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MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
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(54) Title: OPTICAL FIBER WITH LARGE EFFECTIVE AREA AND LOW BENDING LOSS

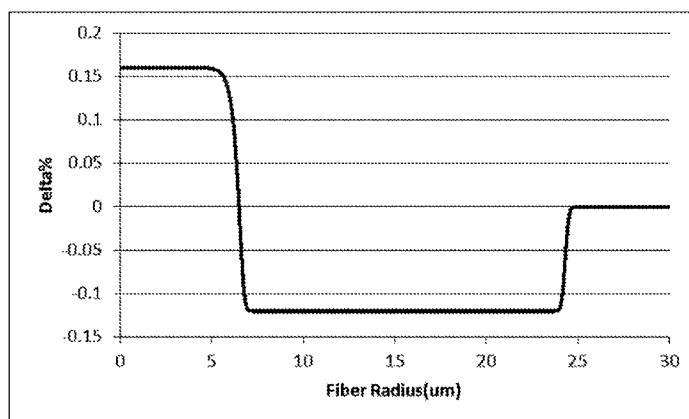


FIG. 6

(57) Abstract: An optical fiber with large effective area, low bending loss and low attenuation. The optical fiber includes a core, an inner cladding region, and an outer cladding region. The core region includes a spatially uniform upodant to minimize low Rayleigh scattering and a relative refractive index and radius configured to provide large effective area. The inner cladding region features a large trench volume to minimize bending loss. The core is doped with CI and the inner cladding region may be doped with F.

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2016/039711

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G02B6/036 G02B6/02 C03B37/012
 ADD.

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)

G02B C03B C03C

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)

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	EP 1 107 027 A1 (SUMITOMO ELECTRIC INDUSTRIES [JP]) 13 June 2001 (2001-06-13) paragraphs [0060] - [0069] figures 9,10,22-28 -----	1-36
X	EP 2 588 905 B1 (CORNING INC [US]) 29 April 2015 (2015-04-29) paragraphs [0005], [0006], [0025] - [0035] tables 1-4 claim 1 figures 1-4 -----	1-36
X,P	WO 2016/007806 A1 (CORNING INC [US]) 14 January 2016 (2016-01-14) paragraphs [0044] - [0066] ----- -/-	37-57



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

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"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

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No

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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.
E	WO 2016/168042 A1 (CORNING INC [US]) 20 October 2016 (2016-10-20) paragraphs [0087] - [0098] figures 1-6 tables 1-6 -----	37-41, 46-49,52
A	EP 1 154 294 A1 (SUMITOMO ELECTRIC INDUSTRIES [JP]) 14 November 2001 (2001-11-14) abstract paragraphs [0065] - [0076] figures 5-7 -----	1-57

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/039711

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:

see additional sheet

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 an 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.:

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-36

An optical fiber comprising:
a core region comprising Cl-doped silica glass having a chlorine concentration greater than 1.5 wt%, said core region having an outer radius r_1 in the range from 6.0 microns to 10.0 microns and a relative refractive index Δ_1 ;
an inner cladding region surrounding said core region, said inner cladding region having an outer radius r_2 in the range from 22 microns to 38 microns and a relative refractive index Δ_2 ; and
an outer cladding region surrounding said inner cladding region, said outer cladding region having a relative refractive index Δ_3 , said relative refractive index Δ_3 exceeding said relative refractive index Δ_2 by at least 0.06%;
wherein said optical fiber has a cable cutoff of less than 1550 nm, an effective area at 1550 nm of at least 100 μm^2 , and a bending loss at 1550 nm, determined from a mandrel wrap test using a mandrel with a diameter of 20 mm, of less than 3.5 dB/turn.

2. claims: 37-57

A method of making an optical fiber comprising: forming soot from an organosilicon compound; and doping said soot with Cl, and sintering said doped soot, said sintered doped soot having a Cl concentration of at least 0.8 wt%.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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