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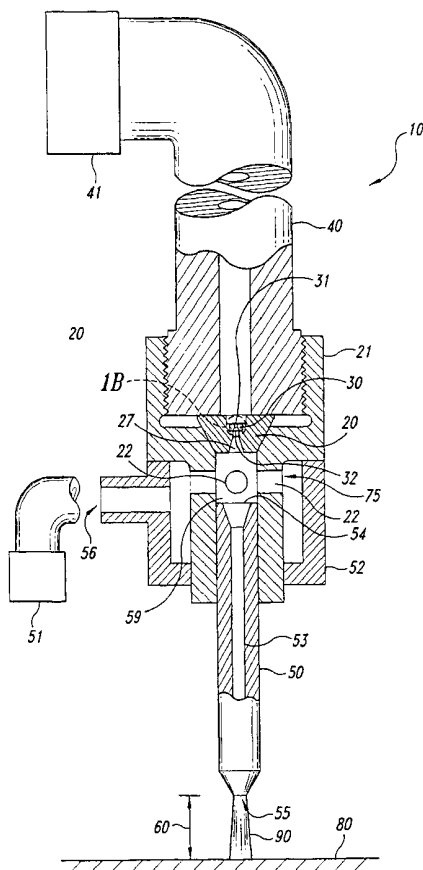
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[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR FLUID JET FORMATION



(57) Abstract: A method and apparatus for controlling the coherence of a high-pressure fluid jet directed toward a selected surface. In one embodiment, the coherence is controlled by manipulating a turbulence level of the fluid forming the fluid jet. The turbulence level can be manipulated upstream or downstream of a nozzle orifice (30) through which the fluid passes. For example, in one embodiment, the fluid is a first fluid and a secondary fluid is entrained with the first fluid. The resulting fluid jet, which includes both the primary and secondary fluids, can be directed toward the selected surface so as to cut, mill, roughen,peen, or otherwise treat the selected surface. The characteristics of the secondary fluid can be selected to either increase or decrease the coherence of the fluid jet. In other embodiments, turbulence generators (75), such as inverted conical channels, upstream orifices, protrusions and other devices can be positioned upstream of the nozzle orifice to control the coherence of the resulting fluid jet.



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(AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

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18 January 2001

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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.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/06352

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B24C5/04

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 B26F B05B B24C

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 382 319 A (FLOW INT CORP) 16 August 1990 (1990-08-16)	1-5, 7-10, 68-72, 76-78, 82,83, 86,87, 92-94
A	*the whole document*	44-46, 73-75, 79-81, 84,85

X	EP 0 391 500 A (FLOW INT CORP) 10 October 1990 (1990-10-10)	1-12, 52-57, 108-113
A	*the whole document*	13-16

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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

20 June 2000

Date of mailing of the international search report

20. 10. 00

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/06352

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 5 851 139 A (XU JIAN) 22 December 1998 (1998-12-22) column 1, line 44 - line 45 column 2, line 15 - line 44 column 3, line 49 - line 59; figure 1 ---	1-7
X	US 4 555 872 A (YIE GENE G) 3 December 1985 (1985-12-03) column 7, line 47 - line 70 column 9, line 7 - line 45; figure 2 -----	1-15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/06352

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:

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.:

1-16, 44-46, 52-57, 68-87, 92-94, 108-113

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

1. Claims: 1-16, 44-46, 52-57, 68-87, 92-94, 108-113

An apparatus for generating a high pressure fluid flow for treatment of a selected surface and method thereof

2. Claims: 17-18, 88-91

An apparatus coupled to a vacuum source for generating a high pressure fluid jet for treatment of a selected surface and method thereof

3. Claims: 19-24

An apparatus with a rotatably coupled nozzle to generate a high pressure fluid jet for the treatment of a surface

4. Claims: 25-34, 58-67, 95-107, 114-115

Jet coherence controlling apparatus fitted with a turbulence generator and method thereof

5. Claims: 35-43

Jet coherence controlling apparatus with two nozzles

6. Claims: 47-51

Removable nozzle assembly

7. Claims: 116-122

A method for cutting a fibrous material

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/06352

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0382319 A	16-08-1990	US 4934111 A JP 2298466 A JP 2868268 B	19-06-1990 10-12-1990 10-03-1999

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