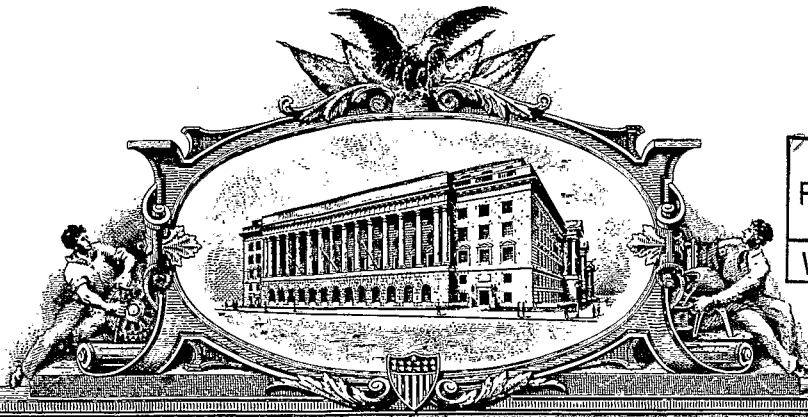


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September 20, 2002

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**APPLICATION NUMBER: 09/951,062
FILING DATE: September 13, 2001
RELATED PCT APPLICATION NUMBER: PCT/US02/28716**



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09/13/01
JCS67 U.S. PTO

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JCS978 U.S. PTO
09/951062
09/13/01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

The Commissioner of Patents and Trademarks
Washington, D.C. 20231

Transmittal Letter

Submitted herewith for filing is a patent application of Eugene J. Novak et al for IMPROVED BEARING FOR DENTAL HANDPIECE, including an unexecuted Declaration.

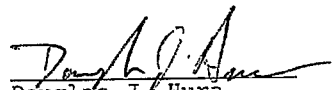
The fee due is calculated as follows:

The filing fee is calculated as follows:		
Basic Filing Fee		\$ 710.00
Total Claims	6 - 20 = 2 x 18 =	\$ 0.00
Independent Claims	2 - 3 = x 80 =	\$ 0.00
	Total filing fee	<u>\$ 710.00</u>

Please charge the fee due for filing in the amount of \$710.00 to Deposit Account 04-0780.

Please charge any additional fee due and credit any overpayment to Deposit Account No. 04-0780.

Respectfully submitted,


Douglas J. Hura
Patent Attorney Reg. No. 33249

September 13, 2001
Address of signer:

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09/13/01 09:43:01

IMPROVED BEARING FOR DENTAL HANDPIECE

TECHNICAL FIELD

[0001] The present invention is directed toward dental handpieces. More particularly, the invention is directed toward a dental handpiece having an improved bearing construction. The inventive bearing has a thick outer race.

BACKGROUND OF THE INVENTION

[0002] Audible sound levels in air-turbine dental highspeed handpieces are currently known to range as high as 65-78 dBA or sometimes higher. This noise level is a primary complaint of users. Furthermore, there is a peak in the sound spectra at about 7,000 Hz, corresponding to the rotation speed of 425,000 rpm, and characterized by users as a "high pitched whine". It is clearly desirable to reduce the sound emitted by dental handpieces. It is believed that the bearing is one of the sources of this noise. For example, the Gyro handpiece available from Bien Air, has an air bearing and is known to have a lower sound intensity at 7,000 Hz.

[0003] Bearings commonly used in dental handpieces today have thin cross sections which make it difficult to fabricate (grind) the bearing races to the desired precision (often required to be 10×10^{-6} inches roundness and concentricity). Any improvements in bearing precision and surface finish are

TECHNICAL FIELD

expected to improve bearing life and reduce bearing noise, are therefore, desirable.

[0004] Dental handpieces of any type or design are useful in conjunction with the bearings according to the present invention. One particularly useful class of such handpieces are conventionally known as "high speed" handpieces, and are often air-driven. Examples of such handpieces are shown for example, in U.S. Pat. Nos. 4,089,115, 4,279,597 and 5,040,980, which are hereby incorporated by reference for such disclosure.

SUMMARY OF THE INVENTION

[0005] It is therefore, an object of the invention to provide a dental handpiece.

[0006] It is another object of the invention to provide a dental handpiece improved with respect to its bearing construction.

[0007] It is a further object of the invention to provide a bearing construction for a dental handpiece which improves the audible sound qualities of the handpiece.

[0008] These and other objects of the invention which will become apparent from the following discussion, are accomplished by the invention as hereinafter described and claimed.

[0009] In general a dental handpiece comprises a rotor and a ball bearing assembly supporting said rotor. Said ball bearing assembly having at least one ball and a bearing, said bearing having an inner and an outer race, said outer race having a thickened diameter.

conventional in the art, and may also include according to the invention, a bearing shield 23 which is integral with the outer race.

[0013] According to the invention, outer race 21 is thicker than has heretofore been known in the art. For example, the outer race according to the invention and used in a dental handpiece of otherwise conventional size, may have a diameter of greater than about 0.25 inches, and preferably 0.28 inches or even thicker. The inventive outer race 21 is approximately double in thickness over those bearings conventionally known in the art, and has as much as 0.03 inches greater in diameter as compared to previous dental handpieces.

[0014] By way of example, TABLE I shows a comparison of an exemplary dental handpiece bearing construction according to the invention, as compared to a commercially available dental handpiece, namely an XGT handpiece available from DENTSPLY International Inc.

TABLE I

	current XGT bearing	Inventive bearing
inner diameter of inner race	.125"	.125"
diameter of inner race ball track	.166" approx.	.166" approx.
diameter of outer race ball track	.220 approx.	.220 approx.
outer diameter of outer race	.250"	.280"

[0015] Also according to the present invention, the bearing does not have a flange, which in the previous conventional bearings served to transmit axial force from an elastomeric suspension "quad-ring". Rather, the new bearing

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has a slight shoulder 30 upon which an elastomeric suspension o-ring 31 rests. O-ring 31 may be held within a groove 32. Axial force is still transferred from the 31 o-ring to the bearing outer race 21 to pre-load the bearing, but the geometry of the inventive bearing directs the vector of that force in-line with the contacts between ball 22 and ball grooves. It is believed that this directed force improves bearing performance under varying load conditions.

[0016] The races of the bearing 14 may be made from any conventional material useful for dental applications, such as for example, 440C "micro-melt" stainless steel.

[0017] As stated above, the outer race 21 of the inventive bearing 14 also includes an integral shield 23 on one side, in contrast to typical bearing practice in which one or both shields are separate rings welded or otherwise held in place. The shield on the opposite side of the new bearing is attached by any conventional means, such as spot-welding to the outer race 21 in a conventional manner.

[0018] The retainer material of the bearing 14 may be any conventional material, such as Torlon, as currently used in many dental bearings. Of course, any retainer material or configuration could be used with the thick outer race.

[0019] The balls 22 of the new bearing are preferably made of stainless steel, as currently used in almost all dental bearings. Of course, any allowable ball material could be used with the thick outer race.

[0020] Alternatively, increased mass of the outer race may be achieved by using a more dense material, without changing the diameter of the outer race. Further, two or more different materials to fabricate the outer race. The innermost portion of the race would be of a material (e.g. hardened steel or ceramic) selected to optimize bearing performance and life. The outermost portion could be a material chosen for sound damping properties or greater density. Additionally, a thin layer of adhesive, plastic, or elastomer between the two layers could further dampen sound transmission. A sleeve of any material surrounding the outer race of a conventional bearing may be employed.

[0021] The bearing could also incorporate other features:

A shield on one side which is integrated (formed with) the outer race.

A radiused flange on the outer race sized to mate with an elastomeric o-ring for suspension.

A bearing in which both the inner and outer race were thicker.

A bearing in which the inner race is comprised of multiple materials or sleeves, as describe above for the outer race.

Various materials for the races, balls, and ball retainer.

Various configurations of ball retainer.

Various configurations and geometry's of ball grooves.

Various sizes of balls.

Reduced audible noise.

Reduced bearing distortion under load.

Increased bearing life.

[0022] Easier to manufacture to high tolerances. Less bearing distortion during manufacturing (during grinding, shield welding, and bearing press-fit assembly).

[0023] A unique, non-interchangeable, geometry.

[0024] Prototype bearings have been assembled into prototype handpieces and testing shows an 8 - 12 dB reduction in noise.

[0025] While in the foregoing specification a detailed description of the invention has been set forth for the purpose of illustration, variations of the details herein given may be made by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A dental handpiece of the type having a rotor supported by a ball bearing assembly, said ball bearing assembly having at least one ball and a bearing, said bearing having an inner and an outer race, wherein the improvement comprises a bearing having an outer race having a thickened diameter.
2. A dental handpiece as in claim 1, wherein said outer race has a diameter greater than about 0.25 inches.
3. A dental handpiece as in claim 2, wherein said outer race has a diameter of at least 0.28 inches.
4. A dental handpiece comprising a rotor, a ball bearing assembly supporting said rotor, said ball bearing assembly having at least one ball and a bearing, said bearing having an inner and an outer race, said outer race having a thickened diameter.
5. A dental handpiece as in claim 3, wherein said outer race has a diameter greater than about 0.25 inches.
6. A dental handpiece as in claim 4, wherein said outer race has a diameter of at least 0.28 inches.

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled IMPROVED BEARING FOR DENTAL HANDPIECE the specification of which

(check one) 1. is attached hereto.

2. was filed on _____ as Application Serial No. _____ was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Number _____ Country _____ Day/Mo/Yr Filed _____

Priority Claimed: Yes No

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

I hereby claim the benefit under Title 35, United States Code, 119(e) of any Provisional United States application(s) listed below.

Provisional Application Serial No. 60/232,256 Filing Date Sept. 14, 2000

Application Case Serial No. None Filing Date _____

Status--patented, pending, abandoned: pending

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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