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Case No: HC06C01151

IN THE HIGH COURT OF JUSTICE
CHANCERY DIVISION
PATENTS COURT

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 26 March 2007

Before :

THE HONOURABLE MR JUSTICE KITCHIN

- -

Between :

EUROPEAN CENTRAL BANK	**Claimant**
- and -	
DOCUMENT SECURITY SYSTEMS INCORPORATED	
(a company incorporated under the laws of the State of New York, USA)	**Defendant**

- -
- -

Simon Thorley QC and Miles Copeland (instructed by **Bird & Bird**) for the Claimant
Henry Carr QC and Piers Acland (instructed by **McDermott Will & Emery**) for the Defendant

Hearing dates: 23 – 26 January, 29 – 30 January 2007

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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.

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THE HONOURABLE MR JUSTICE KITCHIN

Mr Justice Kitchin :

Introduction

1. This is a claim for revocation of European Patent (UK) 0 455 750 ("the Patent") which is directed to a method of making a document which cannot be replicated by a scanning type copying device. It has particular relevance to security documents such as banknotes, travellers' cheques and the like. The defendant ("DSS") has brought a claim for infringement of the Patent against the claimant (the "ECB") in the European Court of First Instance ("CFI") in which it alleges that Euro banknotes are made by an infringing process. The ECB disputes that the CFI has jurisdiction to hear an infringement claim and that issue is currently before the CFI.

2. In the meantime the ECB has issued claims for revocation of the Patent in various European jurisdictions. This case is the first to be heard. Accordingly this court is not concerned with issues of infringement, but only validity.

3. The application for the Patent was filed on 16 January 1990 and claims priority from a US application dated 18 January 1989. The Patent had a long prosecution and the claims were amended on a number of occasions. On 18 July 1995, the claims, as then proposed, were refused by the Examining Division as being obvious in the light of a number of pieces of prior art, including two of those cited in this action. The applicant appealed. The hearing took place before the Board of Appeal on 5 February 1999. During the course of the hearing the applicant proposed the claims as now granted. The Board of Appeal considered they overcame the obviousness objection and were otherwise acceptable. The appeal was therefore allowed (T0933/95).

4. The Patent is now alleged to be invalid on the following grounds:

   i) Added matter arising out of limitations added to claim 1 by the amendment proposed on 5 February 1999.

   ii) Obviousness in the light of

      a) the prior publication of GB 1,138,011 ("011");

      b) the prior publication of DE 602,563 ("Kurowski"); and

      c) the common general knowledge.

   iii) Anticipation in the light of the prior circulation of two series of banknotes:

      a) the UK 1987 Series D £10 note;

      b) the Swiss Sixth series 20 Franc note.

   iv) Insufficiency on the basis that there is no sufficient teaching of how to determine the width of the scanning lines of the copying devices.

Technical background

5. Much of the technical background was not in dispute although the parties were unable to agree a primer. So the following is largely a composite of the relevant and non contentious parts of the primers each side produced.

Security printing

6. Security printing is the field of the printing industry that deals with the printing of items of value such as banknotes, travellers' cheques, passports, stock certificates, postage stamps and identity cards. The goal of security printing is to ensure that original documents can be authenticated, the production of counterfeits is made as difficult as possible and that counterfeits are readily detectable. A number of techniques and materials have been developed over the years to try to ensure that the security printing industry remains ahead of counterfeiters as copying technology has evolved. By 1989, common and well known techniques and materials included the following:

   i) Specialised substrate materials. Banknotes were generally made of good quality paper. Sometimes high quality 100% rag paper was used which is dull when seen under ultra violet light. Coloured fibres and threads were embedded to give the paper added individuality.

   ii) Specialised inks such as magnetic and fluorescent inks which were difficult and expensive to obtain.

   iii) Watermarks which were first introduced in Bologna, Italy in 1282 and have been commonly used in security printing ever since. Watermarks are made either by varying the thickness of the paper in a mould while it is being made, or by impressing a water coated metal stamp or 'dandy roll' onto the paper during manufacturing.

   iv) Printed patterns made using sophisticated and expensive printing techniques such as intaglio printing, which I explain later in this section. These could print with an extremely accurate register and in fine detail.

   v) Iridescent foils and structures such as holograms which display a colour or image change when viewed from different angles.

   vi) Unique serial numbers which make counterfeiting more time consuming and counterfeit notes easier to identify and track.

   vii) Banknotes printed with fine alignment between the printing on each side of the note. Accurate imitation was difficult without printing machinery and technology not readily available to the counterfeiter.

   viii) Screen traps designed to create a moiré pattern when a note is reproduced, as I shall explain.

Printing techniques

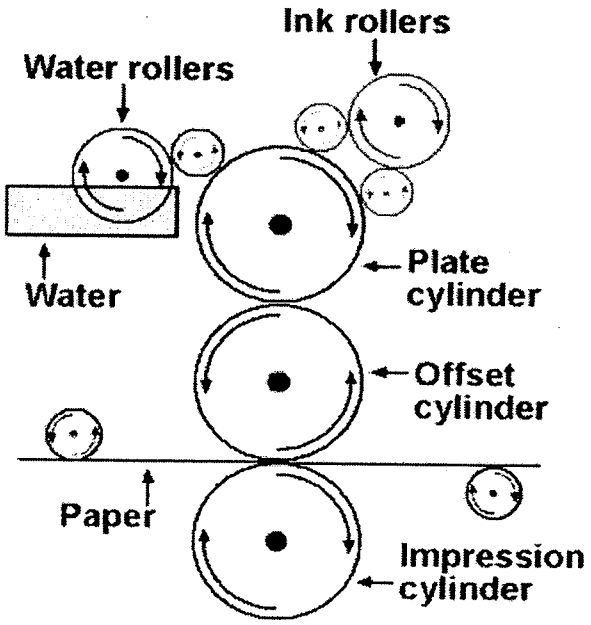
7. *Letterpress printing.* This is a printing technique which has been used since the 13th century. The figures or digits to be printed are raised up from the surface of the printing plate, rather than engraved into it. The plate is then inked and pressed against

the printing substrate to obtain the image. It is still used today for printing serial numbers on banknotes.

8. *Intaglio printing.* Intaglio is a printing technique in which the image to be printed is incised into the surface of a metal plate, typically made from copper or zinc. The incisions may be engraved into the plate by hand or laser or may be etched by the action of an acid.

9. To print from an intaglio plate, the surface is covered in ink and the excess is wiped away leaving it only in the incisions. The substrate is then brought into contact with the plate and both are run through a printing press under very high pressure. The press 'draws' the ink from the incisions by a combination of pressure, osmosis, and electrostatic pull, thus transferring the ink from the plate onto the substrate to form the print. Intaglio printing is commonly used in the production of banknotes, often in combination with other printing methods. It creates a unique texture on the printed copy that is difficult to replicate.

10. *Offset lithography.* Lithography is based upon the repulsion of oil and water, with the image drawn onto a surface and treated in such a way as to retain ink, whilst the non image areas are chemically treated to accept water and repel ink. In offset lithography the inked image is transferred ("offset") from the printing plate to a rubber cylinder and then to the printing substrate. A number of separate plates with different colours can be superimposed to create the final image. The technique is illustrated in the figure below:



11. Banknote printing often uses a variation of the technique called *dry offset printing.* This is similar to offset lithography in that a rubber blanket is used to carry the image from the printing plate to the printing substrate. The image areas on the printing plate are raised above the surface of the plate, much like letterpress printing. Ink is distributed through a series of rollers and onto the raised surface of the plate. The plate transfers the image to the blanket, which then prints the image on the substrate. In banknote technology, offset printing is exploited to print security inks that do not easily emulsify, such as UV fluorescent inks.

12. All the techniques I have described are very expensive to operate. Other printing techniques have therefore been developed to allow printing on smaller commercial and domestic scales. Two have been particularly successful, namely inkjet and laser printing.

13. *Inkjet printing* involves spraying tiny droplets of ink under high pressure onto the printing substrate. There are different ways of depositing a droplet of ink but they all suffer from the problem of "fixing" the ink on the page. Most inks are aqueous and therefore smudge very easily.

14. *Laser printing* is another method of non-impact printing. It is a digital process that relies on a chip within the printer to convert the image data it receives into a series of pixels called a *raster image*.

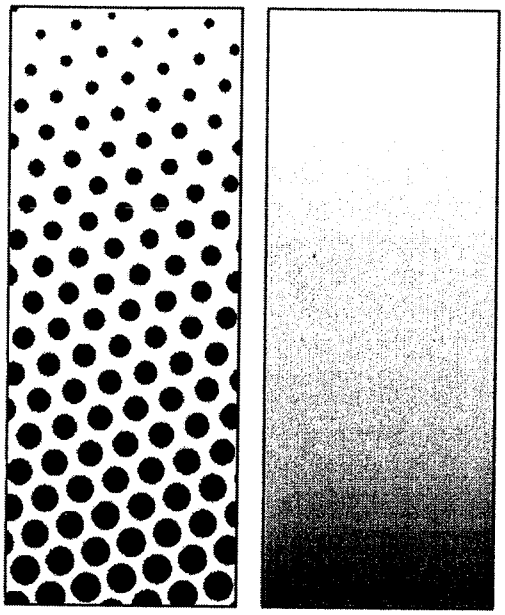
15. Within the laser printer is a rotating electrostatic drum that can be either negatively or positively charged, and the laser unit itself. Once the chip has converted the image to a raster image, the laser is directed by the chip to "draw" the image onto the charged drum as a series of lines of dots, on the same principles of halftoning which I explain below. The rotation of the drum corresponds to the y direction of the image plane, and the switching on and off of the laser (thereby creating the dots) corresponds to the x direction of the image plane, together making up the resolution of the printer.

16. When the laser hits the drum, the charge on the drum is reversed in a small area. The drum is then exposed to very fine particles of toner which are attracted to the charged sections of the drum which were "drawn" by the laser. The image is then transferred to the substrate by rolling the drum over it. Finally, the toner is fused to the substrate by passing it through two heated rollers.

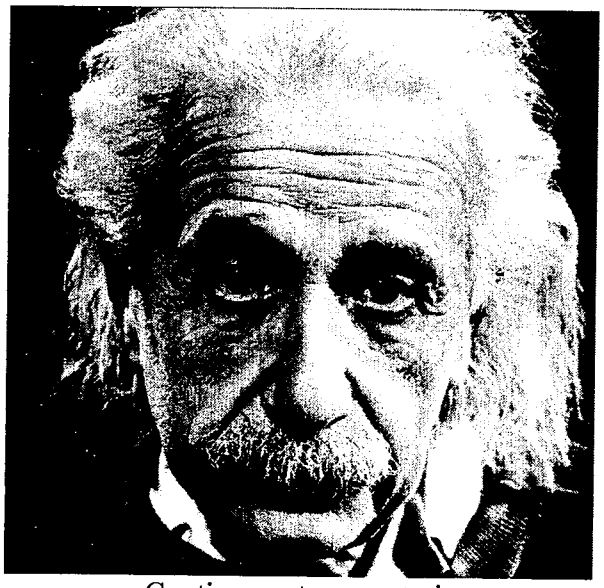
Line and halftone printing

17. A continuous tone image (such as a photograph) may be produced by simply printing it onto the page. But this creates a problem for the printer because a black and white image may have hundreds of shades of grey and a colour image may have millions of different colours. The answer is the technique of halftone printing.

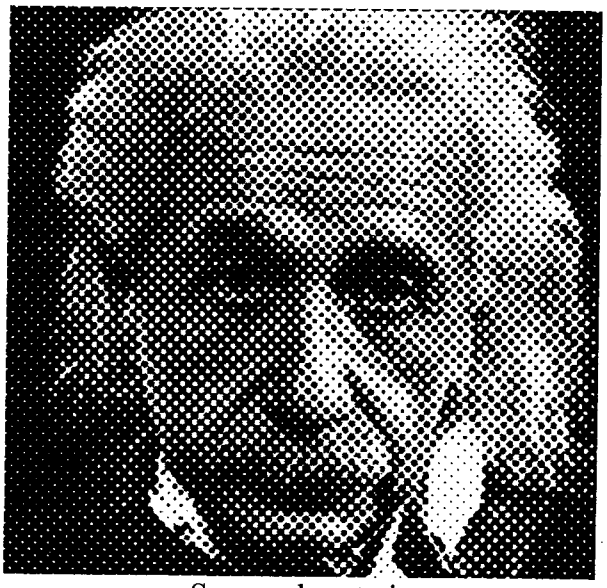
18. Halftone printing is a method of creating printable images by converting an original continuous tone image into an image composed of dots or lines. If the dots are small enough, the dotted areas are perceived as uniform shades of grey or colour. By varying the size of the printed dots, either the shade of grey (in black and white printing) or the precise colour (in colour printing) can be adjusted. This is demonstrated by the diagram below, which shows on the left an enlarged view of a scale of halftone dots, and on the right, how it appears with the dots at normal size:



19. Similarly, the figure below shows a continuous shade image and a dot screened image. From a very short distance away, the halftone dots are clearly visible. However, from a few metres away, the images appear to be the same, due to the limitations of the human eye.



Continuous tone portrait



Screened portrait

20. The main advantage of halftone printing is its capacity to allow a limitless number of shades or colours to be created from a very small number of ink colours.

21. A process called *screening* is used to break down an image into this series of dots. Historically this was achieved by using a contact screen made up of a grid-like mesh that was placed over a photographic film; hence the expression *photographic halftoning*. In this technique the original image is projected through the contact screen onto the photographic film and thus becomes broken up by the mesh of the screen. The resultant image appears on the film or other such surface beneath as a series of

dots i.e. a halftone image. The amount of light that does or does not pass through the image and screen to hit the film corresponds to the size of the dots created on the film. Some information in the image is inevitably lost with this method but, if fine enough screens are used, this is not observed by the naked eye. Thus, the quality of the end result of screening to create halftone images is dependent upon the choice of screen frequency and dot shape.

22. *Screen Frequencies* are measured in lines per inch ("lpi"). The finer the screen (i.e. the higher the lpi), the more detailed the image can be in the finished format. In 1989, a typical frequency of a screen was 100 lpi; a frequency as low as 65 lpi was considered coarse and one of 150 lpi considered fine.

23. The same technique can be used to print colour images. The impression of white can be created by combining three colours of light: red, green and blue. When two of these three colours are combined, the result is one of the three so called subtractive colours: yellow, magenta and cyan. Combinations of the subtractive colours, printed with a transparent ink in varying dot sizes, can make up an almost complete range of colours. Because inks of the three subtractive colours, when they are combined, do not produce black but only a grey (due to fundamental limitations of the ink dyes), black is added in the printing process to achieve sufficient shadow and contrast of the image. Black is referred to as "Key" in the printing industry and together, the four colours of the subtractive printing process are known as CYMK. These four colours alone are generally the basis of all colour printing.

24. Colour images were printed in much the same way as black and white images. The reproduction was achieved by photographing three separate conversions of the original image through red, green and blue colour filters, whilst a fourth colour separation might record the blackish tones of the original. Photographic separation films were then used to produce the printing plates which were mounted on the cylinders of the rotary offset printing press.

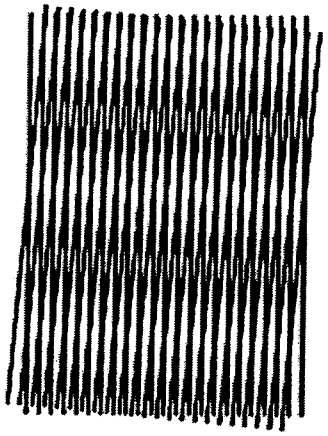
25. From the early 1970s, high-end dot-generating colour scanners became available to the printing industry. Typical of these were the Hell DC and the Crossfield Magnascan. These scanners were expensive and complicated devices that required operation by highly trained personnel. They scanned at a very high resolution. Typically a beam of light passed through a colour transparency original and was then split into three parts, the separated beams then passing through blue, green and red filters to separate photo-electric cells. These photo-cells generated electrical signals proportional to the blue, green and red transmissions at each point in the transparency. The signals were fed to a computer and then colour corrected separations produced. Thereafter the process was essentially the same as the old photographic process in that the colour separations were halftoned and the resulting films were used to make yellow, magenta, cyan and black printing plates. In summary, these machines provided a new way of making films. In order to make a printed image, it was still necessary to use the films to make an offset printing plates and then use the plates in the printing machine.

Moiré effect

26. Moiré is an optical interference effect created when two periodic structures are overlaid. Any variety in the periodic structure, be it a different frequency of line

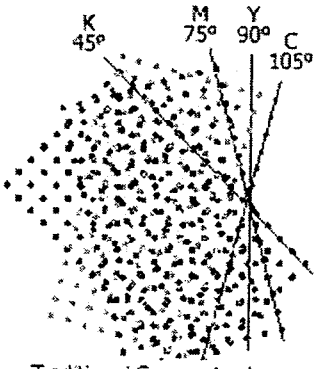
within the structure, a different curvature of line, a different angle of line or a slight mismatch in the overlay of the structures, can result in the appearance of low frequency banding on top of the original structure.

27. The figure below shows a moiré pattern formed by two sets of parallel lines, one set inclined to the other at an angle of 5°. The interaction between the lines creates a visible pattern of roughly horizontal dark and light bands, the moiré pattern, superimposed on the two sets of lines.



28. It is a feature of moiré that a relatively small displacement in the overlaid structures produces a relatively large displacement in the elements of the moiré pattern. So moiré magnifies the original displacement. It therefore provides an extremely sensitive way of detecting minute differences in almost identical repeating structures.

29. In the case of colour halftone printing, moiré patterns can result if the lines of dots of the four different colours are simply printed on top of each other, as it is highly likely there will be some sort of mismatch between them. This problem was solved by changing the angle of each colour screen by 15° as measured from the horizontal, so that the collection of printed dots created "rosettes" of colour, as seen in the figure below:



Traditional Screen Angles

30. The moiré effect has also been put to good use. By 1989 it was appreciated that visible moiré effects could occur if the original image contained pattern with a spatial frequency close to that of the halftone screen. So designers of banknotes and other security documents took advantage of this phenomenon and deliberately introduced

fine line patterns, called *screen traps*, which were *intended* to cause obvious moiré interference if the security document was reproduced. It was unknown what screen frequency or screen orientation the counterfeiter would use so designers tried to use screen traps with as many spatial frequencies and orientations as possible. One way of achieving this is demonstrated in a Dutch 100 Guilder note produced in evidence and called the "snipe" note because it contains a prominent image of that bird. The screen trap covers a circular area of the banknote to the left of the image of the snipe and consists of a pattern of concentric lines that vary in spatial frequency between 75 and 200 lpi. The concentric nature of the design ensured that all possible orientations of halftone screens were covered and the line frequency range extended over the range of commonly used halftone screens.

Copying devices

31. Photocopiers use a combination of light, mirrors, electrostatic charges and toner to sweep across an original document and then print a copy of it. The printing section of the process involves the same thermal toner transfer described in connection with laser printing.

32. The copying section of the process originally involved mirrors projecting light onto a rotating charged drum. A beam of light was passed across an original document placed on the copier's glass surface, thereby illuminating the original in a series of strips. A mirror within the copier directed light reflected from the white areas of the document through a lens and onto the rotating drum. The light discharged those areas of the drum onto which it fell. The copy was then printed by exposing the drum to toner and rolling it against the substrate. The toner and substrate were fused together by heated rollers.

33. In the 1970s and the 1980s the first generation of colour copiers such as the Xerox 6500 and the Canon NP Color T became available. They were analogue machines and worked by filtering the light by which the original was imaged through red, green and blue filters and using corresponding translucent coloured toners, matching the three key colours, cyan, magenta and yellow, together with black as necessary. Copy and print machine cycles were required for each colour. The machines were very large and expensive and the quality of the output was low.

34. The first copiers to use digital technology began to emerge in the mid to late 1980s. The machines made by Canon (the Canon CLC range) were widely regarded as the best, but they were still expensive. Others were made by Sharp and Toshiba. In these machines the original document was no longer passed over by a moving light, but was scanned by a charge-coupled device ("CCD") that was made up of thousands of photodiodes. The photodiodes broadly correspond to pixels. The CCD array was indexed in the x direction and scanned in the y direction. The digitised image was then processed and printed using either laser or ink-jet printing.

35. Early colour copiers presented only a limited threat since they were not capable of highly accurate colour reproduction, and counterfeits made using them were usually easily recognisable. But with models such as the Canon CLC, which was launched in 1987 and quickly gained a large market share, good colour reproductions of banknotes became much easier. By 1988 it was recognised that colour copiers were, or were going to be, a threat to the document security industry. It was appreciated that

such copiers were likely to become cheaper, more widely available and of better quality. The number of casual counterfeiters was expected to grow.

The skilled addressee

36. The Patent is concerned with security documents in general but has obvious and direct relevance to those involved in printing banknotes. There was no dispute between the parties that the skilled addressee is a team comprising a technical specialist and an artist-designer. The ECB argued that the team would be skilled in the design of banknotes. DSS suggested, at least initially, that the skilled team would be generalists and, although they would appreciate the applicability of the invention to banknotes, they would not necessarily be involved in banknote production. I accept the submission advanced by the ECB. Where the specification of a patent explains that the invention has a range of different applications then it is possible that the precise composition and skills of the team may vary from one particular application to another. In these circumstances I do not think it is right to consider only those persons who are common to all the teams. If the patentee has chosen to cast his monopoly so widely that it covers a number of different applications then its validity may be challenged in relation to each of them. In the present case the specification explains that the invention has an application in the field of banknote production. The ECB is therefore entitled to contend that the addressee includes a team skilled in the design of banknotes. If the invention was obvious to such a team then the Patent is invalid.

37. I consider the common general knowledge later in this judgment. At this point I would simply observe that the skilled team would have knowledge of the general functionality of colour copiers but would not have access to detailed technical information on the latest developments in copier technology. Neither side suggested that anyone involved in the development of electro-photographic processes would form part of the team. Members of the skilled team would, however, be familiar with the basics of photocopier technology and, of course, they could make enquiries where necessary of the manufacturers of such machines.

The experts

38. I heard evidence from two experts. Dr Robert Furley gave evidence on behalf of the ECB. In 1969, he was awarded a PhD from Southampton University. In 1971, he joined the Bank of England Printing Works as a technical assistant. He worked with academic institutions, government research laboratories, research companies and suppliers to develop security features and ways in which they could be applied to banknotes. His work also involved the detailed study of banknote production processes. In the course of all of these activities he worked closely with artist-designers, development engineers and production staff. He held many discussions with people in similar positions in overseas security printers and national central banks. In 1982, he was appointed Manager, Scientific Research of the Bank of England. His principal role was to advise the Bank on developing threats to banknote security and to devise and develop measures to combat that threat. From about 1984, he became increasingly involved in discussions with other national central banks and their printers as a result of the increasing international concern at the development of colour copiers.

39. From about 1987, Dr Furley was asked to join a small group of representatives of the European Bankers Printers Conference ("BPC"). The BPC is a conference which, in the 1980s, was attended by representatives from most of the Western European central banks and their printers to share know-how on matters of common interest. Dr Furley was asked to join a group that was given the task of drawing up proposals for a cooperative study of the problems presented by colour copiers. In 1989, he was asked to serve as the Secretary of the group of technical specialists formed for this task. In 1996, Dr Furley was promoted to Chief Scientist and remained in that post until he retired in 1999. DSS advanced no personal criticism of Dr Furley and in my judgment it was right not to do so. He was a careful witness and gave his evidence fairly and honestly. I have found it of great assistance.

40. Mr van Renesse gave evidence on behalf of DSS. He has worked in the field of security printing for over 30 years. He graduated from the Technical Academy for Photography in The Hague in 1965 and joined the Department of Optics of the TNO Institute of Applied Physics in Delft in 1966. This was a contract research organisation working with the public and private sectors. Mr van Renesse worked generally in the field of optics research and specialised in document security. He provided illustrations of some of the projects with which he was involved whilst at TNO. In 1970-2, he developed an intaglio detection system for banknotes for the Dutch National Bank which is still in use today. From 1982-4, he was involved in the design and the development of a watermark bar code detector for banknotes, again for the Dutch National Bank. In 1987-9, he was engaged in the evaluation of security features to combat colour copiers for the Dutch passport. It is apparent from this summary that Mr van Renesse had less experience in the design of security devices in banknotes than Dr Furley. Further, he was never employed by a security printer. Nevertheless, I am satisfied that Mr van Renesse did have a good understanding of the security features employed in banknote design from 1970 onwards. As in the case of Dr Furley, I have no doubt that Mr van Renesse gave his evidence fairly and honestly and once again I found it of considerable assistance.

Common general knowledge

41. The skilled addressee lacks inventive capacity but is deemed to be equipped with the common general knowledge in the field to which the invention relates. As I have indicated, attention was particularly focused on banknote security during the course of these proceedings. The law as to what constitutes common general knowledge was explained by the Court of Appeal in *Beloit Technologies Inc v Valmet Paper Machinery Inc* [1997] RPC 489 at 494-495. In short, it is all that information which is generally known and generally regarded as a good basis for further action by those engaged in the art to which the disclosure relates.

42. In *Raychem Corp's Patents* [1998] RPC 31, Laddie J explained that the common general knowledge is not limited to material that the skilled person has memorised and has at the front of his mind. It includes all that material in the field in which he is working which he knows exists, which he would refer to as a matter of course if he cannot remember it and which he understands is generally regarded as sufficiently reliable to use as a foundation for further work or to help to understand the pleaded prior art.

43. I am satisfied that all of the matters to which I have referred in the technical background section of this judgment were common general knowledge by 1989. In addition there was no dispute between the parties that the following were common general knowledge:

i) The general principles of physics and optics underlying the technical matters set out in the technical background.

ii) The principles underlying the formation of moiré interference fringes.

iii) The printing methods available for large scale production.

iv) The fact that banknote production would involve more than one printing method and intaglio methods were almost universally used, together with other offset printing processes.

v) The fact that the formation of moiré fringes had been a problem arising from the use of copying processes using halftone screens.

vi) The fact that this problem arose from interference between the halftone screens or between the screens and a pattern in the original image.

vii) An appreciation that colour copiers were likely to become much more widespread, cheaper and of better quality as technology advanced and that there was an incentive to incorporate security features that would address the issues raised by these copiers.

viii) The general principles of electrophotography underlying colour photocopier technology.

ix) Familiarity with the design features of banknotes currently and previously in circulation in other major jurisdictions, including the fact that banknotes commonly comprised many closely spaced lines of different orientations and spacings, whether printed by intaglio or offset printing techniques.

44. The principal areas of disagreement between the experts concerned the extent to which screen traps were understood to suffer from drawbacks and limitations, and what was known about the new scanning and copying machines. I will deal with them in turn.

Drawbacks of screen traps

45. I have explained the nature and purpose of screen traps in paragraph [30] of this judgment. The use of such screen traps challenged the counterfeiter to find available halftone screens that did not cause obvious moiré effects, while the currency designers tried to make that as difficult as possible by introducing screen traps with as many spatial frequencies and orientations as possible. This was described in the course of the proceedings as a "scatter gun" approach.

46. I am satisfied that the scatter gun approach was perceived to have a number of problems. First, if a screen trap had a variety of different line frequencies and orientations then obviously only those which coincided with the pitch of the halftone

screen would ever produce a moiré effect. If they constituted a relatively small part of the original image the moiré effect would correspondingly appear on only a small part of the copy. It was therefore desirable from a security perspective to make the screen traps cover as large an area as possible. Secondly, the screen traps needed to have a sufficient line contrast (against the background) and line thickness in order to produce a significant, that is to say clearly visible, moiré effect. Third, the decision where to place the screen traps on a note was considered to be important. If the area of design over which the moiré occurred was "busy" there was a risk that the moiré patterns would not be readily apparent and might not be noticed or their significance appreciated. It was therefore thought to be necessary to choose a quiet area of the note, not an area where there were lots of other images which might obscure any moiré effect. All of these factors tended to create a tension between the artistic designer and the security expert. The security expert wanted large quiet areas of the note to build his traps but this restricted the artistic freedom of the designer.

Screening and scanning

47. Dr Furley confirmed that the principle behind the high-end dot-generating colour scanners was the same as that of the traditional photographic method of halftoning in that the early machines produced continuous tone films which were subsequently contact printed to produce halftone films. In later machines the process was automated to produce halftone films directly. In either case four halftone films were produced, one for each colour, and these were then used to make four separate printing plates. The settings on the machine allowed the screens to be varied in angle and pitch in just the same way that the traditional halftone printer had different screens available. Dr Furley also agreed with Mr van Renesse that it was, in practice, impossible to produce a screen trap of a sufficiently high frequency to interfere with the high resolution input of these high-end dot-generating colour scanners. As Mr van Renesse explained, the sampling frequency of, say, 1,200 to over 2,000 samples per inch, was high enough to capture every little detail, including the screen traps, but was so different to the frequency of the screen traps as not to produce any moiré effect. At a later stage of the process the colour separations were halftoned using conventional screens and it was here that a moiré effect could be produced. As Mr van Renesse put it, that is what the screen traps were made for in the first place. In the light of the evidence of the experts I am satisfied that the basic method of operation of the high-end dot-generating scanners was common general knowledge. This included the fact they had a very high sampling frequency. I am also satisfied that it was common general knowledge that screen traps could reveal copies made on these machines as a result of visible moiré effects created during the halftone screening process.

48. It is also right to note that these high-end scanners were not regarded as creating any problem of casual counterfeiting of banknotes. The machines were expensive and required a skilled operator to use them.

Digital colour copiers

49. Unlike the high-end dot-generating colour scanners, the new generation of digital colour copiers both scanned the original image and produced a colour copy of it. The most significant of these was the Canon CLC. It was common ground that they were seen to pose a real threat to the document security industry and the industry responded by looking for ways to counteract it.

50. Mr van Renesse accepted that it was known in general terms what the copiers consisted of, namely a CCD scanner at the input with minute photodiodes that sampled the original document in the RGB colour space, miscellaneous image processing software, and finally, a printing system which produced a copy in the CMYK colour space.

51. Mr van Renesse also believed that it would have been possible to determine without any difficulty the line frequency of the printer and the scanning protocol of the scanner element of the copier. In this he agreed with Dr Furley who explained that the pitch of the scanner in one of these machines is made up of two components, the x direction and the y direction. In the x direction (perpendicular to the direction of motion of the scanner) the pitch is determined by the number of the photo diodes per inch used in the detector. This was often quoted by the manufacturer and was commonly about 400. In the y direction (along the direction of motion of the scanner) the pitch is determined by the step motor of the scanner. Again, the pitch was often quoted by the manufacturer, at least in the case of stand alone scanners, and was commonly between 200 and 300 lpi.

52. Mr van Renesse also accepted that the input, but not the output, could be described as sampling. The output was simply a printing process which printed continuous lines in one direction. When a banknote was put through the Canon CLC machine it might or not produce moiré on the copy. Mr van Renesse explained that if it did so then it could be produced either by interference arising from the line frequency of the input scanner or from interference arising from the line frequency of the laser printer. Both could technically take place. At the time, however, he only noticed that in some cases the copy might have a slight moiré effect and this could be got rid of by turning the note at an angle. He did not consider whether it had been formed by the input scanner or the output printer. In the light of this evidence I conclude it was a matter of common general knowledge that the new generation of copiers did, on occasion, produce moiré effects with the existing screen traps but I do not accept that it was generally appreciated or understood exactly how those effects were created. This was not a matter to which those in this field had actually turned their minds.

The Patent

53. The specification is not written in the clearest terms. It begins with a description of the "Background of the Invention". It explains in paragraph [0001] that the invention relates generally to bogus or counterfeit document detection methods and particularly to a method of making a document that will not be replicable by any scanning type copying device such as a copying machine, video opticon and the like.

54. It proceeds with a discussion of the prior art. Paragraph [0004] provides a conventional explanation of moiré and the problems it has created in halftone screening (col.2, lines 23-48):

> "Accordingly, and being long familiar with the phenomenon of moiré that often occurs in printing, he reasoned that what had always occurred as a problem could be turned to the advantage of society in the elimination of the counterfeiting of face – value documents. For the edification of the reader it will suffice to say that the moiré is a serious problem in color

> reproduction. It is the occurrence of an interference pattern caused by the over printing of the screens in colorplates (similar effects can be observed by superimposing two pieces of a fine grid network such as window screening). Indeed, the technique of rotating half tone screens, when making the negatives for a printing plate, has been developed in order to avoid the moiré interference. Often it appears as the geometrical design that results when a set of straight or curved lines is superposed onto another set. If a grating design, made of parallel black and white bars of equal width, is superposed on an identical grating, moiré fringes appear as the crossing angle is varied from about one second of arc to about 45 degrees. The pattern will consist of equi-spaced parallel fringes; but, if two gratings of slightly different spacing are superposed, fringes will appear (known as "beat" fringes) which shift positions much faster than does the displacement of one grating with respect to the other. "

55. A little later the specification describes how this moiré effect could be used as a security feature (col.3, lines 15-47):

> "It became apparent to the instant inventor, therefore, that the moiré pattern, rather than as an indicator which is gradually removed from an image, may also be used as an indicator of some perhaps latent defect in a document. More appropriately, there had to be some way in which a pattern could be included in an image by printing it in a selected pattern. Then, when the image was viewed through a superposed grid, such as previously discussed, a moiré pattern would be observed according to the degree in which the patterns interfered with each other. Moreover, if one were to reduce the moiré apparatus to its simplest form, that is, such as viewing some background through the common parallel-stake snow fence (suggested by the previous description of parallel black grid lines spaced by parallel white or clear areas of equal width), and if the pattern over which it is superposed is formed of lines and dots that are equally spaced from each other (whether parallel or curvilinear), but a fraction off the pitch (or spacing) of the overlain grid, the observer would be deprived of a high percentage of the background field of vision. Thus, the background image, if formed of the line and dot printed grid, would be rendered nonreplicable to any apparatus being used to record the view. It is this particular aspect of moiré pattern creation that is used by the instant inventor to create this invention. Further, he also recognized that because the modern copy machine, whether it be a standard color tone copier or a laser printer, scanned the image to be copied with a fixed pitch scanning system, it was unnecessary to devise overlay grid means. In fact, the modern replicator contains such a grid in

> the fixed – pitch, parallel scan format that is used to view the image to be replicated."

56. A number of points emerge from this passage. First, it introduces the notion of a moiré inducing pattern being included in an original image. Second, it describes viewing the image through a superimposed grid or "snow fence" to create a moiré effect. It is important to note that the superimposed grid discussed here is not a part of the original image but rather a grid through which the image is viewed. Third, it explains that the inventor has had the idea that it is not necessary to superimpose a grid because modern copiers or printers scan the image to be copied with a fixed pitch scan format and that this itself involves applying a form of grid - a theme to which the specification later returns.

57. The final part of this section explains the danger posed by the modern copiers and then, in an important passage in paragraph [0005] at col.4, lines 9-15, identifies the problem the invention claims to address:

> "In particular, no one heretofore has found a way to provide an original banknote or important document which embodies the two often-sought features of a copy-proof instrument; for example, one which to the unaided eye is both indistinguishable from a prior (genuine) item and which is capable only of obviously bogus copier replication."

58. The object was therefore to produce a new document which looks the same as an old one but which now embodies protection against copying.

59. The next section of the specification is the "Summary of the Invention". Paragraph [0007], col.4, lines 23-33, asserts that the problem has been solved by the invention which now permits the production of security documents which to the naked eye are identical to prior items of the same kind but have characteristics which will reveal copies to be obvious counterfeits:

> "The problem posed by copier replication has been solved by this invention, which is based upon the serendipitous discovery and novel concepts described below. Consequently, it is now possible, for the first time to produce legal tender paper currency, genuine travelers cheques, original postage stamps, government issued food stamps, important documents or certificates and the like, which to the naked eye are identical to prior items of the same kind but, in fact, have characteristics which reveal copier (especially color) replications to be obvious counterfeits."

60. Paragraphs [0008] and [0009], col.4, lines 34-56, then explain how the invention was made:

> "[0008] The instant inventor in the course of searching for a solution to this problem accidentally discovered that a color copier replication of an original traveler's cheque cannot itself be used to produce a closely matching copy. Actually, it was

> found, surprisingly, that no matter how the color copier was adjusted to eliminate blemishes or defects apparent to the casual observer, the copies made from the first copy always had such prominent tell-tales, in one form or another."
>
> [0009] On the basis of his knowledge and skill as an expert in the printing art and the science of optics, the instant inventor recognized that in this discovery he had the key to solving the copier replicating problem. Thus, he conceived the idea of using the bane of the printer to the advantage of the counterfeit preventor. He would use the moiré effect to reveal the bogus color copy of a genuine banknote, for example, by producing the note image lineations in mismatch to the scanner of a color copier. The mismatch would be slight and not noticeable to the naked eye and thereby both basic requirements, which no one else was ever able to meet, could be totally satisfied. Moreover, the cost of producing such counterfeit-proof certificates need not be substantial. "

61. The patentee found that a copy of a traveller's cheque could not itself be copied without creating a moiré effect on the second generation copy. The first generation copy now carried an image which created a moiré interference pattern when copied again. This gave the inventor the idea of "*producing the note image lineations in mismatch to the scanner of a colour copier*".

62. The specification continues with a summary of the method of the invention (col.5, lines 12-35):

> "The basic method of counterfeit protection teaches the inclusion of lines, dots and/or swirls embodied and integrally formed into art, pictures and other forms of images. The grid lines are made so as to differentiate minutely in vertical and/or horizontal pitch from the linear grids employed by the scanning mechanisms of the machines used to replicate these black-white or colored documents. Generically, such scanning replicators are typically black and white optical reproduction systems, such as office copiers, color copiers, and opticons that are used in conjunction with video systems. Subclassed in this generic group are the new and increasingly common, laser color and black and white optical reproduction systems. After creation of the authentic document, that is, one including the grid lines of predetermined pitch, the primary method of counterfeit protection, as well as the product thereof, have been realized. Any attempt at imitation or replication by means of a scanning-type copier will result in the generation of interference patterns and tones which are readily discernable (by the untrained and naked eye) from the original (or authentic) document in that the aesthetics of the document are distorted, omitted or otherwise completely destroyed in the replication."

63. The reader is therefore taught that the invention is to be performed by forming lines, dots or swirls into an image. These comprise grid lines which are made with a pitch which is minutely different from the pitch of the scanning mechanism of the copier.

64. The same appears from paragraph [0012]:

> "From the foregoing, and in view of the detailed description set forth below, it will be understood that this invention relates to a method producing an article of manufacture or product. Further, in its method aspect this invention comprises the step of producing an electro-optically nonreplicable original-certificate by providing on a matte a lineate pattern of visible image-defining lines which are of predetermined moiré-producing pitch relative to an electro-optic copy machine scan protocol. Otherwise expressed, this method includes the preliminary step of determining the pitch of an electro-optic copy machine scanner."

65. So the reader is taught to begin by determining the pitch of a scanner and then provide a pattern of "*visible image defining lines*" of a predetermined pitch.

66. The specification proceeds with a "Detailed Description of the Preferred Embodiment", and it does so by reference to various figures. These are said to provide instruction in the method of producing the nonreplicable image of the invention. Figures 1a to 1c are described in paragraphs [0018] to [0019]. Figure 1a is said to depict a typical printed pattern of lines, dots and swirls. Figure 1b is described as a "*grid overlay*". This consists of two arrays of equally spaced black stripes oriented orthogonally to each other. It is said to resemble the "*snow fence*" referred to in paragraphs [55] and [56] above. The specification then explains that when the pattern of Figure 1b is laid over that of Figure 1a the result is a distorted image, which the patentee describes as a "*type of moiré distortion pattern*". So the grid produces the moiré pattern.

67. At col.7, lines 51-58 the patentee explains:

> "The solution of the problem to the counterfeiting of printed documents lay in a form of reverse engineering wherein the recognition of a grid form of scanning in all replicating devices, and a knowledge of the moiré effect, led the instant inventor to reason that a distorted image would result any time a grid-like scanning pattern failed to map any discrete part of an authentic document into its replica."

68. Once again the grid, here imposed by the process of scanning, produces the moiré effect.

69. At col.8, lines 8-12, the theme is elaborated:

> "…. if the Figure 1a print were arranged cleverly so as to ensure that the greater part of the image was not picked up by the scanning protocol, the resulting copy would be highly

distorted, full of moiré interference patterns and significant omissions."

70. I will return to these figures when addressing the added matter objection. At this point I would simply note that there is no description here of the overlay of a screen to produce an image which, when copied, will produce a moiré pattern.

71. Paragraph [0020] is said to be a succinct description of the invention, as illustrated by Figures 2a-c. At this stage I can deal with this quite shortly. The figures show an arrangement of screens to produce a moiré pattern. Figure 2a depicts an image consisting of a grid of parallel lines and Figure 2b the scanning pattern of a replicating device. The pitch of the image is so arranged as to be "*minutely*" different from the pitch of the scanning pattern. The resulting moiré pattern is shown in Figure 2c.

72. Finally I should refer to Figures 3a-d. These are said to illustrate a further benefit of the invention. The specification explains that counterfeiters sometimes seek to avoid copy protection systems by defocusing the protected image and then re-screening it. The specification suggests that this is not possible in the case of documents produced according to the invention. The result, it is said, is a badly degraded image.

The claims

73. The Patent has two claims which the ECB conveniently broke down into the following integers:

Claim 1:

A A method of making a document that is not faithfully replicable by scanning-type copying devices, the document using a visible original image comprising art, pictures and/or image forms made of curvilinear lines, dots and/or swirls, the method comprising the steps of

B determining the scanning pitch distance (p) and width of the scanning lines of the copying devices;

C1 producing a grid pattern of parallel lines having a pitch distance (d) minutely more or less than the scanning pitch distance (p),

C2 the difference between the pitch distance (d) of the parallel lines and the scanning pitch distance (p) being within a range from about one-half the width of the scanning lines to about one-half the scanning pitch distance (p); and

D1 overlaying the grid pattern on the original image to produce on the document a printed image which comprises the original image having a superimposed transmitted or obstructed print pattern conforming to the grid pattern

D2 and in which the print pattern normally is not discernible by the naked eye, such that the original image and the printed image appear to the naked eye to be generally the same,

E the print pattern causing visibly discernable interference (e.g. moiré) patterns and/or false tones, colours or omissions to be produced in the printed image in copies of the document made by the copying devices.

Claim 2:

A method in accordance with claim 1 characterised by the parallel lines being uniformly spaced.

74. It is to be noted that these are method claims. They are directed to a way of making a security document which cannot be replicated by a scanning type copying device and, in particular, by the new generation of colour copiers such as the Canon CLC. In summary, the method of claim 1 involves determining the scanning pitch of a particular copying device, producing a grid of very slightly different pitch and then laying the grid over an original image to produce a modified image which is visually indistinguishable from the original but which will produce a moiré pattern when it is copied by that particular device.

75. DSS described this method as a "targeted" approach to copy protection as opposed to the scatter gun approach of the prior art. As I have mentioned, counterfeiters using halftone screening techniques could alter the orientation and pitch of their screens. Consequently, designers of traditional screen traps incorporated lines of different orientations and pitch so as to make the traps effective and the life of the counterfeiters more difficult. By contrast, the casual counterfeiter using one of the new copiers could not alter the pitch or orientation of its scanning mechanism. The method of the invention harnesses this limitation. Once the pitch of such a scanning mechanism is determined it is possible to overlay the artwork with a grid of only one frequency which is matched to that of the scanning mechanism.

76. There is no doubt that the claims cover the particular method I have described in the immediately preceding paragraph. But there was considerable debate between the parties as to whether they were so limited. I will deal with the various integers in turn.

Integer A: "Scanning-type copying device"

77. The expression contains two elements: "scanning-type" and "copying device". Dr Furley explained, and I accept, that "scanning-type" means that that the machine inputs the image information by repeatedly and progressively traversing the image to be copied in discrete lines as opposed to capturing the complete image in one exposure.

78. As to "copying device", DSS contended that the device must produce a final copy of the protected document. The ECB contended that the claim covers any device which produces a replica of the document, including the high-end dot-generating scanners to which I have referred in paragraph [25] above. In my judgment the ECB is essentially correct. Whilst the patentee was particularly concerned with the new generation of copiers, the specification makes it clear that he did not intend the method to be so limited. As I have mentioned, the specification says at the outset (col.1, lines 10-12) that the invention relates to a method of producing a document that will be non replicable by "*any scanning-type copying device such as a copying machine, video opticon and the like*". Similarly, it says of the product of the method (at col.5 lines 3-

5): "*It consists in a product, a face valued document that cannot be replicated by any known colour system*". This is elaborated in the passage containing a summary of the invention I have set out in paragraph [62] above. Here the inventor explains that the method extends to "*black and white and white optical reproduction systems, such as office copiers, color copiers, and opticons that are used in conjunction with video systems*". So the invention is concerned with scanning systems. It matters not whether the copy is produced in the form of a final copy or as colour separations, as in the case of the high-end dot-generating scanners.

Integer A: "The document using a visible original image"

79. The original image is the image over which the grid pattern is to be laid. It may be an image in a pre-existing document such as a banknote which is to be upgraded, or it may be an image designed for a new document.

Integer B: "determining the scanning pitch distance (p) and width of the scanning lines of the copying devices"

80. This was a major area of dispute between the parties and may have a significant bearing on the infringement case before the CFI. The ECB contended that the scanning pitch includes the screening that takes place at the printing or *output* stage. DSS argued that that the scanning pitch is limited to that of the *input*, when the image is captured. Both parties accepted that moiré interference could potentially arise by the interaction of either or both of these and the printed grid in the protected document.

81. I believe there are three powerful arguments in favour of the construction urged by DSS. First, the experts were agreed that as a matter of normal usage scanning is a term which applies to the input – it is the process by which the image to be copied is captured by the machine. Screening, on the other hand, is a process in which an image is broken down into discrete dots or lines so that the image can be printed by a method which is only capable of placing a mark of a single density on to the paper.

82. Second, the specification itself makes clear that scanning is used in its normal sense. It states at col.3, lines 40-47:

> "Further, he also recognized that because the modern copy machine, whether it be a standard color tone copier or a laser printer, scanned the image to be copied with a fixed pitch scanning system, it was unnecessary to devise overlay grid means. In fact, the modern replicator contains such a grid in the fixed – pitch, parallel scan format that is used to view the image to be replicated."

83. Dr Furley agreed that there was no doubt that the specification was here using the term scanning in accordance with the normal usage. Further, he was unable to point to any other passage in the specification where it was used in any other way. Mr van Renesse was of the same mind. He explained that the moiré discussed in the Patent is created in the first stage of the reproduction process by the interaction between the CCD array of the scanner of the copier and the printed grid in the original secure document.

84. Third, it seems to me that this interpretation is consistent with the whole thrust of the specification. As I have found, the teaching is not limited to the use of the new digital copiers. Rather, it extends to any reproduction system which incorporates a scanner – such as the high-end dot-generating scanners of the early 1970s. These produced films, not a printed image.

85. The principal ground advanced by the ECB in support of its contention was that the pitch of the input scanner was generally much smaller than the pitch of the screen at the printer output and it was the latter which would be likely to generate the required interference. There was no dispute that the pitch of the scanner element of the new copiers such as the Canon CLC was about 400 lpi in the x direction and between about 200 and 300 lpi in the y direction. On the other hand, the pitch of the printer output was about 135 lpi. Mr van Renesse accepted that 400 lpi would not have been a conventional line width in 1989 and could only have been printed with great difficulty. It follows that it would have been very difficult to create a secure document with a grid of sufficiently small pitch to create interference with the scanner, at least in the x direction.

86. This is undoubtedly a serious argument but I do not think it is enough to displace the clear meaning of the words of the claim. The specification itself contains none of these details. Moreover, it has not been established that there would have been the same difficulty if the lower resolution in the y direction was used. I have reached the conclusion that the words of the claim should be given their ordinary meaning. It is a meaning which is entirely consistent with the body of the description.

87. Before leaving this issue there is one further matter I should mention. DSS has lodged a statement of case and evidence in support of its infringement proceedings against the ECB before the CFI. In that statement of case DSS asserts that the Patent teaches that the pitch distance of the scanner must be determined and that such determination would confirm that a common pitch distance for many scanning devices in the mid to late 1990s was about 100 lpi (paragraphs 41 and 54). DSS further asserts that typical line spacings in the period before 1989 and even today were and are 85 lpi and 133 lpi (paragraph 52). It then contends (paragraph 69) that one example of a scanning pitch distance of copying devices determined in accordance with claim 1 of the Patent is approximately 100 lpi. Further, if Euro banknotes are scanned using such a machine then moiré patterns can be seen on the copy. Hence, it argues, there is infringement. This statement of case was supported by written evidence from a Professor Noga.

88. The question of infringement is not for me to determine. However, these materials were canvassed in argument and raised in evidence by the ECB in support of its case that the patentee clearly intended the claim to include a determination of the scanning pitch distance (p) at the *output* stage. In these circumstances I would make the following observations. The stance taken by DSS before the CFI cannot affect my conclusion as to the proper interpretation of the Patent. It is nevertheless apparent that the positions adopted by DSS before this court and the CFI are radically different. As I have indicated, DSS contended before me, and I accept, that the scanning pitch distance of the Canon CLC and other machines at the *input* stage was about 400 lpi in the x direction and between about 200 and 300 lpi in the y direction. This is quite different to the 100 lpi contended for in the CFI proceedings and is much closer to the pitch at the *output* stage. Further, in its closing submissions DSS relied upon the evidence given by Mr van Renesse that he thought DSS was referring to the *input*

stage but that the figure of 100 lpi was "not true". This case therefore seems to me to be a very powerful illustration of why it is desirable to try infringement and validity issues together, where at all possible. If they are tried separately it is all too easy for the patentee to argue for a narrow interpretation of his claim when defending it but an expansive interpretation when asserting infringement.

Integer C1: producing a grid pattern of parallel lines having a pitch distance (d) minutely more or less than the scanning pitch distance (p),

89. This refers to the security grid that will be used to interfere with the scanning lines of the copying device. It requires the production of such a grid after the scanning pitch distance has been determined. The pitch can be determined by measurement or found out in some other way.

Integer C2: the difference between the pitch distance (d) of the parallel lines and the scanning pitch distance (p) being within a range from about one-half the width of the scanning lines to about one-half the scanning pitch distance (p); and

90. This raises no difficulties of interpretation. The smaller the difference the more pronounced the moiré effect will be.

Integer D1: overlaying the grid pattern on the original image to produce on the document a printed image which comprises the original image having a superimposed transmitted or obstructed print pattern conforming to the grid pattern

91. This is an important limitation to the claim and is one of the features introduced by amendment. It requires the step of laying a grid over the original image to produce the copy protected document, described here as "*a printed image*". Moreover, as is apparent from the next integer, the protected image must have the same appearance as the original image. The significance of this integer is that it describes the way the protected image must be produced. But it creates some difficulty of interpretation because it is not expressly disclosed in the body of the specification. Indeed, there are aspects of the disclosure which appear to be inconsistent with it – a matter which I consider in detail when addressing the added matter objection. Both sides agreed that the integer is concerned with ensuring that a moiré inducing grid is added to the visible image. DSS submitted that is as far as it goes. In my judgment the skilled person would give the words their ordinary meaning. They call for a moiré inducing grid produced in accordance with integer C1 to be laid over, that is to say imposed upon, the original image. A screen would be one such grid, and this would produce a protected image which appears the same as the original.

Integer D2: and in which the print pattern normally is not discernible by the naked eye, such that the original image and the printed image appear to the naked eye to be generally the same

92. This is another important limitation which is tied to the last one. The original image and the protected image must appear generally the same. This emphasises that the step of protecting the image is an active one which involves manipulating the original image.

Integer E: creating interference patterns

93. The appearance of an interference pattern means that counterfeit copies can readily be identified.

Claim 2: Parallel lines are uniformly spaced

94. In contrast to claim 1, claim 2 confines the method to the use of a single, uniform grid spacing. But neither claim requires the grid to overlay the whole of the original image.

Added matter

Introduction

95. The ECB contends that the matter disclosed in the specification extends beyond that disclosed in the application as filed contrary to section 72(1)(d) of the Patents Act 1977 (corresponding to Art.123(2) of the EPC). The objection is founded on the amended claims accepted by the Board of Appeal in 1999, some 10 years after the priority date. It is set out in paragraph 3 of the Re-Amended Grounds of Invalidity. In substance, it is alleged there was no disclosure in the application as filed of integers D1 and D2 of claim 1. In the end the argument centred on integer D1.

Legal principles

96. The test for added matter was explained by Aldous J in *Bonzel v Intervention Ltd* [1991] R.P.C. 553 at 574:

> "The decision as to whether there was an extension of disclosure must be made on a comparison of the two documents read through the eyes of a skilled addressee. The task of the Court is threefold:
>
> (a) To ascertain through the eyes of the skilled addressee what is disclosed, both explicitly and implicitly in the application.
>
> (b) To do the same in respect of the patent as granted.
>
> (c) To compare the two disclosures and decide whether any subject matter relevant to the invention has been added whether by deletion or addition.
>
> The comparison is strict in the sense that subject matter will be added unless such matter is clearly and unambiguously disclosed in the application either explicitly or implicitly."

97. A number of points emerge from this formulation which have a particular bearing on the present case and merit a little elaboration. First, it requires the court to construe both the original application and specification to determine what they disclose. For this purpose the claims form part of the disclosure (s.130(3) of the Act), though clearly not everything which falls within the scope of the claims is necessarily disclosed.

98. Second, it is the court which must carry out the exercise and it must do so through the eyes of the skilled addressee. Such a person will approach the documents with the benefit of the common general knowledge.

99. Third, the two disclosures must be compared to see whether any subject matter relevant to the invention has been added. This comparison is a strict one. Subject matter will be added unless it is clearly and unambiguously disclosed in the application as filed.

100. Fourth, it is appropriate to consider what has been disclosed both expressly and implicitly. Thus the addition of a reference to that which the skilled person would take for granted does not matter: *DSM NV's Patent* [2001] R.P.C. 25 at [195]-[202]. On the other hand, it is to be emphasised that this is not an obviousness test. A patentee is not permitted to add matter by amendment which would have been obvious to the skilled person from the application.

101. Fifth, the issue is whether subject matter relevant to the invention has been added. In case G1/93, *Advanced Semiconductor Products*, the Enlarged Board of Appeal of the EPO stated (at paragraph [9] of its reasons) that the idea underlying Art. 123(2) is that that an applicant should not be allowed to improve his position by adding subject matter not disclosed in the application as filed, which would give him an unwarranted advantage and could be damaging to the legal security of third parties relying on the content of the original application. At paragraph [16] it explained that whether an added feature which limits the scope of protection is contrary to Art 123(2) must be determined from all the circumstances. If it provides a technical contribution to the subject matter of the claimed invention then it would give an unwarranted advantage to the patentee. If, on the other hand, the feature merely excludes protection for part of the subject matter of the claimed invention as covered by the application as filed, the adding of such a feature cannot reasonably be considered to give any unwarranted advantage to the applicant. Nor does it adversely affect the interests of third parties.

102. Sixth, it is important to avoid hindsight. Care must be taken to consider the disclosure of the application through the eyes of a skilled person who has not seen the amended specification and consequently does not know what he is looking for. This is particularly important where the subject matter is said to be implicitly disclosed in the original specification.

Comparison of the disclosures

103. The body of the specification of the original application is in virtually identical terms to that of the Patent as granted save that a number of passages in the application were deleted during the course of prosecution. Neither party suggested those deletions have any bearing on the issues I have to decide. The claims are, however, quite different. Claim 1 of the application reads:

> "A method for making a nonreplicable image comprising placing on a suitable medium visible and distinct lineations formed into various patterns of lines, dots and swirls to create said image, said lineations having a predetermined lineation pitch which varies from a conventional copy machine scanning pitch by as little as the thickness of a scanning line of said

> machine and as much as 50% of the spacing between said machine's scanning lines, whereby when said image is copied by said machine, a moiré-skewed copy of the image results thus frustrating the photocopy replication of said nonreplicable image."

104. I should also refer to claim 10:

> "The method of making an original certificate that is capable only of electro-optically inaccurate replication, said method comprising the step of placing on a substrate a lineate pattern of visible image-defining lines, said lineate pattern being of predetermined omission-creating, moiré producing, mismatched pitch relative to the scanning pitch and azimuth of an electro-optic copy device"

105. And to part of claim 12:

> "An electro-optically nonreplicable document comprising an image defined by a plurality of lineations which comprise lines, dots and swirls, said lineations of predetermined omission-creating, moiré producing pitch [...]. "

106. It is apparent that claim 1 of the application is much broader than claim 1 of the Patent. It contains nothing about overlaying a grid to produce a combined image as called for by integer D1 and consequently contains nothing about the combined image and the original image appearing to the naked eye to be generally the same as called for by integer D2. The ECB contended that these aspects of the method were not disclosed in the original application (whether in the body of the specification or the claims) and therefore constitute added matter. DSS argued that they were disclosed in the body of the specification of the application and, at least through the evidence of Mr van Renesse, in claims 10 to 13. However most attention was focused on the body of the description. Since this is essentially the same in both documents I will refer primarily to the text of the Patent but also give the references to the application.

107. The original position taken by DSS was that these features were expressly disclosed. The argument ran as follows. Figure 1a is described as a "*pattern, consisting of various lines, dots and swirls*" (Patent, col.6 lines 45-46; application, p.12, last two lines). The specification goes on to explain that "*Those of ordinary skill will readily understand that such an image may be printed in intaglio or gravure (more commonly rotogravure) and adaptations of these processes*" (Patent col.7, lines 15-18; application p.13, last paragraph). In the language of claim 1 of the Patent as granted, Figure 1a was said to represent "*the original image*" referred to in integer D1.

108. Figure 1b is described as "*a grid overlay*" (Patent, col.6 line 47 and col.7, paragraph [00019]; application p.13, line 1 and p.14, first main paragraph).

109. Figure 1c is described as *"the view of Figure 1a through the grid overlay of Figure 1b"* (Patent, col.6, lines 48-49; application, p.13, lines 2-3). The specification describes the effect of the overlay in terms of transmittal or obstruction of the Figure 1a pattern (Patent, col.7 lines 32-44; application, p.14) as follows:

> "When the Figure 1b pattern is overlain the Figure 1a printed pattern, a distortion 20 in the Figure 1a results as shown in Figure 1c. The instant inventor defines the Figure 1c pattern as a type of moire distortion pattern resulting from a mapping of the Figure 1a pattern by the function of the Figure 1b grid overlay. Those of ordinary skill will also recognize that, were the function to be reversed, that is, the grid lines 17', 19' of Figure 1b were to become the areas of image transmittal (rather than obstruction) and the areas denoted k to be areas of obstruction or opacity, the Figure 1c map would depict the compliment of the illustration 20 actually shown."

110. This, it was submitted, clearly and expressly disclosed the overlaying of a grid to produce the combined protected image and hence all the elements of integer D1. The position of DSS was supported by the evidence of Mr van Renesse. He came to the same conclusion in paragraphs 102 to 104 of his first report.

111. On a first reading there appears to be much force in this argument. The use of the terms "grid" and "overlay" do, at least at first sight, suggest integer D1. Mr van Renesse evidently thought so and it may be that the Board of Appeal did too. However, on closer analysis it becomes apparent the description is of something quite different. It is in fact a description of the superimposition of one structure on top of another to create moiré interference. The grid overlay of Figure 1b is that of the scanning type copying device and not a grid which will result in the formation of a combined image on the copy protected document.

112. This is the clear sense of the whole of paragraph [0019] where the pattern of figure 1c is described as being "*a type of moiré distortion pattern*" (Patent, col.7, lines 32-38; application, p.14). It is confirmed by the following passage (Patent, col.7, line 58 – col.8, line 5; application, p.15):

> "If, for example, the horizontal lines 17 of Figure 1b were the nonscanned areas in a **copy machine protocol,** and the interstitial or "see through" areas corresponded to the actual scanning lines, the illustration of Figure 1c would in reality **be the resultant replica or counterfeit**." (emphasis added).

113. If the overlay depicted in Figure 1b were not of the scanning protocol of a scanning-type copying device, Figure 1c could not be "*the resultant replica or counterfeit*".

114. I therefore have no doubt that integer D1 is not expressly or implicitly disclosed in the description or images of Figure 1. In the end Mr van Renesse accepted as much in cross examination. For his part, Dr Furley correctly explained the description in paragraphs 41 to 50 of his second report.

115. Mr van Renesse also referred in paragraph 105 of his first report to various other paragraphs of the specification as disclosing the overlaying of a grid. He first identified the following passages (Patent, col.5, lines 12-29; application, p.9):

> "The basic method of counterfeit protection teaches the **inclusion of lines**, dots and/or swirls **embodied and integrally formed into art**, pictures and other forms of images."
>
> "After creation of the authentic document, that is, one **including the grid lines** of predetermined pitch, the primary method of counterfeit protection, as well as the product thereof, have been realized." (emphasis added)

116. These do not seem to me to teach the overlaying of a grid to produce the protected image. On the contrary, they teach that the protected document is to be created with the lines, dots or swirls integrally formed into the image.

117. He then pointed to these passages (Patent, col.6, lines 11-25; application, pp. 11-12):

> "Further, in its method aspect this invention comprises the step of producing an electro-optically nonreplicable original certificate by providing on matte a lineate pattern of **visible image-defining lines which are of predetermined moiré producing pitch** relative to an electro-optic copy machine scan protocol. Otherwise expressed, this method includes the preliminary step of determining the pitch of an electro-optic copy machine scanner."
>
> "In its article of manufacture or product aspect this invention then, likewise briefly stated, is an electro-optically nonreplicable original certificate which bears **an image defined by a plurality of lines of predetermined moiré-producing pitch** relative to the scan lines or pattern of an electro-optic copy machine." (emphasis added)

118. Once again, there is no disclosure here of the overlaying of a grid. Indeed there is no teaching of how the original protected image is to be produced at all, save that a matte of image-defining lines is to be provided. If anything, this teaching is inconsistent with claim 1 of the Patent which requires the protected image to comprise a print pattern which is normally not discernable by the naked eye, such that the protected image and the original image have the same appearance.

119. Finally Mr van Renesse referred to claims 10, 12 and 13 of the application. I have set out the relevant parts of claims 10 and 12 in paragraphs [104] and [105] of this judgment. Claims 10 and 12 contain a very similar disclosure to that discussed in paragraphs [117] to [118] immediately above. Claim 13 and the passage in the application which supported it were deleted during the course of prosecution. They were directed to a method of detecting counterfeits in which a counterfeit copy made on a particular photocopier can be detected by making a further copy of it on the same copier. Detection is possible because the further copy will bear a moiré interference pattern. I do not consider this to be a disclosure of making a copy protected document by overlaying a grid as called for by claim 1 of the Patent. In summary, I have reached the conclusion that none of these further passages relied upon by Mr van Renesse disclose integer D1.

120. Faced with what I think can only be described as the collapse of the case which it opened, DSS took a very different line during the course of the hearing and in closing. It contended that although there might be no explicit disclosure of integer D1 in the application, the integer was nevertheless implicitly disclosed. In support of this contention it relied particularly upon the passages of the specification which I have set out in my discussion of the disclosure in paragraphs [53] to [65] of this judgment.

121. The further argument was developed as follows. Col.2 of the specification (paragraph [54] above; application, pp.3-4) sets out a conventional description of moiré. It explains that it is caused by the overprinting of screens in colour plates and, more generally, by the superimposition of one grid on top of another. The theme is continued in col.3 of the specification (paragraph [55] above; application, pp.5-6). Here the reader is taught that it is possible to include a pattern in an original image (the first grid) and that the second grid already exists in the fixed-pitch parallel-scan format of the modern copier. Hence, if an appropriate pattern is copied by the copier a moiré interference pattern will be created.

122. Col.4, lines 9-15 of the specification (paragraph [57] above; application, p.7) introduce the concept of doing something to the original document which makes it copy proof but leaves it visually unchanged. This is followed by the summary of the invention at col.4 lines 23-33 (paragraph [59] above; application, p.7) which suggests that the aim has been realised in that valuable documents can be produced which to the naked eye are identical to prior art items of the same kind but, in fact, have copy protection.

123. The specification then discloses how the invention was accidentally discovered by copying a copy of a traveller's cheque: col.4, lines 34-42 (paragraph [60] above; application, p.7). The second copy was found to contain blemishes or defects apparent to the casual observer. The specification continues in col.4, lines 43-55 (paragraph [60] above; application, p.8) that the inventor then realised that he had the answer to the problem. He could use the moiré effect to reveal the bogus colour copy of a genuine banknote by producing the note lineations in mismatch to the scanner of the copier. The mismatch would be slight and not noticeable to the naked eye.

124. Here the parties parted company. DSS urged upon me that these passages in the specification implicitly disclosed the production of the copy protected document by overlaying a screen on top of the original image so as to produce a protected image. This would mean the protected image had the same visual appearance as the original. The ECB argued that the specification did no such thing. It contained a description of how the inventor arrived at his invention but contained no teaching that the invention could be implemented by overlaying the original image with a screen. On the contrary, it simply disclosed that image lineations should be "*produced*", that is to say arranged in mismatch to the scanner of the copier. The specific teaching of the specification was in fact the opposite, namely that the lineations of the copy protected document should be created as part of and at the same time as the artwork.

125. Mr van Renesse provided some support for the DSS position in cross examination. He suggested that everyone would know how it could be done, that is to say by overlaying a line screen. Indeed, he went so far as to say he could not conceive of producing a protected image which looked the same as the original in any other way.

126. However, Mr van Renesse also accepted that the teaching of the specification as to the basic method of the invention is not to do it that way, but rather to make the protected image out of lines, dots and swirls which incorporate the grid. This is explained in paragraph [0009] of the specification, at col.5, lines 12-35 (see paragraph [62] above; application, p.9): "*The basic method of counterfeit protection teaches the inclusion of lines, dots and/or swirls embodied and integrally formed into art, pictures and other forms of images. The grid lines are made so as to differentiate minutely in vertical and/or horizontal pitch from the linear grids employed by the scanning mechanisms...*"

127. He also accepted that the teaching of paragraph [0012], at col.6, lines 11-16 (paragraph [64] above; application, pp.11-12): *providing on a matte an image of visible image defining lines....*" is inconsistent with the DSS position as to how the document would be understood. It is, however, consistent with a method of implementation which involves altering the spatial arrangement of the lines and dots so as to create an image which is visible and will create moiré when screened.

128. Finally, he was asked about the figures, which are, as I have indicated, said to be a detailed description of the preferred embodiment. As to Figure 1, Mr van Renesse accepted that this is teaching the reader to arrange the lines cleverly so as to get moiré (see particularly, Patent, col.7, lines 12-15; col.8, lines 8-10; application, pp.13-15). This is, of course, wholly different to making them by screening.

129. As to Figure 3, Mr van Renesse explained that Figure 3a is the original document and Figure 3b the protected document. Figure 3b involves the re-arrangement of the lines and dots of Figure 3a so as to create a moiré effect. Again, this is not screening.

130. Dr Furley could see nothing in the application which clearly disclosed to him integer D1. He explained his understanding of it in his report. He found it confusing and imprecise. However he did not make the same error as Mr van Renesse as to the teaching concerning the figures. He understood the method of the invention to involve the incorporation of lines dots and swirls into the artwork and then the addition of grid lines – a notion which he found to be very unclear. In cross examination he maintained his position. He had said in his report that it was common general knowledge to incorporate a grid pattern in a note as originally designed, or to print a grid pattern across a design already in circulation. Not surprisingly he therefore accepted that, on the assumption the specification was teaching the skilled person he needed a grid pattern on a document in slight mismatch to the pitch of the scanner, he would know that a simple way of doing that would be to print or superimpose the grid pattern across the design already in circulation. I have to say I do not think this takes DSS very far. A set of rulings could obviously be incorporated into or added to any design. This was the classic way screen traps were made. DSS maintained, however, that the Patent is concerned with something different, namely laying a line screen over the original and so producing a new image which is visually indistinguishable from the old.

131. I can now summarise my conclusions. First, I am satisfied there is no express disclosure of integer D1 in the application. The issue I have to decide is whether it is implicitly disclosed.

132. Second, I think it is tolerably clear from the passages in the "Summary of the Invention" to which I have referred that the patentee had in mind the creation of a protected image by the arrangement of lines, dots and swirls in such a way as to produce a structure which would create a moiré pattern on being scanned by a particular copier. The same appears from the "Detailed description of the preferred embodiment". This is not a case where the application is silent on a point which is said to be implicit. On the contrary, the patentee has provided a description of his method which is different from that which is said to be implicit. The skilled person reading the application has no reason to think there is any gap in the express disclosure which needs to be supplemented.

133. Third, it is true that halftone screening was common general knowledge. Further, it was generally known that halftone screening will produce an image which appears to be the same as the original. However, the skilled person had no experience of screening to create a printed pattern which would interact with the grid of the scanning mechanism of a photocopier so as to produce moiré interference.

134. Fourth, the application does describe the accidental fashion in which the invention was made. It is apparent from this description that there was some sort of interaction between the first image created by the copier and the mechanism of the copier when a further copy was made. But it is not clear whether that interaction was caused by the grid imposed by the output printer of the copier or the grid imposed by the scanning mechanism or by a mixture of the two. Nor does the application suggest that this aspect of the way the invention was made forms part of the teaching as to how it is to be performed.

135. Fifth, the evidence of Mr van Renesse that he could not conceive of a way of producing protected image which looked the same as the original other than by screening is inconsistent with the teaching of the application. It teaches precisely that, namely producing the protected image out of lines, dots and swirls.

136. Finally, the combination of this feature with the other features of claim 1 of the Patent is plainly advanced as part of the inventive concept. It was one of the elements introduced into the claim to address the obviousness objection raised during the course of the prosecution. Further, before this court it was maintained that the invention lay in the combination of appreciating that a pattern could be created on an original document by screening it and that the pattern would create a moiré effect when the document was copied using one of the new generation of copiers (see, for example, Day 5 at p.572). I return to this issue when addressing obviousness. This subject matter is therefore clearly relevant to the invention.

137. In the light of the foregoing I have reached the conclusion that the application does not clearly and unambiguously disclose feature D1. It may well have been obvious to use a screen in the light of the disclosure. But that is not the test. The added matter objection succeeds.

Anticipation

138. Although two series of banknotes were pleaded, namely the UK 1987 Series D £10 note and the Swiss Sixth series 20 Franc note, the ECB accepts that there is nothing to choose between them and it is content for its case in this jurisdiction to be decided on

the basis of the £10 note. In closing, the ECB also accepted that no separate case of obviousness is put forward.

139. The ECB advanced two contentions. First, the skilled addressee would glean from an inspection of the note that the manner of manufacture involved all the steps of the claims. Secondly, the skilled addressee would, from an inspection of the note, be able to make further notes and such notes would inevitably be made by the method of the claims. These two approaches were explained by Lord Hoffmann in *Synthon BV v SmithKline Beecham Plc* [2005] UKHL 59, [2006] RPC 10 at [22]:

> "....the matter relied upon as prior art must disclose the subject-matter which, if performed, would necessarily result in an infringement of the patent. That may be because the prior art discloses the same invention. In that case there will be no question that performance of the earlier invention would infringe and usually it will be apparent to someone who is aware of both the prior art and the patent that it will do so. But patent infringement does not require that one should be aware that one is infringing: "whether or not a person is working [an]...invention is an objective fact independent of what he knows or thinks about what he is doing": *Merrell Dow Pharmaceuticals Inc v H N Norton & Co Ltd* [1996] RPC 76, 90. It follows that, whether or not it would be apparent to anyone at the time, whenever subject-matter described in the prior disclosure is capable of being performed and is such that, if performed, it must result in the patent being infringed, the disclosure condition is satisfied. The flag has been planted, even though the author or maker of the prior art was not aware that he was doing so."

140. The question I have to determine is whether or not the £10 note discloses the method of the claims or subject matter which, if performed, would necessarily involve using the method of the claims.

141. Dr Furley explained how the £10 note was designed. The original issue of the note contained moiré rulings in a panel on the left hand side of the note and these were arranged in blocks of lines oriented at small angles to each other so that a screen of any particular orientation made a small angle with at least one of the blocks. In addition, rulings were used as a tint for the floor tiles in the hospital scene on the reverse of the note. More importantly, it also contained a 68 lpi pattern of lines across the portrait of the Queen. In the mid 1980s the Bank of England decided to modify the note to increase security. Wavy line rulings were introduced across the portrait area, albeit of the same spacing (68 lpi), colour, colour density and line width. Dr Furley explained that the intention of the revised orientation of these lines was to produce moiré when the portrait was halftone screened.

142. Mr van Renesse accepted in cross examination that the skilled person would see a moiré pattern (albeit a faint one) when the note was overlayed with a 100 lpi grid and would appreciate that the design contained a pattern of wavy lines and that the benefit of having the lines in a wavy configuration was that they would reveal moiré with a larger range of screen angles.

143. In my judgment the £10 note would reveal nothing to the skilled person that he did not already know. Assuming, which I think is likely, he recognised the line pattern across the face of the Queen as a screen trap he would consider that it was a trap designed to interfere with halftone screens used in a conventional reproduction process involving photographic halftoning or in one of the new high-end dot-generating colour scanners. He would have no reason to suppose that any determination had been made of the *scanning* pitch distance and width of the scanning lines of a copying device. Nor would he have any reason to suppose that a grid had been produced which had lines of a pitch distance minutely more or less than the scanning pitch distance and that such a grid had been overlayed on an original image. In short, the £10 note teaches nothing about how to solve the problem posed by the new colour copiers in the late 1980s.

144. For like reasons reproduction of the £10 note would not involve carrying out the claimed method. It would involve no determination of the scanning pitch distance of the scanning lines of a copying device, production of a grid having a pitch distance minutely more or less than the scanning pitch distance or overlying such a grid on an original image to produce a protected image as called for by integer D1.

145. For all these reasons I conclude the allegation of anticipation fails.

Obviousness

146. It is convenient, but not essential, to address the question using the structured approach explained by the Court of Appeal in *Windsurfing International Inc. v Tabur Marine (Great Britain) Ltd* [1985] RPC 59. This has been summarised as follows:

i) Identify the inventive concept of the claim;

ii) Identify the common general knowledge of the skilled team;

iii) Identify the difference(s) between the prior art under consideration and the inventive concept of the claim;

iv) Ask whether the difference(s) would have been obvious or required invention.

Obviousness - the 011 patent

The disclosure of 011

147. 011 is a GB patent in the name of the Canadian Bank Note Company. The application was filed on 23 June 1966 and published on 27 December 1968. It relates to the prevention of counterfeiting using halftone screening reproduction by the incorporation of screen traps:

> "According to the present invention printing matter is provided with one or more patterns of configurations which prevent successful counterfeiting by half-tone screening reproduction processes by virtue of the intersection of the patterns on the printed matter with the rectangular screen grid pattern of the half-tone reproduction screen so as to make it substantially

> impossible to avoid creating a Moiré pattern on the reproduced document." (p.1, lines 33 - 43)

148. 011 makes use of the fact that the production of colour separations involves screening an image to create a halftone positive or negative and that interaction of the screen with the pattern on the original can result in the creation of a moiré pattern (p.1, lines 51-61). In short, it teaches the use of patterns to create moiré patterns when an original image is screened, that is to say, traditional screen traps.

149. The specification recognises it is necessary to ensure the spacing of the printed grid is approximately the same as the spacing of the screen grid:

> "It is the interaction of the screen with the pattern on the original that results in the creation of a Moiré pattern, as will be more fully explained below. For example, assuming that a counterfeiter uses a half-tone screen having a grid spacing of 100 lines per inch, a bank note bearing a configuration of parallel straight lines having a spacing approximately 100 lines per inch will, if the angle of intersection of the screen lines with the bank note lines is small enough, produce a Moiré pattern." (p.1, lines 58 – 74).

150. However, it points out that a banknote manufacturer cannot assume that a counterfeiter will use any particular screen line spacing and consequently the aim of the invention is to provide an original document with one or more patterns selected so that a moiré pattern will be created regardless of the orientation of the screen selected by the counterfeiter (p.1, lines 69-82).

151. Before expanding on the ways this may be achieved the specification explains that patterns of dots may produce moiré effects just as effectively as a pattern of lines:

> "It is apparent that not only line patterns but also patterns of dots may give rise to Moiré patterns when intersected by a rectangular or other grid. For example, the series of parallel lines shown in Figure 3 may be approximated by a dot pattern in which the dots lie on the locus defined by the parallel lines." (p.3, lines 92 – 99)

152. And such patterns of dots can be produced by screening an image:

> "Accordingly, an arrangement of dots in which there is some geometrical regularity may, when intersected by a rectangular grid, form a Moiré pattern. A special example of such an arrangement is a design picture, portrait, etc. in dot pattern form, obtained by the use of a half-tone screen." (p.3, lines 103-109)

Indeed, Claim 19 is specifically directed to this:

> "Printed matter as claimed in claim 18, in which the pattern or configuration is a dot pattern obtained from a design by means of a half-tone screen."

153. The patentee then explains his solutions to the problem. One is to provide a number of patterns having different line spacings; another is to use parallel lines with a variety of different spacings (p.3, line 124 – p.4, line 6). In this way there is a high probability of having at least one line spacing that will interact with a screen grid used by a counterfeiter.

154. The specification proceeds to identify another problem, namely the screens used by the counterfeiter may be oriented at any angle. The patentee suggests a number of answers. One is to provide patterns having different orientations. Another is to provide patterns which have intrinsically varying angles of intersection, such as concentric circles, as shown for example in figure 5 (p. 4, lines 37-69).

155. Figure 15 shows a banknote to which a number of patterns have been applied in accordance with the invention. It shows several groups of parallel lines in different orientations, some with regular line spacing and others with variable line spacing. It teaches at p. 5, lines 60-70:

> "Patterns of portions of concentric circles are shown in the lower left and upper right corners of the bank note. The concentric circle pattern in the upper right corner is composed of lines of uniform width and spacing, and therefore would not be effective against all possible half-tone screen grids. However, if a plurality of concentric circle patterns of different spacings were included in the bank note, this deficiency could be overcome."

156. Yet another solution is to provide patterns of lines in which spacing and orientation continually vary.

Inventive concept, addressee and common general knowledge

157. The inventive concepts of claims 1 and 2 are conveniently considered by reference to the integers set out in paragraph [73] above. The addressee of the Patent is considered in paragraphs [36] – [37] above and the common general knowledge is discussed in paragraphs [41] – [52] above

Differences between the inventive concept and 011

158. The key difference between the invention of claim 1 and the disclosure of 011 is that 011 is not concerned with the creation of a protected document which will interact with the scanning mechanism of a scanning type copying device so as to prevent the document from being faithfully replicated on that device. Specifically it does not teach determining the scanning pitch and width of the scanning lines of a copying device (integer B), producing a grid pattern having a pitch distance minutely different from that scanning pitch (integer C1) or overlaying such a grid on the original image (integer D1) so as to produce a protected image (the printed image) which appears to be the same as the original image (integer D2). It is right to note that 011 does

disclose the production of a protected image by screening an original image (as described in paragraph [152] above) and that this protected image will have the appearance of the original image. However, there is no teaching that this is to be done by using a grid which has a pitch minutely different to that of a scanning mechanism. Moreover, this is only part of the disclosure and the bulk of the document is concerned with the creation of conventional screen traps which undoubtedly are visible and intended to be so, as illustrated in figure 15 and described in the accompanying text.

159. As to claim 2, 011 does disclose some screen traps which have uniformly spaced parallel lines.

Do these differences represent obvious steps?

160. The ECB contended that the only question is whether it was obvious in 1989 to apply the principles of moiré creation by devices that used halftone screens to scanning-type copying devices, and that it was obvious so to do. It fairly pointed out that claim 1 is not limited to using only one frequency of lines to combat all possible replicating devices; nor is it limited to a particularly highly visible moiré pattern. Any visible interference will do.

161. The argument then proceeded as follows:

i) The skilled addressee would at once perceive from reading 011 that the problem of the phenomenon of moiré that often occurs in printing was being "turned to the advantage of society in the elimination of the counterfeiting of face-value documents" and that at this level the concept of the Patent is the same as that of 011. The skilled addressee would also immediately appreciate that the principle at work in 011 was the presence of a grid in the document to be copied interfering with the grid imposed by the reproduction system. Moreover, the skilled addressee, on the basis of his understanding of the physics of moiré generation, would understand that the grid imposed by the reproduction system was a regular sampling protocol that sampled the document to be copied in mismatch to the grid overlain on the document.

ii) Further the skilled addressee would understand that the frequency of the sampling protocol at the input scan of high-end scanners was too high for moiré to be produced – the corollary is that it was understood that moiré would be formed if the frequency of the rulings was high enough or the frequency of the scanning lower.

iii) By 1989 it was common general knowledge that moiré inducing rulings to combat the use of screens could be used; indeed it was common general knowledge that such moiré inducing rulings were used. It was also common general knowledge that a new generation of copying device called digital copiers were available (and would become more available) – of which the Canon CLC was a motivating example.

iv) Any skilled addressee wishing to address the possibility of combating counterfeiting using these machines would want to find out how they worked. The skilled addressee would either know or find out how a CCD array worked

and that they impose a regular sampling protocol. Knowing that a halftone screening process is merely an alternative regular sampling protocol, the skilled addressee would immediately realise that techniques used to defeat copying by halftone screening would equally apply to colour copiers using CCD arrays to sample.

v) The skilled person would therefore immediately see that a "scan trap" was the same as a "screen trap" in its moiré producing properties. Accordingly there is no invention in applying the moiré creating disclosure of 011 to the new generation of copiers.

162. Attractively as this argument was put, I do not believe it reflects how the skilled person would approach 011 in 1989. The starting point is the common general knowledge. At that time screen traps effective against counterfeit halftone screening were a well established part of the armoury of the security document designer. But they were perceived to suffer from a number of drawbacks, as I have explained. In particular, it was thought a scatter gun approach should be adopted, that the traps should cover as large an area as possible, that the lines of the traps should be of sufficient line contrast and line thickness to produce a clearly visible moiré effect and that the traps should be placed in a quiet area of the note. All of these tended to produce a tension between the security expert and the artistic designer.

163. I believe the Patent presents a very different approach. As amended, this discloses the ideas that moiré interference will be created by the scanning mechanism of the new copier devices, of determining the pitch of the scanning mechanism of one such device and of laying a grid over an original image to produce a protected image which appears the same as the original but will produce a moiré effect when the protected document is copied on that device. This combination provided a simple way to protect against the amateur counterfeiter using one of the new devices. In contrast to the scatter gun approach, it meant that there was no need to incorporate a large number of screen traps of the conventional kind at all. An original image could be screened to produce a protected image which would appear the same as the original, there was no need to redesign any artwork, the tension between the security expert and the artistic designer disappeared and the protected image could extend over a relatively large area of the document, if so desired.

164. The 011 patent is not directed to the problem of the new copiers. It teaches how to make screen traps effective against counterfeiters using halftone screening. The thrust of the teaching is that a large number of screen traps of different orientations and line frequencies should be used. Moreover these are, in the main, clearly visible (as, for example on page 5, lines 60-74). It is true that 011 discloses the use of a screen to produce a design in a dot pattern form on page 3, lines 106-109. But this is recognised to be a special case and there is no suggestion that the pitch of the screen should be closely matched to that of the scanning mechanism of a copying device.

165. It can be seen therefore that 011 essentially teaches what was, by 1989, common general knowledge. Dr Furley accepted that the document would not tell a person skilled in security features in banknotes anything he did not already know. Interestingly, the 011 patent is itself discussed in Kurowski. On page 5 it states:

> "The basic idea of using moiré effects for improving the security from counterfeiting of printed products has been specified in GB-PS 11 38 011. Examples are given therein for suitable optically active structures with one or a plurality of degrees of freedom (i.e. for complete characterisation of the type of periodicity of the structures it is necessary to specify one or a plurality of values of the spatial frequency) having spatial frequencies which are fixed or vary quasi-continuously as a function of the spatial coordinate. However, with the structures specified therein depending on the screen used for the reproduction, a moiré effect can only be observed for specific screen spatial frequencies or using the likewise specified structures with varying (continuously increasing or decreasing) frequency only at quite specific locations of the optically active structures which change its position and/or its appearance according to the spatial frequency of the reproduction screen and as a consequence is not easily recognisable. "

166. Dr Furley agreed that this described the way that screen traps had been used as a result of the 011 disclosure and that the screen traps used in halftone screening generally had one or more of the disadvantages described. He indicated that some of the problems could be avoided by using a screen trap over a very large area such as in the Dutch "snipe" note, but here one might run into trouble with the designer.

167. In summary, therefore, the weight of Dr Furley's evidence was that 011 would be of little assistance to the skilled person over and above his common general knowledge. And his common general knowledge was to use screen traps in a scatter gun approach.

168. There is no doubt that by late 1987 scanning colour copiers were recognised to be a significant threat to the document security industry and it began to look at ways to counteract that threat. Two documents discussed in evidence reveal the approaches the industry was considering adopting.

169. The first was a 1987 report of the US National Materials Advisory Board. The "Abstract" clearly explains the problem. It was perceived that the new reprographic technology would enable a large number of people with access to such devices to attempt "crime of opportunity" counterfeiting and that traditional deterrents employed to protect US currency were inadequate to prevent it. A large number of potential anti-counterfeiting deterrents previously examined were re-evaluated. They were divided into categories. Category 1 comprised those measures thought to be most effective and compatible with currency use. It included security threads, watermarks and substrate modifications. Category 2 comprised 11 possibilities described as the "least effective or requiring major effort or breakthrough". One of these was moiré generating patterns. Category 2 methods were not reviewed further but it was noted that they had been described in detail in a previous report.

170. Dr Furley suggested in his second report that that the US Bureau of Engraving and Printing did not have offset presses and that it was considered at the time that moiré inducing rulings were best printed by an offset process. In cross examination he

explained that this was his understanding but that he was not sitting on the committee and so could not say for sure why this technique was rejected. Whatever the cause it is clear that moiré patterns were not considered to be the way forward in the US.

171. Of greater significance is a report of the BPC (see paragraph [39] above) of September 1988. It was prepared by a Mr Melendez on behalf of the Spanish Central Bank. Section 1 of the report is entitled "The problem is now here". It describes the introduction of the Canon CLC in September 1987 and that from the outset it was apparent it made high fidelity copies. The committee proceeded to examine copies of banknotes of seven different countries to see whether any of them contained protection measures which could be used. There is no record of any moiré effect being seen. Section 2 of the report contains an analysis of the Canon CLC copier, including the scanning mechanism. Section 3 contains a summary of the work being done and proposed solutions. These include optically variable inks, iridescent pigments, security threads, photochromatic inks and inks with poor reproducibility. There was no suggestion to use screen traps, let alone screen traps produced by overlaying the artwork with a grid having a pitch minutely different from the pitch of the scanning mechanism.

172. Dr Furley was cross examined about this report on Day 2 at pp 244-245:

> "Q. In your reports, you have mentioned the BPC as really, if I may paraphrase it in this way, the hub of knowledge, the most sophisticated western European banks discussing security measures. Correct?
>
> A. Yes.
>
> Q. This is annexed or a part of the BPC general report in September 1988.
>
> A. Yes.
>
> Q. It is specifically considering the very problem that you were concerned with at the time posed by the Canon colour copiers. Yes?
>
> A. Yes.
>
> Q. It has photocopied many notes under those copiers. Yes?
>
> A. A number of notes, yes.
>
> Q. It considers many different solutions. We have looked at some of them.
>
> A. We have looked at some.
>
> Q. It does not mention moiré effect or screen traps as a solution at all, does it?
>
> A. No, it does not.

Q. Screen traps were known about in half-tone screen printing. Indeed, you say, and I am sure you are right, that by this time it was common knowledge amongst those in the security industry. Yes?

A. I believe it was, yes.

Q. You say, I think, that it would be obvious to take that solution and use it to solve the problem of the Canon CLC. Yes?

A. Yes, but the screen traps that were in existence then were aimed at half-tone reproductions, not at colour copies.

Q. Exactly. When testing these notes with those screen traps on aimed at half-tone reproductions, it does not appear to have occurred to these experts that one could take that solution and adapt it for the colour scanners, does it?

A. On the face of it, I have to agree, yes.

Q. If it had been obvious, then of course the more elaborate solutions, such as iridescent inks, and so on, there would be no need to investigate them because that would be the solution.

A. That is quite possible, but I believe that the people here may not have seen screen traps as a solution or they may have done. I saw this report, for sure; but I was not in very close contact, apart from the BPC, with the Bank of Spain or the FNMT at that time. They were not part of my close associates. They were part of this larger group, and I am surprised that they did not."

173. It is apparent that the invention of the Patent did not occur to the BPC and Dr Furley was not able to offer any credible explanation as to why that was so. The relevance of this evidence must be considered against the background that the teaching of 011 was essentially common general knowledge by the priority date. In these circumstances I believe it to be powerful evidence of non obviousness.

174. In his second report Dr Furley said that banknote printers recognised that existing technologies including screen traps would provide some defence against colour copiers if adapted for that purpose. In cross examination he was asked what he had in mind. He said (Day 2 at pp 254-255):

"Q. Right, and how would you do that?

A. Clearly you have to study colour copies, but the view was that you would have to try to get your lines perhaps more dense, stronger, if you like, the lines that are making it, into areas which people would notice more than perhaps we had

done so in the past. This was a developing situation which we have to try and see whether we can improve it.

Q. That is it, is it? You would make the lines denser in other areas?

A. No. You may have to do them in different formations or whatever. There was a lot of things that you could actually apply -- you have to use your intelligence to do it ---

Q. You have to use your imagination, would you not?

A. Yes, I suppose to some extent you would. You have to use some knowledge, but then you have to use knowledge to produce banknotes.

Q. I understand that you may have been brainstorming about how to adapt screen traps in the ways that you have just suggested, but the experts that we have looked at in their reports do not even seem to regard that as a way forward at all, do they, as far as one can tell?

A. No, but I am not sure that the experts that you are talking about represent the totality of the experts in the field.

Q. So some other expert might have thought about adapting screen traps.

A. Some others, yes.

Q. And they would have thought about perhaps making the lines more dense.

A. I suspect they would, yes.

Q. And putting them in other areas.

A. I believe so, yes."

175. Dr Furley did not suggest it was contemplated that screen traps should be modified in the manner of the invention. Again, this is a strong indication of non obviousness.

176. Before leaving Dr Furley I should also mention that he exhibited a number of confidential documents to his second report including, most importantly, a report on colour copiers he produced for the Four Nations Group of Central Banks in 1988. The purpose of the report was to assess the performance of various copiers rather than to look for solutions to the problem they presented. He found that copies produced on the Canon CLC had a moiré pattern when there was a slight mismatch between output line screen and the lines on the original. But it did not lead him to propose any particular solution to the Four Nations Group.

177. Mr van Renesse did not consider the invention of the Patent was obvious in the light of 011. He accepted that screen traps were effective against traditional halftone screening whether carried out by photographic means or as part of the high-end dot generating scanners. He also accepted that the skilled person would have known that with the high-end scanners the sampling scanning frequency of 1200 to over 2000 samples per inch was too high to interfere with the lines of the trap. Further, he agreed that the skilled addressee would know or find out that the new generation of copiers scanned using a CCD and that they imposed a regular sampling protocol. He himself recognised at the time that when some notes were copied on the Canon CLC a slight moiré pattern was produced but he could get rid of it by turning the note at an angle. That, however, was as far as he would go. He was clear that those in the field did not appreciate the potential for creating moiré from the input scanner.

178. In the light of all of the foregoing I have reached the conclusion that the invention of claim 1 was not obvious over 011. It involves a different approach to that adopted in relation to screen traps for halftone screening. The appreciation that moiré could be created using the scanning mechanism and the idea of determining the pitch of that mechanism and then laying a grid over the original image so as to produce a protected image which had the same appearance as the original was not obvious and did not occur to Mr van Renesse, Dr Furley or the industry.

Obviousness – Kurowski

Disclosure of Kurowski

179. Kurowski was filed in January 1986 and published in April 1987. The patentee points out that the new digital scanners can produce good reproductions of banknotes and other security documents and that this must be counteracted by additional "*(optically active) features on the security papers to be protected which, in cooperation with the reproduction device, result in falsifications on the counterfeit*" (translation p. 4, lines 6 – 8).

180. The specification then explains:

> "As a safety feature, periodic or quasi-periodic optically active structures composed of sub-structures in the manner of a pattern repeat and/or suitable combinations of such structures are applied to the banknote or a security paper which, when an attempt is made to produce a screen reproduction by means of a scanner or a reproduction camera, induces an interference effect as a result of the interaction between a material or electronically produced screen and the applied optically active structure, which is known under the name "moiré effect" or "moiré" for short." (p.4, lines 10-15).

181. It continues in a confusing passage at lines 23-25 that:

> "A moiré effect of the type described previously only occurs in screen reproduction but not in half-tone reproduction. Half-tone reproductions are reproductions produced, for example, using photocopiers or photographic materials."

182. On page 5 of the translation there is an extensive reference to the 011 patent and the drawbacks of the screen traps it describes. The specification then proceeds to summarise the disadvantages of such screen traps in the following terms:

> "a) The moiré effect occurs for a quite specific spatial frequency range e.g. from 50 to 60 structural elements per centimetre in the screens used for the reproduction.
>
> b) The moiré effect only occurs for certain angular positions of the master to be reproduced, which contains the moiré producing structure, relative to the reproduction screen so that the moiré effect can be largely suppressed during the reproduction by changing the position of the screen.
>
> c) The moiré effect only occurs in certain sections or areas of the moiré producing structure." (p.6, lines 6-11)

183. The object of the invention of Kurowski is to eliminate these disadvantages by providing specially shaped optically active structures:

> "The object of the invention is to eliminate these disadvantages and provide security papers with moiré producing structures where the moiré effect occurs over a wide range of spatial frequency of the screen usually used for reproduction purposes, the moiré effect is formed over a wide range of optically active structures on the security paper to be protected in a defined and therefore clearly recognisable manner and the moiré effect virtually cannot be suppressed by twisting the screen." (p.6, lines 13-16)

184. The active structures consist of "*open and/or closed substructures recurring in the manner of a pattern repeat and composed of suitable structural elements of different reflectance, in a manner such that they have identical or different spatial extents and/or distances apart*" (p. 6, lines 17-20). The rest of the specification proceeds to describe how these extremely complicated structures can be made and how they work.

185. Dr Furley and Mr van Renesse were agreed that the description indicates that the invention is directed at protection measures against counterfeiters using the high-end dot-generating scanners such as the Magnascan, which produce halftone screens. It is not concerned with the new generation of photocopiers such as the Canon CLC.

Inventive concept, addressee and common general knowledge

186. These are identified in paragraph [157] above.

Differences between the inventive concept and Kurowski

187. The differences between the inventive concept and Kurowski are exactly the same as for 011. It is directed at producing an improved system of screen traps to protect against counterfeits made using halftone screening. There is no disclosure of integers

B, C1, D1 or D2. As to claim 2, Kurowski does not disclose the use of uniformly spaced parallel lines.

Do these differences represent obvious steps?

188. I think the answer to this question is clearly no. It is true that that Kurowski teaches that screen traps are effective against digital scanners. But the screen traps it discloses produce moiré interference when they are halftone screened. The idea of the invention is to provide specially shaped optical structures which consist of repeating sub-structures with the object of catching the counterfeiter irrespective of the screen frequency and orientation he chooses. In this sense the invention is similar to but a development of 011. It is quite different to the invention of the Patent which requires the determination of the pitch of the scanning mechanism of a copier, the creation of a grid and the overlaying of that grid onto an original image to produce a protected image which is targeted to a particular copier. Kurowski teaches away from the invention of the Patent, not towards it. For all the reasons given in relation to 011, this attack of obviousness fails.

Insufficiency

189. There is only one allegation of insufficiency, namely the specification does not disclose the alleged invention clearly and completely enough for it to be performed by a person skilled in the art because there is no, or no sufficient, teaching in the specification as to how to determine the width of the scanning lines of the copying devices.

190. Any specification must be sufficient to enable the invention to be performed across the full width of the claim: *Kirin-Amgen v Hoechst Marion Roussel* [2004] UKHL 46; [2005] RPC 9 at [102]. But patent specifications do not need to set out every detail; they can leave the skilled person to use his skill and common general knowledge to perform the invention. In so doing he must seek success. He should not be required to carry out any prolonged research, enquiry or experiment. But he may need to carry out the ordinary methods of trial and error, which involve no inventive step and generally are necessary in applying the particular discovery to produce a practical result. In each case, it is a question of fact, depending on the nature of the invention, whether the steps need to perform the invention are ordinary steps of trial and error which a skilled man would realise would be necessary and normal to produce a practical result: *Mentor Corp v Hollister Inc* [1991] FSR 557 at 561; [1993] RPC 7 at 10-14 (CA).

191. Mr van Renesse explained in his report that the scanning lines of a copier form part of the scanning protocol and are determined by the arrangement of its CCD elements. The Canon CLC range formed the prime examples of such copiers in the late 1980s. The skilled person tasked with carrying out the determination step for a particular machine would look for technical information and would begin with the technical manual. In the case of the Canon CLC 500 the manual explains that the each photocell is around 20 microns wide and 63.5 microns tall. Thus an image element is represented by a square of about 63.5 microns, allowing for a small space between each photocell unit along the x axis. Dr Furley accepted that given this information there was no difficulty in determining the scanning line width for that machine.

192. It was suggested that some machines use lenses and mirrors and that this might make the determination difficult. One particular machine that emerged during the evidence of Dr Furley was the Sharp CX-5000. He was asked whether information about the width of the scanning lines and the size of the diodes was information which the manufacturer would regard as confidential but he had no idea whether this was so or not. Mr van Renesse, on the other hand, was clear that it would not be. He believed that manufacturers would have no problem disclosing to a skilled person interested in security documents sufficient information to determine the line width.

193. This allegation therefore fails on the evidence. It has not been shown that the skilled person would have any practical difficulty in determining the line width of the scanning mechanism of a copying machine.

Conclusion

194. The claim succeeds. The Patent is invalid on the ground of added matter. The allegations of lack of novelty, obviousness and insufficiency fail. I will hear argument as to the form of order if it cannot be agreed.