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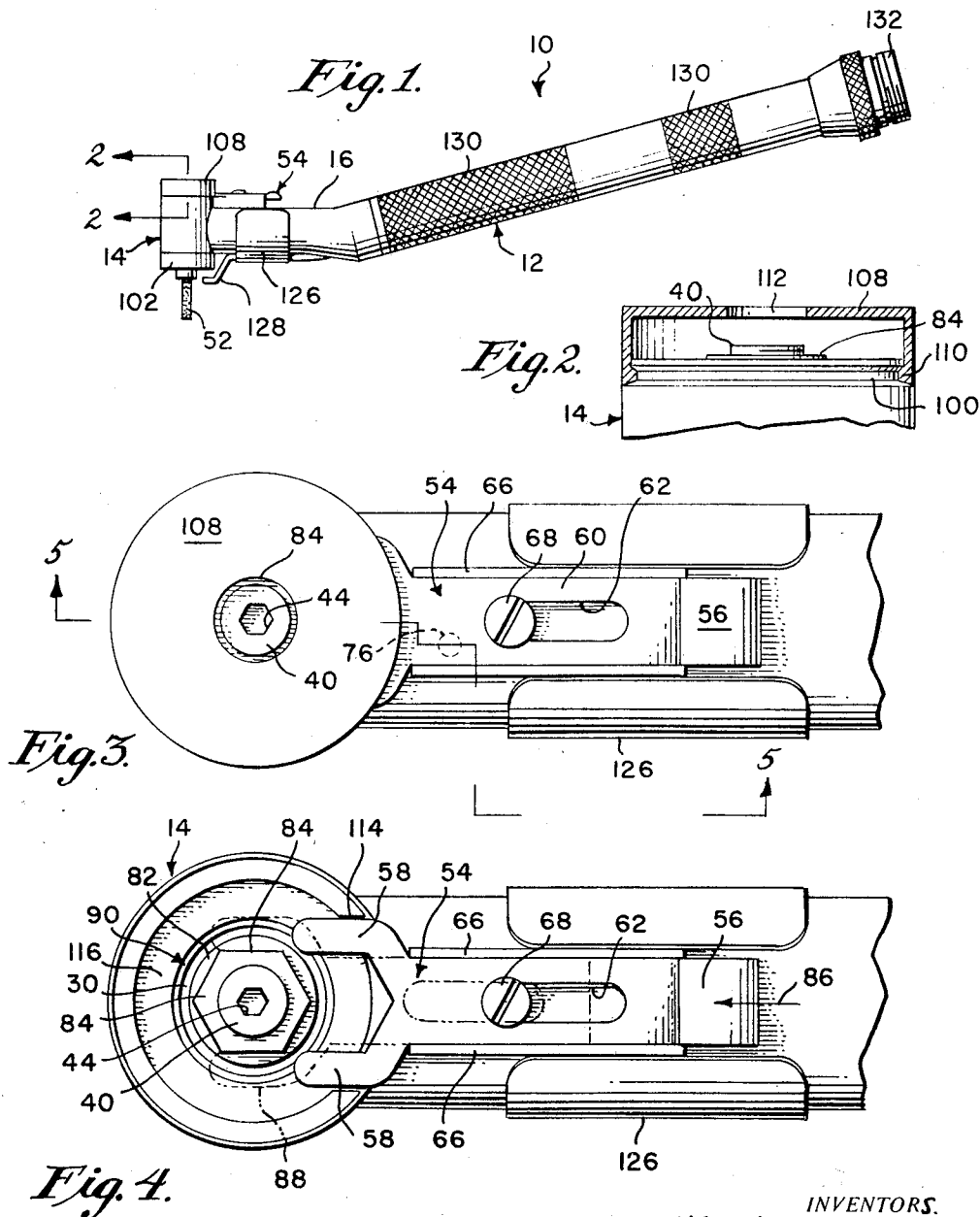
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3,499,223

DENTAL HANDPIECE IN COMBINATION WITH COLLET WRENCH MEANS

Original Filed April 23, 1964

2 Sheets-Sheet 1



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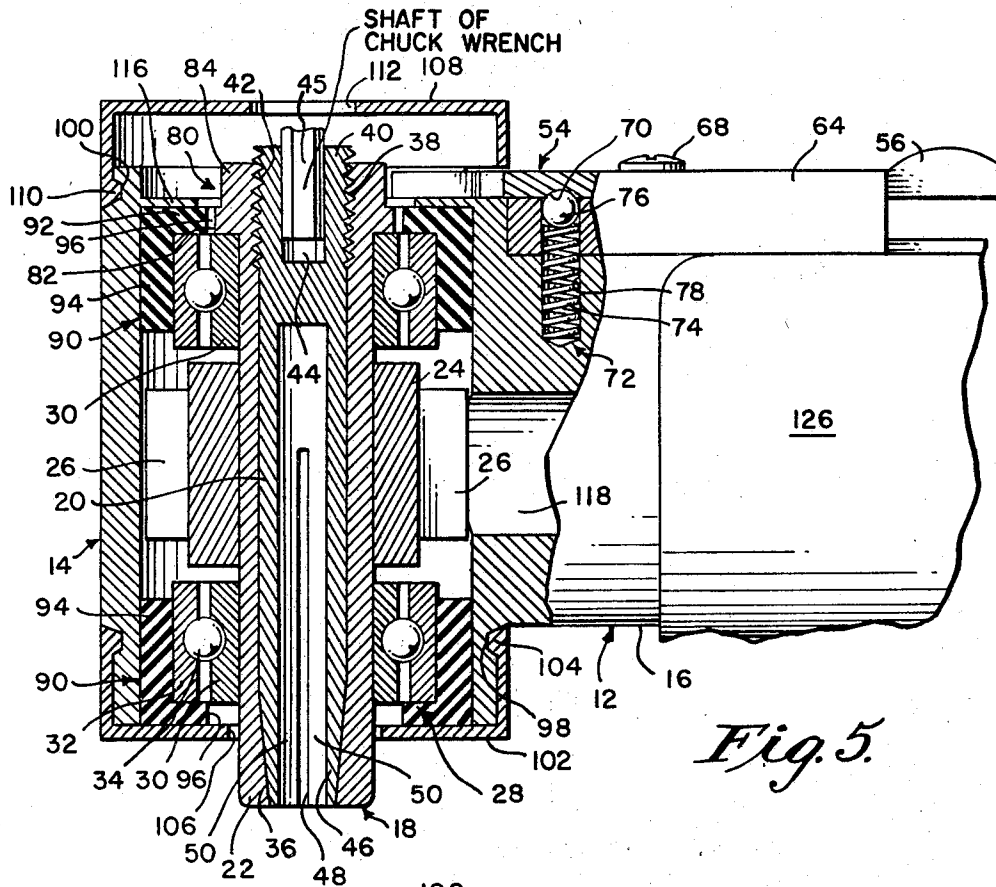


Fig. 5.

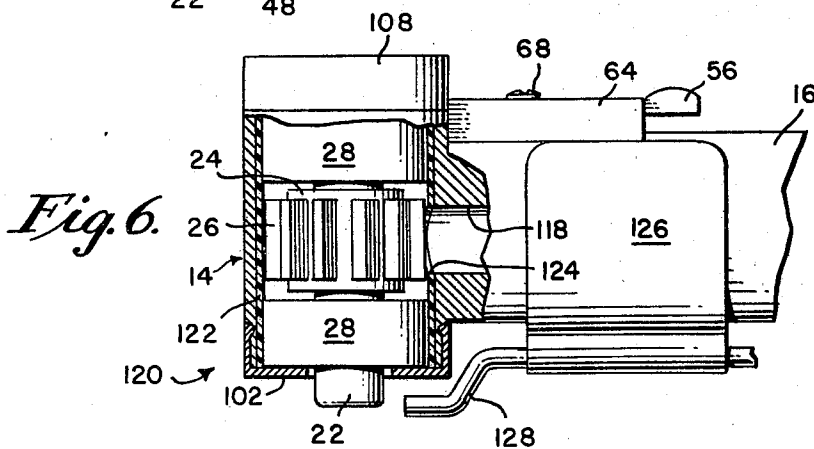


Fig. 6.

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DENTAL HANDPIECE IN COMBINATION WITH COLLET WRENCH MEANS

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Continuation of application Ser. No. 361,988, Apr. 23, 1964. This application Jan. 22, 1968, Ser. No. 699,428
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15 Claims

ABSTRACT OF THE DISCLOSURE

A dental handpiece including turbine rotor means having a hollow bore and a collet chuck threadedly mounted within the bore. The collet chuck is adapted to secure a dental bur within the bore through longitudinal movement of the collet within the bore. A locking wrench is provided for engaging the rotor means at a position spaced from the rotor blades to prevent rotation of the rotor means while a shaft of non-circular cross-section is used for rotating the collet chuck in the threaded means to move the chuck within the rotor means.

This application is a continuation of application Ser. No. 361,988, filed Apr. 23, 1964, now abandoned.

This invention relates to a dental handpiece and has as an object the provision of a device which is an improvement over that disclosed and claimed in our prior United States Patent No. 3,120,706.

High-speed air driven dental handpieces are now in common usage. These handpieces can attain rotational speeds of as high as 400,000 r.p.m. However, these high speed techniques have also brought on attendant problems, such as decreased bur life and a lack of concentricity of the rotating bur. In one aspect of this invention, the effects of these problems are substantially lessened.

Another aspect of this invention relates to a novel and improved device for preventing the rotation of the air turbine when changing burs in a handpiece similar to that disclosed and claimed in our aforementioned Patent No. 3,120,706. In our prior handpiece a resilient finger projected out of the side of the turbine housing, and was depressible for preventing the rotation of the turbine when moving the collet within the rotor shaft. In the handpiece of this invention, a wrench means is provided to prevent the rotation of the shaft. However, this wrench means is provided on the handpiece housing and will not increase the effective size of the turbine housing, as will the resilient finger. Additionally, the wrench means includes locking means alongside the shaft used for permitting the moving of the collet within the rotor shaft.

It is therefore an object of this invention to provide a novel dental handpiece.

It is another object of this invention to provide an air driven dental handpiece having increased torque.

It is a further object of this invention to provide an air driven dental handpiece having reduced noise.

It is a further object of this invention to provide an air driven dental handpiece having reduced vibration.

It is a further object of this invention to provide an air driven dental handpiece in which the bur will rotate with greater concentricity than that previously accomplished by the prior art air driven dental handpieces.

It is a further object of this invention to provide an air driven dental handpiece which results in increased bur life during use.

It is a further object of this invention to provide an air driven dental handpiece with a novel chuck assembly.

It is a further object of this invention to provide a turbine-driven dental handpiece having a novel chuck wrench therefor.

These and other objects are accomplished by providing a dental handpiece including a tubular housing, a chuck housing at one end of said tubular housing, rotatable means within said chuck housing comprising rotor means having a hollow bore, a collet mounted within said bore, and bearing means for said rotor means, and vibration dampening means spacing said rotatable means from said chuck housing.

In another aspect of this invention there is provided a dental handpiece comprising a tubular housing, a chuck housing on one end thereof, a turbine cartridge within said chuck housing comprising rotor means having a hollow bore, a collet mounted within said bore and secured to said rotor means, said collet comprising a plurality of compressible jaws at one end thereof separated by slits, said jaws being longitudinally tapered, said bore tapering at the same end as said jaws, the taper of said bore complementing said taper on the collet jaws, said bore being internally threaded at the end opposite the tapered end, said collet being externally threaded at the end opposite the tapered end, whereby the collet is threadedly connected to the rotor means, said collet being longitudinally movable with respect to said bore, and means slidably mounted on said tubular housing for engaging said rotor means and preventing rotation thereof.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a side elevational view of the dental handpiece of this invention;

FIG. 2 is an enlarged sectional view taken along the line 2-2 of FIG. 1;

FIG. 3 is an enlarged plan view of the forward end of the handpiece shown in FIG. 1;

FIG. 4 is an enlarged plan view, similar to FIG. 3, but with the end cap removed;

FIG. 5 is an enlarged sectional view taken along the line 5-5 of FIG. 3, and further showing the wrench used for moving the collet chuck; and

FIG. 6 is a side elevational view of the forward end of the handpiece of FIG. 1, partially broken away, and showing a modified form of the invention.

Referring now in greater detail to the various figures of the drawings wherein similar reference characters refer to similar parts, a dental handpiece embodying the present invention is generally shown at 10 in FIG. 1. Device 10 basically comprises a tubular housing 12 having a rotor housing 14 on one end thereof. Tubular housing 12 includes a contra-angle section 16 adjacent rotor housing 14.

As best seen in FIG. 5, chuck housing 14 has a turbine cartridge 18 mounted therein. Turbine cartridge 18 comprises a collet 20, a rotor or turbine shaft 22, a hub 24 mounted on said rotor shaft, rotor or turbine blades 26 projecting from said hub, and ball bearings 28. Hub 24 is welded or otherwise secured to the exterior surface of rotor shaft 22. Ball bearings 28 include inner races 30, outer races 32, and balls 34. Ball bearings 28 are of a conventional type and may include sealing rings, if desired.

As seen in FIG. 5, rotor shaft 22 has a bore of substantially uniform thickness. However, the base of the bore tapers inwardly, thereby having a gradually increasing wall thickness at the bottom or base of the bore. This gradually increasing wall thickness is shown at 36 in FIG. 5. The top portion of the bore of shaft 22 is internally threaded, as shown at 38.

Mounted within the rotor shaft 22 is collet chuck 20. The central portion of collet 20 is tubular in shape. The top portion 40 is cylindrical and integral with the central portion. Top portion 40 is externally threaded, as shown at 42. Threads 42 are engaged with the internal threads 38 of rotor shaft 22. Top portion 40 has an axial opening 44 formed therein. Opening 44 is hexagonal in shape, but other polygonal geometric shapes of non-circular cross-section may also be used.

The wall thickness of the central portion of collet 20 is uniform. However, the wall tapers inwardly at the bottom portion 46 of the collet. The angle of taper 46 is complementary to the angle of taper 36 of rotor shaft 22. Thus the external surface of collet 20 abuts the internal surface of rotor shaft 22 throughout their respective lengths. Collet 20 includes two longitudinal slits 48 (one shown) which extend from the lower end thereof through substantially two-thirds of the length of the collet. These slits form two jaws 50 in the collet. When a clamping force is exerted on the jaws 50, they are compressed toward each other, thereby exerting a positive clamping or chucking action on the shank of a dental bur inserted therein.

To the extent described, the handpiece of this invention is substantially identical to that shown in our prior United States Patent No. 3,120,706. One of the novel features of this invention is the means for preventing rotation of the rotor shaft when inserting a dental bur into the collet. Thus, as described in greater detail in United States Patent No. 3,120,706, a dental bur 52 (FIG. 1) is placed within the jaws of collet 20. The shank of the bur is then clamped in place by moving collet 20 downwardly with respect to rotor shaft 22. The action of tapered surface 36 of the rotor shaft against tapered surface 46 of the collet causes the compression of the collet jaws 50. This downward or longitudinal movement is accomplished by rotating collet 20 in a clockwise direction, thereby advancing the threaded portion 42 of the collet in the threaded portion 38 of the rotor shaft. To accomplish this rotation, a chuck wrench having a shank or shaft 45 with a non-circular cross-section such as a hexagonal cross-section, is inserted in opening 44 and rotated in the desired direction.

As is apparent from FIG. 5, since collet 20 abuts and frictionally engages rotor shaft 22 throughout their entire respective lengths, and the collet and rotor shaft are threadedly secured at their tops, rotation of the collet will cause the simultaneous rotation of the rotor shaft 22, which is freely rotatable in ball bearings 28. Thus in order to move collet 20 longitudinally with respect to rotor shaft 22, it is necessary that the rotor shaft be held stationary during the movement of the collet. In our prior aforementioned patent, a resilient finger mounted on rotor housing 14 was used to prevent this rotation. Thus the finger was inserted through an opening in the housing and when depressed, engaged the rotor blades 26 thereby preventing their rotation. In this invention, a slidable wrench, generally shown at 54 in FIGS. 3, 4 and 5, is used to prevent the rotation of the rotor shaft when the collet 20 is moved relative thereto. In combination, the chuck wrench having shank 45 and wrench 54 form collet wrench means.

Wrench 54 comprises a substantially flat plate, but has a raised shoulder 56 (FIG. 5) at the rear end thereof. The front end of wrench 54 flares outwardly into a pair of parallel jaws 58. The jaws are so configured as to have the same appearance and function as a conventional open-end wrench. The central portion 60 of wrench 54 is provided with a longitudinal slot 62.

Wrench 54 is slidably mounted in block 64, which is in turn welded or otherwise secured to tubular housing 12. The top surface of block 64 is provided with a longitudinal channel, thereby leaving a recessed central portion with upstanding walls 66 (FIGS. 3 and 4). As best seen in FIG. 5, the top of wrench 54 lies in the

same horizontal plane as the top of walls 66. A set screw 68 passes through slot 62 and is secured in block 64. The underside of wrench 54 is provided with an arcuate recess 70 (FIG. 5). A detent generally shown at 72 in FIG. 5 releasably engages recess 70. Detent 72 comprises a coiled spring 74 having a ball 76 mounted thereon. The ball is received in recess 70. The spring 74 is mounted within a hole 78 which is tapped through block 64 and into a thickened wall of tubular housing 12.

The top of the rotor shaft 22 is provided with an enlarged portion generally shown at 80 in FIG. 5. Enlarged portion 80 includes an annular shoulder 82 which rests on inner race 30 of upper ball bearing 28. The top portion 84 of shoulder 82 is cut to a hexagonal cross section (FIG. 4).

A bur is inserted in collet 20 by first sliding wrench 54 in the direction of arrow 86 (FIG. 4) until the hexagonal portion 84 of the rotor shaft is engaged by the jaws 58 of the wrench. This engagement is shown in phantom at 88 in FIG. 4. Since the wrench 54 is maintained between walls 66 by set screw 68, it is only slidable and cannot be rotated. Therefore, when the jaws 58 engage the upper portion 84 of the rotor shaft, the rotor shaft will also be prevented from rotating. After portion 84 has been engaged by wrench 54, the chuck wrench having a hexagonal shank or shaft 45 is inserted into opening 44 of the collet, and rotated in a counter-clockwise direction with respect to the position shown in FIG. 5. This rotation of the collet causes it to rise relative to the stationary rotor shaft 22, thereby permitting jaws 50 to expand, since they will no longer be compressed by the tapered walls 36 of the rotor shaft. After the jaws have expanded, the shank of a dental bur is inserted within them. The shank is then clamped in place by rotating the collet in a clockwise direction, thereby causing the compressing of the jaws as they contact the tapered surface 36 of rotor shaft 22. With the bur held securely in place, the wrench 54 is then slid rearwardly to the position shown in full line in FIGS. 3, 4 and 5. This will permit the rotor shaft to again freely rotate, since it will no longer be in contact with the wrench 54. Thus it is seen in FIG. 5, that with the wrench in its rearward position, it will not be in contact with any of the rotating parts in rotor housing 14. Attention is also called to the fact that the rearward and forward movement of wrench 54 are facilitated by shoulder 56, which is easily manipulated by the thumb of the user of the handpiece.

Another feature of the handpiece of this invention is the provision of vibration dampening rings generally shown at 90 in FIG. 5. Rings 90 comprise disks 92 and annular dependent flanges 94 projecting from the outer edge of each disk. Each disk is provided with a central hole 96.

The rings 90 are telescoped over the upper and lower ball bearings 28. Flanges 94 contact the outer lateral surfaces of outer races 32. Disks 92 contact the upper edges of outer races 32. Holes 96 are of a sufficient diameter that the edges of disks 92 adjacent the holes are laterally spaced from the inner races of the ball bearings. Thus, the stationary rings 90 will not interfere with the rotating inner races 30.

Rings 90 can be made of any material which will mechanically insulate the metal ball bearings and their associated metal structure from the metallic rotor housing 14. By having this insulation, a vibration dampening effect is obtained. Prior to this invention the ball bearings in dental handpieces were directly in contact with the chuck housings. The handpiece of prior Patent No. 3,120,706 is exemplary of this structure. Materials that are suitable for rings 90 are natural and synthetic rubber, Teflon (polytetrafluoroethylene), nylon, other rigid plastics, and rigid plastic foams. The rings are made to be of a sufficient diameter as to have the outer circumference of flanges 94 frictionally engage the inner wall of rotor housing 14.

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Rotor housing 14 is basically tubular and has its upper and lower ends open. An annular groove 98, as seen in FIG. 5, is formed in the outer circumference of housing 14 adjacent the bottom thereof. A second annular groove 100 is formed in the outer circumference of rotor housing 14 adjacent the top thereof. An end cap 102 having an annular flange 104 projecting inwardly from the walls thereof is mounted on the bottom of rotor housing 14. End cap 102 is made of a resilient metal and is secured in place by a snap fit of flange 104 in groove 98. End cap 102 is provided with a central hole 106 which has a diameter sufficiently large to permit the rotor shaft 22 to project therethrough.

An end cap 108 having an annular flange 110 is secured on the top of rotor housing 14. This securement is also obtained by snapping flange 110 into groove 100. End cap 108 is provided with a central hole 112 which is of a sufficient diameter to permit the insertion of the shank of a chuck wrench into hexagonal hole 44 of collet 20. Thus when it is desired to remove or insert a bur into the handpiece, the collet can be moved without removing the end cap 108.

End cap 108 is also cut away on one side thereof to permit wrench 54 to slide therethrough. Additionally, as seen in FIG. 4, rotor housing 14 is provided with an opening 114 to permit the sliding of wrench 54 therethrough. Thus the wrench is easily utilized without removing end cap 108.

Another feature of this invention is that the turbine cartridge is easily removed from rotor housing 14 and replaceable, should it become necessary to do so. As previously pointed out, the turbine cartridge comprises the collet 20, rotor shaft 22, hub 24, rotor blades 26, and ball bearings 28. When the turbine cartridge is removed, rings 90 can likewise be removed. This removal is accomplished by first removing end caps 102 and 108. These caps are removed by any conventional tool, such as a screw driver, by snapping the flanges out of their corresponding recesses. With the end caps removed, a pushing instrument is inserted into the top of rotor housing 14 and the entire cartridge assembly is pushed through the bottom of the chuck housing. A new cartridge can then be inserted by pushing it in from the bottom of the chuck housing. A total utilizable for this purpose is shown in our aforementioned Patent No. 3,120,706. In order to insure that the cartridge is inserted to the proper position, an annular flange 116 (FIG. 5) is mounted in rotor housing 14. When the cartridge is inserted to its proper position, ring 90 will contact flange 116. Since the flange is positioned below slidable chuck wrench 54, it will not interfere with the proper functioning of the chuck wrench. When the cartridge is properly inserted, lower ring 90 will contact end cap 102. Therefore, the cartridge will be held securely in place.

After a dental bur is secured in collet 20 as described above, the handpiece is ready for use. In use, air is fed through tubular housing 12 and through a conduit (not shown) in contra-angle section 16. This air causes the rotation of the rotor comprising shaft 22, hub 24 and blades 26. Exhaust air is then passed through conduit 118 in contra-angle section 16 and then through tubular housing 12. It is thus seen that the air will cause the rotation of the rotor and its associated collet 20 in a clockwise direction, as viewed in FIG. 5. If desired, of course, by reversing the inlet and exhaust channels, the direction of rotation can be made to be counterclockwise.

A modified embodiment of this invention is generally shown at 120 in FIG. 6. In this embodiment, rings 90 are replaced by a vibration dampening tube 122 which is glued or otherwise secured to the inner wall of rotor housing 14. Thus, this tube serves the same effect as rings 90 in that it mechanically insulates the turbine cartridge from the rotor housing 14. The tube 122 can be made of any of the materials used for rings 90. Thus rubber, 75

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Teflon, nylon, other rigid plastics and rigid plastic foams may be used. Any of the well known adhesives for securing these materials to metals can be used for holding them in place. A preferred material for the embodiment shown at 120 is Teflon. This material is preferred because of its ease of machinability, the fact that it does not absorb water, and the fact that it provides an extremely smooth surface for inserting the turbine cartridge. An adhesive found particularly effective for holding the Teflon tube in place is Eastman 910 cement, which is a cyanoacrylate cement.

The tube 122 is provided with an opening 124 which is aligned with conduit 118. A second opening is provided which is aligned with a conduit for the incoming air. In all other respects, embodiment 120 is substantially identical to embodiment 10 described above. If desired, a Teflon coating can be placed on the inner surface of flange 116 and the inner surface of end cap 102 to completely insulate the turbine cartridge from the rotor housing 14.

The handpiece of this invention includes many of the other details of the handpiece disclosed in Patent No. 3,120,706. Thus a clip 126 having air and water spray tubes 128 is mounted on contra-angle section 16. The supply of the air and water for these tubes is furnished through conduits within tubular housing 12. Additionally, tubular housing 12 is provided with knurled portions 130 to promote easier handling. The rear end of housing 12 is externally threaded, as shown at 132, to receive an adaptor nut for air and water supply tubes.

It is thus seen that the handpiece of this invention provides a novel means 54 for preventing the rotation of the rotor during the insertion and removal of a dental bur into the handpiece. Slidable wrench 54 is easily used since it forms an integral part of the handpiece. However, it will not interfere with normal operation of the handpiece and does not affect the size of the rotor housing 14. Detent 72 aids in preventing the inadvertent sliding of wrench 54 into the rotor shaft when the shaft is rotating.

The vibration dampening rings 90 and tube 122 have been found to be of significant influence in the operation of the handpiece. Thus these vibration dampening means have resulted in increased torque, reduced noise, reduced vibration, greater concentricity of the rotating bur, and increased bur life, because of the lack of eccentricity.

Without further elaboration, the foregoing will so fully illustrate my invention, that others may, by applying current or future knowledge, adapt the same for use under various conditions of service.

What is claimed as the invention is:

1. A dental handpiece including a tubular housing, a rotor housing at one end of said tubular housing, rotatable means within said rotor housing comprising rotor means having rotor blades and a hollow bore, a collet mounted within said bore, said collet being secured to said rotor means, said collet comprising a plurality of compressible jaws at one end thereof separated by slits, said jaws being longitudinally tapered, said bore tapering at the same end as said jaws, the taper of said bore complementing said taper on the collet jaws, said bore being internally threaded at the end opposite its tapered end, said collet being externally threaded at the end opposite its tapered end, whereby the collet is threadedly connected to the rotor means, said collet being longitudinally movable with respect to said bore, means slidably mounted on said tubular housing for engaging said rotor means at a position spaced from said rotor blades for preventing rotation thereof, bearing means for said rotor means, and vibration dampening means spacing said rotatable means from said rotor housing.

2. The dental handpiece of claim 1 and further including an annular flange projecting inwardly from the wall of said rotor housing, said flange being positioned below said slidable means, said flange serving to limit the movement of said rotatable means toward said slidable means.

3. A dental handpiece comprising a tubular housing, a

rotor housing on one end thereof, a turbine cartridge within said rotor housing comprising rotor means having rotor blades and a hollow bore, a collet mounted within said bore and secured to said rotor means, said collet comprising a plurality of compressible jaws at one end thereof separated by slits, said jaws being longitudinally tapered, said bore tapered at the same end as said jaws, the taper of said bore complementing said taper on the collet jaws, said bore being internally threaded at the end opposite its tapered end, said collet being externally threaded at the end opposite its tapered end, whereby the collet is threadedly connected to the rotor means, said collet being longitudinally movable with respect to said bore, and means slidably mounted on said tubular housing for engaging said rotor means at a position spaced from said rotor blades for preventing rotation thereof.

4. The dental handpiece of claim 3 wherein the means for moving the collet longitudinally comprises an opening in the end adjacent the external threading, said opening being adapted to receive a chuck wrench.

5. The dental handpiece of claim 3 wherein said rotor means comprises a plurality of rotor blades.

6. The dental handpiece of claim 3 wherein said slidably mounted means comprises a plate having a pair of spaced jaws at one end thereof, said rotor means having at least two flat sides which are engageable by said spaced jaws, with said spaced jaws being adapted to be slid into and out of engagement with said flat sides.

7. The dental handpieces of claim 6 wherein said plate includes a shoulder adapted to aid in the sliding thereof.

8. The dental handpiece of claim 7 wherein said plate further includes a longitudinal slot formed therein, with means secured on said tubular housing and positioned within said slot to limit the distance through which said plate may be slid.

9. The dental handpiece of claim 6 and further including detent means to releasably hold said spaced jaws out of engagement with said rotor means.

10. The dental handpiece of claim 9 wherein said detent means comprises a resiliently mounted ball positioned beneath said plate, with said plate being provided with a recess in its undersurface, said ball being engaged in said recess when said spaced jaws are out of engagement with said flat sides.

11. The dental handpiece of claim 6 and further including a block mounted on said tubular housing adjacent said rotor housing, said block having a channel formed in its upper surface, said plate being slidable in said channel.

12. The dental handpiece of claim 6 wherein said rotor has an axis of rotation which is substantially perpendicular to the longitudinal axis of said tubular housing, said rotor housing having an open upper and lower end, each of said ends being closed by end caps, and the upper end of said rotor housing and the upper end cap being provided with openings through which said plate passes.

13. The dental handpiece of claim 12 wherein said

rotor housing is provided with an internal flange, said flange being positioned below said plate, and being adapted to limit the upward movement of said rotor means relative to said plate.

14. In combination, a turbine-driven dental handpiece and collet wrench means therefor, said handpiece comprising a housing, a turbine rotor having a plurality of rotor blades rotatably mounted within said housing and having a bore extending therethrough, a collet chuck threadedly received within said bore, said chuck having a first bore extending inwardly from one end thereof for receiving a dental bur and also having a second bore of non-circular cross sectional configuration extending inwardly from the opposite end thereof, and an end opening in said housing in axial alignment with said second bore for access thereto, said wrench means including a shaft of non-circular cross sectional configuration slidably and removably received within said second bore of said chuck, and locking means provided by said wrench means and said rotor alongside said shaft and at a position spaced from said rotor blades for releasably locking said rotor against rotation relative to said housing.

15. In combination, a turbine-driven dental handpiece and a collet wrench therefor, said handpiece comprising a housing, a turbine rotor having a plurality of rotor blades rotatably mounted within said housing and having a bore extending therethrough, a collet chuck threadedly received within said bore, said chuck having a first bore extending inwardly from one end thereof for receiving a dental bur and also having a second bore of non-circular cross sectional configuration extending inwardly from the opposite end thereof, and an end opening in said housing in axial alignment with said second bore for access thereto, means including a shaft of non-circular cross sectional configuration slidably and removably received within said second bore of said chuck, and locking means provided by said wrench and said rotor alongside said shaft and at a position spaced from said rotor blades for releasably locking said rotor against rotation relative to said housing.

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U.S. Cl. X.R.

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