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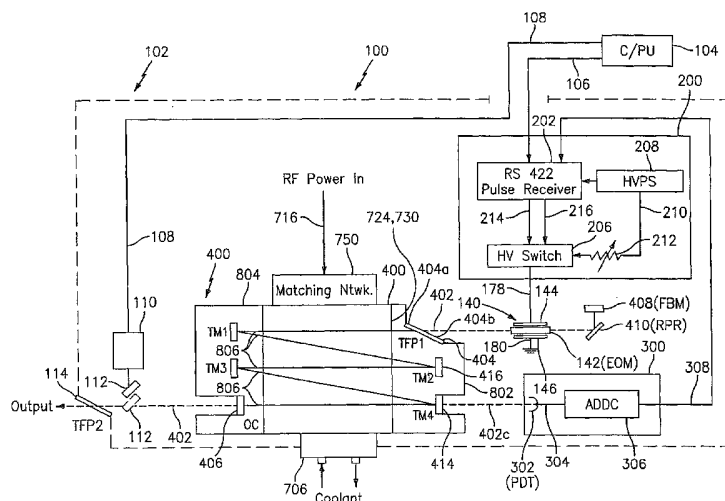
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: Q-SWITCHED CO₂ LASER FOR MATERIAL PROCESSING



(57) Abstract: A simultaneously super pulsed Q-switched CO₂ laser system for material processing is disclosed. The system comprises sealed-off folded waveguides with folder mirrors that are thin film coated to select the output wavelength of the laser. The system also comprises a plurality of reflective devices defining a cavity; a gain medium positioned within the cavity for generating a laser beam; a cavity loss modulator for modulating the laser beam, generating thereby one or more laser pulses; a pulsed signal generation system connected to the cavity loss modulator for delivering pulsed signals to the cavity loss modulator thereby controlling the state of optical loss within the cavity; a control unit connected to the pulsed signal generation system for controlling the pulsed signal generation system; and a pulse clipping circuit receptive of a portion of the laser beam and connected to the pulsed signal generation system for truncating a part of the laser pulses.

INTERNATIONAL SEARCH REPORT

 International Application No
 PCT/US 02/10765

 A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H01S3/223 H01S3/11

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 H01S

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)

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 982 790 A (GROSSMAN WILLIAM MARK ET AL) 9 November 1999 (1999-11-09) column 5, line 39 column 12, line 10 - column 13, line 10; figure 7	1,15,59, 60
A	----- US 3 820 038 A (TOMLINSON R) 25 June 1974 (1974-06-25) column 4, line 20 - line 35	1-42, 59-72, 81-94, 97-99
A	----- US 4 393 517 A (BUSER RUDOLPH G ET AL) 12 July 1983 (1983-07-12) the whole document ----- -/--	1

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in 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 document 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.

"Z" document member of the same patent family

Date of the actual completion of the international search

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26/09/03

Name and mailing address of the ISA

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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.
A	US 4 221 463 A (BARSACK EDWARD ET AL) 9 September 1980 (1980-09-09) column 3 - column 4; figure 1 -----	1
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 511 (E-0999), 8 November 1990 (1990-11-08) & JP 02 211684 A (TOSHIBA CORP), 22 August 1990 (1990-08-22) abstract -----	1,88,90, 91

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 02/10765

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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 fee, this Authority did not invite payment of any additional fee.
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.:

see annex

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ 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: 1-13,15,16,18-24,88-90,97,98,100

Truncation of the laser pulse

2. claim: 14

Shutter system

3. claims: 17, 58

incorporation of a phase grating

4. claims: 25-31

Intra cavity laser beam Polarisation

5. claims: 36-42

Multiple pass through the cavity loss modulator

6. claims: 43-51,91-96

Method of Q-switching

7. claims: 52-57

Timing of the Q-Switch

8. claims: 59,60

Method of manual Q-Switch control

9. claims: 61-72,99

Laser comprising a sealed laser head

10. claims: 32-35,73-77

Electro-optic modulator

11. claims: 81-87

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

System for automatically terminating the laser beam
generation

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 02/10765

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5982790	A	09-11-1999	NONE	

US 3820038	A	25-06-1974	CA 1009356 A1	26-04-1977
			DE 2406285 A1	15-08-1974
			FR 2217834 A1	06-09-1974
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