Neutral Citation Number: [2014] EWHC 14 (Ch)

Case No: HC10C04475

IN THE HIGH COURT OF JUSTICE
CHANCERY DIVISION
PATENTS COURT

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 15/01/2014

Before :

MR JUSTICE ROTH

- -

Between :

EUGEN SEITZ AG	**Claimant**
- and -	
(1) KHS CORPOPLAST GMBH	
(Formerly KHS Corpoplast GmbH & Co KG)	
(2) NORGREN AG	**Defendants**

- -
- -

MR. PIERS ACLAND QC (instructed by **Marks & Clark Solicitors LLP**) appeared for the **Claimant.**
MR. ANDREW LYKIARDOPOULOS (instructed by **Powell Gilbert LLP**) appeared for the **Defendants.**

Hearing dates: 27-30 November, 3-4, 7 December 2012, 25 March, 26 April and 5 June 2013

- -

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.

....

MR JUSTICE ROTH

Mr Justice Roth :

Introduction

1. In this action, the Claimant ("Seitz") seeks revocation of a patent held jointly by the first and second Defendants (respectively, "KHS" and "Norgren"). Both Defendants changed their names during the period addressed in this judgment, but for

convenience their present names are used throughout. The patent in issue is EP (UK) 1 271 029 ("the Patent"). The priority date of the Patent is 29 June 2001.

2. The Patent relates to rotary stretch blow moulding machines used to make plastic bottles. In particular, the Patent concerns the valves in the blowing station of those machines, and provides for a valve with plastic pistons whereas as at 2001 such pistons were made of metal. A notable feature of these valves is that they have to withstand the high pressure of the blowing air and a swift switching time because of the rapid through-put of bottles being formed.

3. Seitz is a Swiss company and a leading manufacturer of valves. KHS is a German company and a manufacturer of blow moulding machines. Norgren is also a Swiss valve manufacturer and a supplier to KHS. The original patent application was filed by KHS alone, and the Patent was assigned to Norgren as joint owner in late 2008.

4. In the alternative to its attack on the validity of the Patent, Seitz seeks a declaration of non-infringement in respect of its proposed product, but that concerns only certain claims in the Patent. There is further a claim for unjustified threats of infringement that has been stayed by consent pending the outcome of the validity challenge.

5. Seitz was represented by Mr Acland QC. KHS and Norgren were represented by Mr Lykiardopoulos. Both counsel presented their clients' respective cases effectively, efficiently and sensibly, avoiding extravagant claims. The court is grateful to both for their assistance.

6. The claim form was issued in December 2010. It finally came on for trial near the end of 2012. Due to an unfortunate misunderstanding which it is now unnecessary to go into, production of the judgment was initially held back, and then in March 2013 Seitz applied for additional specific disclosure of documents that it contended should have been disclosed pre-trial. That application was granted, with time for Seitz to consider this additional material and decide whether to apply to re-open the trial. After a further hearing in June 2013, Seitz finally informed the court that it would not make such an application. This sequence of events led to considerable delay in the preparation of the judgment.

Blow Moulding

7. Blow moulding is a manufacturing process by which bottles, or other hollow containers, are formed from plastics, in particular from polyethylene terepthalate ("PET"), high density polyethylene ("HDPE") and polypropylene. The process involves using compressed air to expand the plastic into a mould cavity. In the leading work on the subject published in 1989, blow moulding was stated to be the fastest growing segment of the total plastics industry and the third largest plastics processing technique worldwide.

8. By 2001 (and therefore as at the priority date), the blow moulding industry was broadly divided into three sectors: (i) extrusion blow moulding ("EBM"); (ii) stretch blow moulding ("SBM"); and (iii) injection blow moulding. The machines required for each of these processes are very different and they are targeted at different end users. The end users of EBM machines tend to be either manufacturers of household items such as shampoo and cleaning bottles, or of technical and automotive parts.

The end users of SBM machines tend to be either manufacturers of bottles for the drinks industry or drinks producers themselves who made their bottles in-house. The end users of injection blow moulding machines tend to be manufacturers of small bottles (up to 500 ml) used in the cosmetics and medical industry. It is the smallest of the three sectors, in terms of machines and products sold, and is not relevant to the present case.

9. Most manufacturers of blow moulding machines specialise in making machines for just one of these three sectors. That was the position in 2001 and remains the case today.

Extrusion blow moulding

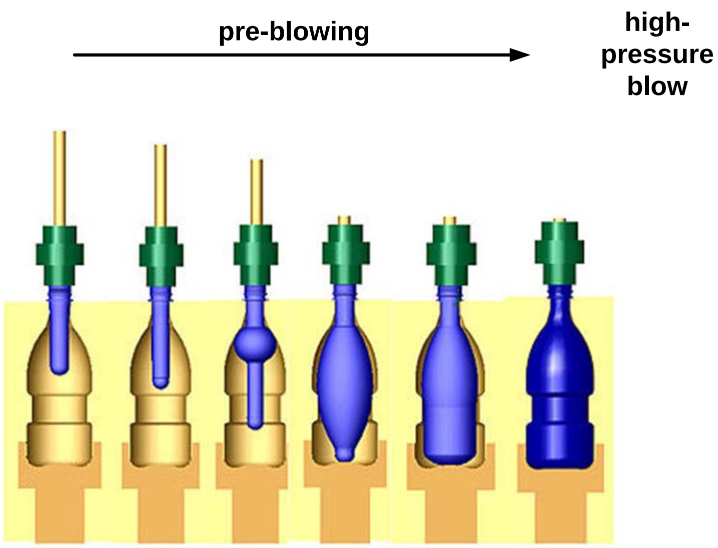
10. EBM is a one-stage process where molten plastic is extruded to create a semi-solid molten tube of plastic, known as a 'parison'. The parison is then clamped into a two part mould. Compressed air is injected into the parison at a pressure of approximately 6-8 bar to expand it to fill the mould. The maximum blow pressure used is 12 bar. This is a much lower pressure than that used in SBM because EBM is usually carried out at a higher temperature of around 170-190°C compared with around 100°C for SBM. The rate of production of EBM machines is always lower than SBM machines with the same number of cavities, but it is a versatile process and the moulds are much cheaper.

Stretch blow moulding

11. SBM is a two-stage process. The first stage is the formation of the test-tube shaped piece of plastic known as a preform by an injection moulding process. The second stage is blowing the preform to produce a finished bottle. Although machines existed which both manufactured and blew the preform (“single-stage machines”), it was much more common for the blow moulding to be carried out separately using pre-made plastic preforms, which could therefore be stored and blown to make bottles as required. The machines with which this case is concerned operated on the latter basis.

12. In summary, the preform is inserted into a heating station where it is heated to the processing temperature to soften the plastic. It is then introduced into a blowing station where it is clamped within a mould. The preform is stretched by a stretch rod inserted through its neck. At the same time, compressed air of a maximum pressure of about 25 bar is blown into the preform causing it to bubble at its weakest point, and the bubble expands to fill most of the cavity. This step is known as 'pre-blowing'. The next step is the main blowing step. Once the stretch rod is fully extended, compressed air of up to 40 bar is blown into the preform. This high pressure air forces the plastic to expand against the cooler walls of the mould, forming the shape of the bottle. The bottle is then cooled and the stretch rod retracts. Finally, an exhaust valve is opened and the air is released. As explained by the Defendants’ expert, the transition from a bubble into a fully formed bottle is explosive and may take as little as 0.02 seconds.

13. The pre-blowing and main blowing steps are demonstrated in the diagram below.



14. The compressed air is delivered in the blowing block of a SBM machine at each blowing station. The three steps involved in the blowing process are controlled by different valves in the blowing block: a pre-blowing valve (P1); a main blowing valve (P2); and an exhaust valve which allows the high pressure air to exit the bottle once blown. The machine also has a master on/off valve and a safety valve. Many machines incorporated in addition a compensation valve that supplies high pressure air to the mould exterior, reducing the forces and wear on the clamp closing mechanism and minimising the appearance of a line on the side of each bottle. The master valve controls the flow of the high pressure air to the machine but opens and closes infrequently, usually only at the start and end of a production run. Similarly, the safety valve operates infrequently. The compensation valve is not essential to the blowing process and some leakage in that valve is tolerable. By contrast, it is critical that the three main valves in the blowing station (P1, P2 and the exhaust valve) provide an effective seal, and they open and close frequently. The pistons in those valves are therefore subject to repeated and rapid impact at the sealing surface upon closing. That leads to wearing, particularly in the P2 and exhaust valves, both of which control the very high pressure air.

15. The machines that were used for two-stage SBM at the priority date were of two types:

i) rotary SBM machines; and

ii) linear SBM machines.

16. The main difference between linear and rotary machines is the arrangement of the mould cavities and blow clamp(s) in the blowing station(s). The blow clamp is the mechanical device that carries the blow cavity and transmits the clamp pressure required to keep the mould closed during the blowing process. In a linear machine there is usually only one blow clamp mounted in a blow station and this one clamp holds all the cavities. The moulds are held in a fixed position and all the cavities open and close simultaneously. In a rotary machine each mould is held in a separate blow clamp mounted in its own blow station. Therefore unlike in linear machines, there are several blow clamps and blowing stations in a rotary machine and the blowing

stations are on a rotating wheel. As the wheel is rotated the various stages of the blowing process are completed in a continuous process until the blown bottle is released from the machine. Linear machines typically have between one and eight cavities and are generally used for low output applications. As at the priority date, the maximum output for linear machines was about 1000 bottles/cavity/hour ("b/c/h"). Rotary machines at that time had up to 32 cavities and could deliver 1000-1500 b/c/h.

17. Thus the output of rotary machines was significantly higher and they also delivered more consistent quality, but they were considerably more expensive than linear machines. Nonetheless, most soft drink and water bottles were blown on rotary machines because of the high volumes required. Rotary machines accounted for approximately 80% of the market and linear machines occupied the remaining 20%.

The SBM industry

18. SBM developed in the late 1970s and grew rapidly in the 1980s (at the expense of EBM). During the 1990s there was increasing specialisation within the SBM industry. As at the priority date, there were six main manufacturers of SBM machines and they tended to specialise in making only one kind of machine: Sidel, KHS and Krones (all of which made rotary machines); Mag-Plastic (which made linear machines); and Nissei and Aoki (which made single-stage machines). Krones entered the SBM market in the late 1990s. As at 2001, Sidel held about 70% of the market in rotary machines.

19. There were also a relatively small number of companies that manufactured and supplied valves for SBM machines. At the priority date, the main valve suppliers in this field were Norgren, Seitz, Asco, Lucifer and Herion. As at 2001, rotary machines used either electric or mechanical valves whereas linear machines used only electric valves. Sidel manufactured its own mechanical valves, which it used in its machines. It appears that at the priority date Seitz predominantly made valve blocks for linear machines, save that it supplied electrically operated valves for the Sidel series 2 machines.

20. Machine development and troubleshooting was predominantly carried out in-house by the manufacturers. Given the small number of players in the industry and the increasing demand for SBM machines, competition between these companies was fierce. Machine manufacturers went to great lengths to achieve technical advantages and improvements in price, performance and efficiency and worked closely with component manufacturers on such developments. Apart from the cost of the preforms, the cost of the compressed air (both for blowing and for the pneumatic control) represented the highest element of the bottle production costs. It was therefore desirable to ensure that this part of the process operated as efficiently as possible, but it was essential that the valves operated with precision and reliability.

21. Although the industry was strongly competitive, it was said also to be conservative. The market for rotary SBM machines was limited and each of the manufacturers relied on making a relatively small number of high value sales in any given year. Maintaining a good relationship with existing clients was therefore essential. The Defendants' expert explained how the cautious nature of the industry was particularly prominent in the context of rotary blow moulding. The results of partial failure in a

rotary machine making, say, 30,000 bottles an hour (assuming a 20 cavity machine running at 1500 b/c/h) are far greater than for a linear machine making, say, 4,000 bottles an hour (assuming a 4 cavity machine running at 1000 b/c/h). Moreover, the testing requirements for carbonated bottles (for which rotary machines are used) are far more stringent. Mr Vogel of KHS said in his evidence that the valves are "like the heart of the blowing process because if anything happens there and you cannot tackle the causes then possibly you have a storage hall half full of bottles that you cannot use." Therefore the competitive spirit pushing the companies to improve their machines was underpinned by caution. The companies were concerned about damage to their reputation and business if a new development turned out to be unsuccessful, which could drive their client to a competitor.

The Patent

22. The original language of the Patent is German. The first paragraph of the description states (in the filed translation):

> "The invention relates to a device with blowing stations disposed on the rotating blow wheel for blow-moulding containers from a thermoplastic material, with a unit for pneumatically controlling a blow pressure."

23. At the start of the trial, the Defendants proposed a further amendment to claim 1 of the Patent, and that was not opposed save that Seitz contended that this did not cure the alleged invalidity. It was agreed that the trial would proceed on the basis of this proposed amendment.[1] As so amended, and omitting the cross-references to the drawings, claim 1 is as follows:

> "Device with blowing stations disposed on a rotating blow wheel for blow-moulding containers made from thermoplastic material, ~~with~~ wherein the blowing stations respectively have a unit for pneumatically controlling a blow pressure in the range of 25 bar to 40 bar, characterised in that the pneumatic control unit has a control piston guided in a cylinder which is mounted so as to be displaceable in the direction of a piston longitudinal axis, with a main flow path which can be closed by the control piston extending through the cylinder, and the control piston is provided with a control surface which is directed towards a control chamber of the cylinder and is designed to transmit a control force to the control piston, wherein the control piston comprises a piston shaft and a piston head and both the piston shaft and the piston head are made from plastic ~~which control piston is at least partially made from a plastic material~~, and in which the main flow path is so disposed that when the control pressure is reduced, the control piston is displaced by the high pressure acting in the direction of the piston longitudinal axis."

24. In essence, the Patent therefore relates to the pneumatic valves in the blowing station of a rotary SBM machine that control the high pressure blowing air (i.e. the P2 and

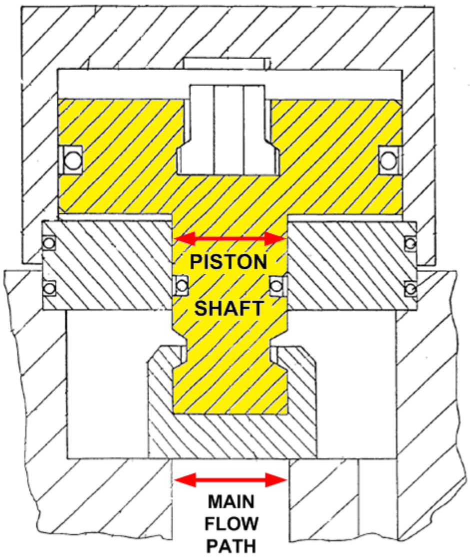
[1] It was amendment no. 3 to claim 1.

exhaust valves) and provides that both the piston shaft and piston head of the control piston are made from plastic.

25. Although the Patent contains a total of 22 claims, by the end of the trial only four other claims were alleged to be independently valid; and by letter from the Defendants' solicitors received shortly afterwards, reliance was no longer placed on one of those. The three other claims now alleged to be independently valid are claims 3, 15 and 18. They read as follows (again omitting the numerical cross-references):

> "3) Device as claimed in claim 1 or 2, characterised in that the control piston has a shaft cap.
>
> ………
>
> 15) Device as claimed in one of claims 1 to 12, characterised in that at least parts of the control piston are made from PETP.
>
> ……...
>
> 18) Device as claimed in one of claims 1 to 17, characterised in that the control piston has a piston shaft, the cross-sectional surface area of which is dimensioned so as to be essentially identical to a cross-sectional surface area of a passage surface of the main flow path which can be closed by the control piston and is directed towards a cylinder interior."

26. The drawing below, derived from figure 6 in the Patent, illustrates the piston shaft and head in the closed position, in the specific context of claim 18:



However, this drawing shows the piston with a shaft cap (i.e. as per claim 3), and since claim 18 is dependent on all the preceding claims, it covers also valves in which the control piston is not fitted with a shaft cap.

The Proceedings and Trial

27. Of the four claims now in issue, Seitz challenges the validity of claims 1 (as amended), 15 and 18. If any of those are held to be valid, it realistically admits infringement, subject to its construction of claim 1 being accepted. Seitz accepts that claim 3 is valid, but denies that it is infringed.

28. The challenge to validity is based on novelty and obviousness. These challenges are not based on the common general knowledge alone, but on particular items of prior art. There was also a pleaded challenge to the specification of the Patent on the grounds of insufficiency, but this was not pursued.

29. Each side called one expert. The expert for Seitz was Mr Thomas Bucher, who was also a witness of fact as regards part of the prior art relied on. Mr Bucher is Swiss and gave his evidence in German through an interpreter. However, it became clear that he was much influenced in his views by his personal involvement in designing a blow moulding machine using plastic pistons. It was therefore difficult for him objectively to assess the position of the notional skilled person who lacked this quality of inventiveness, and in the end Mr Acland very properly recognised that Mr Bucher did not really assist the court as regards primary expert evidence in this case.

30. Accordingly, the relevant expert evidence was that of Mr Ottmar Brandau, called by the Defendants. Mr Brandau is a mechanical engineer who spent several years in the late 1980s and the 1990s in North America working on product development and servicing of SBM machines. Since 1997, he has worked as an independent consultant in the blow moulding industry: his clients include both machine manufacturers and bottle manufacturers and he therefore works with all the major brands of SBM machines. He wrote the “Stretch Blow Moulding Handbook”, the first comprehensive guide to SBM, of which the first edition was published in 2003. I found him to be an impressive and careful witness.

31. The factual evidence in this case was limited. In addition to Mr Bucher, Seitz called Mr Ken Bauer, who has been a senior design engineer at Seitz since late 2010. Prior to joining Seitz, he had worked from February 2003 for Norgren. Seitz also adduced witness statements from Mr Rölli, its Head of Market Segment, Process Automation and Industry; and Mr Egli, its external Swiss patent attorney. Neither Mr Rölli nor Mr Egli was called for cross-examination.

32. The Defendants called just one factual witness, Mr Klaus Vogel. Mr Vogel was employed by KHS between 1972 and his retirement in 2008. In 1988 he became Head of the Engineering Department at KHS, which position he held until his retirement. Mr Vogel gave his evidence in German, through an interpreter.

The Skilled Person

33. A patent specification is addressed to a person skilled in the relevant art. As is well known, this skilled person is a legal construct. He has practical knowledge and experience of the sort of work for which the invention is intended but is wholly unimaginative: see generally *Technip France’s Patent* [2004] RPC 46. The skilled person can comprise a team.

34. It is common ground that the Patent relates to a rotary SBM machine. Seitz contended (by Mr Acland's opening skeleton argument) that the skilled person here comprised an engineer with responsibility for designing the blowing air network in a rotary SBM machine and a specialist valve manufacturer. The Defendants effectively agreed.

The Common General Knowledge ("CGK")

35. The CGK comprises what is generally known and generally accepted by those working in the field in question: see Arnold J in *KCI Licensing v Smith & Nephew* [2010] FSR 740 at [105]-[112], approved by the Court of Appeal: [2011] FSR 8 at [6]. Its importance is that it provides the basis on which the the court determines how the skilled person would have reacted to the pleaded prior art if it had been put to him in his work place or laboratory:

> "The common general knowledge is the technical background of the notional man in the art against which the prior art must be considered."

Per Laddie J in *Raychem Patents* [1998] RPC 31 at 40, quoted by Arnold J in *KCI Licensing.*

36. Here, on the basis in particular of Mr Brandau's evidence, it appears common ground that the relevant CGK included the general features of SBM described above, and more especially the following:

i) The high pressure blowing air and rapid switching imposed significant stress on the valves in the blowing station. The pressure on the P2 and exhaust valves would be up to 40 bar.

ii) Switching time of the valves in the blow station was an important consideration for efficiency. There are three valves that operate sequentially (P1, P2 and the exhaust valve) each of which must switch twice during an operational cycle. Thus a delay of 100 milliseconds per valve switching would increase the cycle time by 0.5 seconds. If the machine was running using a 3 second cycle time, it would produce 1,200 b/c/h. Use of a 3.5 second cycle time would cause output to drop by about 14%.

iii) The size and weight of the valves was important. The valve had to be sufficiently large for a functional volume of air to flow through it but no bigger than was required otherwise it would be unnecessarily heavy.

iv) It was essential for the three pneumatic valves in the blowing station to be air-tight in the closed position. A leak in the P2 or exhaust valve could have a dramatic impact on the quality of the blown bottle.

v) The diameters of the flow path were typically 16-18 mm and the piston must overhang this to ensure an adequate seal. Pistons were often made 2-4 mm wider. However, as the diameter of the piston increased, so the pressure acting on the piston increased. That was undesirable since it meant that either the control pressure or the size of the control surface had to be increased.

vi) The valves used in rotary SBM machines typically used pistons made of steel or aluminium with a vulcanised elastomer on the sealing surface to ensure an effective seal.

vii) An advantage of using aluminium is that it is one third the weight of steel and the piston therefore has lower inertia. As a result, a lower control pressure is required, leading to shorter switching times and increased service life.

viii) The metal pistons incorporated plastic guide bands in the piston head, to minimise wear around the piston head by preventing direct contact between the metal piston head and the cylinder wall. However, the guide bands were susceptible to wear and often had to be replaced.

37. A critical issue in the present case is the attitude of the skilled person to the use of plastic for these valves (i.e., the valves in the blowing station). It is common ground that:

i) the skilled person would be aware of the general trend since the 1950s toward the use of plastics in various engineering applications, including as replacement for metal, and that plastics are substantially lighter than aluminium;

ii) the skilled person would know of the existence of both commodity and engineering plastics and he could find technical data about the properties of plastic materials; but

iii) metal was the material used for the blowing valves in SBM machines by all the major manufacturers at the time, including the largest manufacture of rotary SBM machines, Sidel; and

iv) because of the high stress involved, "[t]he skilled person would not believe that plastic could be used to make pistons for use in the blowing valves of a rotary SBM machine" (Mr Brandau's second report, adopted in Seitz' closing submission).

38. The attitude of the skilled person to the use of plastic will be considered further below in the context of the obviousness challenge.

Novelty

39. Although a number of pieces of prior art had originally been pleaded, in the end Seitz relied only on one matter as constituting alleged anticipation: a fax sent on 27 May 1992 by a Mr Othmar Rymann, then head of design for customised components at Norgren ("the 1992 fax"). The fax is addressed to Mr Vogel of KHS and his colleague Mr Wagner, who was KHS' quality control manager.

40. The background to the 1992 fax is as follows. Norgren was at the time supplying KHS with valves made of aluminium with vulcanised seals for use in its rotary SBM machines, pursuant to a business relationship that went back to the late 1980s. Mr Vogel gave evidence about the nature of this relationship and the regular contact that he and his R&D team at KHS had with Norgren:

> "The relationship between the two companies was primarily a joint research and development collaboration whereby, through close cooperation and multiple discussions, we arrived at bespoke engineering solutions for a variety of pneumatic components for our blow moulding machines. Typically, Norgren would propose a customised design (or a number of customised designs) which aimed to accommodate KHS' specific requirements. Many of the pneumatic solutions ultimately used by KHS were developed with Norgren in this way. Over a period of around 15 years, the collaboration led to the development of a number of generations of unique valves for use in the blowing stations of blow moulding machines. This include[d] the Blue Red Green valve block…"

41. Norgren would manufacture prototype components for testing either at its facility or at KHS (or both). If successful, further field testing took place at some of KHS' clients, before a final decision was taken on whether to adopt the development for commercial production.

42. In 1991, KHS discussed with Norgren the possibility of moving from the mechanically operated valves in its SBM machines to electrically controlled valves, which would have a number of advantages. Mr Rymann began work on developing a customised system of electrically controlled valves for KHS. Mr Vogel explained that this project involved regular "brainstorming" sessions between the companies. As KHS wanted to have the blowing station as compact as possible, Mr Rymann developed, in discussion with KHS, a new design for the valve block, mounting the three types of valves on a single solid block with connecting air-flow holes. As the P1 valve was coloured blue, the P2 red and the exhaust valves (there were two) green, such blocks were referred to as the "Blue Red Green" (or "BRG") valve block. The pistons were made from aluminium and vulcanised with nitrile rubber ("NBR") on the sealing surface. This led to shorter switching times and less impact of the piston on the seal. Prototype BRG blocks were custom made for KHS.

43. However, in early 1992 there was a problem with fraying of these elastomer seals, which was of particular concern as regards bottled drinks because of the potential for contamination. KHS sent to Mr Rymann some 40 bar valves it had received back which displayed such fraying of the seals. Mr Vogel recalled a meeting with Mr Rymann in early 1992 discussing this problem, which it seems had arisen with early prototypes apparently tested with a client. He explained that they would meet with Norgren when they encountered problems, cooperating closely in considering the solution.

44. In his handwritten fax, Mr Rymann proposed, as the primary solution, modifying the shape of the seal and changing the material from NBR to PU (polyurethane), which has greater tensile strength and resistance. He noted that intensive testing of PU in a completely different valve had produced very satisfactory results. He therefore noted that at the end of June Norgren would deliver to KHS two red and two green valves with completely new pistons with the new shape and PU seals. Mr Rymann then continued:

> "II. In parallel to the whole thing we will undertake still something completely different.
>
> A differential piston, made completely of a special plastic that guides itself and therefore requires no guiding bands - AND, no vulcanization. One seals solely on the basis of area pressure. The edge design has matched that [sic] since anyone can remember!!!
>
> A new critical point is thereby the subject of heat expansion, which still has to be investigated.
>
> | |
> |---|
> | May I assume an environmental temperature of -20º to +40ºC? |
>
> In the best of cases I can send you about 4 such pistons at the end of June.
>
> I am however firmly convinced that with the NBR we are already close to the goal, and with the PU we will be solidly in the bull's eye."

45. Mr Vogel could not recall whether the idea of an all plastic piston came from the joint meeting, in which case Mr Rymann would have contributed to it, or from Mr Rymann alone. In any event, KHS did not at that stage pursue the idea of a plastic piston since the primary solution appeared promising, and it does not appear that any plastic pistons were sent in 1992.

46. However, by early 1997 this issue gained increasing significance as there were more persistent complaints from customers of elastomer fraying. Accordingly, in March 1997, Mr Vogel asked Mr Rymann to revisit the idea of making a piston from PET for the BRG block. In July 1997, Mr Rymann reported that laboratory tests at Norgren on PET pistons had been satisfactory and KHS therefore asked Norgren to make and supply for field testing 120 PET pistons. KHS's intention had been to install them on two machines with its clients, Volvic and Mitsubishi. 120 such pistons were duly supplied to KHS in September 1997, without charge as this was still at the stage of prototype development.

47. To constitute prior disclosure, the material relied on must be made available on a non-confidential basis: it must be disclosed to at least one person who is free in law and equity to use it. Secondly, it must disclose the invention such that a skilled person, possessed of the CGK, would be able to reach it without undue burden (irrespective of his motivation to do so). The 1992 fax gives rise to both issues, i.e.:

    i) was the fax confidential; and

    ii) was it enabling?

(i) Confidentiality

48. The test for whether or not a disclosure is confidential was set out by Megarry J in *Coco v. AN Clark (Engineers) Ltd* [1969] RPC 41, in a passage approved by Lord Griffiths in the *Spycatcher* case, *A-G v. Guardian Newspapers (No.2)* [1990] 1 AC 109 at 268B-C. For present purposes, the critical question is whether the information was "imparted in circumstances importing an obligation of confidence". As to that, Megarry J stated (at 48):

> "where information of commercial or industrial value is given on a business-like basis and with some avowed common object in mind, such as a joint venture or the manufacture of articles by one party for the other, I would regard the recipient as carrying a heavy burden if he seeks to repel a contention that he was bound by an obligation of confidence"

See also the cases discussed in *Terrell on the Law of Patents* (17th edn, 2011) at paras 11-16.

49. Mr Vogel had no doubt that matters discussed in the 1992 fax were confidential as between Norgren and KHS. They were part of a joint programme of development of electrically operated valves for a rotary SBM machine. At the time, no SBM machines on the market used electrical valves in the blowing station.

50. Mr Rymann, who now works for Norgren, was not called to give evidence and I do not think much weight can be placed on the answers he gave to questions from Seitz's patent attorney that were put in simply as an exhibit to the attorney's statement: they do not, in any event, directly address the question of the confidentiality of the 1992 fax. As noted above, Seitz called Mr Bauer, a senior design engineer, who himself had worked for Norgren between 2003 and October 2010 as successor to Mr Rymann. Mr Bauer therefore had not been at Norgren at the time of the 1992 fax, but his immediate boss there, Mr Dietschweiler, had been. When asked about this fax, Mr Bauer, who was obviously familiar with the working of Norgren, replied:

> "As far as I understand, this was confidential between Norgren and [KHS]."

And he said that he believed this would have been the understanding of Mr Dietschweiler as well, who it appears had similarly been Mr Rymann's boss at that time.

51. If the idea of a plastic piston emerged at a joint "brainstorming" session between KHS and Norgren as part of this project of developing a new, electrically controlled valve block, it would clearly be confidential. That was very properly accepted by Mr Acland. But in my view it does not matter whether it was actually discussed at a joint meeting, or sent afterwards by Mr Rymann on his own initiative. I consider it was nonetheless written and intended to be viewed in the context of this joint project. The fact that both an addressee of the fax and the one witness who had worked for the company that sent it both considered it was confidential is telling. This was a project relating to the development of customised products specifically for KHS, designed to give it an advantage over its competitors in a very competitive industry with few major players. It would have undermined the commercial basis of this work if either

Norgren or KHS had been free to disclose information about those products to third parties.

52. That does not mean, of course, that Norgren did not have relationships with other blow moulding machine manufacturers. But Mr Vogel's evidence about that was revealing. He said that at one point Mr Rymann told him that he had been asked by Sidel to produce a design for blowing valves for Sidel's machines. But Mr Rymann refused to tell him anything about the customised design proposal for Sidel, and "assured me that he would not provide Sidel with any information about the blowing valves used in our machines."

53. Further, Seitz no longer seeks to rely on the supply by Norgren of the 120 plastic pistons in 1997. No doubt that is because it became evident that, as prototypes supplied free of charge for testing, this supply was on a confidential basis: Mr Bauer was quite clear about that. But the care taken by KHS to protect the confidentiality of those plastic piston blocks developed for it by Norgren is striking. Mr Vogel said that although KHS had at first considered field testing the BRG blocks with its major customer Volvic, he then became aware that Volvic used also SBM machines from Sidel, and he did not want to risk Sidel engineers having access to this new proposed KHS piston when they were on site at Volvic servicing their own machines. In the end, field testing took place of a further design of a smaller valve block with PET pistons made by Norgren, at another KHS customer, Kirin Beverage Corp. ("Kirin"), in Japan, after Kirin, which was supplied with SBM machines exclusively by KHS, had signed a confidentiality agreement. As Mr Vogel put it, when selecting a customer for field testing, "[t]he overarching consideration was confidentiality." This reinforces the view that the earlier communication about the possibility of an all plastic piston in the 1992 fax would properly have been regarded as confidential.

54. As against this, Seitz relied on the facts that in 2001 KHS applied alone for patent protection in respect of a valve made at least partially from plastic and that in June 2002 Mr Vogel and his colleague Mr Litzenberg applied for a US patent covering the same subject matter. It was argued that this showed that KHS regarded itself as free to make use of Mr Rymann's idea. However, Mr Vogel explained the context in which that happened. KHS was facing aggressive new competition from Krones, a well-established manufacturer of bottle filling machines, that had failed in its attempt to acquire KHS and then itself entered the market for rotary SBM machines as a direct competitor. KHS therefore decided to apply for a patent of the plastic piston to protect its position. Mr Vogel accepted that there had been no discussion with Norgren at the time as to who would apply for the patent. Nonetheless, he said that internally KHS recognised that Mr Rymann was involved in the invention:

> "so from a moral standpoint he should have been included but we wanted to protect ourselves from the competition, from the competitors, as regards the pistons so this was a mere measure for protection."

55. Although Seitz submitted that I should reject that evidence, I found Mr Vogel to be an honest witness with good recollection, and I accept it. I therefore do not regard the history of the patent applications many years later as rebutting the clear inference from all the surrounding circumstances that the 1992 fax is properly to be regarded as

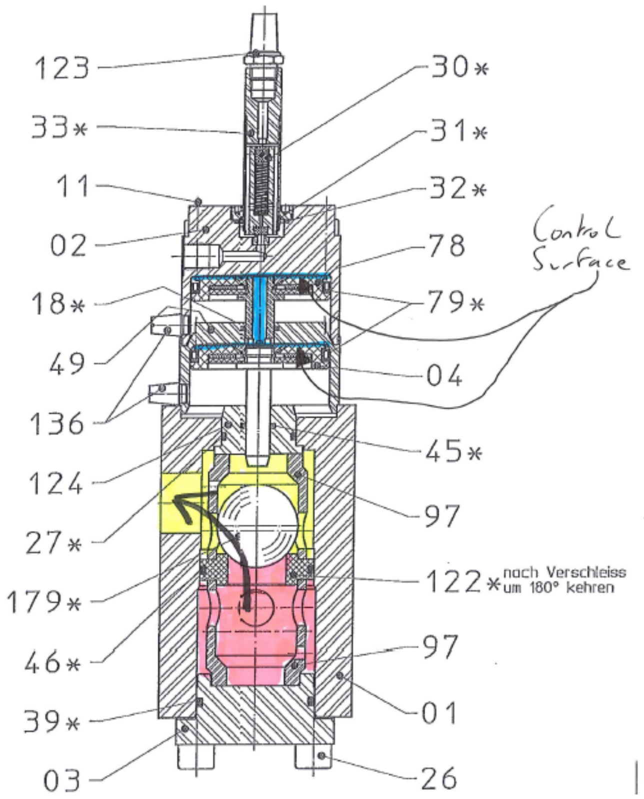
confidential. I note, moreover, that when the Patent was opposed by Krones, KHS eventually agreed with Norgren that they should be joint proprietors of the Patent, which led to the assignment in September 2008.

56. In the light of my finding that the 1992 fax was clearly confidential, it is unnecessary to consider whether its terms were sufficient to disclose the invention in claim 1 (as amended). (It is accepted that it does not anticipate any of the other claims now in issue.)

Obviousness

57. It is not alleged that the Patent was obvious over the CGK. The case on obviousness rests on the supply of four linear SBM machines, known as the ALS 1-4 machines, manufactured by Soplar SA ("Soplar") to two Alpla group companies in the UK in February and March 2001. Those machines had four blowing stations, each incorporating two exhaust valves made partly from plastic. The master valve, safety valve and compensation valve were also made wholly or partly from plastic but since amended claim 1 is limited to the valves in the blowing station that control the very high pressure blowing air, they are no longer of direct relevance. The P1 and P2 valves in the blowing stations were made of metal. The valves in the ALS 1-4 were supplied by Seitz.

58. The exhaust valves in the ALS 1-4 (known as Type 2674) incorporates a double piston and ball as illustrated below:



59. The movement of the pistons is controlled by the delivery of air to the control surface of the upper piston. The upper piston is hollow to allow the control air to pass through it onto the control surface of the lower piston. The lower piston activates a

ball valve which closes the flow path. When control air is applied, both pistons thus move downwards together, and the advantage of using a double piston is that double the downwards force is generated without a corresponding increase in the pressure of the control air. The piston shafts and the ball valve are made entirely from steel. The valve seat (marked 122) against which the ball is pushed is made from plastic (polyoxymethylene or POM). The head of the lower piston (marked 04) also contains a plastic component (also POM) in the control surface; and it seems that the head of the upper piston had an identical composition.

60. The challenge based on the ALS 1-4 machines raises two issues:

i) Did the supply of these machines by Soplar to Alpla constitute disclosure to the public?

ii) Is the Patent obvious over these machines?

61. Soplar is not one of the leading manufacturers of SBM machines: Mr Brandau had never heard of it before this case. As at 2001, it had never made rotary SBM machines. Seitz' expert, Mr Bucher, is the production manager of Soplar, where he has worked since 1992. As well as serving as an expert, he gave factual evidence regarding the ALS 1-4 and he was personally involved in its design.

(i) Disclosure

62. Alpla is a large multi-national group with bottling and packaging plants around the world. Soplar was a small player on the market for SBM machines, founded in 1978, with a manufacturing plant in Switzerland. It emerged in the cross-examination of Mr Bucher that, until at least 2001, Alpla was its sole customer: all Soplar's machines were built for Alpla. Mr Brandau pointed out that this was a unique arrangement in the industry. The founder of Alpla was a Mr Alwin Lehner, and between 1986 and the time of the supply of the ALS 1-4 machines he held, according to the Swiss cantonal commercial register, a management role in Soplar, although Mr Bucher could not explain what it was. But Mr Bucher said that the "ALS" machine was named after Mr Lehner. Soplar also applied for a series of patents in the 1990s naming Mr Lehner as the inventor.

63. It is evident from the above that the relationship between Soplar and Alpla was unusually close. Mr Bucher, although recorded on the commercial register as being a member of the management of Soplar, could not assist much regarding the terms of that arrangement. He said that he assumed that Soplar was committed to supply exclusively to Alpla: as he put it, "Alpla is our market".

64. Mr Lykiardopoulos submitted that the supply by Soplar to Alpla in these circumstances did not amount to a true communication of information at all. He contended that it was akin to the supply by one company to another within the same corporate group.

65. However, I do not consider that the evidence goes that far. Soplar and Alpla were always independent companies and there is no indication of common ownership. Even assuming a contractually exclusive supply arrangement, Alpla was clearly free to purchase, and did purchase, SBM machines from other manufacturers.

Accordingly, although the companies' relationship was unusually close, this was still independent supply.

66. A separate question is whether Alpla was under an obligation of confidence regarding the ALS 1-4. To amount to disclosure, it would have had to be free (in law and equity) to tell others about the internal working or design of the machine. I accept that it is very possible that the contractual basis of the arrangements between Soplar and Alpla contained confidentiality obligations. Soplar would have been commercially very exposed if Alpla had been free to tell other manufacturers the details of the SBM machine Soplar had specially developed for it, so that they might make an equivalent machine to compete for Soplar's only customer. Given that this point was expressly pleaded in the Amended Defence (at para 5(iii)), I would have expected Seitz to adduce clear evidence from Soplar regarding the terms of the arrangement. All that was produced was an email, sent less than a week before the trial started, from a Mr Finch of Alpla UK Ltd stating that "these were ordinary, non-confidential arm's length supplies". Since, as explained above, I do not find the relationship between Soplar and Alpla to have been "ordinary", this is far short of compelling.

67. Nonetheless, I do not feel able to conclude on the material before the court that Alpla was under a confidentiality obligation such that, for example, it could not repair or service the Soplar machines while an engineer from another manufacturer was present at its factory servicing a different machine because he might become aware of the nature of the components in the ALS 1-4.

(ii) Obviousness

68. As the Court of Appeal recently emphasised in *MedImmune v Novartis* [2012] EWCA Civ 1234, there is but one statutory question: was the invention obvious to a person skilled in the art? Answering that question involves considering all the relevant circumstances. The Court approved, but did not require slavish application of, the structured approach set out in *Pozzoli SpA v BDMO SA* [2007] FSR 37 at [23]:

(1) Identify (a) the notional 'person skilled in the art' and (b) their relevant common general knowledge;

(2) Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;

(3) Identify what, if any, differences exist between the matter cited as forming part of the 'state of the art' and the inventive concept of the claim or the claim as construed;

(4) Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?

69. As regards the fourth question, the courts have repeatedly emphasised the danger of hindsight. The fact that something involved only a very simple development does not mean that it did not require invention. In *British Westinghouse Electric v. Braulik* (1910) 27 RPC 209 at 230, Fletcher-Moulton LJ said:

> "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"

70. This observation was approved by Lord Russell of Killowen in *Non-Drip Measures Co., Ltd.* v. *Stranger's Ltd* (1943) 60 RPC 135 at 142; and in *Technip's Patent* Jacob LJ, at [112], described this passage as "as true today as when it was first said". He continued:

> "All the "bits and pieces" of the invention were known separately for many years. The question "why was it not done before" is always a powerful consideration when considering obviousness, particularly when all the components of a combination have been long and widely known. Sometimes there is a good answer (e.g. no demand, not worth the expense, prior art only recent)".

Hence invention may lie in overcoming the prejudice or preconceptions of the skilled person in a field of technology: see *Pozzoli* at [26], where Jacob LJ quoted his earlier observation in *Union Carbide Corp v BP Chemicals*:

> "Invention can lie in finding out that that which those in the art thought ought not to be done, ought to be done."

71. It is in that context that the third and fourth *Pozzoli* questions can be approached. The ALS 1-4 showed a piston-and-ball exhaust valve used in a linear SBM machine, where the valve seat and part of the control surface were made of plastic instead of metal as used hitherto, usually with an elastomer sealing element. The Patent, in amended claim 1, is for a fully plastic piston in the high pressure blowing valves (i.e. P2 as well as the exhaust valve) in a rotary SBM machine.

72. I discuss below, in the context of infringement, the construction of claim 1 and whether it covers a valve where the flow path is not directly sealed by the control piston. However, even if claim 1 is broad enough to cover a piston-and-ball arrangement, I do not find the invention obvious as against the ALS 1-4.

73. It is common ground that the CGK involved a perception that metal had to be used because of the very high pressure and repeated wear involved, and that plastic was used only for the guide bands. The primary evidence when considering obviousness is that of the experts, and thus in this case of Mr Brandau. He pointed out that the skilled person would note that the piston shaft in the Type 2674 valve remained all steel. Even the plastic in the piston head was largely enclosed by metal pieces, which suggested that the designer considered that unprotected plastic in the piston head was unsuitable. Thus although the designer of the ALS 1-4 had evidently addressed his

mind to the incorporation of plastic in the piston, and despite the advantages of plastic in terms of weight, the Type 2674 exhaust valve suggested that significant use of metal in the piston was still necessary. This is reinforced by the fact that the P2 valve in the ALS 1-4 was still made entirely of metal (as was the P1 valve). As Mr Brandau explained in cross-examination:

> "There is so much metal here. The only thing that the skilled person can get out of it is that we have plastic that does not need guide bands but we have to protect this plastic by metal pieces and we have to encase it. The shaft still has to be metal. I think that is what he would get out of this. The weight is not, to a large extent, reduced, so his motivation now to go out and investigate all plastic pistons is, I do not think, there from this piston. On top of that, he sees the other valves in the same block that are made out of metal. So, again, he would think, why would they not also use plastic in this piston? Is there a reason for that? "I have these concerns about plastic so that must be the reason"."

And when challenged as to whether the skilled person would not wish to take forward from inspection of the ALS 1-4 and investigate the idea of making an entirely plastic piston because of the benefit that could bring, Mr Brandau replied:

> "No, I cannot agree to that. Like I said, the skilled person seeing this would think that there must be a reason that it is not all plastic. The valve manufacturer would not go through the trouble to make all these parts, the difficult assembly, if the valve manufacturer was convinced it could all be made out of plastic. So he would actually see this, in conjunction with the other valves, more or less confirming his prejudices, may be saying, "Okay, maybe there is a way of making a part of it in plastic and then encasing it in steel and protecting it and it will still work". I think that is what the skilled person would think about this."

74. I find that evidence compelling and, taken as a whole, I reject the submission that there was any inconsistency in Mr Brandau's evidence.

75. Mr Acland sought ingeniously to suggest that the prejudice in the industry was against *any* use of plastics in the piston (as he put it, against plastics *per se*), not against making the whole piston from plastic; such that when the ALS 1-4 machine showed that the piston could be partially made from plastic that would have served to displace the prejudice and lead the skilled person to consider making the whole piston from plastic. I find that line of argument divorced from reality. The existing metal pistons did in fact contain some plastic, in the guide bands. But aside from that, what amended claim 1 of the Patent is teaching is the ability to use a piston with a plastic shaft and a plastic head. The fact that the exhaust valve in the ALS 1-4 has a piston in which some elements in the piston head are plastic and the rest (including the piston shaft) metal does not begin to make it obvious that an entirely plastic piston could work or even, in my view, to investigate that possibility.

76. Moreover, Soplar's first ALS 1-4 machines were built in 1997. The Type 2674 exhaust valve was a standard Seitz valve. The benefit of plastic as a lighter material and the trend towards the use of hard plastics in place of metal had been CGK for a long time. Seitz had been making such ball-and-piston valves for many years even before 1997. But despite the advantage that could be achieved by using a much lighter piston, and the strong competition between the major players in this industry, none of them adopted an all plastic piston in the blowing block before the priority date. Indeed, in 1997 Sidel, the leading manufacturer of rotary SBM machines that (as Mr Bucher put it) developed a lot of innovative products, together with Seitz undertook a redesign of the solenoid piston-and-ball valves for use in Sidel machines, but opted for entirely steel pistons.

77. In my judgment, the ALS 1-4 would not have displaced the mindset of the skilled person that the high pressure and repeated impact that had to be sustained by the valves in the blowing block meant that the piston could not be made entirely of plastic. I consider that this was the case for all SBM machines, but especially so for rotary SBM machines where the rapid throughput meant that the consequences of failure or defects in the blown bottles were commercially much greater. Accordingly, amended claim 1 of the Patent involved a true inventive step over the cited prior art, and the challenge for obviousness fails.

Infringement

78. The dispute on the construction of amended claim 1 is as to whether it covers only a piston that directly seals the flow path or whether sealing can be achieved through another detached component. Mr Acland submitted that the latter is the correct construction, and on that basis, Seitz admitted that if the claim was valid, it was infringed. The Defendants, however, urged the former construction, so as to support their submission that a piston-and-ball valve of the kind in the ALS 1-4 machine would therefore not fall within the Patent.

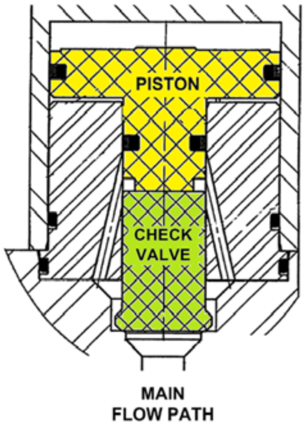
79. The claim is to be construed purposively, having regard to the description and the drawings: Art 69 EPC and the Protocol thereto. The governing approach was explained by Lord Hoffmann in *Kirin-Amgen Inc v Hoechst Marion Roussel Ltd* [2005] RPC 9 at [30]-[35]. See also the list of principles set out by the Court of Appeal in *Virgin Atlantic v Premium Aircraft* [2010] RPC 8 at [5]. In particular, for present purposes it is relevant to note that although there is no general "doctrine of equivalents",

> "purposive construction can lead to the conclusion that a technically trivial or minor difference between an element of a claim and the corresponding element of the alleged infringement nonetheless falls within the meaning of the element when read purposively. This is not because there is a doctrine of equivalents: it is because that is the fair way to read the claim in context."

80. The claim refers to the "main flow path" being "closed by the control piston extending through the cylinder". The drawings all show a directly sealing piston not a piston-and-ball arrangement, which was well-known at the time as a different form.

The general description in the Patent refers to the "known control pistons" having to provide adequate sealing, and that they were therefore usually vulcanised with an elastomer by the sealing surface. That seems to me clearly a reference to a directly sealing piston and not a piston applying force to a metal ball, where the seal is achieved by contact with the side of the ball. The purpose of the invention is stated as being to improve on the construction of the pistons so described. Insofar as it is necessary to resolve this point, I consider that the skilled addressee would fairly understand the claim as relating to a directly sealing piston and not a piston-and-ball valve.

81. However, the particular issue of infringement is raised by the design of the Seitz valve that is alleged to infringe, which is quite different from a piston-and-ball arrangement. That valve has two parts that are not physically connected, both made of plastic: a control piston (made from PET) that operates on a separate check valve (made from PEEK), as illustrated below:



Thus the check valve, with its bulged 'elephant foot', directly seals the flow path.

82. Even on my preferred construction of the claim, I consider that this clearly infringed. The piston shape is essentially that illustrated in the Patent, but divided into two. It works in the same way as a unitary piston. I do not think the skilled addressee of the Patent, giving it a purposive albeit careful reading, would consider that he could avoid infringement by, in effect, cutting the piston into two.

83. Accordingly, on either construction, I find that infringement is made out. That is sufficient to dispose of this case. But since I heard full argument on the other claims, I shall address them briefly.

Claim 3

84. This claim involves the control piston of amended claim 1 (or claim 2) having a shaft cap fitted to the control piston. Seitz accepts the claim is valid but denies infringement.

85. The Seitz valve at issue does not comprise a shaft cap. The only basis on which this Seitz valve could be found to infringe would be if the shaft cap is properly to be regarded as integral to the control piston. Although the Defendants sought to rely on a paragraph in the general description that refers to the shaft cap as being an

"individual part […] of the control piston", I do not think that that kind of minute textual analysis assists. A reading of the claims in the context of the drawings indicates to me that the shaft cap is a separate element, with claim 4 then being a further refinement in that the connection of the shaft cap to the control piston is by a snap-fit. Accordingly, I find that claim 3 is not infringed by the Seitz product, where the "elephant foot" is just a bulge in the check valve, not a discrete cap.

Claim 15

86. This provides that at least parts of the control piston are made from a particular plastic, PETP (which is the same as PET). Therefore, the relevant question is: assuming that amended claim 1 was obvious, was it then obvious to use PET?

87. As at the priority date, PET was commercially the most significant plastic used in SBM. The skilled person would therefore be familiar with it. Moreover, the skilled person would know that there was a wide range of plastics with many different physical properties and resulting performance. Mr Brandau accepted that if the skilled person wanted to obtain information about a particular plastic, it would have been routine to approach a plastics manufacturer. Further, although Mr Brandau said that PET would be regarded by a skilled person in the SBM industry as more a commodity plastic than an engineering plastic, it can come in various grades and can be enhanced by blending or compounding with additives.

88. In *KCI Licensing*, after referring to various authorities Arnold J summarised at [112] the approach to be taken to material that was available although not part of the CGK:

> "It follows that, even if information is neither disclosed by a specific item of prior art nor common general knowledge, it may nevertheless be taken into account as part of a case of obviousness if it is proved that the skilled person faced with the problem to which the patent is addressed would acquire that information as a matter of routine. For example, if the problem is how to formulate a particular pharmaceutical substance for administration to patients, then it may be shown that the skilled formulator would as a matter of routine start by ascertaining certain physical and chemical properties of that substance (e.g. its aqueous solubility) from the literature or by routine testing. If so, it is legitimate to take that information into account when assessing the obviousness of a particular formulation. But that is because it is obvious for the skilled person to obtain the information, not because it is common general knowledge."

89. Adopting that approach, if (contrary to my primary finding), it was obvious for the skilled person to have designed or produced a high pressure valve in the blowing station with the shaft and head made from plastic, I think it was not then an inventive step for him to have come up with the solution that PET was an appropriate plastic to use. On the basis of the literature put in evidence, I consider that it was well-known in the plastics engineering industry at the time that this was a plastic capable of such demanding applications. Therefore I find, on that basis, that claim 15 would be

obvious; or, put another way, that if claim 1 is invalid for obviousness, claim 15 is not independently valid.

Claim 18

90. Claim 18 is set out at para 25 above. It is concerned with the dimensions of the control piston relative to the main air flow path. In brief terms, it provides that the cross-sectional surface area of the piston shaft is "essentially identical" to the cross-sectional area of the main flow path which the piston shaft is to close. The purpose of this feature is explained in para 0034 of the general description as being to enable the actuating forces required to close the valve and to keep it closed to be pre-set to essentially the same intensity.

91. To appreciate the significance of this it is necessary to explain briefly the role of the relative dimensions of the piston and the flow path. It is the main flow path that determines the size of the valves in the blowing station. A necessary minimum volume of high pressure air must pass through the valves to ensure that the SBM is effective. At a given pressure, this therefore dictates the diameter of the main flow path. As noted above, it was CGK that the main flow path diameters of these valves were typically 16-18 mm.

92. The surface area of the piston that seals this path must obviously have a diameter that is larger than that of the path itself, otherwise it would not seal and the valve would not work. At the priority date, the usual approach was to widen the whole of the piston shaft. However, force equates to pressure times cross-sectional area, and therefore the wider the shaft (and thus the greater its cross-sectional area), the greater the upward force on the piston from the 40 bar air of the main flow path. This increase in upward force meant that the downwards force of the control air on the piston had to be increased to overcome this if the valve was to close. That could be done either by increasing the area of the control surface, which would involve making the valve larger; or by increasing the pressure of the control air, but that would be expensive and standard pilot valves had a control air of only 8 bar. Therefore the standard approach was to increase the control surface, and thus the size of the valve.

93. Once in the closed state, the upward force acts only on the portion of the shaft covering the main flow path, and thus is determined by the cross-sectional area of the flow path and not of the shaft. Accordingly, the force required to close the valve was usually greater than that required to keep it closed. However, by minimising the difference between the diameters of the shaft and of the main flow path, the difference between the forces required to close the valve and to keep it closed would be reduced.

94. Claim 18 is not expressed to be dependent on claim 3 (the shaft cap). Therefore it covers valves in which the control piston is not fitted with a shaft cap but has a shaft of constant diameter. When the claim says that the cross-sectional area of the shaft is "essentially identical" to that of the flow path, it clearly does not mean absolutely identical since then the valve would not work. This much is common ground.

95. The expert evidence was that the skilled person would consider that for an effective seal a minimum overhang of 1.5-2 mm each side was required. This was therefore CGK at the priority date. An overhang of 1.5-2 mm amounts to the shaft having a cross-sectional area about 28% larger than that of the flow path.

96. The Seitz valve with the elephant foot (see at para 81 above) has an overhang of only 1 mm on each side. Mr Brandau and Mr Bucher agreed that this came within the scope of claim 18 as being "essentially identical". The consequent increase in cross-sectional area of the shaft over the area of the flow path was 24%.

97. On the basis that 28% was only "marginally higher" than 24%, Seitz submitted that an overhang of 1.5-2 mm was also within the claim. Therefore it was contended that the claim was obvious.

98. Clearly a line has to be drawn as a matter of construction to determine what is and is not "essentially identical" and thus what design dimensions will infringe. In my view, the matter cannot be considered purely in terms of the relative surface area. Given that the diameter of the main flow path was fairly constant in these valves, the consequent dimensions of the shaft in actual terms cannot be left out of account. In my view, there is significant difference between a 1.5-2 mm overhang on each side and an overhang of only 1 mm. On balance, I do not think that the former comes within the claim. And on that basis, I find that it was not obvious that the overhang could be reduced to 1 mm each side.

99. I do not consider that the high pressure valves in the ALS 1-4 machine, displace or qualify that view. Those valves operate by the piston-and-ball method, which is an altogether different way of sealing the flow path from a seal by the juxtaposition of two flat surfaces. Accordingly, the ALS 1-4 does not make the claim any more obvious.

100. I therefore find that claim 18 is valid. As I have noted, on that basis infringement is admitted.

Conclusion

101. For the reasons set out above, the challenges to amended claim 1 on the basis of novelty and obviousness are rejected. I find the claim valid and that the Seitz product would infringe.

102. If that conclusion were wrong, I would hold that Seitz had not infringed claim 3, that claim 15 was not independently valid, but that claim 18 was independently valid and (as is then admitted) would be infringed.