Oct. 14, 1969 A. E. NELSEN ET AL 3,472,045

DENTAL POLISHING APPARATUS

Filed Oct. 4, 1967 2 Sheets-Sheet 1

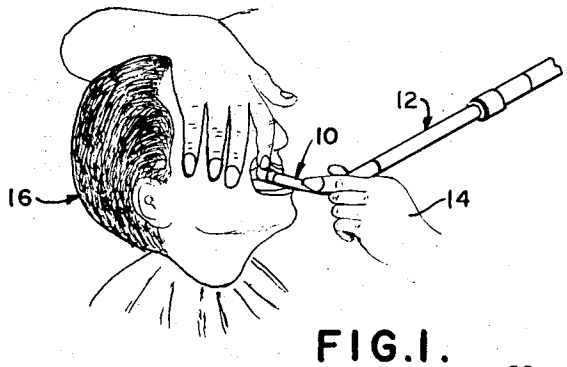

FIG. 1.

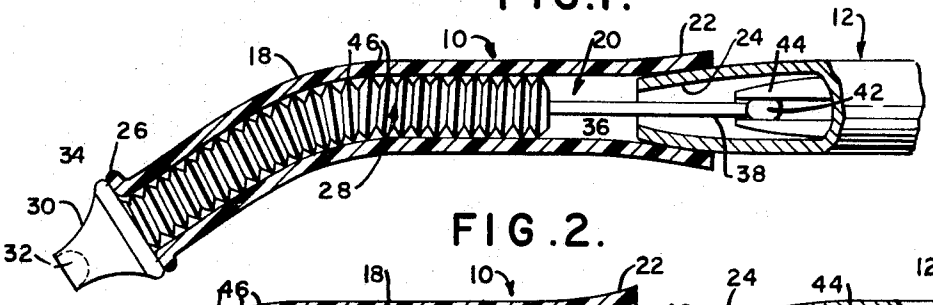

FIG. 2.

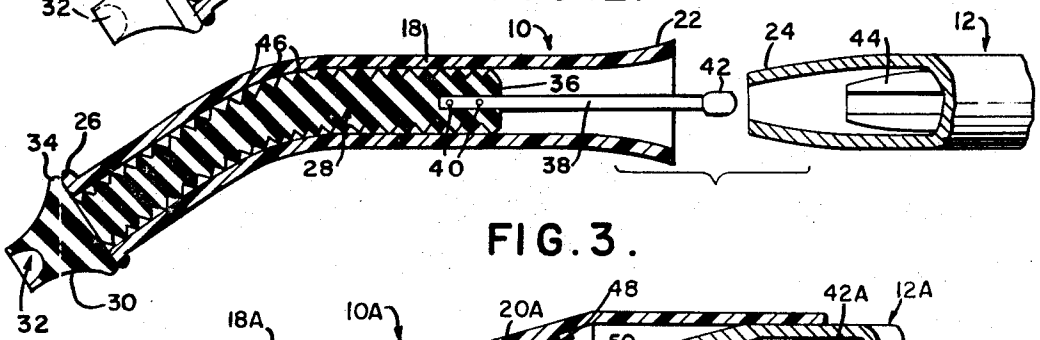

FIG. 3.

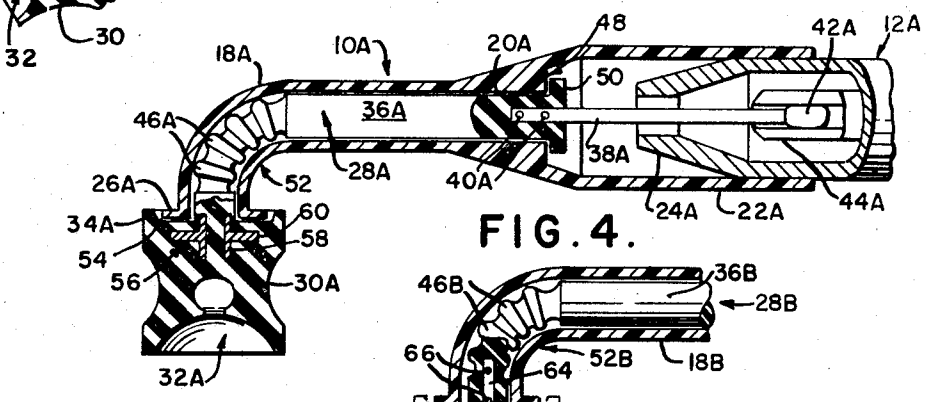

FIG. 4.

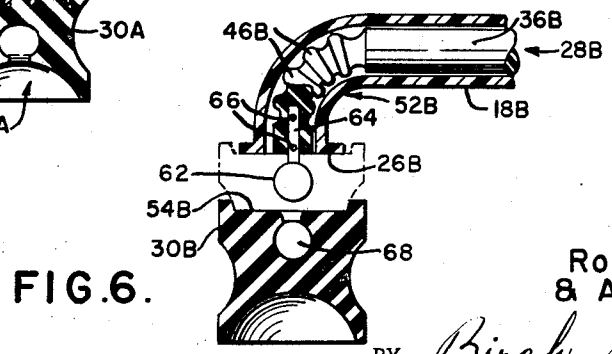

FIG. 6.

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DENTAL POLISHING APPARATUS

Filed Oct. 4, 1967 2 Sheets-Sheet 2

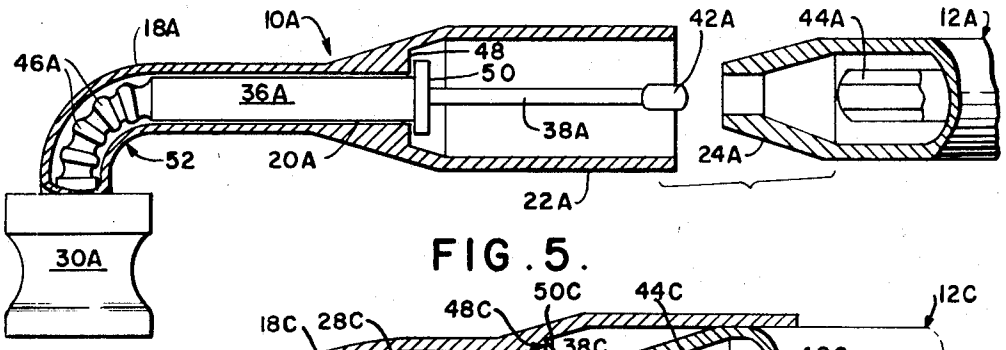

FIG. 5.

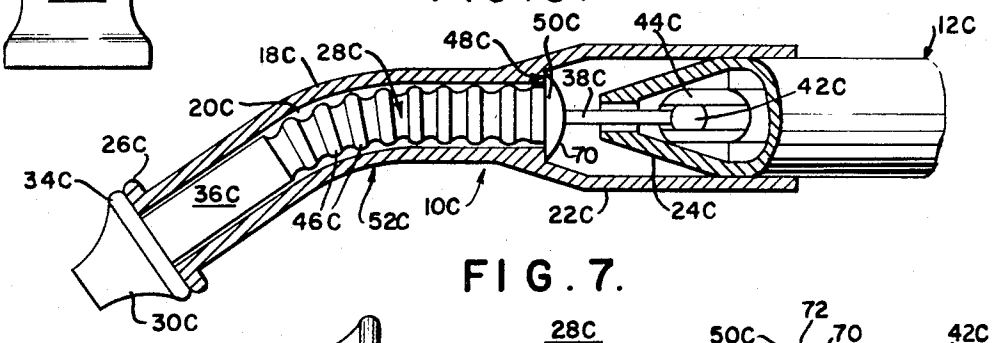

FIG. 7.

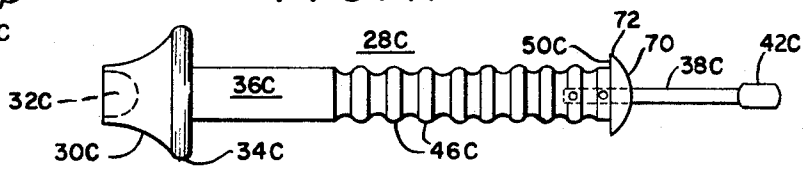

FIG. 8.

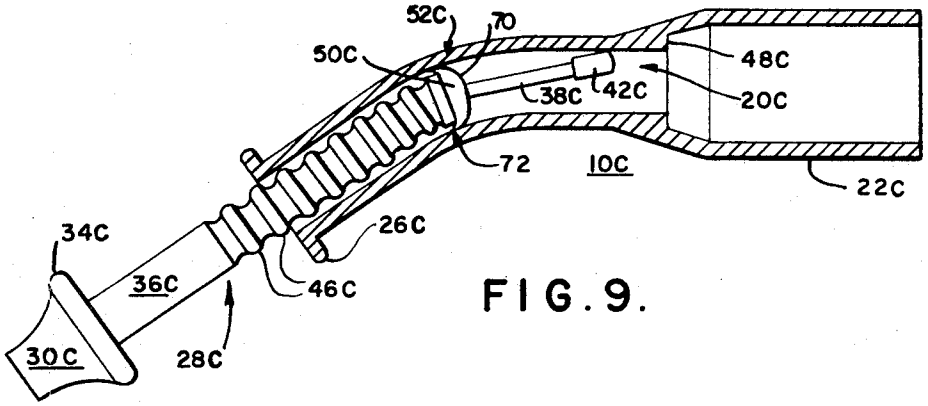

FIG. 9.

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DENTAL POLISHING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A self-protecting tool head for use with abrasive slurries and the like is provided in which a rigid outer tool head housing includes an elastomeric drive shaft and seals which substantially preclude the entrance of foreign material into the housing and provides, in some forms, for ejectment of foreign material from the housing. The structure is such as to provide for disposable use of the tool head structures if desired, the necessity for gearing being precluded by the elastomeric drive shaft.

This invention relates to dental polishing means and, more particularly, to a polishing head assembly adapted to be connected to the power output of conventional dental tools and which is of such simplified and unique construction as to require no maintenance and as to be economically usable as a disposable dental tool of high quality.

Prior art polishing tools, including those currently in widespread use, are comprised of a metal housing, which encloses suitable bearings, a metal drive shaft adapted to be drivably connected with a conventional dental engine, and further includes metal gearing between the drive shaft and an output shaft whereby the output shaft may have a different axis of rotation from the drive shaft. The output shaft includes coupling means designed to removably secure polishing cups or heads of rubber or other elastomeric materials for rotation therewith.

These polishing tools are used with polishing abrasives such as pumice in a slurry or semi-fluid state which ultimately seep into the housings causing excessive wear of the rotating gears, shafts and bearings therein. Therefore, all such polishing tools must be dismantled and subjected to a flushing or scrubbing operation to remove the contaminating abrasive material therefrom after each use.

Further, the metal parts and bearings require lubrication after each use and if lubricant is applied in excess it will seep into the polishing cup area, fouling the polishing abrasive and creating an unsanitary and otherwise undesirable condition.

Failure to maintain such tools in this strict maintenance regimen will result in corrosion and deterioration of the gears, shafts and bearngs therein, requiring replacement of these parts. In such tools the cost of new gears and shafts and the like to restore worn tools is substantially the same as the price of an entire new tool.

Further, when the tool is used as a dental polisher or prophylaxis contra-angle, cleaning after each use is mandatory since the tool, otherwise, would be unsanitary due to the influx of saliva and abrasive into the housing, among the shafts and gears, during use.

The problem is amplified still further when it is considered that either repair or maintenance are time consuming as well as costly and preclude use of the tool by the dentist during such times.

It is, therefore, a primary object of this invention to provide new and novel dental polishing tool or other rotary power tool capable of operating in an abrasive slurry and which obviates the use of gears and rigid shafts.

Another object of this invention is to provide a new and novel dental polishing tool or the like capable of operating in an abrasive slurry and which is of optimum structural simplicity and minimized cost to permit its use as a disposable item, thereby precluding the need and expense of cleaning and sterilizing.

Still another object of this invention is to provide a new and novel dental polishing tool or the like comprising a one-piece rigid housing of metal or plastic and a novel flexible shaft and polishing cup unit inserted therein, the latter being readily removable without the need for special tools or procedures.

Still another object of this invention is to provide for dental polishing tools or the like having a one-piece rigid housing, a new and novel elastomeric flexible shaft insert with either integral or detachable polishing cup means thereon and including an integrally molded drive coupling for engagement with the driving chuck of a dental engine or similar power drive.

Still another object of this invention is to provide for dental polishing tools or the like having a one-piece rigid housing, a new and novel elastomeric flexible shaft insert with either integral or detachable polishing cup means thereon and including an integrally molded drive coupling for engagement with the driving chuck of a dental engine or similar power drive; said insert being easily removable from the housing, without tools, for cleaning and sterilizing or disposal, and replacement, as the case may be.

Still another object of this invention is to provide new and novel disposable dental polishing tool units or the like comprising unitary rigid tubular housings in a selective plurality of configurations and elastomeric flexible shaft means extending through said housings and rotatable therein, said shaft means having integrally molded drive couplings on one end thereof and integrally molded polishing cups or polishing cup retaining means on the other, said tool units being adapted for quick connection to dental engines or similar power drives.

These and other objects of this invention will become more fully apparent with reference to the following specification and drawings, which relate to several preferred embodiments of this invention.

In the drawings:

FIG. 1 is an artist's concept of a dental polishing tool of the present invention in actual use;

FIG. 2 is a side elevation in partial cross-section of a first embodiment of the invention;

FIG. 3 is an exploded view, in partial cross-section, of the embodiment of FIG. 1;

FIG. 4 is a side elevation in partial cross-section of a second embodiment of the invention;

FIG. 5 is an exploded view of the embodiment of FIG. 4;

FIG. 6 is a side-elevation in partial cross-section of a third embodiment of the invention;

FIG. 7 is a side elevation in partial cross-section of a fourth embodiment of the invention;

FIG. 8 is a detail of an integral polishing cup and shaft sub-assembly of the embodiment of FIG. 7 and represents, generally, similar sub-assemblies for the embodiments of FIGS. 2, 3 and 6; and

FIG. 9 is a partially assembled view of the sub-assembly of FIG. 8 in a polishing tool housing of the invention.

Referring in detail to the drawings, and more particularly to FIG. 1, a dental polishing tool **10** of the present invention is shown coupled with a conventional dental engine **12** or other suitable power drive, the tool **10** being held in the hand **14** of a dentist or technician performing dental polishing on a patient **16**.

Now with reference to FIGS. 2 and 3, the dental polishing tool **10** is shown as including a rigid tubular housing

18 of metal or plastic having a central bore 20. An expanded or otherwise suitably formed coupling portion 22 is provided at one end of the housing 18 which is telescopically engageable over the outer tip 24 of the power drive or dental engine 12. The other end of the housing 18 is molded or otherwise suitably formed into an annular bead or boss 26 for a purpose to be hereinafter more fully described.

The tool 10 is further comprised of an integral polishing cup and drive shaft assembly 28, hereinafter refrerred to as sub-assembly 28, the latter comprising an elastomeric polishing cup 30, having an abrasive receiving pocket 32 in the outer tip thereof and an elastomeric annular bead 34 in juxtaposition with the annular boss 26 on the housing 18; an elastomeric shaft 36 integrally formed with the polishing cup 30 and extending through the bore 20 of the housing 18 from a point adjacent the annular boss 26 to a point substantially short of the coupling section 22; and a metal or other substantially rigid axial drive pin 38, integrally molded into the shaft 36 with torque transmitting transverse anchor pins 40 or the like, and having an outer coupling tip 42 extending beyond the coupling section 22 of the housing 18 for selective engagement with a drive chuck 44 in the power drive 12.

The elastomeric shaft 36 of the sub-assembly 28 includes integrally molded auger threads 46 or the like which have the lands thereof in frictional contact with the defining surface of the bore 20. The auger threads 46 are pitched to advance toward the polishing cup 30 during rotation of the sub-assembly 28 for a purpose to be hereinafter more fully described.

Referring additionally to FIGS. 4 and 5, wherein the tool housing is designated as housing 18A, and all like parts bear the suffix A with like numerals to FIGS. 1, 2 and 3, the housing 18A is shown in a substantially ninety-degree (90°) angular configuration as compared with the acute angle deviation shown in FIGS. 1, 2 and 3 for the tool housing 18.

It is to be understood that all curvatures or bends of the tool housings 18, 18A, etc., are contemplated, the only requisite being that the tubular bores 20, 20A, etc., of the said tool housings maintain at least the nominal diameter for same through the area of curvature.

Referring to FIGS. 4 and 5 in greater detail, the tool housing 18A is shown as having an enlarged bore coupling section 22A including an internal annular bearing shoulder 48 at the inner mouth of the tubular bore 20A. The bearing shoulder 48 is engaged by a corresponding annular bearing shoulder 50 integrally molded on the end of the elastomeric shaft 36A of the sub-assembly 28A, concentric with the axial drive pin 38A.

The elastomeric shaft 36A is provided with a plurality of raised annular bosses 46A which are in frictional engagement with the defining surface of the bore 20A in the area 52 of the bend in the tool housing 18A. However, the annular bosses 46A may comprise auger threads such as the threads 46 in FIGS 2 and 3 and/or may extend substantially the full length of the elastomeric shaft 36A.

The annular bead 34A on the polishing cup 30A is formed to provide a depressed annular partial housing or bearing surface 54 for the annular boss 26A on the tool housing 18A.

The polishing cup 30A further includes an integrally molded reinforcement 56 which provides additional rigidity to the shaft 46A and cup 30A both axially and transversely adjacent the annular housing boss 26A. The reinforcement 56 may comprise, in a preferred configuration, co-axially disposed tube 58 with a transversely extending annular flange 60 of a size greater than the bore 20A. This permits the elastomeric shaft 36A to be held in tension in the housing bore 20A between the annular housing boss 26A and the internal bearing shoulder 48 by means of the annular bearings 54 and 50 in respective engagement therewith.

A tensioned elastomeric shaft 36A such as defined in

the embodiment of FIGS. 4 and 5, provides a sealed tool unit 10A, preventing abrasive and saliva from entering the housing 18A. If the annular bosses 46A comprise auger threads such as the threads 46 in the embodiment of FIGS. 2 and 3, any abrasive slurry, saliva or other foreign matter which enters the housing 18A will be auger fed back toward the polishing cup 36A during rotation of the sub-assembly 28A.

The embodiment of FIG. 6 illustrates that the elastomeric shaft 36B (as well as all of the elastomeric shafts for the several embodiments herein and further embodiments) can be adapted to receive interchangeable polishing cups 30B.

As shown in FIG. 6, the elastomeric shaft 36B terminates adjacent the annular housing boss 26B in a first detachable coupling member 62, having a shank 64 with torque transmitting anchor pins 66 or the like integrally molded in axial disposition in the elastomeric shaft 36B.

The coupling member 62 is adapted for detachable engagement with a second detachable coupling member 68 integrally molded or formed in the polishing cup 30B, axially of the annular depressed bearing surface 54B therein.

While a male coupling member 62 and female coupling member 68 are shown on the elastomeric shaft 36B and polishing cup 30B, respectively, it is to be understood that this order may be reversed or substituted by any suitable detachable coupling configuration.

Further, as in the case of the embodiment of FIGS. 4 and 5 and all subsequent or further embodiments herein, the annular shaft bosses 46B may comprise auger threads and/or may be distributed throughout the length of the elastomeric shaft 36B.

Referring to FIGS. 7, 8 and 9, the fourth embodiment of the dental tool 10C to be described herein is shown with like numerals bearing the suffix C identifying like elements of all of the preceding embodiments.

The annular shaft bearing 50C on the elastomeric shaft 36C of the sub-assembly 28C is formed with a convex outer face 70, providing a deformable annular rim portion 72 on the bearing 50C.

As shown in FIG. 9, the deformable rim 72 is adapted to readily deform to permit insertion of the sub-assembly 28C into the tool housing 18C, whereby the sub-assembly 28C may be rapidly replaced by a mere axial insertion thereof in the bore 20C of the tool housing 18C. As clearly shown in FIG. 8, the deformable rim 72 of the bearing 50C expands after passing the annular bearing shoulder 48C to engage same and securely retain the sub-assembly in the tool housing 18C.

The sub-assembly 28C may either be sized for a nominal fit in the tool housing 20C or may be tensioned between the annular housing boss 26C and bearing shoulder 48C as desired.

If a nominal fit is utilized, the diametric fit in the bore 20C is preferably one of frictional engagement and the annular bosses preferably comprise auger threads to thereby render the tool 10C self-cleaning by ejecting foreign matter from the bore 20C between the housing boss 26C and cooperating polishing bead boss 35C.

The entire tool unit 10–10C in any of the foregoing embodiments can be made of such cheap but satisfactory materials as to render the said entire tool unit completely disposable after each use.

Alternatively, the sub-assemblies 28–28C can be made readily removable from the tool housings 18–18C for re-use after cleaning and sterilization. It is particularly advantageous that upon removal of said sub-assemblies from the said tool housings, cleaning is effected by simply swabbing the housing bores 20–20C and wiping the sub-assemblies 28–28C with any suitable cleaning solution.

Both the elastomeric materials of sub-assemblies 28–28C and the plastic or metal materials of the tool housings 18–18C, in combination are not easily deteriorated by abra-

sive particles and require no close machine tolerances to be optimally useful.

The use of annular bosses or auger threads **46–46C** on the elastomeric shafts **36–36C**, provide increased flexibility to the said shafts in negotiating the angular bends **52–52C** in the housing bores **20–20C** of the tools **10–10C**.

In operation, in sealed units such as the embodiments of FIGS. 4 and 5, the bore **20C** is prefilled or premoistened with sanitary wetting agents or the like which, in the case of dental tools, are safe for ingestion by human beings. If the tools are of the readily assembled type utilizing replaceable sub-assemblies **28**, **28B** or **28C**, the said sub-assemblies are simply wetted with such a suitable agent prior to insertion in the bores **20**, **28B** or **28C** of the tool housings **18**, **18B** or **18C**, respectively.

The tools **10–10C** are friction fitted onto the coupling tips **24–24C** of the power drive or dental engines **12–12C** to automatically engage the coupling tips **42–42C** of the drive shafts **38–38C** with the drive chucks **44–44C** of the said power drives. Thus, when the said chucks **44–44C** are rotated, the integral drive shafts **38–38C** cause rotation of the entire sub-assemblies **28–28C** within the bores **20–20C** of the tool housing **18–18C**.

Abrasive slurry is picked up in the abrasive receiving pockets **32–32C** of the polishing cups **30–30C**, rotation of the sub-assemblies **28–28C** initiated, and application of the tip of the said polishing cups to a surface to be polished is effected.

If auger threads **46** are used on the elastomeric shafts, abrasive slurry which tends to enter the bore **70** of the tool housing **18** is forced back out by the auger action of the said auger threads **46**.

In the case of pre-tensioned elastomeric shafts, the resulting pressure at the annular bearing surfaces **34** and **34C** (or **54A** and **54B** as the case may be) and the annular housing bosses **26–26C** as well as that between the integral bearing shoulders **48–48C** and annular shaft bearing bosses **50–50C** act to prevent the admission of abrasive slurry and other foreign matter to the tool housing bores **20–20C**.

As can be readily seen from the foregoing specification and drawings, the present invention provides a long-felt need in the art for an effective, sanitary, cheap, readily repairable and/or disposable dental polishing tool or the like for applying abrasive slurry to surfaces without effecting self-deterioration.

It is to be understood that in all of the embodiments of the invention, the polishing tools **10–10C** have been shown in enlarged form to clearly present the various details of construction. In actual practice, substantial reductions in diameter and overall length can be made to fit the parameters of the particular application.

We claim:

1. A power tool head assembly comprising a hollow rigid housing having inner walls defining an internal bore, an elongated rotary drive shaft of elastomeric material axially disposed within said bore and conforming to the internal contour thereof including substantially annularly disposed, radially extending bosses along a substantial portion thereof engaging said inner walls, a tool head on one end of said drive shaft extending externally of said housing and a relatively rigid drive coupling integral with the other end of said drive shaft, said drive coupling and said housing being adapted to be engaged with a power drive means.

2. The invention defined in claim **1**, wherein said tool head is comprised of elastomeric material and integrally formed with said drive shaft and includes sealing means thereon adapted to be engaged with and to prevent the entry of foreign material into said hollow tool head housing.

3. The invention defined in claim **1**, wherein said bosses comprise continuous spiral convolutions so shaped and so proportioned as to effect an auger feed of any material in said housing toward said tool head during rotation of said drive shaft.

4. The invention defined in claim **3**, wherein said tool head is comprised of elastomeric material and integrally formed with said drive shaft and includes sealing means thereon adapted to be engaged with and to prevent the entry of foreign material into said hollow tool head housing.

5. The invention defined in claim **3**, wherein said assembly comprises a dental polishing tool adapted to be used with an abrasive slurry; and wherein said tool head on said drive shaft comprises a substantially cup-shaped rotary polishing head of elastomeric material, said head having sealing means formed thereon in juxtaposition with said housing to prevent the entry of said abrasive and other foreign matter into said bore.

6. The invention defined in claim **5**, wherein said tool head is detachably coupled to said drive shaft.

7. The invention defined in claim **5**, wherein said tool head is integrally formed with said drive shaft.

8. The invention defined in claim **5**, wherein said housing includes an internal sealing surface around said bore adjacent said rigid drive coupling and wherein said drive shaft includes conformal sealing means formed thereon in juxtaposition with said internal sealing surface.

9. The invention defined in claim **1**, wherein said assembly comprises a dental polishing tool adapted to be used with an abrasive slurry; and wherein said tool head on said drive shaft comprises a substantially cup-shaped rotary polishing head of elastomeric material, said head having sealing means formed thereon in juxtaposition with said housing to prevent the entry of said abrasive and other foreign matter into said bore.

10. The invention defined in claim **9**, wherein said housing includes an internal sealing surface around said bore adjacent said rigid drive coupling and wherein said drive shaft includes conformal sealing means formed thereon in juxtaposition with said internal sealing surface.

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32—59; 64—2