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(54) Title: METHOD AND APPARATUS FOR MEASURING THE TEMPERATURE OF A SHEET MATERIAL

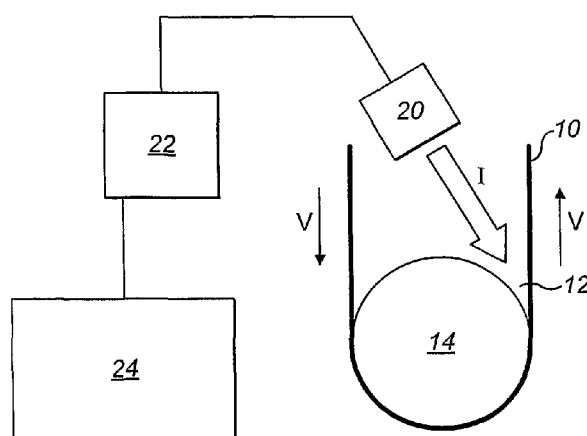


FIG. 1a

(57) Abstract: A method of measuring the temperature of a sheet material is provided. The sheet material is arranged such that it forms at least one side of a cavity so as to enhance the effective emissivity of the sheet material in the vicinity of the cavity. The method comprises: a) generating a thermal image of at least part of the inside of the cavity using a thermal imaging device to detect radiation emitted by the cavity, the thermal image comprising a plurality of pixels each having a pixel value representative of radiation emitted by a respective region of the cavity; b) identifying a first subset of the plurality of pixels whose pixel values meet predetermined criteria; c) using the identified first subset of pixels to determine a line on the thermal image representative of optimal emissivity enhancement in the cavity; and d) selecting a second subset of the plurality of pixels based on the determined line and generating a temperature profile along the determined line derived from the pixel values associated with each of the second subset of pixels.

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2009/000173

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01J5/00 G01J5/52

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)
G01J B21B

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2006 003081 A (NIRECO CORP) 5 January 2006 (2006-01-05)	1-15, 29-33, 38, 39, 44-46
Y	abstract; figures 1, 2a, 2b	16-22
A	-----	23-28
A	JP 2005 233790 A (NIPPON STEEL CORP) 2 September 2005 (2005-09-02)	1-15, 29-33, 38, 39, 44-46
	abstract; figure 1	
A	-----	
A	JP 2002 323381 A (MINOLTA CO LTD) 8 November 2002 (2002-11-08)	1-15, 29-33, 38, 39, 44-46
	abstract; figure 1	

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☒ 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 document 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.
- *G* document member of the same patent family

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.
A	US 4 883 364 A (ASTHEIMER ROBERT W [US]) 28 November 1989 (1989-11-28) column 3, line 23 - column 4, line 63; figure 1 column 4, lines 18-24 -----	1, 38, 39
Y	DE 100 17 405 A1 (PETERS W MASCHF [DE]; GEORG MAURER GMBH OPTOELEKTRON [DE]) 11 October 2001 (2001-10-11) paragraph [0041]; figure 3 -----	16-18
Y	US 4 439 049 A (HOOGENDOORN BASTIAAN [NL] ET AL) 27 March 1984 (1984-03-27) column 4, lines 44-57 -----	16-18
Y	US 4 746 224 A (MIZUNO MASASHI [JP] ET AL) 24 May 1988 (1988-05-24) column 4, line 48 - column 5, line 27; figures 1,2 -----	16-18
Y	JP 2004 279161 A (JFE STEEL KK; JFE ELECTRICAL & CONTROL SYSTE) 7 October 2004 (2004-10-07) abstract; figures 1,2,5,7 -----	19-22
A	JP 58 063822 A (KAWASAKI STEEL CO) 15 April 1983 (1983-04-15) abstract; figure 1 -----	23-28
Y	JP 2005 233731 A (NIPPON STEEL CORP) 2 September 2005 (2005-09-02) abstract; figure 1 -----	19-22
A		23-28

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2009/000173

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 allsearchable 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 reportcovers only those claims for which fees were paid, specifically claims Nos.:
33, 38, 39, 44-46
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: 1,2-15,29-33, 38,39, 44-46

selection of pixels corresponding to highest emissivity

2. claims: 16-18

identification of edges of the sheet material

3. claims: 19-28

temperature profile coordinate transformation

4. claims: 34-37,40-43

mechanical and materials aspects of thermal imaging device

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2009/000173

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
JP 2006003081	A	05-01-2006	NONE		
JP 2005233790	A	02-09-2005	NONE		
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