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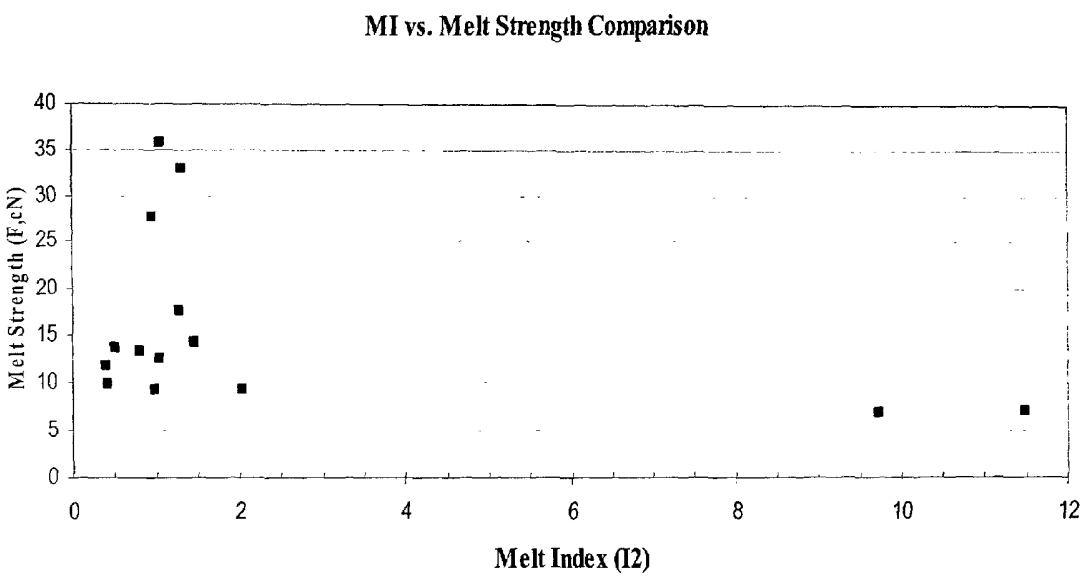
[Continued on next page]

(54) Title: HIGH MELT STRENGTH POLYMERS AND METHOD OF MAKING SAME



(57) Abstract: A polymer composition comprises: (a) a high molecular weight, branched component; and (b) a low molecular weight, branched component. Some polymer compositions are characterized by a substantial absent of amyl or methyl branches and a melt strength (MS) that satisfies the following relationship, formula (I), where x is greater than or equal to about 12.5 and y is greater than or equal to about 3. Some polymers are characterized by a melt strength (MS) that satisfies the following relationship, formula (II), where x is greater than or equal to about 3 and y is greater than or equal to about 4.5 and a molecular weight distribution of greater than 3. A process for making polymers is also disclosed.

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INTERNATIONAL SEARCH REPORT

Inter l Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C08F10/00 C08F4/646 C08F2/00 C08L23/16

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 C08F C08L

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, PAJ, 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	WO 97 48735 A (EXXON CHEMICAL PATENTS INC) 24 December 1997 (1997-12-24) abstract; claims 1-34 page 26, line 33 -page 27, line 5 page 14, line 22	1-8, 11-19
Y	page 15, line 16-25	9,10
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A	abstract; claims 1-32 page 1, line 5-15 page 2, line 9-30 page 28, line 14 page 52; tables 7A,7B,7C	1-19

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[X] Further documents are listed in the continuation of box C.

[X] 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

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 January 2003	24. 01. 2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Bergmans, K

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int[illegible]al Application No
PCT/US 02/07919

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00 50466 A (BOREALIS TECH OY ;COCKBAIN JULIAN (GB); ANDERSEN ARILD GEIR (NO);) 31 August 2000 (2000-08-31) abstract; claims 1-23	1-19
X	EP 1 059 332 A (FINA RESEARCH) 13 December 2000 (2000-12-13) abstract; claims 1-10 page 3, line 13 page 5; table 1	20,21, 23-25, 30-33, 47,54-59
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X	US 6 185 349 B1 (KORVENOJA TARJA ET AL) 6 February 2001 (2001-02-06) abstract; claims 1-15 column 4, line 30,53 column 13; tables 1,2	20, 23-25, 45,47, 54-59
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 02/07919

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.:

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: 1-19

A process of making an olefin polymer using olefinic monomers, high molecular weight catalyst and low molecular weight catalyst in a polymerisation reactor to obtain a polymer.

2. Claims: 20,22-25,30,31,33-38,40-49,54-56,57-59

A bimodal polymer composition comprising a HMW branched component, LMW branched component characterised by a melt strength.

3. Claims: 21,26-32,34-53,57-59

A polymer composition comprising a backbone and long branches connected to the backbone characterised by a branch index.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte ıal Application No
PCT/US 02/07919

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