

**PATENT COOPERATION TREATY**

**TRANSLATION**

From the  
INTERNATIONAL SEARCHING AUTHORITY

**PCT**

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

Date of mailing (day/month/year)	<b>14.11.2017</b>
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Applicant's or agent's file reference <b>2462</b>
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<b>FOR FURTHER ACTION</b> See paragraph 2 below
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International application No. <b>PCT/JP2017/030366</b>	International filing date (day/month/year) <b>24.08.2017</b>	Priority date (day/month/year) <b>30.08.2016</b>
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International Patent Classification (IPC) or both national classification and IPC <b>G02B6/02 (2006.01) i, H01S3/067 (2006.01) i</b>
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Applicant <b>FUJIKURA LTD.</b>
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1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/JP	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
  - the international application in the language in which it was filed
  - a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2.  This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3.  With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
  - a.  forming part of the international application as filed:
    - in the form of an Annex C/ST.25 text file.
    - on paper or in the form of an image file.
  - b.  furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
  - c.  furnished subsequent to the international filing date for the purposes of international search only:
    - in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
    - on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
4.  In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

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<b>Box No. V</b>	<b>Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</b>
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1. Statement			
Novelty (N)		Claims <u>2, 5-6</u> Claims <u>1, 3-4</u>	YES NO
Inventive step (IS)		Claims _____ Claims <u>1-6</u>	YES NO
Industrial applicability (IA)		Claims <u>1-6</u> Claims _____	YES NO

2. Citations and explanations:	
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Document 1: JP 2001-257422 A (SUMITOMO ELECTRIC INDUSTRIES, LTD.) 21 September 2001, paragraphs [0028], [0033]-[0035], fig. 1, 3, 7 & US 2001/0021210 A1, paragraphs [0058], [0063]-[0065], fig. 1, 3, 7 & EP 1133036 A2

Document 2: US 2010/0080499 A1 (SAHLGREN et al.) 01 April 2010, paragraph [0048], fig. 2 & US 8218922 B2 & WO 2008/101636 A1 & EP 1962119 A1 & CA 2621783 A1

Document 3: JP 2002-6148 A (SUMITOMO OSAKA CEMENT CO., LTD.) 09 January 2002, paragraph [0007] (Family: none)

Document 4: JP 2004-109928 A (SUMITOMO ELECTRIC INDUSTRIES, LTD.) 08 April 2004, paragraphs [0016]-[0018], [0022], [0025]-[0028], fig. 1, 4, 6 & US 2004/0109638 A1, paragraphs [0032]-[0034], [0038], [0041], [0042], fig. 5, 8, 11 & US 6952511 B2

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**Box No. V** Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

The invention as in claims 1 and 3-4 lacks novelty in the light of document 1 cited in the ISR.

Regarding claim 1, document 1 discloses an invention relating to a chirped fiber grating element in which a grating composed of a high-refractive-index region is written in a core, and both a pitch of the grating and a refractive index difference of the grating become larger with the distance from one end face (paragraphs [0028], [0033]-[0035], fig. 1, 3, 7).

Further, regarding claim 3, document 1 (paragraph [0034]) indicates that the envelope of the refractive index amplitude may be a triangle.

Further, regarding claim 4, document 1 (paragraph [0035], fig. 7) indicates that both the pitch of the grating and the thickness of the high-refraction-region increase with the distance from one end face.

The invention as in claim 2 does not involve an inventive step in the light of documents 1-3 cited in the ISR.

Regarding claim 2, document 1 indicates that the refractive index amplitude of the grating is apodized by an envelope curve such as a triangle or a Gaussian (paragraph [0034]).

Since the feature of apodizing the refractive index amplitude of a grating element by a quadratic curve is well known (see, for example, document 2: paragraph [0048], fig. 2, document 3: paragraph [0007], etc.), a person skilled in the art could easily have conceived of using a quadratic curve, which is a well-known feature,

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as an envelope curve of the refractive index amplitude of the grating in the chirped fiber grating element in document 1.

The invention as in claims 5-6 does not involve an inventive step in the light of documents 1 and 4 cited in the ISR.

Regarding claim 5, a person skilled in the art could easily have conceived of using the chirped fiber grating element disclosed in document 1 as elements 11, 12 in a fiber laser in which chirped fiber grating elements 11, 12 are connected to one end of the amplification optical fiber disclosed in document 4 (paragraphs [0016]-[0018], [0022], [0025]-[0028], fig. 1, 4, 6).

Regarding claim 6, optimizing the chirped fiber grating element of claim 1 so as to satisfy the configuration disclosed in claim 6 with respect to the wavelength band which is to be reflected is an exercise of ordinary creativity of a person skilled in the art.