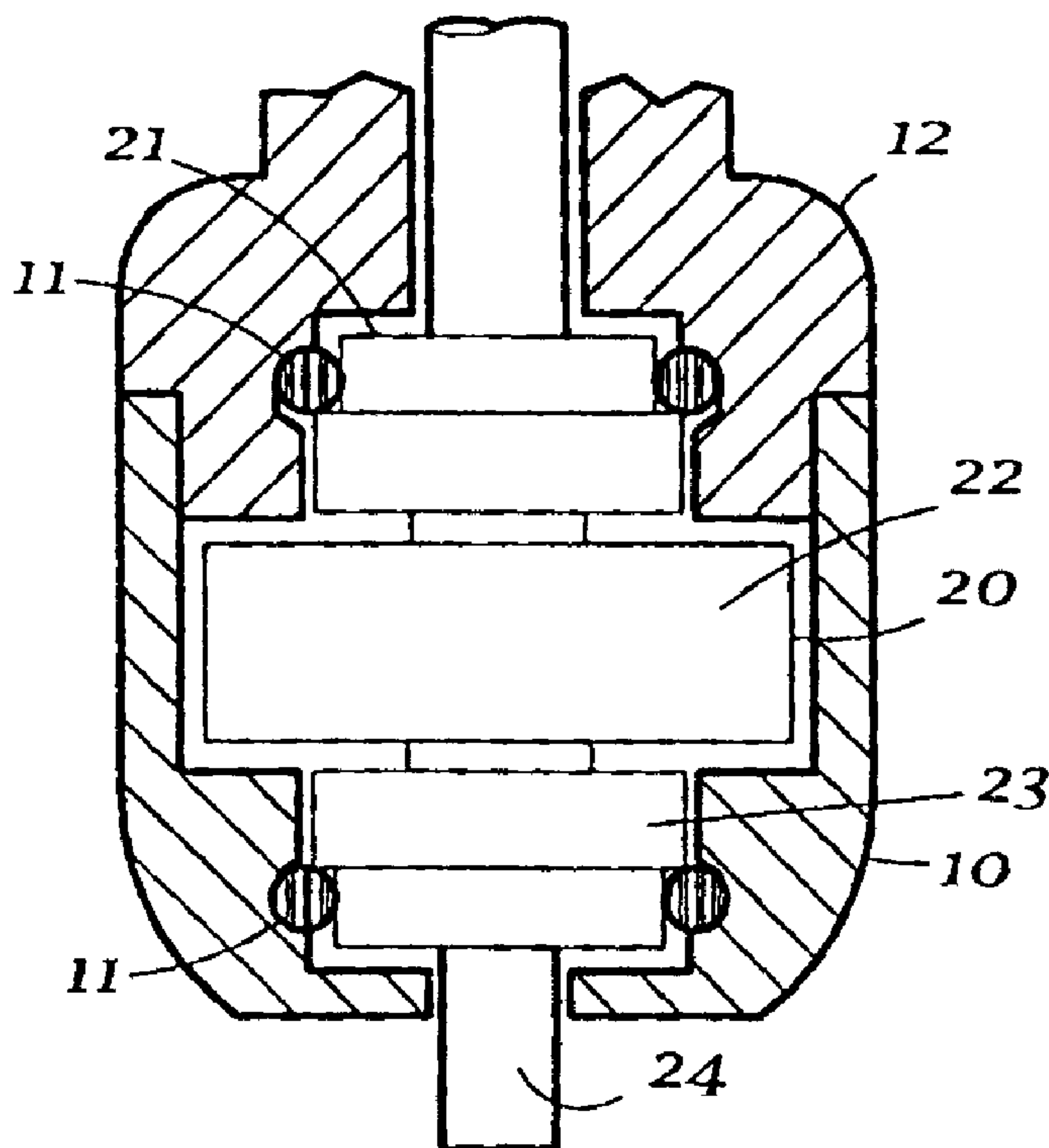




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 (54) Title: IMPROVED DENTAL HANDPIECE COMPONENTS



(57) Abrégé/Abstract:

A dental handpiece (10) of the type having at least one component (11) fabricated from an elastomeric material, is improved by fabricating the component (11) from a perfluoroelastomer.

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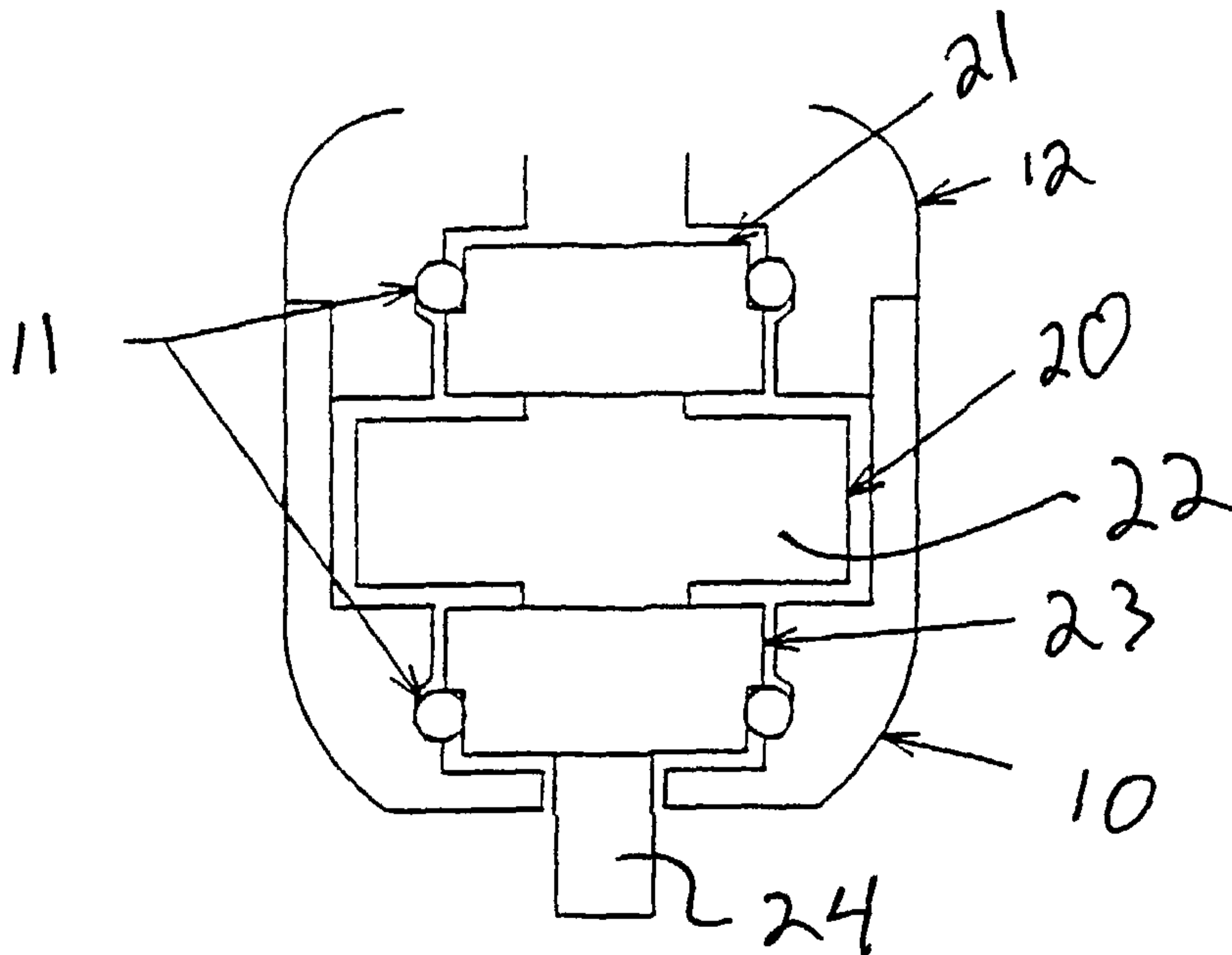
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## IMPROVED DENTAL HANDPIECE COMPONENTS

## TECHNICAL FIELD

(0002) Some embodiments of the present invention are generally directed toward dental handpieces having components such as suspension rings, valves or seals made of an elastomeric material. More particularly, the invention is directed toward dental handpieces, of the type having for example, a rotor set including an air-driven rotor and upper and lower bearing assemblies, wherein the set is suspended axially or radially in the handpiece by means of suspension rings. Specifically, the present invention relates to the fabrication of handpiece components such as suspension rings, seals or valves from a perfluoroelastomer that resists degradation even after repeated sterilization. The invention also has application to other handpiece components, such as motors (air or electric), handpiece attachments and the like.

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## BACKGROUND OF THE INVENTION

(0003) In dental handpieces today, many components such as the bearing suspension, seals and valves are made from elastomeric materials. For example, the bearing suspension is typically an elastomeric ring between bearing outer race and handpiece structure, which supports and isolates the bearings. An example of such a bearing ring is shown in U.S. Pat. No. 4,341,520.

(0004) The stiffness of the suspension plays a role in handpiece "feel" during cutting, audible noise, and bearing life. Currently, the suspension rings in known handpieces are made of various grades of Viton or Kel-F rubbers, and these materials degrade after 300-800 sterilization cycles. It is believed that this degradation is a key determinant of handpiece life (before bearing replacement is required). Degradation can take various forms, including: (1) compression set, such that the suspension no longer provides the design bearing pre-load, which increases noise and leads to bearing failure; (2) changes in stiffness, which alters the dynamic response and "feel" of the handpiece during cutting; and, (3) catastrophic failure of the elastomer, leading rapidly to bearing failure. Such degradation is often exacerbated by repeated use and repeated



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exposure to conventional sterilization practices, which will often include exposure to high temperatures and pressures.

(0005) A need exists for elastomeric handpiece components that will withstand repeated sterilizations with increased  
5 resistance to such degradation. It has been found that components such as suspension rings, seals and valves made of perfluoroelastomers, such as Chemraz available from Green-Tweed, show demonstrably less of each degradation phenomena after repeated sterilization and therefore,  
10 results in longer usable life of the handpiece.

(0006) Use of Chemraz and other perfluoroelastomers is well known in sealing applications requiring high resistance to chemical attack and/or heat (e.g. semiconductor processing equipment). It is believed that there is no known prior art  
15 for a dental handpiece utilizing these materials for bearing suspension or any other purpose. There is no known prior art utilizing perfluoroelastomer elastomers as a bearing suspension material in non-dental applications, although it is known for use as an o-ring material, as is disclosed in  
20 U.S. Pat. No. 6,197,121.

(0007) Some embodiments of the present invention have particular application to dental handpiece components, such as the suspension rings thereof. Some embodiments of the invention also have application to other components, such as  
25 seals, valves, attachments to the handpiece and the like. Some embodiments of the invention also have application to component parts of the handpiece motors which are made of an elastomeric material. By "motor" it is understood to mean any otherwise conventional motor, including air driven and  
30 electric motors. Some embodiments of the present invention will be exemplified herein with reference to a dental handpiece, it being understood that by terms such as

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"handpiece" or "dental handpiece" that all such handpiece components, motors, attachments, valves, seals, rings or the like are included.

## SUMMARY OF THE INVENTION

5 (0008) It is therefore, an object of some embodiments of the present invention to provide an improved dental handpiece.

(0009) It is another object of some embodiments of the invention to provide an improved dental handpiece which is improved in regard to its ability to withstand repeated  
10 sterilization cycles.

(0010) These and other objects of some embodiments of the invention, which will be apparent from the present discussion, are accomplished by the invention as herein described and claimed.

15 (0011) In general, a dental handpiece of the type having at least one component fabricated from an elastomeric material is improved by fabricating the component from a perfluoroelastomer.

According to one aspect of the present invention, there is  
20 provided the dental handpiece comprising: a head, a rotor set within said head, and a rotatable shaft, said rotor set having at least one bearing, wherein said rotor set is suspended within said head with a suspension ring fabricated from a perfluoroelastomer.

## 25 BRIEF DESCRIPTION OF THE DRAWING AND TABLES

(0012) Figure 1 shows a cross section of a dental handpiece head.

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(0013) TABLE I shows the performance in terms of compression set of suspension materials subjected to repeated sterilization cycles. The conventional suspension materials (Viton-B and Kel-F) show up to five times the amount of compression set as the perfluoroelastomer (Chemraz) at 1800 equivalent sterilization cycles.

(0014) TABLE II shows the associated stiffness change occurring in the suspension material over 1800 sterilization cycles. The conventional suspension material stiffens by 137% and 81%, while the perfluoroelastomer stiffens by only 12%.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

(0015) Some embodiments of the present invention have application to dental handpiece components that are conventionally fabricated from an elastomeric material, such as is disclosed in the '520 patent. While the present invention will be exemplified herein by reference to a bearing suspension, it will be appreciated that the scope of the invention includes any dental handpiece component that is conventionally fabricated from an elastomeric material, including for example, seals and valves.

(0016) The head 10 of a conventional dental handpiece is shown in Fig. 1. Head 10 may be of any configuration, the only requirement being that it be of the type employing an elastomeric component, such as suspension rings 11. While the present invention has



particular application to air-driven dental handpieces, any other type of handpiece driven by any conventional means is within the scope of the invention.

(0017) Handpiece head 10 includes a cap 12, and houses a rotor set generally designated by the number 20. Rotor set 20 includes an upper bearing 21, a rotor 22, and a lower bearing 23 with possible other components as is conventional in the dental handpiece art, such as rotatable shaft 24. Rotor set 20 is suspended axially (as shown) and/or radially in the head 10 by means of suspension rings 11.

(0018) Handpiece head 10 utilizes suspension o-rings 11 made of a perfluoroelastomer such as Chemraz available from Green-Tweed Inc. In particular, it has been found that Chemraz composition number CZ605 provides improved resistance to steam sterilization. However, other perfluoroelastomer such as International Seal compound PF128-75 and Forsheda Palmer-Chenard compound ISO9503 also provide performance better than currently used elastomers.

(0019) When used to fabricate an elastomeric dental handpiece component, such as a suspension ring 11, it has been found that the use of a perfluoroelastomer such as Chemraz CZ605 provides improved resistance to degradation as compared to conventional materials such as Viton B and Kel-F. As shown in TABLE I, the compression set of both Viton B and Kel-F were found to be



substantially higher than that of Chemraz, as was the stiffness after repeated sterilization cycles as is reported in TABLE II.

**(0020)** An elastomeric dental handpiece component, including a suspension ring 11, seal or valve (not shown) fabricated from a perfluoroelastomer according to the invention, will therefore, exhibit increased resistance to degradation even after being exposed to repeated sterilization cycles as are conventionally used in dental practices. The present invention therefore provides a useful and unexpected contribution to the art of dental handpieces.

**(0021)** Any geometry of elastomeric component is within the scope of the invention. For example, other geometric forms of elastomeric suspension rings 11 include quad-rings, separate radial and axial rings, multiple rings, and the like (not shown) all of which are within the scope of the invention. Also, elastomeric components such as suspension rings 11 in conjunction with metallic springs (not shown) for axial bearing pre-load may be employed. Various geometry's of the bearing outer race and head cavity which form the boundaries of the suspension, and various formulations of perfluoroelastomeric material itself may all be varied and still fall within the scope of the invention. All such components fall within the scope of the term "suspension ring" and "elastomeric component" as used herein.

**(0022)** It is evident therefore, that the objects of a dental handpiece are carried out by the invention as herein described. All possible

aspects of the invention beyond the best mode have not been necessarily described, and the scope of the invention shall only be determined by the following claims.

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CLAIMS:

1. A dental handpiece comprising:

a head,

a rotor set within said head, and

5 a rotatable shaft,

said rotor set having at least once bearing, wherein said rotor set is suspended within said head with a suspension ring fabricated from a perfluoroelastomer.

2. The dental handpiece of claim 1, wherein the

10 perfluoroelastomer is Chemraz.

3. A method of making the dental handpiece as defined in claim 1 or 2, said method comprising the step of fabricating at least the suspension ring of the handpiece from a perfluoroelastomer.



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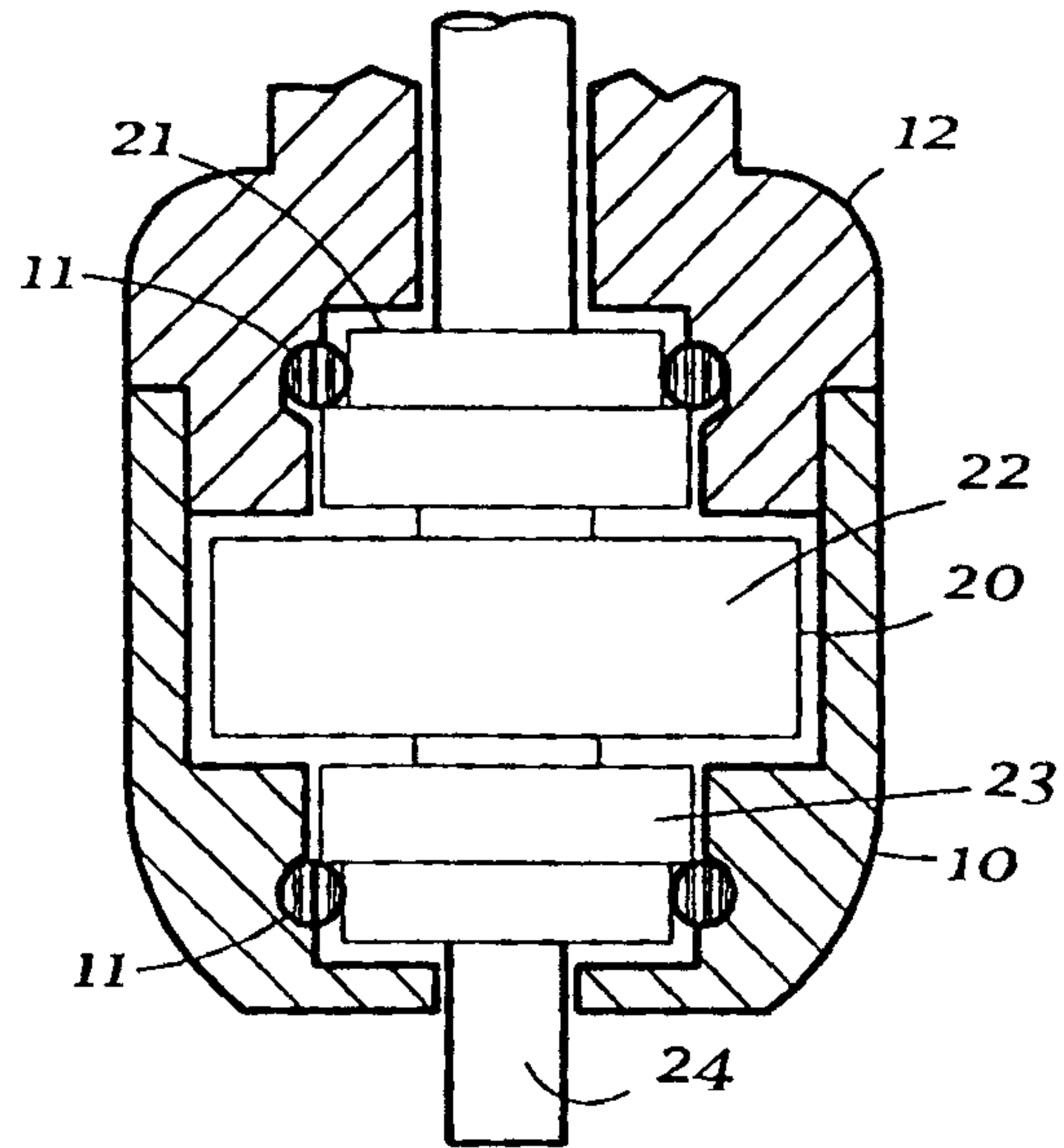


Fig. 1

Suspension System Material Compression Set

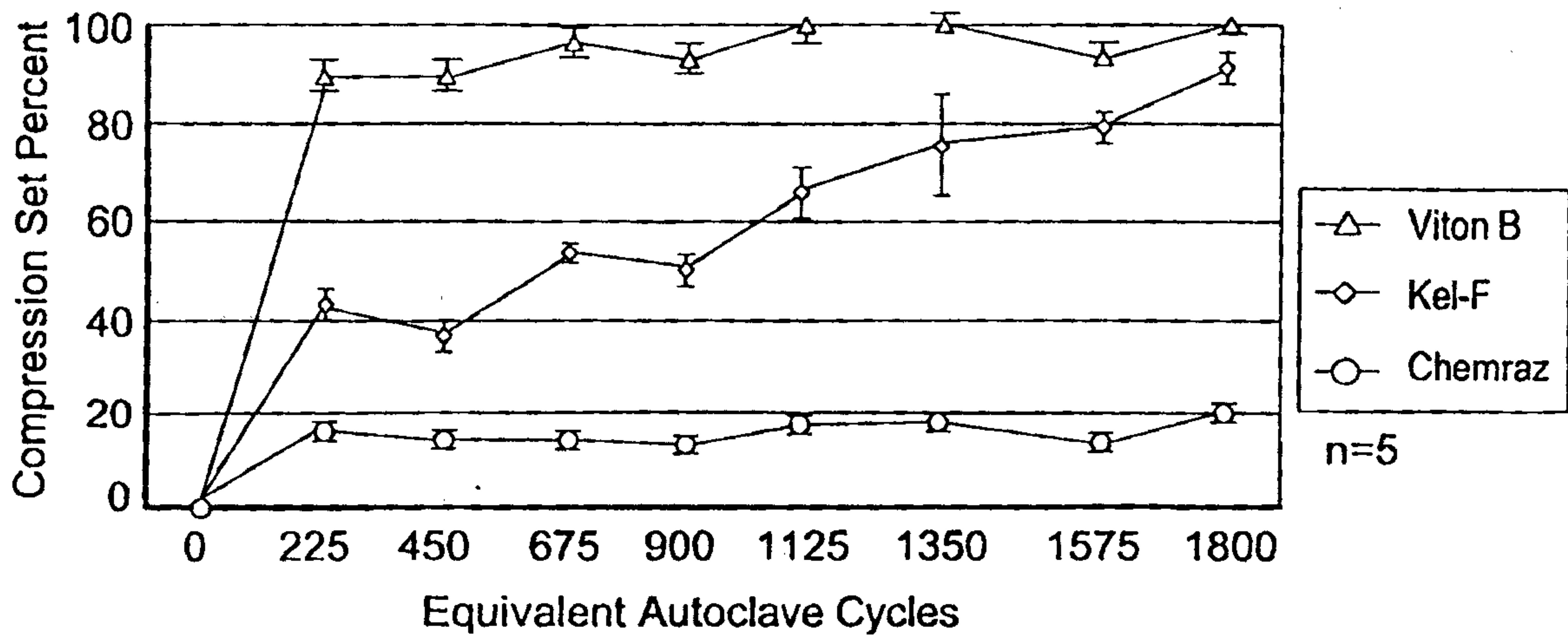


Fig. 2

TABLE I

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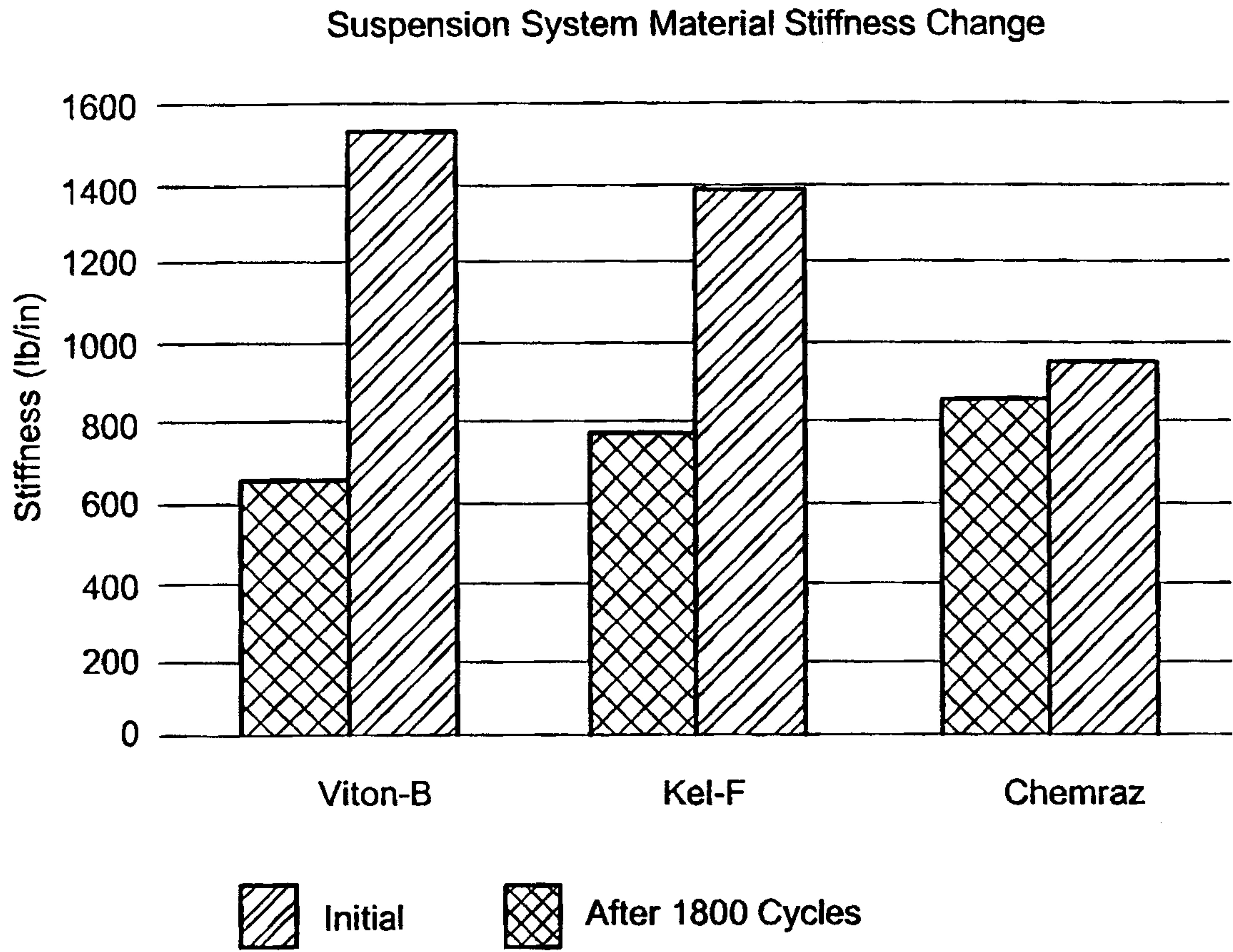


TABLE II

*Fig. 3*

