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(52) UK CL (Edition T)

C3N N1D1V

(56) Documents Cited

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EP 0344141 A1

WO 97/24410 A1

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(58) Field of Search

UK CL (Edition S) C3N

INT CL⁷ C08L 95/00

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(54) Abstract Title

Asphalt composition

(57) A stone mastic composition comprises a mastic, an aggregate and a filler, the aggregate comprises the major portion of the whole composition and is typically granite, basalt, quartzite, industrial slag, crushed bottles, crushed concrete, sand or sludge stones and is of a specified gradation: 60-75% greater than 7mm, but less than 19mm, 80% greater than 2mm. The filler material present may be tyre or latex powder, rock filler, slag filler or a cellulosic fibre, e.g. oil palm fibre, coconut fibre, kenaf fibre, rubber-wood fibre, or paper-pulp fibre.

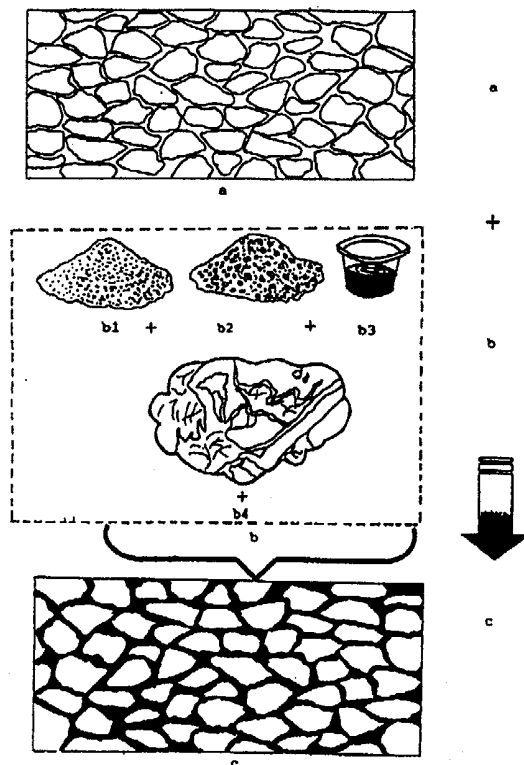
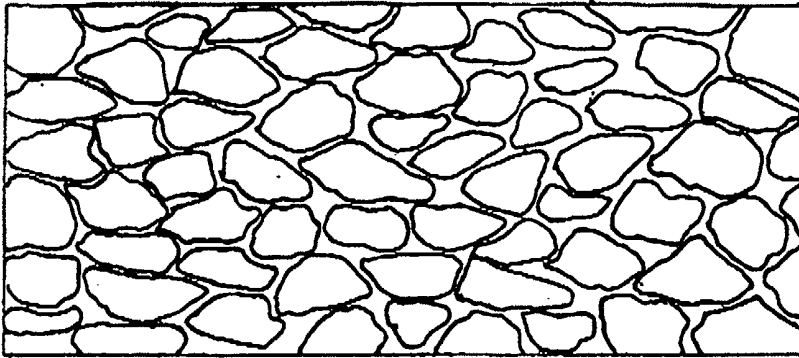


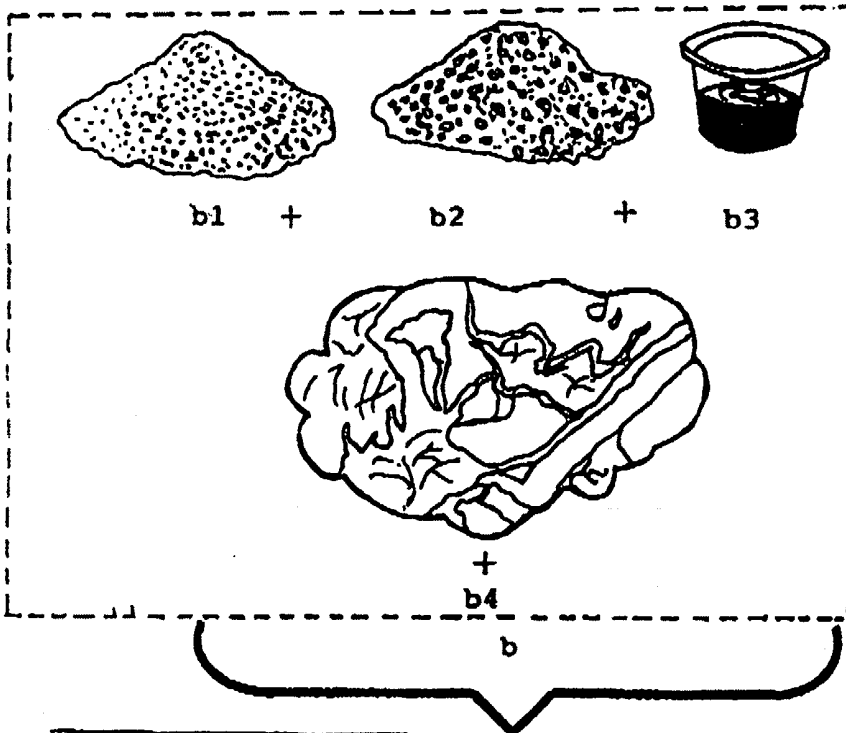
FIGURE 1



a

a

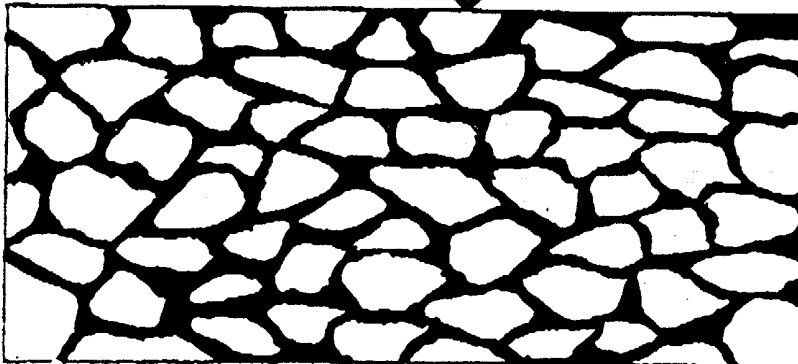
+



b



c



c

FIGURE 1

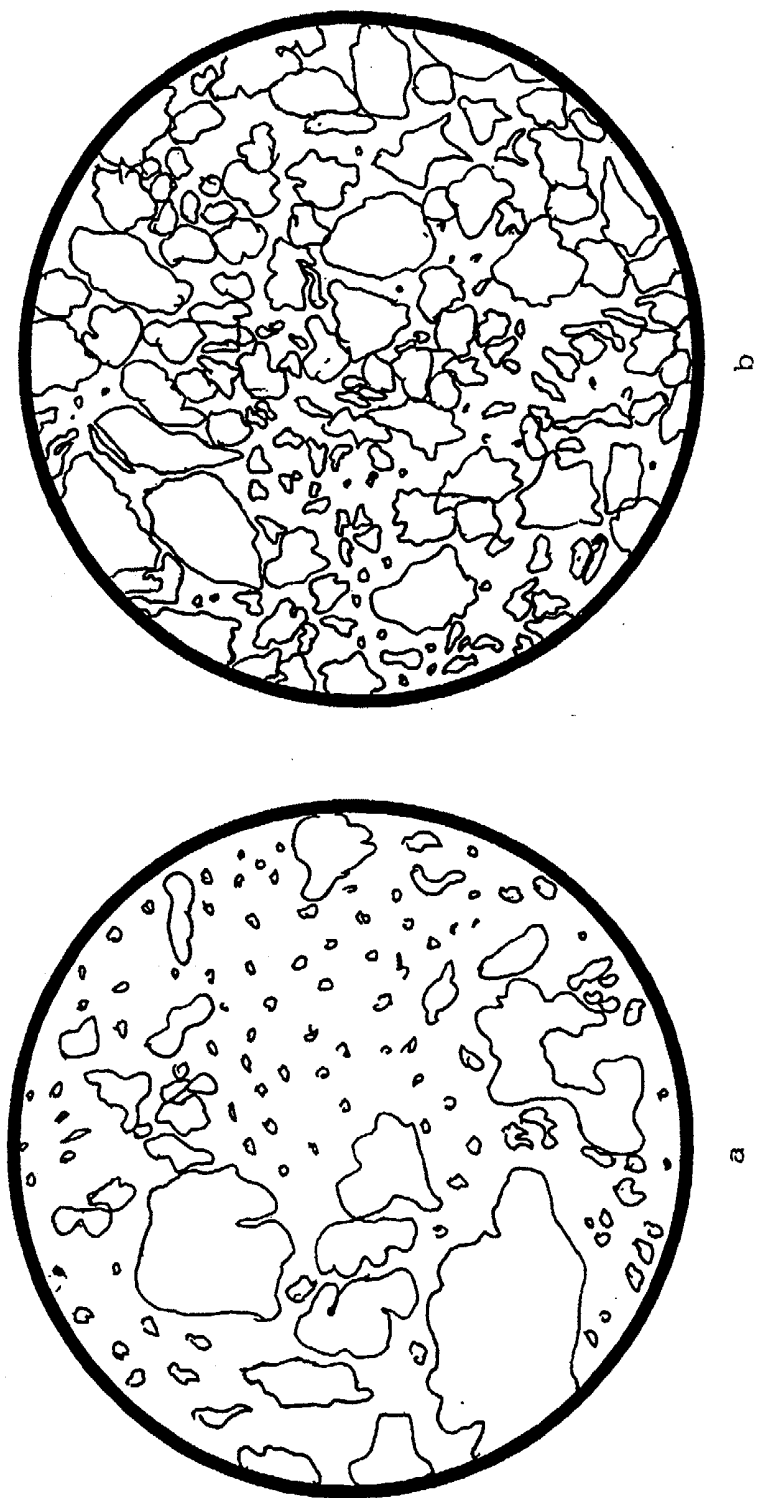


FIGURE 2

Table 1: SMA Aggregate Gradation Envelope

Sieve Sizes	SMA14 % Passing	SMA12.5 % Passing	SMA10 % Passing	SMA7 % Passing	SMA5 % Passing
19.0 mm	100	100			
14.0mm	80-100		100		
12.5mm		80-95			
10.0mm	60-95		80-96	100	100
9.50mm		71-90			
6.70mm	44-76		56-86	75-95	
5.00mm	30-56				65-95
4.75mm		40-70	46-60		
2.36mm	19-30	16-30	17-30	42-60	40-50
0.60mm	10-17	10-20	10-20	10-20	10-20
0.30mm	6-15	9-13	9-13	9-13	9-13
0.075mm	4-10	4-10	4-10	4-10	4-10

- The selection of the above sieve sizes and individual envelopes was developed after interactive research work at UPM Highway laboratory

Table 2: SMA Aggregate Proportions for SMA14, SMA12.5, SMA10, SMA7, and SMA5

Sieve Sizes	SMA14 % Retained	SMA12.5 % Passing	SMA10 % Passing	SMA7 % Passing	SMA5 % Passing
19.0 mm	60 - 70%	55-65%	50-60%	45-55%	40-50%
14.0mm	retained on	retained on	retained on	retained on	retained on
12.5mm	7.0mm sieve	7.0mm sieve	7.0mm sieve	7.0mm sieve	7.0mm sieve
10.0mm	passing 19 or	passing 19	passing 19	passing 19	passing 19
9.50mm	20 mm sieve	or 20 mm	or 20 mm	or 20 mm	or 20 mm
7.0mm	size	sieve size	sieve size	sieve size	sieve size
5.00mm					
4.75mm	80% or more	75% or more	70% or more	65% or more	60% or more
2.36mm	retained on	retained on	retained on	retained on	retained on
0.60mm	2.36mm or	2.36mm or	2.36mm or	2.36mm or	2.36mm or
0.30mm	2.0mm	2.0mm	2.0mm	2.0mm	2.0mm
0.075mm	passing	passing	passing	passing	passing
	19mm or 20	19mm or 20	19mm or 20	19mm or 20	19mm or 20
	mm	mm	mm	mm	mm

Table 3: SMA mix Design Parameter

Voids in Total Mix (VTM), percent	3 - 5
Asphalt Mastic Cement, percent	5.8 minimum
Voids in Mineral Aggregates (VMA)	16 minimum
Stability, kN	7.0 minimum
Flow	2 - 4 mm
Compaction, number of blows on each side of test specimen	50 for normal use and 75 for heavy duty
Drain-down of mastic asphalt, percent	0.35 max (2 hour reading)
Mastic Asphalt Heating temperature	155°C - 175°C
Aggregate Heating temperature	150°C - 180°C
SMA compaction temperature	135°C minimum
#40 tire rubber/latex powder, percent	2 - 10 by weight of 80/100 Asphalt
-#200 rock fillers	4 - 10 by weight of aggregates

Table 4: Aggregate Physical Properties

No.	Aggregate Tests	Quality Requirement
1	Los Angeles Abrasion	30% max
2	Sodium Sulfate Soundness loss	15% max
3	Aggregate Crushing Value	30% max
4	Absorption	2% max
5	Polished Stone Value	49 Minimum
6	Flatness & Elongation	3:1 ratio 25% max 5:1 ratio 10% max
7	Angularity Number	5 - 10
8	Specific Gravity	2.58 minimum

- The above aggregate properties can be confirmed by testing using ASTM, BS.MS or AASHTO standards

KEY TO FIGURES 1 & 2

Figure 1: Schematic representation of a preferred embodiment of the paving composition according to the present invention.

- a : stone skeleton or matrix
- b : mastic
- b1: filler
- b2: quarry dust
- b3: asphalt
- b4: cellulose (oil palm fibre)
- c : stone mastic asphalt comprising stone skeleton filled with mastic.

Figure 2: Comparison between a magnified view of stone mastic asphalt according to the present invention and a magnified view of a conventional mix for road paving.

- a: conventional mix
- b: stone mastic asphalt (SMA)

PAVING COMPOSITION

Technical Field of The Invention

The present invention generally relates to a paving composition, in particular to stone mastic asphalt compound as a road paving composition.

5 Background of The Invention

Aggregate-containing asphalt has been employed as a paving composition for roads or the like for many years. The asphalt includes bitumens as a predominant constituent and is conventionally obtained as a solid residue from the distillation of crude petroleum. The asphalt is converted to a fluid state when paving a road. One fluid form is the suspension or
10 emulsion of the asphalt in water. After spreading and compressing the aggregate-containing asphalt, water evaporates and the asphalt hardens into a continuous mass.

The present invention is a new technology that utilizes a specific aggregate gradation and matrix for high stability. Specially formulated fibre mastic asphalt is used to hold the aggregate matrix in place while providing extended durability. The special formulation would
15 be able to handle heavy loading from commercial trucks and thus minimizing pavement surface distresses. Some of the major applications of this cost effective technology would be at traffic stop signs, exit and access ramps of highways, expressways, water ponding areas on highways, ascending and descending lanes, port areas with heavy container movements and parking lots. The use of the technology of the present invention is expected to reduce the cost
20 of the material by 15 to 20 per cent.

Summary of The Invention

Accordingly, it is the primary object of the present invention to provide a paving composition that has improved resilience and is able to handle heavy loading of commercial vehicles. It is also another object of the present invention to provide a paving composition that can
25 minimize pavement surface distresses and is economical to produce.

This and other objectives of the present invention is accomplished by,

A paving composition comprising aggregate and asphalt characterized in that:

- a) a major proportion of the composition by weight is aggregate; and
- b) a minor proportion of the composition by weight is asphalt.

- 5 The aggregate comprises particles of a size such that at least 80 per cent will be retained on a 2 mm sieve passing 19 or 20 mm sieve sizes, and about 60 to 75 per cent will be retained on a 7 mm sieve passing 19 or 20 mm sieve sizes.

- The paving composition technology according to the present invention provides an economical means to produce paving composition that are resilient, capable of handling
10 heavy loading of commercial vehicles and providing a cost effective technology.

Brief Description of The Drawings

Other aspect of the present invention and their advantages will be discerned after studying the detailed description in conjunction with the accompanying figures in which:

- Figure 1 is a schematic representation of a preferred embodiment of the paving composition
15 according to the present invention.

Figure 2 is a comparison between a magnified view of stone mastic asphalt according to the present invention and a magnified view of a conventional mix for road paving.

Detailed Description of The Invention

- The aggregate used in the paving composition according to the present invention may be of a
20 type conventionally employed in the road building industry. It may range from fine particles, such as sand, to relatively coarse, ground particles such as crushed stone, gravel or slag.

As mentioned above, the paving composition according to the invention contains a major proportion by weight of aggregate; as is conventional for road paving compositions.

- The paving composition according to the invention is generally used in a method of
25 producing a paving layer, which comprises applying a composition according to the invention to a substrate (such as the surface of a road) and curing the asphalt such that the aggregate in the paving layer is bonded together by cured solid asphalt.

Process

The paving composition of the present invention, stone mastic asphalt (SMA), is formulated with raw and processed materials using new techniques and processes, as shown in Tables 2 and 3. The details of the ingredients, mixing and compaction control processes are described
5 below.

Aggregates

The aggregates for use in SMA should conform to the physical property requirement as shown in Table 4. The aggregates shall be heated up to a temperature of between 150°C and 200°C, prior to mixing with the mastic asphalt. SMA uses aggregates like granite, basalt,
10 quartzite, industrial slag, crushed concrete, crushed bottles, sand and sludge stones from domestic wastes. The types, sizes, shapes and gradation of the aggregates to be used in SMA shall be as described in Tables 1 and 2. SMA uses specific gradation envelopes for different SMA products like SMA 14, SMA 12.5, SMA 10, SMA 7, and SMA 5.

Mastic Asphalt

15 An asphalt with a penetration between 80 and 100 (80/100) shall be stabilized or modified with tyre or latex powders of sizes 30 to 50 microns in a proportion of between 2 and 10 per cent by weight of asphalt and cellulose fibre pellets that form the asphalt or binder mastic. Rock or slag fillers may be used in place of the above in a proportion of between 4 and 10 per cent by weight of aggregates.

20 The main source of cellulose fibre are from oil palm, coconut, kenaf, rubber-wood and paper pulp, which are used in the formulation of fibre mastic. The cellulose fibres are specially ground and pulped to specific micron sizes that are found to give the best possible performance in terms of stability and drain down of asphalt. The cellulose fibres are mechanically pelletized with light asphalt emulsions or any other suitable materials, for easy
25 packaging, storage and introduction into drum mix or batch mix plants. The proportion of emulsion to coat cellulose fibres is between 10 and 40 per cent by weight of fibres.

Mix Design and Control

Both the heated materials are mixed for a duration of between 30 seconds to 3 minutes before the specimen can be compacted. The specimen or mixed SMA compound shall be compacted

at a temperature not less than 130°C at 50 blows per side for normal use and 75 blows per side for heavy traffic loading.

SMA Mix Drain -down Analysis

- 5 The uncompacted hot samples are tested for their mastic asphalt drainability using stainless steel $\frac{1}{4}$ inch mesh baskets. The mix shall not drain down more than 0.3% maximum by weight of total mix.

Performance Testing

The compacted samples shall be tested for the following to ensure quality and durability:

Stability:

- 10 It measures the strength of the SMA paving compound after placing the specimen in a water bath of 60°C (service temperature of pavements) for about 30 minutes. The samples are expected to display a minimum strength of 7.0 kN with a flow that falls within 2 to 4 mm range. The specimen is also expected to have a design airvoids of between 3 and 5%.

Moisture Induced Test:

- 15 Tropical countries like Malaysia receives heavy rainfall that cause pavement damages due to moisture problems. SMA samples are expected to display a Tensile Strength Ratio (TSR) of at least 75%.

Modulus Values:

- 20 The resilient modulus of the compacted SMA shall attain a minimum value of 3000 MPa. The samples shall also display a minimum value of 10,000 load cycles to failure in terms of dynamic impact loading.

- 25 While the preferred embodiments of the present invention have been described, it should be understood that various changes, adaptations and modifications may be made thereto. It should be understood, therefore, that the invention is not limited to details of the illustrated invention shown in the figures and tables, and that variations in such minor details will be apparent to one skilled in the art.

Claims:

- 1) A paving composition comprising aggregate and asphalt characterized in that:
 - a) a major proportion of the composition by weight is aggregate; and
 - 5 b) a minor proportion of the composition by weight is asphalt.
- 2) A paving composition as claimed in claim 1 in which the asphalt is present as a mastic.
- 3) A paving composition as claimed in claim 2 in which the asphalt mastic comprises additives to provide enhanced stability and drainability.
- 4) A paving composition as claimed in claim 1 in which the aggregate comprises particles of
10 a size such that at least 80 per cent will be retained on a 2 mm sieve passing 19 or 20 mm sieve sizes, and about 60 to 75 per cent will be retained on a 7 mm sieve passing 19 or 20 mm sieve sizes.
- 5) A paving composition as claimed in claims 1 or 4 in which the aggregate is granite, basalt, quartzite, industrial slag, crushed bottles, crushed concrete, or sand and sludge stones
15 from domestic wastes.
- 6) A paving composition as claimed in claim 3 in which the asphalt mastic comprises additives selected from the group consisting tyre powder, latex powder, rock filler, slag filler and cellulose fibre.
- 7) A paving composition as claimed in claim 6 in which the tyre or latex powders are of
20 sizes 30 to 50 microns in a proportion of between 2 and 10 per cent by weight of asphalt and cellulose fibre pellets that form the asphalt mastic.
- 8) A paving composition as claimed in claim 6 in which the rock or slag fillers are present in a proportion of between 4 and 10 per cent by weight of aggregates.

- 9) A paving composition as claimed in claim 6 in which the cellulose fibre is selected from the group consisting oil palm fibre, coconut fibre, kenaf fibre, rubber-wood fibre and paper pulp fibre.
- 5 10) A paving composition as claimed in claim 9 in which the cellulose fibre is mechanically pelletized with light asphalt emulsions or any other suitable materials.
- 11) A paving composition as claimed in claim 10 in which the proportion of asphalt emulsion to coat the cellulose fibres is between 10 and 40 per cent by weight of fibres.
- 10 12) A method of producing a paving layer, which comprises applying a composition according to any one of claims 1 to 11 to a substrate and curing the asphalt such that the aggregate in the paving layer is bonded together by cured solid asphalt.
- 13) A paved layer which has been produced by a method according to claim 12.
- 14) A paving composition comprising aggregate and asphalt substantially as herein described with reference to the accompanying drawings.



Application No: GB 0114734.7
Claims searched: 1-14

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Examiner: Jason Scott
Date of search: 28 August 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.S): C3N

Int CI (Ed.7): C08L 95/00

Other: ONLINE: WPI, JAPIO, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2339432 A	ODEBRECHT See whole document and in particular page 6, lines 23-28 and examples	1-3, 5, 6, 8, 12 & 13
X	GB 2249103 A	FIBRESCREED See whole document and in particular page 2, lines 8-10 & 34-35	1-3, 5, 6, 12 & 13
X	GB 1494279 A	BP See whole document and in particular page 1, lines 59-74	1-3, 5, 6, 8 & 12
X	GB 0397864 A	GRIFFITHS See whole document and in particular page 2, lines 77-103	1-3, 5, 12 & 13
X	WO 97/24410 A1	HESELBERG See whole document and in particular page 5, lines 4-10	1-3, 5, 6, 8, 12 & 13
X	WO 83/02619 A1	MANVILLE See whole document and in particular claim 1	1-3, 5, 12 & 13

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.

E Patent document published on or after, but with priority date earlier than, the filing date of this application.



INVESTOR IN PEOPLE

Application No: GB 0114734.7
Claims searched: 1-14

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Examiner: Jason Scott
Date of search: 28 August 2001

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0344141 A1 BITUMAR See whole document and in particular column 2, lines 40-45	1-3, 5, 6, 8, 9, 12 & 13
X	US 4579458 OHLSON See whole document and in particular example 1	1-3, 12 & 13

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.