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(54) Title: A WATERWAY POOL ASSEMBLY

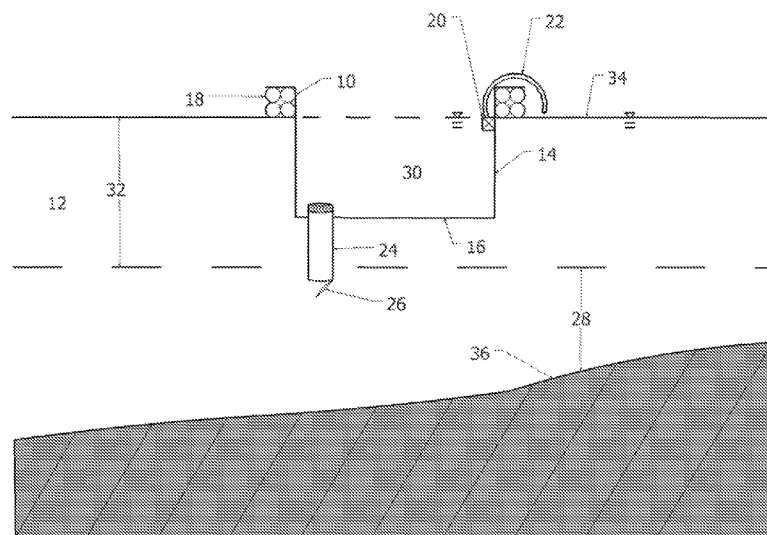


Figure 1

(57) Abstract: The present invention provides a waterway pool assembly for use in a water body, particularly a salt wedge estuary, comprising a pool shell having sidewalls and an optional base; an outlet port fitted with a pump to remove water from the pool interior to the surrounding water body; an inlet port to allow water into the pool interior from the river; wherein the inlet is positioned so that the water which flows into the pool interior is of a higher quality than the water being removed by the outlet. The invention also provide a process for maintaining a waterway pool with water of higher quality than the water surrounding the pool.

TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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A Waterway Pool Assembly

[0001] This application claims priority to Australian provisional application number 2016901481, the entire disclosure of which is incorporated herein by reference.

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Technical Field

[0002] The invention relates to a waterway pool assembly for use in a water body, such as a river.

10 Background of Invention

[0003] Outdoor swimming is a popular recreational activity. Waterway pools have been used on rivers and other bodies of water including lakes, estuaries, and the sea for many years. Such waterway pools may be floating structures or attached to a pier or bank.

15 [0004] Many rivers and other bodies of water, especially those in populated areas, are not suitable for swimming due to contamination and pollution. Swimming pools that are placed in rivers and other bodies of water may rely on complicated filtration systems or an external supply of fresh water to provide water of a safe quality to allow people to swim and recreate in it. This can be expensive and impractical.

20

Summary of Invention

[0005] It is an aspect of the present invention to overcome some or all of the problems outlined above.

25 [0006] Certain bodies of water have naturally occurring two layer systems of distinct types of water. One example of such a water body is a salt wedge estuary, where the upper layer is freshwater usually from a river, and the bottom layer is salt

water from a sea or ocean. Another example of such a water body would be a region of water where two water sources of distinctly different temperatures meet.

[0007] In a salt wedge estuary, the saline water in the bottom salt wedge layer is often of higher quality for swimming than the upper layer freshwater. The inventors have found that water from salt wedges generally has lower levels of faecal contamination, lower turbidity, and higher electric conductivity than the upper freshwater layer. An aspect of the present invention is to take advantage of water bodies which have a naturally occurring two layer systems of distinct types of water.

[0008] The present invention provides a waterway pool assembly for use in a water body, particularly a salt wedge estuary, comprising a pool shell having sidewalls and an optional base; an outlet port fitted with a pump to remove water from the pool interior to the surrounding water body; an inlet port to allow water into the pool interior from the river; wherein the inlet is positioned so that the water which flows into the pool interior is of a higher quality than the water being removed by the outlet. This pool assembly takes advantage of the natural river system, replacing the water in the pool interior with cleaner water, reducing levels of faecal contamination, removing odours and leaving only safe and swimmable water in the pool interior. This is advantageous because it avoids the need for chemical treatment or an external fresh water source and is more economical than previous waterway pool assemblies.

[0009] Preferably, the inlet port is the bottom of the pool shell, or is disposed in the base of the pool shell and may comprise an intake pipe. This can be advantageous because it allows the inlet to reach the water of higher quality toward the bottom of the river.

[0010] Optionally, the intake pipe is fitted with a valve which may be operated based on the salinity measurements of the surrounding water body. This is advantageous because it allows greater and automatic control of water entering the pool. For example, if the intake pipe shifts to an area of water which is not saline then the intake can be stopped automatically.

[0011] Preferably, the outlet is disposed in the upper part of the sidewall of the pool shell and may further comprise a discharge pipe. This is advantageous as it

allows more water to be more easily removed from the pool interior by the pump, which allows water of a higher quality from the inlet port to fill the pool interior.

[0012] Preferably, the water body is a salt wedge estuary and the inlet is positioned in the salt wedge of the salt wedge estuary. This is advantageous because it allows the pool to fill with saline water from the salt wedge which is generally cleaner and of higher swimming quality than the surface fresh water.

[0013] Preferably, the water that flows into the pool interior is of higher salinity than the water surrounding the pool. This is advantageous because saline water is generally less hospitable to bacterial contaminants which may be harmful to swimmers, and therefore such water is generally cleaner and of higher swimming quality than surface river water.

[0014] Preferably, the water that flows into the pool interior is of higher electric conductivity (EC) than the water surrounding the pool. This is advantageous because water of with higher EC generally is more saline and saline water is generally cleaner and of higher swimming quality than surface river water.

[0015] Preferably, the water that flows into the pool interior is of lower turbidity than the water surrounding the pool. This is advantageous because less turbid, clearer water is generally considered more pleasant for swimming.

[0016] Preferably, the water that flows into the pool interior has lower levels of faecal contamination than the water surrounding the pool. Even more preferably, the water that flows into the pool interior will have lower levels of enterococci and/or lower levels of *E. coli*. This is advantageous because lower levels of faecal contamination (as indicated by lower levels of faecal bacteria such as enterococci and/or *E. coli*) indicates that the water has fewer harmful contaminants and is safer for swimming.

[0017] In one aspect, the pool assembly is for swimming and leisure use. In another aspect, the pool assembly is for use in aquaculture.

[0018] Preferably the side walls of the pool assembly will be fitted with floats to assist with buoyancy. This is advantageous as it allows the assembly to move with the level of the river.

[0019] In another embodiment, the present invention is a process of maintaining a waterway pool with water of higher quality than the water surrounding the pool, said process comprising the steps of installing a pool assembly in a waterway in accordance with the present invention; removing water from the pool interior via the outlet; and introducing water of higher quality into the pool interior via the inlet.

[0020] A pool assembly in accordance with the present invention provides a swimming pool environment with water of higher swimming quality than the surrounding water body as it takes advantage of the natural river features. The present invention avoids the need for complex filtration systems or an external supply of clean water.

Brief Description of Drawings

[0021] Figure 1 shows a side view of a waterway pool assembly in accordance with the present invention.

Detailed Description

[0022] Figure 1 shows a preferred embodiment of the present invention to which attention will now be directed.

[0023] In this embodiment, the waterway pool assembly is intended for use in a salt wedge estuary 12. The assembly comprises a shell 10 having side walls 14 and base 16. The side walls 14 are fitted with floats 18 to assist with buoyancy. The pool sits at the estuary water level 34. The outlet port, disposed on the upper part of side wall 14, comprises pump 20 and discharge pipe 22. The inlet port, positioned on the base 16, comprises an intake pipe 24 and a valve 26. The intake pipe 24 is positioned in the salt wedge 28 of the estuary 12. This allows water from the salt wedge 28 to flow into the pool interior 30 when the pump 20 is switched on, and water from the pool interior 30 is removed via discharge pipe 22. Water from the salt wedge 28 is generally of higher swimming quality than water from the upper freshwater layer

32, and so filling the pool interior 30 with water from salt wedge 28 provides a pleasant and safe swimming environment.

[0024] After the pool interior 30 has been used for swimming for a period of time, the water quality may be affected by contaminants introduced by people who have been swimming. The water in the pool interior 30 can be easily replaced by running the pump 20 for a period of time sufficient to replace or dilute the water to return the quality to pleasant and safe levels for swimming. Alternatively, the pump 20 can be run continuously, allowing the water in the pool interior 30 to be continuously refreshed.

[0025] Intake pipe 24 may be of any length suitable to reach the salt wedge 28. Preferably it will not reach the river bed 36 as then it may pull up mud and other contaminants that may affect the water quality. In other embodiments, an intake pipe 24 may not be required, if the dimensions of the pool are such that the base 16 sits in the salt wedge and the inlet port is therefore positioned in the salt wedge. In alternate embodiments, the base 16 may not be present and shell 10, particularly the lower part of side walls 14, is positioned within the salt wedge.

[0026] In this embodiment, valve 26 is included. Valve 26 may operate on the basis of the salinity of the water than surrounds it. This will be useful if, for example, freshwater layer 32 expands in size so that the end of intake pipe 24 were surrounded by freshwater, then valve 26 would close to prevent freshwater from entering the pool. In other embodiments, a valve may not be required and the same effect could be achieved by turning off the pump 20.

[0027] In this embodiment, the pool assembly 10 has floats 18 to assist with buoyancy. In other embodiments, the floats may not be required. For example, the pool assembly may be attached to a pier or similar structure that will assist it with staying afloat. Alternatively, the pool assembly may be attached to floating decks or pontoons that assist it with staying afloat.

[0028] The pool shell 10 in accordance with the present invention may be constructed of any suitable material such as, for example, plastic or polythene sheeting, metallic sheeting or a fibreglass hull.

Estuaries

[0029] An estuary is a system that has two different water sources which have distinct water qualities. Typically estuaries have a freshwater source which has a low level of salinity (typically <1 g/L) such as a river and a seawater source which has a high level of salinity (typically 20-40 g/L) such as an ocean or bay. When these two water sources meet, an estuary is formed. Estuaries are tidal, meaning their water level will fluctuate depending on the position of the moon and sun.

[0030] Depending on the size of the freshwater input, and the connection of the estuary to the seawater source, the system may exhibit a defined "salt wedge". This salt wedge is formed by the fact that the density of sea water is 20-40 g/L heavier than freshwater, and hence will typically sit at the bottom of the water column. This creates the appearance of a salt wedge; the part of the river which is the saltwater and sits on the bottom of the river bed underneath the freshwater layer.

[0031] The thickness of the salt wedge will change according to tides; the thickness of the salt wedge will increase as the tides go up and will decrease as the tides go down. The salt wedge thickness will also be influenced by the amount of water which is coming in from upstream (i.e. the freshwater source); as more water enters the system, the salt wedge will be pushed out because of the energy of the freshwater. The thickness of the freshwater layer will change according to the freshwater flow rate; the higher the flow rate, the thicker the freshwater layer.

[0032] The position where the salt wedge and freshwater both meet the river bed sediments is called the salt wedge tip. This tip will move depending on tides (as tides increase, the pressure from the ocean/sea/bay increases and hence moves the tip upstream) and also on the flow rate of the freshwater source (as the freshwater flows increase, the pressure increases and forces the wedge, and hence the tip, out into the ocean/sea/bay).

Definition of Water Quality

[0033] The quality of water may be measured in a number of ways. Water that is of good quality for swimming is not necessarily of good quality for drinking as saline water is often of better swimming quality than freshwaters. For the purposes of the present invention, swimming quality is more important than drinking quality.

5 [0034] Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a useful test of water quality. Clearer water is generally considered more pleasant for swimming. In some embodiments, the present invention will lead to a reduction in turbidity of the water in the pool interior
10 compared with the water outside the pool.

[0035] Levels of faecal contamination present in water, particularly enterococci and *Escherichia coli* (*E. coli*), are good indicators of water quality for bathing and drinking water. Enterococci and *E. coli* are almost exclusively of faecal origin and their presence is thus an effective confirmation of faecal contamination. Many strains
15 of enterococci and *E. coli* are harmless, but some can cause serious illness in humans. Infection symptoms and signs include bloody diarrhoea, stomach cramps, vomiting and occasionally, fever. Faecal bacteria can also cause pneumonia, other respiratory illnesses and urinary tract infections. Reduced levels of faecal contamination indicate an improvement in water quality. In some embodiments, the present invention will lead to a reduction in the levels of faecal contamination
20 (particularly as indicated by the levels of enterococci and/or *E. coli*) in the water in the pool interior compared with the water outside the pool. Preferably, the present invention will lead to a level of enterococci of less than 500 MPN/100 mL in the water in the pool interior. More preferably, the present invention will lead to a level of
25 enterococci of 201-500 MPN/100 mL in the water in the pool interior. Even more preferably, the present invention will lead to a level of enterococci of 41-200 MPN/100 mL in the water in the pool interior. Most preferably, the present invention will lead to a level of enterococci of less than 40 MPN/100 mL in the water in the pool interior.

[0036] Electric conductivity (EC) measurements are a way of measuring the ionic
30 content in a solution. For example, the measurement of product conductivity is a typical way to monitor and continuously trend the performance of water purification systems. While a low salinity (and hence low ionic content and low EC measurement)

is important for drinking water quality, this is not the case for swimming pool systems. Saline water is generally safer for swimming and therefore an increased EC measurement may indicate an improvement in water quality for swimming. When the invention is used in an estuarine salt wedge, the water that flows into the pool interior will be saline and will have an increased EC compared to the water surrounding the pool. In some embodiments, the invention will lead to an increase in electric conductivity of the water in the pool interior compared with the water outside the pool. In a preferred embodiment, the present invention will lead to an EC of greater than 20 mS/cm in the water in the pool interior. In a more preferred embodiment, the present invention will lead to an EC of greater than 30 mS/cm in the water in the pool interior. In a more preferred embodiment, the present invention will lead to an EC of greater than 40 mS/cm in the water in the pool interior.

[0037] It is to be appreciated that a pool assembly in accordance with the present invention will have applications beyond swimming pools, such as in aquaculture.

Example 1

[0038] A prototype pool assembly in accordance with Figure 1 was placed in an estuarine river system for approximately 2 weeks and samples were taken periodically, from the surrounding river and from the pool interior both “before pumping” (with the pool sat stagnant between sampling dates) and “after pumping” (having run the pump for about 10-15 minutes). The samples were tested following standard procedures (IDEXX Laboratories Colilert and Enterolert test kits) for *E. coli* and enterococci, while turbidity, EC and turbidity were measured using a calibrated HORIBA multi-probe, and the results are shown in Table 1.

LOCATION	DAY	CONCENTRATION		WATER QUALITY		
		E. coli	Enterococci	Temp	EC	Turb
		MPN/100mL	MPN/100mL	[degC]	[mS/cm]	[NTU]
River	1	98	64			
After pumping	1	31	<10	11.0	51.1	2.1
River	5	244	273	11.9	15.6	4.4
Before pumping	5	<10	<10	11.7	51.5	1.1
After pumping	5	20	10	11.3	52.5	1.7
River	9	<10	<10	13.9	49.0	0.7
Before pumping	9	<10	<10	14.8	50.5	0.8
After pumping	9	<10	<10	13.1	50.4	1.2
River	11	498	1692	14.0	31	4.6
Before pumping	11	<10	10	13.7	50.4	1.2
After pumping	11	<10	10	12.5	51.8	1.8
River	13	784	270	13.3	14.5	4.0
Before pumping	13	<10	31	13.1	50.3	1.5
After pumping	13	42	87	12.7	50.7	2.4

Table 1

[0039] As Table 1 shows, the prototype pool assembly provides an environment within the pool interior with significantly reduced levels of faecal contamination, particularly as evidenced by the reduced concentrations of the faecal bacteria *E. coli* and enterococci.

[0040] The pool interior also has water with reduced turbidity and increased electric conductivity, whilst the temperature is not significantly altered. While the turbidity increases after pumping, this is likely due to the increased movement of the water and the overall turbidity is still lower than that of the surrounding water.

[0041] Significantly, the favourable water quality does not change significantly between sampling periods meaning that the pool interior maintains a fairly constant environment between pumping sessions.

[0042] The discussion of documents, acts, materials, devices, articles and the like is included in this specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of these matters formed part of the prior art base or were common general knowledge in the field relevant to the present invention as it existed before the priority date of each claim of this application.

[0043] Where the terms "comprise", "comprises", "comprised" or "comprising" are used in this specification (including the claims) they are to be interpreted as specifying the presence of the stated features, integers, steps or components, but not precluding the presence of one or more other features, integers, steps or components, or group thereof.

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CLAIMS

1. A waterway pool assembly for use in a water body comprising:
a pool shell having sidewalls and an optional base;
5 an outlet port fitted with a pump to remove water from the pool interior to the river;
an inlet port to allow water into the pool interior from the surrounding water body;
10 wherein the inlet is positioned so that the water which flows into the pool interior is of a higher quality than the water being removed by the outlet.
2. A pool assembly according to claim 1, wherein the inlet is disposed in the base of the pool shell or is the bottom of the pool shell.
- 15 3. A pool assembly according to claim 1 or claim 2, wherein the inlet comprises an intake pipe.
4. A pool assembly according to claim 3, wherein the intake pipe is fitted with a valve.
20
5. A pool assembly according to any one of the preceding claims, wherein the water body is a salt wedge estuary.
6. A pool assembly according to claim 5, wherein the inlet is positioned in the
25 salt wedge of the salt wedge estuary.
7. A pool assembly according to any one of the preceding claims, wherein the outlet is disposed in the upper part of the sidewall of the pool shell.
- 30 8. A pool assembly according to any one of the preceding claims, wherein the outlet further comprises a discharge pipe.

9. A pool assembly according to any one of the preceding claims, wherein the water that flows into the pool interior is of higher salinity than the water surrounding the pool.
- 5 10. A pool assembly according to any one of the preceding claims, wherein the water that flows into the pool interior is of higher electric conductivity than the water surrounding the pool.
- 10 11. A pool assembly according to any one of the preceding claims, wherein the water that flows into the pool interior is of lower turbidity than the water surrounding the pool.
12. A pool assembly according to any one of the preceding claims, wherein the water that flows into the pool interior has lower levels of faecal contamination than the water surrounding the pool.
- 15 12. A pool assembly according to any one of the preceding claims, wherein the water that flows into the pool interior has lower levels of faecal contamination than the water surrounding the pool.
13. A pool assembly according to claim 12, wherein the water that flows into the pool interior has lower levels of enterococci than the water surrounding the pool.
- 20 14. A pool assembly according to claim 12 or claim 13, wherein the water that flows into the pool interior has lower levels of *E. coli* than the water surrounding the pool.
- 25 15. A pool assembly according to any one of the preceding claims, wherein the pool assembly is for swimming and leisure use.
16. A pool assembly according to any one of the preceding claims, wherein the pool assembly is for use in aquaculture.
- 30 17. A pool assembly according to any one of the preceding claims, wherein the sidewalls are fitted with floats to assist with buoyancy.

18. A process of maintaining a waterway pool with water of higher quality than the water surrounding the pool, said process comprising the steps of

- installing a pool assembly according to any one of claims 1-17 in a waterway;

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- removing water from the pool interior via the outlet; and
- introducing water of higher quality into the pool interior via the inlet.

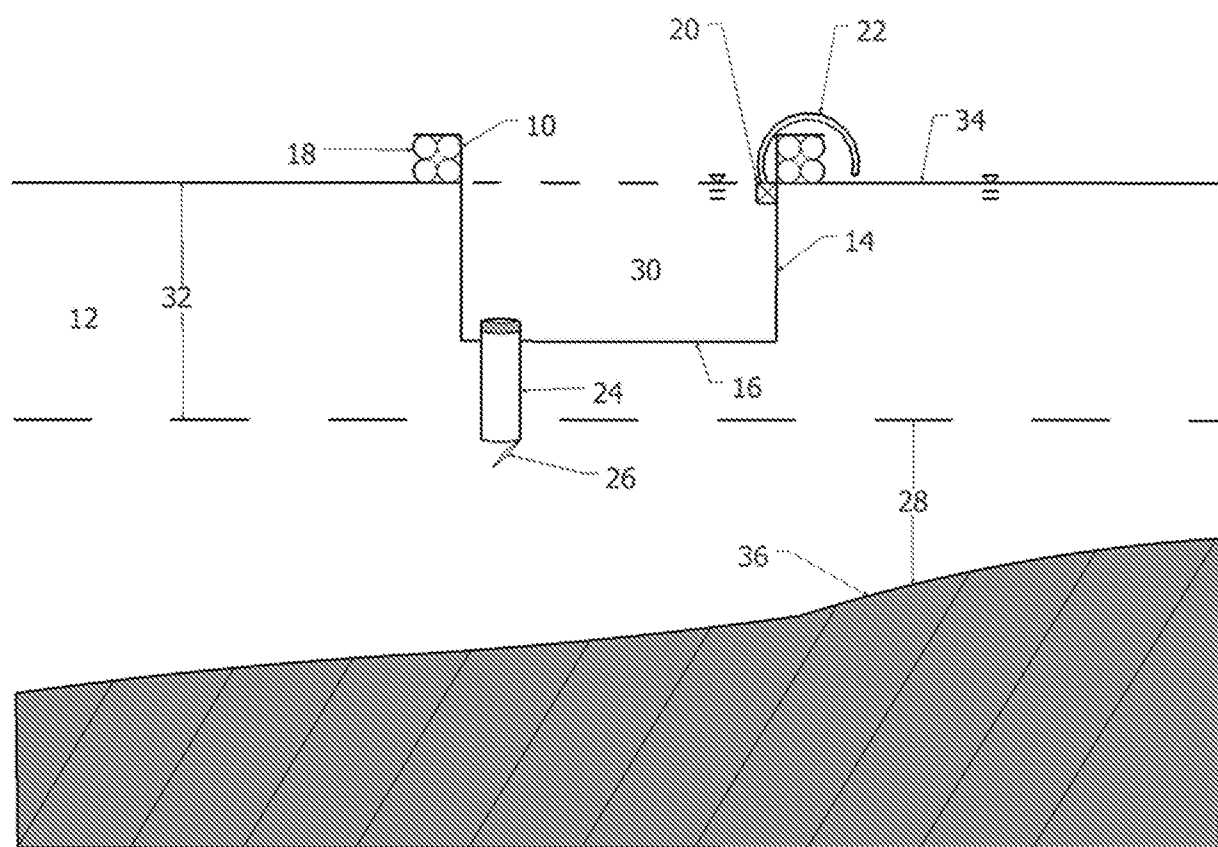


Figure 1

INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

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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)

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 practicable, search terms used)

Epoque database PATENW, which includes WPIAP, EPODOC and English full text; IP Australia Internal databases; Espacenet (Worldwide); Google Search & Google Patents; IPC/CPC: E04H4/[00, 12, 0018, 0012], A01K61/[00, 60], A61H33/00, A47K3/06.

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Applicant/Inventors: YARO TECHNOLOGIES; MCCARTHY, David Thomas; STEWART, Matthew James

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent but published on or after the international filing date	"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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"P"	document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 26 June 2017		Date of mailing of the international search report 26 June 2017	
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au		Authorised officer Ernst le Roux AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262832497	

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/AU2017/050362
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/0020010 A1 (MIZUTANI) 21 February 2002 Abstract, Paragraphs 0034, 0035, 0039, 0045-0047, 0063, 0065 & Fig. 1-2	1-18
X	US 4149281 A (BOB et al.) 17 April 1979 Columns 1-4 & Figs. 1, 3	1-5, 8-14, 17, 18
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A	US 4044720 A (FAST) 30 August 1977 Whole document	1, 2, 18

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INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/AU2017/050362	
This Annex lists known 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/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
US 2002/0020010 A1	21 February 2002	US 2002020010 A1	21 Feb 2002
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End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			