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Case No: IP-2015-000039

## IN THE HIGH COURT OF JUSTICE <br> CHANCERY DIVISION <br> INTELLECTUAL PROPERTY ENTERPRISE COURT

Royal Courts of Justice, Rolls Building
Fetter Lane, London, EC4A 1NL
Date: 15/02/2017

## Before :

HIS HONOUR JUDGE HACON
Between :
AP RACING LIMITED
Claimant

- and -

ALCON COMPONENTS LIMITED Defendant

Hugo Cuddigan QC (instructed by Kempner \& Partners LLP) for the Claimant Douglas Campbell QC (instructed by Gowling WLG) for the Defendant

Hearing date: 17 November 2016

## Approved Judgment

I direct that pursuant to CPR PD 39A para 6.1 no official shorthand note shall be taken of this Judgment and that copies of this version as handed down may be treated as authentic.

## Judge Hacon :

## Introduction

1. This is the second action brought by the claimant ("AP Racing") against the defendant ("Alcon") for infringement of UK Patent No. 2,451,690 ("the Patent").
2. On 24 May 2011 AP Racing issued a claim for infringement in the Patents Court ("the First Action"). The patent concerned disc brake calipers for motor vehicles, particularly racing cars. The proceedings were transferred to the Patents County Court.
3. The trial was heard on 19 and 20 December 2012. On 5 February 2013 His Honour Judge Birss QC gave judgment, [2013] EWPCC 3, finding the Patent invalid on the ground of added matter but also finding that if the patent had been valid it would have been infringed by four out of five models of Alcon's calipers of which AP had complained. I will refer to the five pleaded products as "the First Action Products".
4. AP Racing appealed the finding of invalidity. On 28 January 2014 the Court of Appeal allowed the appeal, ruling that the patent was valid [2014] EWCA Civ 40; [2014] R.P.C. 27. Among other things the Court ordered that at AP Racing's election there would be an account of profits or an inquiry as to damages. In a letter dated 31 January 2014 AP Racing raised an allegation of infringement in relation to other calipers sold by Alcon. Alcon did not accept this broadening of AP Racing's claim to relief and limited its disclosure to the First Action Products. AP Racing elected for an inquiry and served its Points of Claim on 7 April 2014. The Points of Claim related only to the First Action Products.
5. On 3 October 2014 AP Racing wrote to Alcon raising again a claim for relief in relation to the further calipers referred to in its letter of 31 January 2014. In the meantime, the inquiry as to damages in the First Action went to trial and in a judgment dated 28 January 2016 damages in the sum of a little less than $£ 500,000$ were awarded.
6. On 4 March 2015 the present action was started ("the Second Action"). In this Second Action AP Racing alleges that the Patent has been infringed by Alcon's making and disposing of further models of caliper identified by reference to 10 product codes.
7. By an application dated 20 April 2015 Alcon sought to strike out the Second Action pursuant to CPR 3.4(2)(b) in so far as it related to 7 out of the 10 types of caliper. Alcon argued that because those 7 calipers were publicly available before the start of the First Action, AP Racing could and should have made them part of its claim in the First Action and that therefore the Second Action was an abuse of process following the rule in Henderson v Henderson (1843) 3 Hare 100. In a judgment dated 15 May 2015 [2015] EWHC 1371 (IPEC); [2016] F.S.R. 1, Alcon's application was dismissed. An appeal from the order was also subsequently dismissed [2016] EWHC 815 (Ch); [2016] F.S.R. 28.
8. The Second Action therefore went forward and now comes to trial. Despite the 10 product codes for Alcon's accused calipers in the Particulars of Infringement, AP Racing's complaint has consolidated down to 8 models in issue. The trial was concerned solely with infringement.
9. As before, Hugo Cuddigan QC appeared for AP Racing, Douglas Campbell QC for Alcon.

## The law

10. The general principles of law on the construction of patent claims is well established, see Kirin Amgen Inc v Hoechst Marion Roussel Ltd [2004] UKHL 46, [2005] RPC 9 at [18]-[52] and Virgin Atlantic Airways Ltd v Premium Aircraft Interiors UK Ltd [2009] EWCA Civ 1062, [2010] RPC 8 at [5]. The court must identify what the person skilled in the art would have understood the patentee to be using the language of the claim to mean.

## The Technical Background

11. I have the benefit of the analysis contained in the judgment of the Court of Appeal of January 2014 and that in the earlier judgment of Judge Birss delivered in February 2013.
12. I begin with the Court of Appeal's summary of the technical background. The leading judgment was that of Floyd LJ:
"[2] The patent relates to disc brake calipers for motor vehicles. Although the claims of the granted patent are not so limited, the invention is particularly directed to brake calipers for racing cars. The parties are involved in designing and making calipers for racing cars.
[3] Disc brakes are so called because they operate on a disc which rotates with the road wheels of the vehicle on a hub carried by the vehicle chassis. The caliper is the body into which brake pads are fitted and in which the brake pads can be actuated to make contact with the disc. When so actuated the pads slow down the disc and, with it, the road wheels. The caliper body straddles the disc at its periphery and can be thought of as comprising two limbs, one on each side of the disc. In the type of caliper with which this case is concerned the limbs are rigidly connected or of 'monobloc' construction. The parts which straddle the disc are called the bridging members. At least one piston is mounted within the caliper body and, when actuated, squeezes the pad against the disc.
[4] Calipers are mounted on the fixed uprights. For ease of description, they have a mounting side and a non-mounting side which are on opposite sides of the disc. Rather than describe the forward and rearward parts of the caliper as such, it is conventional to refer to a leading and trailing edge of the caliper by reference to the edges where the disc enters and exits the caliper body respectively when the vehicle is moving forward.
[5] When the brakes are actuated, the pistons apply pressure from each side via the pads onto the disc. When the vehicle is stationary this results in a reaction force which splays the two limbs of the caliper outwardly and away from each other. This is referred to as the 'static' or 'pressure' load case. It can be thought of as splaying the limbs from a ' $U$ ' shape into a ' $V$ ' shape. There is also a 'dynamic' or 'torque' load case which arises when the vehicle is moving. Because the caliper is mounted on only one side, braking makes the non-mounting side limb of the caliper turn or twist relative to the mounting side limb. If, looking from above, the caliper is seen as a rectangle, the torque or dynamic load will tend to deform it out of its rectangular shape. All this was well known to a disc brake designer at the priority date of the patent.
[6] High performance brake calipers such as those used in motor racing need to be stiff and light. If the caliper is not stiff enough it will flex under load, and if it is heavy the performance of the car will suffer. The forces experienced by calipers in motor racing are particularly high."

## The skilled person

13. Judge Birss held that the skilled person was a braking engineer. He or she worked in motorsport, as opposed to the manufacture of cars for the general public. This was not disputed on appeal.

## Common general knowledge

14. Judge Birss set out the common general knowledge in his paragraphs 22 to 28 , including the trade-off between stiffness and weight referred to by Floyd LJ in the passage above, at [6]. Neither side sought to amend any of this.
15. Calipers embodying the invention are created by the use of what is known as 'structural optimisation software', which allows computer aided optimisation of the design of a caliper, particularly with regard to the trade-off between weight and stiffness. Judge Birss described how it works:
"[29] The way optimisation software is used is as follows. A general shape is defined. This may be the space envelope in which the component may fit or it could be a basic component shape. All the fixed points which must be included are given. For a caliper this would include things such as mounting points and pistons. The load scenarios which the component must withstand are given, along with the material properties. The software then carries out a finite element analysis and removes material where it is not needed. This is repeated iteratively until a target weight is achieved. The process produces a final shape. Very often using this technique the final shape is rather organic in appearance, no doubt because in some ways the process has similarities to evolution by natural selection.
[30] The key difference between this technique and the conventional design process using CAD/CAM and FEM is that in the conventional process the designer designs the shape of the article and uses software, including FEM, to model its behaviour in various load cases. He or she then uses design and engineering skill and experience to adjust the design. The structural
optimisation technique does not really start with a design: it might start simply with the volume in which the component will reside. The final shape arises from the iterative removal of material found to be unnecessary by the computer.
[31] Nevertheless, although much of the design work is carried out by the computer, the shape produced by the structural optimisation technique will depend on decisions made by the engineers using it. Two obvious examples are the choices about which load scenarios to model, and about the starting shape and volume of material. The technique works by removing material from within the given volume. Looking ahead to the obviousness argument, structural optimisation software will not produce a design for a caliper with parts (say "peripheral stiffening bands") which are located beyond the normal envelope of a caliper body unless the engineer decides in the first place to define a starting volume beyond the normal envelope of a caliper."
16. A key point of dispute between the parties was whether the use of optimisation software was part of the common general knowledge. Judge Birss found that it was not; nor was it common general knowledge that optimisation software might have any tangible benefit in designing calipers. This was of significance in relation to inventive step.

## The invention

17. The deficiency in prior art calipers is described in the Patent as follows (at p.3, lines 6-8):
"There is a need, therefore, for an improved disc brake caliper body which has increased structural rigidity or which can provide equivalent structural rigidity to that of conventional caliper bodies but using less material."
18. The invention claimed overcomes this deficiency by incorporating 'peripheral stiffening bands' into the design of calipers. They were referred to as 'PSBs' in argument. PSBs address, in particular, the need to resist the dynamic or torque loads referred to by Floyd LJ above. Judge Birss discussed how the Patent explains the function of PSBs:
"[45] ... The patent then asserts that conventionally caliper bodies have been designed to resist the static load (i.e. the well-known pressure load) but have not taken into account the bending moment. In contrast the caliper according to the invention has been designed to take account of the bending moment generated by brake torque under dynamic braking loads. At p12 $\ln 4-12$ the patent states:

In this regard, the peripheral stiffening bands 45,55 are configured to resist the bending moment generated during braking. In tests, it has been found that the caliper body 30 exhibits increased stiffness when the body is subject to a bending moment under dynamic braking loads than when subject to static brake loads.

Due to the presence of the stiffening bands, less material is required elsewhere in the caliper body 30 so that the overall weight of the caliper is reduced when compared with a conventional caliper body having an equivalent stiffness."
19. The Patent further explains that the introduction of PSBs and the removal of material elsewhere in the caliper body gives rise to an asymmetrical shape when viewed from above, or indeed below:
"Because conventional caliper bodies are designed [to] cope with static braking forces they tend to have a generally symmetrical outer profile when viewed in plan. Of course conventional caliper bodies are not perfectly symmetrical because of the need to provide mountings and fluid connections but generally they have a largely symmetrical profile when viewed in plan. It will be noted that use of peripheral stiffening bands 45 , 55 in the caliper body 30 and the removal of material elsewhere gives the body 30 a distinctly asymmetrical appearance when viewed in plan." (p.12, line 26 to p.13, line5)
20. This could be taken to imply that no prior art calipers had been designed to deal with the bending moment generated by brake torque. Judge Birss's review of the prior art relevant to the validity of the Patent shows that this was not the case, see [95].
21. The passages from the Patent quoted above are directed at a first embodiment of the invention, illustrated in plan view in Figure 4. There is a second embodiment, shown in plan view in Figure 9. A similar function of PSBs is described in the context of this embodiment, together with the teaching that PSBs allow material elsewhere in the caliper body to be reduced to a minimum, resulting in a caliper profile which is highly asymmetrical when viewed in plan, see p.17, line 22 to p.18, line 5.
22. The invention was described by Judge Birss in this way:
"[50] From the perspective of a skilled person reading the patent, the invention is really quite simple. The distinctive asymmetrical appearance of the calipers is ultimately a consequence of the asymmetrical torque load they are designed to resist. The reason stiffness can be improved relative to weight is because these calipers extend over a larger area than a conventional caliper. The stiffening bands are on the periphery where they can do more good. As a result of material being moved to the outer periphery of the caliper, material from the interior can be taken away without compromising stiffness. So there are numerous openings in the structure. Also, instead of the cylinders simply looking like holes bored in a block, the material around the cylinders has been removed, making the shape of the cylinders visible from the outside and contributing to an organic, rather skeletal appearance."

## Claim 1

23. Only claim 1 is relevant, here broken down into 6 integers, with integers 4 and 5 subdivided for reasons that will become apparent.
24. A body for a fixed type disc brake caliper,
25. the body comprising a mounting side limb and a non-mounting side limb,
26. each limb having two or more hydraulic brake cylinders suitable for receiving corresponding hydraulic brake pistons,
27. the limbs being (a) rigidly inter-connected at either end by spaced bridging members and (b) profiled to define a shaped housing portion about each cylinder,
28. each of the limbs having (a) a peripheral stiffening band (b) extending in a longitudinal direction about and interconnecting outer lateral end regions of the housing portions,
29. in which each of the stiffening bands has a profile that is asymmetric about a lateral axis of the body when viewed in plan.
30. Alcon's Particulars of Non-Infringement raise arguments of construction in relation to integers 4(b), 5(a), 5(b) and 6.

## Integer 4(b): The limbs being profiled to define a shaped housing portion about each cylinder

25. Judge Birss was not called upon to construe this integer. I interpret 'profiling' to mean shaping. For instance, the Patent states (at p.9, lines 3-4):
"Each of the limbs 31, 32 is profiled so as to form distinct housing portions 42 about each of the cylinders."
26. The limbs are shaped to create a housing portion about, i.e. around, each cylinder. The cylinders must be within the limbs, so necessarily the limbs are shaped to create a space around each cylinder: the housing portion. This must be 'shaped', but since there is no limitation to the shape, it doesn't add much.
27. Mr Campbell equated 'profiling' with the removal of limb material. I do not accept that for two reasons. The first is that it is not consistent with the way that 'profile' is used in the Patent. I have given one example above. Another is found at the bottom of page 17 and the top of page 18 where there is a paragraph in which the specification explains how the presence of a peripheral stiffening band enables material to be removed from elsewhere in the caliper body and concludes:
"These arrangements result in a caliper profile that is highly asymmetrical when viewed in plan."
28. Secondly, the term 'machining' is used in the Patent to indicate the removal of part of the body of the caliper. The advantage of keeping the weight of a caliper bulk to a minimum, without compromising its rigidity, was well known. In its discussion of the prior art the Patent says this by reference to figure 1 (p.3, lines 15-22):
"To save weight, the radially outer and inner faces (the upper and lower faces as shown) 22,23 of the housing are sometimes machined to match the profile of the cylinders where this can be achieved without compromising the structural rigidity of the caliper. Where the upper and lower faces 22,23 of
the housing are machined in this way, the regions of the housing 24 surrounding the side walls of each cylinder extend generally parallel to the axis of the cylinder, except at the lateral inner and outer edges where they are radiused."
29. The machining performed in the prior art and described here gave rise to a housing portion matching the shape of the cylinder within.
30. Turning to the invention, as I have said, claim 1 does not require that the housing portions have any particular shape. In the first embodiment of the invention described in the Patent they are generally frusto-conical in shape (p.9, lines 3-6), in the second they are partially dome shaped (p.15, lines 20-23). But a housing portion similar in profile to that used in the prior art is not ruled out by integer 4(b). It might be ruled out in practice by the skilled person's desire to keep weight to a minimum and to make the most of the advantages of stiffening afforded by a peripheral stiffening band, but that is another matter. Claim 1 does not require any particular shape of housing portions.
31. Claim 2, by contrast, requires that each limb is profiled to define a partially domed or tapered cylinder housing portion about each cylinder.
32. Returning to claim 1, the profiling must define a shaped housing portion about each cylinder. A single housing portion surrounding both or all cylinders would not suffice. This was not an issue raised at the trial.
33. It follows from the construction I have reached that I need not consider Alcon's arguments in relation to this integer of claim 1.

## Integer 5(a): A peripheral stiffening band

34. 'Peripheral stiffening band' is not a term of art. It was common ground that its meaning can only be inferred from use of the term in the Patent.
35. It was also not in dispute that the band is peripheral in the sense that it lies along outer edges of the caliper. Figure 4 is a plan view of the first embodiment described:

36. As explained by Floyd LJ, each caliper has a mounting side - the side on which it is mounted on fixed uprights by means of mounting holes 35 . In figure 4 this is the lower side, so the upper part of the diagram represents the non-mounting side. The leading edge as described by Floyd LJ is to the right, the trailing edge on the left. The two PSBs are marked 45 and 55. The one which runs along the edge of the mounting limb of the caliper starts at the bottom left and continues towards the right, 45 b then 45 c , turning to form a lower part of the leading edge 45 a . The other PSB is shown at the top to lie along the outer part of the non-mounting limb, running right to left from the portion marked $55 \mathrm{c}, 55,55 \mathrm{~b}$ and then around to form part of the trailing edge of the caliper 55a.
37. Two points of construction arise. They are related but it is convenient to consider them separately. First, it is necessary to identify the characterising features of a PSB which enable the skilled person to recognise whether a caliper has one or not. Secondly, assuming that the skilled person would recognise the presence of a PSB, identifying its limits - where it starts and where it ends.

## The characterising features of a PSB

38. Before Judge Birss Alcon's expert, Phillip Smith, advanced the view that a PSB was material axially outboard of the end of the cylinder housings, which reduces the tendency of the parts it joins to deflect relative to each other. The judge rejected this, pointing out that there must always be material at the end of the cylinders, otherwise they would be open. Inevitably, this material would make some contribution to a reduction in the tendency of parts of the caliper limb to deflect under stress.
39. In other words, the judge recognised that in prior art calipers, each of the limbs had material interconnecting outer lateral end regions of the housing portions. This material was approximately where a PSB would be found, it contributed to the function that a PSB would be expected to perform, but it could be distinguished from a PSB. Figure 1 of the Patent shows a prior art caliper with a rib of material at the end of the cylinders. Judge Birss found this a useful means of distinguishing what is found in the prior art from a PSB as described in the Patent:
"[57] ... Mr Cuddigan pointed out that the part of the limb which numeral 11 happens to point to is a small rib of material 'outboard' the ends of the cylinders. He said that the skilled reader, seeking to understand what the patentee was using the words to mean, would not think that this rib was what the patentee meant by 'peripheral stiffening band' even if the rib could be said at some level to contribute a degree of stiffness to the structure. I do not think a skilled person would analyse figure 1 of the patent in this sort of detail but I do accept the general point Mr Cuddigan is making. The rib in figure 1 is a useful illustration of the argument. It has material which is probably within Mr Smith's definition but that material is not what the reader would understand the patentee to be talking about."
40. This led the judge to his definition of a PSB, in the sense of its characterising features:
"[58] A skilled person would understand 'peripheral stiffening band' in the patent in the following way. A peripheral stiffening band is plainly supposed to stiffen the caliper. It is a band of material and it is meant to be appreciably beyond and distinct from the limb material at the ends of cylinders. That is what the word 'peripheral' is getting at. I do not think a skilled person would understand the patent to be trying to include within this expression some relatively arbitrary outer portion of the thickness of the limb material on the ends of the cylinders simply because it contributes to stiffening."
41. Thus, what distinguishes a PSB from what I might call prior art limb material at the ends of the cylinders is that it is appreciably beyond and distinct from that material. Before the Court of Appeal this was criticised by Alcon as being too vague:
"[46] Mr Campbell attacked the judge's construction as being of uncertain scope, as failing to identify any criterion as to what is meant by 'appreciably beyond', as being unsupported by the description and as placing excessive reliance on Figure 1. He invited us to accept the alternative construction put forward by Mr Smith.
[47] I was not persuaded by Mr Campbell's argument that the judge's approach to the meaning of 'PSB' was incorrect. According to the specification, Figure 1 is representative of the prior art. The patentee is proposing the addition of a peripheral stiffening band to the known construction. The judge was correct that the skilled person would not expect the patentee to be using the term to cover just the material at the margin of the ends of the pistons. The arguments as to the precise scope of what the judge meant by appreciably beyond do not seem to me to be material to the outcome of the appeal."
42. I will return to the construction of the term 'PSB', but will go first to integer 6 of claim 1.

## Integer 6: Each of the stiffening bands has a profile that is asymmetric about a lateral axis of the body when viewed in plan

43. A further characteristic of a PSB expressly stated in claim 1 is that it must be asymmetric about a lateral axis of the body of the caliper when viewed in plan.
44. Judge Birss began by pointing out that the asymmetry of the PSB is not to be interpreted with mathematical precision:
"[59] ... It is plain that although to a mathematician symmetry and asymmetry may be regarded as absolutes, to a skilled reader of the patent, the expressions are not absolute. This is clear from the passage quoted above from p12 $\ln 26-$ p13 $\ln 5$. Some minor asymmetry at a detailed level is acknowledged to be known and irrelevant."
45. The passage in the Patent to which the judge referred was discussing the asymmetry of the caliper as a whole, not the PSB, but I take the judge to mean, and I agree, that the skilled person would not interpret the specification to mean that the patentee had
absolute asymmetry in mind in either context. The asymmetry must be more than minor.
46. The judge went on to explain more fully what was meant by the asymmetry of a PSB:
"[65] Thus although it is true that the patent never defines the precise location of 'the' lateral axis, there is no practical difficulty in either of the two embodiments depicted. The bands shown are all asymmetric about any lateral axis. I note that the claim uses the indefinite article: ' $a$ ' lateral axis. In my judgment, if a band is asymmetric about any lateral axis then it will fall within the claim. Conversely if there is a lateral axis about which the band is symmetrical, the band is not within the claim.
[66] There was an argument that since the asymmetry is a consequence of the asymmetric torque load, to be relevant the asymmetry had to be enough to affect the torque response or the overall braking efficiency. I do not accept this. No criteria are laid down by the patent in order to make that sort of assessment. The specification is talking about an asymmetric appearance. A visual assessment is required. For the hockey stick shaped bands, the skilled person would have no difficulty seeing the asymmetry referred to and would not be puzzled by the reference to a lateral axis. Even for band 145, one can see that the band has an asymmetrical shape as a result of the offset of the hole towards one end and possibly also the angles of the outer edges. What may make the visual assessment difficult in some cases is that minor asymmetry is not relevant. This is not a practical problem for the caliper in figure 4, is harder but not insurmountable for the caliper in figure 9 , but may be more difficult to deal with in other cases."
47. I should add a point about what Judge Birss said in his paragraph 65, specifically the penultimate sentence. I think he meant there that if there is no lateral axis about which the band is symmetric, it will fall within integer 6 of the claim. This is then consistent with the final sentence. That, in any event, is how I construe claim 1 and, as I understand it, this is how the claim was construed in the Court of Appeal.
48. The PSBs which Judge Birss held to be asymmetrical qualified for that description because they had a hockey stick shape. In other words, they extended along the outer edge of the mounting or non-mounting limb and also curved around towards the leading or trailing edge, as the case may be. A hockey stick shaped band could never be symmetrical about any lateral axis of the caliper.

## Where a PSB starts and ends

49. A critical factor affecting whether a PSB is asymmetrical or not is the determination of where it starts and ends. This was recognised by Judge Birss:
"[68] I have found that four shapes infringe and one does not. Nonetheless, the issue of infringement is not easy to decide. I have not reached this view without some hesitation. There is no difficulty in relation to a lateral axis. The area of doubt concerns identifying what level of detail the asymmetry should relate to and, to some extent, which features should be regarded as part of the profile of the peripheral stiffening bands."
50. At each end the PSB meets limb or possibly bridge material. The skilled person is left to decide where, at each end, the PSB ends and the other material begins, and the consequent shape of the PSB.
51. This is an extension of the difficulty which Floyd LJ touched upon in his paragraph 47 (quoted above). He accepted Judge Birss's test for identifying a PSB - that it must be a band appreciably beyond and distinct from the limb material at the ends of cylinders - and by inference acknowledged that the precise scope of what is meant by 'appreciably beyond and distinct' may be difficult to determine in practice. The court, through the eyes of the skilled person, must do its best.
52. It follows from Judge Birss's test that there must be some sort of perceptible distinction between PSB and limb. It was common ground before me that the limb and the PSB must be mutually exclusive parts of a caliper. Yet while this distinction is easy to state, it not easy to apply.
53. I pressed Mr Cuddigan for a test to resolve the difficulty in distinguishing PSB from limb. Eventually he said it was a matter for judgment, not really much help.
54. However, I think Mr Cuddigan was right to say that Figure 4 of the Patent provides as good a guide as any. He drew my attention to this passage in the specification (p.9, line 28 to p.10, line 1 ):
"Several openings 47, 48, 49, 50, 51, 52 are formed through the band to reduce the weight of the material without compromising the structural rigidity of the body 30 ."
55. It is clear from earlier passages of the specification that the 'band' is a PSB. If and where openings of the type there described appear in Alcon's calipers, it is likely that they will be formed through a PSB. Therefore the immediately surrounding material will be part of a PSB, as opposed to being limb or bridge material, see in particular openings 51 and 52 on the bottom left of Figure 4. On the other hand, as Mr Campbell pointed out, Mr Cuddigan went too far in saying that towards the other end of the band, the region marked 31 is part of the PSB. The Patent expressly identifies this as part of the limb.
56. Mr Cuddigan also pointed to this part in the specification (p.4, lines 19-22):
"For at least part of its length, at least one peripheral stiffening band may comprise a laterally outer region connected with a cylinder housing portions [sic] by means of a web, the web having a reduced thickness when compared with the laterally outer region of the band."

As there stated, a 'web' is a zone of thinner material. This part of the specification could be taken to suggest that a web is attached to, but distinct from the laterally outer region of the PSB. But at page 9 , lines $16-24$, the specification states that a web may form part of a PSB. This is part of that passage:
"The first band includes a web portion 45 b which is connected with the lateral outer end regions 43 of the housing portions 42. (my italics)
57. What I take from this is that a PSB might, but need not necessarily, extend round a corner towards the leading or trailing end of a caliper. One way of telling is whether there are openings of the type to which Mr Cuddigan drew my attention, surrounding which there is likely to be PSB material. Alternatively, there may be a web which forms part of the PSB. By contrast and absent any other indication, what looks like limb material is likely to be so if it contains no holes or web.
58. Mr Campbell actively relied on the difficulty in distinguishing PSB from limb and thus the undoubted difficulty in construing claim 1. He submitted that proof of this difficulty, if proof were needed, was provided by AP Racing's drawings in its Reply which reflected a substantial change in AP Racing's case and which, by implication, revealed substantially differing views in the AP Racing camp as to which parts of a caliper could accurately be called PSBs.
59. Mr Campbell referred me to Millikin Denmark AS v Walk Off Mats Limited [1996] F.S.R. 292. In that case Jacob J pointed out that it was not possible to challenge the validity of a granted patent on the ground that its claims are ambiguous. Counsel for the first defendant argued that a claim could nevertheless be so ambiguous that it was not possible for it to be infringed. The requirement in issue, that a floor covering should exhibit certain qualities "in normal use" - broadly that it would not leak - was an example of this. Jacob J accepted the proposition in principle, though not its application in that instance (at p.301):
> "Now, I think Mr Pumfrey must be right in principle. It is possible to imagine claims which simply have no meaning to the skilled man. A lie detector which had to be calibrated in Pinocchio units, no one knowing what these were, would be an example. But I have, not without some hesitation, come to the conclusion that the concept of normal use is clear enough for the skilled man."
60. In Millikin counsel for the plaintiff was able to formulate a submission as to how 'normal use' would be interpreted by the skilled person: the sort of use to which the mats are generally put and one way of testing this was to see whether there had been complaints of leakage from customers who had used the mats.
61. The lack of any equivalently clear formulation in the present case might, on one view, push the present claim forward as a candidate for an uninfringeable claim in the Millikin sense. However, I think there are just about enough visual clues for the skilled person to reach a conclusion. Although these are far too imprecise to be satisfactory, I believe that the task of deciding where the PSBs are to be found on a caliper is just about workable.

## The overall characteristics of a PSB

62. A PSB which satisfies integers 5 and 6 of claim 1 must be a single band of material appreciably beyond and distinct from material at the outer ends of the cylinders, which serves to stiffen the caliper and which is clearly asymmetric to the eye in plan view about any lateral axis of the caliper.
63. Mr Campbell emphasised that the PSB must materially increase the stiffness of the caliper. I do not believe that this was disputed, but anyway effect must be given to the word 'stiffening' in the name and I accept that the band must stiffen the caliper to
a material degree. I doubt that this adds anything to the present dispute. If there is a band appreciably beyond and distinct from the limb material at the ends of cylinders, a matter for the eye, I think I am entitled to assume that it will make a material contribution to the stiffness of the caliper unless there is evidence to the contrary. There was none.

## Integer 5(b): the PSB must extend in a longitudinal direction about and interconnect outer lateral end regions of the housing portions,

64. The requirement that the PSB must interconnect outer lateral regions of the housing portions was not in issue before Judge Birss (or the Court of Appeal), although the judge said something briefly about it:
"[54] Feature 5 also refers to housing portions, these are the shaped parts of the limbs around each cylinder. The extent in the longitudinal direction is said to be 'about and interconnecting' the outer lateral end regions of the housing portions. This is referring to the peripheral stiffening band running along the outer ends of the housing portions, in effect joining them up (although they are not separate)."
65. This straightforward interpretation was not challenged. The purpose of connecting the outer lateral end regions of the housing portions is to resist the distortion to the caliper body that would otherwise be caused by the forces generated during braking.

## The parties' drawings of PSBs

66. On 9 March 2015 AP Racing served its Particulars of Infringement. Annex 1 to that pleading contained plan drawings of Alcon's calipers complained of with what AP Racing said were the PSBs marked in colour. On 19 June 2015 Alcon served its Defence, to which were annexed Particulars of Non-Infringement containing a number of drawings, including isometric drawings of its calipers, and plan drawings showing Alcon's contentions as to where the PSB was to be found in each of its calipers in issue. A year later AP Racing served a Reply to Particulars of NonInfringement, on 20 June 2016. Contained in this were further plan drawings of Alcon's calipers, amending all but one of the earlier AP Racing drawings. The Reply stated that the new drawings had been created with the assistance of Carlo Cantoni, AP Racing's expert, and superseded AP Racing's earlier drawings, bar the one left unchanged.
67. The new drawings displayed an often very significant alteration in AP Racing's case as to where PSBs were to be found. Below are two sets of examples, showing Alcon's calipers CAR 37 and CAR 0349 in plan view, in each case with the PSB or PSBs represented in colour by the relevant party:

CAR 37


AP Racing Particulars of Infringement


Alcon Particulars of Non-Infringement


AP Racing Reply

CAR 0349


## AP Racing Particulars of Infringement



Alcon Particulars of Non-Infringement


AP Racing Reply
68. Mr Cantoni was cross-examined on the reasons for the changes in AP Racing's case. I have to say that his answers were not always easy to follow, but the principal reason given was that Mr Cantoni felt better informed about the PSBs upon seeing the isometric drawings provided with Alcon's Defence.
69. In his report Mr Cantoni referred mostly to the drawings in AP Racing's Reply as stating AP Racing's case, but appeared to amend AP Racing's argument in the case of one caliper, CAR 1249. I return to this below.

## The Alcon calipers alleged to infringe

CAR 17
70. Alcon argued that (i) there were no PSBs at all in the CAR 17 caliper, (ii) if there were, they were symmetrical and (iii) neither side limb was profiled to define a shaped housing portion about each cylinder.
71. Looking at a production sample of the CAR 17 caliper, on balance I take the view that there are PSBs on both the mounting and non-mounting side. I can see that arguably they constitute nothing more than limb material at the ends of the cylinders, of the sort acknowledged in the Patent to exist in the prior art. I also accept that distinguishing this from "a band of material ... appreciably beyond and distinct from the limb material at the ends of cylinders", to quote Judge Birss's characterisation of a PSB, is difficult. However, it seems to me that in the CAR 17 caliper there are such bands.
72. It is very hard to say where those bands start and end. In this regard, it is not helpful to assess which parts of the caliper contribute to stiffening. Although PSBs must do so, other parts of the caliper may also contribute.
73. AP Racing did not change its case in Reply in relation to the CAR 17 calipers so there are only two drawings with alternative representations of the PSBs. The main distinction is that AP Racing's drawing includes blocks of material to which the fluid connectors are attached and more of what Alcon characterises as limb or even bridge material. Comparing the example caliper with the drawings, Alcon's drawing seems to me to make more sense, particularly on the mounting side. At least the PSB on the mounting side is broadly symmetrical.
74. Claim 1 requires that both PSBs have a profile that is asymmetric, so CAR 17 does not infringe.

## CAR 37

75. There was no sample of a CAR 37 caliper, so argument and assessment was based on the parties' drawings, which have been reproduced above.
76. Phillip Smith, Alcon's expert, in his report annotated the drawing used in Alcon's Particulars of Non-Infringement. He drew a series of horizontal lines across the drawing to demarcate PSBs, limbs and bridging members. Unlike the original Alcon drawing, he suggested that there was a PSB on the mounting side, shown in the upper part of the drawing. On the other hand, the PSB on the non-mounting side was reduced in size.
77. Mr Cuddigan submitted that it was not possible to reconcile Mr Smith's annotations with the description in the Patent and particularly Figure 4. I agree. Certainly it would be highly convenient to differentiate PSBs, limbs and bridging members by Mr Smith's simple expedient of strict lateral demarcations, but I do not at all accept that this reflects what is described and illustrated in the Patent.
78. Alcon argued that the PSB on the mounting side did not interconnect outer lateral end regions of the housing portions (integer 5(b)), nor was it asymmetrical (integer 6).
79. With regard to the alleged lack of interconnection of the end regions of the housing portions, this was not supported either by Mr Cantoni or, in cross-examination, by Mr Smith. I agree with both. The drawings suggest that the PSB runs along the ends of
the housing portions and in that sense interconnects the end regions of the housing portions.
80. Of the three marked-up versions of the plan drawing of CAR 37, I do not accept AP Racing's Reply version. According to this, the PSBs have practically taken over the periphery of the caliper, leaving bridging members but apparently no side limbs. In my view this pushes the extent of PSBs beyond what is sanctioned in the Patent.
81. The visible openings might suggest that the PSB on the non-mounting (lower) side extends further than shown in either AP Racing's initial drawing or Alcon's drawing (no point was taken with regard to the annotated angles). But there are openings on both sides, so the extension at the leading end is liable to be about the same as the extension towards the trailing end. On balance I think that the PSB on the nonmounting side not sufficiently asymmetrical to satisfy integer 6.
82. For reasons given above, I do not accept Alcon's argument with regard to integer 5(b) of claim 1 .
83. CAR 37 does not infringe.

CAR 0349
84. Caliper CAR 0349 has, overall, quite a symmetrical appearance. The sole point was whether the PSBs are asymmetrical.
85. The three drawings advanced by the parties are shown above. I also had the benefit of looking at a sample caliper.
86. The question was whether it was appropriate to extend the PSBs in the manner shown in AP Racing's drawing in Reply. Comparing this drawing with the sample, I take the view that the blue shading encroaches on what would better be regarded as limb material. Although it is by no means decisive, there are, for instance, no openings or webs suggesting that the PSBs extend much beyond the material immediately outboard of the housing portions.
87. I think Alcon's drawing provides the most accurate image of the PSBs. They are broadly symmetrical.
88. CAR 0349 does not infringe.

CAR $9549 Y 73$
89. Alcon argued that this caliper does not have a PSB on the non-mounting side and that the PSB on the mounting side was symmetrical. Alternatively, the PSBs on both sides were symmetrical.
90. I had some trouble matching the sample caliper I was given with the drawings. The centre portion of the sample seemed to be a mirror image of the equivalent part shown in the drawings and there were other minor mis-matches. I took the sample to be a production sample and I paid most attention to that.
91. I think there is clearly a PSB on the mounting side, not in my view exactly as shown in any of the drawings, but in any event asymmetrical. There is also a PSB on the non-mounting side. Its length is harder to tell but I am persuaded by the presence of a web towards the leading end and what might be a small web nearer the trailing end that the PSB extends further than at first appears. I also think that whether there is one web or two, this PSB is also asymmetrical.
92. CAR 9549Y73 infringes the Patent.

CAR 9549 Y 71 and 72
93. CAR 9549Y72 is an updated version of CAR 9549Y71. They can be taken together. Aside from the alleged absence of integer 4(b) (as to which see above), the point in dispute was whether this caliper has any PSBs and, if so, whether both are asymmetrical. I was provided with a polymer model of the 71 caliper and a production sample of the 72 .
94. I find it hard to discern a PSB on either the mounting or non-mounting side. There are no openings or webs to suggest the presence of a PSB. To the extent that there is one on either side, I think both are likely to be symmetrical.
95. Calipers CAR 9549Y 71 and 72 do not infringe.

CAR 1249
96. Alcon's case was that this caliper has no PSB on the non-mounting side or if there is one, it is symmetrical.
97. This was another instance in which the drawings seemed to present a mirror image of the production caliper. As before, I had AP Racing's pleaded proposed location of the PSBs in its Reply (the shaded drawing in the Reply illustrated only the PSB on the non-mounting side) and Alcon's annexed to the Particulars of Non-Infringement. There was then a further drawing exhibited to Mr Cantoni's report (which showed both PSBs) in which AP Racing appeared to be taking the opportunity to extend the PSB on the non-mounting side. The PSBs in this drawing cover almost the entirety of the periphery of the caliper, meeting at the leading and almost meeting at the trailing end.
98. Alcon did not dispute that there was an asymmetric PSB on the mounting side. However, its case was otherwise the polar opposite of AP Racing's: if there was a PSB at all on the non-mounting side, it was a thin, straight and thus symmetrical strip along the periphery.
99. In my view the position and structure of the PSB on the non-mounting side are closer to those contended for by Alcon than that shown in AP Racing's Reply. They are even more removed from Mr Cantoni's revised and extravagant contention. It is a strip, as shown by Alcon, which may extend a little further at each end, but if so, in a broadly symmetrical fashion.
100. CAR 1279 does not infringe.
101. There was no example of this caliper available, so there were only the rival drawings to guide me. Alcon argued that the PSBs were symmetrical.
102. Although it is particularly difficult to tell just from drawings, the openings near the PSB on the non-mounting side suggest that the PSB extends further in both directions than as shown in the Alcon drawing. That being so, AP Racing's Reply shading is probably more accurate and suggests sufficient asymmetry for this PSB to satisfy integer 6 of claim 1 .
103. In cross-examination Mr Cantoni conceded that the degree of asymmetry of the PSB on the mounting side, as marked up in the Particulars of Infringement, was only a small detail. I agree that it looks almost symmetric - so not asymmetric within the meaning of integer 6. Mr Campbell pointed out that AP Racing's Reply drawing, its final position on this, had a PSB on the mounting side marked up in the same way. Mr Cuddigan took me to the end views of the caliper provided by Alcon, both leading and trailing. These views are of themselves irrelevant, though absent a physical example they throw a limited degree of light on where the PSB might start and finish from the plan perspective. However, given Mr Cantoni's concession I accept that the PSB on the mounting side has a profile that is not asymmetric when viewed in plan, within the meaning of claim 1 .
104. CAR 2849 does not infringe the Patent.

## Conclusion

105. Alcon's caliper CAR 9549 Y73 infringes the Patent. Calipers 17, 37, 0349, 9549Y 71 and 72, 1279 and 2849 do not infringe.
