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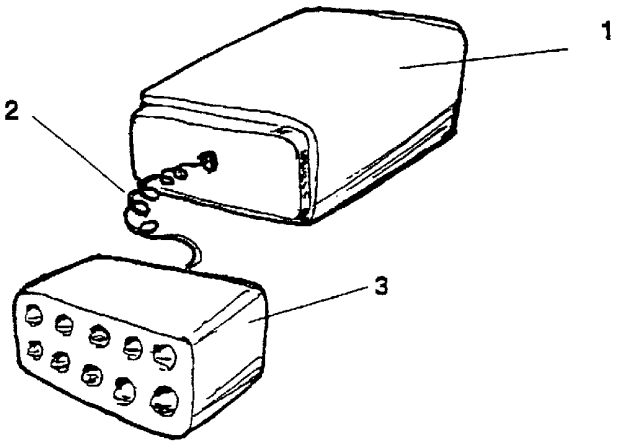
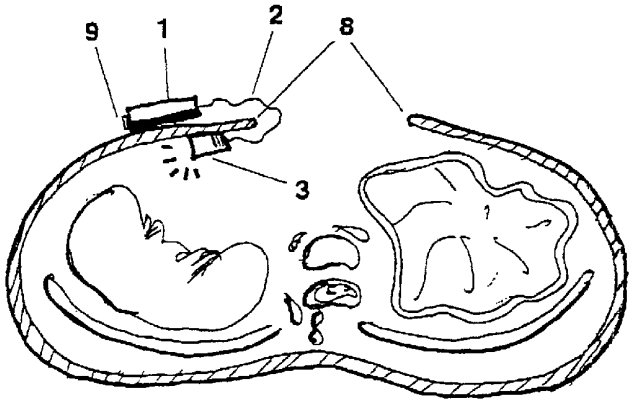
(54) Title: ILLUMINATING DEVICES FOR MEDICAL USE





(57) Abstract: A self maintained, fiberoptic-free illuminating device for medical applications characterized by having at least one white LED and a built-in battery. The said illuminating device is a light-weight, portable, sterilizable, disposable, user friendly and highly effective instrument. It is easily inserted into body cavities and inside any surgery field to provide cold light in any desired direction and angle.

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ILLUMINATING DEVICES FOR MEDICAL USE

Field of the Invention

The present invention provides a series of new illuminating devices, intended for use by physicians, surgeons, veterinarians and other medical staff, in their daily activities. More specifically, it offers cord-less and fiberoptic-less illumination devices characterized by being long lasting, small, light-weight, portable, sterilizable, disposable, user friendly, highly effective, energy efficient and cold light emitters.

Background of the Invention

There are several methods currently used for illuminating operating theaters:

1. Heavy top lamps connected to the ceiling. Many operation theaters are equipped with more than one top light. These illuminating devices have some major disadvantages, among them are:
   - High power devices (3000-6000 Watt).
   - It is very difficult to keep the illumination focused on the desired spot.
   - There are shaded areas where the top light cannot provide a satisfactory illumination effect.

- The top lamps have a side effect of heating which causes discomfort to the surgeons and the related staff.
- Focusing and adjustment of top light lamps require special sterile handles and may cause sterilization and cleaning problems.
- Top light lamps can get in the way of the surgeons and hit their head or shoulders.
- Top light lamps are high cost items.

2. There is a wide range of illuminating devices based on fiber optic technology - among them are:

- Fiberoptic head light: This device is a kind of helmet which the surgeon carries on his head, and consequently, should direct his head to the desired area that needs to be illuminated.

It has several major disadvantages:

(i) The device is heavy and may cause pain in the surgeon's neck and back.

(ii) It is sometimes difficult, or impossible, to direct the illumination to a desired angle, in particular in shaded areas in the open abdomen or chest.

(iii) The light coming out of the fiber is focused to illuminate a certain area, according to the distance of illumination. In other words, the surgeon must stay at a constant distance from the operated area. Beside the need to direct the light continuously with his head, this causes the surgeon a further inconvenience.

(iv) The device is expensive. In addition, the fiber cable that connects the generator and the helmet, gets damaged frequently.

(v) The thick cable connected to the helmet may limit the surgeon's movement.

- Illuminated retractors: These devices are specifically designed to have built-in fiberoptic cables. The beam of light is very narrow and its direction is dictated by the shape of the retractor. Consequently, the device is not as effective as this kind of illuminating device should be. In addition, the fiberoptic cable that connects the device to the generator causes further disadvantages as described above.

- Fiberoptics-based devices used in illumination of laparoscopic and endoscopic procedures are also common.

- Some drilling equipment for dentists' use contain fiberoptic means for illumination.

Prior art teaches mostly of fiberoptic-based illuminating devices for use in surgery and other medical applications, among them are:

US Patent 4,551,129 provides technique and apparatus for intraocular and microsurgery including lighter-irrigator hypodermic tube which utilizes a central light guide to conduct light into the area of the surgery along the fluid infusion pathway. An auxiliary to the lighter-irrigator comprises a fiberoptic work cord or light pipe characterized by light

transmission and light dispersion along the path between a light source and the lighter-irrigator.

US Patent 5,569,300 relates to a surgical instrument for performing subcutaneous surgery, specifically the utilization of the surgical instrument to illuminate the carpal tunnel area of a patient to effect the severance of the transverse carpal ligament. The patent discloses dilating surgical forceps having fiberoptics illumination means on the blade inner surface.

US Patent 5,722,426 discloses a coronary light probe for determining the location of arterial structures and blockages thereof during surgery so as to facilitate making incisions where necessary. The light probe has an elongated portion with fiberoptic cables for conveying light to a distal tip of the probe. The light emitted from the distal tip illuminates the vessel adjacent the distal tip.

US Patent 5,931,670 teaches of an illuminated dental suction appliance that contains a suction component having a tubular member and a light projecting tip. Light is transmitted from a fiberoptic illuminator along the length of the tubular member to the light projecting tip.

WO 99,56633A1 reveals an illuminated surgical retractor for creating a working space for dissecting instruments in support of a surgical

procedure such as coronary bypass procedure or other type of vessel harvest procedures. More specifically, the patent provides an illuminated retractor for illuminating a subcutaneous surgical field in the space between a vessel, such as the saphenous vein, the subcutaneous tissue when the illuminated retractor is used to retract the subcutaneous tissue away from the superior surface of the vessel. A distal end of the second blade section is connected to an illumination source so that the second blade section is substantially illuminated.

The above devices suffer from the disadvantage of having cords or cables connecting the device to an external electrical or illumination source. Furthermore, they create heat, have a small illumination area and are relatively expensive. Consequently, there is a need for an illuminating device free of these shortcomings, applicable in medical fields, in particular, in surgery.

Upon searching for such a device it was found that a combination of self-maintained power (a battery), a cold white light emitter (a white LED), and various devices, applicable in medical treatment, in particular in surgery, may provide a new device, highly effective in illumination of the region of interest while at the same time, being free of the above mentioned shortcomings. Such combination of a battery, white LED and a device applicable in medical treatment, is new. The present invention is an example of how ingenuity may provide a relatively simple solution to several yet unsolved problems. In other words, such a solution, in this

particular case, has led to a new series of illuminating devices applicable in a wide range of medical applications, free of any of the above described long-lasting shortcomings.

Objects and Summary of the Invention

It is the object of present invention to provide a self-maintained, fiber optic-free illuminating device characterized by being long lasting, small, light-weight, portable, sterilizable, disposable, user friendly, highly effective, energy efficient and cold light emitter.

It is an additional object of the present invention to provide a series of small and portable illumination devices containing white LEDs and batteries.

It is a further object of present invention to provide an illumination device that is free of many disadvantages existing in present illumination devices, as described here-in-above.

The illumination device of the present invention provides a white LED light power-supplied by a built-in battery. Both, the LEDs and the battery are integrated parts of the devices. The device according to the present invention has some major advantages over the current existing illumination devices:

1. The illuminating part is placed inside the operation field, unlike the top light which is placed distantly.
2. No need for a connecting cable that causes inconvenience.

3. No need for highly expensive fiberoptic means such as light generators, which are placed next to the operating site and are very expensive.
4. The device is small, portable, sterilizable and disposable and as such is easily inserted into body cavities and any surgery field to provide light in any desired direction and angle.
5. The combination of a white LED and suitable powered battery provides a desired amount of illumination for a significant period of time. Furthermore, this combination intends to provide a new illumination tool applicable in examination and treatment of "internal" cavities (such as in laparoscopy and endoscopy procedures), as well as in examination and treatment of "external" cavities, such as ear, nose, throat, mouth (ENT, laryngoscopy, etc.).
6. Same principle of combination (white LEDs + baterry) is applicable for a series of illumination devices specifically designed for use by dentists, general practitioners, ophthalmologists and other physicians and specialists, including veterinary and veterinarian surgeons.

Brief Description of the Drawings

FIG. 1 demonstrates a cross section of a human under open surgery. The illuminating device comprises of an illuminating head (3) is attached to the inner part of the abdominal wall. A flexible cord (2) supplies energy from a second part of the device (1), which includes a battery and an operating switch (9)

FIG. 2 depicts an illuminating device comprising a main housing (1) which includes a 4 to 6 volt battery inside it, an illuminating head (3) carries 4-12 white LED's (5) arranged in rows or in any other desired manner. A built- in clip is placed on the main housing including a spring-loaded moveable clip (10) and stationary teeth (11) on the opposite side. The main housing is connected to the illumination head in a rigid, firm manner. The complete illuminating device may be attached to the abdominal wall by means of the clip (8).

FIG. 3 demonstrates a miniature, disposable illuminating device comprising a two button battery housing (12), a disposable switch (13) that when pulled out switches the light on, one LED (14), a led housing (15) allowing to adjust LED direction for providing optimal effective illumination in any desired direction. Attachment means comprising at least one long needle (16), which penetrate through the patients skin or other surface tissues (17) and at least one short needle that insure the device from shaking, moving, vibrating or rotating. An additional attachment mean (18) is placed in the opposite side of the skin surface and together with the long needle(s) attaches the device firmly to place.

FIG. 4 depicts an illuminating device which is similar to the one described in FIG 2. The device is illustrated when the illuminating head (3) is detached from the battery housing (1) and a thin flexible cord (2) supplies

the power from the batteries to the illuminating head. The head (3) has built in portions (19) with holes (20) allowing attachment of the device to the patient by stitching with sutures (21) in the desired place.

The device described in 4a is similar to the device in figure 4. However, in the first, all the 1 to 4 sutures (6) are originally built-in and connected to the device. Furthermore, the sutures have needles (7) at their distal end for stitching the device in place.

FIG. 5 describes attachment means (88) which allows the attachment of an illuminating device to a rigid retractor in a firm manner (89).

FIG. 6 illustrates a surgical retractor with a built-in illuminating device carrying a set of LED's (23) on either side of the retractor. In some retractors there are up to four retraction elements, each may carry a set of LEDs . A built-in operating switch (24), and batteries (25) on the retractor is one of the preferred embodiments. When using said retractor, the whole operation cavity (26) is illuminated sufficiently.

FIG. 7a demonstrates a Duval forceps with a built-in illuminating device, which comprises a battery housing (27) an operating switch (28), a double illuminating head (29) including two LEDs (30).

FIG. 7b depicts a spatula with 2-4 built-in LEDs (31), a battery housing (32) with one or two button batteries (33) and a battery cover (34).

FIG. 8 demonstrates an illuminating device having the same battery setting (35) as shown in FIG. 2, an attachment means (36) as shown in FIG. 3, and an operating switch (37). This device has a 20-30 cm, flexible, neck (38) consisting of a main tube (44), a soft stainless-steel wire (39) and an electric cord (40) for transmitting power to a set of 6-12 LEDs (42) that are desirely arranged in the illuminating head (41). The device is attachable to the patient's body (45) in a firm way, wherein the illuminating head (41) can be placed in the operation area by manually bending the neck (43) and directing the head to the desired position and location. The stainless-steel wire maintains the selected position of the neck.

FIG. 9 illustrates a patient (46) in a Mediastinoscopy procedure. The device shown (47) represents a Mediastinoscop with built-in illumination means (48) comprising a set of LEDs arranged in a ring formation or may be arranged in any other desired formation.

FIG. 10 describes a catheter (49) especially designed for illuminating the point of the esophagus – gastric junction (50). The catheter comprises of a main body portion (51), which allows good pushability of the catheter, an inflatable flexible balloon (52) at the distal part, an inflating valve (53) through which the balloon is inflated and deflated. 2-5 LEDs (54) are placed in the distal portion of the catheter adjacent to the balloon. When switched on, the light is seen through the transparent wall of the catheter.

An electric cord (58) supplies the power from the battery, which is placed in the battery housing (55) and operated by the operating switch (56). Distance measurement marks on the catheter body (61) allow to measure or appreciate the distance from the balloon to the catheter's proximal side. A main lumen (59) allows access to the stomach from the entrance (57). The catheter is inserted to the stomach via the esophagus, the balloon is then inflated and the catheter is pulled back until the balloon stops at the joining point. The illuminated distal portion is seen through the esophagus wall, indicating the exact point of interest. The distance from the stomach to the throat can be easily appreciated and measured by the marks on the catheter body.

FIG.11 depicts a similar illuminating device as described in FIG. 10. However, in this case, a set of 6-20 LEDs (62) are arranged in the distal portion of the catheter creating a 4-15 cm portion of illuminating catheter. The catheter is inserted to the colon or intestine via the rectum. It is then possible to see differences in trans-illumination between normal parts of the organ (63) and the pathologic parts. For example, a tumor (67) in the colon causes a dark portion (64) when examining the trans-illuminated colon. Another use of this device is in surgery procedures. For example, trans-illumination clarifies the shape of the organ and helps avoiding dissections in wrong places and cutting blood vessels (66).

FIG.12 illustrates a rod-shaped instrument, a suction device (68) for example. An illuminating device (69) comprised of a battery housing (70), a head (71) a set of 2-4 LEDs (72) attachment means (74) and an operating switch button (73). This device is attached to the suction instrument providing an excellent illumination.

FIG. 13 depicts a disposable dentist mirror (75) having built-in illuminating means in the form of LEDs (76) pointing to the mirrors sight direction, a battery housing (77) and an operating switch (78). In one option the battery is a reusable battery, and inserted into the disposable mirror prior to use.

FIG. 14 demonstrates a headlight having fitting means to the surgeon's head (84). Said headlight device comprises an illuminating head with a set of 6-15 LEDs (79), an angle adjustment capability (82), a battery housing (81), an operating switch (83) and a focusing lens (80).

FIG.15 demonstrates a disposable, illuminating thimble. Said illuminating thimble comprising a housing (85), two LEDs (86) and an operating switch button (87).

FIG.16 illustrates a miniature illuminating device comprising a battery housing (90), an illuminating head (91) having a set of 2-5 LEDs (95), electric cord (92) and an operating switch (93). The illustrated setting

allows the illuminating head (91) to be placed apart and independently of the battery housing. When it is placed at the operation field (94) it provides a very close and effective illumination.

FIG. 17 describes an illuminating device (98) attached to a mounting device which comprises a set of rods (96) and hinges (99) to maintain positioning of the illuminating head in the desired position. The mounting device is attachable to the operating table (97). A further way of achieving positioning of said illuminating device is by means of a flexible neck, as described in FIG. 8.

FIG. 18 demonstrates an illuminating device (103) placed in a mouth of a patient suffering from sinusitis (100). The light creates trans-illumination effect through the sinuses. The left sinus (101) is clear, whereas the right (102) is blocked, as reflected by the difference in light brightness.

FIG. 19 depicts a miniature illuminating device (104), similar to the one shown in FIG. 16, including a shield (105) preventing from the light to be seen from the side, hence helps in hiding the light beam from spectators away from the focused beam of light (106). The said shield can be moved to a second back position (107) allowing a wide beam as well.

FIG. 20 describes theracotomy retractor (108) with an illumination accessory device, including an illumination head (109) with 7-12 LEDs

(110) an extension neck (113), battery housing (111), operating button (115) and attachment means (112) to the retractor. The surgeon can move the neck (113) and adjust it to any desired direction.

Examples and Clinical Applications

As was mentioned here-in-before there are numerous medical procedures, in particular, surgical operations, that require highly effective illumination means.

1. Open chest surgery is a common operation procedure that requires effective illumination. In heart surgery, for example, the surgeon may dissect and stitch blood vessels of less than 2 mm in diameter. Furthermore, he may insert up to 15 miniature stitches into the vessel wall, at a shortest possible time, usually within up to ten minutes. This procedure may be repeated several times during a single operation. Consequently, a highly effective illumination of the operation area, should facilitate the surgeon to achieve a better quality surgery procedure in a shorter time. In this connection, it should be pointed out that top and/or headlights, currently in use in same surgical procedures, found to be very uncomfortable for surgeons and sometimes limited in lighting hidden cavities, in the surgery area. The illumination device of present invention (FIG 1) may be inserted into the operation area to provide an effective illumination of any hidden spot. Such a device must be attached to the operation area by fast and friendly means, the invention reveals several different options of attachment means as shown in drawings: built in

forceps to attach the device (FIG 2), specially designed pins which are inserted from the inner part of the open belly via the abdominal wall and attached by a clip to the outer surface of the patients belly (FIG 3). This allows steady and firm attachment of the device in the operation field. A different approach to the attachment is by suturing the device to the inner wall inside the operation area, either by means of standard stitching (FIG 4.), or by a built in suture and needle setting which already exists on the device (FIG 5). In any case, using the device of the present invention, should relieve the surgeon from the current headlight that was found to be both inconvenient and not always sufficiently effective.

2. Chest surgery is carried out either in a regular approach or in a less invasive approach, where the chest is opened in-between two ribs. In both approaches, by using instruments such as varies retractors, it allows the surgeon a sufficient opening for approaching the operation area. Illumination of the operated zone, in this kind of procedures, is very difficult to achieve, as most of the operated area is placed deep in the body, relatively far away from the retractor. Using the device of the invention for illuminating the operation zone in such procedures, for example a retractor containing a built-in illumination capability (FIG. 6), or a special illumination accessory device attached to the retractor (FIG. 20) may overcome the above obstacle and yields an improved result, namely a more accurate performance, in a shorter time.

3. Chest surgery also includes lung operations. In such operations, highly effective illumination is required for enabling manipulation of soft tissue

and identifying pathological findings. A series of manual surgical instruments are in use in such procedures including, Collin-Duval grasping forceps, Martel tissue holders, Israel retractors, spatulas, suction tubes and many others. According to the present invention, a device including white LEDs and a battery are attached to these instruments to convert them into illuminating devices, as well (FIGS 7a and 7b).

Consequently, said surgical instruments may have dual functions: in addition to their regular function as manual surgical instruments, they may function as illuminating devices that provide a closed, very effective, illumination of the operation area.

4. While performing Mediastinoscopy, a tube is inserted into the cavity of the upper chest through the lower part of the neck. The tube provides ability to see the inside of the chest cavity and enables the surgeon to observe findings that should be diagnosed in real-time. The present invention provides a Mediastinoscope tube containing built-in illumination means, namely, white LEDs and a battery (FIG 9).

5. Many operations in the abdominal cavity suffer from deficient illumination. Specially, in the upper abdominal procedures (such as, liver, spleen, esophagus, stomach, and left colon), or the lower abdominal and pelvic procedures (such as, rectum and sigmoid colon), improved illumination is necessary. The device shown in FIG. 8 comprises a housing that includes a battery, an operation button, attachment means, an illumination head and a flexible neck in-between. The neck having a soft stainless steel rod in it, allows bending and moving it to the exact desired

position needed for achieving the maximum illumination in the desired spot.

6. Some of the common operations are carried out while the patient lies on his side, for example, during spine and back surgeries. The top light is usually not effective in such conditions and the headlights cause inconvenience.

7. Other cold-lighted illumination special devices revealed here are trans-illuminating devices. The devices shown in the present invention are useful in the surgery of specific organs, such as, for example, rectum, sigmoid, colon, esophagus and stomach. Said cold-lighted trans-illuminating devices are in the form of a long flexible tube with illumination means (white LEDs) at its tip or on its whole distal portion and marks along its length to indicate the distance between the light and the marks.

This device illuminates the operated organ from the inside and at the same time allows the physician to estimate the location of the illuminated end and to determine the distance from that location to the entrance to the body.

8. When performing anti reflux procedure, in open surgery or laparoscopic surgery, it is required to find the exact point of the esophago – gastric junction, in order to prevent hazardous damage to the esophagus and to perform the rap in the exact location.

A special trans-illumination catheter (FIG 10) consisting of a catheter body, an inflatable balloon at the distal portion, illumination means

proximal to the balloon, power supply, and an open lumens through the catheter. The device revealed here allows the surgeon to insert the catheter into the stomach via the esophagus, inflate the balloon and pull the catheter back, at this stage the laminated LED will indicate the exact required point. The advantage of this device is that the surgeons will save time finding the point and furthermore will decrease the danger of damage to the esophagus, which can be fatal.

9. In another different procedure the surgeon needs to locate the exact location of a tumor in the sigmoid colon, intestine or rectum (for example). Presently it is done by feeling the organ with the fingers via the feroza during performance of open surgery. The trans-illumination catheter shown in FIG 11 has a series of LEDs on its distal portion, which when inserted into the colon via the rectum allow the surgeon to see a tumor through the colon wall. Tumors in the colon, which are thick and non-transparent, will be clearly seen as dark areas compared to the trans-illuminated areas, which are seen with bright light. The distance marks on the catheter will also help in more precise description of the operation, a feature important for the medical file (FIGS 10 and 11).

10. This trans-illumination catheter will also be used in operation of the rectum. When performing such procedures there is a need to separate the organ from the surrounding tissue. The trans-illumination catheter will help identifying the exact borders of the rectum and assist in dissecting in a more precise way.

11. Another use of a trans-illumination device shown in fig 16 is to diagnose the sinus cavities in a patient face, the doctor inserts the device into the patients mouth and can see clearly a difference between a clear sinus and a sinus cavity which is blocked with liquid.

12. There are many non-surgical procedures that require effective illumination. The devices of the present invention may be useful tools in illumination of such procedures. Among these procedures are: ENT, gynecological procedures, and many others (FIGS 3,4, 5, 7,15,16,17)

In addition, the device of present invention includes instruments of a rod-shaped design, applicable in diathermia, suction, etc., in which white LEDs and a battery are implemented, in order to convert them to illuminating devices, as well. (FIG 12).

13. Other medical disciplines, may also get benefit resulting from the use of the device of the present invention. For example, veterinarians who perform all procedures in their clinic cannot usually afford purchasing heavy top-light equipment. Dentists may use a special designed mirror in which white LEDs and a battery are implemented (FIG 13). Same is true regarding specially designed illumination devices for the general surgery in form of an illuminating thimble (FIG 15). The military medicine as well may get benefit of present invention. A special illuminating device designed for using by an army physician, in the battle field, provides an effective focused illumination beam with a shield which prevents the light from being seen from side directions, and helps in preventing disclosure of the medical units location (FIG 19).

14. A new design of head light which is cable free and comprises LEDs batteries as well as a focus lens is shown in FIG. 14.

Claims

1. A self maintained, fiberoptic-free illuminating device for medical application characterized by having at least one white LED and a battery.

2. An illuminating device, according to claim 1, characterized by having at least one feature, or any combination of features, selected from the group comprising: long-lasting, small, light-weight, portable, sterilizable, disposable, user friendly, highly effective, energy efficient and cold light emitter.

3. An illuminating device, according to claim 2, characterized by having all said features.

4. An illuminating device, according to any of claims 1 - 3, for application in any medical or veterinarian procedure, including surgery, non-surgery, diagnosis and treatment.

5. A device, according to claim 4, for illuminating a surgery procedure, wherein said device is selected from the group comprising a forceps, a retractor, a tissue holder, a spatula and a suction tube.

6. A trans-illuminating device or catheter, according to claim 4, applicable in illumination, diagnosis and treatment of disorders in internal cavities.

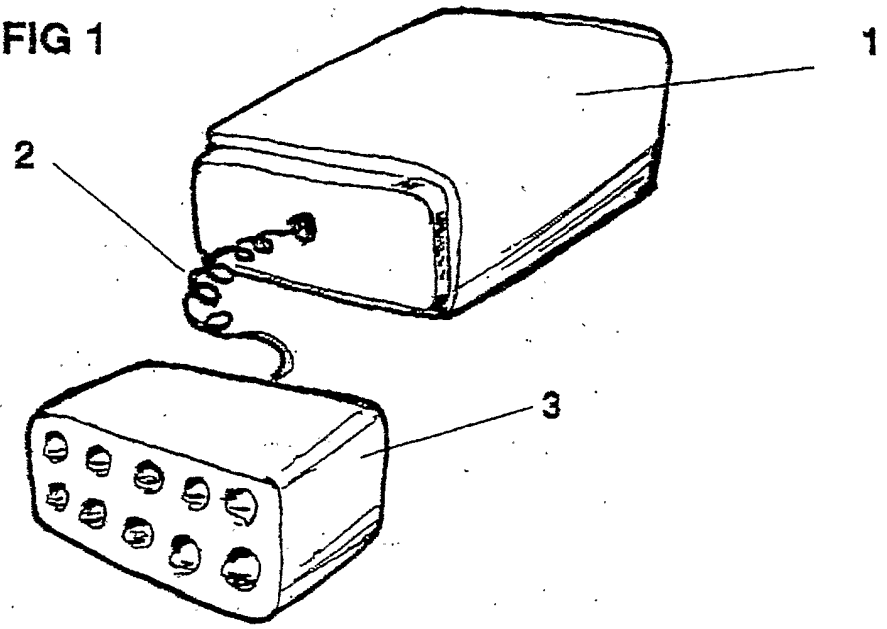
7. An illuminating device, according to claim 4, carrying in hand, or on a finger of a hand.

8. An illuminating device, according to claim 4 , carrying on forehead.

9. An illuminating device, according to any of claims 1-4, applicable in dentistry and ophthalmology.

10. An illuminating device, according to any of claims 1-4, applicable in veterinary.

FIG 1



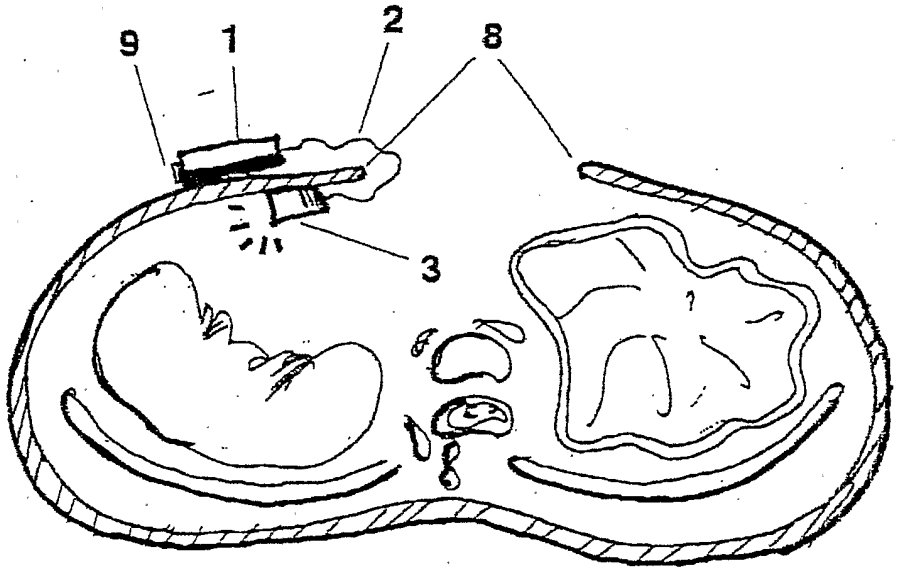
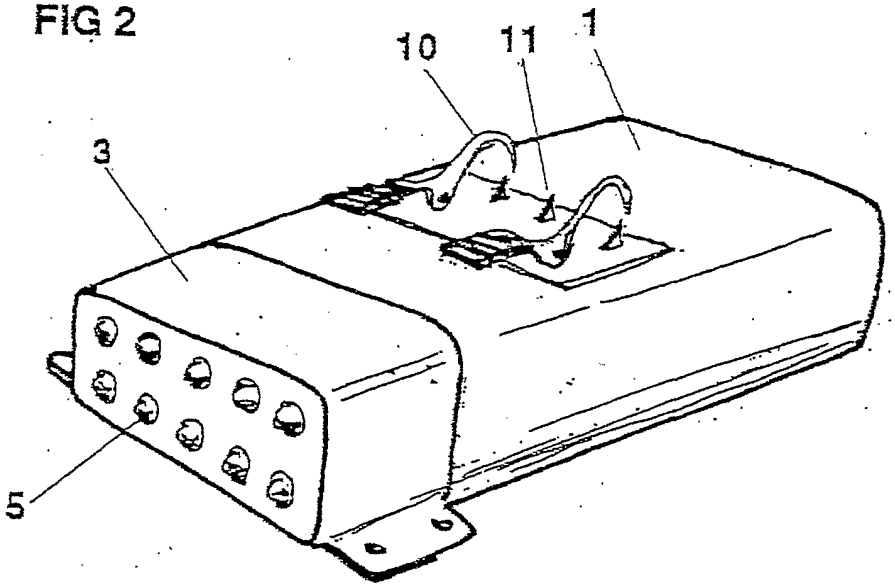


FIG 2



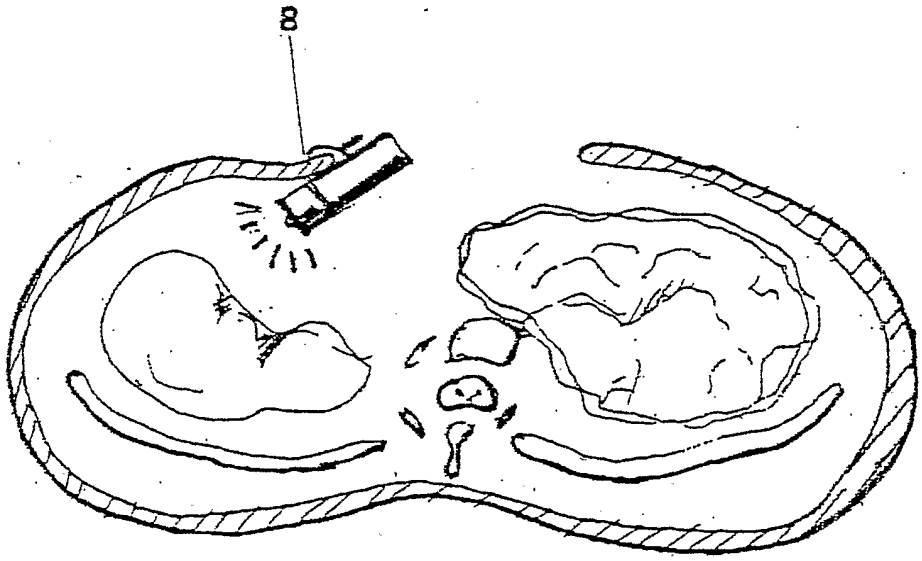


FIG 3

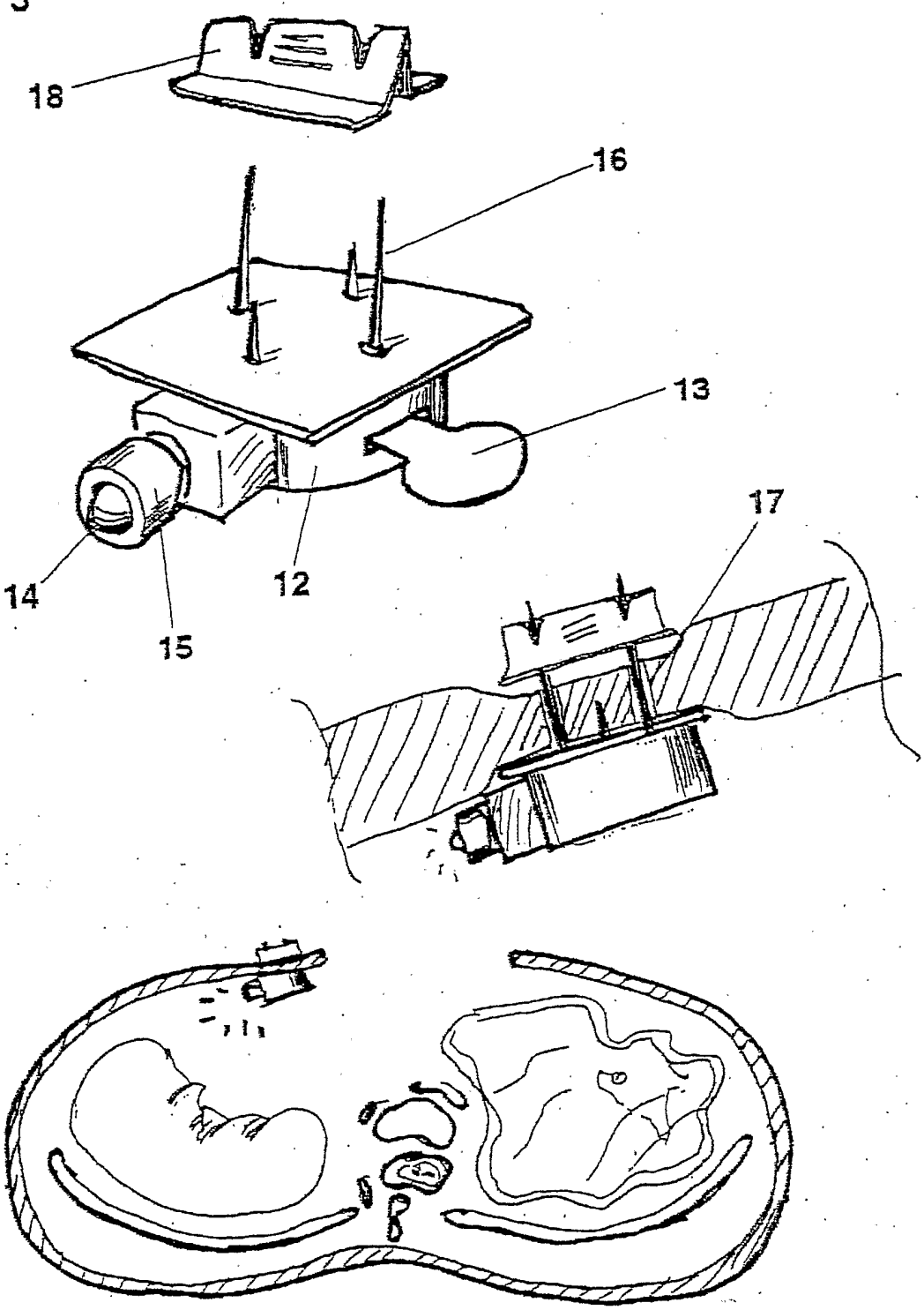


FIG 4a

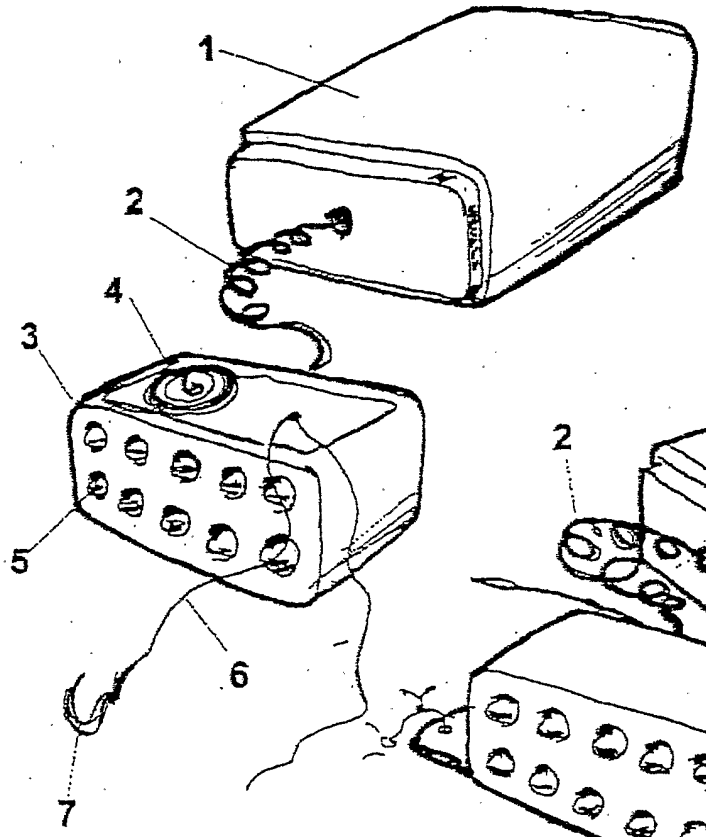


FIG 4

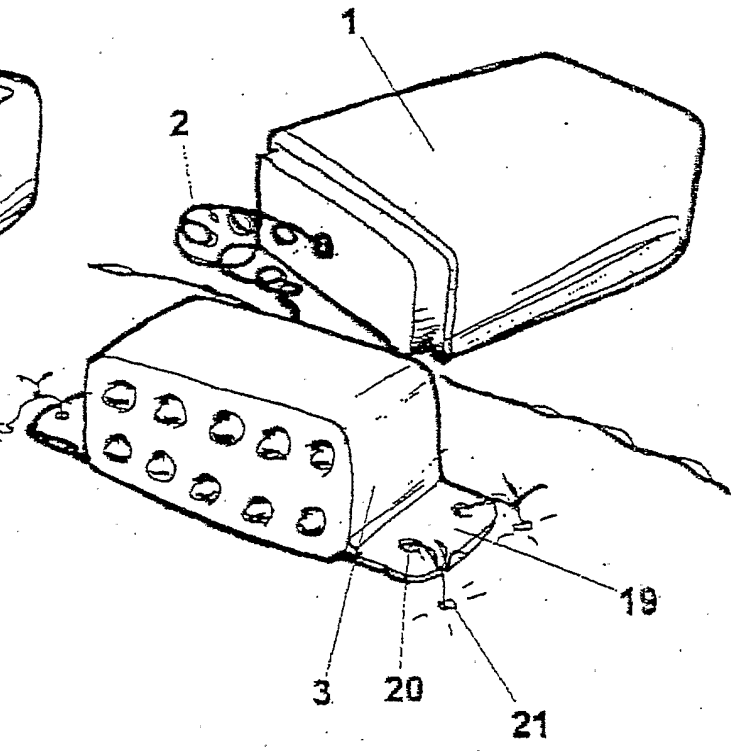


FIG 5

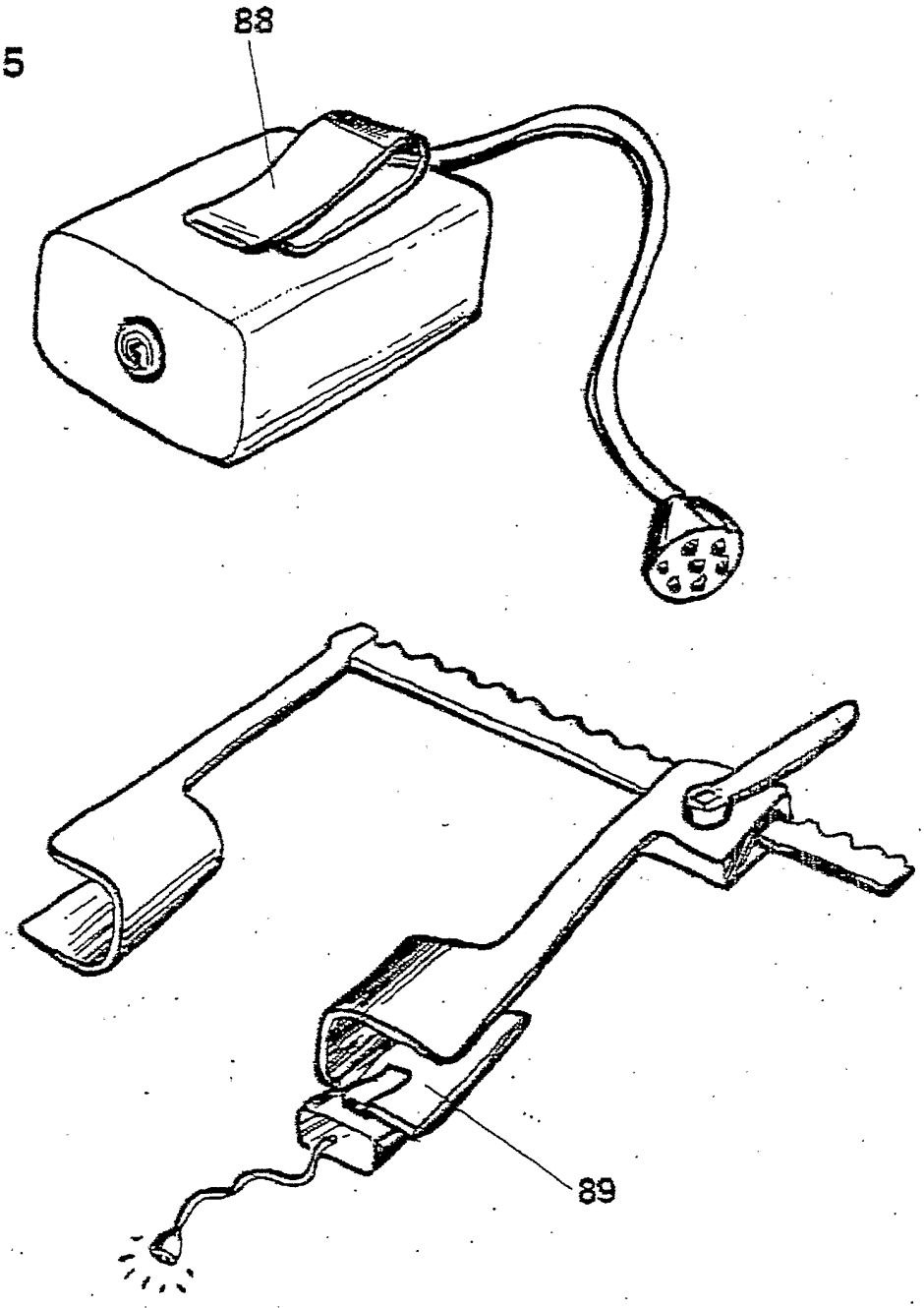


FIG 6

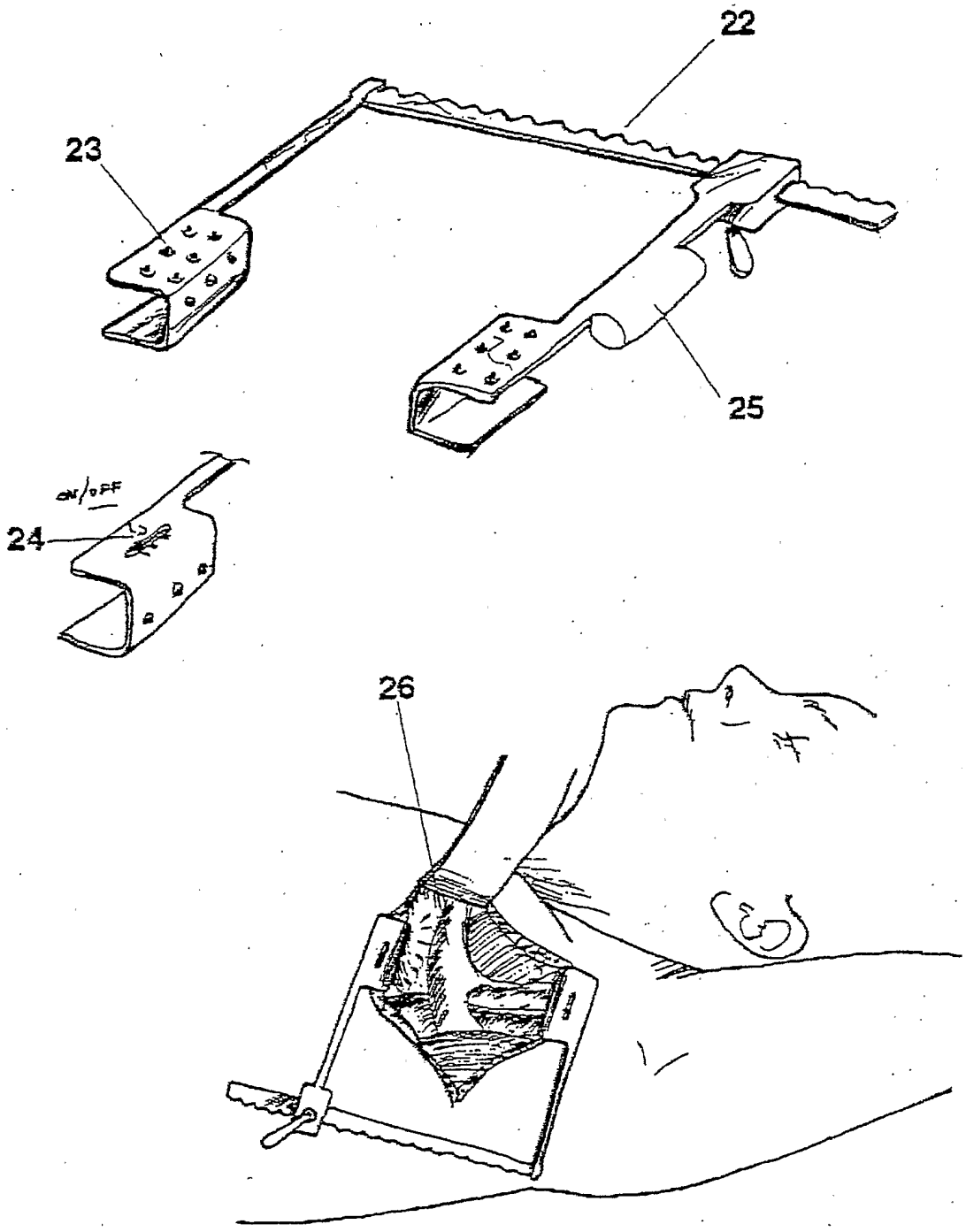


FIG 7a

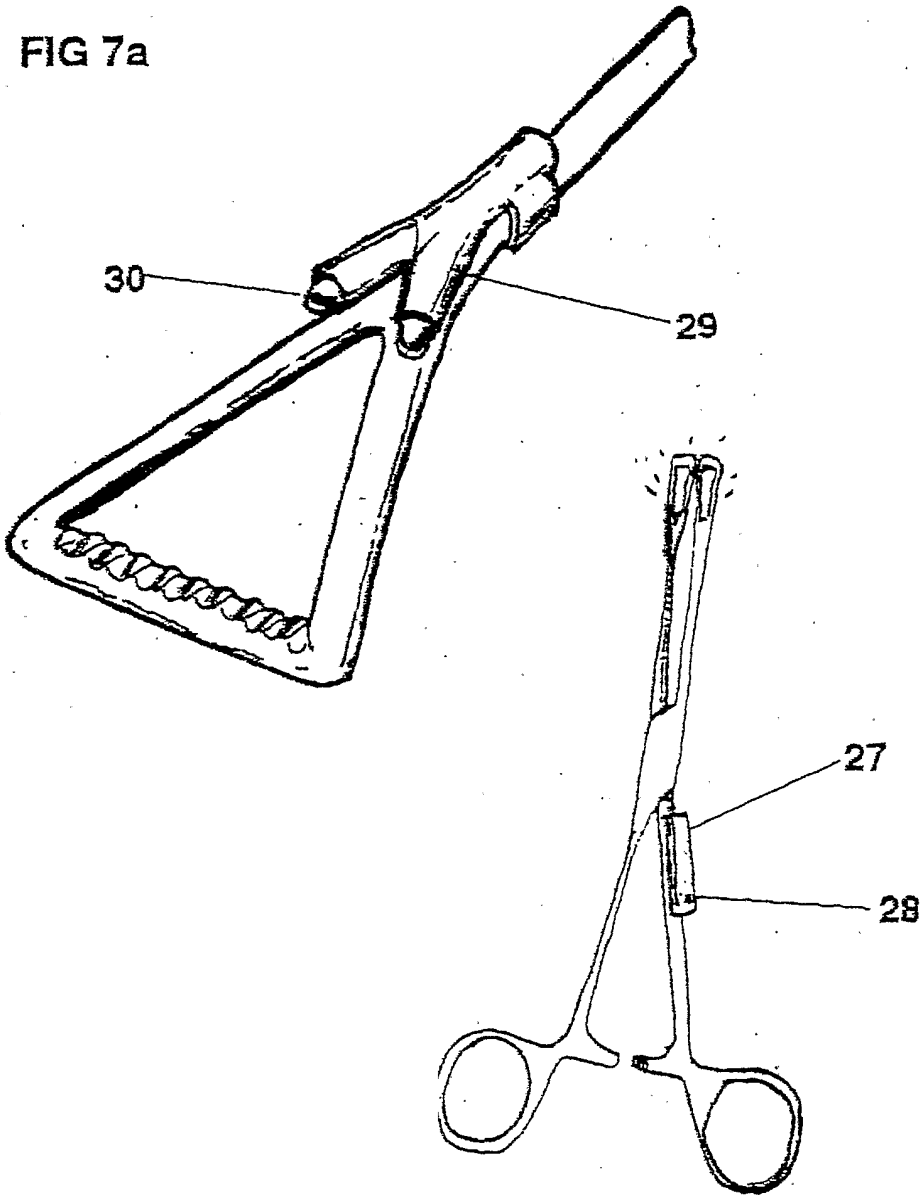


FIG 7b

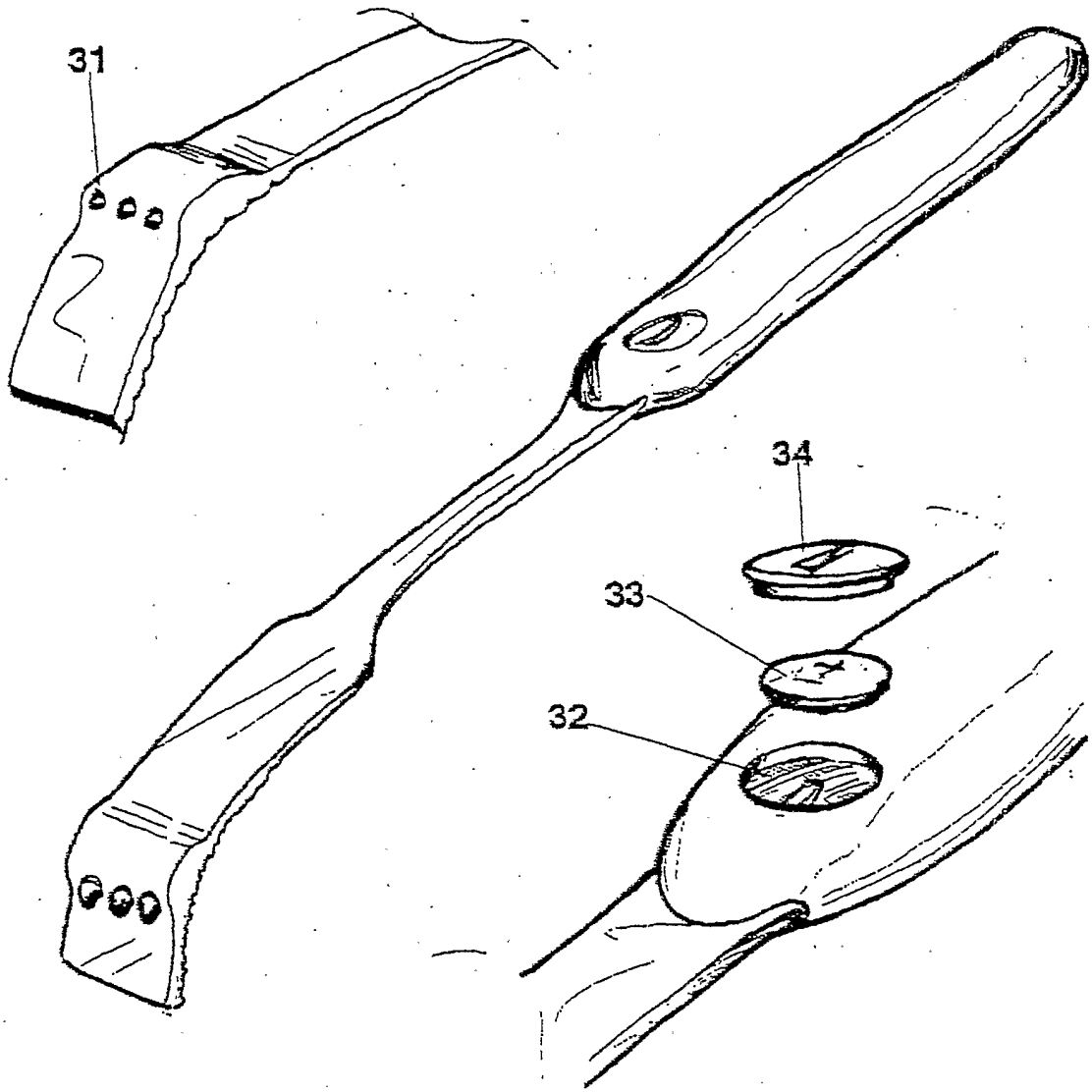


FIG 8

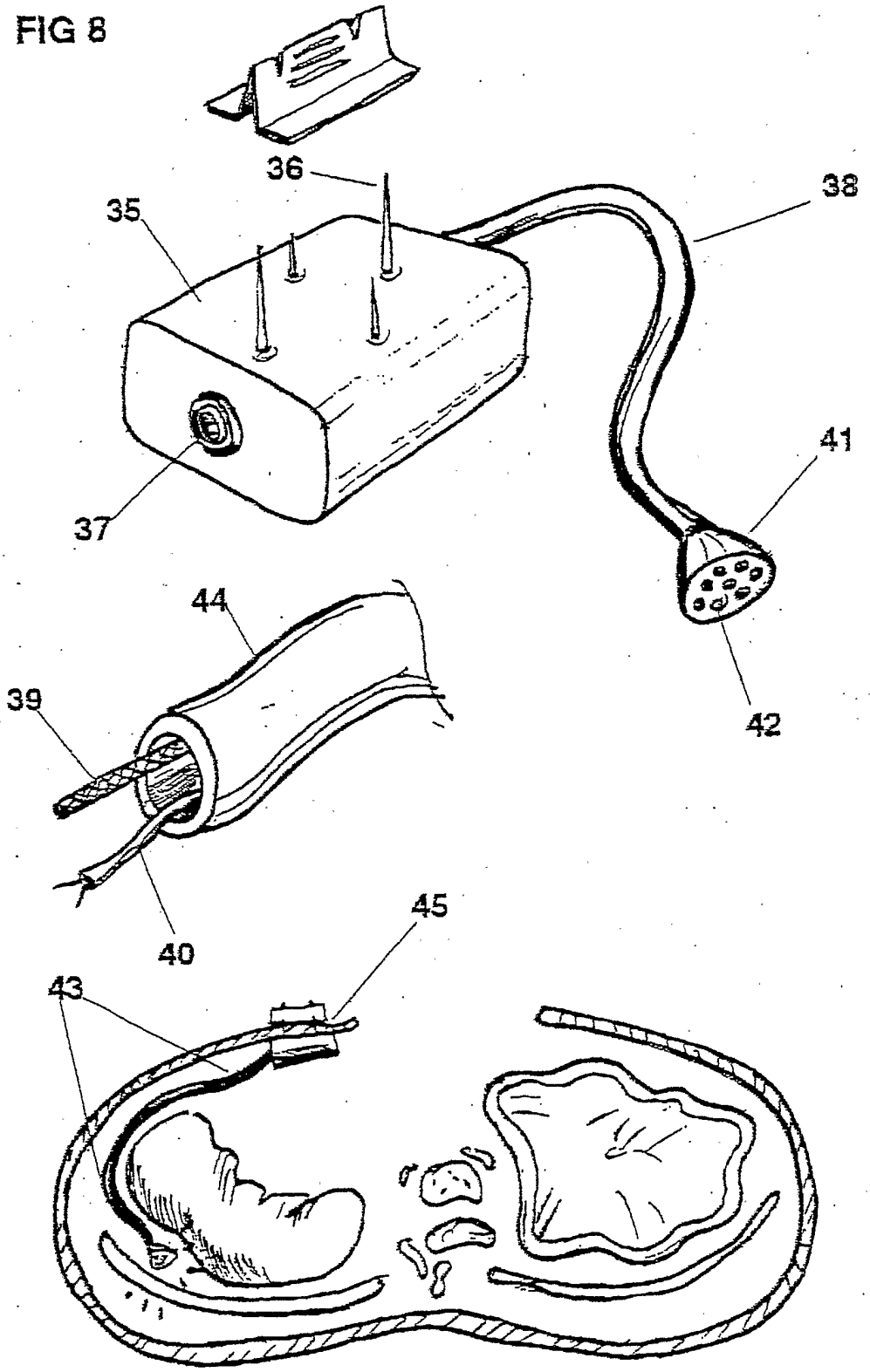


FIG 9

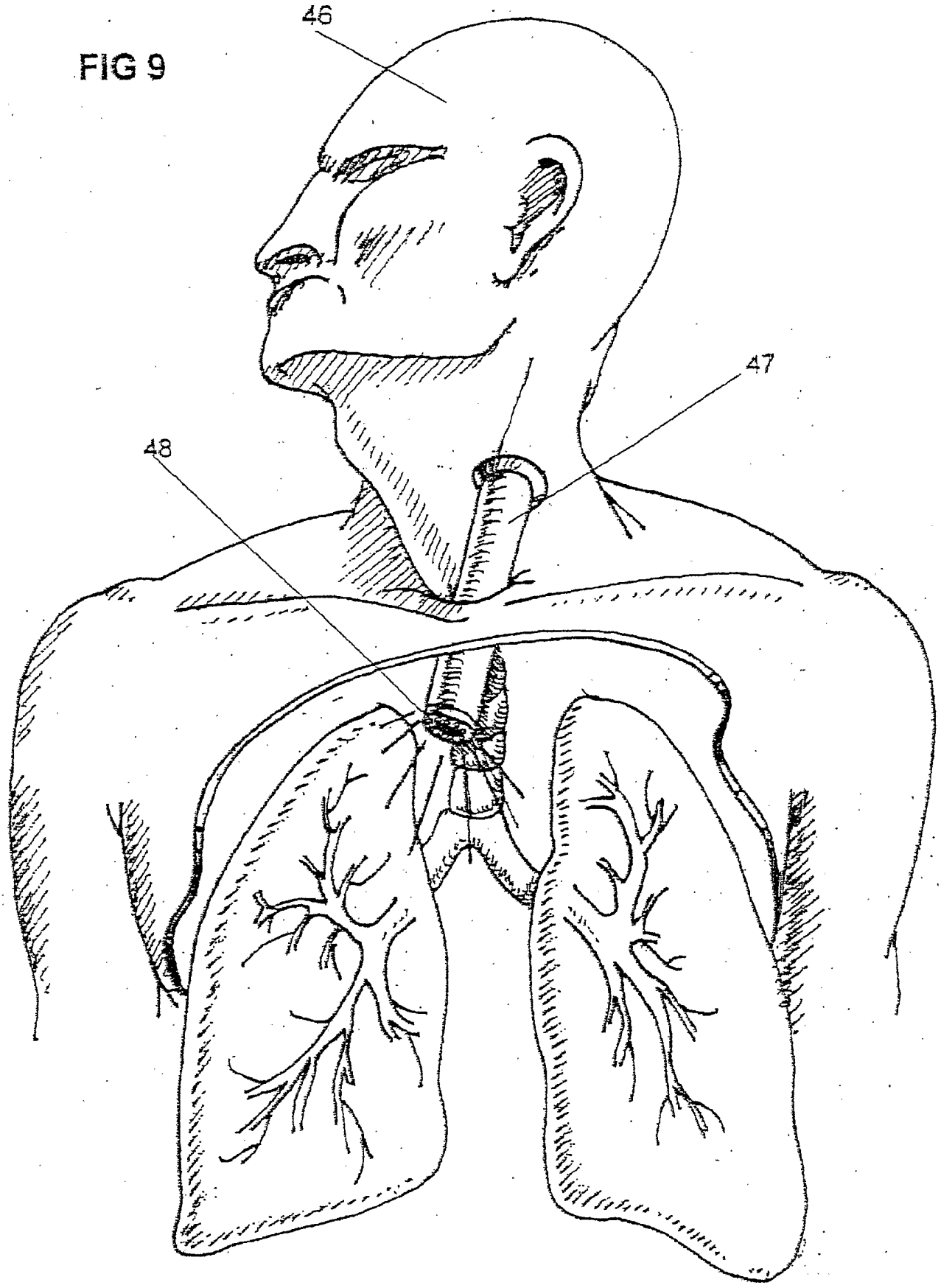


FIG 10

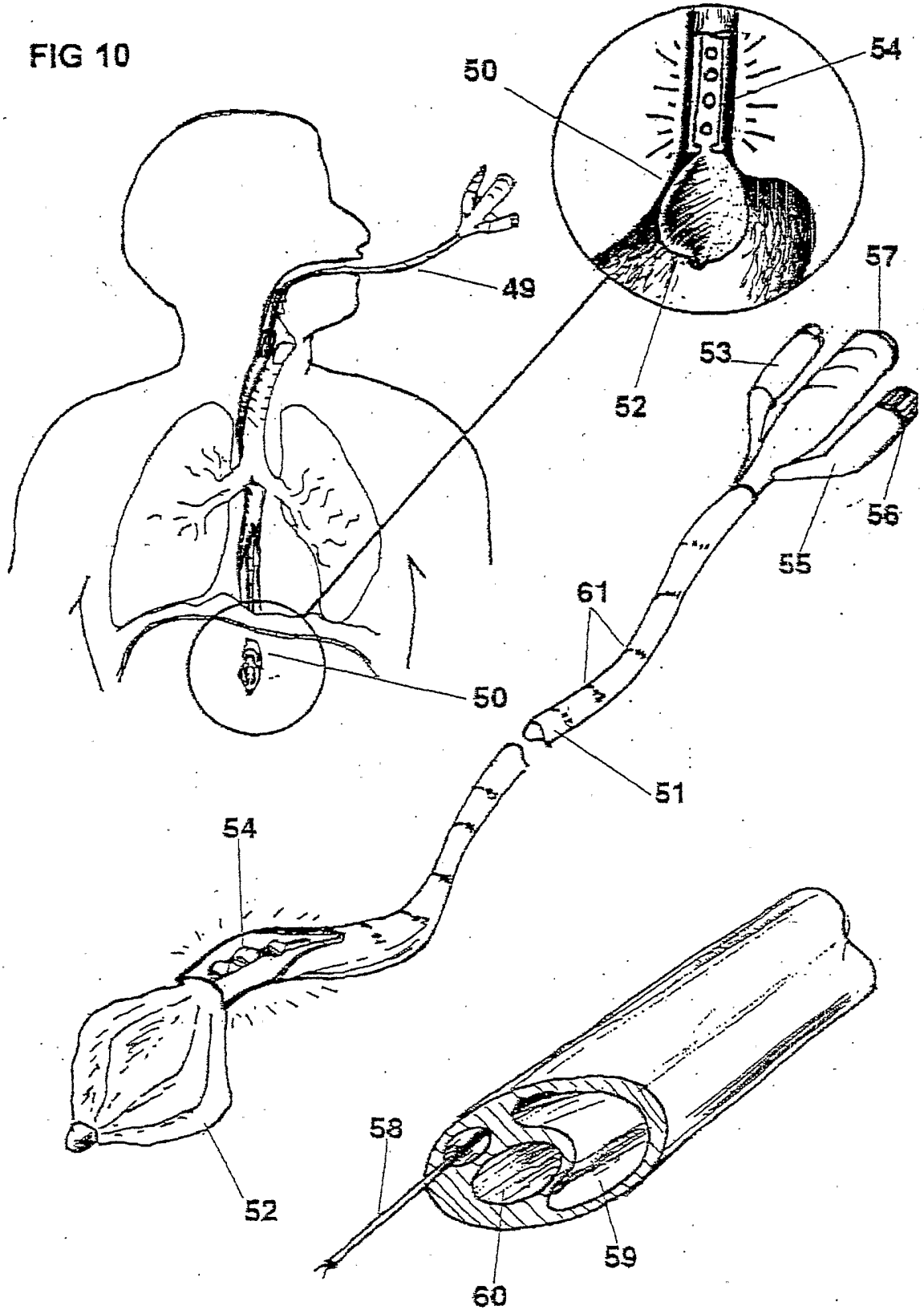


FIG 11

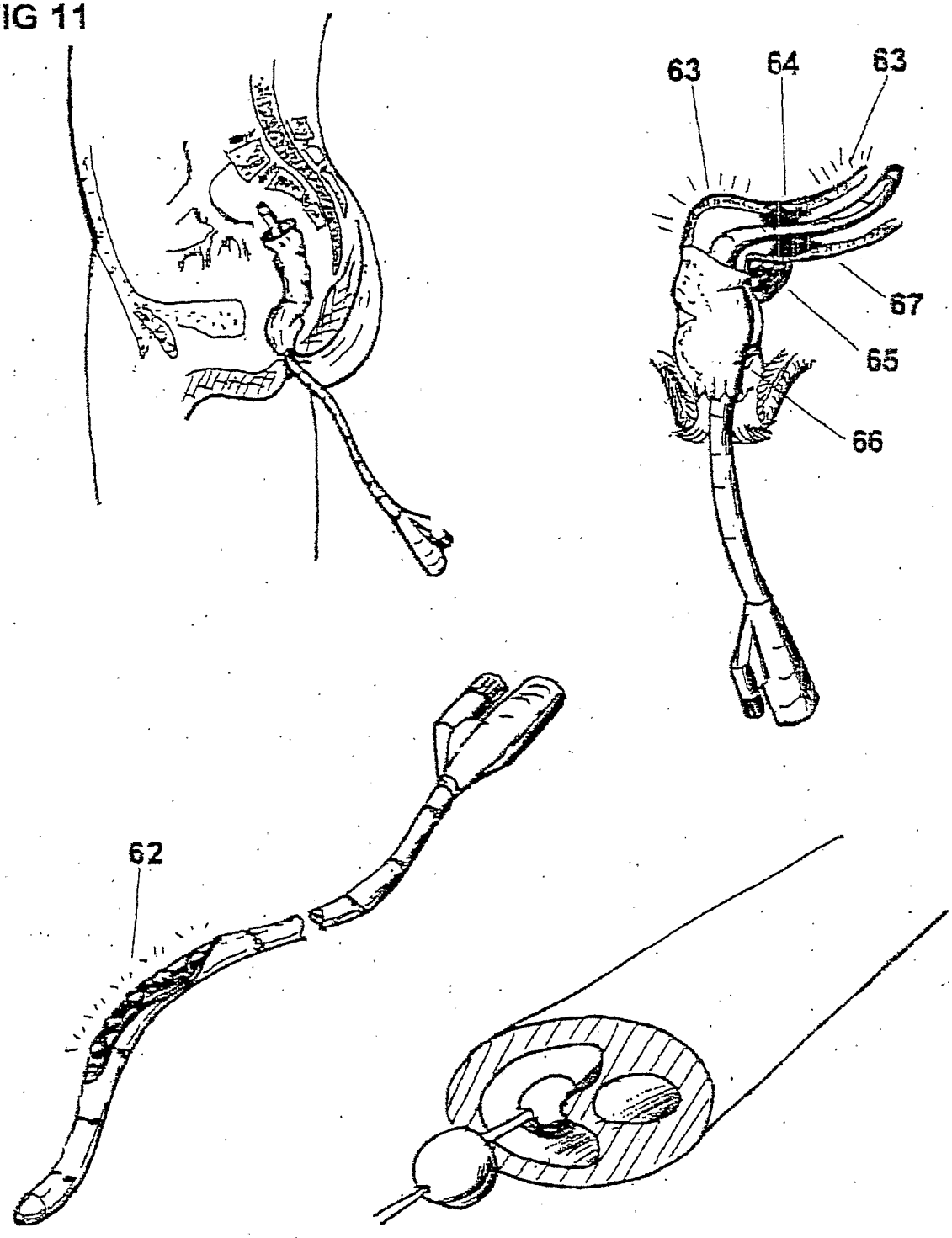


FIG 12

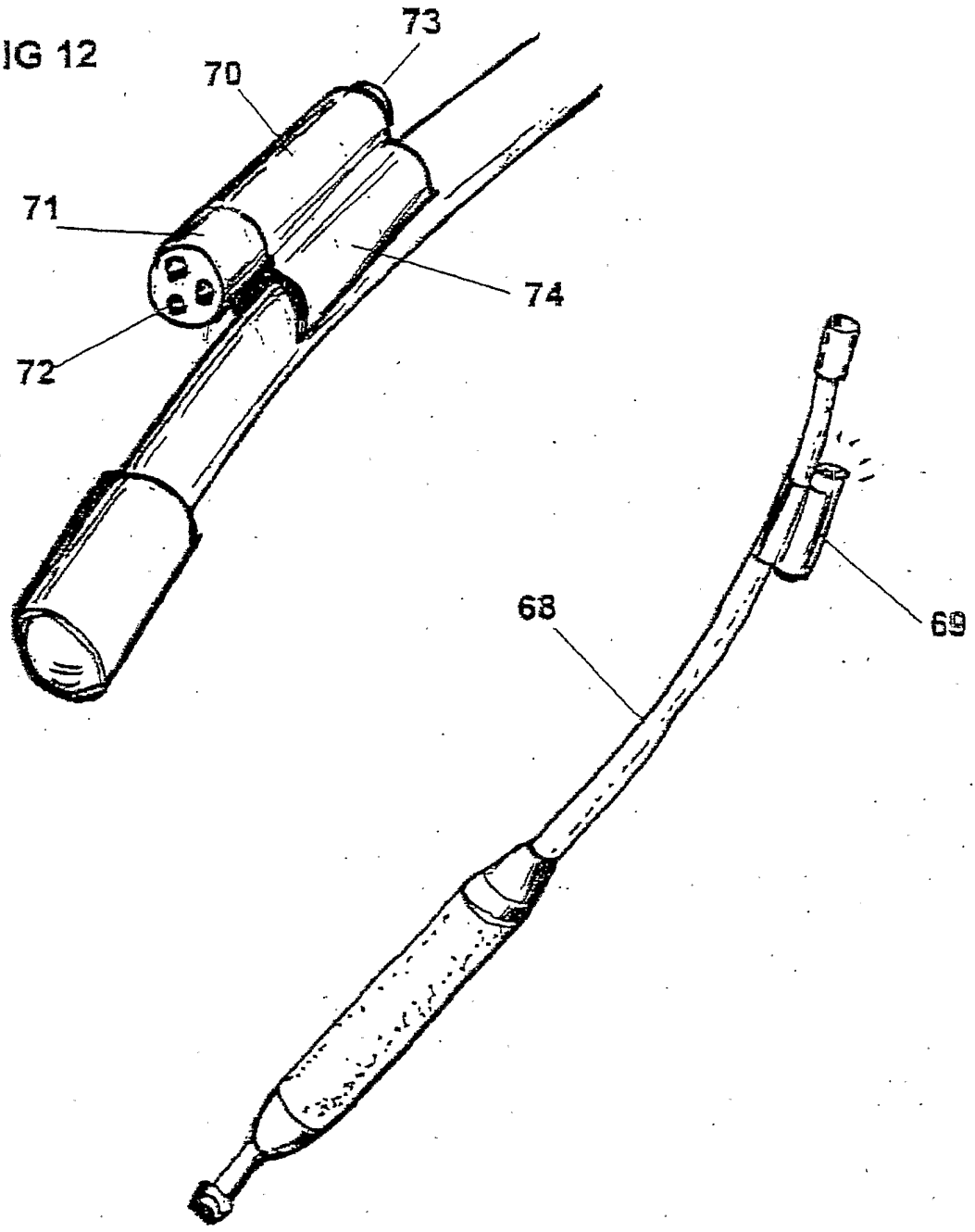


FIG 13

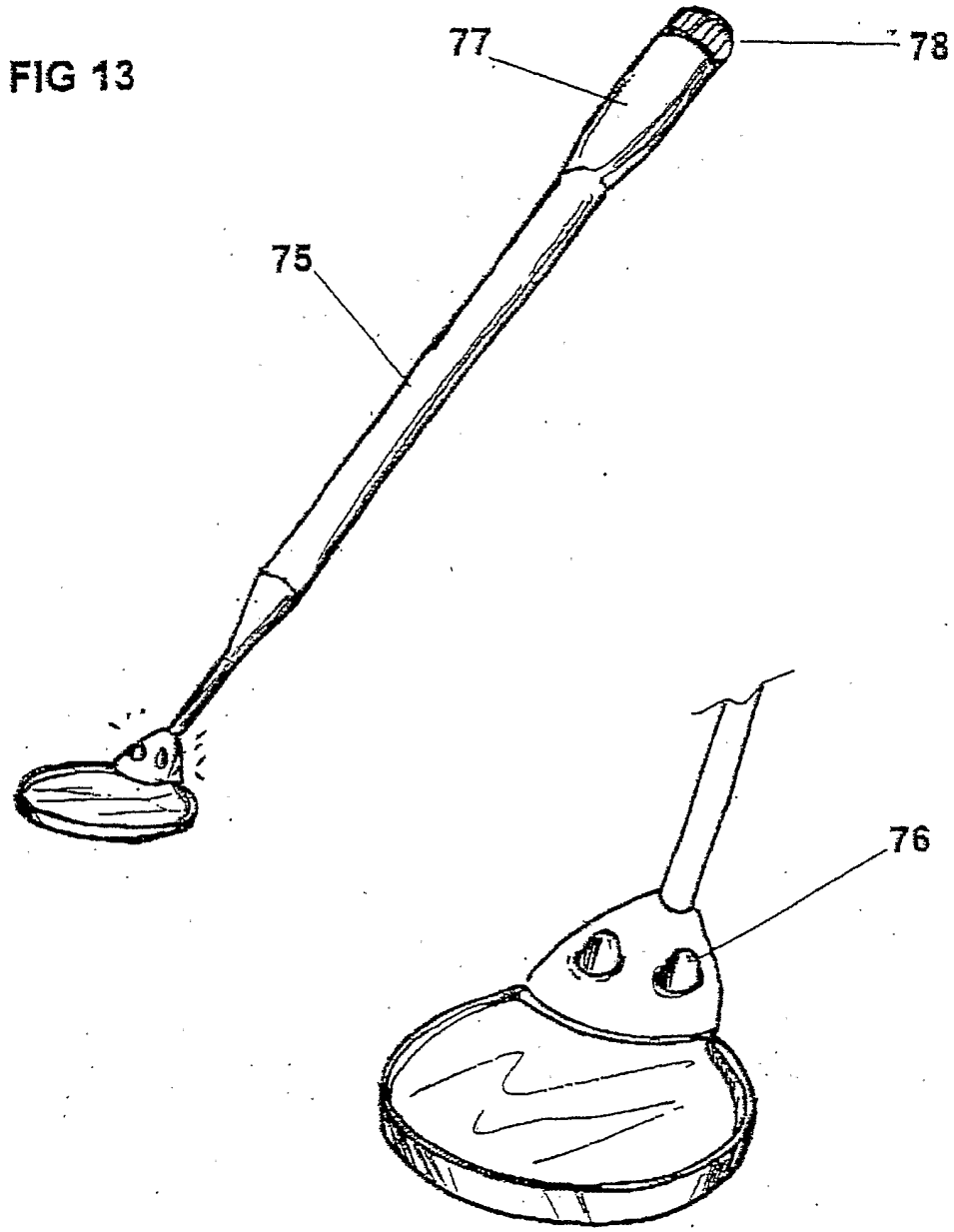


FIG 14

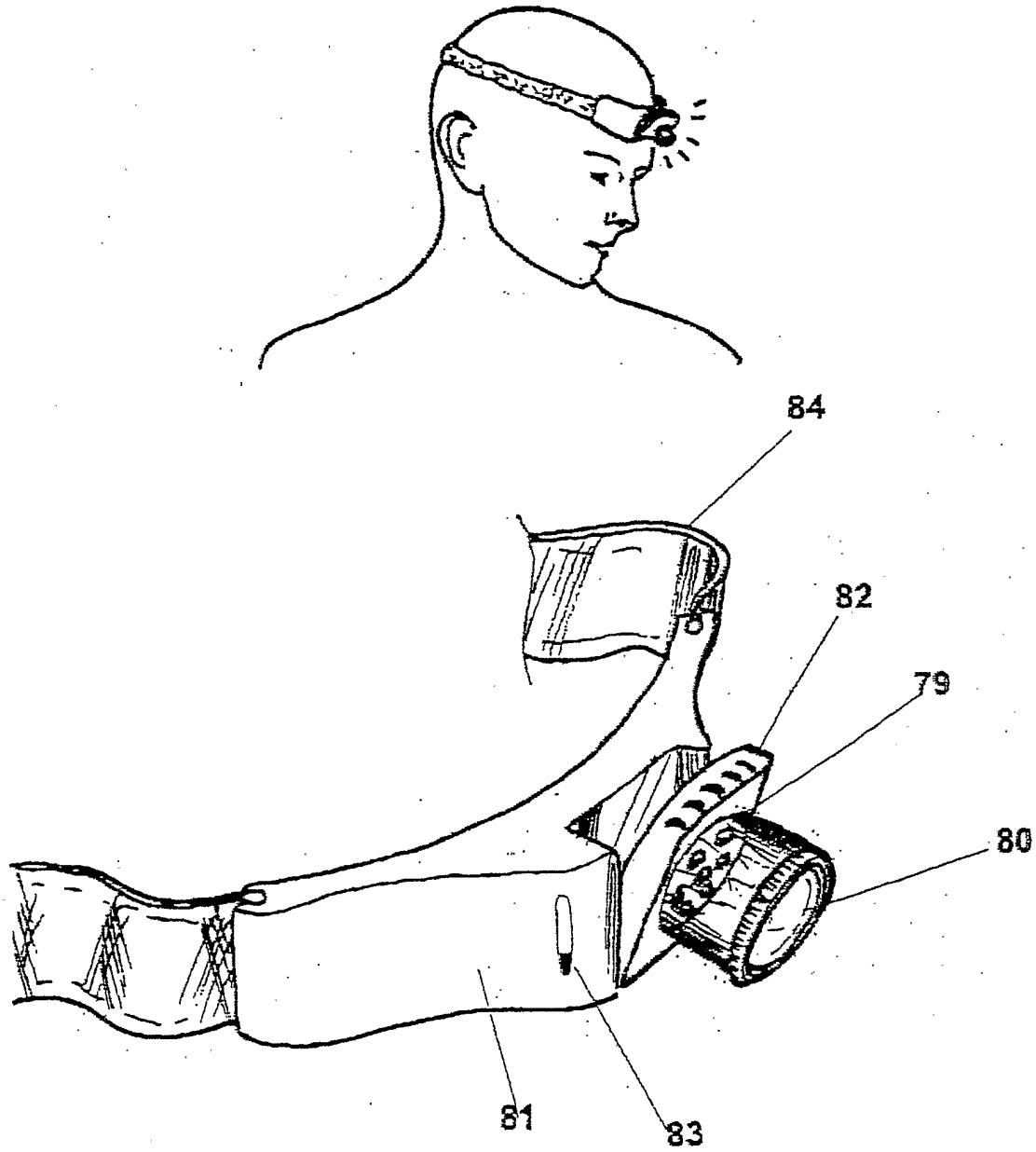


FIG 15

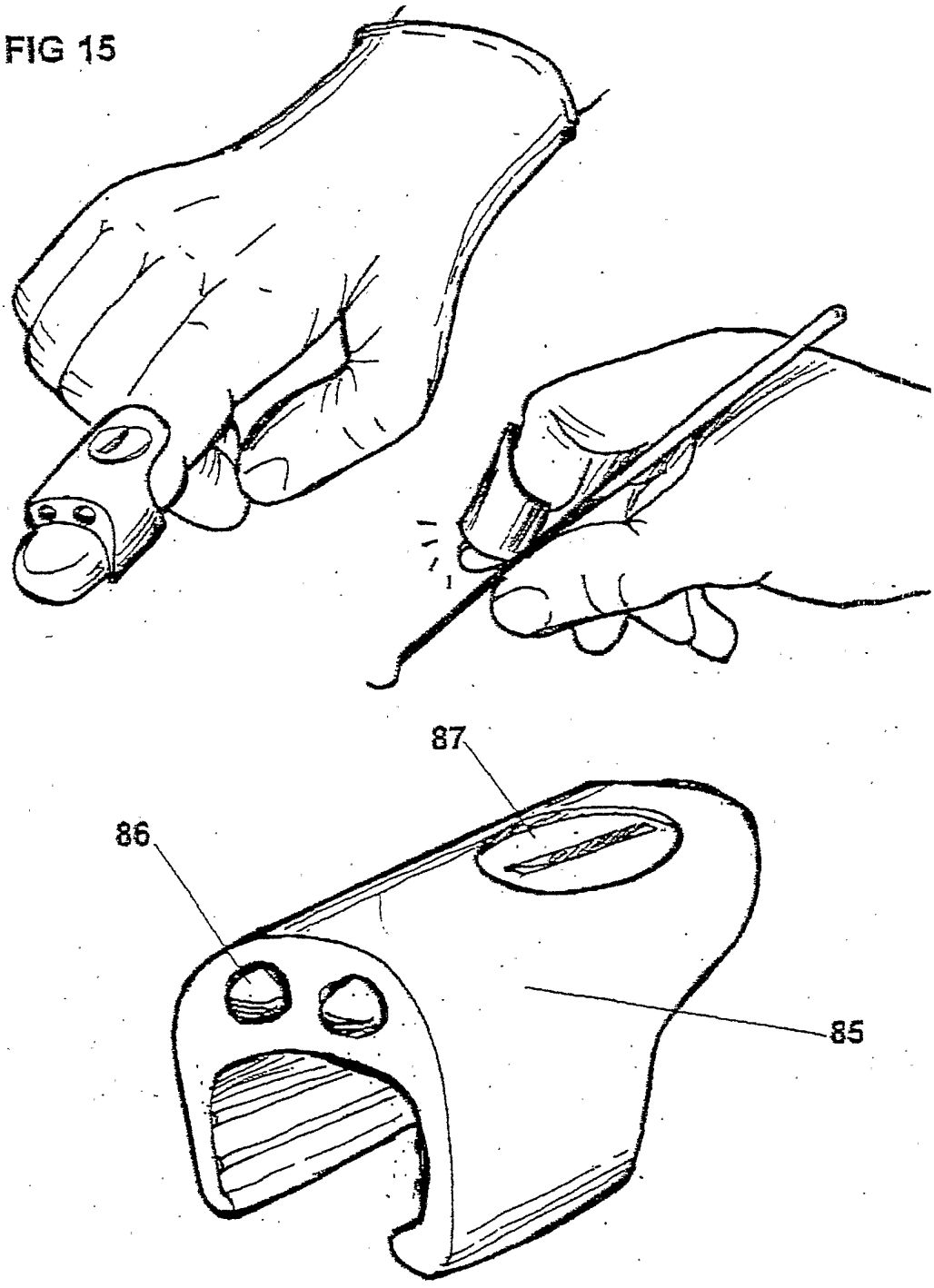


FIG 16

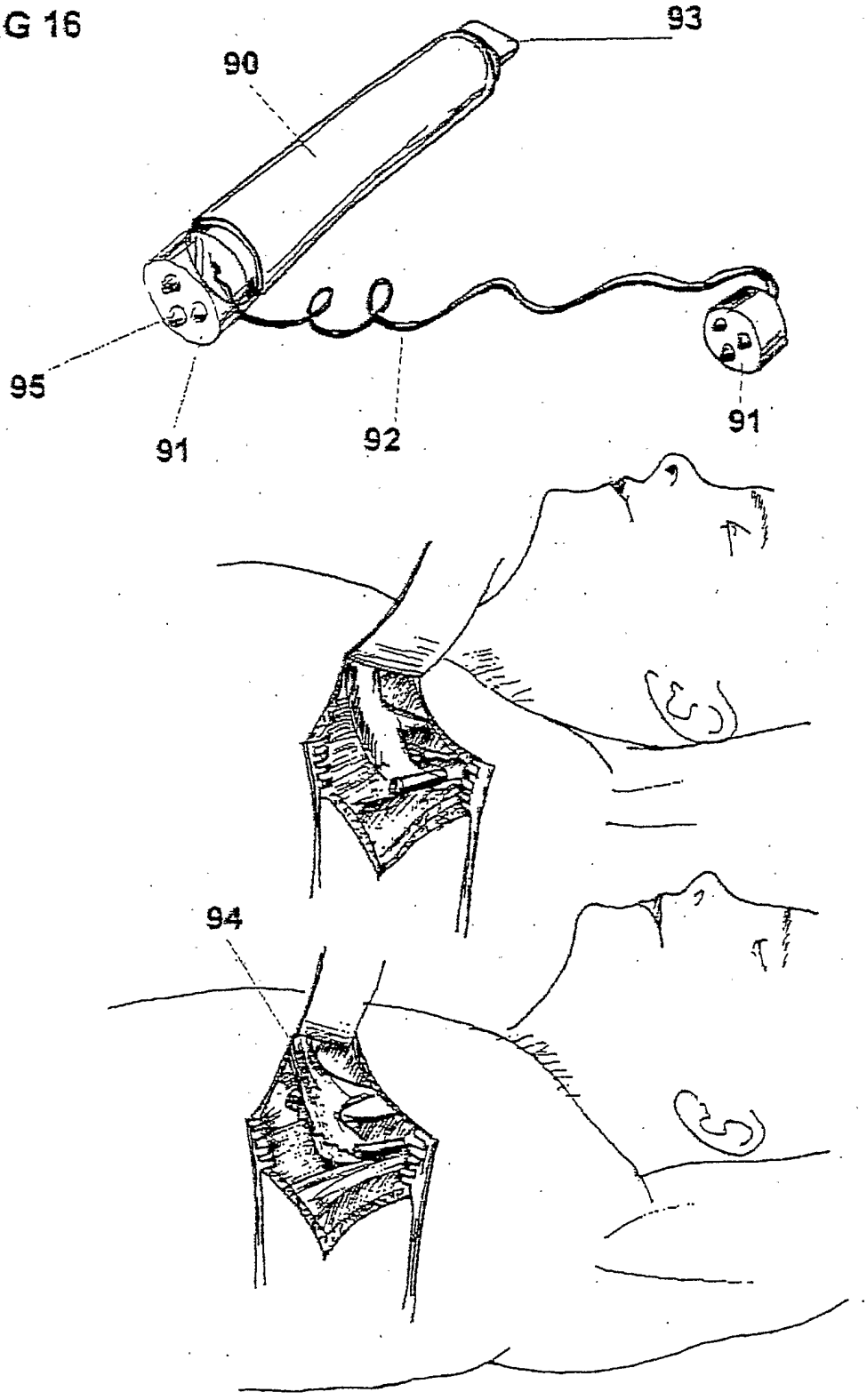


FIG 17

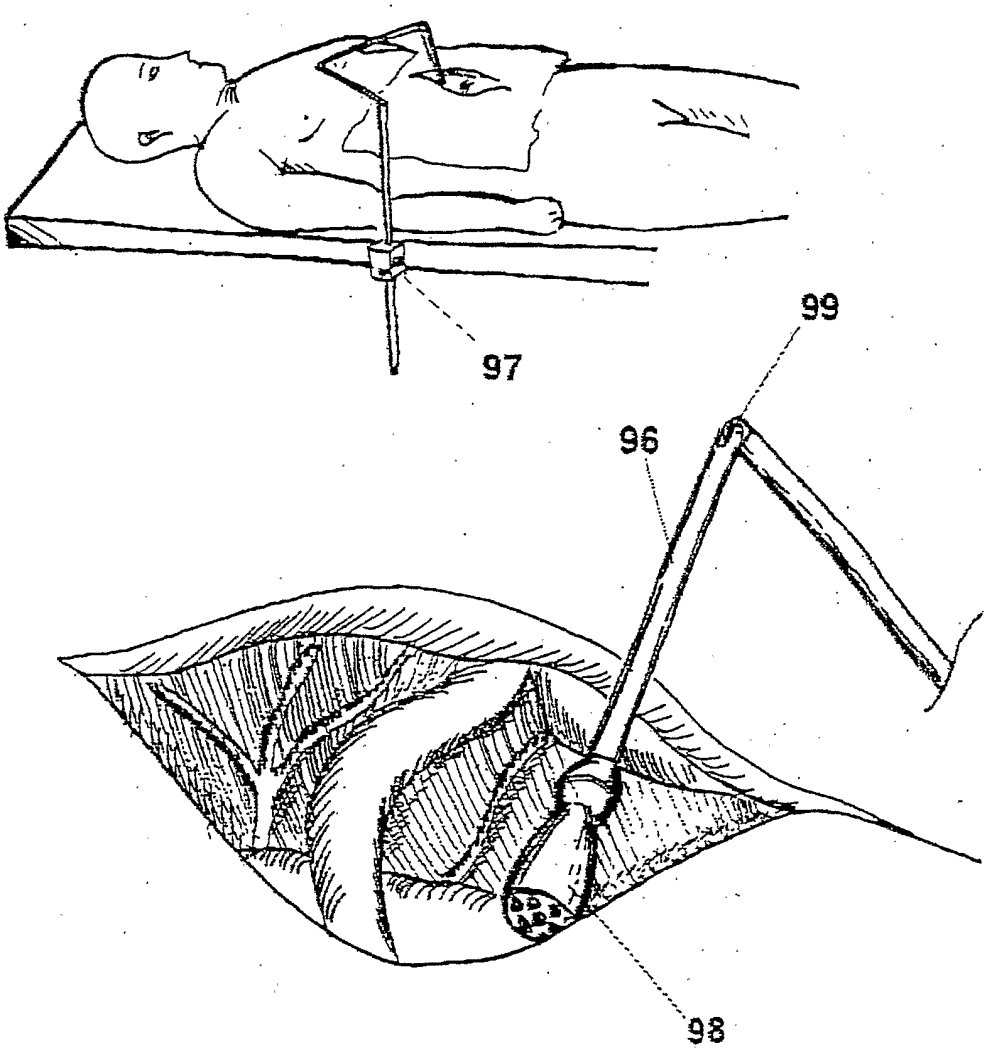


FIG 18

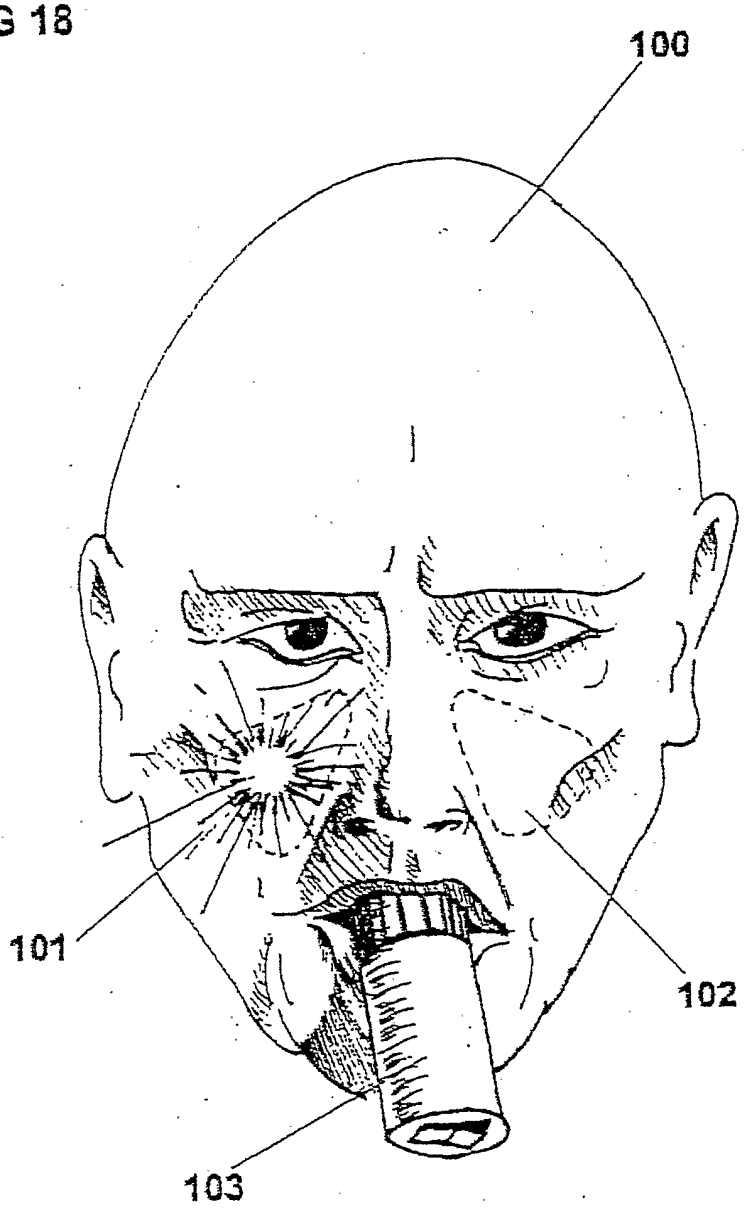
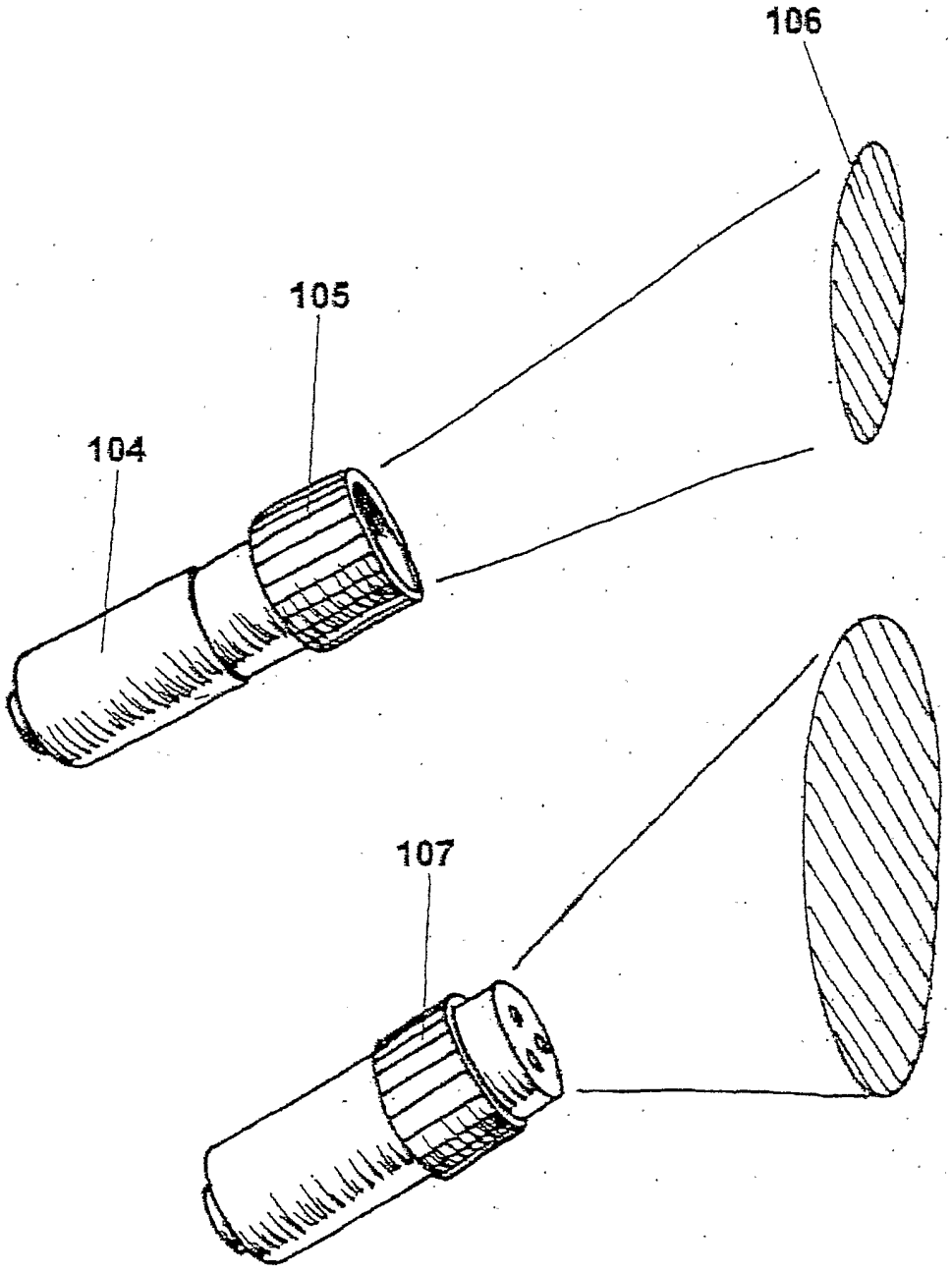


FIG 19



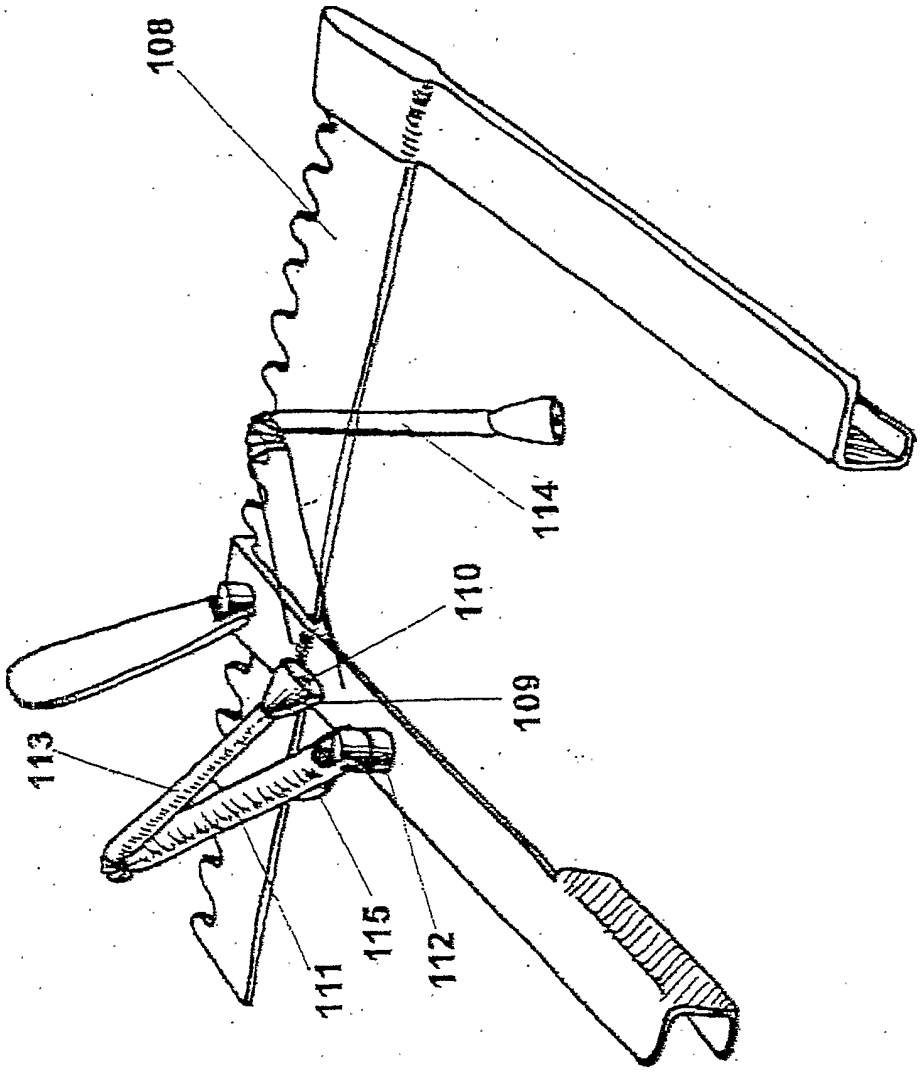


FIG 20

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 01/00665

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B19/00 A61B5/00 A61B1/24

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 7 A61B F21V A61C

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 practical, search terms used)

PAJ, EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 23812 A (SIGHTLINE TECHN LTD ;AVNI ARIE (IL); SHTUL BORIS (IL); LEVIN VICTO) 14 May 1999 (1999-05-14)	1-6,10
Y	page 10, line 17 - line 28 page 11, line 10 - line 18; figure 1	7,8
X	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 04, 30 April 1999 (1999-04-30) & JP 11 009548 A (FUJI PHOTO OPTICAL CO LTD), 19 January 1999 (1999-01-19) abstract	1-4,6,10
Y	US 5 816 676 A (KOENEN MYERS HOWARD P ET AL) 6 October 1998 (1998-10-06) abstract; figure 1	7

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
12 November 2001	19/11/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Mayer, E

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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P,X	US 6 244 863 B1 (MELNYK IVAN ET AL) 12 June 2001 (2001-06-12) abstract; figure 1	1-4,6,7, 9,10

INTERNATIONAL SEARCH REPORT

Information on patent family members

In nal Application No
PCT/IL 01/00665

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