

OPINION UNDER SECTION 74A

Patent	EP(UK) 0751605
Proprietor(s)	Newport News Shipbuilding and Dry Dock Co
Exclusive Licensee	
Requester	James Love Legal, on 6 February 2009
Observer(s)	
Date Opinion issued	21 May 2009

The request

1. The comptroller has been requested to issue an opinion as to whether the invention defined by claims 1 and 3 of EP 0751605 lacks an inventive step in light of the following documents;

D1 US 4724348 (Stokes)

D2 JP 7-116866 (Honda) provided with a translation into English

2. Further the comptroller has also been requested to issue an opinion in relation to infringement in respect of six possible configurations of part of an electric machine. Whilst not expressly stated in the request I regard this request is intended to relate to the question of infringement of claims 1 and 3 of EP 0751605.

Observations

3. Observations in response to the request were received from Mewburn Ellis on behalf of the patent proprietor Newport News Shipbuilding & Dry Dock Company. With regards to the first aspect of the request the Patentee submits that the comptroller should refuse the request on the grounds set out in Rule 94(1)(b) that the request relates to a question which has been "sufficiently considered during relevant proceedings". The Patentee also makes further submissions regarding the question of validity in the event that I am minded to proceed with the opinion. These submissions include a drawing of what the patentee believes the combination of D1 and D2 would suggest. The Patentee makes no

observations on the question of infringement.

4. Observations in reply were received from the requester. These contend a number of the points made in the observations by the patentee including the question regarding the allowance of the request and include an illustration which they propose “more accurately reflects the arrangement that results from the proposed combination of documents D1 and D2”.

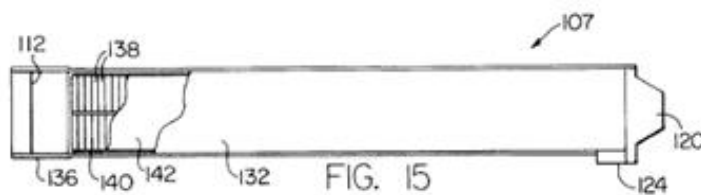
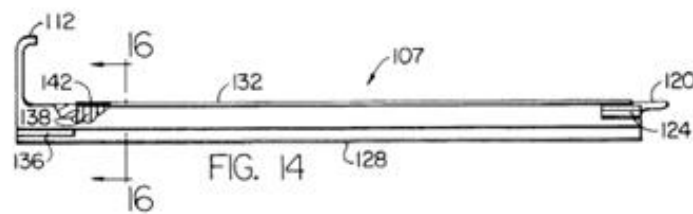
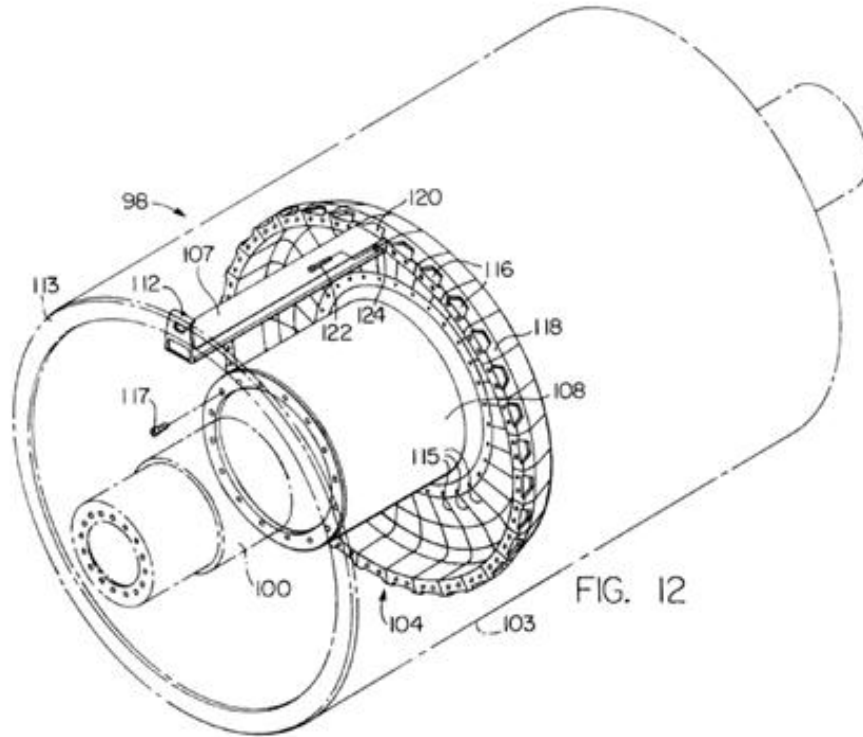
Discussion

5. I have reviewed the proceedings concerning the prosecution of the application to grant before the Examining Division in the European Patent Office for EP 0751605. It is clear that the question of Inventive Step in relation to D1 alone has been fully considered during proceedings. However there is no suggestion that the proceedings considered D2 or the combination of D1 and D2. Hence I am satisfied that it is appropriate to issue an opinion in respect of the questions arising from D2.

The patent

6. The Patent was filed on 28 June 1996; claims priority from an earlier US application filed on 30 June 1995, was granted on 6 October 1999 and is still in force in the UK. It relates essentially to high horsepower electric machines and deals more specifically with a releasable magnet carrier assembly particularly suited for holding and carrying a high-energy-product (also known as rare earth) permanent magnet.
7. The invention of claim 1 has application to both axial field rotor electric machines, as shown in figures 2 to 8 and drum rotor electric machines as shown in figures 9 to 19. The invention of claim 3 relates only to the later of these two applications.
8. Figure 12 of the patent (below) shows a schematic illustration of an electric machine 96 characterized by a drum rotor assembly 98 which extends substantially about the outer circumference of the active portion of the machine. The rotor assembly is drum shaped and includes a radial, centrally extending hub that acts as a support and which is integral with a preferably hollow rotating shaft 100. The rotating shaft is supported by conventional end bearings within the machine housing 103. The rotor assembly includes a central cup member 104 and an armature assembly on either side of a central plane. Each magnet carrier assembly 107 includes a plurality of magnets 138 (Figures 14 and 15) which may be configured as one or more magnet modules. Each magnet carrier assembly 107 has a hook

112 which is seated on a portion of rotor rim 113. There is a plurality of recesses 116 spaced about cup member outer surface 118 to receive magnet carrier assembly tabs 120 which fix the magnet carrier assembly tangential position and prevent rotation about a radial axis. The magnet carrier assemblies 107 are connected to the cup member by bolts 122.



9. Claims 1 and 3 read:

1. Electrodynamic machine comprising
 - a rotor (22,204) having a plurality of poles located along said rotor (22,204);
 - stator means cooperating with and adjacent to said rotor;
 - means for supporting said rotor and said stator for relative rotation between said rotor and said stator;
 - carrier means for receiving a high-energy-product permanent magnet;
 - attachment means for positioning said carrier means on the rotor at a pole location to position a magnet received in said carrier means relative to said rotor;
 - wherein said carrier means and said attachment means provide a magnetic flux path between a magnet received in said carrier means and the rotor when said carrier means is positioned on the rotor;characterized
 - in that said carrier means comprise a housing (30, 107) which encapsulates said magnet (68, 138); and
 - in that said attachment means comprises a portion (66, 112) of said housing (30, 107) which is to be fastened mechanically and releasably to an appropriate portion of said rotor (22, 204).

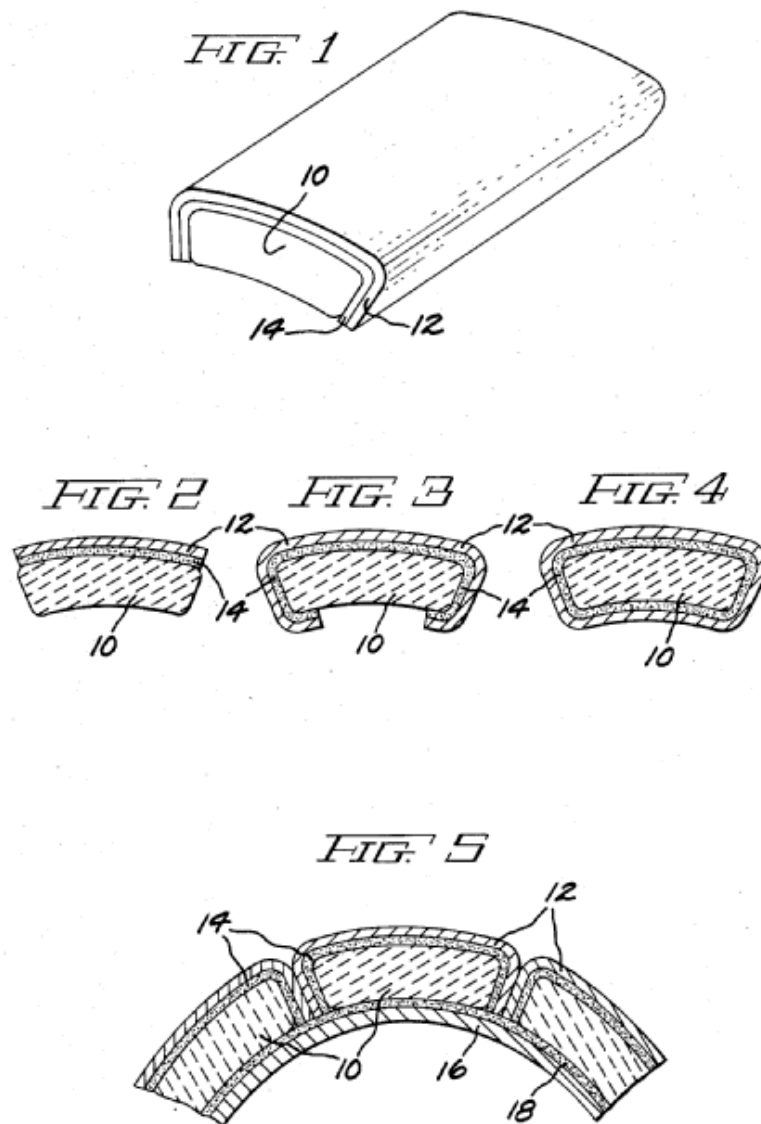
3. Electrodynamic machine in accordance with claim 1 , characterized in that said rotor (22, 204) comprises a cylindrical rotor (111) assembly and in that the plurality of magnetic poles are configured along a cylindrical rotor (111) surface with one of said carrier means (30) located in each pole position.

10. From the submissions made in the request and the observations I believe that it is clear that the question of validity and infringement will turn on the arrangement of the housing which encapsulates the magnet and a portion of which is to be mechanically and releasably fastened to the rotor. I do not however believe that there is any disagreement between the request and the observations from the patentee as to the construction of claims 1 and 3.

The prior art

11. Document D1 was published on 9 February 1988 and relates generally to dynamoelectric machines. More particularly it relates to a means 12 for reducing shedding of particles from the permanently magnetizable materials 10 which form the magnet elements for such machines. In all

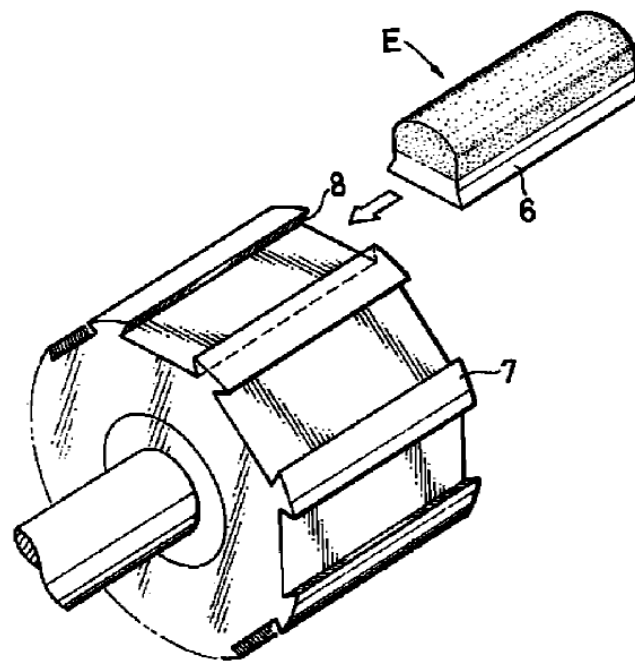
the embodiments this is achieved by at least partially surrounding the permanently magnetizable material 10 by a shell 12 using attaching means 14 which preferably comprises an adhesive to bond the adjacent surfaces of the body 10 and the shell 12 together. Cross-sectional views of the magnet assemblies are shown in figures 2 to 4. In the embodiments shown in Figures 5 and 7, the magnet assemblies are fastened to flux ring 16 by adhesive material 18. In order to minimize the effect of the shell 12 on the magnetic performance of body 10, shell 12 preferably comprises a thin sheath of material which does not significantly affect the magnetic properties of body 10. In one embodiment, the shell 12 comprises stainless steel foil.



12. Document D2 was published on 9 May 1995 and relates generally to a method of joining a permanent magnet and a supporting member. The

permanent magnet is made of an alloy composed essentially of a rare earth element (specifically praseodymium), transition metal (specifically iron) and boron. The discussion of the prior art refers to the problems associated with working such a material so as to securely mount it to a rotor which mean that conventional secure mounting means such as dovetailing, bolting, brazing or welding cannot be employed. It is stated that the prior art solution is to employ adhesive to adhere the permanent magnets to a rotor. The solution proposed is to diffusion join the permanent magnet to a support member by hot working with ranges of temperature, strain and working ratio defined in the claims. Figure 10 shows an example of an application of this invention to mount a permanent magnet E to a rotor 7 using a support member 6 which is shaped so as to correspond to dovetail groove 8 in rotor 7 with an interference fit.

【图 10】



Inventive Step

13. When considering a question of inventive step it is necessary to consider the structured approach to assessing obviousness formulated by the Court of Appeal in *Windsurfing International Inc. v Tabur Marine (Great Britain) Ltd* [1985] RPC 59 and reformulated in *Pozzoli SPA v*

BDMO SA [2007] EWCA Civ 588. This approach has the following steps:

1. (a) Identify the notional “person skilled in the art” and (b) identify the relevant common general knowledge of that person;
2. Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;
3. Identify what, if any, differences exist between the matter cited as forming part of the “state of the art” and the inventive concept of the claim or the claim as construed;
4. Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?

Step 1

14. To my mind the person skilled in the art is someone working in the design and manufacture of dynamo-electric machines. Such a person would regard the term “high-energy-product magnets” used in claim 1 to be referring to what I believe are more commonly known as “rare-earth magnets” (the term used in D2). The person skilled in this art is aware of the benefits (higher flux densities) and limitations (extremely brittle) of rare-earth magnets.

Step 2

15. As I discuss in paragraph 10 above I believe that there is no difficulty in identifying the inventive concept in claim 1. The inventive concept lies in a housing for rare-earth magnets which encapsulates a magnet and facilitates mechanical and releasable attachment of the housing to a rotor of a dynamo-electric machine. The housing also provides a magnetic flux path between a magnet received in the housing and the rotor when the housing is positioned on the rotor. Claim 3 simply recites the application of the inventive concept of claim 1 to cylindrical/drum rotor electric machines.

Step 3

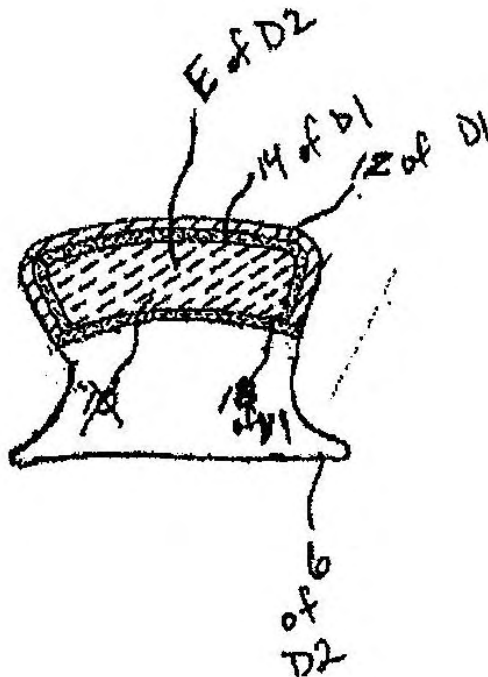
16. Document D1 differs from the inventive concept in the claims in that the magnet assemblies are adhered to the rotor using adhesive rather than a mechanical and releasable fastening. The observations from the patentee also call into question whether the arrangement of the magnet

assemblies would be “suitable for” receiving a high-energy-product permanent magnet as required by claim 1.

17. Document D2 differs from the inventive concept in the claims in there being no suggestion of the arrangement of the support member and magnet providing encapsulation of the magnet.

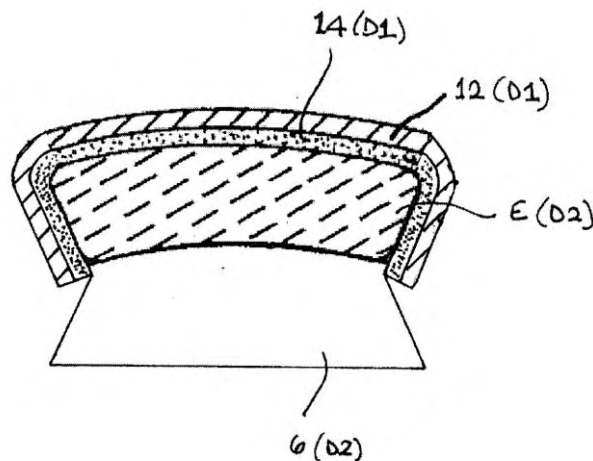
Step 4

18. The request suggests that a combination of documents D1 and D2 would result in a device which would infringe upon the claims and moreover that such a combination would have been obvious to the person skilled in the art at the priority date. I will deal with each of these points in turn.
19. As referenced above both the observations from the patentee and the observations in reply include an illustration of what the two parties believe would be the result of a combination of D1 and D2. The patentee suggests that the person skilled in the art would combine the two disclosures as illustrated below so as to encapsulate the magnet E with a shell 12 adhered to the magnet by adhesive 14 and that this assembly would in turn be adhered to support member 6 using adhesive 18.



20. The observations in reply suggest that this is not the combination being proposed in the request. The illustration provided with the reply (below) indicates that the requester believes the person skilled in the art would

see the benefit of diffusion joining the magnet E and support 6 as set out in D2 and retain this method of attachment with the shell 12 being extended to join the support member thus encapsulating magnet and forming a carrier means with attachment portion (support 6).



21. I find the illustration provided with the observations in reply to be a far more plausible result of combining the disclosures of these two documents; the benefits of the diffusion joining method in D2 are clear and the person skilled in the art minded to combine these two disclosures would, I believe, produce a carrier means similar to that proposed in the request and illustrated above. Whether the person skilled in the art would extend the shell 12 in the manner proposed in the request is debatable (as can be seen from the illustration provided with the patentee's observations) but it is clear from the combined teachings that the magnet must be encapsulated, however that is achieved in practice.
22. The request proposes that such a construction infringes upon the claim with the support 6 (from D2) and shell 12 (from D1) together forming a housing which encapsulates the magnet and provides for attachment of the magnet to a rotor and provides a magnetic flux path to the rotor. The observations by the patentee do not contest this aspect of the proposal and as such it seems that the proposed combination would be regarded by the person skilled in the art as meeting these aspects of claim 1.
23. The observations by the patentee do however contest whether the shell 12 of D1 can be considered to be "suitable for" receiving a high-energy-product permanent magnet as required of the carrier means of the claims. This is derived from the statement in the request that since D1 does not contain anything to suggest it is unsuitable for application to rare-earth magnets then it follows that the shell can be considered

suitable for this application. To this end the patentee proposes that the “thin, lightweight, low-strength shell would be unsuitable for receiving high-energy-product magnets”. The patentee does not elaborate upon its statement in its observations and the observations in reply do not address this contention. I am unable to confirm or deny the suitability or otherwise of shell 12 of D1 for application to a rare-earth magnet. On balance I believe that the proper way to proceed is to assume that whilst there may be problems associated with this application that they would not be insurmountable and hence that the shell 12 of D1 can be considered suitable for application to rare-earth magnets.

24. Overall therefore it seems that on balance the most plausible arrangements which would result from a combination of the disclosures in D1 and D2 would fulfill the requirements of claim 1 and 3 so I must now turn to the question of whether the person skilled in the art would consider the teachings of document D1 and D2 together.
25. To answer this question it is necessary for me to consider whether the person skilled in the art would seek to combine these two documents and if it is found that such a combination is desirable I must consider whether the skilled addressee would discover both documents as a result of their enquiries.
26. From the precedent case law¹ it is clear that any enquiry of whether or not a claimed invention lacks an inventive step in light of a combination of documents must begin with a consideration of what the skilled addressee would think and do on the basis of one of the disclosures. Since the mindset of the skilled addressee presented with D1 has already been fully considered in proceedings before the EPO I must restrict my consideration to what the skilled addressee would think and do when presented with document D2.
27. The skilled addressee presented with document D2 would be well aware that the rare-earth magnets used therein are extremely brittle (indeed the description says as much). When investigating (through design or experimentation) how to construct the machine proposed in figure 10 of D2 the skilled addressee would have this in mind and would, I believe, seek to mitigate problems associated with this frailty.
28. The patent in issue here, EP 0751605, highlights a number of problems associated with the use of rare-earth magnets in high speed electric machines. Firstly rare-earth magnets are susceptible to damage and

1. See for example the comments of Laddie J in *Pfizer Ltd's Patent* [2001] FSR 16 at paragraph 66 and of Whitford J in *Dow Chemical Company (Mildner's Patent)* [1973] RPC 804.

breakage during handling and assembly of the electric machine. The brittle nature of the material is said to preclude alteration such as drilling to attach screws or other mounting aids and therefore that attachment methods are limited. The patent also states that the deliverable power in high speed electric machines is directly dependent upon the mechanical stress state of the rotor at maximum speed and that the proposed solution addresses this through retention arrangement to eliminate rotor stress concentrations. The description of the preferred embodiments of the invention in the patent refers to the purpose of magnet encapsulation as being both to retain and locate the magnet and to prevent corrosion. This reference to preventing corrosion suggests that a requirement to exclude atmospheric moisture, as suggested in the request, did exist at the priority date and would have been in the mind of the person skilled in the art.

29. The disclosure in D2 also refers to the problems associated with handling the rare-earth magnets during construction of a dynamo-electric machine stating that the brittle nature of the material precludes working to employ conventional secure mounting means such as dovetailing, bolting, brazing or welding. Document D2 goes on to state that the conventional solution to this problem is to adhere the magnet to the rotor but says that the adhesive does not have sufficient joint strength to mount rare-earth magnets to rotors especially at high operating temperatures.
30. Neither the patent in issue (EP 0751605) nor document D2 refer to the problem highlighted in the request that there is a requirement for minimizing shedding of magnetic particles from the magnet during operation of the electric machine. Whilst this may be a benefit of the solution proposed in the patent I have not been able to confirm that it was a problem that the person skilled in the art would have been aware of at the priority date.
31. I therefore believe that, at the priority date of the patent, the person skilled in the art would be minded to make an enquiry as to a means for preventing corrosion of the magnets when presented with document D2. From the evidence provided there does not seem to be a conventional solution to this problem in the art and therefore I find that there is no prejudice in the art against making an enquiry for solutions. Next I must decide whether in making such an enquiry the person skilled in the art would discover and think to apply the teachings in D1.
32. It is clear that both documents D1 and D2 can be regarded as part of the same technical field (dynamo-electric machines). Whilst D1 is not specifically directed to the rare-earth magnets employed in D2, I believe that the shell disclosed therein would be "suitable for"

35. The magnet holder 5 defines a shallow axially-extending elongate channel 6 for receiving one or more magnets 4 and is formed of a material, such as steel, which provides a magnetic flux path between the magnet(s) 4 and the rotor 1. The magnet holder 5 includes a series of axially spaced threaded passages 7 and is releasably attached to an outer surface 8 of the rotor 1 by way of a series of axially spaced threaded fasteners 9 which cooperate with the threaded passages 7. The magnet holder 5 includes a recess 12 in its lower surface to facilitate location of the magnet holder 5 on the outer surface 8 of the rotor 1.
36. The mounting arrangement 3 further includes a carrier means in the form of a cover 10 for encapsulating the magnet(s) 4 received in the shallow channel 6 defined in the magnet holder 5, and the cover 10 is releasably fastened to the magnet holder 5 by a series of axially-spaced threaded fasteners 11. It is stated in the request that alternative fastening means, such as welding, could be employed – although not stated I presume that this is proposed as an alternative to releasably fastening of the cover 10 to holder 5 and not as an alternative to the releasable fastening of the mounting arrangement 3 to rotor 1.
37. I believe it is clear that the mounting arrangement 3 of configuration A falls within the scope of claims 1 and 3, the arrangement provides for encapsulation of the magnet, mechanical and releasable fastening to a rotor and is formed of steel to provide a flux path to the rotor. It is stated in the request that the arrangement is suitable for use with high-energy-product magnets and hence a dynamo-electric machine constructed as described in configuration A will infringe claims 1 and 3.
38. Configuration D (shown below) has an electric machine which is similar to the electric machine of Configuration A. However, the outer surface of the rotor 8 includes a channel 13 in which a projecting region 14 of the magnet holder 5 is located.

that, in both cases, the head of each of the threaded fasteners 9 is inaccessible. This, it is postulated, could be achieved by locating the head of each of the threaded fasteners 9 in a respective recess in the inner circumferential surface of the rotor and by permanently fixing a cover over the recess to prevent access to it. The cover could be permanently fixed to the inner circumferential surface of the rotor 1 by any suitable means, such as welding. It is proposed that the magnet holder 5 is thus permanently, as opposed to releasably, attached to the rotor 1.

44. I believe that the cover of configurations C and F is an additional feature provided to permanently obscure what remains a mechanical and releasable fastening. It therefore follows that the mounting arrangement 3 of configurations C and F fall within the scope of claims 1 and 3 and hence a dynamo-electric machine constructed as described in these configurations will infringe claims 1 and 3.
45. To conclude I have found that a dynamo-electric machine constructed as described in all of the proposed configurations will infringe claims 1 and 3 whether or not high-energy-product magnets are used.

Opinion

46. I conclude that request demonstrates that claims 1 and 3 of the patent lack an inventive step. I also conclude that all of the six proposed configurations will infringe claims 1 and 3 of the patent.

Application for review

47. Under section 74B and rule 98, the proprietor may, within three months of the date of issue of this opinion, apply to the comptroller for a review of the opinion.

NOTE

This opinion is not based on the outcome of fully litigated proceedings. Rather, it is based on whatever material the persons requesting the opinion and filing observations have chosen to put before the Office.

N. Dowell
Examiner