Mühlbauer AG *v* Manufacturing Integration Technology Ltd [2010] SGCA 6

Case Number	: Civil Appeal No 34 of 2009
Decision Date	: 23 February 2010
Tribunal/Court	: Court of Appeal
Coram	: Chao Hick Tin JA; Andrew Phang Boon Leong JA; V K Rajah JA
Counsel Name(s)	: Dr Stanley Lai and Vignesh Vaerhn (Allen & Gledhill LLP) for the appellant; Foo Maw Shen, Koh Kia Jeng and Calvin Lim (Rodyk & Davidson LLP) for the respondent.
Parties	: Mühlbauer AG — Manufacturing Integration Technology Ltd

Patents and Inventions

[LawNet Editorial Note: This was an appeal from the decision of the High Court in [2009] SGHC 45.]

23 February 2010 Judgment reserved.

Andrew Phang Boon Leong JA (delivering the judgment of the court):

1 This is an appeal against the decision of the trial judge ("the Judge") in *Mühlbauer AG v Manufacturing Integration Technology Ltd* [2009] SGHC 45 ("the GD"). The Judge allowed the respondent's counterclaim that the appellant's patent be declared invalid for want of both novelty as well as an inventive step. Accordingly, the appellant's claim for infringement was dismissed.

2 The appellant, Mühlbauer AG ("the Appellant"), is a company incorporated in Germany. It is the registered proprietor of Singapore patent No 117982 entitled "Device for *Inspecting and* Rotating Electronic Components" [emphasis added] ("the Patent"), filed in Singapore sometime in December 2005. The Patent is in force in Singapore, with its priority date being 16 February 2004.

3 The respondent, Manufacturing Integration Technology Ltd ("the Respondent"), is a Singapore company. It is alleged to have infringed the Patent pursuant to s 66(1)(*a*) of the Patents Act (Cap 221, 2005 Rev Ed) ("the Act") by making, disposing of, offering to dispose of, using or importing the patented product and/or keeping the patented product, whether for disposal or otherwise. In particular, the Appellant complained that the Respondent had manufactured and marketed a device under the trademark or name "CAERUS" which infringed the Patent.

4 In the court below, the Respondent acknowledged that its machine infringed all 10 claims of the Patent. In its counterclaim, however, the Respondent contended that the Patent lacked novelty as well as any inventive step *vis-à-vis* the prior state of the art ("the state of the art"), and should therefore be found to be invalid. In any case, for the purposes of this judgment, we shall be taking the Patent and the Respondent's "CAERUS" device to be exactly identical.

5 Although the issues canvassed in the present appeal were straightforward, a number of significant (and *broader*) issues were raised, including (as we shall see) the role of *characterisation* in the context of deciding patent disputes as well as the (no less important) *role of experts* in the same context.

Facts (including a description of the Patent)

6 The Patent describes a machine for inspecting, picking up and placing electronic components onto printed circuit boards or tape and reel packaging. The Respondent's "CAERUS" device is also a machine that facilitates the inspection and rotation of electronic components.

7 The 10 claims countenanced by the Patent are important, and they are as follows (see also Appendix A): [note: 1]

1. A *device* for *checking and* rotating electronic components, in particular flip chips, with a pivoting part attached to a pivoting point for rotating the electronic components, on the exterior of which part a *first* pickup element is fixed for taking up a single electronic component from a substrate and keeping hold of it during a rotational movement of the part, characterized in that a *second* pickup element is arranged externally on the part *opposite the first* pickup element in relation to the pivotal point in such a way that in each case one pickup element is facing the substrate for each rotation of the part through 180º, and that in the part *a through opening* is arranged between the pickup elements in such a way that the through opening is facing the substrate for a rotation of the pivoting part through 90º or 270º.

2. Device according to Claim 1, characterized in that the first pickup element is attached on a first projection and the second pickup element on a second projection of the part.

3. Device according to Claim 2, characterized in that the through opening is developed between the projections as a through channel open on one long side.

4. Device according to one of the preceding claims, characterized in that on a side of the pivoting part facing the substrate a first optical facility is arranged for optical checking of surfaces and correct positions of the electronic components arranged on the substrate before being picked up.

5. Device according to Claim 4, characterized *in that the through opening is formed in such a way that it permits an optical connection between the first optical facility and an electronic component arranged on the substrate during a rotational movement of the pivoting part*.

6. Device according to one of the preceding claims, characterized by a second optical facility for checking a correct position of the rotated and deposited electronic component.

7 . *Method* for checking and rotating electronic components, in particular flip chips, which are picked up individually from a sandwich of electronic components arranged on a substrate, by means of a *first* pickup element arranged on a pivoting part and are deposited in a rotated position, the pivoting part being placeable between the substrate and a first optical facility for checking the surface and the correct position of a single component arranged on the substrate, characterized in that *during* a 180º rotation of the pivoting part a pickup by the first pickup element of a single electronic component arranged on the substrate, *a check of a surface and the correct position of* a *further* electronic component arranged on the substrate, *by means of the optical facility and a through opening arranged in the pivoting part*, a *depositing of* the electronic component *held by the first* pickup element on a placing facility *after* a 180º rotation of the pivoting part *and at the same time a further pickup* of the *further* individual electronic component arranged on the substrate, by a *second* pickup element arranged externally opposite the first pickup element on the pivoting part, are *executed*.

8. Method according to Claim 7, characterized in that after the 180º rotation a 180º rotation going in the *other* direction is executed.

9. Method according to Claim 7 or 8, characterized in that by means of a second optical facility, a correct position of the turned and deposited component is checked and adjusted during or after its transport.

10. Method according to one of the claims 7 – 9, characterized in that the first optical facility is activated with a predefinable time delay after a rotation of the through opening into an optical connection line between the first optical facility and the electronic component still arranged on the substrate.

[emphasis added]

8 Put simply, the Patent describes both a *device* (Claims 1 through 6, with Claims 2 to 6 being dependent claims) *and* a *method* (Claims 7 through 10, with Claims 8 to 10 being dependent claims) in which an optical inspection of a wafer chip, a pickup of a wafer chip, a turning-around and subsequent deposit of the wafer chip all occur within a *single* 180-degree rotation of a *two-headed* pivoting part of the device. At the end of the 180-degree rotation, the device is primed to pick up the next wafer chip in line. *The device alternates between clockwise and anti-clockwise 180-degree rotations of the pivoting pickup heads*. The apparent ingenuity of this device (and method) lies in *its circumventing the need for separate stages for optical inspection and pickup*. *By means of a through opening located transversely between the two pickup heads*, the top-mounted camera inspects the wafer chip below on the substrate – the base material on which semiconductor devices are fabricated – while the pivoting part, picking up another wafer chip simultaneously, rotates through an angle of 90 or 270 degrees. As optical inspection and pickup are *concurrent*, *the cycle time is reduced, resulting in greater productivity*. [note: 2]

9 It was previously thought that since both the camera and the pickup head had to be located directly over the electronic component to carry out their respective tasks (of determining the position/orientation of the component and picking it up after correcting for any offset, respectively), this method required the pickup head to move out of the line of sight of the camera before each and every optical inspection. This was time-consuming. The device and method countenanced in the Patent, however, overcame this difficulty with apparent efficiency as well as elegance. Indeed, as we shall see, it is crucial to the present appeal that:

(a) The Patent operates with two pickup heads – and two pickup heads only.

(b) The Patent alternates between clockwise and anti-clockwise 180-degree rotations of the pivoting pickup heads, thus enabling a through opening located transversely between the two pickup heads that (in turn) facilitates visual inspection of the electronic component below.

It is also important to note that the *combined result* of (a) *and* (b) above – from the important *practical* perspective – is *a much improved overall throughput*. This has, in turn, translated to *significant commercial success as well* – a point that was acknowledged by the Judge (see the GD at [44]), although he correctly pointed out that the commercial success of an invention "alone is not conclusive" as to whether the invention is novel and/or one involving an inventive step (see the GD at [47]). But we are running ahead of the story as these (as well as other) characteristics relating to the Patent will need to be compared with the relevant characteristics in the other patents mentioned below (see [11], and which are relied upon by the Respondent as forming part of the state of the art) in order to ascertain whether or not the Patent is new and/or involved an inventive step.

The decision below

10 After considering the evidence on both sides, in particular, the testimony of two expert witnesses, the Judge found (at [48] of the GD) that:

> … what the [Appellant] has succeeded in inventing is not that described in its patent claims … but a more efficient utilisation of two pick up heads (perhaps by decreasing the size of the rotating parts and improving on the vacuum suction) thereby enhancing the speed of the throughput on its machine.

He further commented (at [45] of the GD) that:

> [a]s time passes, with better equipment, throughput would naturally improve but there is no novelty or inventive step in this.

11 Chief amongst the Judge's considerations was the fact that the Patent appeared to have been anticipated by four prior patents and a machine, as follows:

(a) Advanced Systems Automation Limited's ("ASA") Singapore patent No 104292 dated 30 September 2005, and which relates to a flip chip die bonder ("the ASA Patent");

(b) Matsushita Electric Industrial Co's United States patent No 5,839,187 dated 24 November 1998 ("the Matsushita Patent");

(c) National Semiconductor Corporation's United States patent No 6,364,089 B1 dated 2 April 2002 ("the National Semiconductor Patent");

(d) Kabushiki Kaisha Shinkawa's United States patent No 6,311,391 B1 dated 6 November 2001 ("the Shinkawa Patent"); and

(e) ASA's flip chip die bonder known as the AFC 800, which incorporates the ASA Patent ("the AFC 800").

A short note on terminology is in order at this particular juncture. A die is a small block of wafer, usually a semiconducting material, on which a given functional circuit is fabricated. "Die bonding" is the attachment of the semiconductor die either to its package or to some other substrate. The die is picked from a wafer table, aligned to a target pad on the substrate, and then permanently attached via means of a solder or epoxy bond. This process should be distinguished from that of "die sorting", which merely involves the sorting of good and bad dies or chips on a wafer.

12 Preferring the opinion of the Respondent's expert, Mr John Briar ("Mr Briar"), over that of the Appellant's expert, Associate Professor Tay Meng Leong ("A/P Tay"), with respect to the state of the art as embodied in the patents and machine referred to in the preceding paragraph, the Judge found that the Patent failed on two of the three conditions governing patentable inventions in s 13(1) of the Act (as set out below at [15]), namely, that the invention must be new and must involve an inventive step. In arriving at this conclusion, the Judge was careful to highlight the fact that while Mr Briar had "extensive experience in flip chip packaging technology and equipment development for use in the semi-conductor industry" (the GD at [18]) and possessed "personal knowledge and experience of what the state of the art was at the material time" (the GD at [28]), A/P Tay was not in the semiconductor industry and was unfamiliar with flip chip machines prior to receiving his instructions from the Appellant.

13 The Judge also observed that the crux of the inventive concept in the Patent, *viz*, the "carrying out of vision inspection concurrently during the rotation of the pick up heads and via the through opening between the pick up heads", was already disclosed in the state of the art. Specifically, he noted that (see the GD at [36]):

> [s]uch a concept was already disclosed in the ASA Patent's two head system. Further, such a concept involving four pick up heads was also public knowledge and commonly known to a person skilled in the art, notwithstanding the narrower windows of vision available between each pair of heads. The vision inspection process in the Shinkawa Patent's one head system … is also similar to the one contained in the [Appellant's] patent. There can therefore be no inventive step in having two flipper heads, as further evidenced by the Matsushita Patent and the National Semiconductor Patent.

14 In the circumstances, therefore, the Patent was declared invalid and was accordingly revoked.

The law on patentability

Introduction

15 In order for an invention to be a patentable one, it must satisfy the three conditions laid down in s 13(1) of the Act. These are that:

(a) the invention is new;

(b) it involves an inventive step; and

(c) it is capable of industrial application.

The Respondent maintains on appeal that the Patent should be invalidated as it is lacking in both novelty as well as in an inventive step (*viz*, that conditions (a) and (b) above have not been satisfied).

Novelty

16 The conditions for novelty (or, utilising the statutory language, that the invention concerned is "new") are set out in s 14 of the Act as follows:

> **14**. —(1) An invention shall be taken to be new if it does not form part of the state of the art.
>
> (2) The state of the art in the case of an invention shall be taken to comprise all matter (whether a product, a process, information about either, or anything else) which has at any time before the priority date of that invention been made available to the public (whether in Singapore or elsewhere) by written or oral description, by use or in any other way.
>
> (3) The state of the art in the case of an invention to which an application for a patent or a patent relates shall be taken also to comprise matter contained in an application for another patent which was published on or after the priority date of that invention, if the following conditions are satisfied:
>
> (*a*) that matter was contained in the application for that other patent both as filed and as

published; and

(*b*) the priority date of that matter is earlier than that of the invention.

…

17 In the English Court of Appeal decision of *The General Tire & Rubber Company v The Firestone Tyre and Rubber Company Limited and Others* [1972] RPC 457 ("*General Tire*"), Sachs LJ set out the test for determining the novelty in a patent under s 32(1)(e) of the Patents Act 1949 (c 87) (UK) in the case of anticipation by prior publication as follows (at 485–486):

> … the question whether the patentee's claim is new for the purposes of section 32(1)(e) falls to be decided as a question of fact. If the prior inventor's publication contains a clear description of, or clear instructions to do or make, something that would infringe the patentee's claim if carried out after the grant of the patentee's patent, the patentee's claim will have been shown to lack the necessary novelty, that is to say, it will have been anticipated. The prior inventor, however, and the patentee may have approached the same device from different starting points and may for this reason, or it may be for other reasons, have so described their devices that it cannot be immediately discerned from a reading of the language which they have respectively used that they have discovered in truth the same device; but *if carrying out the directions contained in the prior inventor's publication will inevitably result in something being made or done which, if the patentee's patent were valid, would constitute an infringement of the patentee's claim, this circumstance demonstrates that the patentee's claim has in fact been anticipated*.
>
> … *To anticipate the patentee's claim the prior publication must contain clear and unmistakeable directions to do what the patentee claims to have invented … A signpost, however clear, upon the road to the patentee's invention will not suffice. The prior inventor must be clearly shown to have planted his flag at the precise destination before the patentee*.
>
> [emphasis added]

In other words, in seeking to establish anticipation for the purposes of discounting (or even ruling out altogether) novelty, the directions contained in a prior publication (which constitutes part of the state of the art) must be so clear that following those directions must *inevitably* lead to something that would, if the patentee's patent were valid, infringe the patentee's claim. Sachs LJ's views were endorsed by this court in *Merck & Co Inc v Pharmaforte Singapore Pte Ltd* [2000] 2 SLR(R) 708 ("*Merck & Co Inc*") and in *Genelabs Diagnostics Pte Ltd v Institut Pasteur and another* [2000] 3 SLR(R) 530 ("*Genelabs Diagnostics*") as well as by the Singapore High Court in *Dextra Asia Co Ltd and another v Mariwu Industrial Co (S) Pte Ltd and another suit* [2006] 2 SLR(R) 154 ("*Dextra Asia Co Ltd*") (for related proceedings, see *Mariwu Industrial Co (S) Pte Ltd v Dextra Asia Co Ltd and another* [2006] 4 SLR(R) 807 and *Dextra Asia Co Ltd and another v Mariwu Industrial Co (S) Pte Ltd* [2007] 3 SLR(R) 29). It has further been held in *Genelabs Diagnostics* that the prior publication must "*not only* identify the subject matter of the claim in the later patent" [emphasis added] but must also be an "enabling disclosure" (at [24]). This means that an invention "would be anticipated by a piece of prior art if the teachings disclosed in this prior art *are sufficiently clear and complete to allow the skilled addressee to make the invention*" [emphasis added] (see Ng-Loy Wee Loon in *Law of Intellectual Property of Singapore* (Sweet & Maxwell Asia, Rev Ed, 2009) at para 30.1.38 as well as *SmithKline Beecham Plc's (Paroxetine Methanesulfonate) Patent* [2006] RPC 10, where the House of Lords clarified that the concepts of disclosure and enablement are distinct).

18 And, in the Singapore High Court decision of *Trek Technology (Singapore) Pte Ltd v FE Global*

Electronics Pte Ltd and others and other suits [2005] 3 SLR(R) 389 ("*Trek Technology*") (affirmed by this court in *FE Global Electronics Pte Ltd and others v Trek Technology (Singapore) Pte Ltd and another appeal* [2006] 1 SLR(R) 874 ("*FE Global Electronics*")), Lai Kew Chai J laid down the following principles for determining anticipation by the prior art (at [87]):

> (a) The prior art documents (which contain patent specifications and other literature) must be *construed as if the court had to construe it at the date of publication*, to the exclusion of information subsequently discovered by a reader skilled in the art to which they relate having regard to the state of knowledge in such art at the relevant date. An *ex post facto* analysis is not appropriate. Subsequent events or matters must be disregarded. (*General Tire & Rubber Company v The Firestone Tyre and Rubber Company Limited* [1972] RPC 457 ("*General Tire*") at 485; *Minnesota Mining & Manufacturing Co v Bondina Ltd* [1973] RPC 491 at 522);
>
> (b) *The court must not combine or "mosaic" disparate pieces of prior art in order to arrive at the invention in question. Each document should be considered separately;* and
>
> (c) The reader skilled in such art is *a person of competent but average technical skill, who is unimaginative*.
>
> [emphasis added]

In conjunction with the observations of Sachs LJ in *General Tire*, the principles set out by Lai J above are instructive in resolving the question of fact as to whether or not an invention may be considered "new" for the purposes of s 14 of the Act.

Inventive step

19 Section 15 of the Act defines an "inventive step" by stating that "[a]n invention shall be taken to involve an inventive step if it is not obvious to a person skilled in the art". In the Singapore High Court decision of *Ng Kok Cheng v Chua Say Tiong* [2001] 2 SLR(R) 326 ("*Ng Kok Cheng*"), Judith Prakash J observed as follows (at [16]):

> The English Court of Appeal had a useful discussion on the ideas of obviousness and inventive concept in *Mölnlycke AB v Procter & Gamble* [1994] RPC 49. The judgment of the court given by the Vice-Chancellor, Sir Donald Nicholls referred to the UK Patents Act 1977 ("the UK Act") on which our own Patents Act is substantially based and stated that the UK Act was a statutory code which was passed to establish a new law of patents, to amend the law and to give effect to certain international conventions, most importantly, the European Patent Convention of 1973 (at p 111). The following passages from the judgment are instructive:
>
> > … We do not consider that it assists to ask whether 'the patent discloses something sufficiently inventive to deserve the grant of a monopoly'. Nor is it useful to extract from older judgments expressions such as 'that scintilla of invention necessary to support a patent'. The statute has laid down what the criterion is to be: it is a qualitative not a quantitative test … [at p 112 lines 40–49]
> >
> > *The Act requires the court to make a finding of fact as to what was, at the priority date, included in the state of the art and then to find again as a fact, whether, having regard to that state of the art, the alleged inventive step would be obvious to a person skilled in the art*. [at p 113 lines 2–6]

In applying the statutory criterion and making these findings the court will almost invariably require the assistance of expert evidence. *The primary evidence will be that of properly qualified expert witnesses who will say whether or not in their opinions the relevant step would have been obvious to a skilled man having regard to the state of the art. All other evidence is secondary to that primary evidence*. In the past, evidential criteria may have been useful to help elucidate the approach of the common law to the question of inventiveness. Now that there is a statutory definition, evidential criteria do not form part of the formulation of the question to be decided. [at p 113 lines 8–15]

…

Although formulated with reference to the Patents Act 1949, the analysis of Oliver LJ in *Windsurfing International v Tabur Marine* [1985] RPC 59 at 73 continues to provide assistance. There are four steps:

(*1*) *What is the inventive step said to be involved in the patent in suit?*

(*2*) *What was, at the priority date, the state of the art (as statutorily defined) relevant to that step?*

(*3*) *In what respects does the step go beyond, or differ from, that state of the art?*

(*4*) *Having regard to such development or difference, would the taking of the step be obvious to the skilled man?* [at p 115 lines 1–14]

…

The burden of proof is upon the person attacking the validity of the patent to show that no inventive step was involved. It is therefore for him to make out the case of obviousness and prove it by appropriate expert evidence. Accordingly in any given case it will be for that person to marshal and prove those aspects of the state of the art which he alleges make the relevant step obvious. The matter will come before the court on the basis of certain allegations which have to be used for the purposes of deciding upon the answer to the second and third questions posed above. [at p 115 lines 21–25]

[emphasis added]

20 The four-step test for inventiveness espoused in the English Court of Appeal decision of *Windsurfing International Inc v Tabur Marine (Great Britain) Ltd* [1985] RPC 59 ("the *Windsurfing* test") provides a structured approach to resolving what would be an otherwise vague inquiry, and has been followed and applied in numerous cases, both foreign as well as domestic. As set out in *Trek Technology* (at [94]), the *Windsurfing* test may be formulated as follows:

(a) Identify the inventive concept embodied in the patent in suit.

(b) The court then assumes the mantle of the normally skilled but unimaginative addressee in the art at the priority date, imputing to him what was, at that date, common general knowledge in the art in question.

(c) Identify what, if any, differences exist between the matter cited as being "known or used" and the alleged invention.

(d) The court then asks itself the question whether, viewed without any knowledge of the alleged invention, those differences constitute steps which would have been obvious to the skilled man or whether they require any degree of invention.

It should be noted that the reference to "common general knowledge" in (b) above does itself raise difficulties which were noted by this court in *First Currency Choice Pte Ltd v Main-Line Corporate Holdings Ltd and another appeal* [2008] 1 SLR(R) 335 ("*First Currency Choice Pte Ltd*") at [38]–[41] (for related proceedings, see the Singapore High Court decisions of *Main-Line Corporate Holdings Ltd v Overseas Bank Ltd and another* [2008] SGHC 55, *Main-Line Corporate Holdings Ltd v United Overseas Bank Ltd and another (First Currency Choice Pte Ltd, third party)* [2010] 1 SLR 189 and *Main-Line Corporate Holdings Ltd v United Overseas Bank Ltd and another* [2009] SGHC 212), but which do not arise in the context of the present appeal (*cf* also the proposed solution proffered by Ng-Loy Wee Loon in *Law of Intellectual Property of Singapore* at para 30.1.47). It should also be noted that whilst the various criticisms of the *Windsurfing* test itself were acknowledged by this court in *First Currency Choice Pte Ltd*, V K Rajah JA, who delivered the judgment of the court observed (at [44]) that "[n]onetheless, the *Windsurfing* test … appears to be here to stay". Indeed, Rajah JA was of the view that the *Windsurfing* test could also prevent erroneous *ex post facto* reasoning (see also [101] below). He also proceeded to add thus (at [44]):

> … When all is said and done, the *Windsurfing* approach has its advantages. The first three steps of this test lay the ground work for the final question – which is ultimately the only critical question – namely: Is the alleged invention obvious? … As aptly pointed out by Neuberger J in *DSM NV's Patent* [2001] RPC 35 at [58]:
>
> > By adopting the structured approach, one ensures that there is a measure of discipline, reasoning and method in one's approach. Indeed, it helps to ensure that there is consistency of approach in different cases involving the issue of obviousness.

However, Rajah JA also sought (bearing in mind the various criticisms of the *Windsurfing* test) to bring some practical balance to this test by observing as follows (at [45]):

> Be that as it may, simplicity is certainly to be appreciated, and, in assessing the obviousness of an alleged invention, it may sometimes suffice in straightforward cases to refer to the test formulated by Lord Herschell in Vickers, Sons And Co, Limited v Siddell (1890) 7 RPC 292, where he stated (at 304) that an invention lacked an inventive step if what was claimed was "so obvious that it would at once occur to anyone acquainted with the subject, and desirous of accomplishing the end". Quite often, it is difficult, in practice, to break down the Windsurfing test … into its component parts. Thus, while the Windsurfing test remains a useful guide, it is no more than that. Above all, it should be borne in mind that the Windsurfing test is merely a manifestation of judicial inventiveness on how best to pragmatically interpret and elucidate the requirements of s 15 of the Act.

21 In so far as the concept of the "notional skilled person" is concerned, Rajah JA made the following observations in *First Currency Choice Pte Ltd* (at [28]):

> **The notional skilled person with the common general knowledge of the art**
>
> 28 As stated above, the "audience" whom the patentee is addressing is the person skilled in the art (*per* Lord Hoffman in *Kirin-Amgen* [[2005] RPC 9] at [33]; *FE Global Electronics* [[2006] 1 SLR(R) 874] at [14]). As a general rule, the notional 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 (*per* Laddie J in *Pfizer Ltd's Patent* [2001] FSR 16 at [62]–[63]). His level of skill will depend on the scope of the subject matter of the patent in question (see *Dyson Appliances Ltd v Hoover Ltd* [2001] RPC 26 ("*Dyson v Hoover*") at [30]). The notional skilled person is, thus, usually defined according to the qualities which he possesses. As stated in *McGhan Medical UK Limited v Nagor Limited* Case No CH 1999 1720 (28 February 2001) at [23]–[24] and followed in *Ng Kok Cheng v Chua Say Tiong* [2001] 2 SLR(R) 326 at [21]:

> This notional person is deemed to possess the common general knowledge of the subject matter in question. It is through the eyes of the skilled addressee that the [p]atent will fall to be interpreted. And it is by the standards of this person that the question of inventive step is to be judged when this topic is addressed in the counterclaim.
>
> A patent is addressed to persons who are likely to have a practical interest in its subject matter or to act on the directions given in it for it to be put into practice. *The addressee is deemed to be unimaginative and uninventive but is equipped nevertheless with a reasonable degree of intelligence and with a wish to make the directions in the patent work*.

The approach taken by the notional skilled person in construing the claims in a patent specification has been broadly described in the following practical terms (see *Kirin-Amgen* [[2005] RPC 9] at [33]):

> [H]e reads the specification on the assumption that its purpose is ... both to describe and to demarcate an invention – a practical idea which the patentee has had for a new product or process – and not to be a textbook in mathematics or chemistry or a shopping list of chemicals or hardware. It is this insight which lies at the heart of "purposive construction".

[emphasis added]

For the purposes of steps (b) and (d) of the *Windsurfing* test for obviousness (see [20] above), the court should therefore assume the mantle of *only* a skilled but unimaginative addressee. Care must be taken not to either go beyond or fall short of this rather nuanced standard as set out above.

Patent construction

22 The courts have consistently endorsed adopting a "purposive construction" of patent claims so as to determine the essential features of any particular invention. This approach received judicial affirmation in the seminal decision of the House of Lords in *Catnic Components Limited and Another v Hill & Smith Limited* [1982] RPC 183, where Lord Diplock observed as follows (at 242–243):

> [A] patent specification is a unilateral statement by the patentee, in words of his own choosing, addressed to those likely to have a practical interest in the subject matter of his invention (i.e. "skilled in the art"), by which he informs them [of] what he claims to be the essential features of the new product or process for which the letters patent grant him a monopoly. It is those novel features only that he claims to be essential that constitute the so-called "pith and marrow" of the claim. A patent specification should be given a purposive construction rather than a purely literal one derived from applying to it the kind of meticulous verbal analysis in which lawyers are too often tempted by their training to indulge.

23 This approach was reiterated more recently in the (also) House of Lords decision of *Kirin-Amgen Inc v Hoechst Marion Roussel Ltd* [2005] RPC 9 ("*Kirin-Amgen*") as constituting the bedrock of all

patent construction. Lord Hoffmann elaborated on this principle (at [32]) as follows:

> Construction, whether of a patent or any other document, is of course not directly concerned with what the author meant to say. There is no window into the mind of the patentee or the author of any other document. Construction is objective in the sense that it is concerned with what a reasonable person to whom the utterance was addressed would have understood the author to be using the words to mean. Notice, however, that it is not, as is sometimes said, "the meaning of the words the author used", but rather what the notional addressee would have understood the author to mean by using those words. The meaning of words is a matter of convention, governed by rules, which can be found in dictionaries and grammars. *What the author would have been understood to mean by using those words is not simply a matter of rules. It is highly sensitive to the context of, and background to, the particular utterance. It depends not only upon the words the author has chosen but also upon the identity of the audience he is taken to have been addressing and the knowledge and assumptions which one attributes to that audience*. [emphasis added]

24 This sensible approach has also been adopted by this court in *FE Global Electronics*, where it was held (at [14]) that the purposive construction of patent claims was preferred as "it balance[d] the rights of the patentee and those of third parties" (see also the decision of this court in *First Currency Choice Pte Ltd* (at [25]–[26]) as well as the Singapore High Court decision of *Merck & Co Inc v Pharmaforte Singapore Pte Ltd* [1999] 3 SLR(R) 1072 ("*Merck & Co Inc (1)*") at [54] (affirmed by this court in *Merck & Co Inc*)). A purposive construction of the claims would give the patentee the full extent, but no more than the full extent, of the monopoly which a reasonable person skilled in the art, reading the claims in context, would think that he (the patentee) was intending to claim.

25 Clearly then, the starting point in patent construction is to ask the following threshold question: What would the notional skilled person have understood the patentee to mean by the use of the language of the claims? This question, however, is difficult to answer without first coming into possession of the knowledge that a notional skilled person would have. Accordingly, a brief excursion through the state of the art, as referred to above (at [11]), is necessary. However, a preliminary objection concerning the novelty of the ASA Patent must be dealt with first.

A preliminary objection: Did the ASA Patent form part of the state of the art having regard to ss 14(2) and (3) of the Act?

26 Before proceeding to set out what the state of the art was in the context of the present appeal *vis-à-vis* the requirements in relation to both novelty as well as an inventive step, it would be useful to set out the relevant parts of s 14 once more. Sections 14(2) and (3) of the Act provide as follows:

> (2) The state of the art in the case of an invention shall be taken to comprise all matter (whether a product, a process, information about either, or anything else) which has at any time before the priority date of that invention been made available to the public (whether in Singapore or elsewhere) by written or oral description, by use or in any other way.
>
> (3) The state of the art in the case of an invention to which an application for a patent or a patent relates shall be taken also to comprise matter contained in an application for another patent which was published on or after the priority date of that invention, if the following conditions are satisfied:
>
> (*a*) that matter was contained in the application for that other patent both as filed and as

published; and

(*b*) the priority date of that matter is earlier than that of the invention.

27 Indeed, the provisions just set out in the preceding paragraph are especially relevant in the context of a preliminary objection raised by counsel for the Appellant, Dr Stanley Lai ("Dr Lai"), to the effect that the ASA Patent did not, on a proper construction of ss 14(2) and (3) of the Act, even form part of the state of the art to begin with. Let us now turn to the detailed argument itself, commencing with the relevant factual background.

28 The ASA Patent was published on 21 June 2004 and was granted in September 2005. All this took place *after* the Patent's priority date of 16 February 2004. *However*, the *priority date* for the ASA Patent was on 7 January 2002. In other words, while the ASA Patent was *published after* the priority date of the Patent, it had been *filed before* that same priority date.

29 Section 14(3) of the Act makes it clear that the state of the art in relation to the Patent comprises matter contained in an application for another patent (*ie*, the ASA Patent) which was published *on or after* the priority date of the Patent, *if both* conditions in ss 14(3)(*a*) *and* (*b*) of the Act are met. The condition in s 14(3)(*b*) of the Act is easily met in the context of the present appeal: the priority date for the ASA Patent was earlier than the priority date for the Patent. It is, however, less clear whether the requirements in s 14(3)(*a*) of the Act have been met. It is to this particular issue that our attention now turns.

30 The Appellant argued that the Respondent had failed to satisfy the requirement that the subject matter impugning the novelty of the Patent was contained in the application for the ASA Patent *as filed and as published*, pursuant to s 14(3)(*a*). It contended that the burden lay on the Respondent to demonstrate that all the requirements of s 14(3)(*a*) had been met, since it was the Respondent who was asserting that the ASA Patent was part of the state of the art.

31 In particular, the Appellant argued that in order to qualify to be considered as prior art under s 14(3)(*a*), the Respondent had to demonstrate that what was *published* under the ASA Patent corresponded *exactly* to what was *filed* for that same patent. This, however, the Respondent had apparently failed to do.

32 With respect, this particular argument is extremely technical in nature. More importantly, it appears to discount the fact that s 14(2) of the Act already provides (by way of an *alternative, and no less efficacious*, "route", so to speak) that the state of the art includes "all matter … which has at any time before the priority date of [the Patent] been made available to the public (*whether in Singapore or elsewhere*) by *written or oral description*, by use or in any other way" [emphasis added]. Under s 14(2), therefore, the ASA Patent would have already been considered as well as classified as prior art, given the *international publication date* of its Patent Cooperation Treaty ("PCT") application on 17 July 2003. We pause here to note the Appellant's attempt to curtail reliance on s 14(2) on the basis that it had not been raised in the court below. Even assuming that this was the case, the nature of the argument is such that it ought to be considered by this court and would not, in any event, entail any adduction of further evidence of any kind (see also generally the decision of this court in *Panwah Steel Pte Ltd v Koh Brothers Building & Civil Engineering Contractor (Pte) Ltd* [2006] 4 SLR(R) 571).

33 We do not, with respect, consider the Appellant's objections to the effect that "[t]he Respondent has not satisfied proving that the PCT Application meets the publication requirement under the Act" [note: 3] to be persuasive. While the PCT system does not grant full patent protection

in the same way that a national patent would, it is well-known that PCT applications, once lodged, are subject to search, examination and challenge. The PCT system permits the suspension – for up to 18 months – of national or regional filing procedures while the inventor refines and assesses the prospects of his patent. Such suspension, and the corresponding delay in national registration, would only make sense if the inventor is assured of the priority of his invention.

34 In any event, during and after publication of a PCT application, written descriptions are made available to the public – whether in Singapore or elsewhere – in line with the stipulations in s 14(2). It is perhaps useful to note at this juncture that in *FE Global Electronics*, a published PCT application, filed by the Lexar Corporation, was considered sufficient to constitute prior art for the purposes of assessing novelty. Another PCT application in the same case, subsequently converted to a domestic Singapore patent, was also considered by this court to form part of the state of the art.

35 It is also noteworthy that the Appellant filed its own PCT application for the Patent on 31 January 2005, almost one and a half years later than ASA's PCT application.

36 Returning to the Appellant's concerns centring on s 14(3)(*a*) and relating to the possible non-correspondence of matters *filed* against matters *published* (see [31]–[32] above), we are of the view that this is something that can be easily verified, even by the court, by retrieving the relevant records and effecting the necessary comparisons. However, there is no necessity to adopt this particular course of action in the context of the present appeal (or, indeed, to even contemplate utilising s 14(3) in the first place), given the applicability of s 14(2) as noted above. That having been said, and although there is no necessity for us to express a concluded view on this particular argument, it would appear that, adopting an approach that looks more to the substance rather than the form, there is some doubt as to whether such an argument would be persuasive in the light of the views we expressed at the commencement of this particular paragraph.

37 With respect to the state of the art for an *inventive step*, s 15 states as follows:

> **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)* [emphasis added].

38 Accordingly, given the operation of s 14(2), *regardless* of the applicability of s 14(3), the Appellant cannot avail itself of the arguments contained in the preliminary objection for the purposes of assessing the state of the art under s 15.

39 Before we turn to consider what the state of the art in the context of the present appeal in fact was (which will set the appropriate backdrop required for considering the two legal issues in this appeal, *viz*, whether or not the Patent is new (or novel) and whether or not it involved an inventive step – both of which the Judge held were absent, thus resulting in (as we have already recounted above) judgment in favour of the Respondent in the court below), we would like to address two important preliminary points which, albeit more general in nature, are not only germane to the present appeal but also have wider implications for other cases as well. The first preliminary point relates to the role of logic and legal argument in the context of patent disputes or, to be more precise, what ought to be *avoided* by counsel in relation to such disputes and (as we shall see) in relation to any other dispute in any other area of the law for that matter. The second preliminary point relates to the role of expert evidence, which evidence is almost invariably (and understandably) adduced in the context of patent disputes. Let us turn, then, to each of these preliminary points *seriatim* before proceeding to consider the particular issues and facts that are raised in the context of the present appeal.

A first preliminary point: the importance of logic and rational argument as well as the danger of over-generalisation and over-abstraction

40 The present appeal illustrates the very important *general* point to the effect that no area of the law (including that relating to patents) is exempt from the general principles of logic and rational argument. Indeed, this point is so obvious that it is often taken for granted. In this appeal, it is illustrated (especially during oral submissions before this court) by the argument by counsel for the Respondent, Mr Foo Maw Shen ("Mr Foo"), that, because the use of pick up heads was nothing new and (more importantly) because his client's patents had, in fact, more pick up heads, the Appellant's claim that the Patent was novel and embodied an inventive step must fail. Such an argument is, at first blush, admittedly persuasive. However, it is our view that Mr Foo (albeit unintentionally) has pitched the argument on behalf of his client at *too high a level of abstraction* (reference may also be made, in this regard, to the interesting paper by Tun-Jen Chiang, "*The Levels of Abstraction Problem in Patent Law*" George Mason University Law and Economics Research Paper No 09-33 <http://ssrn.com/abstract id=1434465> (accessed 12 January 2010), exploring the "correct" level of abstraction in view of the tug-of-war between a patentee's claim to a broader level of abstraction (to promote incentives) and limiting the patentee to specific embodiments (to reduce the monopoly cost of each patent)). Put simply, whilst the proposition advanced is not factually incorrect, it does not include that degree of specificity which is required under the particular principles embodied in the current law (as to which see generally [15]–[25] above). Indeed, if Mr Foo's argument is correct, *any* novelty and/or further inventive step would, literally, be (virtually, if not wholly) *impossible*. A moment's reflection would reveal that this is incorrect simply because it is *always possible* for there to be novelty and/or a further inventive step – particularly if we view the inquiry from a *qualitative* point of view. Everything would depend, in the final analysis, on the particular facts and (more importantly) the impact (if any) that the patent concerned has on the existing state of the art in that particular sphere. Indeed, one of the Respondent's arguments, as we have just seen, centred really on the *quantity* of pick up heads, rather than (as we think ought to be the case) *the overall qualitative difference (if any) between the Patent on the one hand and the patents relied on by the Respondent on the other*.

41 It is important to emphasise, at this juncture, that the use of the general principles of logic and rational argument do *not*, in any way whatsoever, undermine the *legal* principles that are germane to a particular area of the law (in this case, that relating to patents). Indeed, on one view, the legal principles themselves are the product – in part at least – of the process of logic as well as rational argument. It is no surprise, therefore, that the application and/or development of general principles of logic and rational argument must (as we shall see) be *integrated with* the particular legal principles as well. In other words, the general principles of logic and rational argument and the particular legal principles (here, in relation to the patent law) are *complementary* in nature.

42 Turning, then, to the perspective of general principle and logic, there is an irreducible tension between universality and particularity (or, to use equally clear terminology, between generality and specificity; *cf* also the decision of this court in *Spandeck Engineering (S) Pte Ltd v Defence Science & Technology Agency* [2007] 4 SLR(R) 100 at [28] (in the context of liability in negligence for pure economic loss)). However, as we shall see, this is not a tension that necessarily leads to paralysis or inaction; on the contrary, it (as we shall attempt to demonstrate in a moment) is, in fact, mediated via an *interactive process* that defines what the law and decision-making are all about in the *practical* sphere. Indeed, the unique combination (or, perhaps more appropriately, integration) of the universal and particular, of the general and the specific, and of the normative and the descriptive, produce not only decisions for the case at hand but also precedents for the future.

43 To elaborate, when an argument is pitched at too high a level of abstraction, it will probably

attract no controversy (and may even achieve consensus) but, because it is at such a "rarefied" level, it is actually unhelpful in most cases (for example, virtually all persons will agree that it is desirable to "do good", but, of course, once we descend into the *specifics* (*ie*, what "doing good" means to each person), the opposite extreme will be reached, with little (if any) agreement amongst all concerned). Indeed, such an approach is *especially* unhelpful in cases involving *patents*, simply because, in many cases (such as this), a necessary step involved in the court's decision entails a *comparison* of the competing patents. At this point, *specific details* must *necessarily* come into play. However, it is also acknowledged that the court cannot go to the other extreme in focusing only on the trees and missing the wood. This is, however, unlikely to happen in practice because the court must perforce come to *an overall conclusion*, and that would entail gathering together all the relevant (and *specific*) details *and analysing* them in the context of the applicable legal rules and principles *before* arriving at *an overall conclusion*. Here, we see the *interaction* between the universal and the particular, between generality and specificity, as well as between the descriptive and the normative. It is *not* something which can be reduced to a mechanistic formula simply because life in general and the decisions of courts (as a consequence) in particular are too complex to admit of a rigid formulaic approach. However, that does not mean that there are no *general principles* that ought to guide the court. As already mentioned, there are, of course, the general principles of logic and argumentation. More importantly, each area (as well as sub-area) of the law will also embody general legal rules and principles which are to be applied to the facts at hand. In the specific sphere of patent law, we would think that, in addition to the general legal rules and principles (embodied in ss 13, 14 and 15 of the Act; see also generally [15]–[25] above), the court would *also need to apply* those rules and principles (as well as those relating to general logic and argumentation) to the *specific claims which are contained within the patent(s) concerned*. Indeed, these claims constitute the *specific factual matrix as well as context* which the court takes into account in arriving at its decision. Again, however, it is of the first importance to emphasise that this is an *interactional* process that is not susceptible of mechanical application. Put crudely, it entails *an exercise of judgment by the court concerned in applying the general principles of law as well as logic to the facts concerned, and as understood in the context in which they occur*.

A second preliminary point relating to the role of expert evidence

44 The difficulties engendered by the issue of *bias* with regard to experts for the respective parties are, unfortunately, perennial in nature. Indeed, in the Singapore High Court decision of *Khoo Bee Keong v Ang Chun Hong and another* [2005] SGHC 128, this difficulty, amongst others, was referred to, as follows (at [68] and [82]–[87]):

> 68 It is important to ascertain what precisely constituted the *basis* for the respective expert reports (and see generally Jeffrey Pinsler, *Evidence, Advocacy and the Litigation Process* (LexisNexis, 2nd Ed, 2003) at pp 185–187, 553–554 and 646–647; *Halsbury's Laws of Singapore* … at paras 120.256 and 120.258; *Sarkar's Law of Evidence* (Wadhwa and Company, 15th Ed, 1999), vol 1 at pp 878–880; *Sir John Woodroffe & Syed Amir Ali's Law of Evidence* (LexisNexis Butterworths, 17th Ed, 2002), vol 2 at pp 2520–2530; Tristram Hodgkinson, *Expert Evidence: Law and Practice* (Sweet & Maxwell, 1990) at pp 136–138; and Ian Freckelton & Hugh Selby, "The Basis Rule" in Ian Freckelton & Hugh Selby, *The Law of Expert Evidence* (LBC Information Services, 1999) at ch 5; and see, by the same authors, *Expert Evidence* vol 1 (The Law Book Company Limited, Looseleaf Ed, 2001) at ch 11). It is both logical and commonsensical that if the basis or starting-point is either shaky or (worse still) flawed, the conclusion arrived at will be of little or no use to the court. Indeed, if there is in fact something untoward in the starting-point, even the most impeccable reasoning process will be of no avail in so far as the quest for a fair and just result is concerned. This principle is of particular importance with respect to expert reports generally – and especially in the present context of traffic accidents. Unfortunately,

however, the general provisions with respect to expert evidence, ss 47 and 48 of the Evidence Act (Cap 97, 1997 Rev Ed), do not furnish us with specific guidance in this particular regard.

…

82 There are also *other* more general – yet no less intractable – difficulties with regard to expert evidence generally. One has been hinted at, but is in fact an extremely pressing problem and ought therefore to be mentioned. It would surprise no one. It relates to the alleged bias on the part of the expert concerned. It would surprise no one simply because, apart from court-appointed experts, every expert is appointed (and remunerated) by the party who has engaged his or her services. It is true that the expert concerned has, in the final analysis, an overriding duty to objective justice and to the court (see, for example, the oft-cited observations by Lord Wilberforce in the House of Lords decision of *Whitehouse v Jordan* [1981] 1 WLR 246 at 256–257). The principle just mentioned is now embodied, in the local context, in O 40A r 2 of the Rules of Court, as follows:

> **Expert's duty to the Court (O. 40A, r. 2)**
>
> **2**.—(1) It is *the duty* of an expert *to assist the Court* on the matters within his expertise.
>
> (2) This duty overrides any obligation to the person from whom he has received instructions or by whom he is paid.
>
> [emphasis added]

Reference may be made, in addition, to O 40A r 3(2)(*h*) as well as the views of V K Rajah JC (as he then was) in the Singapore High Court decision of *Vita Health Laboratories Pte Ltd v Pang Seng Meng* [2004] 4 SLR 162 at [79]–[90].

83 All this is only to be expected as "[e]xpert witnesses are in a privileged position; indeed only experts are permitted to give an *opinion* in evidence" [emphasis in original] (*per* Cazalet J in the English decision of *Re J (Child Abuse: Expert Evidence)* [1991] FCR 193 at 226. To this end, the duties of experts have been set out in detail in many cases. Perhaps one of the most detailed formulations is that by Cresswell J in the English High Court decision of *The Ikarian Reefer* [1993] 2 Lloyd's Rep 68 at 81–82, which was endorsed (with one modification) on appeal: see *per* Stuart-Smith LJ, delivering the judgment of the English Court of Appeal in *The Ikarian Reefer* [1995] 1 Lloyd's Rep 455 at 496. Indeed, Cresswell J's formulation has been described as "[t]he most important enunciation of the duties and responsibilities of expert witnesses" (see Freckelton & Selby, *The Law of Expert Evidence* ([68] *supra*) at p 594).

84 However, one cannot be faulted for taking the views just expressed, with respect to an expert's duty to the court and to justice, with the proverbial pinch of salt, especially when one views this proposition through the lenses of practical reality. Not surprisingly, therefore, this datum difficulty is almost always referred to in the literature and the case law which it cites (see, for example, Jeffrey Pinsler, "Expert's Duty to be Truthful in the Light of the Rules of Court" (2004) 16 SAcLJ 407 and, by the same author, *Evidence, Advocacy and the Litigation Process* ([68] *supra*) at p 650; *Sir John Woodroffe & Syed Amir Ali's Law of Evidence*, vol 2 ([68] *supra*), especially at pp 2354–2355; and Anthony Kenny, "The Expert in Court" (1983) 99 LQR 197 at 214). It has also been pointed out that "the Court may be induced to believe the expert who has succeeded in putting forward his views in the most persuasive and plausible manner" (see H A Hammelmann, "Expert Evidence" (1947) 10 MLR 32 at 34). This poses no real difficulty if the

expert concerned has, *in fact*, a persuasive case. However, where he or she does not, the intensity surrounding problems of bias (already undesirable in themselves) is driven home – in spades.

85 The real and effective solution to the difficulties centring on the alleged bias of experts probably lies in the sphere of the extra-legal and this, in itself, reflects, once again, the almost natural intractability that especially characterises the law relating to expert evidence.

86 The second related difficulty also relates more specifically to the expert himself or herself (and see generally *Halsbury's Laws of Singapore* [vol 10 (Butterworths Asia, 2000)] at para 120.259). And that is the issue of the respective *qualifications* of the expert. For example, counsel for the defendants in the present case focused on the fact that PW4 did not have any certificates but was, rather, mentored by what appeared then to be the only accredited accident reconstructionist in Singapore. DW7, on the other hand, is an accredited reconstruction expert (under the US National Highway Traffic Safety Administration) and had approximately two years of working experience. Certificates are of course not imperative (see the oft-cited Singapore Court of Criminal Appeal decision of *Leong Wing Kong v PP* [1994] 2 SLR 54 at 59, [15]). Further, given the relative "simplicity" of the facts involved in the present case, I was unable to ascertain whether or not formal accreditation did in fact make a significant difference. What appears clear, however, is that, as with the situation with respect to the *techniques* of accident reconstruction, there is much room for the development (in tandem) of methods of upgrading *the expertise* of practitioners in this particular field.

87 All the issues canvassed above – and more besides – point to the fact that the area of expert evidence generally is in need of re-examination. Fortunately, none of the issues raised had any impact on the resolution of the present proceedings. This was due, as already mentioned, to the fact that the case was a relatively straightforward one, where the expert evidence proffered was not (unfortunately) particularly helpful … However, Singapore is not the only jurisdiction where a review might be necessary. Significantly, the New South Wales Law Reform Commission's Issues Paper entitled *Expert witnesses* (IP 25, November 2004) refers (at para 1.2) to the "*world-wide* reassessment and change relating to the management of court business generally and expert witnesses in particular" [emphasis added].

[emphasis in original]

45 The issue of the need for *review* in this area of the law referred to in the last paragraph of the passage quoted in the preceding paragraph was also alluded to by counsel for the Appellant, Dr Lai. Dr Lai emphasised that the issue in relation to the possible (or even probable) bias of experts is an especially significant one in patent cases and suggested that a new system involving impartial *assessors* might be a possible solution. The special difficulties just mentioned might well be the case, given the very nature of the inquiry in such cases, in which the court also often does not possess the requisite technical expertise. However, it is obviously also significant with respect to all other areas of the law as well. In the meantime, however, it may well be wise and prudent for the parties concerned in future cases (especially of this nature) to apply to the court to appoint an impartial and objective expert (whose views they would agree to abide by) pursuant to O 40 r 1 of the Rules of Court (Cap 322, R 5, 2006 Rev Ed) (which permits the court to appoint one or more independent experts on the application of any party which, under O 40 r 1(2) "shall, if possible, be a person agreed between the parties and, failing agreement, shall be nominated by the Court"). It should, however, also be noted that this same Rule also permits the court to appoint one or more independent experts "on its own motion", although, in the nature of things (particularly in patent disputes), this particular avenue will probably prove to be less than practical.

46 Returning to this particular appeal, we note that one of the Appellant's main arguments centred on the alleged bias on the part of Mr Briar. In particular, Dr Lai noted that he was *one of the actual inventors of the machine which constituted the subject matter of the Respondent's (and, more importantly, opposing) patent*. Indeed, he argued, the Judge appeared to accept *wholly* this particular expert's views without more (*cf* also [12] above).

47 However, as was observed in the Singapore High Court decision of *Asia Hotel Investments Ltd v Starwood Asia Pacific Management Pte Ltd* [2007] SGHC 50 at [206]–[207], for the purposes of determining whether the evidence of an expert should be discounted, the relevant test is one of *actual* partiality, rather than merely the *appearance* of partiality. In any event, however, there is insufficient evidence on the record to demonstrate that the Judge did not discount the views of Mr Briar accordingly. The mere acceptance (even in its entirety) of such views does *not necessarily* entail the *absence* of such a discount. As it turns out, however, it is clear (for reasons that will be elaborated upon below) that the views by the experts appointed by *both* parties were *not*, in our view, *critical*, *except* in so far as they enabled this court to understand what were the precise claims in the respective patents. To this end, *both* the experts' views were helpful, bearing in mind that it is, in the final analysis, *the court* which decides whether or not the requisite legal criteria have (or have not) been satisfied. It should also be borne in mind that the expert evidence is – in so far as the issues as to whether the Patent is novel and/or whether an "inventive step" exists *vis-à-vis* the state of the art – itself subject to the legal criteria contained in ss 14 and 15 of the Act, respectively (as well as the accompanying legal rules and principles).

48 In particular, the court must bear in mind the fact that the legal criteria just set out in the preceding paragraph does *not* (in the context of whether there is an inventive step within the meaning of s 15) assume knowledge and expertise that goes *beyond* what a *reasonable* person "skilled in the art" would possess (see also [21] above as well as *FE Global Electronics* (at [22])). This is not an unimportant practical point, simply because many experts would *not themselves* fall within this particular category of persons "skilled in the art" as they would possess *extraordinary* knowledge as well as expertise. It is therefore important for such experts to bear this particular point in mind when they tender their evidence before the court in future. It would also be wise for counsel (and, if necessary, the court) to remind the experts concerned of this point if they appear to have forgotten it.

The state of the art described

49 In light of the Appellant's (not unwarranted) contention that "significant portions of the [Judge's] grounds of decision originate from the evidence of the Respondent's expert [*ie*, Mr Briar]" [note: 4] (see also [12] and [46] above), care will be taken here to describe each and every piece of prior art as objectively and neutrally as possible.

The ASA Patent and the AFC 800

50 The ASA Patent [note: 5] (see Appendix B) is described in its certificate as a "flip chip bonder and method therefor". [note: 6] Essentially, it is a wafer chip bonding apparatus comprising a rotating pickup turret "having a *plurality* of pick-up heads, wherein each of the plurality of pick-up heads is adapted for picking at least one component having a picking orientation" [note: 7] [emphasis added]. This is different from the Patent, which specifically lays out its requirement for two *and only two* rotating pickup heads (see also [9] above).

51 In the ASA Patent, it is mentioned that there is an optically assisted pick-and-place system for

inspecting the wafer chips, but few details are provided. In particular, *specific* instruction as to concurrent pickup and inspection is *not* alluded to. At p 7 of that patent, it is only stated as follows: [note: 8]

> Optically assisted pick and place systems, as will be known to one skilled in the art, *may* be employed to determine the location and orientation of the die 107 on the movable wafer mount 105. The output of such optically assisted pick and place systems that employ optical detectors can then be provided to the movable wafer mount 105. The movable wafer mount 105 then moves to align the particular die 107 with the pick-up location. *Further elaboration on optically assisted pick and place systems, will not be provided here, except to the extent that such elaboration facilitates a better understanding of the present invention, as described*. [emphasis added]

This is repeated at pp 11–12 of the patent. [note: 9]

52 The idea of using two heads for the pick-up turret assembly is mentioned in the ASA Patent, but in a negative, "teaching away", sense: [note: 10]

> Although a pick-up turret assembly 110 with two heads mounted opposite each other may be employed, the distance of travel of a die from the pick location to the transfer location through an angle of one hundred and eighty degrees and the short time travel time to meet the required throughput, *poses the risk of a picked die flying off a pick-up nozzle due to centrifugal force thereon. The four-head arrangement reduces the distance of travel of the dies for a given throughput, thus reducing this risk*. It will be appreciated by one skilled in the art that different die sizes and throughput requirements, may result in a pick-up assembly with more than four heads. [emphasis added]

53 It is also significant to note that the ASA Patent also envisages an increased throughput (this is stated right at the outset of the patent itself [note: 11]), much like the Patent does. In the case of the ASA Patent, however, the increased throughput is: [note: 12]

> … accomplished by a pick-up turret and a placing turret, each turret having multiple nozzles. The pick-up and placing nozzles are synchronized so that each pick-up nozzle picks and flips dies, and concurrently each placing nozzle picks a flipped die from a pick-up nozzle, dips another die in flux and places yet another die on a leadframe. *Due [to] the multiple nozzles each holding a die for a separate operation i.e. picking a die, transferring a die from pick-up to a placing nozzle, fluxing a die and placing a die, these operations can be performed concurrently*. The concurrency of operations advantageously improves the throughput of the flip chip bonder, as described. [emphasis added]

Indeed, the overall process of the ASA Patent relies on *unidirectional circular rotations*, [note: 13] as opposed to the *clockwise and anticlockwise 180-degree rotations* of the Patent (see [9] above). It is significant that the "concurrency of operations" [note: 14] *does not include the simultaneous inspection of the next wafer chip (or die) to be picked up*.

54 The *AFC 800*, a die bonder machine with four pickup heads, incorporates the ASA Patent [note: 15] (see Appendix C). As noted pointedly in the Appellant's Case ("the AC"), while the machine implements an optical system for the inspection of the next wafer chip to be picked up, the camera is positioned *parallel* to the substrate, at a nine o'clock position to the rotating pickup turret. In order to

establish an optical line to the wafer chip to be picked up, the optical path is accordingly bent by 90 degrees via a prism/mirror located in the centre of the rotating pickup turret. This is *in contrast to* the optical system countenanced in the Patent, where the optical path between the wafer chip and the camera is vertical, with the camera mounted directly above the two-headed pickup and the wafer chip below. [note: 16]

55 It is not disputed by the Appellant, however, that the arrangement of the optical system in the AFC 800 does allow for the concurrent inspection of wafer chip(s) as each of the four pickup heads is rotated around the rotating turret. [note: 17]

The Matsushita Patent

56 The Matsushita Patent [note: 18] (see Appendix D) describes an apparatus and a method for bonding a chip via three pickup heads, and in a manner similar to that found in the ASA Patent. Importantly, however, the Matsushita Patent does make express mention (although the word "preferably" is also utilised as well in so far as the use of camera is concerned [note: 19]) of the ostensibly concurrent inspection and pickup of two wafer chips as follows: [note: 20]

> What is claimed is:
>
> **1**. A chip mounting apparatus comprising:
>
> a chip supply portion for supplying chips;
>
> a substrate positioning section for positioning a substrate;
>
> a head assembly provided with a plurality of nozzles which pick up the chips from said chip supply portion and perform a horizontal rotation and a vertical rotation so as to invert the chips vertically; and
>
> a transferring head which picks up the chips, which have been vertically inverted by said vertical rotation, from said nozzles, and mounts the chips on the substrate.
>
> **2.** A chip mounting apparatus according to claim **1**, *further comprising a camera for observing a next chip*, which is to be picked up next, from above said next chip to capture an image of said next chip so as to recognize a position of said next chip, *under a condition wherein one nozzle of said plurality of nozzles has been horizontally rotated to a position where said one nozzle hands one of said chips over to said transferring head and a next nozzle of said plurality of nozzles is in a position where said next nozzle has been displaced from a position for picking up said next chip in said chip supply portion*.
>
> [emphasis added, bold font in original]

57 Simply put, Claim 2 (as set out in the preceding paragraph) defines that the camera observes the next wafer chip to be picked up whilst the "plurality of nozzles" (in the incarnation laid out in the Matsushita Patent, being three in number) are displaced from their regular pickup positions, thereby leaving a gap for an optical path to be established between the camera and the wafer chip below. [note: 21] As the Appellant's own expert, A/P Tay, notes in his own report: [note: 22]

> As the pickup heads are equidistantly arranged at 120º about the central axis, the camera that is

mounted directly above the pickup station would have a clear view of the pickup station when the pickup head is rotated 180º horizontally from the pickup station.

Further corroboration of the concurrent pickup and inspection afforded by the device may be found at column 6 of the Matsushita Patent: [note: 23]

> FIG. **5** shows *the head* ***70*** *which has picked up the flip chip* ***P*** and moved to the substrate **20** to hand it over to the transferring head **31**. Under this condition, *all three heads* ***70*** *have been in positions displaced from the point right below the camera* ***68*** . Hence, the X table **4** and the Y table **5** are driven to move the flip chip P on the wafer **2**, which is to be picked up next, *to right under the camera* ***68*** *which checks it for a defect*. [emphasis added, bold font in original]

5 8 *However*, an important difference between the process envisioned by the Matsushita Patent and that embodied in the Patent is that the former does *not* countenance *true* concurrence in inspection and pickup. Under what is envisaged by the Matsushita Patent, the inspection of the next wafer chip in line takes place when the three-headed pickup head has rotated away from the "position for picking up". [note: 24] The inspection does *not* take place as the pickup head is in the *midst* of rotating. [note: 25] This is necessarily a function of the unidirectional incremental rotation mechanism employed by the Matsushita Patent, which is not dissimilar to the mechanism mentioned in the ASA Patent and implemented in the AFC 800. As can be seen from the extract in the preceding paragraph, the inspection for defects only takes place when "all three heads *have been in positions displaced*" [emphasis added]; *not* (instead) when "all three heads are *being* displaced" or are "*in the process of* rotation". Similar language is employed in the relevant claims (see [56] above), where it is stated that observation of the next chip to be picked up only takes places "under a condition wherein one nozzle of said plurality of nozzles *has been horizontally rotated* to a position where said one nozzle hands one of said chips over to said transferring head" [emphasis added].

59 It should be noted, in passing, that the rotation of the pickup head turret in the Matsushita Patent is executed about a vertical axis, [note: 26] whereas the rotation of the two-headed pivoting pickup in the Patent is executed about a horizontal axis. In the court below, the Respondent's expert, Mr Briar, opined that the horizontal orientation disclosed in the Matsushita Patent was not a material difference for the purposes of comparison *vis-à-vis* the Patent. He was not challenged on this view. [note: 27]

The National Semiconductor Patent

60 Like the ASA Patent and the Matsushita Patent, the die-handling device countenanced in the National Semiconductor Patent [note: 28] (see Appendix E) comprises a "*plurality* of stations" [note: 29] [emphasis added] mounted on a rotary flipper. The device is responsible for transferring a wafer chip (or die) from a stretched wafer to a tape cavity. Briefly, it functions as follows. A wafer chip is placed within a first station in a first orientation. While the chip is held, the wheel portion of the rotary flipper rotates and the next station receives another chip. When the first station is in an unloading position, the chip is released. At this point, the chip is oriented in a second orientation. While the chip is released into a cavity of a tape and reel, vacuum pressure is applied to hold on to the second chip. [note: 30]

61 As noted by Mr Briar himself, the National Semiconductor Patent is "very limited in text description", [note: 31] and only mentions that a camera *may* be used to determine if the chip or die is correctly released into the cavity. [note: 32] The only graphical illustration of any vision inspection

system is in an example of *prior art* found in FIGS 1A and 1B of the National Semiconductor Patent. [note: 33] *None* of these allusions to an optical inspection system or a camera dictates the *concurrent* inspection of any wafer chips during operation of the rotary flipper. Significantly, in a graphical representation of the work steps of the National Semiconductor Patent, prepared by Mr Briar and the Respondent, there are *no indications of any optical inspection system present*. [note: 34] Indeed, Mr Briar is at pains to qualify himself in asserting the anticipation of the Patent by the National Semiconductor Patent, as follows: [note: 35]

> Accordingly, *notwithstanding the assumption that is made in respect of the vision inspection system*, to a person skilled in the art, it can be said that Claims 1 and 7 [of the Patent], are anticipated by the [National Semiconductor] Patent. [emphasis added]

The Shinkawa Patent

62 The Shinkawa Patent [note: 36] (see Appendix F) describes a "flip-chip bonding apparatus" in which a "die inverting device is installed on an optical recognition device" so that a *single* "vacuum suction chucking nozzle that is provided on the die inverting device" can rotate between a "pick-up position" and a "die transfer position". [note: 37]

63 In other words, the Shinkawa Patent envisages a one-armed pickup head swivelling about an optical inspection system located directly above the wafer sheet (the surface on which the chips or dies are placed prior to pickup). When the pickup head is swivelling to transfer an already-picked-up wafer chip to the "die transfer position", a direct optical line may be established between the optical inspection system and the wafer sheet, since the one-armed pickup head is out of the way. Accordingly, the optical inspection system immediately inspects the next wafer chip for pick-up at the "pick-up position". The pickup head then swivels back towards the "pick-up position", having deposited the chip it was holding, and the cycle of pickup and inspection begins again.

64 While reference to an "optical recognition device" is explicit in the Shinkawa Patent, inspection is via a bent optical path courtesy of a prism/mirror, much like that seen in the AFC 800. Visual information about the next wafer chip to be picked up enters the optical recognition device via an open window **(21a)** and is refracted into an image pick-up element **(25)**. [note: 38] Again, this is *in contrast to* the situation of the camera in the Patent, which is *directly* (*ie*, *vertically*) above the wafer chip to be picked up. It should also be noted that the optical recognition device in the Shinkawa Patent is integrated with the swivelling die inverting device, whereas the camera in the Patent is mounted independently of the rotating two-headed pickups.

6 5 *Another significant difference* between the Patent and the Shinkawa Patent is the fact that *the device envisaged by the Shinkawa Patent possesses only one arm*. This is true of whichever of the three embodiments one chooses to opt for under the Shinkawa patent. [note: 39] Therefore, although the die inverting device in the Shinkawa Patent (not unlike the Patent, but only in this particular respect) also alternates between rotating 180 degrees in one direction and then 180 degrees in the other direction, *it operates with only one pickup head throughout*.

66 Mr Briar stated in his report that "[w]hilst the [Appellant's] Patent has a vision inspection system that is not an integrated part of the pivoting unit and that Shinkawa's Patent utilizes a vision inspection system that is an integrated part of the pivoting unit, nonetheless, the concept of vision inspection through an opening in the pivoting unit is similar". [note: 40] With respect, this is factually incorrect. The Patent performs its vision inspection through an opening in the pivoting dual pickup

head (see [9] above). The Shinkawa Patent, on the other hand, performs its vision inspection *only when the single pickup head has moved out of the way*. The difference is a subtle one, and should be borne in mind when applying the law on novelty as well as that on obviousness to the Patent later in this judgment.

67 We turn now to consider the respective patents themselves in the context of the two main legal issues in the present appeal, *viz*, whether the Patent was novel and/or whether the Patent involved an inventive step. It bears reiterating that, in the court below, the Judge held in favour of the Respondent in respect of both these issues.

Is the Patent novel *vis-à-vis* the state of the art?

68 Turning, first, to the issue as to whether the Patent is novel *vis-à-vis* the state of the art (which has been described at [50]–[66] above), generally speaking, it is not permissible to assemble all the pieces of prior art together into a "mosaic", and then to compare the invention under question against this "mosaic" (see [18] above as well as *Dextra Asia Co Ltd* (at [53])). The invention must be compared against each individual piece of prior art, and the question is repeated each time: has this particular piece of prior art anticipated the invention? The *limited exception* to this rule against "mosaicing" only states that where an earlier document is referred to in a later document, it is possible to refer to the earlier document; but, even then, only to the extent of the specific portions referred to by the later document. Reference may also be made, for example, to the decision of this court in *Genelabs Diagnostics* (at [26]–[28]). This limited exception, however, does not apply in the context of the present appeal simply because the examples of prior art under consideration do not cite one another as references. [note: 41]

The ASA Patent and the AFC 800

69 The *ASA Patent* may be dismissed as a potential anticipator of the Patent right from the outset. Even taking the Judge's interpretation of the inventive concept at face value – "inspection on the fly", as noted at [12] of the GD – the ASA Patent fails to pass muster. As has already been noted at [51] above, the ASA Patent does not provide any enabling disclosure with respect to a *concurrent* pickup and inspection system; it only alludes to "[o]ptically assisted pick and place systems, as will be known to one skilled in the art". [note: 42] Even so, it sanctions these optically assisted pick and place systems in a non-imperative sense, stating that they "*may* be employed to determine the location and orientation of the target location 122A [*ie*, the die]" [note: 43] [emphasis added].

70 The AFC 800 goes one step further in implementing a prism/mirror system to enable concurrent optical inspection and pickup of wafer dies. This falls within the "inspection on the fly" inventive concept as preferred by the Judge. More importantly, there is, as a result, some *ostensible* similarity between the AFC 800 and the Patent. *However*, the adoption of such an approach falls afoul of the very over-generalisation as well as over-abstraction referred to earlier in this judgment, which ought, in fact, to be assiduously avoided at all costs for the same reasons stated earlier on (see generally [40]–[43] above). Put simply, adopting "inspection on the fly" as the defining inventive concept would constitute *far too broad* an approach and would, in effect, prevent *specific* inventions which come under the *broad "umbrella heading"* of "inspection on the fly" from even being considered for the purposes of patent protection in the first instance. In other words, just because two (or more) inventions share the *broad "umbrella heading"* of "inspection on the fly" does *not* mean that they cannot be novel *if the specific method adopted* indeed justifies the invention concerned being considered novel.

71 A similar approach was, in fact, adopted by the expert for the defendant in *Dextra Asia Co Ltd*, where the expert "assumed that cold forging was not new or inventive because others who had patented processes before had used the term "forging", which could mean either hot or cold forging" (at [54]). Not surprisingly, Tan Lee Meng J rejected such an approach which was too general and, indeed, led to confusion instead (at [54]).

72 Reference may also be made to the House of Lords decision of *Biogen Inc v Medeva Plc* [1997] RPC 1, where Lord Hoffmann observed as follows (at 34):

> Whenever anything inventive is done for the first time it is the result of the addition of a new idea to the existing stock of knowledge. Sometimes, it is the idea of using established techniques to do something which no one had previously thought of doing. In that case, the inventive idea will be doing the new thing. *Sometimes, it is finding a way of doing something which people had wanted to do but could not think how. The inventive idea would be the way of achieving the goal. In yet other cases, many people may have a general idea of how they might achieve a goal but not know how to solve a particular problem which stands in their way. If someone devises a way of solving the problem, his inventive step will be that solution, but not the goal itself or the general method of achieving it*. [emphasis added]

73 The learned law lord also observed (in the same decision) thus (*id* at 52):

> Those who followed, even by different routes, could have greater confidence by reason of his success. I do not think this is enough to justify a monopoly of the whole field. I suppose it could be said that Samuel Morse had shown that electric telegraphy could be done. The Wright Brothers showed that heavier-than-air flight was possible, but that did not entitle them to a monopoly of heavier-than-air flying machines. …. *The technical contribution made in such cases deserves to be recognised. But care is needed not to stifle further research and healthy competition by allowing the first person who has found a way of achieving an obviously desirable goal to monopolise every other way of doing so*. [emphasis added]

However, much would, of course, depend on the precise facts of the case concerned itself (see, for example, the recent House of Lords decision of *Generics (UK) Ltd v H Lundbeck A/S* [2009] RPC 13).

74 Consider, also (to take an everyday example), the ubiquitous television, which inventive concept might be summarised as "a viewable screen for the projection of moving images". Liquid crystal display ("LCD") and plasma technology (quite apart from CRT (*ie*, cathode ray tube) and projection televisions) have separately attained this end through starkly contrasting processes. LCD screens are, in layperson's terms, sandwiches made up of liquid crystal pushed into the space between two glass plates. Images are created by varying the amount of electrical charge applied to the crystals. Plasma screens, on the other hand, utilise a matrix of tiny gas plasma cells charged by precise electrical voltages to create a picture. Both technologies have their own separate patents, similar end results notwithstanding.

75 Applying the above principles to the facts of the present case, the Patent (the key characteristics of which have been set out above (at [6]–[9])) is, in our view, a genuinely different (and specific) method of achieving the desired result of "inspection on the fly". In particular, the true inventive concept which the Patent embodies (and which is required under the first stage of the *Windsurfing* test (at [20] above)) is the *genuinely concurrent* inspection (as opposed to *stop-start* "concurrence" (see [58] above)) of a wafer die *through a pivoting part* [note: 44] located between *two pickup heads*. [note: 45] *Neither* the ASA Patent *nor* the AFC 800 achieves the said result in the

same manner.

76 It should *also* be noted that the Patent also includes claims for a *method and process* (see [8] above), which at first glance operates according to a procedure that is very markedly different from the existing art (two pickup heads only, and alternating 180-degree motion of the pickup heads, with a through opening for establishing an optical path *within* the pivoting portion of the device). We have already noted that Claims 1 through 6 of the Patent (see [7] above) envisage a *device* that is *not*, in the final analysis, similar to the state of the art. This finding of novelty is *further* confirmed (as just noted) via the *processes* enshrined in Claims 7 through 10 of the Patent (see [7] above).

77 Turning now to compare both the *device* and *process* countenanced in the Patent with those in *the AFC 800*, we see that the primary *material* differences between the two lie in the following aspects:

(a) The optical inspection system described by the Patent does away with the need for a prism/mirror to bend the optical path (which is the case with the AFC 800), since the optical path is a vertical one from the camera down to the wafer table.

(b) The two pickup heads in the Patent move in a reciprocal clockwise/counter-clockwise 180-degree pivoting motion, *in contrast to* the rotating pickup turret in the AFC 800, which performs unidirectional incremental rotations.

78 The differences referred to in the preceding paragraph relate to neutral and objective facts that are not – and, indeed, cannot be – disputed by either party and which are, more importantly, claimed in the Patent itself (see [7] above). What *is* disputed are the alleged advantages of the Patent over the AFC 800 as a result of these two differences. With respect to the difference in para 77(a) above, the Appellant argued (at para 325 of the AC) that the Patent is novel *vis-à-vis* the state of the art as it implements:

> … a vision inspection system that avoids the prism/mirror arrangement altogether, thereby *reducing the machine complexity and the costs of parts* as well as of mounting/adjusting the prism/mirror arrangement. In addition, the invention allows for an *increased accuracy of the vision inspection by avoiding optical components (i.e. the mirror/prism) that are exposed to shock, vibration, etc*. during operation of the machine. An important aspect of not having a prism/mirror in a straight optical path from the camera via the through opening in the pivoting part during its pivotal motion through 90° or 270°, is that *the lack of the mirror allows for a longer unobstructed vision inspection or for a faster pivoting motion* – thereby increasing the throughput of chips. [emphasis added]

In so far as the difference in para 77(b) above is concerned, the Appellant argued that the Patent is novel *vis-à-vis* the state of the art, as follows (see the AC at paras 328–329):

> 328. In the ASA configuration, the wheel performs unidirectional incremental angular steps. At the end of each such step, a pickup head reaches a chip on the substrate and hands over a turned chip. This motion requires an acceleration of the wheel followed by a deceleration and a precisely position-controlled stop where the pickup head is accurately positioned over the chip to be picked up. *This requires a high precision servo motor with the respective closed-loop position control. The precise positioning of each of the pickup heads mounted along the circumference of the wheel results in a relatively low overall turning speed of the wheel*. A restricted throughput is the consequence.

329. In contrast, the inventors [of the Patent] have realized that a *reciprocal (clockwise/counter-clockwise) 180° pivoting motion of the compact pivoting part allows for a simple control mechanism where the drive of the pivoting part can abut against abutments at each end of the 180° motion because it reverses its driving direction thereafter*. Such a simple drive control mechanism is reliable and requires little adjustment during operation. More importantly, the motion itself can be fast and requires very little control overhead in comparison to the **(1) unidirectional accelerate – (2) decelerate – (3) fine-position the pickup head – (4) stop – (5) accelerate ...** sequenced articulated step motion of the ASA configuration.

[emphasis added in italics; bold and underlining in original]

79 The Respondent chose to respond to the above with the usual procedural arguments of "not raised before the Court below" [note: 46] and also that "A/P Tay did not give evidence on this before the court" [note: 47] . This was not, however, for want of trying to meet the Appellant's substantive reasoning; indeed, before resorting to these technical procedural arguments, the Respondent had attempted to field its own *substantive* rebuttals. In contrast to the Appellant's contentions, however, these rebuttals appeared to be extremely general and lacking the convincing specificity possessed by the former. For example, the Respondent argued thus: [note: 48]

It is clear that there are many factors that determine/affect the throughput of flip chip machines.

And, in a similar vein, the Respondent also argued as follows: [note: 49]

In any event, by February 2004 i.e. the priority date of the [Appellant's] Patent, there would have been technological advances enabling the issues raised in the ASA Patent concerning the 2 head flipper to be resolved.

80 The disclosure in a patent claim must enable a "skilled person in the art" to make the invention (see *Merck & Co Inc (1)*, applying the House of Lords decision in *Merrell Dow Pharmaceuticals Inc and Another v HN Norton & Co Ltd and Others* [1996] RPC 76). This standard is arguably similar to that of the "normally skilled but unimaginative addressee", as required by the second stage of the *Windsurfing* test for obviousness (see [20] above). Here, however, even *without* assuming the mantle of a person skilled in the art, the logical arguments put forth by the Appellant (at [78] above) are, in fact, extremely clear and certainly do not require any expert clarification. A mirror/prism (that is an integral part of *the AFC 800*) *is* an additional, unnecessary step that results in a less efficient process. In *contrast*, the 180-degree alternating rotation (that is an integral part of *the Patent*) is not only different but also results in a different (and more efficient) process. Indeed, the Respondent's own witness, Mr Boh Teck Keong ("Mr Boh"), admitted that "[i]f you do a continuous turning [as opposed to a 180-degree alternating rotation], you will have a cumulative error that eventually affect[s] the stopping accuracy". [note: 50]

81 In any event, regardless of the precise advantages (or disadvantages) engendered by the changes wrought in the Patent *vis-à-vis* the AFC 800, it is plain to see that both the *device* and the *method* envisaged in the Patent facilitate "inspection on the fly" in a manner *different from* that countenanced by the AFC 800. When we recall the analogy furnished above (at [74]) with respect to separate patents being granted to plasma and LCD televisions, this finding becomes almost self-evident. Accordingly, we find that that there is novelty in the Patent relative to the AFC 800.

The Matsushita Patent

82 As has already been pointed out (see [56] above), the Matsushita Patent is (*unlike* the Patent) capable of *only a limited form* of *concurrent* inspection and pickup. As a result of the *three* rotating pickup heads having to come to a halt before inspection can take place, precious time is consumed. The Patent, on the other hand, envisages *only two* pickup heads at opposite ends. When one pickup head *picks up* a wafer die, the *other* pickup head is *simultaneously depositing* the wafer die it had already been holding onto a placing facility. When both pickup heads are in motion (*ie*, the pivoting part is being rotated), *transferring* a wafer die on one hand and returning empty to collect another wafer die on the other, *concurrent inspection* via the camera mounted above takes place through the transverse opening on the pivoting part. Therefore, instead of this relentless (1) transfer-inspect and (2) deposit-pickup cycle facilitated by the rotating two-headed pickup in the Patent, the three-headed pickup head in the Matsushita Patent requires an intermediate stage in which two pickup heads are stationary and *doing nothing* while a wafer die is picked up. [note: 51] Indeed, in this aspect, the Matsushita Patent resembles the sort of prior art that the Patent *sought precisely to avoid*. This is, in fact, underscored by reference to the following part of the description of the Patent: [note: 52]

> In order to check the surface of the individual chip still arranged on the substrate for intactness before it is picked up, and at the same time to be able to check that it is in the correct position before it is picked up, *a first optical facility, for example a camera, is arranged above the pivoting part for the inspection of the wafer*. Since an optical connection line set up perpendicular to the surface of the wafer and the chip between the first optical facility and the wafer surface is important for an optimized check, the camera is arranged directly over the chip to be picked up. For this reason, the pivoting part must be rotated out of the perpendicularly running optical connection line each time before a chip is picked up, in order that a so-called wafer inspection can be performed.
>
> This results in the following sequentially occurring method sequence for each flip chip: First, *a check of the surface of the chip to be picked up must be performed* using the camera. *The flip head is then rotated into the optical connection line, in order to pick up the chip* by its upper surface using the vacuum pipette attached to the flip head. By means of the pivoting part, whose rotational axis is arranged outside the optical connection line, *the chip is now rotated through 180° in such a way that the flip head is now in a rotated position outside the optical connection line*. A further check performed on the chip's position by means of a second optical facility in the form of a camera should supply data on a flip offset of the flipped chip. *The flipped or rotated chip is then transferred to a placing facility in the form of a place head*, and a correction is made to the flip offset based on transferred correction values.
>
> Such a *sequence of successive steps* leads to a high time requirement for the overall process of checking and rotating a chip, and thereby reduces the throughput of the device. It therefore also results in higher operating costs.
>
> [emphasis added]

From the above, it can be seen that the description of the *prior art* in the Patent corresponds closely to the operation of device exemplified by the Matsushita Patent. Accordingly, the Patent does not appear to have been properly anticipated by the Matsushita Patent.

8 3 *Another difference* between the Matsushita Patent and the Patent lies in the fact that the former utilises *three* pickup heads (or a "plurality of nozzles") rotating unidirectionally in increments (not unlike a ferris wheel), whereas the latter utilises *two pickup* heads alternating between 180-

degree rotations in clockwise and anti-clockwise directions (not unlike a see-saw). The unidirectional movement of the pickup assembly is similar to that countenanced in the rotary pickup turret described in the ASA Patent (with its concomitant problems) (see [50]–[52] and [78] above).

84 The Respondent's expert, Mr Briar, however, cited *another* Matsushita patent [note: 53] to demonstrate that "the clockwise/anticlockwise rotation [was] nothing novel". [note: 54] This, however, does not the change the fact that, for the purposes of the Matsushita Patent, the description of such alternating rotation (as found in the Patent) is *absent*. Indeed, this additional citation only underscores the fact that the Matsushita Patent lacks something which the Patent possesses. Further, as has already been noted, there can be no mosaicing of prior art with respect to an inquiry into novelty (see [18] and [68] above).

85 For the above reasons, therefore, it is our view that the Patent is novel *vis-à-vis* the Matsushita Patent as well. Even if it is the case – which has not (significantly, in our view) been argued – that the Matsushita Patent is more efficient than the Patent, the fact remains that the Patent has accomplished the same task in a markedly different manner.

The National Semiconductor Patent

86 The National Semiconductor Patent, like the ASA Patent and the Matsushita Patent, dictates a "*plurality* of stations" [note: 55] [emphasis added] on a wheel moving in only one direction. Additionally, the only illustration of any vision inspection system – and not even an explicitly concurrent vision inspection system at that – occurs in diagrams referring to the *state of the art*. In other words, any vision inspection system, concurrent or otherwise (this is not, in fact, taught by the patent), is alluded to only in diagrams of a "conventional semiconductor device transfer machine" [note: 56] that the National Semiconductor Patent purports to *improve* upon.

87 In view of the above, we are of the view that the Patent is novel with respect to the National Semiconductor Patent as well.

The Shinkawa Patent

88 As has already been noted earlier, the device envisaged by the Shinkawa Patent possesses *only one* pickup head. *Further*, its optical inspection system utilises the same prism/mirror concept as the AFC 800, thereby being subject to the same vulnerabilities found therein (as explained at [80] above).

89 More importantly, the ingenuity of optical inspection taking place *through* a pivoting part in the Patent is *absent* in the Shinkawa Patent (as noted at [64] above). Optical inspection in the Shinkawa Patent simply takes place when the single pickup arm has *moved out of the way*. This is decidedly different from the concept in relation to optical inspection enshrined in the Patent. Indeed, it would appear that the concept utilised by the Shinkawa Patent is no different from the prior art outlined and critiqued by the Patent (quoted at [82] above). Without a second pickup head *and* without a pivoting part *through* which vision inspection may take place, the Shinkawa Patent is condemned to the same "pickup head moves away – inspection – pickup head moves back to pick up – pickup head moves away" cycle as the prior art that the Patent has sought to distinguish – and, in our view, has in fact succeeded in distinguishing – itself from.

90 In this respect, the diagrams (*ie*, FIGS 9–11 [note: 57]) provided by the Respondent's own expert, Mr Briar, in his report are instructive. Inspection of the next flip chip die to be picked up can only occur (as illustrated in FIG 9), where the open window is *facing* the wafer table. At this juncture,

the pickup head is facing the nine o'clock direction. The moment the pickup head moves *upwards* or *downwards*, the angle of the half-mirror for bending the optical path is changed and the optical connection line to the next flip chip die is immediately lost. This is, *a fortiori*, the case when the pickup head is completely at rest pointing downwards to the wafer table (for pickup (see FIG 10)), or when the pickup head is completely at rest pointing upwards to the bonding nozzle (for deposit and bonding (see FIG 11)). In both these situations, the open window is precluded from sighting the wafer table entirely (as it points towards three o'clock in the former and nine o'clock in the latter). In short, there is *no* real *contemporaneous* inspection of the wafer die in the Shinkawa Patent. *In contrast*, such *contemporaneous* inspection, which would occur without requiring the pickup head to get out of the way *completely*, is in fact the hallmark of *the Patent*. Even so, whatever concurrent inspection that can realistically take place in the Shinkawa Patent is limited to only a scintilla of time when the pickup head is pointed *exactly* in a nine o'clock direction (see FIG 9). This is *quite different* from the process envisaged in the Patent, where, by virtue of the fixed camera position, optical inspection may take place during a broader range of the rotating movement of the pivoting two-headed pickup. [note: 58]

91 In addition, the fact of the fragile optical apparatus in the Shinkawa Patent having to rotate *along* with the pickup head surely brings with it potential complications, particularly since parts in the half-mirror and camera involve the use of mirror and glass. In any case, it is difficult to see how this rotating optical inspection system anticipates the fixed camera system implemented in the Patent. Further, it is also difficult to see how the Shinkawa Patent's *one-armed* pickup head anticipates the Appellant's elegant *two-headed* pickup solution, which solution permits the establishment of an optical connection line via a transverse opening in the middle of its pivoting part.

92 In the light of the reasons outlined above, the Patent is novel with respect to the Shinkawa Patent as well.

Does the Patent involve an inventive step over the state of the art?

93 Turning to the second main issue in this appeal (*viz*, whether the Patent involved an inventive step), unlike the inquiry for novelty considered in the preceding part of this judgment, it is permissible to construct a "mosaic" out of the various pieces of prior art in the inquiry for obviousness (*ie*, an inventive step) – *unless* the act of "mosaicing" itself is not obvious to the notional skilled person. This was made clear in the decision of this court in *Peng Lian Trading Co v Contour Optik Inc and others* [2003] 2 SLR(R) 560 ("*Peng Lian Trading Co*") at [18], where the court cited with approval Lord Reid's observations in the House of Lords decision of *Technograph Printed Circuits Ltd v Mills & Rockley (Electronics) Ltd* [1972] RPC 346 at 355 to the effect that the "mosaic" must be one which is "put together by an unimaginative man with no inventive capacity" (reference may also be made to the Singapore High Court decision of *ASM Assembly Automation Ltd v Aurigin Technology Pte Ltd and others* [2010] 1 SLR 1 at [41]). In other words, as pertinently observed in *Law of Intellectual Property of Singapore* (at para 30.1.50):

> … the skilled addressee assesses the obviousness of an invention by reference to the whole of the state of the art relevant to this invention, whereas he assesses the novelty of the invention by reference to each individual piece of prior art in this state of the art. There is, however, an exception to this scenario: 'mosaicing' is not permitted in the obviousness inquiry if it would not be obvious to the skilled addressee to 'mosaic' the different pieces of prior art.

94 In the present case, it *would* be fair to mosaic the various pieces of prior art outlined earlier for the purposes of identifying any inventive step contained in the Patent. The ASA Patent, the Matsushita Patent, the Shinkawa Patent and the AFC 800 are all obviously concerned with the

business of handling wafer dies, either for the purposes of sorting or bonding. The notional skilled addressee would not find it too far-fetched to mosaic these pieces of prior art to form a considered view of the state of the art.

95 If, however, in order to arrive at the subject-matter of a claim, it is necessary to make a mosaic of extracts from documents published over a period of time, taking suggestions from one with suggestions from others independent of it, there can be little doubt that the claim has inventive subject-matter.

96 The point in the preceding paragraph, notwithstanding, even allowing for "mosaicing", there is still the need for the state of the art to be considered as *a whole* for the purposes of locating whether any inventive step exists in the patent being considered (in this case, the Patent). To this end, a more global approach is appropriate and the pieces of prior art will therefore not be examined individually *vis-à-vis* the Patent. In any event, we pause to observe that even if the Patent was compared individually against each of the pieces of prior art, the result would have been (particularly having regard to our analysis in the context of the issue of novelty) an *a fortiori* one simply because (as we have seen) none of the individual patents relied upon by the Respondent was as comprehensive as a mosaic of extracts constructed from these very same patents. Indeed, as we have seen, some of these patents were, viewed from an individual perspective, clearly lacking what the Patent possessed (for example, in the context of optical inspection). Put simply, the "*mosaicing*" of the various extracts from the individual patents relied upon by the Respondent would, in fact, present the case for the Respondent *in its strongest possible light*.

97 In the Appellant's cross-examination of Mr Briar, it was suggested that the ASA Patent "taught away" from the use of two pickup heads because of concomitant issues associated with such use. According to the Appellant, the ASA Patent proceeded on the premise that the number of pickup heads had to be *increased* to improve throughput. In other words, the more pickup heads, the more dies that could be picked up, and the greater the productivity of the machine. Accordingly, in the ASA Patent, a rotating turret which rotated 360 degrees so as to allow for a *plurality* of pickup heads was opted for (which is *unlike* the *two* pickup heads which forms the basis of *the Patent*). Since the turret was to be about 20 cm in diameter, the risk of centrifugal force causing the die to fly off the pickup heads was addressed by slowing down the speed of the turret's rotation. By going against this conventional wisdom that "taught away" from using only two pickup heads, the Appellant argued, the Patent had shown that it involved an inventive step that was not obvious to the notional skilled man. The Patent had, accordingly, passed the fourth stage of the *Windsurfing* test.

98 With respect, however, the Judge appeared to have misunderstood the Appellant's argument when he stated thus (see the GD at [41]):

> In answer to the[Appellant's] criticism that the ASA Patent in fact "teaches away" from the use of two pick up heads, the [Respondent's] expert states that the ASA Patent teaches that two heads may be employed but it also acknowledges that there is a risk of the die flying off as a result of centrifugal force where two heads are used. However, as an engineer and one skilled in the art, he would simply slow down the rotation speed to address this risk. With four heads, the distance travelled during rotation is reduced and, at the same speed, centrifugal force would also be reduced. Speed of throughput is an important concern in the semiconductor industry. Another way of addressing the risk of centrifugal force is to make improvements to the equipment used, such as increasing the strength of vacuum suction of the pick up heads.

99 The fact that the ASA Patent "teaches that two heads may be employed" does *not* make it similar to (let alone the same as) the Patent. Indeed, as Mr Briar himself admitted (and as noted by

the Judge in the passage of his judgment quoted in the preceding paragraph), the employment of *two* heads is, in fact, an apparent non-starter *precisely* because (as the Judge noted in the same passage) the ASA Patent "also acknowledges that there is a risk of the die flying off as a result of centrifugal force where two heads are used", as a result of which the employment of *four* heads was recommended instead. This same admission is also to be found in the Respondent's Case ("the RC"), where it is stated (in a similar vein) that the use of two heads was considered a "regression". [note: 59] In the circumstances, therefore, the Patent has indeed adopted an inventive step by choosing to go with *two* pickup heads – *and two pickup heads only*. Interestingly, too, there appear to have been no technical hitches with the employment of two pickup heads by the Patent as evidenced by the commercial success of the Patent which we will touch upon briefly below (at [104]–[107]).

100 The fact that the ASA Patent, the Matsushita Patent and the National Semiconductor Patent all employed more than two pickup heads (advocating, for most part, the use of a "*plurality* of nozzles" or a "*plurality* of stations") only serves to throw the inventive nature of the step taken by the Appellant into starker relief. As was noted by Jacob LJ in the English Court of Appeal decision of *Pozzoli SpA v BDMO SA* [2007] FSR 37 at [27]:

> Patentability is justified because the prior idea which was thought not to work must, as a piece of prior art, be taken as it would be understood by the person skilled in the art. He will read it with the prejudice of such a person. So that which forms part of the state of the art really consists of two things in combination, the idea *and* the prejudice that it would not work or be impractical. ***A patentee who contributes something new by showing that, contrary to the mistaken prejudice, the idea will work or is practical has shown something new*** . He has shown that an apparent "lion in the path" is merely a paper tiger. Then his contribution is novel and non-obvious and he deserves his patent. [emphasis added in bold italics]

It should be noted that *two* prejudices were overcome here by the Appellant: the prejudice *against* the use of two heads, *and* the prejudice *in favour* of multiple heads.

101 It should further be noted that Mr Briar's *removal* of two pickup heads from the ASA Patent, in order to form a two-headed ASA Patent device, [note: 60] is a classic case of *ex post facto* reasoning. It is trite law that the fourth step of the *Windsurfing* test is to be applied without assuming knowledge of the invention. The inventor himself did not have the advantage that hindsight brings. In the House of Lords decision of *Non-Drip Measure Coy Ld v Stranger's Ld and Others* (1943) 60 RPC 135 ("*Non-Drip Measure Coy Ld*"), for example, Lord Russell of Killowen stated (at 142):

> Nothing is easier than to say, after the event, that the thing was obvious and involved no invention. The words of Moulton L.J. ([in] *British Westinghouse Coy. V. Braulik* [(1910) 27 RPC 209 at 230]) may well be called to mind in this connection: – "I confess … that I view with suspicion arguments to the effect that a new combination, bringing with it new and important consequences in the shape of practical machines, is not an invention, because, when it has once been established, it is easy to show how it might be arrived at by starting from something known, and taking a series of apparently easy steps. This *ex post facto* analysis of invention is unfair to the inventors and, in my opinion it is not countenanced by English patent law."

As Chao Hick Tin JA, delivering the judgment of this court in *Peng Lian Trading Co* (at [28]) observed (which views were cited and applied in *Dextra Asia Co Ltd* (at [68])):

> It is all too easy to say, after the event, that the thing was obvious and involved no invention. *Ex post facto* analysis can often be unfair to inventors [citing *Non-Drip Measure Coy Ld*].

And, in a similar vein, the learned author of *Law of Intellectual Property of Singapore* also observes as follows (at para 30.1.49):

> The fourth step in the *Windsurfing* approach is where the assessment for obviousness is made. In fact, the fourth step is the critical question; the first three steps merely laying the ground work for this final question. The valuable guide given in the fourth step is that the assessment must be made without the benefit of hindsight (*i.e*. without the benefit of the information available after the priority date). One must guard against an *ex post facto* analysis because this would be unfair to inventors.

In the circumstances, that portion of Mr Briar's expert report should be given little – or no – weight.

102 It should be further noted also that the upgrade from *one* pickup head, as embodied in the Shinkawa Patent, to two in the Patent, also constitutes a ground for finding an inventive step on the part of the Appellant's invention. The simplicity of the invention does not mean that the invention is obvious, or lacking in any inventive step. Simplicity is simply no bar to inventiveness, and this point has been noted in various local decisions (see, for example, the decision of this court in *Peng Lian Trading Co* (at [29]) and in *First Currency Choice Pte Ltd* (at [51]) as well as that of the Singapore High Court in *Institut Pasteur v Genelabs Diagnostics Pte Ltd* [2000] SGHC 53 at [197] (affirmed by this court in *Genelabs Diagnostics*) and in *Dextra Asia Co Ltd* (at [68]–[69])). Indeed, as a leading expert in the field has very pithily observed (see *Law of Intellectual Property of Singapore* (at para 30.1.53):

> The simplicity of the invention does not mean that the invention is obvious. The irrelevance of this factor has been noted in various cases, and described in various ways. Thus, it has been said that simplicity is no bar to inventiveness, that simplicity is not equivalent to obviousness, and that inventiveness is not synonymous with complexity.

In this case, the inventive step comprises the insertion of a through opening in the middle of a two-headed pickup assembly, from a normal opaque one-headed assembly.

103 Finally, in doing away with the need for a mirror/prism system to establish an optical connection line to the next wafer die *and combining this method* with the innovation of two pickup heads rotating about a transverse opening, the Appellant's inventive step becomes a significantly larger one. The Matsushita Patent had established a system for direct vertical inspection, but this in itself did not lead to truly *concurrent* inspection and pickup. Mr Boh (see [80] above) gave evidence of the state of the art relating to two-headed pickups, stating that: [note: 61]

> [i]f we are adopting a two-head flipper, any experienced technical person would know when we do a clockwise and anti-clockwise, it will have a consistent stopping accuracy. If you do a continuous turning, you will have a cumulative error that eventually affect[s] the stopping accuracy. So a sound technical person, when you using a two-head flipper, we will go for clockwise and anti-clockwise motion …

However, Mr Boh's testimony did *not* show that a two-headed pickup would be able to facilitate concurrent inspection and pickup. By combining these two examples of prior art – vertical optical inspection and alternating clockwise/anti-clockwise rotation – with a new concept, the transverse opening *within* the middle of the pivoting dual-headed pickup assembly (not merely gaps between a "plurality of nozzles"), the Appellant had come up with an invention that was not at all obvious to the notional skilled person. In other words, even "mosaicing" together myriad pieces of prior art, the Appellant was still able to come up with a patent that involved an inventive step which satisfied the

requirements of the *Windsurfing* test. As already emphasised above (at [101]), one must assiduously avoid *ex post facto* rationalisation. Indeed, as the popular adage goes, "Hindsight is 20/20 vision."

Commercial success of the Patent

104 Finally, a few short observations on the role of commercial success in the context of patent disputes are in order. The Judge was careful to state in the GD (at [47]) that commercial success alone is not a conclusive for the purposes of an inquiry into novelty or the presence of an inventive step (see [9] above):

> Where commercial success of an invention is concerned, this factor alone is not conclusive. A product that sells well is not necessarily novel or one involving an inventive step. Good advertising, marketing and pricing could also play a part.

Similarly, the Respondent asserts that the ostensibly greater productivity engendered by the Patent could also be attributed to factors *other* than the supposed novelty or the presence of any inventive step: [note: 62]

> It is clear that there are many factors that determine/affect the throughput of flip chip machines. Mr Briar clearly explained that the downstream or subsequent processes (after flipping) dictate the speed of the whole system and that die sorters (like the [Appellant's] DS 10 000) would perform differently in terms of throughput compared to a die bonder (like the ASA AFC 800 or the purposes intended under the ASA Patent) even if all such machines share the same pick and place concept (i.e. concurrent vision inspection of the 2nd chip to be picked up through the gap or through opening afforded between the 2 pick up heads as the 1st chip is being rotated through 180°).

105 It is undeniable, however, that the Patent has succeeded in increasing throughput in a significant fashion. Comparing like with like, we see that the National Semiconductor Patent, a "multi-station rotary die handling device", [note: 63] can only manage throughputs of between 5,000 and 6,000 units per hour. The Appellant's invention, a "device for inspecting and rotating electronic components", [note: 64] is able to handle throughputs of up to 20,000 units per hour. Both of these are die sorters and handlers rather than bonders.

106 To date, only four units of the AFC 800 have been sold while the Appellant has sold more than 100 of its die sorter machines using the system outlined in the Patent. [note: 65]

107 While the fact of increased throughput and higher sales are arguably not conclusive as to matters of novelty and obviousness, in the light of our earlier discussion, we take the view that these facts *do* function in some measure, not least by way of confirmatory evidence of the novelty and obviousness of the Patent. Indeed, the factor of "commercial success" has been approved and applied by both this court (in *FE Global Electronics* (at [47])) as well as by the Singapore High Court (in *Trek Technology* (at [100]–[102] (affirmed in *FE Global Electronics*); *Ng Kok Cheng* (at [44]); and *Dextra Asia Co Ltd* (at [70]–[72])) in considering and finding inventiveness. And the following observations in a leading local textbook (in the context of the issue of obviousness) succinctly describe what is, in fact, the situation in so far as the Patent is concerned (see *Law of Intellectual Property of Singapore* (at para 30.1.52)):

> Commercial success enjoyed by the patented invention may also indicate that the invention was not obvious. The reason why commercial success can be [a] relevant factor has been explained

in this way: commercial success is an indication that the patented invention meets a long-felt need in the industry and, if the invention was obvious, why was it not done before? However, commercial success is not conclusive of the non-obviousness of the invention. The inventor who is relying on this factor must convince the tribunal that the commercial success of the patented invention is credited to the invention itself, and not because of other factors such as clever advertising gimmicks.

Conclusion

108 In any event, for the reasons we have already set out above, the Patent is both novel and non-obvious *vis-à-vis* the prior art in the sphere of die handling. Accordingly, full protection should be accorded to this valuable contribution to the state of the art by the Appellant. We therefore allow the appeal with costs and with the usual consequential orders. We also grant the Appellant a certificate of contested validity in respect of the Patent pursuant to s 72 of the Act. In the circumstances, it also follows that the Appellant's correspondence with the Respondent (in particular, that embodied in its letter dated 5 July 2006 [note: 66]) could not have constituted a groundless threat pursuant to s 77 of the Act.

109 We would also like to make a few observations about the length of written cases submitted to this court. In this particular appeal, for example, both the AC as well as the RC were extremely lengthy (the former exceeding 300 pages and the latter exceeding 100 pages). This court has not, in fact, placed a cap on the maximum number of pages on the respective parties' cases. This is because it hears a myriad of cases over the entire spectrum of the law, all of which vary in complexity (both in relation to the facts as well as to the law). On occasion, therefore (particularly in a case involving a complex factual matrix and/or novel questions of law), a case may indeed be (*justifiably*) very lengthy. *However, the key consideration in so far as this court is concerned is whether or not the central thrust(s) of the party's appeal in the case at hand is clearly stated in as persuasive a manner as possible*. To this end, an *overly* lengthy submission may *not necessarily* achieve this end. On the contrary, the overall persuasiveness of the case may be *diminished or diluted* by an overly lengthy submission that may well serve (instead) to cloud or obscure the central thrust(s) of the party's case rather than advance them. Put simply, the modern adage that "Less is more" might well apply instead. There is the understandable desire for all counsel to err on the side of thoroughness. That having been said, a balance must always be struck between thoroughness on the one hand and the clarity (and, hence, persuasiveness) of the case advanced on behalf of one's client on the other.

110 Returning to the present appeal, although both counsel were extremely thorough in the presentation of their respective cases to this court, they had, with respect, swung far too much to that particular side of the pendulum. Whilst we commend their spirit of thoroughness, we must also state (again, with respect) that the clarity of their respective cases suffered as a result. The court had to wade through far too many unnecessary pages of analysis in order to understand what, in the final analysis, were the key issues of the appeal (as outlined and decided upon above). Indeed, as Rajah JA aptly put it in *First Currency Choice Pte Ltd* (at [1]), although "[t]he courts often have the unenviable task of choosing between seemingly intractable opposing views … often, apparently complex technical issues when properly understood and assessed, do yield to common-sense and relatively straightforward answers". As we have seen above, this case is, in fact, no exception.

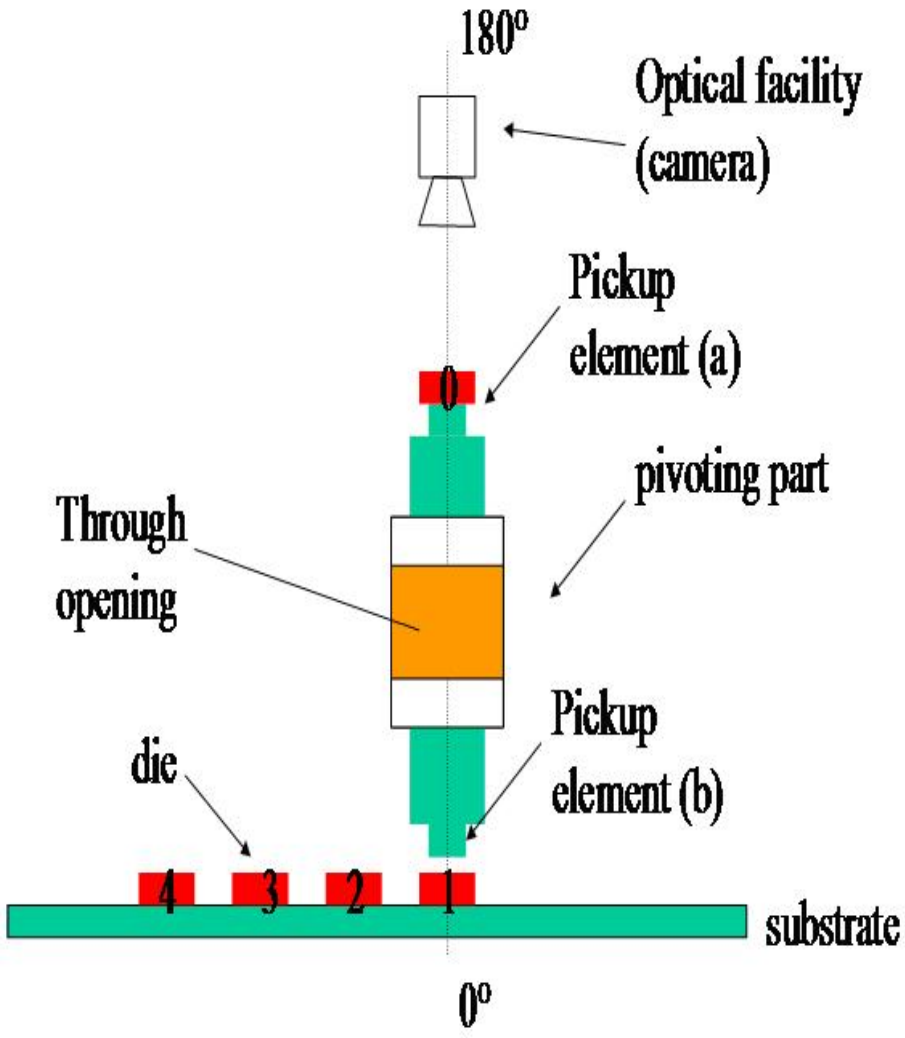
111 That having been stated, we must emphasise once again that there is no magical formula as to length. The best approach is, as already mentioned above, to ensure that the central thrust(s) of one's case are stated in as clear and as persuasive a manner as possible. In this regard, depending on the factual and legal complexity of the case, each counsel should strive to state only as much as will achieve this result. It might be helpful to both counsel as well as to the court if the former could

state – in no more than one to two pages – the central issues, facts as well as arguments by way of *an executive summary* which is appended to the case concerned, preferably at the *commencement* of that case. In fairness, summaries of a rough and ready nature were to be found in the respective parties' cases in the context of the present appeal. However, they tended to be pitched at *too general* a level and did not focus on the respective nubs of the cases themselves.

112 In *factually* complex cases, counsel could, additionally, list – in a succinct table – the key facts that need to be considered by the court. Finally, in a *legally* complex case, counsel could also list the key legal issues as well as analysis and conclusion(s); if necessary, this could even take the form of a flow chart. All these could also be appended to the executive summary mentioned in the preceding paragraph.

113 We emphasise that these are merely suggestions that might not always apply to the myriad of situations that come before this court. However, there is, in our view, much merit in counsel being as clear as possible in as simple a manner as possible (without sliding into oversimplification or reductionism). In this respect, we do not rule out other innovative methods of presenting a case although we would emphasise that there should not be innovation only for its own sake.

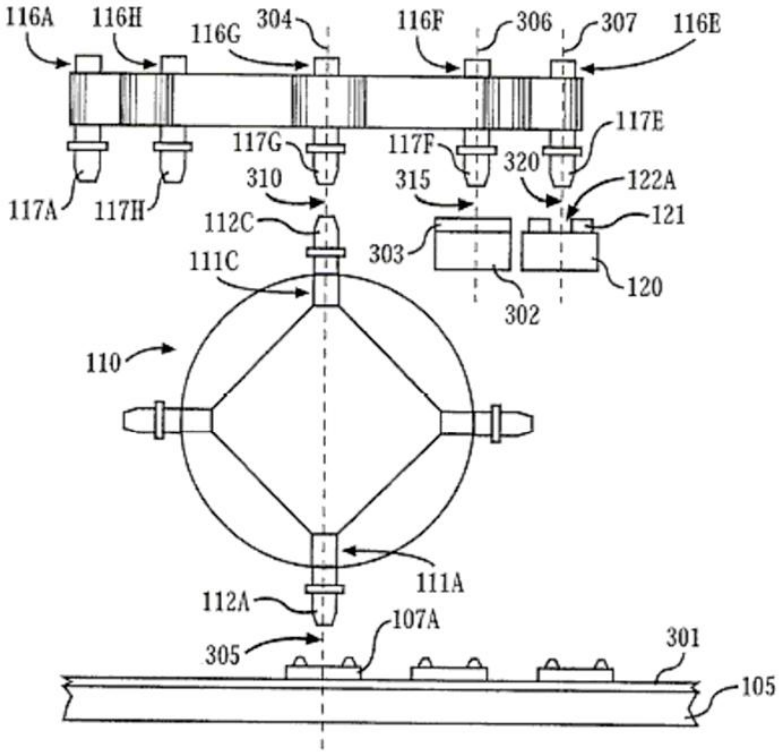
APPENDIX A



The Appellant's Patent

[Source: Appellant's Case at 48 (arrows indicating direction of rotation inserted)]

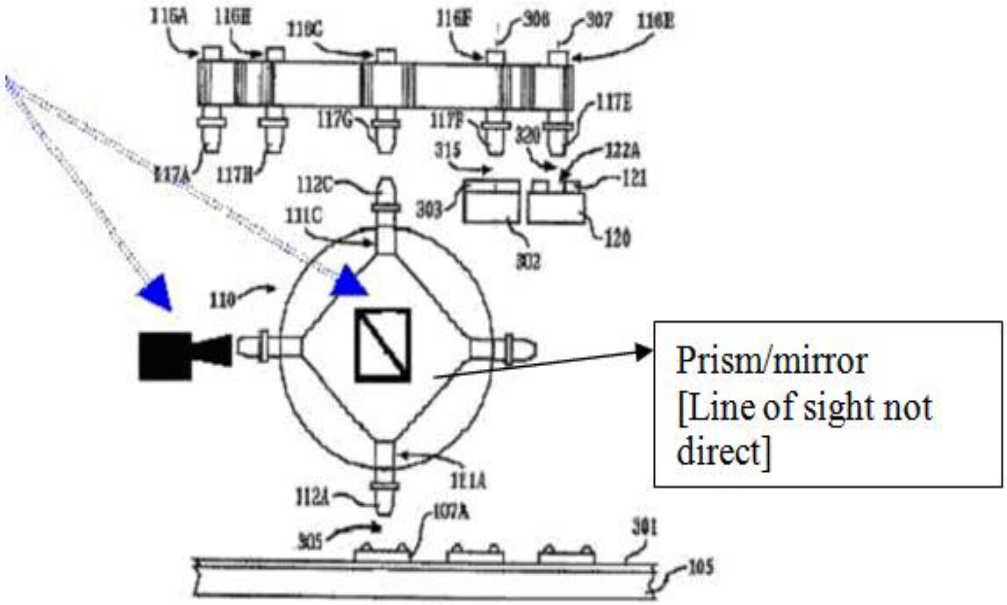
APPENDIX B



The ASA Patent

[Source: Appellant's Core Bundle Vol II Part B at 365]

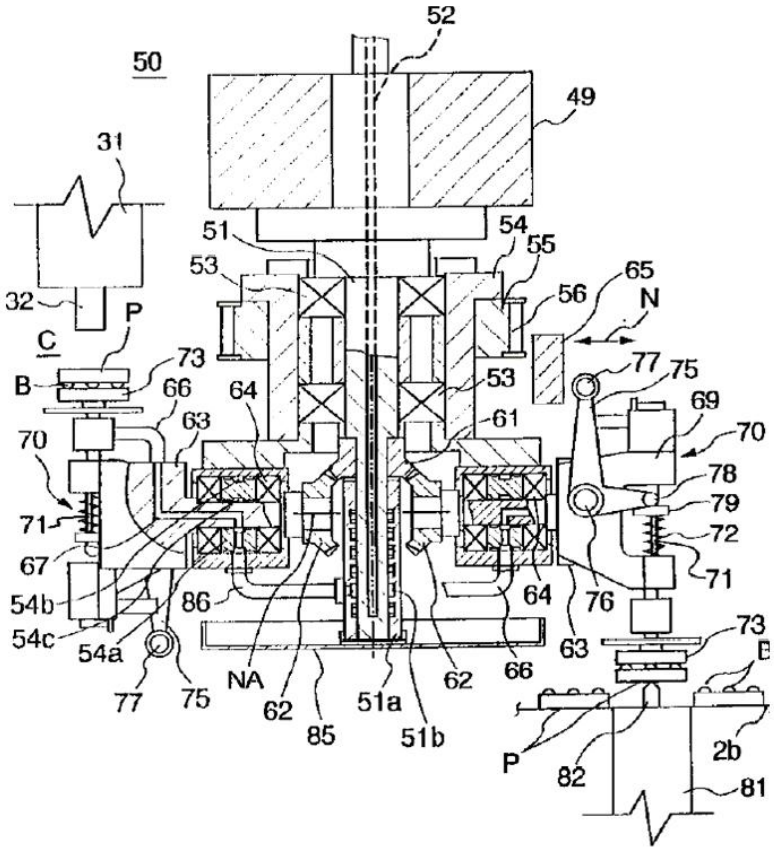
APPENDIX C



The AFC 800, incorporating the ASA Patent

[Source: Appellant's Case at 108 (observation inserted)]

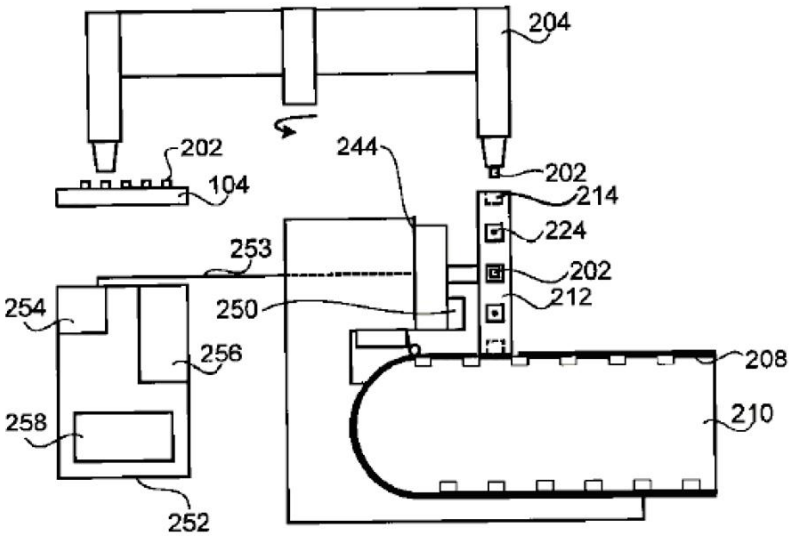
APPENDIX D



The Matsushita Patent

[Source: Appellant's Core Bundle Vol II Part B at 297]

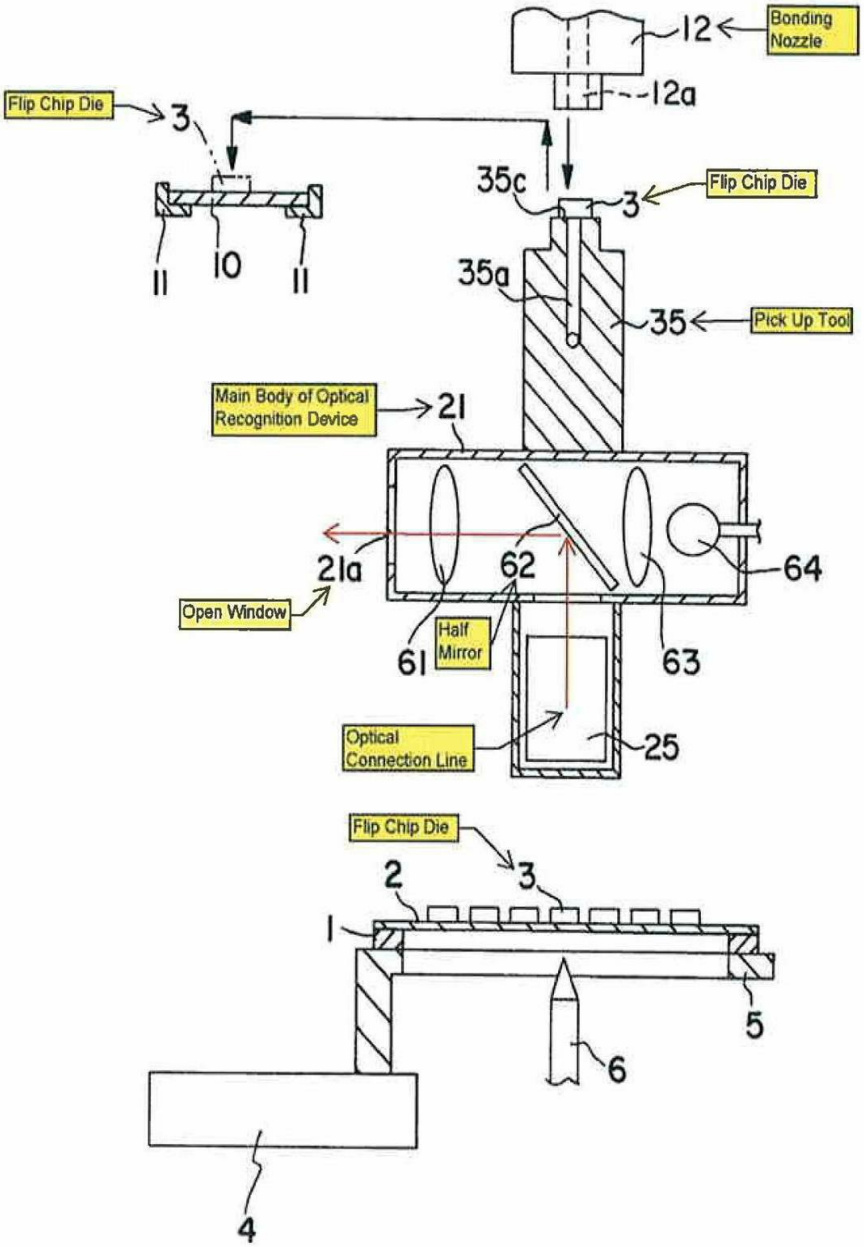
APPENDIX E



The National Semiconductor Patent

[Source: Appellant's Core Bundle Vol II Part B at 325]

APPENDIX F



The Shinkawa Patent

[Source: Appellant's Core Bundle Vol II Part B at 235]

[note: 1] Appellant's Core Bundle ("ACB") Vol II Part A at pp 108–110.

[note: 2] For a clearer exposition, please refer to the graphical representations of these claims at pp 45–46 of the Appellant's Case ("AC"). The key reference Nos to note in the graphical representations are: 23 (optical facility/camera), 14 (pivoting part), 19 and 20 (pickup heads located at opposite ends of the pivoting part) and 17 (through opening in centre of pivoting part allowing for

camera to inspect the next wafer chip in line).

[note: 3] Appellant's Skeletal Arguments at para 30.

[note: 4] AC at para 376. Note, especially, the table provided comparing the correspondence of multiple portions of the GD with the relevant views tendered by the Respondent's expert, Mr John Briar ("Mr Briar").

[note: 5] ACB Vol II Part B at p 365.

[note: 6] ACB Vol II Part B at p 332.

[note: 7] ACB Vol II Part B at p 336.

[note: 8] ACB Vol II Part B at p 339.

[note: 9] ACB Vol II Part B at pp 343–344.

[note: 10] ACB Vol II Part B at p 341.

[note: 11] ACB Vol II Part B at p 333.

[note: 12] ACB Vol II Part B at p 353.

[note: 13] See generally ACB Vol II Part B at pp 356–358.

[note: 14] ACB Vol II Part B at p 353.

[note: 15] AC at p 108.

[note: 16] See the accompanying diagram at para 169 of the AC.

[note: 17] See the expert report of the appellant's expert witness, Associate Professor Tay Meng Leong ("A/P Tay") in ACB Vol II Part A at p 176. According to A/P Tay, "the checking is probably done when the disc is rotated by about 45 degrees".

[note: 18] See ACB Vol II Part B at p 297.

[note: 19] ACB Vol II Part B at p 300A.

[note: 20] See United States patent No 5,839,187 at column 7 in ACB Vol II Part B at p 302.

[note: 21] See Appendix I of the expert report of Mr Briar in ACB Vol II Part B at pp 256–269 for a very useful graphical representation of this work process.

[note: 22] See ACB Vol II Part A at p 137.

[note: 23] See United States patent No 5,839,187 at column 6 in ACB Vol II Part B at p 301.

[note: 24] See United States patent No 5,839,187 at column 7 in ACB Vol II Part B at p 302.

[note: 25] See also ACB Vol II Part A at p 165.

[note: 26] "Three heads are provided around a center rod of a head assembly; they horizontally rotate around the center rod." (see Abstract, United States Patent No 5,839,187 in ACB Vol II Part B at p 293).

[note: 27] See the Respondent's Case ("RC") at para 5.81.

[note: 28] See ACB Vol II Part B at p 325.

[note: 29] See Abstract, United States patent No 6,364,089 B1 in ACB Vol II Part B at p 322.

[note: 30] The diagrams in ACB Vol II Part B at pp 324-325 (*ie*, FIGS 2 and 3) are crucial for understanding the operation of the National Semiconductor Patent.

[note: 31] ACB Vol II Part B at p 227.

[note: 32] See United States patent No 6,364,089 B1 at column 5 in ACB Vol II Part B at p 329.

[note: 33] See ACB Vol II Part B at p 323.

[note: 34] ACB Vol II Part B at pp 270–280.

[note: 35] ACB Vol II Part B at p 228.

[note: 36] See ACB Vol II Part B at p 233.

[note: 37] See Abstract, United States patent No 6,311,391 B1 in ACB Vol II Part B at p 307. See also the diagram of the Shinkawa Patent on the same page and the larger diagrams illustrating the rotation of the vacuum suction chucking nozzle on the pages following (at pp 308–309).

[note: 38] For a detailed description of this process, see United States patent No 6,311,391 B1 at column 4 in ACB Vol II Part B at p 317. The diagrams referred to in the footnote above are also helpful – observe the periscope-like nature of the optical recognition device, albeit oriented horizontally.

[note: 39] For reference, see generally United States patent No 6,311,391 B1 in ACB Vol II Part B at pp 317–321 for the three different embodiments of the Shinkawa Patent.

[note: 40] See ACB Vol II Part B at p 213.

[note: 41] See ACB Vol II Part B at pp 293, 307, 322 and 332.

[note: 42] ACB Vol II Part B at p 339.

[note: 43] ACB Vol II Part B at pp 343–344.

[note: 44] See [66] above and [89]–[90] below, where the significance of the difference between inspection *through a pivoting part* and inspection *when the pivoting part has moved out of the way* is explained in greater detail.

[note: 45] See [97]–[100] below for a discussion on the differences between the utilisation of *two pickup heads* and a *"plurality of nozzles"*.

[note: 46] RC at para 5.75.

[note: 47] RC at para 6.64.

[note: 48] RC at para 6.51.

[note: 49] RC at para 6.60.

[note: 50] See the Respondent's Supplementary Core Bundle ("RSCB") at p 198.

[note: 51] See ACB Vol II Part B at pp 266-267.

[note: 52] See "Device For Inspecting And Rotating Electronic Components" in ACB Vol II Part A at p 98. Also see [9] above, where this laborious process is described in simpler terms.

[note: 53] See United States patent No 6,467,158 B1 in RSCB at p 197.

[note: 54] See RC at para 5.58.

[note: 55] See Abstract, United States patent No 6,364,089 B1 in ACB Vol II Part B at p 322.

[note: 56] See ACB Vol II Part B at p 327.

[note: 57] See ACB Vol II Part B at pp 233–235.

[note: 58] See AC at paras 67–69. See also ACB Vol II Part A at pp 104 (lines 22–27) and 116 (FIG 6 – The available inspection angles during a 360-degree rotation of the two-headed pickup are highlighted by the portions in the pie graph labelled 35 and 36).

[note: 59] See RC at para 5.46.

[note: 60] See ACB Vol II Part B at pp 236–237.

[note: 61] See RSCB at p 198.

[note: 62] See RC at para 6.51.

[note: 63] See ACB Vol II Part B at p 322.

[note: 64] See ACB Vol II Part A at p 96.

[note: 65] See also the GD at [44].

[note: 66] See ACB Vol II Part B at p 477.