

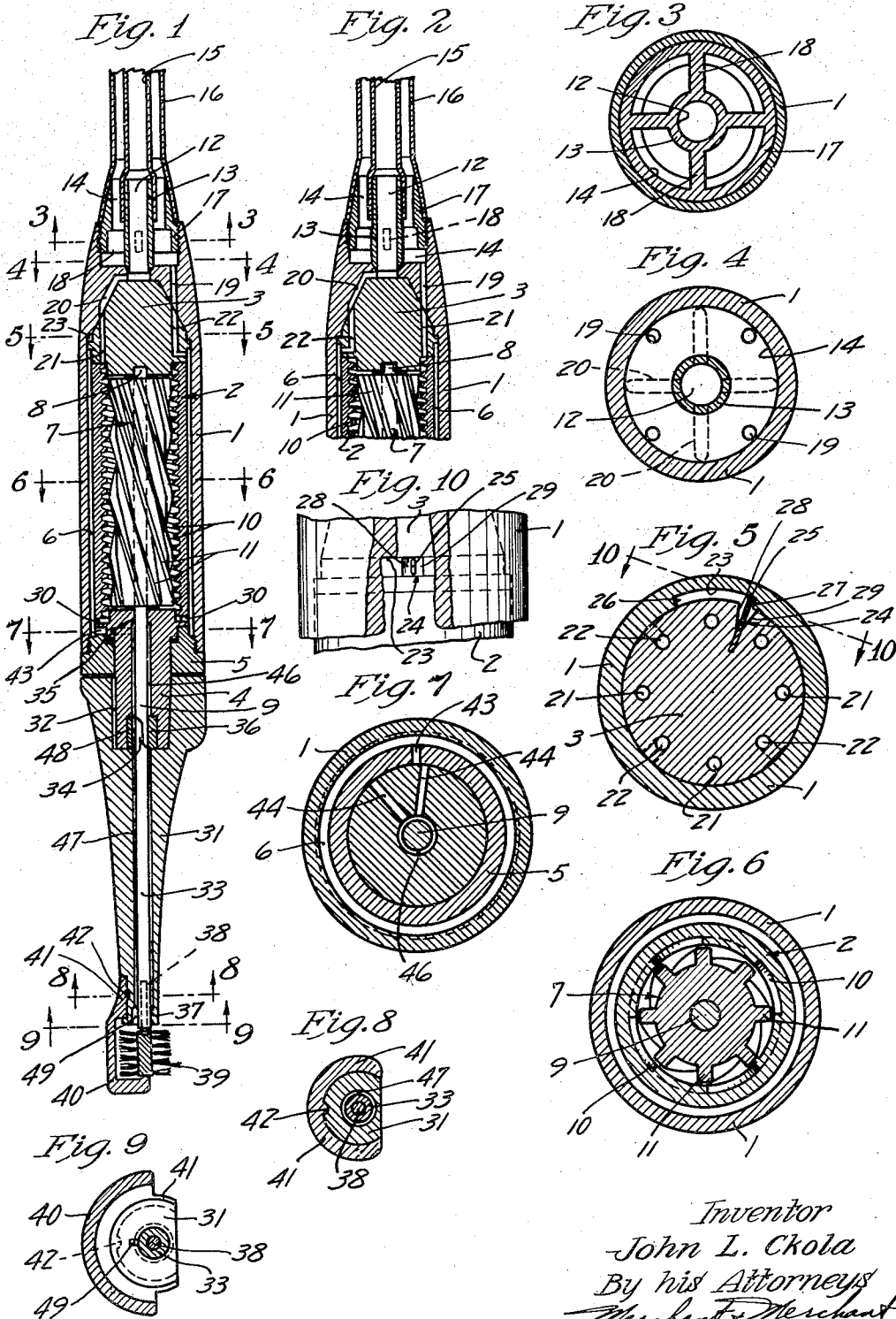
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ROTARY TOOTHBRUSH

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ROTARY TOOTHBRUSH

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My invention relates broadly to fluid motors and more specifically to fluid-operated rotary tooth brushes and the like.

An important object of my invention is the provision of a structure which is simple, inexpensive to build, durable in use, and easy to operate.

Another object of my invention is the provision of novel means for reversing the direction of rotation of the tool-equipped rotary spindle operated by the fluid motor.

Another important object of my invention is the provision of novel means for by-passing fluid to the rotary brush or tool when desired so that the tool may be used either without the fluid or in conjunction with the fluid.

The above and numerous other objects and advantages of my invention will become apparent from the following detailed specification, appended claims, and attached drawings.

Referring to the drawings wherein like characters indicate like parts throughout the several views:

Fig. 1 is a vertical axial section of my novel device;

Fig. 2 is a fragmentary sectional view corresponding to Fig. 1, but showing a different arrangement of some of the parts;

Fig. 3 is an enlarged transverse sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is an enlarged sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is an enlarged sectional view taken on the line 6—6 of Fig. 1;

Fig. 7 is an enlarged sectional view taken on the line 7—7 of Fig. 1;

Fig. 8 is an enlarged sectional view taken on the line 8—8 of Fig. 1;

Fig. 9 is an enlarged sectional view taken on the line 9—9 of Fig. 1; and

Fig. 10 is an enlarged fragmentary sectional view taken on the line 10—10 of Fig. 5.

Referring with greater particularity to the drawings, the numeral 1 indicates an elongated casing, preferably cylindrical, containing a cylindrical bore in which is mounted for limited rotation a stator 2. Stator 2 is provided at its opposite ends with bearing acting valve elements 3 and 4, both of which are secured fast thereto. It will be observed that the valve element 3 is preferably, and as shown, conical in form while the valve element 4 is in the nature of a bearing sleeve which projects out one end of casing 1,

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which casing is restricted by means of an annular end-forming ring 5. Member 5 may either be formed integrally with the casing 1, screw threaded thereto, or otherwise made fast therewith. Bearing-like valve elements 3 and 4 retain the intermediate portion of stator 2 in spaced relation to the cylindrical bore of casing 1 to provide therebetween an annular fluid passage 6. Valve elements 3 and 4, together with the stator 2, provide a chamber in which is mounted a rotor 7. As shown, one end of the rotor 7 is provided with a stub shaft 8 while a drive shaft 9 projects axially from the opposite end. As shown, shafts 8 and 9 may be integrally formed. In any event, drive shaft 9 extends axially outwardly from the casing 1 through bearing sleeve 4. The interior wall of the stator 2 preferably, and as shown, is provided with one or more spiral vanes 10, whereas the rotor 7 is provided with one or more spiral vanes 11 which are pitched in a direction opposite to the pitch of the spiral vanes 10 of the stator, the purpose of which will hereinafter be disclosed.

Connected axially to the end of the casing 1, opposite the drive shaft 9, is a fluid inlet passage 12 formed by a short tube 13. Concentric with the tube 13 and surrounding same is an annular fluid discharge passage 14. Fluid inlet and outlet passages 12 and 14 are connected to a suitable fluid source and drain, respectively (not shown), by means of concentric inlet and discharge tubes 15 and 16 respectively. It will be noted that the outlet tube 16 is secured to a ring 17 which is threaded into the end of the casing 1 and is integrally formed with the tube 13 by means of radial partitions in the form of a spider 18. (See particularly Fig. 3.) A plurality (four in number) of fluid passages 19, preferably, and as shown, extend longitudinally from the fluid outlet passage 14 to the interior of the casing 1; and a plurality (four) of relatively short fluid passages 20 extend from the inlet passage 12 to the interior of the casing 1. It will be noted, particularly by reference to Fig. 4, that the interior ends of the passages 19 and 20 are not only equi-distant from the center of the casing 1 and valve element 3, but are also equally circumferentially spaced in the casing 1, in alternative arrangement. A plurality (four) of fluid passages 21 in valve element 3 communicate with one end of the stator 2 and are so positioned so as to be aligned with any of the passages 19 or 20 upon rotation of the stator 2 within the casing 1. Similarly, a plurality (four) of fluid passages 22 in the valve element 3 communicate

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with the annular passage 6 and are adapted to be aligned with the fluid passages 19 and 20 upon rotation of the stator within the casing. When the fluid passages 21 in the valve element 3 are in alignment with the passages 19 in the casing 1, it will be seen that the passages 22 in the valve element 3 communicate with the passages 20 of the casing 1; and similarly, when the passages 21 in the valve element 3 are in alignment with the passages 20 of the casing 1, the passages 22 in the valve element 3 will communicate with the passages 19 in the casing 1.

The interior of the casing 1 is provided with a circumferentially extended segmental slot 23 (see particularly Figs. 5 and 10) whereas the peripheral surface of the stator 2 is provided with a longitudinally extended V-shaped slot 24. Securely anchored in the center of the V-shaped slot 24 and projecting radially therefrom into slot 23, is a resilient stop finger 25 in the form of a leaf spring. The opposite ends of the slot 23 define stop shoulders 26 and 27, whereas the opposite sides of the V-shaped slot 24 are indicated by the numerals 28 and 29. It will be noted that the relationship of the segmental slot 23 and the stop finger 25 is such that when the stator 2 is rotated with respect to the casing 1 to a point where the stop finger 25 rests lightly against the shoulder 27, then and in that event, the passages 21 of the valve element 3 will be aligned with the passages 20 of the casing 1, and the passages 22 of the valve element 3 will be aligned with the passages 19 of the casing. With the valve in this position, fluid under pressure will pass through the inlet passage 12, the passages 20 and 21, and from thence through the rotor chamber, out of the opposite end of the rotor chamber, through a radial passage 30 in the stator, into and through the annular passage 6, and out through aligned passages 22 and 19 to the outlet 14, from whence it will be discharged. Similarly, when the stator 2 is turned with respect to the casing 1 so that the resilient stop finger rests lightly against the shoulder 26, the passages 22 of the valve element 3 are aligned with the passages 20 of the casing, and passages 21 of the valve element 3 are aligned with passages 19 of the casing. With the passages thus aligned, fluid under pressure will flow inwardly through the inlet passage 12 through aligned passages 20 and 22 into and through the annular passage 6 through the radial passages 30 into and through the rotor chamber and out through aligned passages 21 and 19 into the fluid discharge passage 14. It will be noted that with the valve 3 positioned as in Fig. 1, fluid under pressure flows downwardly through the rotor chamber causing the rotor 7 to rotate clockwise with respect to Fig. 6. With the valve positioned as in Fig. 2, fluid under pressure will flow upwardly through the rotor chamber and cause the rotor 7 to revolve in a clockwise direction with respect to Fig. 6.

It is important to note that as fluid passes through the rotor-containing stator chamber, it is deflected radially inwardly by the spiral vanes 10 of the stator and thereby caused to impinge with greater force upon the spiral vanes 11 of the rotor. This action continues from one end of the stator chamber to the other and the speed of rotation of the rotor 7 is thus greatly increased thereby.

Various types of tools may be mounted on the end of drive shaft 9. However, when my novel water motor is used in conjunction with a rotary

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tooth brush, I provide a removable stem portion 31 which is provided with an axial recess which frictionally engages the outwardly projecting end of bearing sleeve 4. A key 32 prevents rotation of the stem 31 on the bearing sleeve 4. As here shown, drive shaft 9 terminates within the bearing sleeve 4 and is provided with an irregularly tapered end. An extension shaft 33 within the removable stem 31 is provided at its inner end with a tapered end 34 that matches the end of the drive shaft 9. Drive shaft 9 is supported by suitable bearings 35 and 36 whereas the extension shaft 33 is supported by a suitable bearing in the stem 37 adjacent the outer end thereof and by the bearing 36 in the outer end of bearing sleeve 4. At its outer end, the extension shaft 33 is recessed to receive the stem 38 of a rotary tooth brush 39.

The brush 39 is partially contained within a segmental hood 40 which is removably secured to the end of a stem 31 by means of a resilient locking collar 41 and a detent 42. (See Figs. 1 and 8.) A radial slot 43 in the casing element 5 extends from the annular passage 6 and terminates adjacent the sleeve 4 and is adapted upon rotation of the sleeve 4 to communicate with two spaced radially extending passages 44 and 45, which in turn extend from the periphery of the sleeve 4 to an axial passage 46 surrounding the drive shaft 9. Passage 46 extends outwardly to the bearing element 36 on the end of sleeve 4 where it communicates with an axial passage 47 by means of the slot 48 in the bearing 36. Said passage 46 is open to atmosphere adjacent the brush 39 through a radial slot 49 in the bearing 37.

It will be noted that when the stator 2 is rotated with respect to the casing 1 so as to position the resilient stop finger 25 against the ends 26 or 27 that the passages 44 and 45 are circumferentially offset from the radial slot 43 so that no fluid passes through the passages 44 or 45. When it is desired to pass fluid through the passages 44 and 45 and from thence through the passages of the sleeve 4 and stem 38 to the brush 39, the casing 1 is rotated with respect to the stator so as to cause the resilient stop finger 25 to yield to a point where it engages one of the sides 28 or 29 of V-shaped slot 24 at which point the corresponding radial passages in the sleeve 4 will become aligned with the radial slot 43. However, it will be noted that when either of the radial passages 44 or 45 are aligned with the radial slot 43, the passages in the valve element 3 are in at least partial alignment with the passages 19 and 20 in the casing, so that fluid is passing through the stator chamber under pressure to cause rotation of the rotor in the desired direction.

My device is so constructed that it may be held and the stem 31 manipulated to allow water or other fluid to pass outwardly therethrough with the use of but one of the operator's hands. Manipulation of the stem 31 may be as readily accomplished to change the direction of rotation of the brush 39.

Dental authorities are uniformly of the opinion that teeth should be brushed in a direction away from the gums and in the direction of the teeth. This function is readily accomplished by my device, simply, by changing direction of rotation of the brush 39. It is not necessary to remove the brush from the mouth when rinsing the brush and the teeth as this is accomplished by merely aligning the slot 43 with either of the radial passages 44 or 45 to allow water under

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pressure to pass downwardly through the stem 31 and unto the brush 39.

In use, but one fluid motor is needed for an entire household. It is but necessary to supply each member of a household with a stem 31 and its associated parts 39 and 40 as a unit. Thus, each member of a family is provided with a personal motordriven tooth brush and sanitary conditions associated therewith are accomplished at a high standard.

While I have shown a commercial form of my device in accordance with section 4888 of the United States Statutes, it will be readily understood that my device is capable of modification without departure from the scope of the appended claims.

What I claim is:

1. A fluid motor including a casing, a stator coaxially mounted in said casing for limited rotary movements in respect thereto, a rotor coaxially journaled in said stator, a drive shaft secured to said rotor and projecting axially from one end of said casing, fluid inlet and outlet passages on the opposite end of said casing, valve elements at opposite ends of said stator, said stator and said valve elements defining a chamber in which the rotor revolves, a passage in one of said valve elements communicating with one end of said chamber and with the fluid inlet passage in the casing upon rotary movement of the stator to its limit in one direction and communicating with the same end of the chamber and the fluid outlet passage in the casing upon rotary movement of the stator to its limit in the opposite direction, and a second passage in said valve element communicating with the opposite end of said chamber and the fluid outlet passage in said casing upon rotary movement of the stator to its limit in one direction and communicating with said opposite end of the chamber and the fluid inlet passage in the casing upon rotary movement of the stator to its limit in the opposite direction.

2. The structure defined in claim 1 in which the stator is provided with a spiral vane and the rotor is provided with a peripheral spiral vane pitched in a direction opposite to the pitch of the spiral vane of the stator.

3. The structure defined in claim 1 in which said inlet and outlet passages in the casing are concentric one to the other.

4. The structure defined in claim 1 in which the rotation of said stator is limited within the casing by means comprising circumferentially spaced stop shoulders in one thereof and a yielding stop member in the other thereof working between said stop shoulders.

5. In a device of the class described, an elongated open-ended casing having a cylindrical bore, concentric fluid inlet and outlet passages connected to one end of said casing, a stator within said casing bore, bearing means on opposite ends of said stator mounting said stator for limited rotary movement with respect to said casing and spacing the intermediate portion thereof from the wall of said casing bore to provide an annular fluid passage, said bearing means and stator providing a rotor chamber, a rotor mounted in said chamber and having a drive shaft projecting axially through the end of the casing opposite the fluid inlet, a passage in the bearing means adjacent the fluid inlet communicating with one end of said chamber and the fluid inlet upon rotary movement of the stator to its limit in one direction and communicating

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with the same end of the chamber and the fluid outlet upon rotary movement of the stator to its limit in the opposite direction, and a second passage in said bearing means communicating through said annular passage with the opposite end of the chamber and the fluid outlet in the casing upon rotary movement of the stator to its limit in one direction and communicating through said annular passage with said opposite end of the chamber and the fluid inlet passage in the casing upon rotary movement of the stator to its limit in the opposite direction, the stator bearing means in the end of the casing opposite the fluid inlet being in the nature of a sleeve which projects outwardly through the casing to provide means for rotating the stator in respect to the casing, said drive shaft being journaled in and projecting outwardly from said sleeve.

6. The structure defined in claim 5 in which the inside wall of the stator is provided with a continuous spiral vane extending from one end thereof to the other end thereof, said rotor being provided with a continuous peripheral spiral vane which is pitched opposite to the direction of the pitch of the spiral vane of the stator.

7. The structure defined in claim 5 in which the rotary movements of the stator within said casing are limited by means including a circumferentially extended slot in one thereof and a yielding stop finger in the other thereof.

8. The structure defined in claim 5 in further combination with a fluid outlet passage in said bearing sleeve adjacent said drive shaft, and a radial passage in said bearing sleeve adapted to communicate with said annular passage and said last-named fluid outlet passage only when the stator is rotated within the casing to an extent to cause a yielding of the stop finger.

9. In a device of the class described, an elongated open-ended casing having a cylindrical bore, fluid inlet and outlet passages connected to one end of said casing, a stator within said casing bore, bearing-like valve elements on opposite ends of said stator mounting said stator for limited rotary movement with respect to said casing and spacing the intermediate portion thereof from the wall of the casing bore to provide an annular fluid passage, a circumferentially extended slot in the bore of said casing, an axially extended V-shaped notch in the peripheral surface of said stator, a resilient stop finger projecting radially from said stator centrally of said V-shaped notch and adapted to engage the ends of the slot in the casing, said valve elements and said stator defining a rotor chamber, a rotor mounted in said chamber and having a drive shaft projecting axially through the end of the casing opposite the fluid inlet, a passage for admitting fluid under pressure through one end of the chamber, a passage from the other end of said chamber for the discharge of said fluid, the valve elements in the end of the casing opposite the fluid inlet being in the nature of a bearing sleeve which projects outwardly through the casing to provide means for rotating the stator with respect to the casing, said drive shaft being journaled in said sleeve, a fluid outlet passage in said sleeve parallel to said drive shaft, and a pair of radial fluid passages in said sleeve extending from said outlet passage and adapted to communicate with the annular passage intermediate the casing and stator upon extreme movements of said resilient

stop finger in the circumferentially extended slot in the casing.

10. The structure defined in claim 9 in further combination with a removable stem secured to said sleeve axially of said casing, an extension shaft journaled in said stem for operative engagement with said drive shaft, and a tool mounted on the end of said extension shaft for rotation therewith.

11. A fluid motor including a casing, a stator 10 coaxially mounted in said casing for limited rotary movements in respect thereto, a rotor coaxially journaled in said stator, a drive shaft secured to said rotor and projecting axially from one end of said casing, fluid inlet and outlet 15 passages on the opposite end of said casing, valve elements at opposite ends of said stator, said stator and said valve elements defining a chamber in which the rotor revolves, a passage in one of said valve elements communicating with one 20 end of said chamber and the fluid inlet passage upon rotary movement of the stator to its limit in one direction and communicating with the same end of the chamber and the fluid outlet passage upon rotary movement of the stator to 25 its limit in the opposite direction, a second passage in said valve element communicating with the opposite end of said chamber and the fluid outlet in said casing passage upon rotary movement of the stator to its limit in one direction 30 and communicating with said opposite end of the chamber and the fluid inlet passage in the casing passage upon rotary movement of the stator to its limit in the opposite direction, the valve element adjacent the drive shaft end of the casing being in the nature of an axially ex-

tended bearing sleeve which projects through the end of the casing to provide means for rotating the stator with respect to the casing, said drive shaft being journaled within said bearing sleeve, a removable stem secured to said bearing sleeve for rotation therewith, an extension shaft journaled in said stem for cooperation with said drive shaft, and a tool mounted on the extreme end of said extension shaft for rotation therewith.

12. The structure defined in claim 9 in further combination with a removable stem removably secured to said bearing sleeve for rotation therewith, an axially mounted shaft extension on said stem cooperating with said drive shaft, a tool 15 on the end of said extension shaft, and a fluid passage in said stem parallel with said extension shaft and communicating with the fluid outlet passage in said sleeve, said passage terminating adjacent the tool.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
912,061	Beckman	Feb. 9, 1909
1,212,967	Light et al.	Jan. 16, 1917
1,971,283	Stimson	Aug. 21, 1934
2,283,314	Ckola	May 19, 1942
2,406,959	Millard	Sept. 3, 1946

FOREIGN PATENTS

Number	Country	Date
553,757	France	May 30, 1923