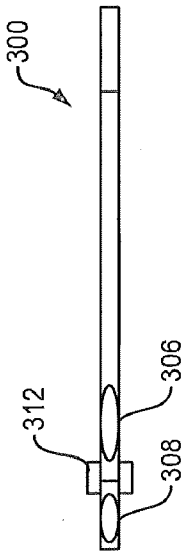

FIG. 15

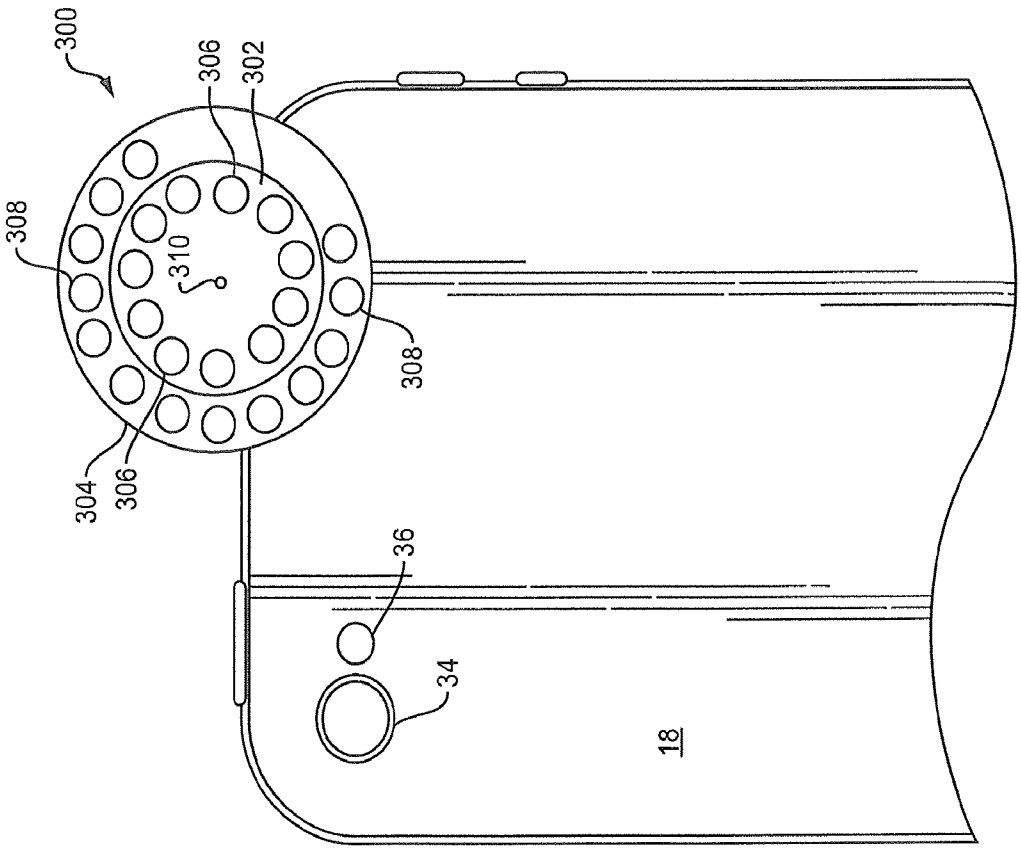

FIG. 14

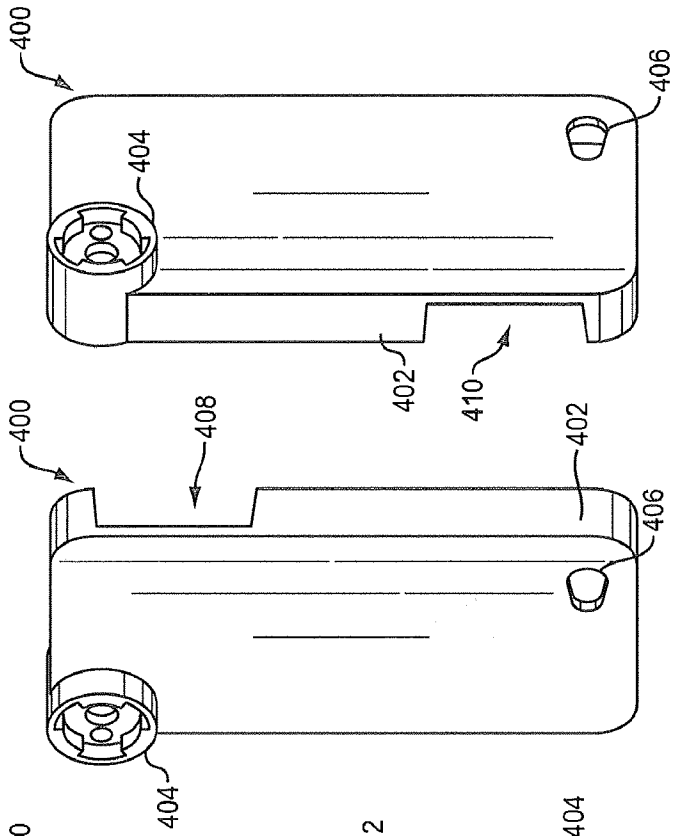

FIG. 19

FIG. 18

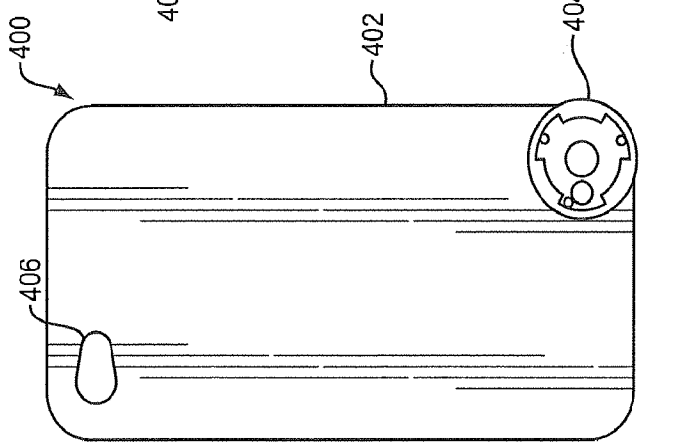

FIG. 17

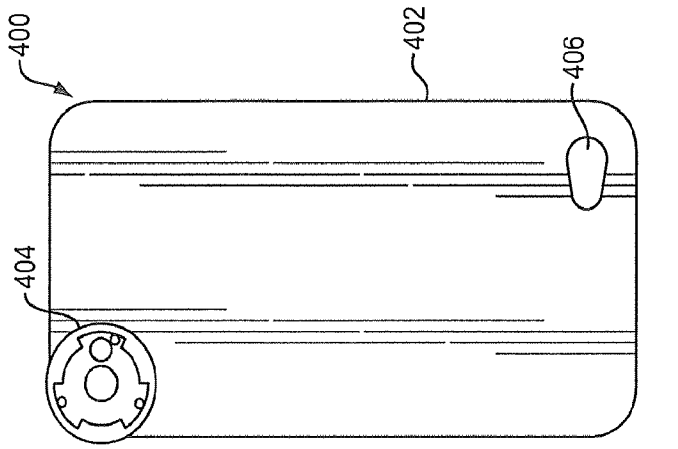

FIG. 16

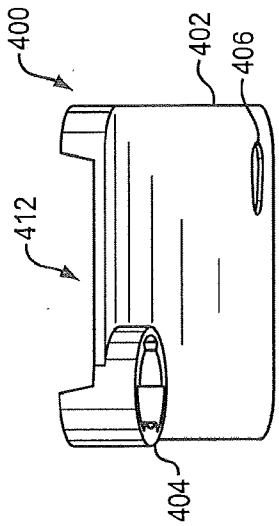

FIG. 21

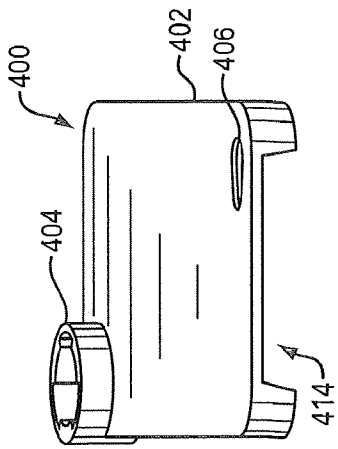

FIG. 20

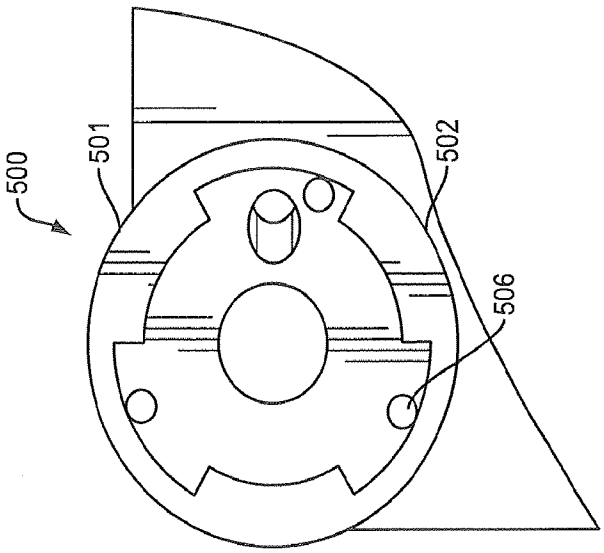

FIG. 23

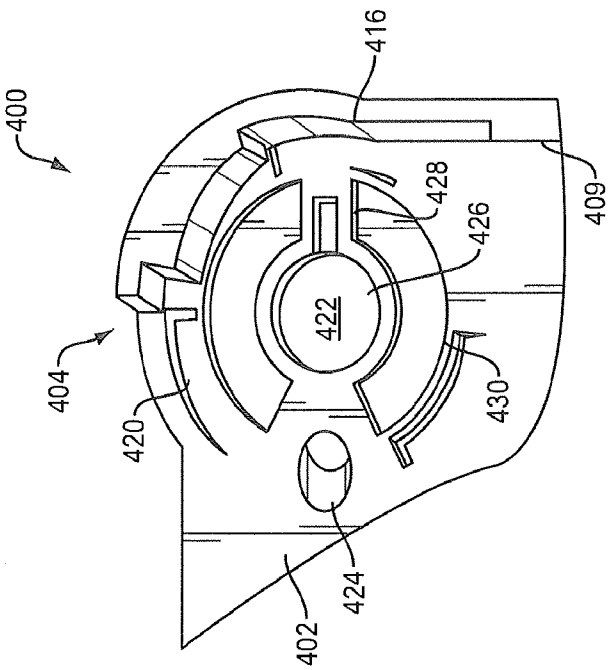

FIG. 22

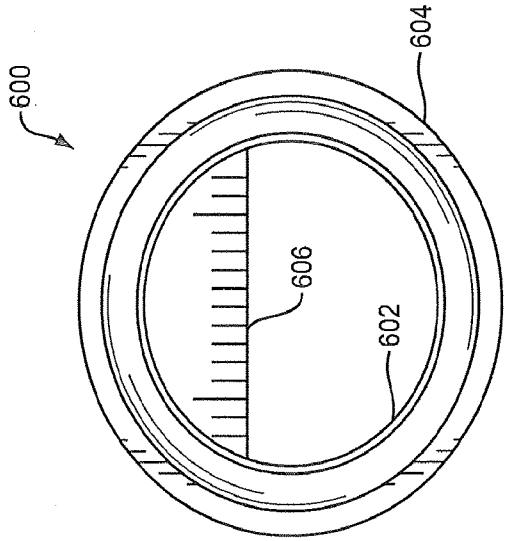

FIG. 25

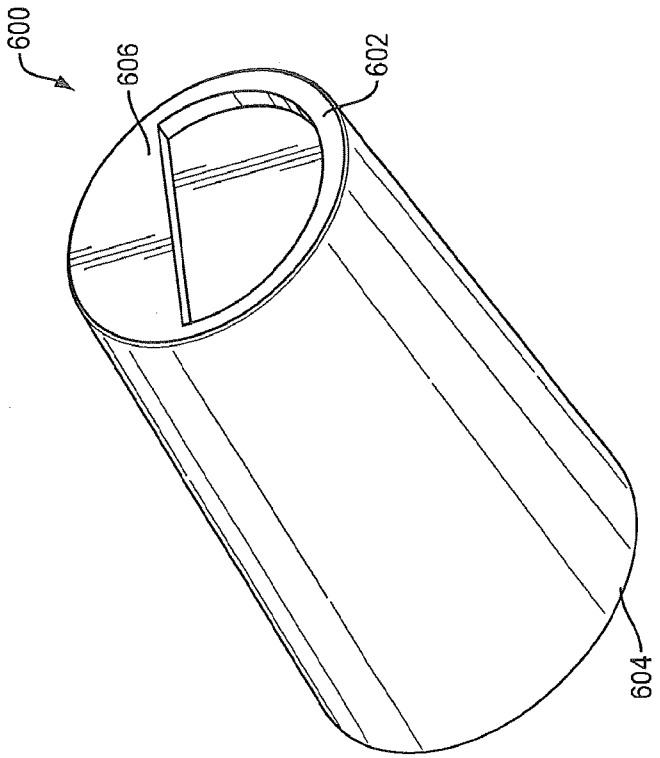

FIG. 24

INTERNATIONAL SEARCH REPORT PCT/US2013/032558 17.06.2013

International application No.
PCT/US13/32558

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G02B 23/16; G02B 7/16 (2013.01)
USPC - 359/894, 508, 511
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - G02B 23/16; G02B 7/16 (2013.01)
USPC - 359/894, 508, 511

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
MicroPatent (US-Granted, US-Applications, EP-A, EP-B, WO, JP, DE-G, DE-A, DE-T, DE-U, GB-A, FR-A); DialogPRO (Derwent, INSPEC, NTIS, PASCAL, Current Contents Search, Dissertation Abstracts Online, Inside Conferences); Google Scholar; Search terms used: camera, imaging, lens, light, optical, channel, aperture, isolate, retain, filter, taper, curve

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 8,098,278 B2 (YUMIKAKE, K et al.) January 17, 2012; figure 1; column 6, lines 46-51; column 8, lines 17-23	1-2, 4-8, 10, 12-16 --- 3, 9, 11, 17-23
Y	US 8,059,953 B2 (NOMURA, H) November 15, 2011; figures 12b; column 8, lines 35-50	3
Y	US 5,253,169 A (CORBY JR, N) October 12, 1993; column 4, lines 21-30	9
Y	US 7,909,521 B2 (SON, K) March 22, 2011; figure 2; column 4, lines 24-29; column 5, lines 6-9	17-23
Y	US 7,892,239 B2 (WARNICK, D et al.) February 22, 2011; figure 5A; column 7, lines 54-67	11
A	US 6,867,933 B2 (MATSUSAKA, K) March 15, 2005; whole document	1-23

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 June 2013 (05.06.2013)	17 JUN 2013
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774