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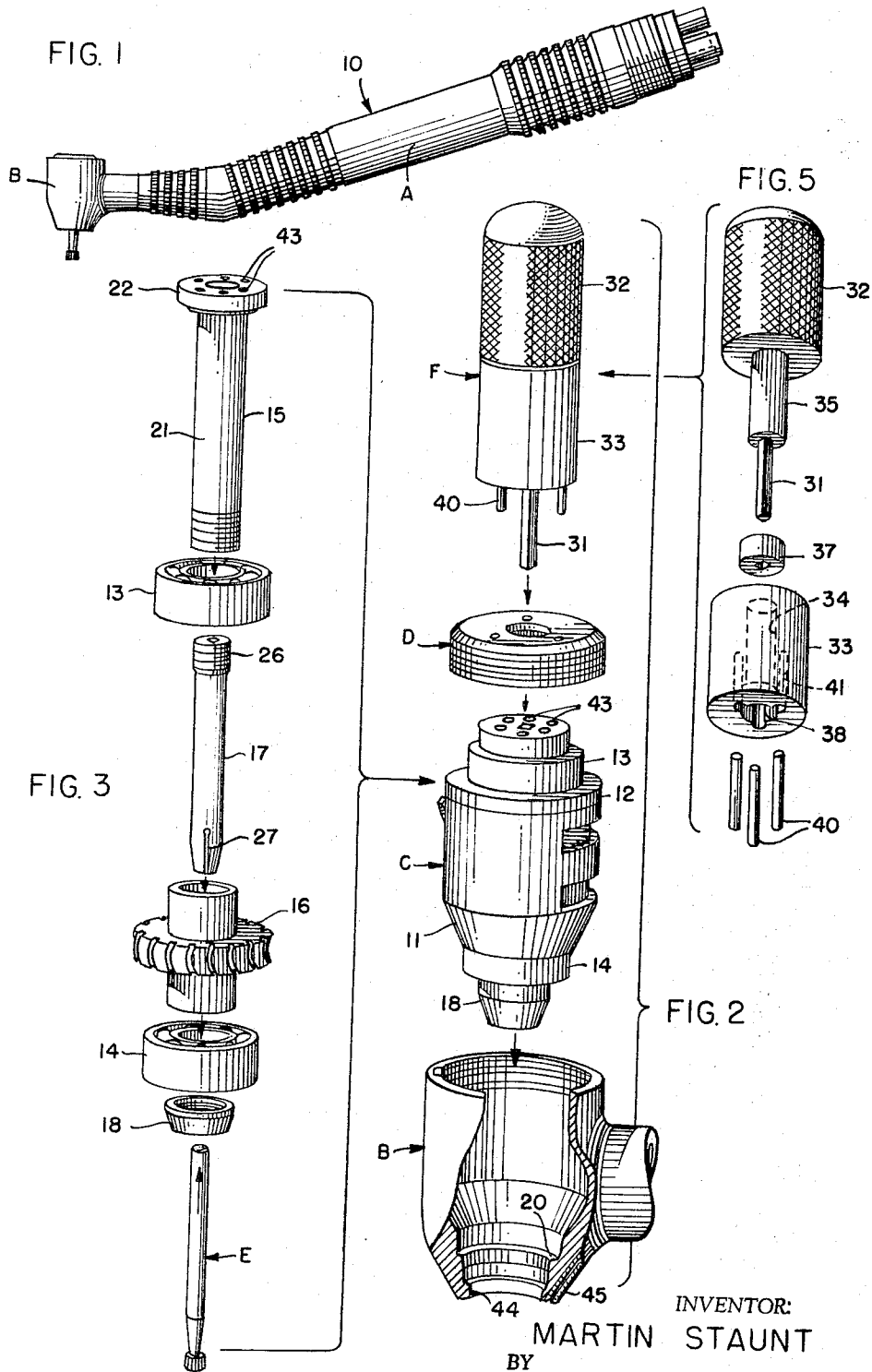
M. STAUNT

**3,325,899**

DENTAL HANDPIECE AND COLLET WRENCH THEREFOR

Filed Sept. 25, 1964

2 Sheets-Sheet 1



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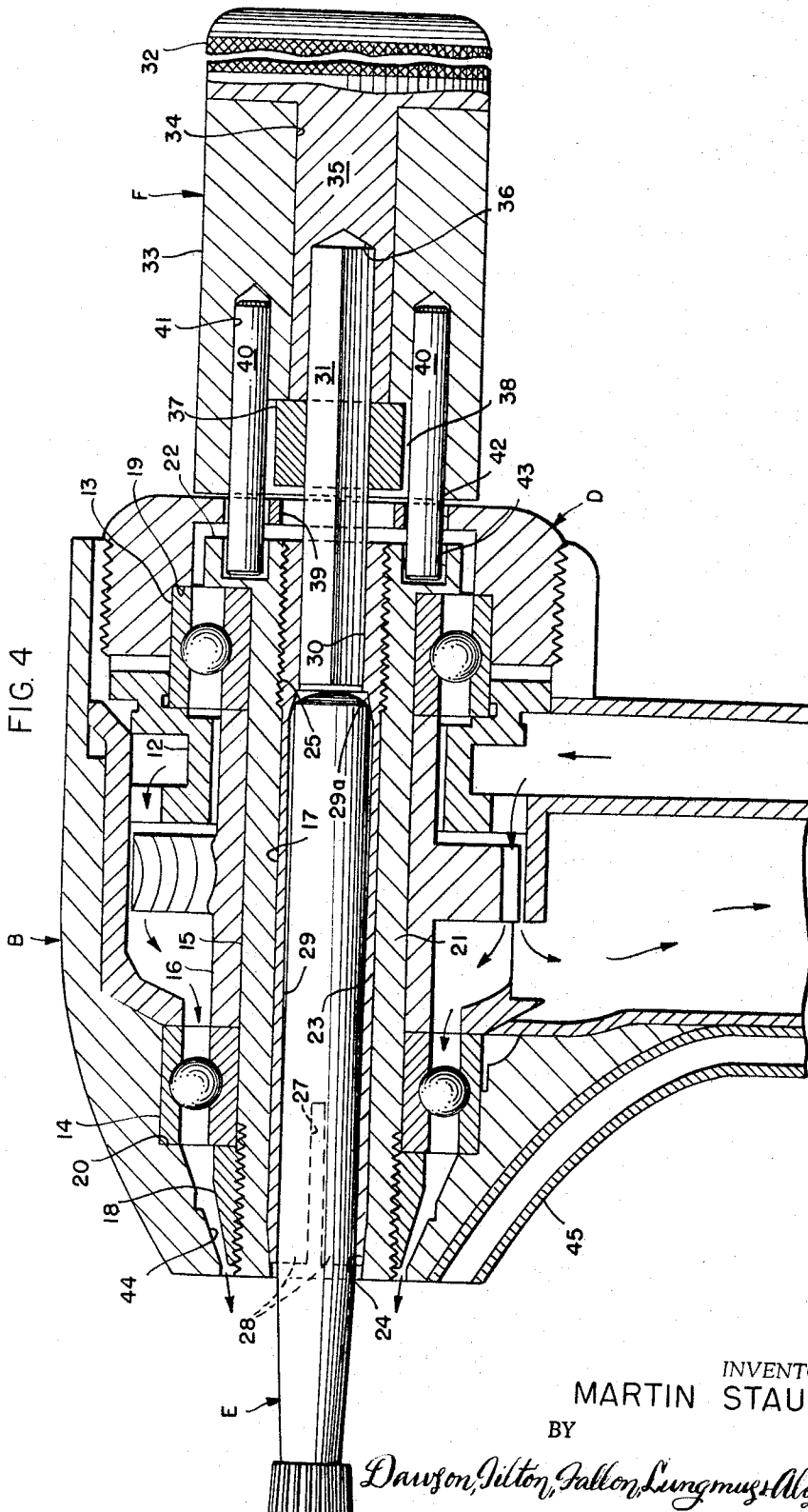
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2 Sheets-Sheet 2



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## DENTAL HANDPIECE AND COLLET WRENCH THEREFOR

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### ABSTRACT OF THE DISCLOSURE

The combination of a collet-equipped dental handpiece and a wrench for adjusting the collet, the wrench having a non-circular shaft insertable into a central end-wall opening in the handpiece for rotating the collet, and having one or more parallel locking pins which fit into sockets in the rotor through an opening in the same end wall of the handpiece for holding the rotor stationary during such adjustment.

Collets have long been known in the art, including the dental handpiece art, for releasably holding tools or burs in place. In the case of conventional belt-driven handpieces the provision of collets which may be readily adjusted has posed no difficult problem; such a collet is expanded or contracted in its tubular rotor simply by screwing it axially one way or the other while the end of the rotor (normally the end provided with a belt-engaging pulley) is gripped between the fingers and is thereby prevented from rotating. In a turbine-driven handpiece, however, a special problem arises because the rotor is fully encased and cannot be locked against rotation in the usual manner.

While efforts have been made to develop a satisfactory means for locking the rotors of turbine-driven handpieces during collet adjustment such efforts have been generally unsatisfactory. For example, in one proposed construction the rotor housing is provided with a side opening through which a tool may be inserted to engage the turbine blades and lock the rotor against movement. Such an opening is undesirable because it constitutes an access port for moisture and particulate matter which might enter the rotor chamber and interfere with turbine operation. Furthermore, such an opening provides an outlet for turbine-driving air which not only reduces turbine efficiency but which also directs a lateral stream of air to dry the membranes of the mouth and cause considerable patient discomfort. There is also the serious possibility that even with careful manipulation of the rotor-locking tool the precisely-formed and delicate blades of the turbine may be damaged or deformed when such a tool is braced against them during collet adjustment.

In a modified construction, the access opening has been eliminated and the end of the rotor adjacent the bur is provided with an extension of non-circular or hexagonal cross section. A wrench is fitted upon the extension to hold the rotor stationary as the collet is rotatably adjusted therein. While such a design eliminates some of the problems inherent in the side-apertured construction described above, it presents new problems and disadvantages of at least equal magnitude. The hexagonal extension, if made large enough for secure attachment of a rotor-locking wrench, may cause serious injury to a patient should the hexagonal surfaces contact oral membranes or teeth during high speed drilling operations. If, on the other hand, the extension is reduced in size to minimize the dangers to patients, the surfaces of the extension will be too small to provide secure attachment for a wrench without rapid wear or deformation.

### Summary of invention

Accordingly, it is a principal object of the present invention to overcome the aforementioned defects and disadvantages of prior constructions. Specifically, it is an object to provide a collet-equipped air-driven dental handpiece in which the rotor may be easily and firmly locked in place during collet adjustment without contacting the delicate turbine blades and without providing means which might constitute a potential source of injury to a patient.

Another object of the invention is to provide a turbine handpiece in which the rotor is adapted to be locked against rotation during collet adjustment and in which such adaptation does not appreciably alter the flow of exhaust air or otherwise interfere with turbine operation. A further object is to provide a handpiece in which adjustment of the collet and locking of the rotor during such adjustment are carried out by operations performed only at one end of the turbine housing. In this regard, it is a specific object to provide a handpiece construction in which such operations are performed only at the housing's upper end; that is, the end opposite from the bur.

Another object is to provide a handpiece and wrench combination which cooperate in the locking of a rotor against rotation while at the same time coupling a collet with the wrench for longitudinal adjustment within the rotor. A further object is to provide a compact wrench which may be easily and quickly coupled to the upper end of a handpiece for locking a turbine rotor in place and for adjusting the bur-supporting collet of that handpiece.

Still another object is to provide a collet and rotor construction for a dental handpiece which insure proper centering of a bur and which thereby eliminate or greatly reduce operation vibration and the wear and other disadvantages which would normally be associated with such vibration. An additional object is to provide a rotor and bur tube construction which not only direct expansion and contraction of a collet but which also contribute in directing the discharge of cooling air towards a bur.

### Drawings

FIGURE 1 is a side elevational view of a dental handpiece embodying the present invention;

FIGURE 2 is an exploded and partially cut away perspective view of the head assembly of the handpiece and also illustrating a collet wrench for adjusting the collet of that handpiece;

FIGURE 3 is an exploded perspective view illustrating the major components within the turbine cartridge illustrated in FIGURE 2;

FIGURE 4 is an enlarged longitudinal sectional view of a head assembly showing the collet wrench operatively associated therewith;

FIGURE 5 is an exploded perspective view showing the components of the collet wrench.

### Description

In the embodiment of the invention illustrated in the drawings, the numeral 10 generally designates a contra-angle turbine-driven dental handpiece having an elongated handle portion A and a head housing B. Other than in the respects pointed out below, such a handpiece is similar in construction and operation to the handpiece disclosed in Staunt Patent 3,084,439, issued Apr. 9, 1963. Since turbine-driven contra-angle dental handpieces are now well known in the art, a detailed description of the components which constitute environmental elements for the structure of the present invention is believed unnecessary herein.

Within the the housing B is a cartridge assembly C which comprises a cartridge casing 11, stator 12, spaced

ball bearing assemblies 13 and 14, and a rotor comprising bur tube 15, turbine 16, and tubular collet or chuck 17. The cartridge assembly also includes a bur tube nut 18. An externally-threaded cap D constitutes a part of the complete housing B and is threadedly connected to the remainder of the housing to secure the cartridge assembly in place.

The rotor, comprising turbine 16, bur tube 15, chuck 17, and nut 18, is supported for rotation within the housing by bearing assemblies 13 and 14. As shown most clearly in FIGURE 4, cap D is provided with an internal shoulder 19 which bears against the outer race of upper bearing assembly 13. The inner races of the upper and lower bearing assemblies engage turbine unit 16 which is in turn press fitted upon bur tube 15. The outer race of bearing assembly 13 also engages stator 12 which in turn bears against cartridge casing 11. At its lower end, the cartridge casing engages the outer race of bearing assembly 14. Thus, as the threaded cap D is tightened within housing B, the entire turbine cartridge assembly is urged downwardly until the outer race of bearing assembly 14 seats against internal shoulder 20 of the housing.

Referring to FIGURES 3 and 4, it will be seen that the bur tube 15 has a generally cylindrical body portion 21 and an enlarged head portion 22 at its upper end. A bore 23 extends axially through both the body and head portions and is of substantially uniform diameter except at its lower end where the inner surfaces of the bur tube taper inwardly, as indicated at 24 (FIGURE 4). At its opposite upper end, the bur tube has its internal surfaces provided with threads 25 for adjustably engaging the external threads at the upper end 26 of chuck 17.

The chuck 17 is also of generally cylindrical shape and is disposed within the bore 23 of bur tube 15. At its lower end, the chuck's outer surface tapers inwardly and the wall of the chuck is provided with a plurality of axially-extending circumferentially spaced slots 27. The circumferentially spaced slots define therebetween a plurality of spring fingers 28 for gripping and holding a conventional dental bur E within bore 29.

It is to be noted that bore 29 terminates at a point below the chuck's upper end and that along most of its longitudinal extent (and when spring fingers 28 are in an untensioned state) bore 29 is sufficiently larger than the outer diameter of the bur to provide a definite clearance or spacing therebetween. However, the extreme upper end portion 29a of the bore tapers inwardly to a diameter slightly smaller than the outside diameter of a bur. Therefore, the frusto-conical surfaces 29a at the upper end of bore 29 automatically center the upper end of a bur E within chuck 17 when the bur is fully inserted within the bore.

The upper end portion 26 of chuck 17 is provided with an axial bore 30 of non-circular cross section. In the illustration given, bore 30 is of rectangular cross section although it is to be understood that other shapes, such as a hexagonal cross sectional configuration, might be used. If desired, the coaxial bores 29 and 30 may communicate with each other as shown in FIGURE 4.

Non-circular bore 30 slidably and removably receives the projecting end portion of key shaft 31 provided by collet wrench F. As shown in FIGURES 2, 4 and 5, key shaft 31 is of non-circular (square) cross sectional configuration so that when the shaft is received within bore 30, the chuck 17 and the key shaft are locked against independent relative rotation.

Referring to FIGURES 2 and 5, it will be seen that the collet wrench F is provided with longitudinally aligned upper and lower cylindrical sections 32 and 33, respectively. The lower section is provided with an axial bore 34 which rotatably receives a stem extension 35 of the upper section. Key shaft 31 is securely anchored within a socket 36 (FIGURE 4) in the stem extension and, when the parts are assembled as illustrated in FIGURES 2 and

4, the lower end portion of the key shaft projects downwardly below the wrench's lower section 33.

The upper and lower sections of the collet wrench are rotatably connected by means of a stop ring 37 (FIGURES 4 and 5) which is tightly fitted upon the key shaft 31 and which is rotatably disposed within an enlarged opening 38 in the lower end of section 33. As shown in FIGURE 4, the diameter of the stop ring is larger than the diameter of bore 34; therefore, the collet wrench's lower section 33 is rotatably supported upon stem 35 and is restrained against relative axial movement by upper section 32 and by the lower stop ring 37.

To permit insertion of the key shaft 31 into the non-circular bore 30 of chuck 17, the cap D of the head housing is provided with a central access opening 39 which is in axial alignment with the bore of the chuck and which is not only of substantially greater width than the maximum cross sectional dimensions of the key shaft, but which is preferably slightly larger in diameter than collet chuck 17.

It is believed apparent from the foregoing that when the key shaft is inserted through the head housing and into the bore of chuck 17, rotation of the wrench's upper section 32 will cause rotation of the collet chuck. However, unless some locking means is provided for locking bur tube 15 in place, the rotation of the chuck will be accompanied by simultaneous rotation of the bur tube and the turbine.

In the embodiment illustrated in the drawings, such locking means comprises a plurality of locking pins 40 which project downwardly from the lower end of the wrench's lower section 33 and which are arranged in uniformly-spaced circumferential series about key shaft 31. Theoretically, only a single locking pin is needed; however, as a practical matter, to facilitate operation of the wrench and to reduce wear and possible injury to the parts, a plurality of such locking pins is preferred. In the illustration given, three uniformly-spaced pins are used although it is to be understood that a greater or smaller number may be provided.

The upper end portions of the pins are tightly fitted within sockets 41 extending upwardly from the lower end of the wrench's lower section. The lower end portions of the locking pins project downwardly from the wrench a distance sufficient to pass through openings 42 in end cap D and into sockets 43 in the enlarged head 22 of the bur tube (FIGURE 4). Preferably, the number of openings in cap D corresponds with the number of locking pins, but the number of sockets 43 in the bur tube is a multiple of the number of pins. In the embodiment illustrated in the drawings, the bur tube is provided with six sockets 43 (FIGURES 2 and 3), the locking pins being adapted to be received in any alternate three sockets provided by the bur tube. The provision of an additional number of bur tube sockets facilitates connection of the wrench when the sockets are not in precise alignment with openings 42 in the end cap. In such a case, the key shaft 31, which is substantially longer than the locking pins, is first inserted into the bore of the collet chuck and the chuck and bur tube are then rotated (by rotating the upper section of the wrench) until three of the bur tube sockets 43 are in direct alignment with the pins 40 which have already been inserted into cap openings 42 and which bear against the upper end of the bur tube. The larger number of sockets in the bur tube permits a more rapid coupling of the wrench to the head assembly because it reduces the degree of rotation of the bur tube which is required before alignment of the sockets and the locking pins is achieved.

Once the locking pins have been received within the sockets of the bur tube, the pins anchor the bur tube, the head housing, and the wrench's lower section against independent relative rotation. Thereafter, a user, holding the handpiece in one hand and the upper section 32 of the collet wrench in the fingers of the other hand, simply rotates that upper section to thread the collet chuck 17

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downwardly or upwardly within the bur tube. As the collet chuck is shifted upwardly, spring fingers 28 release bur E and the bur may be easily removed from the handpiece. To facilitate operation of the collet wrench, it is desirable to provide the outer surface of the wrench's upper section 32 with knurling, as illustrated in FIGURES 2 and 5.

Attachment of a bur is accomplished simply by reversing the above-described procedure. In this connection, it should be noted that the bur, after it has been fully inserted into the bore 29 of the collet chuck and after the chuck has been rotated to force the jaws or fingers 28 inwardly into tight frictional engagement with the bur, is held in place only at the front and rear ends of bore 29. Specifically, the bur is engaged only by the tapered rear surfaces 29a and by the front jaws 28 of the chuck. Precise axial alignment of the bur is thereby achieved without providing a tight fit between the bur and the chuck which might otherwise interfere with insertion or removal of the bur. Furthermore, the precise orientation of the bur within the collet chuck eliminates rapid wear of the bearings which might otherwise occur during high-speed operation should bur eccentricity exist.

In the unlikely event that a bur should tend to stick within the collet chuck after jaws 28 are released, the bur may be easily pushed from the chuck by inserting a suitable tool (not shown) through opening 39 in end cap and through bore 30 which communicates with bore 29.

Since opening 39 is slightly larger in diameter than chuck 17, there is no danger that unthreading of the chuck to release a bur might cause the chuck to jam against the inner face of end cap D. At the same time, opening 39 provides an effective discharge port for air which leaks through bearing assembly 13 to cool and lubricate the ball bearings thereof.

It will also be observed that the outer surface of bur nut 18 tapers downwardly and inwardly towards the bur, and that the inner surface 44 of the housing adjacent the bur tube nut is similarly tapered, to direct a conical stream of air towards the bur. Such a conical stream of air tends to uniformly distribute water discharged from tube 45 onto the bur to prevent dry cutting which might otherwise result in the generation of heat sufficient to damage the nerve of a tooth being drilled.

While in the foregoing I have disclosed an embodiment of the invention in considerable detail for purposes of illustration, it will be understood by those skilled in the art that many of these details may be varied without departing from the spirit and scope of the invention.

I claim:

1. In combination with a turbine-driven dental handpiece having a housing, a turbine rotor rotatably mounted within said housing with a bore extending therethrough, a collet chuck threadably received within said bore and having a bore of non-circular cross section extending inwardly from one end thereof, a socket provided by said turbine rotor adjacent said non-circular bore and extending inwardly at said one end, and opening means in said housing for access to said socket and to said non-circular bore; a collet wrench comprising (1) a pair of members disposed in axial alignment; (2) means interconnecting said members for independent relative rotation thereof and locking said members against relative axial movement; (3) one of said members having at least one locking pin projecting from an end thereof opposite from the other of said members and extending along a line substantially parallel to but spaced from the axes of said members; and (4) the other of said members being provided with an axially-disposed shaft of non-circular cross sectional configuration extending through said one member and projecting outwardly beyond said one member in spaced parallel relation with respect to said locking pin; whereby, upon insertion of said shaft into the non-circular bore of a handpiece and upon the insertion

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of said locking pin into an adjacent rotor socket, said other member of said wrench may be rotated with respect to said one member and to said handpiece to adjust said collet within the rotor's threaded bore.

2. The structure of claim 1 in which said members are generally cylindrical in shape.

3. The structure of claim 1 in which said shaft projects axially from said one member beyond said pin.

4. The structure of claim 1 in which said one member is provided with a plurality of locking pins arranged in a circumferentially-spaced series about said shaft.

5. The structure of claim 1 in which said shaft is of square cross sectional configuration.

6. In combination, a turbine-driven dental handpiece and a collet wrench therefor, said handpiece comprising a housing, a turbine rotor rotatably mounted within said housing and having a bore extending therethrough, a collet chuck threadably 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 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 for releasably locking said rotor against rotation relative to said housing.

7. The structure of claim 6 in which said first bore of said collet chuck is tapered at its inner end for centering a bur inserted therein.

8. The structure of claim 6 in which said locking means includes a plurality of locking pins provided by said wrench and disposed in parallel relation in a circumferentially-spaced series about said shaft, said housing having a plurality of openings immediately adjacent said first-mentioned opening and said rotor having a plurality of sockets adjacent said non-circular bore removably receiving said pins for locking said rotor against rotation with respect to said housing.

9. The structure of claim 6 in which said wrench is provided with generally cylindrical upper and lower sections interconnected in axial alignment for independent relative rotation, means provided by said upper section extending through said lower section and supporting said shaft, said shaft projecting through and below said lower section, and said pin being mounted upon said lower section and projecting downwardly therefrom adjacent said shaft.

10. The structure of claim 9 in which said shaft projects downwardly beyond said pin.

11. The structure of claim 6 in which the first and second bores of said collet chuck are in axial communication with each other.

12. A turbine-driven dental handpiece comprising a head housing, a turbine rotor rotatably mounted within said housing and having a bore extending therethrough, said bore being tapered at one end thereof and being internally threaded at its opposite end, a collet chuck threadably mounted within said bore and having a plurality of flexible jaws engagable with the internal surfaces of said rotor at said tapered end of said bore, said chuck having a first bore extending inwardly from said jaws for receiving a dental bur and having a second bore of non-circular cross section extending inwardly from its opposite end, said rotor having at least one socket extending inwardly in an axial direction from the end thereof adjacent the non-circular bore of said chuck and spaced laterally from the rotational axis of said rotor, and opening means in an end wall of said housing for access to said non-circular bore of said chuck and to said socket of said rotor, whereby, a wrench having a locking pin receivable in said socket and an independently rotatable non-circular shaft receivable in the non-circular bore of said chuck may be

coupled to said handpiece for adjustment of said collet chuck within said rotor.

13. The structure of claim 12 in which said rotor is provided with a plurality of sockets extending inwardly in an axial direction from the end thereof adjacent the non-circular bore of said chuck and being disposed in a uniformly-spaced circumferential series about said non-circular bore.

14. The structure of claim 12 in which said first bore of said collet chuck is tapered at its inner end for centering of a bur inserted therein.

15. The structure of claim 12 in which said first and second bores of said collet chuck are in axial communication with each other.

16. The structure of claim 12 in which said head housing is provided adjacent the non-circular bore of said chuck with a central opening coaxial with said chuck and of a diameter slightly larger than that of said chuck.

17. In combination, a turbine-driven dental handpiece and a collet wrench therefor, said handpiece comprising a housing, a turbine rotor 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 ex-

tending 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 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 for releasably locking said rotor against rotation relative to said housing, said locking means including at least one locking pin provided by said wrench and disposed in spaced parallel relation with respect to said shaft, said housing having an end opening immediately adjacent said first-mentioned opening and said rotor having a socket adjacent said non-circular bore releasably receiving said pin for locking said rotor against rotation with respect to said housing.

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