

**IN THE HEARINGS AND MEDIATION DEPARTMENT OF
THE INTELLECTUAL PROPERTY OFFICE OF SINGAPORE**

REPUBLIC OF SINGAPORE

Patent No. 10201602094R
26 March 2018

IN THE MATTER OF A PATENT

IN THE NAME OF

HITACHI, LTD.

AND

APPLICATION FOR REVOCATION THEREOF BY

- (1) SINGAPORE SHIPPING ASSOCIATION
(2) ASSOCIATION OF SINGAPORE MARINE INDUSTRIES**

Hearing Officer: Ms See Tho Sok Yee
Principal Assistant Registrar of Patents

Representation:

Mr Alban Kang and Ms Oh Pin-Ping (Bird & Bird ATMD LLP) for the Applicants

GROUNDINGS OF DECISION

- 1 Singapore Patent No. 10201602094R (“the 94R patent”), entitled “Vessel” was filed on 4 November 2008, in the name of Hitachi, Ltd. (“the Proprietor”), claiming a priority date of 8 November 2007 from Japanese application JP 2007-290955. It is a divisional application of Singapore Patent Application No. 2012082558, which has yet to be granted, and which itself is a divisional application of Singapore Patent Application No. 201031078 granted as Singapore Patent No. 161075 and entitled “Ballast Water Treatment System” (“the 075 patent”). The 94R patent was granted on 23 November 2016. The invention under the 94R patent (“the invention”) relates to a ballast water management system (“BWMS”) for a ship. As of the date of this decision, the patent was in force.

- 2 The present application is one of three applications filed jointly by Singapore Shipping Association and Association of Singapore Marine Industries (“the Applicants”) for revocation of patents related to the proprietor, pertaining to ballast water treatment. Proceedings for the 94R patent and the 075 patent were uncontested by the Proprietor ([6] below), progressed concurrently, and were heard on the same day. Proceedings for Singapore Patent No. 159788 entitled “Vessel Structure” were, on the other hand, contested, and are pending an ancillary opposition to amendments proposed by the proprietors, Hitachi, Ltd. and Mitsubishi Heavy Industries, Ltd.

Applicable Law and Burden of Proof

- 3 The applicable law is the Patents Act (Cap 221, 2005 Rev Ed) (“the Act”) and the Patents Rules (Cap 221, 2007 Rev Ed) (“the Rules”). Unless otherwise specified, references to rules in these grounds of decision are references from the Rules. The burden of proof in the present case falls on the Applicants.

Procedural History

- 4 An application for revocation of the 94R patent was filed jointly by the Applicants on 22 June 2017. The Applicants amended their statement of grounds (“the Grounds”) on 10 July 2017 and accordingly, the Proprietor’s deadline to file its counter-statement was adjusted to 10 October 2017.
- 5 A case management conference (“CMC”) was first held on 2 August 2017, with both parties in attendance, and various procedural matters were discussed. I also impressed upon parties that they could resolve their disputes through negotiation, mediation and/or expert determination, which may prove more time- and cost-effective.
- 6 On 9 October 2017, the Proprietor informed the Registrar in writing that it denied the Applicants’ assertions but that for business reasons, it would not be filing a counter-statement. In this regard, Rule 80(4) states the consequences of a counter-statement not being filed, as follows:

If the proprietor of the patent fails to file the counter-statement in accordance with paragraph (3), he shall not be allowed to take part in the subsequent proceedings, and the application for revocation shall be considered by the Registrar as if each specific fact set out in the statement were conceded, except in so far as it is contradicted by other document in the possession of the Registrar.

- 7 I met the Applicants at a second CMC (the Proprietor being disallowed from participation by application of Rule 80(4)) on 20 October 2017 to discuss the conduct of the case. On 26 October 2017, the Applicants confirmed their intention to file expert evidence and requested an oral hearing. The Applicants went on to file a statutory declaration by its expert witness, Peter Sahlen, on 20 December 2017 (“1st SD”). Mr Sahlen’s qualifications to establish him as a viable expert witness are exhibited as Exhibit “PS-1”, and his expert report exhibited as Exhibit “PS-2”. Mr Sahlen also exhibited a claim chart comparing the claims of the 94R patent with the disclosures of the prior art; this is found at Exhibit “PS-3” in his 1st SD.

- 8 Written submissions were filed by the Applicants on 22 January 2018. In view of the detailed reasoning provided by Mr Sahlen in his evidence, I decided that the presence of Mr Sahlen would not be required at the hearing, if he could satisfactorily clarify some points arising from his evidence; and informed the Applicants of this, along with the points to clarify, in my letter of 29 January 2018.
- 9 The Applicants responded with their letter of 31 January 2018, clarifying some of the points raised, and followed with further evidence (“2nd SD”) from Mr Sahlen on 12 February 2018. After a review of this further evidence, I wrote to the Applicants on 14 February 2018 with some questions in relation to their 2nd SD. From the Applicants’ response on 21 February 2018, it appeared that the questions I asked may not have been clearly understood, and therefore I wrote again to the Applicants on 23 February 2018, rephrasing the questions asked on 14 February 2018, as well as asking the Applicants for details of any proceedings in other jurisdictions in relation to family members of the 94R patent. The Applicants responded in writing on 16 March 2018, where they denied any knowledge of proceedings in other jurisdictions in relation to family members of the 94R patent, and filed further evidence (“3rd SD”) from Mr Sahlen. The case was heard before me on 26 March 2018.

Grounds of Revocation

- 10 The Applicants cite the following in the Grounds, in relation to the Act:
- (i) The invention is not a patentable invention as it lacks an inventive step (Section 80(1)(a)); and
 - (ii) The patent is one of two or more patents for the same invention having the same priority date and filed by the same party or his successor in title (Section 80(1)(g)).
- 11 I will therefore make an assessment on the validity of the 94R patent taking into account the Applicants’ Grounds, and the documents provided in relation thereto. This includes the 1st SD, 2nd SD and 3rd SD sworn by the expert witness, Mr Peter Sahlen. I further note the Applicants’ reference to the last line of Rule 80(4), which provides the exception that the facts alleged by the Applicants are conceded except in so far as they are contradicted by other documents in the possession of the Registrar. At the hearing, the Applicants’ counsel pointed out that the Applicants have not seen any other such documents, and given that as a matter of natural justice these should be provided, it is assumed that there are no such additional documents.
- 12 I can confirm that there are no additional documents, and that my decision will be made based solely upon the Applicants’ submissions, expert evidence, and the prior art documents provided. However, I should still make an independent assessment of the relevance of all the documents and submissions provided by the Applicants in order to determine the validity of the 94R patent

Context of the Invention

- 13 Ballast is used to control the stability of ships by controlling the depth of submergence of the vessel in the water. In earlier times, sailors used rocks and sandbags as ballast. These were loaded as cargo was discharged from their vessels and unloaded as cargo was loaded. By and large, the same principle is applied today, except that today’s vessels use liquid ballast, such as sea water, instead.

- 14 Complications set in when water is used as ballast in vessels, because the quality of water differs at the place where it was taken onboard, and at the place of discharge during the voyage or at the arrival port. Aquatic organisms are transferred to new environments where their species is non-indigenous, leading to undesirable environmental and economic impact. To mitigate this, there is a need to treat the ballast water before discharge. Details on the background of a BWMS have been set out in Mr Sahlen's evidence, such as that described at [48]-[49] below.

The Invention

- 15 The invention generally relates to a BWMS for a ship. The system comprises a pump to withdraw the ballast water, a treatment apparatus to remove substances from the ballast water, and a ballast tank. A monitoring apparatus monitors the concentration of aquatic organisms at an inlet part of the water treatment apparatus and in the ballast tank. The control apparatus controls the degree of opening of a valve situated between the ballast tank and the pump, in order to adjust the flow rate into the treatment apparatus depending upon the results of the monitoring, and also controls the re-treatment of the ballast water in the tank if the concentration of organisms in the tank does not satisfy a permissible value.
- 16 The description provides some background into the invention, and specifically highlights the problems faced in trying to maintain the quality of ballast water within the standards established by the International Maritime Organization (IMO). It provides some examples of solutions to this problem, such as injecting an excess of disinfectant or an excess of chemicals for forming magnetic flocs. However, these pose problems in either affecting the coating of the ballast tank and subsequently killing microorganisms in that area when the ballast water is discharged, or requiring a needless increase in the amount of magnetic flocs that need to be recovered.
- 17 At this point, I should note that because the present invention is one of a number of family members relating to a water treatment system, the description provided includes a number of embodiments that are not claimed in the present invention but instead are apparently claimed in related patents or patent applications. I will therefore refer only to those embodiments which, in my view, relate to the invention as defined in the claims of the present patent, and not the others, unless it is necessary to further understand the invention.
- 18 The invention aims to alleviate some of the identified problems with BWMS by controlling the operational conditions of the water treatment apparatus such that a constant water quality is obtained, even when there are significant variations in the water intake conditions. The water treatment is performed in accordance with the variation in the ballast water at the time of water intake by monitoring the ballast water at an inlet of the water treatment apparatus. Further monitoring of the water quality of the ballast water at an outlet part of the water treatment apparatus allows the system to cope with a change in performance, such as degradation, of the water treatment apparatus. According to the description, because the quality of the ballast water is monitored and the operational conditions of the water treatment apparatus are controlled as a result, a desired water quality can be obtained for the ballast water, despite variations in the water intake conditions.
- 19 The figures relating to the 94R patent provide a schematic view of the system of the invention. Figure 2 provides the simplest interpretation of the invention according to the

claims, and is reproduced below, along with explanations of the reference numerals *most relevant* for this invention:

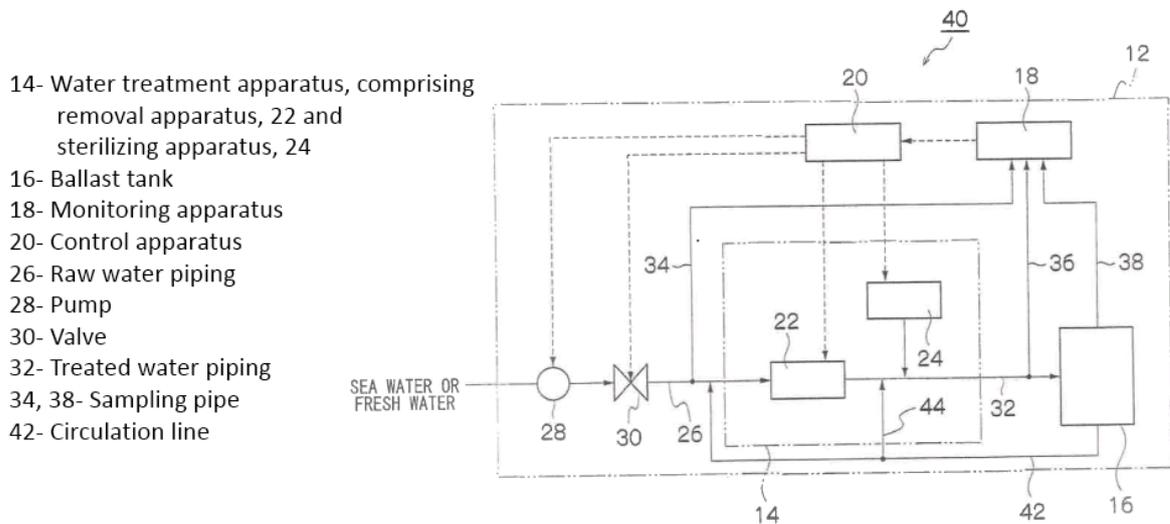


Figure 2

- 20 The ballast water treatment system of the invention is installed in a ship, and is primarily made up of a water treatment apparatus (14), a ballast tank (16), a monitoring apparatus (18), and a control apparatus (20). According to the schematic depicted in Figure 2, the water enters the system through the raw water piping (26), through a pump (28). A valve (30) is present after the pump and I note here that each schematic provided, as with Figure 2, depicts this as being located in the raw water piping, i.e. between the pump and the treatment apparatus. The water then enters the water treatment apparatus (14), where it undergoes treatment, before exiting through the treated water piping (32) to the ballast tank (16). Sampling pipes (34) and (38) respectively connect the raw water piping (26) and the ballast tank (16) to the monitoring apparatus (18), which automatically samples the water at these locations in order to determine the water quality. The information from the monitoring apparatus (18) is then fed to the control apparatus (20), which can be connected to various components of the system. For the present invention, the control apparatus is connected to, and adjusts the opening of, the valve (30).
- 21 In operation, the pump takes in ballast water, and the ballast water is sampled at the time of water intake (34) and sent to the monitoring apparatus (18). When the monitoring apparatus detects that the quality of the ballast water has decreased, indicating an increase in the concentration of aquatic organisms, the treatment capacity of the treatment apparatus is increased by decreasing the flow rate of the ballast water through the treatment apparatus, utilising the valve (30). Although it is not explicitly disclosed in the specification that the control through the valve is through the opening degree of the valve, this would be implicit, simply because it would be understood that this is how a flow rate through piping systems, via a valve, is controlled. Therefore, the control of the flow rate into the treatment apparatus (14) will be enabled by the control apparatus changing the opening degree of the valve (30) such that less water can flow through the raw water piping (26) into the treatment apparatus (14). This means that where a decrease in ballast water quality has been detected, the treatment flow rate, i.e. the volume that is treated by the apparatus per unit time, is decreased, and the ballast water will remain in the water treatment apparatus longer, thus ensuring a longer treatment time. The treated ballast water then leaves the treatment

apparatus (14), through the treated water piping (32), where it is fed to the ballast tank (16). The ballast water is sampled again in the ballast tank (16), using the sampling pipe (38), and if the quality of the water in the ballast tank does not meet required standards then it is re-circulated to the treatment apparatus, using circulation line (42), where it is subjected to further treatment.

- 22 Whilst the above describes operation in the event of a decrease in water quality, it is clear that the opposite would apply if the water quality had improved, i.e. the control apparatus would open the valve to enable a faster flow rate through the treatment apparatus. In essence, the monitoring system at the inlet part of the system determines the flow rate through the raw water piping and into the treatment apparatus, by controlling the opening degree of the valve. An additional safeguard is in place by the use of a monitoring system in the ballast tank, which will control whether the ballast water needs re-treating, depending upon the quality of the ballast water stored therein. If the ballast water does not need re-treatment, then presumably the water is able to be discharged to the environment.
- 23 There is only one independent claim, which reads as follows:

1. A vessel comprising:
 a pump which withdraws a ballast water;
 a water treatment apparatus which removes a substance to be removed from the ballast water;
 a ballast tank which stores the ballast water treated by the water treatment apparatus;
 a valve which is disposed in a piping between the ballast tank and the pump;
 a monitoring apparatus which monitors a concentration of aquatic organisms in the ballast water at an inlet part of the water treatment apparatus and a concentration of aquatic organisms in the ballast water in the ballast tank; and
 a control apparatus which monitors the concentration of aquatic organisms in the ballast water at the inlet part of the water treatment apparatus using the monitoring apparatus when the ballast water is withdrawn and controls an opening degree of the valve based on a result of the monitoring so as to control a treatment flow rate per unit time in the water treatment apparatus, the control apparatus which monitors the concentration of aquatic organisms in the ballast water in the ballast tank using the monitoring apparatus and controls to retreat the ballast water in the ballast tank by the water treatment apparatus when it is determined that the concentration of aquatic organisms in the ballast water in the ballast tank does not satisfy a permissible value based on a result of the monitoring.

- 24 There are 11 claims in total. Claims 2-11 are dependent upon Claim 1 and define further features of the vessel and the ballast system.

MAIN DECISION

Ground of Revocation under Section 80(1)(a): Not Inventive

- 25 Section 80(1)(a) of the Act reads:

80.–(1) Subject to the provisions of this Act, the Registrar may, on the application of any person, by order revoke a patent for an invention on (but only on) any of the following grounds:

(a) the invention is not a patentable invention

...

Section 13 of the Act reads:

13.–(1) Subject to subsection (2), a patentable invention is one that satisfies the following conditions:

- (a) the invention is new;
- (b) it involves an inventive step; and
- (c) it is capable of industrial application.

Section 15 of the Act reads:

15. An invention shall be taken to involve an inventive step if it is not obvious to a person skilled in the art, having regard to any matter which forms part of the state of the art by virtue only of section 14(2) and without having regard to section 14(3).

Section 113(1) of the Act reads:

113.–(1) For the purposes of this Act, an invention for a patent for which an application has been made or for which a patent has been granted shall, unless the context otherwise requires, be taken to be that specified in a claim of the specification of the application or patent, as the case may be, as interpreted by the description and any drawings contained in that specification, and the extent of the protection conferred by a patent or application for a patent shall be determined accordingly.

26 An invention is therefore considered to be patentable if it involves an inventive step, as set out in Section 13(1) of the Act. Section 15 sets out the requirements of inventive step, in that the invention is not obvious to the person skilled in the art, taking into account all matter made available to the public before the priority date (i.e. the provisions of Section 14(2)). An invention, as required by Section 113(1), is that which is specified in the claims, when interpreted in light of the description.

The Applicants' Representations

27 The Applicants allege that Claims 1-11 of the 94R patent are all invalid due to a lack of inventive step, citing documents D1-D14 as follows:

D1: US7059261 “*Wastewater ballast system and method*”;

D2: “*Stemming the Tide: Controlling introductions of nonindigenous species by ships' ballast water*”; National Academy Press, Washington D.C. 1996;

D3: WO2007/108012 “*An apparatus for filtration and disinfection of sea water/ship's ballast water and a method thereof*”;

D4: “*Environment-friendly ballast water treatment system*” (For ICBWM 2006). Mochizuki *et al*; Hitachi, Ltd. *et al*;

D5: US3937662 “*Marine discharge control apparatus and method for treating fluids on a marine vessel*”;

D6: CA2578751 “*Reservoir management system*”;

D7: US7540251 “*Apparatus and method for treating ballast water by using electrolysis of natural seawater*”;

D8: JP2007044567 “*Ship ballast water treatment device*”;

D9: “*Harmful Aquatic Organisms in Ballast Water. Guidelines for ballast water sampling (G2)*”; submitted by Germany. Marine Environment Protection Committee, 53rd session, MEPC 53/2/7, 15 April 2005;

D10: “*Harmful Aquatic Organisms in Ballast Water. Draft guidelines for the uniform implementation of the BWM Convention*”; submitted by Norway. Marine Environment Protection Committee, 53rd session, MEPC 53/2/13, 15 April 2005;

D11: “*Harmful Aquatic Organisms in Ballast Water. Basic approval of active substances used by the hybrid ballast water treatment system using seawater electrolytic process*”; submitted by Japan. Marine Environment Protection Committee, 56th session, MEPC 56/2, 14 December 2006;

D12: “*Harmful Aquatic Organisms in Ballast Water. Basic approval of active substances used by resource ballast technologies system (cavitation combined with ozone and sodium hypochlorite treatment)*”; submitted by South Africa. Marine Environment Protection Committee, 56th session, MEPC 56/2/3, 6 April 2007;

D13: “*Harmful Aquatic Organisms in Ballast Water. Application for basic approval of active substances used by Hitachi ballast water purification system (Clearballast)*”; submitted by Japan. Marine Environment Protection Committee, 57th session, MEPC 57/2/2, 7 September 2007; and

D14: “*Harmful Aquatic Organisms in Ballast Water. Application for final approval of a ballast water management system using active substances*”; submitted by Germany. Marine Environment Protection Committee, 57th session, MEPC 57/2/3, 7 September 2007;

- 28 D1, D3-D5, D7, D8, D11-D14 all disclose various embodiments of ballast water treatment systems; D2, D9 and D10 provide further background into ballast water treatment systems, and D6 discloses a reservoir management system.

Test and Principles Relating to Inventive Step

- 29 Millett LJ in *PLG Research Ltd v Ardon International Ltd* [1995] RPC 287 at 313 identified the rationale underpinning the requirement of inventive step (also understood as the requirement of non-obviousness) as being that “*the public should not be prevented from doing anything which was merely an obvious extension or workshop variation of what was already known at the priority date*”.

30 In Singapore, inventive step is assessed using the four-step approach laid down by the UK Court of Appeal in *Windsurfing International Inc. v Tabur Marine (Great Britain) Ltd* [1985] RPC 59 at 73 (now known as the “Windsurfing” test) in order to reduce the risk of the use of hindsight when assessing obviousness. It can be summarised as follows:

- (i) Identify the inventive concept embodied in the patent in suit.
- (ii) Assume the mantle of the normally skilled but unimaginative addressee in the art at the priority date and impute to him what was, at that date, common general knowledge of the art in question.
- (iii) Identify what, if any, differences exist between the matter cited as being “known or used” and the alleged invention.
- (iv) Decide, without any knowledge of the alleged invention, whether these differences constitute steps which would have been obvious to the person skilled in the art or whether they require any degree of invention.

31 The High Court in *Lee Tat Cheng v Maka GPS Technologies Pte Ltd* [2017] SGHC 48 (“*Lee Tat Cheng HC*”) highlighted the following comment made by the judge of appeal in *First Currency Choice Pte Ltd v Main-Line Corporate Holdings Ltd and another appeal* [2008] 1 SLR(R) 335 (“*First Currency Choice*”):

126 As VK Rajah JA observed in *First Currency Choice* ([50] *supra*) at [44], the first three steps of this test lay the ground work for the final critical question of *non-obviousness*: is the alleged invention obvious in the eyes of the notional skill reader? As discussed earlier, while the court is often assisted in the assessment of obviousness by experts, the ultimate decision on non-obviousness is one of fact, impression and judgment which only the court can answer.

32 Therefore, whilst I will take into account the detailed submissions from the Applicants, and particularly the expert evidence from Mr Sahlen, without any counter-arguments from the Proprietor, I have to consider the facts before me. This means that I cannot simply take the Applicants’ arguments at face value; I still have to consider whether the invention would be obvious to the unimaginative skilled person, in view of the prior art documents D1-D14 and the common general knowledge.

33 The following principles relating to the assessment of inventive step are also pertinent:

- (i) The notional skilled person assesses obviousness by reference to the whole of the state of the art relevant to the invention, including common general knowledge.
- (ii) It is permissible to construct a mosaic out of the various pieces of prior art available: *Mühlbauer AG v Manufacturing Integration Technology Ltd* [2010] 2 SLR 724 (“*Mühlbauer*”) at [93]. Mosaicing of prior art documents is permitted if it could be put together by an unimaginative man with no inventive capacity: *Peng Lian Trading Co v Contour Optik Inc* [2003] 2 SLR(R) 560 at [18].

The Inventive Concept and Claim Construction

34 The Applicants, in their submissions, outlined the inventive concept of the 94R patent, and went into some detail to identify the ‘technical problem to be solved’ by the invention. In the Applicants’ opinion, the problem to be solved is the need to consistently achieve ballast water management standards established by the IMO due to variability in the intake water

quality. The invention aims to solve this problem by monitoring the quality of the ballast water and controlling the conditions of the water treatment apparatus, based upon the quality of the water intake, and the Applicants refer to the passage of the specification at page 6, lines 26-29, which outlines the advantageous effects of the invention. Based on this, the Applicants surmise that the inventive concept is “controlling the treatment time of the ballast water in the water treatment apparatus depending on the intake water quality, and whether the treated ballast water should be discharged or recirculated for retreatment depending on the quality of the ballast water in the ballast tank”. According to the Applicants, this concept is found in Claim 1.

- 35 I agree with the Applicants that this is the basis of the invention, and indeed this is consistent with my understanding of the invention as I outlined in [15]-[22] above. I also note that Step 1 of the “Windsurfing” test requires the identification of the *inventive concept* embodied in the patent in suit. However, as made clear by Section 113(1), the scope of protection is determined by its claims.
- 36 As noted by the Court of Appeal in *First Currency Choice* (at [22]), “*Once the scope of the claims has been ascertained, the questions of whether the claims are obvious, whether a piece of prior art anticipated the claims and whether there has been an infringement of the patent can then be answered in concrete terms*”. The Court went on to endorse the principles of “purposive construction” of the claims (which had been adopted earlier by the Court of Appeal in *FE Global Electronics Pte Ltd v Trek Technology (Singapore) Pte Ltd* [2006] 1 SLR(R) 874) in order to determine the essential features of the invention, and referred to the decisions of the UK House of Lords in both *Catnic Components Limited v Hill & Smith Limited* [1982] RPC 183, and *Kirin-Amgen Inc v Hoechst Marion Roussel Ltd* [2005] RPC 9. The crux of these decisions is essentially that the starting point in patent construction is to ask the threshold question: What would the *notional skilled person* have understood the patentee to mean by the use of the *language of the claims*? This affirms that Step 1 of the “Windsurfing” test is in fact to identify the invention *as defined in the claims*, and not by a vague assertion of the problem to be solved present in the description. Moreover, the emphasis is placed upon the wording of the claims, and if the words of the claims are clear, then the monopoly sought should not be extended or cut down by reference to the specification.
- 37 In the course of last year, the controversial UK Supreme Court decision in *Actavis UK Limited and others v Eli Lilly and Company* [2017] UKSC 48 (“*Actavis*”) gave us cause to wonder whether the approach in Singapore, as described above, should and would still stand. It did not take long for Singapore’s Court of Appeal in *Lee Tat Cheng v Maka GPS Technologies Pte Ltd* [2018] SGCA 18 to put to rest any doubts when it categorically rejected the application of *Actavis* and reaffirmed the principles of purposive construction as Singapore has known it: see [50]-[55].
- 38 With this in mind, whilst the Applicants have identified the basis of the invention of the 94R patent, I am not convinced at this point that they have properly construed the claims in accordance with what is required by the authorities in [36] above. What the Applicants have done is outline the purpose of the invention, i.e. the result that the system defined in Claim 1 actually achieves. Nevertheless, this result does have a material role to play in the functioning of the system, and the skilled person reading Claim 1, with an understanding of the invention from the description and from the common general knowledge, would appreciate that the ultimate *goal* of the invention defined in the claim is to control the

treatment time in the water treatment apparatus, and to determine whether the ballast water should be discharged or recirculated, depending on the quality of the water. However, from a fair reading of the claim, the skilled person would understand that the inventive concept also lies in the arrangement of the parts of the system that allow the system to achieve this result. Therefore, I am of the opinion that the Applicants have over-simplified the claim in their written submissions and in doing so have omitted to identify some of the key features of the invention.

- 39 Mr Sahlen has laid out what he understands the technical features of the claim to mean as part of his expert evidence. At this point I will reiterate that purposive construction requires that the claims are to be read as they would be understood by the notional person skilled in the art, and it is necessary here to consider whether Mr Sahlen is in fact a person skilled in the art. As underscored in *Lee Tat Cheng HC*, at [29], the expert's role is to assist in the viewing of the claims through the eyes of the skilled person. However, the High Court also referred to the cautionary comment of the Court of Appeal in *Mühlbauer*, at [48], that many experts would not themselves fall within the category of the 'person skilled in the art' for the purposes of inventive step as they possess extraordinary knowledge as well as expertise.
- 40 Mr Sahlen has provided a brief biography, in Exhibit "PS-1" of his 1st SD, and from this it is clear that he has a wealth of experience in BWMS. Along with his career in research and development in these systems, he is also an advisor to the Swedish IMO delegation on ballast water topics. It is clear that Mr Sahlen does possess the credentials of an expert in this technical field, and indeed may in fact possess the extraordinary knowledge cautioned against in *Mühlbauer*. However, in the absence of any submissions to the contrary from the Proprietor, I have no reason to believe that Mr Sahlen's opinions extend beyond what would be understood by the person skilled in the art, and therefore find they will be of use in determining what the technical features of the claims would mean to the skilled person.
- 41 Claim 1 has already been set out in [23] above, and in its broadest sense defines a vessel comprising a pump, a water treatment apparatus, a ballast tank, a valve, a monitoring apparatus and a control apparatus. However, I do note from the wording of the claim that the precise positioning of the different components of the system is not explicitly defined therein. Nevertheless, given how the system should operate, the skilled person would be able to make some assumptions in relation to the position of some of the key features of the claim. In particular, the water treatment apparatus removes a substance from *the* ballast water, the antecedent for this being *a* ballast water withdrawn by the pump, thereby implying that the pump is upstream of the water treatment apparatus. The ballast tank stores the treated ballast water, and therefore would necessarily be located downstream of the water treatment apparatus. This would appear to be consistent with the understanding of these features of the claim by Mr Sahlen.
- 42 When the claim is read in conjunction with the figures, and particularly Figure 2 reproduced above, the position of the valve in relation to the pump, the treatment apparatus and the ballast tank is clear, and Mr Sahlen considers that the valve should be located in accordance with this. However, from the wording of the claim alone, it appears that the valve merely needs to be disposed in a piping somewhere between the ballast tank and the pump. Nevertheless, in each of the figures and the specification, the valve is generally disposed between the pump and the water treatment apparatus. Whilst I acknowledge that figures, as a rule, merely define a preferred embodiment of the invention, I think given the requirement that the valve controls the flow of the ballast water through the treatment apparatus, it

makes sense for the valve to be located between the pump and the water treatment apparatus. I also note here that this is essentially how Mr Sahlen, as the person skilled in the art, understood these features. Therefore, I agree with Mr Sahlen’s interpretation and consider that the valve is located between the pump and the water treatment apparatus.

- 43 Similarly, from the figures, it is clear where the monitoring of the aquatic organisms takes place. Whilst it is also clear from the wording of the claim that monitoring takes place in the ballast tank, the monitoring *at an inlet part* of the water treatment apparatus is less clear. All this requires is that the concentration of the microorganisms is monitored *at an inlet* of the water treatment apparatus, with the claim further defining that the concentration of aquatic organisms is monitored *at the inlet part*, using the monitoring apparatus. I note here that the water treatment apparatus is one component of the system defined in Claim 1, and therefore this part of the claim is clearly directed to monitoring at an inlet of that apparatus. Whilst it would *prima facie* appear that the monitoring occurs in the raw water piping proximal to the treatment apparatus, the use of the phrase “an inlet” (as opposed to “*the inlet*”) suggests that the water treatment apparatus may have more than one inlet and therefore the claim would not be limited to an embodiment where there is only a single inlet. As such, from a plain reading of Claim 1, the monitoring of the concentration of aquatic organisms may occur at *any* entry point to the water treatment apparatus. This is a slightly broader interpretation than that given by Mr Sahlen. Nevertheless, in my opinion the skilled person would understand that this monitoring takes place in a piping proximal to the treatment apparatus and not in any other part of the system.
- 44 As an aside, I note that Mr Sahlen made reference to the control apparatus, and suggested that there may be two control apparatus from the wording of the claim, although the presence of more than one would not make any difference to the controlling function. However, I do not understand the basis for this assertion – there is one reference to ‘a control apparatus’ in Claim 1, with further reference to ‘the control apparatus’, implying that the claim was in fact referring to the same control apparatus. Consequently, it appears that there is only one control apparatus present in the system of the invention.
- 45 Therefore, in my opinion, Claim 1 can be construed as a vessel comprising a pump, a water treatment apparatus and a ballast tank. A monitoring apparatus monitors the concentration of aquatic organisms at an inlet into the water treatment apparatus, and in the ballast tank; and a control apparatus controls the system in response to the results of the monitoring. A valve is positioned either upstream or downstream of the water treatment apparatus. This valve controls the flow of water through the treatment apparatus, the opening degree of the valve being controlled by the control apparatus in response to the result of the monitoring of the concentration of the aquatic organisms at an inlet into the water treatment apparatus. The control apparatus also controls the retreatment of the water in the ballast tank, if the results of the monitoring of the concentration of the aquatic organisms in the tank indicate that the levels do not satisfy a permissible value.

The Person Skilled In the Art and The Common General Knowledge

- 46 In their submissions, the Applicants refer to the Court of Appeal in *First Currency Choice* (at [28]), where it states that the skilled person “*should be taken to be the workman or technician who is aware of everything encompassed in the state of the art and who has the skill to make routine workshop developments, but not to exercise inventive ingenuity or think laterally*”. As such, they submit that the skilled person would be someone who has a

Bachelor's degree in Engineering and who would have experience in the design of ballast water treatment systems. As the Proprietor has not challenged this, I agree that the skilled person would indeed be someone as submitted by the Applicants.

- 47 The Applicants did not elaborate on what would be the common general knowledge of this notional skilled person. However, during the course of his evidence, Mr Sahlen does discuss what the common general knowledge would be, and therefore I will take this into consideration. Indeed, in his evidence, Mr Sahlen goes into some detail regarding the common general knowledge at the priority date.
- 48 In his 1st SD, Mr Sahlen provides some useful background into the purpose of a BWMS. It is clear that the problem of transfer of aquatic organisms into an alien marine environment has been known for many years, and in 1948 a UN agency with responsibility for, amongst other things, prevention of marine pollution by ships, was established. Within the IMO, the Marine Environment Protection Committee (MEPC) addresses environmental issues, including ballast water management, anti-fouling systems, and the like. All members of the IMO are signatories to the International Convention for the Control and Management of Ships' Ballast Water and Sediments ("the Convention"), which was adopted in 2004, and entered into force in September 2017. The Convention aims to prevent the spread of harmful aquatic organisms from one region to another by establishing standards and procedures for management and control of ships' ballast water and sediments. All ships under the Convention are required to manage their ballast water and sediments to a certain standard, and this establishes the need for an effective BWMS within maritime vessels.
- 49 It is clear from this that the skilled person would fully understand the problems faced by ships when trying to perform ballasting and deballasting operations in different regions. It would also be within the knowledge of the skilled person that different amounts of contaminating aquatic organisms would be present at different locations, and therefore the amount of decontamination required prior to deballasting would vary depending upon the degree of contamination in the region in which ballast water was taken on board.
- 50 Following on from his discussion of the background to BWMS, Mr Sahlen elaborates on what he considers to be the common general knowledge of the skilled person. In his evidence, Mr Sahlen referred to the "*Guidelines for Approval of Ballast Water Management Systems (G8)*" ("Guidelines"), which was adopted by the MEPC in July 2005. This document states that "sampling facilities should in any case be located on the BWMS intake, before the discharging points, and any other points necessary for sampling to ascertain the proper functioning of the equipment". A copy of the Guidelines was exhibited in Mr Sahlen's 1st SD. I find these of interest, and of relevance in establishing the common general knowledge, as they are indicated as being of use in providing guidance to manufacturers and ship owners on what is required of a BWMS, and how the systems will be evaluated. In other words, it seems to me that these Guidelines would indicate to the skilled person what the minimum requirements would be for a BWMS to ensure that it met the required standards in accordance with the Convention.
- 51 Whilst the Guidelines provide the requirements of the technical specifications of a BWMS, it appears to me that many of these requirements relate to the system as a whole, its operation, and its location on the ship. However, there are some references within these Guidelines that do assist in the understanding that the skilled person would have in relation to the specific parts of the system, which would be of importance in the understanding of

the present invention. In particular, [4.8] of the Guidelines points out that the means for operation and control of the treatment equipment should be simple and effective, and that operation should be ensured through the necessary automatic arrangements. The Guidelines at [4.10] go on to suggest that the BWMS should automatically monitor and adjust the necessary treatment dosages or intensities, or other aspects of the BWMS of the vessel. However, whilst these sections establish that automated control of the treatment and/or dosage would be well within the understanding of the person skilled in the art, they do not go into any further detail on what would fall under this ‘automation’.

- 52 The remainder of the Guidelines outlines what tests will be performed upon the BWMS in order to ensure that it meets the requirements of the Convention. These include testing the ballast water at various stages between uptake and discharge, in order to evaluate the efficacy of the treatment system. This includes, as pointed out by Mr Sahlen, sampling the water on the BWMS intake, before any discharge points, in order to ascertain the proper functioning of the equipment. Mr Sahlen goes on to point out that it was well known at the priority date that the information gathered at these sampling points could be used to control the treatment process, as well as to determine if ballast water should be re-circulated for additional treatment. From this observation drawn from outside the Guidelines, Mr Sahlen appears to acknowledge that the Guidelines do not provide specifications of a BWMS, but rather are used to determine how the BWMS already installed in the ship is performing. Therefore, whilst the Guidelines indicate where sampling will occur during such checks, they do not definitively state the BWMS itself should in fact have sampling points placed at these positions, *in order to* control the system based on the results. Nevertheless, I accept Mr Sahlen’s expert opinion that information from these sample points could be used to control the treatment process.
- 53 Mr Sahlen goes on to briefly discuss the different solutions that had been in place before the adoption of the Convention, as well as the considerations of vessel owners when selecting what BWMS to incorporate into their specific vessel. Mr Sahlen then discusses the importance of pumps and valves in any vessel with ballasting capacity in order to uptake/discharge ballast water and control the flow respectively. This seems to be common sense to me, and I accept that such features would form part of the common general knowledge of the skilled person.
- 54 To summarise, from the expert evidence provided by Mr Sahlen and from the Guidelines, BWMS were well known at the priority date of the 94R patent, in order to ensure that there was no transfer of aquatic organisms from one ecosystem to another as the ships travelled from port to port. These BWMS were generally known to comprise a pump, a treatment system and ballast tanks for storing the treated water. It is clear from the Guidelines that in order to ensure the water quality, the ballast water should be sampled and tested at several locations in the system, including at uptake and before discharge, and other locations in between. I also consider that it would be common general knowledge to the skilled person that the amount of treatment required to remove the contaminating aquatic organisms from the ballast water would depend upon the concentration of aquatic organisms present in the ballast water at intake, and this treatment could be in terms of amount or concentration of the treatment provided, or in terms of the length of time that the treatment takes place.

Differences Between the Claim and the Prior Art, and Whether They Are Obvious

- 55 As a signpost, this part of the analysis delves, in essence, into the fourth step of the “Windsurfing” test. As emphasised by the Court of Appeal in *First Currency Choice* at [44], this step grapples with the critical question of non-obviousness.
- 56 In their written submissions, the Applicants provided a detailed claim chart mapping the common features of Claim 1 (and its dependent claims) to the cited prior art. From the written submissions and from Mr Sahlen’s evidence, it is clear that the inventive step arguments are based upon D1 as the closest prior art, with the features not taught in D1 being found in one or more of the remaining prior art documents. Mr Sahlen gives his expert opinion why these features not taught in D1 would be obvious to the skilled person.
- 57 The wastewater ballast system of D1 is best illustrated by Figure 6 therein (reproduced below), and comprises a wastewater treatment unit (10), a monitoring unit (18), a ballast tank (12), a disinfection unit (14) and a ballast discharge unit (24). The system may comprise sampling ports at various locations, depicted in Figure 6 as 30, 32, 34, 36, 38, which enable testing of samples of the treated wastewater:

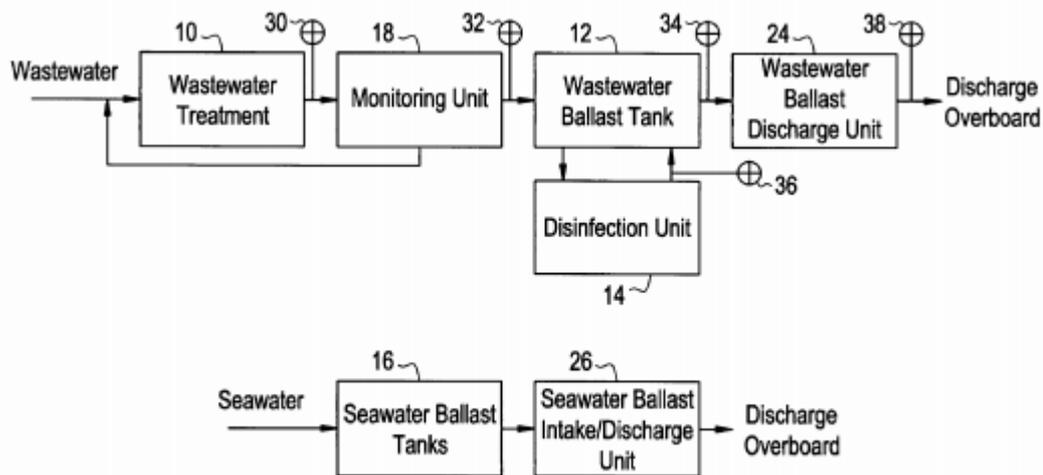


Figure 6

- 58 In use, the wastewater enters the treatment system (10), where it is filtered and treated to remove sludge and particulate matter. Further decontamination is performed by dosing with electromagnetic radiation, such as UV, to kill fecal coliforms and other pathogens. The water is then passed to the monitoring unit (18), which uses the turbidity of the water as an indication of the degree of microbial contamination. If the latter does not meet threshold levels, the water may be recirculated through the treatment system until it does meet the required standards. On the other hand, if the threshold levels are satisfied, then the water passes to the wastewater ballast tank (12). Once in the wastewater ballast tank, the water may be circulated into a disinfection unit (14), which controls the growth of residual bacterial in the wastewater ballast tank, if a monitoring system in the ballast tank determines the contamination levels do not meet regulatory standards.
- 59 The system in D1 is under the control of a control system. As correctly pointed out by Mr Sahlen in his evidence, column 8 lines 51-56 state that the control system monitors wastewater flow rates through the wastewater treatment unit, as well as monitors and controls operation of the wastewater treatment unit, such as dosage, or flow rates through the filtration units. This control system also controls the operation of the monitoring unit,

to measure parameters of the treated wastewater and to determine whether the treated wastewater should be recirculated through the treatment unit.

- 60 Mr Sahlen considers that the only difference between D1 and the inventive concept is the monitoring of the water quality at the inlet to the water treatment apparatus, yet this feature is taught by a number of the prior art documents. For example, in his evidence, Mr Sahlen points out that D2 recognises the problem with variability of intake water quality and teaches monitoring ballast water both before and after treatment. D10 and D12-D14 also disclose sampling ballast water both pre-and post-treatment. As such, in Mr Sahlen's opinion, it would be obvious to combine D1 with D2, D10 or D12-D14 and arrive at the inventive concept.
- 61 Mr Sahlen goes on to explain that the requirement of a control apparatus that monitors the concentration of aquatic organisms in the ballast water at the inlet part of the water treatment apparatus, and adjusts the flow rate by controlling the degree of opening of an inlet valve, as well as monitors the concentration of aquatic organisms, is taught in D2, D10 or D12-D14, as these documents are concerned with ballast water treatment methods and the strategies for treating ballast water to meet regulatory discharge standards. He specifically refers to D2, and the fact that the skilled person reading this document would know that the quality of ballast water taken in depends on the shipping route, and that this document teaches monitoring quality both before and after treatment to assess the effectiveness of different treatment scenarios. In view of this, in Mr Sahlen's opinion, the skilled person looking to reduce the amount of chemical biocides would be led by D2 to introduce an additional sample port at the inlet port of the wastewater treatment unit of D1, such that the use of chemical biocides can be regulated depending on incoming water quality.
- 62 Prior to the hearing, some additional questions were posed to Mr Sahlen, specifically trying to understand why the skilled person, reading D1, would consider monitoring the quality of the water at the inlet, and use this to control the flow rate through the apparatus, given that the system already had a contingency for this by allowing re-circulation from the monitoring unit after treatment if the water did not meet the required standards. In his 2nd SD, Mr Sahlen acknowledged that re-treating the water would be effective to address variations in water quality, but this was not the most optimum way of fine-tuning the treatment. Therefore, the skilled person would look to improve the system of D1 by avoiding the need to recirculate and re-treat the water, whilst being able to address differences in incoming water quality.
- 63 I have carefully considered the Applicants' submissions and Mr Sahlen's evidence in relation to D1, and I acknowledge that, generally, one way of improving a system where water quality was variable is to control the degree of treatment, either through the amount of de-contaminant applied or the time spent (i.e. flow rate) in the treatment apparatus; and in order to do this, it would be necessary to determine the level of contamination prior to treatment. However, I have to consider whether such a system would be applied to D1 specifically, and particularly whether there is in fact motivation for the skilled person to make such modifications considering the teaching of D1 as a whole, in light of the common general knowledge and/or the teachings of D2-D14 submitted by the Applicants.
- 64 It is clear that the Applicants' submissions and Mr Sahlen's evidence in relation to the lack of inventive step of the 94R patent are all based upon the knowledge that aquatic organisms

from one region can contaminate the waters of another region, due to the different locations of ballasting and de-ballasting activities during a vessel's voyage. Indeed, many of the documents submitted by the Applicants relate to the Convention, and how ships can effectively deal with the problem of the spread of aquatic organisms from one region to another. However, whilst D1 does generally disclose a wastewater management system, it is primarily concerned with dealing with waste water (such as inherently contaminated toilet waste) *generated on board* large vessels such as passenger or military vessels, during seagoing operations, and not with dealing with the *intake* of ballast water from external sources. In fact, D1 even goes so far as to say that the system provides an advantage in using wastewater generated on board as ballast, as it reduces the amount of seawater ballast needed. In particular, Figure 5 and the description of D1 suggest that the use of seawater is merely a contingency, and the seawater ballast water is a separate system from the system of the invention.

- 65 Therefore, whilst I acknowledge that D1 could be used to treat ballast water taken on at sea to ensure that aquatic organisms are not transferred from one location to another, in my opinion, the skilled person reading this document would consider that it is actually primarily intended to deal with wastewater generated on board a vessel. Nevertheless, the water quality at the inlet to the BWMS of D1 may be varied depending on the type of water pumped into the system at any one time (i.e. blackwater or greywater), and I note Mr Sahlen's comments in his 3rd SD that the skilled person would have a goal to adjust the treatment amount to cater for the variations in incoming water quality, and one way of doing this would be to adjust the flow rates through the system. In his opinion, this would be particularly important where time is limited, and he refers in particular to Chapter 4 of D2, where for ballasting at the cargo discharge port or deballasting at the cargo loading port, large quantities of water must be treated in a short period of time, so flow rates through the system are high. However, I am not sure that this is directly applicable to the system of D1, where the wastewater will be generated consistently throughout the voyage and not in a large quantity at a short period of time. Furthermore, the system already has in place a contingency for dealing with wastewater that has a higher degree of contamination, by monitoring the water quality after treatment, and recirculating it through the treatment unit if not decontaminated to a satisfactory degree.
- 66 As such, at first reading, I have cause to wonder if the skilled person, reading D1, would consider adapting the system therein to meet the requirements of decontamination of seawater ballast by monitoring the levels of aquatic organisms at an inlet of the system, and adjusting flow rates through the system depending on the results of this monitoring. Even when D1 is read in combination with D2 and any of the other documents provided by the Applicants, it is not clear that the skilled person would make such a modification, mainly because the purpose of the systems of D2 and the remaining documents is to prevent transfer of aquatic organisms from one location to another during uptake and discharge of ballast water, whereas this does not appear to be the primary intention of D1.
- 67 Nevertheless, the Proprietor has chosen not to defend its patent and I have no arguments before me that would contradict the Applicants' submissions. Therefore, despite not being wholly convinced that the skilled person would arrive at the invention from D1, I have taken into consideration the expert evidence of Mr Sahlen when considering the inventive step of the claims. In particular, I have read the general documents provided in relation to BWMS, especially the IMO documents which discuss how these BWMS are arranged, and

how the IMO will sample ballast water for the presence of aquatic organisms at different points in the system, including at the inlet, outlet, and various points in between.

- 68 It is clear to me that, in general, BWMS are arranged in the following order: inlet → pump → treatment apparatus → ballast tank → discharge outlet, with various features to control the flow of ballast water through the system, including further pumps and valves. Such systems are illustrated, for example, in D3-D5, D7 and D8, D11-D13. It also appears to be common to re-treat the water from the ballast tanks if it is detected that the quality does not meet the required standards (for example, this is shown in at least D1, D3, D5 and D7). Whether the monitoring is performed in the ballast tank or before discharge would appear to be immaterial – the purpose is to ensure that the water being discharged is of an acceptable standard, and if not, it will be re-treated. Therefore, and in line with what Mr Sahlen, from the perspective of the person skilled in the art, has opined in conjunction with his evidence establishing the common features of a BWMS, the major difference between the present invention and what is generally known in the art about BWMS is using the results of monitoring the water at intake to control the flow rate in the treatment apparatus.
- 69 In his evidence, Mr Sahlen points out that the overuse of chemical biocides is undesirable to the environment. Whilst he discusses this in relation to D1, I note that this is also recognised as a potential issue in a number of the other prior art documents, including D11 and D14. I also think that the skilled person in this area would appreciate the environmental issues associated with overuse of chemical biocides, and it would in fact be counter-productive to prevent the spread of non-local aquatic organisms whilst at the same time killing those aquatic organisms native to the local environment. I therefore accept Mr Sahlen's assertions that the skilled person would actively seek to provide a mechanism to discharge non-local ballast water with as little effect to the environment as possible. It would therefore follow that one way to control the amount of chemical biocides discharged to the environment with the ballast water would be to adjust the amount of treatment needed in accordance with the degree of contamination of the water at intake. However, in this regard, I am not convinced that the most straightforward way to compensate for excess chemical biocide would be to adjust the flow of ballast water through the treatment apparatus; rather, it would seem more likely that, following an assessment of the degree of contamination at intake, the amount of chemical biocide added would be adjusted instead.
- 70 The question of why it would be obvious (based on the disclosure of D1) for the skilled person to monitor the quality of the water at intake and adjust the flow rate in the water treatment apparatus was posed to Mr Sahlen in my letter of 29 January 2018 (see Procedural History above). In his 2nd SD, Mr Sahlen moved away from the objective of the skilled person to reduce the amount of chemical biocides that he had relied upon in his 1st SD as a motivation to arrive at the invention. Instead, he pointed out that if the quality of the water taken in is poor, then a longer treatment time would be needed to obtain a target water quality post-treatment, and that this quality standard is achieved by lowering the flow rate through the treatment system. In other words, rather than relying solely upon the objective of reducing the amount of biocide, Mr Sahlen seemed to suggest that it would be obvious to simply adjust the flow rate through the apparatus, i.e. the dwell time of the ballast water in the treatment apparatus, in order to fine tune the level of treatment needed. I note again here that Mr Sahlen's opinion is in relation to the inventive step of the claims over disclosure of D1, but as explained in [67] above, I find these comments of relevance to BWMS in general.

- 71 Mr Sahlen expands upon this in his 3rd SD, and refers in particular to the following passage of D2 (chapter 4, page 3) (emphasis his):

Treatment technology options can be incorporated during three different phases of ballast operations: (1) during ballasting at the cargo discharge port; (2) during the voyage, between ports; and (3) during deballasting at the cargo loading port (see Figure 3-1). Each of these scenarios has significantly different constraints with respect to treatment options. *In the first and third scenarios, large quantities of water must be treated in a short period of time, while water is taken on board or discharged and flow rates through the treatment system are high. In the second scenario, water resides in the ballast tanks or cargo/ ballast holds between ports; more time is available for treatment; and flow rates through the treatment system may be lower.*

- 72 In Mr Sahlen's expert opinion, the longer the vessel has to stay at the cargo discharge port or loading port for ballasting or deballasting operations, the higher the costs to the owner. This necessitates speed in the ballast water decontamination process, and therefore the skilled person would be motivated to modify BWMS to avoid having to re-circulate and re-treat the water and achieve a higher water quality in a single pass. Therefore, in order to avoid or reduce the need for re-treatment, Mr Sahlen considered that the skilled person would look to improve BWMS by avoiding the need to re-treat the water whilst being able to address variations in incoming water quality, and would do so by considering ways to fine tune the treatment amount in each pass, depending on variations in incoming water quality. As such, the skilled person, using his common general knowledge, would know that one way to do this would be to adjust the flow rate of the water entering the system. With the goal of adjusting the treatment to cater for variations in incoming water quality in mind, the skilled person would be motivated to introduce a monitoring point at the inlet to the water treatment system to monitor the incoming water quality, and provide for control of the flow rate based on the results of the monitoring, and in doing so, according to Mr Sahlen, would arrive at the invention.

- 73 As I have no submissions to the contrary from the Proprietor, I accept the opinion of Mr Sahlen that this would be deemed well within the knowledge of a person skilled in the art. Further and in any case, it makes sense that the longer something is exposed to a treatment system, the more 'dosing' it would receive. Therefore, in order to increase the amount of treatment the water receives, in the instance where the water at intake is of a particularly poor quality, it would seem logical to the skilled person to slow the flow of water through the system. It would therefore follow, as testified by Mr Sahlen in his 3rd SD, that in order to do this, some form of monitoring would be required at intake to enable the system to adjust the rate accordingly.

- 74 Consequently, on balance of the evidence of Mr Sahlen and in the absence of any other evidence to dispute this, I accept that implementing a system to monitor the quality of water at the inlet to any standard wastewater treatment system, and subsequently to control the flow of the water through this treatment system would be something that would be obvious to the person skilled in the art. Given that valves are the most commonly used means to control the flow of fluids, and that valves are already known to be readily controllable by automated means in a number of systems, including BWMS (such as in D3, D5, D7, D8, D11 & D12), the use of such a mechanism to control the flow of the ballast water through the treatment system would also be obvious. In the words of the High Court in *Merck & Co Inc v Pharmaforte Singapore Pte Ltd* [1999] 3 SLR(R) 1072 at [42], mosaicing the

prior art and common general knowledge in this way appears to be “worth trying out” and can lead to a solution that is “lying on the road”. As such, based upon the evidence provided by Mr Sahlen, as well as the documents submitted by the Applicants, and in the absence of any counter-arguments or evidence from the Proprietor, I accept the assertions from the Applicants that Claim 1 lacks an inventive step. The remaining claims do not seem to extend beyond the common general knowledge of the skilled person, as detailed in Mr Sahlen’s evidence, and therefore I accept that Claims 2-11 also lack an inventive step.

75 As an aside, my approach to the issue of inventiveness here is circumscribed by the requirements in Rule 80(4) of the Rules as well as the procedural history. As the Applicants have filed sworn evidence by Mr Sahlen, and the Proprietor has filed neither counter-statement nor evidence, I have relied on the Applicants’ evidence significantly, especially in the absence of counter-arguments and/or challenge by the Proprietor. In particular, I have given much weight to what Mr Sahlen claims to be the common general knowledge, in the context of what would be obvious to the skilled expert. This is in contrast to my earlier decision of *Cambrian Engineering Corporation Pte Ltd v FOSTA Pte Ltd* [2016] SGIPOS 13, where the applicant for revocation did not file expert evidence, relying on its bare assertions in the pleadings. In both cases, I have made independent assessments; but in the present case, I was particularly assisted by the expert evidence from the Applicants (without merely taking it at face value).

Conclusion

76 The ground of revocation under Section 80(1)(a) therefore succeeds.

Ground of Revocation under Section 80(1)(g): Double Patenting

77 Section 80(1)(g) of the Act reads:

80.—(1) Subject to the provisions of this Act, the Registrar may, on the application of any person, by order revoke a patent for an invention on (but only on) any of the following grounds:

...

(g) the patent is one of 2 or more patents for the same invention having the same priority date and filed by the same party or his successor in title.

The Applicants’ Representations

78 The Applicants submit that the 94R patent is invalid for double patenting, as it is identical in scope to the 075 patent. In particular, they refer to the “*Examination Guidelines for Patent Applications at IPO*” (October 2017 version), where it is stated that double patenting applies if two claims are identical in scope or are otherwise identical in substance (at [6.103]). Therefore, here, even though the wording of the claims in the 94R patent and the 075 patent is not identical, the Applicants submit that the claims are identical in substance such as to amount to double patenting.

79 The Applicants submit that in the absence of any local decisions in relation to double patenting, the decisions of the UK Intellectual Property Office are persuasive due to the

close correlation of Section 18(5) of the UK Patents Act with Section 80(1)(g) of the Act. I agree and have referred to such a decision below. The Applicants also refer to their submissions in their parallel application to revoke the 075 patent. There, the Applicants have set out a detailed juxtaposition of the claims of both patents, with a feature by feature analysis of the integers of the claims. I take this into consideration.

Analysis

80 There are three elements to be established under Section 80(1)(g):

- (i) the patents have the same priority date;
- (ii) the patents are filed by the same party (or his successor-in-title); and
- (iii) the patents are for the same invention.

81 As the 94R patent is a divisional application of the 075 patent, and hence filed by the same proprietor, it has been accorded the same filing date as the 075 patent, in accordance with Section 26(11) of the Act. Furthermore, both patents claim a priority date of 8 November 2007 from Japanese application JP 2007-290955. Therefore, the criteria in (i) and (ii) above, for having the same priority date and being filed by the same party, have been fulfilled. I now turn my mind to the third element, and consider whether the 94R patent and the 075 patent are directed at the same invention.

82 Claim 1 of the 94R patent has been set out in [23] above. Claim 1 of the 075 patent reads as follows:

1. A ship comprising:
 - a pump which intakes and discharges ballast water;
 - a water treatment apparatus which removes a substance to be removed from ballast water;
 - a ballast tank which stores the ballast water treated by the water treatment apparatus;
 - a valve which is arranged between the pump and the water treatment apparatus;
 - a monitoring apparatus which monitors the concentration of aquatic organisms in the ballast water at an inlet part and an outlet part of the water treatment apparatus; and
 - a control apparatus which monitors the concentration of aquatic organisms in the ballast water when the ballast water is taken;
 - controls the opening of the valve based on the result of the monitoring to adjust the treatment amount per unit time of the water treatment apparatus;
 - monitors the concentration of aquatic organisms in the ballast water when the ballast water is discharged;
 - controls to discharge the ballast water if the concentration of aquatic organisms based on the result of the monitoring satisfies a permissive value; and
 - controls to discharge the ballast water after the water treatment apparatus retreats the ballast water if the concentration of aquatic organisms based on the result of the monitoring does not satisfy the permissive value.

83 I have reproduced the Applicants' comparison table below in relation to Claim 1 of the two patents, along with their emphasis regarding what they perceive to be the apparent differences between the two claims:

Feature	94R Patent	075 Patent
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1.1	A vessel comprising	A ship comprising
1.2	a pump which withdraws a ballast water;	a pump which intakes and discharges ballast water;
1.3	a water treatment apparatus which removes a substance to be removed from the ballast water;	a water treatment apparatus which removes a substance to be removed from ballast water;
1.4	a ballast tank which stores the ballast water treated by the water treatment apparatus;	a ballast tank which stores the ballast water treated by the water treatment apparatus;
1.5	a valve which is disposed in a piping between the ballast tank and the pump;	a valve which is arranged between the pump and the water treatment apparatus;
1.6	a monitoring apparatus which monitors a concentration of aquatic organisms in the ballast water at an inlet part of the water treatment apparatus and a concentration of aquatic organisms in the ballast water in the ballast tank ; and	a monitoring apparatus which monitors the concentration of aquatic organisms in the ballast water at an inlet part and an outlet part of the water treatment apparatus ; and
1.7	a control apparatus which monitors the concentration of aquatic organisms in the ballast water at the inlet part of the water treatment apparatus using the monitoring apparatus when the ballast water is withdrawn and	a control apparatus which monitors the concentration of aquatic organisms in the ballast water when the ballast water is taken ;
1.8	controls an opening degree of the valve based on a result of the monitoring so as to control a treatment flow rate per unit time in the water treatment apparatus,	controls the opening of the valve based on the result of the monitoring to adjust the treatment amount per unit time of the water treatment apparatus;
1.9	the control apparatus which monitors the concentration of aquatic organisms in the ballast water in the ballast tank using the monitoring apparatus and	monitors the concentration of aquatic organisms in the ballast water when the ballast water is discharged ;
1.10		controls to discharge the ballast water if the concentration of aquatic organisms based on the result of the monitoring satisfies a permissive value ; and
1.11	controls to retreat the ballast water in the ballast tank by the water treatment apparatus when it is determined that the concentration of aquatic organisms in the ballast water	controls to discharge the ballast water after the water treatment apparatus retreats the ballast water if the concentration of aquatic organisms based on the

	in the ballast tank does not satisfy a permissible value based on a result of the monitoring.	result of the monitoring does not satisfy the permissive value.
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- 84 It is clear from the case law that assessing double patenting depends primarily upon the facts of the individual case, and therefore it can be difficult to apply past principles to the particular case in hand. However, what is clear is the long standing principle that the same monopoly should not be granted twice, and I will therefore bear this in mind when coming to my conclusion on double patenting. Nevertheless, it is also clear that some degree of overlap between the claims is permissible.
- 85 In order to determine whether the claims overlap, and if so, to what extent the overlap is, it is necessary to construe the claims, particularly as it is important to determine whether the wording of the claims, when properly construed, define the same features either explicitly or implicitly. As intimated in [35] above, the invention is as defined by the language of the claims, and the description should not be used to extend or narrow the monopoly sought. This legislated approach is particularly pertinent in the present case: as the 94R patent is a divisional of the 075 patent, the description and embodiments therein are the same. This is common with divisional applications where the embodiments in the specification may be the same amongst family members, but the claims in the family members are restricted to particular inventions from within those embodiments. The same applies in the present case – the specification describes variations of ballast water management systems, where not all those variations are relevant to the inventions defined in the claims of either patent. Therefore, I will focus on the words of the claims at face value, as they would be understood by the skilled person.
- 86 Upon considering the Applicants’ comparison table, I agree with them that the features they have emphasised in bold font are the only substantive features that may distinguish between the claims of the patents under dispute. Therefore, I will assess these features as numbered in the table above, taking into account what the skilled person would understand them to mean, in the context of the ballast water treatment system of the claims.

Feature 1.2: the pump

- 87 Claim 1 of the 94R patent defines a pump which withdraws a ballast water, whereas Claim 1 of the 075 patent defines a pump which both intakes and discharges ballast water. The Applicants submit that the terms “withdraws” and “intakes” have the same meaning. I agree with this – the skilled person reading this would understand that the pumps in both claims take in ballast water. The Applicants concede that the additional feature in the 075 patent is therefore that the pump “discharges” ballast water. In this regard, the Applicants refer to Mr Sahlen’s evidence that every vessel will have one or more pumps for taking in and discharging water, and that the specification does not contemplate a scenario where there is no means for discharging ballast water. They further submit that whether there is a single pump or separate pumps to facilitate intake and discharge makes no difference to the invention and as such these features of the claims are identical in substance.
- 88 I agree with the Applicants that it would be inherent that there would be a pump that can facilitate the discharge of the ballast water, and indeed Claim 1 of the 94R patent does not exclude such a feature. I also acknowledge that the description does include the possibility

of a pump that can be used for both intake and discharge, as submitted by the Applicants. However, the description also includes an embodiment where the pump may be different from that used at water intake, and this embodiment is also present in the description of the 075 patent; this is an example of the overlapping and unclaimed embodiments in divisional applications that I alluded to in [85] above. Therefore, the skilled person reading Claim 1 of the 94R patent would understand that the system at least required a pump for intake of ballast water, and whilst it was likely that a pump would also be required to discharge the water, the specifics of such a pump did not fall within the scope of the claim. As such, the pump of Claim 1 of the 94R patent is merely required to perform the single function of intake of water.

89 On the other hand, the skilled person reading Claim 1 of the 075 patent would understand that the pump in that system has to both take in and discharge the ballast water. In other words, the pump has an additional feature over that of the pump defined in Claim 1 of the 94R patent. The Applicants argue that as this makes no difference to the invention, the claims are identical in substance. However, I cannot accept this assertion. Whilst it *prima facie* would make no difference whether the same pump is used for intake and discharge of ballast water when the system is in operation, Claim 1 of the 075 patent requires that the pump *necessarily* performs both these functions, whereas the pump of Claim 1 of the 94R patent only needs to pump water into the system. In my opinion, this goes beyond an immaterial variant. Moreover, this interpretation is consistent with that of the hearing officer in the UK decision of *Optinose AS* (BL O/026/12), where he considered that a patent claiming feature A and feature B was not directed to the same invention as a patent claiming feature A alone, at [18].

90 Therefore, in view of this feature alone, I consider that there is no double patenting with respect to Claim 1 of the 94R patent and Claim 1 of the 075 patent. However, for completeness and in the event I am wrong in this assessment, I will consider the other individual features that the Applicants have highlighted in the table above.

Feature 1.6: location of the monitoring apparatus

91 The difference in location of the monitoring apparatus is that in the 94R patent, it is in the ballast water in the ballast tank, whereas in the 075 patent, it is at an outlet part of the water treatment apparatus. The Applicants acknowledge that these relate to different sampling points, but argue that, as none of the control functions performed by the control apparatus are based on a result of the monitoring at the outlet part of the water treatment apparatus, it makes no difference whether this point is monitored or not.

92 I cannot agree with this assertion. Even if there is no clear purpose for the monitoring apparatus at the outlet part of the water treatment apparatus defined in Claim 1 of the 075 patent, it does not negate the fact that there is still a monitoring apparatus present at a location in the 075 patent that is not present in the 94R patent. As such, even if I am wrong in my assessment in relation to the pump (Feature 1.2) above, this feature (on the location of the monitoring apparatus) alone distinguishes Claim 1 of the 94R patent from Claim 1 of the 075 patent.

Feature 1.7: monitoring of aquatic organisms prior to entry to treatment apparatus

- 93 I agree with the Applicants that the features of ‘at the inlet part of the water treatment apparatus’ and ‘when the ballast water is taken’ are directed to the same sampling point, and therefore these features, in substance, are the same in both claims.

Feature 1.8: rate of treatment

- 94 The 94R patent requires that the opening of the valve controls a treatment flow rate per unit time in the water treatment apparatus, whereas the 075 patent requires that the valve adjusts the treatment amount per unit time. According to Mr Sahlen’s evidence, the treatment amount per unit time is dependent upon the flow rate per unit time of ballast water through the water treatment apparatus. As such, the Applicants contend that these terms mean the same thing. I agree with this, and it is clear from reading the description that this is also meant to mean the same thing. These features are therefore also the same, in substance.

Feature 1.9: monitoring of aquatic organisms in the ballast water

- 95 The control apparatus of the 94R patent monitors the concentration of aquatic organisms in the ballast water of the ballast tank, whereas the control apparatus in the 075 patent monitors the concentration of aquatic organisms in the ballast water when it is discharged. The Applicants refer to Mr Sahlen’s evidence that these two locations relate to the same sampling point, as the water quality in these two locations would be expected to be the same.

- 96 It is clear from the 94R patent that the monitoring occurs in the ballast tank and whilst, *prima facie*, it would appear from the 075 patent that the monitoring point is at a different location, from reading the specification (such as the parts pertaining to Features 1.10 and 1.11) and from understanding the purpose of this monitoring point, it appears that the monitoring point in the 075 patent is in fact in the same location as that of the 94R patent. In fact, there does not appear to be any additional monitoring point *at the point of discharge* of the water. Given that the purpose of this monitoring point is to re-treat the ballast water if the quality has degraded, it does not make sense for this point to be positioned at a location after the water has been discharged from the ballast tank. Furthermore, there is no suggestion in the specification that monitoring occurs at discharge from the ballast tank, and that this then enables the water to be re-circulated to the treatment apparatus. Instead, it is clear from the specification that this monitoring occurs in the ballast tank, and it does not make sense for it to be in any other location. I strongly suspect that this anomaly in the wording of Claim 1 of the 075 patent is due to poor translation from the original Japanese language into the English language. Therefore, I am prepared to accept that this feature is the same, in substance, in the claims of both the 94R patent and the 075 patent.

Features 1.10 and 1.11: discharge of the ballast water

- 97 These features define the conditions which determine whether the ballast water is sent for re-treatment or whether the ballast water is discharged. As I noted in [96] above, the monitoring of the ballast water prior to discharge would appear to be at the same location for both the 94R patent and the 075 patent, and the purpose of this monitoring is to determine whether the ballast water is of a standard that can be discharged to the environment; if not, the water is sent for re-treatment by the water treatment apparatus.

98 I note that Claim 1 of the 94R patent is silent regarding the feature of discharging the water, and the control system defined therein only controls the re-treatment of the ballast water if it does not satisfy a permissible value. Claim 1 of the 075 patent, on the other hand defines the control apparatus as controlling both the discharge of the ballast water if the standard is of a permissible value, or sending the ballast water to be re-treated if it is not. However, in my opinion, and from my understanding of how the invention works, it would be inherent that the system of the 94R patent would also discharge the ballast water if it satisfied a permissible value. This is also consistent with the Applicants' assertion, based upon the evidence provided by Mr Sahlen. Therefore, I agree that these features of Claim 1 of the 94R patent and of Claim 1 of the 075 patent are the same.

Summary on Ground of Double Patenting

99 Therefore, to summarise, I do not agree with the Applicants that Claim 1 of the 94R patent defines the same invention as Claim 1 of the 075 patent. This is due to the requirement that the pump in the 075 patent necessarily can both intake and discharge ballast water, whereas the pump of the 94R patent need only intake ballast water (discharge may be performed by a different pump). The claims are also distinguished by the location of a monitoring apparatus at the outlet of the water treatment apparatus in the 075 patent, as there is no monitoring apparatus in this location in the 94R patent. Therefore, Claim 1 is not found invalid on the grounds of double patenting.

100 Nevertheless, double patenting can still arise due to additional features of dependent claims. The simplest way to assess whether double patenting arises here is to determine whether the features in Claim 1 of the 075 patent that are not present in Claim 1 of the 94R patent are in fact introduced into the 94R patent as features in the dependent claims. Upon review of the dependent claims of the 94R patent, the features of a pump that can both intake and discharge water, and a monitoring system at the outlet of the treatment apparatus are not present. Therefore, even though the dependent claims in both patents are highly similar, the inventions remain distinct from each other by virtue of these two features, and therefore Claims 1-11 of the 94R patent do not define the same invention as the claims of the 075 patent. Therefore, having considered the dependent claims, the 94R patent is not invalid on the grounds of double patenting.

Conclusion

101 The ground of revocation under Section 80(1)(g) therefore fails.

Overall Conclusion

102 Having considered all the pleadings and evidence filed and the submissions made in writing and orally, I find that the application for revocation only succeeds under Section 80(1)(a) of the Act as the 94R patent lacks inventiveness, but fails under Section 80(1)(g) as there is no double patenting.

103 I therefore allow the application for revocation. In accordance with Section 80(7) of the Act, my order to revoke the 94R patent in full takes effect from the date of grant. The Applicants are entitled to 80% of their costs, to be taxed if not agreed. This award takes into account the relative substantiality of each of the Applicants' grounds, as well as the fact that the Proprietor could have surrendered its patent to minimize costs all round, but

did not, thus putting the successful Applicants through the full proceedings with the attendant expenses.

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