COMMISSIONER'S DECISION

Obviousness: Magnetizable Fluid Bearing

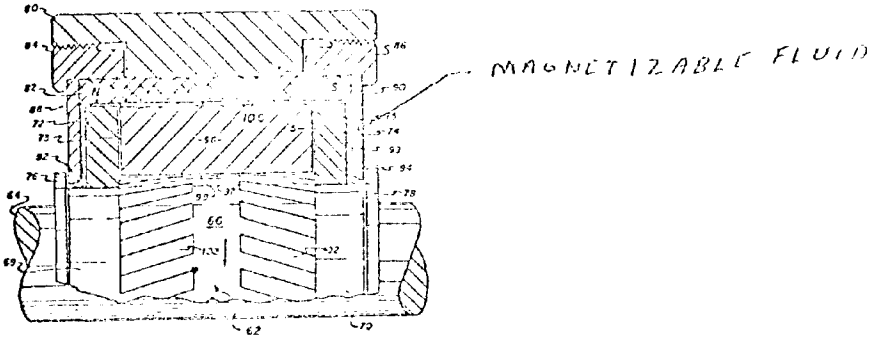
Use of ferromagnetic fluid as a journal bearing lubricant when subjected to a magnetic field is shown in the prior art. Applicant uses ferromagnetic fluid in a combined journal and thrust bearing arrangement. This was found to be obvious. A special sealing arrangement for the fluid was held to be allowable.

Final Action: Modified, claims 1 to 10 rejected, claims 11 and 12 allowed.

****

This decision deals with a request for review by the Commissioner of Patents of the Examiner's Final Action dated March 19, 1976, on application 160,525 (Class 308-1.6). The application was filed on January 4, 1973, in the name of John C. Stiles et al, and is entitled "Lubrication." The Patent Appeal Board conducted a Hearing on September 21, 1977, at which Mr. J. Nelson Landry represented the applicant.

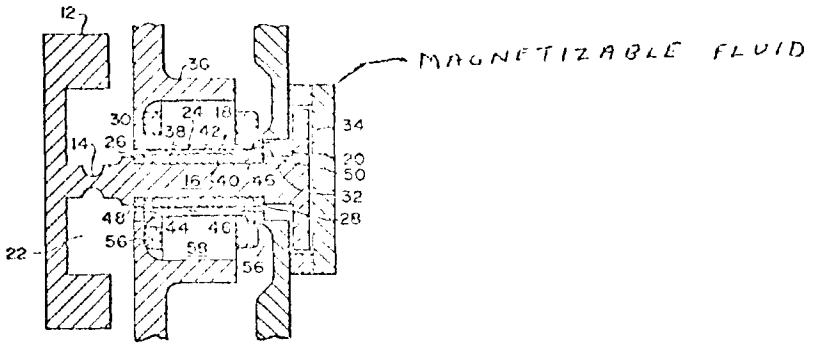
This application relates to a lubrication technique which serves as a bearing to allow movement of two surfaces relative to one another. A magnetizable fluid is used in the gap between the two surfaces and a sufficiently strong magnetic field is applied which allows the fluid to maintain the surfaces out of contact. Figure 3 of the application is illustrative of the invention:



In the Final Action the examiner rejected the claims of this application for failing to define patentable subject matter over the following patent:

United States		
3,439,961	April 22, 1969	Stiles

The Stiles patent relates to a bifluid hydrodynamic bearing wherein a ferromagnetic fluid is used as a bearing lubricant. Means for magnetizing th fluid are provided by electrically energized coils. Figure 1 of Stiles is own below:



Claim 1 of that patent reads as follows:

> A hydrodynamic bearing for a free rotor gyro, comprising an inner bearing element; an outer bearing element, coaxial with said inner bearing element and spaced therefrom to provide a bearing cavity; a fluid lubricant supported therebetween, having poor wetting characteristics; and, axially-spaced non-wettable means attached to said inner and said outer bearing elements at the ends of the bearing cavity for trapping said fluid within the bearing cavity.

In that action the examiner stated (in part) as follows:

> Applicant discloses and claims as his alleged invention the combination of movable elements with a magnetizable fluid in a constraining magnetic field as the only lubricant within a gap between all surfaces of the elements requiring lubrication (claim 1). A specific application is in the field of self-lubricating bearings wherein the only lubricant is a magnetizable fluid as defined in claim 6. More specifically such a bearing may be a journal or radial bearing as defined in claims 10 or 12.
>
> The Stiles reference can be seen from the drawings and disclosure to show a combination thrust and journal bearing. The thrust bearing operates as an aerodynamic bearing by using air 34 between the relatively moving surfaces (thrust collar at end of shaft 16 and its associated housing, as seen on the right-hand side of Figure 1.)
>
> The journal or radial bearing may operate as described on column 3 lines 24 to 46 inclusive of the disclosure from which it is clearly evident that fluid 24 carrying ferromagnetic particles 54 is the only bearing lubricant between radial bearing surfaces 42 and 36. Coils 56 produce the magnetic field to maintain the fluid in the bearing cavity 38.

Thus the hydrodynamic journal bearing acts to carry or support radial loads while the aerodynamic thrust bearing supports axial loads. In Stiles, the ferromagnetic fluid serves the added function of sealing off the air 34 in the high pressure chamber 20 from leaking to the low pressure chamber.

With reference to the more specific form of claims such as 10 or 12 which relate to a journal bearing, as such, it is clear that these claims read on the journal bearing of Stiles. Consequently, this is also true of the broader claims 1 and 6 which could cover either a journal bearing per se, a thrust bearing per se or the combination thereof.

Applicant submits (page 2 of his latest remarks) that the entire assembly as seen in figure 1 is a single bearing because one without the other would be an inoperative device. While this may be true under the conditions in which the Stiles device operates, nevertheless it is held that there is no invention in the use of only the journal bearing of Stiles without the thrust bearing under conditions where only radial loads apply (as implied by claims 10 and 12), any more than there would be no invention in the reverse case, that is, the use of only the thrust bearing of Stiles without the journal bearing under essentially thrust load conditions. The elimination of any part with its corresponding function, where conditions permit, is not patentable.

It is interesting to note that claim 3 of the Stiles patent defines a bearing using a magnetizable fluid as the sole lubricant and the use of a second fluid is not claimed except in claim 6, in the form of assisting the bearing function of the hydrodynamic bearing. It is seen that the structure of broad claims such as 1 and 6 herein and the specific journal claims 10 and 12 would infringe the structure recited in claim 3 of the Stiles patent.

In response to the Final Action the applicant submitted an amended set of claims and stated (in part):

In the substitute claims it is to be noted that the Applicant has restricted the scope of all claims to a combined thrust-and-journal bearing. Claim 1 of the enclosed claims is based on former Claim 2 and the broad former Claim 1 has not been maintained. It is also to be noted that, in order to facilitate examination, numerous dependent claims of lesser importance have not been included in the enclosed new set of claims.

Since all of the amended claims submitted herewith refer to a combined thrust-and-journal bearing, Applicant submits that they are no longer susceptible of interpretation that they read on the applied reference, United States Patent No. 3,439,961 (Stiles). This is so, because, in accordance with the Examiner's interpretation, the claims were allegedly readable on a journal bearing of this reference. Even though Applicant cannot share the Examiner's opinion that it is proper to speak about a journal bearing in the Stiles patent, because there is only a combined bearing disclosed, the restriction to a combined thrust-and-journal bearing emphasizes the distinction, inasmuch as the thrust portion of the combined bearing by Stiles is an aerodynamic bearing portion.

> In view of the restricted scope of the claims presented herewith, Applicant believes that the objectionable matter has been removed, that the final objection has been overcome and that the application is in condition for allowance.

The issue to be considered by the Board is whether or not the applicant has made a patentable advance in the art over the cited references. Amended claim 1 reads as follows:

> A combined thrust-and-journal bearing comprising structural elements mounted for motion of a surface of one element along a surface of another element, with a lubricant within a gap between the surfaces, wherein the only lubricant between all surfaces requiring lubrication is a magnetizable fluid, the magnetizable fluid forming its own sealing medium by virtue of a magnetic field which causes portions of the magnetizable fluid to be attracted toward every opening of the gap.

Considering the Stiles citation we find that the concept of using a magnetizable fluid lubricant and electromagnetic means to create a magnetic field to maintain the fluid in position between moving surfaces is known. This patent also shows the use of pressurized air to provide a bearing arrangement to compensate for the thrust force. It is the applicant's contention that his combined thrust and journal bearing, which uses only magnetizable fluid for both functions, is a patentable advance in the art.

The applicant argues that the hydrodynamic bearing disclosed by Stiles is a single bearing wherein the "so called gas bearing" acts as a thrust bearing which is not independent of the radial magnetic fluid bearing since they both form part of the same assembly. Considering the force components involved in Stiles we conclude that rotary motion of the shaft 16 would generate radial force and an axial end load on this shaft would produce the thrust force. These are two separate and distinct force factors. While it is desirable to have a unitary bearing capable of overcoming both component factors it does not necessarily have to be one assembly. Clearly Stiles does show the use of a magnetic fluid bearing for radial force, but it will operate in this mode irrespective of the thrust bearing arrangement that is located in the adjacent area.

Applicant's amended claims, which were submitted in response to the Final Action, specify a combined thrust and journal bearing wherein the only lubricant between all bearing surfaces requiring lubrication is a magnetizable fluid, and wherein the magnetizable fluid forms its own sealing medium by virtue of a magnetic field. Stiles also seals the fluid with no contact between the shaft and housing "by a magnetic field so that the fluid may be maintained within the bearing cavity and not leak out from the ends." Figure 1 of Stiles supra shows the use of magnetizable fluid for the journal bearing area with the coils for producing the magnetic field which prevents leakage.

Claim 1 of Stiles specifies "an outer bearing element coaxial with said inner bearing element and spaced therefrom to provide a bearing cavity; a fluid lubricant supported therebetween...." This claim covers either a journal or radial bearing arrangement that would be used in this manner. Amended claim 1 specifies a combined thrust and end bearing with one magnetizable fluid which forms a sealing medium when subjected to a magnetic field. The concept of a magnetizable fluid bearing is disclosed in Stiles. The practical application is a difference in design or layout only. In our view no result has been achieved which can be considered to have flowed from an inventive step and we recommend claim 1 be refused. Claims 2 to 4, which depend on claim 1, add the magnetic field in combination with the bearing and this does not render these claims patentable over refused claim 1.

Claim 5 specifies a self lubricating combined thrust and journal bearing wherein the only lubricant is a magnetizable fluid. We recommend that this claim be refused as the arguments applied to claim 1 apply equally to it. Claims 6 to 10, which depend on amended claim 5, detail the magnetic force providing means. These claims do not define patentable subject matter over refused claim 5.

Claims 11 and 12 are directed to specify sealing arrangement in conjunction with the magnetizable fluid means which, in our opinion, is a new combination

that represents a patentable advance over the cited art. These claims appear allowable. They must however, be submitted in proper form as claims 1 and 2.

In summary, we recommend that claims 1 to 10 be refused, but that claims 11 and 12 are allowable.

S.F. Hughes
Assistant Chairman
Patent Appeal Board, Canada

I have reviewed the prosecution of this application and I concur with the recommendation of the Patent Appeal Board. Accordingly, I refuse to grant a patent on claims 1 to 10. I will however, accept claims 11 and 12 when presented as claims 1 and 2. The applicant has six months within which to make the appropriate amendment, or to appeal this decision under the provision of Section 44 of the Patent Act.

J.H.A. Gariepy
Commissioner of Patents

Dated at Hull, Quebec

this 14th. day of October, 1977

Agent for Applicant

Ogilvy, Cope, Porteous, Montgomery,
Renault, Clarke & Kirkpatrick,
Suite 700, The Royal Bank Bldg.
1 Place Ville Marie,
Montreal, Quebec H3B 1Z7