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NOTICE OF ENTITLEMENT

We, BST HOLDINGS PTY. LIMITED, A.C.N. 003 983 524, of 4th Floor, BST House, 3 Small Street, BROADWAY, NEW SOUTH WALES 2007, AUSTRALIA, being the applicant in respect of Application No. 23996/92, state the following:-

1. The person nominated for the grant of the patent has entitlement from the actual inventors by assignment.

2. The provisional application listed in the declaration made under Article 8 of the PCT was filed in Australia not more than 12 months before the filing date of this application.

3. The person nominated for the grant of the patent is the applicant of the application listed in the declaration under Article 8 of the PCT.

For and on behalf of
BST HOLDINGS PTY. LIMITED

by..... 22nd December, 1993

(Signature) (Date)

Name: Thomas E. WRIGHT.....

Title: Managing Director.....

File: 16580

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AU9223996

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LIGHTWEIGHT AGGREGATE COATED WITH BINDING AGENT/TRANSITION METAL COMPOUND

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(56) Prior Art Documents
AU 54540/80 C04B 25/04 C08K 3/24
EP 339343
GB 2018806

(57) Claim

1. A lightweight aggregate comprising particles of polymer foam coated with a binding agent, said binding agent having dispersed therein in total at least 10% by dry weight thereof of one or more transition metal ions, said particles being free flowing.

2. An aggregate according to Claim 1 wherein the transition metal ions are predominantly ferric ions.

4. An aggregate according to any one of the preceding claims wherein the binding agent is selected from the group comprising phenolic resins, shellac, epoxy resins, polyvinyl acetate, and bituminous binders.

8. An aggregate according to any one of the preceding claims wherein the coated porous particles are of expanded polystyrene foam.

13. A method of manufacture of a lightweight aggregate coated with a binding agent in which transition metal ions are dispersed, said method comprising the steps of emulsifying a binder in water, dispersing iron oxide in the aqueous phase so that the

.../2

emulsion comprises at least 10% by weight of dry solids of a transition metal ion, and

coating a lightweight porous aggregate with the emulsion.

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(54) Title: LIGHTWEIGHT AGGREGATE COATED WITH BINDING AGENT/TRANSITION METAL COMPOUND

(57) Abstract

The invention relates to improved light weight aggregate for use in the production of building materials. Light weight aggregate comprises porous particles coated with a binding agent which contains at least 10 % by weight of one or more transition metal ions such as ferric ions. The invention described extends to include emulsions and solutions suitable for coating aggregate as described as well as to coated particles.

TITLE: LIGHTWEIGHT AGGREGATE COATED WITH BINDING AGENT/TRANSITION METAL COMPOUND

FIELD OF THE INVENTION

This invention relates to improved light weight aggregate for use in the production of building materials such as cementitious products, gypsum products, plaster boards and the like. The invention further relates to construction materials incorporating the aggregate, and to methods of manufacture of lightweight aggregate and of products incorporating the aggregate.

PRIOR ART

The preparation of low density concrete by incorporation of light weight aggregates such as vermiculite, cork, slag, asbestos, bagasse and the like in a hydraulic binder such as a cement/sand/water mixture is well known. Low density concrete having much improved characteristics may be prepared by incorporation of foam particles, for example polystyrene foam, as the light weight aggregate. However cementitious materials do not readily bond with

these light weight aggregates which are hydrophobic. In use of polystyrene foam particles (which are by nature highly hydrophobic) it has been proposed to incorporate a binding agent in the cement, or to pre-coat the particles with a binding agent, the purpose of which is to promote adhesion between the foam particles on the one hand and cement on the other.

Various binding agents have been proposed included bituminous products, coal tars and mixtures of pitch with epoxy resins or phenolic resins. These binding agents are believed to act by softening the surface of the expanded polystyrene particles, thereby enhancing the bond strength between the particles and cured concrete.

The use of such materials has suffered from the disadvantages that bituminous and tar-like products when applied to polystyrene particles tend to result in a tacky surface causing the particles to coalesce into a mass which is difficult to disperse. Furthermore, the coatings have a strong bituminous odour which in the past has been detectable in the end product. More importantly the bonding strength between the polystyrene foam particles and cured cement has been less than is desired.

Because the binder is tacky it is usual to coat the polystyrene with binder in a mixer and then add cement and water to the same mixer to form concrete so avoiding handling of the tacky aggregate. Alternatively the tacky aggregate has been detackified by subsequently dusting the bituminous coated polystyrene balls, in situ, with a finely granulated substance such as cement powder and then adding further cement and water for compression into moulds.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved light weight aggregate which avoids or at least ameliorates disadvantages of the prior art and which in preferred embodiments provides enhanced bonding between the aggregate and cementitious material. By enhanced bonding is meant a greater bond strength than obtainable with prior art light weight aggregates.

According to one aspect the present invention consists in a light weight aggregate comprising particles of polymer foam coated with a binding agent, said binding agent having dispersed therein in total at least 10% by dry weight thereof of one or more transition metal ions, said particles being free flowing.

The transition metal ion may be selected from the group commonly known as transition metals such as cobalt and chromium and this group also includes all known oxidation states of the transition metal. The transition metal ion may be in an ionic compound or complex.

In preferred embodiments of the light weight aggregate the porous particles are expanded polystyrene foam particles of from 0.5 to 15 mm average diameter and may be balls, beads. pellets or reclaimed particles. The preferred binding agent is a bitumen which is applied to the surface of the polystyrene particles from aqueous emulsion. The transition metal ion is desirably ferric ion present as iron oxide which is suspended in the aqueous phase of the bituminous emulsion by use of viscosity modifying agents prior to application of the emulsion to the polystyrene particles.

Desirably also the emulsion contains surfactants and dispersing agents which are bound to the polystyrene particles with the binder.

Polystyrene balls coated with the binder of the invention are free flowing. They may be incorporated directly into a hydraulic cementitious mixture or may be packaged, stored, transported and subsequently incorporated in a concrete mixture for example at a construction site. The polystyrene balls carry a unique "chemical package" which enables them to disperse evenly and to strongly bond to the cementitious material without the necessity to add further chemicals for this purpose. Concrete which contains aggregate according to the invention is of a surprisingly high compressive strength to weight ratio and has other improved properties in comparison with prior art.

The exact mechanism whereby the presence of the iron oxide increases the binding strength between the cement and the aggregate is not certain. Portland cement is a calcium alumino silicate powder which sets as a solid mass on treatment with water. Prior to addition of water it consists mainly of a mixture of calcium silicates ($Ca_2 SiO_4$ and $Ca_3 SiO_5$) and calcium aluminate ($Ca_3 Al_2 O_6$) When treated with water the aluminate hydrolyses to form calcium and aluminium hydroxides which react further with the calcium silicates to form intermeshing crystals of calcium alumino silicates. It is hypothesised that in aggregates according to the present invention, bonding between the calcium alumino silicates and the polystyrene is strengthened by the formation of stable bonds between ferric iron and the donor groups of the polystyrene on the one hand (using pi bonds) and with silica and alumina on the other (using coordinate bonds).

Thus it is well known that iron forms numerous compounds with oxygen and other inorganic donors such as hydrated Fe $(H_2 0)_6^{++}$ and $Fe_2 (OH_2) (H_20)_8^{+4}$. Likewise it is well known that ferrous ion forms extremely strong complexes with organic molecules as exemplified by haemoglobin and ferrocene. It is believed that the iron forms a similar bridging function in the present invention when aggregate according to the invention is incorporated into a cementitious mixture. Another possibility is that the transition metal ion compound crystal structure aids in physical interlocking between the polystyrene and the cement.

Scanning electron microscopy has shown a localisation of iron atoms around the polystyrene beads/granulate. This confirms the bonding role of iron, whether it be through transition metal bonding, the formation of crystalline phases which add strength to the cement, or some alternative mechanism. Similar mechanisms are believed to be involved when other transition metals are employed.

BEST MODES OF PERFORMING THE INVENTION

Various embodiments of the invention will now be more particularly described by way of example only.

According to the invention a light weight particulate material is first selected. The preferred material is a closed cell foamed particulate material such as an expanded polystyrene foam. The polystyrene is typically in bead or spherical-shape but irregular particles such are obtainable by breaking up or recycling waste polystyrene foam (with the correct grading procedure) are also suitable. Particles of other material such as cork, vermiculite, pearlite, blast furnace slag, bagasse and similar light weight aggregate material as

well as other foamed polymers may be selected for use in cementitious products wherein the required performance criteria are less stringent than for concrete.

The preferred closed cell foam polystyrene balls may be for example 0.5 to 15 mm in diameter, more preferably from 3 to 5 mm in diameter and typically have a density of from 12 to 20 kg per cubic meter, more preferably from 14 to 18 kg per cubic meter. However the density of the polystyrene foam is not critical.

The polystyrene balls are coated with a binding agent. The binding agent is preferably a bitumen or tar but may be a suitable polymer or resin of natural or synthetic origin. Examples include phenolic resins, shellac, epoxy resins, polyvinyl acetate or the like. A preferred binding agent is a bituminous toluene soluble mixture of phenolic and alkyl substituted aliphatic, aromatic, and hetero aromatic compounds of molecular weight range 500 - 1000 and having a softening point of 40 - 45°C. The binding agent acts to bind iron oxide to the surface of the polystyrene particles and to reduce the hydrophobicity of the polystyrene.

For preference the binding agent is emulsified in water in suitable agitation apparatus for example a homogenizer.

A surfactant is desirably added. The surfactants are believed to perform at least two important functions. One is to aid in the emulsification of the biturnen. However surfactants bound to the polystyrene by the bitumen are also believed to aid dispersion of the aggregate in cement. The quantity of surfactant used is therefore greater than that merely required for emulsification per se. A wide variety of anionic, cationic or non-ionic surface active agents are useful for the invention. Anionic agents are preferred. Suitable anionic agents include

alkyl and aryl sulphonates such as those sold under the Alkanol trade marks. Sodium ligno sulphonates and saponified resin anionic surfactants are preferred.

In preparation of the aggregate of the invention a transition metal compound is dispersed in the aqueous phase of the emulsion. The preferred transition metal compound is a transition metal oxide and preferably ferric oxide. The contribution of the ferric ion to bonding has been discussed above. It is also believed that when an iron oxide is used the presence of the oxide ions impedes diffusion of carbon dioxide through concrete in which the aggregate is incorporated. Carbon dioxide normally reacts with cement lime to produce calcite thus lowering the pH and contributing to the corrosion of metals reinforcement in concrete construction. When transition metal oxides are present in the aggregate the carbon dioxide reacts with the oxide anions to form carbonate ions, thus reducing the carbonation corrosion. The iron oxide is desirably present in the form of a metal oxide pigment. Other transition metal compounds such as chromium, cobalt and nickel, for example as oxides or salts or complexes may also be used. A viscosity moderator or thickening agent is employed to maintain the iron oxide in suspension. A suitable viscosity modifying agent is a modified cellulosic compound such as an alkyl carboxy cellulose. In order to prevent precipitation of iron oxide from the emulsion it is desirable to increase the viscosity to approximately 25 Pascal seconds.

In a preferred embodiment the emulsion used to coat the light weight particulate material comprises from 30 - 45 parts by weight of a non-aqueous dispersed phase and from 70 to 55 parts by weight of the emulsion of aqueous phase. More preferably the dispersed phase is from 35 - 40 parts by weight of the emulsion. The non-aqueous phase is a tolulene

soluble mixture of phenolic and alkyl substituted aliphatic aromatic and hetero aromatic compounds of molecular weight range 500 - 1000 with a softening point of 40 - 45°C. In a preferred embodiment the aqueous phase consists of approximately 50 parts of water with 2 parts of high molecular weight phenolic and acidic compounds viz. abietic acid, neutralised with sodium hydroxide to form an anionic emulsifying agent. The aqueous phase has dispersed therein approximately 5 to 20 parts by weight of the aqueous phase of metal oxide pigment, and approximately 1 - 2 parts by weight of the aqueous phase of modified cellulosic compounds (such as carboxy methyl cellulose) to increase the viscosity and to stabilise the suspension. An orthoxinol or other fungicide (0.05 parts) and 0.05 parts of a fragrance are optionally included. The bituminous phase is then emulsified in the aqueous phase. The viscosity of the resultant emulsion should be such that there is no apparent settling of the solid and the product is just able to be poured. The pH of the final formulation should be in the range pH 9- pH 10 for preference. Before application to the surface of the expanded polystyrene balls, the emulsion is diluted with water on a 1 to 1 basis and then mixed with the balls.

The transition metal ion comprises at least 10% by dry weight of the binder. In a preferred emulsion as much as 15% of the emulsion by weight is iron oxide. As from 40 - 60% of the emulsion is water, the iron ion as a percentage of the bitumen phase is in the range of from about 10 to about 50% of the weight of the dry bitumen. The iron oxide may be in the form of a mineral pigment.

The following are examples of formulations according to the invention:-

Example 1		Example 2	
Bitumen	33.50 kg	Bitumen	35.50 kg
Water	51.00	Water	48.00
Chromium trioxide	12.00	Cobaltic oxide	13.00
Vinsol resin	2.00	Vinsol resin	2.00
Methocel	1.00	Methocel	1.00
Sodium hydroxide	0.25	Sodium hydroxide	0.25
Dowicide A	0.15	Dowicide A	0.15
Fragrance	0.10	Fragrance	0.10
	100.00 kg		100.00 kg

Example 3		Example 4	
Bitumen	36.50 kg	Bitumen	35.00 kg
Water	51.00	Water	50 00
Iron Oxide	9.00	Iron Oxide	12.00
Vinsol resin	2.00	Vinsol resin	1.75
Methocel	1.00	Methocel	1.00
Sodium hydroxide	0.25	Sodium hydroxide	0.25
Dowicide A	0.15		100.00 kg
Fragrance	0.10		
	100.00 kg		

Example 5		Example 6	
Bitumen	32.00 kg	PVA emulsion	
Water	45.00	[50% solids]	35.50 kg
Nickel Sulfate	20.00	Water	48.00
Vinsol resin	1.75	Iron Oxide	15.00
Methocel	1.00	Vinsol resin	3.00
Sodium hydroxide	0.25	Methocel	1.00
	100.00 kg	Sodium hydroxide	0.30
		Dowicide A	0.20
			100.00 kg

Example 7		Example 8	
Phenolic Prepolymer	10.00 kg	Styrene-Acrylic emulsion	
Water	70.00	[50% solids]	20.00 kg
Chromium oxide	15.00	Water	60.00
Vinsol resin	3.00	Iron oxide	15.00
Methocel	1.50	Vinsol resin	3.00
Sodium hydroxide	0.30	Methocel	1.50
Dowicide A	0.20	Sodium hydroxide	0.30
	100.00 kg	Dowicide A	0.20
			100.00 kg

A preferred method for manufacture of the coating material of examples 1 to 5 is as follows:-

The bitumen is first pre-heated to 140°C and the water is heated to approximately 60°C. The surfactant is dispersed in the water and then the viscosity modifier is added to the solution taking care to avoid the formation of lumps. The transition metal oxide is nest added to the aqueous phase with high speed mixing and is dispersed completely. A fragrance and fungicide are next added to the aqueous phase and dissolved. The hot bitumen is then emulsified in the aqueous phase. After emulsification is completed, the mixture is allowed to cool to ambient temperature. The final emulsion has a viscosity of approximately 25 ± 5 Pascal seconds after approximately 24 hours. There should be no settling of the transition metal oxides.

In the case of examples 6 to 8 the resin is pre-emulsified prior to addition to the viscosity modifier or an emulsion of suitable viscosity is selected prior to disposal of the transition metal oxide.

The aggregate is coated with the emulsion by conventional means. The ratio of coating composition to aggregate varies according to the aggregate selected, the solids content of the emulsion, the humidity on the day of application and such like factors. However a satisfactory ratio of coating solids to aggregate can readily be determined by making samples of concrete using various ratios of coating solids to aggregate and then testing the samples for compressive strength.

Calcium carbonate is desirably added to the coated aggregate during or immediately following the coating process. Calcium carbonate adheres to the treated aggregate.

The light weight aggregate particles when coated with the emulsion and dried are free flowing and may be stored without agglomeration.

The aggregate can be used in the manufacture of low density concrete by adding the light weight aggregate of the invention to the sand/cement/water mix in a manner similar to the addition of stone or gravel aggregate.

A continuous curve can be graphed which relates compressive strength (MPa) to density (Kg/Cu.M) of light weight concrete incorporating the aggregate of the invention. Densities vary from 300 kg per cubic meter to 1800 kg per cubic meter and related compressive strengths vary from 0.5 MPa to 25 MPa. The mix designs corresponding to these various densities and compressive strengths involve a high cement content and low water/cement ratio. The cement content in various mixes varies from 200 kg per cubic meter to 550 kg per cubic meter and have a water/cement ratio of 0.4 or less. These quantities may be compared with standard concrete in which compressive strengths are from 20 - 60 MPa. The aggregate of the invention provides excellent workability at low water/cement ratios so that good compaction is achieved. The coating on the aggregate assists in producing a solid matrix by reducing the amount of air in the concrete and also increases the bonding between the aggregate and the cement while reducing the susceptibility of the concrete to carbon dioxide. The density of various mixtures of concrete incorporating an aggregate according to the invention is shown in Table 1.

Lightweight aggregate according to the invention may be used in other construction materials for example plaster. Example 9 is a lightweight plaster in which the aggregate is polystyrene beads coated with the formulation of Example 3. In accordance with the invention the quantities shown produce approximately 1 cubic metre of final plaster mix and a weight saving of approximately 25%.

Example 9

Plaster/gypsum	530 Kg
Water	315 Kg
Lightweight aggregate according to the invention	300 Litres

Although the invention has been described with reference to the application of emulsions to polystyrene particles, it will be understood that the coating of the invention could be applied by other means for example from solution. The aggregate may be coated by any methods known in the coating art.

The invention described extends to include emulsions and solutions suitable for coating aggregate as described as well as to coated particles.

As will be apparent to those skilled in the art from the teaching hereof one ingredient may be substituted for another of similar performance characteristics and the relative proportions of the various components of the emulsion, the ratio of coating to aggregate, and of the aggregate in concrete may be varied without departing from the scope of the invention.

TABLE I

MIX NO.	TYPE A CEMENT: (kg.)	SAND: (kg.)	10 mm AGGREGATE (kg.) (stone,gravel)	AGGREGATE according to invention	WATER: (lit.)	COMPRESSIVE STRENGTH (MPa:)	DENSITY (kg/cu.m)
0.5	200	-	-	1000	80	0.5	300
2	350	-	-	900	140	2	500
4	350	180	-	850	140	4	700
8	350	420	-	800	140	8	1000
12	450	540	-	700	140	12	1200
15	450	430	300	700	150	15	1500
20	450	600	400	600	160	20	1700
25	550	600	450	500	190	25	1800

CLAIMS:-

1. A lightweight aggregate comprising particles of polymer foam coated with a binding agent, said binding agent having dispersed therein in total at least 10% by dry weight thereof of one or more transition metal ions, said particles being free flowing.

2. An aggregate according to Claim 1 wherein the transition metal ions are predominantly ferric ions.

3. An aggregate according to Claim 1 or Claim 2, wherein the transition metal ions are present in ferric oxide dispersed in the binding agent.

4. An aggregate according to any one of the preceding claims wherein the binding agent is selected from the group comprising phenolic resins, shellac, epoxy resins, polyvinyl acetate, and bituminous binders.

5. An aggregate according to Claim 4 wherein the binding agent is bituminous.

6. An aggregate according to Claim 5 wherein the bituminous binding agent is a toluene soluble bituminous composition having a softening point of from 40°C to 45°C.

7. An aggregate according to any one of the preceding claims wherein the binding agent is a mixture of phenolic and alkyl substituted aliphatic aromatic and hetero aromatic compounds of molecular weight range 500 - 1000.

8. An aggregate according to any one of the preceding claims wherein the coated porous particles are of expanded polystyrene foam.

9. An aggregate according to Claim 8 wherein the particles have an average diameter of from 0.5 to 15 mm.

10. An aggregate according to anyone of the preceding claims wherein the binding agent includes iron oxide in an amount of from 10 to 50% by weight of dry binder.

11. Concrete comprising a lightweight aggregate in accordance with any one of claims 1 to 10.

12. Plaster board comprising a lightweight aggregate in accordance with any one of claims 1 to 10.

13. A method of manufacture of a lightweight aggregate coated with a binding agent in which transition metal ions are dispersed, said method comprising the steps of emulsifying a binder in water, dispersing iron oxide in the aqueous phase so that the emulsion comprises at least 10% by weight of dry solids of a transition metal ion, and coating a lightweight porous aggregate with the emulsion.

14. A method according to claim 23 wherein the lightweight aggregate is polystyrene foam.

15. A lightweight aggregate substantially as herein described with reference to any one of the examples.

~~16. An emulsion for coating a lightweight aggregate substantially as herein described with reference to any one of examples 1, 2, 5, 6, 7 or 8.~~

16. A concrete including a lightweight aggregate substantially as herein described with reference to any one of the examples.

17. A method for manufacture of a lightweight aggregate substantially as herein described with reference to the examples.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU92/00407

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.[5] C04B 20/10, 16/08, 16/10, 28/02

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)
C04B 20/10, 16/08, 16/10, 14/16, 14/18, 14/20; C08L 95/00;
C04B 31/44, 15/02, 21/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)
CHEM ABS : polystyrene and BITUMEN : and BINDER
DERWENT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	EP,A, 0339343 (T & N TECHNOLOGY LIMITED) 2 November 1989 (02.11. .89) Example 2	1
X	GB,A, 2018806 (ERRICO ROMANO) 24 October 1979 (24.10.79) Second Example	1-4, 10
X	US,A, 4332620 (ROBERT L. QUINN) 1 June 1982 (01.06.82) Columns 1 and 2	1-6, 10

☐ 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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 October 1992 (16.10.92)	22 Oct 1992 (22.10.92)
Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA	J. BODEGRAVEN
Facsimile No. 06 2853929	Telephone No. (06) 2832281

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	AU,A, 54540/80 (SCAMPTON NOMINEES PTY LTD) 17 July 1980 (17.07.80) Example, page 3	11, 14
X	Derwent Abstract Accession No. 64243X/34 Class A93L02 JP,A, 51-079118 MITSUBISHI PETROCH KK) 9 July 1976 (09.07.76) Abstract	1, 2, 4, 5
X	Derwent Abstract Accession No. 51078C/29 Class A93L02 JP,B4, 55-023793 (JAPAN NATIONAL RAILWAY) 25 June 1980 (25.06.80) Abstract	1, 2, 11, 12, 23

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
GB	2018806	DE	2835990	ES	474868	FR	2422867
		IT	1172888	SE	7809752		
EP	339343	AU	33226/89	AU	611281	BR	8901920
		GB	2217742	JP	1313321	US	4915871
		ZA	8902781				

END OF ANNEX