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(71) Applicant: ENDOCHOICE, INC. [US/US]; 11405 Old Roswell Rd., Alpharetta, GA 30009 (US).

(72) Inventors: KRIVOPISK, Leonid; Hashita 1/6, 3680001 Neshet (IL). AIZENFELD, Amram; Ramot Menashe, 1924500 Ramot Menashe (IL).

(74) Agent: DALAL, Sona; Novel IP, 191 West Second Street, Santa Ana, CA 92701 (US).

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(54) Title: ILLUMINATOR CIRCUIT BOARD ASSEMBLY FOR AN ENDOSCOPE

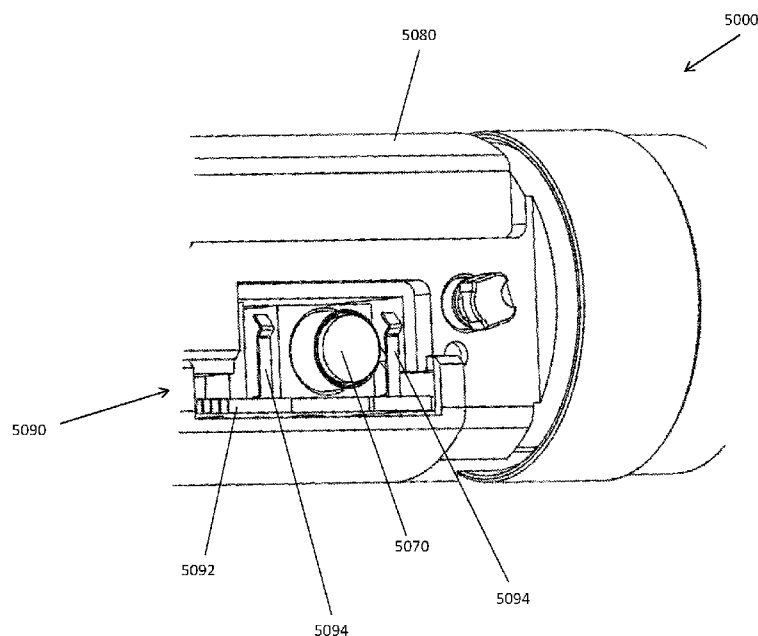


Figure 5

(57) Abstract: The present specification describes a circuit board design that uses circuit boards for illuminator sets associated with the various optical assemblies. In one configuration, front and side illuminators are assembled on front and side illuminator circuit boards. Leaf connectors associated with each illuminator are provided to interface with a common base board.



Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 17/35269

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61B 1/05, A61B 1/06 (2017.01)

CPC - A61B 1/00142, A61B 1/00137, A61B 1/00089, A61B 1/0676, A61B 1/00181, G02B 23/2484, G02B 23/2476

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)

See Search History Document

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

See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/0305601 A1 (EndoChoice Innovation Center Ltd.), 29 October 2015 (29.10.2015), entire document, especially	1
A	US 2015/0208900 A1 (EndoChoice, Inc.), 30 July 2015 (30.07.2015), entire document	1
A	US 2012/0232340 A1 (LEVY et al.), 13 September 2012 (13.09.2012), entire document	1
A	US 9,351,629 B2 (EndoChoice Innovation Center Ltd.), 31 May 2016 (31.05.2016), entire document	1
A	US 2007/0213591 A1 (Aizenfeld et al.), 13 September 2007 (13.09.2007), entire document	1
A	US 9,101,266 B2 (Levi et al.), 11 August 2015 (11.08.2015), entire document	1
X, P	US 2017/0127914 A1 (EndoChoice, Inc.), 11 May 2017 (11.05.2017), entire document	1

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* 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

27 November 2017

Date of mailing of the international search report

18 DEC 2017

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Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
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Facsimile No. 571-273-8300

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 17/35269

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claim 1, directed to a tip cover for a multi-viewing element endoscope.

Group II: Claims 2-18 directed to a circuit board assembly for a multi-viewing element endoscope.

.-Continued in Supplemental Box.-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

- Box III - Observations where Unity of Invention is Lacking --

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

SPECIAL TECHNICAL FEATURES

The invention of Group I includes the special technical features of a tip cover comprising a side removable window component located in a side panel recess of said main component portion, said side removable window component further comprising a flat depression which comprises a plurality of windows for accessing optical lens assembly, illuminators and components associated with a side pointing viewing element; and a front panel positioned on a front end of tip cover, said front panel comprising a plurality of windows for accessing optical lens assembly, illuminators and components associated with a front pointing viewing element, not required by the claims of Group II.

The invention of Group II includes the special technical features of a circuit board assembly comprising a first base board to which the front pointing viewing element is connected; a second base board to which the at least one side pointing viewing element is connected; a third base board to which said first and said second base boards are connected, wherein said first and said second base boards are placed perpendicular to said third base board; and at least one illuminator associated with each of the front and side pointing viewing elements, wherein said circuit board assembly comprises a separate circuit board to hold each illuminator, not required by the claims of Group I.

COMMON TECHNICAL FEATURES

Groups I-II share the common technical features of a tip section of a multi-viewing element endoscope, said tip comprising a front pointing viewing element and at least one side pointing viewing element, wherein each viewing element comprises an image sensor and a lens assembly. However, these shared technical features do not represent a contribution over prior art as being anticipated by US 2012/0232340 A1 to Levy et al. (hereinafter 'Levy'), which discloses a tip section of a multi-viewing element endoscope (tip section 200 of an endoscope assembly 100, Fig. 2A-2B; para [0065]; see also para [0002], [0067] and [0072] - endoscope assembly 100 is a multi-camera endoscope), said tip comprising a front pointing viewing element (front optical assembly 256 includes front looking camera 116, para [0067]; Fig. 1 and 2A) and at least one side pointing viewing element (side optical assembly 256B including side looking camera 116B, para [0072]; Fig. 1 and 2A), wherein each viewing element comprises an image sensor (front looking camera 116 and side looking camera 116B include CMOS image sensors, para [0060]) and a lens assembly (front optical assembly 256 includes lenses, para [0067]; side optical assembly 256B is similar to front optical assembly 256, para [0072] - and thus includes lenses, as stated in para [0067]).

As the common technical features were known in the art at the time of the invention, these cannot be considered special technical feature that would otherwise unify the groups.

Therefore, Groups I-II lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.