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WATER-COOLED DENTAL CUTTING MEMBER
AND HANDPIECE FOR USE THEREWITH
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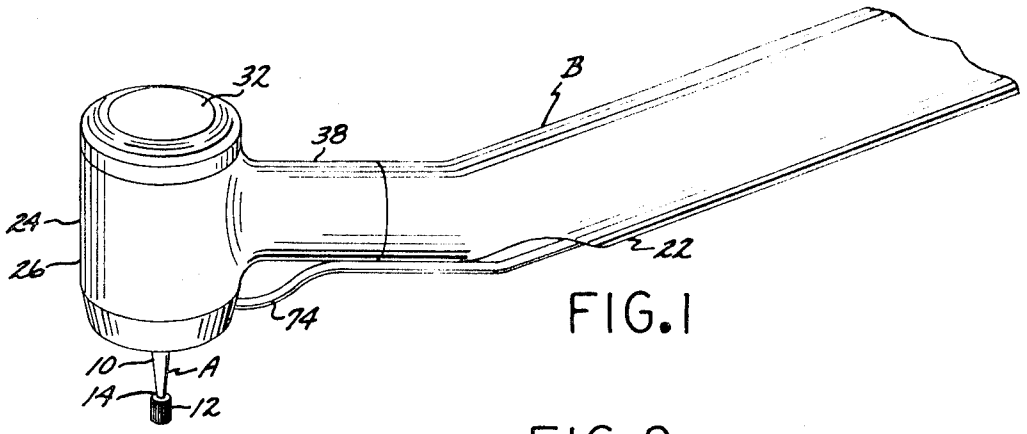


FIG. 1

FIG. 2

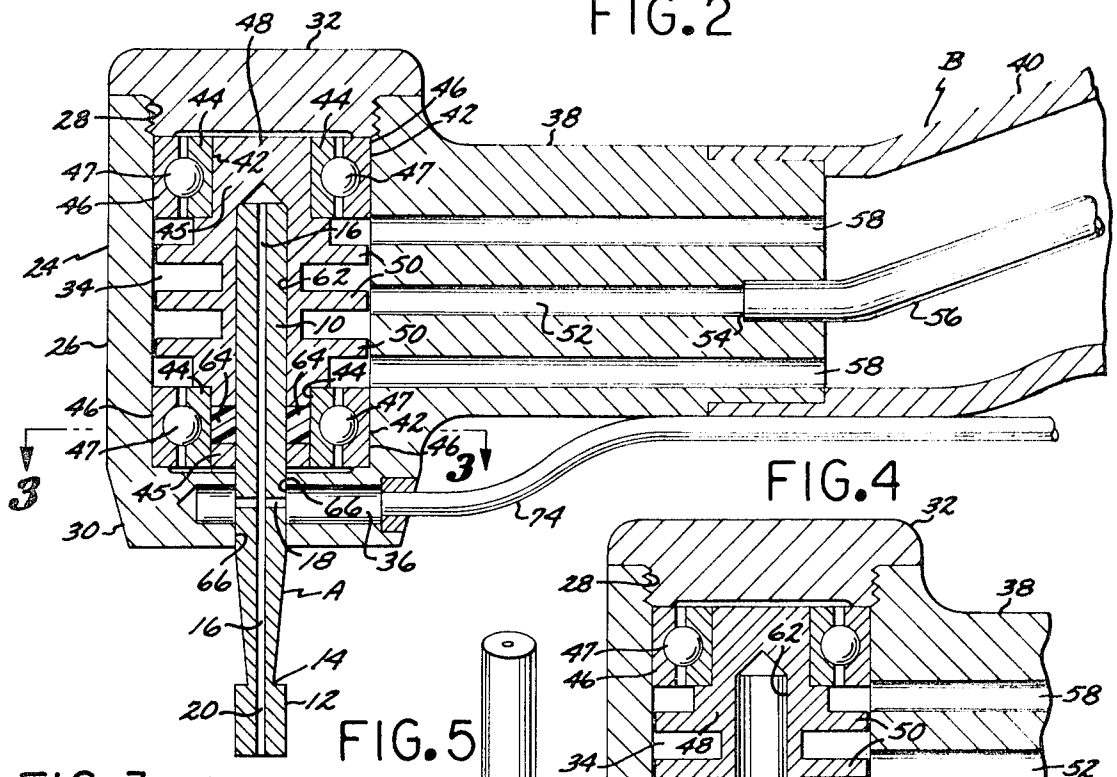


FIG. 4

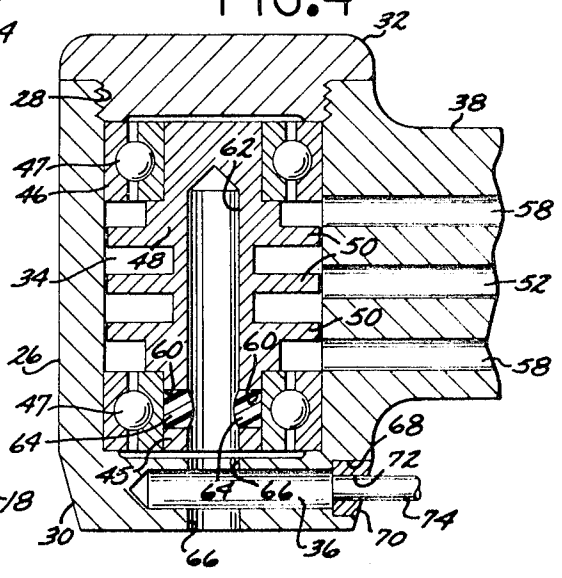


FIG. 5

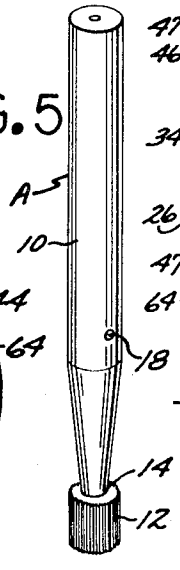
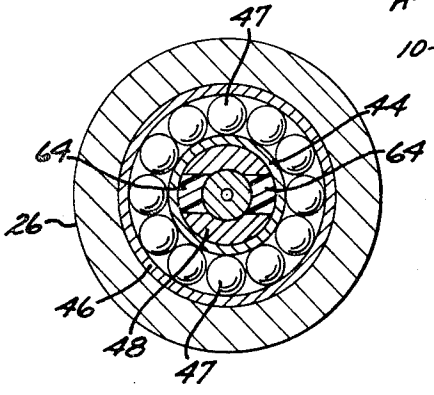


FIG. 3



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WATER-COOLED DENTAL CUTTING MEMBER AND HANDPIECE FOR USE THEREWITH

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ABSTRACT OF THE DISCLOSURE

A water-cooled dental cutting member that may be used for cutting, grinding, or drilling, depending upon the configuration of the tooth-contacting portion thereof, and a turbine-type dental handpiece that is particularly adapted for removably supporting the cutting member, as well as supplying a constant flow of cooling water thereto. The turbine rotor in the handpiece operates within a confined space that is at a substantially higher air pressure than the pressure of the cooling water. Accordingly, cooling water has no tendency to enter that portion of the handpiece in which the rotor is supported to slow down the rate of rotation of the rotor or stop the rotor by frictional contact therewith.

BACKGROUND OF THE INVENTION

Field of the invention

A water-cooled dental cutting member and handpiece for use therewith.

Description of the prior art

Turbine type dental handpieces have been used for a number of years to drive cutting members used for drilling and grinding by abrasive frictional contact with a tooth, contact generates heat that is most uncomfortable to a patient. To alleviate the discomfort of the heat so generated, the dentist intermittently conducts the cutting, grinding or drilling operations.

Numerous attempts have been made in the past to provide a dental handpiece that would drive a cutting member at high speed and also water-cool the latter as well as that portion of the tooth with which the member is in functional contact. These attempts have not been successful, for in the prior handpieces the cooling water has a tendency to ultimately flow into the portion of the handpiece in which the rotor is supported, which slows down the rate of rotation of the rotor by frictional contact therewith. The purpose of the present invention is to supply a water-cooled dental cutting member and handpiece for use therewith that is free of the operational disadvantages found in prior art devices of this nature.

SUMMARY OF THE INVENTION

A water-cooled rotatable dental cutting member that includes a shank and a cutting body supported from a first end thereof. A transverse water passage is formed in the shank that is in communication with a longitudinal passage extending at least through the cutting body. Although the operational portion of the dental cutting member is hereinafter referred to as a cutting body, it may serve not only this function, but may also be used for drilling or grinding. The shape of the cutting body will, of course, determine the function that it is most suited for.

The dental cutting member is rotated by a turbine-type dental handpiece that includes a recessed turbine rotor which frictionally and removably engages the cutting member. Water is supplied to a confined space in the handpiece that is in communication with said transverse passage. The interior portion of the handpiece in which the rotor is supported is in communication with an air discharge member and a pressurized air inlet member. The air pressure in the portion of the handpiece in which the rotor is supported is higher than that of the cooling water in the confined space, whereby there is no tendency for water to contact the rotor and slow the rotation thereof or stop the same. Water flows from the confined space into the cutting member to discharge therefrom and cool the cutting body, together with the portion of a patient's tooth with which it is in rotational frictional contact.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of the handpiece and the water-cooled cutting member;

FIG. 2 is a longitudinal cross-sectional view of the head portion of the device;

FIG. 3 is a transverse cross-sectional view of the device taken on the line 3—3 of FIG. 2;

FIG. 4 is a second longitudinal cross-sectional view of the head portion, but with the cutting member removed therefrom;

FIG. 5 is a perspective view of the cutting member.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The water-cooled cutting member A, as may best be seen in FIGS. 1 and 2, is adapted to be removably supported in a turbine-type dental handpiece B.

Cutting member A includes an elongate shank **10**, and a cutting body **12** is supported on a first end portion **14** thereof. The shank **10** and cutting body **12** are preferably formed as an integral unit from a single body of metallic material such as high speed steel, or the like. A first longitudinal passage **16** is formed in shank **10** and intersects a second transverse passage **18** also formed in the shank. A third longitudinal passage **20** is formed in cutting body **12**, is axially aligned with first passage **16**, and in communication therewith.

The dental handpiece B, as may be seen in FIG. 1 includes a tubular elongate barrel assembly **22** that serves as a grip for manipulating the head **24** that rotatably supports cutting member A. Head **24** includes a cylindrical shell **26** having a tapped first end **28** and a second closed end portion **30**. First end **28** is sealingly and threadedly engaged by an externally threaded end piece **32**, which end piece cooperates with a shell **26** to define a first confined space **34**. A second transverse confined space **36** is provided in the second closed end portion **30**.

A cylindrical plug **38** extends outwardly from one side of shell **26**, which plug removably and slidably engages a second cylindrical shell **40** (FIGS. 1 and 2) that forms a part of the barrel assembly **22**. Second shell **40** is connected on its free end to a flexible conduit (not shown) as is conventional with dental handpieces.

First and second longitudinally spaced ball bearing assemblies **42**, are mounted in the confined space **34** of shell **26**. Each assembly **42** includes inner and outer races **44** and **46**, respectively, in which races a number of circumferentially arranged ball bearings **47** disposed therebetween. The inner races **44** frictionally engage the end portions **45** of a turbine rotor **48**. Rotor **48**, as illustrated in FIG. 2, has three longitudinally spaced circular blades **50** projecting outwardly therefrom.

An air inlet passage **52** extends longitudinally through plug **38**, and is connected on a first end portion **54** thereof to a conduit **56**. The conduit **56** is connected to a source of air under pressure (not shown). Air inlet passage **52** is of greater diameter than the width of the center blade **50** with which it is aligned as shown in FIG. 2.

Air from inlet passage **52** discharges on to rotor **48** on both sides of the center blade **50**, and causes rotation of

the rotor, due to frictional contact with the center blade and the two blades **50** on each side thereof. Air in first confined space **34**, after frictional contact with the blades **50** is discharged through two passages **58** in plug **38** that are in communication with the interior of the second shell **40** (FIG. 2). The interior of shell **40** is in communication with the ambient atmosphere by conventional means (not shown).

The end portion **45** of rotor **48** closest to second end portion **30**, as may best be seen in FIG. 4, is provided with two transversely aligned bores **60** that are in communication with a longitudinal recess **62** formed in rotor **48**. Recess **62** is of such transverse cross section as to snugly and slidably engage shank **10** of cutting member A. Two resilient cylindrical plugs **64** are positioned in bores **60** and extend slightly into recess **62**. The outer ends of plugs **64** abut against the inner race **44** most adjacent thereto. The portions of plugs **64** projecting into recess **62** are of slightly convex configuration. Plugs **64** frictionally engage shank **10**, and serve to removably support cutting member A from rotor **48**. Plugs **64** are preferably formed from "nylon," or like material.

A bore **66** is formed in the second closed end **30**, and is in axial alignment with recess **62**, and is also in communication with second confined space **36**. When cutting member A is mounted in dental handpiece B (FIG. 1), the shank **10** is disposed in recess **62** and bore **66**, with second passage **18** being in communication with second confined space **36**.

A recess **68** is formed in second closed end **30**, and is in longitudinal alignment with the second confined space **36**. Recess **68** supports a resilient tube **70** through which a bore **72** extends. A first end portion of a water supply line **74** is in sealing engagement with bore **72**, as may be seen in FIG. 4. The water supply line **74** extends longitudinally along the dental handpiece B as shown in FIG. 2, and is connected to a source of water under pressure (not shown).

In use, operation of the invention is relatively simple. One of the cutting members A is mounted in the dental handpiece B in the manner shown in FIG. 2. Air under pressure is caused to discharge through conduit **56** to drive rotor **48**. Water under pressure is caused to discharge through line **74** into second confined space **36**, from which the water flows through first, second, and third passages **16**, **18**, and **20** to discharge onto that portion of the tooth (not shown) being cut, drilled or ground by the rotating body **12**. The discharging water not only cools the body **12**, but the surface of the tooth (not shown) with which the body **12** is in frictional cutting contact.

To prevent water in second confined space **36** from migrating into first confined space **34** and stopping or slowing down the rate of rotation of rotor **48**, the air pressure in first confined space **34** should be maintained at a substantially higher than the pressure of the cooling water in second confined space **36**.

I claim:

1. An air driven, water-cooled dental cutting assembly that includes:

(a) an elongate rigid shank that supports a cutting member in the form of a surface of revolution from a first end thereof, said shank having a transverse bore therein intermediate said surface of revolution and a second end of said shank, and said transverse bore in communication with a longitudinal passage in said shank that extends through said surface of revolution;

(b) a rotor having a longitudinal opening therein that frictionally and removably receives said shank;

(c) a pair of spaced bearings that frictionally engage end portions of said rotor;

(d) a head that includes a cylindrical shell and first and second end pieces, said head defining a first confined space in which said bearings are disposed to rotatably support said rotor, with said shank extending outwardly through a longitudinal bore in said second end piece, and said second end piece having a transverse cavity therein that intersects said bore and is in communication with said transverse bore in said shank;

(e) a cylindrical plug that supports said head from a first end thereof, said plug having at least one first and one second longitudinal passage therein that are in communication with said first confined space, with said first passage serving to have compressed air discharged therethrough at a first pressure to impinge on said rotor to rotate the latter and said shank and cutting member, and said second passage permitting air to escape therefrom to the ambient atmosphere after rotating said rotor; and

(f) first means for discharging water to said cavity in said second end piece at a second pressure less than that of said first pressure to flow through said transverse bore in said shank and said longitudinal passage in said shank and cutting member to cool said cutting member and the body said cutting member is cutting, with said flow of water not impeding the rate of rotation of said rotor by frictional contact therewith due to said air at said first pressure preventing water at said second pressure entering said first confined space.

2. A dental cutting assembly as defined in claim **1** in which each of said bearings is a ball bearing assembly that includes inner and outer races, with said inner races frictionally engaging end portions of said rotors to rotatably support said rotor relative to said head, and said outer races occupying fixed positions in said first confined space.

3. A dental cutting assembly as defined in claim **2** in which a first end of said cylindrical shell is open and said shell has threads formed on the interior surface thereof adjacent said open end, and said first end piece is an externally threaded member that removably engages said threads on said internal surface.

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ROBERT PESHOCK, Primary Examiner

U.S. Cl. X.R.

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