

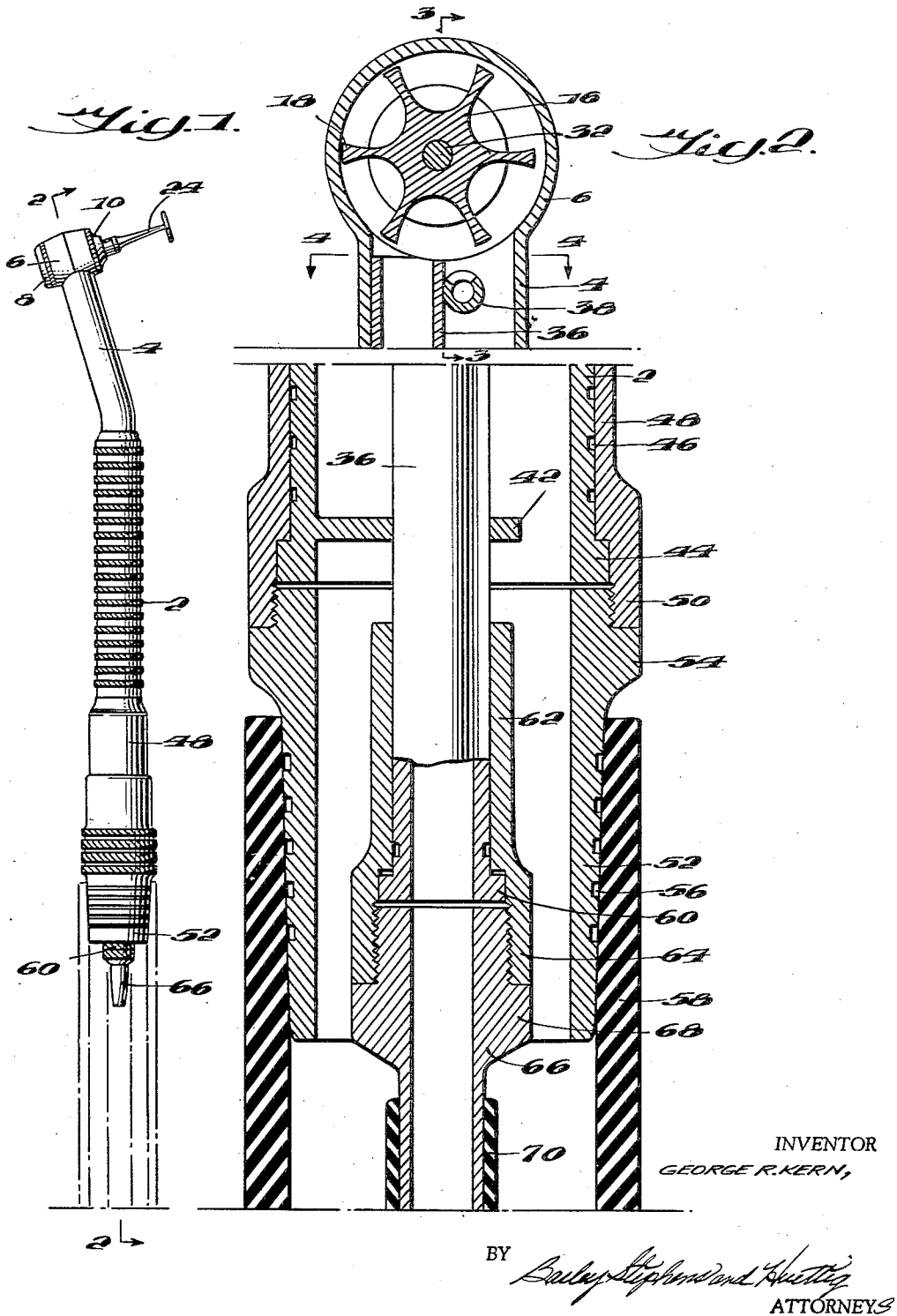
July 23, 1957

G. R. KERN
DENTAL DRILL

2,799,934

Filed Dec. 1, 1955

3 Sheets-Sheet 1



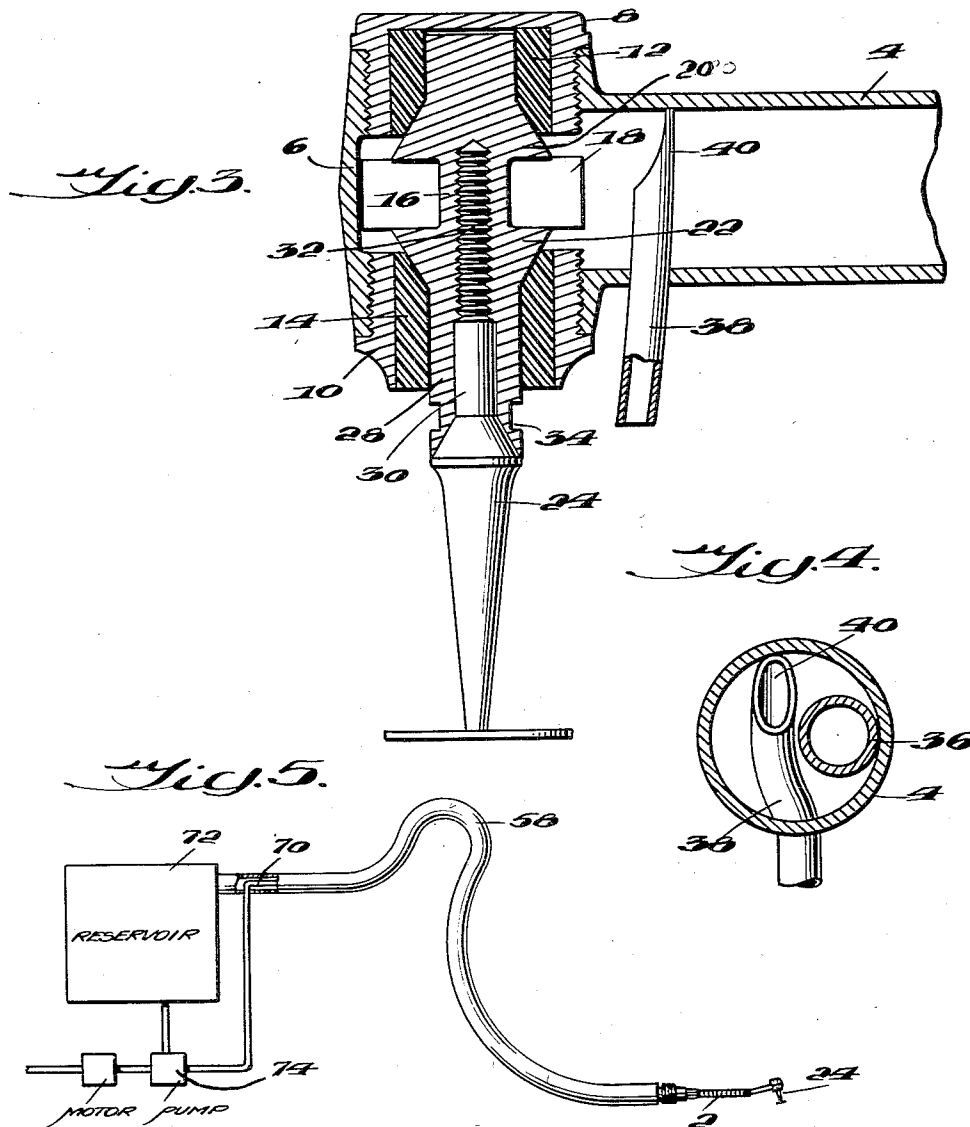
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3 Sheets-Sheet 2



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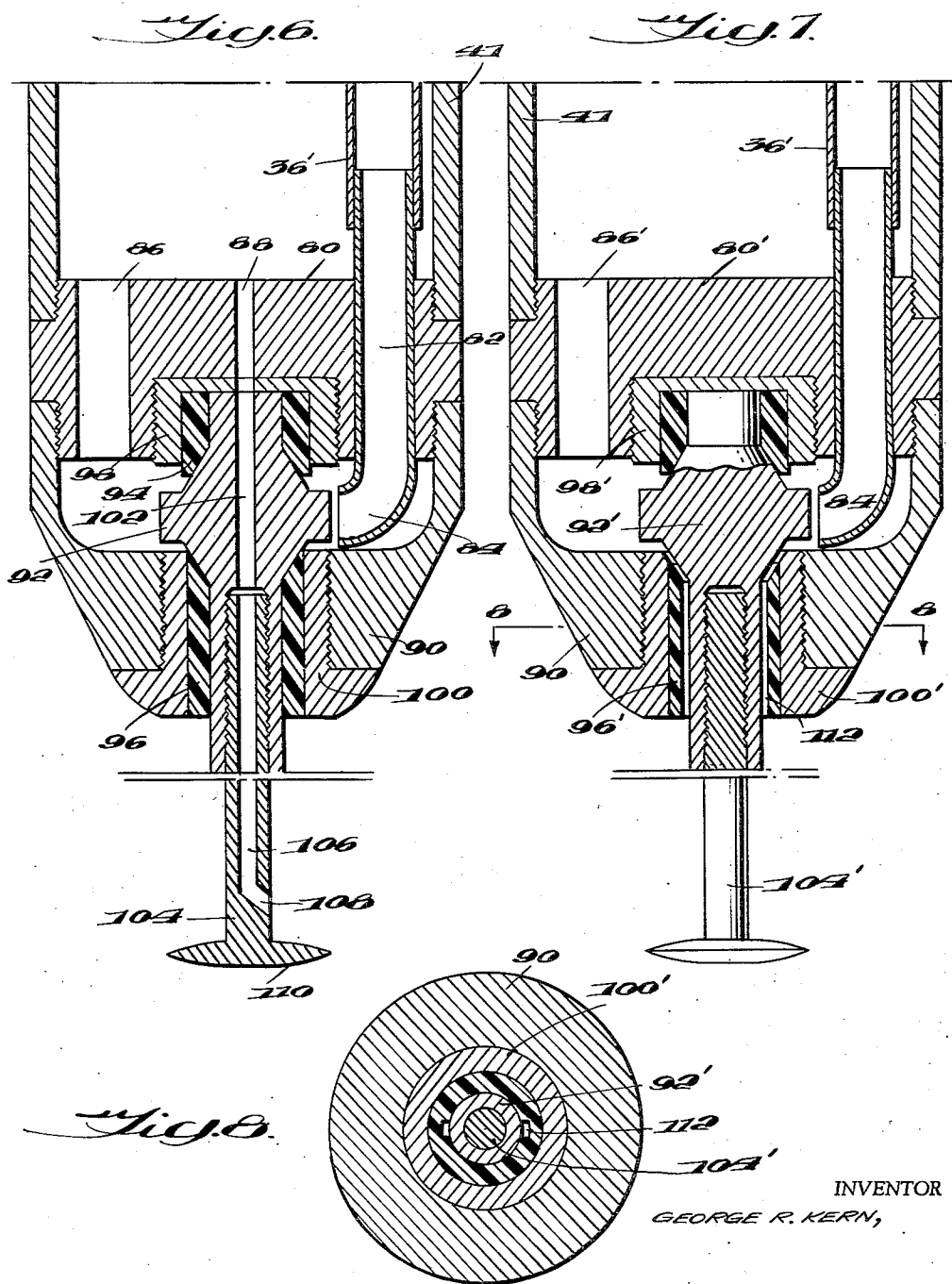
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DENTAL DRILL

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14 Claims. (Cl. 32—27)

The invention relates to dental drills, and more particularly to hydraulically driven drills.

This application is a continuation in part of my application S. N. 483,295, filed January 21, 1955, and now abandoned.

A hydraulically driven dental drill is disclosed in the Journal of the American Dental Association, vol. 47, pages 324—329, September 1953. Such a drill has not proven entirely satisfactory.

The primary object of the present invention is to provide a hydraulically driven dental drill which is better adapted for clinical use than dental drills heretofore known.

One object of the invention is to provide a dental drill which is driven by water under pressure, in which a portion of this driving water is jetted into the area of a drilling tool so as to clean out the area being worked on.

In this respect, I have found that the drill described in the article described above will operate more smoothly and with less vibration, as well as more efficiently, if the turbine rotor is mounted with a slight eccentricity in the surrounding casing. It has further been found that smoother rotation can be achieved if the drilling tool, which of course must be interchangeable, extends up into the interior of the turbine rotor and is securely held therein.

It is recognized in dentistry that it is desirable to have a stream of water impinging on the tooth when drilling is taking place, but that this stream should be discontinued when the drill is not in use.

A further object of one form of the present invention is to provide a drill structure which will automatically form a jet of water against the tooth whenever the drill is in engagement with the tooth, but which will discontinue the jet action when the drill is moved away from the tooth, even though the drill continues to rotate. More specifically, the invention provides an arrangement which utilizes a part of the water which drives the turbine to form this jet, this arrangement operating without the use of valves or other moving parts and entirely on hydraulic principles.

It is apparent that the drill should be free to be turned at different angles, and it is desirable that there be no resistance to such turning, so that the dentist is relieved of any need to exert any force in order to hold the drill at the desired angle. The present invention provides joints between the drill head on the one hand, and the tube supplying and returning the water on the other hand, which are freely turnable without setting up any force tending to restore the drill head to some particular position.

Further objects and advantages of the invention will appear more fully from the following description, especially when taken in conjunction with the accompanying drawings which form a part thereof.

In the drawings:

Fig. 1 shows in side elevation a drill head for a dentist's drill embodying my invention;

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Fig. 2 is a cross-section substantially on the line 2—2 of Fig. 1;

Figs. 3 and 4 are cross-sections on the lines 3—3 and 4—4 respectively of Fig. 2;

Fig. 5 is a diagrammatic showing of a drill unit embodying the invention.

Fig. 6 shows in cross-section a modified form of drill; Fig. 7 is a similar view of another modification; and Fig. 8 is a cross-section on the line 8—8 of Fig. 7.

The drill of Figs. 1 to 5 includes a main hollow stem 2 forming a hand grip portion, one end 4 of which is bent off at an angle in conventional fashion. At the free end of portion 4 is a barrel 6, internally threaded at both top and bottom, the central portion of this barrel communicating with the interior of stem 2 and end portion 4 and forming the turbine chamber.

Threaded into the upper and lower ends of barrel 6 are a cap 8 and a ring 10 respectively. Secured in these parts are bearings 12, 14, formed of a plastic material, these bearings having substantially conical seating surfaces. The openings into which the cap and ring fit have their centers slightly to the left (Fig. 2) of the longitudinal axis of the end portion 4, although the center of the unthreaded central part of barrel 6 forming the turbine chamber is located in the axis of portion 4. Thus the axis of rotation of the turbine rotor, which is mounted in bearings 12, 14, is positioned eccentrically within the turbine housing.

The turbine rotor 16 has vanes or blades 18 around its periphery. The rotor has frusto-conical extensions 20, 22 which engage bearings 12, 14 so as to mount the rotor for rotation in housing 6. The rotor has a bore of stepwise decreasing cross-section extending upwardly thereinto, the upper portion of this bore being internally threaded. This serves to receive interchangeably various drilling tools, one of which is shown in Fig. 3. This tool has an enlarged portion 24 which seats in the flaring lower end of rotor extension 23, a cylindrical portion 30 fitting snugly in the larger portion of the rotor bore, and a smaller portion 32 threadedly engaged in the upper portion of the rotor bore. Extension 28 has flats 34 so that it can be held by a wrench while the drilling tool is being screwed into it.

It will be noted that part 32 of the tool extends upwardly into the area of the main rotor body which carries blades 18. Such an arrangement prevents wobbling of the tool and causes the rotor to turn smoothly and without vibration.

Water under pressure is supplied to the turbine chamber through a small pipe 36 secured inside the handle. This pipe, as seen in Fig. 2, is located on the left hand side of handle extension 4, so that it opens into that half of the turbine chamber in which blades 18 are closest to the chamber walls. Such a turbine operates more smoothly and efficiently and with less vibration than one in which the rotor is centered within the chamber.

The water which has driven the turbine escapes through handle extension 4, and is returned to the source in a manner to be described below. A nozzle or small pipe section 38 is mounted in and extends through the bottom wall of section 4, and its lower end directed toward the tip of the drilling tool and its upper end mounted in the water return passage. This upper end is cut away as at 40 to provide an opening facing towards the turbine chamber.

I have found that, with such a construction, no water is fed to nozzle 38 as long as the turbine is rotating freely and under no-load conditions. However, as soon as the tool engages a tooth in drilling, and is slowed down, a stream of water is ejected through nozzle 38 against the tooth. As soon as the drill is removed from the tooth, this flow of water stops.

At its end remote from the barrel 6, handle 2 has an internal spider 42 which holds pipe 36 centrally therein. The handle has a projecting flange 44 and a series of grooves 46 on its outer surface. A sleeve 43 is slidable on the outside of handle 4, abutting against flange 44, and having an internally threaded flange 50 surrounding flange 44 and extending beyond it. A fitting 52 has an externally threaded end engageable in flange 50 and a projecting ring 54 engageable against the end of flange 50. The parts are so dimensioned that flange 44 is of less thickness than the space in which it is positioned when parts 46, 52 are screwed tightly together with ring 54 abutting against flange 50. Thus, the handle 2 can turn freely about its axis.

Fitting 52 has groove 56 in its outer surface, and fits into a rubber tube 58. When grooves 46, 56 are filled with a lubricant, water-tight joints are formed.

Pipe 36 ends in a flange 60. A sleeve 62 slidable on the outside of pipe 36 abuts against flange 62, and has a flange 64, which is internally threaded, surrounding and extending beyond flange 60. A fitting 66 has an externally threaded end engageable in flange 64, and a ring 68 which abuts against flange 64. The dimensions are again such that pipe 36 can turn freely. A rubber hose 70 inside hose 58 is secured on the end of fitting 66.

Referring to Fig. 5, water from tank 72 is fed by pump 74 through hose 70 and pipe 36 to the turbine. The water returns through handle 4, 6 and hose 58 to the tank.

When pump 74 is in operation, the turbine will be driven at all times. However, water will be expelled from nozzle 38 only when there is a load on the drilling tool.

Fig. 6 shows a drill which supplies a part of the driving water to the work area, but which lacks the automatic arrangement of the form of Figs. 1 to 5, the water being supplied whenever the drill is being driven. Also, this is a straight drill, and not a contra-angle type.

Handle 41 and pipe 36' are connected to a source of water under pressure in the same manner as parts 4 and 36 of Figs. 1 to 5. Threaded in the end of handle 41 is a block 80, in which is mounted a pipe section 82 having an inwardly bent end 84, this pipe communicating with pipe 36'. Block 80 has at least one passage 86 therethrough for the escape of water to the interior of handle 41, and a small central passage 88.

A cap 90 is threadedly secured on block 80, and forms with it a chamber for turbine rotor 92 which lies opposite the outlet 84 of pipe 82. The turbine is mounted in bearings 94, 96 of plastic or hard rubber which are secured in sleeves 98, 100 threaded in block 80 and cap 90 respectively. Sleeve 98 has an opening aligned with passage 88, and rotor 92 also has a passage 102 aligned with this hole.

A special tool 104 is threaded in rotor 92, this tool having a longitudinal passage 106 which connects with passage 102 and terminates at 108 on the side of the tool, being downwardly inclined, and directed generally towards the tool head 110.

With this arrangement, as long as the turbine is rotating, centrifugal force will throw water from passage section 108, drawing more water from the interior of handle 4 back of block 80.

In the form of Figs. 7 and 8, block 80' lacks any central passage, as do sleeve 98', rotor 92' and tool 104'. However, bearing 96' is provided with one or more grooves 112, which permit water to escape under pressure from the turbine chamber and thereby to be jetted in the direction of the tool and into the work area. Otherwise, the construction of Figs. 7 and 8 is similar to that of Fig. 6.

While I have described herein some embodiments of my invention, I wish it to be understood that I do not intend to limit myself thereby except within the scope of the claims hereto or hereinafter appended.

I claim:

1. A dental drill comprising a handle, a turbine casing carried by said handle, a turbine rotor rotatably mounted in said casing and having means for holding a drilling tool, a nozzle carried by said handle directed towards the end of a tool carried by such holding means, means to conduct water under pressure to said casing to drive said rotor and to conduct water away from the casing, the nozzle extending through a wall of and communicating with said conducting means.

2. A dental drill comprising a handle, a turbine casing carried by said handle, a turbine rotor rotatably mounted in said casing having means for holding a drilling tool, a nozzle carried by said handle directed towards the end of a tool carried by such holding means, means to conduct water under pressure to said casing to drive said rotor and to conduct water away from the casing, and means responsive to the load on the turbine rotor to eject water from said conducting means through said nozzle when said rotor is under load and to stop the ejection of water when the turbine is running freely.

3. A dental drill comprising a handle, a turbine casing carried by said handle, a turbine rotor rotatably mounted in said casing having means for holding a drilling tool, means to supply water under pressure to said casing to drive said rotor and to conduct water away from the casing, a nozzle having communication with said conducting means carried by said handle and directed towards the end of a tool carried by said holding means, and means responsive to the load on the turbine rotor to eject water from said conducting means through said nozzle when said rotor is under load and to stop the ejection of water when the turbine is running freely.

4. A dental drill comprising an elongated hollow handle, a turbine casing at one end of the handle communicating with the interior thereof, a turbine rotor rotatably mounted in said casing having means for holding a drilling tool, means associated with said handle to conduct water under pressure to said casing to drive the turbine rotor, such water being conducted away from the casing through the interior of the handle, a nozzle communicating with the interior of the handle and directed towards the end of a tool carried by said holding means and means responsive to the load on the turbine rotor to eject water from the interior of the handle through said nozzle when said rotor is under load and to stop the ejection of water when the turbine is running freely.

5. A drill as claimed in claim 4 in which said water conducting means includes a pipe in the interior of the handle of substantially smaller cross-section than such interior and terminating adjacent such casing.

6. A drill as claimed in claim 5 in which said pipe terminates at one side of the interior of the handle, the axis of rotation of the turbine rotor being offset from the center of the turbine casing towards the same side.

7. A drill as claimed in claim 6 in which said casing includes bearings at top and bottom, said rotor being mounted in said bearings and having blades between the bearings, said rotor having a recess therein extending upwardly from the bottom thereof through the zone of the lower bearing and a substantial distance into the zone of the blades, the upper part of the recess being internally threaded, said recess constituting the drilling tool holding means.

8. A dental drill comprising an elongated hollow handle, a turbine casing at one end of the handle communicating with the interior thereof, a turbine rotor rotatably mounted in said casing having means for holding a drilling tool, means associated with said handle to conduct water under pressure to said casing to drive the turbine rotor, such water being conducted away from the casing through the interior of the handle, a nozzle communicating with the interior of the handle and directed towards the end of a tool carried by said holding

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means, said nozzle comprising a pipe extending through the handle wall into the interior of the handle and having an opening into such interior, and means responsive to the load on the turbine rotor to eject water from the interior of the handle through said nozzle when said rotor is under load and to stop the ejection of water when the turbine is running freely.

9. A dental drill comprising an elongated hollow handle, a turbine casing at one end of the handle communicating with the interior thereof, a turbine rotor rotatably mounted in said casing having means for holding a drilling tool, a small pipe smaller than the interior of said handle in the interior thereof and terminating adjacent said turbine casing to conduct water under pressure to said casing to drive the turbine rotor, such water being conducted away from the casing through the interior of the handle, a nozzle communicating with the interior of the handle and directed towards the end of a tool carried by said holding means, said nozzle comprising a pipe extending through the handle wall into the interior of the handle adjacent the turbine casing and having an opening therein directed towards the turbine casing, said small pipe extending along one side of the interior of the handle, the axis of rotation of the turbine rotor being offset from the center of the turbine casing towards the same side.

10. A dental drill comprising a handle, a turbine casing carried by said handle, a unitary turbine rotor rotatably mounted in said casing and having means for releasably holding a drilling tool, means to conduct water under pressure to said casing to drive said rotor and to conduct water away from the casing, the axis of rotation of the turbine rotor being offset from the center of the turbine casing.

11. A dental drill comprising an elongated hollow handle, a turbine casing at one end of the handle communicating with the interior thereof, a turbine rotor rotatably mounted in said casing having means for holding a drilling tool, means to supply water under pressure

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to the turbine casing comprising a pipe in the interior of the handle of substantially smaller cross-section than such interior and terminating adjacent such casing, said pipe terminating at one side of the interior of the handle, the axis of rotation of the turbine rotor being offset from the center of the turbine casing towards the same side.

12. A drill as claimed in claim 11 in which said casing includes bearings at top and bottom, said rotor being mounted in said bearings and having blades between the bearings, said rotor having a recess therein extending upwardly from the bottom thereof through the zone of the lower bearing and a substantial distance into the zone of the blades, the upper part of the recess being internally threaded, said recess constituting the drilling tool holding means.

13. A dental tool comprising a handle, a turbine casing carried by said handle, said casing having a closed end and an open end, bearings at each of said ends, a turbine rotor mounted in said bearings and having blades between the bearings, an end portion of said rotor extending outwardly of said casing through said open end, said end portion having a recess therein extending axially inwardly of said end portion through the zone of the adjacent bearing and a substantial distance into the zone of the blades, the inner part of said recess being internally threaded and defining a rotary tool holding means.

14. A dental tool as defined in claim 13, wherein the outer portion of said recess comprises an inwardly tapered frusto-conical surface concentric to the axis of rotation of said rotor and constituting means for accurately and rigidly centering said rotary tool.

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